



Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS FOR PARTIAL DEPTH PCC FINISH PATCHES

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THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

This specification replaces Section 2530 of the Standard Specifications for Partial Depth Portland Cement Concrete Patches.

2530.01 DESCRIPTION.

- A. This specification contains requirements for Partial Depth PCC Patches, Partial Depth PCC Joint and Crack Repair Patches, and Overdepth Patches.
- B. Remove pavement in areas designated in the contract documents. This includes furnishing and placing patching material to provide a new traffic surface, and restoring adjacent shoulder as shown in the contract documents. This work is in areas where the size, shape, and depth of patch depends on extent of pavement deterioration and shall be determined during removal operation.
- C. Patches may be identified and constructed as one of the following types:
 - 1. **Finish Patches.**
Finish patches are square or rectangular in shape. They will be less than 6 feet (2 m) in length when placed on a longitudinal or transverse joint or random crack. Patches will be identified by tabulation in the contract documents. The patch size and location for each lane will be shown. Patch size and locations may be adjusted by the Engineer to fit field conditions.
 - 2. **Joint and Crack Repair Patches.**
Joint and crack repairs are square or rectangular in shape. They will be placed at a longitudinal or transverse joint or random crack. They will be a minimum of 6 feet (2 m) in length, and will be identified by tabulation in the contract documents. Size and location will be shown. Repair size and location may be adjusted to fit field conditions.
 - 3. **Overdepth Patches**
Overdepth Patches are irregular in shape. They are placed to the full depth of existing pavement in areas of unsound concrete as designated by the Engineer. Repair size and location will be determined at time of construction.

2530.02 MATERIALS.

Meet the requirements for the type of material specified.

A. PCC Patching Material.

Meet one of the requirements below. When patching encroaches on an adjacent lane open to traffic or when there is patching on two lane pavements or other locations where overnight closures are not permitted, use Class A or Class B patching material. Pavements with three or more lanes and when overnight closure is permitted, use Class C patching material.

1. Class A Patching Material.

- a. Use a modified Portland cement type manufactured to provide rapid set and high early strength. Meet requirements of Materials I.M. 491.20.
- b. When a mortar is furnished, add the manufacturer's recommended quantity of coarse aggregate. Use pea gravel, minimum Class 2 durability, meeting requirements of Section 4112.

2. Class B Patching Material.

Use high early strength rapid set (5 hour) concrete meeting requirements of Materials I.M. 529 and the following requirements:

- Use Class M mixture patching material with calcium chloride. Class M mixtures with calcium chloride shall not contain fly ash.
- Place concrete within 30 minutes after introduction of calcium chloride.
- For coarse aggregate, use crushed carbonate stone chips or pea gravel, minimum Class 2 durability, meeting requirements of Section 4112.

3. Class C Patching Material.

Use mixture with an early set that will allow time of opening to traffic in 24 to 36 hours as directed by the Engineer. For coarse aggregate, meet requirements for Class B patching material. Use Class M mixture meeting requirements of Materials I.M. 529 without addition of calcium chloride.

4. Modifications to Mixtures for Class B and Class C Patching Material.

Apply the following modifications to mixtures for Class B and Class C patching material:

a. Slump.

- 1) Slump, measured according to Materials I.M. 317 prior to addition of calcium chloride solution, shall be between 1 and 2.5 inches (25 and 65 mm) as a target range, allowing a maximum of 3 inches (75 mm). If calcium chloride solution is not to be added, slump shall be between 1 and 3 inches (25 and 75 mm) as a target range, allowing a maximum of 4 inches (100 mm).
- 2) When a Type A Mid Range water reducing admixture is used, the slump, tested prior to the addition of calcium chloride, shall be between 1 and 4 inches (25 and 100 mm) as a target range, allowing a maximum of 5 inches (125 mm).

b. Air Entrainment.

Entrained air content of unconsolidated concrete will be determined according to Materials I.M. 318, prior to addition of calcium chloride if it is to be added. When calcium chloride is to be added, air entrainment shall be 5.0%, with a tolerance of $\pm 2.0\%$. When calcium chloride is not to be added, air entrainment shall be 6.5%, with a tolerance of $\pm 1.5\%$.

c. Temperature.

Temperature of Class B patching material, as delivered to job site, shall be as required in Article 2530.02, B, 4, d. Ensure temperature of Class C patching material, as delivered to the job site, is greater than 65°F (18°C). Heating water, aggregate, or both, may be necessary. Cost of heating is incidental to patching.

d. Cement.

- 1) For Class M concrete mixtures, meet requirements of Section 4101.
- 2) Refer to Table 2530.02-1 for cement types and maximum allowable substitution rates. Maximum substitution for Type IS shall not exceed 25%.

Table 2530.02-1: Cement Types and Maximum Allowable Substitution Rates

Patch Class	Cement Type	Maximum Allowable Substitution	Minimum Mix Temperature
B	Type I, Type II Type IS	0% Fly Ash 0% Fly Ash	75°F (24°C) 80°F (27°C)*
C	Type I, Type II Type IS	10% Fly Ash 0% Fly Ash	65°F (18°C) 70°F (21°C)*
* When Type A Mid Range water reducing admixture is used, limit the minimum mix temperature to that required when Type I/II cement is used.			

e. Calcium Chloride.

- 1) Where calcium chloride is required, furnish it in water solution form and add it to the mix at job site. Use a commercial 32% calcium chloride solution, or equivalent, prepared according to Table 2530.02-2:

Table 2530.02-2: Proportions for 32% Calcium Chloride Solutions

Type of Solid Calcium Chloride	Pounds (Grams) of Solid per Gallon (liter) of Water	Solution Produced per Gallon (liter) of Water
Type 1 – Regular Flake (77% material)	6 (720)	1.3
Type 2 – Concrete Flake or Pellets (94% material)	4.5 (540)	1.2

- 2) Engineer will check solution concentration using a hydrometer according to Materials I.M. 373. Add solution at the rate of 3.0 gallons per cubic yard (14.8 L/m³) of concrete. Calcium chloride solutions of different concentrations may be approved by the Engineer, provided appropriate adjustments in the total concrete composition are made.
- 3) Agitate mixture until calcium chloride is completely in solution, and continue agitation as necessary to maintain uniformity.
- 4) Except when using continuous mixing equipment described in Article 2001.20, E, ensure calcium chloride solution is present in mix for at least 2 minutes of mixing.

f. Water Reducer.

Type A Mid Range water reducing admixture may be used. Use one listed in Materials I.M. 403, at manufacturer's recommended dosage.

g. Transit Mix Concrete.

Use mix from a plant which can be delivered and placed within 60 minutes from start of mixing. Time may be extended to 90 minutes when a retarding admixture, used according to Materials I.M. 403 including temperature dosage guidelines (and at no additional cost to Contracting Authority), is added at the plant. Continuous mixing equipment using volumetric proportioning may be used according to Article 2001.20, E.

h. Prepackaged Mixture.

A prepackaged mixture, proportioned as specified above for Class B or Class C matching material, may be furnished as a Class B or Class C patching material with the Engineer's approval. Coarse aggregate for prepackaged mixtures shall meet the requirements of Article 4115.05. Mix prepackaged mixtures in an on-site paddle type mixer; or proportion and mix with continuous mixing equipment using volumetric proportioning according to Article 2001.20, E.

B. Joint Boards.

Comply with the following:

1. Joint boards for recreating joints and cracks: use a resilient filler, cellulosic fiber, paraffin coated cardboard, or other nonabsorbent, compressible material of proper shape to recreate joint during placement of patch material.
2. Boards for recreating transverse joints: one piece. One piece boards will not be required in lengths exceeding 6 feet (1.8 m).
3. Boards for recreating longitudinal joints: one piece. One piece boards will not be required in lengths exceeding 6 feet (1.8 m).
4. Joints and open transverse cracks: use a board with a nominal width of 0.25 inch (5 mm). Metal strips may be used for narrow cracks.
5. Extend boards and metal strips into the pavement to bottom of patch; no horizontal joints permitted.
6. Use of a bond breaker on board surfaces is encouraged.

C. Joint Sealer.

Use hot poured joint sealer meeting requirements of Section 4136.

2530.03 CONSTRUCTION.

A. Equipment.

1. Remove using milling machine, jack hammer, or similar equipment. Equip milling machines to stop at preset depths to prevent damage to dowel bars and reinforcement. Hand equipment may be necessary to achieve designated shape.
2. The following additional equipment is required:
 - a. Sandblasting equipment for cleaning prepared patch area.
 - b. Air chisel, 15 pound (7 kg) (or less), to complete patch area preparation. Larger air chisel, not to exceed 30 pound (14 kg), may be used if it does not result in significant damage to patch area and edges.
 - c. Air compressor that emits oil and moisture free air for cleaning prepared area.
 - d. On-site paddle type concrete mixer for mixing Class A patching material or other prepackaged mixtures.

B. Patch Construction.

1. General.

- a. Tabulations for partial depth patches shown in the contract documents are for estimating purposes only. Engineer will designate location and limits of patches.
- b. Hand operated equipment may be necessary for all or some removal.
- c. Remove pavement within designated area to a minimum depth of 2 inches (50 mm) or to sound concrete as determined by the Engineer. Material removed and not designated for salvage becomes property of the Contractor and shall be removed according to Article 1104.08.

2. Preparation of Patch Area.

- a. Remove concrete in designated repair area to a minimum width of 12 inches (300 mm) using either of the following methods:
 - 1) Mill transversely or longitudinally matching general alignment of patch. Use a mill that produces patch edges with a 30 to 60 degree angle or chip back patch edges to a 30 to 60 degree angle. Chip out secondary spalling resulting from milling at no additional cost to the Contracting Authority.

- 2) Place 2 inch (50 mm) saw cuts along perimeter of patch area and chip back patch edges to a 30 to 60 degree angle.
 - b. If a joint or crack is within patch area, construct bottom edge of patch at least 3 inches (75 mm) beyond joint or crack. ~~Minimum patch width will be 12 inch (300 mm).~~
 - c. Form or saw patch edges to prevent them from protruding beyond edge of existing pavement by more than 3/8 inch (10 mm).
 - d. Each patch will have a generally rectangular area. Remove concrete to a minimum depth of 2 inches (50 mm). Many areas will require removal of unsound concrete to a greater depth to reach sound concrete. Maximum depth is one half existing pavement thickness.
 - e. Do not damage steel reinforcement during removal process. Damaged steel will be the responsibility of the Contractor. If the end of a dowel bar is exposed, cut or remove dowel. Place duct tape, form oil, grease, or other method approved by the Engineer as a bond breaker on exposed dowels not removed.
 - f. When removal to a depth of one half existing pavement thickness leaves unsound concrete within patch area, the Engineer may designate part of the patch area as a Overdepth Patch. Remove concrete for the full depth of the pavement. Consolidate subgrade or subbase material using mechanical tamper or other compaction equipment as directed by Engineer. Furnish and install No. 4 (No. 15) tie bars at mid-depth of existing pavement using an approved non-shrink grout. Place bar to provide a minimum two inch concrete cover.
 - g. When it is necessary to go below reinforcing steel to reach sound concrete, cut reinforcing steel flush with perimeter patch edges and remove.
 - h. Clean patch area by sandblasting, followed by cleaning with compressed air. Completed surfaces shall appear surface dry to visual examination.
 - i. Recreate a joint or crack in patch area with a joint board of proper size and shape. Extend board to bottom of patch area to completely separate patching material on both sides. Use board of a width approximately equal to joint or crack. For wide openings, several thicknesses may be used. For patches 6 feet (2 m) or greater in length:
 - 1) Longitudinal joints may be reestablished by sawing to a depth of 1/3 the pavement thickness.
 - 2) With approval of the Engineer, transverse joints may be reestablished by sawing the full depth of the patch when use of a form board will not allow complete separation of patch material on both sides of joint.
- 3. Placing Patch Material.**
- a. Scrub cement-sand-water grout of creamy consistency onto patch surface, including edges. Grout shall consist of two parts of Type I or Type I/II Portland cement and one part sand mixed with water. Mix grout by mechanical means. Place patch material before grout dries. If grout dries before placement of patch material, clean patch area again by sandblasting and air blasting, then reapply grout.
 - b. Mix patching material and place in patch area. Consolidate and work into place in a manner ensuring good bonding. Level it with adjacent pavement to provide a smooth riding surface not varying from existing pavement surface by more than 1/8 inch (3 mm) when measured with a 10 foot (3 m) straightedge placed over patch. Replace or grind patch to correct deficiencies. Texture patches longer than 1 foot (0.3 m) in the manner of adjacent pavement surface.
 - c. For Class A patching materials, perform work according to patching manufacturer's recommendations and limitations, subject to approval of the Engineer. Furnish these recommendations to the Engineer.
- 4. Surface Finish.**
- Level partial depth patches with adjacent pavement. Trowel toward edge of the repair when finishing. Edge adjacent to joint boards or inserts in fresh concrete. Ensure they have a smooth riding surface.

5. Protecting and Curing.

a. Class A Patching Material.

Cure according to manufacturer's recommendations. ~~Use minimum curing time according to Materials I.M. 491.20, Appendix A.~~

b. Class B Patching Material.

- 1) Cure as specified in Article 2529.03, H.
- 2) Cure for minimum time specified in Article 2529.02 for mixture used.

c. Class C Patching Material.

- 1) Cure patches with an approved white pigmented curing compound meeting the requirements of Section 4105. Apply curing compound within 30 minutes after placement of patching material.
- 2) Cure patches involving Class M concrete a minimum of 36 hours.
- 3) Cure according to Article 2529.03, H, when overnight low temperatures are forecast to be below 35°F (2°C).

6. Joint and Crack Sealing.

Where joints and cracks cross patches; saw, seal, and clean patch according to Article 2301.03, P. Complete sealing within 5 working days after patch is placed. When joint and crack sealing is included in the contract, perform sealing as part of that operation.

C. Limitations of Operations.

1. Unless road is closed, maintain traffic during construction operations. Conduct operations with minimum inconvenience to traffic. On two-lane roads, limit operations to one traffic lane at a time, except for minor encroachment in adjacent lane for sawing and installing forms when traffic is maintained. For multiple lane roadways, work area may include one lane in each direction.
2. Adjacent lane shall be opened to traffic prior to the pavement being removed from a patch area.
3. When approved by the Engineer, patch areas may extend up to 2 feet (0.6 m) into adjacent lane as allowed by the contract documents.
4. Place PCC patching material when ambient air and pavement temperatures are at least 45°F (7°C).
5. The Engineer may limit advance sawing.
6. If an emergency makes a DW joint necessary, temporarily fill excavated area following the joint with a suitable hot or cold paving mixture or stable granular material, as directed by the Engineer. The Engineer may direct the lane remain closed to traffic overnight. Provide traffic control.

D. Area Restoration.

When patch is completed, remove forms if they have been used. Fill excavated space along outside pavement edge with material similar to existing shoulder, satisfactory to the Engineer. Thoroughly compact material before section is opened to traffic.

E. Failure Repair.

Repair failed patches that appear within 30 calendar days of original construction or subsequent repair at no cost to Contracting Authority. Failures may include, but are not limited to, loss of bond between patch and underlying pavement or random cracking.

2530.04 METHOD OF MEASUREMENT.

Engineer will determine quantities involved in satisfactory construction of partial depth patches for areas specified as follows:

A. Partial Depth PCC Finish Patches.

1. Engineer will calculate area of each patch in square feet (square meters) from surface measurements. Area of each patch less than 1 square foot (0.1 m^2) will be counted as 1 square foot (0.1 m^2) for payment purposes. If patch area is increased by Contractor to accommodate milling equipment, only area designated by the Engineer will be measured for payment.
2. Removal and repair of areas up to one half existing pavement thickness will be included in this payment.

B. Partial Depth PCC Joint and Crack Repair Patches.

1. Measurement for Partial Depth PCC Joint and Crack Repair Patches will be to the nearest 0.1 linear foot (0.1 m) on the basis of 12 inch (300 mm) width of repair. Areas designated for repair outside the 12 inch (300 mm) repair width will be measured as Partial Depth PCC Finish Patches per Article 2530.04, A, 1.
2. Removal and repair of areas up to one half existing pavement thickness will be included in this payment.

C. Overdepth Patches.

Engineer will calculate area of each Overdepth Patch in square feet (square meters) at the mid-depth of the pavement. Area of each patch less than 1 square foot (0.1 m^2) will be counted as 1 square foot (0.1 m^2) for payment purposes.

2530.05 BASIS OF PAYMENT.

Payment for construction of various types of partial depth patches, satisfactorily constructed, at areas specified, will be the contract unit price as follows:

A. Partial Depth PCC Finish Patches.

1. Per square foot (square meter).
2. Payment is full compensation for repairs up to one half existing pavement thickness and includes removal of pavement, preparing patch area, furnishing and placing material, construction of joints, sawing, finishing, curing, and restoration of area.

B. Partial Depth PCC Joint and Crack Repair Patches.

1. Per linear foot (meter)
2. Payment is full compensation for repairs up to one half existing pavement thickness and includes removal of pavement, preparing the patch area, furnishing and placing material, construction of joints, sawing, finishing, curing, and restoration of area.

C. Overdepth Patches.

1. Per square foot (square meter). Payment for Overdepth Patches will be in addition to Partial Depth PCC Finish Patch or Partial Depth PCC Joint and Crack Repair Patch quantities for the same area.

- 2.** Payment is full compensation for repairs designated in lower half of existing pavement and includes removal of pavement, preparing the patch area, and furnishing and placing material.
- D.** When joint and crack sealing is included in the contract, it will be paid for as a part of that work.

