Recalibration of the Asphalt Layer Coefficient

RESEARCH SYNOPSIS 09-03

National Center for Asphalt Technology
NCAT
at AUBURN UNIVERSITY

Background

Although many highway agencies are exploring the use of new mechanistic-empirical pavement design methods, many currently still use the pavement design guide based on the AASHO Road Test in Ottawa, Illinois, from 1958 to 1960. This test established an empirical relationship between traffic loading and pavement thickness. One of the key inputs to this method is the layer coefficient for the hot mix asphalt (HMA) layers. This HMA layer coefficient has not been updated in more than 50 years despite numerous improvements in mix design methods, quality control and construction of HMA.

Objective

The primary objective of this study was to recalibrate the asphalt layer coefficient based on current paving materials and construction using data collected at the NCAT Test Track accelerated pavement testing facility (Figure 1).

Figure 1. NCAT test track

Description of Study

In the first phase of the study, a sensitivity analysis was performed to determine the influence of design inputs on the resulting HMA thickness. A total of 5,120 design iterations were conducted as the inputs were varied. Analysis of these data showed that the layer coefficient was the most influential parameter on the resulting HMA thickness.

The second phase of the study involved recalibrating the asphalt layer coefficient using traffic and performance data from the structural sections of the 2003 and 2006 NCAT Test Track. Using the 1993 AASHTO Design Guide flexible pavement design equation, the predicted amounts of traffic in equivalent single axle loads (ESALs) were calculated to reach given levels of pavement serviceability. The predicted ESALs were compared to actual traffic on the sections. Least squares regression was performed to determine new asphalt layer coefficients for each section.

Key Findings

Figure 2 shows the computed layer coefficients for each section individually, as well as the average HMA layer coefficient of 0.54. Two test sections resulted in layer coefficients lower than the AASHTO recommended value of 0.44; however, forensic investigations showed that both sections had poor bonds between asphalt layers. No trends were observed relative to overall pavement cross-section, HMA layer thickness or binder grade.

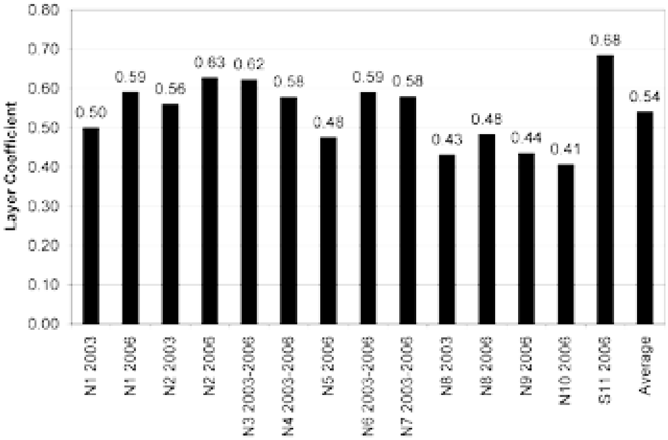

Figure 2. Computed layer coefficients for NCAT Test Track structural sections

The relationship between HMA layer coefficient and HMA modulus at 68°F is given graphically in the 1993 AASHTO Design Guide. This relationship can be modeled using a natural logarithmic function, allowing extrapolation for higher modulus values. When using the average HMA modulus value (backcalculated using falling weight deflectometer data) for the structural sections of the 2003 NCAT Test Track, this extrapolation yielded a corresponding layer coefficient of 0.543, which serves as additional validation of the 0.54 value in Figure 2.

Recommendations for Implementation

This study recommends an asphalt layer coefficient of 0.54 for flexible pavement designs using the AASHTO Design Guide. Increasing the coefficient will result in approximately 18 percent thinner HMA cross-sections. This translates directly into annual cost savings and/or more efficient use of HMA material to pave more highway mileage.

Care should be exercised when applying this coefficient in other states, as the recommended layer coefficient is based on the environmental conditions and materials used in this study.

For the Full Report, see NCAT Report 09 - 03 at www. N C AT. us

Acknowledgements and Disclaimer

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