PAVEMENT REHABILITATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Full and Partial Depth PCC Patches

B. Full and Partial Depth HMA Patches

C. Full Depth Composite Patches

D. Diamond Grinding

E. Milling

F. Cleaning and Filling Joints and Cracks

G. Curb and Gutter Replacement

1.02 DESCRIPTION OF WORK

A. Construct full depth PCC, HMA, and composite patches.

B. Construct partial depth PCC and HMA patches.

C. Grind existing PCC pavement surface for profile improvement using a diamond grinder.

D. Mill the surface of HMA or PCC pavement to improve the surface profile and cross-section in preparation for resurfacing.

E. Clean and fill longitudinal and transverse joints and random cracks in PCC and HMA pavement.

F. Remove existing pavement and curb and gutter.

1.03 SUBMITTALS

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. PCC mix design.

B. HMA mix design.

1.04 SUBSTITUTIONS

Follow the General Provisions (Requirements) and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

Follow the General Provisions (Requirements) and Covenants, as well as the following:

A. PCC: See Section 7010.

B. HMA: See Section 7020.

1.06 SCHEDULING AND CONFLICTS

Follow the General Provisions (Requirements) and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Full Depth Patches

1. **Measurement:** Measurement will be in square yards for each type of full depth patch. Patches less than 2 square yards in area will be considered 2 square yards.

2. **Payment:** Payment will be made at the unit price per square yard for each type of full depth patch.

3. **Includes:** Unit price includes, but is not limited to, sawing, removing, and disposing of existing pavement and reinforcing; restoring the subgrade; furnishing and installing tie bars and dowel bars; furnishing and placing the patch material, including the asphalt binder and tack coat; forming and constructing integral curb; surface curing and pavement protection; joint sawing and filling; and placing backfill and restoring disturbed surfaces.

B. Subbase Overexcavation:

1. **Measurement:** Measurement will be in tons of subbase material placed for authorized overexcavation.

2. **Payment:** Payment will be made at the unit price per ton of subbase material.

3. **Includes:** Unit price includes, but is not limited to, removal of existing subbase or subgrade, disposal of materials removed, furnishing and placing subbase material, and any additional excavation required for subbase placement.

C. Partial Depth Patches:

1. **Measurement:** Measurement will be in square feet for each type of partial depth patch. Patches less than 1 square foot in area will be considered 1 square foot.

2. **Payment:** Payment will be made at the unit price per square foot for each type of partial depth patch.

3. **Includes:** Unit price includes, but is not limited to, sawing, removing, and disposing of existing pavement; furnishing tack coat or bonding agent; furnishing and placing the patch material; curing; joint filling (PCC patches only); placing backfill; and restoring disturbed surfaces.

4. **Extra Payment:** When partial depth patches are constructed to full depth at the direction of the Engineer, payment will be at 2 times the unit price per square foot for each type of partial depth patch.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Crack and Joint Cleaning and Filling, Hot Pour:

1. **Measurement:** Measurement will be in linear feet measured along the cracks or joints.

2. **Payment:** Payment will be made at the unit price per linear foot of crack and joint cleaning and filling.

3. **Includes:** Unit price includes, but is not limited to, furnishing crack and joint filler material and routing, sawing, cleaning, and filling joints or cracks.

E. Crack Cleaning and Filling, Emulsion:

1. **Crack Cleaning and Filling, Emulsion:**
   a. **Measurement:** Measurement will be in linear feet measured along the cracks. Map cracked areas will not be measured.
   b. **Payment:** Payment will be made at the unit price per linear foot of crack cleaning and filling.
   c. **Includes:** Unit price includes, but is not limited to, furnishing emulsified crack filler material, cleaning cracks, placing soil sterilant, and filling cracks.

2. **Hot Mix Asphalt for Crack Filling:**
   a. **Measurement:** Measurement will be in tons of HMA used for filling cracks greater than 1 inch. Quantity will be based upon scale tickets. Mixture not used in the work will be deducted based upon scaled weights.
   b. **Payment:** Payment will be made at the unit price per ton for HMA used in filling cracks over 1 inch.
   c. **Includes:** Unit price includes, but is not limited to, cleaning, applying tack coat, and furnishing and placing HMA for crack filling.

F. Diamond Grinding:

1. **Measurement:** Measurement will be in square yards for the area of diamond grinding.

2. **Payment:** Payment will be made at the unit price per square yard of diamond grinding.

3. **Includes:** Unit price includes, but is not limited to, diamond grinding pavement, testing for smoothness according to the contract documents, and removal of slurry and residue from the project site.

G. Milling:

1. **Measurement:** Measurement will be in square yards for the area of milling.

2. **Payment:** Payment will be made at the unit price per square yard of milling.

3. **Includes:** Unit price includes, but is not limited to, milling pavement; furnishing water; and salvaging, stockpiling, and removing cuttings and debris.

1.08 MEASUREMENT AND PAYMENT (Continued)

H. Pavement Removal:

1. **Measurement:** Measurement will be in square yards. No deduction in area will be made for manholes, storm sewer intakes, valve boxes, or other structures less than 2 square yards in area. Pavement removal for patching is included as part of the patching item and will not be measured separately.

2. **Payment:** Payment will be made at the unit price per square yard.

3. **Includes:** Unit price includes, but is not limited to, sawing, breaking, removing, and disposing of existing pavement and reinforcing steel.

I. Curb and Gutter Removal:

1. **Measurement:** Measurement will be in linear feet measured along the back of curb.

2. **Payment:** Payment will be made at the unit price per linear foot of curb and gutter removed.

3. **Includes:** Unit price includes, but is not limited to, sawing, breaking removing, and disposing of existing curb and gutter.

J. Sampling and Testing: Required sampling and testing for pavement repair and rehabilitation work is incidental to other project costs and will not be paid for separately.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PCC:

1. **Standard Patching:** Use Class C mix complying with Section 7010. Comply with Iowa DOT Materials I.M. 401. Construct all patches as standard patches unless otherwise specified in the contract documents.

2. **High Early Strength Patching:** Use Class M mix complying with Section 7010. Do not use calcium chloride unless otherwise specified in the contract documents.

3. **Partial Depth Patching:** Use a coarse aggregate in concrete mix complying with Iowa DOT Article 4109.02, Gradation No. 5.

B. HMA: Provide a minimum 300,000 ESAL mixture complying with Iowa DOT Article 2303.02, unless otherwise specified in the contract documents. Provide mixture with a PG 64-22 asphalt binder.

C. Crack and Joint Filler Material:

1. **Hot Pour Crack and Joint Filler:** Comply with Iowa DOT Section 4136.

2. **Emulsified Asphalt Crack Filler:** Provide CRS-2 or CRS-2P emulsions complying with Iowa DOT Section 4140.

3. **HMA for Filling Cracks:**
   a. Provide a 3/4 inch, 1/2 inch, or 3/8 inch HMA mixture complying with Section 7020, or a similar mixture from a commercial source subject to approval from the Engineer.
   b. Upon approval of the Engineer, a high performance bituminous cold premix may be used, depending on the availability of the specified hot mix asphalt.

4. **Blotting Material:** Provide sand complying with Iowa DOT Sections 4124 or 4125, or similar sand approved by the Engineer.

5. **Soil Sterilant:** Provide soil sterilant as specified in the contract documents.

D. Primer or Tack Coat Bitumen: Comply with Iowa DOT Article 2303.02.

E. Epoxy for Bonding Dowel and Tie Bars: Comply with Iowa DOT Materials I.M. 491.11.

F. Tie Bars and Dowel Bars: Provide epoxy coated bars complying with Iowa DOT Section 4151.

G. Subbase Material: Unless otherwise specified in the contract documents, use modified subbase complying with Section 2010.

H. Liquid Curing Compound: Comply with Iowa DOT Section 4105.

I. Cement Grout: Provide a water cement grout mixture with a ratio of one part water to one part cement.

PART 3 - EXECUTION

3.01 GENERAL

A. Conduct all operations to minimize inconvenience to traffic. Confine operations to one traffic lane, unless the road is to be closed to traffic. Minor encroachment into the adjacent lane, such as for sawing and installing forms, will be acceptable with the use of a flagger according to MUTCD.

B. Do not remove pavement for either full depth or partial depth patching unless the patch can be completed before the end of the working day.

C. Construct full depth and partial depth patches to the dimensions specified in the contract documents or as marked by the Engineer in the field. Construct all full depth patches to full panel width.

D. Make saw cuts parallel or perpendicular to the centerline.

E. Remove and dispose of materials not designated for salvage.

F. Restore the area outside the pavement by placing and compacting backfill material, placing topsoil, and sodding or seeding as specified in the contract documents.

3.02 FULL DEPTH PATCHING

A. Pavement Removal:

1. Saw pavement to full depth at the edges of the patch. A second saw cut, 2 inches inside the initial saw cut, may be required to prevent damage to adjacent pavement.

2. Do not damage pavement that is to remain. Do not use heavy equipment adjacent to new concrete until the opening strength is achieved.

B. Restoring Subgrade or Subbase:

1. Excavate 2 inches below the bottom of the existing pavement. If more than 2 inches is excavated, place and compact new subbase material as required to bring the subbase to a level 2 inches below the bottom of the existing pavement. Correct unauthorized over-excavation at no additional cost to the Contracting Authority.

2. Compact the exposed subgrade or subbase by a minimum of four complete passes with a plate-type vibratory compactor with a minimum force rating of 3,500 pounds.

3. When unstable material or excessive moisture is encountered, the Engineer may order removal and replacement of the unstable material.
   a. Remove existing unstable subgrade or subbase, or both, to the depth directed by the Engineer.
   b. Place and compact new subbase material as required to bring the subbase to a level 2 inches below the bottom of the existing pavement.

C. Placing PCC Patches:

1. **Equipment:** Comply with Iowa DOT Article 2301.03, A, specifications on equipment for standard concrete pavement.

3.02 FULL DEPTH PATCHING (Continued)

2. **Tie Bars and Dowel Bars:** Comply with Section 7010 and the figures in Sections 7010 and 7040.
   a. When there is a common line between two adjacent patches, a bent bar may be placed in a keyway and later straightened.
   b. Coat dowel bars extending into the patch area with a bond breaker. Do not coat tie bars.

3. **Forms:** Comply with Section 7010, 3.02, D, as well as the following.
   a. Use forms on all exposed edges and along the centerline for patches that extend into an adjacent lane, unless full pavement width patches are constructed.
   b. Rigid wood forms may be used in lieu of steel.

4. **Placing, Consolidation, and Finishing the Concrete:**
   a. Moisten the subbase or subgrade, or cover with a single layer of polyethylene film lapped at 12 inches for large areas.
   b. Except for preplanned joints, place the patch continuously until the patch is completed.
   c. When a delay of 45 minutes cannot be avoided, construct a day's work ('DW') joint.
   d. Carefully place concrete into the patch area to avoid segregation; spread into place and consolidate with a mechanical vibrator. Place full lane width patches over 25 feet in length with a suitable finishing machine that has at least one vibrating screed. Avoid excessive vibrating.
   e. Finish patches per Section 7010, 3.02, H.
   f. For joints with tie bars, tool the edge. For joints with dowel bars, saw to a depth of approximately 1 1/8 inch, leaving an opening of at least 3/8 inch in width to provide a reservoir for joint filler.
   g. Texture the patch to match the adjacent surface.

5. **Curing:** Comply with Section 7010, 3.02, I. Cure the concrete, including exposed vertical edges, immediately after the concrete has been finished and the surface water has evaporated.

6. **Joints:** Construct and fill joints according to Section 7010, 3.02. Place joints at locations specified in the contract documents.

7. **Pavement Protection:** Comply with Section 7010, 3.05.

8. **Use of Pavement:** Comply with opening strength requirements of Section 7010, 3.06. Maturity testing is not required.

D. Placing HMA Patches:

1. Use equipment complying with Iowa DOT Article 2303.03. Use of a paving machine is not required.

2. Apply tack coat to the vertical edges of the remaining pavement at a rate of 0.10 to 0.15 gallons per square yard.

3. Place HMA patch mixture in lifts that will not exceed 3 inches in thickness after compaction, with the top lift not exceeding 2 inches in thickness when compacted.

4. Compact each lift while hot by rolling or compacting with a vibratory compactor. Subsequent lifts may be placed as soon as the preceding lift has been properly compacted.

3.02 FULL DEPTH PATCHING (Continued)

5. Smooth the final lift with a steel-tired finish roller. Ensure the final compacted surface is level with, or no more than 1/8 inch above, the adjacent pavement and has a smooth riding surface. If the patch becomes distorted for any reason, smooth the surface by blading, scraping, grinding, filling, or other approved means.

6. Do not extend patch material beyond the edge of the existing pavement; remove patch material that extends outside the patch limits.

7. Do not open to traffic until the mixture has cooled sufficiently to provide stability.

3.03 PARTIAL DEPTH PATCHING

A. Pavement Removal:

1. Ensure all patches are square or rectangular in shape.

2. Saw to a depth of 2 inches at the removal limits.

3. Using a 15 pound maximum size pneumatic hammer, remove the deteriorated pavement down to sound pavement.

4. In lieu of sawing and removal with a pneumatic hammer, the designated patch area may be milled to the prescribed depth. Saw edges of milled removal areas to create vertical face, unless otherwise specified in the contract documents.

5. Remove pavement to the appropriate depth. If the required depth to sound pavement exceeds the maximum removal depth, construct a full depth patch.
   a. PCC Pavement: Minimum removal depth of 2 inches or a maximum depth of 1/3 of the pavement thickness.
   b. HMA Pavement: Minimum removal depth of 2 inches or a maximum depth of 1/2 of the pavement thickness.

B. PCC Patch Placement:

1. Clean removal area by sandblasting, followed by airblasting, until the area is clean and dry. Ensure the compressed air used for cleaning is oil and moisture free. Place concrete the same day as sandblasting.

2. Place resilient filler material complying with Iowa DOT Article 4136.03 along existing joints. Filler material is to extend 1 inch below the patch and 3 inches beyond the patch boundaries.

3. Thoroughly coat the bottom and sides of the patch area with a cement grout immediately prior to placement of concrete. Do not allow grout to set prior to placement of concrete. Remove grout set by sandblasting and reapply.

4. Deposit concrete in the patch; finish patch from the center outward. Ensure concrete does not infiltrate into existing cracks or joints.

5. Apply joint filler material to expansion joints. At the interface between the patch and the slab, apply cement grout to fill.

6. Texture the patch similar to the adjacent surface.

7. Cure patch according to Section 7040, 3.02.

3.03 PARTIAL DEPTH PATCHING (Continued)

C. HMA Patch Placement:

1. Clean removal area by airblasting until the area is clean and dry. Ensure the compressed air used for cleaning is moisture free.

2. Cover the entire removal area with tack coat at a rate of 0.10 to 0.15 gallons per square yard.

3. Place HMA patch mixture in lifts that will not exceed 3 inches in thickness after compaction, with the top lift not exceeding 2 inches in thickness when compacted.

4. Compact each lift while hot by rolling with an adequately weighted pneumatic tire roller or by tamping with a mechanical tamper. Succeeding lifts may be placed as soon as the preceding lift has been properly compacted.

5. Smooth the final lift with a steel-tired finish roller. Ensure the final compacted surface is level with, or not more than 1/8 inch above, the adjacent pavement and has a smooth riding surface. If the patch becomes distorted for any reason, smooth the surface by blading, scraping, grinding, filling, or other approved means.

6. Do not open to traffic until the mixture has cooled sufficiently to provide stability.

3.04 DIAMOND GRINDING

A. Use equipment complying with Iowa DOT Article 2532.03, A.

B. Grind and texture the entire surface of the pavement parallel to the centerline until the pavement surface on both sides of transverse joints and all cracks are in the same plane and meets the required smoothness.

C. Ensure the ground surface is of uniform texture. In each lane, ensure at least 95% of the area in each 100 foot section has a newly textured surface.

D. Except at joints and cracks, ensure grinding depth does not exceed 1/2 inch. At joints and cracks, ensure grinding depth does not exceed 3/4 inch.

E. For multiple passes, ensure overlaps do not exceed 1 inch. Begin at the crown of the roadway, proceeding toward the pavement edge with each subsequent pass. Ensure each subsequent pass is at least as deep as the previous pass in order to provide transverse drainage. All passes are to begin and end at the same station location.

F. Assemble and adjust the grinding head as necessary during the project to produce the following tolerances on pavements with the indicated coarse aggregates. Both the distance between grooves and the texture depth must be within the specified range to be in compliance.

	Crushed Stone	Gravel
Blade Segment Thickness	0.130” max.	0.130” max.
Distance Between Grooves*	0.100” to 0.125”	0.080” to 0.110”
Texture Depth**	Target of 1/16” with average between 1/32” and 3/32”	

*Based on an average of a minimum of ten measurements across the ground width for one pass.
**Based on an average of a minimum of six measurements across the ground width for one pass.

3.04 DIAMOND GRINDING (Continued)

G. Prior to enforcement of the tolerances listed above, a 1,000 square yard test area will be allowed for a new head that has been restacked, provided a surface texture in reasonable conformance with the specifications, as determined by the Engineer, is being produced.

H. Ensure the transverse slope of the ground pavement is uniform to a degree that there are no depressions or misalignment of slope greater than 1/4 inch in 12 feet when tested by string line or straightedge placed perpendicular to the centerline.

I. Continuously remove all slurry or residue resulting from the grinding operations, and remove from the project limits. Ensure residue from grinding operations does not flow across lanes occupied by public traffic or into gutters, storm sewers, ditches, or other drainage facilities.

J. When pavement smoothness testing is specified in the contract documents, measure smoothness with a profilograph, which produces a profilogram (profile trace) of the surface tested, according to Iowa DOT Materials I.M. 341 and the following requirements:

1. Prior to performing any grinding work, provide a control profilogram for each lane and/or segment over 50 feet in length that is to be ground. Ensure pavement is relatively clean and free of debris prior to establishing the control profilogram.

2. Ensure each segment of the finished ground surface has a final profile index less than or equal to 35% of the control profilogram trace or 22 inches per mile, whichever is greater, and does not include any bumps exeeding 1/2 inch in 25 feet.

3. Depressed pavement areas due to subsidence or other localized causes and areas where the maximum cut restricts further grinding will be excluded from testing with the profilograph when approved by the Engineer.

3.05 MILLING

A. Use equipment complying with Iowa DOT Article 2531.03, A.

B. Mill the entire pavement area designated to the depth specified in the contract documents. Mill in straight lines. Make sufficient passes, or cuts, such that all irregularities or high spots are eliminated.

C. Control milling operations to provide a surface that is true within a nominal tolerance of 1/4 inch and 1/4 inch at longitudinal joints where adjacent passes meet. The profile may be inspected by checking with a 10 foot surface checker placed parallel to the centerline. Correct variations greater than 1/4 inch.

D. Load cuttings directly into dump trucks and remove the remaining small cuttings and debris from the street. Sweep the scarified surface with a rotary broom before opening to traffic. Unless otherwise specified in the contract documents, all materials removed are property of the Contractor.

E. Do not operate metal tracked equipment on streets, other than those being milled.

F. Ensure excessive dust does not become airborne during construction. Additional water may be required at any time for dust control.

G. Mill around manholes and utility valves. Correct any damage to manholes or valves by the milling operation at no additional cost to the Contracting Authority.

H. Do not leave a vertical drop of more than 2 inches at the centerline or lane line overnight. Taper the ends of milled sections subject to traffic to provide a uniform and gradual transition.

3.06 CRACK AND JOINT CLEANING AND FILLING, HOT POUR

A. General:

1. Use equipment complying with Iowa DOT Articles 2541.03 (HMA) and 2542.03 (PCC).

2. Route or saw joints and cracks with an average opening of 3/8 inch or less to provide a minimum sealant reservoir of 3/8 inch wide by a nominal 1/2 inch deep. For joints and cracks less than 3/8 inch wide, widen by routing or sawing to a minimum width of 3/8 inch and depth of 1/2 inch.

B. Crack and Joint Cleaning:

1. Clean cracks or joints of existing joint filler material, backer rod, vegetation, dirt, and other foreign material.

2. Clean joints or cracks by air blasting or by other methods as necessary to remove debris.

3. If specified in the contract documents, clean wet sawn joints with high pressure water immediately after sawing to remove residue produced by the sawing operation.

4. When cleaned joints or cracks are contaminated before being filled, clean them again before filling.

C. Crack and Joint Filling:

1. Ensure cracks and joints are dry prior to placement of filler material.

2. Heat, handle, and apply joint filler material to the proper level as specified in the contract documents and as recommended by the manufacturer.
   a. PCC Pavement: Do not overfill joint or crack with filler material. Immediately remove filler material placed on the pavement surface.
   b. HMA Pavement: Slightly overfill the entire crack reservoir with filler material. Smooth with a narrow V-shaped squeegee immediately after placement of the filler material to within 1/2 inch on each side of the crack edge.

4. Place joint filler material when the pavement and ambient air temperatures are 40°F or higher. When near this minimum, additional air blasting or drying time, or both, may be necessary to ensure a satisfactory bond to the joint surfaces.

5. Lanes may be opened to traffic only after the filler material has set sufficiently so it will not pick up under traffic. Blotting material may be applied to the filler material, but only after the surface has set to avoid penetration of the blotting material into the filler material.

3.07 CRACK CLEANING AND FILLING, EMULSION

Use emulsified asphalt for filling cracks in HMA surfaces only. Do not use on PCC pavements.

A. General:

1. Clean cracks with either high pressure air or water equipment. Do not use water when freezing temperatures exist or are forecasted.

2. Ensure vegetation is removed from cracks. Alternative cleaning methods may be necessary to remove vegetation.

3.07 CRACK CLEANING AND FILLING, EMULSION (Continued)

3. When specified in the contract documents, apply a soil sterilant in crack prior to placing the filler material.

4. For filling cracks, use a hand operated wand or pouring pot, capable of placing the filler material into the crack and filling to the adjacent surface. Use a spout or nozzle small enough to place the filler material into the crack without soiling the adjacent surface.

5. Immediately after placement of the filler material, tightly spread the emulsion using a 2 inch, or less, V-shaped rubber-edged squeegee. Take proper measures to hold the filler in place and prevent runout at edge of pavement or at low areas.

B. Cracks Wider Than 1 inch:

1. Clean the cracks of loose and spalled material, sand, and other foreign debris to a depth of 3 inches using high pressure water.

2. When specified in the contract documents, utilize additional methods to clean cracks of old crack filler.

3. Blow the cleaned cracks free of water with high pressure air.

4. Lightly apply a tack coat to the crack surfaces.

5. Fill the cracks with hot mix asphalt.
   a. Ensure mix is warm and pliable when placed.
   b. Rod and tamp the mix into place level with the adjacent surface.
   c. Place mixture prior to filling cracks with emulsion.

6. Place a thin application of emulsion over the hot mix asphalt and tightly spread with a squeegee.

C. Cracks 1/4 inch to 1 inch in Width:

1. Clean the cracks of loose and spalled material, sand, and other foreign debris with high pressure air or high pressure water. Clean crack down to sound material, but a depth greater than 3 inches will not be required.

2. When specified in the contract documents, utilize additional methods to clean cracks of old crack filler.

3. Fill cracks with emulsion filler material.

D. Cracks Less Than 1/4 inch in Width:

1. Clean sufficiently to remove sand and other foreign debris.

2. Fill cracks with emulsion filler material.

E. Map-cracked (Alligator) Areas:

1. Cover area with emulsion filler material.

2. Spread emulsion over area with squeegee, working emulsion into cracks. Provide a thin, smooth application.

3. Promptly cover the filler material with a light application of blotter material.

3.08 PAVEMENT REMOVAL

A. Saw full depth at pavement removal limits.

B. Extend pavement removal limits to existing joint lines as directed by the Engineer.

C. Protect existing pavement, beyond removal limits, from damage. Remove to a new saw line and replace, at no additional cost to the Contracting Authority, all concrete broken or damaged beyond the removal limits designated by the Engineer.

3.09 CURB AND GUTTER REMOVAL

A. Saw longitudinally along the existing gutter joint or at a location directed by Engineer. Saw transversely at the curb and gutter removal limits.

B. Remove existing curb and gutter without damaging the existing pavement to remain.

END OF SECTION