

Pavement Preservation
Checklist Series

10

Full-Depth Repair
of Portland Cement
Concrete Pavement



U.S. Department
of Transportation
**Federal Highway
Administration**

Full-Depth Repair of Portland Cement Concrete Pavements Checklist

This checklist is one of a series created to guide State and local highway maintenance and inspection staff in the use of innovative pavement preventive maintenance processes. The series is provided through the joint efforts of the Pavement Preservation Program of the Federal Highway Administration (FHWA) and the Foundation for Pavement Preservation (FP²).

FHWA uses its partnerships with FP², the American Association of State Highway and Transportation Officials, and State and local transportation agencies to promote pavement preservation.

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www.fhwa.dot.gov/preservation

www.fhwa.dot.gov/infrastructure/asstmgmt/resource.htm

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Full-Depth Repair of Portland Cement Concrete Pavements Checklist

Preliminary Responsibilities

Document Review

- Bid/project specifications and design
- Special provisions
- Traffic control plan
- Manufacturers' instructions
- Material safety data sheets

Project Review

- Verify that pavement conditions have not significantly changed since the project was designed and that full-depth repair is appropriate for the pavement.
- Check estimated number of full-depth repairs against the number specified in the contract.
- Agree on quantities to be placed, but allow flexibility if additional deterioration is found below the surface.

Materials Checks

- Verify that concrete patch material is being produced by a supplier listed on the agency's Approve/Qualified Supplier List as required by contract documents.

- ❑ Verify that the mix design for the material being supplied meets the criteria of the contract documents.
- ❑ Verify that concrete patch material has been sampled and tested prior to installation, and is not contaminated.
- ❑ Verify that load transfer units (dowels) meet specifications and that dowels are properly coated with epoxy (or other approved material) and free of any minor surface damage in accordance with contract documents.
- ❑ Verify that dowel-hole cementing grout meets specifications.
- ❑ Verify that bond-breaking board meets specifications (typically asphalt-impregnated fiberboard).
- ❑ Verify that joint sealant material meets specifications.
- ❑ Verify that sufficient quantities of materials are on hand for completion of the project.
- ❑ Ensure that all material certifications required by contract documents have been provided to the agency prior to construction.

Equipment Inspections

Concrete Removal Equipment

- ❑ Verify that concrete saws and blades are in good condition and of sufficient diameter and horsepower to adequately cut the required patch boundaries.

- ❑ Verify that required equipment used for concrete removal is all on-site and in proper working order and of sufficient size, weight, and horsepower to accomplish the removal process (including front-end loader, crane, fork lift, backhoe, skid steer, and jackhammers).

Patch Area Preparation Equipment

- ❑ Verify that the plate compactor is working properly and capable of compacting subbase material.
- ❑ Verify that gang drills are calibrated, aligned, and sufficiently heavy and powerful enough to drill multiple holes for dowel bars.
- ❑ Verify that air compressors have oil and properly functioning moisture filters/traps. Prior to use, check the airstream for water and/or oil by passing the stream over a board, then examining the board for contaminants.

Testing Equipment

- ❑ Verify that the concrete testing technician meets the requirements of the contract documents for training/certification.
- ❑ Ensure that all material test equipment required by the specifications is available on-site and in proper working condition (typically including slump cone, pressure-type air meter, cylinder molds and lids, rod, mallet, ruler, and 3 m [10 ft] straightedge).
- ❑ Ensure that sufficient storage area on the project site is specifically designated for the storage of concrete cylinders.

Placing and Finishing Equipment

- ❑ Verify that handheld concrete vibrators are the proper diameter and operating correctly.
- ❑ Verify that all floats and screeds are straight, free of defects, and capable of producing the desired finish.
- ❑ Verify that sufficient polyethylene sheeting is readily available on-site for immediate deployment as rain protection of freshly placed concrete, should it be required.

Weather Requirements

- ❑ Verify that air and surface temperatures meet contract document requirements (typically a minimum of 4 °C [40 °F] and rising) for concrete placement.
- ❑ Patching should not proceed if rain is imminent. Patches that have been completed should be covered with polyethylene sheeting to prevent rain damage.

Traffic Control

- ❑ Verify that signs and devices match the traffic control plan presented in the contract documents.
- ❑ Verify that the setup complies with the *Federal Manual on Uniform Traffic Control Devices* or local agency traffic control procedures.
- ❑ Verify that traffic control personnel are trained/qualified in accordance with contract documents and agency requirements.

- ❑ Ensure that the repaired pavement is not opened to traffic until the patch material has met the minimum strength specified in the contract documents.
- ❑ Ensure that signs are removed or covered when they are no longer needed.
- ❑ *Verify that any unsafe conditions are reported to a supervisor (contractor or agency).*

Project Inspection Responsibilities

Concrete Removal and Cleanup

- ❑ Verify that the boundaries of the removal areas are clearly marked on the pavement surface and the cumulative area of the pavement to be removed is consistent with quantities in the contract documents.
- ❑ Verify that the patch size is large enough to accommodate a gang-mounted dowel drilling rig, if one is being used. Note: The minimum longitudinal length of patch is usually 1.8 m (6 ft).
- ❑ Verify that boundaries are sawed vertically the full thickness of the pavement.
- ❑ Verify that concrete is removed using either the break-up or lift-out method and minimizing disturbance to the base or subbase as much as possible. Note: The sawcut and lift method is preferred to jackhammer removal.

- ❑ Verify that after concrete removal, disturbed base or subbase is re-compacted, and additional subbase material is added and compacted if necessary.
- ❑ Verify that concrete adjoining the patch is not damaged or undercut by the concrete-removal operation.
- ❑ Ensure that removed concrete is disposed of in the manner described in the contract documents.

Patch Preparation

- ❑ Verify that dowel holes are drilled perpendicular to the vertical edge of the remaining concrete pavement using a gang-mounted drill rig.
- ❑ Verify that holes are thoroughly cleaned using compressed air.
- ❑ Verify that approved cement grout or epoxy is placed in dowel holes, from back to front.
- ❑ Verify that dowels are inserted with a twisting motion, spreading the grout along the bar inside the hole. A grout-retention disk can be used to keep the grout from seeping out of the hole.
- ❑ Verify that dowels are installed in transverse joints to the proper depth of insertion and at the proper orientation (parallel to the centerline and perpendicular to the vertical face of the sawcut excavation) in accordance with contract specifications. Typical tolerances measured perpendicularly to the sawed faced are 6 mm (1/4 in.) misalignment per 300 mm (12 in.) of dowel bar length.

- ❑ Verify that tiebars are installed at the proper location, to the proper depth of insertion, and to the proper orientation in accordance with contract documents. When the length of the longitudinal joint is 4.5 m (15 ft) or greater, tiebars are typically installed in the manner used for dowels. When the length of the longitudinal joint is less than 4.5 m (15 ft), a bond-breaker board is placed along the length of the patch to isolate it from the adjacent slab.
- ❑ Ensure that tiebars are checked for location, depth of insertion, and orientation (perpendicular to centerline and parallel to slab surface).

Placing, Finishing, and Curing Concrete

- ❑ Concrete is typically placed from ready-mix trucks or mobile mixing vehicles in accordance with contract specifications.
- ❑ Verify that the fresh concrete is properly consolidated using several vertical penetrations of the concrete surface with a handheld concrete vibrator.
- ❑ Verify that the surface of the concrete patch is level with the adjacent slab using a straightedge or vibratory screed in accordance with contract documents.
- ❑ Verify that the surface of the fresh concrete patch is finished and textured to match adjacent surfaces.

- ❑ Verify that adequate curing compound is applied to the surface of the fresh concrete immediately following finishing and texturing in accordance with contract documents. Note: Best practice suggests that two applications of curing compound be applied to the finished and textured surface, one perpendicular to the other.
- ❑ Ensure that insulation blankets are used when ambient temperatures are expected to fall below 4 °C (40 °F). Maintain blanket cover until concrete attains the strength required in the contract documents.

Resealing Joints and Cracks

- ❑ Verify that patches have attained adequate strength to support concrete saws, patch perimeters and other unsealed joints are sawed off to specified joint reservoir dimensions.
- ❑ 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.
- ❑ Verify that old concrete is disposed of according to contract documents.
- ❑ Verify that mixing, placement, and finishing equipment is properly cleaned for the next use.
- ❑ Verify that all construction-related signs are removed when opening pavement to normal traffic.

Common Problems and Solutions

(Problem: Solution)

- ❑ **Undercut spalling (deterioration on bottom of slab) is evident after removal of concrete from patch area:**
 1. Saw back into adjacent slab until sound concrete is encountered.
 2. Make double saw cuts, 150 mm (6 in.) apart, around patch area to reduce damage to adjacent slabs during concrete removal.
 3. Use a carbide-tipped wheel saw to make pressure-relief cuts 100 mm (4 in.) wide inside the area to be removed.
- ❑ **Saw binds when cutting full-depth exterior cuts:**
 1. Shut down saw and remove blade from saw.
 2. Wait for slab to cool, then release blade if possible, or make another full-depth angled cut inside the area to be removed to provide a small pie-shaped piece adjacent to the stuck saw blade.
 3. Make transverse saw cuts when the pavement is cool.
 4. Use a carbide-tipped wheel saw to make pressure-relief cuts 100 mm (4 in.) wide inside the area to be removed.

- ❑ **Lifting out a patch for a full-depth repair damages adjacent slab:**
 1. Adjust lifting cables and re-position lifting device to assure a vertical pull.
 2. Re-saw and remove broken section of adjacent slab.
 3. Use a forklift or crane instead of a front-end loader.
- ❑ **Slab disintegrates when attempts are made to lift it out:**
 1. Complete removal of patch area with backhoe or shovels.
 2. Angle the lift pins and position the cables so that fragmented pieces are bound together during liftout.
 3. Keep lift height to an absolute minimum on fragmented slabs.
- ❑ **Patches become filled with rainwater or groundwater seepage, saturating the subbase:**
 1. Pump the water from the patch area, or drain it through a trench cut into the shoulder.
 2. Re-compact subbase to a density consistent with contract documents, adding material as necessary.
 3. Allow small depressions in subbase to be filled with aggregate dust or fine sand before patch material is placed. Permit the use of aggregate dust or fine sand to level small surface irregularities (12 mm [1/2 in.] or less) in surface of subbase before concrete patch is placed.

- ❑ **Grout around dowel bars flows back out of the holes after dowels are inserted:**
 1. Pump grout to the back of the hole first.
 2. Use a twisting motion when inserting the dowel.
 3. Add a grout retention disk around the bar to prevent grout from leaking out.
- ❑ **Dowels appear to be misaligned once they are inserted into holes:**
 1. If misalignment is less than 6 mm (1/4 in.) per 300 mm (12 in.) of dowel bar length, do nothing.
 2. If misalignment is greater than 6 mm (1/4 in.) per 300 mm (12 in.) of dowel bar length on more than three bars, re-saw patch boundaries beyond dowels and re-drill holes.
 3. Use a gang-mounted drill rig referenced off the slab surface to drill dowel holes.

Sources

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

- ❑ “Guidelines for Full-Depth Repair,” *Concrete Paving Technology*. Pub. No. TB002P. 1995. Skokie, IL: American Concrete Pavement Association. Available at www.pavement.com.
- ❑ *Manual on Uniform Traffic Control Devices*. 2003. Washington, DC: Federal Highway Administration. Available at <http://mutcd.fhwa.dot.gov>.
- ❑ “Portland Cement Concrete Pavement Evaluation and Rehabilitation.” NHI Course 131062A. Washington, DC: National Highway Institute, Federal Highway Administration. Available at www.nhi.fhwa.dot.gov.
- ❑ *Rehabilitation of Concrete Pavements, Volume 1: Repair Rehabilitation Techniques*. Pub. No. FHWA-RD-88-071. 1989. Washington, DC: Federal Highway Administration.
- ❑ *Techniques for Pavement Rehabilitation, Reference Manual* (6th ed.). Pub. No. FHWA-HI-98-033. 1998. Washington, DC: Federal Highway Administration.

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