US 31W Jefferson Country Pavement Surface Treatment Evaluation

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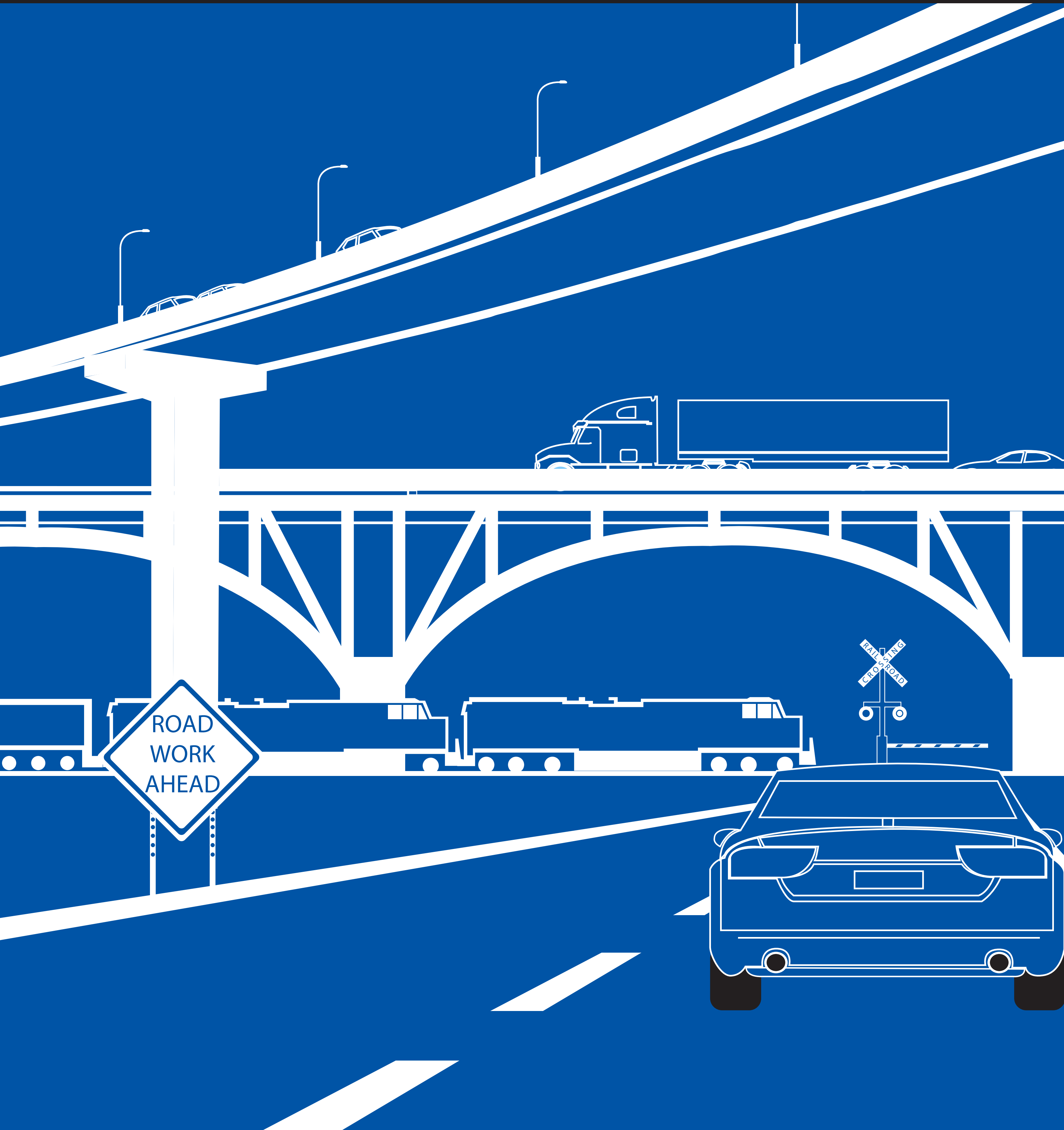

Kentucky Transportation Center
College of Engineering, University of Kentucky, Lexington, Kentucky

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Research Report
KTC-18-14/FRT 209 SHRP II

US 31W Jefferson County
Pavement Surface Treatment Evaluation

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1. Problem Statement

Reflective cracking inevitably occurs when asphaltic concrete (AC) is placed over an existing un-fractured Portland cement concrete (PCC) pavement. However, manufacturers state their products will mitigate reflective cracking, therefore extending the pavement life cycle.

Figure 1 Example of Reflective Cracking

To evaluate the performance of each manufacturer's product, an experimental test section consisting of a southbound and northbound segment was established on US 31W in Louisville, Kentucky. The funding for this project will help track the performance of each product from the construction phase through the long-term monitoring phase. Hall Construction performed all work.

The southbound roadway segment utilizes three different reflective crack suppression fabrics to mitigate cracking. After the fabric was placed on existing PCC the roadway was paved with conventional asphalt.

The northbound segment utilizes a reflective crack relief interlayer (RCRI) to mitigate reflective cracking. Once the interlayer was placed on existing PCC the roadway was paved. Sections 1 and 2 have Aramid Fiber modified asphalt, while Sections 3 and 4 received conventional asphalt. Kentucky Transportation Center (KTC) personnel monitored the installation of each product. Table 1 summarizes information on installation locations, the products used, and completion dates.

Table 1 Study Roadway Segments

Section	Begin Station (Street)	End Station (Street)	Northbound		Southbound		Completion Date
			Interlayer Product	Aramid Fibers Added (Top Base Lift and Surface)	Interlayer Product	Aramid Fibers Added (Top Base Lift and Surface)	
1	98+50 Moorman	160+00 Bethany	None	Yes	None	No	SB August 2015 NB August 2015
2	160+00 Bethany	202+50 Valley Station	Reflective Crack Relief Interlayer	Yes	Multi-Axial Fiberglass Paving Mat	No	SB October 2016 NB October 2017
3	202+50 Valley Station	301+00 E Pages	Reflective Crack Relief Interlayer	No	Multi-Axial Comp Paving Grid	No	SB (SB portion) October 2016 (NB portion) April 2018 NB April 2018
4	301+00 E Pages	360+57 Greenwood	Reflective Crack Relief Interlayer	No	Bi-Axial Comp Paving Grid	No	SB May 2018 NB April 2018

2. Product Installation and Load Transfer Efficiency by Direction and Section

This project sought to identify a viable reflective crack relief system to mitigate reflective cracking. The section of roadway being evaluated is uniform in design, therefore assisting researchers in their evaluation of crack suppression products. It would have been beneficial to install each product continuously along the entirety of each section. Unfortunately, due to the many businesses along this route the products were installed in a piecemeal manner. Once the products were in place an asphalt overlay was added, giving the surface a uniform appearance. KTC personnel monitored the installation of each product and this document reports their findings.

Before the pavement was milled, a falling weight deflectometer (FWD) was utilized to evaluate load transfer efficiency (LTE) of the transverse joint. Using a stationary camera, the operator can see the transverse joint, which makes data collection possible. Typically, LTEs are collected directly on top of the PCC pavement. This route had approximately six inches of asphalt over the original PCC pavement, therefore LTE values may be skewed. The following equation is used to calculate LTE:

$$Efficiency\ (\%) = \frac{\triangle_a}{\triangle_l}\ x\ 100$$

where:
$\triangle_a$ = approach slab deflection, and
$\triangle_l$ = leave slab deflection

3. Northbound Roadway Segments

3.1 Section 1 (No Interlayer Fibers Added)

This section received no reflective crack relief interlayer. The asphalt pavement was milled to the existing PCC then repaved utilizing Aramid Fibers in the top lift of the base course and pavement surface. This section was tested with an FWD to evaluate LTE before pavement milling, the results of which are presented in Figure 2.

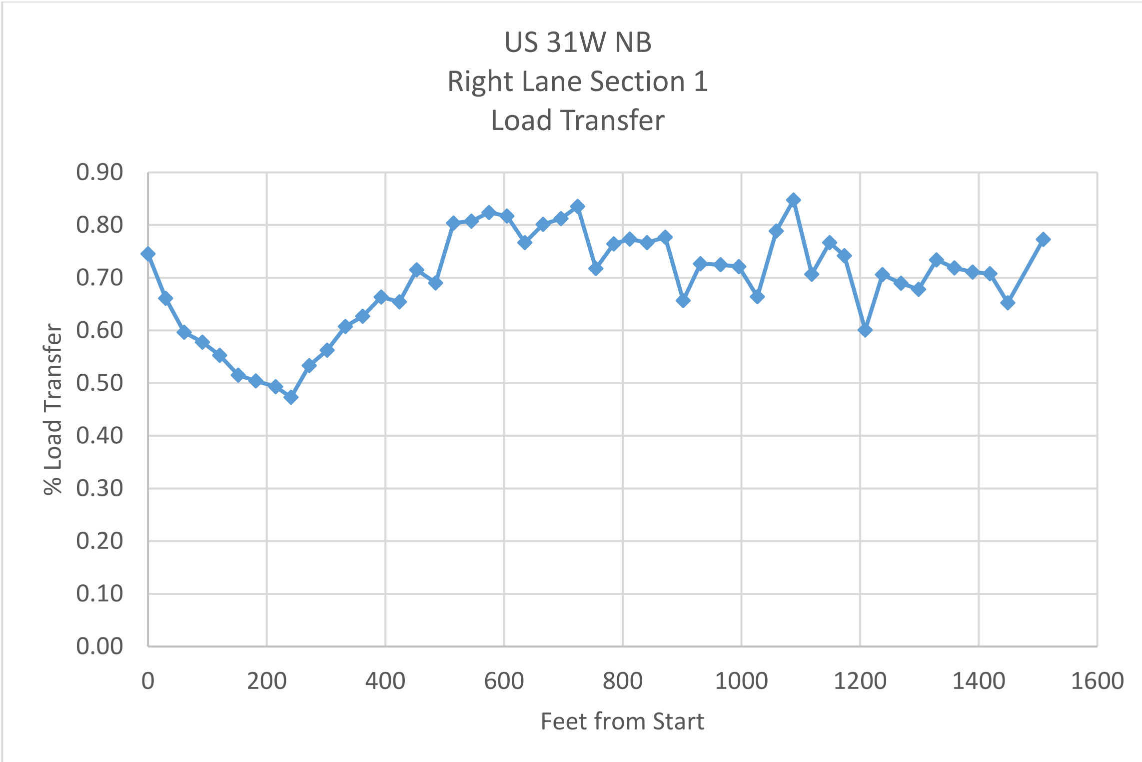

Figure 2 Load Transfer Efficiency NB Right Lane Section 1

3.2 Section 2 (Reflective Crack Relief Interlayer [RCRI] – Fibers Added)
Sections 2, 3, and 4 utilized RCRI to mitigate cracking on the northbound side of roadway. A RCRI is a highly elastic, impermeable, asphalt mixture interlayer designed to reduce reflective cracking. The asphalt mixture was a fine-graded, polymer-modified hot-mix asphalt. When using RCRI the special note states that all joints greater than ½ inch are to be sealed before installation. No sealing was performed at the time of installation. After installation of the RCRI, the roadway was overlaid. Aramid Fibers were in the top lift of the base course and pavement surfaces.

Prior to pavement milling FWD data were collected to evaluate LTE's on Sections 1, 2, and 3, however, due to a scheduling conflict, no FWD data were collected on Section 4. Figure 3 captures LTE results for Section 2.

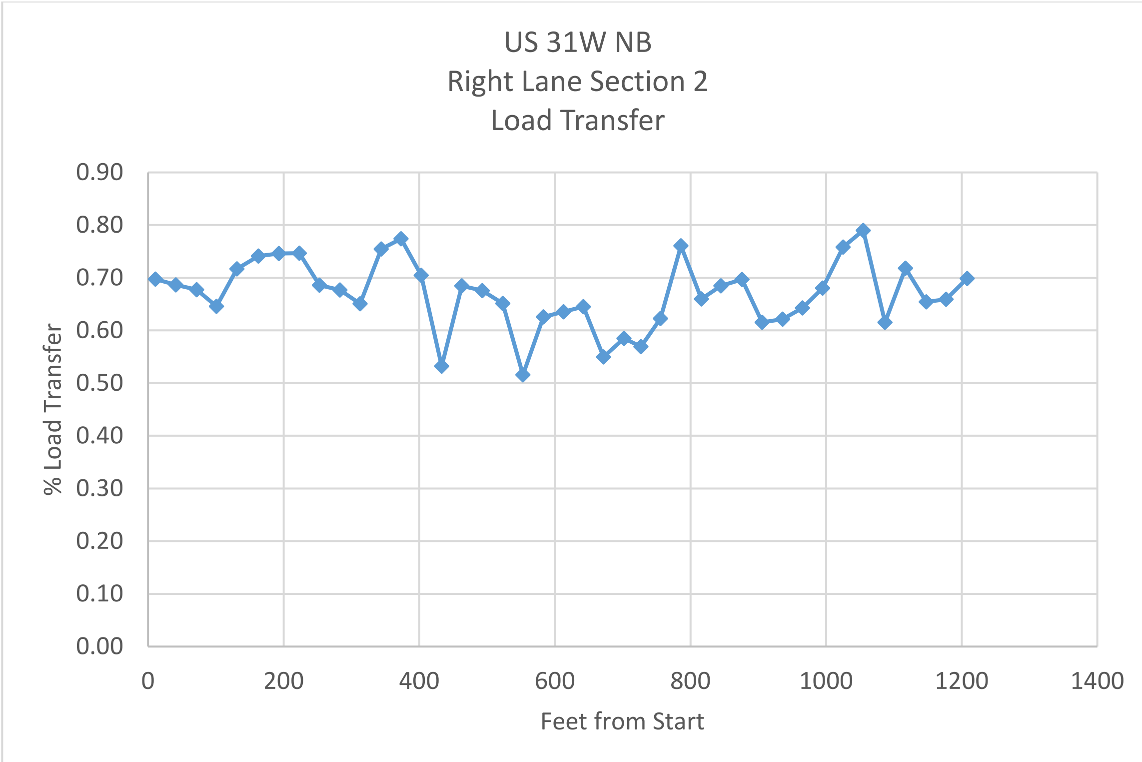

Figure 3 Load Transfer Efficiency NB Right Lane Section 2

3.3 Section 3 (Reflective Crack Relief Interlayer)

This section also utilized RCRI to mitigate reflective cracking. Prior to milling, FWD data were collected to determine the transverse joint's LTE. Figure 4 provides these results.

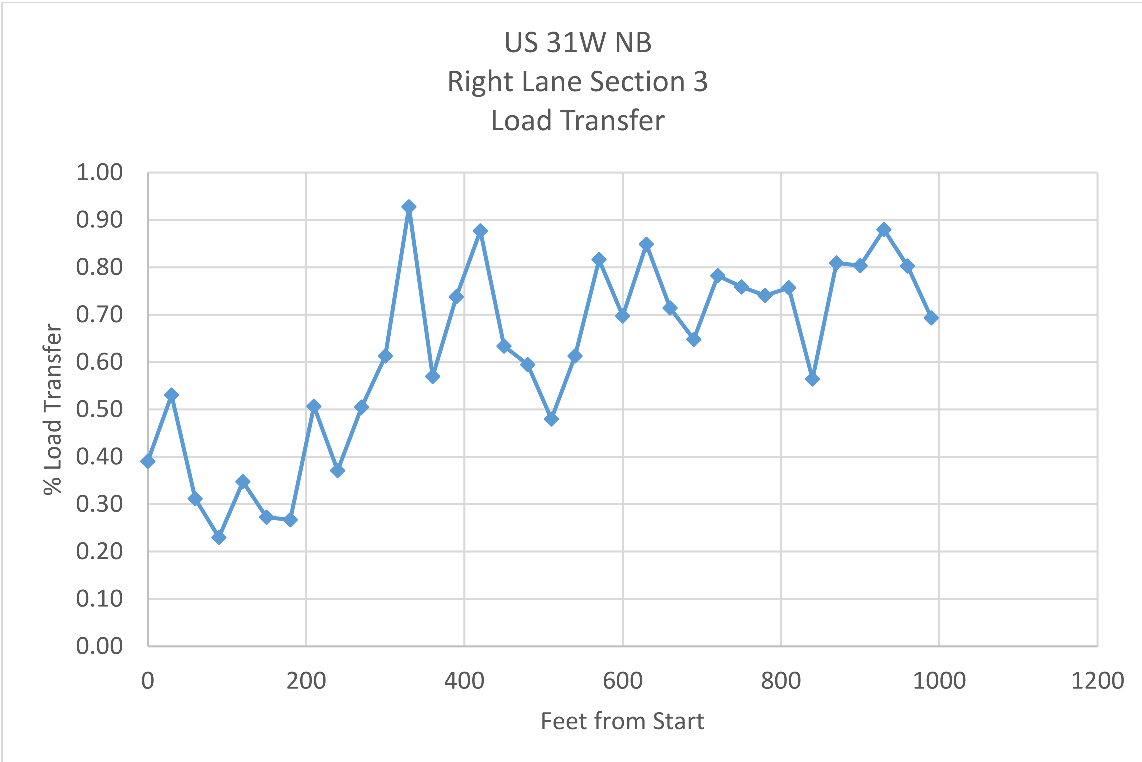

Figure 4 Load Transfer Efficiency NB Right Lane Section 3

KTC technicians were onsite at Section 3 at the time of installation to monitor and document any problems. There were no problems associated with placement of RCRI at time of KTC's visit. Although this section was also to receive joint sealing before installation, no joint sealer was applied. Several pictures were taken as RCRI was placed atop existing PCC pavement. See RCRI installation photographs in Figures 5-8.

Figure 6 Pavement Milling Process

Figure 5 Pavement Prep For RCRI

Figure 7 Placement of RCRI

Figure 8 Compaction of RCRI

3.4 Section 4 (Reflective Crack Relief Interlayer)

Section 4 also had RCRI applied to mitigate cracking. Once again, no joint sealing was performed before the RCRI was installed. Pavement milling, preparation, RCRI installation, and compaction were performed in the same manner as the other northbound sections. No FWD data were collected on this section prior to pavement milling due to a scheduling conflict.

4. Southbound Roadway Segments

4.1 Section 1 (Control)

Section 1 southbound served as the control section for this project. Once construction began, the asphalt pavement was milled to expose existing PCC pavement. The base course and pavement surface consisted of conventional asphalt. No crack suppression product was utilized. FWD data were not collected for this site due to poor communication on the paving schedule.

4.2 Section 2 (Multi-Axial Fiberglass Paving Mat)

Prior to milling FWD data were collected to determine LTE of the transverse joint. Results are provided in Figure 9.

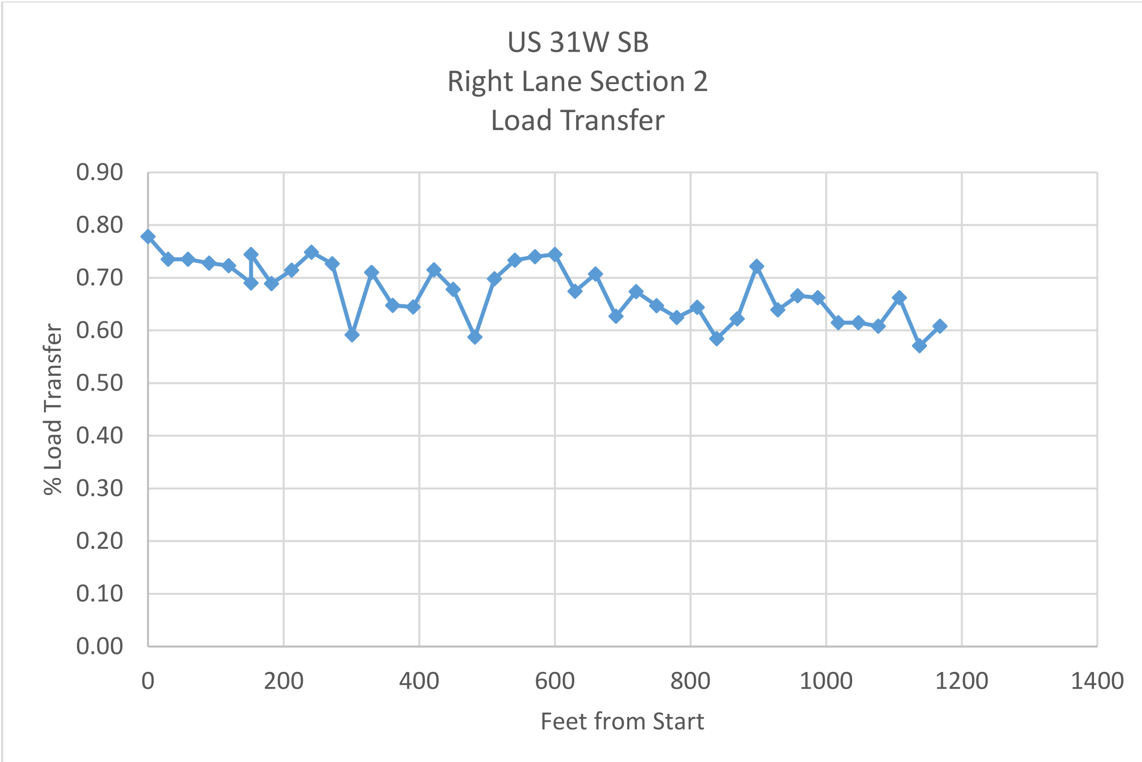

Figure 9 Load Transfer Efficiency SB Right Lane Section 2

Section 2 utilized a Multi-Axial Fiberglass Paving Mat. The paving mat is constructed of a non-woven material consisting of at least 60% fiberglass (by weight), with the remainder comprised of polyester and binder. The material has a minimum average roll value (MARV) unit weight of 3.69 oz./yd^2. It is also resistant to chemicals, mildew and rot, and does not have any tears or holes that will adversely affect the material's in-situ performance and physical properties. At the time of installation there were no problems associated with the placement of paving mat. Details of the installation can be seen Figures 10-15.

Figure 10 Pavement Prepped for Fabric

Figure 11 Applying Tack Coat as Adhesive

Figure 12 Fabric Placement

Figure 13 Piecemeal Installation

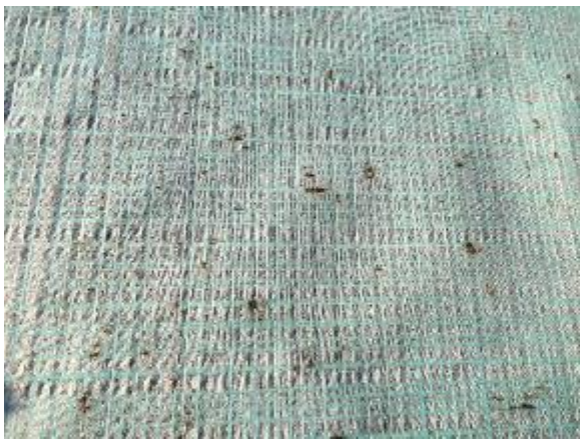

Figure 15 Close-Up of Paving Mat

Figure 14 Compaction of Base Course

4.3 Section 3 (Multi-Axial Composite Paving Grid)

Once again, before milling FWD data were collected to determine LTE of the transverse joint. Results are presented in Figure 16.

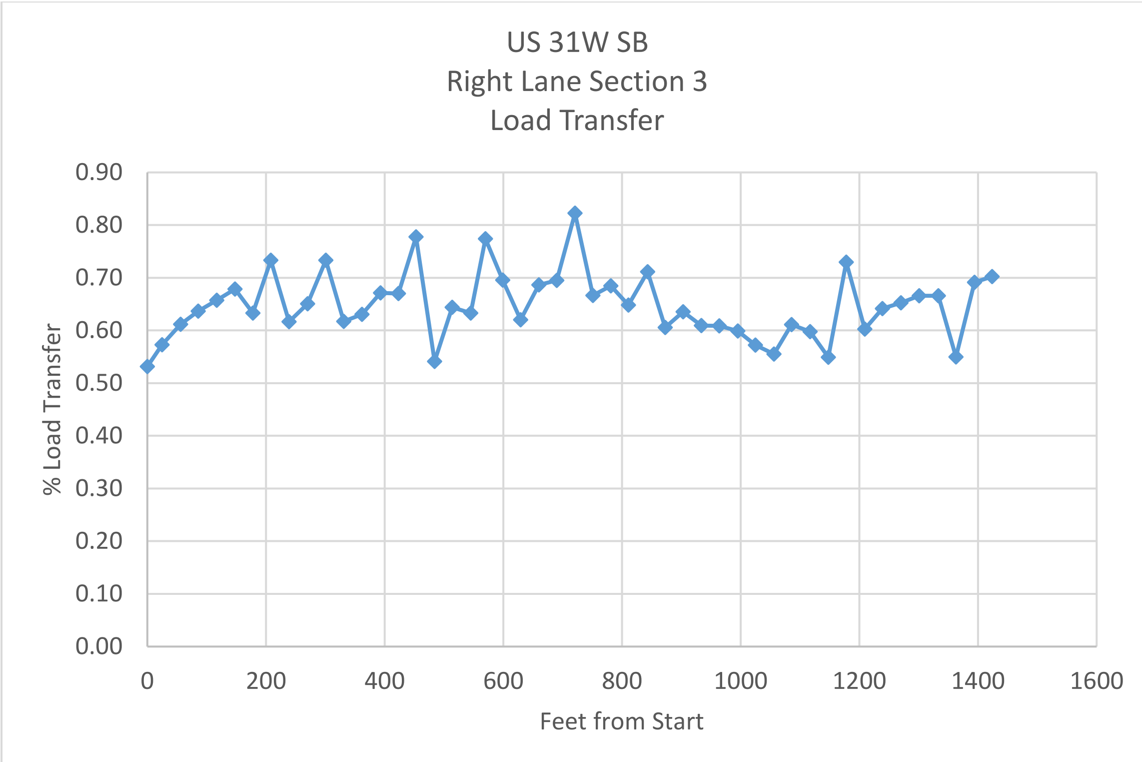

Figure 16 Load Transfer Efficiency SB Right Lane Section 3

Section 3 southbound utilized a Multi-Axial Composite Paving Grid. The paving grid is an engineered multi-axial composite paving grid interlayer constructed of uncoated, multi-directional, continuous strand, high strength fiberglass fibers, bound to a carrier that when properly saturated with hot asphalt binder forms a moisture barrier and provides multidirectional tensile strength. At the time of installation there were no problems associated with the placement of paving grid. Photographs of installation can be seen Figures 17-22.

Figure 17 Pavement Prepped for Fabric

Figure 18 Applying Tack Coat as Adhesive

Figure 19 Fabric Placement

Figure 20 Piecemeal Installation

Figure 21 Close-Up of Paving Grid

Figure 22 Compaction of Base Course

4.4 Section 4 (Bi-Axial Composite Paving Grid)

Section 4 southbound utilized a Bi-Axial Composite Paving Grid. The paving grid used for this location is a bi-axial composite paving grid interlayer consisting of a fiberglass grid and a nonwoven paving fabric that acts as a moisture barrier. At the time of installation there were no problems associated with the placement of paving grid. No FWD data were collected at this location due to a scheduling conflict. Figures 23-26 are photographs of the installation.

Figure 23 Pavement Prep for Paving Grid

Figure 24 Applying Tack Coat as Adhesive

Figure 25 Fabric Placement

Figure 26 View of Installed Fabric

5. Conclusion

This project had an initial completion date of June 2016. Due to several setbacks during construction, the project was not finalized until May 2018. All crack suppression products were placed in their respective locations. No difficulties were encountered placing any of the products, however, the piecemeal approach used for product installation was not expected. As stated earlier, placing each product along a continuous, uninterrupted roadway section would have been preferable. Monitoring will be more difficult due to the products being installed in a piecemeal manner. KTC will include this project in its long-term monitoring program to ascertain the effectiveness of each product.