

**SECTION 32 13 20
SITE CONCRETE**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all labor, materials, equipment and services required for and incidental to the installation of site concrete including the site concrete as noted below.
- B. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown.
- C. This section specifically covers the following site components.
 - 1. Site walls including footings, excluding architectural canopy footing walls
 - 2. Curbs, walks, and pavements, including aggregate base
 - 3. Footings for posts and structures, excluding architectural canopies
 - 4. Color and Finishes for site walls and pedestrian concrete paving.
 - 5. Concrete work for footings/foundations of art features.

1.02 RELATED WORK

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 00, EARTH MOVING.
- C. Site drainage structures: Section 33 40 00, STORM DRAINAGE UTILITIES
- D. Section 32 14 12, CONCRETE PAVERS
- E. Section 32 05 23, CEMENT/CONCRETE FOR EXTERIOR IMPROVEMENTS, for specifications pertaining to architectural canopy footing walls see

1.03 TOLERANCES:

- A. ACI 117

1.04 DESIGN REQUIREMENTS

- A. Design all elements with the latest published version of applicable codes.

1.05 TESTS

- A. The Owner will select a qualified testing laboratory to take samples for testing during the course of the work as considered necessary. Costs for such tests will be paid by the Owner. Contractor shall cooperate in arranging tests and shall be responsible for notifying the designated laboratory in sufficient time to allow taking of samples at time of pour.
- B. Should tests show that concrete is below specified strength, Contractor shall remove all such concrete, as directed by the Owner. Full cost of removal of low strength concrete, its replacement with concrete of proper specified strength and testing, shall be borne by Contractor.
- C. Tests shall include:
 - 1. Subgrade compaction testing for concrete flatwork.
 - 2. Subgrade compaction testing for concrete pavers
 - 3. Subgrade compaction testing for concrete walls

1.06 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the

- requirements specified.
1. Expansion joint filler
 2. Reinforcement
 3. Curing materials
- C. Data and Test Reports: Select subbase material.
1. Job-mix formula.
 2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.
- D. Samples and Mockups:
1. Full-scale mock-up (minimum 4' by 4') sample panels of all concrete paving finishes and color, subject to approval by Resident Engineer. The samples shall include curing compound if any is to be used, and include example of expansion joints, both with and without sealant, and a score joint, as indicated in drawings.
 2. Caulking – submit samples colored to match adjacent paving.
 3. Full scale mock-up of Glass Water Feature base edge condition (minimum 5' length by 3' width) including any curing compound, admixtures, and form release agents that are to be used, and include edge profile, reinforcing, face texturing, finishes, and color as indicated in drawings.
 4. Provide mock-ups as necessary to achieve satisfactory results in finishing/textures/color, subject to approval by Resident Engineer.
 5. Mock ups shall be constructed at the project site and available for review by Resident Engineer in time to allow time for mix design revision as necessary to achieve color and finish matching existing concrete paving. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the work.
- E. Concrete Mix Design: Submit for each type and strength of concrete.
1. Include unit weight, slump, water-cement fly ash ratio curves, concrete mix ingredients, admixtures and compression test reports. Results of testing or test data used to establish mix proportions are to be provided for each mix design.
 2. Mix designs to be prepared, stamped and signed by a Professional Engineer registered in the State of California.
- F. Shop Drawings: Reinforcing steel: Complete shop drawings. Comply with requirements of ACI SP-66. Include bar sizes, material types, lengths, spacings, locations, and quantities of reinforcing steel; bar schedules, stirrup spacing, shapes of bent bars, spacing of bars, and types and location of splices.

1.07 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- | | |
|----------------|--|
| M31 | Deformed and Plain Billet Steel Bars for Concrete Reinforcement (ASTM A615/A615M-96A) |
| M55M/55M | Welded Steel Wire Fabric for Concrete Reinforcement (ASTM A185) |
| M147 | Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 1996) |
| M148 | Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309A) |
| M171 | Sheet Materials for Curing Concrete (ASTM C171) |
| M182 | Burlap Cloth Made from Jute or Kenaf |
| M213 | Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751) |

- T99 Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop
- T180 Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
- C. American Concrete Institute (ACI):
 - 117R-06 Tolerances for Concrete Construction and Materials
 - 211.1-91(R2002) Proportions for Normal, Heavyweight, and Mass Concrete
 - 301-05 Specification for Structural Concrete
 - SP-66-04 ACI Detailing Manual
 - 318/318R-05 Building Code Requirements for Reinforced Concrete
 - 347R-04 Guide to Formwork for Concrete
- D. American Society for Testing and Materials (ASTM):
 - A615/A615M-08 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - C33-07 Concrete Aggregates
 - C39/C39M-05 Compressive Strength of Cylindrical Concrete Specimens
 - C94/C94M-07 Ready-Mixed Concrete
 - C143/C143M-05 Standard Test Method for Slump of Hydraulic Cement Concrete
 - C150-07 Portland Cement
 - C171-07 Sheet Material for Curing Concrete
 - C172-07 Sampling Freshly Mixed Concrete
 - C173-07 Air Content of Freshly Mixed Concrete by the Volumetric Method
 - C192/C192M-07 Making and Curing Concrete Test Specimens in the Laboratory
 - C260-06 Air-Entraining Admixtures for Concrete
 - C494/C494M-08 Chemical Admixtures for Concrete
 - C618-08 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b
 - D3963/D3963M Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007)

1.08 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement and fly ash in separate suitable bins.
- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.
- D. Store reinforcement in a manner that will prevent rusting or coating with grease, oil, dirt, and other objectionable material.
- E. Deliver reinforcement to the job site bundled, tagged and marked using metal tags.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Cement and aggregates shall have proven history of successful use with one another. Sources of cement and aggregate shall remain unchanged throughout work.
- B. Mixes:
 - 1. Ready-mixed concrete shall meet requirements of ASTM C94.
 - 2. The Contractor shall perform tests or assemble the necessary data indicating

- conformance with specifications.
3. For each mix, submit data showing that proposed mix will attain the required strength in accordance with requirements of Caltrans Standard Specifications, Section 90.
 4. Instruct Laboratory to base mix design on use of materials specified and approved by the Resident Engineer.
 5. Insure mix designs will produce concrete to strengths specified and of uniform density without segregation.
 6. If mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard, without changing cement content.
 7. Introduction of calcium chloride will not be permitted.
 8. Mix design shall match appearance of existing site concrete, subject to approval by Resident Engineer.

C. Concrete Types (See Drawings for any other miscellaneous items not listed below):

TYPE	28-DAY STRENGTH	AGGREGATE SIZE	FINISH & COLOR	COMMENTS
Integral Color Concrete Slabs and Pavement	3,000	1" X #4	Davis Color 'Pebble' per campus standard; Light sandblast	
Natural Grey Concrete Slabs and Pavement	3,000	1" X #4	Light sandblast	
Glass Art Water Feature	4,000	1/2" X #4	Davis Color 'Dark Grey' #860 (Iron Oxide) See drawings for finish	Air –entrained Xypex Waterproofing added at 2% by weight of cement content, not to exceed 12 pounds per cubic yard of concrete; Provide continuous PVC water-stop at all cold joints

2.02 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. New, free of rust, Billet steel bars: Current ASTM designation A615.
- C. Bar Reinforcement: ASTM A615.
 1. #3 and smaller: Grade 40.
 2. #4 and larger: Grade 60.
- D. Bar Reinforcement recycled content shall be a minimum of 75% recycled post consumer steel.
- E. Dowels shall be plain steel bars conforming to AASHTO M31 or M42. Tie bars shall be deformed steel bars conforming to AASHTO M31 or M42.
- F. Epoxy coated reinforcement bars:
 1. Shall be in accordance with ASTM A775/A775M
 2. Shall be fabricated and handled in accordance with ASTM D3963/D3963M.

2.03 FORMWORK MATERIALS

- A. For Exposed Smooth Form-finished Concrete: Use Medium Density (or better) Overlaid

- Concrete Form Exterior (MDO), to provide continuous straight, smooth, exposed surfaces without grain patterns. Furnish in largest practicable sizes to minimize number of joints and to conform to a joint system as approved by Resident Engineer.
- B. For all planter walls: Laminate-lined wood, extra smooth form finish by Olympic Panel, or equal.
 - C. Chamfer Strips: Meadow-Burke Concrete Accessories, PVC type CSF ½-inch or as otherwise noted, all exposed corners.
 - D. Form Release Agent: Form release agent may be used at the discretion of the contractor as necessary to prevent peeling away of concrete material when forms are removed. Must not stain or otherwise adversely affect architectural concrete surfaces. "Nox-Crete Form Coating"; Industrial Synthetics Corp.'s "Synthex"; or equal.
 - E. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.
 - F. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.04 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type II. Use one brand of cement throughout project.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Aggregates: ASTM C33, materials from established sources with proven history of successful use in producing concrete with minimum shrinkage. Course Aggregate to be Size 67.
- D. Water: Clear and potable, free from deleterious impurities.
- E. Admixtures:
 - 1. Admixtures are at the discretion of and shall be determined by the contractor as needed to achieve the design intent of the drawings and prevent honeycombing, bug holes, rock pockets, voids, spalling, or other deficiencies. However, a water reducer or plasticizing admixture shall be included in the concrete mix.
 - 2. Any proposed admixture shall comply with ASTM C494.
 - 3. Where more than one admixture is proposed, include statement from admixture manufacturer indicating that admixtures proposed for use are compatible, such that desirable effects of each admixture will be realized.
 - 4. Accelerating admixtures and admixtures containing more than 0.05 percent chloride ions are not permitted. If an accelerator is used, it shall be a non-chloride accelerator.
 - 5. Liquid admixtures shall be considered part of the total water.
 - 6. Admixtures must be compatible with color pigments where color pigments are used.
 - 7. Refer to Color Additives/Pigments herein for color admixtures.
- F. Color Additives/Pigments: Insoluble minerals, light fast, at least 95 percent passing #325 sieve complying with ASTM C979: Davis Colors, Los Angeles, CA (800) 356-4848; Color(s) shall be as follows:
 - 1. As noted in chart above
 - 2. Color additives containing carbon black are not acceptable.

2.05 CURING COMPOUNDS FOR COLORED CONCRETE

- A. Curing Compound for Colored Concrete: Water-base acrylic type, free of permanent color, oil or wax, complying with ASTM C309: "W 1000" by Davis Colors, Los Angeles, CA (800) 356-4848; or equal.

2.06 CONCRETE MIXES

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Cementitious Material: An intimate blend of type II Portland cement and fly ash. Cementitious material shall include 15 percent maximum fly ash by weight unless the strength is specified to be achieved on 7 or 14 days.
- C. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.
- D. Cement and water factor (See Table I):

TABLE 2 - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
30 (4000) ¹	325 (550)	0.50	340 (570)	0.50
25 (3000) ¹	280 (470)	0.55	290 (490)	0.55

- 1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
- E. Air-entrainment is required for all exterior concrete. Air content shall conform with the following table:

**TABLE 3 - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
10 mm (3/8 in)	6 to 10
13 mm (1/2 in)	5 to 9
19 mm (3/4 in)	4 to 8
25 mm (1 in)	3 1/2 to 6 1/2

- F. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Resident Engineer. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

2.07 BATCHING & MIXING:

- A. Store, batch, and mix materials as specified in ASTM C94.
 - 1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.

2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

2.08 ANCILLARY MATERIALS

- A. Aggregate Base: Class II aggregate base conforming to Section 26 of the Standard Specifications and Subgrade Specifications herein.
- B. Expansion Joint Material
 1. Fiber Expansion Joint: A non-extruding resilient filler, saturated with high quality bituminous materials having preserving characteristics. Conform to ASTM-D1751-04.
 2. Caulking at Expansion Joint: "Sonolastic Sealant Two-Part" as manufactured by Sonneborn-Contech, Building Products Division, Contech, Inc.; or approved equal. Joint caps or bond breaker tape to be as recommended by sealant manufacturer. Color shall be to match adjacent paving.
- C. Dampproofing behind Planter Walls: Per CALTRANS Standard Specifications, Section 54.
- D. Subsurface Drain behind Planter Walls: All concrete walls that retain 30 inches of soil or more shall include a subsurface drainage system to relieve water pressure in accordance with Section 68 of the CALTRANS Standard Specifications and as shown. If no subsurface drain is shown, provide corrugated polyethylene plastic tubing per 68-1.02K surrounded with an envelope of Class 2 permeable material per 68-1.025 and wrapped with filter fabric per 68-1.028. Provide black colored rodent-proof cap over exposed outfalls as accepted by Resident Engineer.
- E. Form-Ties: Form-ties shall not be used for any exposed concrete surfaces.

PART 3 - EXECUTION

3.01 SUBGRADE PENETRATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.02 SETTING FORMS

- A. Base Support:
 1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
 2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.
- B. Form Setting:
 1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
 2. Formwork installation conform to ACI 347. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction and will hold concrete without leakage.

3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
 4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
 5. Clean and oil forms each time they are used.
- C. The Contractor's Registered Professional Land Surveyor shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.
1. Make necessary corrections to forms immediately before placing concrete.
 2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.
- D. Form Liners:
1. Provide form-liners for specialty textures as shown in drawings

3.03 EQUIPMENT

- A. The Resident Engineer shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

3.04 PLACING REINFORCEMENT

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the Resident Engineer shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.05 PLACING CONCRETE – GENERAL

- A. Obtain approval of the Resident Engineer before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Resident Engineer before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.
- H. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- I. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Resident Engineer.

3.06 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.07 CONCRETE FINISHING – GENERAL

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
 - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
 - 2. Maintain finishing equipment and tools in a clean and approved condition.

3.08 JOINTS – GENERAL

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.
- C. Sawn Contraction Joints:
 - 1. General: Provide where shown. Saw cut straight, true, and uniform, and not less than 1/4 of slab thickness in depth, unless otherwise noted. Cut with a power saw fitted with an abrasive or diamond blade.
 - 2. Commence saw cutting operations after concrete has cured long enough to resist damage by the saw cutting operations and early enough to avoid random contraction cracks.
 - 3. Contractor shall coordinate form removal and sequencing of adjacent concrete placement to minimize unnecessary saw cutting of adjacent surfaces.
 - 4. Contractor shall plan for the use of varying types of saw cutting apparatus to provide acceptable finishes in areas limited in accessibility.
 - 5. Fill saw cut over-runs and inadvertent saw cutting of adjacent surfaces with cement mortar to match color and finish of sawn pavement.
 - 6. If the joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Resident Engineer.
- D. Tooled Joints / Score Joints
 - 1. Form joints in fresh concrete using a jointer to cut the groove so that a smooth, uniform impression is obtained to 1/4 depth of pavement unless shown otherwise.
 - 2. All joints shall be struck before and after brooming. Tool concrete both sides of joint.
 - 3. If joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Resident Engineer.

3.09 CONTRACTION JOINTS

- A. Cut joints to depth as shown, min 1/4 of slab thickness, by sawing with a blade producing the required width and depth.
- B. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

3.10 EXPANSION JOINTS

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown,
- C. Top edges of joint filler shall not exceed 1/8 inch below finish grade of adjacent concrete, except that top edges of joint filler shall be below the finished concrete surface to allow for sealing where shown.
- D. Anchor with approved devices to prevent displacing during placing and finishing operations.
- E. Round the edges of joints with an edging tool.
- F. Form expansion joints as follows:
 - 1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
 - 2. Using joint filler of the type, thickness, and width as shown.
 - 3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.11 FINISHING OF FLATWORK AND WALLS

- A. Surface Finishes for Glass Water Feature Base:
 - 1. Form-liner finish: Provide form liner to achieve texture per drawings
 - 2. Steel Trowel Finish (top): After surface water disappears and floated surfaces sufficiently hardened, steel trowel and retrowel to smooth surface. After concrete has set enough to ring trowel, retrowel to a smooth uniform finish free of trowel marks or other blemishes. Avoid excessive troweling that produces burnished areas.
- B. Flatwork (pedestrian)
 - 1. Sandblast Finish: Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.
 - a. Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to match sample panel, as follows:
 - i. Light Cut: approximately 1/16" depth
 - ii. Medium Cut: approximately 1/8" to 3/16" depth
 - (a) Heavy Cut: approximately 1/4" to 5/16" depth
 - b. Blast corners and edge of patterns carefully, using backup boards in order to maintain a uniform corner of edge line.
 - c. Use same nozzle, nozzle pressure and blasting technique as used for sample panel.
 - d. Maintain control of abrasive grit and concrete dust in each area of blasting. Clean up and remove all expended abrasive grit, concrete dust and debris at the end of each day of blasting operations.
- A. Sub-slabs:
 - 1. Medium Broom Finish: Obtain by drawing a stiff bristled broom across a floated finish for a nonslip surface. Perform brooming while concrete is still wet enough to receive broom marks to match approved sample. Direction of brooming to be perpendicular to direction of work or as otherwise shown on the drawings.

3.12 DAMPPROOFING

- A. Mop apply one heavy coat of asphalt dampproofing to soil side of retaining walls and planter walls from top of wall footing to a minus 2 inches below finished soil grade.

3.13 FORM REMOVAL

- B. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- C. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.14 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Resident Engineer.
- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.
- D. Liquid Membrane Curing:
 - 1. For colored concrete, refer to CURING COMPOUNDS FOR COLORED CONCRETE above in PART 2- PRODUCTS. Apply as recommended by manufacturer.

3.15 CLEANING, PATCHING AND DEFECTIVE WORK

- A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, mismatched color, or is otherwise defective or impairs proper strength or appearance of the work in the Resident Engineer's judgment, the concrete work shall be removed and replaced at the Contractor's expense.
- B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, etc., with patching mortar colored and textured to match concrete. Remove ledges and bulges.
- C. Compact mortar into place and neatly file defective surfaces to produce level, true planes. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.
- D. Rock Pockets:
 - 1. Cut out to full solid surface and form key.
 - 2. Thoroughly wet before casting mortar.
 - 3. Where the Resident Engineer deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, and replace.
- E. Cleaning

1. Insure removal of bituminous materials, form release agents, bond breakers, curing compounds, if permitted and other materials employed in work of concreting that would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

3.16 PROTECTION

- A. The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

3.17 FINAL CLEAN-UP

- A. Remove all debris, rubbish and excess material from the project site.

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