TECHBRIEF

Comparison of Rehabilitation Strategies for AC Pavements

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Background

A key objective of the Long Term Pavement Performance (LTPP) program is to develop improved design methodologies and strategies for the rehabilitation of existing pavements. One of the experiments designed to address this objective is Specific Pavement Study (SPS) 5.

The SPS-5 experiment, "Study of Rehabilitation of Asphalt Concrete Pavements," has 17 projects. Each project has nine test sections. The nine test sections consist of one control section (no rehabilitation applied to the surface) and eight test sections with different combinations of the following strategies:

- Thin (51-mm) and thick (127-mm) overlays.
- Virgin and recycled mixtures used for the overlay.
- Milled and non-milled surfaces prior to overlay placement.

This TechBrief summarizes the results of a study of the SPS-5 experiment entitled, "Performance of Rehabilitated Asphalt Concrete Pavements in the LTPP Experiments—Data Collected Through February 1997." The study documents performance trends of the 17 SPS-5 projects using distress data collected through February 1997. The age of these SPS-5 projects vary from 0.1 to 6.1 years, but most are less than 4 years old.

Distresses Considered in the Study

Six distress types or performance indicators were used in the study to evaluate the performance trends of the LTPP SPS-5 test sections. These distress types include fatigue cracking, longitudinal cracking in the wheelpath, longitudinal cracking not in the wheelpath, transverse cracking, rutting, and roughness (as measured by the International Roughness Index [IRI]). The area or extent of the distress was divided into different categories for relative comparison. The different levels of distress used in the study are defined in table 1 on the following page.

The Long Term Pavement Performance (LTPP) program is a 20-year study of in-service pavements across North America. Its goal is to extend the life of highway pavements through various designs of new and rehabilitated pavement structures, using different materials and under different loads, environments, subgrade soil, and maintenance practices. LTPP was established under the Strategic Highway Research Program, and is now managed by the Federal Highway Administration.

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Table 1. Magnitude of distress for each category.

Distress Type	Nominal	Moderate	Excessive
Fatigue cracking, m^2	1 - 10	11 - 60	> 60
Longitudinal cracking in the wheelpath, m	1 - 50	51 - 160	> 160
Longitudinal cracking not in the wheelpath, m	1 - 50	51 - 160	> 160
Transverse cracks, no.	1 - 10	11 - 50	> 50
Rutting, mm	< 7	7 - 20	> 20
Roughness (IRI), m/km	< 1.6	1.6 - 2.4	> 2.4

Table 2 shows that more than half of the SPS-5 test sections had no fatigue cracking, longitudinal cracking in the wheelpath, or longitudinal cracking not in the wheelpath, and only a small percentage had exceeded the nominal levels of distress.

Table 3 provides the results from a comparison of the performance of overlaid test sections with thin and thick overlays, virgin or recycled overlay mixes, and milled and unmilled test sections. However, these are preliminary results and continued monitoring and materials data are needed to achieve the objectives of the experiment.

The following is a summary of observations regarding each treatment type:

Hot-Mix Asphalt (HMA) Overlay Thickness

- As expected, the nominal 127-mm overlays have less fatigue cracking, and fewer transverse cracks and longitudinal cracking outside the wheelpaths than the nomi-

Table 2. Percentages of SPS-5 test sections with none, nominal, or greater than nominal levels of distress for AC overlays 2 years of age or older.

Distress Type	Levels of Distress			
	None, %	Nominal, %	Greater Than Nominal, %	
			Moderate	Excessive
Fatigue cracking	85	10	5	0
Longitudinal cracking in wheelpaths	58	27	8	7
Transverse cracking	58	30	12	0
Longitudinal cracking not in wheelpaths	54	19	18	9
Rutting	n/a*	84	16	0
Roughness	n/a	93	7	0

**n/a = not applicable*

nal 52-mm overlays, although there were exceptions. The average area of fatigue cracking that occurred on those test sections with a thin overlay is 10.2 m^2 and only 4.1 m^2 for those with a thick overlay.

- The thicker overlays consistently have less longitudinal cracking not in the wheelpath, as well as a lower incidence of this type of cracking.
- Overlay thickness did not appear to have a strong effect on the occurrence of longitudinal cracking in the wheelpath and rutting, and there was no apparent effect on roughness based on these early observations.

Milling With Overlays

- In general, it is believed that if you mill off damaged asphalt concrete (AC) material and replace it with new AC material, the overlay will last longer than if you left the damaged material in place. The initial performance trends from the SPS-5 projects, however, appear to contradict this hypothesis. Currently, certain materials data for these test sections are not available. Review of this data, when available, may provide insight into this apparent contradiction.
- The test sections that were milled prior to the overlays generally performed better than the unmilled test sections for transverse cracking, but they seemed to have little or no advantage in resisting both types of longitudinal cracking, fatigue cracking, rutting, or roughness (over the early life of the overlay).
- The data consistently show fewer transverse cracks on milled surfaces, compared to unmilled surfaces, prior to overlay placement. This seems logical because removal of the top material from the original AC layer should reduce the effects of the cracks in the original pavement on the overlay, while replacement of the milled materials in effect increases the thickness of the uncracked new material over the original pavement. This difference in the number of transverse cracks, however, does not represent a significant difference.
- The data show that milling offers no consistent advantage for resisting longitudinal cracking not in the wheelpath during the early life of an overlay. For half of the projects, the milled test sec-

Table 3. Summary of the results from the SPS-5 data.

Distress Type	Factor: Overlay Thickness Increasing	Factor: Milling Surface	Factor: Recycled Mix
Fatigue cracking	Less	Less	No advantage over virgin
Longitudinal cracking in wheelpaths	No advantage	No advantage	More
Transverse cracking	Less	Less	No advantage over virgin
Longitudinal cracking not in wheelpaths	No advantage	No advantage	Less
Rutting	No advantage	No advantage	No advantage over virgin
Roughness	No advantage	No advantage	No advantage over virgin

tions performed better than the unmilled test sections, while the reverse was true for the other half of the projects. The only conclusion that can be drawn at this time with respect to milling versus non-milling is that milling apparently had little effect in the short run.

Overlay Mixture Type—With and Without Recycled Asphalt Pavement

- The effect of mix type (virgin versus recycled) for the overlays seemed to be important only for the two types of longitudinal cracking (longitudinal cracking in the wheelpath and longitudinal cracking not in the wheelpath). However, the results contradict one another as shown in table 3. The test sections with recycled mixes had more longitudinal cracking in the wheelpath than the test sections with virgin mixes, while the test sections with virgin mixes had more longitudinal cracking not in the wheelpath than the sections with recycled mixes.

- It is generally believed that mixtures with recycled asphalt pavement are stiffer (higher moduli), but are no more or less susceptible to repeated load fracture than those mixtures without recycled asphalt pavement. The initial performance trends from the SPS-5 projects are in line with this hypothesis.

- There is no benefit or advantage derived from using one mix type over the other (virgin versus recycled mixes) in reducing the number of transverse cracks.

- The recycled AC mixes resisted longitudinal cracking not in the wheelpath substantially better than the virgin mixes for five of the six projects, with the overall average amount of longitudinal cracking not in the wheelpath being only 40 percent of that for the virgin mixes.

Researcher—This study was performed by Fugro-BRE, 8240 MoPac Expressway, Suite 220, Austin, TX 78759, telephone: (512) 346-0870, fax: (512) 346-8750. Contract No. DTFH61-96-C-00003.

Distribution—This TechBrief is being distributed according to a standard distribution. Direct distribution is being made to the Resource Centers and Divisions.

Availability—This TechBrief is based on *Performance of Rehabilitated Asphalt Concrete Pavements in the LTPP Experiments—Data Collected Through February 1997* (Report No. FHWA-RD-00-029). Copies will be available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A limited number of copies will be available from the R&T Report Center, HRD-11, FHWA, 9701 Philadelphia Court, Unit Q, Lanham, MD 20706, telephone: (301) 577-0818, fax: (301) 577-1421.

Key Words—Asphalt concrete pavements, rehabilitation, and asphalt concrete overlays.