Condition Evaluation of 57 Bridge Decks in Michigan's SW Region using Ground Penetrating Radar and Infrared Thermography

FINAL REPORT

Submitted to

NTH Consultants, Ltd.
608 S. Washington Ave.
Lansing, MI 48933

for the

Michigan Department of Transportation
Southwest Region

by

Infrasense, Inc
14 Kensington Road
Arlington, MA 02476

January 30, 2014
1. Introduction and Summary

High-speed deck scanning surveys were carried out on 57 bridges in Michigan Department of Transportation’s Southwest Region. Ground Penetrating Radar (GPR) was used to evaluate 49 bridges, Infrared Thermography (IR) on 12 bridges, and a combination of the two technologies was used on 4 bridges.

The field survey work began on July 29, 2013 and was completed on August 2, 2013. Weather conditions were a mix of cloudy to mostly sunny with temperatures in the mid 60's to high 70's (°F). IR surveys were carried out on August 1, when the weather conditions were mostly sunny, and the temperatures reached into the high 70's (°F). The equipment used in this evaluation is shown in Attachment B.

The GPR survey was carried out using a GSSI SIR-20 system with twin air-coupled horn antennas suspended above the pavement surface. The vehicle was equipped with an electronic distance-measuring instrument (DMI) mounted to the rear wheel of the survey vehicle, providing synchronous distance data as the GPR data was collected. The GPR survey was carried out at normal driving speeds, and the survey vehicle was followed by a shadow vehicle provided by NTH Consultants.

The Infrared Thermography survey was carried out using a high-resolution FLIR Systems Model A-40 infrared camera and an ordinary color video camera, both mounted to an elevated platform on top of the survey vehicle and operated remotely from within the vehicle. Data was collected from 10 AM to 5 PM, ensuring maximum temperature differentials caused by delamination. Infrared and video data were displayed on a live video monitor and recorded for later office processing. The survey covered one lane per driving pass, and the vehicle traveled at normal driving speed. The survey vehicle was followed by a shadow vehicle as with the GPR survey.

This report provides a description of the data collection procedures, the methodology for the data analysis, and the results obtained. Level 2 analyses were performed on 42 decks as prescribed by Michigan Department of Transportation (see Attachment A). The objective of the level 2 analysis is to provide a more detailed interpretation of the GPR and IR data, which includes maps showing detected areas of concrete damage.

The maps resulting from the Level 2 analysis are presented in Attachment D and provided electronically as a CAD compatible .dxf format files. The data presented in these plots include:

1. Detailed mapping of the IR and GPR results.
2. Mapping of patched areas observed in visual data.

2. Data Collection and Analysis

2.1 Infrared Thermography

Infrared thermography detects overlay debonding and deck delamination by sensing the local surface temperature increases produced by these defects under the influence of solar heating. The data was collected according to ASTM D-4788-03, with the one exception that data was collected at driving speed, rather than at "speeds no greater than 10 mph" as stated in the specification. The infrared data is collected in a series of passes across each deck at normal driving speed. For a 2-lane deck, one pass
is carried out in each lane and one in each shoulder. Each pass covers a deck width of 12 to 15 feet.
The infrared survey equipment is shown in Attachment B. The survey produces a series of infrared
images collected across the length of the deck.

After the survey, the center foot of each image is attached to the center foot of the following image
and so on, so that a single strip image is obtained for each pass. The strip image for each pass is
placed next to those of adjacent passes to produce a thermal image of the entire deck. Figure 1 shows
a typical IR image created using this process.

![Figure 1 – Sample IR Image of Bridge 1205](image)

The white blotchy areas on the IR image of Figure 1 indicate delaminations. These are "hot spots"
where the surface temperatures are higher due to the thermal barrier produced by the delaminations.
Areas of patching, spalling, and staining, also produce a thermal contrast. These areas are
differentiated from the subsurface delaminated areas using a high definition video image that is
collected synchronously with the infrared data. Figure 2 shows a sample video imaged used to
differentiate surface features from the subsurface damage.

Thermal images such as those shown in Figure 1 have been created for each bridge surveyed under
this project. For the Level 1 analysis, the delaminated and debonded areas that appear in each image
are outlined with a cursor, and the total of the outlined areas provides an estimate of the percentage of
delamination and debonding for each deck. For a Level 2 analysis, these images, and the outlined
areas, are used to provide plan area maps showing the details of the delaminated and debonded areas.

The sample map for bridge 1205, shown in Figure 3 below, was created from the Figure 1 and Figure
2 data as described above.
Figure 2 – Sample Video Image of Bridge 1205

Figure 3 - Sample IR Delamination Map (Red) and Patch Map (Green), Bridge 1205

2.2 Ground Penetrating Radar

GPR is used to detect deck deterioration by tracking the strength of the reflections from overlay boundaries, rebar, and the deck bottom. Details of the method used in this work can be found in ASTM D-6087-08. The GPR data is collected in a series of lines spaced 3 feet transversely across the width of the deck. A typical deck 40 foot wide would have 13 lines of data, each representing a cross sectional slice of the deck at that offset. Figures 4 and 5 show samples of GPR data used for this evaluation. Figure 4 shows typical GPR data for a deck in good condition. Note that the reflection from the rebar is fairly uniform throughout the length of the deck. Note also that the depth of the top rebar is about 3.5 inches from the deck surface.
Figure 4 – Sample GPR Data from Bridge 888
(Along Lane Line Between Passing and Mainline)

Figure 5 shows an example of GPR data showing signs of rebar-level deterioration. The weakening of the rebar-level and bottom deck signal is associated with corrosion, chloride contamination, and concrete cracking. Note that the depth of top rebar in Figure 4 is approximately 4.5 inches from the surface.

Figure 5 – Sample GPR Data from Bridge 816 Showing Deterioration
(Left Wheel-path of Right Lane)

Figure 6 shows the Level 2 map created from the full set of data lines of the type shown in Figure 5. The map depicts the low amplitude deteriorated areas, as shown in Figure 5. Note that the GPR analysis is quantitative, producing a value for rebar level reflection strength at each point on the deck. These values are converted to a color scale, as shown in Figure 6. The color scale incorporates a threshold amplitude, above which we assume there is no deterioration. Once the threshold is passed, the color variation from blue to magenta corresponds to decreasing reflection amplitude. Qualitatively, the lower reflection amplitudes signify greater severity of concrete deterioration - i.e., more extensive corrosion and concrete damage. This interpretation is depicted in the color scale below the map.
2.3. Level 1 Summary

The complete Level 1 analysis results are presented in a table in Attachment C. The data in the table includes:

1. Percent of total deck area showing overlay debonding and delamination based on infrared data
2. Percent of total deck area showing corrosion and delamination based on GPR data
3. Percent of total deck area with visually observable patching
4. Comments pertaining to the deck surface condition

2.4 Limitations of IR and GPR Methods

The IR method detects the surface temperature change caused by subsurface debonding and delamination. Its reliable detection capability is limited to a depth of 4 inches (see ASTM D-4788-03). Also, the presence of an AC or epoxy overlay may limit the effectiveness of the IR method, due to the nature of the bonding between these materials and the concrete substrate. The use of driving speed data collection (vs. 10 mph limit in the ASTM spec.) diminishes the resolution of the infrared images, and can add some uncertainty to the interpretation of the data.

The GPR method detects rebar-level corrosion and delamination based on variations in the strength of rebar reflections, and deteriorated concrete under an asphalt overlay based on changes in the concrete dielectric properties (ASTM D-6087-08). The rebar level detection method works when there is a uniform mat of transverse rebar, as occurs in girder-type decks and box beam decks. These are the types of decks that were surveyed in this project.
3. Level 2 Evaluations

The Level 2 evaluations involve mapping the IR and GPR results, analyzing the visual data to assess the surface conditions including mapping of the patched areas, and interpreting all the data to determine the final quantities (see Attachment C). The detailed Level 2 evaluations were carried out on 42 bridge decks selected by the Michigan DOT based both the Level 1 results and current rehabilitation plans.

Detailed condition maps for the 42 decks are included in Attachment D. Each map shows concrete delamination and deterioration as determined from the analysis of the IR and/or GPR data. The areas detected by infrared are shown in red hatch, and the areas detected by GPR are shown in a blue to magenta color scale (indicating severity of damage).

Visual data was analyzed for the 42 bridges selected for the Level 2 evaluations. All observed patches were mapped and are shown in green hatch in the final condition maps. Additionally, comments regarding deck surface conditions (cracking, spalling, etc) are included in the Results Summary Table in Attachment C. The quantities of delamination and patching are summarized on each map.

Most of the bridge decks in this project were surveyed with either infrared thermography or ground penetrating radar. Four decks, however, were surveyed with both methods, and two of these decks (#'s 1200 and 1208) were selected for Level 2 evaluation. The following sections provide a detailed discussion of bridge 544, a discussion of the relationship between IR and GPR results where both methods were used, and higher level analysis of the NDT results and how these results can be used by MDOT.

3.1 Detailed Discussion of the Results for M-66, over the Quaker Brook, Bridge 544

Due to the unique structure of Bridge 544, a detailed discussion of the GPR analysis and results are provided in this section. The bridge is comprised of a series of 3-foot wide prestressed concrete box beams with a bituminous overlay. It is assumed that the concrete boxes have prestressed reinforcement running parallel to the direction of travel, and steel reinforcement that ties the boxes together running perpendicular to the direction of travel. For this type of structure, the top flange of the box beam also serves as the bridge deck.

The GPR survey does not pick up the reinforcement parallel to the direction of travel, but it does clearly detect the perpendicular steel. GPR reflections from this transverse steel, along with those from the bottom of the top flange and the interface at the bottom of the AC overlay are analyzed and combined to predict the condition of the deck.

To clarify this analysis, two GPR cross sections are shown in the figure below. Significant features within each cross section are labeled, including an area where the GPR signal is attenuated, indicating deck deterioration. This attenuation, shown at the north end of the offset 14 feet from the east edge, could be a combination of corrosion and deck delamination. The GPR analysis combines these individual cross sections to produce the a plan view condition map, shown in Figure 8 and Appendix
D. Additionally, Figure 8 shows the significant variation in asphalt overlay thickness, from 1.5 inches at the north end, to close to 5 inches in the SW corner.

![Figure 7: Bridge 544 GPR sample cross sections](image)

![Figure 8 - GPR Results for bridge 544](image)

**Figure 7: Bridge 544 GPR sample cross sections**

**Figure 8 - GPR Results for bridge 544**
The result of this analysis shows close to 40% of the deck area with evidence of concrete deterioration. As indicated earlier, this deterioration is comprised of chloride infiltration, steel corrosion, and delamination. Since the deck also serves as the top flange of the box beam, there is concern that this deterioration might compromise the capacity of one or more of the box beams. It is not possible, however, to assess this potential structural damage using the GPR data alone. The effective prestressing and capacity of the concrete are the primary factors, and these can only be evaluated with load testing or some other type of direct mechanical testing. One thing to note is that the variation in overlay thickness, from the design value of 1.5" at the north end, to close to 5" observed in the SW corner, suggests that the superstructure has settled at some point in time, and that additional asphalt was added to keep the riding surface level with that of the approach pavement.

3.2 - IR vs. GPR Results

The maps in Attachment D show both the areas identified by GPR and IR for bridges 1200 and 1208. An examination of the maps shows that there is some overlap between the IR and GPR areas, and where they do not overlap they are often close to one another. However, there are a number of areas that do not overlap, and the GPR areas appear to occupy a larger extent on the map. The reasons for this are as twofold. First, GPR and IR detect different aspects of deck deterioration. For example, IR detects overlay debonding, which is not detected by GPR, while GPR detects rebar-level corrosion which is not detected by IR. Second, since GPR detects corrosion conditions which occur prior to delamination, GPR quantities will often be greater than IR quantities.

4. Overview of Level 2 Results

To further analyze the results obtained using both the GPR and IR methods, a histogram of deterioration levels for the 42 decks prescribed for Level 2 analyses is provided in Figure 9 below. Based on our experience, agencies will use this type of information to create "condition bins" with different rehabilitation actions associated with ranges of deck deterioration. An example of this type of decision matrix utilized by the Minnesota DOT is provided in Table 1 (Maser et. al., 2012).

In addition to the subsurface deck condition evaluated using GPR and IR, patching quantities were also obtained under this project and could be included in any rehabilitation decisions. The amount of the patching that should be added to the total area depending on the correlation between the subsurface deterioration and the patch locations. The more correlated, the less additional area needs to be added.

MDOT may wish to create a similar rehabilitation decision matrix which considers their specific planning needs and funding limitations. Specific rehabilitation recommendations for each of the 42 Level 2 decks have been prepared by NTH Consultants and have been provided in Attachment E.
*Note: % deterioration determined by GPR, IR, or a combination of both.

**Figure 9 - Distribution of % Deck Deterioration for 42 Level 2 Decks**

**Table 1 - Sample Rehabilitation Decision Matrix Using "Deck Condition Bins"**
(from Maser et. al., 2012)

<table>
<thead>
<tr>
<th>Deck Category</th>
<th>Deck Condition (% Unsound Concrete)</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-2</td>
<td>Do nothing or spot repairs.</td>
</tr>
<tr>
<td>2</td>
<td>2-10</td>
<td>Mill &amp; patch repairs. Consider complete low-slump overlay for interstates or ADT greater than 10,000.</td>
</tr>
<tr>
<td>3</td>
<td>10-25</td>
<td>Scarify 100%, perform appropriate repairs &amp; apply a 2-inch low-slump overlay</td>
</tr>
<tr>
<td>4</td>
<td>&gt;25</td>
<td>Schedule replacement after useable life of in place deck is expended</td>
</tr>
</tbody>
</table>
5. References

Ground Penetrating Radar” Designation D 6087-08, ASTM International, West Conshohocken,
PA, 2008.

Thermography,” ASTM, Annual Book of ASTM Standards, Vol 04.03, Designation: D 4788-03,
2007.

Signature Analysis of Radar Waveforms from Bridge Decks”, Canadian Electrical Engineering

Studies of 44 Decks”, Transportation Research Record No. 1347, Transportation Research

Decks, Transportation Research Record No. 1304”, Transportation Research Board. National

for the New England Transportation Consortium, Center for Transportation Studies,


SHRP C-101, “Condition Evaluation of Concrete Bridges Relative to Reinforcement Corrosion –
Volume 3: Method of Evaluating the Condition of Asphalt-Covered Decks”, Strategic Highway

Level Bridge Deck Condition Assessment in Minnesota. NDE/NDT for Highways and Bridges:
Structural Materials Technology (SMT) 2012 Conference, New York, NY, American Society for
Nondestructive Testing.
## ATTACHMENT A

### Bridge List

<table>
<thead>
<tr>
<th>Bridge ID</th>
<th>Feature On</th>
<th>Feature Under</th>
<th>Deck Area</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>I-196 E &amp; US-31 N</td>
<td>KALAMAZOO RIVER</td>
<td>20396</td>
<td>X</td>
</tr>
<tr>
<td>116</td>
<td>I-196 W &amp; US-31 S</td>
<td>KALAMAZOO RIVER</td>
<td>20396</td>
<td>X</td>
</tr>
<tr>
<td>119</td>
<td>I-196 &amp; US-31NB</td>
<td>OLD ALLEGAN RD</td>
<td>4982</td>
<td>X</td>
</tr>
<tr>
<td>120</td>
<td>I-196 &amp; US-31SB</td>
<td>OLD ALLEGAN RD</td>
<td>4982</td>
<td>X</td>
</tr>
<tr>
<td>127</td>
<td>I-196 WB</td>
<td>US-31 NB</td>
<td>11001</td>
<td>X</td>
</tr>
<tr>
<td>544</td>
<td>M-66</td>
<td>QUAKER BROOK</td>
<td>1148</td>
<td>X</td>
</tr>
<tr>
<td>792</td>
<td>I-94 EB</td>
<td>CSX RR SPUR (ABN)</td>
<td>1718</td>
<td></td>
</tr>
<tr>
<td>793</td>
<td>I-94 WB</td>
<td>CSX RR SPUR (ABN)</td>
<td>1718</td>
<td></td>
</tr>
<tr>
<td>794</td>
<td>I-94 EB</td>
<td>CSX RR</td>
<td>13755</td>
<td>X</td>
</tr>
<tr>
<td>795</td>
<td>I-94 WB</td>
<td>CSX RR</td>
<td>11402</td>
<td>X</td>
</tr>
<tr>
<td>798</td>
<td>I-94 EB</td>
<td>US-12</td>
<td>18018</td>
<td>X</td>
</tr>
<tr>
<td>816</td>
<td>I-94 EB</td>
<td>PUETZ RD</td>
<td>8640</td>
<td>X</td>
</tr>
<tr>
<td>817</td>
<td>I-94 WB</td>
<td>PUETZ RD</td>
<td>8640</td>
<td>X</td>
</tr>
<tr>
<td>818</td>
<td>I-94 EB</td>
<td>I-94 BL (LAKESHORE DR)</td>
<td>19454</td>
<td>X</td>
</tr>
<tr>
<td>823</td>
<td>I-94 EB</td>
<td>LINCOLN AVE</td>
<td>6626</td>
<td>X</td>
</tr>
<tr>
<td>827</td>
<td>I-94 EB</td>
<td>ST JOSEPH RIVER</td>
<td>30637</td>
<td>X</td>
</tr>
<tr>
<td>828</td>
<td>I-94 WB</td>
<td>ST JOSEPH RIVER</td>
<td>30637</td>
<td>X</td>
</tr>
<tr>
<td>836</td>
<td>I-94 WB</td>
<td>PIPESTONE ROAD</td>
<td>10799</td>
<td>X</td>
</tr>
<tr>
<td>835</td>
<td>I-94 EB</td>
<td>PIPESTONE ROAD</td>
<td>10504</td>
<td>X</td>
</tr>
<tr>
<td>850</td>
<td>I-94 EB</td>
<td>HENNESSY ROAD</td>
<td>6330</td>
<td>X</td>
</tr>
<tr>
<td>851</td>
<td>I-94 WB</td>
<td>HENNESSY ROAD</td>
<td>6330</td>
<td>X</td>
</tr>
<tr>
<td>852</td>
<td>I-94 EB</td>
<td>M-140</td>
<td>9632</td>
<td>X</td>
</tr>
<tr>
<td>853</td>
<td>I-94 WB</td>
<td>M-140</td>
<td>7417</td>
<td>X</td>
</tr>
<tr>
<td>888</td>
<td>US-31 NB</td>
<td>US-12</td>
<td>13806</td>
<td></td>
</tr>
<tr>
<td>887</td>
<td>US-31 SB</td>
<td>US-12</td>
<td>13806</td>
<td></td>
</tr>
<tr>
<td>12750</td>
<td>US-31 NB</td>
<td>MATTHEW ROAD</td>
<td>4433</td>
<td>X</td>
</tr>
<tr>
<td>12751</td>
<td>US-31 SB</td>
<td>MATTHEW ROAD</td>
<td>4433</td>
<td>X</td>
</tr>
<tr>
<td>1077</td>
<td>I-69 SB</td>
<td>INDIANA NE RR, SAUK R RD</td>
<td>9393</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>I-194</td>
<td>KALAMAZOO RIVER</td>
<td>32347</td>
<td>X</td>
</tr>
<tr>
<td>1205</td>
<td>I-194 NB</td>
<td>GOLDEN AVE</td>
<td>5333</td>
<td></td>
</tr>
<tr>
<td>1206</td>
<td>I-194 SB</td>
<td>GOLDEN AVE</td>
<td>5860</td>
<td></td>
</tr>
<tr>
<td>1208</td>
<td>I-194</td>
<td>BURNHAM ST</td>
<td>12995</td>
<td>X</td>
</tr>
<tr>
<td>1213</td>
<td>I-69 SB</td>
<td>ST JOSEPH RIVER</td>
<td>5626</td>
<td>X</td>
</tr>
<tr>
<td>1215</td>
<td>I-69 NB</td>
<td>ST JOSEPH RIVER</td>
<td>5498</td>
<td>X</td>
</tr>
<tr>
<td>1246</td>
<td>I-94 EB</td>
<td>GTW RR</td>
<td>9067</td>
<td>X</td>
</tr>
<tr>
<td>Bridge ID</td>
<td>Feature On</td>
<td>Feature Under</td>
<td>Deck Area</td>
<td>Level 2</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>1247</td>
<td>I-94 WB</td>
<td>GTW RR</td>
<td>9067</td>
<td>X</td>
</tr>
<tr>
<td>1256</td>
<td>I-94 EB</td>
<td>KALAMAZOO RIVER</td>
<td>10301</td>
<td>X</td>
</tr>
<tr>
<td>1257</td>
<td>I-94 WB</td>
<td>KALAMAZOO RIVER</td>
<td>10301</td>
<td>X</td>
</tr>
<tr>
<td>1261</td>
<td>I-94 EB</td>
<td>6 1/2 MILE ROAD</td>
<td>7362</td>
<td>X</td>
</tr>
<tr>
<td>1262</td>
<td>I-94 WB</td>
<td>6 1/2 MILE ROAD</td>
<td>7362</td>
<td>X</td>
</tr>
<tr>
<td>1263</td>
<td>I-94 EB</td>
<td>M-294 BEADLE LAKE</td>
<td>5716</td>
<td>X</td>
</tr>
<tr>
<td>1264</td>
<td>I-94 WB</td>
<td>M-294 BEADLE LAKE</td>
<td>5716</td>
<td>X</td>
</tr>
<tr>
<td>1265</td>
<td>I-94 EB</td>
<td>9 MILE ROAD</td>
<td>5556</td>
<td>X</td>
</tr>
<tr>
<td>1266</td>
<td>I-94 WB</td>
<td>9 MILE ROAD</td>
<td>5556</td>
<td>X</td>
</tr>
<tr>
<td>4556</td>
<td>US-131 NB</td>
<td>AMTRAK &amp; KL AVE</td>
<td>11101</td>
<td></td>
</tr>
<tr>
<td>4557</td>
<td>US-131 SB</td>
<td>AMTRAK &amp; KL AVE</td>
<td>11101</td>
<td></td>
</tr>
<tr>
<td>4607</td>
<td>US-131 BR NB</td>
<td>DOUGLAS AVE</td>
<td>6601</td>
<td>X</td>
</tr>
<tr>
<td>4608</td>
<td>US-131 BR SB</td>
<td>DOUGLAS AVE</td>
<td>5878</td>
<td>X</td>
</tr>
<tr>
<td>10264</td>
<td>US-131 NB</td>
<td>ROCKY RIVER</td>
<td>4277</td>
<td></td>
</tr>
<tr>
<td>10265</td>
<td>US-131 SB</td>
<td>ROCKY RIVER</td>
<td>4424</td>
<td></td>
</tr>
<tr>
<td>10686</td>
<td>I-196 NB</td>
<td>32 ND AVE (CR378)</td>
<td>4688</td>
<td></td>
</tr>
<tr>
<td>10687</td>
<td>I-196 SB</td>
<td>32 ND AVE (CR378)</td>
<td>4688</td>
<td></td>
</tr>
<tr>
<td>10709</td>
<td>I-94 EB</td>
<td>PAW PAW RIVER</td>
<td>6849</td>
<td>X</td>
</tr>
<tr>
<td>10710</td>
<td>I-94 WB</td>
<td>PAW PAW RIVER</td>
<td>6849</td>
<td>X</td>
</tr>
<tr>
<td>10711</td>
<td>I-94 EB</td>
<td>E BR OF PAW PAW RIVER</td>
<td>1707</td>
<td></td>
</tr>
<tr>
<td>10712</td>
<td>I-94 WB</td>
<td>E BR OF PAW PAW RIVER</td>
<td>1707</td>
<td></td>
</tr>
</tbody>
</table>
ATTACHMENT B
Equipment used for Deck Evaluations

GPR Equipment

IR Equipment
ATTACHMENT C
Results Summary Table
<table>
<thead>
<tr>
<th>Bridge ID</th>
<th>Feature On</th>
<th>Feature Under</th>
<th>Width (ft)</th>
<th>Length (ft)</th>
<th>Overlay</th>
<th>GPR Quantity (%)</th>
<th>IR Quantity (%)</th>
<th>PCC Patching (%)</th>
<th>AC Patching (%)</th>
<th>Spalling (%)</th>
<th>Total Defect (%)</th>
<th>Avg. Concrete Cover (in.)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>US-31 SB</td>
<td>US-31 BR (58 TH STREET)</td>
<td>39.5</td>
<td>190.9</td>
<td>-</td>
<td>NA</td>
<td>1.8%</td>
<td>3.0%</td>
<td>0.9%</td>
<td>0.1%</td>
<td>5.8%</td>
<td>NA</td>
<td>Spall with patching along CL, particularly in the end spans. Large crack in NE corner of the deck.</td>
</tr>
<tr>
<td>115</td>
<td>I-196 E &amp; US-31 N</td>
<td>KALAMAZOO RIVER</td>
<td>30</td>
<td>560.0</td>
<td>LMC</td>
<td>NA</td>
<td>6.0%</td>
<td>0.2%</td>
<td>-</td>
<td>-</td>
<td>6.2%</td>
<td>NA</td>
<td>Transverse cracking throughout bridge.</td>
</tr>
<tr>
<td>116</td>
<td>I-196 W &amp; US-31 S</td>
<td>KALAMAZOO RIVER</td>
<td>30</td>
<td>560.0</td>
<td>LMC</td>
<td>NA</td>
<td>6.7%</td>
<td>0.2%</td>
<td>0.02%</td>
<td>6.72%</td>
<td>NA</td>
<td>NA</td>
<td>Small spall at north abutment. Small number of transverse cracks distributed throughout deck.</td>
</tr>
<tr>
<td>119</td>
<td>I-196 &amp; US-31NB</td>
<td>OLD ALLEGAN RD</td>
<td>39.5</td>
<td>116.8</td>
<td>-</td>
<td>NA</td>
<td>3.8%</td>
<td>16.2%</td>
<td>-</td>
<td>20.0%</td>
<td>NA</td>
<td>NA</td>
<td>Transverse and longitudinal cracking throughout deck; some of which is sealed.</td>
</tr>
<tr>
<td>120</td>
<td>I-196 &amp; US-31SB</td>
<td>OLD ALLEGAN RD</td>
<td>39.5</td>
<td>116.8</td>
<td>-</td>
<td>NA</td>
<td>2.9%</td>
<td>4.7%</td>
<td>-</td>
<td>7.6%</td>
<td>NA</td>
<td>NA</td>
<td>Transverse and longitudinal cracking throughout deck; select cracks sealed.</td>
</tr>
<tr>
<td>127</td>
<td>I-196 WB</td>
<td>US-31 NB</td>
<td>40.5</td>
<td>250.0</td>
<td>-</td>
<td>NA</td>
<td>3.4%</td>
<td>6.3%</td>
<td>-</td>
<td>9.5%</td>
<td>NA</td>
<td>NA</td>
<td>Transverse cracking observed throughout deck.</td>
</tr>
<tr>
<td>544</td>
<td>M-66</td>
<td>QUAKER BROOK</td>
<td>33</td>
<td>34.8</td>
<td>Bit.</td>
<td>39.7%</td>
<td>NA</td>
<td>20.6%</td>
<td>-</td>
<td>0.3%</td>
<td>60.6%</td>
<td>NA</td>
<td>Sealed cracking along west edge and north abutment. Spall near CL at south abutment.</td>
</tr>
<tr>
<td>792</td>
<td>I-94 EB</td>
<td>CSX RR SPUR (ABN)</td>
<td>52</td>
<td>30.8</td>
<td>LMC</td>
<td>9.8%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>9.8%</td>
<td>3.8</td>
<td>NA</td>
</tr>
<tr>
<td>793</td>
<td>I-94 WB</td>
<td>CSX RR SPUR (ABN)</td>
<td>52</td>
<td>30.8</td>
<td>LMC</td>
<td>6.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>6.0%</td>
<td>NA</td>
<td>4.2</td>
<td>NA</td>
</tr>
<tr>
<td>794</td>
<td>I-94 EB</td>
<td>CSX RR</td>
<td>68</td>
<td>195.9</td>
<td>LMC</td>
<td>11.9%*</td>
<td>NA</td>
<td>22.9%</td>
<td>-</td>
<td>0.1%</td>
<td>34.9%</td>
<td>4.3</td>
<td>Cracking and spalling along south abutment.</td>
</tr>
<tr>
<td>795</td>
<td>I-94 WB</td>
<td>CSX RR</td>
<td>47</td>
<td>195.9</td>
<td>LMC</td>
<td>5.0%*</td>
<td>NA</td>
<td>20.8%</td>
<td>-</td>
<td>-</td>
<td>25.8%</td>
<td>4.1</td>
<td>Cracking at the piers.</td>
</tr>
<tr>
<td>797</td>
<td>I-94 EB</td>
<td>US-12</td>
<td>72.3</td>
<td>239.8</td>
<td>-</td>
<td>27.5%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>27.5%</td>
<td>3.5</td>
<td>Minor spalling at east abutment. Transverse and longitudinal cracking throughout deck; particularly in the left lane and shoulder, and along piers.</td>
</tr>
<tr>
<td>816</td>
<td>I-94 EB</td>
<td>PUYETZ RD</td>
<td>51.3</td>
<td>154.9</td>
<td>LMC</td>
<td>28.0%</td>
<td>NA</td>
<td>12.1%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>40.5%</td>
<td>4.5</td>
<td>Transverse and longitudinal cracking throughout deck; particularly in the right lane and shoulder.</td>
</tr>
<tr>
<td>817</td>
<td>I-94 WB</td>
<td>PUYETZ RD</td>
<td>51.8</td>
<td>154.9</td>
<td>LMC</td>
<td>19.7%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>19.7%</td>
<td>5.8</td>
<td>Sealed longitudinal cracking along right shoulder line and transverse cracking along the left lane and shoulder.</td>
</tr>
<tr>
<td>818</td>
<td>I-94 EB</td>
<td>I-94 BL (LAKE SHORE DR)</td>
<td>95.0</td>
<td>190.9</td>
<td>LMC</td>
<td>4.5%*</td>
<td>NA</td>
<td>1.9%</td>
<td>-</td>
<td>-</td>
<td>6.4%</td>
<td>4.7</td>
<td>Sealed transverse cracking along the left lane and shoulder.</td>
</tr>
<tr>
<td>823</td>
<td>I-94 EB</td>
<td>LINCOLN AVE</td>
<td>51.4</td>
<td>118.8</td>
<td>LMC</td>
<td>10.9%*</td>
<td>NA</td>
<td>10.5%</td>
<td>-</td>
<td>-</td>
<td>21.4%</td>
<td>4.6</td>
<td>Transverse cracking along the left lane and shoulder.</td>
</tr>
<tr>
<td>827</td>
<td>I-94 EB</td>
<td>ST JOSEPH RIVER</td>
<td>44</td>
<td>644.0</td>
<td>LMC</td>
<td>9.1%</td>
<td>NA</td>
<td>5.6%</td>
<td>-</td>
<td>-</td>
<td>14.7%</td>
<td>4.2</td>
<td>Transverse cracking throughout deck but concentrated in right lane and shoulder; some of which is sealed.</td>
</tr>
<tr>
<td>828</td>
<td>I-94 WB</td>
<td>ST JOSEPH RIVER</td>
<td>44</td>
<td>644.0</td>
<td>LMC</td>
<td>9.8%</td>
<td>NA</td>
<td>5.4%</td>
<td>0.02%</td>
<td>15.2%</td>
<td>4.1</td>
<td></td>
<td>Transverse cracking concentrated along right shoulder.</td>
</tr>
<tr>
<td>835</td>
<td>I-94 EB</td>
<td>PIPESTONE ROAD</td>
<td>43.8</td>
<td>220.8</td>
<td>LMC</td>
<td>22.5%</td>
<td>NA</td>
<td>13.1%</td>
<td>-</td>
<td>-</td>
<td>35.6%</td>
<td>4.0</td>
<td>Transverse and longitudinal cracking throughout deck; particularly along the piers. A few severe cracks in western span.</td>
</tr>
<tr>
<td>836</td>
<td>I-94 WB</td>
<td>PIPESTONE ROAD</td>
<td>43.8</td>
<td>227.0</td>
<td>LMC</td>
<td>16.3%</td>
<td>NA</td>
<td>8.4%</td>
<td>0.1%</td>
<td>24.8%</td>
<td>4.2</td>
<td></td>
<td>Some light spalling at the beginning and end joints. Cracking along both piers. Longitudinal and transverse cracking concentrated in the right lane and shoulder.</td>
</tr>
<tr>
<td>850</td>
<td>I-94 EB</td>
<td>HENNESSY ROAD</td>
<td>42.5</td>
<td>134.0</td>
<td>Epoxy</td>
<td>4.5%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4.5%</td>
<td>3.8</td>
<td>Transverse cracking throughout deck. A few severe cracks in the left lane.</td>
</tr>
<tr>
<td>851</td>
<td>I-94 WB</td>
<td>HENNESSY ROAD</td>
<td>42.5</td>
<td>134.0</td>
<td>Epoxy</td>
<td>6.5%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>6.5%</td>
<td>4.7</td>
<td>Longitudinal and transverse cracking concentrated along CL, particularly in the left lane and shoulder.</td>
</tr>
<tr>
<td>852</td>
<td>I-94 EB</td>
<td>M-140</td>
<td>57.9</td>
<td>157.0</td>
<td>LMC</td>
<td>9.7%*</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.7%</td>
<td>5.6</td>
<td>Transverse cracking. Some longitudinal cracking concentrated along left lane, lane-line.</td>
</tr>
<tr>
<td>853</td>
<td>I-94 WB</td>
<td>M-140</td>
<td>42</td>
<td>157.0</td>
<td>HMA</td>
<td>14.3%</td>
<td>NA</td>
<td>14.3%</td>
<td>-</td>
<td>-</td>
<td>14.3%</td>
<td>4.0</td>
<td>Longitudinal cracking along CL of road and in right shoulder. Concrete surface not observable due to AC overlay.</td>
</tr>
<tr>
<td>888</td>
<td>US-31 NB</td>
<td>US-12</td>
<td>52.2</td>
<td>246.1</td>
<td>LMC</td>
<td>2.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>2.0%</td>
<td>3.6</td>
<td>NA</td>
<td>A considerable number of sealed cracks concentrated near beginning and end joints and within the right lane.</td>
</tr>
<tr>
<td>887</td>
<td>US-31 SB</td>
<td>US-12</td>
<td>52.5</td>
<td>246.1</td>
<td>LMC</td>
<td>9.0%</td>
<td>NA</td>
<td>NA</td>
<td>9.0%</td>
<td>NA</td>
<td>3.6</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>12750</td>
<td>US-31 NB</td>
<td>MATTHEW ROAD</td>
<td>44.2</td>
<td>93.8</td>
<td>-</td>
<td>NA</td>
<td>3.9%</td>
<td>2.0%</td>
<td>-</td>
<td>5.9%</td>
<td>NA</td>
<td></td>
<td>A considerable number of sealed cracks concentrated near beginning and end joints and within the right lane.</td>
</tr>
<tr>
<td>Bridge ID</td>
<td>Feature On</td>
<td>Feature Under</td>
<td>Width (ft)</td>
<td>Length (ft)</td>
<td>Overlay</td>
<td>GPR Quantity (%)</td>
<td>IR Quantity (%)</td>
<td>PCC Patching (%)</td>
<td>AC Patching (%)</td>
<td>Spalling (%)</td>
<td>Total Defect (%)</td>
<td>Avg. Concrete Cover (in.)</td>
<td>Comments</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>---------------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------</td>
<td>------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>----------------</td>
<td>-------------</td>
<td>------------------</td>
<td>-----------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>12751</td>
<td>US-31 SB</td>
<td>MATTHEW ROAD</td>
<td>44.2</td>
<td>93.8</td>
<td>-</td>
<td>NA</td>
<td>5.5%</td>
<td>1.8%</td>
<td>-</td>
<td>-</td>
<td>3.3%</td>
<td>NA</td>
<td>Transverse cracks throughout deck</td>
</tr>
<tr>
<td>1077</td>
<td>I-69 SB</td>
<td>INDIANA NE RR, SAUK R RD</td>
<td>44.7</td>
<td>196.9</td>
<td>LMC</td>
<td>1.3%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1.3%</td>
<td>3.6</td>
<td>NA</td>
</tr>
<tr>
<td>1200</td>
<td>I-194</td>
<td>KALAMAZOO RIVER</td>
<td>81</td>
<td>372.0</td>
<td>LMC</td>
<td>11.4%</td>
<td>5.4%</td>
<td>2.3%</td>
<td>-</td>
<td>-</td>
<td>19.1%</td>
<td>3.6</td>
<td>Sealed cracking concentrated in the SB lanes and in the end spans of the NB lanes. There is also unsensed longitudinal and transverse cracking throughout the deck.</td>
</tr>
<tr>
<td>1205</td>
<td>I-194 NB</td>
<td>GOLDEN AVE</td>
<td>41.9</td>
<td>124.0</td>
<td>-</td>
<td>2.8%</td>
<td>5.1%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>7.9%</td>
<td>2.7</td>
<td>NA</td>
</tr>
<tr>
<td>1206</td>
<td>I-194 SB</td>
<td>GOLDEN AVE</td>
<td>42.2</td>
<td>124.0</td>
<td>-</td>
<td>0.9%</td>
<td>8.2%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>9.1%</td>
<td>2.7</td>
<td>NA</td>
</tr>
<tr>
<td>1208</td>
<td>I-194</td>
<td>BURNHAM ST</td>
<td>90.5</td>
<td>132.9</td>
<td>-</td>
<td>10.6%*</td>
<td>2.5%</td>
<td>8.0%</td>
<td>0.3%</td>
<td>-</td>
<td>21.4%</td>
<td>2.9</td>
<td>Transverse and longitudinal cracking concentrated along inside shoulders, the piers, and beginning and end joints.</td>
</tr>
<tr>
<td>1213</td>
<td>I-69 SB</td>
<td>ST JOSEPH RIVER</td>
<td>38</td>
<td>112.9</td>
<td>-</td>
<td>9.3%*</td>
<td>NA</td>
<td>13.1%</td>
<td>0.6%</td>
<td>-</td>
<td>23.0%</td>
<td>3.0</td>
<td>Transverse and longitudinal cracking throughout deck.</td>
</tr>
<tr>
<td>1215</td>
<td>I-69 NB</td>
<td>ST JOSEPH RIVER</td>
<td>38</td>
<td>129.9</td>
<td>-</td>
<td>11.1%*</td>
<td>NA</td>
<td>8.8%</td>
<td>5.2%</td>
<td>-</td>
<td>25.1%</td>
<td>2.8</td>
<td>Transverse and longitudinal cracking throughout deck.</td>
</tr>
<tr>
<td>1246</td>
<td>I-94 EB</td>
<td>GTW RR</td>
<td>43</td>
<td>191.9</td>
<td>LMC</td>
<td>21.3%</td>
<td>NA</td>
<td>5.0%</td>
<td>-</td>
<td>-</td>
<td>26.3%</td>
<td>4.2</td>
<td>Transverse and longitudinal cracking throughout deck; particularly along CL of deck and at piers.</td>
</tr>
<tr>
<td>1247</td>
<td>I-94 WB</td>
<td>GTW RR</td>
<td>43</td>
<td>191.9</td>
<td>LMC</td>
<td>14.1%</td>
<td>NA</td>
<td>3.7%</td>
<td>1.4%</td>
<td>-</td>
<td>19.2%</td>
<td>4.4</td>
<td>Transverse and longitudinal cracking throughout deck; particularly in the right lane. Sealed longitudinal crack along CL of deck.</td>
</tr>
<tr>
<td>1256</td>
<td>I-94 EB</td>
<td>KALAMAZOO RIVER</td>
<td>34</td>
<td>275.4</td>
<td>LMC</td>
<td>13.2%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>13.2%</td>
<td>5.7</td>
<td>Transverse and longitudinal cracking throughout deck; particularly in the right lane and shoulder (mostly sealed). Sealed longitudinal crack along CL of deck.</td>
</tr>
<tr>
<td>1257</td>
<td>I-94 WB</td>
<td>KALAMAZOO RIVER</td>
<td>34</td>
<td>275.4</td>
<td>LMC</td>
<td>21.7%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>21.7%</td>
<td>6.1</td>
<td>Transverse and longitudinal cracking throughout deck; most of which is in a severe state (wider cracks).</td>
</tr>
<tr>
<td>1261</td>
<td>I-94 EB</td>
<td>6 1/2 MILE ROAD</td>
<td>42</td>
<td>155.3</td>
<td>LMC</td>
<td>36.7%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>36.7%</td>
<td>5.4</td>
<td>Transverse and longitudinal cracking throughout deck; most of which is in a severe state (wider cracks).</td>
</tr>
<tr>
<td>1262</td>
<td>I-94 WB</td>
<td>6 1/2 MILE ROAD</td>
<td>42</td>
<td>155.3</td>
<td>LMC</td>
<td>33.3%</td>
<td>NA</td>
<td>6.9%</td>
<td>0.3%</td>
<td>-</td>
<td>40.5%</td>
<td>4.8</td>
<td>Longitudinal and transverse cracking concentrated in the right lane and shoulder; some of which is sealed.</td>
</tr>
<tr>
<td>1263</td>
<td>I-94 EB</td>
<td>M-294 BEADLE LAKE</td>
<td>42</td>
<td>121.6</td>
<td>LMC</td>
<td>17.0%</td>
<td>NA</td>
<td>5.9%</td>
<td>-</td>
<td>-</td>
<td>22.9%</td>
<td>5.8</td>
<td>Longitudinal and transverse cracking throughout deck; some sealed in the SE corner of deck.</td>
</tr>
<tr>
<td>1264</td>
<td>I-94 WB</td>
<td>M-294 BEADLE LAKE</td>
<td>42</td>
<td>121.6</td>
<td>LMC</td>
<td>11.6%</td>
<td>NA</td>
<td>5.6%</td>
<td>-</td>
<td>-</td>
<td>17.2%</td>
<td>5.0</td>
<td>Longitudinal and transverse cracking throughout deck; some sealed in right lane/shoulder and along CL of bridge.</td>
</tr>
<tr>
<td>1265</td>
<td>I-94 EB</td>
<td>9 MILE ROAD</td>
<td>42</td>
<td>117.2</td>
<td>LMC</td>
<td>31.1%</td>
<td>NA</td>
<td>8.7%</td>
<td>-</td>
<td>-</td>
<td>39.8%</td>
<td>5.1</td>
<td>Transverse and transverse cracking throughout deck; some at a severe state (wider cracks). Relatively greater amount of cracking along piers.</td>
</tr>
<tr>
<td>1266</td>
<td>I-94 WB</td>
<td>9 MILE ROAD</td>
<td>42</td>
<td>117.2</td>
<td>LMC</td>
<td>17.6%</td>
<td>NA</td>
<td>5.6%</td>
<td>-</td>
<td>-</td>
<td>23.2%</td>
<td>5.5</td>
<td>Longitudinal and transverse cracking throughout deck; some sealed in right lane/shoulder and along CL of bridge.</td>
</tr>
<tr>
<td>4556</td>
<td>US-131 NB</td>
<td>AMTRAK &amp; KL AVE</td>
<td>33</td>
<td>304.8</td>
<td>HMA</td>
<td>13.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>13.0%</td>
<td>2.8**</td>
<td>3.7</td>
</tr>
<tr>
<td>4557</td>
<td>US-131 SB</td>
<td>AMTRAK &amp; KL AVE</td>
<td>33</td>
<td>304.8</td>
<td>HMA</td>
<td>20.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>20.0%</td>
<td>2.9**</td>
<td>3.6</td>
</tr>
<tr>
<td>4607</td>
<td>US-131 BR NB</td>
<td>DOUGLAS AVE</td>
<td>44.8</td>
<td>137.8</td>
<td>LMC</td>
<td>19.4%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>19.4%</td>
<td>3.3</td>
<td>Longitudinal and transverse cracking throughout the deck; some of which is sealed in the center and right lanes.</td>
</tr>
<tr>
<td>Bridge ID</td>
<td>Feature On</td>
<td>Feature Under</td>
<td>Width (ft)</td>
<td>Length (ft)</td>
<td>Overlay</td>
<td>GPR Quantity (%)</td>
<td>IR Quantity (%)</td>
<td>PCC Patching (%)</td>
<td>AC Patching (%)</td>
<td>Spalling (%)</td>
<td>Total Defect (%)</td>
<td>Avg. Concrete Cover (in.)</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------</td>
<td>------------------</td>
<td>----------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4608</td>
<td>US-131 BR SB</td>
<td>DOUGLAS AVE</td>
<td>40</td>
<td>137.8</td>
<td>LMC</td>
<td>19.7%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>19.7%</td>
<td>3.2</td>
<td></td>
<td>Longitudinal and transverse cracking concentrated in the west span and along the CL joint.</td>
</tr>
<tr>
<td>10264</td>
<td>US-131 NB</td>
<td>ROCKY RIVER</td>
<td>43</td>
<td>89.9</td>
<td>LMC</td>
<td>27.2%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>27.2%</td>
<td>3.2</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>10265</td>
<td>US-131 SB</td>
<td>ROCKY RIVER</td>
<td>47</td>
<td>89.9</td>
<td>LMC</td>
<td>2.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>2.0%</td>
<td>3.4</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>10686</td>
<td>I-196 NB</td>
<td>32 ND AVE (CR378)</td>
<td>39.8</td>
<td>109.9</td>
<td>LMC</td>
<td>14.0%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>14.0%</td>
<td>4.1</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>10687</td>
<td>I-196 SB</td>
<td>32 ND AVE (CR378)</td>
<td>39.8</td>
<td>109.9</td>
<td>LMC</td>
<td>12.3%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>12.3%</td>
<td>4.3</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>10709</td>
<td>I-94 EB</td>
<td>PAW PAW RIVER</td>
<td>45</td>
<td>145.7</td>
<td>LMC</td>
<td>21.1%*</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>21.1%</td>
<td>5.3</td>
<td></td>
<td>Longitudinal and transverse cracking concentrated along CL of bridge deck.</td>
</tr>
<tr>
<td>10710</td>
<td>I-94 WB</td>
<td>PAW PAW RIVER</td>
<td>44</td>
<td>145.7</td>
<td>LMC</td>
<td>22.3%</td>
<td>NA</td>
<td>-</td>
<td>-</td>
<td>22.3%</td>
<td>5.6</td>
<td></td>
<td>Longitudinal and transverse cracking throughout deck. Regularly spaced transverse cracks in the left lane.</td>
</tr>
<tr>
<td>10711</td>
<td>I-94 EB</td>
<td>E BR OF PAW PAW RIVER</td>
<td>43</td>
<td>36.0</td>
<td>LMC</td>
<td>9.2%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>9.2%</td>
<td>5.3</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>10712</td>
<td>I-94 WB</td>
<td>E BR OF PAW PAW RIVER</td>
<td>43</td>
<td>36.0</td>
<td>LMC</td>
<td>22.7%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>22.7%</td>
<td>4.8</td>
<td></td>
<td>NA</td>
</tr>
</tbody>
</table>

Notes:
- Some AC patching may be presented, but could not be distinguished
++ Total defect quantity may include overlap of different defects, resulting in an overestimated quantity
* Quantity adjusted as a result of the Level 2 Analysis.
** Average HMA Overlay Thickness.
NA No Level 2 analysis conducted, or not surveyed with the given method.
ATTACHMENT D
Deck Condition Maps
Direction of traffic

North Abutment

Pier

Pier

Pier

South Abutment

Pier

Pier

Pier

Bridge Deck Condition Evaluation

Bridge ID: 116
I-196/US-31SB over Kalamazoo Ri.

Deficiencies | Area (ft²) | %
--- | --- | ---
GPR | - | -
IR | 1367.7 | 6.7
Concrete Patch | 0.0 | 0.0
Spalling | 3.8 | 0.02

Delamination / debonding detected by Infrared Thermography
Concrete Patching
Spalling

INFRASENSE, Inc.

Analyzed by: EMG  Date: 10/24/13
Checked by: KRM  Date: 10/24/13
### Bridge Deck Condition Evaluation

**Bridge ID:** 127  
**I-196 WB over US-31 NB**

**Data Sheet:** 1 of 1  
**Analysis Date:** 10/25/13  
**Checked Date:** 10/25/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IR</td>
<td>370.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Patching</td>
<td>621.0</td>
<td>6.1</td>
</tr>
</tbody>
</table>

- **Red:** Delamination / debonding detected by Infrared Thermography
- **Light Green:** Patching (Material indistinguishable)

**Direction of Traffic:** East Abutment → West Abutment

---

**Legend:**
- **Red:** Delamination / debonding detected by Infrared Thermography
- **Light Green:** Patching (Material indistinguishable)
Bridge Deck Condition Evaluation

Bridge ID: 544
M-66 over Quaker Brook

Analyzed by: AJC                 Date:  10/09/13
Checked by: KRM                 Date:  10/09/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>456.1</td>
<td>39.7</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Asphalt Patch</td>
<td>236.8</td>
<td>20.6</td>
</tr>
<tr>
<td>Spalling</td>
<td>3.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Direction of traffic
Increasing severity →

Direction of traffic

South Abutment

Pier

Pier

North Abutment

Deficiencies

<table>
<thead>
<tr>
<th></th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1453.7</td>
<td>11.9</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>3052.8</td>
<td>22.9</td>
</tr>
<tr>
<td>Spalling</td>
<td>8.5</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Bridge Deck Condition Evaluation

Bridge ID: 794
I-94 EB over CSX RR

Analyzed by: AJC
Date: 10/09/13
Checked by: KRM
Date: 10/09/13

INFRASENSE, Inc.
Deficiencies | Area (ft²) | %  
---|---|---  
GPR | 4749.0 | 27.5  
IR | - | -  
Concrete Patch | 0.0 | 0.0

Concrete Patching

Deterioration detected with GPR

Increasing severity -->

Direction of traffic
Increasing severity -->

Direction of traffic

East Abutment

West Abutment

Pier

Pier

Concrete Patching

Deterioration detected with GPR

Increasing severity -->

Bridge Deck Condition Evaluation

Bridge ID: 835
I-94 EB over Pipestone Road

Analyzed by: AJC  Date: 10/15/13
Checked by: KRM  Date: 10/15/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>2159.9</td>
<td>22.5</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>1264.0</td>
<td>13.1</td>
</tr>
</tbody>
</table>

INFRASENSE, Inc.
Bridge Deck Condition Evaluation

Bridge ID: 836
I-94 WB over Pipestone Road

Analyzed by: AJC                 Date:  10/15/13
Checked by: KRM                 Date:  10/15/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1490.7</td>
<td>16.3</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>837.1</td>
<td>8.4</td>
</tr>
<tr>
<td>Spalling</td>
<td>6.0</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Deficiencies: Concrete Patching, Spalling

Deterioration detected with GPR
Increasing severity -->

Direction of traffic

INFRASENSE, Inc.
Increasing severity -->

Direction of traffic

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>252.4</td>
<td>4.5</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>1.4</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Concrete Patching

Deterioration detected with GPR

Increasing severity -->

Bridge ID: 850
I-94 EB over Hennessy Road

Analyzed by: AJC  Date: 10/16/13
Checked by: KRM  Date: 10/17/13

INFRASENSE, Inc.
Bridge Deck Condition Evaluation

Bridge ID: 852
I-94 EB over M-140

Distance from W. Abutment (ft)

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>872.7</td>
<td>9.7</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Concrete Patching

Deterioration detected with GPR
Increasing severity -->

Direction of traffic

Analyzed by: AJC                 Date:  10/16/13
Checked by: KRM                 Date:  10/17/13
Bridge Deck Condition Evaluation

Deficiencies | Area (ft²) | %
--- | --- | ---
GPR | 944.3 | 14.3
IR | - | -
Concrete Patch | 0.0 | 0.0

Concrete Patching

Deterioration detected with GPR
Increasing severity -->

Direction of traffic

Bridge ID: 853
I-94 WB over M-140

Analyzed by: AJC  Date: 10/17/13
Checked by: KRM  Date: 10/18/13

INFRASENSE, Inc.
**Deficiencies** | Area (ft²) | %
--- | --- | ---
GPR | 472.1 | 9.3
IR | - | -
Concrete Patch | 662.5 | 13.1

**Bridge Deck Condition Evaluation**

Bridge ID: 1213
I-69 SB over St. Joseph River

Analyzed by: AJC  
Date: 10/18/13

Checked by: KRM  
Date: 10/19/13

**INFRASENSE, Inc.**

Sheet: 1 of 1
Bridge Deck Condition Evaluation

Bridge ID: 1215
I-69 NB over St. Joseph River

Analyzed by: AJC Date: 10/18/13
Checked by: KRM Date: 10/19/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>547.7</td>
<td>11.1</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>434.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Asphalt Patch</td>
<td>255.3</td>
<td>5.2</td>
</tr>
</tbody>
</table>

- **Concrete Patching**
- **Asphalt Patching**

Deterioration detected with GPR

Increasing severity -->

Direction of traffic
Bridge Deck Condition Evaluation

Bridge ID: 1256
I-94 EB over Kalamazoo River

Analyzed by: AJC  Date: 10/21/13
Checked by: KRM  Date: 10/22/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1219.9</td>
<td>13.2</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>0.00</td>
<td>0.0</td>
</tr>
</tbody>
</table>

- **Concrete Patching**
- **Deterioration detected with GPR (Increasing severity -->)**
- **Direction of traffic**
Increasing severity -->

Direction of traffic

East Abutment
West Abutment
Pier
Pier

Deficiencies | Area (ft²) | %
---|---|---
GPR | 2354.9 | 36.7
IR | - | -
Concrete Patch | 0.0 | 0.0

Concrete Patching

Deterioration detected with GPR

Increasing severity -->

Bridge Deck Condition Evaluation

Bridge ID: 1261
I-94 EB over 6 1/2 Mile Road

Analyzed by: AJC  Date: 10/21/13
Checked by: KRM  Date: 10/22/13

INFRASENSE, Inc.
Bridge Deck Condition Evaluation

Bridge ID: 1262
I-94 WB over 6 1/2 Mile Road

Analyzed by: AJC      Date: 10/22/13
Checked by: KRM      Date: 10/23/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>2136.3</td>
<td>33.3</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>453.3</td>
<td>6.9</td>
</tr>
<tr>
<td>Asphalt Patch</td>
<td>18.2</td>
<td>0.3</td>
</tr>
</tbody>
</table>

- **Concrete Patching**
- **Asphalt Patching**
- **Deterioration detected with GPR**
- **Increasing severity -->**

Direction of traffic
Bridge Deck Condition Evaluation

Bridge ID: 1263
I-94 EB over M-294 Beadle Lake

Analyzed by: AJC                 Date: 10/23/13
Checked by: KRM                 Date: 10/24/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>852.4</td>
<td>17.0</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>300.1</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Concrete Patching

Deterioration detected with GPR
Increasing severity -->

Direction of traffic

East Abutment
West Abutment
Pier
Pier
East Abutment

Distance from W. Abutment (ft)
Bridge Deck Condition Evaluation

Bridge ID: 1265
I-94 EB over 9 Mile Road

Analyzed by: AJC                 Date:  10/23/13
Checked by: KRM                 Date:  10/24/13

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1854.4</td>
<td>31.1</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>430.6</td>
<td>8.7</td>
</tr>
</tbody>
</table>

- **Concrete Patching**
- **Deterioration detected with GPR**
  - Increasing severity -->

Direction of traffic

Increasing severity -->
### Bridge Deck Condition Evaluation

**Bridge ID: 1266**  
**I-94 WB over 9 Mile Road**

**Analyzed by:** AJC  
**Checked by:** KRM  
**Date:** 10/23/13 - 10/24/13

#### Deficiencies

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>850.1</td>
<td>17.6</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>274.8</td>
<td>5.6</td>
</tr>
</tbody>
</table>

- **Concrete Patching**
- **Deterioration detected with GPR**
- **Increasing severity -->**
- **Direction of traffic**

**Direction of traffic**
- West Abutment
- East Abutment
- Pier
- Pier

**Bridge Deck Condition Evaluation**

**Sheet:** 1 of 1
Increasing severity -->

Direction of traffic

West Abutment

Pier

Pier

East Abutment

Analyzed by: AJC                 Date:  10/24/13
Checked by: KRM                 Date:  10/25/13

Concrete Patching

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1195.9</td>
<td>19.4</td>
</tr>
<tr>
<td>IR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Bridge ID: 4607
US-131 NB over Douglas Avenue

INFRASENSE, Inc.

Sheet: 1 of 1
Deficiencies | Area (ft²) | %
---|---|---
GPR | 1302.3 | 22.3
IR | - | -
Concrete Patch | 0.0 | 0.0
Direction of traffic

<table>
<thead>
<tr>
<th>Deficiencies</th>
<th>Area (ft²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>IR</td>
<td>67.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Concrete Patch</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Delamination / debonding detected by Infrared Thermography

Bridge Deck Condition Evaluation

Bridge ID: 12751
US-31 SB over Matthew Road

Analyzed by: AJC  Date: 10/17/13
Checked by: KRM   Date: 10/18/13
Attachment E

Bridge Scoping Recommendations

The following section documents the bridge rehabilitation scoping recommendations prepared by NTH Consultants for the 42 bridge decks prescribed for Level 2 analyses and mapping under this project. For each of the following bridges, the Michigan Department of Transportation’s Bridge Deck Preservation Matrix – Decks with Epoxy Coated Rebar, was used as a guide for recommended maintenance, repair, or rehabilitation strategies. As such, if there are existing bridges/structures constructed with un-coated rebar, then bridge decks with top surfaces with greater than 25% deficiencies may consider implementing deep overlays.

Structure 103

The US-131 SB bridge over US-31BR (58th St.) is approximately 190.9 feet long and 39.5 feet wide with an overall deck area of approximately 8,363 square feet. The bridge was scanned utilizing infrared Thermography with the scan revealing 1.8% of the bridge deck exhibiting delamination/debonding and 3.9% of the deck already having been patched. The total deck deficiency percentage was found to be 5.8%.

Recommendation: Clean, epoxy inject, and seal any cracks in the deck and along the perimeter of existing patches. Clean and repair the spalls, and perform deck patching on delamination/debonding areas.

Structure 115

The I-196/US-31NB bridge over the Kalamazoo River is approximately 560 feet long, and 30 feet wide with an overall deck area of approximately 20,396 square feet. The bridge was scanned utilizing Infrared Thermography with the scan revealing 6.0% of the deck exhibiting delamination/debonding and 0.2% of the deck having been patched. The total deck deficiency percentage was found to be 6.2%.

Recommendation: Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.

Structure 116

The I-196/US-31SB bridge over the Kalamazoo River is approximately 560 feet long, and 30 feet wide with an overall deck area of approximately 20,396 square feet. The bridge was scanned utilizing Infrared Thermography with the scan revealing 6.7% of the deck exhibiting delamination/debonding and 0.02% of the deck consists of spalls. The total deck deficiency percentage was found to be 6.72%.

Recommendation: Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.
**Recommendation:** Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.

**Structure 119**

The I-196/US-31NB bridge over Old Allegan Road is approximately 116.8 feet long and 39.5 feet wide with an overall deck area of approximately 4,982 square feet. The bridge was scanned utilizing Infrared Thermography with the revealing 3.8% of the deck exhibiting delamination/debonding and 16.2% of the deck having been patched. The total deck deficiency percentage was found to be 20.00%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an HMA Cap rehabilitation treatment. Investigate existing concrete pavement for slag. If slag is present, then perform a deck replacement. Since an overlay has not been performed in the past, consider a shallow concrete overlay or HMA overlay with a waterproofing membrane if deck bottom deficiencies are less than 25%.

**Structure 120**

The I-196/US-31SB bridge over Old Allegan Road is approximately 116.8 feet long and 39.5 feet wide with an overall deck area of approximately 4,982 square feet. The bridge was scanned utilizing Infrared Thermography with the revealing 2.9% of the deck exhibiting delamination/debonding and 4.7% of the deck having been patched. The total deck deficiency percentage was found to be 7.6%.

**Recommendation:** Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.

**Structure 127**

The I-196WB bridge over US-31NB is approximately 250 feet long and 40.5 feet wide with an overall deck area of approximately 11,001 square feet. The bridge was scanned utilizing Infrared Thermography with the scan revealing 3.4% of the deck exhibiting delamination/debonding and 6.1% of the deck having been patched. The total deck deficiency percentage was found to be 9.5%.

**Recommendation:** Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.
Structure 544

The M-66 bridge over Quaker Brook is approximately 34.8 feet long and 33 feet wide with an overall deck area of approximately 1,148 square feet. This bridge has an existing HMA overlay on the deck surface. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 39.7% of the deck exhibiting deterioration and observation of the video exhibiting an additional 20.6% of the deck having patching, and 0.3% of the HMA deck exhibiting spalls. The total deck deficiency percentage was found to be 60.6%.

**Recommendation:** Due to the high amount of deficiencies in the top surface, perform an in-depth inspection, and perform a structure study to determine replacement options. The Department may opt for removing the HMA overlay and reviewing the existing concrete box beams for deterioration. If deterioration exists in the box beams, it is recommended that the box beam superstructure be removed and replaced with a different supporting superstructure based on the findings of the structure study. If deterioration does not exist in the box beams, then consider removing and replacing the HMA overlay, with a waterproofing membrane.

Structure 794

The I-94EB bridge over the CSX RR is approximately 195.5 feet long and 68 feet wide with an overall deck area of approximately 13,755 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 11.9% of the deck exhibiting deterioration and observation of the video exhibiting an additional 22.9% of the deck having patching, and 0.1% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 34.9%.

**Recommendation:** Review deck bottom surface for deficiencies and perform an in-depth inspection. If deck bottom deficiencies are greater than 25%, Replace bridge deck with an Epoxy Coated Rebar (ECR) deck. If the deck bottom surface deficiencies are less than 25% and since an overlay has been performed in the past, consider removing the existing overlay, repair existing underlying deck, and re-paving a shallow concrete overlay or HMA overlay with a waterproofing membrane.

Structure 795

The I-94WB bridge over the CSX RR is approximately 195.5 feet long and 47 feet wide with an overall deck area of approximately 11,402 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 5.0% of the deck exhibiting deterioration and observation of the video exhibiting an additional 20.8% of the deck having patching, and 0.1% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 25.8%.

**Recommendation:** Review deck bottom surface for deficiencies and perform an in-depth inspection. If deck bottom deficiencies are greater than 25%, Replace bridge deck with an Epoxy Coated Rebar (ECR) deck. If the deck bottom surface deficiencies are less than 25% and since an overlay has been performed
in the past, consider removing the existing overlay, repair existing underlying deck, and re-paving a shallow concrete overlay or HMA overlay with a waterproofing membrane.

Structure 798

The I-94EB bridge over US-12 is approximately 239.8 feet long and 72.3 feet wide with an overall deck area of approximately 18,018 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 27.5% of the deck exhibiting deterioration. The total deck deficiency percentage was found to be 27.5%.

**Recommendation:** Review deck bottom surface for deficiencies and perform an in-depth inspection. If deck bottom deficiencies are greater than 25%, replace bridge deck with an Epoxy Coated Rebar (ECR) deck. Investigate existing concrete pavement for slag. If slag is present, then perform a deck replacement. Since an overlay has not been performed in the past, consider a shallow concrete overlay or HMA overlay with a waterproofing membrane if deck bottom deficiencies are less than 25%.

Structure 816

The I-94EB bridge over Puetz Road is approximately 154.9 feet long and 51.3 feet wide with an overall deck area of approximately 8,640 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 28.0% of the deck exhibiting deterioration and observation of the video exhibiting an additional 12.3% of the deck having patching, and 0.2% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 40.5%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete pavement for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay. Since this deck exhibits a high degree of deficiency, the MDOT may opt for an in-depth review of this bridge for potential superstructure and substructure rehabilitation or replacement.

Structure 817

The I-94WB bridge over Puetz Road is approximately 154.9 feet long and 51.8 feet wide with an overall deck area of approximately 8,640 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 19.7% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 19.7%.
**Recommendation:** Review deck bottom surface for deficiencies and perform an in-depth inspection. If deck bottom deficiencies are greater than 25%, Replace bridge deck with an Epoxy Coated Rebar (ECR) deck. If the deck bottom surface deficiencies are less than 25% and since an overlay has been performed in the past, consider removing the existing overlay, repair existing underlying deck, and re-paving a shallow concrete overlay or HMA overlay with a waterproofing membrane.

**Structure 818**

The I-94EB bridge over Lakeshore Drive is approximately 190.9 feet long and 95.9 feet wide with an overall deck area of approximately 19,454 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 4.5% of the deck exhibiting deterioration and observation of the video exhibiting 1.9% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 6.4%.

**Recommendation:** Sound the existing bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.

**Structure 823**

The I-94EB Bridge over Lincoln Avenue is approximately 118.8 feet long and 51.4 feet wide with an overall deck area of approximately 6,626 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 10.9% of the deck exhibiting deterioration and observation of the video exhibiting 10.5% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 21.4%.

**Recommendation:** Review deck bottom surface for deficiencies and perform an in-depth inspection. If deck bottom deficiencies are greater than 25%, Replace bridge deck with an Epoxy Coated Rebar (ECR) deck. If the deck bottom surface deficiencies are less than 25% and since an overlay has been performed in the past, consider removing the existing overlay, repair existing underlying deck, and re-paving a shallow concrete overlay or HMA overlay with a waterproofing membrane.

**Structure 827**

The I-94EB bridge over the St. Joseph River is approximately 644 feet long and 44 feet wide with an overall deck area of approximately 30,637 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 9.1% of the deck exhibiting deterioration and observation of the video exhibiting 5.6% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 14.7%.

**Recommendation:** While the surface deterioration is only 14.7%, since false decking has been placed to catch delaminating concrete, it is assumed that the bottom deck surface is in poor condition. Remove false
decking and review the deck bottom condition. If the bottom condition exhibits map cracking, spalling, and/or delamination, replace the existing deck with an Epoxy Coated Rebar (ECR) deck. Otherwise, perform an in-depth inspection of this bridge and develop an alternative course of action.

**Structure 828**

The I-94WB bridge over the St. Joseph River is approximately 644 feet long and 44 feet wide with an overall deck area of approximately 30,637 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 9.8% of the deck exhibiting deterioration and observation of the video exhibiting 5.4% of the deck having patching, and 0.02% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 15.22%.

**Recommendation:** While the surface deterioration is only 15.22%, since false decking has been placed to catch delaminating concrete, it is assumed that the bottom deck surface is in poor condition. Remove false decking and review the deck bottom condition. If the bottom condition exhibits map cracking, spalling, and/or delamination, replace the existing deck with an Epoxy Coated Rebar (ECR) deck. Otherwise, perform an in-depth inspection of this bridge and develop an alternative course of action.

**Structure 835**

The I-94 EB bridge over Pipestone Road is approximately 220.8 feet long and 43.8 feet wide with an overall deck area of approximately 10,504 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 22.5% of the deck exhibiting deterioration and observation of the video exhibiting 13.1% of the deck having patching, and 0.00% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 35.6%.

**Recommendation:** Remove false decking and replace the existing deck with an Epoxy Coated Rebar (ECR) deck. See ‘Structure 836’ below for additional recommendations.

**Structure 836**

The I-94 WB bridge over Pipestone Road is approximately 220.8 feet long and 43.8 feet wide with an overall deck area of approximately 10,504 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 16.3% of the deck exhibiting deterioration and observation of the video exhibiting 8.4% of the deck having patching, and 0.1% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 24.8%.

**Recommendation:** Due to the high deterioration, and similar nature to structure 835, it is recommended to remove false decking and replace the existing deck with an Epoxy Coated Rebar (ECR) deck. These bridges could be packaged together with similar improvements and a similar maintaining traffic scheme.
Structure 850

The I-94EB bridge over Hennessy Road is approximately 134 feet long and 42.5 feet wide with an overall deck area of approximately 6,330 square feet. It has an existing Epoxy Overlay over the T-beam supported deck. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 4.5% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 4.5%.

**Recommendation:** Identify and repair cracks in the deck and along the perimeter of the Epoxy Overlay by cleaning, injecting epoxy into cracks, and re-sealing the epoxy floodcoat.

Structure 851

The I-94WB bridge over Hennessy Road is approximately 134 feet long and 42.5 feet wide with an overall deck area of approximately 6,330 square feet. It has an existing Epoxy Overlay over the T-beam supported deck. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 6.5% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 6.5%.

**Recommendation:** Identify and repair cracks in the deck and along the perimeter of the Epoxy Overlay by cleaning, injecting epoxy into cracks, and re-sealing the epoxy floodcoat.

Structure 852

The I-94EB bridge over M-140 is approximately 157 feet long and 57.9 feet wide with an overall deck area of approximately 9,632 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 9.7% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 9.7%.

**Recommendation:** Sound the bridge deck to accurately locate the areas of delamination, and perform Deck Patching. It is also recommended that any cracks in the deck and along the perimeter of existing patches be cleaned, epoxy injected, and sealed.

Structure 853

The I-94WB bridge over M-140 is approximately 157 feet long and 42 feet wide with an overall deck area of approximately 7,147 square feet. This bridge possesses an existing HMA overlay. It is unknown if a waterproofing membrane exists or not. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 14.3% of the deck exhibiting deterioration and observation of the video exhibiting deterioration.
0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 14.3%.

**Recommendation:** Remove the HMA overlay and sound the existing concrete deck. Since an HMA treatment was already implemented it is suggested that, at a minimum, a new Shallow Concrete Overlay treatment be implemented, with a suggested preference for removing the existing deck and replacing it with an Epoxy Coated Rebar (ECR) deck.

**Structure 1200**

The I-194 bridge over the Kalamazoo River is approximately 372 feet long and 81 feet wide with an overall deck area of approximately 32,347 square feet. The bridge deck was scanned using both Infrared Thermography as well as Ground Penetrating Radar. The infrared scan detected 5.4% of the deck exhibiting delamination/debonding and the Ground Penetrating Radar revealing an additional 11.4% of deterioration. The deck exhibits existing patches over 2.3% of its surface and 0.0% of the deck exhibits spalling. The total deck deficiency percentage was found to be 19.1%.

**Recommendation:** Deck patching alone may address much of the issues with this bridge deck. However, a review of the deck bottom surface for deficiencies should be performed. If deck bottom deficiencies are greater than 25%, a Shallow Concrete Overlay rehabilitation treatment could be considered. Investigate existing concrete pavement for slag. If slag is present, then perform a deck replacement. Since an overlay has not been performed in the past, consider an HMA overlay with a waterproofing membrane if deck bottom deficiencies are less than 25%.

**Structure 1208**

The I-194 bridge over Burnham Street is approximately 132.9 feet long and 90.5 feet wide with an overall deck area of approximately 12,995 square feet. The bridge deck was scanned using both Infrared Thermography as well as Ground Penetrating Radar. The infrared scan detected 2.5% of the deck exhibiting delamination/debonding and the Ground Penetrating Radar revealing an additional 10.6% of deterioration. The deck exhibits existing patches over 8.3% of its surface and 0.0% of the deck exhibits spalling. The total deck deficiency percentage was found to be 21.4%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an HMA Cap rehabilitation treatment. Investigate existing concrete pavement for slag. If slag is present, then perform a deck replacement. Since an overlay has not been performed in the past, consider a shallow concrete overlay or HMA overlay with a waterproofing membrane if deck bottom deficiencies are less than 25%.
Structure 1213

The I-69SB bridge over the St. Joseph River is approximately 132.9 feet long and 38 feet wide with an overall deck area of approximately 5,626 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 9.3% of the deck exhibiting deterioration and observation of the video exhibiting 13.7% of the deck having patching, and 0.02% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 23.0%.

**Recommendation:** Review the bottom of deck condition. If the bottom of deck exhibits less than 25% deficiencies, then consider either a Shallow Concrete Overlay or an HMA Overlay with waterproofing membrane treatment. If the bottom deck condition exhibits greater than 25% deficiencies, then consider an HMA Cap.

Structure 1215

The I-69NB bridge over the St. Joseph River is approximately 129.9 feet long and 38 feet wide with an overall deck area of approximately 5,498 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 11.1% of the deck exhibiting deterioration and observation of the video exhibiting 14.0% of the deck having patching, and 0.00% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 25.1%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an HMA Cap rehabilitation treatment. If deck bottom deficiencies are less than 25%, and no slag is present then consider either a Shallow Concrete Overlay or an HMA Overlay with waterproofing membrane.

Structure 1246

The I-94EB bridge over the GTW RR is approximately 191.9 feet long and 43 feet wide with an overall deck area of approximately 9,067 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 21.3% of the deck exhibiting deterioration and observation of the video exhibiting 5.0% of the deck having patching, and 0.00% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 26.3%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and perform an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.
Structure 1247

The I-94WB bridge over the GTW RR is approximately 191.9 feet long and 43 feet wide with an overall deck area of approximately 9,067 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 14.1% of the deck exhibiting deterioration and observation of the video exhibiting 5.1% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 19.1%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and perform an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1256

The I-94EB bridge over the Kalamazoo River is approximately 275.4 feet long and 34 feet wide with an overall deck area of approximately 10,301 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 13.2% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 13.2%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and perform an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1257

The I-94WB bridge over the Kalamazoo River is approximately 275.4 feet long and 34 feet wide with an overall deck area of approximately 10,301 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 21.7% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 21.7%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and perform an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.
deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and perform an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1261

The I-94EB bridge over 6 ½ Mile Road is approximately 155.3 feet long and 42 feet wide with an overall deck area of approximately 7,362 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 36.7% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 36.7%.

**Recommendation:** Since this deck exhibits a high degree of deficiency, the MDOT may opt for an in-depth review of this bridge for potential superstructure and substructure rehabilitation or replacement. Otherwise, review the deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge, and perform either a HMA Cap rehabilitation or completely remove the existing deck and replace with an Epoxy Coated Rebar Deck. Also, investigate the existing concrete pavement for slag. If slag is present, then performing a deck replacement is recommended. If the deck bottom deficiencies are less than 25%, then the Department may consider removing the existing Latex Modified Concrete overlay, sounding the existing deck (below the LMC overlay) for additional areas of repair, repair the unsound/unbonded/delaminated areas, implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1262

The I-94WB bridge over 6 ½ Mile Road is approximately 155.3 feet long and 42 feet wide with an overall deck area of approximately 7,362 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 33.3% of the deck exhibiting deterioration and observation of the video exhibiting 7.2% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 40.5%.

**Recommendation:** Since this deck exhibits a high degree of deficiency, the MDOT may opt for an in-depth review of this bridge for potential superstructure and substructure rehabilitation or replacement. Otherwise, review the deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge, and perform either a HMA Cap rehabilitation or completely remove the existing deck and replace with an Epoxy Coated Rebar Deck. Also, investigate the existing concrete pavement for slag. If slag is present, then performing a deck replacement is recommended. If the deck bottom deficiencies are less than 25%, then the Department may consider removing the existing Latex Modified Concrete overlay, sounding the existing deck (below the LMC overlay) for additional areas of repair, repair the unsound/unbonded/delaminated areas, implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.
Structure 1263

The I-94EB bridge over M-294 is approximately 121.6 feet long and 42 feet wide with an overall deck area of approximately 5,716 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 17.0% of the deck exhibiting deterioration and observation of the video exhibiting 5.9% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 22.9%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and performing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1264

The I-94WB bridge over M-294 is approximately 121.6 feet long and 42 feet wide with an overall deck area of approximately 5,716 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 11.6% of the deck exhibiting deterioration and observation of the video exhibiting 5.6% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 17.2%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and performing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1265

The I-94EB bridge over 9 Mile Road is approximately 117.2 feet long and 42 feet wide with an overall deck area of approximately 5,556 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 31.1% of the deck exhibiting deterioration and observation of the video exhibiting 8.7% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 39.8%.

**Recommendation:** Since this deck exhibits a high degree of deficiency, the MDOT may opt for an in-depth review of this bridge for potential superstructure and substructure rehabilitation or replacement. Otherwise, review the deck bottom surface for deficiencies. If deck bottom deficiencies are greater than
25%, perform an in-depth review of the bridge, and perform either a HMA Cap rehabilitation or completely remove the existing deck and replace with an Epoxy Coated Rebar Deck. Also, investigate the existing concrete pavement for slag. If slag is present, then performing a deck replacement is recommended. If the deck bottom deficiencies are less than 25%, then the Department may consider removing the existing Latex Modified Concrete overlay, sounding the existing deck (below the LMC overlay) for additional areas of repair, repair the unsound/unbonded/delaminated areas, implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 1266

The I-94WB bridge over 9 Mile Road is approximately 117.2 feet long and 42 feet wide with an overall deck area of approximately 5,556 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 17.6% of the deck exhibiting deterioration and observation of the video exhibiting 5.6% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 23.2%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and performing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 4607

The US-131NB bridge over Douglas Avenue is approximately 137.8 feet long and 44.8 feet wide with an overall deck area of approximately 6,601 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 19.4% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 19.4%.

**Recommendation:** Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and performing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.
Structure 4608

The US-131SB bridge over Douglas Avenue is approximately 137.8 feet long and 40 feet wide with an overall deck area of approximately 5,878 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 19.7% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 19.7%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and performing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 10709

The I-94EB bridge over the Paw Paw River is approximately 145.7 feet long and 45 feet wide with an overall deck area of approximately 6,849 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 21.1% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 21.1%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 10710

The I-94WB bridge over the Paw Paw River is approximately 145.7 feet long and 45 feet wide with an overall deck area of approximately 6,849 square feet. The bridge was scanned utilizing Ground Penetrating Radar with the scan revealing 22.3% of the deck exhibiting deterioration and observation of the video exhibiting 0.0% of the deck having patching, and 0.0% of the deck exhibiting spalls. The total deck deficiency percentage was found to be 22.3%.

Recommendation: Review deck bottom surface for deficiencies. If deck bottom deficiencies are greater than 25%, perform an in-depth review of the bridge and perform either a HMA Cap rehabilitation or remove the existing deck and replace with an Epoxy Coated Rebar Deck. Investigate existing concrete
deck (below LMC overlay) for slag. If slag is present, then perform a deck replacement. If deck bottom deficiencies are less than 25%, then consider removing the existing LMC overlay, repairing existing deck (below LMC overlay) and implementing an HMA Overlay with waterproofing membrane or a Shallow Concrete Overlay.

Structure 12750

The US-31NB bridge over Matthew Road is approximately 93.8 feet long and 44.2 feet wide with an overall deck area of approximately 4,433 square feet. The bridge was scanned utilizing Infrared Thermography with the scan revealing 3.9% of the deck exhibiting delamination / debonding and 2.0% of the deck having been patched. The total deck deficiency percentage was found to be 5.9%.

**Recommendation:** Review the bottom of deck condition. Sound the deck to accurately locate the areas of delamination and patch the areas located because of the localized and irregular spacing of the areas of delamination, as well as seal any unsealed cracks along with the perimeter of any existing patches. An epoxy overlay may be considered for implementation, if it is found (by sounding) that there is no appreciable increase in the amount of delamination/debonding.

Structure 12751

The US-31SB bridge over Matthew Road is approximately 93.8 feet long and 44.2 feet wide with an overall deck area of approximately 4,433 square feet. The bridge was scanned utilizing Infrared Thermography with the scan revealing 3.9% of the deck exhibiting delamination / debonding and 2.0% of the deck having been patched.

**Recommendation:** Review the bottom of deck condition. Sound the deck to accurately locate the areas of delamination and patch the areas located because of the localized and irregular spacing of the areas of delamination, as well as seal any unsealed cracks along with the perimeter of any existing patches. An epoxy overlay may be considered for implementation, if it is found (by sounding) that there is no appreciable increase in the amount of delamination/debonding.