

**KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, 2007 EDITION**

SECTION 501

PORTLAND CEMENT CONCRETE PAVEMENT (QC/QA)

Page 500-1. Delete block and replace with the following:

Note: PCCP is considered QC/QA when the bid item Quality Control Testing is included in the contract. Note the exceptions in subsection 501.5.

Page 500-2, subsection 501.2f.(1). Add the following to the beginning of subsection 501.2f.(1):

Record all original documentation in a bound field book or other KDOT approved bound record and turn over to KDOT at the end of the project.

Page 500-3, subsection 501.3. Add the following material:

Backer Rod.....DIVISION 1500

Page 500-5, subsection 501.4c. In the second paragraph, delete the first sentence ("Longitudinal joint tie bars...") and replace with the following:

Joint tie bars and dowel bars may be installed mechanically if approved by the Engineer.

Page 500-6, subsection 501.4d. In the first paragraph on this page, delete "subsection 154.2d." and replace with "subsection 154.2e."

Page 500-6, subsection 501.4f. Delete the third paragraph and replace with the following:

Following the dragging operation, use a mechanical device to make a final finish or texture by giving the surface of the plastic pavement a longitudinal tining, unless shown otherwise in the Contract Documents. Perform the operation at such time to minimize displacement of larger aggregate particles and before the surface permanently sets.

Page 500-10, add the following subsection 501.4g.(10):

(10) Sawed (Non-Sealed) Joints.

(a) Joint Construction. The joint location, size and configuration are shown in the Contract Documents. Use concrete saws to saw all joints a nominal 1/8 inch wide to the full joint depth, D/3± ¼ inch, unless shown otherwise in the Contract Documents.

Make the saw cut as soon as the concrete has hardened enough so that no excess raveling or spalling occurs, but before any random cracks develop. The sequence of the sawing is at the Contractor's option, provided all sawing is completed before random cracking develops. Use suitable guide lines or devices to cut the joint straight and in the correct location.

(b) Cleaning Joints. Immediately clean freshly cut sawed joints by flushing with a jet of water under pressure and other necessary tools to remove the resulting slurry from the joint and immediate area. Repair curing membrane damaged during sawing and cleaning, as directed by the Engineer.

(c) Backer Rod. Install and maintain backer rod (of a size sufficient to prevent debris from entering the joint) in the joint. When major construction traffic is no longer driving on the

pavement, and prior to opening to the public, remove the backer rod, and follow with an air blast to remove any debris.

(d) Repair of Joints. If the sawed joint is $\geq \frac{1}{4}$ inch, seal the joint using Hot Applied Joint Sealing Compound, according to **subsections 501.4g.(7) thru (9)(b)**. Seal transverse joints the full width of pavement. Seal longitudinal joints the full length of the panel. If the joint can not be properly sealed, see **subsection 501.4k**.

(e) Opening to Traffic. When no joints require sealing, disregard **subsection 501.4i.(3)(a)**, third bullet and **501.4i.(3)(b)**.

(f) Side Roads and Entrance Pavement. If the PCCP is designated with sawed (non-sealed joints), construct the side road and entrance pavement joints according to **subsection 501.4g.(10)** above, unless otherwise specified in the Contract Documents.

(g) Curb and Gutter/Valley Gutter. Unless specified otherwise in the Contract Documents, if the PCCP is designated with sawed (non-sealed) joints, construct the curb and gutter/valley gutter joints according to **subsections 501.4g.(10)(a) thru (c)** above with the following exception: saw to a depth a minimum of $1 \frac{1}{4}$ inches below the surface of the gutter. If the curb and gutter is placed monolithically with the pavement, saw to the same depth as the pavement.

Page 500-10, subsection 501.4h. In the sixth paragraph, delete "subsection 154.7b." and replace with "subsection 154.7c."

Page 500-12. Delete subsection 501.4k. and replace with the following:

k. Repair of Defective Pavement Slabs. It is the responsibility of the Contractor to repair any spalled, cracked or broken panels as specified hereinafter at no cost to KDOT. Completely remove and replace pavement panels (area between contraction joint and contraction joint) containing both transverse and longitudinal cracks (separating the panel into 4 or more parts) through the full depth of the slab.

Properly seal the joints of the repaired or replaced panels.

(1) Repair of Spalls.

- In no case shall an individual patch of a spall be less than 1 square foot with no dimension less than 1 foot.
- For spalls greater than $\frac{1}{4}$ inch and less than or equal to $\frac{1}{2}$ inch from edge of the original sawed joint, repair with hot pour.
- For spalls greater than $\frac{1}{2}$ inch and less than or equal to 1 inch from the edge of the original sawed joint, blast clean and repair with epoxy patch material.
- For spalls greater than 1 inch from the edge of original sawed joint, repair by making a saw cut a minimum of 1 inch outside the spalled area to a minimum depth of 2 inches. The interior angles formed by the intersection of adjacent sides of the patch shall be a minimum of 60° . When the spalled area abuts a joint, make the saw cut to a depth of 2 inches or $\frac{1}{6}$ the slab thickness, whichever is greater. Chip out the concrete between the saw cut and the joint or primary crack to solid concrete. Do not use chipping hammers greater than 15 pounds. Thoroughly clean all loose material from the formed cavity. Apply a coat of an approved concrete bonding epoxy to the dry, cleaned surface of all sides of the cavity, except the joint. Apply the epoxy by scrubbing the material into the surface with a stiff bristle brush. Place portland cement concrete, epoxy resin concrete or mortar, immediately following application of the epoxy, according to the manufacturer's recommendations. If the spalled area to be patched abuts a working joint, use an insert or other bond breaking medium during the repair work to maintain working joints. Remove and replace major honeycombed areas found after removal of the forms. Removed areas or sections so removed shall be a minimum of 6 feet in length if less than full width of the lane involved. When it is necessary to remove a section of pavement, also remove and replace any remaining portion of the slab adjacent to the joints that is less than 6 feet in length.

(2) Repair of Cracks in New Reinforced, Dowel Jointed PCCP.

(a) Transverse and Diagonal Cracks.

(i) Full Depth.

- When a single full-depth transverse crack falls within the middle $\frac{1}{3}$ of the panel, no corrective work will be required.
- Should a second full-depth crack develop within the middle $\frac{1}{3}$ of the panel, remove and replace the panel to the nearest planned contraction joint, eliminating both cracks. If the location of the mid-panel full-depth crack is within 6 feet of the boundaries of the area to be repaired, extend the area to be repaired to include the mid-panel crack.
- When any portion of a full-depth crack falls outside the middle $\frac{1}{3}$ of the panel, remove and replace the portion of panel between the contraction joint and the crack. Make 1 full-depth saw cut parallel to the contraction joint on the mid-panel side of the crack to be removed. Make another cut in the adjacent panel, parallel to the contraction joint, clear of the basket assembly, but not less than 6 feet from the first cut. Remove the cracked section and basket assembly. Drill holes in both sawed faces, and insert bars to make 2 contraction joints. Use dowels of the same size and spaced the same distance as those shown in the Contract Documents. Drill bar holes $\frac{1}{4}$ inch \pm 0.05 inch larger than the diameter of the bar and fill them with epoxy or grout and insert the new dowel. Support the free ends of the bars parallel to the pavement surface until the epoxy or grout has set, obtaining proper alignment of the bar. Apply grease or an approved bond breaker to the free ends.
- If the boundaries of consecutive areas to be repaired are less than 6 feet apart, also remove and replace the areas between the patches.
- Saw off the longitudinal joint tie bars at the longitudinal joint. Drill holes midway between the existing bars and insert tie bars to make a new tied longitudinal hinged joint. Use tie bars of the same size and spacing as those in the Contract Documents. Drill bar holes $\frac{1}{4}$ inch \pm 0.05 inch larger than the diameter of the bar and fill them with epoxy or grout and insert new tie bars.

(b) Longitudinal Cracks. When a single longitudinal crack falls within a panel, no corrective work will be required.

When a second full-depth longitudinal crack falls within a panel, remove and replace the panel to the nearest planned contraction joint, eliminating both cracks.

(3) Repair of Cracks in both New Non-reinforced Dowel Jointed PCCP and Mainline Plain PCCP.

(a) Transverse and Diagonal Cracks.

(i) Full Depth.

- If a maximum of 4 panels per any lane mile has a crack, repair according to Dowel Bar Retrofit-Repair (this specification), or remove and replace the pavement.
- If 5 to 18 of the panels per any lane mile has a crack, repair according to Dowel Bar Retrofit-Repair (this specification). When 2 consecutive panels have a crack, remove and replace the panels from contraction joint to contraction joint.
- If more than 18 of the panels per any lane mile have a crack, remove and replace the pavement bounded by the cracks in that segment. Remove and replace until $\frac{1}{4}$ mile segment has less than 4 panels cracked, then repair or replace.

(ii) Partial Depth. If coring (at no additional cost to KDOT) verifies the transverse cracks are not full depth, repairs can be made by Tie Bar Insertion-Repair (this specification).

(iii) When required or at the Contractor's option, remove and replace pavement panels containing any transverse or diagonal crack according to the following:

- Make a full-depth saw cut in the abutting panel nearest to the crack, parallel to the contraction joint, just clear of the basket assembly to allow the existing dowel basket assembly to be completely removed. Make a second saw cut parallel with the contraction joint on the opposite side of the crack away from the contraction joint. For plain PCCP, make the saw cut at the joint nearest to the crack. Make the second saw cut opposite the

first cut a minimum of 6 foot from the first saw cut to include the crack. Remove the resulting area.

- The minimum longitudinal length of a patch is 6 feet.
- Do not permit a patch to fall within 6 feet of a contraction joint.
- The maximum distance between doweled/non-doweled contraction joints is 18 feet.
- Drill holes and insert dowel bars to make new contraction joints within the vertical faces of both newly created panel ends. Use dowels of the same size and spaced the same distance as shown in the Contract Documents. Drill bar holes $\frac{1}{4}$ inch \pm 0.05 inch larger than the diameter of the bar and fill with epoxy or portland cement grout and insert the new dowel. Support the free ends of the bars until the epoxy or grout has set to obtain proper alignment of the bar. Apply grease or an approved bond breaker to the free ends. Do not use dowel bars in plain PCCP.
- Saw off the longitudinal joint tie bars at the longitudinal joint. Drill holes midway between the existing bars and insert tie bars to make a new tied longitudinal hinged joint. Do not place new tie bars within 12 inches of doweled joint. Use tie bars of the same size and spacing as those in the Contract Documents. Drill bar holes $\frac{1}{4}$ inch \pm 0.05 inch larger than the diameter of the bar and fill them with epoxy or grout and insert new tie bars.

(b) Longitudinal Cracks. Repair or remove and replace pavement panels that contain a single longitudinal crack, according to the following:

- Repair longitudinal cracks that are within 3 inches of the planned longitudinal joint for their entire length with a partial depth patch as specified for spall in **subsection 501.4k.(1)(a)**, except make the transverse dimension of the patch 6 inches and saw cuts to $D/3 \pm \frac{1}{4}$ inch.
- For longitudinal cracks between 3 and 6 inches from the planned longitudinal joint, fill the entire planned longitudinal joint full depth with epoxy through the length of the longitudinal crack.
- Repair longitudinal cracks that are 6 inches or more from the planned longitudinal joint by removing and replacing pavement panels, or repair pavement by Tie Bar Insertion-Repair (this specification).

Remove and replace pavement panels that contain 2 or more longitudinal cracks.

(4) Repair of Cracks in Shoulder Plain PCCP.

(a) Transverse and Diagonal Cracks.

- When a single transverse crack falls within a panel and is within 3 feet of the transverse contraction joint, fill the contraction joint according to the Contract Documents and rout and seal the crack.
- When 2 or more transverse cracks fall within a panel, remove and replace the panels.

(b) Longitudinal Cracks.

- When a single longitudinal crack falls within a panel, repair pavement by Tie Bar Insertion-Repair (this specification).
- When 2 or more longitudinal cracks fall within a panel, remove and replace the panels.

Page 500-14. Delete subsection 501.5g.(2)(a) and replace with the following:

(a) For mainline and other pavement subject to coring for pay adjustments for both thickness and strength, a lot is defined as the surface area of mainline lane placed in a single day. Normally, divide a lot representing a day's production into 5 sublots of approximately equal surface area. For high daily production rates, rates exceeding 6000 square yards per day, the Contractor may choose to divide the day's production into 2 approximately equal lots consisting of 5 sublots each. Prior to taking any core samples, notify the Engineer of the decision to divide a day's production

into 2 equal lots. For low daily production rates (and not in an urban PCCP environment), the Contractor may choose to divide the lot into a lesser number of sublots as shown in **TABLE 501-1**. When daily production rates are less than 1000 square yards, and not in an urban PCCP environment, combine the day's production with the next day's production to form a lot. When a day's production involves less than 1000 square yards while completing a particular mix design or project, combine with the previous day's production and treat as a single lot. For low daily production rates less than 1000 square yards in an urban PCCP environment (pieced construction due to business entrances), consider each day's production as a separate lot. KDOT's representative will core (or have cored) a minimum of two randomly-determined sublots per day; one in the morning and one in the afternoon. Each randomly-determined location will be cored for both strength and thickness, and results inserted into the "Urban PCCP" worksheet for pay adjustment.

TABLE 501-1: PCCP SUBLOT BREAKDOWN	
Daily Production Rate in square yards	Number of Sublots
Under 1000 (Urban)	2
1000 – 2000	3
2001 - 4000	4
4001 or more	5

Page 500-15. Add the following to the end of subsection 501.5g.(3)(a):

No initial QC compressive strength data will be accepted for concrete paving that is more than 28 days of age, unless approved by the Engineer.

Page 500-15, subsection 501.5g.(4). In both the last sentence in the first paragraph and in the fifth sentence in the fourth paragraph, replace "0.1 inch" with "0.01 inch".

Page 500-16, subsection 501.5g.(4). Delete the last paragraph and replace with the following:

KDOT will routinely compare the variances (F-test) and the means (t-test) of the verification test results with the quality control test results for thickness and compressive strength as appropriate using a KDOT spreadsheet. The F and t-tests, along with the KDOT Spreadsheet used to compare the Contractor's Quality Control (QC) results and KDOT's verification (QA) results, are described in Section 5.17.08, Part V. If KDOT verification test results do not show favorable comparison with the Contractor's quality control test results, KDOT verification test results will be used for material acceptance, material rejection and the determination of any pay adjustment for thickness and compressive strength. Follow the requirements stated in subsection 501.5h.(6) for failing t-tests. If the Contractor disputes KDOT's verification test results, and the Contractor and the Engineer cannot mutually agree on the use of KDOT test results to determine pay adjustments, the test results for the lot in question will be voided. In such case, new cores to represent each sublot will be taken on a 2-for-1 frequency, tested in the presence of the Engineer, and a new pay factor will be calculated using the KDOT spreadsheet. These cores shall be obtained in time to determine the 35-day compressive strengths unless approved by the Engineer. If the new pay factor results in the same or less pay due the Contractor than the voided pay factor, no payment will be made for the additional coring. If the new pay factor results in greater payment to the Contractor, KDOT will pay for each additional core at the contract set unit price.

Page 500-16, subsection 501.5g.(5). Add the following to the end of the first paragraph:

All exploratory cores will be obtained in time to determine the compressive strengths within 35 days from the time the pavement was placed, unless approved by the Engineer. All cores representing the remainder of the sublot and used to compute the pay factor for the lot shall be obtained in time to determine the 35-day compressive strengths, unless approved by the Engineer.

Page 500-18. Add the following new subsection 501.5ii. after subsection 501.5i.:

ii. Pay Adjustments for Urban PCCP environment.

(1) General. A single pay adjustment will be made on a subplot-by-subplot basis. The adjustment will be based on a single randomly-selected (by KDOT) core for both strength and thickness. Compute the pay factor (P_U) (incentive or disincentive) as shown in **Equation 3**.

The thickness component will be based on values determined by using the difference between plan thickness and the measured core sample thickness. When the measured core sample thickness is greater than the plan thickness, the “ Δ thickness” of **Equation 3** is positive. When the core thickness is less than the plan thickness, the “ Δ thickness” is negative. The compressive strength component will be based on values determined by breaking the core. Pay adjustment amount will be added or subtracted on the pay estimate. Remove and replace when values are less than those stipulated in **subsection 501.5g.(5)**. Maximum individual or combined pay adjustment is 103%.

(2) Computation of Urban PCCP Pay Factor. Compute the pay factor for thickness and strength using **Equation 3** and round to nearest hundredth.

$$\text{Equation 3: } P_U = (P_{UC} + P_{UT})/2$$

Where:

$$P_{UC} = 0.0001 * (\text{strength}) + 0.59; \text{ where strength is measured to the nearest 1 psi.}$$

$P_{UT} = 0.15 * (\Delta \text{ thickness}) + 1.00$; where Δ thickness is measured to the nearest 0.01 inch from plan thickness.

(3) Computation of Urban PCCP Pay Adjustment. Compute the subplot pay adjustment using **Equation 4**.

$$\text{Equation 4: Urban PCCP Pay Adjustment} = (P_U - 1) \times (\text{the number of square yards included in the subplot}) \times (\text{the contract unit price per square yard})$$

DOWEL BAR RETROFIT-REPAIR

1.0 DESCRIPTION

Cut slots normal to the transverse cracks and place epoxy-coated steel dowel bars to repair the newly constructed PCCP that is damaged. See Standard Drawing RD723, latest version.

2.0 MATERIALS

a. Epoxy-Coated Dowel Bars. Provide epoxy-coated steel dowel bars that comply with **DIVISION 1600**.

Provide a tight fitting nonmetallic expansion cap on one end of the dowel bars. The Engineer must approve the expansion cap before it is used.

Provide epoxy-coated or nonmetallic chair devices to support and hold the dowel bars. The Engineer must approve the chair devices before they are used.

b. Bondbreaker for Dowel Bars. Provide a bondbreaker that complies with **DIVISION 1700**.

c. Caulking Filler. Provide a silicone sealant caulking filler intended for filling cracks in PCCP. The Engineer must approve the caulking filler before it is used.

d. Board Filler. Provide a closed-cell foam core board filler (the width of the joint thick) faced with poster board material on each side. The Engineer must approve the board filler before it is used.

e. Grout. Provide a product that complies with **DIVISION 1700** and is prequalified as “very rapid hardening” when extended. The grout may be extended as the manufacturer recommends. The extender aggregate must be of size to allow complete distribution and consolidation around the bar. (For practical purposes the maximum aggregate size should be no more than 1/2 the size of the distance between the dowel bar and the adjacent

concrete pavement.) All extender aggregate used on contracts must be from a source that has a current Official Quality approval status for Mixed Aggregate per **DIVISION 1100**.

f. Liquid Membrane-Forming Compound. Provide a liquid membrane-forming compound that complies with **DIVISION 1400**.

3.0 CONSTRUCTION REQUIREMENTS

Cut slots for the dowel bars into the PCCP as needed to repair the damaged PCCP. Use a gang saw capable of simultaneously cutting all the slots at one location (one wheel path). A single or dual blade saw may be used provided the production rate for sawing equals or exceeds 15 slots per hour. Hand saws are prohibited. Make the slots large enough to provide the minimum clearances shown in the Contract Documents. If necessary, make multiple parallel saw cuts to remove the existing concrete from the slot.

If jackhammers are used to break the concrete loose, do not use jackhammers larger than the nominal 15 pound class.

Sandblast and clean all surfaces of the slot. Sandblast and clean all cracks in the slot. Remove all broken concrete and debris from the project.

Fill the transverse crack in the bottom and sides of the slot with caulking filler. Prevent the caulking filler from contacting the surfaces outside the crack.

Before the dowel bar is placed in the slot, cut a piece of the board filler material to fit tightly around the dowel bar and against the bottom and sides of the slot. Place the board filler material vertically above the transverse crack in the bottom of the slot and prevent it from being displaced in the slot. Keep the board filler material in this position during placement of the grout.

Use chair devices to position and hold the dowel bars parallel ($\pm 1/8$ inch) to the pavement centerline and the pavement surface, and at the depth shown in the Contract Documents. Coat the dowel bars with an approved bondbreaker before the grout is placed.

Place and consolidate the grout as recommended by the manufacturer. Cure the surface of the grouted slots with a liquid membrane-forming compound.

The extended grout must obtain a minimum of 2000 psi compressive strength before the roadway can be opened to traffic, but no sooner than 2 hours. Provide data that accounts for actual temperatures work is being performed.

Saw the transverse joint through the patched areas within 24 hours of the placement of the grout. Saw and seal the joint as shown in the Contract Documents.

TIE BAR INSERTION-REPAIR

1.0 DESCRIPTION

Drill holes and anchor deformed tie bar reinforcement diagonally across all longitudinal cracks and only those transverse cracks that extend partial depth, as determined through coring, to repair the newly constructed PCCP that is damaged. See Standard Drawing RD723, latest version.

2.0 MATERIALS

a. Tie Bars. Provide epoxy-coated (including the ends) deformed reinforcing steel bars, hereafter referred to as tie bars that comply with **SECTION 1600**.

b. Anchoring System. Use Type IV, Grade 1 - low viscosity Epoxy-Resin-Based Bonding System and the Class that complies with **SECTION 1700**.

3.0 CONSTRUCTION REQUIREMENTS

a. Equipment. Use a hydraulic drill with tungsten carbide bits. Control the forward and reverse travel of the drills by mechanically applied pressure. Mount the drill on a suitable piece of equipment such that it is quickly transported and positioned. Rest and reference the drill rig frame on and to the pavement surface such that the drilled holes are cylindrical and repeatable in terms of position and alignment on the surface being drilled. Hand-

held pneumatic or electric drills may be used when they can be demonstrated to produce the same results as hydraulic drills with regard to drilling cylindrical holes and repeatable in terms of position and alignment. The Engineer may establish production rates for the hand-held drills.

b. General. Drill the holes in a slab at the offset, depth, and angle shown in the Contract Documents.

Drill such that the:

- Centerline of the holes is perpendicular to the crack/joint (in plan view) at each location being drilled.
- Adjacent holes are drilled in opposite directions across the crack/joint.

Repair cracks and spalls that result from drilling with a partial or full-depth repair as directed by the Engineer.

Clean the drilled holes (and chipped areas at the surface resulting from drilling) in accordance with the anchoring material Manufacturer's written recommendations. Submit recommendations to the Engineer before drilling any holes. As a minimum, clean holes with oil-free and moisture-free compressed air. The Engineer will check the compressed air stream purity with a clean white cloth. Use a compressor that delivers air at a minimum flow volume of 120 cubic feet per minute and develops a minimum nozzle pressure of 90 psi. Insert the nozzle to the back of the hole to force out all dust and debris.

Place the anchoring system material into the back of the hole using a nozzle or wand of sufficient length. Insert the tie bar such that the anchoring material is evenly distributed around the tie bar. Use an amount that slightly extrudes out the hole as the tie bar is inserted. Remove the excess and trowel the anchoring material smooth to the pavement surface, filling any chipped areas. Do not allow traffic on the repaired area until the anchoring material is cured as recommended by the manufacturer's specifications.

10-20-10 M&R (SKD)
Feb-11 Letting