

**Pavement Preservation
Checklist Series**

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Slurry Seal



U.S. Department of Transportation
Federal Highway Administration

Slurry Seal 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.roadresource.org
- www.fp2.org
- www.tsp2pavement.pavementpreservation.org

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Preliminary Responsibilities

Document Review

- Project plans and specifications
- Project special provisions
- Traffic control plan
- Mix design information including:
 - Aggregate source with pit or quarry location
 - Asphalt emulsion manufacturer with terminal source location
- International Slurry Surfacing Association (ISSA) Inspector's Manual
- Equipment manufacturer's calibration instructions
- Material safety data sheets
- Applicable Occupational Safety and Health Administration (OSHA) safety requirements
- Certification requirements
- Contractor quality control (QC) plan

Project Review

- Verify that the project is a good candidate for slurry seal by confirming the absence of any alligator cracking indicative of subgrade failure or inadequate subsurface drainage.
- Investigate whether any rutting exists on the pavement, and if so, is $\frac{1}{4}$ in. or less in depth.
- Determine if crack treatment is needed. Cracks wider than $\frac{1}{4}$ in. must be sealed.
- Verify the aggregate type for the slurry seal (Type I, II, or III).
 - Type I (fine) aggregate mixtures are typically used for maximum crack penetration and sealing minor raveling within areas of low traffic volume.
 - Type II (general) aggregate mixtures are typically used to stabilize moderate to severe raveling conditions in moderate traffic conditions and correct oxidation damage.
 - Type III (coarse) aggregate mixtures are typically used to fill slight depressions and correct severe surface raveling and provide skid resistance in heavily trafficked areas.
- Determine whether the treatment is cost-effective.

Materials Checks

- A full mix design has been done by an accredited laboratory.
- The asphalt emulsion is from an approved supplier.
- The asphalt emulsion is certified as passing specifications or is sampled and submitted for testing.
- The aggregate is from an approved supplier.
- The aggregate is regularly sampled and submitted for testing (preferably from the project stockpile).
- The aggregate is clean and free of deleterious materials.
- Verify the aggregate stockpile site is well drained and that stockpiles are not segregated.
- The aggregate is not overly wet. (The moisture content is typically between 2% and 5%.)
- The asphalt emulsion temperature is consistent throughout the job. Large variations in temperature may adversely impact the mixing and set time.
- Mineral filler is the same material as identified in the mix design.
- Water must be potable and free of reactive minerals (e.g., iron, soluble salts).
- Additives used to accelerate or retard the break/set are approved and identified in the mix design.

Pre-Application Inspection Responsibilities

Pavement Surface Preparation

- Pavement repairs, including patching and crack treatments, were completed and have sufficiently cured.
- Grass and weeds have been removed or destroyed by chemical herbicide and removed from the pavement prior to slurry sealing. Chemical herbicides need approximately one to two weeks to kill the vegetation.
- Extensive grease spots or oil saturated surfaces have been removed by washing or lightly grinding the pavement.
- Thermoplastic markings must be removed to produce a textured surface.
- Raised pavement markers or paint markings with substantial paint buildup should be removed.
- Utility structures and castings such as manhole covers and valve boxes have been covered with heavy paper, plastic, or roofing felt.
- Review the existing surface for possible overspray by lawn or field irrigation systems during construction. Inspect the pavement for existing drainage issues from stormwater.

- Check for low hanging tree limbs that may interfere with passage of the slurry paver. Tree trimming may be necessary to ensure access of the application equipment.
- The surface is dry and has been swept clean immediately prior to slurry sealing.
- A tack coat may be necessary when the pavement surface is dry, raveling, or is concrete.

Equipment Inspections

All Equipment

- All equipment is in good working order and functions as intended by the manufacturer.
- All equipment is free of any fluid leaks.
- All equipment is clean and free of unwanted materials and debris.

Sweepers

- Sweepers shall meet applicable U.S. Environmental Protection Agency standards.
- The bristles are the proper length.
- The sweeper can be adjusted vertically to exert the proper downforce on the bristles.
- The sweeper bristles should be made of nylon, fiber, or plastic (no metal).

Slurry Seal Paver

- The slurry seal paver is fully functional and can accurately proportion and deliver materials through a pugmill.
- All paddles in the pugmill are intact and not severely worn that could limit the mixing ability.
- Each paver has been calibrated using the materials specified in the project mix design.

Spreader Box

- The spreader box is clean of excess accumulations of the slurry mixture.
- Spreader box seals and strike-offs are clean and not worn.
- If the spreader box has an auger, the auger height must be adjustable to maintain the proper clearance to the road surface.
- The burlap drag, or other material, if used to create a uniform surface texture, must be replaced when stiffened by hardened slurry accumulation.

Mobile Support Units for Continuous Run Pavers

- Mobile support units or feeder truck units are clean and functional.
- The continuous run paver is supported by enough mobile support units to avoid unnecessary stopping and waiting for materials.

Screening Equipment (Recommended)

- The screen mesh is properly sized to remove oversized aggregate.

Rollers (If Used)

- A 5 to 8 ton pneumatic-tired roller is recommended.
- The roller tire size, rating, and pressure comply with manufacturer's recommendations.
- Tire pressure is the same on all tires.
- All tires have a smooth surface.

Weather Requirements

- Follow the range of dates established by the agency when slurry seals can be applied.
- Air and surface temperatures have been checked at the coolest location on the project.
- Verify that the air and surface temperatures are a minimum of 50°F and rising unless warranted by agency requirements.
- High temperatures, humidity, and wind will affect how quickly the slurry seal breaks.
- Ensure that application of slurry seal does not begin if rain is likely.
- Application does not begin if temperatures could be freezing within 48 hours.

Application Rates

- The application rate is based on the weight of the dry aggregate in the mixture.
- Follow the application rate identified in the contract documents.

Calibration of the Slurry Seal Paver

- Each machine has been calibrated with the aggregate and emulsion to be used.
- Calibrate the slurry seal paver(s) according to the manufacturer's instruction procedures.
- Calibration worksheets are to be completed during the calibration procedure and saved as essential documentation.
- Calibration of the asphalt emulsion pumps, mineral filler delivery system, and aggregate are always tied to the head pulley count. Each material is always calibrated separately.
- Ensure the aggregate moisture content is tested and accounted for in the calibration calculations.
- The name of the person who carried out calibration and documentation has been provided.
- Agency personnel should participate in the calibration (recommended).

Traffic Control

- Verify that traffic control conforms to plans and specifications and complies with the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Verify that traffic control personnel are trained and qualified in accordance with contract documents and agency requirements.
- Any unsafe situations are reported to a supervisor.
- Ensure that flaggers do not allow traffic on freshly placed slurry seal.
- Long work zones on two-lane roads should have two-way communication between flaggers.
- Signs are removed or covered when they no longer needed.

Project Inspection Responsibilities

Slurry Seal Application

- If required, ensure that a test strip of satisfactory quality has been placed before starting work.
- Verify material testing is being performed in accordance with the contractor's quality control plan.

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- Confirm the field tests to be performed by the agency are consistent with the contract specifications.
 - If using a continuous run paver, there are enough mobile support units to avoid unnecessary stopping and waiting for materials.
 - The application starts and stops on heavy (kraft) paper, roofing felt, or a plastic sheet.
 - Verify that the machine is traveling at the proper speed (no faster than a “brisk” walking pace).
 - The finished surface is free of excessive drag marks due to oversize aggregate or dirty strike-offs on the spreader box. Any excessive drag marks must be corrected immediately.
 - Spreader box strike-offs and seals are cleaned regularly and at the end of each day.
 - Verify that the surface texture is uniform, smooth, and does not exhibit a ripple pattern. Do not leave ripples greater than $\frac{1}{8}$ in. measured by a 10 ft straight edge.
 - Areas inaccessible to the spreader box require handwork. Ensure that the mixture is not overworked during handwork, which may cause segregation.
 - Verify that the consistency and application of the mix is uniform and does not float fines.
 - The application is stopped as soon as any problems are detected.

- Check the percent of asphalt in the mixture at least three times per day by randomly reading the paver counter readings.
- Yield checks should be performed at least four times per day.
- The hours of slurry seal application may require adjustments to an acceptable time when traffic is light at intersections that cannot be taken out of service.

Longitudinal Joints

- All longitudinal joints on tangent sections are straight and on curves uniformly follow a consistent radius. Along curb and gutter sections, a straight joint abuts the gutter.
- Pavement sections having significant superelevation will require the first application to begin along the lower (elevation) edge of the pavement and with adjacent applications made upslope until the entire width of the pavement is covered.
- The longitudinal joint is made at the center of the road or edge of a lane. Never construct longitudinal joints in the wheel paths.
- Longitudinal joints must have less than 3 in. overlap on adjacent passes and no more than $\frac{3}{8}$ in. overlap thickness as measured with a 10 ft straight edge.
- The spreader box runners are adjusted so that the spreader box doesn't run on fresh mat.

Transverse Joints

- Verify that all paver starts and stops have neat transverse joints. Kraft paper, roofing felt, or a plastic sheet may be used to achieve neat transverse joints. The transverse joint must be less than 1/8 in. difference in elevation across the joint as measured with a 10 ft straight edge.
- The slurry seal texture is consistent throughout the application.
- Excess mixture materials and underlying paper, felt, or plastic are properly disposed at all starts and stops.

Sweeping

- Sweeping must always be performed immediately before the application of slurry seal.

Rolling

- Parking areas and airports should be rolled once the slurry seal has cured sufficiently to avoid damage by the roller. Rolling roadways is usually not necessary.
- Areas being rolling should receive at least two full coverage passes.
- Ensure that the roller travel slowly, not more than 5 mph.
- If rolling sloped area, the rolling begins at the down-slope edge and proceeds up-slope, taking care to roll the joint.

Opening to Traffic

- ❑ The road cannot be reopened to traffic until the slurry seal has cured sufficiently to resist damage from traffic.
- ❑ Temporary pavement markings are placed before opening the pavement to normal traffic.
- ❑ All construction-related signs are removed when opening the pavement to normal traffic.

Cleanup Responsibilities

- ❑ The spreader box, seals, and strike-offs are cleaned at the end of each day or at any time the paver is shut down long enough to allow material to break. Cleaning avoids drag marks.
- ❑ Material spills are removed from the site and disposed of in accordance with the contract documents.

Common Problems and Solutions

(Problem: Solution)

Drag Marks:

- Clean spreader box strike-offs and check aggregate supply for oversized stone.
- The burlap drag has accumulated hardened slurry and must be replaced.
- The application rate may be too low for the given gradation.

Flush Surface:

- Adjust the mineral filler within the design parameters.
- Reduce water content. (Increase break retarding additive if more mix time is needed.)
- Increase time prior to the opening to traffic.
- Assure application rate is not too high for the given aggregate gradation.

Uneven Surface—Washboarding:

- Assure the paver is not moving too fast.
- Spreader box is set up incorrectly and the skis are not running smoothly on the pavement.
- Strike-off and spreader box seals are not operating properly—try alternate strike-off material.

- Mix is breaking too fast—increase break retarding additive.
- Use water spray preceding spreader box.
- Viscosity of mix is too high—increase water content or break retarding additive.

Poor Joints:

- Too much water or not enough water at start-up.
- Assure kraft paper or other suitable material is used on transverse joints.
- Runners of spreader box running on fresh slurry—use water spray or let the slurry cure longer.
- Too much or not enough overlap may suggest an inexperienced line driver.

Excessive Ravel:

- Mix is breaking and curing too slowly.
- Make mix faster; adjust mineral filler.
- The application rate is too low for the given gradation.
- The slurry mix is too dry.
- Control traffic.
- Wait until slurry seal has fully cured before opening to traffic.
- Traffic or equipment speed too high—slow down.
- Sweeping or trafficking before the mixture is properly set.

Mixture Is Breaking Too Quickly:

- Temperature variations may require a change in the amount of additive used to control the break from the amount in the mix design.
- The asphalt emulsion is too hot—let it cool down to a workable temperature.
- The aggregate has changed and is not consistent with the job mix formula.
- Pavement surface temperature is excessive.

Mixture Is Breaking Too Slowly:

- Suspend operations until temperature is within the recommended application range. Never allow application outside of the recommended temperature range.
- In shaded areas, when possible, place the treatment early in the day to provide extra time to facilitate breaking and curing.
- The aggregate has changed and is not consistent with the job mix formula.

Unsatisfactory Surface Finish from Handwork:

- Try to time handwork for early in the day when cooler ambient and pavement temperatures allow extra time for the mixture to be worked before the set begins.
- Water should be sprayed on the surface first to be sure the material does not dehydrate during placement.
- When large areas require handwork, apply small amounts of material at a time and avoid segregation by not overworking the handwork area.
- Add a little more break time by using more additive. Do not add extra water in the mixture.

Tire Marks and Surface Abrasions (Scuffing):

- Roll the slurry seal with a rubber-tired roller.
- Place the slurry seal during the cooler weather.
- Broadcast sand on the slurry seal to break the bond. Avoid using light colored sand, which may discolor the slurry.

Adhesion to Crack Sealants and Fillers:

- Before placing crack treatment, obtain crack treatment manufacturer's information about suitability as a slurry system pretreatment.
- Avoid overfilling cracks with sealant.
- Allow crack treatment sufficient time to cure prior to placing the slurry seal. Sealant cure time can range from several weeks to several months.

Debonding:

- Extensive grease spots or oil saturated surfaces with industrial detergents. For severe problems, acrylic seals are available for oil spot treatment.
- Ensure the existing pavement has been swept free of dust and debris.
- The equipment is leaking oil, hydraulic fluid, or spilling dry aggregate.
- Material characteristics of the existing pavement surface is reducing or preventing bond.

Unexpected Rain:

- ❑ Always check weather radar to guard against unexpected rain.
- ❑ Light rain will require a road closure until the surface is dry and can be reopened to traffic.
- ❑ A heavy rain may wash the slurry seal emulsion off the top of the aggregate. A road closure is required and the slurry seal emulsion must be allowed to dry and set. Once set, sweep all loose aggregate off the pavement surface and reopen to traffic. A new slurry seal can be placed over the remaining material.

False Break or False Slurry:

- ❑ Wet the surface with water to help keep pavement temperatures down. In severe cases, it may be necessary to work earlier in the day before the temperature elevates.
- ❑ Check calibration of placement machine and compliance of materials with the mix design and the job mix formula.

Grade Flow:

- Partially compensate by diverting mixture to the higher part of the spreader box. This should only be attempted by an experienced operator.
- For an uphill application use a more fluid slurry mixture. For a downhill application, use a stiffer mixture.
- Use a spreader box equipped with augers to distribute the mixture.

Non-Uniform Appearance of the Finished Surface:

- Ensure that the slurry seal paver(s) are properly calibrated.
- All materials are consistent with the job mix formula.
- Assure the strike-offs are tight and cleaned frequently. Change the burlap drag with accumulated slurry mixture.
- The mixture consistency is uniform throughout the application.
- A constant application rate is being applied.
- Delay application in event of cool or wet weather.

Sources

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

The Basic Asphalt Emulsion Manual, MS-19, 4th Edition. Revised 2004. Annapolis, MD: The Asphalt Institute/Asphalt Emulsion Manufacturers Association.

ISSA High Performance Slurry Systems Inspector's Manual. 2010. Annapolis, MD: International Slurry Surfacing Association.

Manual on Uniform Traffic Control Devices. 2009, Revised May 2012. Washington, DC: Federal Highway Administration.

Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal, A105. Revised February 2010. Annapolis, MD: International Slurry Surfacing Association.

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

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