

**SECTION 02700
PORTLAND CEMENT CONCRETE PAVEMENT**

PART 1 GENERAL

1.01 – GENERAL

1.02 – Section Includes

- A. Portland Cement Concrete (PCC) Pavement Roadway.
- B. PCC Pavement Roadway Repair.
- C. PCC Overlay.
- D. PCC Curb and Gutter.
- E. PCC Sidewalk.
- F. PCC Driveway.
- G. PCC Pedestrian Appurtenances.
- H. PCC Curb Repair.

1.03 – Description of Work

- A. PCC Pavement Roadway: includes the furnishing and placement of PCC Pavement roadway and pavement roadway widening using fixed forms or slip form equipment including integral curbs, applicable reinforcing steel, expansion material, jointing, joint sealing and finishing.
- B. PCC Pavement Roadway Repair: includes the furnishing and placement of PCC for repairing an existing pavement slab, including integral curbs, applicable reinforcing steel, expansion material, jointing, joint sealing, and finishing.
- C. PCC Overlay: includes the furnishing and placement of PCC for constructing an unbonded or bonded overlay, including applicable reinforcing steel, expansion material, jointing, joint sealing, and finishing.
- D. PCC Curb and Gutter: includes the furnishing and placement of PCC for constructing curb and gutter, including applicable reinforcing steel, expansion material, jointing, joint sealing, and finishing.
- E. PCC Sidewalk: includes the furnishing and placement of PCC for constructing sidewalk (not through driveway aprons), including applicable reinforcing steel, expansion material, jointing, joint sealing, and finishing.
- F. PCC Driveway: includes the furnishing and placement of PCC for constructing driveway pavement, driveway aprons, including driveways through sidewalks, including applicable reinforcing steel, expansion joint material, joint sealing, jointing and finishing.
- G. PCC Pedestrian Appurtenances: includes the furnishing and placement of PCC for constructing pedestrian ramps and median crossovers including applicable reinforcing steel, detectable warning panels (DWP), expansion joint material, joint sealing, jointing, and finishing.
- H. PCC Curb Repair: includes the removal and disposal of existing curb, and the placement of PCC for constructing curb and gutter, including applicable reinforcing steel, expansion material, jointing, joint sealing, and finishing.

1.04 - Submittals

- A. Submit samples and test results as set forth in the Contract Documents.
- B. Submit certificate of compliance indicating the materials incorporated into the Work comply with the Contract Documents. Suppliers shall be Iowa DOT certified.
- C. Submit verification of Iowa DOT certification for PCC ready-mix supplier.
- D. Submit plan of proposed concrete joints to Engineer for approval.

- E. If applicable, submit paving mix design for each different aggregate source for review and approval by engineer. This submittal not required if Iowa DOT mixes used.
- F. Maturity curves for paving mixes and maturity reading results.

1.05 – Scheduling and Conflicts

- A. Schedule Work to minimize disruption of public streets and facilities.
- B. Provide minimum 24-hour notice to Engineer, not including weekends or holidays, of pavement pours.

1.06 – Special Requirements

- A. All Work and materials incorporated into this Project shall conform to all applicable local, state, and federal requirements.
- B. Before PCC pavement can be opened to traffic, either the requirements of destructive method strength testing or maturity method testing must be met:
 - 1. Destructive Method Strength Testing: All samples shall meet 3,000 psi compressive strength and 500 psi flexural strength. Class C mix with Type I cement shall be tested at 7 days; Class M mix with Type I cement shall be tested at 48 hours; Class M-4 mix with Type I cement and **non-chloride accelerating admixture** shall be tested at 8 hours.
 - 2. Maturity Method Testing
 - a. When the maturity method is used, the time for opening pavement shall be based upon the strength requirements only, as listed in paragraph 1.06.B.1
 - b. Personnel performing maturity testing shall be Level I PCC certified plant inspectors, with training for maturity testing. The certified inspector may supervise other persons who may then perform the temperature testing of the constructed pavement.
- C. For Contractor operations only, and subject to Engineer's approval, pavement may be used for light vehicles and to support a paving machine traffic if a compressive strength of 3,000 psi and a minimum age of three days have been achieved after placement, and if appropriate protective measures are taken.
- D. All equipment used in the completion of the Work included in Section 02700 shall comply with Iowa DOT Standard Specification 2301.03.A, or shall be as approved by the Engineer.
- E. The Contractor is responsible for the maintenance of the completed subgrade. If rutting or any other damage occurs to the subgrade for any reason, the Contractor shall immediately repair the subgrade in accordance with Section 02100.
- F. Contractor/subcontractor vehicles licensed at five tons or greater will not be permitted on the roadway pavement until the pavement has reached the strength requirements of 1.06.B.
- G. Excess PCC shall be disposed of in a manner as to not cause damage or harm to adjacent properties or public facilities.
- H. **When specified in Contract Documents, pavement cores shall be taken in accordance with Section 01110 (Testing and Quality Control).**

PART 2 PRODUCTS

2.01 – PCC Pavement

- A. The materials incorporated in PCC pavement shall comply with the following Iowa DOT Standard Specifications and Materials Instructional Memorandum (IM), where indicated in parenthesis:
 - 1. Portland Cement – (4101. (IM 401))
 - 2. Water – (Potable).

3. Liquid Admixtures for PCC – (4103. (IM 403))
4. Liquid Curing Compounds – (4105.)
 - a. White pigmented compounds shall comply with AASHTO M148.
 - b. Linseed oil.
5. Plastic Film and Insulating Covers for Curing Concrete – (4106)
6. Class C Fly Ash – (4108.(IM 491.17))
7. **Ground granulated blast furnace slag (GGBFS) – (4108)**
8. **Limestone: IM 401**
9. Aggregates
 - a. Fine aggregates
 - 1) Standard Specification – (4110)
 - 2) IM's 409, T-203
 - b. Coarse aggregates
 - 1) Standard Specification – (4115)
 - 2) Class 3 durability unless noted otherwise
 - 3) IM's 409, T-203
10. Preformed Expansion Joint Filler. Preformed fillers for joints shall conform to AASHTO M33, AASHTO M153 Type II, and AASHTO M213 and shall be punched to admit the dowels.
11. Joint Fillers and Sealers – (4136. (IM 436.01))
12. Liquid Sealing Materials for PCC Surfaces – (4139. (IM 491.12))
13. Steel Reinforcement – (4151. (IM 451, 451.01, 451.03B)), Epoxy Coated.
14. Keyway and Expansion Tubes 9 (4191)
15. Maturity Method Testing. (IM 383)
- B. The PCC class and associated mix design shall be as defined in Iowa DOT IM 529. The concrete mix class shall be C-3, C-4 or M unless noted otherwise in the Contract Documents. Calcium chloride is not permitted. Non-chloride accelerating admixtures may be used if specifically provided for in a mix design approved by the Engineer. Fly ash and/or water reducers, when used, shall conform to Iowa DOT Standard Specifications.
- C. Entrained air
 1. **Measure air content on-grade prior to consolidation.**
 2. **Slip Form and Fixed Form Machine-Placed Pavement: 8% plus or minus 2%**
 3. **Hand-Placed Pavement: 7.0% plus or minus 1.5%**
 4. **Engineer may adjust target air control based on random tests on consolidated concrete behind the paving machine.**
- D. Reinforcing steel shall be epoxy coated and of the size as set forth in the standard details.
- E. Portland cement shall be the type appropriate for the specified mix. **Use of Type III cement is not allowed.**
- F. Epoxy bond material for anchoring reinforcing steel and dowel bars to existing pavements shall conform to IM 491.11 and 491.22.
- G. Except as specifically modified by the Engineer, the slump shall not be less than ½ inch or more than 2 ½ inches for machine finished, fixed form pavement, or 4 inches for hand-finished pavement. **Slump requirements will not apply to slip-form paving.**

2.02 – PCC Pavement Roadway Repair

The materials shall be as set forth in Section 2.01 herein. The concrete class mix shall be M-4, unless noted in the Contract Documents.

2.03 – PCC Pavement Roadway Overlay

- A. The materials shall be as set forth in Section 2.01 herein. The mix class shall be C-4WR or C-4WR-C, unless noted in the Contract Documents.

- B. Coarse aggregate shall meet the requirements of Iowa DOT Standard Specification 4109, Gradation 3 or 5, and a durability of Class 3 or better.
- C. Joint filler and sealer shall meet requirements of Iowa DOT Standard Specification 4136.02, A.

2.04 – PCC Pavement Curb and Gutter

The materials shall be Class M concrete, for roads under traffic, or Class C concrete for unopened and fully closed streets, as set forth in Section 2.01.

2.05 – PCC Pavement Sidewalk

The materials shall be as set forth in Section 2.01 herein.

2.06 – PCC Driveway

The materials shall be Class M concrete as set forth in Section 2.01 herein.

2.07 – Welded Steel Wire Fabric

Wire mesh reinforcement for concrete shall be electrically welded rectangular mesh. Size and spacing of wires and weight per 100 square feet shall conform to requirements shown on plans.

2.08 – Reinforcing Bars

Reinforcing steel shall be deformed and manufactured to current ASTM standards with the following minimum yield points. Beam stirrups and column ties, 40 ksi. All others shall be 60 ksi unless otherwise noted on the plans. Reinforcing bars shall be epoxy coated by electrostatic spray, and conform to ASTM D3963 and IM 451.

2.09 – Insulating Cover

- A. **Burlap conforming to Iowa DOT Standard Specification 4104.**
- B. **Plastic film conforming to Iowa DOT Standard Specification 4106.**
- C. **Insulating sheets or blankets**
 - 1. **Sheeting conforming to Iowa DOT Standard Specification 4106.02. Sheeting may be covered with plastic film for rain protection.**
 - 2. **Blanket consisting of a layer of closed cell polystyrene foam protected by at least one (1) layer of plastic film, rated by the manufacturer with a minimum R-value of 1.0.**

2.10 – Form Work

- A. Lumber: Use lumber free of material effects that would deform the finished concrete product. Form framing, sheathing and shoring shall conform to WWPA Catalog A.
- B. Plywood:
 - 1. Form Sheathing and Panels: Not less than 5/8-inch thick Exterior Type B-B Plywood Class I and II EXT-APA conforming to U. S. Product Standard PS-1-74.
 - 2. Use Class II only on surfaces not exposed to view.
- C. Steel: Metal forms of a pre-engineered standard design, but conforming to the concrete sections indicated on the Contract Drawings may be used in lieu of wood forms.
- D. Form Ties:
 - 1. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347.
 - 2. Use snap-off metal ties with ends that break at least 1 ½ inches from the face of the wall.
 - 3. Removable ties that leave holes larger than 7/8 inch are not permitted.
 - 4. Form ties fabricated on the Project Site and wire ties or flat bands are not acceptable.
 - 5. Wood spacers are not permitted within the pour.

- E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.
- F. Chamfer Strips: Triangular fillets all of which shall be milled from clear, straight-grain pine, surfaced each side, or all of which shall be extruded vinyl type with or without nailing flange unless otherwise indicated.
- G. Leakage Control Materials:
 - 1. General: Produces which are capable of producing flush, watertight and non-absorbent surfaces and joints and are compatible with type of forming material and concrete ingredients used.
 - 2. Caulking compound: One of the following products or approved equal:
 - a. Clear silicone-type similar to Series 1200 Construction Caulking as produced by General Electric – Silicone Products Division.
 - b. Dow Corning 781 Caulking as produced by DOW Corning Adhesives.
 - 3. Tapes: One of the following products or approved equal:
 - a. Seam-Strip by Preco Industries.
 - b. Tesa Formstik Tape Number 720 by United Mineral and Chemical
 - c. Form film tapes: Polypropylene plastic tape treated with waterproof adhesive for joint conditions.
- H. **Finishing and Texturing Materials:**
 - 1. **Microtexturing**
 - a. **Preferred material is artificial turf.**
 - b. **Coarse carpet or dampened burlap may be used if approved by Engineer.**
 - 2. **Macrotexturing**
 - a. **Use mechanical device conforming to Iowa DOT Standard Specification 2301.03.H.3.**
 - 1) **Single row of tines 1/8 inch plus or minus 1/64 inch wide.**
 - 2) **Forms grooves in plastic concrete 1/8 inch depth plus or minus 1/16 inch.**

2.11 – Detectable Warning Panels (DWP)

- A. Panels shall be 24" x 24", 24" x 30", 24" x 48" or 24" x 60" dimensions.
 - 1. Two (2) 24" x 30" panels may be substituted for one 24" x 60" panel.
 - 2. Two (2) 24" x 24" panels may be substituted for one 24" x 48" panel.
- B. Panels shall have truncated domes with a diameter of no less than 0.9" and no greater than 1.4". The dome height shall be 0.2". The top of the dome shall be a minimum of 50%, but no larger than 65% of the base diameter. The domes shall be in a square pattern with parallel alignment. Spacing of the domes shall be 1.6" minimum or 2.4" maximum center-to-center measurement. Base of the domes shall be 0.65" minimum from adjacent dome bases.
- C. The panels shall be bright red in color or shall weather to a comparable color within six (6) months of installation.
- D. Unless another configuration is specified in Contract Documents, radius panels shall be for a 16-foot radius and shall consist of all required sections to start and complete the radius installation while conforming to ADA requirements for width, length and dome spacing.
- E. Trimming of panels, if required to conform to ADA requirements, shall be in accordance with manufacturer's recommendations.

- F. Panel materials shall be one of the following:
 - 1. Plastic type material either a Vitrified Polymer Composite or a homogenous glass and carbon reinforced composite, e.g.: Armor Tile, Armormat or ADA Solutions type product or equivalent.
 - 2. Stainless Steel, e.g.: Meta Dome or Advantage Tactile System type product or equivalent.
 - 3. Cast iron, e.g.: Neenah or East Jordan type product or equivalent.
 - 4. Corian base type material, e.g.: USA Safety Dome type product or equivalent.
- G. Compressive strength shall be a minimum of 18,000 PSI with a flexural strength of 16,000 PSI. All panels shall be designed to be inset into freshly poured concrete with a built-in anchoring system. A minimum 6" x 6" sized sample of the type and color shall be supplied.

2.12 – Materials for colored concrete surfaces

- A. Integral Coloring Agent
 - 1. Integral coloring agent shall achieve a bright red color similar to color of detectable warning panels.
 - 2. Approved products
 - a. #417 Red (4 ½ pounds color chips per 100 pounds of gray Portland Cement, tan sand and crushed rock by SGS Concentrated Mortar Colors "A Series".
 - b. Similar colors from L.M. Scofield Company "Chromix" admixture.
 - c. Similar colors from Chem Masters Chemtint.
 - d. Approved equals to above products.
 - 3. Integral color admixture shall be added to concrete mix at the batch plant per manufacturer's recommendations.
- B. Sealer
 - 1. Non-yellowing curing membrane.
 - 2. Comply with ASTM C309.

PART 3 EXECUTION

3.01 – PCC - General

- A. No PCC paving of any type shall commence until subbase (where applicable) has been prepared as set forth in Section 02100.
- B. PCC shall not be placed if the air, subbase or pavement temperature is less than 35 degrees F., if raining, or on subgrade with a moisture content greater than 2 percent above the optimum moisture content. Procedure for hot and cold weather concreting shall be as specified below:
 - 1. Cold Weather Concreting:
 - a. The minimum air temperature at the point of application for concrete shall be 30 degrees F. Where the air temperature at the point of application is below 45 degrees F, concrete delivered at the job site shall conform to the following temperature limitations:
 - 1) For sections with least dimension of 12 inches or less: 60 degrees F.
 - 2) For sections with least dimension greater than 12 inches: 50 degrees F.
 - b. If water or aggregate is heated above 100 degrees F, combine water with aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.

- c. Provide equipment for heating concrete materials and protection of concrete during freezing or near freezing weather. Do not use foreign materials or materials containing snow or ice.
 - d. Surfaces of which the concrete shall contact must be free of frost, snow or ice.
 - e. Concrete placed in forms shall have a temperature of 50 degrees F or higher after placement. Maintain this temperature a minimum of five days. Provide additional time if necessary for proper curing.
 - f. Housing, covering or other protection used incurring shall remain intact at least 24 hours after artificial heating is discontinued. Do not rely on salt or other chemicals for the prevention of freezing.
 - g. Perform cold weather concreting work in accordance with ACI 306
2. Hot Weather Concreting:
- a. Temperature of concrete delivered at the job site shall not exceed 90 degrees F.
 - b. Cool ingredients before mixing to prevent temperatures in excess of 90 degrees F.
 - c. Make provisions for windbreaks, shading, fog spraying, sprinkling or wet cover when necessary.
 - d. Perform hot weather concreting work in accordance with ACI 305.
- C. Engineer shall have the authority to shut down paving operations if weather conditions do not allow for proper placement of PCC.
- D. Do not start PCC paving until traffic control is in place in accordance with Section 01200.
- E. PCC shall not be placed unless the proper protective and insulative materials are on Site, readily available for use, and used in accordance with the requirements of this section.
- F. If Work is to take place within existing public rights-of-way, the Contractor shall be required to obtain all necessary permits and shall be responsible for all applicable fees.
- G. The Contractor shall adjust fixtures to conform to the proposed finished surface within the area to be paved. The outside of the fixture shall be cleaned to base of pavement before commencing the paving operation. The fixture shall be boxed out if required by the Contract Documents.
- H. If fixed forms are being used, the Contractor shall place the forms plumb and to the line and grade as set forth in the Contract Documents. The base of the form shall be at or below the bottom of the concrete.
- I. Fixed forms shall be coated with suitable form oil prior to commencing the paving operation.
- J. Reinforcing steel shall be clean, straight and free from distortion, and shall be positioned on approved support assemblies. Bar crossings shall be tied. Bar supports shall insure that bars remain horizontal in plastic concrete.
- K. If holes for tie bars or dowel bars are required in existing pavement, they shall be drilled at mid height of the existing slab face and to the required depth. A drill on a fixed frame shall be used in order to provide for proper alignment of the hole. The hole shall be blown clean and the tie bar or dowel bar bonded in place with an epoxy compound.
- L. If reinforcing mesh fabric is required, the mesh fabric shall be installed by placing concrete to half the full depth and placing the reinforcing fabric on the concrete, then placing the remainder of the concrete over the top of the mesh fabric. The concrete in the lower half of the installation shall not have been placed longer than 15 minutes before the mesh fabric is placed and the remaining concrete is placed.
- M. The finished pavement surface including exposed vertical edges and back of curb shall be coated with a curing compound by the Contractor.
1. Use white pigmented liquid curing compound between March 1st and October 31st.

2. Use linseed oil curing compound for all paving operations between October 15 and February 28. Apply only when surface temperature and air temperature are 40 degrees F or more and rising.
 3. Apply curing compound in a fine spray to form a continuous, uniform film on the surface and exposed, vertical edges as soon as the free water has appreciably evaporated.
 4. The curing compound application rate shall not be less than 0.067 gallons per square yard (covering 16 square yards per gallon) for all concrete classes.
 5. Spread sand over linseed oil curing compound to prevent slick roadway surfaces.
- N. If the curing film is damaged within 72 hours after being applied, the Contractor shall recoat the area immediately upon discovery. Coating of the sawed surface with curing compound will not be permitted on joints that are to be sealed.
- O. As necessary, the Contractor shall provide cold weather protection following the application of the curing compound for the concrete less than 36 hours old.
1. For temperatures from 35 to 32 degrees, one layer of burlap.
 2. For temperatures from 25 to 31 degrees, two layers of burlap, or one layer of plastic film on one layer of burlap.
 3. For temperatures below 25 degrees, four layers of burlap between alternating layers of 4-mil plastic or four layers of burlene, **insulating blankets** or equivalent commercial insulating material approved by the Engineer.
 4. The insulation shall be maintained in place until the pavement is five days old for C mixes, or three days old for M mixes, or opening strength is attained.
 5. The Contractor shall remove and immediately replace insulation to provide for the saw cutting of joints while minimizing the loss of insulation to the concrete.
- P. The Contractor shall provide for protection of the pavement against the effects of rain. Burlap, paper or plastic shall be on the job Site and available for protection from the rain. If rain damage occurs, the Contractor shall be responsible to repair or replace the defective material as determined by the Engineer.
- Q. Paving operations shall terminate with ample time to allow for complying with finishing and protection requirements during daylight hours, unless approved otherwise by the Engineer.
- R. The Contractor shall be responsible to protect the new concrete from damage due to traffic, the elements and vandalism, until the Work is accepted. Any damaged concrete shall be repaired or replaced as determined by the Engineer and at the Contractor's cost.
- S. Protection and repair of subgrade:
1. The Contractor is responsible for the maintenance of the completed subgrade. Hauling equipment and other traffic will not be allowed on the completed subgrade. If rutting or any other damage occurs to the subgrade for any reason, the Contractor shall immediately repair the subgrade. Such repair will include, if necessary, scarifying to a depth of 8 inches, aerating, and recompacting the subgrade.
 2. Existing subgrade or subbase disturbed during repair or retrofit operations will be protected and restored to original condition, unless improvements beyond original conditions are set forth in the Contract Documents.
- T. Fly ash shall not be used in concrete mixes between October 16th and March 15th unless maturity method of strength determination is used.
- U. Joints shall be placed as set forth in the Contract Documents.
- V. Finish concrete promptly after it has been placed and consolidated. No additional water shall be added to facilitate finishing the surface of the plastic concrete. Following consolidation, the concrete shall be struck off to the true section with a screed. Unless macro-texturing is specified, drag artificial turf over the surface longitudinally to produce a tight, uniform, textured surface. Edges shall be rounded.

- W Forms may be removed after six hours with the following requirements:
 - 1. Edge of pavement shall be cured in a manner similar to the pavement surface.
 - 2. Backfill after pavement has attained minimum strength for opening. Contractor shall protect pavement edges.
- X. Joints shall be sawn, cleaned, filled and sealed according to the Contract Documents, in a timely manner, and prior to accepting the Work. Full depth sawcut is required at the perimeter of all repairs.

3.02 – PCC Pavement Roadway – General

- A. The PCC shall be placed to the line, grade, and depth as set forth in the Contract Documents. Concrete shall be placed full depth except as noted herein. Use shovels if hand spreading of material is required. Do not spread concrete with rakes or vibratory equipment. Consolidate concrete to provide for a secure bond and the removal of voids. Provide vibration if concrete is being finished by hand-methods.
- B. Whenever thirty minutes or more has elapsed since the last concrete has been deposited, or if such a delay is anticipated, a header shall be installed. It shall conform to the typical section of the pavement and the location shall coincide with the required transverse and longitudinal joint pattern.
- C. Joints shall be sawed, cleaned, filled, and sealed in accordance with the Contract Documents, in a timely manner, and prior to acceptance of the Work.

3.03 – PCC Pavement Roadway Repair - General

- A. Existing concrete shall be removed to expose sound concrete.
- B. The PCC shall be placed to the line, grade, and depth as set forth in the Contract Documents. Concrete shall be placed full depth except as noted herein. Use shovels if hand spreading of material is required. Do not spread concrete with rakes or vibratory equipment. Consolidate concrete to provide for a secure bond and the removal of voids. Provide vibration if concrete is being finished by hand-methods.
- C. Joints shall be sawn, cleaned, filled, and sealed in accordance with the Contract Documents, in a timely manner, and prior to acceptance of the Work. A full depth sawcut is required at the perimeter of all repairs.
- D. Resurfacing
 - 1. The surface shall be scarified, following by sandblasting. Scarification shall be to a nominal depth of $\frac{1}{4}$ inch. At the Contractor's option, the surface may be prepared by shot blasting. In either case, the preparation shall be of an extent to remove all dirt, oil, and other foreign materials, as well as any laitance or loose material from the surface and edges against which new concrete is to be placed. Materials removed in the preparation operation shall be removed from the roadway and shall be disposed of in a manner approved by the Engineer.
 - 2. The exact location of each contraction and expansion joint in the existing pavement and the joint to be sawed at each full depth repair shall be identified on both sides by a reliable method.
 - 3. Joints shall be sawed in the resurfacing directly over existing transverse joints. A joint shall be sawed directly over the existing centerline. Transverse joints shall be sawed to the full depth of new resurfacing concrete, including depressions created in the existing surface, and as specified in the widening areas. Transverse joints shall be sawed as soon as possible without causing excessive raveling. The joint over the existing longitudinal joints shall be sawed within 48 hours after placement and to a 2-inch minimum depth.
- E. PCC repair, including base
 - 1. For PCC full depth and partial depth repair patches, the concrete shall be finished level with, or not more than approximately $\frac{1}{4}$ inch above the existing surface for repair of PCC pavements to be resurfaced. For PCC pavements previously

resurfaced with HMA, the surface of the repair patch shall be finished at approximately the level of the old PCC surface. The patch shall then be finished to the surface of the surrounding pavement with HMA.

2. PCC full depth and partial depth repair patches shall be covered immediately with an insulating blanket-type cover as specified in Section 02700. **The blanket-type cover shall be covered with insulating sheeting as specified in Paragraph 2.09 C. Place blanket and sheeting over the patch and adjacent surface and hold tightly in place with weights to retain all possible heat in the concrete.**
3. Curing compound not allowed on repair patches.
4. If sawed joints are required in repair patches, the curing protection may be removed from each patch immediately prior to sawing and must be replaced immediately after sawing joints in that patch. **If HMA or PCC resurfacing is scheduled to follow repairs, joints shall not be sealed on repair patches.**
5. Heavy equipment shall not be used adjacent to new concrete until the curing is completed.

3.04 – PCC Pavement Curb and Gutter - General

- A. The PCC shall be placed to the line, grade, and depth as set forth in the Contract Documents. Concrete shall be placed full depth except as noted herein. Use shovels if hand spreading of material is required. Do not use rakes or vibratory equipment. Consolidate concrete to provide for a secure bond and the removal of voids.
- B. Whenever thirty minutes or more has elapsed since the last concrete has been deposited, or if such a delay is anticipated, install header conforming to the typical section of the curb and gutter. Location shall coincide with the required transverse and longitudinal joint pattern.

3.05 – Curb Repair

- A. Saw existing pavement full depth for removals to provide a true edge.
- B. Existing curb-and-gutter sections shall be removed. Existing brick and subbase shall be removed as necessary to provide a reasonably straight and uniform joint.
- C. Longitudinal joints between curb replacement sections and existing slab shall not be sawn, tooled, or sealed on roadways with an existing ACC surface. Joints shall be sawn and sealed according to standard details on existing PCC roadways including those scheduled to receive an ACC overlay.
- D. The PCC shall be placed to the line, grade, and depth as set forth in the Contract Documents. Concrete shall be placed full depth except as noted herein. If hand spreading of material is required, it shall be accomplished with shovels and not rakes or vibratory equipment. It shall be consolidated to provide for a secure bond and the removal of voids.
- E. Whenever thirty minutes or more has elapsed since the last concrete has been deposited, or if such a delay is anticipated, a header shall be installed. It shall conform to the typical section of the curb and gutter, and the location shall coincide with the required transverse and longitudinal joint pattern.

3.06 – PCC Pavement Sidewalk – General

- A. The PCC shall be placed to the line, grade, and depth as set forth in the Contract Documents. Concrete shall be placed full depth except as noted herein. Use shovels if hand spreading of material is required. Do not use rakes or vibratory equipment. Consolidate concrete to provide for a secure bond and the removal of voids.
- B. If a utility fixture falls within the proposed sidewalk, Contractor shall contact appropriate utility company and request relocation of the fixture.
- C. Whenever thirty minutes or more has elapsed since the last concrete has been deposited, or if such a delay is anticipated, install header conforming to the typical section of the pavement. Location shall coincide with the required transverse and longitudinal joint pattern.

3.07 – PCC Pedestrian Appurtenances

Construction: Refer to the Standard Details for Public Improvements.

3.08 – Setting Forms

- A. The material under the forms shall be compacted and shall be at grade so as to be in firm contact with the form for its entire length.
- B. Subbase at the form line which is below grade shall be brought up to grade with clean granular material in lifts of ½ inch or less for a distance of 18 inches on each side of the base of the form and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or cutting as necessary. Pedestals of subbase or other materials upon which to reset the forms to bring them to grade will not be permitted.
- C. Form coating shall be as specified below:
 - 1. Coat form contact surfaces with form release agent compound before reinforcement is placed. Do not allow excess form release agent material to accumulate in the forms or to come into contact with surfaces that shall be bonded to fresh concrete such as concrete reinforcement and embedded items. Apply form release agent in compliance with manufacturer's instructions.
 - 2. Coat steel forms with non-staining, rust-preventive form oil or otherwise protect against rusting. Do not use rust-stained steel surfaces for contact with concrete.
- D. Set forms for PCC roadway to the required grade and alignment to the following tolerances:
 - 1. Grade: Plus or minus 1/8 inch.
 - 2. Alignment: Plus or minus ¼ inch at any point and no more than 1/8 inch deviation from a 10 foot straightedge.

3.09 – Joints and Embedded Items

- A. Construction Joints
 - 1. Place construction joints where indicated on the Contract Documents.
 - 2. Secure Engineer's approval prior to making additional or revised locations of construction joints.
- B. Bond new concrete with hardened concrete using one of the following methods:
 - 1. Grout Method.
 - a. Clean hardened concrete of foreign matter and residue, roughen and saturate with water.
 - b. Cover the hardened concrete with a 3-inch layer of grout. Use grout of same material composition and proportions of concrete being poured except coarse aggregate omitted.
 - c. Place new concrete on grout before it has attained its initial set.
 - 2. Epoxy Bonding Method: Apply "Epoxy Bonding Compound" over existing concrete, prepared in accordance with manufacturer's instructions.
 - 3. Other bonding methods shall be as approved by the Engineer.
- C. When concreting is to be discontinued for more than 45 minutes and if the construction plane is to be horizontal, install keyways and embed dowel bars in the concrete before initial hardening. Use keyways and dowels in vertical concrete construction only when indicated on the Contract Documents or directed by the Engineer.
- D. Expansion Joints and Contraction Joints
 - 1. Install where indicated on the Contract Documents.
 - 2. Do not extend reinforcing or other embedded metal items through expansion and contraction joints; except where indicated on Contract Documents.
- E. Waterstops
 - 1. Install waterstops where indicated on the Contract Documents.

2. Use continuous lengths without splices where possible.
3. Connect all adjoining waterstops including vertical and horizontal runs, so as to provide a continuous water barrier, in accordance with manufacturer's recommendations.
4. Splices
 - a. Strength: Not less than that of the parent section.
 - b. Water-tightness: Make equal to that of continuous material.
 - c. Heat seal adjacent surfaces in accordance with manufacturer's recommendations using a thermostatically controlled electric source of heat that provides sufficient heat to melt but not char the material.
- F. Other Embedded Items: Place sleeves, inserts, anchors and embedded items required for adjoining or related work prior to concreting. Place accurately, and support against displacement.
- G. Sidewalk Joints
 1. When walkway abuts existing walks, place transverse joints to align with previous joints.
 2. Contraction Joints: Provide contraction joints to section the walkway into areas to match pattern and construction of existing joints.
 3. Construction Joints: Place construction joints at the end of pours and at locations where placement operations are stopped for a period of more than ½ hour, except where such pours terminate at expansion joints.
 4. Expansion and Isolation Joints.
 - a. Provide pre-molded joint filler for expansion joints and isolation joints abutting concrete paving, curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects.
 - b. Extend joint fillers full width and depth of the joint, and between ½ inch and 1 inch below the finished pavement surface where joint sealer is indicated. If no joint sealer is shown on the Contract Documents, place top of joint filler flush with finished concrete surface.
 - c. Use joint fillers in one-piece lengths for the full width being placed. Where more than one length is required, lace or clip joint filler sections together.
 - d. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after both sides of joint are placed.

3.10 – Placing Reinforcement

- A. Reinforcement shall be installed prior to vibration so as to be in the intended position in the completed pavement. Bars may be supported by approved chairs or may be placed in position by a machine or method subject to prior approval of the Engineer.
- B. When welded wire fabric reinforcement is used, the concrete shall first be struck off at the elevation specified for the fabric reinforcement, and the sheets of fabric shall be placed as indicated in the Contract Documents. The sheets of fabric shall be flat, and care shall be used in handling and placing the fabric to ensure its installation in the proper position. The balance of the concrete shall then be deposited and vibrated in a manner to not displace or distort the fabric. Sheets that have become bent or kinked may be rejected.
- C. Load transfer devices may be required in the Contract Documents. These assemblies shall be accurately placed as shown and shall be securely staked or fastened to the base to line and grade to prevent their movement during subsequent concrete paving operations. Assemblies may be placed in fresh PCC concrete of a Class A subbase, to assure a firm connection for the subsequent paving operation. Assemblies placed on hardened PCC or Class A subbase shall be attached with nails, pins, etc., in at least eight locations, based on a 12-foot width. Assemblies placed on granular subbase or natural subgrade shall be

attached with hooks in at least eight locations, based on a 12-foot width. These hooks shall be at least a 0 gauge wire (0.306-inch diameter) and at least 12 inches long.

- D. Assemblies damaged prior to placement shall not be used. Assemblies damaged after placement shall be replaced prior to paving. Horizontal and vertical alignment of the load transfer bars shall not exceed ¼ inch from parallel to line and grade. Each assembly shall be placed so the bars are in a horizontal plane at T/2 plus or minus ½ inch.
- E. All joints or splices shall be made by using approved clamps, welding, or by lapping the ends of the bars a distance of at least 40 times their normal diameters. Joints in longitudinal bars shall be staggered as directed. Splicing at points of maximum stress shall be avoided.
- F. Except where noted, bars shall be placed the following minimum distances:

Bar Location		Minimum Clearance (inches)
Walls, beams, and columns		1½, 2 if exposed to weather or water
Slab (bottom and top)		¾, 2 if exposed to weather or water
Slab on grade and footings	Top	2
	Bottom	3 unless otherwise noted

1. These distances apply to the bars closest to the surface
 2. Lap splices and embedment lengths for all reinforcing bars are shown on the plans.
 3. Field bending of Grade 60 steel will not be permitted.
- G. The Contractor shall check, with a suitable template or other device approved by the Engineer, the placement of each assembly and the position of the bars within the assembly. If the assembly is placed outside any one of these tolerances, the placement shall be corrected.
 - H. When dowels or tie bars or other articles are to be anchored in existing concrete, a grout system shall be used in accordance with manufacturer's instructions, subject to the approval of the Engineer.
 - I. For horizontal installation of dowels or tie bars, either a pressure injection system with mechanical proportioning and mixing or encapsulated chemical anchors shall be used. Installation shall be as follows:
 1. The drilled or preformed hole to receive the grout shall be of the dimensions and spacing shown in the Contract Documents. When not shown in the Contract Documents, the hole shall be of a nominal maximum diameter 1/8 inch larger than the outside diameter of the dowel or bar, or as recommended by the manufacturer. Immediately prior to placing the grout, the hole shall be blown clean with compressed air. The grout shall be pressure injected into the rear of the hole.
 2. Sufficient grout shall be used so that when the bar, insert, or other article to be grouted is placed in position, there will be an excess of grout forced out the front of the hole. The article to be grouted shall be rotated in the insertion process to ensure complete coating with the grouting material. Hand proportioning and mixing will not be allowed.
 - J. For vertical or angled installations, the procedures shall be similar to those for horizontal installation except that pourable grouts may be used. Pourable grouts must be mechanically mixed.

3.11 - Initial Strike-off of Concrete and Placement of Reinforcement

- A. The placing of the concrete between transverse joints shall be carried out as a continuous operation. If a delay of more than 30 minutes occurs because of a plant breakdown or other emergency and it is not possible to carry out a continuous paving operation, an intermediate transverse expansion joint shall be constructed and so located that the short slab will have a minimum length of 15 feet or of one normal reinforcement mat, whichever is less.

- B. The mixing and placing of concrete shall progress at such a rate as to permit proper finishing, protecting and curing.
- C. Placement of Reinforcement:
 - 1. A layer of concrete mixture shall be placed first and then spread and struck off with a mechanical spreader equipped with a screed board so that the entire area between side forms, and for a distance sufficient for placing a reinforcing mat, is covered to such a depth that the surface of the layer will be at the proper elevation to receive the reinforcement steel.
 - 2. Hand tampers shall be used to secure the steel in place at its proper elevation.
 - 3. Place the next layer of concrete mixture and spread immediately in such a manner to prevent segregation and so that the surface will be at the proper grade when the consolidation and finishing are completed.
 - 4. Concrete of the lower layer which has developed initial set or has been in place more than 30 minutes before being covered with the next layer will be removed and reset.
 - 5. The use of power equipment for placing reinforcement steel may be permitted with the approval of the Engineer. If such equipment is used, the concrete mixture may be placed in a single layer to the full depth of the side forms prior to the placement of reinforcing steel.
- D. After the concrete is placed the portions thereof within one foot of all side forms including boxouts shall be compacted with suitable tools and by vibrating.

3.12 - Final Strike-off, Consolidating and Finishing

- A. The sequence of operations shall be strike-off and consolidation floating and removal of laitance, straightening, and surface texture.
- B. The addition of water to the surface of the concrete to assist in finishing operations will not be permitted.
- C. Machine Finishing:
 - 1. As soon as the concrete has been placed it shall be struck-off and screeded with a finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give the proper compaction and leave a surface of uniform texture. Excessive operation over a given area shall be avoided.
 - 2. The machine and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variations that could affect the finish. During the first pass of the machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length. The moving of rolls of concrete in excess of 6 inches with the finishing machine will not be permitted.
 - 3. If thorough consolidation of the concrete is not obtained by the vibratory method at joints, along forms, at structure, and throughout the concrete, then other equipment and methods shall be furnished and employed which will produce thorough consolidation.
- D. Finishing at Joints:
 - 1. The concrete adjacent to joints shall be placed and consolidated against the joint material, under and around all load transfer devices, joint assembly units and other features which extend into the concrete.
 - 2. After the concrete has been placed and vibrated, the finishing machine shall be brought forward in a manner to avoid damage or misalignment of joints.
 - 3. If continuous operation of the finishing machine to, over and beyond the joints causes segregation of concrete, damage to or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 8 inches from the

- joint. Segregated concrete shall be removed in front of and off the joint, the front screed shall be lifted and set directly on top of the joint and the forward motion of the machine resumed.
4. When the second screed is close enough to permit the excess mortar in front of it to flow over the joint it shall be lifted and carried over the joint. Thereafter the finishing machine may be run over the joint without lifting the screeds provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.
- E. Hand Finishing:
1. Hand finishing methods will not be permitted except under the following conditions and approval of the Engineer:
 - a. In the event of the breakdown of mechanical equipment, concrete already deposited on grade or in transit to the job.
 - b. Where variable width areas or other special conditions render the use of the finishing machine impractical.
 - c. Sidewalk construction.
 - d. Vibratory screed may be used for concrete slabs less than 6 inches thick.
 2. When hand finishing is permitted, the concrete shall be struck-off and screeded as soon as placed with a hand-operated vibratory screed, moved forward with a combined longitudinal and transverse motion and so manipulated that it remains in contact with the side forms.
 3. The vibrating screed shall be at least two feet longer than the maximum width of the slab. It shall be sufficiently rigid to retain its shape and constructed of metal or other suitable material shod with steel. It shall be adjustable for crown, or a separate screed for each variation in crown shall be furnished.
 4. Screeding shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.
 5. Immediately following the longitudinal screeding operation, further finishing with straightedges or lutes, final surfacing with metal tine, rounding of joint edges, checking of the concrete surface with a straightedge, and the correction of excessive surface irregularities shall be performed as specified for machine finishing except that a mechanical tining machine need not be used. A spud-type vibration shall be used to consolidate the concrete around joints and along forms.
 6. Vibrators: The rate of vibration shall be not less than 3500 to 6000 vibrations per minute, and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete more than 12 inches from the vibrating unit.
- F. Floating:
1. After the concrete has been struck off and consolidated, it shall be further smoothed and trued by either hand methods or an approved tube finisher.
 2. After finishing, any excess water and laitance shall be removed from the surface by a 10-foot straightedge. Successive drags shall be lapped over one-half the length of the blade.
- G. Straightedge Control Testing and Surface Correction:
1. The pavement shall be finished to provide a smooth riding surface. The entire pavement surface shall be checked after the concrete has been consolidated and excess water has been removed, and while still plastic, and the surface shall be corrected to the following tolerances:
 - a. The pavement shall be checked longitudinally with a 10-foot straightedge, and the surface shall not deviate from a straight line by more than 1/8 inch in 10 feet. If slip form methods are used, the 6 inches nearest the edge may exceed the 1/8 inch tolerance but shall not exceed 1/2 inch deviation in 10 feet. Where

abutting pavement is to be placed adjacent to the pavement being checked, the surface shall not deviate by more than ¼ inch when checked 1 inch from the edge with a 3 foot straightedge used transversely and a 10-foot straightedge used longitudinally.

2. When surface corrections are made, the correction shall be completed prior to applying surface texture. Grooving shall be accomplished with devices equipped with diamond saw blades or equal. Use of hand held equipment (cut off saws) will not be permitted.
- H. Surface Texture:
1. **Surface texture of any approved type shall not be applied within 12 inches of face of curb or raised median. Apply surface texture after water sheen has practically disappeared.**
 2. **Microtexturing**
 - a. **Unless otherwise noted in Contract Documents, use microtexture methods to texture pavement surfaces.**
 - b. **Approved methods:**
 - 1) **Artificial turf drag**
 - 2) **If desired texture is not obtained using drag finish, the Engineer may require broom finish in lieu of, or in addition to, artificial turf drag finish. Drag suitable broom transversely across surface of plastic concrete.**
 3. **Macrotexturing**
 - a. **Place transverse or longitudinal grooving if specified in Contract Documents.**
 - b. **Iowa DOT Standard Specification 2301.03.H.3 applies.**
- I. Edging and Marking: After the final finish, but before the concrete has set, the outside edges of the concrete shall be rounded with an edging tool. All joints shall be tested with a straightedge before the concrete has set, and corrections made to comply with surface requirements.

3.13 – Surface Requirements

- A. All finished concrete slabs shall exhibit positive drainage, without any standing water. Correct areas without positive drainage, in a method approved by the Engineer.
- B. Grading Tolerances
 1. **Pavement and Curbs: ±0.03'**
 2. **Sidewalks: ±0.10'**
 3. **Pedestrian Ramps and Landings: ±0.02'**
- C. New pavement surfaces shall be flush with existing pavement surfaces.
- D. Surface correction by grinding may be permitted at the discretion of the Engineer provided that correction does not require the removal of more than 1/4 inch of concrete from the surface.

3.14 – Tolerance in Surface Thickness

The Engineer may take one core sample for every 200 square yards of concrete installed with a minimum of three cores. The average core thickness must equal or exceed the thickness specified in the Contract Documents. No individual core will vary more than 1/2 inch from the required thickness.

3.15 – Defective Concrete

- A. Any concrete which in the opinion of the Engineer is or becomes defective before final acceptance will either be repaired or removed and replaced at the discretion of the Engineer without further cost to the Owner.

- B. Repair of defective concrete shall be performed as specified below. The Engineer will determine the extent and manner of action to be taken for the correction of defective concrete as may be revealed by surface defects or otherwise.
- C. Repair of Formed Surfaces:
 - 1. As soon as possible after stripping forms, thoroughly clean and fill holes left by form ties, and other temporary inserts, and perform corrective Work.
 - 2. Repair and patch defective areas with cement mortar of mix proportions and materials identical to those used in the surrounding concrete; and produce a finish on the patch that is indistinguishable from the finish of the surrounding concrete, immediately after removing forms, in a manner and by a method accepted by the Engineer in writing prior to start of repair operation.
 - 3. Cut-out honeycomb, rock pockets, and voids having a diameter more than 1/2 inch to solid concrete but not shallower than 1 inch. Before placing cement mortar, thoroughly clean, dampen, and brush-coat area to be patched with neat cement grout. Proprietary patching compounds may be used if accepted by the Engineer in writing prior to start of repair operation.
 - 4. Remove imperfect texture, laitance, fins and roughness by rubbing affected areas with concrete block or carborundum stone until smooth and uniform.
- D. Repair of Unformed Surfaces:
 - 1. Test unformed surfaces for smoothness and to verify conformance of surface plane to tolerances specified. Correct low and high areas.
 - 2. Test unformed sloped surfaces for trueness of slope and smoothness, using a template having required slope. Correct high and low areas as specified.
 - 3. Repair finished unformed surfaces with defects that adversely affect concrete durability.
 - 4. Grind high areas of unformed surfaces after concrete has cured sufficiently to permit repairs without damaging adjacent areas.
 - 5. Cut-out low areas of unformed surfaces either during or immediately after completion of surface finishing operations, and replace with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used if acceptable to the Engineer.
 - 6. Cut out defective areas, except random cracks and single holes not exceeding 1 inch diameter, and replace with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout coating or use concrete bonding agent. Place patching concrete before grout takes initial set. Mix patching concrete of same materials and in same proportions as adjacent concrete. Place, compact, and finish as required to blend with adjacent concrete. Cure in same manner as adjacent concrete.
 - 7. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry-pack method. Groove tops of cracks, cut-out holes to sound concrete, and remove dust, dirt, and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout coating. Mix drypack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing No. 16 sieve, using only enough water for handling and patching. Place dry-pack before grout takes initial set. Compact dry-pack mixture in-place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
 - 8. Obtain approval of the Engineer before performing repair work other than the removal of imperfect texture, filling of pinholes, holes less than 3/4 inch wide, and insert holes. The Engineer will determine whether the defective area is sufficiently imperfect to warrant rejection of the structural unit.

9. Repair methods not specified above may be used, subject to acceptance by Engineer in writing.

3.16 – Construction of Colored Concrete Surface

- A. Concrete finishing and placement shall be in accordance with these standard specifications and recommendations of manufacturer of coloring agent.
- B. The Engineer must approve the use of admixtures. Calcium chloride admixture is not allowed.
- C. Integral Mix: Mix color pigment in designated mix at the rate of 4 ½ pounds per 100 pounds of cement, not to exceed 10% of the weight of cement, as per manufacturer's recommendations. Add ingredients in the same order for each batch.
- D. Slump shall be maintained at a 3-inch maximum. Addition of a super-plasticizer is acceptable to improve placing concrete. While concrete is still in the plastic stage of set, concrete shall be tooled and textured to make the desired surface.
- E. Curing: The use of burlap, plastic sheeting or togging with water is not recommended for curing. The use of a membrane forming cure and seal is recommended alternative. Slabs should not be walked on for 36 hours. For protection from construction damage, cover with waterproof paper after the slab has cured for a period of two (2) days.
- F. The CONTRACTOR shall patch and repair all surface defects.
- G. The substrate shall be free of all debris, oils, grease, curing compounds, joint sealers, etc. prior to the application of the sealer.
- H. The finished surface shall be sealed using concrete sealer in accordance with the manufacturer's recommendations to complete the coloring process. Wait eight (8) hours for foot traffic.

END OF SECTION 02700