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Hot In-Place Recycling



Hot In-Place Recycling (HIR) 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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Hot In-Place Recycling (HIR) Application Checklist

This checklist encompasses the three main hot in-place asphalt recycling (HIR) processes:

- Surface Recycling
- Remixing
- Repaving

Surface Recycling consists of milling/scarifying the pavement to the required depth, adding a rejuvenating agent, if required, mixing, placing, and compacting the recycled mixture.

Remixing consists of milling/scarifying the pavement to the required depth, adding a rejuvenating agent and admixture (new aggregate or hot mix asphalt [HMA]), if required, mixing, placing, and compacting the recycled mixture.

Repaving combines the surface recycling or remixing process with the placement of a simultaneous or integral overlay of new HMA.

Some of the issues addressed in this checklist may not apply to all three of the processes.

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

Preliminary Responsibilities

Document Review

- Project specifications
- As built plans, if available
- Mix design
- Construction manual
- Traffic control plan
- Agency requirements
- Additive 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 hot in-place recycling (HIR).
 - Determine whether cutback asphalts or heavy crack sealants have been used as surface treatments in the past. The presence of flammable solvents or rubberized materials may preclude the use of HIR methods.
 - Pavement distresses that are the result of base or subgrade failure may preclude the use of HIR methods. Check if testing has determined the presence of a weak underlying layer.
 - The current surface and subsurface drainage conditions are sufficient to prevent surface deterioration and softening of the subgrade and will enable long-term performance of the pavement after HIR treatment.
 - No paving fabric can be within 1 in. of the layers to be recycled.
- Note the types of distresses that exist and consider the cause and severity of each.
- Consider whether distresses are primarily limited to one of the following: aging, raveling, bleeding, potholes, poor surface friction, rutting less than ½ in., corrugations, shoving, light cracking, or ride quality due to minor to moderate distresses in the upper 2 to 3 in. of the pavement section.

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- Consider whether existing materials are of sufficient quality to be recycled or if the mixture will need to be improved via the addition of admixtures (new aggregates or hot mix asphalt [HMA]) during the recycling process.
 - Cores from both the center and edge of the pavement have been obtained at various locations along the project that confirm the thickness of the bituminous layers.
 - Determine whether the existing pavement can support the expected traffic loading during the design life without additional strengthening.
 - If strengthening is required in certain locations, determine the thickness of HMA that is required to support the anticipated traffic.
 - Review existing ride measurements and correct any issues that could adversely affect the ride quality of the final recycled project.
 - Determine whether any geometric corrections, e.g., alignment and width, are required during the construction period.
 - Ensure that the environmental impact assessment of the project on the surrounding area has been completed.
 - Based on the existing pavement condition, determine whether the treatment is cost-effective.

Materials Checks

- Verify that project cores and samples were obtained during the subsurface investigation.
- Examine samples for consistency over the length of the project.
- Note the presence of any surface treatments, paving fabrics, or exotic mixes.
- Select the appropriate HIR process to correct deficiencies found in the field investigation.

Pre-Construction Inspection Responsibilities

Pavement Preparation

- Confirm that all necessary contractor and agency personnel attend the pre-construction meeting.
- Areas with existing drainage issues from stormwater have been corrected.
- Isolated base failures have been removed and patched.
- Existing surface courses exhibiting major rutting (1 in. or greater) and abrupt vertical changes at joints due to wear or post construction consolidation have been removed by cold planing or repaired with a leveling course prior to recycling.
- Raised pavement markers and thermoplastic markings have been removed.

- ❑ Excessive rubberized crack filler should be removed by cold planing or other approved method.
- ❑ Utilities and other underground obstructions within the recycling area should be identified, checked for flammable vapors, and protected from damage.
- ❑ Ensure the pavement surface is clean and free of vegetation and other deleterious materials, especially along the pavement edge.

Equipment Inspections

Preheaters

- ❑ Verify that the number of preheaters is adequate to sufficiently heat the pavement to facilitate scarification to the depth required in the project specifications, typically a temperature of 230°F to 300°F.
- ❑ Verify that each preheater unit is equipped with an enclosed or shielded thermal containment hood capable of heating the pavement surface to the required temperature.
- ❑ Verify that the preheater hood is a minimum of 4 in. wider than the scarification on either side of the machine.

Milling/Scarifying Units

- ❑ Verify that the milling/scarifying units are capable of scarifying the existing pavement surface to the required depth.

- Verify that the milling/scarifying units are equipped with height controls to facilitate clearance of manholes and other obstructions in the pavement surface.

Rejuvenating Agent and Admixture System

- Verify that the discharge rate of the rejuvenating agent and admixture (new aggregates or HMA) is calibrated relative to the forward speed of the recycling unit so that the quantity of material added is consistent with the project specifications.
- Verify that the recycling unit is equipped with meters that show continuous readout for monitoring quantities.

Mixing System

- Verify that the mixing system is capable of thoroughly mixing the scarified material with rejuvenating agent and/or admixture (new aggregate or HMA) in accordance with the project specifications.

Spreaders

- Verify that the equipment includes a form of spreader box and screed capable of spreading and leveling the blended material uniformly over the width of the pavement being processed, in accordance with the project specifications.

Paver (Repaving)

- Verify that the paving machine is capable of automatically matching a longitudinal joint in accordance with the project specifications.
- Verify that the screed pulled by the paving unit is equipped with slope and grade controls capable of automatic screed leveling to construct the pavement to the line and grade required in the project specifications.
- Verify that sufficient heat is maintained on the screed to prevent scraping, scuffing, or gouging of the newly completed surface.

Rollers

- Determine the type(s) of rollers that will be used for breakdown, intermediate, and finish rolling.
- A sufficient number of rollers of adequate size are available to achieve the desired compaction.
- Water spray bars, wetting pads, and scraping bars are working on all rollers to avoid material buildup.
- Approved asphalt release agents are available. Note: Do NOT use diesel fuel to clean roller drums or tires.
- Steel drums are free of grooves and dents and not warped.

- ❑ Pneumatic-tired rollers comply with the manufacturer's recommendation for tire pressure.
- ❑ Pneumatic-tired roller tires do not vary more than 5 psi from the prescribed pressure.
- ❑ Vibratory plates or hand tampers are available for areas inaccessible to rollers.

Project Inspection Responsibilities

Weather Requirements

- ❑ Confirm that the ambient air temperature meets project specifications, typically the same as for HMA, a minimum of 45°F in the shade.
- ❑ Verify that no significant precipitation is predicted during construction.
- ❑ Consider that variations in temperature, humidity, and wind conditions will affect breaking and curing times. Specifications typically require that fog is not present during construction operations. Consider that at high altitudes, greater than 6,500 ft, the effect of temperature needs to be taken into account.
- ❑ Consider that recent rainfall will affect the HIR process more than conventional asphalt due to the energy required to remove the excess moisture.

Mix Design (When Required)

- Confirm that a mix design has been performed and that the resulting mixture characteristics meet the project specifications.
- Verify that any special instructions included with the mix design are incorporated into the contractor's preparation for construction operations.
- Confirm that the contractor has submitted the final mix design to the owner/agency for review and approval prior to initiation of construction operations.
- In areas where in-place materials change significantly, additional mix designs should be performed to establish representative mixtures.
- The mix design should indicate the allowable tolerance for the application of rejuvenating agent and admixture or new aggregate, if required.

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 the 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 the traffic for extended periods of time. Long work zones need two-way communication between flaggers.
- Ensure that flaggers do not hold traffic over freshly placed material.
- 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.

Preheaters

- Confirm that the surface and internal areas of the pavement are dry to decrease energy demand during the HIR process.
- Verify that the asphalt pavement surface is being sufficiently softened, typically at temperatures of 230°F to 320°F, to facilitate milling/scarification without undue aggregate degradation.
- Ensure that the asphalt pavement surface is not being burned or charred, which typically occurs at temperatures of 330°F and above.
- Ensure that under no circumstances does the temperature of the surface exceed 375°F.

- Substantiate that an adequate temperature is achieved for mixing the rejuvenating agent and admixture, typically between 230°F and 320°F.
- Heating units should extend beyond the treatment width by a minimum of 4 in. to heat and soften the adjoining pavement and provide a thermal bond to create a seamless longitudinal joint.

Milling/Scarifying Unit(s)

- Verify by visual observation that the tines are scarifying or the milling drum is removing the existing pavement surface to the treatment depth required in the project specifications.
- Check by visual observation that the coarse aggregate is not excessively degrading or fracturing, an indication that the existing pavement surface has been heated to an insufficient temperature.
- The single stage process is generally for treatment depths of 1 in. to 2 in. in a single pass. Multistage process generally removes ½ in. to ¾ in. per pass.
- Treatment depth should remain ¾ in. to 1 in. above any paving fabric to prevent pullout or delamination of the mixture.

Rejuvenating Agent and Admixture System

- Verify that the application rate of the rejuvenating agent and admixture (new aggregate or HMA) is consistent with the mix design by keeping track of the quantity of material used to treat a given volume of the pavement surface.
- Take into account that the quantity of admixture can be influenced by surface irregularities, such as rutting, and can vary from section to section.
- Record any adjustments to the rejuvenating agent or additive rate during construction.

Mixing Unit/Spreader

- Check by visual observation that a uniform, consistent product is being produced.

Paver (Repaving)

- Check by visual observation that the product is uniform and consistent and not segregated by an abundance of coarse aggregate or flushed with an excess of fine material.
- Confirm that longitudinal joints are uniformly straight and overlap the previously treated area by a minimum of 2 in.

Rolling

- ❑ Confirm the compaction temperature of the HIR mixture is above 175°F.
- ❑ Ensure that a rolling pattern is developed at the beginning of construction to determine the number of passes required using the specified rollers.
- ❑ Ensure that there is no damage from potential over rolling.
- ❑ Communicate daily with the roller operators to review the developed rolling pattern.
- ❑ Ensure that stops, starts, and turns are gradual.
- ❑ Ensure that finish rolling is completed at or above the minimum required temperature designated in the project specifications.
- ❑ Ensure that water (or an approved wetting agent, such as dishwashing detergent, if permitted by the project specifications) is lightly sprayed onto the roller drums and tires to prevent pickup. Under no circumstances should diesel or other solvents be used to prevent pickup.

Opening to Traffic

- Place temporary pavement markers on lane lines for delineation before opening the pavement to normal traffic.
- The pavement can be opened to traffic after the mix has been compacted and the mat has cooled to 150°F or the agency's required temperature.
- All construction-related signs are removed when opening pavement to normal traffic.

Common Problems and Solutions

(Problem: Solution)

Oversize Material or Chunks:

- Slow down to allow material to heat properly.

Blue or Black Smoke:

- Reduce intensity of the heating units, raise the heating units from the paving surface, or increase the forward speed of the heating units.

Non-Homogenous Mixture:

- Slow down to allow enough mixing time.

Segregation:

- Pavement may not be sufficiently heated.
- Kickback on the screed is not working.

Drag Marks in Uncompacted Mixture:

- Check for cool material and possibly increase the heat.
- Slow down.
- Look for crack sealant or other foreign material.

Insufficient Compaction:

- Check the roller pattern and roller type, or add rollers.
- Increase the heat.

Rain:

- Stop the process.
- Ensure the roadway is dry before restarting.

Loose Material:

- Check for improper compaction.
- Increase rejuvenating agent content.

Flushing:

- Decrease rejuvenating content.
- Check for improper mixing.

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 & Reclaiming Association. Available at www.arra.org.

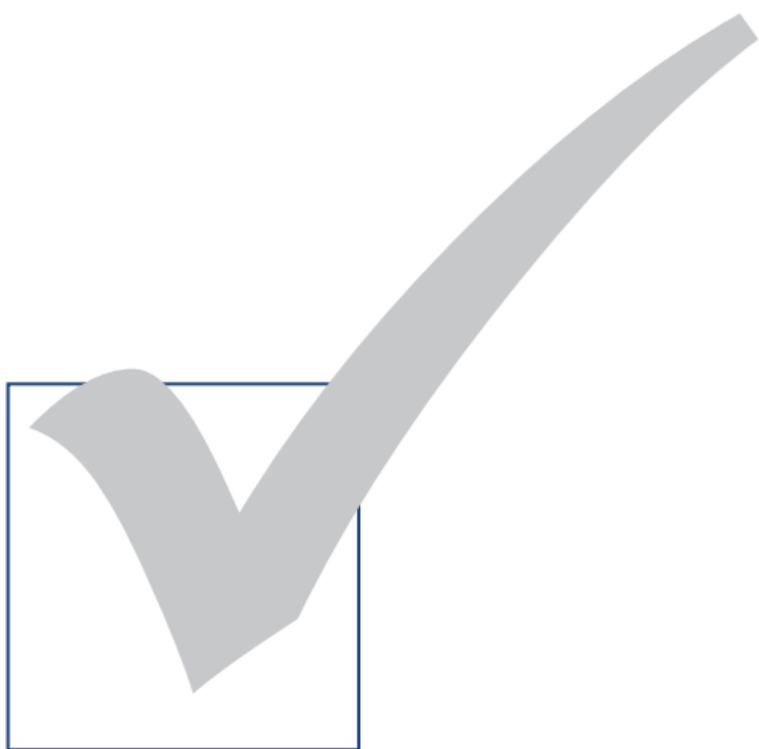
Manual on Uniform Traffic Control Devices. 2009, Revised May 2012. Washington, DC: Federal Highway Administration. Available at <http://mutcd.fhwa.dot.gov>.

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

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www.fhwa.dot.gov/pavement/preservation

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