

## SECTION 02550

### CONCRETE IMPROVEMENTS

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

- A. Traffic control as required to divert vehicular and pedestrian traffic around the construction.
- B. Mixing and transporting Portland Cement Concrete.
- C. Forming concrete.
- D. Placing and finishing concrete.
- E. Curing concrete.
- F. Protecting concrete improvements.
- G. Steel Reinforcement.
- H. Dust alleviation and control.
- I. Cleanup and disposal of debris.
- J. Supplying all labor, materials and equipment not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

##### 1.02 APPLICABLE PUBLICATION

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publication:
  - A - 82 Cold Drawn Steel Wire for Concrete Reinforcement.
  - A - 185 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
  - A - 615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
  - C - 94 Specification for Ready-mixed Concrete.
  - C - 114 Method for Chemical Analysis of Hydraulic Cement.

C - 150	Portland Cement.
C - 452	Test Methods for potential Expansion of Portland Cement Mortars exposed to Sulfate.
C - 618	Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement.
C - 1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.(Non- extruding and Resilient Bituminous Types)

### 1.03 QUALITY ASSURANCE

- A. Compressive strength and cement content for the class of Portland Cement Concrete herein designated shall be the minimum acceptable.
- B. No concrete for concrete improvements shall be placed until the subgrade, the forms, and reinforcement have been approved.
- C. Color and surface texture of decorative concrete paving or surfacing shall closely match the approved sample for the work.
- D. Codes and Standards:
  1. Proportioning of Portland Cement concrete shall conform to the applicable provisions of Section 90-5 of the State Standard Specifications.
  2. Mixing and transporting of Portland Cement Concrete shall conform to the applicable provisions of Section 90-6 of the State Standard Specifications.
  3. Curing of Portland Cement Concrete shall conform to the applicable provisions of Sections 90-7.03 and 90-8.02 of the State Standard Specifications.
  4. Protection of Portland Cement Concrete shall be provided in conformance with the applicable provisions of Section 90-8 of the State Standard Specifications.
  5. Forming of concrete for improvements shall conform to the provisions of Section 73-1.04 of the State Standard Specifications forming for cast-in-place structures shall conform to Section 51-1.05 of the State Standard Specifications.
  6. Placing of concrete improvements shall conform to the provisions of Sections 73-1.05 and 73-1.05A, of the State Standard Specifications; placing of concrete for cast-in-place concrete structures shall conform to Section 51-1.09 of the State Standard Specifications.
  7. Finishing of cast-in-place concrete structures shall conform to the provisions of Section 51-1.18 of the State Standard Specifications. Finishing of concrete improvements shall conform to Section 73 of the Standard Specifications. Unless otherwise called for on the plans, all

buried surfaces shall have "Ordinary Surface Finish" all exposed surfaces shall have "Class 1 Surface Finish".

8. Placing of steel reinforcement shall conform to the requirements of Section 52-1.07 of the State Standard Specifications.
9. Splicing of steel reinforcement shall conform to the requirements of Section 52-1.08 of the State Standard Specifications.

**E. Certifications**

1. At the time of delivery provide certificates of compliance signed by both Contractor and Supplier containing the following statements:
  - a. Materials supplied comply with the specification in all respects.
  - b. Proportioning and mixing is in compliance with a design mix which has been field tested in accordance with the herein requirements and produces the required compressive strength under like conditions.
  - c. Statement of type and amount of any admixtures.
  - d. All certificates shall include the Material and Supplier's mix design number.
2. At time of delivery provide certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

**1.04 JOB CONDITIONS**

- A.** Admixtures shall not be used except upon the prior written permission of the Engineer and, if permitted, the concrete containing same will be subject to the same compliance testing as herein specified for the various classes of concrete.
- B.** Temperature of mixed concrete, immediately prior to placement, shall not be less than 50° F, nor more than 90°F. Aggregates and water shall be heated or cooled at the mixing plant by supplier as necessary to produce concrete within these limits. Neither aggregates nor mixing water shall be heated to exceed 150°F.
- C.** No additional mixing water shall be incorporated into the concrete during transport or after arrival at the work site unless such water is specifically authorized by the Engineer. If authorization to add mixing water is obtained and mixing water is added to the mix, the mixer drum shall then be revolved a minimum of thirty (30) revolutions.
- D.** Hand mixing of Portland Cement Concrete shall not be allowed except upon prior written approval.
- E.** Where a portion of existing concrete improvements is to be reconstructed, the section to be removed shall first be a cut with an approved concrete saw to a

minimum depth of one-half the depth of the existing concrete at the first score line beyond the area to be replaced.

- F. Where concrete removal is required, it shall be removed to the nearest score line of joints.
- G. Prior to placing concrete for concrete structures, Contractor shall first secure approval of the forms and any required reinforcement.

## **PART 2- PRODUCTS**

### **2.01 AGGREGATE FOR PORTLAND CEMENT CONCRETE**

- A. Aggregates for Portland Cement Concrete shall conform to the requirements of Section 90-2.02A and B of the State Standard Specification.
- B. Unless otherwise specified or called for on the plans for the work, aggregate size and gradation for Portland Cement Concrete shall conform to the requirements of Section 90-3.04 of the State Standard Specifications for one inch (1") maximum combined aggregate.

### **2.02 WATER FOR PORTLAND CEMENT CONCRETE**

- A. Water for mixing and curing concrete and for washing aggregates shall conform to the requirements of Section 90-2.03 of the State Standard Specifications.

### **2.03 CEMENT FOR PORTLAND CEMENT CONCRETE**

- A. Cement for Portland Cement Concrete to be placed in roadway improvements such as curbs, gutters, walks, valley gutters, driveways, surface and subsurface pads or slabs shall be Type V or Type II (modified) cement conforming to the requirements of ASTM Designation C150, with the following modifications:
  1. The cement shall not contain more than 0.60% by weight of alkalis, calculated as the percentage of  $\text{Na}_2\text{O}$  plus 0.658 times the percentage of  $\text{K}_2\text{O}$  when determined by either direct 4 intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM Designation C114.
  2. The autoclave expansion shall not exceed 0.50%.
  3. Mortar, containing the Portland Cement to be used and the sand, when tested in accordance with Test Method No. Calif 527, shall not expand in water more than 0.010% and shall have an air content less than 048%.
  4. Allowable tri-calcium Aluminate ( $\text{C}_3\text{A}$ ) by weight shall not exceed 5%. Allowable tetracalcium alumino ferrite plus twice the tricalcium aluminate ( $\text{C}_4\text{AF}+2\text{C}_3\text{A}$ ) by weight shall not exceed 25%. The sulfate expansion test (ASTM C452) may be used in lieu of the above chemical requirements, provided the sulfate expansion does not exceed 0.040% at 14 days (max).

5. The Contractor may substitute pozzolan for Portland Cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F fly ash meeting the requirements of ASTM C618.
- B. Cement for Portland Cement Concrete to be placed in surface improvements shall contain a coloring compound equivalent to 1/4 pound of lampblack per cubic yard, added to the concrete at the central mixing plant.
- C. Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

#### **2.04 CLASSIFICATION OF PORTLAND CEMENT CONCRETE**

- A. Portland Cement Concrete shall be classified Class "A" or according to the compressive strength requirements specified in Section 90 of the State Standard Specifications.
- B. Portland Cement Concrete not conforming to the above classification or having required minimum compressive strengths other than those set forth above, shall conform to requirements to be set forth for same noted on the plans or detail drawings.

#### **2.05 EXPANSION JOINT MATERIAL**

- A. Material for expansion joints in Portland cement concrete improvements shall be premolded expansion joint fillers of the thickness called for on the plans and conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

#### **2.06 REINFORCEMENT AND DOWELS**

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the plans.
- B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil will be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A82 for the material and ASTM Designation A185 for the mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.

- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier black annealed conforming to the requirements of ASTM Designation A82.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

## **2.07 COLOR AND PATTERN FOR DECORATIVE PAVEMENT**

- A. Colors for decorative pavement and surfacing shall be CHROMIX admixtures as manufactured by the L. M. Scofield Company, Schedule A-312.05 or approved equal. The specific color shall be as designated or called for on the plans.
- B. Curing compound for color conditioned decorative pavement shall be LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.
- C. Patterns for decorative pavement or surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or equal. The specific pattern shall be as designated or called for on the plans.

## **2.08 ACCESSORY MATERIALS**

- A. Materials for water stops and other items required in the placement of Portland Cement Concrete shall conform to the applicable requirements of Section 51 of the State Standard Specifications unless otherwise specifically noted or called for on the plans or detail drawings.
- B. Curing compound for use on exposed surfaces of Portland Cement Concrete shall be "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" conforming to the requirements contained in Section 90-7.01B of the State Standard Specifications.

## **2.09 MATERIAL FOR FORMS**

- A. Material for forms for cast-in-place concrete shall conform to the requirements of Section 51-1.05 of the State Standard Specifications.

# **PART 3 - EXECUTION**

## **3.01 STRUCTURAL EXCAVATION**

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, the bottom of the excavation shall be backfilled to grade with approved material and compacted in place to 95% of the maximum dry density.

- C. Surplus excavation material remaining upon completion of the work shall be either removed from job site, or conditioned to optimum moisture content and compacted as fill at the site.

### **3.02 BRACING AND SHORING**

- A. The Contractor shall furnish, place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection to workmen; to facilitate the work; to prevent damage to adjacent structures or facilities. Upon completion of the work, all bracing and shoring shall be removed, unless otherwise directed.
- B. The Contractor is solely responsible for all bracing and shoring and shall, if required, submit an application and supporting data for an effective shoring system to the Engineer. The Engineer may forward the application to the California Division of Industrial Safety for design, assumed soils conditions, and the estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used. The application shall be prepared by a Civil Engineer registered in California. No excavation around cast-in-place concrete structures shall proceed until the Contractor has received the return of an approved application, if required.
- C. Refer to Section 02202 for Special Requirements for Shoring in Bay Mud Conditions.

### **3.03 FORMS FOR CONCRETE**

- A. Concrete improvements shall be formed with a smooth and true upper edge and the side of the form shall be placed next to concrete with a smooth finish. Forms shall be constructed or made rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. All forms shall have been thoroughly cleaned prior to placement and shall be coated with an approved form oil sufficient to prevent adherence of concrete prior to placing.
- C. Forms shall be carefully set to the alignment and grade established and shall conform to the required dimensions. Forms shall be rigidly held in place by stakes set at satisfactory intervals. Sufficient clamps, spreaders and braces shall be installed to insure the rigidity of the forms.
- D. Forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs shall be equal to the full depth of the concrete as shown, noted or called for on the plans or detail drawings. Composite forms made up from benders or thin planks of sufficient ply to ensure rigidity of the form in the shape required may be used on curves and curb returns.

### **3.04 PLACING STEEL REINFORCEMENT**

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All

bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:

1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
  2. Splice locations shall be made as indicated on the plans.
- B.** Reinforcement shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections and splices and by using precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Supports and ties shall be such as to permit walking on reinforcing without undue displacement.
- C.** Reinforcing shall be placed so as to have the following minimum concrete cover:
- |   |    |
|---|----|
| Surfaces exposed to water                     | 4" |
| Surfaces poured against earth                 | 3" |
| Formed surfaces exposed to earth or weather   | 2" |
| Slabs, walls, not exposed to weather or earth | 1" |
- D.** Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. All reinforcing shall be securely tied in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

### **3.05 MIXING CONCRETE**

- A.** All concrete shall be transit mixed in accordance with the requirements of ASTM Designation C94. Transit mixed concrete shall be mixed for not less than ten (10) minutes total, of which not less than three (3) minutes shall be on the site just prior to pouring. Mixing shall be continuous with no interruptions from the time the truck is filled until the time it is emptied. Concrete shall be placed within one hour of the time water is first added.
- B.** Hand mixing of concrete for use in concrete structures will not be permitted.

### **3.06 PLACING CONCRETE**

- A.** Subgrade shall be thoroughly wetted prior to the placing of concrete for all concrete placed directly on soil. All standing water shall be removed prior to placing of concrete.
- B.** No concrete shall be placed until the subgrade and the forms have been approved.



- C. Concrete shall be conveyed from mixer to final location as rapidly as possible by methods preventing separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Concrete shall be placed and compacted in forms without segregation by means of mechanical vibration or by other means as approved by the Engineer. Vibration shall continue until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. All control and construction joints shall be as shown on the plans.
- F. Concrete in certain locations may be pumped into place upon prior approval. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

### **3.07 FORM REMOVAL**

- A. Forms shall be removed without damage to concrete. All forms below the ground surface, together with all shores and braces, shall be removed before backfilling.
- B. Backfill against concrete shall not commence until the concrete has developed sufficient strength to prevent damage.
- C. Forms with cast-in-place walls shall remain in place at least 72 hours after pouring.
- D. Forms with suspended slabs shall remain in place at least 28 days after pouring.
- E. Edge forms shall remain in place at least 24 hours after pouring.

### **3.08 EXPANSION JOINTS**

- A. Expansion joints incorporating premolded joint fillers shall be constructed at twenty (20) foot intervals in all concrete curbs, gutters and sidewalks, and at the ends of curb returns. At each expansion joint, one-half by twelve inch (1/2" x 12") smooth slip dowels shall be installed in the positions shown or noted on the detail drawings.
- B. Slip dowels shall be oriented at right angles to the expansion joint and shall be held firmly in place during the construction process by means of appropriate chairs.
- C. Expansion joints and slip dowels shall be constructed in valley gutters and driveway approaches in the positions indicated or called for on the detail drawings.

### **3.09 CONTROL JOINTS**

- A.** Control joints shall be constructed in concrete curbs, gutters, walkways and pavements between expansion joints at ten (10) foot intervals throughout, or as shown on the plans. Depth of joint score shall be a minimum of one-fourth (25%) the thickness of the concrete.

### **3.10 FINISHING**

- A.** Concrete curb and gutter shall be finished in conformance with the applicable requirements of Section 73-1.04 and 73-1.05A of the State Standard Specifications as modified herein.
- B.** Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C.** Horizontal surfaces shall receive a medium broom finish unless otherwise shown.

### **3.11 ROADWAY ACCESSORY CONSTRUCTION**

- A.** Concrete walkways, island paving, valley gutters and driveway approaches shall be formed, placed and finished in conformance with the applicable requirements of Section 73-1.04 and 73-1.06 of the State Standard Specifications as modified herein.
- B.** Where new concrete curb and gutter is to be constructed against existing AC remove 12" of the AC to form new gutter lip. Patch pave after gutter form is removed.

### **3.12 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS**

- A.** Whenever new curb, gutter, or sidewalk is to connect to existing improvements to remain, sawcut to existing sound concrete at the nearest score line or expansion joint. Drill and insert ½ " diameter by 12" long dowels at 24" on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B.** A "cold" joint to the existing curb, gutter or sidewalk is not permitted.

### **3.13 DECORATIVE PAVEMENT CONSTRUCTION**

- A.** Decorative pavement for streets or roadways and decorative surfacing for median islands or other installations shall be formed and placed as a concrete slab conforming to the details therefor shown or noted on the drawings.

### **3.14 FIELD QUALITY CONTROL**

- A.** Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.

- B. No concrete shall be placed prior to approval of forms.
- C. Appearance and finish of all concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements shall conform to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Sections 73-1.05 and/or 73-1.06 of the State Standard Specifications, as applicable.

### **3.15 RESTORATION OF EXISTING IMPROVEMENTS**

- A. Existing pavement or other improvements removed or damaged due to the installation of concrete improvements shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of concrete improvements shall be replaced in kind.

### **3.16 CLEANUP**

- A. Surplus material and debris remaining upon completion of the work shall be segregated as to type, and transported from the job site and disposed of in a legal manner.

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