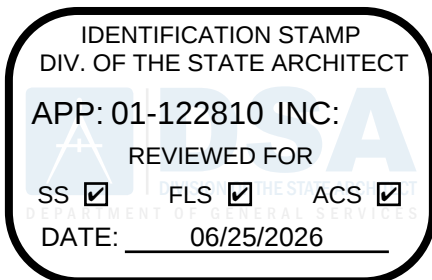


LA PALOMA HIGH SCHOOL NEW SHADE STRUCTURE PROJECT MANUAL

BID NUMBER: -



LIBERTY HIGH SCHOOL DISTRICT

400 Ghiggeri Dr. Brentwood, CA 94513

December 23, 2025



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TECHNICAL SPECIFICATIONS

Division 3 – Concrete

<u>Section</u>	<u>Title</u>
03 25 00	Concrete Formwork
03 30 00	Cast in place concrete

Division 31- Earthwork

<u>Section</u>	<u>Title</u>
31 00 00	Site Clearing
31 20 00	Earthwork
31 31 15	Termite Control

Division 32- Exterior Improvements

<u>Section</u>	<u>Title</u>
32 12 16	Asphalt Concrete Paving
32 17 20	Pavement Marking
32 37 26	Tactile Warning

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittals for review, and information.
- B. Submittal procedures.

1.02 PROJECT COORDINATION

- A. Project Coordinator: Construction Manager.
- B. Construction, fabrication, or ordering of materials must not begin until Contractor has received final submittals reviewed by the Architect/Engineer governing all aspects of the intended work.
- C. Make the submittals to the Architect through the Project Coordinator.

1.03 SHOP DRAWINGS

- A. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
- B. Identify details on Shop Drawings by reference to sheet and detail numbers of Contract Drawings and/or specific reference to Sections and Paragraphs of the Specifications.

1.04 PRODUCT DATA

- A. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data must:
 - 1. Have each copy clearly marked to identify pertinent materials, products, finishes, etc.
 - 2. Show clearly all standard options included.
 - 3. Show dimensions and clearances required.
 - 4. Show performance characteristics and capacities.
 - 5. Show wiring diagrams and controls and necessary rough-in requirements for utility services and connections (where applicable).
- C. Identify each item of Product Data by reference to sheet and detail numbers of Contract Drawings and/or specific reference to Sections and Paragraphs of the Specifications.

- D. Where Product Data, as submitted, contains extraneous information, unmarked options, or is incomplete, it must be returned to the Contractor without review.

1.05 MILL CERTIFICATES

- A. Mill Certificates are documents that provide testing data regarding the fabrication and strength of metal products. Mill Certificates must be less than 1 year old.

1.06 SAMPLES

- A. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.
- B. Where samples are required of materials which inherently show a range of size, color, texture or finish, submit Samples in sufficient quantity to show this range.
- C. Samples must be tagged or otherwise clearly identified as to pertinent information illustrated and specific relationship to the Work, and must show the name and address of the Subcontractor or agency submitting them, the date, and the name of the Work for which they are intended.
- D. Unless the Architect determines that Samples must be retained for reference purposes, Samples will be returned when so requested by the Contractor. No Sample must be incorporated into the Work unless specific approval is given by the Architect/Engineer.
- E. Charges for submission of Samples and for their return must be borne by the Contractor.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. Transmit each submittal with approved form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Document: Submit one electronic copy in pdf or word format. Illegible files will be rejected. If a printed copy is required to be returned, submit two printed sets for review.
- D. Submittals must contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The Project title and number.
 - 3. Contract identification.
 - 4. The names of Contractor, Supplier, Manufacturer
 - 5. Identification of the product

6. Field dimensions, clearly identified as such.
 7. Relation to adjacent or critical features of the Work or materials.
 8. Applicable standards, such as ASTM or Federal Specifications numbers.
 9. Identification of deviations from Contract Documents and Product
 10. Identification of revisions on resubmittals.
 11. An 8 inches x 3 inches blank space for Contractor and Architect/Engineer stamps.
 12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
- E. Make submittals promptly in accordance with an approved submittal schedule, as put forth by the General Contractor, and in such sequence as to cause no delay in the work or in the work of any other contractor.
- F. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- G. The General Contractor must review each submittal and only forward to the Architect/Engineer after verifying that the submittal 1) is complete, 2) is requested by and is based on the current edition of the contract documents including all supplements, addenda, RFI's, etc., 3) has been coordinated among all trades, 4) has revisions clouded, and 5) does not include substitution requests. Submittals not meeting these requirements will be returned for revision and resubmittal. The applicable work must not proceed until the submittal is returned without a required resubmittal.

3.02 RESUBMISSION REQUIREMENTS

- A. Make any corrections or changes in the submittals required by the Architect/Engineer and resubmit.
- B. Shop Drawings and Product Data
1. Revise initial drawings or data and resubmit as specified for the initial submittal.
 2. Indicate any changes which have been made other than those requested by the Architect/Engineer.
- C. Samples: Submit new Samples as required for initial submittal.

3.03 DISTRIBUTION

- A. Distribute copies of Shop Drawings and Product Data which carry the Architect/Engineer stamp to:
1. Job site file.
 2. Record Documents file.
 3. Other affected contractors.

4. Subcontractors.
 5. Supplier or Fabricator.
- B. Distribute Samples that carry the Architect stamp as directed by the Architect.

END OF SECTION 01 33 00

SECTION 032500
CONCRETE FORMWORK

PART 1: GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Work Included: Provide formwork in accordance with the provisions of this section for all concrete shown on the Drawings or required by other Sections of these Specifications.
- B. Related Work in Other Sections: The following items of associated work are included in other sections of these specifications:
 - 1. Division 02 – “Subsurface Investigations”
 - 2. Division 03 – “Tilt-Up Concrete”
 - 2. Division 03 – “Steel Reinforcement”
 - 3. Division 03 – “Cast-in-Place Concrete”
 - 4. Division 05 – “Structural Steel”
 - 5. Division 31 – “Trenching and Backfilling”
 - 6. Specification Section – 321800 “Concrete Flatwork & Sitework”

1.3 QUALITY ASSURANCE

- A. Design of Formwork is the Contractor's responsibility.
- B. Standards: Comply with the following standards:
 - 1. American Concrete Institute (ACI):
ACI 347-04 Recommended Practice for Concrete Formwork
 - 2. International Conference of Building Officials (ICBO):
California Building Code, (CBC) 2001 Edition
 - 3. West Coast Lumber Inspection Bureau (WCLIB):
Standard Grading Rules for West Coast Lumber, No. 17, 2001 Edition.
 - 4. U.S. Department of Commerce Product Standard
PS 1-95 Construction and Industrial Plywood
 - 5. Redwood Inspection service (RIS) Publication:
Standard Specifications for Grades of California Redwood Lumber, 1988 Edition.

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

C31-06 Standard Practice for Making and Curing Concrete Test Specimens in the field.

A525-83 Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process
7. Title 24, Part 2, California Building Code.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the contract and Division 1 Specifications.
- B. Manufacturers' data: Submit manufacturers' data and installation instructions for proprietary materials including form coatings, ties and accessories, and manufactured form systems if used.
- C. Sample Panel: Before constructing formwork, a sample concrete panel shall be constructed and reviewed by the Architect.

PART 2: PRODUCTS

2.1 FORM MATERIALS

- A. Earth Forms: Use for footing only where soil is firm and stable and concrete will not be exposed. Where earth forms are used, cut excavations neat and accurate to size for placing concrete directly against the excavation.
- B. Forms for Unexposed Concrete:
 1. For concrete which will not be exposed in the finished work, and which are not otherwise scheduled or specified, use one of the following form materials:
 - a. 6" or 8" wide, 1" nominal thickness boards with shiplapped or tongue and groove edges conforming to WCLIB paragraph 118c for STANDARD grade Douglas Fir. Boards shall be S4S.
 - b. 5/8" minimum thickness plywood conforming to PS1 grade marked B-B Plyform Class I Exterior.
 2. For unexposed concrete below grade which is to receive membrane waterproofing use 5/8" minimum thickness plywood grade conforming to PS-1 grade marked B-B Plyform Class I Exterior.
- C. Forms for Exposed Surfaces:
 1. General: For concrete which will be exposed in the finished work, except where otherwise scheduled or specified, use 5/8" "B-B Plyform Class I Exterior" grade plywood conforming to PS1.
 2. Plywood for standard architectural finish, concrete surfaces to receive a "rubbed" finish, and surfaces to receive membrane waterproofing shall be "B-B Plyform Cla

ss I Exterior" grade.

3. Plywood for smooth architectural finish shall be "HD Overlay Plyform Class I Exterior" grade.
- D. Round Column Forms: Prefabricated seamless fibre forms.
- E. Dividers for Concrete Slabs: Nominal 2 x 4 inch in size, "Foundation Grade" redwood conforming to paragraph 319, RIS.
- F. Form Ties:
 1. Provide factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1 1/2" from the outer concrete surface. Provide form ties which will not leave a hole larger than 1" diameter in the concrete surface.
- G. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, not impede the wetting of surfaces to be cured with water or curing compounds.

2.1 DESIGN OF FORMWORK

- A. General:
 1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads that might be applied, until such loads can be supported by the concrete structure. The design and engineering of the formwork shall be the responsibility of the contractor.
 2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.
 3. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
 4. Design forms to include assumed values of live load, dead load, wind load, seismic load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, allowable stresses, lateral stability, and other factors pertinent to safety of structure during construction.
 5. Provide shore and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations using wedges or jacks or a combination thereof.
 6. Support form facing materials by structural members spaced sufficiently close to prevent objectionable deflection. Limit deflection of facing materials reflected in concrete surfaces exposed to view to 1/240 of the span.
 7. Fit forms placed in successive units for continuous surfaces to accurate alignment, fre

e from irregularities, and within allowable tolerance.

8. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads.
 9. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- B. Tolerances and Variations: The Contractor shall set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed any of the tolerances specified. The Contractor shall be responsible for variations due to deflection, when the latter results from concrete quality or curing other than that which has been specified. The tolerances specified shall not be exceeded by any portion of any concrete surface; the specified variation for one element of the structure will not be applicable when it will permit another element of the structure to exceed its allowable variations. Except as otherwise specified herein, tolerances shall conform to ACI 347.
- C. Earth Forms: Side forms of footings may be omitted and concrete placed directly against excavation only when requested by the Contractor and reviewed by the Architect. When omission of forms is reviewed, provide additional concrete 1" on each side of the minimum design profiles and dimensions shown. Wood edge strips shall be provided at the top on each side of the excavation to secure reinforcing and to prevent soil from sloughing into the excavation. Earth forms shall be tamped firm and clean of all debris and loose material before depositing concrete.

PART 3: EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the substrate and conditions under which work of this Section is to be performed, and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 FORM CONSTRUCTION

- A. General:
1. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, level, and plumb work in finish structures.
 2. Provide for openings, offsets, sinkages, keyways, recesses moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
 3. Forms for openings, and construction which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which affects such installations, shall be accurately sized and located as dimensioned on the drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the con

ditions without additional expense to the Owner.

B. Fabrication:

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like to prevent swelling and assure ease of removal.
2. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to temporary openings on forms in as inconspicuous locations as possible, consistent with design requirements. Form intersecting planes to provide true, clean cut corners.

C. Forms for Exposed Concrete:

1. Forms for architectural concrete shall be designed to produce the required finish or finishes. Deflection of facing materials between studs as well as deflection of studs and walers shall be limited to 0.0025 times the span or as otherwise specified. Forms shall be designed to permit easy removal. Prying against the face of the concrete shall not be allowed. Only wooden wedges shall be used.
2. Where natural plywood form finish, grout cleaned finish, smooth rubbed finish, scrubbed finish, or sand floated finish is required, forms shall be smooth (faced with plywood, liner sheets, or prefabricated panels) and true to line, in order that the surfaces produced will require little dressing to arrive at true surfaces. Where any as-cast finish is required, no dressing shall be permitted in the finishing operation.
3. Where as-cast surfaces, including natural plywood form finish, are specified, the panels of material against which concrete is cast shall be orderly in arrangement, with joints between panels planned in acceptable relation to openings, building corners, and other architectural features.
4. Where panels for as-cast surfaces are separated by recessed or otherwise emphasized joints, the structural design of the forms shall provide for locating form ties, where possible, within the joints so that patches of tie holes will not fall within the panel areas.
5. In addition to shop drawings normally required, fabricating drawings of forms for architectural concrete shall be submitted for acceptance showing the jointing of facing panels, the locations of form ties, and any necessary alignment bracing.
6. Forms shall not be reused if there is any evidence of surface wear and tear or defect which would impair the quality of the surface. Forms shall be thoroughly cleaned and properly coated before reused.
7. Formwork for architectural concrete shall be observed continuously while concrete is being placed to see that there are no deviations from desired elevation, alignment, plumbness, or camber. If, during construction, any weakness develops and the falsework shows any undue settlement or distortion, the work shall be stopped, the affected construction removed if permanently damaged, and the falsework strengthened.

8. All cracks and openings in formwork joints larger than 1/8" shall be filled with a crack filler.
- D. Corner Treatment: Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
- E. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.
- F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.
- G. Screeds: Set screeds and establish levels for tops of concrete slabs and leveling for finish on slabs. Shape slabs to drain where required or as indicated on drawings.
- H. Screenshot Supports: For concrete over waterproof membranes and/or vapor-barrier membranes, use cradle, pad, or base type which will not puncture the membrane. Do not stake through membrane.
- I. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required. Slope floors uniformly to drains and depress slabs at tile floors.

3.3 FORM COATINGS

- A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
- B. Coordination: All contractors whose work is related to the concrete, or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.
- C. Anchorage: Expansion joint material, waterstops, and other embedded items shall be positioned accurately and supported against displacement, prior to placing concrete. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.
- D. Anchor Bolts: Anchor bolts shall be set to templates, shall be plumbed carefully and checked for location and elevation with an instrument, and shall be held in position rigidly to pre

vent displacement before concrete is placed.

3.5 REMOVAL OF FORMS

A. General:

1. When repair of surface defects or finishing is required at an early age, forms shall be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
2. Top forms on sloping surfaces of concrete shall 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 be followed by the specified curing.
3. Wood forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
4. Formwork for columns, walls, sides of beams, sides of slabs on grade and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.
5. Forms and shoring in the formwork used to support the weight of concrete in beams, slabs, and other structural members shall remain in place until the concrete has reached the specified 28 day compressive strength.

B. Removal Strength:

1. Although forms may be removed as specified above, members may be loaded only after the minimum design strengths as specified on the drawings are attained. Any request for earlier removal of forms and shoring shall be made to the Architect in writing, along with supporting evidence that the safety of the structure will not be impaired.
2. When removal of formwork is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength when either of the following conditions has been met.
 - a. When test cylinders, field cured along with the concrete they represent, have reached the strength specified for removal of formwork. Except for the field curing and age at test, the cylinders shall be molded and tested as specified in ASTM C31.
 - b. When the concrete has been cured for the same length of time as the age at test of laboratory-cured cylinders which reached the specified strength. The length of time the concrete has been cured in the structure shall be determined by a cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50 °F and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

C. Removal:

1. In removing plywood forms, no metal pinch bars shall be used and special care sha

It be taken in stripping. Start at top edge or vertical corner where it is possible to insert wooden wedges. Wedges shall be done gradually and shall be accompanied by light tapping on the plywood panels to crack them loose. Do not remove forms with a single jerk after it has been started at one end.

2. Forms shall be left in place as long as possible to permit shrinkage away from concrete, and plywood forms shall be left in place until all other forms around are stripped and until there is no danger of damaging the architectural concrete due to other work in the vicinity.
- D. Protection: After stripping, Contractor shall properly protect all concrete to be exposed in the finish work from damage, with boards and nonstaining building paper to prevent staining, spalled edges, chips, etc.

3.6 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged formfacing material will not be acceptable. Apply new form coating compound material to concrete surfaces as specified for new formwork. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.7 FIELD QUALITY CONTROL

- A. The Contractor shall notify the Architect 48 hours prior to placing of any concrete, and after placement of reinforcing steel in the forms.
- B. Rejection of Defective Work Due to Improper Forms: Any movement or bellying of forms during construction or variations in excess of the tolerances specified will be considered just cause for the removal of such forms and, in addition, the concrete work so affected. Reconstruction of forms and new concrete shall be furnished at no additional cost to the Owner.

END OF SECTION 032500

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- B. Work Included: Provide all cast-in-place concrete for buildings and structures, complete, in place, as indicated on the Drawings, specified herein, and as required for a complete and proper installation.
- C. Related Sections Include the Following:
1. Division 03 – “Concrete Formwork”
 2. Division 03 – “Steel Reinforcement”
 3. Division 03 – “Tilt-Up Concrete”
 4. Division 05 – “Structural Steel”
 5. Division 05 – “Miscellaneous Metals”
 6. Division 07 – “Under Slab Vapor Barrier”
 7. Division 22 and 23 – “Mechanical and Plumbing” for items embedded in concrete
 8. Division 26 – “Electrical” for items embedded in concrete
 9. Division 31 – “Earthwork”
 10. Division 32 – “Concrete Flatwork & Sitework”

1.3 QUALITY ASSURANCE

- A. Codes and Standards:
1. Comply with applicable provisions of the following codes and standards:
 - a. International Conference of Building Officials (ICBO):
California Building Code, (CBC), 1998 Edition.
 - b. American Concrete Institute (ACI):

ACI 211.1-91	Standard Practice for Selecting Proportions for Normal and Heavyweight Concrete.
ACI 214.4R-03	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 304R-00	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R-99	Hot Weather Concreting
ACI 306.1-90	Standard Specification for Cold Weather Concreting
ACI 308R-01	Standard Practice for Curing Concrete

ACI 309R-05	Guide for Consolidation of Concrete
ACI 318-05	Building Code Requirements for Reinforced Concrete
SP-2	Manual of Concrete Inspection

- c. American Society for Testing and Materials (ASTM): The specifications and standards hereinafter referred to, are the latest editions, except when year is specified.

C31-06	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
C33-03	Standard Specification for Concrete Aggregates.
C39-05e1	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C40-04	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
C42-04	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C88-05	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C94-06	Standard Specification for Ready-Mixed Concrete
C114-05	Methods of Chemical Analysis of Hydraulic Cement
C127-04	Test Method for Specific Gravity and Absorption of Coarse Aggregate
C128-04a	Test Method for Specific Gravity and Absorption of Fine Aggregate
C131-06	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C136-06	Method for Sieve Analysis of Fine and Coarse Aggregates
C138-01a	Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C142-97 (2004)	Test Method for Clay Lumps and Friable Products in Aggregates

C143-05a	Standard Test Method for Slump of Portland Cement Concrete
C144-04	Standard Specification for Aggregates for Masonry Mortars
C150-05	Standard Specification for Portland Cement
C156-05	Test Method for Water Retention by Concrete Curing Materials
C157-06	Test Method for Length Change of Hardened Cement Mortar and Concrete
C167-98 (2003)	Standard Test Methods for Thickness and Density of Blanket or Batt Type Thermal Insulating Materials
C171-03	Standard Specification for Sheet Materials for Curing Concrete
C172-04	Standard Method of Sampling Freshly Mixed Concrete
C173-01e1	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C192-06	Standard Method of Making and Curing Concrete Test Specimens in the Laboratory
C227-03	Test Method for Potential Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
C231-04	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C233-04	Testing for Air-Entraining Admixtures for Concrete
C260-06	Standard Specifications for Air-Entraining Admixtures for Concrete
C289-03	Potential Reactivity of Aggregates (Chemical Method)
C309-06	Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete
C387-06a	Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
C494-05a	Standard Specification for Chemical Admixtures

for Concrete

C535-03e1	Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C595-06	Standard Specification for Blended Hydraulic Cements
C618-05	Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland Cement concrete
C666-03	Resistance of Concrete to Rapid Freezing and Thawing
D75-03	Method for Sampling Aggregates
D1751-04	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural construction (Nonextruding and Resilient Bituminous Types)
D1752- 04a	Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
D2103-05	Polyethylene Film and Sheeting
E329-06a	Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
E1155-96(2001)	Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System

d. Federal Specifications (Fed. Spec.)

UU-B-790A	Building Paper, Vegetable Fiber; (Kraft, Waterproofed, Water Repellent and Fire Resistant)
CCC-C-467C	Cloth, Burlap, Jute (or Kenaf)
DDD-M-148	Mats; Cotton (for Concrete Curing)

e. Provisions of California Building Code, Title 24, Part 2 are applicable to the work. When requirements of such codes are at variance with requirements specified in foregoing paragraph, the provisions of California Building Code shall take precedence.

f. U.S. Army Corps of Engineers Handbook for Concrete and Cement.

CRD-C572-74	Polyvinyl Chloride Waterstop
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CRD-C621-80

Non-Shrink Grout

B. Qualifications of Installer:

1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.
2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents design.
3. In acceptance or rejection of work performed under this Section, the Architect will make no allowance for lack of skill on the part of the workmen.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the contract and Division 1 Specifications.
- B. Shop Drawings: Submit shop drawings showing location of construction and control joints other than as indicated on the drawings.
- C. Delivery Tags: Submit copies of delivery tags for all concrete.
- D. Test Reports: Submit reports of tests hereinafter required to Architect.
- E. Sample: Submit two quart sample of aggregate to be used for seeding in exposed aggregate finish.
- F. Concrete Mix Designs: Submit proposed concrete mix designs for all types and uses of concrete.
- G. Cement: Submit manufacturer's certificate of conformance and affidavit for cement.

PART 2: PRODUCTS

2.1 MATERIALS

- A. Cement:
 1. Cement shall conform to ASTM C150, Type I or Type II. The cement used in the work shall correspond to that on which the selection of concrete proportions is based.
 2. Where aggregates contain reactive substances low alkali cement shall be used in all structural concrete. Low alkali cement shall not contain more than 0.6 percent total alkali when calculated as sodium oxide as determined by the method given in ASTM C114.
 3. All cement used in the manufacture of concrete for exposed surfaces shall be of the same brand and type, except as otherwise specifically permitted in writing by the Architect.

4. The contractor shall furnish to the Architect and the Division of the State Architect a certification from the cement manufacturer that the cement proposed for use in the project has been manufactured and tested in compliance with ASTM C150. An affidavit shall be provided by the contractor which identifies the cementitious material used for the project by the manufacturer's lot number, date of shipment from the manufacturer, date of receipt of cementitious material by the contractor, place of storage and date of use.

B. Concrete Aggregates:

1. Hardrock Aggregate:

- a. Concrete aggregate shall conform to ASTM C33, except as modified herein. The sieves used in the sieve analysis shall be of square mesh wire cloth.
- b. Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the grading requirements of ASTM C33.
- c. Coarse aggregate: Coarse aggregate shall consist of a clean, hard, fine grained, sound crushed rock, or washed gravel or a combination of both. It shall be free from oil, organic matter, or other deleterious substances. Aggregate shall be uniformly graded from one-quarter inch size to maximum size.
- d. The maximum size of aggregates used in the project shall be consistent with the dimensions and form of the section being placed, the location and spacing of the reinforcing bars, and with the method of compaction, and shall be such as will produce dense and uniform concrete free from rock pockets, honey-comb and other irregularities. The nominal maximum size of the aggregate shall not be more than one-fifth the narrowest dimension between forms, one-third the depth of slabs nor three-fourths the minimum clear spacing between reinforcing bars.
- e. Combined Grading: The combined grading shall be such that the percentage by weight of the combined aggregates shall fall within the limits established as follows:

Percentage by weight

Sieve number or size in inches maximum

	1 1/2 "	1"	3/4"
Passing a 2-inch	----	----	----
Passing a 1-1/2 inch	95-100	----	----
Passing a 1-inch	70-90	90-100	----
Passing a 3/4-inch	50-80	70-95	90-100
Passing a 3/8-inch	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28

Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

- f. Special grading or size limitations: When reviewed by the Architect and approved by the Division of the State Architect other gradings or maximum size limitations may be used if mixes are designed and tested in accordance with Method 1 specified in Para 2-02B.
- g. Soundness of Aggregates: Both the coarse and fine aggregate shall be tested by the use of a solution of sodium or magnesium sulfate, or both, whenever in the judgment of the Architect, or the Division of the State Architect such tests are necessary to determine the quality of the material. Such tests shall be performed in accordance with ASTM C88 and the results shall show compliance with the limits set forth in ASTM C33.
- h. Reactivity: Aggregates shall be free from any substance which may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete or which will interfere with normal hydration of the cement. Acceptability of the aggregate shall be based upon satisfactory evidence that the aggregate is free from such materials.
- i. Aggregates shall be tested, when required by the Architect prior to the concrete mix being established, in accordance with the following specifications:

Test	Specification
Abrasion	ASTM C131 and C535
Gradation	ASTM C136
Alkali Reactivity	ASTM C289
Organic Impurities	ASTM C40
Clay Lumps	ASTM C142
Alkali Reactivity	ASTM C227

C. Water:

- 1. Water used in mixing concrete shall be clean, potable, and free from injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that may be deleterious to concrete or reinforcement.
- 2. Conform to the requirements of ASTM C94.

D. Admixtures:

- 1. Admixtures shall be reviewed by the Architect and approved by the Division of the State Architect.
- 2. An admixture shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions.
- 3. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

4. Admixtures to be used in concrete shall conform to the specifications listed below:
 - a. Air-entraining admixtures: Conform to ASTM C260. Use Air Mix by the Euclid Chemical Company, Micro-Air by Master Builders, Sika AER by Sika Corporation or equivalent.
 - b. Water-reducing admixtures: Conform to ASTM C494 Type A. Use Eucon WR-75 by the Euclid Chemical Company, Pozzolith 220N by Master Builders, Plastocrete 161 by Sika Corporation or equivalent.
 - c. Water-reducing, retarding admixtures: Conform to ASTM C494 Type D. Use Eucon Retarder-75 by the Euclid Chemical Company, Pozzolith 300-R by Master Builders, Plastiment by Sika Corporation or equivalent.
 - d. High Range Water-Reducing Admixture (HRWR): Conform to ASTM C494 type F or G. Use Eucon 37 by the Euclid Chemical Company, Pozzolith Rheobuild 100 or 716 by Master Builders, Sikament 300 or 320 by Sika Corporation or equivalent. Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D and E) may be used.
 - e. Non-Corrosive, Non-Chloride Accelerator: Conform to ASTM C494 Type C or E. Use Accelguard 80 by the Euclid Chemical Company, Pozzutec 20 by Master Builders, Plastocrete 161FL by Sika Corporation or equivalent. The admixture manufacturer shall have long-term (more than one year duration) non-corrosive test data on metal deck and reinforcing steel from an independent testing laboratory using an acceptable accelerated corrosion test method such as using electrical potential measures.
 - a. Fly Ash: Conform to ASTM C618 Class C or F. The use of a quality fly ash will be permitted as a cement-reducing admixture up to a maximum of 15% of the weight of portland-cement. The loss on ignition in Table 1 or C618 shall not exceed 3%. Quality assurance testing and reports for a minimum of six months shall be submitted by the fly ash supplier. The amount retained on the 325 sieve in Table 2 shall not exceed 20%.
 5. Certification: Certification of the above requirements and chloride ion content is required from the admixture manufacturer prior to mix design review.
- E. Preformed Expansion Joint Filler:
1. Premolded expansion joint filler shall be of the type required by the contract documents and shall conform to one of the following.
 - a. General Use: ASTM D1751
 - b. Sealant Topped: ASTM D1752, Type I or II.
- F. Curing Materials:
1. Liquid membrane-forming compound shall conform to ASTM C309, Type 1, Class B and shall conform to the California Air Resources Board requirements. Use Kur

- ez VOX by the Euclid Chemical Company, Masterkure or Masterkure W by Master Builders, Aqua Resin Cure by Burke or equivalent.
2. Impervious Membrane conforming to ASTM C171:
 - a. Clear or white polyethylene sheeting, 6 mil minimum thickness.
 - b. Waterproof kraft paper conforming to Fed. Spec. UU-B-790A.
 - c. Polyethylene coated burlap. 6 mil white opaque polyethylene film impregnated or extruded on one side of burlap. Burlap shall weigh not less than 9 ounces per square yard and shall conform to Fed. Spec. CCC-C-467C.
 3. Absorptive Mats:
 - a. Burlap conforming to Fed. Spec. CCC-C-467C weighing not less than 9 ounces per square yard.
 - b. Cotton mats conforming to Fed. Spec DDD-M-148 and free from any substance which may have a deleterious effect on fresh concrete.
 - G. Curing and Sealing Compounds: The compound shall conform to ASTM C309 Type 1, Class B and the California Air Resources Board with 30% solids content minimum and having moisture retention tests per ASTM C156 by an independent testing laboratory showing a maximum moisture loss of 0.03 gm/cm² at a coverage of 300 square feet per gallon. Use Super Aqua Cure VOX by the Euclid Chemical Company, Kure-N-Seal WB by Sonneborn, Spartan-cote WB by Burke, or equivalent.
 - H. Waterstops: Elastomer waterstops shall be made of virgin polyvinyl chloride and shall conform to CRD-C-572; shall be dense, homogeneous, free from porosity and other imperfections, and symmetrical in shape. Materials shall be resistant to chemical action with portland cement, acids and alkalies, and not affected by fungi. The waterstops shall be ribbed with an expandable center bulb. Minimum thickness at center = 3/8". Minimum width = 9". Provide prefabricated waterstop accessories of the same material for use at intersections (ells, tees, crosses, etc.)
 - I. Abrasive Aggregate: Aluminum oxide grits or crushed emery. Use material that is factory-graded, packaged, rust-proof, non-glazing, and unaffected by freezing, moisture and cleaning materials. Use Non-Slip by Euclid Chemical Company, Frictex H or NS by Sonneborn or equivalent.
 - J. Carbon Black: Dispersed carbon black, similar and equivalent to Carbo-Jet, Sonneborn Building Products, Inc., or Carblak by the Euclid Chemical Company.
 - K. Integral Coloring System:
 1. Pigments: Metallic oxide pigments, approved equal to Davis Colors, Sonobrite, Sonneborn Building Products Co., Staybrite, Grace Construction Materials, or Colormix, Masters Builders.
 2. Wax: Paste or liquid, buffing type, homogeneous blend of carnauba and other waxes, similar and approved equal to Sonosheen, Sonneborn Building Products, Inc.
 - L. Dry Shake Hardeners:
 1. Mineral Aggregate Hardener: Mastercron by Master Builders or Surflex by the Euc

- lid Chemical Company or equivalent.
 - 2. Metallic Aggregate Hardener: Masterplate 200 by Master Builders or Euco-Plate the Euclid Chemical Company or equivalent.
 - 3. Heavy Duty Metallic Aggregate Topping: Anvil-Top 200-I by Master Builders or Euco Top by the Euclid Chemical Company or equivalent.
- M. Concrete Sealer: The compound shall be a water based acrylic sealer and shall meet the California Air Regulation Board requirements. Use Floor Seal VOX at interior locations and Diamond Seal VOX at exterior slabs by the Euclid Chemical Company or equivalent.
- N. Plastic Strip Control Joint Filler: Plastic control joint material shall be at least one inch deep, T-shaped 1/16" thick plastic strip, with a minimum 3/4" wide Pull-Top stiffener. This plastic strip shall have suitable anchor to prevent vertical movement.
- O. Bonding Agent (non-structural): The compound shall be a polyvinyl acetate, re-wettable type, with a visible tinted pigment to indicate coverage. Use Euroweld by the Euclid Chemical Company or Weld-Crete by the Larsen Company. Use only in areas not subject to constant moisture.
- P. Patching Mortar: The compound shall be an epoxy type, three component, 100% solids, pre-packaged and ready to use. Use Euco 456 Mortar by the Euclid Chemical Company, Sidadur 43 Patch-Pak by Sika Corporation or equivalent.
- Q. Epoxy Adhesive: Two part component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces. Use Euco Epoxy #452 or Eucopoxy LPL by the Euclid Chemical Company, Concrese 1001 or Brutem AB by Master Builders, or Sikadur Hi-Mod by the Sika Corporation.
- R. Epoxy Joint Filler: For use in all control and construction joints in exposed concrete floors subject to wheeled traffic use a two component, 100% solids compound with a minimum Shore "D" hardness of 50. Use Euco 700 or Euco Soff-Cut by Euclid Chemical Company, Masterfill CJ by Master Builders, Epolith P by Sonneborn or equivalent.
- S. Slab Joint Sealant: The sealant shall be a two component polyurethane joint sealant conforming to ASTM C920, Type M, Class 25. Use Eucolastic II by Euclid Chemical Company, Sikaflex-2c NS/SL by the Sika Corporation or Sonolastic SL2 by Sonneborn or equivalent.
- T. Slab Joint Sealant (Jet Fuel Resistant): The sealant shall be a two component polyurethane joint sealant conforming ASTM C920, Type M, Class 25 and shall be jet fuel resistant. Use Euco Neo-Seal by Euclid Chemical Company or equivalent.
- U. Surface Evaporation Retardant: For use on hot and/or windy days to prevent rapid moisture loss and subsequent plastic shrinkage cracks in concrete slabs: Use Eucobar by the Euclid Chemical Company or Confilm by Master Builders or equivalent.

2.2 CONCRETE MIXES

- A. General:
 - 1. The proportions of ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the work, but without per

mitting the materials to segregate or excessive free water to collect on the surface and to provide resistance to special exposures as given in ACI 318, Chapter 4.

2. Proportion and design structural concrete to develop the stipulated minimum ultimate compressive strength at 28 days by limiting the maximum proportions of the aggregates and water to the total volume of cement incorporated therein.
3. Aggregate shall be uniformly graded of the maximum size required in the structural notes included on the Drawings, shall produce concrete developing strength not less than that required in such notes.
4. Where different materials are to be used for different portions of the work, each combination shall be evaluated separately.
5. The Contractor shall submit the concrete mix designs to the Architect for review prior to placing any concrete.
6. The concrete mix design shall be prepared and signed by a civil engineer registered in California, when method B or C is used.
7. The mix-design shall be based on recent materials data, tested by an approved testing laboratory within the past six months.
8. If the source or character of the aggregate or cement changes during the course of the work, the Contractor shall resubmit a new mix design for review.
9. The concrete mix design submitted to the Architect shall include, but not necessarily be limited to the following:
 - a. Aggregate source and type
 - b. Aggregate sieve analysis
 - c. Aggregate combined grading
 - d. Moisture content of fine aggregate
 - e. Aggregate specific gravity and unit weight
 - f. Weights of aggregate (saturated surface dry condition and stockpiled condition) weight of cement, and volume (or weight) of water
 - g. Type and source of cement
 - h. Proposed use of each mix design
 - i. Certification of the chloride content of individual admixtures and of the mixes proposed.
 - j. Admixture type and proportions
 - k. Amount of air entrainment
 - l. Maximum permissible slump
 - m. Design compressive strength at 28 days
 - n. Maximum aggregate size
 - o. Test reports of trial batches or previous batch tests used as the basis of the mix design

B. Design Methods: Mixture proportions to provide the desired characteristics shall be developed using one of the methods described below.

1. Method A:

- a. If suitable data from a record of at least 15 consecutive tests (Method B) or from laboratory trial batches (Method C) are not available, the concrete mix proportions shall be selected from the following table based on the required compressive strength and maximum permissible aggregate size:

Maximum Size Aggregate	Required Compressive Strength	Minimum Cement Content	Maximum Water-Cement Ratio
3/4 inch and 1 inch	2000 psi	5.7 sacks/cy	7.50 gal/sack
	2500 psi	6.5 sacks/cy	6.75 gal/sack
	3000 psi	7.1 sacks/cy	6.0 gal/sack
1-1/2 inch	2000 psi	5.3 sacks/cy	7.50 gal/sack
	2500 psi	5.8 sacks/cy	6.75 gal/sack
	3000 psi	6.6 sacks/cy	6.0 gal/sack

C. Limitations

- Method A shall not be used for required concrete strengths exceeding 3000 psi.
- Concrete mix designs for pumped concrete shall be based on Method B or C.

- D. Air Entrainment: Exterior concrete that, after curing, will be permanently exposed to freezing temperatures or de-icing chemicals shall contain entrained air within limits of the following table:

Total air content, %

<u>Nominal Max. Size Aggregate</u>		<u>percent by volume</u>	
		Severe	Moderate
3/8 inch		7.5	6
1/2 inch		7	5.5
3/4 inch		6	5
1 inch	6	4.5	
1-1/2 inch		5.5	4.5
2 inch	5	4	

The tolerance on air content as delivered shall be ± 1.5 percent.

- E. Concrete for floors: The minimum cement content for floors shall be as follows regardless of the mix design method used and the maximum water-cement ratio shall not exceed 0.45.

Maximum size of aggregate, in.	Cement, lb per cu yd
1-1/2	470
1	520
3/4	540
1/2	590
3/8	610

- F. Slump: The concrete mixes shall be proportioned for and placed the following slump. The max

imum shall be allowed for one batch in any five consecutive batches tested. The slump shall be determined by ASTM C143:

1. 4 inch maximum for consolidation by vibration.
2. 5 inch maximum for consolidation by other methods.
3. 8 inch maximum for flowable concrete containing HRWR admixture (superplasticizer) with 3 inch maximum slump before addition of HRWR.

G. Admixtures: All concrete placed at ambient temperatures below 50°F shall contain the specified accelerator. All concrete placed at ambient temperatures above 80°F shall contain the specified retarder. All concrete required to be air-entrained shall contain the specified air-entraining admixture. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the specified HRWR admixture may be used.

H. Special Exposure Requirements:

1. Concrete that will be subject to freezing and thawing in a moist condition shall have a maximum water cement ratio of 0.45 and shall have a minimum cement content of 6 sacks/cy.
2. Concrete that is intended to be water-tight shall have a maximum water cement ratio of 0.50.
3. Concrete that will be exposed to deicing salts, brackish water, saltwater or spray from these sources shall have a maximum water cement ratio of 0.40 and shall have a minimum content of 6 sacks/cy.

I. Chloride Ion Content: The maximum water-soluble chloride ion concentrations in hardened concrete at age 28 days, as a percentage by weight of cement, contributed from the ingredients including water, aggregates, cementitious materials and admixtures shall not exceed the following:

1. Prestressed Concrete: 0.06%
2. Reinforced Concrete exposed to chloride in service: 0.15%
3. Reinforced concrete that will be dry or protected from moisture in service: 1.00%
4. Other Reinforced Concrete: 0.30%
5. Method B:
 - a. In lieu of trial batches to establish required average strength level, appropriate field test data for concrete made with similar ingredients may be used as the basis of the mix design. The ability to produce the required average strength calculated in accordance with this method shall be determined on the basis of the strength test record of at least 15 tests made during the past year which will permit establishing, directly or by interpolation, the water-cement ratio corresponding to the required average strength.
 - b. Where a concrete production facility has a record, based on at least 30 consecutive strength tests or two groups of tests totaling at least 30 within the past 12 months, the standard deviation shall be calculated. The record of tests from which the standard deviation is calculated shall:
 - (1) Represent similar materials, quality control procedures, and conditions to those expected. Changes in materials and proportions within the test record shall not have been more closely res

tricted than those for the proposed work.

- (2) Represent concrete produced to meet a specified strength or a strength within 500 psi of that specified for the proposed work.
- (3) Consist of at least 30 consecutive tests or two groups of tests totaling at least 30 tests.

c. Where a concrete production facility does not have 30 test records, but there is a record of 15 to 29 consecutive tests, a standard deviation may be established as the product of the calculated standard deviation and the modification factor below. The compressive test records used for this calculation shall:

- (1) Represent similar materials, quality control procedures, and conditions to those expected. Changes in materials and proportions within the test record shall not have been more closely restricted than those for the proposed work.
- (2) Represent concrete produced to meet a specified strength or a strength within 500 psi of that specified for the proposed work.
- (3) Represent only a single record of consecutive tests that span a period of not less than 45 calendar days.

MODIFICATION FACTOR FOR STANDARD DEVIATION WHEN LESS THAN 30 TESTS ARE AVAILABLE:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

- d. A strength test is the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.
- e. The required average compressive strength f'_{cr} used as the basis for selection of concrete proportions shall be the larger of the following formulas using a standard deviation as calculated above.

$$f'_{cr} = f'_c + 1.34s$$

$$f'_{cr} = f'_c + 2.33s - 500$$

where f'_c = specified compressive strength of concrete (psi) and S = Standard Deviation.

6. Method C:

- a. Method C shall be used when the combination of materials is to be evaluated and the proportions selected on the basis of trial mixes.
- b. Trial mixtures having proportions and consistencies suitable for the work shall be made based on ACI 211.1 using at least three different water-cement ratios or cement contents which will produce a range of strengths encompassing those required for the work. Trial mixes shall be designed to produce a slump within .75 in. of the maximum permitted, and for air-entrained concrete, within plus or minus .5 percent of the maximum all

owable air content. The temperature of concrete used in trial batches shall be reported.

- c. For each water-cement ratio or cement content, at least three compression test cylinders for each test age shall be made and cured in accordance with ASTM C192. They shall be tested for strength at 28 days or at the earlier or later age specified in accordance with ASTM C39. From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio or cement content and the compressive strength. From this curve, the water-cement ratio or cement content to be used in the concrete shall be selected to produce the required average strength. The cement content and mixture proportions to be used shall be such that this water-cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content, slump, and air content.
- d. The required average strength of the concrete mixes as tested in the laboratory shall be as follows unless a lower water-cement ratio or higher strength is required by special exposure requirements.

Specified Strength, f'c, psi	Required average Strength, psi
less than 3000	f'c + 1000
3000 to 5000	f'c + 1200
over 5000	f'c + 1400

- e. Tests shall be made by a testing laboratory approved by the Architect

2.3 GROUT MIXES

- A. Dry Pack Grout: One part portland cement to 2 parts fine sand.
- B. Non-Shrink Grout:
 - 1. Ready to use non-metallic aggregate product requiring only the addition of water at the job site. Product shall have the following characteristics:
 - a. Be capable of producing a mortar bed material having no drying shrinkage or settlement at any age.
 - b. Compressive strength of mortar (2" cubes) shall be not less than 5,000 psi at age seven days and 7,500 psi at age 28 days.
 - 2. Use Euco N-S Grout or Euco High Flow Grout by Euclid Chemical Company, Masterflow 928 or Masterflow 713 by Master Builders, or SonogROUT by Sonneborn or equivalent.

2.4 STORAGE OF MATERIALS

- A. Cement shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive seg

regation and to prevent contamination with other materials or with other sizes of like aggregates. To insure that this condition is met, any test for determining conformance to requirements for cleanness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

- C. Stockpiles of natural or manufactured sand shall be allowed to drain to insure a relatively uniform moisture content throughout the stockpile.
- D. Admixtures shall be stored in such a manner as to avoid contamination, evaporation, or damage. For those used in the form of suspensions or non-stable solutions, agitating equipment shall be provided to assure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

PART 3: EXECUTION

3.1 PREPARATION BEFORE PLACING

- A. Before concrete is placed, all equipment for mixing and transporting the concrete shall be clean, all debris and ice shall be removed from the spaces to be occupied by the concrete, forms shall be properly coated, and the reinforcing shall be thoroughly clean of ice or other deleterious coatings. Water shall be removed from the place of deposit before concrete is placed. All laitance and other unsound material shall be removed from hardened concrete before additional concrete is placed.
- B. Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.
- C. Formwork shall have been completed; reinforcement shall have been secured in place; expansion joint material, anchors, and other embedded items shall have been positioned; all preparations shall be reviewed by Architect and project inspector.
- D. Semiporous subgrades shall be sprinkled sufficiently to eliminate suction and porous subgrades shall be sealed.
- E. Concrete shall not be placed on frozen ground.

3.2 PRODUCTION OF CONCRETE

- A. General: All concrete shall be mixed until there is a uniform distribution of materials and shall be discharged completely before mixer is recharged.
- B. Ready-Mixed Concrete: Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.
- C. Job-Mixing: Job mixing of structural concrete will not be permitted. Job mixing of concrete for other purposes will be permitted only when reviewed by the Architect. Job mixed concrete shall conform to ACI 318. The capacity of the mixer shall be such that it will handle one or more full sack batches.
- D. Control of Admixtures:

1. Admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.
2. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.
3. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.
4. Admixtures shall be used in accordance with the manufacturer's instructions.

3.3 CONVEYING

- A. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
- B. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:
 1. Truck mixers, agitators and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.
 2. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. A suitable device shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
- C. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
- D. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2-in. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. When the concrete is placed into final position by means of pumping, the pumping method for placing concrete shall be reviewed by the Architect and approved by the Division of the State Architect, at least one week prior to placing the concrete.

3.4 DEPOSITING

- A. General: Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the for

mation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as shown in the contract documents or as approved. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

- B. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.
- C. Consolidation: All concrete shall be consolidated by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8,000 vibrations per min. and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 in. apart. At each insertion, the duration shall be sufficient to consolidate the concrete, but not sufficient to cause segregation. A spare vibrator shall be kept on the job site during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented if necessary by spading to work the coarse aggregate back from the formed surface.
- D. In depositing concrete in columns, walls or thin sections of considerable height, openings in forms, elephant trunks, tremies or other devices, shall be used that will permit the concrete to be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or metal reinforcement above the level of the concrete. Concrete shall not be allowed to drop freely more than six feet. Such devices shall be so installed that concrete will be dropped vertically.
- E. After concreting is started, it shall be carried on as a continuous operation until placing of a panel or section, as defined by its boundaries or predetermined joints, is completed.
- F. Top surfaces of vertically formed lifts shall be poured generally level in layers not to exceed 18 inches.
- G. Where conditions made consolidation difficult, or where reinforcement is congested, batches of concrete adjusted to smaller size aggregates shall be used. The concrete batches shall be reviewed by the Architect.

3.5 TEMPERING AND CONTROL OF MIXING WATER

- A. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.
- B. When concrete arrives at the project with slump below that suitable for placing, as indicated by the specifications, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. An addition of water shall be accompanied by a quantity of cement sufficient to maintain the proper water-cement ratio. Such addition shall be reviewed by the Architect.

3.6 WEATHER CONDITIONS

A. Cold Weather Requirements:

1. Comply with the applicable provisions of ACI 306.1, except as modified herein.
2. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing or near freezing weather. All concrete materials and all reinforcement, forms, fillers, and ground with which the concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.
3. When mixing concrete during freezing or near freezing weather, or when the surrounding air is expected to be below 40° F. during placing or within 24 hr. thereafter, the mix shall have a temperature of at least 50° F., but not more than 90° F. The concrete shall be maintained at a temperature of at least 50° F. (55° F for sections less than 12 inches in any dimension) for not less than 72 hours after placing. When necessary, concrete materials shall be heated before mixing. Special precautions shall be taken for the protection of transit- mixed concrete.
4. If water or aggregate is heated above 100°F, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 100° F.
5. Do not place concrete during rain, sleet or snow.
6. All concrete placed at ambient temperatures below 50° F shall contain an accelerator admixture as specified herein.

B. Hot Weather Requirements:

1. Comply with the applicable provisions of ACI 305 except as modified herein.
2. When the ambient temperature exceeds 90° F, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that may impair required strength or serviceability of the member or structure.
3. The ingredients shall be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for all or part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered.
4. The placing temperature of the mix shall not exceed 90 ° F.
5. All concrete placed at ambient temperatures above 80°F shall contain a retarding admixture as specified herein.

3.7 EMBEDDED ITEMS AND CONSTRUCTION JOINTS

A. Conduits and Pipes Embedded in Concrete:

1. Pipes, other than conduits for electrical circuits, shall not be embedded in structural concrete unless specifically reviewed by the Architect and approved by the Division of

the State Architect. Any pipe or conduit may pass through any walls or floor slab by means of a sleeve so located that it does not impair the strength of the structure. Openings larger than 12 inches in any dimension shall be as detailed on the structural plans.

2. Unless otherwise approved, embedded pipes or conduits, other than those merely passing through, shall be not larger in outside dimension than one-third the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters or widths on center and shall have at least 1.5 inch concrete cover.
3. Sleeves, pipes, or conduits of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

B. Construction Joints:

1. Typical details and proposed locations of construction joints shall be as indicated on the Drawings. Joints shall be located as to least impair the strength of the structure as directed by the Architect and shall conform to the typical details.
2. Joints not indicated on the contract documents shall be located and constructed to minimize the impact on the strength of the structure. Joint types and location shall be acceptable to the Architect. In general, joints shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.
3. All reinforcement shall be continued across joints. Longitudinal keys at least 1-1/2 in. deep shall be provided in all joints in walls and between walls and slabs or footings. Other keys and inclined dowels shall be acceptable to the Architect.
4. The surface of all horizontal construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix. The contact surface must be thoroughly cleaned by chipping or sand blasting the entire surface not earlier than five days after initial pour or by an approved method that will assure equal bond such as a thorough hose washing of the surface not less than two or more than four hours after the concrete is placed (depending on setting time), all wash water and chalk-like material being entirely cleaned from the surface.
5. In the event that the contact surface becomes coated with earth, sawdust, etc., after being cleaned, the entire surface so coated shall be recleaned.
6. A mix containing the same proportion of sand and cement used in the concrete plus a maximum of 50 percent of the coarse aggregate shall be placed on horizontal joints before proceeding with the regular specified mix.
7. A delay at least until the concrete in columns and walls is no longer plastic must occur before casting or erecting beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

8. Bonding: When a bonded construction joint is required, bond shall be obtained by the use of a bonding compound for concrete as specified herein and shall conform to the manufacturer's instructions.
- C. Waterstops:
1. The material, design, and location of waterstops in joints shall be as indicated in the contract documents.
 2. Each piece of premolded waterstop shall be of maximum practicable length in order that the number of end joints will be held to a minimum.
 3. Joints at intersections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective watertightness fully equal to that of the continuous waterstop material, shall permanently develop not less than 50 percent of the mechanical strength of the parent section, and shall permanently retain their flexibility.
 4. The waterstop shall be securely held in place prior to pouring concrete.
 5. The concrete shall be well vibrated adjacent to the waterstops to insure consolidated concrete without voids.
- D. Control Joints:
1. Joints in slabs on grade shall be located and detailed as indicated in the contract documents.
 2. If saw-cut joints are required or permitted, cutting shall be timed properly with the set of concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking.
 3. Plastic Strip Slab Control Joints: After preliminary troweling, the concrete shall be parted to a depth of approximately 2" with a joint thin metal straight edge. The plastic strip shall then be inserted in the impression so that the upper surface of the pull-top stiffener is flush with the concrete and pull-top stiffener is immediately peeled off. After the pull-top is removed the concrete shall be floated to fill all voids adjacent to the strip. During final troweling, the edges at plastic control joints shall be finished to a radius not to exceed 1/8" using a slit jointer tool. The finished joint opening shall not be wider than 1/8" exclusive of radii.
 4. Sawcut joints in concrete may be used as an alternative to plastic strip control joints. At each control joint location saw cut concrete with Soff-Cut Model 566/656 Saw as manufactured by Soff-Cut International, Corona, CA. Sawings shall be completed no later than 2 hours after final finish, but sooner than 2 hours if the weight of the saw and operator can cut the concrete without disturbing the final finished product. The depth of cut as indicated on drawings.

3.8 CURING AND PROTECTION

- A. General:
1. Comply with the applicable provisions of ACI 308 except as modified herein.

2. Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval.

B. Preservation of Moisture:

1. For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing:
 - a. Ponding or continuous sprinkling
 - b. Application of absorptive mats or fabric kept continuously wet
 - c. Application of sand kept continuously wet
 - d. Application of waterproof sheet materials, conforming to ASTM C171
 - e. Application of other moisture-retaining covering reviewed by Architect.
 - f. Application of a curing compound conforming to ASTM C309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proven that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications. Exterior slabs, sidewalks, curbs, and architectural concrete shall be cured with the specified clear, non-yellowing curing compound.
2. When concrete slab placements are subject to high temperatures, wind and/or low humidity, the Architect may require the use of the specified surface evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation.
3. Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the time prescribed.
4. Curing in accordance with Subparagraph 1 or 2 shall be continued for at least 7 days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached 70 percent of the specified 28 day strength. If one of the curing procedures of Subparagraph 1(a) through 1(c) is used initially, it may be replaced by one of the other procedures of Subparagraph 1 any time after the concrete is 1 day old provided the concrete is not permitted to become surface dry during the transition.
5. Liquid membrane curing compounds shall not be used for curing slabs on grade when the ambient temperature exceeds 90° F or the wind velocity exceeds 10 mph.

6. Liquid membrane curing compounds shall not be used for curing when freezing weather is anticipated during the first few days of curing period.

C. Temperature, Wind and Humidity:

1. Cold weather: When the mean daily outdoor temperature is less than 40 degrees F, the temperature of the concrete shall be maintained between 50 and 70 degrees F for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hr. unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
2. Hot weather: When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
3. Rate of temperature change: Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5° F in any 1 hour or 50° F in any 24 hour period.

- D. Protection from Mechanical Injury: During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete. During the first 2 day period of curing, no traffic on or loading of the floors will be permitted.

3.9 FINISHING OF FORMED CONCRETE SURFACES

A. General:

1. After removal of forms the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the contract documents or if the finish is not designated in the contract documents, the following as-cast finishes shall be used as applicable:
 - a. Rough form finish - For all concrete surfaces not exposed to public view.
 - b. Smooth form finish - For all concrete surfaces exposed to public view.
 - c. Slip resistance $SCOF > 0.6$**
2. When finishing is required to match a small sample furnished to the contractor, the sample finish shall be reproduced on an area at least 100 sq. ft. in an inconspicuous location designated by the Architect before proceeding with the finish in the specified location.

B. As-cast finishes:

1. Rough form finish: No selected form facing materials shall be required for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with

h the texture imparted by the forms.

2. Smooth form finish: The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other acceptable material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

C. Rubbed Finishes: The following finishes shall be produced on concrete with a smooth form finish. Where smooth rubbed finish is to be applied, the forms shall have been removed and necessary patching completed as soon after placement as possible without jeopardizing the structure.

1. Grout cleaned finish: No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accessible. Cleaning as the work progresses shall not be permitted. Mix 1 part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint. White portland cement shall be substituted for a part of the gray portland cement in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, burlap, or other means. After the surface whitens from drying (about thirty minutes at normal temperatures), rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.
2. Cork floated finish: Remove forms at an early stage, within 2 to 3 days of placement where possible. Remove ties. Remove all burrs and fins. Mix one part portland cement and one part fine sand with sufficient water to produce a stiff mortar. Dampen wall surface. Apply mortar with firm rubber float or with trowel, filling all surface voids. Compress mortar into voids using a slow-speed grinder or stone. If the mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer. Produce the final texture with a cork float using a swirling motion.

D. Related unformed surfaces: Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonable consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

3.10 CONCRETE SLAB FINISHES

- A. Integral monolithic finish shall be produced by striking surfaces of structural slabs at proper level. The concrete shall be rolled or tamped to force aggregate away from surfaces and surface shall then be screeded. After screeding and while the concrete is still plastic, the surface shall be floated with wood, cork, or metal floats or with a power finishing machine. During this operation, the surface shall be brought to a true grade by cutting or filing as may be

appropriate. Care shall be exercised to avoid overworking the plastic concrete.

- B. Specified Finishes: Concrete finishes shall be as noted or scheduled on the Drawings to conform to the finish types listed below. When a specific type finish is not scheduled or otherwise noted, the finish shall be as follows:

<u>Floor Use</u>	<u>Finish Type</u>
Surfaces intended to receive bonded applied cementitious applications	Scratch finish
Surfaces intended to receive roofing, waterproofing membranes, or sand bed terrazzo	Floated Finish
Floors intended as walking surfaces; surfaces intended to receive floor coverings	Medium Brown Finish
Exterior Exposed Concrete	Medium Broom Finish
Exterior Steps and Landings	Medium Broom Finish
Interior or Exterior Pedestrian Ramps (with slopes exceeding 6%)	Heavy Broom Finish
Interior Exposed Concrete	Medium Broom and Sealed Finish

- C. Finish types:

1. Scratched Finish: After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, the surface shall be roughened with stiff brushes or rakes before the final set.
2. Floated Finish: After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10-ft. straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface within Class B tolerance throughout. The slab shall then be refloated immediately to a uniform sandy texture.
3. Troweled Finish: The surface shall first be float-finished as specified above. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture and app

earance and shall be plane to a Class A tolerance, except tolerance for concrete on metal

deck shall be Class B. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

4. Broom or Belt Finish: Immediately after the concrete has received a float finish as specified above, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.
5. Cured and Sealed Finish: Apply liquid membrane curing and sealing compound specified herein to the troweled finish in accordance with the manufacturer's recommendations.
6. Sealed Finish: Apply concrete sealer specified herein to a troweled finish in accordance with the manufacturer's recommendations.

D. Finishing tolerances:

1. Finishes with Class A tolerances shall be true planes within 1/8 in. in 10 ft. as determined by a 10-ft straightedge placed anywhere on the slab in any direction.
2. Finishes with Class B tolerances shall be true planes within 1/4 in. in 10 ft., as determined by a 10-ft straightedge placed anywhere on the slab in any direction.
3. Finishes with Class C tolerances shall be true planes within 1/4 in. in 2 ft. as determined by a 2-ft straightedge placed anywhere on the slab in any direction.

E. Subfloors:

1. Concrete floors scheduled to receive finish floor materials, e.g. resilient floor coverings, carpeting, ceramic tile, shall be prepared in accordance with requirements specified in the appropriate floor covering sections of these specifications. In the absence of specific requirements, the subfloor shall be prepared in accordance with recommendations of the finish floor material manufacturer.

3.101 FIELD QUALITY CONTROL

A. General:

1. Concrete materials and operations will be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Architect for final acceptance.
2. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in concrete construction to determine if they are of the quality specified.

B. Testing and Inspection Agencies:

1. The required inspection services shall be performed by the inspection agency designated and/or the project inspector.

2. The necessary testing services shall be performed by a testing agency acceptable to the Architect.
 3. All testing and inspection agencies shall meet the requirements of ASTM E 329.
- C. Testing and Inspection Services: The inspection shall conform to ACI SP-2. The following testing and inspection services shall be performed by the designated agency and the project inspector:
1. Preconstruction Testing: Sample and test aggregates for compliance.
 2. Review and/or check-test the contractor's proposed materials for compliance with the drawings and specifications.
 3. Keep records of all tests and inspections.
 4. Observe forms and placement of placement of reinforcing steel, embedded items, and joints.
 5. Batch Plant Inspection: The quality and quantity of materials used in transit mixed concrete and batched aggregates shall be continuously inspected at the location where materials are measured by a specially approved inspector.
 6. Secure production samples of materials at plants, stock- piles, and at the point of placement during the course of the work and test for compliance with the specifications.
 7. Conduct strength tests of the concrete during construction in accordance with the following procedures:
 - a. Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
 - b. Mold and cure three specimens from each sample in accordance with ASTM C31. Any deviations from the requirements of this Standard shall be recorded in the test report.
 - c. Test specimens in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. The acceptance test results shall be the average of the strengths of the two specimens tested at 28 days. If one specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded. When high early strength concrete is used, the specimens shall be tested at the ages indicated in the contract documents.
 - d. Make at least one strength test (a set of 3 cylinders) for each 50 cubic yards of structural concrete for each grade of concrete used and there shall be at least one test for each day's placement for each grade of concrete used. Provide at least one strength test for each 2000 square fee

t of surface area for slabs or walls.

- e. On a given project, if the total volume of concrete is such that the frequency of testing above would provide less than five strength tests (a set of 3 cylinders) for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- 8. Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C 143.
- 9. Determine air content of normal weight concrete sample for each strength test in accordance with either ASTM C231 or ASTM C 173.
- 10. Determine temperature of concrete sample for each strength test.
- 11. Determine air temperature at placement time. When the ambient temperature falls below 40°F or rises above 95°F, a complete record shall be kept of concrete temperatures and of protection given to concrete during placement and curing.
- 12. Inspect concrete batching, mixing and delivery operations.
- 13. Inspect the construction and removal of forms, falsework and shoring.
- 14. Inspect the conveying, placement, consolidation, finishing, curing, protection, repair, and patching of the concrete.
- 15. Review the contractor's plan for stripping and form removal.
- 16. Provide additional testing and inspection required because of changes in materials or proportions requested by the contractor.
- 17. Record any significant construction loads on completed floors, members, or walls.
- 18. Provide additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.
- 19. Obtain the manufacturer's certificate of conformance and affidavit for cement. If not available, secure and test samples of cement. One sample of cement shall be taken for each 100 tons of cement, except that when used in bulk loading ready-mix plants where separate bins for pretested cement are not available, grab samples shall be taken for each shipment of cement placed in the bin, with not less than one sample being taken for each day's pour and such samples shall be subsequently tested.
- 20. A record shall be kept on the work of the time and date of placing concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the Division of the State Architect.
- 21. Obtain licensed weighmaster's certificates for all concrete deliveries to verify quantities of materials.
- D. Duties and Authorities of Designated Testing and Inspection Agency:
 - 1. Representatives of the agency shall inspect, sample and test the materials and the production of concrete as required by the Architect. When it appears that any material furnished or work performed by the contractor fails to fulfill specification req

uirements, the testing agency shall report such deficiency to the Architect and the contractor.

2. The agency shall report all test and inspection results to the Architect and contractor immediately after they are performed. All test reports shall include the exact location in the work at which the batch represented by a test was deposited. Reports of strength tests shall include detailed information on storage and curing of specimens prior to testing.

E. Responsibilities and Duties of Contractor:

1. The contractor shall submit to the Architect the concrete materials and the concrete mix designs proposed for use.

3.12 SUPERVISION AND TESTING

- A. The contractor is solely responsible for the direction and supervision of the entire construction operation, the performance of materials and labor, safety of working conditions, and the ultimate quality of the structure.

2. The Contractor shall provide and maintain an adequate program of quality control for materials, production methods, and workmanship to assure conformance of all work to the project documents.

3. To facilitate testing and inspection, the contractor shall:

- a. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials.
- b. Advise the designated testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
- c. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hr. as required by ASTM C31.

B. Waivers of Tests and Inspections:

1. Batch Plant Inspection: Batch plant inspection will not be required under the following conditions:
 - a. The concrete plant complies fully with the requirements of ASTM C94, and UBC STD 26-13, and has been certified by an approved testing laboratory to comply with the requirements of the National Ready Mixed Concrete Association. The plant must be equipped with an automatic batcher in which the total batching cycle, except for the measuring and introduction of an admixture, is completed by activating a single starter device.
 - b. The Testing Laboratory shall certify and submit evidence of compliance to the Division of the State Architect and obtain their approval prior for a waiver of batch plant inspection prior to mixing the concrete.
 - c. Batch plant inspection is not required for foundation and slab on grade concrete.

2. If batch plant inspection is not provided the quantities of materials shall be certified by a licensed weighmaster.

3.13 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Evaluation of test results:

1. Test results for standard molded and standard cured test cylinders shall be evaluated separately for each specified concrete mix design.
2. For evaluation of potential strength and uniformity, each specified mix design shall be represented by at least five tests.
3. Acceptance of Concrete: The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three consecutive strength tests results equal or exceed the specified strength f'_c , and no individual strength test result falls below the specified strength f'_c .

B. Investigation of Low-Strength Test Results:

1. If the strength of the molded test cylinders falls below the minimum ultimate compressive strength assumed in the design, the proportions of the concrete mix for the remaining portion of the structure shall be adjusted so as to give concrete of the assumed minimum strength. The doubtful concrete in place shall be tested by taking cores as outline below.

C. Core Tests:

1. Cores shall be taken at representative places throughout the structure as designated by the Architect.
2. Cores at least 4 in. in diameter shall be obtained and tested in accordance with ASTM C42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 to 80 F. relative humidity less than 60 percent), for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
3. The cores shall be tested as required for cylinders.
4. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. If, before testing, one or more of the core shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.
5. Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85 percent of the required compressive strength and no single core is less than 75 percent of the required compressive strength.
6. Core holes shall be coated with an epoxy resin binder and packed with epoxy mortar as described in Paragraph 3-13.

3.14 REPAIR OF SURFACE DEFECTS

A. General:

1. Surface defects, including tie holes, unless otherwise specified by the contract documents, shall be repaired immediately after form removal.

B. Repair of Defective Areas:

1. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No feathered edges will be permitted. The area to be patched and an area at least 6 in. wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. The specified bonding agent shall be used for all patching and the specified epoxy adhesive/ and or epoxy mortar shall be used for all structural repairs. All patching and repairs shall have prior approval of the Architect as to method and procedure. Any concrete which has not been formed as shown on the contract drawings, is out of alignment or level or indicated a defective surface or unsoundness of any nature shall be removed and replaced to the limits required by the Architect unless the Architect grants permission to patch or otherwise correct the defective work. Permission to patch or attempt the correction shall not be construed to be a waiver of the Architect's right to require complete removal of the defective work.
2. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White portland cement shall be substituted for a part of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
3. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patch area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.
4. Repair materials and procedures, other than those specified may be used for repair when reviewed by the Architect. Materials include but are not limited to:
 - a. Shotcrete.
 - b. Commercial patching products, including:
 - (1) Latex-modified portland cement mortar.
 - (2) Latex bonding agents if not re-emulsifiable when subsequently exposed to moisture.

- (3) Epoxy mortars and compounds that are moisture insensitive with an epoxy binder that conforms to ASTM C 811, Type III.

Caution shall be exercised when using these materials with regard to possible color changes from weathering and delamination due to different coefficients of thermal expansion.

- 5. When required for exposed concrete that will be left unpainted, color tests shall be made with patching methods and materials to determine color compatibility.
- C. Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.
- D. Foreign Materials: In the event efflorescence, stains, oil, grease, or any unsightly accumulation of foreign materials are visible on the exposed interior or exterior surfaces of finished concrete, the Architect may require remedial action to remove such blemishes.
 - 1. Remove oil and grease with detergents and scrubbing and thoroughly wash with water. While the surface is wet, apply a grout coat of cement and fine sand mixed 1 to 1-1/2 with white cement added as directed to attain desired color. Immediately float surface with cork or other suitable floats to fill any holes. While the grout is plastic, finish with a sponge rubber float, removing excess grout. This shall be done when grout will not be pulled from holes. Allow surface to dry thoroughly, then rub with dry burlap to remove all dry loose grout. Complete all cleaning on any section in one day, leaving no loose grout on the surface after the termination of the regular work day.
 - 2. Spots or streaks remaining may be lightly dry honed in such manner that will not change the texture of the concrete.

3.15 CLEANING:

- A. All interior cement finishes shall be washed and mopped clean. Floors scheduled to receive floor coverings shall be left in proper condition to receive such covering. Integrally colored floors shall be waxed, except as may otherwise be required for a specified system. Exterior slab finishes shall be hosed clean, with all mortar or paint splashes, stains, or other defacements removed to the satisfaction of the Architect. Upon completion all equipment, forming materials and debris shall be removed from the site.

END OF SECTION 033000

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. Clear and grub the site as shown on the Drawings and specified in this Section.
- B. Related Sections:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 31 2000: Earthwork.
 - 3. Section 02 4100: Selective demolition.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials, not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PROTECTION

- A. Protect existing utilities indicated or made known.
- B. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub of sufficient distance away and of sufficient height so trees and shrubs will not be damaged in any way as part of this Work.
- C. Protection of persons and property:
 - 1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.
 - 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.
 - 4. Barricade and post or backfill all open trenches outside of fenced areas when not on job site.
- D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- E. Maintain access to the site at all times.

3.3 CLEARING

- A. Prior to earthwork operations, strip entire site of vegetation, organic topsoil. Clear surface and subsurface obstructions and miscellaneous debris from the proposed building, exterior concrete, and paving areas.
 - 1. Stripping: Approximately 3" deep. The actual depth of stripping will be reviewed by the responsible inspecting Geotechnical Engineer.
- B. Clear organic matter, vegetation, rubbish, debris, and loose soil deposits from the banks and bottoms of the irrigation canal and ditch.

3.4 CONSERVATION OF TOPSOIL

- A. Stockpile the stripped organic topsoil in an area clear of new construction in order to provide topsoil for areas shown on the Drawings to be turfed or planted, and to fill planters, without contamination with subsoils.
- B. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.
 - 1. Maintain stockpile free from debris and trash.
 - 2. Keep the topsoil damp to prevent dust and drying out.

3.5 DISPOSAL

- A. Remove brush, grass, roots, trash, and other material from clearing operations. Dispose of away from the site in a legal manner.
- B. Do not store or permit debris to accumulate on the job site.
- C. Dispose of any excess topsoil after fine grading has been accepted by the Architect.
- D. Do not burn debris at the site.
- E. Excavated Soils and Land Clearing Debris: 100% of trees, stumps, rocks, and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled, except for reuse, either on site or off site of vegetation or soil contaminated by disease or pest infestation.
 - 1. Refer to Section 01 7425.

3.6 UTILITIES

- A. Coordinate with utility companies and agencies as required. See Section 02 3100.
- B. Where utility cutting, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

END OF SECTION 31 1000

SECTION 31 2000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. In accordance with pertinent provisions of this Section, trench, excavate, fill, backfill, compact, and grade the site to the elevations shown on the Drawings and as needed to meet the requirements of the construction shown in the Contract Documents.
- B. The work of this Section includes, but is not limited to, the following:
 - 1. Preparation of sub-grade for buildings, walks, pavements, and landscaping.
 - 2. Site grading, cut, fill, and finish, off-haul or import of soil necessary to meet finish grades indicated on the Drawings.
 - 3. Excavation, backfill and compaction for filling construction and trenches.
- C. Related Sections:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 00 3100: Geotechnical data.
 - 3. Section 01 4520: Testing and inspection requirements.
 - 4. Section 01 5720: Storm Water Pollution Protection Plan.
 - 5. Section 01 7120: Field engineering.
 - 6. Section 22 0000: Excavation and backfill for plumbing work.
 - 7. Section 26 6000: Excavation and backfill for electrical work.
 - 8. Section 31 1000: Site clearing, removal and storage of top soil.
 - 9. Section 31 3115: Termite control.
 - 10. Section 32 9000: Top soil amendments and soil preparation for plantings.

1.2 QUALITY ASSURANCE

- A. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the geotechnical engineer.
- C. Verify all grade and trench elevations as specified in Section 01 7120.
- D. All improvements within property owned by a City, County or State Entity, shall be in accordance with the Standard Specifications of the authority having jurisdiction.

1.3 TRENCHING AND EXCAVATION SAFETY

- A. All trenches and excavation in excess of 4'-0" in depth and areas of visibly unstable soils shall be shored or otherwise stabilized in conformance with current local or state codes, ordinances and requirements. In addition, the Contractor shall notify the Owner of suspected hazardous waste or other unusual physical conditions as provided by law.
- B. All open trenches and excavations outside the fenced construction area shall be properly barricaded for public and worker safety. Trenches shall be adequately covered or backfilled prior to ceasing work or leaving the work site.
- C. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

1.4 EXISTING UTILITIES

- A. Field verify the location of all existing underground utilities prior to beginning any earthwork. Work around and protect all existing utilities during the course of the Work.
- B. Where existing utilities are indicated on the drawings, extreme care shall be exercised in excavating near these utilities to avoid damage, and the Contractor will be held responsible for any damage caused by construction operations.
- C. Should utilities not indicated on the drawings be found during construction, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage arising from construction operations after discovery of these utilities.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2S00.

2.2 SOIL MATERIALS

- A. Fill and Backfill Materials: Fill shall consist of select material. Native soil, free from organic matter and rocks or cobbles larger than 3", may be used as fill at the site as follows:
 - 1. Satisfactory Soil Materials: Are defined as those complying with ASTM D2487 Soil Classification Groups GW, GP, GM, SM, SW, and SP.
 - 2. Unsatisfactory Soil Materials: are defined as those complying with ASTM D2487 Soil Classification Groups GC, SC, MH, ML, CL, CH, OL, OH, and PT.
- B. Import Material: Import material, if required, shall consist of homogenous, non-corrosive, non-expansive, inorganic granular soils free of toxic materials and conforming to the following criteria:
 - 1. Gradation:
 - a. 3" Sieve: 100% passing
 - b. 3/4" Sieve: 80-100% passing
 - c. No. 4 Sieve: 60-100% passing
 - d. No. 200 Sieve: 20-70% passing
 - 2. Plasticity Index, ASTM D4318:
 - a. Liquid limit: < 25
 - b. Plasticity index: < 9
 - 3. Expansion Index: < 20
 - 4. Organic Content: < 3% by dry weight.
 - 5. Minimum "R" Value: 15
 - 6. Corrosivity:
 - a. pH: 6 to 8
 - b. Minimum resistivity (ohm-cm): > 2,000
 - c. Soluble sulfate (ppm): < 2,000
 - d. Soluble chloride (ppm): < 500
 - 7. Import fill material shall be approved by the geotechnical engineer prior to transport to the site.
- C. Engineered Fill Materials:
 - 1. Satisfactory Soil Materials as defined in paragraph 2.2.A.1 above, or
 - 2. Import Material defined in 2.2.B above.

- D. Sand for Utility Bedding: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- E. Toxic Testing of Import Fill Material:
 - 1. The Contractor shall notify the Owner, Architect, and Testing Laboratory for the project, of the location and origin of all fill material intended for this project. Such notification shall be not less than 21 days prior to transport of the material.
 - 2. Both native and stockpile soils shall be subject to testing to determine suitability of the soil as related to toxic substances on school sites.
 - 3. The Owner will pay for only one passing test from one import source. Additional tests, and retests of failed material shall be paid by the Contractor.
 - 4. Should testing indicate toxic substances at levels above those acceptable on school sites by the State of California, Department of Toxic Substance Control (DTSC), the subject soil will not be permitted on the proposed school site.
 - 5. Any delay caused by materials found not to be compliant, shall not be accepted as justification for contract time extension or related claims.

2.3 TOPSOIL

- A. Topsoil:
 - 1. Friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoils, roots, heavy or stiff clay, stones and gravel, noxious weeds, sticks, brush, litter, and other deleterious matter.

2.4 ACCESSORY MATERIALS

- A. Utility Identification Tape: 2" wide metallic plastic material inscribed with caution message related to the buried utility below (i.e., **ELECTRICAL LINE BURIED BELOW, SEWER LINE BURIED BELOW**, etc.) by McMaster-Carr or approved equal.
- B. Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this Work by governmental agencies having jurisdiction.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

- A. Comply with pertinent provisions of this Section, Section 01 7120, and the Grading Plan.

3.3 DEWATERING AND WATER CONTROL

- A. Water Control:
 - 1. Establish and construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils.

2. Completely drain construction site during periods of construction to keep soil materials sufficiently dry.
 3. Temporary excavations for the project construction should be left open only for as short a time as possible and should be protected from water runoff.
- B. Dewatering:
1. Remove all water, including rain water, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
 2. Keep excavations and site construction area free from water.
 3. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 4. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
 5. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from open excavations, unfinished fills, or other low areas to prevent softening of exposed surfaces.
 6. Dispose of water away from the work in a suitable manner without damage to adjacent property or menace to public health.
 7. Protect existing storm drain system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.
- C. Unsuitable Soil Support: When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified.

3.4 DUST CONTROL

- A. The San Joaquin Valley Air Pollution Control District regulates all dust control and emission standards throughout the Central Valley. Regulation VIII – Fugitive PM₁₀ Prohibitions requires that a Dust Control Plan be completed for a large majority of construction projects.
- B. The Contractor shall be responsible to prepare the Dust Control Plan in accordance with SJVAPCD Rule 8021 and obtain approvals from San Joaquin Valley Pollution Control District prior to any earthwork operations.
- C. The Contractor shall implement all measures listed in the Dust Control Plan as required for the project.
- D. Construction work shall not commence until the Dust Control plan is completed and approved by the District.
- E. Whether a Dust Control Plan is required for the project or not, the Contractor shall be responsible for complying with the requirements of Rule 8021.

3.5 PROCEDURES

- A. Utilities:
1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
 2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.
 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Utility Company.
- B. Protection of Persons and Property:

1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.
- C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- D. Maintain access to adjacent areas at all times.

3.6 BORING

- A. Provide mechanical boring equipment to bore under existing asphalt, concrete, or other surfaces or objects as noted on the drawings. All borings shall be a minimum of 24" under the substrate material unless otherwise authorized by the Architect.
- B. Holes shall be bored not to exceed 1" larger diameter than the largest component remaining in the excavation.
- C. **Water or air pressure jetting** are not permitted, unless they comply with the following requirements.
1. All surfaces of the hole can be visually inspected with 6' maximum length and,
 2. All objects shall be supported continuously to prevent sagging and,
 3. The hole shall be filled with compacted damp sand and inspected by the Project Inspector or Materials Testing Lab technician.
- D. Comply with requirements of Section 01 7330.

3.7 SITE PREPARATION

- A. Over-excavation and Preparation at Building Areas:
1. After clearing, excavate native soils in areas indicated to a depth of 3'-6" below the present site grade. Final over-excavation depth should be determined by the geotechnical engineer at the time of grading and will be dependent on the depth of the root system and soil disturbance caused by their removal.
 2. At a minimum, include entire building areas, and extend at least 5'-0" beyond exterior footing line, including 5'-0" beyond exterior column footing edges.
 3. Remove roots and other vegetation remaining in excavated area which are larger than ½" in diameter.
 4. Scarify bottom of excavation to minimum depth of 8".
 5. Bring moisture conditions to above optimum moisture content and compact excavated area to a minimum of 90% of maximum dry density; ASTM D1557.
 6. Place engineered fill materials required to establish finish grade in lifts no greater than 8" loose depth and compact to a minimum of 90% of maximum dry density; ASTM D1557.
- B. Over-excavation and Preparation at Asphalt or Concrete Pavement and Concrete Flatwork Areas:
1. Excavate native soils to a minimum depth of 3'-6" below the present site grade. Final over-excavation depth should be determined by the geotechnical engineer at the time of grading and will be dependent on the depth of the root system and soil disturbance caused by their removal, in an area extending a minimum of 5'-0" beyond the edge of the pavements.
 2. Remove roots and other vegetation remaining in excavated area which are larger than ½" in diameter.
 3. Scarify bottom of excavation to minimum depth of 8".
 4. Bring moisture conditions to above optimum moisture content and compact excavated area to a minimum of 90% of maximum dry density; ASTM D1557.
 5. Place engineered fill materials required to establish finish grade in lifts no greater than 8" loose depth and compact to a minimum of 90% of maximum dry density; ASTM D1557.
 6. Compact the top 12" of subgrade to a minimum of 95% of maximum dry density; ASTM D1557.

- C. Root Removal at Trees:
 - 1. Completely remove root systems to a minimum depth of 24" below the bottom of the lowest structure or footing or 36" below finished subgrade, whichever is lower.
 - 2. Excavate root systems deeper than the elevation indicated above to allow no roots larger than 2" in diameter.
 - 3. Treat roots remaining in the soil with a weed killer approved by the State of California for that purpose.
 - 4. Backfill cavities resulting from root removal with earth materials placed and compacted as required by this Section.

3.8 EXCAVATION

- A. Perform excavation of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated and specified herein.
- B. Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
- C. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on a track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.
- D. Surplus Materials: Dispose of unsatisfactory excavated materials, and surplus satisfactory excavated material, away from the site at disposal areas arranged and paid for by the Contractor.
- E. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect/Engineer. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.
- F. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.
- G. Unauthorized Excavation:
 - 1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Architect or the geotechnical engineer.
 - 2. Under footings, foundations, or retaining walls:
 - a. Fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.
 - b. When acceptable to the geotechnical engineer, lean concrete (minimum 2000 psi) may be used to bring bottom elevations to proper position.
 - 3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the geotechnical engineer.
- H. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.
- I. Stability of Excavations:
 - 1. Slope sides of excavation to comply with local codes and ordinances having jurisdiction.
 - 2. Shore and brace where sloping is not possible because of space restrictions or stability of the materials being excavated.
 - 3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- J. Shoring and Bracing:
 - 1. Provide materials for shoring and bracing as may be necessary for safety or personnel, protection of work, and

- compliance with requirements of governmental agencies having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.
 3. Carry shoring and bracing down as excavation progresses.

K. Use of Explosives: **NOT PERMITTED.**

3.9 FILLING AND BACKFILLING

- A. Backfill excavations as promptly as progress of the Work permits, but not until:
1. Acceptance of construction below finish grade;
 2. Inspecting, testing, approving, and recording locations of underground utilities;
 3. Concrete formwork is removed;
 4. Shoring and bracing are removed, and voids have been backfilled with satisfactory materials;
 5. Trash and debris have been removed; and
 6. Horizontal bracing is in place on horizontally supported walls.
- B. Placing and Compaction:
1. Place backfill and fill materials in layers not more than 8" in loose depth.
 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
 3. Compact each layer to required percentage of maximum density for the area.
- C. Moisture Content:
1. When the moisture content of fill material is below the lower limit specified by the Geotechnical Engineer, add water until the moisture content is as specified.
 2. When the moisture content of fill material is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.
 3. Do not place, spread, or compact fill while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, do not resume fill operations until moisture content and density of previously placed fill are satisfactory.
 4. Where soil has been softened or eroded by flooding, by placement during unfavorable weather, remove damaged areas and recompact as described for fill and compaction.
 5. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
 6. Where subgrade is spongy or pumping due to conditions beyond the Contractor's control, and aeration or other methods do not bring moisture content within specified levels, stop work and contact the Architect and Geotechnical Engineer for further direction.

3.10 TOPSOIL

- A. Place topsoil to the following compacted thicknesses:
1. Areas to be seeded: 6"
 2. Areas to be sodded: 4"
 3. Shrub beds: 18"
 4. Flower beds: 12"
- B. Topsoil Placement:
1. Where topsoil is to be placed, scarify surface to depth of 6".
 2. Place topsoil during dry weather.
 3. Remove roots, weeds, rocks, and foreign material while spreading.
 4. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
 5. Roll placed topsoil.

3.11 TRENCHING

- A. Trenching:

1. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
 2. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
 3. Do not interfere with 45 degree bearing splay of foundations.
 4. Cut trenches wide enough to allow inspection of installed utilities.
 5. Hand trim excavations. Remove loose matter.
 6. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
 7. Remove lumped subsoil, boulders, and rock up to 1.0 cu yd measured by volume.
 8. Remove excavated material that is unsuitable for re-use from site.
 9. Stockpile excavated material to be re-used in area designated on site in accordance with this Section 31 2000.
 10. Remove excess excavated material from site.
- B. Preparation for Utility Placement:
1. Cut out soft areas of subgrade not capable of compaction in place. Backfill with engineered fill.
 2. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
 3. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.
- C. Backfilling:
1. Backfill to contours and elevations indicated using unfrozen materials.
 2. Employ a placement method that does not disturb or damage other work.
 3. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
 4. Maintain optimum moisture content of fill materials to attain required compaction density.
 5. Slope grade away from building. Make gradual grade changes. Blend slope into level areas.
 6. Correct areas that are over-excavated.
 7. Reshape and re-compact fills subjected to vehicular traffic.
- D. Utility Installation: Install underground utilities according to the manufacturer's written recommendations. In addition to the manufacturer's recommendations, install underground utilities as follows:
1. Underground Utility Line Cover: No less than 12".
 2. Bedding: Minimum of 6" compacted sand bedding under the pipe or conduit.
 3. Envelope: Compacted sand extending 6" above and around the pipe or conduit.
 4. Backfill Material: Remaining backfill material may consist of native soil or engineered fill material as described above.
 5. Place and compact utility trench backfill in accordance with the requirements for engineered fill.
- E. Utility Identification:
1. Utility Identification Tape: 2" wide metallic plastic material inscribed with a CAUTION message related to the buried utility.
 2. Identify each utility pipe or conduit by the use of a continuous underground warning tape.
 3. Locate tape 12" directly above the pipe or conduit and not less than 6" below the finished grade.
 4. Provide one strip of identification tape for each 18" of trench width.

3.12 GRADING

- A. General: Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas. Smooth the finished surfaces within specified tolerance.
- B. Finish Grading Outside Building Lines:
1. Grade areas adjacent to buildings to achieve drainage away from the structures, and to prevent ponding.
 2. Finish the surfaces to be free from irregular surface changes, and:
 - a. Shape the surface of areas scheduled to be under walks to line, grade, and cross-section, with finished

- surface not more than 0.10 foot above or below the required subgrade elevation.
- b. Shape the surface of areas scheduled to be under pavement to line, grade, and cross-section, with finished surface not more than 0.10 feet above or below the required subgrade elevation.
- c. Shape finish grade adjacent to building to slope a minimum of 2% away from the exterior footings and wall, for a distance of 5'-0".

3.13 COMPACTION

- A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D1557.
- B. Moisture Control: Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.
- C. Densities: Provide not less than the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place, and as approved by the geotechnical engineer.
 - 1. **Structures:** Scarify and compact the top 8" of subgrade and each layer of fill material or backfill material at 90% of maximum density.
 - 2. **Lawn and unpaved areas:** Compact the top 8" of subgrade and each layer of fill material or backfill material at 85% of maximum density;
 - 3. **Concrete Walks:** Scarify and compact the top 8" of subgrade and each layer of fill material or backfill material at 90% of maximum density.
 - 4. **Asphalt Pavements:** Scarify and compact the top 12" of subgrade and each layer of fill material or backfill material at 95% of maximum density.
 - 5. **Trenches:** Provide a minimum of 3" of compacted sand bedding under pipe or conduit, and provide envelope extending 12" above pipe or conduit. Compact remaining backfill to 90% of maximum density except the upper 24" of those trenches located within structures, walks, and pavement areas which shall be compacted to a minimum of 95% of maximum dry density.

3.14 FIELD QUALITY CONTROL

- A. Secure the Geotechnical Engineer's inspection and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- B. The Owner's testing laboratory will provide at least the following tests:
 - 1. At paved areas, at least 1 field density test for every 10,000 sq. ft. of paved area, but not less than 3 tests.
 - 2. In each compacted underlying fill layer, 1 field density test for every 7,500 sq. ft. of overlaying paved area, but not less than 3 tests.
 - 3. In building areas, at least 1 field density test for every 2,000 sq. ft. of building coverage.
 - 4. At least 1 field density test per every 200 lineal foot of trench over 3'-0" of trench depth.
- C. If, in the Geotechnical Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing under the provisions of Section 01 4520 of these Specifications.

END OF SECTION 31 2000

SECTION 31 3115 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide soil poisoning to control subterranean termites as specified herein and needed for a complete and proper treatment.
- B. Related Sections:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.
 - 2. Section 31 2000: Earthwork.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 3300.
 - 1. **Product Data:** Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
 - 2. **Installation Procedures:** Submit manufacturer's recommended installation procedures. **Provide additional copy of manufacturer's application recommendations and rates, to Architect and Inspector of Record, not less than 72 hours prior to application of termite treatment.**

1.3 QUALITY ASSURANCE

- A. Qualifications of Applicator:
 - 1. Properly licensed to provide such services by governmental agencies having jurisdiction.
 - 2. Not less than five years' successful experience in soil treatment for subterranean termites.

1.4 SPECIAL WARRANTY

- A. Upon completion of the Work, and as a condition of its acceptance, deliver to the Architect two copies of a special warranty and maintenance agreement signed by an authorized representative of the installing subcontractor, and co-signed by the Contractor, agreeing:
 - 1. To make an inspection of the Work once each year for a total period of five years following Date of Substantial Completion for the purpose of detecting termite infestation;
 - 2. If termite infestation is found during that five year period, to retreat in accordance with prevailing practices of the trade and within ten calendar days after such infestation is discovered;
 - 3. To repair damage to the Work caused by termites during that five year period, to a maximum cost of \$5,000;
 - 4. To make such inspections, retreatment, and repairs at no additional cost to the Owner.
 - 5. This Warranty and Maintenance Agreement shall be in addition to the warranty requirements of the Contract Documents, and the enforcement of its provisions, shall not deprive the Owner of any action, right, or remedy otherwise available to him.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions and requirements of State of California, and EPA.

PART 2 - PRODUCTS

2.1 TERMITE CONTROL MATERIALS

- A. Acceptable Products:
 - 1. Demon MAX by Syngenta.
 - 2. Talstar by FMC Corporation.
 - 3. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2S00.
- B. Product Characteristics:
 - 1. Approved by governmental agencies having jurisdiction.
 - 2. Active ingredients: Minimum of 25.3% Cypermethrin
 - 3. Inert ingredients: 74.7%
- C. If combinations of toxicants are approved by governmental agencies having jurisdiction, provide toxicants having such approval and in the maximum strength so approved, at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION

- A. Apply toxicant at following locations:
 - 1. Under slabs-on-grade.
 - 2. At both sides of foundation surface.
- B. Place all termite control materials in strict accordance with the manufacturers requirements and recommendations. Follow printed labels and instructions in a manner as to provide complete coverage without jeopardizing public safety.

END OF SECTION 31 3115

SECTION 32 1210 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide asphalt paving, aggregate base, and wheel stops where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related Sections:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.
 - 2. Section 31 2000: Earthwork
 - 3. Section 32 1720: Pavement Marking

1.2 COMPENSATION FOR ASPHALT OIL

- A. The compensation payable for asphalt oil will be increased or decreased in conformance with the provisions of this section for fluctuations in crude oil prices exceeding 5 percent higher or lower than the price index at the time of bid.
- B. The adjustment in compensation in each monthly billing will be determined in conformance with the formulae indicated in Exhibit A attached at the end of this section.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 3300.
 - 1. Manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
 - 2. Certificates, signed by the asphaltic concrete paving materials producer and the asphaltic concrete paving subcontractor, stating that materials meet or exceed the specified requirements.

1.4 QUALITY ASSURANCE

- A. All improvements within property owned by a City, County or State Entity, shall be in accordance with the Standard Specifications of the authority having jurisdiction.

1.5 SPECIAL WARRANTY

- A. In addition to the warranty requirements of the Contract Documents, provide a material and workmanship warranty signed by an authorized representative of the installing subcontractor and cosigned by the Contractor with an extended warranty correction period of 2-years.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 6200.
- B. All materials and products shall be in conformance with the current construction standards and construction

specifications of the governing jurisdiction.

2.2 ASPHALT CONCRETE

- A. Asphalt Concrete: Type B; Standard Specifications Section 39, California Department of Transportation, 2006 edition.
- B. Aggregate: 1/2" maximum (medium).
- C. Asphalt Binder: Steam refined paving asphalt classified as PG 64-10 ; Section 92 of the State of California Standard Specifications, 2006 edition.

2.3 AGGREGATE BASES, SUBBASES, AND RECYCLED BASES

- A. Aggregate Bases:
 - 1. Class 2 conforming to Section 26 of the Caltrans Specifications, 2010 edition.
 - 2. Gradation: As specified for 1-1/2 inch maximum aggregate.
- B. Aggregate Subbase:
 - 1. Conform to Section 2S of the Caltrans Specifications, 2010 edition.
 - 2. Class as noted on the Drawings.
- C. Recycled Base and Subbase Courses: Aggregate base or subbase may be composed of salvaged oiled earth and asphalt concrete from the existing roadway recycled and mixed with imported materials to meet the requirements of the base or subbase class noted on the Drawings.
 - 1. Contractor shall be responsible for paying for "R" Value testing and other required testing of the salvaged materials.
 - 2. Contractor must show that "R" Value and other properties of the salvaged material meets or exceeds the requirements of the base or subbase class noted on the Drawings.
 - 3. The amount of recycled/reclaimed material in the mix may be up to 100 percent of the total volume of the aggregate used.

2.4 SEAL COAT

- A. Asphalt based seal coat shall be "Guardtop" by Industrial Asphalt or approved equal.

2.5 OTHER MATERIALS

- A. Weed Killer: Treflan by Elanco Products Co. or Oust by Dupont.
- B. Wheel Stops: 6"x6"x48" reinforced precast concrete with two 3/4"x24" steel anchor pins set in epoxy.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINAL PREPARATION OF SUBGRADE

- A. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle

the entire area to be paved, and then compact to a smooth, hard, even surface of 95% compaction to receive the aggregates.

- B. Apply the specified weed killer to the entire area to be paved. Adhere to the manufacturer's application recommendations.

3.3 PLACEMENT OF BASE COURSES

- A. Base:
 - 1. Spread specified base material to a thickness providing the compacted thickness indicated.
 - 2. Place in lifts not exceeding 8" in thickness.
 - 3. Compact to 95%.
- B. Moisture Content: Use only the amount of moisture needed to achieve the specified compaction.

3.4 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Install the specified headers and stakes to achieve the arrangement of paving indicated.
- B. Remove all loose materials from the compacted base.
- C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations.
- D. Adjust frames and covers, if so required, to meet final grades.
- E. Receipt of Asphaltic Concrete Materials:
 - 1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.
 - 2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, nor during fog, rain, or other unsuitable conditions. Begin placement only when temperature is above 51 degrees F **and rising**.
- F. Spreading:
 - 1. Spread material in a manner which requires the least handling.
 - 2. Where thickness of finished paving will exceed 2.5", spread in two or more layers, with top layer no thinner than 1.5". No lift shall exceed 2.5".
 - 3. Provide compacted thicknesses shown on the Drawings within a tolerance of minus 0.0" to plus 0.5".
- G. Rolling:
 - 1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.
 - 2. Roll in at least two directions until no roller marks are visible.
 - 3. Finished paving smoothness tolerance:
 - a. Free from birdbaths.
 - b. No deviations greater than 1/8" in 6 feet.
 - c. Compact to an maximum relative compaction of 97%, with no single test value being below a minimum relative compaction of 91% based on a 50 blow Marshall maximum density.
 - d. **Percentage of voids shall not exceed 9%**

3.5 FLOOD TEST

- A. Prior to application of seal coat, perform a flood test in the presence of the Architect.

- B. Method: Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.
 - 1. If a depression is found where water ponds to a depth of more than 1/8" in six feet, fill or otherwise correct to provide proper drainage.
 - 2. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.6 INSTALLATION OF SEAL COAT

- A. Immediately prior to applying the sealer, clean surface of all loose material which might adversely affect bonding of the sealer. Use any standard cleaning method such as power sweepers and blowers.
- B. Apply a prime coat of SS-1 asphalt emulsion diluted with water, to 5 parts water to 1 part asphaltic emulsion, to all existing (not new) pavement surfaces at a rate of application of 0.05 to 0.10 gallon of diluted primer per square yard.
- C. Following the prime coat, apply 2 coats of seal coat.
 - 1. Add silica sand mineral filler to first coat, passing a 50-mesh screen, at a rate of 2 to 3 pounds per 1 gallon of concentrated sealer.
 - 2. When the first coat is dry enough to walk on without picking the material up, apply a second coat without mineral filler.
 - 3. If the manufacturer indicates that the product may be diluted, it may be diluted with no more than 20 percent by volume clean fresh water with the prior approval of the Architect.
 - 4. Apply at minimum rate of 35 to 45 gallons of undiluted product per 1,000 square feet, in accordance with the manufacturer's written instructions.
 - 5. Provide finished surface with smooth and uniform appearance. If existing depressions are such that aggregate still protrudes after the second coat of asphalt based sealer has been applied, the Contractor shall apply a third coat when so directed by the Architect.
 - 6. Protect sealed surface until cured.

3.7 INSTALLING WHEEL STOPS

- A. Install the specified precast concrete wheel stops as shown on the Drawings, driving the approved 3/4" dia. anchor pins not less than 2'-0" through the paving into the earth.

3.8 PROTECTION

- A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.9 FIELD QUALITY CONTROL

- A. Secure the geotechnical engineer's inspection and approval of subgrades before subsequent construction is permitted thereon.
- B. In-Place Density: Owner's testing laboratory will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

- C. In-place Compacted Thickness: Owner's testing laboratory will determine compacted thickness according to ASTM D3549.
- D. Repair or remove and replace unacceptable paving as directed by the Architect.
- E. Replace and compact asphalt where core tests were taken.

END OF SECTION 32 1210

EXHIBIT "A"

COMPENSATION ADJUSTMENTS FOR CRUDE OIL PRICE INDEX FLUCTUATIONS

The compensation payable for asphalt oil will be increased or decreased in conformance with the provisions of this Exhibit "A" for crude oil fluctuations more than 5 percent higher or lower than the price index at the time of bid.

The adjustment in compensation will be determined in conformance with the following formula:

DETERMINE ASPHALT QUANTITIES:

Calculate the quantity of asphalt oil in hot mix asphalt using the following formula:

$$Qh = HMATT \times [Xa / (100 + Xa)]$$

Qh = quantity in tons of asphalt oil used in hot mix asphalt

$HMATT$ = hot mix asphalt total tons placed

Xa = theoretical asphalt oil content from job mix formula expressed as percentage of the weight of dry aggregate

DETERMINE PAYMENT ADJUSTMENTS:

If material containing asphalt oil is placed within multiple months, calculate separate adjustments for each month.

Each adjustment is calculated using the price index for the month in which the quantity of material containing asphalt oil subject to adjustment is placed in the work. The sum of all the adjustments is used for increasing or decreasing payment.

Calculate each payment adjustment as follows:

$$PA = Qh \times A$$

PA = Payment adjustment in dollars for asphalt oil contained in materials placed in the work for a given month.

Qh = quantity in tons of asphalt oil used in hot mix asphalt.

A = Adjustment in dollars per ton of asphalt oil used to produce materials placed in the work rounded to the nearest \$0.01.

$$A = [(Iu / Ib) - 1.05] \times Ib \times [1 + (T / 100)] \text{ for an increase in the crude oil price index exceeding 5\%}$$

$$A = [(Iu / Ib) - 0.95] \times Ib \times [1 + (T / 100)] \text{ for a decrease in the crude oil price index exceeding 5\%}$$

Iu = California Statewide Crude Oil Price Index for the month in which the quantity of asphalt oil subject to adjustment was placed in the work.

Ib = California Statewide Crude Oil Price Index for the month in which the bid opening for the project occurred

T = Sales and use tax rate, expressed as a percent, currently in effect in the tax jurisdiction where the material is placed. If the tax rate information is not submitted timely, the statewide sales and use tax rate is used in the payment adjustment calculations until the tax rate information is submitted.

ADJUST THE CONTRACT SUM:

The Contract Sum will be increased or decreased based on the sum of the Payment Adjustments.

If the price index at the time of placement increases:

50% percent or more over the price index at bid opening, notify the Architect.

100% or more over the price index at bid opening, do not furnish material containing asphalt oil until the Architect authorizes the work to proceed. The Owner decrease or eliminate asphalt paving work.

The adjustment shall also be subject to the following:

The Contractor shall be liable to the Owner for decreased compensation adjustments and the Owner may deduct the amount thereof for moneys due or that may become due the Contractor.

In the event of an overrun of contract time, adjustment in compensation for asphalt oil during this overrun period will be determined using the California Statewide Crude Oil Price Index in effect on the first business day of the month within the month in which the overrun began.

CALIFORNIA STATEWIDE CRUDE OIL PRICE INDEX:

The California Statewide Crude Oil Price Index is determined each month on or about the 1st business day of the month by the California Department of Transportation using the average of the posted prices in effect for the previous month as posted by Chevron, ExxonMobil, and ConocoPhillips for the Buena Vista, Huntington Beach, and Midway Sunset fields.

If a company discontinues posting its prices for a field, the California Department of Transportation determines the index from the remaining posted prices. The Department may include additional fields to determine the index.

For the California Statewide Crude Oil Price Index, go to:

<http://www.dot.ca.gov/hq/construc/crudeoilindex/>

SUBMITTALS:

Before placing material containing asphalt oil, submit the current sales and use tax rate in effect in the tax jurisdiction where the material is to be placed.

Submit certified weight slips for hot mix asphalt, including those materials not paid for by weight.

SECTION 32 1720 - PAVEMENT MARKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide pavement marking in the types and arrangements shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
 - 1. Crosswalk, striping and graphics.
 - 2. Parking lot striping and graphics.
 - 3. Other lines and graphics as indicated.
- B. Related Sections:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.

1.2 SUBMITTALS

- A. General: Submit in accordance with Section 01 3300.
 - 1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
 - 2. Installation Procedures: Submit manufacturer's recommended installation procedures.
 - 3. Shop Drawings: Photographs, scale drawings, or other data acceptable to the Architect, showing types of graphics proposed to be used.

PART 2 - PRODUCTS

2.1 MATERIALS GENERAL

- A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.1 PAVEMENT MARKING PAINT

- A. Provide paint specifically formulated for use as pavement marking in automobile traffic areas, and in the colors selected by the Architect from standard no lead colors of the approved manufacturer.
 - 1. Slip-resistant coefficient of friction ≥ 0.6 ; ADA Standard A4.5.1, for all paint.
 - 2. Blue at accessible parking to be color #15090; Federal Standard 595B or equal.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following
 - 1. Zoneline by PPG Architectural Coatings; 100% acrylic.
 - 2. SetFast Acrylic Waterborne Traffic Marking Paint by Sherwin-Williams.
 - 3. Vin-L-Stripe W801 Series by Dunn-Edwards.
 - 4. 506 Traffic Paint by Frazee; 100% acrylic.

2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Allow a minimum of 24 hours before applying striping over asphalt paving fog seal.

3.2 APPLICATION

- A. Secure the Architect's approval of graphics design and layout prior to start of application.
- B. Using proper masking, stencils, and application equipment recommended for the purpose by the manufacturer of the approved paint, apply the approved paint in strict accordance with its manufacturer's recommendations.
- C. **Provide 2 coats** of paint material at all markings.

3.3 PROTECTION

- A. Provide traffic cones, barricades, and other devices needed to protect workmen and the paint until it is sufficiently dry to with-stand traffic.

3.4 CLEANUP

- A. When paint is thoroughly dry, visually inspect the entire application, touchup as required to provide clean, straight lines and surfaces throughout.
- B. Using a permanently opaque paint identical in color to the surface on which the paint was applied, block out and eliminate all traces of splashed, tracked, and/or spilled pavement marking paint from the background surfaces.

END OF SECTION 32 1720

SECTION 321726.02 - TACTILE WARNING TRUNCATED DOMES DETECTABLE WARNINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Truncated Domes Detectable Warnings.

1.2 RELATED REQUIREMENTS

- A. 033000 - Cast-in-place Concrete: Concrete for sidewalks and platforms.
- B. 321313 - Concrete Paving: Concrete sidewalks.
- C. 321723 - Pavement Markings: Crosswalk and curb markings.

1.3 SUBMITTALS

- A. Qualification Data: For installer including documentation of approval and training by manufacturer.
- B. Product Data: Provide product criteria, characteristics, and required details.
- C. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.
- D. Warranty: Submit warranties upon completion of work and ensure forms have been completed in Owner's name within 10 days of scope completion.
- E. Maintenance Data: For users operation and maintenance of system including:
 - 1. Methods for maintaining system's materials and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized and trained by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.
- B. Store in temperature ranges of 25 - 90 degrees F.

1.6 WARRANTY

- A. Installation Warranty: Contractor shall correct defective Work within a 2 year period after Date of Substantial Completion.
- B. Manufacturer Warranty: Provide 5 year warranty for tactile warning surfacing for failing to maintain more than 95% of their surface installation/adhesion, color retention or non skid characteristics.
 - 1. Exception: Where such failures are the result of vehicular traffic, shopping cart trucks or tractors, blade or rotary snow removal or other mechanically abrasive devices.
 - 2. Exception: Where surface coloring agents or sealers have been applied to concrete substrate.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Tactile warning surfacing and non skid coatings for pedestrian traffic.

2.2 PERFORMANCE AND DESIGN CRITERIA

- A. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way; 2011.
- B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

- C. 49 CFR 27, 37, and 38 - Standards for Accessible Transportation Facilities, Final Rule; Department of Transportation; current edition.
- D. ADAAG requirements (Title 49, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 – Detectable warnings on walking surfaces)

2.3 MANUFACTURERS

- A. Specification is based on products listed by Vanguard ADA Systems: www.VanguardOnline.com.
 - 1. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.

2.4 DETECTABLE WARNING

- A. Truncated Domes:
 - 1. Basis of Design Product: Detectable Warning (Truncated Dome) by Vanguard ADA Systems. Comparable and substituted products will be judged based on the following performance criteria, features, warranty, and qualifications.
 - 2. Performance Criteria:
 - a. Substrate Requirements:
 - 1) Portland Cement:
 - a) Strength: 3,000 PSI minimum.
 - b) Finish: medium broom finish or coarser profile.
 - c) Cure: 20 day minimum.
 - 2) Asphalt:
 - a) Compaction: 95% minimum.
 - b) Finish: Rolled, compacted, smooth.
 - c) Cure: 20 day minimum.
 - b. Skid Resistance: 0.80 minimum in accordance with ASTM F1679.
 - c. UV Resistance: 99% minimum Fade Resistance and Color Retention in accordance with ASTM G155.
 - d. Chemical Resistance: Tested for 7 days.
 - 1) Road Salts: no effect.
 - 2) Anti-freeze: no effect.
 - 3) Diesel fuel: no effect.
 - 4) Gasoline: no effect.

- 5) Transmission fluid: no effect.
- 6) Motor oil: no effect.
- e. VOC: 25 g/l maximum. Tested in accordance with ASTM D2205.
- f. Water Absorption: Maximum 0.5%. Tested in accordance with ASTM D570.
- g. Smoke Development: Pass. Tested in accordance with EN ISO 9239-1.
- h. Flame Spread: Less than 150 mm. Tested in accordance with EN ISO 11925-2.
- i. Shore Hardness: Shore Durometer, A-1, 80 minimum after 24 hours. Tested in accordance with ASTM D2240.
- j. Tracking: None. Tested for 32 minutes maximum in accordance with ASTM D711.
- k. Viscosity: 6000-12000 cps ASTM D2196 - Brookfield #7 spindle @20 rpm, 77 degF
- l. Color: Yellow and approximate 33538 SAE AMS-STD-595A
- m. Seamless installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surface is free of surface applied sealers, coloring agents, or other materials detrimental to surface bond.
- B. Verify existing conditions meet manufacturer's requirements before starting work.
- C. Verify surface temperature is between 35 degrees F and 88 degrees F.

3.2 PREPARATION

- A. Prepare surfaces to receive work in accordance with manufacturer's instructions.
- B. Grind to remove surface applied sealers, coloring agents, or other surface applied materials and provide required surface profile.
- C. Broom or air sweep clean surfaces free of debris, vegetation and material impacting adhesion.
- D. Provide completely dry surface.

3.3 INSTALLATION

- A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.
- B. Truncated Domes:
 - 1. Mask work area.
 - 2. Reducer:
 - a. Mix and catalyze Reducer component in accordance with installation instructions.
 - b. Install Reducer component. Cross roll at 90 degrees to ensure appropriate coverage and penetration.
 - c. Wait minimum 30 minutes for Reducer component to cure.
 - 3. Base/Non skid:
 - a. Mix and catalyze base component in approved color(s) in accordance with installation instructions.
 - b. Fill all surface deformities with manufacture's recommended materials.
 - c. Install Base component and cross roll at 90 degrees to ensure adequate coverage and penetration.
 - d. Remove masking immediately upon completion.
 - e. Wait minimum 45 minutes for base component to cure.
 - 4. Domes:
 - a. Layout dome forms in accordance with contract documents and dimensional allowances.
 - b. Mix and catalyze base component in approved color(s) in accordance with installation instructions.
 - c. Pour catalyzed base component onto mats in coverage rates indicated by manufacturer.
 - d. Squeegee material to ensure adequate coverage and penetration of all apertures.
 - e. Remove excess material
 - f. Remove forms immediately in accordance with manufacturer's instructions.
 - g. Wait minimum 60 minutes for final component to cure.
 - h. When material is tack free, surface is ready for pedestrian traffic.

3.4 CLEANING

- A. Clean as needed with very light pressure wash without the use of soaps, abrasives or rotary tip.

3.5 PROTECTION

- A. Protect installed work areas required by the manufacturer until work is complete to maintain product performance, design criteria and warranty.

3.6 SCHEDULE

A. Curb Cuts.

1. Features:

- a. Product: Truncated
- b. Color: YELLOW AND APPROXIMATE 33538 SAE AMS-STD-595A

2. Locations:

- a. As indicated on drawings.

END OF SECTION