U.S. Department of Transportation
Federal Highway Administration

Spotlight on Pavement Density: Ohio Department of Transportation

MATC
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Starting Out with Dielectric Profiling Systems

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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 Ohio Department of Transportation (ODOT) purchased its first dielectric profiling system (DPS) unit in late 2018 with the goal of achieving better representations of the quality of newly laid asphalt than through its existing practice of obtaining sample cores. ODOT hoped the DPS unit would better identify the variability noticed from core samples and ultimately lead to changes during construction that would improve quality.

DPS use a ground-penetrating radar (GPR) to determine the density of hot-mix asphalt, a key indicator for pavement quality control. After seeing promise in initial results from the first DPS unit, ODOT bought a second one in 2019.

“We think a major step forward to getting more service life out of our pavements is to eliminate some of these built-in defects that maybe we don't recognize during the construction process," says Craig Landefeld, Administrator, ODOT Office of Pavement Engineering. "If we can improve the overall density and have uniformity, we’re going to anticipate having less mid-cycle repairs and preventive maintenance.”

Lessons Learned with DPS

ODOT's first focus with its DPS units was: "Is this giving us anything we can actually use?” Landefeld says. The pavement staff started by familiarizing themselves with the equipment and learning to read the intricate data, receiving technical assistance from the FHWA Ohio Division Office. They then ran DPS tests on several projects simultaneously with taking core samples. Then they compared results.

To meet ODOT acceptance standards with cores, the testing department inspects 10 random 4-inch cores from each production lot, equal to about one day’s paving. Cores are almost always extracted and filled on the day of paving. Test results generally lag placement by 1 or 2 days.

ODOT found that the DPS unit could assess more territory, more quickly, than by obtaining cores. The DPS unit has three antennas that can cover up to 6 feet transversely. They take continuous measurements and report readings every 6 inches longitudinally. On a day's production on I-77 in Guernsey, Ohio, for example, 10 random cores represented nearly 3 miles of pavement, while the DPS collected over 45,000 density readings in the same area. Table 1 below shows a comparison between DPS data and data from sample cores. The data indicates that very little difference exists in the mean and standard deviation of results, despite the large difference in sample size.

Example Use

The pavement team was out with the DPS unit one day when the transportation district asked for the DPS to scan a road construction job on I-75 in Allen County. After placement, the mix exhibited areas of fine cracking and tearing, yet sample cores weren’t showing density issues, Landefeld remembers. The contractor and project staff had very different opinions on the amount of pavement to be replaced. The crew scanned the section in question with the DPS cart and brought the readings back to their office. From a combination of visual observation and the DPS data, the crew could identify the problem areas and confidently set the boundaries of the area to be removed. “I think it was probably the best result for everybody,” Landefeld says. “We were pretty effectively able to remove what was problematic and replace the material. The project was able to keep moving and a claim was avoided.”

Table 1. ODOT GUE-77 Lot #3 Standard Error Calculations; *Source: ODOT*

Description	Mean	SD	Sample Size	Standard Error of the Mean	Lower 95% Limit		Upper 95% Limit
Acceptance Cores	94.70%	1.51	10	0.4775	93.76%	to	95.64%
Acceptance Cores with DPS SD	94.70%	1.73	10	0.5471	93.63%	to	95.77%
DPS Data	94.03%	1.73	48,396	0.0079	94.01%	to	94.05%