CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

5-9046-01: Evaluation of the Benefits of Diamond Grinding of CRC Pavements

Background

The Fort Worth District recently funded the first continuously reinforced concrete pavement (CRCP) rehabilitation project using the diamond grinding technique on a 20- to 40-year-old 8.5-mile stretch of IH35W. The primary objective of this rehabilitation was to improve the friction characteristics of the old pavement. The urban location and relatively lower budget available motivated the selection of diamond grinding over the conventional thin asphalt overlay for rehabilitation of this facility. Based on the Texas Department of Transportation's (TxDOT's) experience, the cost of resurfacing with diamond grinding is approximately less than half the estimated cost of an asphalt overlay. TxDOT reportedly saved approximately $3 million by using diamond grinding instead of constructing an asphalt overlay.

What the Researchers Did

Extensive field testing was conducted prior to the diamond grinding to establish reference levels for comparison:

- Surface macrotexture was measured using the circular texture meter (CTM) and sand patch methods.
- Skid was measured using the dynamic friction tester and TxDOT's locked wheel skid trailers.
- Roughness was measured in terms of the International Roughness Index as measured by TxDOT.
- Noise testing was conducted using the onboard sound intensity method and standard reference test tires.

After grinding, the macrotexture, skid, roughness, and noise testing of the surface was repeated after 4, 9, and 15 months to evaluate the effectiveness and efficiency of this rehabilitation strategy. Statistical analyses of the data collected were conducted to investigate the change in surface properties with diamond grinding and how the surface's macrotexture, skid, roughness, and noise changed over time. The influence of traffic load and speed on the deterioration of the diamond-ground surface was also investigated. In addition, preliminary cost analyses were performed, comparing the costs of diamond grinding to asphalt overlays.

What They Found

A relatively strong correlation was evident between CTM and sand patch measurements of the diamond-ground surface. Diamond grinding significantly increased the macrotexture and skid resistance of the aged CRCP and significantly reduced its roughness and noise. The study provides adequate statistical evidence for concluding that the grinding operation produced a relatively uniform surface in terms of macrotexture, skid, roughness, and noise levels despite the variation in pre-existing conditions across the CRCP. The deterioration of the diamond-ground surface was observed to be different for each of the four measured surface properties. A significant reduction in surface macrotexture and skid resistance was observed in the 15 months following the diamond grinding. Over this period, noise levels

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appear to have returned to the pre-grinding levels. No change in surface roughness was observed.

It was found that four site-specific features controlled the deterioration of the diamond-ground surface in terms of the monitored surface properties. First, based on the model estimates, the type of pre-texturing the section had prior to the grinding operation did not appear to have influenced the deterioration of essential surface properties monitored as part of the study. Second, slower and heavier traffic accelerated the deterioration of macrotexture, skid resistance, and pavement noise abatement. Third, according to observed data, the direction of the traffic appears to influence macrotexture and skid resistance, although the reason for this is unclear. Fourth, more rapid deterioration was observed in the right wheel path, in terms of both macrotexture and surface roughness.

In summary, the study provides statistical evidence that the diamond-ground surface did deteriorate in terms of macrotexture, skid resistance, roughness, and noise after 15 months in service—but additional measurements and monitoring of the sections over time are recommended to better model this deterioration toward establishing the long-term benefits of diamond grinding. This uncertainty is emphasized in Figure 1, which shows the monitored skid resistance over time and extrapolates this trend to provide a conservative estimate of service life for the diamond-grinding strategy before the skid returns to pre-grinding levels.

What This Means

The diamond-ground section on IH35W near Fort Forth is currently 15 months old. With no clear indication of its estimated service life, no accurate assessment of the cost-effectiveness of this strategy can currently be made. Preliminary evidence (based on a life-cycle cost analysis comparing diamond grinding to an asphalt overlay) suggests that the effects of diamond grinding must last as long as 3 years to break even with the cost of an asphalt overlay over an analysis period of 15 years. It is strongly recommended that monitoring of the diamond-ground sections continue to better evaluate the effectiveness and efficiency of this strategy.

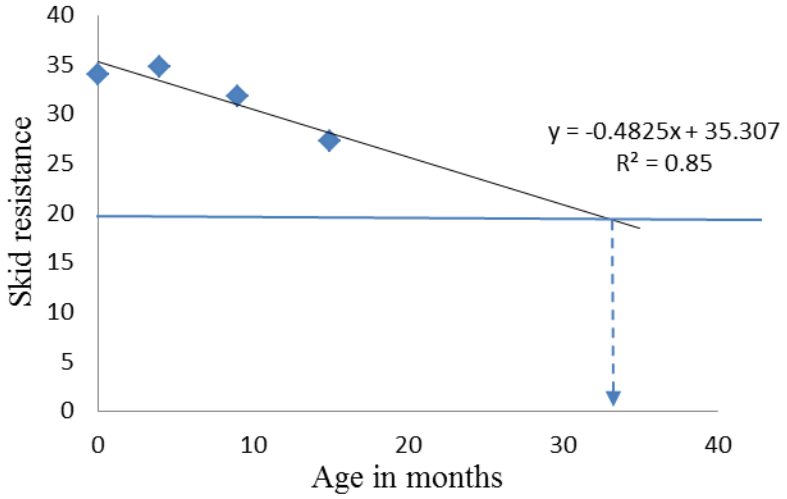

Figure 1. Monitored Skid Resistance over Time.

For More Information

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