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High Friction Surface Treatment



High Friction Surface Treatment 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
- Manufacturer's instructions
- Material 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 high-friction surface treatment. Pavements that are deteriorated, are an open graded friction course (OGFC), or have significant rutting, raveling, or bleeding are not recommended candidates and require repair prior to construction.
- Determine start and end points of the treatment.
- For a curved section, the treatment typically begins at the point of curvature (or the point where vehicles start to brake) and ends at the point of tangency.
- Verify that the asphalt pavement surface is at least 30 days old.
- Confirm whether the treatment will be placed in one layer or multiple layers.
- Verify the target application rate of the binder and aggregate.
- Confirm whether the treatment is being placed with fully automated equipment (automated mixing and automated application), semi-automated equipment (automated mixing and manual application), or manually. The method used must meet project specifications. Manual application should be limited to small spot locations, typically 200 yd² or less.

Materials Checks

- The binder and aggregate are from an approved source.
- The binder and aggregate are submitted for testing.
- The aggregate is clean and free of excess fines.
- Determine the initial set time for the binder at the application temperature. The Gel Time Test (ASTMC881) can be used to estimate set time in the field by performing the following steps:
 - Place binder components of proper proportion in an 8 oz unwaxed paper cup.
 - Record the time when the mixing begins.
 - Mix thoroughly for three minutes using a wooden tongue depressor or stick of similar size.
 - After mixing, set the cup on a surface subject to ambient temperature and normal air flow.
 - Probe the mixture every two minutes beginning at eight minutes after the mixing began to determine when a soft gelatinous mass forms in the center of the sample.
 - Once the gelatinous mass forms in the sample, record the elapsed time, which is an estimate of the initial set time.

- Confirm the timeframe that traffic is permitted onto the finished treatment per the binder manufacturer's recommendations.
- Confirm whether the manufacturer recommends removing existing permanent pavement markings prior to installation of the high-friction surface treatment.

Pre-Application Inspection Responsibilities

Pavement Surface Preparation

- If placing the high-friction surface treatment on concrete, the surface should be shot blasted to produce the desired texture of the agency. The shot blasting should remove curing compounds, loosely bonded mortar, and surface carbonation.
- The surface has been swept clean and is dry. Sweeping may be followed by high-pressure air blasting if any material remains on the surface.
- Existing pavement cracks have been pretreated per agency requirements.
- Other existing pavement distresses have been repaired.
- Raised pavement markers have been removed.
- Paint and thermoplastic pavement markings have been removed.

- Grass and weeds have been removed or destroyed by chemical herbicide. If herbicide was used, allow approximately one to two weeks to kill the vegetation before applying the treatment.
- Utilities, drainage structures, and curbs have been protected from the application of the binder and aggregate.

Equipment Inspections

Automated Applicator Vehicle

- The machine must be capable of continuously mixing and metering the binder and aggregate in one continuous pass.
- The on-board data management system is fully functional and is capable of providing the volume of binder, binder thickness, and volume of aggregate applied.

Manual Application Equipment

The following items should be used if manually applying the high-friction surface treatment:

- A device to mix the binder such as a torque drill with a “Jiffy mixer” or equivalent stirrer attachment.
- 5 gal bucket, wheelbarrow, or equivalent container to mix and place the binder.
- Serrated edge or notched neoprene squeegees to spread the binder on the pavement surface.
- Steel spiked shoes.

Weather Requirements

- Air and surface temperatures have been checked and are within the manufacturer's recommended application temperature range.
- Do not begin operations if precipitation is forecast during the application and product set period.

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 agency requirements.
- Determine whether conditions warrant use of a pilot vehicle. The pilot car leads traffic slowly, 25 mph or less, through the work zone.
- Ensure that flaggers do not hold the traffic for extended periods of time. Long work zones need two-way communication between flaggers.
- Any unsafe conditions are reported to a supervisor.
- Construction signs are removed or covered when they no longer apply.
- It is recommended that loose stone warning signage remain at each end of the construction zone for one month after construction.

Project Inspection Responsibilities

- If applying the high-friction surface treatment manually, verify that the binder has been mixed proportionally and thoroughly. Allow at least three minutes of mixing time and ensure that the sides and bottom of the container are agitated sufficiently.
- Aggregate should be applied immediately after the binder.
- Typically, the aggregate should achieve 50% embedment depth in the binder.
- Verify that there is no exposed uncured binder visible after the aggregate has been applied. If exposed binder is found, apply aggregate to the area by an approved application method.
- Confirm the binder remains free of contamination until it has cured. Any contaminated sections of binder must be removed and replaced.
- Ensure construction personnel do not walk or stand on the binder once it has been spread without wearing steel spiked shoes.
- Ensure that the operation proceeds in a timely manner so that mixed binder is not allowed to separate or cure prior to bonding with the aggregate.

- If applying the high-friction surface treatment with an applicator vehicle, ensure that the mix head and delivery lines are cleaned on the applicator vehicle if application of the binder is stopped for more than 30 minutes.
- Ensure no seams are visible in the middle of the lane after application of the aggregate.
- In the event of unexpected precipitation, any uncured treatment where both the binder and aggregate have been placed must immediately be covered with plastic sheeting.

Checking Application Rates

- The thickness of the applied binder should be checked at different locations using a wet film thickness gauge.
- Yield checks should be performed periodically to ensure that the proper quantity of binder constituents and aggregate are being applied.

Sweeping

- Sweep excess cover aggregate from the pavement surface as soon as the treatment has cured.
- Do not permit traffic on high-friction surface treatment prior to sweeping.
- Sweeping should not dislodge the aggregate that has set.
- Clean excess aggregate that is recovered during the sweeping operation may be reused on other treatment sections provided that it is allowable per agency requirements. If allowed, the reclaimed aggregate must be clean, dry, and uncontaminated.

Opening to Traffic

- Verify the coefficient of friction meets agency requirements (if applicable).
- All loose aggregate from sweeping is removed from the roadway before reopening to traffic.

Cleanup Responsibilities

- Secondary cleanup should be performed three to five days after construction.
- The treatment will commonly shed aggregate for the first few weeks after placement. Weekly sweeping is recommended for the first month.

Common Problems and Solutions

(Problem: Solution)

Aggregate Loss:

- Binder application rate was too low.
- Aggregate was not clean or dry.

Delamination:

- Surface contamination occurred during construction.
- Poor sweeping and air blasting practices.
- Moisture was present during construction.
- Concrete shot blasting was inadequate.

Uncured Binder Failure:

- Poor binder mixing.
- Incorrect proportioning.

Failure of the Underlying Layer (Top-Down or Horizontal Tearing):

- Treatment applied on weak underlying layer.
- Presence of extreme stopping and turning traffic.
- Excessively thick and stiff high-friction surface treatment.
- Thermally-induced stress.

Sources

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

EDC-2: High Friction Surface Treatments (HFST). 2014. Washington, DC: Federal Highway Administration. Available at <https://www.fhwa.dot.gov/innovation/everydaycounts/edc-2/hfst.cfm>.

High Friction Surface Treatments. 2018. Fredericksburg, VA: The American Traffic Safety Services Association (ATSSA). Available at <http://www.atssa.com/Tech-Innovation/High-Friction-Surface-Treatment>.

Manual on Uniform Traffic Control Devices. 2009, Revised May 2012. Washington, DC: Federal Highway Administration. Available at <http://mutcd.fhwa.dot.gov>.

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

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www.fhwa.dot.gov/pavement/preservation

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