OKLAHOMA Transportation

TASK ORDER

PROJECT TITLE
REPAIR EVALUATIONS OF DEPRESSED TRANSVERSE CRACKS IN ASPHALT PAVEMENTS IN DISTRICT 6

FINAL REPORT ~
ODOT TASK ORDER
2160-20-02

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HIGHLIGHTER

REPAIR EVALUATIONS OF DEPRESSED TRANSVERSE CRACKS IN ASPHALT PAVEMENTS IN DISTRICT 6

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OVERVIEW Transverse cracking is one of the major problems in asphalt pavements in north-western (Panhandle) regions of Oklahoma. The eastbound lane and shoulder of US-270 in Harper County northwest of Woodward, Oklahoma has experienced significant transverse cracking (Figure 1). The extent and probable causes of the transverse cracking at US-270 were documented during Phase 1 of this forensic investigation (ODOT Task Order 2160-18-07). It was evident from the field and laboratory tests that the base supports were still structurally sound. The main issue resided with the cracks in the asphalt layer. The two most probable causes of the surface cracks, identified during Phase 1, were: (1) inability of the asphalt binder to resist low temperature cracking under extreme weather conditions including large thermal cycles with a rapid drop or rise in temperature; and/or (2) brittleness of the asphalt mixes due to aging. This Task Order (2160-20-02) was a follow-up study. It was aimed at evaluating the effectiveness of two transverse crack repair methods, namely (1) trenching and patching using Fibrecrete, and (2) trenching and patching using HMA.

RESULTS This Task Order was divided into the following tasks: selection of crack

(a) (b) (c)

Figure 1 Transverse cracks observed in US-270: (a) view from the top; (b) width of crack; and (c) depth of crack

site, repair of selected cracks, and assessment of performance using non-destructive testing. Three transverse cracks were selected for each repair method. Also, three non-repaired (i.e., "do nothing") cracks were selected as control. The locations of these cracks were relatively close to each other to minimize the extent of traffic control. The performance of two repair methods and control was evaluated using physical observations as well as Falling Weight Deflectometer (FWD), Ground Penetrating Radar (GPR), Straightedge, Face Dipstick and PaveVision3D and Pave 3D 8K testing. These tests were scheduled to be conducted during the following times: (1) before the repair,

(2) five months after the repair, and (3) ten months after the repair. The first repair evaluation (Evaluation #1, before the repair) was performed on July 22, 2020. Both Fibrecrete and HMA repairs were completed on July 24, 2020. Evaluations #2 and #3 were performed on November 18, 2020, and June 2, 2021, respectively. Performance of the Fibrecrete and HMA repairs was compared with each other and with the control cracks. Also, the changes in performance of the repaired sections over time were evaluated by comparing Evaluations #1, #2 and #3. The key findings from this investigation are summarized below:

- The physical inspection and GPR results indicated that the propagation of the cracks was fully suppressed by the use of the Fibrecrete layer.
- Repair with coarse HMA with no tack coat may not produce satisfactory results. Typically, the rate of propagation of reflective cracks in HMA layer is 1-in. per year. However, for the studied sections, reflective cracks were found to propagate 2-in. in one year through the HMA layer. Use of coarse HMA (S3) may be responsible for this faster propagation of cracks. Additional cracks may have occurred due to absence of tack coat (Figure 2).

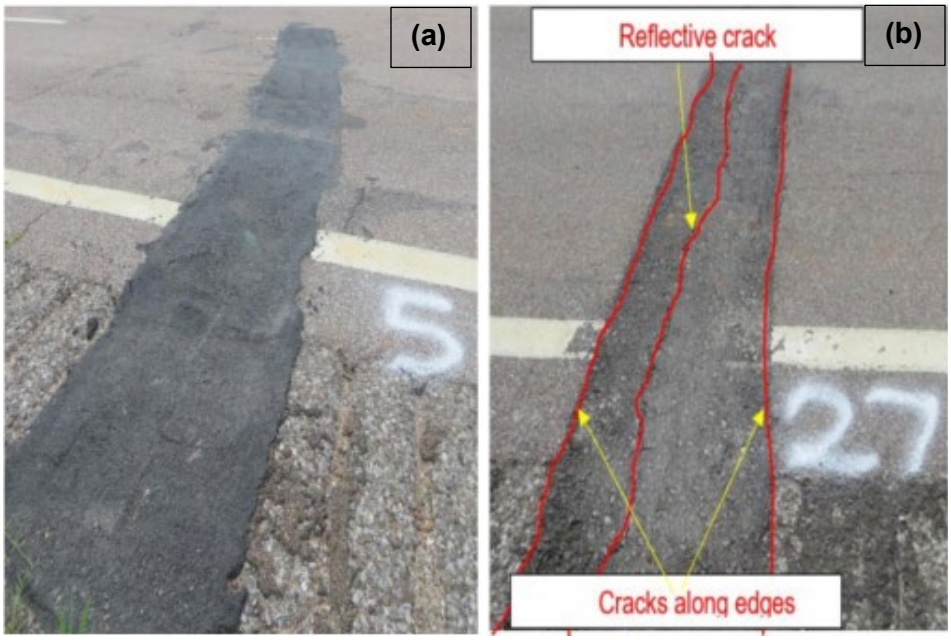

Figure 2 Photographs of (a) Fibrecrete-repaired and (b) HMA-repaired cracks during Evaluation #3

- From Face Dipstick and PaveVision3D/Pave 3D 8K evaluations, both HMA and Fibrecrete were found to exhibit increased rut depths after repair. This was due to the initial compaction of the HMA and Fibrecrete which happened in the early stage of opening to traffic. However, the IRI of the Fibrecrete- and HMA-repaired sections were found to be comparable.
- No significant changes in the crack geometry were observed for the controlled cracks over the observation period (1-year). However, cracks may widen and more rutting may occur over time if no-repair activity is pursued.
- Based on the life cycle cost analysis results and the results from the three evaluations, Fibrecrete repair method was recommended when pavement performance degrades due to similar transverse cracking and rutting.

POTENTIAL BENEFITS Cracking is one of the most common distresses in asphalt pavements. About 45% of asphalt pavements experience transverse cracking and reflective cracking during their service lives. This Task Order evaluated the use and effectiveness of Fibrecrete repair method for transverse cracks in north-western Oklahoma. Elimination of transverse cracks are expected to enhance serviceability and functionality of Oklahoma pavements significantly.