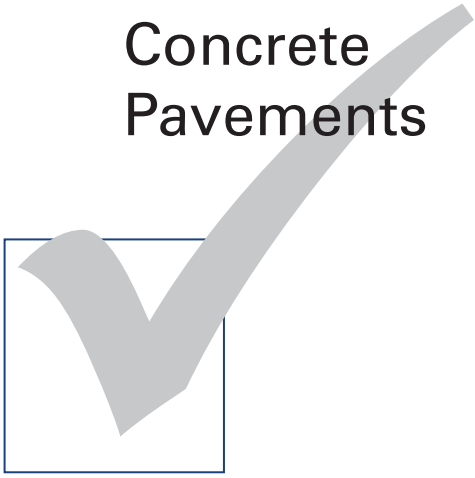
Pavement Preservation
Checklist Series

20

Partial-Depth Repair of Portland Cement Concrete Pavements



U.S. Department of Transportation
Federal Highway Administration

Partial-Depth Repair of Portland Cement Concrete Pavements Checklist

This checklist is one in a series created to guide State and local highway preservation/maintenance and inspection staff on the use of innovative pavement preservation techniques.

FHWA uses its partnerships with different pavement preservation organizations including American Association of State Highway and Transportation Officials, and State and local transportation agencies to promote pavement preservation.

To obtain other checklists or to find out more about pavement preservation, contact your local FHWA division office or check the following FHWA Web page:

www.fhwa.dot.gov/pavement/preservation/resources.cfm

Other valuable resources on pavement preservation:

- www.acpa.org
- www.cement.org
- www.cptechcenter.org
- www.igga.net

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Preliminary Responsibilities

Document Review

- ☐ Bid/project specifications and design
- ☐ Special provisions
- ☐ Agency application requirements
- ☐ Traffic control plan
- ☐ Manufacturer's installation instructions
- ☐ Material safety data sheets
- ☐ National Concrete Pavement Technology (CP Tech) Center *Concrete Pavement Preservation Guide*

Project Review

- ☐ Verify that pavement conditions have not significantly changed since the project was designed and that partial-depth repair is appropriate for the pavement.
- ☐ Agency and contractor should collaboratively verify that the estimated number/quantity of partial-depth repairs agrees with the number specified in the contract.
- ☐ Note whether the partial-depth repairs are primarily a result of joint-related distress or more traditional spalls resulting from construction defects and/or incompressibles in the joints.

- ☐ Agree on quantities to be placed, but allow flexibility if additional deterioration is found below the surface.
- ☐ Note that some partial-depth repairs may become full-depth repairs if deterioration extends below the top third to one-half of the slab; the exception to this is the Type 3 repairs.

Materials Checks

- ☐ Verify that repair material is of the correct type and meets specifications.
- ☐ Verify that repair material is obtained from an approved source or is listed on agency Qualified Products List as required by the contract documents.
- ☐ Verify that repair material has been sampled and tested prior to installation as required by the contract documents.
- ☐ Verify that additional or extender aggregates have been properly produced and meet requirements of contract documents.
- ☐ If a mix design is required, ensure it has been approved and includes all the materials/additives to be incorporated into the mix.
- ☐ Verify that material packaging is not damaged (e.g., packages leaking, torn, or pierced), preventing proper use.
- ☐ Verify that bonding agent (if required) meets specifications.

- ☐ Verify that curing compound (if required) meets specifications.
- ☐ Verify that joint/crack re-forming material (compressible insert) meets specifications (typically polystyrene foam board, ½ in. thick).
- ☐ Verify that joint-sealant material meets specifications.
- ☐ Verify that sufficient quantities of materials are on hand for completion of the project.

Equipment Inspections

Concrete Removal Equipment

- ☐ Verify that concrete saws are of sufficient weight and horsepower to adequately cut the existing concrete pavement to the depth required along the patch boundaries as required by the contract documents.
- ☐ Verify that concrete saws and blades are in good working order.
- ☐ Verify that pavement milling machines are power-operated, self-propelled, cold-milling machines capable of removing concrete as required by the contract documents.
- ☐ Verify that milling machines used for concrete removal are equipped with a device that allows them to stop at pre-set depths to prevent removal of more than the top third of the slab and to prevent damage to embedded steel.
- ☐ Verify that the maximum rated weight of removal jackhammers is 30 lb.

Repair Area Cleaning Equipment

- ☐ Verify that the media-blasting unit is adjusted for correct application rate and that it is equipped with and using properly functioning oil/moisture traps.
- ☐ Verify that air compressors have sufficient pressure and volume to clean repair area in accordance with contract specifications.
- ☐ Verify that air compressors are operated at proper oil level and equipped with functioning oil and moisture filters/traps. This can be accomplished by passing the airstream over a board and then examining the board for contaminants.
- ☐ Verify that the volume and pressure of the water-blasting equipment (if necessary) meets the specifications.

Mixing and Testing Equipment

- ☐ Verify that auger flights and paddles within auger-type mixing equipment are kept free of material buildup that can result in inefficient mixing operations.
- ☐ Ensure that volumetric mixing equipment such as mobile mixers are kept in good condition and are calibrated on a regular basis to properly proportion mixes.
- ☐ Verify that the concrete testing technician meets the requirements of the contract documents for training/certification.

- ☐ Ensure that material test equipment required by the specifications are all available on-site and in proper working condition. (Equipment typically includes slump cone, pressure-type air meter, cylinder molds and lids, rod, mallet, and ruler.)

Placing and Finishing Equipment

- ☐ Verify that a sufficient number of concrete vibrators 1 in. in diameter or less are available on-site and in proper working condition.
- ☐ Verify that all floats and screeds are straight, free of defects, and capable of producing the desired finish.

Other Equipment

- ☐ Ensure that a steel chain, rod, or hammer is available on-site to check for unsound concrete around the repair area.
- ☐ Verify that grout-application brushes (if necessary) are available.

Weather Requirements

- ☐ Review manufacturer's installation instructions for requirements specific to the repair material being used.
- ☐ Ensure that air and surface temperature meet manufacturer and contract requirements (typically 40°F and rising) for concrete placement. At temperatures below 55°F, additional precautions (warm water, insulation cover, and longer cure time) should be considered.
- ☐ Ensure that repair activity does not proceed if rain is imminent.

Traffic Control

- ☐ Verify that signs and devices conform to the traffic control plan presented in the contract documents.
- ☐ Verify that the setup complies with the *Manual on Uniform Traffic Control Devices (*MUTCD).
- ☐ Ensure that traffic control personnel are trained/qualified in accordance with contract documents/agency requirements.
- ☐ Ensure that the repaired pavement is not opened to traffic until the repair material meets strength requirements presented in the contract documents.
- ☐ Verify that signs are removed or covered when they are no longer needed.

- ☐ Ensure that any unsafe conditions are reported to a supervisor (contractor or agency).

Project Inspection Responsibilities

Repair Removal and Cleaning

- ☐ Ensure that the area surrounding the patch is checked for delamination and unsound concrete using a steel chain, rod, or hammer.
- ☐ Ensure that the boundaries of unsound concrete area(s) are marked at least 3 in. beyond the area of deterioration.
- ☐ Verify that concrete is removed by either (1) saw cutting the boundaries and jackhammering the interior concrete, (2) using just chipping hammers to remove concrete, or (3) using a cold-milling machine.
- ☐ Verify that vacuum equipment used in conjunction with sawing operations to remove slurry or collect dust is functioning properly.
- ☐ Verify that concrete removal extends at least 2 in. in depth and does not extend below one-third to one-half of the slab depth, and that load transfer devices are not exposed.
- ☐ If dowels are exposed, verify that repairs are conducted in accordance with applicable specification.

- ☐ Ensure that Type 3 repairs, if allowed, do not extend longer than 18 in. and are constructed in accordance with specifications.
- ☐ Verify that, after concrete removal, the repair area is prepared by sandblasting or waterblasting.
- ☐ Verify that the repair area is cleaned by air blasting. A second air blasting may be required immediately before placement of repair material if the areas become dirty.

Repair Preparation

- ☐ Ensure that compressible joint inserts (joint/crack re-formers) are inserted into existing cracks/joints in accordance with contract documents. It is recommended that the compressible insert extend ¼ in. to 1 in. below the deepest removal depth and 3 in. beyond the repair boundaries. In lieu of compressible joint inserts, tooling and sawing to re-establish the joint may be performed.
- ☐ When a repair abuts a bituminous shoulder, ensure that a wooden form is used to prevent patch material from entering the shoulder joint.
- ☐ Pre-wetting the patch areas with water mist prior to grout application may help prevent moisture loss from grout. Ensure that bonding agent (epoxy- or cement-based) is placed on clean, prepared surface of existing concrete immediately prior to placement of patch material as required by the contract documents.

If bonding agent shows any sign of drying before patch material is placed, it must be removed by media blasting, cleaned with compressed air, and reapplied.

- ☐ Verify that cement-based bonding agents are applied using a stiff brush; epoxy-based bonding agents are applied using a soft brush.

Placing, Finishing, and Curing Patch Material

- ☐ Verify that repair materials are mixed in accordance with manufacturer recommendations (mix design), and in small enough quantities to prevent material from setting prematurely.
- ☐ Verify that the fresh concrete is properly consolidated using several vertical penetrations of the surface with a small head vibrator. Adequate consolidation is achieved when the mix stops settling, air bubbles no longer emerge, and a smooth layer of mortar appears at the surface.
- ☐ Verify that the surface of the repair is level with the adjacent slab using a straightedge in accordance with contract documents. Note: To prevent pulling material away from the repair boundaries, work material from the center of the patch outward toward the edges.

- ☐ Verify that the surface of the repair material is finished and textured to match the adjacent surface.
- ☐ Verify that the perimeter of the patch and saw-cut runouts (if saws are used) are sealed using grout material. Alternatively, saw-cut runouts can be sealed using joint-sealant material.
- ☐ Verify that adequate curing compound is applied to the surface of the finished and textured repair in accordance with contract documents.
- ☐ Ensure that insulation blankets are used when ambient temperatures are expected to fall below 40°F. Maintain blanket cover until concrete attains the strength required in the contract documents.

Resealing Joints and Cracks

- ☐ Verify that the compressible inserts are sawed out to the dimensions specified in the contract documents when the repair material has attained sufficient strength to support concrete saws.
- ☐ Verify that joints are cleaned and resealed according to contract documents.

Cleanup Responsibilities

- ☐ Verify that all concrete pieces and loose debris are removed from the pavement surface and disposed of in accordance with contract documents.
- ☐ Verify that mixing, placement, and finishing equipment is properly cleaned for the next use.

Common Problems and Solutions

(Problem: Solution)

More Deterioration below Surface Than Is Evident Above:

- ☐ Extend limits of repair area into sound concrete.
- ☐ If deterioration extends below one-third to one-half of the depth, do a full-depth repair.

Dowel Bar or Reinforcing Steel Is Exposed During Concrete Removal:

- ☐ If steel is in the upper third of slab, remove the steel to the edges of the repair and continue.
- ☐ If removal extends to mid-depth of the slab, consider a full-depth repair.

Repair Material Flows into Joint or Crack:

- ☐ Ensure joint insert extends far enough into the adjacent joint/crack and below the patch (typically ¼ in. to 1 in. below and 3 in. beyond).
- ☐ Ensure insert is correctly sized for joint/crack width.

Repair Is Cracking or Debonding:

- ☐ Check that joint insert is being used properly.
- ☐ Ensure that the insert is correctly sized for the joint/crack width and that it has been inserted correctly.
- ☐ Check that repair area was cleaned immediately prior to grouting/concrete placement.
- ☐ Check whether bonding grout dried out before concrete placement.
- ☐ Check whether curing compound had been applied adequately.
- ☐ Check whether repair material is susceptible to shrinkage.

Repair Has Shrinkage Cracking or Surface Scaling:

- ☐ Generally, this is not an issue, but repair should be monitored to see if additional deterioration occurs. If so, repair may need to be replaced.
- ☐ Verify that adequate curing was conducted.
- ☐ Verify that proper mix and placement procedures were followed.

Web-Based Training

- NHI-134207B How to Construct Durable Partial-Depth Repairs in Concrete Pavements

Sources

Information in this checklist is based on or refers to the following sources:

Concrete Pavement Preservation Guide, Second Edition. Pub. No. FHWA-HIF-14-004. 2014. Ames, IA: Iowa State University, National Concrete Pavement Technology Center. Available at https://intrans.iastate.edu/app/uploads/2018/08/preservation_guide_2nd_ed_508_final.pdf.

Darter, M. 2017. *Concrete Repair Best Practices: A Series of Case Studies / Partial Depth Repair Tech Brief*. Missouri Department of Transportation, Jefferson City, MO.

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Guidelines for Partial-Depth Spall Repair. Pub. No. TB003P. 1998. Skokie, IL: American Concrete Pavement Association. Available at www.pavement.com.

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Manual on Uniform Traffic Control Devices. 2009, Revised May 2012. Washington, DC: Federal Highway Administration. Available at http://mutcd.fhwa.dot.gov.

For more information on the Pavement Preservation Checklist Series, contact:

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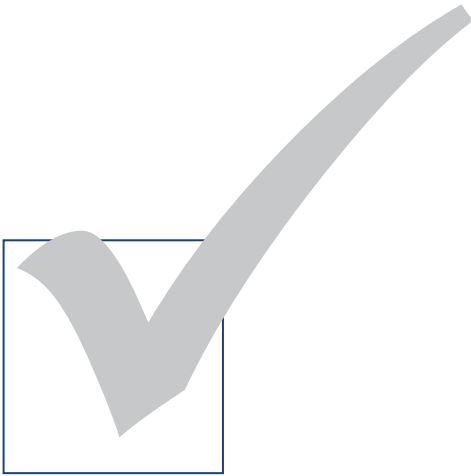

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