Research Brief

Wisconsin Highway Research Program
Project 0092-17-06
August 2019

Tracking Performance of Tack Coat Materials

Research Objectives

- Evaluate the performance of various tack coat materials, techniques and technologies
- Determine best practices to prevent tracking and increase interlayer shear strength

Research Benefits

- Affirmed the primary cause of tracking: high pavement temperature during curing
- Developed a chart of tracking, transition and tracking zones for different emulsion types to help determine when each should be used
- Recommended revisions to specifications to reduce tracking and improve interlayer shear strength

Principal Investigator

Hussain Bahia
University of Wisconsin - Madison
bahia@engr.wisc.edu

Project Manager

Steve Hefel
WisDOT
steven.hefel@dot.wi.gov

Background

Tack coat is a bituminous material used to bond layers of pavement to ensure they act as a monolithic layer under loading. Tack is sprayed over an existing layer of pavement, and the new pavement layer is laid on top of it. Insufficient tack causes layer slippage and bottom-up cracking, but too much tack yields low strength shear planes; therefore, it is critical to ensure tack is applied uniformly at the proper rate. Even if laid properly, tack can be compromised by tracking, incidental pickup of the coating by vehicle tires during construction of the overlying pavement. Tracking creates non-uniform distribution of tack and can lead to bond failure and raveling of the new pavement. The objectives of this project were to evaluate the performance of different tack coat materials, techniques, practices and technologies and determine optimum application rates and curing times to prevent tracking.

Vehicle tires track tack coat during pavement construction

Methodology

Six emulsions with varying residual asphalt properties (including a commercially available “trackless” material) were subjected to asphalt emulsion curing time; residue resistance to tracking; and interlayer shear strength (ISS) tests in the lab. The research team examined the effects of existing surface texture, application rate, dilution rate, curing temperature, curing humidity and bond strength.

Field materials and cores from five active paving projects representing nine combinations of existing surface condition, tack coat type and residual application rate were tested to validate current specifications and the use of the ISS tester in the laboratory to predict field performance.

"Understanding the tracking and bonding properties of the various tack coat products is important to assure the best performance of our HMA pavements."
– Steve Hefel, WisDOT

Interested in finding out more?

Final report is available at:
WisDOT Research website

Results

Two distinct types of tracking were identified: complete pickup and incomplete pickup. The type and severity of tracking is determined by cohesion of the tack, adhesion of the tack to tires and adhesion of the tack to underlying pavement layers. Pavement temperature during curing has the most significant impact on tracking, and each emulsion type has a critical curing temperature at which tracking commences and shear strength is reduced, in some cases by more than 50 percent. Little or no relationship was found between tracking and strength of pull off test, curing time, curing humidity or application rates.

There were large variances between field and lab ISS tests. The effect of compaction method (lab vs field) was inconsistent, but statistically significant for nine of 12 combinations. The effect of surface type is pronounced; milled samples exhibited lower ISS relative to the new surfaces. All materials specified and commonly used in Wisconsin exhibited similar drying rates and did not result in significantly different ISS values.

Recommendations for Implementation

Choice of emulsion should be based on ability to achieve coverage, propensity to track and bond strength development. The research team created a chart of transition and tracking zones for different emulsion types to help determine when each should be used. Recommended revisions to WisDOT's Standard Specifications, Construction Materials Manual, and Facilities Development Manual to reduce tracking, include:

- Ensure the surface is clean before applying tack coat
- Allow light pre-wetting to aid in tack uniformity
- Apply no less tack than required to achieve uniform coverage: a suggested initial application rate is 0.05 gallons per square yard (gal/SY) on new surfaces and 0.07 gal/SY on older or milled surfaces
- Use hard-base emulsions during all seasons; these emulsions will still track in summer months or during periods of higher pavement temperature
- Allow tack coat to dry before paving

Based on the results of this research, WisDOT has already increased application rates to ensure uniform coverage and now allows non-slow-setting emulsion products.

This brief summarizes Project 0092-17-06,
"Investigation of Tack Coat Materials on Tracking Performance"
Wisconsin Highway Research Program