HIGHLIGHTER

3D LASER IMAGING FOR ODOT INTERSTATE NETWORK AT TRUE 1-MM RESOLUTION

November 2016

PROJECT TITLE
3D LASER IMAGING FOR ODOT INTERSTATE NETWORK AT TRUE 1-MM RESOLUTION

FINAL REPORT ~
FHWA-OK-14-14
ODOT SP&R 2251

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OVERVIEW Accurate and timely information related to pavement surface characteristics is critical for evaluating the performance, condition, and safety of pavement and bridge infrastructure. Typical data collection methods are slow, and because of the presence of traffic, are disruptive and unsafe. Additionally, data sets for surface characteristics generally exhibit poor quality related to consistency, repeatability and accuracy, which can skew subsequent analyses and hinder state agency decision making. With the development of three-dimensional (3D) laser imaging technology, the latest iteration of PaveVision3D Ultra (Figure 1) can obtain true 1 millimeter (mm) resolution 3D data at full-lane coverage at highway speed (up to 60 miles per hour (mph)). This innovative technology facilitates state agency design and management processes, particularly in supplying quality data for pavement management system (PMS), bridge deck evaluation, Pavement Mechanistic-Empirical Design and Highway Performance Monitoring System (HPMS) functions.

Figure 1 PaveVision3D Ultra

RESULTS This project provides the Oklahoma Department of Transportation (ODOT) with a methodology for automated surface characteristic evaluation that improves data quality in terms of consistency, repeatability, and accuracy, thereby improving subsequent analyses to support state agency decision making. It uses the sophisticated Automated Distress Analyzer 3D (ADA-3D) software interface and collected 1mm 3D data for pavement and bridge surface evaluation (Figure 2, from the I-35 data collection). The study yielded rapid condition survey data for selected interstate highways, state highways and bridges in Oklahoma (approximately 1,280 centerline miles). ADA-3D computer software provided pavement surface cracking, rutting, roughness (in terms of the International Roughness Index (IRI)), predicted hydroplaning speed and roadway geometry.

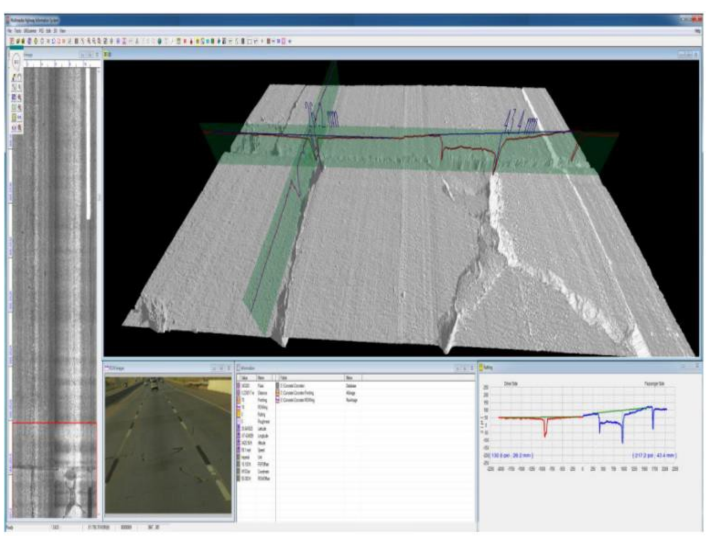

Figure 2 ADA-3D Display for I-35 Section

Segmenting a pavement network into homogenous sections is important for road maintenance scheduling and management systems. In this project, the newly developed Pruned Exact Linear Time (PELT) method was implemented to dynamically segment pavement sections into uniform subsections using 1mm 3D pavement surface data. The PELT algorithm is significantly more computationally efficient than other methods because it removes segmentation scenarios that are not optimal (known as "prune" process). The results (illustrated in Figure 3) can assist DOT decision makers in identifying the locations where pavement issues may be present. Results can also support agencies in evaluating pavement performance in a comprehensive manner for project prioritization and maintenance scheduling.

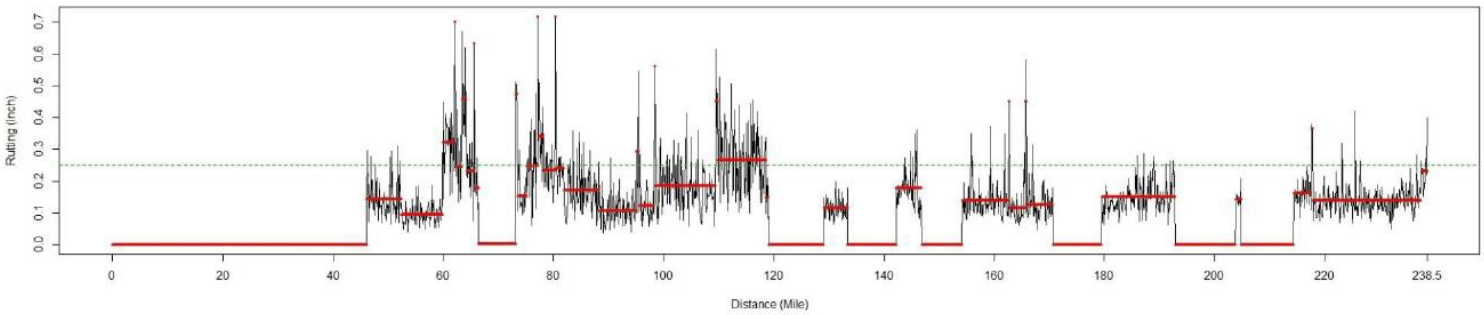

Figure 3 Example Output: Rutting (in inches) and PELT Segmentation (in distance – miles)

PaveVision3D can provide most of the data that are required in the Pavement ME Design, including IRI, rut depth, and longitudinal, transverse, and pattern cracking. During the process of local calibration of the Pavement ME Design, PaveVision3D can be used as the major data collection source consistent with the following recommendations:

- For roughness, use data directly from PaveVision3D Ultra output.
- For cracks, confine refinement to total cracking (combine alligator and longitudinal cracks in the wheel-path) per the AASHTO Local Calibration Guide (2012). Use the alligator transfer function in the local calibration process for determining the local calibration values.
- For reflective cracks, confine refinement to total cracking of HMA overlays. In this case, all surface cracks in the wheel path (reflective, alligator, and longitudinal cracks) should be combined. Use the alligator and reflection cracking transfer functions in the local calibration process.
- For rutting, confine refinement to the total rut depth predicted with the Pavement ME Design.

State Highway Agencies are primarily responsible for collecting HPMS data and providing it to the Federal Highway Administration. PaveVision3D Ultra data collection can be used to prepare the following full extent HPMS data items per the following recommendations:

- Item 47 (IRI): use data directly from PaveVision3D Ultra output.
- Item 50 (rutting): use data directly from PaveVision3D Ultra output (rounded to nearest 0.1 inch).
- Item 51 (faulting): use average of data from PaveVision3D Ultra output.
- Item 52 (crack percentage): use calculated values from PaveVision3D Ultra output relating to fatigue type cracking (all severity levels) for asphalt pavements (in wheel path) and percent of slabs with cracking for concrete (jointed and continuous) pavements.
- Item 53 (crack length): use calculated values from PaveVision3D Ultra output relating to relative length in feet per mile of transverse cracking for asphalt pavements and reflection transverse cracking for composite pavements.

POTENTIAL BENEFITS This study demonstrates improvement in data quality and collection of pavement and bridge surface characteristics to support comprehensive evaluation related to performance, condition, and safety of infrastructure. The equipment and methodology can provide data for cracking detection, profiling (transverse for rutting and longitudinal for roughness), roadway geometry (horizontal curve, longitudinal grade and cross slope) and safety (hydroplaning prediction). Implementation can facilitate management efforts by ODOT in the areas of condition assessment, monitoring and reporting, decision-making and pavement design.