Technical Memorandum

To: Jeff Uhlmeyer

From: Gary Elkins, Gonzalo Rada, Kevin Senn and David Jones

cc: Mustafa Mohamedali

Date: March 8, 2019

Re. Forensic Desktop Study Report: Kansas SPS-2 test sections 0201, 0203, 0206, 0212

Test sections located at the Long-Term Pavement Performance (LTPP) Specific Pavement Studies 2 (SPS-2) project site in Kansas were recommended for forensic analysis based on findings from a recent SPS-2 Tech Day, where state and industry engineers performed an on-site visit. During the visit, it was observed that cracking mirroring the presence of dowel bars was present in many sections across the transverse joints, particularly on the 8" thick test sections. Accordingly, a study of existing MIT scan data is recommended to see if depth of dowel bars was an issue. Depending on the findings, additional investigations could also be warranted.

SITE DESCRIPTION

The SPS-2 project site is located on west bound Interstate 70, in Dickinson County, east of Abilene Kansas, starting at milepost 289.3. This is a two-lane rural interstate highway in the direction of travel. It is classified in the wet-freeze climatic zone with an annual average annual precipitation of 33 inches per year and an annual average freezing index of 453-degree F degree days. The coordinates of the first test section at this site in the direction of traffic, which is section 29_0203, are 38.9939, -96.9677. Figure 1 shows the geographical location of the project within the State of Kansas, while Figure 2 shows the actual location for each section within the project.

In the SPS-2 test section numbering scheme used by LTPP, the last four digits of the test section ID, formally called SHRP_ID in the LTPP database, indicates the general type of pavement structure according to the experimental plan. In concept, a SPS-2 test section with a SHRP_ID of 0201, is supposed to be comparable with all other SPS-2 test sections with a SHRP_ID of 0201 located on other test sites. However, due to deviations in pavement construction, what is more important than understanding the generic pavement structure designated in the experimental plan are the actual details of constructed test section. For the selected SPS-2 test sections in Kansas, the as-constructed details of the pavement test sections are as follows:

- 20_0201 – the experimental portion of this test section structure is 7.7-inch thick unreinforced PCC surface layer, with specified highway agency normal PCC compressive strength (actual 600 psi), 12-foot slab width, over a 6-inch thick unbound base. The dowel bars used on this test section have a nominal 1.25-inch diameter.

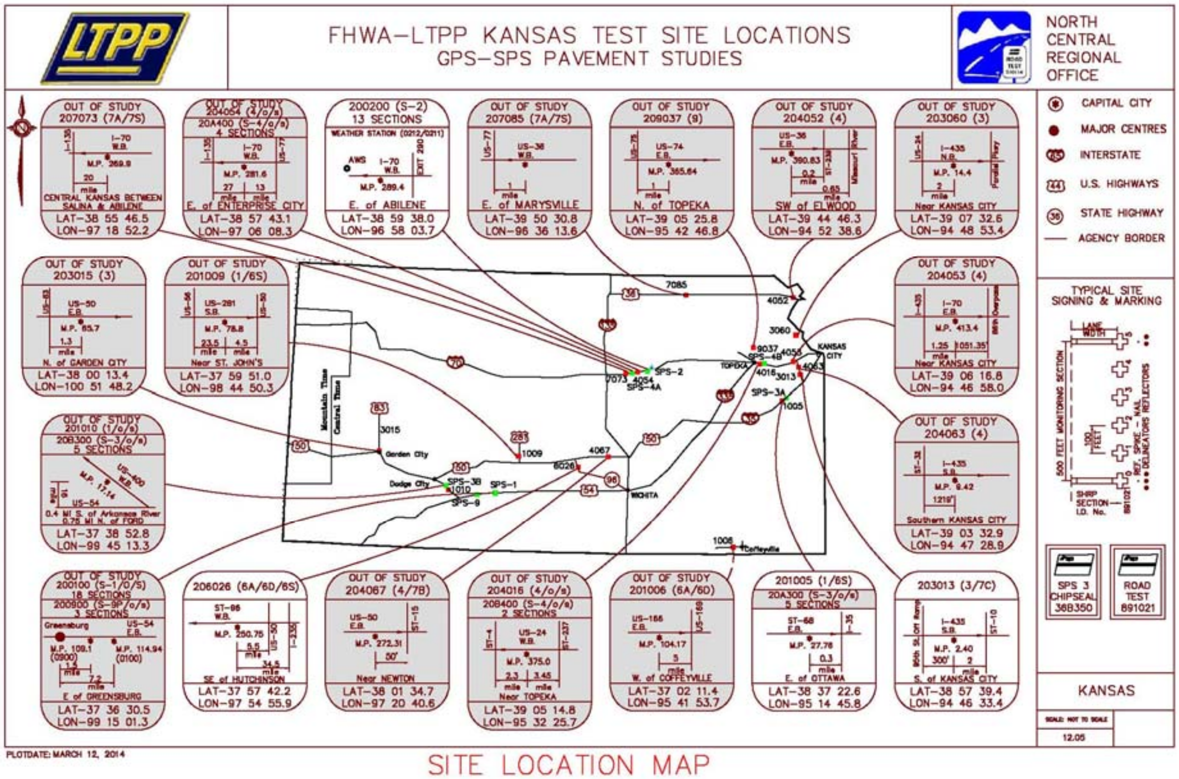

Figure 1. Kansas SPS-2 Project Location

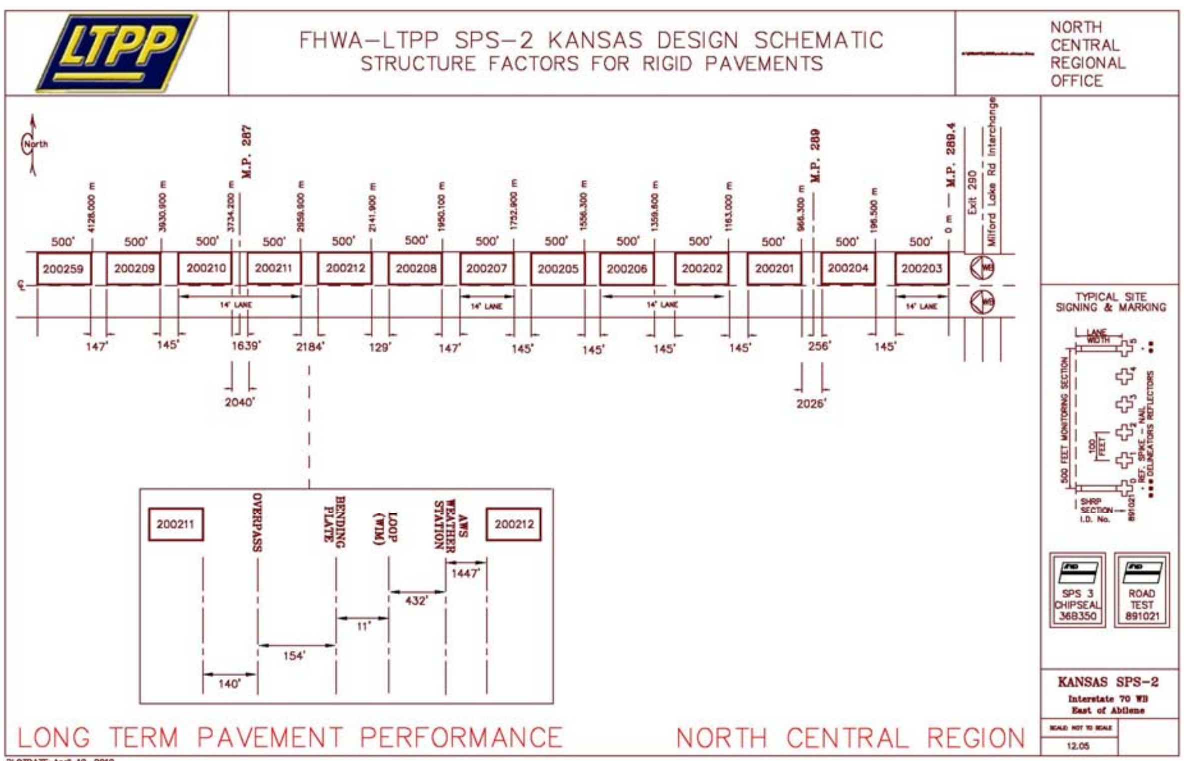

Figure 1. Kansas SPS-2 Test Section Locations

Test sections 20_0201 and 20_0206 were reported as exhibiting distress conditions that might be considered in the failure range for this pavement type. Test sections 20_0203 and 20_0212 were reported to exhibit little distresses, which results in an excellent performance history rating in this type of comparison for test sections co-located at the same site. All test sections on this SPS-2 project are constructed on fill locations with an approximate 6-inch layer of fly ash modified subgrade, which is reported as a silty clay. The construction reports indicates the fly ash was added to mitigate the generally wet condition of the subgrade at this site.

Pictures showing the general location and surrounding landscape of each test section are shown in figures 3 through 6, which were obtained from the most recent distress survey performed in 2015.

Figure 3. Test section 20_0201.

Figure 4. Test section 20_0203 (first section located in direction of travel).

Figure 5. Test section 20_0206.

Figure 6. Test section 20_0212.

BACKGROUND

The Kansas SPS-2 project was constructed between June 1 and July 25, 1992, and it is in the westbound driving lane of Interstate 70, near Abilene Kansas. The existing concrete pavement structure was removed and replaced with the experimental pavement structures specified in the SPS-2 research plan. This was the first SPS-2 project constructed for this LTPP experiment, using the guidelines available at the time.

TEST SECTION PERFORMANCE HISTORIES

The available data from LTPP to document the pavement performance histories of these test sections are contained in the following graphs.

IRI Roughness and Construction Time Histories

The IRI and construction time history for test section 20_0201 is shown in figure 7. The vertical lines are construction events, as follows:

CN1 – test section accepted into LTPP program, January 1992

CN2 – partial depth patching at joints, replaced one PCC slab, December 1995

CN3 – replaced 2 PCC slabs, June 2002

CN4 – replaced 4 PCC slabs some previously replaced, August 2004

CN5 – joint Sealing, March 2005

CN6 – full depth transverse joint repair, full depth patching other than joint, June 2011

The IRI shows a relatively steep increase in IRI, until the slab replacement performed in 2002. There is a drop in IRI after the slab replacements, and then the IRI starts increasing again. The apparent "spikes" in the May 2014 measurements is a bit of a mystery. The distress survey performed at this time indicates diamond grinding that was not captured in a construction event. However, the more probable explanation is that profile measurements on May 5, 2014 were performed following standard LTPP protocol and a set of LTPP diurnal profile measurements on May 6, 2014 were performed at times when the temperature gradient in the top and bottom of the PCC slab was the greatest positive, neutral, and greatest negative.

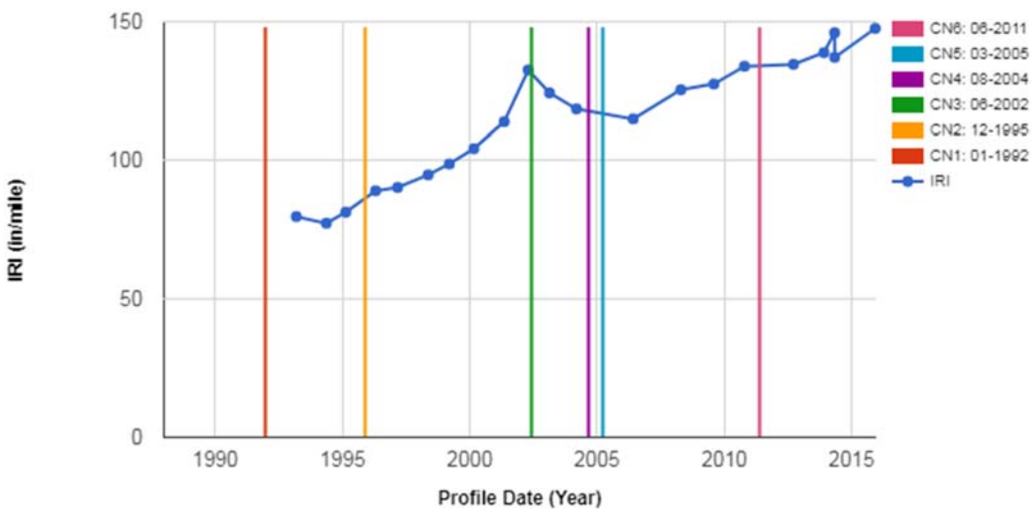

Figure 7. Section 20_0201 IRI and construction time history plot.

Figure 8 shows the IRI and construction time history plot for section 20_0203. The only maintenance event performed on this test section was joint sealing in March 2005. The IRI for this section has remained relatively stable with only a slight increase over time.

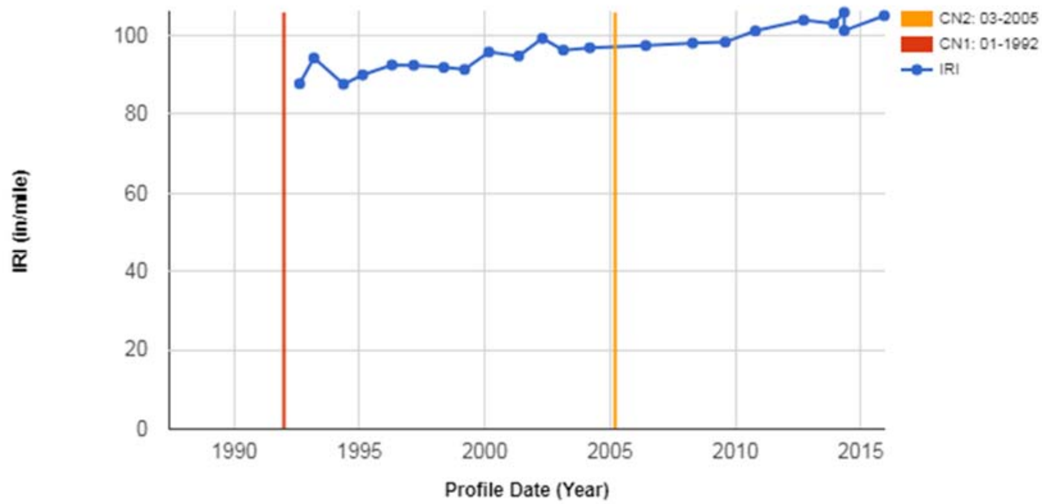

Figure 8. Section 20_0203 IRI and construction time history plot.

Figure 9 shows the IRI and construction time history for section 20_0206. The following construction events have occurred on this test section:

CN1- test section accepted into LTPP program, January 1992

CN2- joint sealing, March 2005

CN3 – replaced one PCC slab, June 2011

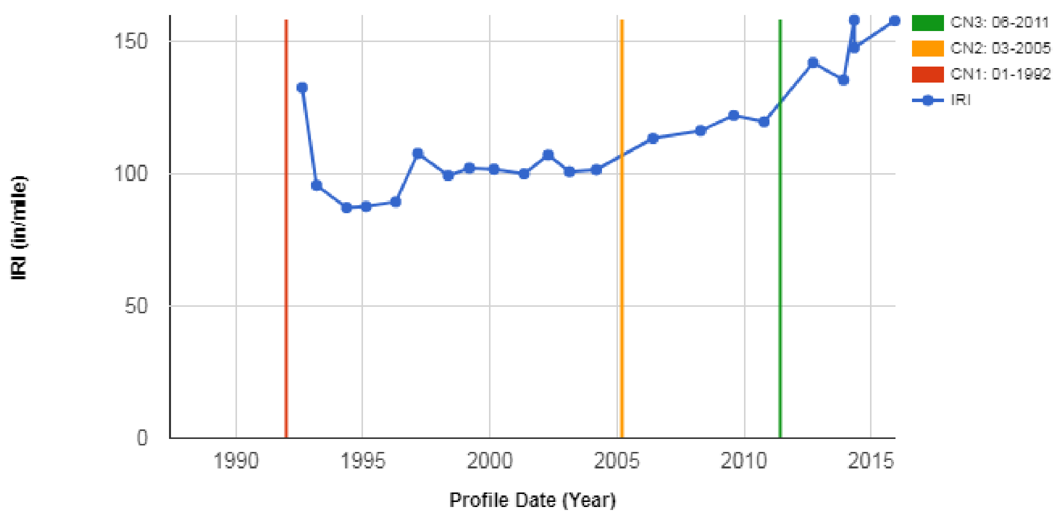

Figure 9. Section 20_0206 IRI time history plot.

The initial IRI values measured in August 1992 appear high as compared to future measurements. There are no noted problems in the profile operator comments for the August 1992 IRI measurements. In the 1992 measurements, the roughness of the left wheelpath was considerably higher than the right wheelpath. The 1992 profile measurements were performed from approximately 1 pm to 3 pm on 8/14/1992. Profile operator notes in the March 1993 profile measurement indicated the IRI values had dropped since the 1992 measurements; however, no equipment related issues were reported. These measurements were performed on 3/10/1993 from 11 am to 12:30 pm. The apparent “spikes” in the May 2014 measurements is due to a standard profile measurement set measurement on May 5, 2014 and a set of diurnal measurements performed on May 6, 2014 at times when the temperature gradient in the top and bottom of the PCC slab was the greatest positive, neutral, and greatest negative.

Figure 10 shows the IRI construction time history for section 20_0212. Joint sealing in March 2015 is the only maintenance event that has occurred on this test section. It is unknown why the average IRI prior to 2004 shows variability, and after 2004 becomes very stable. There is one operator comment in the measurements performed in 2002 indicating that profile spikes are pavement related. Other than having a significant cross tining pavement texture, the only other notable issue with the test section are random white paint spatters on the pavement surface in 2002. The diurnal profile measurements performed in 2015 did not show very much diurnal variability on this test section.

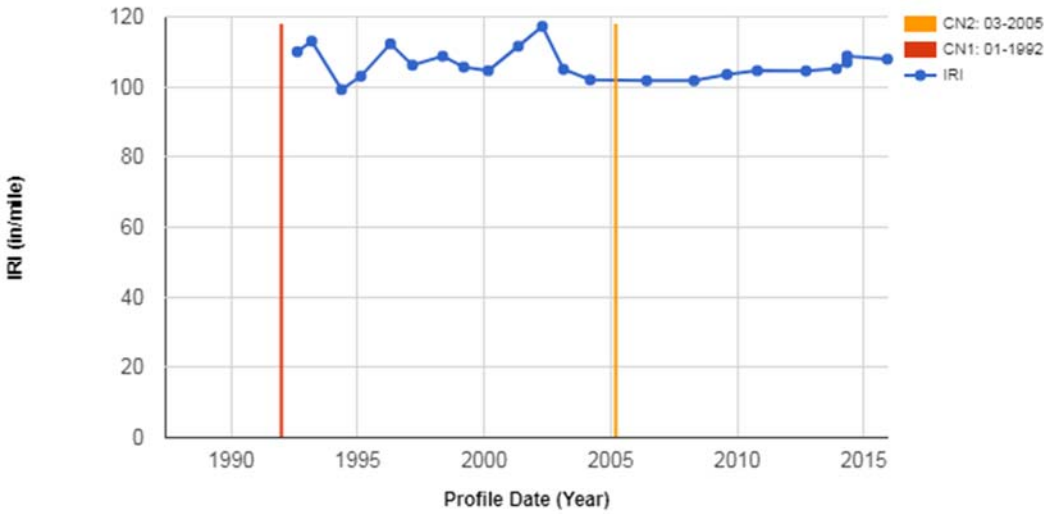

Figure 10. Section 20_0212 IRI and construction time history plot.

Faulting Time Histories

Figure 11 shows the average faulting time histories on the selected Kansas SPS-2 test sections. Note that a positive fault height occurs when the leave side of the joint has a higher elevation than the approach. As can be seen in figure 11, the amount of faulting observed on these test sections is very minor.

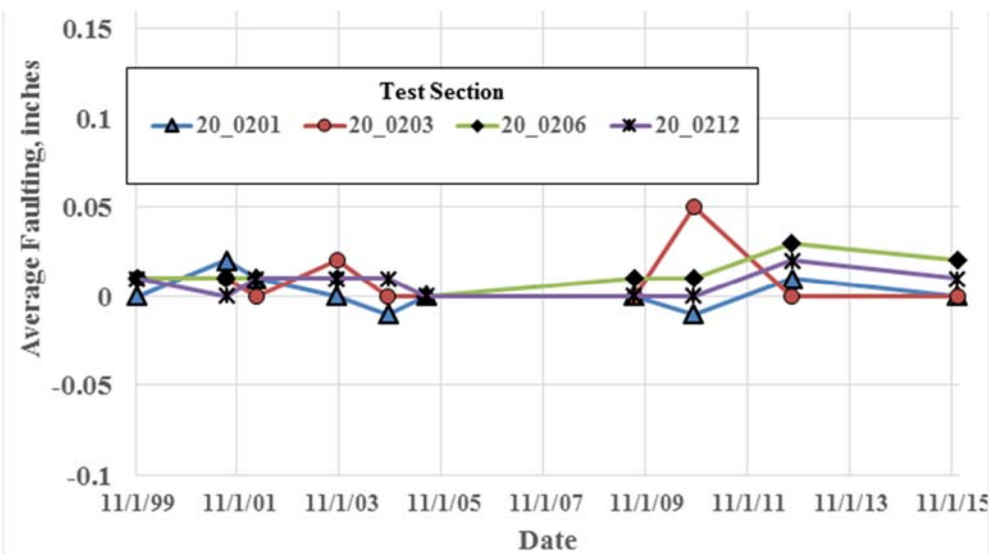

Figure 11. Average faulting time history for selected Kansas SPS-2 test sections.

Transverse Cracking Time Histories

Figure 12 shows the time history progression of transverse cracking on the four selected test sections for this study from the Kansas SPS-2 project site. Test section 20_0201 was the only test section of the selected group to experience transverse cracking. Variations in the number of transverse cracks may be due to full depth slab replacements on the slabs at the end of the test section which exhibited the most significant distress, and growth of transverse cracks on other slabs. In the SPS-2 experiment design, this test section was designed to be the weakest PCC test section structure (without consideration of applied pavement loads).

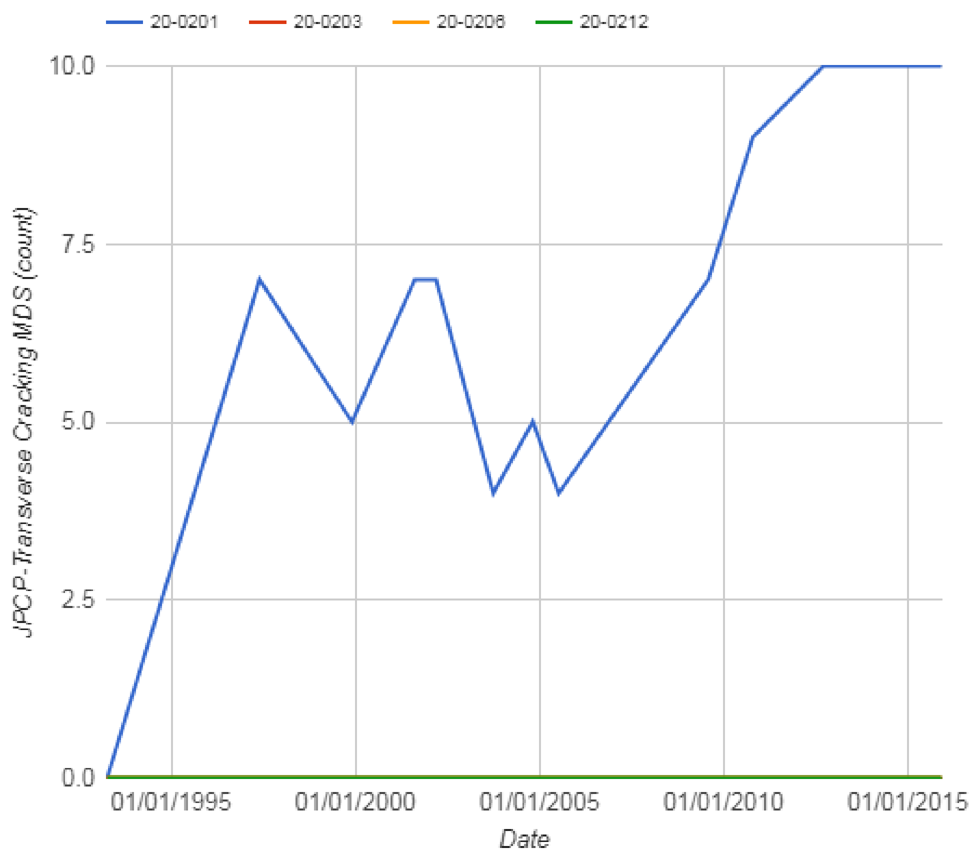

Figure 12. Transverse cracking history on the selected SPS-2 test sections, by number of transverse cracks.

Spalling at Transverse Joints and Cracks

Figure 13 shows the number and length of spalling at transverse cracks and joints from the last distress survey performed in 2015 on the test section under study. Only test section 20_0201 has significant spalling. From the distress surveys it is clear that many patches have been placed at joints to correct spalling defects.

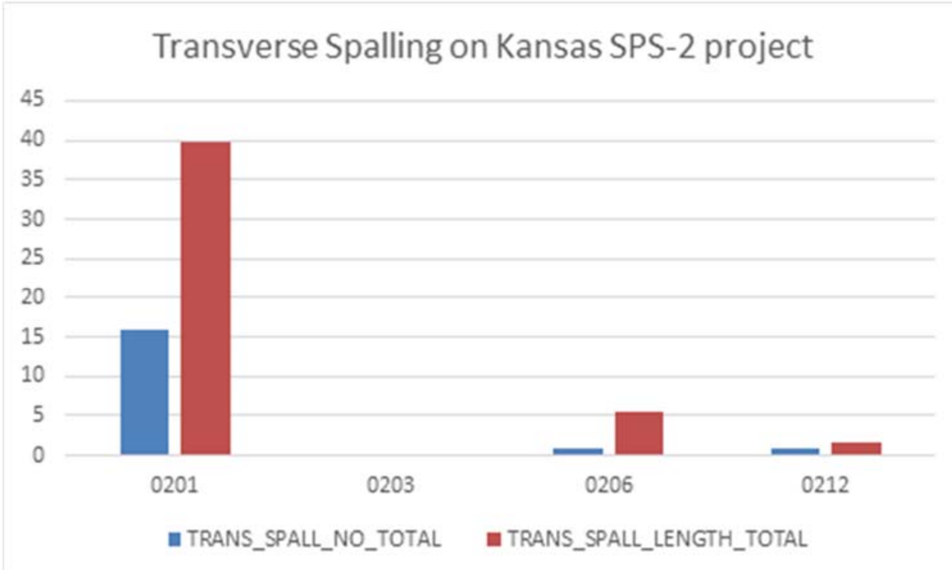

Figure 13. Plot of transverse joint and crack spalling by number and length.

Longitudinal Cracks at Joints

One of the observations from the SPS-2 Tech Day was the presence of short longitudinal cracks that appeared to be located above dowel bar locations. The reason for this assumption is that the cracks were limited to the length of a dowel bar, and at several locations the spacing between the cracks approximated the spacing between dowel bars. To investigate this phenomenon, the study team examined the hand drawn crack maps from the last manual distress surveys performed at this site in December 2015 and compared them to dowel bar alignment measurements also performed in December 2015.

The longitudinal cracking at joints information is presented first, then the MIT dowel bar measurement data is provided, and finally the relationships between the two data sets is examined.

On pavement distress maps, LTPP distress rates records longitudinal cracks as a type 3 crack, and the associated letter indicates the severity. A 3L crack is a longitudinal crack with low severity. The number associated with this code indicates the length of the crack. The reason this is important is that in the following figures images of hand drawn distress maps and photographs are presented that show the cracks at obvious dowel bar locations as reported from the SPS-2 Tech Day.

Figure 14 is the image of the manual distress map on section 20_0201 from the December 2015 distress survey for test stations between 400–450 feet (122-137 m)[1]. The joint located at around 432 feet (131.4 m) shows 5 short longitudinal cracks centered on the joint location. These are labelled as 3L cracks. A more thorough review of this image also shows transverse cracking approximate to the joint located at the joint located at~ 460 feet (136 m). The downstream portion of this joint is a complete slab replacement type of patch.

Figure 15 is a close-up picture of the short longitudinal cracks at the joint located approximate to station 432 ft (131.1 m). This picture appears to reinforce the observation that these cracks are above dowel bar locations. From review of the manual distress map test section 20_0201 from December 2015, 16 of the 33

[1] Mixed units are presented to describe some of the following figures, since the stations in the figures have mixed US Customary and Metric stations.

joints showed between 1 to 5 short longitudinal cracks at the joint, which appears to be associated with dowel bar locations.

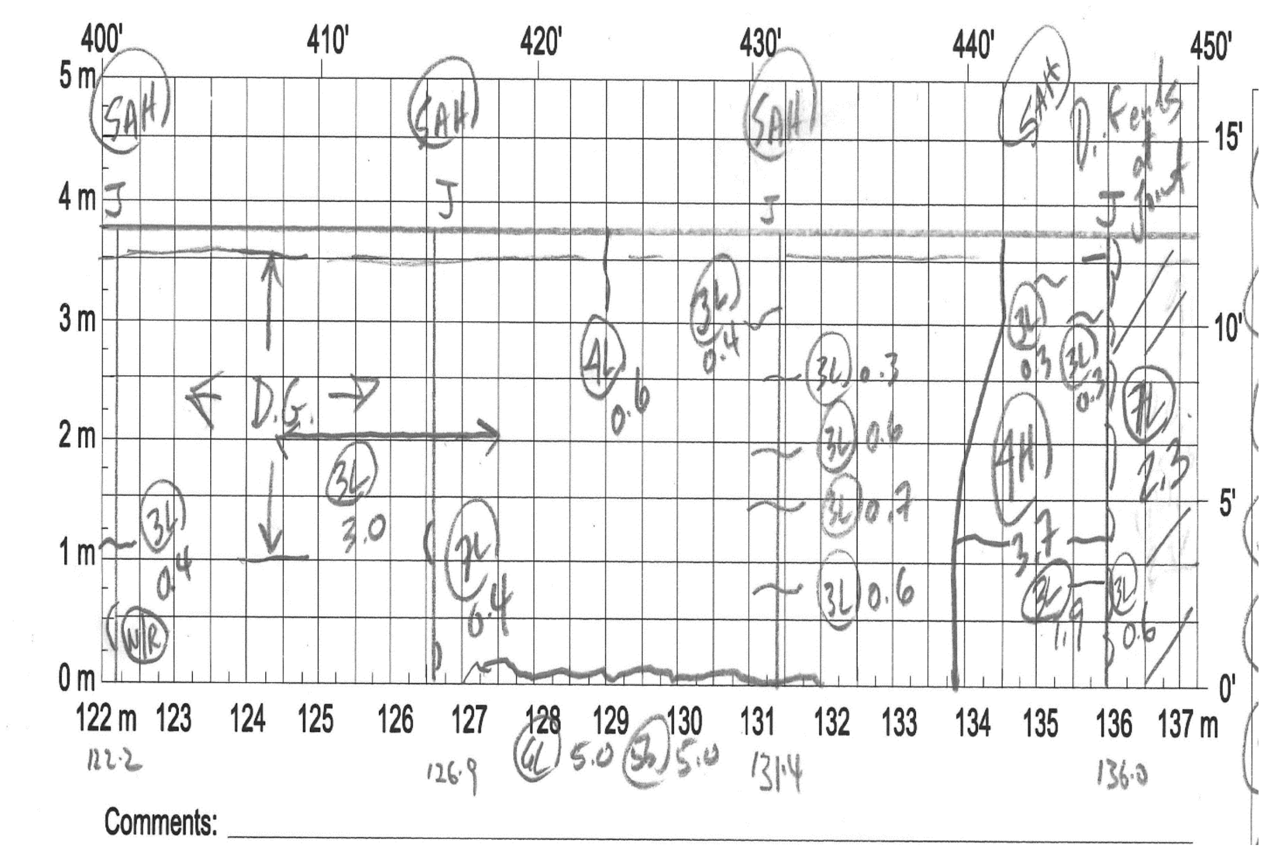

Figure 14. Distress map from December 2015 distress survey that appears to illustrate longitudinal cracking at dowel bar locations.

Figure 15. Close-up image of joint located at station 432 ft (131.1 m) on test section 20_0201 in December 2015, showing short longitudinal cracks that approximate the location of dowel bars.

The distress survey from section 20_0206, showed two joints with potential longitudinal cracks located over dowel bars. Figure 16 is the relevant portion of the manual distress survey map for section 20_0206 in December 2015. The transverse joints at approximate stations 11 feet (3.5 m) and 26 feet (8 m), were the only two joints with this issue. Another feature of this distress map is distress 8A, which is map cracking on the pavement surface. There is also a significant longitudinal crack with on offset of about 5 feet (1.5 m) from the lane edge. This is a 14-foot-wide pavement slab.

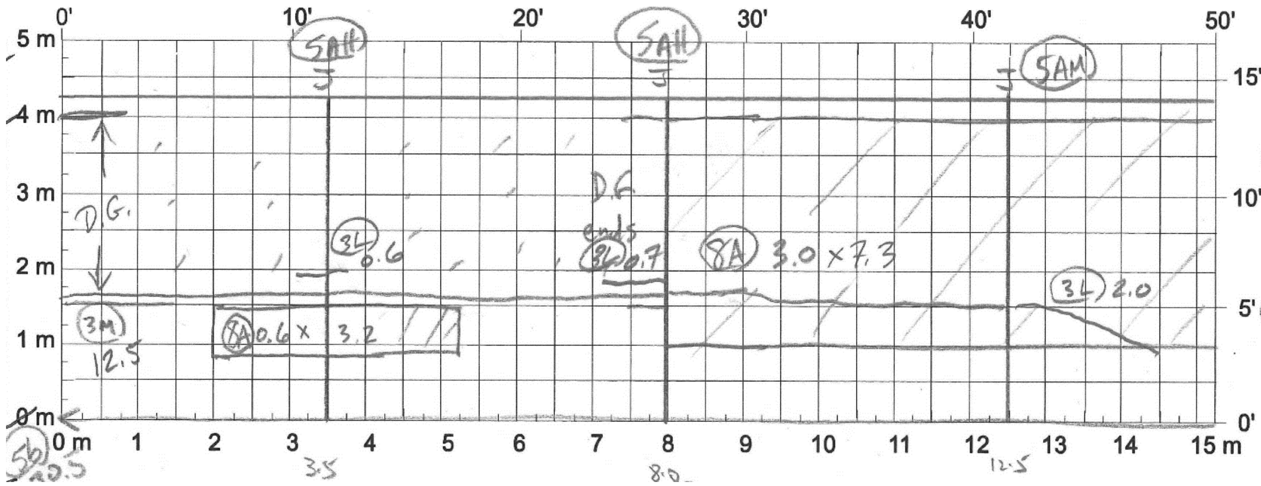

Figure 16. Manual distress survey map from December 2015, of the start of test section 20_0206.

Figure 17 shows a close-up picture of the joint located at 26 feet (8 m). There appears to be more short longitudinal cracks at this joint than noted in the manual distress survey. Also the map cracking noted in the distress survey could be influencing the rating of longitudinal cracks at the joint in this distress survey.

Figure 17. December 2015 image of joint on test section 20_0206 at stations 26 feet (8 m). Image shows potential masking of short longitudinal cracking over dowel bars rated as map cracking.

DOWEL BAR ALIGNMENT MEASUREMENTS

In December 2015, dowel bar alignment measurements were performed on the Kansas SPS-2 site using the MIT device. The MIT device uses magnetic induction tomography to detect the position, alignment, and location of dowel bars at joints in PCC pavements. The raw data collection includes measurements of each dowel location at each joint location on a pavement test section. Since most of the LTPP SPS-2 test sections contain 34 joints, and have 12 dowels for each joint, the number of dowel alignment measurements for a test section exceeds 400 measurements.

The MIT computed parameters data set includes:

- Minimum depth of cover – this measurement is based on the highest point in a dowel bar, relative to the pavement surface, at each joint location. Lower effective cover depth means the dowel bars are nearer to the pavement surface.
- The dowel score and joint score dowel alignment indices are based on FHWA metrics[2] – the dowel score is primarily based on dowel rotational misalignments of individual bars at a joint. The joint score is a summation of weighted factors based on total dowel misalignment numeric. The higher the dowel or joint score, the worse the alignment of the dowels at a joint.
- Effective dowel bar diameter – this is a computed parameter based on dowel bar misalignment statistics using the methodology contained in NCHRP report 637[3]. Lower computed effective dowel diameters from MIT measurements are supposed to indicate lower effective load transfer efficiency provided by the dowel bars.

Attachment A contains the joint score and computed effective dowel diameter from measurements at each joint from MIT measurements, while Figure 18 illustrates average and minimum depth of PCC coverage over the dowel bars on the Kansas SPS-2 test sections included in this study. Sections 20_0201 and 20_0206, have the lowest depth of cover. They are also the thinnest test sections on the project site. While the design construction thickness was specified as 8 inch, these test sections have an average thickness of the PCC layer of 7.7 inches.

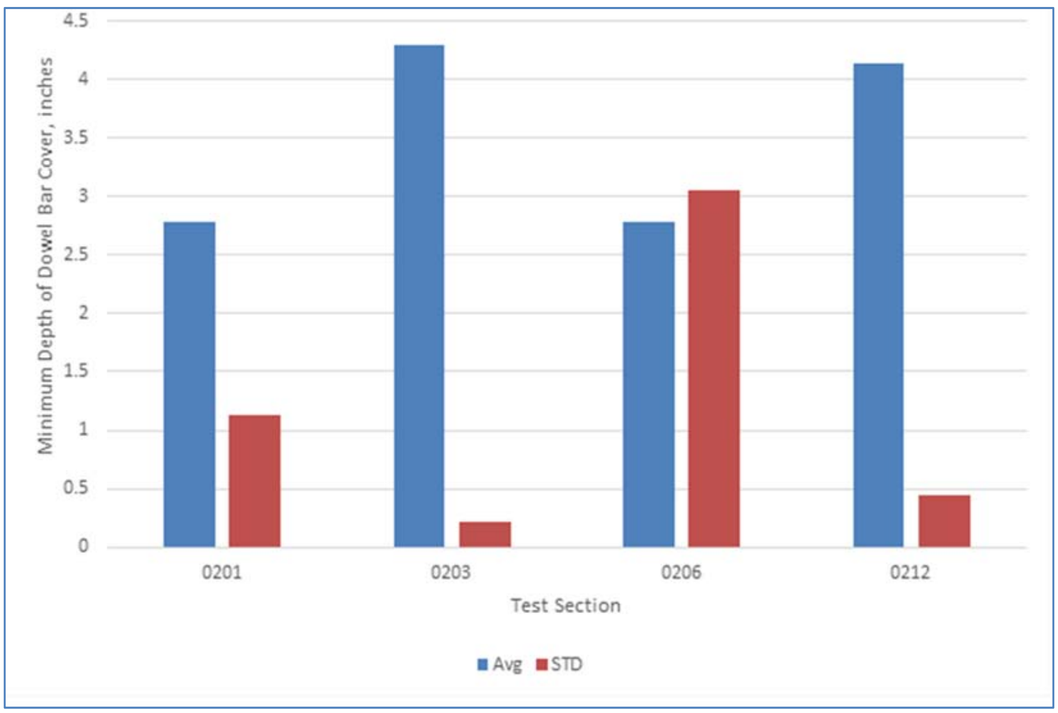

Figure 18. Depth of coverage dowel bar statistics for the selected test sections on the Kansas SPS-2 project site.

[2] Yu, H.T., and L. Khazanovich. (2005) *Use of Magnetic Tomography Technology to Evaluate Dowel Placement.* Report No. FHWA-IF-06-006. FHWA

[3] Khazanovich, L., K. Hoegh, and M. Snyder. (2009) *Guidelines for Dowel Alignment in Concrete Pavements.* NCHRP Report 637.

One of the postulates from the SPS-2 Tech day was that cracking at the joints appeared to be located above dowel bar locations. Figure 19 shows the relationship between the number of short longitudinal cracks at each joint location on test section 20_0201 and the average dowel bar coverage depth statistic for each joint. Joint 29 had the most longitudinal cracks at the joint and the shallowest depth of dowel bar embedment. The outlier in this plot is for joint 30, which has 4 longitudinal cracks located at the transverse joint. The minimal coverage MIT measurements reported in the baseline at this joint range between 18.3, which is thicker than the PCC pavement, and -2.4 inches which is above the pavement surface; thus, the depth of coverage MIT measurements at joint 30 on this test section are not reliable.

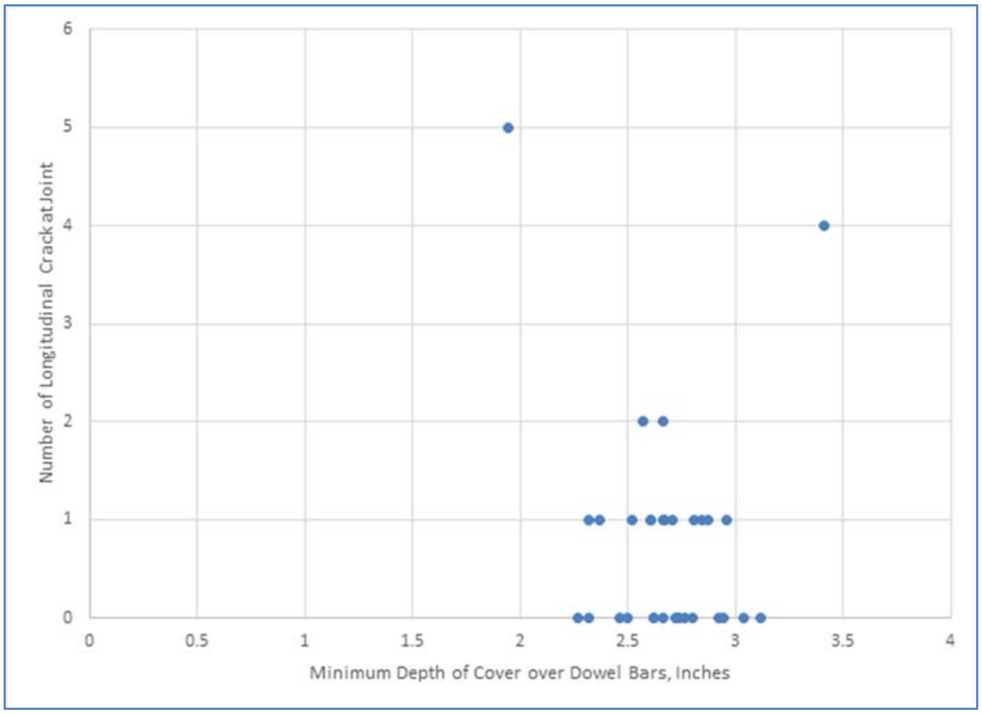

Figure 19. Minimum depth of dowel bar coverage from MIT measurements versus number of longitudinal cracks at each joint location on section 20_0201. It is noted that the computation of minimum depth of cover for the data point with 4 longitudinal cracks has indicated MIT measurement discrepancies.

Figure 20 shows the fault height at each joint on test section 20_0201 as a function of joint score. There appears to be no relationship between fault height and joint score on this test section. It should be noted that a negative fault height measurement means the leave side of the joint has a higher elevation than the approach. The largest negative fault height on this test section is located where a new full depth slab was replaced and created an upward “bump” in the longitudinal profile.

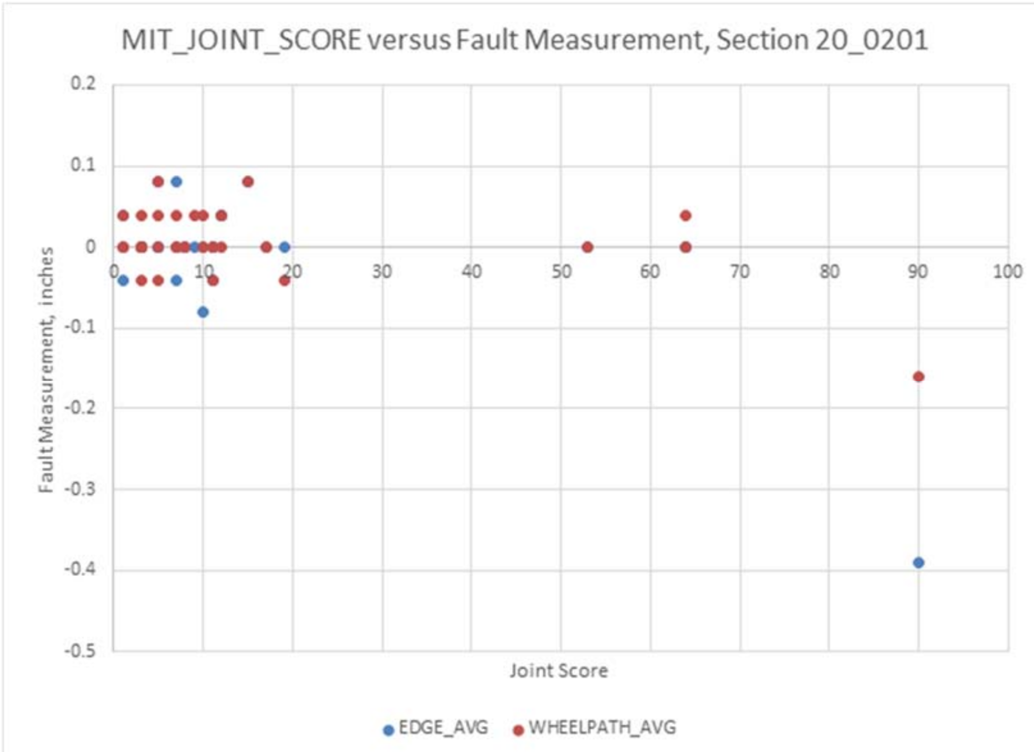

Figure 20. Fault measurements versus joint scores from MIT measurements on test section 20_0201.

Figure 21 illustrates the relationship between the MIT derived joint score and the number of longitudinal cracks at transverse joints interpreted from the LTPP manual distress survey maps. While there is a causal trend for the joints with the highest dowel score to also contain the most longitudinal cracks at dowel bar locations, there are also joints with high joint scores that have no indication of longitudinal cracks over the dowel bars.

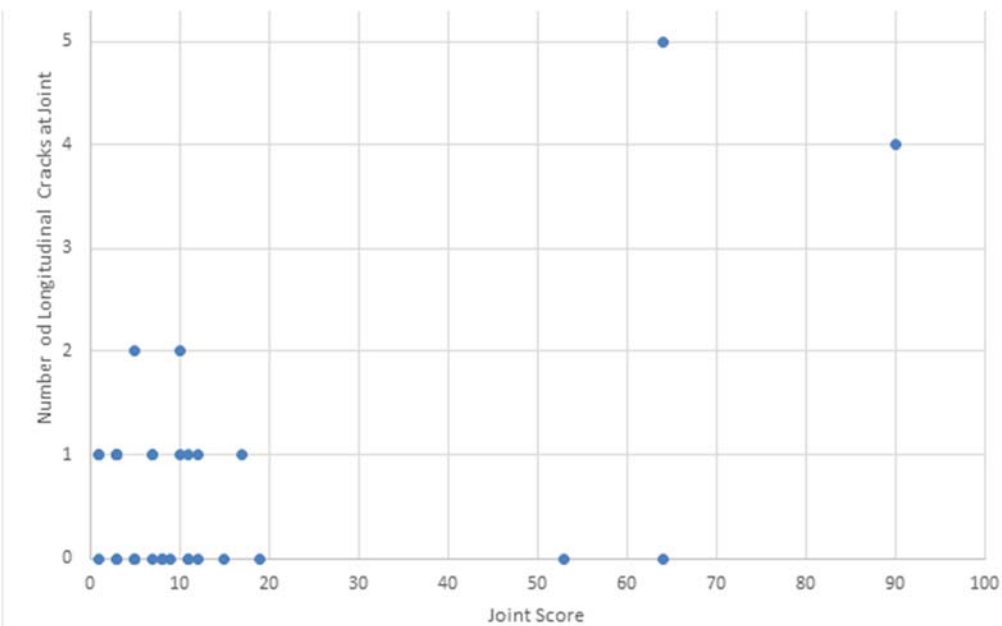

Figure 21. Number of longitudinal joints at transverse joints versus joint score from MIT measurements for test section 20_0201.

Figure 22 shows the relationship between computed effective dowel diameter and number of longitudinal cracks over dowel bars on section 20_0201. The actual dowel bar size used on this test section was 1.25 inches. The effective dowel bar parameter computed from MIT measurements appears to have some promise since the joints with the greatest number of apparent transverse cracks occur over the dowel bars with the smallest effective dowel diameter. While there is some variability, the effective dowel bar diameter from computation from MIT measurements appears to show a rough rank order correlation with number of longitudinal cracks at dowel bar locations.

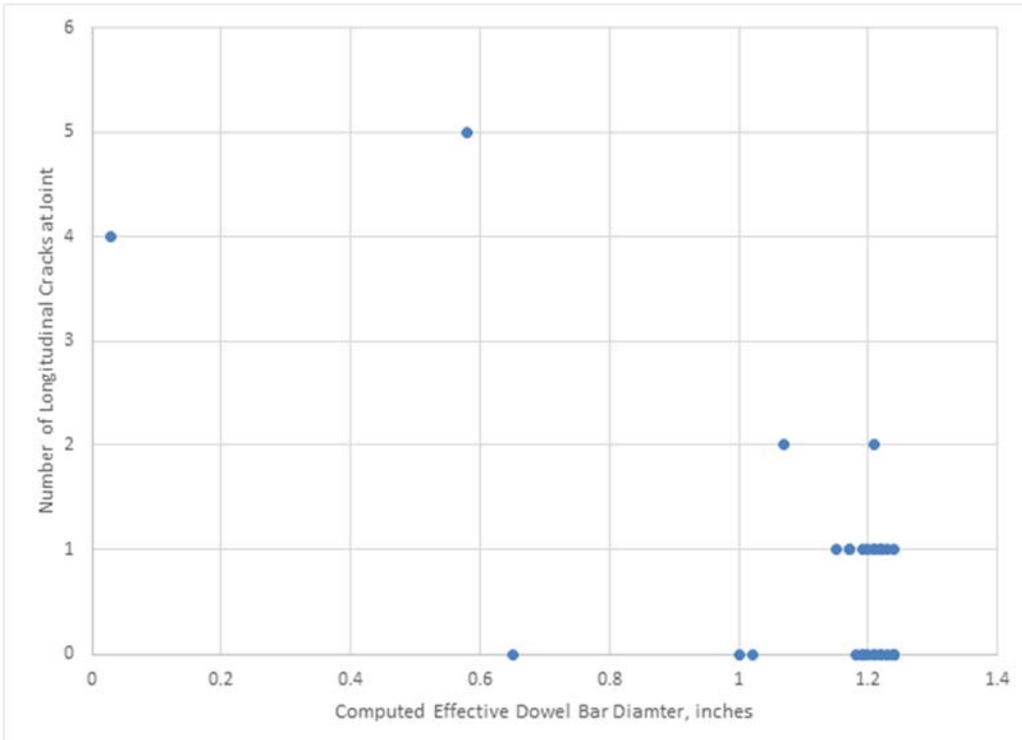

Figure 22. Number of longitudinal cracks at transverse joints versus computed effective dowel bar diameters from MIT measurements for test section 20_0201.

These findings suggest that the current summary statistics derived from the MIT measurements do not satisfactorily explain the performance of doweled joints relative to surface distresses as related to current dowel bar alignment statistics.

JOINT DEFLECTION LOAD TRANSFER MEASUREMENTS

Deflection load transfer measurements are performed with the Falling Weight Deflectometer (FWD) load plate positioned adjacent to a transverse joint in a PCC pavement. The deflection Load Transfer Efficiency (LTE) statistic is based on the ratio of the deflection under the load and the deflection sensor located at about the same offset on the other side of the joint. Measurements are performed with the load plate positioned on the approach and leave side of the joint. The load transfer efficiency computed parameters are based on direct sensor measurements and are not adjusted. Higher LTE numbers are associated with PCC joints that more efficiently distribute truck loads across joints and minimize localized edge loading.

Figure 23 shows the time history plot of LTE at the joint on section 20_0201 which exhibits the most longitudinal cracks over the dowel bars on this test section. Average LTE measurements from the highest load level are shown in this figure. It is unknown why there was a dip in approach LTE between 1996 and 2001. Overall there has been a decrease in LTE at this joint, but the decreases are relatively minor. This suggests that the cracks that appear to be located over the dowel bars are not having a significant impact on the dowel bar function related to load transfer across the joint.

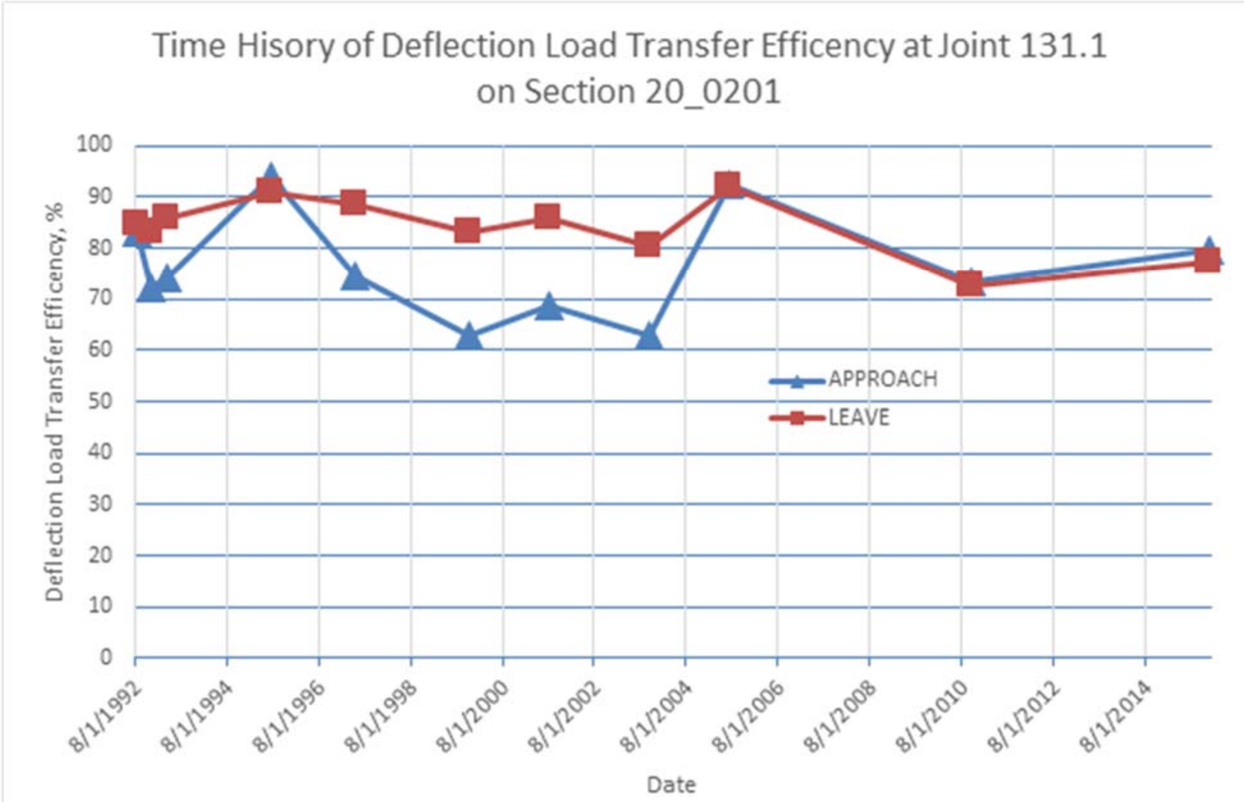

Figure 23. Time history of average deflection load transfer efficiency at joint 131.1 on section 20_0201 from drop height 4.

Figure 24 shows the time history LTE measurements from the joint on test section 20_0201 at station 3.1. This joint had one minor longitudinal crack associated with a dowel bar. LTPP LTE measurements are performed in the wheel path which is not near the longitudinal crack associated with dowel bar cracks. While this time history plot shows a general decrease in LTE over time, the decrease in LTE is not very significant from those for the joint at station 131.1.

SUMMARY OF OBSERVATIONS

The following summarize the findings from this study.

- On the four test sections selected for this study, the longitudinal cracking at dowel bar locations occurred mostly on test section 20_0201 and to a lesser extent on test section 20_0206.
- The one thing in common with sections 20_0201 and 20_0206 was the thickness of the PCC surface slab. While these sections were designated as an 8-inch nominal thick PCC surface layer, they were constructed to a 7.7 inch thick PCC surface layer.
- The average minimum depth of coverage of PCC over the top of the dowel bars on these test sections was 2.8 inches. This is less than half of the thickness of the as constructed PCC surface layer. Adding the extra 0.3 inches of PCC surface layer thickness as specified in the construction guidelines, and accounting for the diameter of the dowel bars, still indicates that the dowel bars were positioned about 10% higher in the PCC layer than desired.

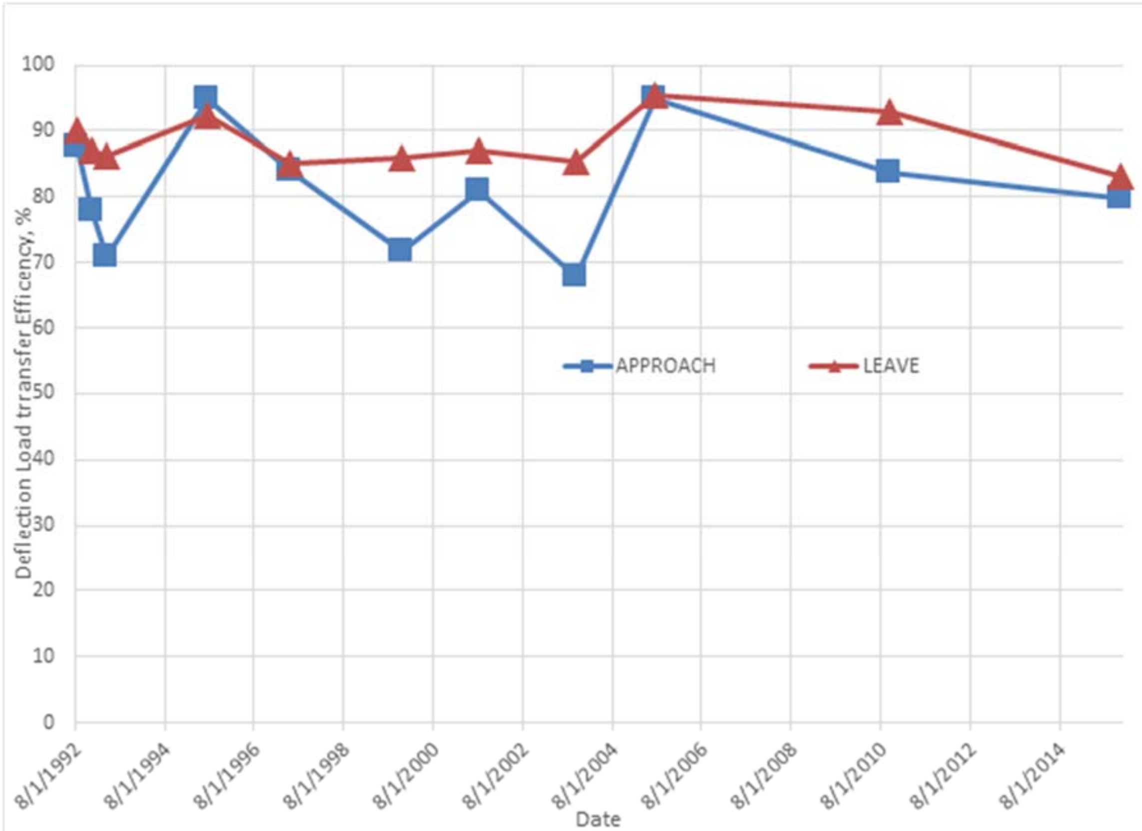

Figure 24. Time history plot of average deflection load transfer efficiency at joint 3.1 on test section 20_0201 from drop height 4.

- Test section 20_0201 had the lower strength concrete as compared to test section 20_0206, and exhibited more longitudinal cracking at dowel bar locations.
- Test Section 20_0201 had some significant issues with the slabs located at the end of the test section that caused Kansas DOT to replace them with full depth slab replacements. The largest indication of unaligned dowels bars was measured at one of these new joints, however no distress was observed at this joint. It is theorized that the lack of distress observations at this joint is due to the young age of the full depth panel and joint replacement.
- One of the motivations for this investigation was to examine the relationship between MIT measurements of dowel bar alignment and test section performance related to joints in in PCC pavements. The study team used available LTPP joint faulting data and developed a new data set that included the number of longitudinal cracks at transverse joint to investigate the relationship with MIT dowel bar alignment data. These observations are based on a limited amount of data.
    - Some of the MIT dowel bar coverage data are not reliable. As noted, the depth of coverage reported for joint 30 on test section 20_0201, ranged from -2.4 to 18.3 inches, which indicates dowel bars were positioned above the PCC pavement surface and below the depth of the PCC layer.
    - The composite joint scores from MIT measurements did not appear to provide a satisfactory relationship between fault height and number of longitudinal cracks at transverse joints.

    - The effective computed dowel bar diameter statistic from the MIT measurements appeared to provide the most logical rank ordering of observed longitudinal cracks at the transverse joints.
- The FWD load transfer measurements at joints with the most longitudinal cracks over dowel bar locations did not illustrate a significant loss in load transfer as might be expected. This is an unexpected finding.

The overall conclusion from this investigation, is that these test sections need to be monitored into the future to record changes in test section condition. This expanded data coverage will allow a more refined explanation of the performance of these experimental test sections. The LTPP data readily available was sufficient to evaluate the performance to date, and no further forensic work is recommended at this time.

Attachment A. Joint Score and Effective Dowel Diameter Computed Parameters from MIT Measurements

Table A.1 presents the joint score and computed effective dowel diameter from measurements at each joint from MIT measurements. Dowel scores greater than 50 are indicative of poor dowel bar alignment. Low computed effective bar diameters are also an indication of poor dowel alignment and placement.

Table A.1. Composite Joint scores and computed effective dowel bar diameters from LTPP MIT measurements.

STATE_CODE_EXP	SHRP_ID	JOINT_NO	JOINT_SCORE	EFFECTIVE_DOWEL_DIAMETER
Kansas	0201	1	5	1.220000029
Kansas	0201	2	53	1.019999981
Kansas	0201	3	15	1.179999948
Kansas	0201	4	3	1.220000029
Kansas	0201	5	3	1.230000019
Kansas	0201	6	3	1.200000048
Kansas	0201	7	7	1.220000029
Kansas	0201	8	5	1.210000038
Kansas	0201	9	3	1.149999976
Kansas	0201	10	5	1.210000038
Kansas	0201	11	8	1.190000057
Kansas	0201	12	12	1.190000057
Kansas	0201	13	1	1.190000057
Kansas	0201	14	8	1.190000057
Kansas	0201	15	7	1.220000029
Kansas	0201	16	64	1
Kansas	0201	17	17	1.220000029
Kansas	0201	18	3	1.169999957
Kansas	0201	19	10	1.070000052
Kansas	0201	20	1	1.210000038
Kansas	0201	21	1	1.24000001
Kansas	0201	22	11	1.230000019
Kansas	0201	23	12	1.169999957
Kansas	0201	24	7	1.24000001
Kansas	0201	25	3	1.24000001
Kansas	0201	26	5	1.24000001
Kansas	0201	27	10	1.210000038
Kansas	0201	28	9	1.210000038
Kansas	0201	29	64	0.579999983
Kansas	0201	30	90	0.029999999
Kansas	0201	31	11	1.24000001

STATE_CODE_EXP	SHRP_ID	JOINT_NO	JOINT_SCORE	EFFECTIVE_DOWEL_DIAMETER
Kansas	0201	32	19	1.200000048
Kansas	0201	33	11	0.649999976
Kansas	0201	34	50	0
Kansas	0203	1	1	1.49000001
Kansas	0203	2	1	1.480000019
Kansas	0203	3	9	1.49000001
Kansas	0203	4	21	1.440000057
Kansas	0203	5	17	1.440000057
Kansas	0203	6	7	1.49000001
Kansas	0203	7	1	1.5
Kansas	0203	8	3	1.49000001
Kansas	0203	9	3	1.49000001
Kansas	0203	10	5	1.49000001
Kansas	0203	11	1	1.49000001
Kansas	0203	12	27	1.419999957
Kansas	0203	13	3	1.49000001
Kansas	0203	14	9	1.480000019
Kansas	0203	15	3	1.49000001
Kansas	0203	16	1	1.49000001
Kansas	0203	17	1	1.480000019
Kansas	0203	18	5	1.440000057
Kansas	0203	19	17	1.450000048
Kansas	0203	20	18	1.450000048
Kansas	0203	21	14	1.470000029
Kansas	0203	22	32	1.460000038
Kansas	0203	23	5	1.49000001
Kansas	0203	24	36	1.350000024
Kansas	0203	25	1	1.480000019
Kansas	0203	26	27	1.450000048
Kansas	0203	27	24	1.470000029
Kansas	0203	28	1	1.49000001
Kansas	0203	29	7	1.49000001
Kansas	0203	30	29	1.450000048
Kansas	0203	31		
Kansas	0203	32	1	1.49000001
Kansas	0203	33	5	1.49000001
Kansas	0206	1	3	1.230000019
Kansas	0206	2	9	1.24000001
Kansas	0206	3	32	1.210000038
Kansas	0206	4	3	1.25

STATE_CODE_EXP	SHRP_ID	JOINT_NO	JOINT_SCORE	EFFECTIVE_DOWEL_DIAMETER
Kansas	0206	5	46	1.059999943
Kansas	0206	6	9	1.24000001
Kansas	0206	7	7	0.970000029
Kansas	0206	8	20	1.220000029
Kansas	0206	9	54	1.080000043
Kansas	0206	10	5	1.24000001
Kansas	0206	11	27	0.930000007
Kansas	0206	12	9	1.230000019
Kansas	0206	13	25	1.210000038
Kansas	0206	14	17	1.179999948
Kansas	0206	15		
Kansas	0206	16	44	0.850000024
Kansas	0206	17	1	1.24000001
Kansas	0206	18	7	1.230000019
Kansas	0206	19	25	1.179999948
Kansas	0206	20	33	1.080000043
Kansas	0206	21	31	1.190000057
Kansas	0206	22	1	1.24000001
Kansas	0206	23	35	0.870000005
Kansas	0206	24	33	1.200000048
Kansas	0206	25	14	1.179999948
Kansas	0206	26	5	1.24000001
Kansas	0206	27	9	1.220000029
Kansas	0206	28	1	1.25
Kansas	0206	29	1	1.25
Kansas	0206	30	1	1.25
Kansas	0206	31	3	1.200000048
Kansas	0206	32		
Kansas	0206	33		
Kansas	0206	34	17	1.159999967
Kansas	0212	1	44	1.460000038
Kansas	0212	2	15	1.49000001
Kansas	0212	3	7	1.49000001
Kansas	0212	4	38	1.450000048
Kansas	0212	5	34	1.470000029
Kansas	0212	6	32	1.409999967
Kansas	0212	7	23	1.470000029
Kansas	0212	8	57	1.309999943
Kansas	0212	9	5	1.480000019
Kansas	0212	10	21	1.480000019

STATE_CODE_EXP	SHRP_ID	JOINT_NO	JOINT_SCORE	EFFECTIVE_DOWEL_DIAMETER
Kansas	0212	11	1	1.470000029
Kansas	0212	12	11	1.460000038
Kansas	0212	13	33	1.450000048
Kansas	0212	14	36	1.429999948
Kansas	0212	15	30	1.440000057
Kansas	0212	16	40	1.419999957
Kansas	0212	17	11	1.450000048
Kansas	0212	18	25	1.419999957
Kansas	0212	19	19	1.440000057
Kansas	0212	20	5	1.470000029
Kansas	0212	21	18	1.480000019
Kansas	0212	22	29	1.49000001
Kansas	0212	23	53	1.460000038
Kansas	0212	24	24	1.419999957
Kansas	0212	25	11	1.480000019
Kansas	0212	26	66	0.579999983
Kansas	0212	27	1	1.5
Kansas	0212	28	30	1.470000029
Kansas	0212	29	27	1.480000019
Kansas	0212	30	43	1.460000038
Kansas	0212	31	8	1.49000001
Kansas	0212	32	77	1.399999976
Kansas	0212	33	17	1.470000029
Kansas	0212	34	29	1.419999957