**PART 1 - GENERAL**

* 1. **SUMMARY**
     1. This Section includes exterior Portland cement concrete paving for the following:
        1. Sidewalks
        2. Ramps
     2. Portland cement concrete paving shall be stable, firm and slip-resistant and shall comply with current edition of CBC Sections 11B-302 and 11B-403.
     3. All sidewalks along the Accessible Path of Travel to be slip-resistant finish.
     4. Related Sections:
        1. Section 31 23 00 – Excavating, Backfilling and Compaction
  2. **RELATED DOCUMENTS**

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

* 1. **PROJECT CONDITIONS**

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

**PART 2 - PRODUCTS**

* 1. **FORMS**
     1. Form Materials: Plywood, metal, metal framed plywood, or other acceptable panel type materials to provide full depth, continuous, straight, smooth exposed surfaces.
        1. Use flexible or curved forms for curves of a 100 foot or less radius.
     2. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOC) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  2. **CONCRETE MATERIALS**
     1. Portland Cement: ASTM C150/C150M-09, Type I.
        1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
     2. Fly Ash: ASTM C 618, Type F.
     3. Normal Weight Aggregates: ASTM C33/C33M-08, Class 4, and as follows. Provide aggregates from a single source.
        1. Maximum Aggregate Size: 3/4 inches.
        2. Do not use fine or coarse aggregates that contain substances that cause spalling.
        3. Local aggregate not complying with ASTM C33/C33M-08 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
     4. Water: Potable.
  3. **ADMIXTURES**
     1. Provide concrete admixtures that contain not more than 0.1 percent chloride ions and are certified to be compatible with each other.
     2. Air-Entraining Admixture: ASTM C260-06.
     3. Water-Reducing Admixture: ASTM C494/C494M-10a, Type A or High-Range. Water-Reducing Admixture: ASTM C494/C494M-10a, Type F or Type G.
  4. **CURING MATERIALS**
     1. Clear Waterborne Membrane-Forming Curing Comb: ASTM C309-07, Type I, Class B.
        1. Provide material that has a maximum VOC rating meeting California Air Resource Board requirements.
  5. **CONCRETE MIX**
     1. Prepare design mixes for each type and strength.
     2. Proportion mixes conforming to CALTRANS Class B minimum to provide normal-weight concrete with the following properties:
        1. Compressive Strength (28-Day): 2000 psi.
        2. Maximum Water-Cement Ratio at Point of Placement: 0.45.
        3. Slump Limit at Point of Placement: 3 inches.
           1. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-inch slump concrete.
     3. Add concrete accelerator to speed up curing time as needed to meet schedule.
     4. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent:
     5. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.
  6. **CONCRETE MIXING**
     1. Ready-Mixed Concrete: Comply with requirements and with ASTM C94/C94M-10a.
     2. When air temperature is between 85F (30C) and 90F (32C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90F (32C), reduce mixing and delivery time to 60 minutes.

**PART 3 - EXECUTION**

* 1. **SUBSURFACE PREPARATION**
     1. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
     2. Remove loose material from compacted subbase surface immediately before placing concrete.
     3. Base:
        1. Provide 2" sand or decomposed granite aggregate base under all concrete.
  2. EDGE FORMS AND SCREED CONSTRUCTION
     1. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
     2. Check completed formwork and screeds for grade and alignment to following tolerances:
        1. Top of Forms: Not more than 1/8 inch in 10 feet.
        2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
     3. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.
  3. **PLACING REINFORCEMENT**
     1. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
     2. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond- reducing materials.
     3. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
     4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
  4. **JOINTS**
     1. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
        1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
     2. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
        1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
        2. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.
     3. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
        1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
        2. Provide tie bars at sides of paving strips where indicated.
        3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
     4. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
        1. Locate expansion joints at intervals of 20 feet, unless indicated otherwise.
        2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated.
        3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
        4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
     5. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.
  5. **CONCRETE PLACEMENT**
     1. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
     2. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
     3. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
     4. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
     5. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
        1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
     6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
     7. Consolidate concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
        1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
        2. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
  6. **CONCRETE FINISHING**
     1. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
        1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
     2. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
        1. Radius: 3/8 inch.
  7. **CONCRETE PROTECTION AND CURING**
     1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
     2. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
     3. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
     4. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
        1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
           1. Water.
           2. Continuous water-fog spray.
           3. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

* + 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture- retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
  1. **REPAIRS AND PROTECTION**
     1. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
     2. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
     3. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION