OKLAHOMA Transportation

TASK ORDER

PROJECT TITLE
I-35/SH-7 SUBSURFACE INVESTIGATION

FINAL REPORT ~
ODOT TASK ORDER
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HIGHLIGHTER

I-35/SH-7 SUBSURFACE INVESTIGATION

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OVERVIEW Reflection cracking, edge cracking, rut and longitudinal edge depressions are some of the major problems in asphalt pavements near the intersection of I-35 and SH-7 in Oklahoma. Specifically, reflection cracking and edge cracking were observed on I-35 from Mile Post 45 to Mile Post 59.5 and severe rut and longitudinal joint depressions were observed on SH-7 located approximately 6 miles west of I-35 heading east approximately 5 miles (Figure 1). The purpose of this Task Order was to perform a subsurface investigation using the Ground Penetrating Radar (GPR) system from Texas Transportation Institute (TTI) to identify locations of subsurface distresses and develop data-driven recommendations for maintenance and rehabilitation. As a part of the Task Order, Traffic Speed Deflection Device (TSDD) data, collected by ODOT on the same segments of I-35 and SH-7 as part of a pooled fund study conducted by Virginia Tech Transportation Institute (VTTI), were compared with the Fast Falling Weight Deflectometer (FFWD) data.

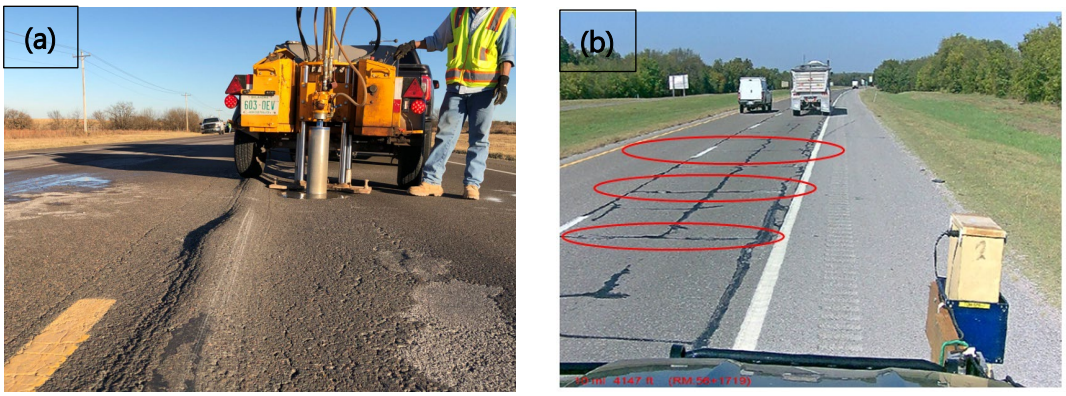

Figure 1 (a) Rutting on SH-7; (b) reflective cracking on I-35

RESULTS This Task Order was divided into the following tasks: collecting project information, collecting data using the TTI-GPR system, analyzing GPR data and identifying distressed locations, conducting FFWD testing selectively based on the GPR data and visual images from the video camera, field sampling from distressed locations, conducting laboratory testing on core samples, and comparing surface deflections obtained from the FFWD testing with the TSDD data selectively.

The subsurface investigation using GPR was performed on the above-mentioned sections of I-35 and SH-7 using a 1-GHz air-coupled TTI-GPR with the help of Dr. Tom Scullion. The collected GPR data were sorted, filtered, and analyzed using the software developed by TTI. The GPR data were then used to determine the layer thicknesses, presence of moisture, voids, stripping and other anomalies

in the asphalt pavement, which could be responsible for the pavement distresses (Figure 2). The GPR results were used to identify areas for extraction of cores. A total of sixteen (16) cores were extracted, eleven (11) from the I-35 section and five (5) from the SH-7 section. The structural conditions of the pavement sections were assessed using Dynatest FFWD equipment. Laboratory performance tests, namely Semi-Circular Bend (SCB) test, Texas Overlay (OT) test, Tensile Strength Ratio (TSR) test, Indirect Tensile Asphalt Cracking (IDEAL-CT) test and Hamburg Wheel Tracking (HWT) test, were conducted on asphalt cores. The key findings of this Task Order are as follows:

Figure 2 GPR and video images from north-bound I-35 section near Mile Post 51.5

- The GPR images showed two different types of pavements in the studied section of I-35, namely Jointed Concrete Pavement (JCP) and Continuously Reinforced Concrete Pavement (CRCP). The JCP section showed severe reflection cracking. Excessive truck loading and change in pavement section between shoulders and driving lanes are likely causes of edge failures.
- Significant rutting, cracking and longitudinal joint cracking were observed on the east-bound lane of SH-7. The GPR images and extracted cores revealed a very thick layer of HMA in this section. A loose or delaminated fabric layer not attached to the pavement below might be responsible for shear failure and rutting in the HMA layer. The GPR data exhibited an increase in moisture over the joint indicating infiltration of water through the longitudinal joint crack.
- Overall, good modulus (E) values were observed on I-35 and low modulus values were observed on the east-bound inside lane of SH-7, where major depressions and ruts were observed.
- Cracking tests were conducted on asphalt cores collected from the I-35 section. None of these tests met the minimum passing criteria for cracking indicating that the studied I-35 section is prone to further cracking without appropriate maintenance or rehabilitation measures.
- The HWT tests showed excessive rut in the east-bound and west-bound lanes of SH-7 indicating potential for rut failure. Significantly high rut and roughness were observed on the east-bound inside lane of SH-7 from TSDD measurements.
- The FFWD and TSDD deflection data under the center of the loads (W1 and D0, respectively) exhibited a correlation of 0.45. The overall R^2 between W1 and D0 deflections for both sections were found as 0.21.
- The Task Order proposed several repair/rehabilitation options along with their Life Cycle Cost Analysis (LCCA).

POTENTIAL BENEFITS This Task Order demonstrated that use of a GPR (specialized GPR from TTI/TAMU used in this Task Order) can be a useful tool for selective data-driven coring of pavement, which is a destructive process. Also, FFWD or FWD when used in conjunction with TSDD can be a useful tool for validating TSDD results and identifying pavement conditions (project level) confidently. The LCCA provided options for ODOT to select economically feasible repair/rehabilitation methods for I-35 and SH-7.