Presentation to C-TEP

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Tetra Tech
Pavement Distress Data

- Pavement Evaluation Background
- Technical Development
- Technology Used in the Current AT Project
- Results/Opportunities
Pavement Evaluation Background

Efforts to automate pavement evaluation

- Pavement Roughness – IRI (ASTM E950-09)
- Deflection – FWD, RWD and TSD
- Surface distress – mixed picture from manual methods (FHWA-RD-03-031) to 3D-Laser (AASHTO PP-67 & PP-68)
Development Timeline

Early 1990’s
- Windshield and keyboard surveys

1993-2003
- SHRP-LTPP Distress Identification Manual

Mid 2000’s
- Roadware Wisecrax™ System

2005~2012
- Studies based on 2D Image and LiDAR

2013
- 1st AT contract using 3D Image and LiDAR

~ 1996
- Visual surveys (VCI)

1997
- Gaging Length and Windshield (SCR)
Technology Used in the Current AT Project

Pavement Surface Profiler

Cross-Plane LiDAR

PSP-7000

- Inertially Aided GPS (+IMU)
- Linear Referencing
- WheelPath Profile
- Wheelpath Rut Measurements
- Digital ROW Imagery
- Digital Panoramic Imagery
- Geometrics

- 3D LiDAR
- 3D Pavement Distress
- 3D Surface Texture
Technology Used in the Current AT Project

3D Pavement Surface Scanning Pattern
Technology Used in the Current AT Project

Projected Laser Line Draped Across the Pavement Surface

Both Elevation and Laser Intensity Data

Sensor Triangulation Geometry Critical!
Technology Used in the Current AT Project

3D Pavement Surface Elevation Map (continuous, repeatable, accurate and objective)

Resolution: 1mm Transverse, 5mm Longitudinal, 0.5mm Vertical
Technology Used in the Current AT Project

Fundamental Crack Analysis Methodology

\[
\text{Crack}_N = [\text{CrackPath}(x,y), \text{Width}(x,y), \text{Depth}(x,y)];
\]
Technology Used in the Current AT Project

Pavement Intensity Map Overlayed with Detected Crack Classifications

Lane Annotated with AT Lane Zone Definitions
Technology Used in the Current AT Project

Objective Crack Detection Presents Distress Classification Opportunities

Client Specific Definitions for Distress Types and Thresholds
Technology Used in the Current AT Project

Objective Fully Referenced Pavement Crack Map
Technology Used in the Current AT Project

Pavement Intensity Map Overlayed with Detected Crack Classifications

AT Lane Zone Boundary Effects
Technology Used in the Current AT Project
Technology Used in the Current AT Project

360° LiDAR Intensity Map Processed For Shoulder Cracks
Results/Opportunities

Data Verification

• Automated distress results delivered in 50 m data table format
• 3D Laser distress results checked with manual crack maps
• Random data checking with TIMS video logs
### Results/Opportunities

- Automated distress results delivered in 50 m data table format
- 3D Laser distress results checked with manual crack maps
- Random checking with TIMS video logs
Technology Used in the Current AT Project
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Results/Opportunities

Areas needing more studies

- Fine tuning sensitivity with Trans. Crack detection
- Improving chip seal identification
- Patch Indicator algorithm
- Future “class 1” verification/QA
Results/Opportunities

- More accurate rut measurement

- Texture measurement using “Digital Sand Patch”

- Crack data for maintenance decisions
Results/Opportunities

Questions ?