



U.S. Department
of Transportation

Federal Highway
Administration

Spotlight on Pavement Density: Minnesota Department of Transportation

MATC
MOBILE ASPHALT
TECHNOLOGY CENTER

Status of Dielectric Profiling Systems in Minnesota

Overview

Optimistic about dielectric profiling systems' (DPS)' effectiveness in improving pavement performance and assessing compaction for acceptance, the Minnesota Department of Transportation is leading efforts to develop and fine-tune the technology. DPS use a ground-penetrating radar (GPR) to assess the density of hot-mix asphalt, a key indicator for pavement performance.

MnDOT is the lead agency for a national transportation pooled fund study (Pooled Fund TPF-5 [443]) to address research gaps and share resources with other State highway departments on making DPS more viable as a method to evaluate quality in pavement construction. "Because one thing we can all rally around is that nobody likes cutting cores in our pavements," says Kyle Hoegh, MnDOT Office of Materials and Road Research. "... There's an incentive for all parties involved to work towards something better."

Findings and Next Steps for DPS

MnDOT evaluated its three DPS units on more than 20 projects since receiving its first unit in 2016. It observed this benefit for the agency: a greater ability to expand assessment of the pavement surface for compaction adequacy, which equates to long-term performance.

Benefits for a contractor are the ability to receive greater, near real-time information on the density of the final product, allowing for operation adjustments to improve production and save costs. As a result, "when you identify an issue, it doesn't occur for the rest of the paving project that day or even the rest of the project," Hoegh says. The DPS tool "gives us a comprehensive and real-time result that can actually get better compaction in the first place." Ideally, the number of cores on a project will be reduced when also checked by DPS, according to Hoegh.

The research team is working on handling the volume of data output to make it more manageable and accurate, as well as to make the DPS more user-friendly to physically operate.

These efforts include:

- Incorporating DPS into project acceptance. The agency has had at least four projects with the contractor collecting DPS data, and aims for others. The agency also would like contractors to supply the equipment and be responsible for the DPS data as a condition on a construction job, Hoegh says. States are currently evaluating approaches to independently validate this contractor data used in the acceptance decision to meet Federal-aid project requirements.
- Writing protocols for users on statistical correlation to identify bias between what the research team uses to correlate the DPS unit in the lab with specimens versus what the team measures in the field. MnDOT has developed a method to correlate a DPS unit with specimens from the Superpave gyratory compactor to convert from a dielectric reading to pavement density to allow States to use existing density specifications.
- Improving software and hardware to manage data.
- Developing AASHTO standards for data collection and analysis, including a precision and bias statement for the DPS equipment.

MnDOT is experimenting with ways to minimize the amount of walking with the cart, such as by mounting the DPS on a small robotic utility vehicle or by having the pushcart operator ride an electric scooter. "Pushing the cart 1 or 2 miles is fine," says Shongtao Dai, MnDOT Office of Materials and Road Research. But some projects would mean pushing the cart for as many as 10 to 20 miles, he notes.

MnDOT Suggestions for Other Agencies

Hoegh and Dai suggest reviewing the wide range of information and training tools already collected by the FHWA Resource Center and the Mobile Asphalt Technology Center (MATC), which also has units available for loan and which MnDOT has used for some projects. MnDOT also provides numerous DPS training materials and resources on its DPS Pooled Fund site (<http://www.dot.state.mn.us/materials/dps/index.html>) on MnDOT.gov.

This document does not have the force and effect of law and is not meant to bind States in any way.



Below: MnDOT tests mounting DPS on a utility vehicle. Source: MnDOT.

FHWA-HIF-21-041

For more information on DPS and related technology, contact Monica Jurado Pavement & Materials Engineer, FHWA Resource Center monica.jurado@dot.gov

This equipment and more are available on loan at the MATC. <https://www.fhwa.dot.gov/pavement/asphalt/matc/equipment-loan-program.cfm>

The dielectric profiling system series shares information on pavement testing programs.

To access the full series, visit <https://www.fhwa.dot.gov/pavement/asphalt/matc/technical-documents.cfm>