

# PAVEMENT PRESERVATION GUIDELINES

## What is pavement preservation?

Pavement Preservation is “a [systematic approach] ...employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations.” Source: FHWA Pavement Preservation Expert Task Group.<sup>1</sup> Pavement preservation relies on the principle that the cost of a pavement improvement is much higher at lower condition levels – that the cost increase with a decrease in pavement condition is not linear. Under this principle, the ongoing cost of maintaining the pavement condition of a highway network is lower if pavement-preservation principles are followed.

In practical terms, pavement preservation means the “right treatment to the right road at the right time.” In other words, it pays off to maintain your good, structurally-sound roadways in good condition before having to repair significant damage. Pavement preservation represents “...a proactive approach in maintaining our existing highways.”<sup>2</sup> Pavement preservation treatments extend the pavement life and/or restore serviceability but are not intended to increase capacity or strength. According to the FHWA, “Functionally, Federal-aid eligible preventive maintenance activities are those that address aging, oxidation, surface deterioration, and normal wear and tear from day-to-day performance and environmental conditions. Preventive maintenance activities extend the service life of the roadway asset or facility in a cost-effective manner.”<sup>3</sup>

Pavement preservation treatments for hot-mix asphalt (HMA) surfaced pavements include crack sealing, surface treatments, and ultra-thin and thin hot-mix asphalt overlays, among others; in Portland-cement concrete (PCC) pavements treatments include cleaning and sealing joints and cracks, diamond grinding, and dowel-bar retrofitting. Note that, when placed much later in the pavement life cycle, these treatments are sometimes also used for corrective (reactive) maintenance and/or catastrophic maintenance (to maintain a minimum level of serviceability) – these uses of pavement treatments are not considered pavement preservation.

## Why are pavement-preservation projects especially suited for the fiscal stimulus program?

Timing is critical for the application of preservation treatments – a list of projects for one year may not be the best list the following year. This requires rapid project development and timely execution; the Federal Highway Administration has issued guidance on how to achieve compliance with Title 23 and the Code of Federal Regulations and accommodate the timing requirements of preservation treatments (a list of relevant references is available at the bottom of the page.) This very feature makes them excellent stimulus projects: besides constituting best pavement-management practice, they can be initiated, selected, and constructed rapidly.

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<sup>1</sup> <http://www.fhwa.dot.gov/pavement/preservation/091205.cfm> , Federal Highway Administration September 12, 2005 Memorandum, accessed February 9, 2009 on the World Wide Web

<sup>2</sup> Ibid.

<sup>3</sup> <http://www.fhwa.dot.gov/preservation/100804.cfm>, Federal Highway Administration October 8, 2004 Memorandum, accessed February 9, 2008 on the World Wide Web

The following features of pavement-preservation projects allow them to be developed and executed quickly:

1. They require a limited amount of preliminary engineering because they do not substantially alter the characteristics of roadways but rather focus on extending the life of pavements in good condition.
2. In virtually all cases they qualify for a categorical exclusion (in terms of environmental impact). Categorical exclusion means a category of actions which do not individually or cumulatively have a significant effect on the human environment ... and ... for which, therefore, neither an environmental assessment nor an environmental impact statement is required.
3. These projects do not constitute alterations or new highway construction, thus the ADA does not require the upgrading of accessibility requirements.
4. Some safety upgrades can be deferred and put into a programmatic upgrade project for safety.

## **How do I select projects for preservation?**

There are two major criteria for project selection:

- a. Pavement condition – this is related to the central feature of pavement preservation projects: the right project on the right road at the right time. Each pavement treatment has an optimal condition range for applicability.
- b. Safety requirements – this is related to the requirements for FHWA participation. Guidance on safety upgrade requirements is available [here](#) (it is also included as Appendix A at the end of this document). Look for pavement with few or no safety issues as ideal for preservation.

### Agencies with a Pavement Management System

The project-selection process is simplified if your agency has a pavement-management system already in place that is able to select treatments in the preservation category at the appropriate condition levels. In this case, run an analysis of a large budget with only the preservation treatments that you use and use the project list as your starting list, filtering out those roads with an inadequate structural index. Use this list as the basis for your project submittal along with the output of the pavement-management system. If your pavement management system only considers rehabilitation or reconstruction activities, please follow the guidelines for agencies without a Pavement Management System.

### Agencies without a Pavement Management System

For simplicity, look for “ideal” preservation candidates for each treatment in terms of pavement condition. In the broadest terms, ideal preservation candidates are those that are aging but are still in good condition and have a sound structure.

1. Concentrate on those treatments that you are familiar with, that you use on a regular basis, and that are acceptable to the FHWA.
2. Use Table 1 below and the following distress definitions to select good preservation candidates based on condition.
  - a. Focus on the following distress types:

- i. Alligator (fatigue) cracking – this denotes structural distress; alligator cracks are typically longitudinal cracks forming small elongated pieces at: wheelpaths, at the pavement edge, or around cracks in thin pavements.
  - ii. Block (age) cracking – this is an environmental distress; block cracks are cracks forming roughly square blocks (4x4 feet or smaller) throughout the pavement structure (not specifically at the wheelpaths); often, block cracking is followed by alligator (fatigue) cracks in the wheelpaths as the weakened pavement fails under heavier loads.
  - iii. Longitudinal wheelpath cracking – this denotes structural distress; longitudinal cracking in the wheelpaths is the typical way a thicker pavement structure fails under heavy loading (thinner pavements typically exhibit alligator cracking instead).
  - iv. Transverse (full-width) cracking – this is an environmental distress caused by shrinkage of the hot-mix asphalt and thermal expansion and contraction.
  - v. Transverse and Longitudinal (non-wheelpath) cracking – this is typically an environmental distress that eventually can lead to block cracking.
  - vi. Raveling – the loss of aggregate (typically coarse stone) caused by aging, lack of compaction, or material segregation in the mix.
  - vii. Bleeding/flushing – excess asphalt or an unstable mix may push binder to the surface, resulting in a dark, sometimes shiny appearance. Often combines with rutting if the cause is an unstable mix.
  - viii. Rutting – depression of the pavement structure in the wheelpaths. Can be caused either by pavement structural deficiency/inadequate compaction of the granular base, or by mix instability. Rutting that is caused by mix instability may show small ridges around wheelpaths and/or is accompanied by bleeding or flushing.
  - ix. Reflection cracks (composite pavements only) – these cracks form over the joints in underlying concrete slabs in a composite (Portland-cement concrete overlaid with hot-mix asphalt) pavement.
  - x. Roughness – the ride quality of the roadway, typically measured through the International Roughness Index (IRI) and expressed in vertical displacement over a distance (e.g. inches/mile).
  - xi. Patching/deterioration – potholes and/or depressions formed by base failure (or by delamination of the pavement surface in some cases). If caused by base failure, patching/deterioration is a form of structural distress.
3. Then follow the safety review procedures and commit to addressing those issues as required by Title 23 and instructed in FHWA memoranda.

**TABLE 1 – PAVEMENT PRESERVATION PROJECT SELECTION (PAVEMENT CONDITION CRITERIA)**

<b>Treatment</b>	<b>Good preservation candidates (Flexible<sup>4</sup> pavement)</b>	<b>Good preservation candidates (Composite<sup>5</sup> pavement)</b>
<b>Surface Treatments</b> (Slurry, Microsurfacing, Ultra-thin HMA overlay (1 inch or less))	Built, reclaimed, or rehabilitated 7-12 years ago No structural issues (no base failures (rutting or patching/deterioration), no alligator cracking, little or slight wheelpath longitudinal cracking)); Good condition with minor cracking (transverse-crack spacing no more than one full-width crack every 150 feet; non-wheelpath longitudinal-crack lengths no more than 200 feet every 100 feet of roadway); little or no rutting (bleeding, flushing OK); segregation OK, but not severe raveling; Smooth to average roughness (rideability)	Built, reclaimed, or rehabilitated 7-12 years ago No structural issues (no base failures (potholes/patching/deterioration), no alligator cracking outside the underlying concrete slab, little or slight wheelpath longitudinal cracking)) Good condition with single reflection cracks (from the underlying slab joints); little or no rutting (bleeding, flushing OK); segregation OK, but not severe raveling. Smooth to average roughness (rideability)
<b>Crack Sealing</b> (hot-applied)	Roads built, surfaced, reclaimed, or rehabilitated 3-9 years ago; No more than 500 feet of cracks between ¼” and ¾” in width per 100 feet of roadway, curb to curb	Roads built, surfaced, reclaimed, or rehabilitated 3-9 years ago; Single reflection cracks with no more than 10% multiple reflection cracks at the underlying slab joints. (No condition on rutting, bleeding, flushing, raveling, or segregation)
<b>Thin HMA Overlay</b> (more than 1 inch up to 2 inches)	No structural issues (no base failures (rutting or patching/deterioration), no alligator cracking, little wheelpath longitudinal cracking)) Good condition with minor cracking (transverse-crack spacing no more than one full-width crack every 150 feet; non-wheelpath longitudinal-crack lengths no more than 300 feet every 100 feet of roadway); little or no rutting (bleeding, flushing OK). Block cracking OK up to 10% of	No structural issues (no base failures (rutting or patching/deterioration), no alligator cracking, little wheelpath longitudinal cracking)) Good condition with minor cracking (transverse-crack spacing no more than one full-width crack every 150 feet; non-wheelpath longitudinal-crack lengths no more than 300 feet every 100 feet of roadway); little or no rutting

<sup>4</sup> Full-depth hot-mix asphalt pavements.

<sup>5</sup> Pavements consisting of Portland-Cement Concrete pavement overlaid with hot-mix asphalt.

Treatment	Good preservation candidates (Flexible <sup>4</sup> pavement)	Good preservation candidates (Composite <sup>5</sup> pavement)
	surface if low severity. Smooth to fair roughness (rideability)	(bleeding, flushing OK). Block cracking OK up to 10% of surface if low severity. Smooth to fair roughness (rideability).
<b>Mill-and-Fill With HMA</b> (1.5-2 inches)	No structural issues (no base failures (rutting or patching/deterioration), no alligator cracking, little wheelpath longitudinal cracking)) Good condition with minor cracking (transverse-crack spacing no more than one full-width crack every 150 feet; non-wheelpath longitudinal-crack lengths no more than 300 feet every 100 feet of roadway) Rutting OK if due to soft mix and not base failure. Block cracking OK up to 10% of surface if low severity. Raveling or pitting OK since top lift is to be removed and replaced. Smooth to mediocre roughness (rideability)	No structural issues (no base failures (potholes/patching/deterioration), no alligator cracking outside the underlying concrete slab, no wheelpath longitudinal cracking)) Good condition with single reflection cracks (from the underlying slab joints); rutting is OK if due to soft mix and not base failure; segregation, raveling, bleeding, and/or flushing are OK. Smooth to mediocre roughness (rideability).

**NOTE:** *Isolated patching/deterioration and alligator cracking areas due to base failure should be fixed with full-depth patching including base repair; if this is an isolated occurrence and is repaired, a preservation treatment can be placed. Potholes formed by delamination or severe segregation/raveling can be fixed by milling the surface layer and patching the milled area; if this is an isolated occurrence and is repaired, a preservation treatment can be placed.*

### **How do I prioritize projects for pavement preservation?**

Use objective criteria in prioritizing your projects. In general, the most life extension is achieved on the oldest pavements in best condition (also, more benefit to users is accrued on more heavily-traveled roadways); thus, an acceptable prioritization scheme would be to sort out projects by year (oldest first) and then, within each year, by condition (from best to worst). However, regardless of the exact set of criteria, aim for maximum impact of the treatment in prioritizing your list and, most of all, have a set of objective criteria.

### **What do I do after the stimulus funding is completed?**

Pavement preservation is good pavement-management practice. Track the performance of the preserved pavements and observe the conditions under which they worked best. Then incorporate other treatments as they become available and share your practices and findings with other peer agencies.

If you have additional questions, please contact:

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## **PAVEMENT PRESERVATION RESOURCES**

**FHWA**

Memorandum on Pavement Preservation

<http://www.fhwa.dot.gov/pavement/preservation/091205.cfm>

Memorandum on Preventive Maintenance Eligibility

<http://www.fhwa.dot.gov/preservation/100804.cfm>

Memorandum on Accessibility

[http://www.fhwa.dot.gov/civilrights/ada\\_memo\\_clarificationa.htm](http://www.fhwa.dot.gov/civilrights/ada_memo_clarificationa.htm)

Pavement Preservation Fact Sheet

[http://www.fhwa.dot.gov/resourcecenter/teams/pavement/pave\\_4PPC.pdf](http://www.fhwa.dot.gov/resourcecenter/teams/pavement/pave_4PPC.pdf)

Pavement Preservation Checklist Series

<http://www.fhwa.dot.gov/pavement/preservation/ppcl00.cfm>

A Quick Check of Your Highway Network Health

<http://www.fhwa.dot.gov/pavement/preservation/if07006.pdf>

General Pavement Preservation Information

<http://www.fhwa.dot.gov/pavement/pres.cfm>

**National Center for Pavement Preservation**

<http://www.pavementpreservation.org>

**Foundation for Pavement Preservation**

<http://www.fp2.org>

# APPENDIX A

## PAVEMENT PRESERVATION FHWA SAFETY GUIDANCE 4/29/2008

### 1. BACKGROUND:

Preventive Maintenance is “a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).” Source: AASHTO Standing Committee on Highways, 1997. It should be applied to pavements in good condition having significant remaining service life.

Preventive maintenance activities are a key component of a strong Pavement Preservation Program. It is FHWA, Connecticut Division’s goal to assist the Connecticut Department of Transportation (ConnDOT) in the development and implementation of an effective pavement preservation program as much as possible.

As part of our Stewardship Plan and Letter of Agreement between ConnDOT and the FHWA Connecticut Division Office dated 25 October, 2007, a list of Preventive Roadway Maintenance items were included that meet the FHWA requirements for promoting system preservation to include Crack Sealing, Chip Sealing, Ultra-Thin HMA Overlays (Novachip) and thin HMA Overlays.

All preventive maintenance projects should consider appropriate ways to maintain or enhance the current level of safety and accessibility. Isolated or obvious deficiencies should always be addressed. However, to maintain preservation program flexibility, and in accordance with U.S.C 109(q), safety enhancements can be deferred and included within an operative safety management system or included in a future project in the STIP. Source: FHWA Memorandum entitled “Preventive Maintenance Eligibility,” dated October 8, 2004 Further, since maintenance activities are not considered alterations to existing highway facilities, simultaneous improvement to pedestrian accessibility under the Americans and Disabilities Act of 1990 and Section 404 of the Rehabilitation Act of 1973 are not required. Source: FHWA Memorandum entitled “Clarification of FHWA’s Oversight Role in Accessibility,” dated September 12, 2006

### 2. PURPOSE:

The purpose of this memorandum is to provide FHWA, Connecticut Division Office guidance to ConnDOT’s Pavement Preservation program to ensure highway safety is in no way degraded and safety maintenance and enhancements are considered for incorporation into each Pavement Preservation project.

### 3. GENERAL:

Pavement preservation activities generally do not require safety enhancements incorporated into the project. They should however address isolated or obvious deficiencies and in no way degrade

highway safety. Existing safety related items negatively impacted by the pavement preservation activity should be restored. Pavement markings for example if impacted during the construction process should be restored as part of the pavement preservation project. Safety enhancements can be deferred and included within an operative safety management system or included in a future project in the STIP. Adequate maintenance and protection of traffic is required during construction.

#### 4. REQUIREMENTS:

After a preliminary project candidate list of Pavement Preservation Projects has been prepared, each pavement preservation project shall include a project review for the purpose of deciding upon safety work to be implemented before, at the time of, or deferred to a later date after the pavement preservation project is completed.

The safety review must be completed by a team and should include Department personnel (Design, Maintenance, etc.) involved in the safety aspects of the project. The FHWA Division Office should also be invited to participate in this safety review.

Decisions regarding the disposition of the team recommendations for work that is practical and necessary to address existing or potentially safety problems shall reside with the Department. The Department shall also be responsible for implementing and/or programming the safety work accordingly.

Each pavement preservation project shall include safety review recommendations and disposition of recommendations as part of the Request for Design Approval.

#### 5. GENERAL GUIDANCE:

Milling may be performed for the traveled way or traveled way and full depth shoulders to maintain the existing surface elevation. Reasons for milling include: maintaining vertical clearances, maintaining proper barrier heights, maintaining curb height for drainage, and most importantly, so as to maximize our existing investment in pavement layers that are in good condition and do not warrant removal.

Overlays must extend the full width of the paved roadway (travel lanes & paved shoulders) unless the edge of drop offs is less than ½-inch, or milling is performed as noted above and the paved shoulders, if any, are in satisfactory condition.

Ideally, the safety work should be done before or immediately following the paving work in order to minimize the public's exposure to existing or potentially safety problems. However, scheduling the work requires consideration of:

- the need to mitigate accident problems,
- the potential for future accidents,
- the extent and complexity and staging of the work involved,
- impacts of winter shutdowns,
- contractor or State force availability.

While the list of safety work below contains general time frames, the most critical safety needs should be addressed earlier. Additionally, safety work, such as brush removal, etc. may be completed before the paving operation, as appropriate.

Note that the implementation of safety work items identified by the team and approved by the Department are to be programmed and/or scheduled and reported accordingly. The work may be accomplished as part of the pavement preservation contract, separate contract(s), or by State maintenance force.

Roadway work done by State-forces is presently not eligible for federal-aid.

Examples to be done before the paving contract, as required

- Replace missing or damaged regulatory or warning signs.
- Repairing damaged existing guide rail.

Examples to be done during the paving preservation project, as required

- Pavement markings (if existing markings are degraded as a result of the preservation treatment).
- Rumble Strips (if existing rumble strips exist and are seriously degraded as a result of the preservation treatment).
- Reset guide rail that are at an improper height.

Examples of Safety Enhancements to be done in a timely manner following the completion of the project

- Rumble Strips
- Mitigation of edge drop offs
- Addition of paved shoulders
- Shoulder resurfacing
- Additional / updated regulatory, advisory and warning signs not addressed above
- Brush removal, clearing and grubbing
- Fixed objects: remove, modify, relocate, delineate, or protect by guide rail.
- Guide rail:
  - Replace severely deteriorated and non-functional guide rail.
  - Replace severely substandard guide rail and connections to bridge rail (e.g., concrete post/cable or railroad rail post/cable).
- Delineation (e.g., reflectors on u-posts).