

Research Spotlight

Project Information

REPORT NAME: A Method to Assess the Use of New and Recycled Materials in Pavements

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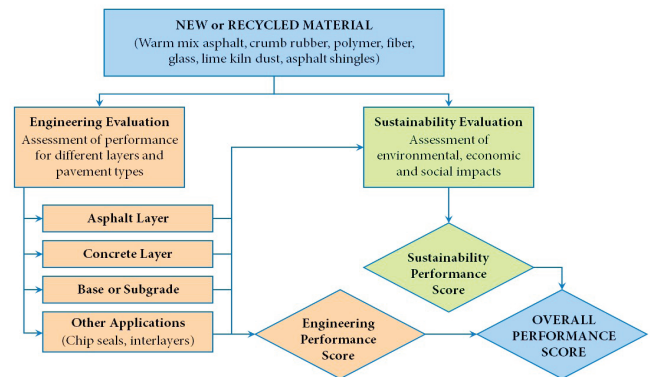
Software offers transparent, straightforward assessment of pavement additives

Adding new materials to pavement layers is a proven technique to improve performance. Many types of additives—from engineered polymers and acids to recycled pavement, crumb rubber, shingles and glass—have been used to help construct better roadways. MDOT research helped address a sizable knowledge gap in this area: how to determine whether an untested material will live up to its promise as an additive. The resulting evaluation software is a helpful tool to assist MDOT pavement designers in making smart engineering decisions about new materials.

Problem

Pavement designers regularly learn about the “next great material” that can be added to concrete, asphalt or unbound base layers to improve pavement quality and performance. Whether faced with new commercial products or alternative recycled materials, MDOT very often does not have sufficient information to know just how well such additives will perform.

The department looked to research to develop a rational and impartial approach to judging how different materials perform as pavement additives. An evaluation tool would give the department clear guidance



The NewPave evaluation software factors in multiple engineering and sustainability criteria for a pavement additive to calculate an overall Performance Score.

on whether a given additive might be an improvement worth exploring in field tests, pilot projects and ultimately standard specifications.

“The NewPave software will be a great help to MDOT. I can see it becoming a standard tool for evaluating all types of pavement additives.”

Nathan Maack, P.E.
Project Manager

Research

A Michigan State University (MSU) research team set out on an ambitious task of quantifying the many aspects of concrete, asphalt and base layer performance. It was necessary not only to develop a process for judging the effects of additives but to develop a straightforward and easy-to-use tool into which MDOT could input testing data and receive unambiguous guidance about how additives rate.

The evaluation framework developed by the MSU researchers includes two main components: engineering and sustainability performance.

- **Engineering performance** involves different evaluation methodologies for various pavement types (concrete, asphalt, base layers/subgrades and specialty layers like chip seals and interlayers). Among the different options, the most desirable data are based on field testing—measurable parameters like fatigue cracking, low-temperature cracking, rutting and roughness. Alternatively, lab performance data and predicted mechanistic-empirical design data are permissible for some pavement types.
- **Sustainability performance** analysis includes three components: environmental, economic and social analysis. These take into account carbon emissions, life cycle costs and social factors like aesthetics, noise and landfill impacts.

Data for pavements built both with and without the additive under evaluation are used to calculate an Engineering Performance Score and a Sustainability Performance Score. The separate scores are averaged for an overall Performance Score. This score represents the percentage by which a pavement built with the additive outperforms one built without it. (A negative score means the additive made the pavement perform worse.) For example, a Performance Score of 5 means that the concrete, asphalt or base layer built with the additive under evaluation outperformed the comparison layer by 5 percent.

Results

Researchers developed and delivered a software package called NewPave that incorporates this evaluation framework. The Windows-based software allows MDOT engineers to input engineering and sustainability data and make judgments based on the resulting individual and combined performance scores.

A key feature of the NewPave software is its flexibility. Users can give specific parameters more or less weight. For example, if MDOT is interested in a particular additive specifically to combat rutting, then an adjustment of the software settings will make rutting a stronger factor than other types of distress in the Engineering Performance Score.

The software also allows users to enter parameters in alternate units of measure, such as fatigue cracking in either “percentage cracking” or “cracks per mile.” This feature allows MDOT to enter its own testing data as well as data collected from other sources, such as labs, test tracks and roads across the nation.

Value

MDOT plans to start using the NewPave software in the immediate future. The software not only provides a systematic

approach to assessing pavement additives, it serves as a highly transparent evaluation process. NewPave analysis data can help the agency clearly explain its decisions related to new additives to all interested parties, from vendors to taxpayers to policymakers.

The department expects that other state transportation agencies and pavement designers will be interested in the NewPave software as well. This systematic and user-friendly tool for evaluating materials added to pavements is believed to be among the first of its kind among transportation agencies. MDOT may lead a national trend toward additive evaluation that could improve and refine this assessment methodology.

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**This final report is available
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