Reducing Roughness in Rehabilitated Asphalt Concrete (AC) Pavements

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Introduction

How much do different rehabilitation treatments reduce roughness? The answer to this question can be found in a recently completed study entitled, “The Investigation of Development of Pavement Roughness.” Initiated by the Long Term Pavement Performance (LTPP) program, a component of this study investigates selected asphalt concrete (AC) rehabilitation treatment factors in reducing roughness. Specific factors considered include: overlay mix type (recycled and virgin), overlay thickness, and surface preparation of the existing AC surface prior to overlay (minimal and intensive preparation).

Key Findings

• Regardless of the roughness before overlay, the roughness for each test section at a site after the overlay fell within a relatively narrow band. The range of this band varied from project to project.

• Even thin overlays substantially reduced the roughness of a pavement.

• 85 percent of the sections that received either a 50-mm or 125-mm AC overlay had an International Roughness Index (IRI) of less than 1.2 m/km.

Roughness Before and After Overlay

Figure 1 (on the following page) shows the roughness before and after rehabilitation for four Special Pavement Study (SPS)-5 projects. As you will note, regardless of the roughness before the overlay of a section, the roughness after the overlay for all treatments fell within a narrow band, which varied from project to project. Factors that could determine the range of this band include construction procedures, contractor capabil-
Figure 1. IRI before and after overlay for four SPS-5 projects.
ity, and the predominant wave-
lenghts that contribute to rough-
ness and are present in the pave-
ment prior to overlay.

A comparison of the roughness 
after overlay for the test sections 
that received minimum and inten-
sive surface preparation prior to 
overlay is shown in figure 2. The 
roughness values presented in this 
figure for each category of surface 
preparation is the average rough-
ness computed from four test sec-
tions that are in each category. 
Overall, the average IRI values for 
the minimum and intensive surface 
preparation sections were close to 
each other, with the intensive sur-
face preparation sections having a 
slightly lower IRI value for a major-
ity of the sections.

Figure 3 shows the relationship 
between roughness before and af-
after overlay for all sections. The 
sections that have an IRI before over-
lay of less than 1.4 m/km are from 
two projects. If the sections in these 
two projects are not considered, 
and only the sections that have an 
IRI greater than 1.4 m/km before 
overlay are considered, data in fig-
ure 3 show that there is no relation-
ship between the IRI before and 
after the overlay. Thin overlays are 
seen to be capable of reducing the 
roughness of a pavement by a sub-
stantial amount in some cases. For 
example, figure 3 shows that in 
three sections that had IRI between 
2.5 and 3 m/km, a 50-mm-thick 
overlay reduced the IRI to approxi-
mately 0.8 m/km.

**Roughness After Overlay**

A frequency distribution of the IRI 
after overlay for the test sections

![Figure 2. Average IRI after overlay for sections receiving minimum and intensive surface preparation prior to overlay.](image)

![Figure 3. IRI before and after overlay.](image)

![Figure 4. Frequency distribution of IRI after overlay for sections that received a 50-mm overlay.](image)
that received a 50-mm overlay are shown in figure 4. This figure also presents the cumulative frequency curve, and shows that approximately 55 percent of the test sections had an IRI value of less than 1 m/km, while 85 percent of the test sections had an IRI value of less than 1.2 m/km.

A frequency distribution of the IRI after overlay of the test sections that received a 125-mm overlay is shown in figure 5. The frequency distribution curve in this figure shows that approximately 65 percent of the test sections had an IRI after overlay of less than 1 m/km, while 85 percent of the test sections had an IRI after overlay of less than 1.2 m/km. These data indicate that in 85 percent of the cases the IRI of an overlaid pavement would be less than 1.2 m/km.

Summary

In general, overlays reduce pavement roughness. When specific rehabilitated SPS-5 project test sections were analyzed, roughness values fell within a relatively narrow band, regardless of the treatment type. The range of this band varied from project to project. Factors that are expected to influence the roughness value of an overlaid section include: profile of the pavement prior to overlay, the predominant wave lengths in the section that contribute to roughness, and the capability of the contractor placing the overlay.

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Availability: Copies of Report No. FHWA-RD-97-147, Investigation of Development of Pavement Roughness, are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A limited number of copies are 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 pavement, overlays, pavement roughness.

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