U.S. Department of Transportation
Federal Highway Administration

MATC
MOBILE ASPHALT TECHNOLOGY CENTER

Spotlight on Pavement Density: North Dakota Department of Transportation

Working with the Dielectric Profiling System

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For more information on DPS and related technology contact Monica Jurado Pavements & 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

Background

The North Dakota Department of Transportation (NDDOT) acquired a dielectric profiling system (DPS) in 2020 after neighboring Minnesota DOT (MnDOT) demonstrated the technology's potential on a local construction project the previous year. NDDOT had been concerned that its existing practice of obtaining sample cores from newly-placed asphalt provides too small a representation of the density of rest of the mat. "We felt that the DPS could probably provide you a more comprehensive picture about the density of the asphalt, along with eliminating some of the need for destructive coring," says Amy Beise, NDDOT Research Manager.

DPS technologies use ground-penetrating radar that can be correlated to the placement uniformity and density of an asphalt pavement mat, both of which are key indicators of pavement performance. The system that NDDOT uses is mounted on a pushcart with three sensors that collect dielectric readings from the newly compacted asphalt.

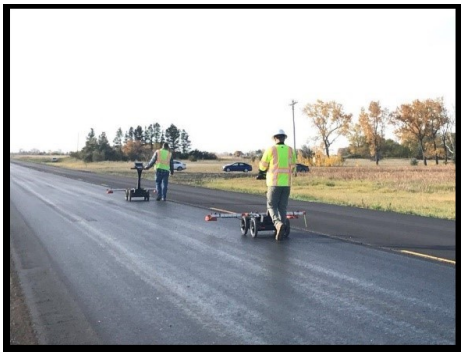
Observations from DPS Use

Jonathan Stork, NDDOT Materials & Research, and others on the research team shared these observations after collecting and analyzing data from six projects during three construction seasons:

- DPS data seemed to fill the gap in information from sample cores, with clear results in certain cases. Three passes along a test segment produced tens of thousands of data points, as compared to one set of cores per 2,000 feet, which is NDDOT's current acceptance standard.
- Analyzing the data took more lab time than expected. At first, the immense amount of data slowed the lab's computers. NDDOT then used free software for managing and displaying the data, which made data analysis easier but took time to learn. NDDOT benefited from technical support and shared resources from MnDOT, involvement in the national transportation pooled fund study, and resources from the Federal Highway Administration (FHWA) Mobile Asphalt Technology Center (MATC).
- Staffing and proximity to the central office were issues for data collection, with some projects located as far as a 4- to 5-hour drive from Bismarck, Stork says.
- One adjustment that extended DPS operations in the field was to buy a second set of batteries as a backup. The device's original batteries lasted about 5 to 6 hours and created downtime to recharge. The research team also upgraded GPS systems to equalize pinpoint locations in the field.

Example Research Projects

Researchers scanned two test sections on a $4.5 million, 18-mile project on ND 32 in June 2021, applying the DPS after the finish roller and then before and after the fog coat to compare dielectric readings. According to Stork, the device confirmed uniformity and predicted density values across those test sections and showed low density in areas the roller had missed. These results did not contractually affect the project, where other intelligent paving technologies also were used. But according to Stork, "the DPS was a great addition to the group, as it allowed for full-density coverage."



NDDOT and FHWA DPS devices operate in tandem. Source: FHWA

In September 2021, NDDOT had the opportunity to run its DPS device alongside FHWA's device when the Mobile Asphalt Technology Center (MATC) brought its trailer to North Dakota. NDDOT and the FHWA used both DPS devices on a paving project on US-83 near Maxbass, ND. The testing showed good agreement in terms of mat uniformity on the project between the two devices and the DPS's potential for evaluating asphalt materials and mixtures.