SECTION 32 13 13

CONCRETE PAVEMENT CURB AND SIDEWALK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Driveways and roadways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Walkways.
   5. Unit paver base (if used).

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
   2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
   3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction (if used).

1.03 REFERENCE STANDARDS

A. American Society of Testing Materials (ASTM)
   1. A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
   2. A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
   3. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   4. C33 - Standard Specification for Concrete Aggregates
   5. C94 - Standard Specification for Ready-Mixed Concrete
   6. C150 - Standard Specification for Portland Cement
   7. C171 - Standard Specification for Sheet Materials for Curing Concrete
   8. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
   9. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   10. C494/C494M - Standard Specification for Chemical Admixtures for Concrete
   11. C979 - Standard Specification for Pigments for Integrally Colored Concrete
   12. C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete
   13. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   14. D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
   15. D3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements
   16. D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
   17. D5893 - Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

B. American Concrete Institute (ACI)
   1. 301R-99 – Specifications for Structural Concrete
   2. 304R – Placing and Handling Concrete, etc.
   3. 309R-96 – Guide for Consolidating of Concrete
   4. 330.1 – Standard Specifications for Plain Concrete Parking Lots
   5. 330R-92 – Guide for Design & Construction of Concrete Parking Lots

6. 211.1R-91 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete

C. American Association of State Highway and Transportation Officials (AASHTO)
1. M182 – Standard Specifications for Burlap Cloth made from Jute for Kenaf
2. M153 – Standard Specifications for Preformed Sponge Rubber and Cork Expansion Joint Filler.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product mix indicated.

B. Design Mixtures: For each concrete pavement mixture (see attached form at the end of this section). Include alternate mixture designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. General Contractor and Subcontractor shall execute the Conformance Submittal(s) at the end of this section.

D. Minutes of pre-installation conference.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

C. Concrete Testing Service: The Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
1. A slump test and an air entrainment test shall be performed for each load delivered.
2. Four (4) standard test cylinders shall be taken for each 55 cubic yards of concrete or each days pour, whichever is more frequent. Two cylinders shall be broken at 7 days and two cylinders shall be broken at 28 days.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete producer.
    d. Concrete pavement subcontractor.

1.06 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, 6 inches x 6 inches #10 mesh fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 40 deformed.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Diamond Dowel Bars: ¼" x 4-1/2" Diamond Dowels by PNA.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: ASTM C 150, Type I, Type II or III.
   2. If indicated on the plan and only as approved by the Owner supplement with the following:
      a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Combined aggregate gradation for concrete pavement and other designated concrete shall be 8% - 18% for large top size aggregates (1-1/2") or 8% - 22% for smaller top size aggregates (1" or ¾") retained on each sieve below the top size above the no. 100 sieve. Select coarse-aggregate size from options in first subparagraph below; add gradation requirements if preferred. PCA recommends maximum aggregate size of 3/4 inch (19 mm) in base slab if seeded exposed aggregate is pavement finish.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Calcium Chloride: The use of calcium chloride or admixtures containing more than 0.05% chloride ions is prohibited.

F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Air-Entraining Admixture: ASTM C 260.
   2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   3. Retarding Admixture: ASTM C 494/C 494M, Type B.
   4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   6. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

E. Clear Solvent Borne Liquid Membrane Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

G. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 175, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Coloring Agent: When required, add coloring agent to mix according to manufacturer's written instructions.
   1. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black**,** non-fading, and resistant to lime and other alkalis.
   2. Color: As indicated on Drawings and per manufacturer's designation.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

G. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

2.07 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Lead and chromate free, ready mixed, complying with AASHTO M 248.
   1. Color: Yellow (on concrete).

B. Materials:
   1. **Sherwin Williams Setfast Non- leaded Chlorinated Rubber -** White on asphalt (TM5126), yellow on concrete (TM5127), or as indicated on the drawing(s) is preferred.
   2. **Sherwin Williams "Setfast Acrylic Waterborne Traffic Marking Paint"** – White on asphalt (TM226, yellow on concrete (TM225), or as indicated on the drawing(s)
   3. **Valspar Enterprise Latex Traffic Marking Paint** - White on asphalt (#2540), yellow on concrete (#2541), or as indicated on the drawing(s).
   4. **PPG (Pittsburg Paints)"SEEDHIDE® Traffic and Zone Marking Flat Latex" –** White on asphalt (11-23), yellow on concrete, or as indicated on the drawing(s).

C. Execution
   1. New concrete pavement shall age a minimum of 30 days before painting, unless otherwise approved by the Owner.
   2. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 degrees F not exceeding 90 degrees F and relative humidity at a maximum of 85%.
   3. Surface shall be clean and free of dirt, grease, oil, or other contaminants which could interfere with adhesion.
   4. Apply paint material at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils and dry film thickness of 10 mils per coat.
   5. Paint to be applied in 2 coats using a template or striping machine. Stripes shall be a minimum width of 4 inches unless otherwise noted on the Drawings.

D. Temporary Pavement Markings
   1. Temporary paint shall be applied in accordance with permanent pavement marking specifications however only one (1) coat of paint shall be required. The contractor may use a temporary removable pavement marking tape only as approved in writing by the Owner. Tape that has become damaged and is no longer serviceable shall be replaced without additional compensation.

2. All temporary markings shall be removed when no longer required. Any pavement area that has been determined to be damaged as a result of the removal operation shall be repaired at no additional cost to the Owner.

E. Pavement Marking Removal
1. A motorized abrasive device shall be utilized to remove existing markings. Existing pavement marking lines and symbols that are to be removed shall be accomplished such that material or structural damage to the surface or texture of the pavement is avoided. The Contractor shall repair any damage to the pavement at no expense to the Owner. After removal, the pavement shall be in a condition that will not mislead or misdirect customers or motorists. Pavement marking removal within public rights of way shall be completed in accordance with the regulatory authority having jurisdiction and the Drawings and Specifications.

2.08 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, 6 inches (150 mm) high by 6 inches (150 mm) wide by 72 inches (1820 mm) long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 12-inch (300-mm) minimum length. Or #4 bars 12-inch (300 mm) minimum.

2.09 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 211.IR-91 and ACI 304 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Slump Limit: Maximum 5 inches (125 mm) at time of placement for pavement, 2 inch (50 mm) for curb and sidewalk.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 5-% to 8% for pavement, curb and sidewalk.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements, only as authorized by the Owner in writing as follows:
1. Fly Ash or Pozzolan: 25 percent.

G. Color Pigment: When indicated on the Drawings add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: On-site mixing must be approved by the Owner. Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared sub-base surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
   3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inc**h (13 mm)** require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and sub-grade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted sub-base surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Maintain sufficient quantity of forms to allow continuing work so that forms are in place a minimum of 24 hours after concrete placement.

C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

D. Flexible or curved forms shall be used on curves. Forms shall be of full depth of the concrete and of strength when staked sufficient to resist the pressure of concrete and the loads resulting from the finishing operations without springing, settling or losing shape.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Accurately position and support reinforcement and secure against displacement. Set wire ties with ends directly into concrete.

E. Install welded wire reinforcement 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. Support reinforcing steel on wire chairs to ensure wire stays mid-depth of sidewalk section during concrete pour.

3.05 JOINTS

A. General: Form pre-molded expansion and contraction joints, construction joints, control joints, thickened edge expansion joints, isolation joints, and tool edgings true to line with faces

perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Diamond Dowels: Install ¼" x 4-1/2" Diamond Dowels by PNA at 24" on center or as shown on the drawings. Install per manufacturer's recommendations.

C. Isolation Joints: Locate isolation joints as shown on the Drawings. Form isolation joints of preformed joint-filler strips abutting Provide catch basins, manholes, inlets, structures, walks, light pole bases and other fixed objects , and where indicated.

1. Expansion: Provide joint filler for the entire depth of the slab section and not less than one (1) inch below finished surface so as to allow for joint sealer. Provide thickened edge expansion joint as indicated on the Drawings.
    a. Provide ½" expansion joints for curb and gutter and sidewalk at 100 feet on center.
    b. Provide ½" contraction joints for curb and gutter at 10 feet on center.
    c. Extend joint fillers full width and depth of joint.
    d. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
    e. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
    f. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
    g. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction ("control") Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, or 1 inch, whichever is deeper. For sidewalks, control joint spacing shall be equal to the sidewalk width. For concrete pavement, control joint spacing shall be placed as shown on the drawings but no greater than 30 times the slab thickness on center both ways.

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groove marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete within 24 hours of concrete placement and as soon as the cutting action will not tear, abrade, or otherwise damage surface. If required re-saw joint immediately prior to installing sealant to achieve a ¼ inch joint width - second saw joint to be ¼-inch (6 mm) if required. Power saws are to be equipped with a bag to collect concrete dust. Concrete dust shall be disposed of in accordance with the Stormwater Pollution Prevention Plan.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. General: All concrete walks and aprons shall be a minimum of 4 inches thick as shown on the Drawings, with a turned down edge as detailed. Comply with tolerances in ACI 330.1 Specification for Plain Concrete Parking Lots.

B. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

C. Remove snow, ice, or frost from sub-base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

D. Moisten sub-base to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

E. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
F. Do not add water to fresh concrete after testing.
G. 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.
H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   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 reinforcement, dowels, and joint devices.
I. Screed pavement surfaces with a straightedge and strike off.
J. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.
B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and 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. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium Textured Broom Finish: Draw a medium bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, medium (1/16 (1.6mm)) texture.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.
C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
    1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
        a. Water.
        b. Continuous water-fog spray.
        c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
    2. 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 (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    4. All exterior concrete surfaces shall receive one coat of exterior sealer.

3.09 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 (based on ACI 330.1) and as follows:
    1. Elevation: 1/4 inch (6 mm).
    2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
    3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
    4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
    5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
    6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
    7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
    8. Joint Spacing: 3 inches (75 mm).
    9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
    10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner.
B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.11 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond

each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Slump and Air Content Testing Frequency: Obtain at least 1 composite sample for each load delivered.
    a. Slump: ASTM C 143/C 143M; Perform additional tests when concrete consistency appears to change.
    b. Air Content: ASTM C 231, pressure method.
    c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above.
2. Test Cylinder Frequency: Obtain four standard test cylinders for each 55 cubic yards of concrete or each day's pour, whichever is more frequent.
    a. Compressive-Strength Tests: ASTM C 39/C 39M; test 2 specimen cylinders at 7 days and 2 specimen cylinders at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Owner, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

F. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

DESIGN INFORMATION

	Please check one
Based on Standard Deviation Analysis	
Trial Mix Test Data	

DESIGN CHARACTERISTICS

Density		pcf
Strength		psi (28 day)
Air		% specified

If trial mixes are used the Mix Design is proportioned to achieve f'cr = f'c + 1200 psi
(1400 psi for strength higher than 5000 psi at 28 days)

MATERIALS	***Type/ Source***	***Specific Gravity***	***Weight/lb.***	***Absolute Vol. cu.ft.***
Cement				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Other				
		TOTAL		27.0 cu. ft.

* Water/Cement Ratio (lbs. water/lbs. cement) = _____%

ADMIXTURES	**Manufacturer**	**Dosage oz/cwt**
Water Reducer		
Air Entraining Agent		
High Range Water Reducer		
Non-Corrosive Accelerator		
Other		

Slump before HRWR _____ *inches*
Slump after HRWR _____ *inches*

Standard Deviation Analysis (from experience records):

# of Test Cylinders Evaluated:	
Standard Deviation:	

f'cr-f'c + 1.34s or f'cr = f'c + 2.33s - 500

Slump before HRWR _____ *inches*
Slump after HRWR _____ *inches*

Standard Deviation Analysis (from experience records):

# of Test Cylinders Evaluated:	
Standard Deviation:	

f'cr-f'c + 1.34s or f'cr = f'c + 2.33s - 500

(Refer to ACI 301 for increased deviation factor when less than 30 tests are available)

LABORATORY TEST DATA

Compressive Strength

Age (days)	**Mix # 1**	**Mix #2**	**Mix #3**
7	psi	psi	psi
7	psi	psi	psi
28	psi	psi	psi
28	psi	psi	psi
28 average	psi	psi	psi

REQUIRED ATTACHMENTS

	Please Check
Coarse Aggregate Gradation Report	
Fine Aggregate Gradation Report	
Concrete Compressive Strength Data or Trial Mixture Test Data	
Admixture Compatability certification letter	

Submitted by:

Name: _____
Address: _____
_____
Phone #: _____
Main Plant Location: _____
Miles from Project: _____
Secondary Plant Location: _____
Miles from Project: _____
_____
Date: _____

CONFORMANCE SUBMITTAL
SECTION 321313 – CONCRETE PAVEMENT CURB AND SIDEWALK

Project Location _____
(*City, State*)

General Contractor: _____
(*Company Name, Phone Number*)

_____
(*Address*)

Sub-Contractor: _____
(*Company Name, Phone Number*)

_____
(*Address*)

The following products have been selected (check one box) for use in this project from the list of acceptable products specified:

Exterior Concrete Sealant:
☐ Sonneborn "Kure-N-Seal 30" exterior acrylic sealer
☐ Euclid "Super Rez-Seal

Cold-Applied Joint Sealant ASTM D5893, self leveling silicone sealant:
☐ Crafco Inc. "Roadwaver Silicone-SL"
☐ Dow Corning 888
☐ Dow Corning 890-SL
☐ Sonneborn "Sonomeric 1 Sealant"
☐ Tremco "Vulkem 45"

Hot-Applied Joint Sealant: ASTM D3405, Polymeric sealant.
☐ Crafco Inc. "ROADSAVER 22"
☐ W.R. Meadows, Inc. "SEALTIGHT HI-SPEC"

I represent to City/Owner/Engineer that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the contract documents. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Owner the work shall be completed without additional cost to the Owner and / or the contract.

Sub-Contractor: _____
(*Signature of the Authorized Agent of the Sub-Contractor*) Date

_____
(*Print Name of the Authorized Agent of the Sub-Contractor*)

General Contractor: _____
(*Signature of the Authorized Agent of the General Contractor*) Date

_____
(Print Name of the Authorized Agent of the General Contractor