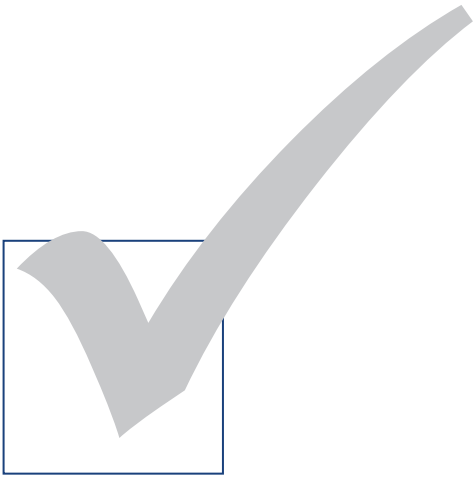
Pavement Preservation
Checklist Series

2 Chip Seal



U.S. Department of Transportation
Federal Highway Administration

Chip Seal Checklist

Includes Emulsion-Based Chip Seals, Asphalt Rubber Chip Seals, and Hot Applied Chip Seals

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
- ☐ Traffic control plan
- ☐ Construction manual
- ☐ Agency requirements
- ☐ Manufacturer's instructions
- ☐ 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 a chip seal application (emulsion based, asphalt rubber, or hot applied).
  - Limit existing rutting to less than ⅜ in. in depth.
  - Determine the type, amount, and severity of existing cracks. Chip seals should not be used on pavements with structural distress.
  - Limit the average daily traffic and percentage of commercial vehicles to the agency requirement for a chip seal.

- ☐ Investigate whether crack sealing is needed.
- ☐ Determine if bleeding or flushing exists.
- ☐ Review project plans and specifications.
- ☐ Based on the existing pavement condition, determine whether the treatment is cost-effective.

Materials Checks

Emulsion-Based Chip Seals

- ☐ The type of asphalt emulsion to be used is compatible with the aggregate.
- ☐ 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.
- ☐ All aggregate chips are close to the same size.
- ☐ The aggregate is clean and free of excess fines.
- ☐ The asphalt emulsion application temperature range is specified.

Asphalt Rubber Chip Seals and Hot Applied Chip Seals

- ☐ The type of asphalt to be used is compatible with the aggregate.
- ☐ The asphalt is from an approved supplier.
- ☐ The asphalt 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.
- ☐ All aggregate chips are clean, are close to the same size, and meet specification requirements.
- ☐ The aggregate pretreatment meets specification.
- ☐ The asphalt application temperature range is specified.

Pre-Application Inspection Responsibilities

Pavement Surface Preparation

- ☐ The surface has been swept clean and is dry.
- ☐ All pavement distresses have been repaired.
- ☐ Cracks wider than ¼ in. have been filled or sealed.
- ☐ Raised pavement markers and thermoplastic markings have been removed.

- ☐ Temporary road markers have been placed on lane lines for delineation after chip sealing.
- ☐ 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 chip seal.
- ☐ Utility castings have been protected with kraft paper or roofing felt to prevent coating the casting with asphalt. A temporary road marker has been placed on the protected cover to locate casting after chip sealing.
- ☐ Asphalt patches placed within six months have been fog sealed prior to chip sealing. The fog seal must be completely cured prior to chip seal construction.
- ☐ Review the existing surface for possible overspray by working irrigation systems during construction. Inspect the pavement for existing drainage issues from stormwater.

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.
- ☐ Nozzles deviating more than 10% from the average flow rate 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 triple overlap 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 distributor, if required by the specification.
- ☐ Asphalt rubber and hot applied chip seals require distributors and transports to have heating capabilities, an internal mixing device in the tank, and appropriate pumps to handle the viscous asphalt.

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 cowling 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 pneumatic-tired roller is recommended for chip 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 are the proper length.
- ☐ The broom can be adjusted vertically to avoid excess pressure.
- ☐ The broom bristles should be made of nylon, fiber, or plastic (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 chip sealing can be performed.
- ☐ Construct a chip seal only during daylight hours.
- ☐ Air and surface temperatures have been checked at the coolest location on the project.
- ☐ Air and surface temperatures is 50°F and rising unless warranted by agency requirements.
- ☐ Suspend chip sealing if pavement temperatures exceed 140°F unless warranted by agency requirements.
- ☐ Construct chip seal only when chance for precipitation is zero or very low.
- ☐ High winds can create problems with asphalt application. Work should be avoided when wind speeds exceed 20 mph.
- ☐ Air and pavement surface temperatures, humidity, and wind will affect how long the asphalt emulsion takes to break.

Determining Application Rates

- ☐ Agency specifications and standards are followed.
- ☐ A chip seal design has been performed and the initial application rates are established.
- ☐ Asphalt application rates are generally increased on heavily oxidized and porous surfaces.

- ☐ Asphalt application rates are generally increased on roads with low traffic volumes.
- ☐ Asphalt application rates are generally decreased on nonporous and asphalt-rich surfaces.
- ☐ Asphalt application rates are generally decreased on roads with high traffic volumes.
- ☐ Aggregate should be applied at a sufficient rate so that equipment tires do not pick up asphalt as the aggregate is placed.

Checking Application Rates

Asphalt—Method A
(RECOMMENDED FOR CALIBRATION)

- ☐ Record the weight of a 1 yd^2 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.
- ☐ Subtract the two weights to obtain the weight of the applied asphalt.
- ☐ 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—Method B
(RECOMMENDED FOR RANDOM CHECKS)

- ☐ Park the distributor on level ground, measure the asphalt, and recover the number of gallons of asphalt (note: conversion for temperature is not necessary).
- ☐ Measure off a known area for a test section.
- ☐ Have the distributor apply asphalt to the test section.
- ☐ Park the distributor on level ground and remeasure and record the gallons of asphalt.
- ☐ Subtract the two numbers to obtain the gallons of asphalt applied.
- ☐ Divide the gallons applied by the area covered by asphalt. The result equals the application rate in gal/yd^2. (If using feet, there are 9 ft^2 per yd^2.)

Aggregate—Method A
(RECOMMENDED FOR CALIBRATION)

- ☐ Weigh a 1 yd^2 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 yd^2 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 ft^2 per yd^2.)
- ☐ Divide the weight of the chips by the area of spread to determine the actual application rate in lb/yd^2.

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 chip seal.
- ☐ Signs are removed or covered when they are no longer needed.

Project Inspection Responsibilities

Asphalt Application

- ☐ Ample approved distributors are available for continuous operation of the process.
- ☐ Kraft paper or roofing felt is used to start and stop asphalt application for straight transverse joints.
- ☐ The asphalt temperature is within the required application range.
- ☐ The application looks uniform and free of streaking that leaves ridges or gaps.
- ☐ A check is made for plugged or dripping nozzles. A "bootman" may be required on asphalt rubber applications to ensure that any plugged nozzle is cleaned as the distributor is spraying.
- ☐ Random checks of application rates are performed.
- ☐ The distributor speed is matched to the chip spreader speed to prevent stop-start operations.
- ☐ The distributor is stopped if any problems are observed.

Aggregate Application

- ☐ Enough trucks are on hand to keep a steady supply of aggregate for the spreader.
- ☐ The aggregate should be applied at a rate to cover the asphalt so that there is no pickup on the equipment tires prior to rolling.
- ☐ The application starts and stops on building paper to create neat, straight transverse joints.
- ☐ The aggregate spreader follows closely (100 ft or less) behind the distributor.
- ☐ The aggregate spreader travels slowly enough to avoid the chips from rolling when they hit the surface.
- ☐ The aggregate, when using emulsified asphalt, is in a surface-damp condition. When applying an asphalt rubber or hot applied chip seal, the aggregate is dry and pretreated.
- ☐ The application is stopped if the asphalt covers the top of the chips or if aggregate streaks or plug-ups are detected.
- ☐ The application of aggregate appears uniform.
- ☐ The percentage of aggregate embedment in the asphalt is checked and the asphalt application rate adjusted if necessary.

Truck Operation

- ☐ Trucks travel slowly on the fresh chip 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 and leaving the chip spreader to help eliminate aggregate rollover and to aid in rolling.

Rolling

- ☐ Ensure that the rollers follow closely behind the chip spreader. If using an asphalt emulsion, complete the first roller pass as soon as possible but not longer than two minutes after applying the aggregate. For asphalt rubber and hot applied chip seals, the first roller pass should be completed as soon as possible, but not longer than two minutes after applying the aggregate.
- ☐ 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.

- ☐ Rollers should make a minimum of three passes for an asphalt emulsion and five passes for an asphalt rubber or hot-applied asphalt binder.
- ☐ The rolling is completed quickly enough to embed the aggregate, before the emulsified asphalt breaks and no longer than 15 minutes. Complete the rolling on asphalt rubber and hot applied chip seals within 15 minutes of aggregate placement.

Longitudinal Joints

- ☐ The distributor lines up so that the end nozzle sprays the longitudinal joint.
- ☐ The longitudinal joint should be overlapped 2–4 in. for uniform appearance.
- ☐ The longitudinal joints are never 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.
- ☐ The longitudinal joints are not left uncovered overnight.

Longitudinal Joint Construction—Method A

- ☐ Leave a 6–8 in. strip of asphalt exposed when applying the aggregate.
- ☐ Apply asphalt to the strip on the next distributor's pass.
- ☐ Apply aggregate to the asphalt.

Longitudinal Joint Construction—Method B

- ☐ Turn the end nozzle 90°.
- ☐ Apply asphalt and aggregate the full width of the binder.
- ☐ Repeat the process on subsequent passes.

Transverse Joints

- ☐ All asphalt applications begin and end on kraft paper or roofing 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 chip seal.
- ☐ Do not permit traffic on chip 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 imbedded aggregate in an asphalt emulsion chip seal.
- ☐ The traffic should travel slowly, 25 mph or less, over the asphalt emulsion chip 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 chip sealing before opening the pavement to normal traffic.
- ☐ All construction-related signs are removed when opening pavement to normal traffic.
- ☐ Traffic can return to asphalt rubber and hot applied chip seals once the final sweeping is complete.

Cleanup Responsibilities

- ☐ All loose aggregate from sweeping is removed from the roadway. Swept aggregate cannot be reused for chip 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 or Drill Marks in Asphalt:

- ☐ Asphalt is too cold.
- ☐ Viscosity of the asphalt is too high.
- ☐ All the nozzles are not at the same angle.
- ☐ Spray bar is too high.
- ☐ Spray bar is too low.
- ☐ Spray bar pressure is too high.
- ☐ Nozzle is plugged.

Exposed Asphalt Remains After Aggregate Application:

- ☐ Chip 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 chip 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.

Chips Being Dislodged:

- ☐ Asphalt application rate is too low.
- ☐ Aggregate is dirty or dusty.
- ☐ Traffic or equipment speeds are too high.
- ☐ Emulsion break occurred before the aggregate was placed and rolled. If asphalt rubber or hot applied chip seal, the asphalt had set before the aggregate was placed and rolled.
- ☐ Sweeping has been started before the asphalt emulsion has 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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Manual for Emulsion-Based Chip Seals for Pavement Preservation, NCHRP Report 680. 2011. Washington, DC: Transportation Research Board, National Cooperative Highway Research Program.

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An Overview of Surface Rehabilitation Techniques for Asphalt Pavements, Pub. No. FHWA-PD-92-008. 1992. Washington, DC: Federal Highway Administration.

Thin-Surfaced Pavements, Synthesis of User Practices, NCHRP Synthesis 260. 1998. Washington, DC: Transportation Research Board, National Cooperative Highway Research Program.

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

Construction Management Team, HICP-30
Office of Preconstruction, Construction, and Pavements
Federal Highway Administration
U.S. Department of Transportation
www.fhwa.dot.gov/pavement/preservation

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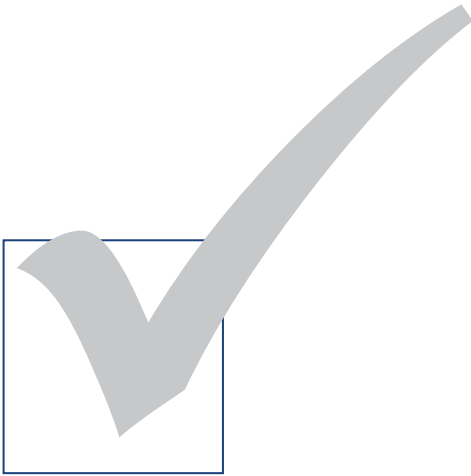
July 2019

Publication No. FHWA-HIF-19-029



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