

Full Depth Reclamation Construction Checklist



Pavement
Recycling



Reclaiming
Center

CAL POLY POMONA



U.S. Department
of Transportation

**Federal Highway
Administration**

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This checklist was created to complement the existing Pavement Preservation Checklist Series. Although not a preservation strategy, full depth reclamation (FDR) is a proven alternative to traditional reconstruction.

FDR promotes the reuse of existing road materials and significantly reduces the use of fossil fuels and virgin resources such as aggregate and asphalt.

FDR consists of pulverizing and mixing in place distressed asphalt materials and underlying pavement materials with or without the addition of stabilizing agents such as cement, lime, fly ash, or asphalt. The resulting material is used as base for the renewed pavement structure.

This document is a field guide which is not intended to replace project specifications.

Quality Assurance Notice

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Preliminary Responsibilities

This section includes documents and information that should be available prior to any construction activities.

Document Review

- Project Specifications
- Mix Design
- Structural Pavement Design
- Construction Manual
- Traffic Control Plan
- Owner/Agency Requirements
- Stabilizing Agent Manufacturers' Instructions
- Safety Data Sheets (SDSs)
- Health and Safety Plan and Job Hazard Analysis

Project Review

- Note the types and causes of existing pavement distresses.
- 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.

- 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, to confirm the thickness of materials to be reclaimed, and base and/or subgrade samples have been obtained at various locations along the length of the project. Verify that existing structures, e.g. 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 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.
- Verify that the project is a good candidate for FDR based on the project review.

Materials Checks

- ❑ A sufficient number of cores/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**
 - Hydraulic 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, hydraulic cement, lime, fly ash or kiln dust.

Preconstruction Inspection Responsibilities

This section identifies activities that should be performed before proceeding with construction activities.

Preconstruction Meeting

- ❑ Ensure that all necessary contractor and agency personnel attend the preconstruction meeting.

Surface Preparation

- ❑ Identify and repair areas of excessive surface deformation and poor subgrade support.
- ❑ Identify and correct any subsurface drainage problems.
- ❑ Ensure that pre-milling, if required, was performed satisfactorily.

Equipment Inspections

Reclaimer

- ❑ Verify 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.
- ❑ Verify that the carbide cutting teeth are all in place and in adequate condition.

- ❑ Verify 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.
- ❑ Verify that the reclaimer is equipped with an on-board foam generating system including a foamed asphalt sampling valve when foamed asphalt is being used as the stabilizing agent.
- ❑ Verify 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 stabilizing agent being added will change according to the operational speed of the reclaimer.
- ❑ Verify that the correct amount of water is being added to achieve a homogenous mixture and achieve specified percent compaction.

Calibrated Bulk Spreader

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

Nurse Trucks

- Verify that the interior of the nurse tank is not contaminated and that the trailer is dedicated to transporting only the specific material used.
- Verify that the flexible hose used to convey 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 contract documents.

Compaction Rollers

- Verify that the rollers proposed for use by the contractor are in accordance with those specified in the contract documents. Large pneumatic-tired, vibratory smooth drum, or padfoot rollers may be used for initial and intermediate compaction. Finishing rolling is typically performed with a vibrating smooth drum or static steel roller.
- Verify that the number of rollers used is consistent with the rate of material being processed and placed.
- Verify that rollers have the proper operating weight and that the tire pressures on pneumatic-tired rollers are consistent

with the tire pressures specified in the contract documents.

- ❑ Verify that working water systems are installed on all rollers as required by the contract documents.
- ❑ Verify that working scrapers are in place on all rollers as required by the contract documents.

Other Equipment

- ❑ Haul trucks
- ❑ Front End Loader
- ❑ Water Truck

Weather Requirements

- ❑ Verify that the ambient air temperature (in the shade) meets contract specification requirements, typically a minimum of 45 °F (7 °C) and rising when using bituminous products and a minimum of 35 °F (2 °C) and rising when cementitious materials are incorporated.
- ❑ Consider that variations in temperature, humidity, and wind conditions will all affect breaking and curing times. Specifications typically require no freezing temperatures within 7 days of the end of FDR placement.
- ❑ Verify that no significant precipitation (or fog for bituminous stabilization) is

predicted during construction operations, in accordance with contract specifications.

Mix Design (when required)

- ❑ Verify that a mix design has been performed and that the resulting mixture meets the specifications in the contract documents.
- ❑ Verify that any special instructions included with the mix design are incorporated into the contractor's preparations for construction operations.
- ❑ Verify 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 the traffic control plan complies with the contract documents and the Manual on Uniform Traffic Control Devices (Federal Highway Administration, 2009).
- ❑ Verify that the signs and devices erected on the roadway match the traffic control plan contained in the contract documents.
- ❑ Ensure that flaggers do not hold traffic for extended periods of time.
- ❑ Ensure that flaggers do not hold traffic stopped on freshly treated material.

- ❑ Ensure that signs are removed or covered when they no longer apply.
- ❑ Ensure that an appropriate action plan is developed and implemented for emergency vehicles passing through the project.
- ❑ Ensure that any unsafe conditions are reported to a supervisor or the appropriate law enforcement officials.

Project Inspection Responsibilities

This section identifies activities that should be performed during the construction process.

Pre-Pulverization/ Pulverization

- ❑ Verify that the depth of pulverization meets the specification/contract documents.
- ❑ Verify that the pulverized material meets gradation per the specification/contract documents.
- ❑ Verify that the pulverized material is consistent with samples/cores provided for the mix design.
- ❑ Verify the moisture content of the pre-pulverized material to determine if an adjustment is needed to reach or maintain optimum moisture.

Mixing and Placement

- ❑ Verify that the blending/mixing of water (if needed) and stabilizing agent is adequate to ensure a homogenous, consistent blend throughout the treatment section.
- ❑ Monitor the amount of water introduced to maintain the specified range of optimum moisture content.
- ❑ Check that longitudinal joints overlap a minimum of 6 inches (150 mm).

- ❑ Check that transverse joints overlap a minimum of 2 feet (0.6 m).

Stabilizing Agent and Stabilizing Additive Spreading

- ❑ Verify 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 (bituminous binder) are accurate and that the calibration on the spreader equipment is correct (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 proper mellowing period between first and final mixings for lime stabilizer.

Initial Compaction

- ❑ Verify that an adequate rolling pattern has been established 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 that density/compaction of the mat meets specification/contract document requirements.

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.
- ❑ Check profile.
- ❑ Check cross-slope.

Finish Rolling

- ❑ It is preferred to roll the mat in static mode to reduce the opportunity for micro-cracking of the FDR surface.

- Verify that micro-cracking, if required, is performed in accordance with contract documents.

Initial Opening to Traffic

- ❑ Ensure that the material in the recently completed mat meets the contract requirements for compaction density.
- ❑ Proof roll the surface prior to opening to initial traffic to verify material can support light traffic.
- ❑ Ensure that temporary pavement markings required by the contract documents 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 3 to 5 days prior to application of the surface course.
- ❑ Cure bituminous stabilizers in accordance with the contract documents.
- ❑ After curing, protect the surface of the FDR material by applying a surface course such as hot mix asphalt or other surfacing material.

Common Problems and Solutions

- Pulverized material is not consistent with the 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.
- The FDR material is soft or deforms excessively
 - Aerate, reshape and compact if instability is due to excessive moisture.
 - Replace with suitable materials.
- The 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% - 15% of the original volume); this is particularly important on projects that are locked in by grade.

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Sources

- *Basic Asphalt Recycling Manual, Second Edition, 2013*. Annapolis, MD: Asphalt Recycling & Reclaiming Association. Available at www.arra.org.
- *Manual on Uniform Traffic Control Devices*. 2009. Washington, DC: Federal Highway Administration. Available at <http://mutcd.fhwa.dot.gov>.

To obtain other checklists or to learn more about asphalt recycling and reclaiming please contact:

Federal Highway Administration, HIAP-1
Office of Asset Management, Pavement and
Construction
Room E75-340
1200 New Jersey Ave, SE
Washington, DC 20590
www.fhwa.dot.gov/pavement

Pavement Recycling and Reclaiming Center
Cal Poly Pomona Civil Engineering
3801 West Temple Avenue
Pomona, CA 91768
E-mail: info@prrcenter.org
Telephone: 909.979.6650
www.prrcenter.org

Asphalt Recycling & Reclaiming Association
#3 Church Circle – PMB 250
Annapolis, Maryland 21401
Telephone: 410-267-0023
Fax: 410-267-7546
E-mail krissoff@arra.org
www.arra.org

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