THIN MILL & OVERLAY USING SOFT BINDER (MNROAD CELL 1)

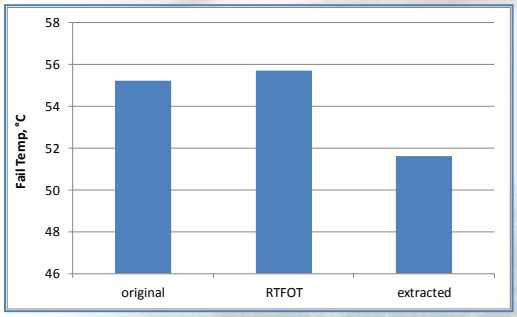
Introduction

Sometimes we learn our most valuable lessons at MnROAD by stretching the limits of what is normally done out in our districts. Such was the case back in 2006 when we repaired a badly damaged mainline test section with a thin mill and overlay. This practice was not unusual, but the materials we used to repair an Interstate pavement sure were.

Cell 1 was in particularly poor condition, primarily in the driving (right) lane. Transverse and top down cracking, rutting, and ride quality were all approaching levels that require extensive repair. A dense array of instrumentation was placed in the right wheel path a small area during initial construction in 1993. The pavement was significantly weakened around these sensors and was becoming badly damaged by traffic, as shown in the photo above.

It was decided that a thin 1.5" mill and overlay was the proper fix to eliminate the cracks in the driving lane and restore ride quality for the driving public. Conveniently enough, we were reconstructing two cells on the Low Volume Road. Unfortunately, the asphalt mixture that was specified was designed for a low volume road, not Interstate traffic.

Asphalt Binder and Mixture Properties

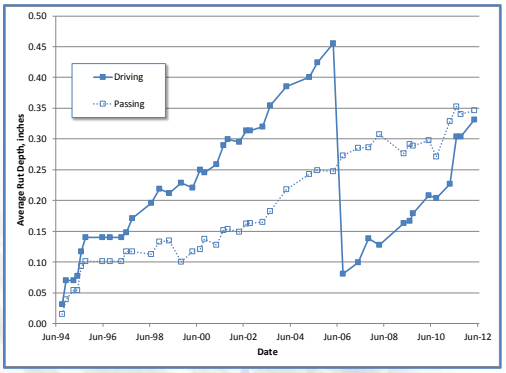


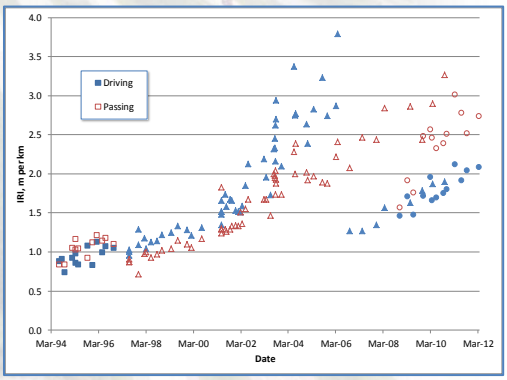
The mixture that was specified for the project was a Level 3 Superpave mixture, which is a low volume mix intended for 1-3 million Equivalent Single Axle Loads (ESALs). The asphalt binder was a PG 52-34, which because of its low stiffness should resist cracking but potentially be susceptible to rutting. The figure to the left shows laboratory test results of the asphalt binder. The original and RTFO conditions sampled during paving met the PG 52 high temperature specification, but in fact the binder extracted from loose mix behind the paver was even softer than a PG 52. In addition, no recycled asphalt pavement (RAP) was allowed in the mix, so no added stiffness was apparent. The table at the left shows the volumetric properties of the mixture sampled behind the paver. Laboratory performance tests were also performed on the mixture for rutting and reflective cracking. The Asphalt Pavement Analyzer (APA) rut test showed failure of 10 mm rutting after only 2000 cycles. However, the Texas Overlay Tester measured very good cracking performance of about 900 cycles to failure.

Property	Result
Lab Voids, %	4.9
VMA, %	16.5
Asphalt Content, %	5.8
Fine Aggregate Angularity, %	41.0
Field Voids, %	7.1

Pavement Field Performance

Since the mill and overlay was placed in 2006, Cell 1 has seen approximately 3 million ESALS. This is the upper limit of what the asphalt mixture was designed for. The encouraging news is that the pavement has held up very well considering the low volume mixture. The rut depth has increased some since it was paved, but at 0.35" is less than it was before the overlay and is well below the threshold of requireing maintenance. The ride quality was significantly improved with the overlay and continues to ride relatively smoothly. In terms of cracking, the total length of cracks (transverse, top down, and centerline) now is about the same as it was before the overlay. However, the current cracks are all low severity, while before the overlay the cracks were almost exclusively medium and high severity. The soft binder, while not eliminating reflective cracking, has managed to minimize deterioration of the cracks.





Total Length of Cracking, ft			
Year	**Transverse**	**Top Down**	**Centerline Joint**
2006	209	850	376
2012	215	927	122

Summary

To summarize, MnROAD took a risk by placing an asphalt mixture in an application where it had no business of being. The combination of very soft asphalt binder, no RAP, and low volume road mix design should have failed miserably in rutting under Interstate traffic. The fact that the pavement is still performing very well has taught us something about what performance requirements we really need out of our asphalt mixtures. This experience indicated that if the aggregate structure is properly designed to carry heavy traffic loads and the asphalt binder is properly selected to resist cracking, the proper balance of high and low temperature performance can be realized.

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