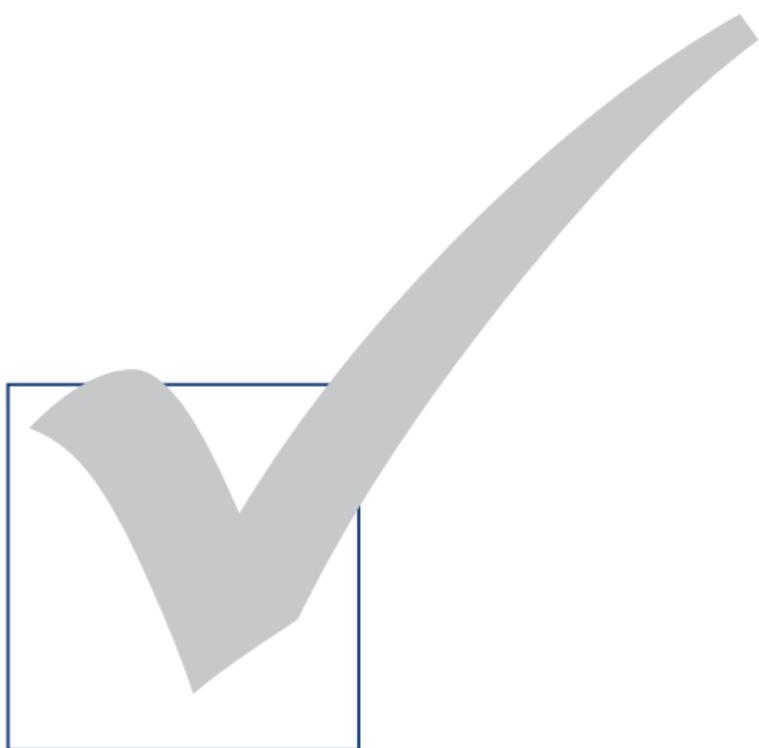


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Scrub Seal



Scrub 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 specifications
- Construction manual
- Traffic control plan
- Agency requirements
- Safety data sheets
- Applicable Occupational Safety and Health Administration (OSHA) safety requirements
- Contractor quality control (QC) plan

Project Review

- Verify that the project is a good candidate for a scrub seal.
 - Limit the average daily traffic and percentage of commercial vehicles to the same agency requirements for a chip seal.
 - Limit existing rutting to less than $\frac{3}{8}$ in. in depth.
 - Determine the type, amount, and severity of existing cracks. Scrub seal is effective for nonstructural cracking up to $\frac{1}{2}$ in. wide.
 - Scrub seals are not recommended for pavements with bleeding or flushing. Small areas of pavement bleeding or flushing should be repaired or removed in advance of the project.

- Review project plans and specifications.
- Based on the existing pavement condition, determine whether the treatment is cost-effective.

Materials Checks

- The asphalt emulsion used is compatible with the aggregate surface charge.
- The asphalt emulsion is from an approved supplier.
- The asphalt emulsion is sampled and submitted for testing (if required).
- The aggregate is from an approved supplier.
- The aggregate stockpile is sampled and the sample is submitted for testing.
- The aggregate should be uniformly graded, but meet project specification.
- The aggregate is free of dust.
- The asphalt emulsion application temperature range is specified.

Pre-Application Inspection Responsibilities

Pavement Surface Preparation

- All high-severity distresses have been repaired.
- Asphalt patches placed within six months have been fog sealed prior to scrub sealing. The fog seal must be completely cured prior to scrub seal construction.
- Review the existing surface for possible overspray by working irrigation systems during construction. Inspect the pavement for existing drainage issues from stormwater.
- Raised pavement markers and thermoplastic markings are removed according to the project specification.
- Grass and weeds have been removed or destroyed by chemical herbicide. If an herbicide was used, approximately one to two weeks has been given to kill the vegetation before applying the scrub seal.
- The surface has been swept clean and is dry immediately prior to application.
- Utility castings have been protected with kraft paper or roofing felt to prevent coating the casting with asphalt emulsion. A temporary road marker has been placed on the protected cover to locate casting after scrub sealing.

Equipment Inspections

All Equipment

- All equipment meets manufacturer's standards.
- All equipment is free of any fluid leaks.
- All equipment is clean and properly calibrated.

Distributor

- All nozzles are uniformly angled 15° to 30° from the spray bar, as recommended by the manufacturer.
- All nozzles are free of clogs.
- Ensure the emulsion is uniformly and evenly distributed across the full width of the spray bar. Nozzles showing a noticeable deviation in flow should be replaced.
- The spray bar has been checked for constant pressure along the entire length.
- The thermometer for measuring temperatures of the asphalt emulsion in the tank has been checked for accuracy.
- The spray bar is at the proper height and the spray pattern has been checked for uniformity and proper coverage.
- The distributor's application calibration has been checked.
- The ground speed computerized application control has been checked for providing a uniform application rate at different speeds.

- Annual certification of the distributor, if required by the specification.
- A hitch or assembly that can tow the scrub broom even and level along the pavement.

Scrub Broom

- Verify there is a means to mechanically raise and lower the scrub broom on and off the pavement surface.
- Verify the scrub broom has appropriate adjustments to maintain uniform contact across the pavement, creating a 4 to 6 in. wave of emulsion ahead of each of the broom sections (front, middle, and rear). The emulsion must be retained within the area contacted by the brooms and not squeegeed off the pavement surface.
- Check the hitch attachment and connection with the asphalt emulsion distributor to assure the broom assembly is towed relatively level to the pavement.
- Confirm there are hinged wing extensions attached to the scrub broom frame that can be raised and lowered if needed to meet the specified width requirements.
- Check that the front and rear brooms are angled off the parallel to the distributor spray bar 15°, with the front and back brooms angled in the opposite direction. The middle brooms are aligned at diagonal angles that comply with project specifications.

- Verify the broom bristles are flexible and clean. The bristle height must meet the project specifications. (Typically, bristles are a minimum of 5 in. high.)

Chip Spreader

- Gates are adjustable and each gate control and setting has been checked.
- The roller is straight and not warped.
- The scalping screen is in good condition.
- The chip spreader's calibration across the entire chipper head has been checked for uniformity as specified or by ASTM standard.
- The truck hookup hitches have been checked.
- The truck release latch on the aggregate spreader is in working order.
- The receiving hopper has no holes or large gaps that would allow aggregate to fall through.
- The rubber shield on the receiving hopper should be in good condition and not torn or missing.
- The conveyor belt system has a rubber, neoprene, or fabric cowl around it to prevent aggregate loss.
- The conveyor belt is tight.
- The aggregate spreader computer rate control has been checked for a uniform application rate at different speeds.

Haul Trucks

- The truck box is clean and free of debris and other deleterious materials.
- The truck hookup hitch is in working order.
- If required, a truck box apron or extension for loading the chip spreader is in place to eliminate any spillage.
- There are enough haul trucks on the project to keep up with the application rate of the aggregate spreader.

Rollers

- The type of roller to be used must comply with project specifications. The pneumatic-tired roller is recommended for scrub seals. The roller tire size, rating, and pressure comply with the manufacturer's recommendations.
- The tire pressure is the same on all tires.
- All tires have a smooth surface.
- A sufficient number of rollers are available that when placed in echelon can provide full lane coverage in each pass.

Sweepers

- Sweepers shall meet applicable U.S. Environmental Protection Agency standards.
- The bristles have even length and are not severely worn. Typically, replacement of the bristles (filaments) is necessary when the length reaches 5 to 6 in.

- The broom can be adjusted vertically to avoid excess pressure.
- The broom bristles should be made of nylon, fiber, or polypropylene (no metal).
- Pickup sweepers should be used to remove excess aggregate once rolling is complete.

Weather Requirements

- Follow the range of dates established by the agency when scrub sealing can be performed.
- Construct a scrub seal only during daylight hours, unless permitted by the project specification.
- Air and surface temperatures have been checked at the coolest location on the project.
- Air and surface temperatures meet agency requirements.
- Application does not begin if rain is likely within four hours.
- High winds can create problems with application. Work should be avoided when wind speeds exceed 20 mph.
- High temperatures, humidity, and wind will affect how long the asphalt emulsion takes to break.

Determining Application Rates

- Agency specifications and standards are followed.
- A scrub seal design has been done for the chip application.
- Confirm the application rate by placing a test strip prior to beginning the project.
- The scrub seal emulsion is applied to cracked, oxidized, and porous surfaces.
- Less scrub seal emulsion can be applied to smooth, nonporous, or asphalt-rich surfaces.

Checking Application Rates

Asphalt Emulsion – Method A (RECOMMENDED FOR CALIBRATION)

- Record the weight of a 1 yd² pan or nonwoven geotextile material.
- Place the pan or geotextile on the road surface.
- Have the distributor apply asphalt over the pan or geotextile.
- Record the weight of the pan and asphalt or the geotextile and asphalt emulsion.
- Subtract the two weights to obtain the weight of the applied asphalt emulsion.
- Divide the net weight in pounds by the weight per gallon to determine gallons per square yard.
- To check application across the bar, repeat above procedure.

Asphalt Emulsion—Method B **(RECOMMENDED FOR RANDOM CHECKS)**

- Park the distributor on level ground, measure the asphalt emulsion, and recover the number of gallons of asphalt emulsion (note: conversion for temperature is not necessary).
- Measure off a known area for a test section.
- Have the distributor apply asphalt emulsion to the test section.
- Park the distributor on level ground and remeasure and record the gallons of asphalt emulsion.
- Subtract the two numbers to obtain the gallons of asphalt emulsion applied.
- Divide the gallons applied by the area covered by asphalt emulsion. The result equals the application rate in gal/yd². (If using feet, there are 9 ft² per yd².)

Aggregate—Method A **(RECOMMENDED FOR CALIBRATION)**

- Weigh a 1 yd² tarp or geotextile material.
- Place the tarp or geotextile on the roadway.
- Have the chip spreader apply the aggregate over the tarp or geotextile.
- Weigh the tarp or the geotextile material with the aggregate.
- Subtract the two weights to obtain the weight of the aggregate.
- Divide the weight of the aggregate by 1 yd² to determine the application rate.

Aggregate—Method B

(RECOMMENDED FOR RANDOM CHECKS)

- Weigh a haul truck empty.
- Load the haul truck with aggregate and reweigh the truck.
- Subtract the two weights to obtain the net weight of the aggregate.
- Empty all the aggregate into the chip spreader.
- Have the chip spreader apply all the aggregate from the weighed truck.
- Measure the length and width of the aggregate spread and calculate the area. (If using feet, there are 9 ft² per yd².)
- Divide the weight of the chips by the area of spread to determine the actual application rate in lb/yd².

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 conditions are reported to a supervisor.
- Ensure that flaggers do not hold traffic for too long. Long work zones need two-way communication between flaggers.

- The pilot car leads traffic slowly, 25 mph or less, through the work zone and over the fresh scrub seal.
- Signs are removed or covered when they are no longer needed.

Project Inspection Responsibilities

Sweeping

- Verify the pavement is swept to provide a clean surface for the asphalt emulsion.

Asphalt Emulsion Application

- Building paper is used to start and stop asphalt application for straight edges.
- Check that the asphalt emulsion is within the temperature range recommended by the manufacturer.
- Ensure the application looks uniform and free of streaking that leaves ridges or gaps.
- Check for plugged or dripping nozzles.
- Random checks of application rates are performed.
- The distributor speed is adjusted to match the chip spreader speed to prevent stop-start operations.
- The distributor is stopped if any problems are observed.

Scrub Broom Application

- The scrub broom should exert sufficient down-pressure to force the asphalt emulsion down into the cracks in the pavement surface, but not so much down-pressure that it squeegees emulsion outside the area contacted by the broom heads.
- Verify that the asphalt emulsion is being worked evenly across the width of the pavement surface and the cracks are being filled.
- There should be a significant quantity of emulsion contained in the scrub broom sled during normal operation.
- It is important to turn off the spray bar at a predetermined distance (such as 50 ft) from the intended stop line to avoid a pool of emulsion on the pavement surface.

Aggregate Application

- Enough trucks are on hand to keep a steady supply of aggregate for the spreader.
- The application starts and stops on building paper to create neat, straight transverse joints.
- The chip spreader follows closely (100 ft or less) behind the emulsion distributor.
- The aggregate should be applied at a rate to cover the asphalt emulsion so that there is no pickup on the equipment tires prior to rolling.
- The spreader travels slowly enough to prevent chips from rolling when they hit the surface.

- The aggregate is in a surface-damp condition.
- The application is stopped if the asphalt emulsion covers the top of the chips or if aggregate streaks or plug-ups are detected.
- The application of aggregate appears uniform.
- Visually inspect the aggregate embedment in the asphalt emulsion and adjust the asphalt application rate if necessary. Check the recommended percent of aggregate embedment for the climatic condition.

Truck Operation

- Trucks are staggered across the fresh scrub seal to avoid driving over the same area.
- Trucks travel slowly on the fresh scrub seal.
- Stops and turns are made gradually.
- Truck operators avoid driving over exposed asphalt.
- Trucks stagger their wheel paths when backing into the chip spreader to help eliminate aggregate rollover and to aid in rolling.

Rolling

- Ensure that the rollers follow closely behind the chip spreader.
- Position rollers in echelon so the entire width of the pavement lane is covered in one pass of the rollers.

- Roll in a longitudinal direction at a speed less or equal to 3 mph. Roll three complete passes over the aggregate, with one pass defined as the roller moving over the chips in either direction.
- Rollers must avoid driving on exposed asphalt.
- All stops, starts, and turns are made gradually.
- The rolling is completed quickly enough to embed the aggregate, before the asphalt emulsion breaks and no longer than 15 minutes.

Longitudinal Joints

- The longitudinal joint should be overlapped 2 to 4 in. for uniform appearance.
- The longitudinal joints are not made in the wheel paths.
- The longitudinal joints are made at the center of the road, center of a lane, or edge of a lane.

Transverse Joints

- All asphalt emulsion applications begin and end on kraft paper or roofing felt, using care not to tear the applied paper or felt.
- All aggregate applications begin and end on kraft paper or roofing felt.
- The kraft paper or roofing felt is disposed of properly.

Sweeping

- After rolling is completed, sweeping should be accomplished using self-contained pickup sweepers capable of removing all excess aggregate.
- Sweep excess cover aggregate from the pavement surface as soon as possible. Final sweeping should be completed no later than the morning after placement of the scrub seal.
- Do not permit traffic on scrub seal prior to initial sweeping.
- Sweeping should not dislodge the aggregate that has set.
- Resweep prior to opening to unrestricted traffic.

Opening to Traffic

- Control traffic speeds with pilot vehicles so that traffic does not displace embedded aggregate in the scrub seal.
- The traffic should travel slowly, 25 mph or less, over the scrub seal until it is reswept and opened for normal traffic.
- Reduced speed limit signs are posted when pilot cars are not in use.
- After sweeping, place temporary pavement markers on lane lines for delineation after scrub sealing before opening the pavement to normal traffic.
- All construction-related signs are removed when opening pavement to normal traffic.

Cleanup Responsibilities

- All loose aggregate from sweeping is removed from the roadway. Swept aggregate cannot be reused for scrub sealing.
- Temporary staging areas for construction equipment and stockpiles are returned to pre-construction condition.

Common Problems and Solutions

(Problem: Solution)

Aggregate Embedment Over 80%:

- Consider lowering the asphalt application rate.

Aggregate Embedment Less Than 50%:

- Consider raising the asphalt application rate.

Excessive Asphalt Splattering:

- The spray pressure is too high.

Streaking in Asphalt Emulsion:

- Scrub broom's down-pressure is not even across the pavement surface.
- Scrub broom bristles are worn, caked together, and not clean.
- Scrub broom heads are not properly aligned.
- Distributor nozzles are plugged.
- Asphalt emulsion is too cold or the viscosity is too high.

Exposed Asphalt Remains after Aggregate Application:

- Aggregate spreader gate may be clogged or malfunctioning.

Excessive Aggregate:

- Spreader gate may be malfunctioning or chipper head may be overloaded.

Uneven Aggregate Application:

- Recalibrate the aggregate spreader. Hopper gates may not all be set the same.

Asphalt on Top of the Aggregate:

- Chip spreader may be operating too fast.
- Truck, roller, or pilot car may be operating incorrectly.

Aggregate Being Dislodged:

- Asphalt emulsion application rate is set too low.
- Too much down-pressure on the scrub brooms that the emulsion is squeegeed outside of the area contacted by the broom heads.
- Aggregate is dirty or dusty.
- Traffic or equipment speeds are too high.
- Emulsion break occurred before the aggregate was placed and rolled.
- Sweeping has been started before the asphalt is properly set.

Asphalt Bleeding or Flushing:

- Asphalt application rate is too high.
- Ensure that a cubical aggregate is being used instead of a flat and elongated aggregate.
- Verify that the distributor and aggregate spreader have been properly calibrated.

Loss of Aggregate at Longitudinal Joints after Sweeping:

- Check longitudinal joint procedures.

Web-Based Training

International Slurry Surfacing Association Web-Based Training. Retrieved from www.slurry.org.

Sources

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

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