Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Updated Analysis of Michigan Traffic Inputs for Pavement-ME Design

START DATE: October 2016

REPORT DATE: August 2018

RESEARCH REPORT NUMBER: SPR-1678

TOTAL COST: $253,563

COST SHARING: 20% MDOT, 80% FHWA through the SPR, Part II, Program

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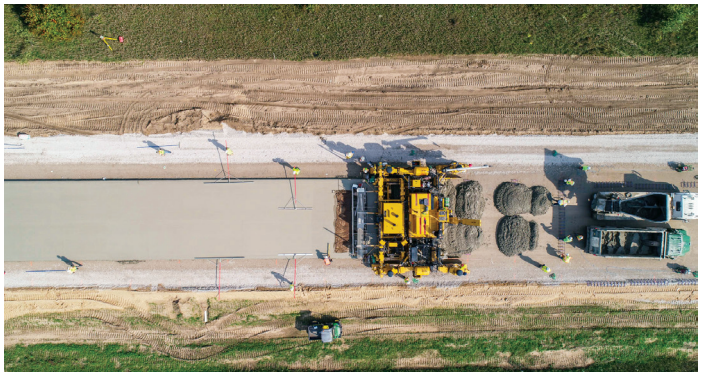
Improving traffic data inputs for mechanistic-empirical pavement design software

MDOT is implementing mechanistic-empirical (ME) pavement design using the Pavement-ME software from the American Association of State Highway and Transportation Officials. The software uses materials, climate and traffic information to predict pavement degradation, such as cracking, rutting and International Roughness Index (IRI) by combining mechanistic models with empirical transfer functions. MDOT staff will use updated procedures from this research to design pavements best fitted to expected conditions. By analyzing Michigan's statewide traffic data (2011 to 2015), researchers developed guidelines for preparing the Pavement-ME traffic input files for future pavement construction projects.

PROBLEM



MDOT will soon use the Pavement-ME software to design new pavement projects tailored to Michigan's traffic and weather patterns.

Pavement performance depends heavily on the volume of trucks that use the road. Ideally, truck traffic data would be collected at each project site prior to construction, using weigh-in-motion (WIM) sensors that record a vehicle's weight as it passes over a pavement section. However, installing WIMs and collecting long-term traffic data at each project site is cost-prohibitive.

A more feasible approach is to match a project site to a previously identified group of road segments with similar traffic characteristics (attributes) that contain WIM data. These attributes include information such as freeway vs. non-freeway, urban vs. rural, number of lanes, annual commercial traffic, or short-count data from non-permanent devices.

The research goal was to develop a process for grouping road segments that

(continued)

"This project improved the development of MDOT's traffic data for use in mechanistic-empirical pavement design when site-specific information is unavailable and simplified the updating of this data for future use."

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have WIM data and assigning sites without this data to those groups. As a result, traffic input files are created for each group for ME pavement design. Additionally, this research sought ways to more easily update the groups of road segments, the assignment method, and input files when new traffic data are available. Meanwhile, the researchers needed to determine the level of detail for the attributes that will ensure accurate pavement performance predictions.

RESEARCH

Using statewide traffic data (2011-2015) from 41 WIMs, the researchers performed a statistical cluster analysis to identify groups of sites with similar traffic characteristics. If site-specific WIM data (Level 1) aren't available, the researchers studied two methods of assigning the project site to a similar group of sites (Level 2).

The first Level 2 method, 2A, requires a large number of region-specific traffic attributes to calculate input files. The second Level 2 method, 2B, calculates input files from a much smaller number of region-specific attributes. The first method may be more accurate than 2B because it requires more attributes, but may be more difficult for MDOT use due to the many needed attributes. Using sensitivity analyses, the researchers compared and quantified the effect of less detailed traffic information on the predicted performance. The researchers also calculated Level 3 input files from statewide averages.

RESULTS

The researchers found the difference in predicted performance for Levels 2A versus 2B data to be of little practical significance, so where Level 2A would be recommended, Level 2B could be used instead due to its ease of use. For both rigid (concrete) and flexible (asphalt) pavements, the following parameters had a moderate impact on predicted performance and should be calculated from Level 2B data, if Level 1 data aren't available: vehicle class distribution (VCD), tandem axle load spectra (TALS) and hourly distribution factors (HDFs), which capture variation in traffic patterns during a 24-hour day.

The remaining less significant inputs include monthly adjustment factors (MAFs) for capturing seasonal variation, axle groups per vehicle (AGPV) and single, tridem and quad ALS. The researchers recommend that these inputs can be derived from the use of statewide averages, calculated separately for freeways and non-freeway (Level 3A), except for AGPV, which can be statewide data (Level 3B).

The researchers provided a new tool for preparing the Pavement-ME input files that makes it easier to update them when new traffic data become available. They made recommendations for the frequency of updates and prioritized regions where new WIMs should be installed in the future.

VALUE

The volume and characteristics of truck traffic have a large influence on the expected service life of new and reconstructed pavement. Thus, it is vital for MDOT to use the site- or region-specific traffic data to predict pavement performance. The project made the determination of traffic data easier and will help prioritize future traffic data collection efforts.

It is essential that pavement designs achieve their anticipated service lives. The Pavement-ME provides a tool for MDOT to predict pavement performance more accurately and more precisely design their pavements. Using this kind of support technology is expected to improve MDOT effectiveness and lower the overall cost of pavement projects, which make up a significant part of MDOT's budget.

Research Administration

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This final report is available online at
www.michigan.gov/mdot/0,4616,7-151-9622_11045_24249_76865_76875-480198--,00.html.

Research Spotlight produced by
CTC & Associates LLC, December 2018.