Section 2530. Partial Depth Finish Patches

2530.01 DESCRIPTION.

A. Remove pavement in areas designated in the contract documents or by the Engineer to be patches. This includes furnishing and placing patching material to provide a new traffic surface, and restoring the adjacent shoulder as shown in the contract documents. This work is in areas where the size, shape, and depth of patch depends on the extent of pavement deterioration and shall be determined during the removal operation.

B. Partial depth finish patches may be identified and constructed as one of the following types:

1. Partial Depth PCC Finish Patches.
These patches are square or rectangular in shape. Saw the edges. Removal may be by milling or other equipment. This type of patch will be identified by tabulation in the contract documents. The size and location for each lane will be shown.

2. Partial Depth Regular HMA Finish Patches.
These patches are in the shape of a square or rectangle. They have square corners and straight edges to allow almost all of the removal by a milling machine. An air hammer or saw may be necessary to complete removal along edges and at corners. This type of patch will be identified by tabulation in the contract documents. The size and location in each lane will be shown.

3. Partial Depth Irregular HMA Finish Patches.
These patches are not square or rectangular in shape. They have at least one side that is not straight or one corner that is not square which will prohibit complete removal by a milling machine. Other equipment such as an air hammer or saw may be necessary to accomplish the removal. This type of patch will be identified by tabulation in the contract documents. This tabulation will be an estimate of the number of patches per lane mile, and the estimated total area of patch.

2530.02 MATERIALS.

Meet the requirements for the type of material specified.

A. Hot Mix Asphalt Patching Material.
Unless stated elsewhere in the contract documents, use HMA meeting or exceeding Section 2303 requirements for a 300,000 ESAL 3/8 or 1/2 inch (9.5 mm or 12.5 mm) surface mixture with PG 64-22 Performance Graded asphalt binder.

B. Portland Cement Concrete Patching Material.
Meet one of the requirements below. When patching encroaches on an adjacent lane which is 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. On pavements with three or more

lanes and where 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 the requirements of Materials I.M. 491.20.
   - **b.** When a mortar is furnished, add the manufacturer's recommended quantity of coarse aggregate.

2. **Class B Patching Material.**
   - **a.** Use high early strength rapid set (5 hour) PCC meeting the 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 are not to contain fly ash. When calcium chloride is used in a mixture, place the concrete within 30 minutes after the introduction of the calcium chloride. For coarse aggregate, meet the requirements of Section 4115 and Gradation No. 5, Aggregate Gradation Table, Appendix.
   - **b.** When Class B patching material is furnished for partial depth patches, it may also be furnished for full depth patches.

3. **Class C Patching Material.**
   - **a.** Use a PCC mixture with an early set that will allow time of opening to traffic in 24 hours to 36 hours as directed by the Engineer. For coarse aggregate, meet the requirements for Class B patching material. Use Class M mixture meeting the requirements of the current Materials I.M. 529 without the addition of calcium chloride.
   - **b.** When Class C patching material is furnished for partial depth patches, it may also be furnished for full depth patches.

4. **Modifications to Mixtures for Class B and Class C Patching Material.**
   Apply the following modifications to the PCC 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, is to be between 1 inch and 2 1/2 inches (25 mm and 65 mm) as a target range, allowing a maximum of 3 inches (75 mm). If calcium chloride solution is not to be added, the slump is to be between 1 inch and 3 inches (25 mm 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, is to be between 1 inch (25 mm) and 4 inches (100 mm) as a target range, allowing a maximum of 5 inches (125 mm).
   - **b. Air Entrainment.**
     The entrained air content of the 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 is to be 5.0%, with a tolerance of ± 2.0%. When no calcium chloride is to be added, air entrainment is to be 6.5%, with a tolerance of ± 1.5%.

c. Temperature.

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

d. Cement.

1) For Class M concrete mixtures, meet the requirements of Section 4101.

2) Refer to Table 2530.02-1 for cement types and maximum allowable substitution rates. The maximum substitution for Type IS is not to 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	75ºF (24ºC) 80ºF (27ºC)*
C	Type I, Type II Type IS	10% Fly Ash 0% Fly Ash	65ºF (18ºC) 70ºF (21ºC)*
* When a 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 the 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) The Engineer will check the solution concentration using a hydrometer according to Materials I.M. 373. Add the solution at

the rate of 3.0 gallons per cubic yard (14.8 L/m^3) 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 the mixture until the 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 the calcium chloride solution is present in the mix for at least 2 minutes of mixing.

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

g. Aggregate Durability.
Unless specified otherwise, use coarse aggregate of the proper class of durability, as defined in Article 4115.04.

h. Transit Mix Concrete.
Use a mix from a plant from which the concrete can be delivered and placed within 60 minutes from the start of mixing. The 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 the Contracting Authority), is added at the plant. Continuous mixing equipment using volumetric proportioning may be used according to Article 2001.20, E.

i. 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. The coarse aggregate for prepackaged mixtures is limited to that meeting 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.

C. 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 compressible material of the proper shape to recreate the joint during placement of the patch material.

2. Boards for recreating transverse joints: one piece, so as to have no horizontal joints.

3. Boards for recreating longitudinal joints: one piece. One piece boards will not be required in lengths exceeding 4 feet (1.2 m).

4. Joints and open transverse cracks: use a board with a nominal width of 1/4 inch (5 mm). Metal strips may be used for narrow cracks.

5. Extend boards and metal strips into the pavement to the bottom of the patch.

6. Use of a bond breaker on board surfaces is encouraged.

D. Joint Sealer.
Use joint sealer and backer rod meeting the requirements of Section 4136. Unless specified otherwise, use only hot poured joint sealer.

E. Tack Coat Bitumen.
For HMA patches, use tack coat bitumen as specified in Article 2303.02, E.

2530.03 CONSTRUCTION.

A. Equipment.

1. Remove existing surface material using a milling machine, jack hammers, or similar equipment. Hand equipment may be necessary to achieve a vertical edge and the designated shape.

2. Sawing equipment is required at edges from a milling operation.

3. The following additional equipment is required for PCC patches:
   - **a.** Sandblasting equipment for cleaning of the prepared patch area on PCC pavements.
   - **b.** 15 pound (7 kg) (or less) air chisel to complete patch area preparation. A 30 pound (14 kg) air chisel may be used if its use does not result in significant damage to the patch area and edges.
   - **c.** Air compressor that emits oil and moisture free air for cleaning the prepared area.
   - **d.** On-site paddle type concrete mixer for mixing Class A patching material or other prepackaged mixtures.

B. Partial Depth Finish Patch Construction.

1. **General.**
   - **a.** The tabulations for partial depth finish patches shown in the contract documents are for estimating purposes only. The Engineer will designate the location and limits of these patches.
   - **b.** The shape and depth may be irregular so that hand operated equipment may be necessary for all or some of the removal.
   - **c.** Remove the existing pavement material within the designated area to sound concrete as determined by the Engineer. All material removed not designated for salvage becomes the property of the Contractor and shall be removed according to Article 1104.08.

2. **Hot Mix Asphalt Patches.**
   Construct partial depth HMA finish patches as follows:
   - **a. Preparation of Patch Area.**
     - **1)** Remove material to a minimum depth of 3 inches (80 mm). Where this depth is adequate, make the prepared surface

relatively even. The maximum depth is 75% of the pavement thickness, but no more than 9 inches (230 mm).

2) Remove material so that the edges of all patch areas are vertical to a depth of 1 1/2 inches (40 mm). Minor rounding of the bottom edge is permissible. Cut and remove exposed reinforcing steel. Clean the patch area.

3) Where removal to the depth described above leaves unsound concrete within the limits of the patch area, the Engineer may designate a part of the patch area as a full depth patch. Remove the concrete for the full depth, but removal to a depth greater than 12 inches (300 mm) will not be required. Consolidate the subgrade or subbase material with a mechanical tamper or other compaction equipment as directed by the Engineer.

b. Placing HMA Patch Material.

1) After removal of the old pavement, lightly tack the edges and bottom of the patch area. Deposit and compact the HMA patch mixture in layers as follows:

a) Deposit the upper 5 inches (130 mm) in at least two layers, with the top layer not exceeding 2 inches (50 mm) in thickness, when compacted. Lifts should be at least 3 times the mixture size.

b) Thoroughly compact each layer, while hot, using appropriate compaction equipment. Succeeding layers may be placed as soon as the preceding layer has been properly compacted.

c) Smooth the final layer with a steel tired finish roller meeting requirements of Article 2001.05, B or F. A roller meeting requirement of Article 2001.05, F, may be a small roller suitable for this type of operation.

d) Ensure the final compacted surface is level with, or not more than approximately 1/4 inch (6 mm) above, the surrounding pavement.

2) Open the patch to traffic after the mixture has cooled to provide stability; however, on two lane roadways, do not leave barricades in place overnight. If the patch becomes distorted beyond the smoothness requirements for any reason, smooth the surface within 1 working day by blading, scraping, filling, or by other approved means.

3) Prior to final acceptance, a finish patch shall be level with, or not more than 1/8 inch (3 mm) above, the adjacent pavement, and have a smooth riding surface.

c. Sealing Joints and Cracks.

1) Seal all edges of HMA patches to a width of 3 inches (80 mm) centered on the edge. Use CRS-2 bitumen applied with a "V" shaped squeegee tool. Blot excess bitumen material with sand.

2) When joint and crack sealing work is part of the contract, saw joints and cracks that cross areas of HMA finish patches to a width of 1/8 inch to 1/4 inch (3 mm to 6 mm). Saw to the depth of the patch with a maximum depth of 3 inches (80 mm). Perform this work within 3 working days after placement.

3. Portland Cement Concrete Patches.

Construct partial depth PCC finish patches as follows:

a. Preparation of Patch Area.

1) If a joint or crack is within a patch area, construct the edge of that patch to be at least 6 inches (150 mm) beyond the joint or crack.

2) Each patch will have a generally rectangular area. Remove the PCC concrete in that area to a minimum depth of 3 inches (80 mm). Many areas will require removal of unsound PCC concrete to a greater depth to reach sound concrete. The maximum depth is 75% of the pavement thickness but not more than 9 inches (230 mm).

3) Milling will be allowed, but the depth within the designated patch area is to be at least 3 inches (80 mm). Remove concrete from feathered runouts to a depth of 3 inches (80 mm) if within the designated patch area, or to a depth of 2 inches (50 mm) if outside the designated patch area. Saw these edges vertically. Ensure the prepared area has reasonably straight and vertical edges, not to exceed 1 inch (25 mm) in saw cut depth. Sawing will be required around the remainder of the patch perimeter, unless the Contractor demonstrates that an edge can be produced that is true and vertical, without sawing.

4) When removal to the maximum depth leaves unsound concrete within the patch area, the Engineer may designate a part of the patch area as a full depth patch. Remove the concrete for the full depth of the existing pavement, but no more than 12 inches (300 mm). Consolidate the subgrade or subbase material using a mechanical tamper or other compaction equipment as directed by the Engineer.

5) When it is necessary to go below reinforcing steel to reach sound concrete, cut the reinforcing steel flush with the perimeter edges of the patch and remove.

6) Clean the patch area by sandblasting, followed by cleaning with compressed air. The completed surfaces are to appear surface dry to visual examination.

7) Recreate a joint or crack in the patch area with a joint board of the proper size and shape. Extend the board to the bottom of the area to be patched, so as to separate completely all patching material on both sides. Use a board of a width approximately equal to the joint or crack. For wide openings, several thicknesses may be used.

b. Placing PCC Patch Material.

1) Scrub a cement-sand-water grout of creamy consistency onto the patch surfaces, including the edges. Place the patch material before the grout dries.

2) Mix Class A patching material with water and coarse aggregate, if required. Place the properly mixed material in the patch area, consolidated and worked into place in a manner that will provide good bonding. Level it with the adjacent pavement to provide a smooth riding surface. Texture patches

longer than 1 foot (0.3 m) in the manner of the adjacent pavement surface.

3) Perform this work according to the patching manufacturer's recommendations and limitations, subject to approval of the Engineer. Furnish these recommendations to the Engineer. After 1 hour, remove the joint board in a manner that does not damage the patch. The area may then be returned to public traffic.

4) Mix Class B and Class C patching material and place in the patch area. Consolidate it by vibration in a manner that will provide good bonding. Level the patch to provide a smooth riding surface. Texture patches longer than 1 foot (0.3 m) in the manner of the adjacent pavement surface.

c. Protecting and Curing.

1) Class A patching material.
Cure according to the manufacturer's recommendations. Use a minimum curing time according to Materials I.M. 491.20, Appendix A.

2) Class B patching material.

a) Cure as specified in Article 2529.03, H.

b) Cure these patches for the minimum time specified in Article 2529.02 for the mixture used.

3) Class C patching material.

a) Cure according to Article 2529.03, H. Patches may be covered immediately with white pigmented curing compound. In this case, the specified cure may be delayed as much as 2 hours.

b) Cure patches with Class M concrete a minimum of 36 hours or as directed by the Engineer.

c) After the required curing period, the insulation blanket and the joint forming board may be removed in a manner that does not damage the patch, or removal may be delayed until the sealing is to be done provided no damage results from the delay.

d. Surface Finish.
Prior to final acceptance, level finish partial depth patches with the adjacent pavement. Ensure they have a smooth riding surface.

e. Joint and Crack Sealing.
Where joints and cracks cross areas of partial depth PCC patches, saw, seal, and clean the patch according to Article 2301.03, P. Complete sealing within 5 working days after the patch is placed. When joint and crack sealing is included in the contract, perform sealing as part of that work.

C. Limitations of Operations.

1. Unless the road is closed, maintain traffic during construction operations. Conduct all operations with minimum inconvenience to traffic. On two-lane roads, limit operations to one traffic lane at a time, except for minor encroachment in the adjacent lane for sawing and installing forms when traffic is maintained. For multiple lane roadways, the work area may include one lane in each direction.

2. An adjacent lane shall be opened to traffic prior to the old 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 an adjacent lane as allowed by the contract documents.

4. Adjust the work schedule so all work for each patch, including removal of barricades and equipment (except the cure period for PCC Class C concrete), will be completed on the same day it is started between the hours of 30 minutes after sunrise to 30 minutes before sunset. If unforeseen conditions result in excavated areas being left overnight, assign a sufficient number of flaggers to warn and direct traffic until the patches are placed. Extra payment will not be made for the necessary flaggers.

5. Place PCC patching material only when the ambient air and pavement temperatures are 45°F (7°C) or above.

6. The Engineer may limit advance sawing.

7. If an emergency makes a DW joint necessary, temporarily fill the 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 that the lane remain closed to traffic overnight. Provide traffic control.

8. When PCC patches without calcium chloride are constructed, place two drums meeting the requirements of Article 2528.03, C, in front of each patch location where there is a possibility of turning into or returning to the closed lane. Additional drums need not be placed for patches spaced closer than 150 feet (45 m).

9. Apply Articles 1107.08, 1107.09, and 1108.03.

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

2530.04 METHOD OF MEASUREMENT.
The Engineer will determine the quantities involved in satisfactory construction of partial depth finish patches for the areas specified as follows:

A. Partial Depth PCC Finish Patches.

1. The Engineer will calculate the area of each patch in square feet (square meters) from surface measurements. The 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 the patch area is increased by the Contractor to accommodate milling equipment, only the area designated by the Engineer will be measured for payment.

2. The Engineer will also calculate the area of patches in square feet (square meters) which have been directed to be constructed full depth.

B. Partial Depth HMA Finish Patches.

1. The Engineer will measure the area for each patch and the weight (mass) of HMA placed in partial depth patches according to Article 2303.04. Regular patches and irregular patches will be calculated and totaled separately. If the patch area is increased to accommodate milling equipment, only the quantities for the area designated by the Engineer will be measured for payment.

2. Asphalt binder and tack coat will not be measured separately for payment.

3. The Engineer will also calculate the area and weight (mass) of patch material placed in HMA patches which have been directed to be constructed full depth. The Engineer will deduct quantities not used.

2530.05 BASIS OF PAYMENT.

Payment for construction of the various types of partial depth finish patches, satisfactorily constructed, at the 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 removal of all pavement, preparing the patch area, furnishing and placing all material, construction of joints, sawing, finishing, curing, and restoration of the area.

3. When parts of PCC partial depth finish patches are constructed to full depth at the direction of the Engineer, payment will be for the areas of those parts at 2.0 times the contract price per square foot (square meter) for partial depth PCC patches.

B. Partial Depth HMA Finish Patches.

1. Payment will be for both the patch area and the quantity of HMA placed in the patch.
   a. **Regular Partial Depth HMA Finish Patches, by Area.**
      Per square yard (square meter).
   b. **Irregular Partial Depth HMA Finish Patches, by Area.**
      Per square yard (square meter).
   c. **Hot Mix Asphalt Mixture.**
      Per ton (megagram). Includes mixture designated for full depth patches.

2. When parts of regular or irregular partial depth HMA finish patches are constructed to full depth at the direction of the Engineer, payment will be for the areas of those parts at 2.0 times the contract price per square

yard (square meter) for regular or irregular partial depth HMA finish patches.

3. Payments are full compensation for:
- Removal of the old pavement,
- Preparing the patch area,
- Furnishing and placing the HMA patching material, including asphalt binder in the mixture and necessary tack coat bitumen,
- Sawing and sealing,
- Sealing the patch edges, and
- Restoration of the area.

4. When joint and crack sealing is included in the contract, it will be paid for as a part of that work.