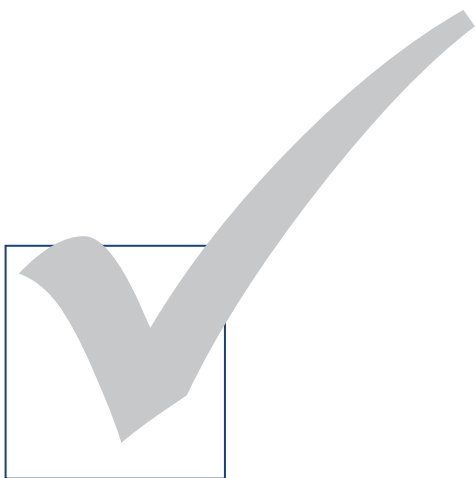


**Pavement Preservation
Checklist Series**

10

Full Depth Reclamation



U.S. Department of Transportation
Federal Highway Administration

Full Depth Reclamation (FDR) 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
- As built plans, if available
- Mix design
- Construction manual
- Traffic control plan
- Agency requirements
- Stabilizing manufacturer's instructions
- Safety data sheets
- Health and safety plan and job hazard analysis
- 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 full depth reclamation (FDR).
 - Identify areas of excessive surface deformation, which may indicate soft subgrade conditions or drainage deficiencies. To correct subgrade problems, the reclaimed material typically is moved to one side, the subgrade is reworked or stabilized with a stabilizing agent, and then the reclaimed material is placed back on the prepared subgrade. Poor drainage conditions can be addressed by eliminating the source of water or by installing drains to direct the water away from the roadway.
 - Verify that existing appurtenance structures including guardrails, curbs, and bridge clearances do not impose limitations on FDR operations or final pavement geometry.
 - Determine whether paving fabric is present within any of the layers to be recycled and if it can be dealt with during construction.
- Note the types of distresses that exist and consider the cause and severity of each.
- Identify large/deep patches and determine if removal and replacement is necessary to attain consistent materials throughout the project. Patched areas may also indicate soft subgrade conditions.

- Verify that cores from both the center and edge of the pavement have been obtained at various locations along the length of the project that confirm the thickness of materials to be reclaimed. Samples must include the pavement base and subgrade materials.
- Note the presence, frequency, and elevation of utility covers (manholes and valves), and develop a plan to address affected areas without disturbing utilities.
- Consider the impact of other issues such as reclaiming shoulders or potential increases to traffic loading.
- Based on the forensic data, verify that the project is a cost-effective solution and a good candidate for FDR.

Material Checks

- A sufficient number of cores and samples are obtained for mix design.
- Samples are evaluated for consistency over the length of the project.
- The stabilizing agent is compatible with the materials and processes. The stabilizing agent may be
 - Aggregate or Reclaimed Asphalt Pavement (RAP) for **mechanical stabilization**.
 - Emulsified asphalt or foamed asphalt for **bituminous stabilization**.
 - Cement, lime, or fly ash for **chemical stabilization**.
- Stabilizing additives can be added in small amounts to the stabilizing agent. The stabilizing additives may be
 - New aggregate or RAP, cement, lime, fly ash, or kiln dust.

Pre-Construction Inspection Responsibilities

Pavement Preparation

- Confirm that all necessary contractor and agency personnel attend the pre-construction meeting.
- Identify and repair areas of excessive surface deformation and poor subgrade support.
- Verify areas with existing drainage issues from stormwater or subsurface aquifers (springs) have been corrected.
- Ensure that pre-milling, if required, was performed satisfactorily.

Equipment Inspections

Reclaimer

- Confirm that the cutting drum is the correct width.
- Verify that the reclaimer has sufficient weight and horsepower to cut to the depth and tolerances specified within the contract documents.
- Check that the cutting teeth are all in place and not broken or badly worn.
- Visually confirm that the spray bar and nozzles are working properly and not clogged.

- Verify that the on-board stabilizing agent system is equipped with a meter capable of recording the rate of flow and total amount of each liquid being added to the reclaimed material.
- When foamed asphalt is being used as the stabilizing agent, verify that the reclaimer is equipped with an on-board foam generating system including a foamed asphalt sampling valve.
- Confirm that the on-board stabilizing agent system has a positive interlock system linked to the forward speed of the reclaimer so that the amount of liquid recycling agent being added will change according to the operational speed of the reclaimer.

Calibrated Bulk Spreader

- Verify that the bulk spreader is properly calibrated and is capable of accurately dispensing the required quantity of stabilizing agent and additive.

Nurse Trailer

- Confirm that the tank is dedicated to transporting only the material specified and has not been contaminated.
- Verify that the flexible hose used to flow material from the nurse trailer to the reclaimer is clean and not contaminated.

Motor Graders

- Verify that the motor graders used have cross-slope indicators and are in accordance with those specified in the project specifications.

Compaction Rollers

- Verify that the rollers proposed for use by the contractor are in accordance with those specified in the project specifications. A large pneumatic-tired, vibratory smooth drum or padfoot rollers are typically used for initial and intermediate compaction. Finishing rolling is generally performed with a vibrating smooth drum or static steel roller.
- Verify that the number of rollers necessary for the compaction effort can keep pace with the rate of material being processed and placed.
- Verify that rollers have the proper operating weight specified and that the pneumatic-tired rollers comply with the manufacturer's recommendation for tire pressure.
- All rollers are equipped with working water spray bars, wetting pads, and scraping bars to avoid material buildup.

Other Equipment

- Haul trucks
- Front-end loader
- Water truck

Weather Requirements

- Verify that the ambient air temperature (in the shade) meets the project specification. This is typically a minimum of 45°F and rising when using bituminous products and a minimum of 35°F and rising when cementitious materials are incorporated.
- Consider that variations in temperature, humidity, and wind conditions will all affect breaking and curing times. No freezing temperatures are forecast within seven days of the end of FDR placement.
- Verify that no significant precipitation (or fog for bituminous stabilization) is predicted during the daily construction period.

Mix Design (When Required)

- Confirm that a mix design has been performed and that the resulting mixture meets the project specifications.
- Verify that any special instructions included with the mix design are incorporated into the contractor's preparations for construction operations.
- Confirm that the contractor has submitted the final mix design to the owner agency for review and acceptance prior to initiation of construction operations.

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.
- Any unsafe conditions are reported to a supervisor.
- 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 traffic for extended periods of time. Long work zones need two-way communication between flaggers.
- Ensure that flaggers do not hold traffic stopped on freshly treated material.
- Ensure that signs are removed or covered when they no longer apply.

Project Inspection Responsibilities

Pre-Pulverization/Pulverization

- Ensure that the depth of pulverization meets the project specifications.
- Verify that the pulverized material meets the gradation requirement in the project specification.
- Verify that the pulverized material is consistent with cores and samples provided for the mix design.
- Measure the moisture content of the pre-pulverized material to determine if an adjustment is needed to obtain optimum moisture.

Mixing and Placement

- Verify that the blending and mixing of water (if needed) and stabilizing agent are adequate to ensure a homogenous, consistent blend throughout the entire project.
- Routinely monitor the amount of water introduced to maintain the specified range of optimum moisture content and to achieve a homogenous mixture.
- Check that longitudinal joints overlap a minimum of 6 in.
- Check that transverse joints overlap a minimum of 2 ft.

Stabilizing Agent and Stabilizing Additive Spreading

- Confirm that application rates of stabilizing agent and additive are meeting the application rates specified in the mix design and remain consistent throughout the treatment area.
- Check that application rates on the reclaimer's flow meter for bituminous binder is accurate and that the calibration on the spreader equipment is correct for the chemical powder by manually laying out each load of stabilizing agent.

Stabilizing Agent Mixing

- Ensure that the time between the first contact with water and cementitious stabilizer does not exceed 60 minutes and that mixing begins within 30 minutes of placement of the stabilizer.
- Ensure a proper mellowing period between first and final mixings for lime stabilizer.

Initial Compaction

- Develop a rolling pattern at the beginning of construction and that the compaction roller is immediately following the reclaimer.
- For bituminous and lime stabilization, breakdown rolling should be with a padfoot or pneumatic-tired roller and continue until the roller "walks out" of the material.

- Verify that compaction of cementitious stabilizer begins within 20 minutes after mixing and achieving gradation and moisture requirements.
- Monitor the compaction of the mat to ensure the density requirements meet project specifications.

Grading

- Monitor to ensure the motor grader (preferably with automatic grade control) is closely following the compaction rollers.
- Be careful to not overwork the treated mat as to compromise its structural integrity during the curing process.
- Ensure that the material is kept within the roadway width.
- Monitor surface moisture content and apply water as necessary to maintain optimum moisture.
- Routinely check profile.
- Routinely check cross-slope.

Finish Rolling

- It is preferred to roll the mat in static mode to reduce the possibility of developing micro-cracking in the FDR surface.
- Verify that micro-cracking, if required, is performed in accordance with project specifications.

Opening to Traffic

- Ensure that the material in the recently completed mat meets the project specification compaction density requirement.
- Proof roll the surface prior to opening to initial traffic to verify material can support light traffic.
- Ensure that temporary pavement markings are in place prior to opening the surface to traffic.
- Ensure initial traffic does not impair material curing.

Seal or Overlay

- Cure cementitious and lime stabilized materials by application of a bituminous or other approved sealing membrane or by keeping continuously moist for three to five days prior to application of the surface course.
- Cure bituminous stabilizers in accordance with the project specifications.
- After curing, protect the surface of the FDR material by applying a surface course such as a surface seal treatment or hot mix asphalt overlay.

Common Problems and Solutions

(Problem: Solution)

Pulverized Material Inconsistent with Material Samples Used In Mix Design:

- Determine if the current mix design is still applicable.
- Determine if a new stabilizing agent or alternative application rates will be better suited based on the actual material being used.

Pulverized Material is Not at Target Moisture Content:

- Add water to reach target moisture content before or during treatment.
- Dry the pulverized material by aeration before treatment.

FDR Material is Soft or Deforms Excessively:

- Aerate, reshape, and compact if instability is due to excessive moisture.
- Replace with suitable materials.

Subgrade is Failing Below the Proposed FDR Section:

- Laterally displace the pre-pulverized FDR material and repair the subgrade with stabilization.
- Replace the pre-pulverized FDR material and treat on the repaired subgrade.

Pre-Milling Depth:

- Mill and remove enough material to account for the volume gain acquired by the pulverization process and addition of a stabilizing agent (typically 5% to 15% of the original volume); this is particularly important on projects that are locked in by grade.

Sources

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

Basic Asphalt Recycling Manual, Second Edition. Pub. No. FHWA-HIF-14-001. 2014. Glen Ellyn, IL: Asphalt Recycling and Reclaiming Association. Available at www.arra.org.

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:

Construction Management Team, HICP-30
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