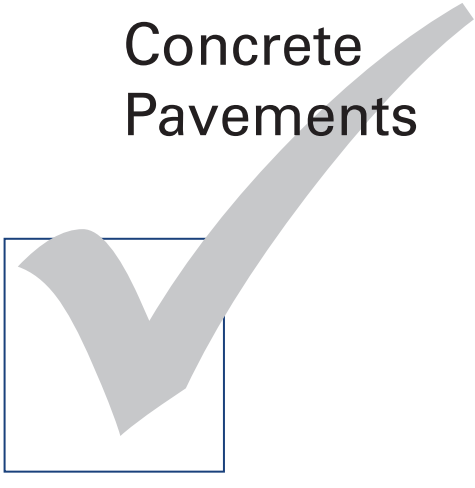
Pavement Preservation
Checklist Series

17

Joint and Crack Sealing of Portland Cement Concrete Pavements



U.S. Department of Transportation
Federal Highway Administration

Joint and Crack Sealing 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
- ☐ Traffic control plan
- ☐ Manufacturer's sealant installation instructions
- ☐ Sealant material safety data sheets (MSDS)
- ☐ Applicable Occupational Safety and Health Administration (OSHA) safety requirements
- ☐ See source

Project Review

- ☐ Review selected joint condition to verify that the specified joint size is appropriate.
- ☐ Verify that pavement conditions have not significantly changed since the project was designed and that joint sealing is appropriate for the pavement.
- ☐ Joint design and sealant type are appropriate for the project climate and conditions.
- ☐ Joint sawing and cleaning methods are appropriate.
- ☐ Methods to remove old sealant materials are appropriate and in accordance with resealing project specifications.

Materials Checks

- ☐ Sealant conforms to project specification requirements.
- ☐ Sealant is from an approved source or listed on agency qualified products list (if required).
- ☐ Sealant has been sampled and tested prior to installation (if required) or appropriate certification submitted/approved.
- ☐ Sealant packaging is not damaged in a way that will prevent proper use (boxes leaking, pail or drums dented or pierced).
- ☐ Primer, if used, meets specification requirements.
- ☐ Backer rod is of the proper size and type for selected sealant type and installation requirements.
- ☐ Sealants are within manufacturer's recommended shelf life.
- ☐ Sufficient quantities of all materials are available for completion of the project.

Equipment Inspections

Hot-Pour Sealant Melters

- ☐ For hot-applied sealants, an indirectly heated, double boiler type melter with effective agitation is being used.
- ☐ Melters are in good working order with all heating, agitation, pumping systems, valves, thermostats, etc., functioning.

- ☐ Melter heating system is thermostatically controlled and maintains product heated in the wand.
- ☐ Temperature gauges have been calibrated and checked for accuracy. Equipment has automatic high and low temperature controls.
- ☐ Proper size wand tips for desired application are available.
- ☐ Melter is of sufficient size for the project.

Silicone Sealant Pumps

- ☐ The pump is designed for the intended purpose and is in proper working order.
- ☐ Hoses and fittings prevent intrusion of moisture into the system and can sustain pumping pressures. Teflon lined hoses are preferred.
- ☐ The follower plate(s) are in good shape and lubricated.
- ☐ Hoses are not plugged.

Joint Cleaning Equipment

- ☐ Abrasive cleaning unit is adjusted for correct abrasive feed rate and has oil and moisture trap.
- ☐ Abrasive cleaning uses environmentally acceptable abrasive media.
- ☐ Abrasive cleaning operators use appropriate air purification systems as required by OSHA.
- ☐ Air compressors have sufficient pressure and volume to clean joints adequately and meet agency requirements.

- ☐ Air compressors are equipped with oil and moisture filters/traps that are properly functioning. Check the airstream for water or oil prior to use by passing the stream over a board and examining for contaminants.
- ☐ Joint plows (if used in resealing project) are of correct size and configuration to remove required amount of old sealant without spalling joint edges. Plow must be rectangular shaped.
- ☐ Concrete saws/blades are of sufficient size to adequately cut the required joint width and depth, and saw is in good working order. Ensure saw blade is mounted in correct direction for proper saw operation.
- ☐ Waterblasting equipment can supply the water volume and pressure required by specifications.

Other Equipment

- ☐ Backer rod insertion tool is adjusted for correct installation depth and does not have sharp or jagged edges that could cut or abrade backer material.
- ☐ Brushes or sprayers for primer application (if used) are available.
- ☐ Tooling/leveling devices (if needed) for finishing the sealant to the required dimensions are available.
- ☐ Preformed sealant insertion devices function properly and insert seal strips without excessive stretching and to the correct recess.

Weather Requirements

- ☐ Review manufacturer installation instructions for requirements specific to sealant used.
- ☐ Air and/or surface temperature shall meet manufacturer and all agency requirements (typically 40°F and rising) for sawing and sealing.
- ☐ Sealant should not be installed when temperatures are at or below the dew point. Conditions should be closely monitored if temperatures are approaching the dew point.
- ☐ Sealing shall not proceed if rain is imminent. Operations shall cease if rain commences during installation.
- ☐ Application does not begin if there is any sign of moisture on the surface or in the joint.

Traffic Control

- ☐ The signs and devices used match the traffic control plan.
- ☐ The setup complies with the *Manual on Uniform Traffic Control Devices (*MUTCD).
- ☐ Any unsafe conditions are reported to a supervisor.
- ☐ The sealed pavement is not opened to traffic until the sealant has adequately cooled or cured to not pick up on vehicle tires. Verify that the set-up complies with the MUTCD.

Project Inspection Responsibilities

Joint Preparation

- ☐ During cutting and cleaning operations, all safety mechanisms and guards on equipment are in place and functioning properly, and operators are using required personal protective equipment.
- ☐ Old sealant (if present) is removed from the joint.
- ☐ Concrete is allowed to cure for the specified time (minimum of seven days of dry weather) prior to sawing joints.
- ☐ Joint is sawn or refaced to produce a rectangular reservoir of the specified depth with cut vertical sides.
- ☐ After sawing, joints are flushed with high pressure water to remove all saw slurry and debris.
- ☐ Joint surfaces are cleaned using abrasive cleaning, or waterblasting.
- ☐ Abrasive cleaning is accomplished with the nozzle 1 to 2 in. above the joint using two passes, each directed at one of the joint faces.
- ☐ Joint is blown clean with clean, dry air.
- ☐ Primer, if used, is applied at the correct coverage rate and allowed to cure as required by the manufacturer.

- ☐ Inspect joints prior to sealing by rubbing your finger along the joint walls to ensure that no contaminants (dust, dried saw residue, dirt, moisture, or oil) are on the joint walls. The "wipe test" may also be performed (ACPA 2018). If dust or other contaminants are present, reclean joints to a satisfactory condition.
- ☐ Inspect joints for proper sealant geometry.

Backer Material Installation (If Used)

- ☐ Ensure correct backer rod material is being used and is installed properly. Backer rod diameter shall be 25%–50% greater than reservoir width.
- ☐ Backer rod is installed after final joint cleaning and inspection for cleanliness, and just prior to sealant installation.
- ☐ Backer rod is inserted uniformly without stretching into the joint to the required depth to provide the specified sealant dimensions.
- ☐ Backer rod fits snugly in the joint with no gaps along the joint sides.
- ☐ Backer rod is not torn, abraded, ripped, or otherwise damaged during installation.
- ☐ Install backer rod first in longitudinal joints, continuously, followed by transverse joint placement last. The transverse backer rod will be placed on top of the longitudinal joint backer rod at the corners.

Sealant Installation

Formed In-Place Hot Pour Sealants

- ☐ Operator is aware of the joint configuration to be installed and has appropriate equipment.
- ☐ Manufacturer's/owner's installation instructions are being followed.
- ☐ Melter heat transfer medium is heated to the correct temperature range.
- ☐ Sealant is heated to a minimum of the manufacturer's recommended pouring or application temperature, but the temperature shall not exceed the material's safe heating temperature.
- ☐ Sealant is continuously agitated to assure uniformity, except when adding additional material.
- ☐ Operator wears required personal protective equipment.
- ☐ Ensure melter is equipped with a heated hose system, and the hose is heated to operating temperature prior to beginning sealant application.
- ☐ Sealant temperature is checked periodically to assure proper temperatures.
- ☐ Melting vat should be kept at least one-third full to help maintain temperature uniformity.
- ☐ Joint is filled from the bottom up (where joint reservoir dimensions permit, typically when backer rod is used) to be flush with the surface with no voids in the sealant.

- ☐ Detackifier or other blotter is applied to reduce tack prior to opening to traffic, if needed.
- ☐ Traffic is not allowed on sealant until it is tack-free.

Formed In-Place Silicone Sealants

- ☐ Operator is aware of the joint configuration and material to be installed and has appropriate equipment.
- ☐ Joint/crack is filled from the bottom up to the specified level to produce a uniform surface with no voids in the sealant.
- ☐ Tool non-sag sealants to force the material against the sidewalls, and to form a smooth surface at the specified recess from the surface.
- ☐ Sealant is permitted to cure to a tack-free condition prior to opening the pavement to traffic.
- ☐ Verify adequate adhesion by pulling up several random sections of cured sealant. Verify that joints are cleaned and resealed according to contract documents. The sample stretch test and hand pulled test may be performed to ensure adhesion (ACPA 2018).

Preformed Compression Sealants

- ☐ Ensure manufacturer's installation instructions are being followed.
- ☐ Lubricant/adhesive is installed as specified.
- ☐ Seal size is appropriate for the reservoir dimensions and expected joint movement.
- ☐ Compression seal is installed so that stretch is within manufacturer's requirements (typically < 4% of length).
- ☐ Seal is installed to the required recess below surface level (typically ⅛ in. to ¼ in.).

Cleanup Responsibilities

- ☐ Any excess sealant application or spills are removed.
- ☐ All loose debris from cleaning is removed from the pavement surface.
- ☐ Sealant containers or other miscellaneous debris are removed and disposed of properly.
- ☐ Melters and other application equipment are properly cleaned for the next use.

Opening the Pavement to Traffic

- ☐ The sealed pavement is not opened to traffic until the sealant has adequately cooled or cured to not pick up on vehicle tires.

Common Problems and Solutions

(Problem: Solution)

Sealant Not Adhering to Joint:

- ☐ Joint/Crack not clean enough—reclean.
- ☐ Wet joint/Crack surfaces—allow to dry.
- ☐ Low sealant application temperature (hot applied sealants)—heat to correct temperature and verify temperature gauges.
- ☐ Cold ambient temperature—allow temperature to rise.
- ☐ Concrete not cured sufficiently—allow concrete to further cure (typically seven days).
- ☐ Applying sealant at temperatures below the dew point—apply sealant only when temperature is above the dew point and rising.

Sealant Pickup, Pullout, or Failure When Opened to Traffic:

- ☐ Opened to traffic too soon after application—delay opening.
- ☐ Insufficient recess for silicone sealants, traffic debonding sealant—use correct recess for joint width.
- ☐ High ambient temperature—seal in cooler temperatures.
- ☐ Excessive sealant application—apply flush with surface or with specified recess.

- ☐ Use a detackifier or blotter to reduce initial tack on hot applied sealants.
- ☐ Sealant contaminated with solvent or heat transfer oil from tank leak. Repair or replace leaking tank. Do not use contaminated sealant.
- ☐ On reseal project, joint faces contaminated with old, incompatible sealant. May also cause bleeding—reclean joint to remove old sealant.
- ☐ Preformed compression seal installed too high in joint—install with required recess.

Sealant Gelling in Melter:

- ☐ Overheated sealant—check melter temperature gauges.
- ☐ Sealant reheated too many times—use fresh sealant.
- ☐ Using sealant with insufficient pot life—use sealant with longer pot life.

Voids or Bubbles in Sealant:

- ☐ High pavement temperature and moisture content when sealed—seal during cooler periods and allow portland cement concrete to further dry or cure.
- ☐ Outgassing of backer material—backer rod may be melting with hot applied sealants; use heat-resistant backer material and check for proper sealant temperature.
- ☐ Backer may be punctured during installation—install backer without damaging.

- ☐ Top-down sealing, which can trap air—apply sealant from bottom up.
- ☐ Air entering the sealant pumping lines—tighten all connections or bleed off entrapped air.
- ☐ Moisture buildup on backer material due to being installed night before—replace backer material.

Sink Holes in Sealants:

- ☐ Sealant flowing past gaps in backer material—use larger backer material, reapply (top off) sealant to correct level, or for silicone use non-sag sealant.
- ☐ Backer rod melting when using hot-applied sealants—use heat-resistant backer rod.

Formed In-Place Silicone Sealants Not Setting Up:

- ☐ Sealant has exceeded its shelf life or has been contaminated—use appropriate sealant.

Sealant Cracking or Debonding in Winter:

- ☐ Sealant too stiff (hot pour)—use sealant that is more extensible at low temperatures.
- ☐ Poor cleaning during installation—improve cleaning methods.
- ☐ Joint too narrow for the movement experienced—use wider joints.
- ☐ Incorrect joint configuration, sealant installed too thick or too thin—use correct depth-to-width ratio.

Web-Based Training

- NHI-134207E Proper Joint Sealing Techniques for Pavement Preservation

Sources

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

ACPA. 2018. *Concrete Pavement Joint Sealing/Filling*. TB010-2018. American Concrete Pavement Association, Rosemont, IL.

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.* Missouri Department of Transportation, Jefferson City, MO.

Proper Joint Sealing Techniques for Pavement Preservation, Web Based Training (WBT). NHI-134207E. Washington, DC: Federal Highway Administration, National Highway Institute.

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

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U.S. Department of Transportation
www.fhwa.dot.gov/pavement/preservation

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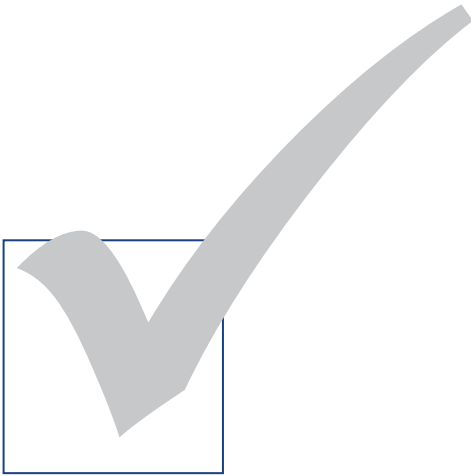

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