### Programmed Work:

<table>
<thead>
<tr>
<th>Work</th>
<th>Cost w/o PE&amp;CE</th>
<th>Cost w/ PE&amp;CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B01 of 23151</td>
<td>$19,661,000</td>
<td>$21,499,000</td>
</tr>
<tr>
<td>Bridge Replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B02 of 23151</td>
<td>$19,508,000</td>
<td>$21,331,000</td>
</tr>
<tr>
<td>Bridge Replacement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2024 University Region Call for Projects

Lansing TSC

B01 of 23151 (SN 2310)
I-96 EB over Grand River & Billwood Hwy
B02 of 23151 (SN 2310)
I-96 WB over Grand River & Billwood Hwy
Windsor Township, Eaton County
September 29, 2017
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1.0 Executive Summary

Bergmann Associates performed the scoping inspection of Structures B01 of 23151 (SN 2310) and B02 of 23151 (SN 2310) located in Windsor Township, Eaton County on 1/9/2017. The recommended options shown below should only be considered if they can be combined with an I-96 roadway corridor project due to the significant maintenance of traffic required for this bridge work.

### I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>Recommended Work Category</th>
<th>Construction &amp; CE Cost:</th>
<th>PE Cost:</th>
<th>Total Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Replacement</td>
<td>$19,661,000 2024 $'s</td>
<td>$1,838,000 2024 $'s</td>
<td>$21,499,000 2024 $'s</td>
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</tbody>
</table>

- Deck epoxy overlay
- Deck patching (full depth and surface repairs)
- Drill arrest holes at horizontal crack on Beam 1s in Span 3 near Abutment B.
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Substructure patching at Abutment A & Abutment B (2 locations at Abutment A requiring a temporary support: Beam 3S and Beam 4S)
- Substructure crack sealing (1 location at Abutment B)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace all deck joint devices at Abutment A, Pier 1, Pier 2, and Abutment B
- Reseal abutment end joints at Abutment A and Abutment B
- New pressure relief joints (PRJ’s) at east and west approaches
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Part Width)

### I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>Recommended Work Category</th>
<th>Construction &amp; CE Cost:</th>
<th>PE Cost:</th>
<th>Total Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Replacement</td>
<td>$19,508,000 2024 $'s</td>
<td>$1,823,000 2024 $'s</td>
<td>$21,331,000 2024 $'s</td>
</tr>
</tbody>
</table>

- Deck epoxy overlay
- Deck patching (full depth and surface repairs)
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Miscellaneous steel repairs (1 location) (replacing two missing bolts at cross frame connection on Beam 2S at Pier 1W)
• Substructure patching at Abutment A, Pier 1, and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 1S and Beam 4S)
• Concrete surface coat all substructure units, barriers and deck fascia
• Replace all deck joint devices at Pier 1 and Pier 2
• Reseal abutment end joints at Abutment A and Abutment B
• Replace pressure relief joints (PRJ's) at east and west approaches
• Replace guardrail anchorage (1 location in NW quadrant)
• Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
• HMA overlay of approach at east abutment
• Scour Countermeasures (Riprap) at Piers 1 and 2
• Maintenance of traffic (Part Width)

1.1 Structure Description

The bridge components are identified as follows:

- The beams are labeled 1 to 4 from south to north.
- Abutment A is located at the west end and Abutment B is located at the east end.
- The Piers are labeled 1 to 2 from west to east.

The components are labeled to coincide with current NBIS reports and, where possible, record plans. Below is a description of the data for this bridge.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>No. Spans:</th>
<th>3</th>
<th>Year Constructed:</th>
<th>1962</th>
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</thead>
<tbody>
<tr>
<td>Overall Length:</td>
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<td>Year Painted:</td>
<td>1987</td>
</tr>
<tr>
<td>O/O Deck Width:</td>
<td>35.5 ft</td>
<td>Year Overlay:</td>
<td>2001</td>
</tr>
<tr>
<td>Clear Road Width</td>
<td>32.5 ft</td>
<td>Design Live Load:</td>
<td>HS-20+Mod</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. Traffic Lanes:</td>
<td>2</td>
</tr>
<tr>
<td>Superstructure Type:</td>
<td>Steel Plate Girder with Pin and Hangers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge Barrier Type:</td>
<td>Type 4 Barrier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abutment Type:</td>
<td>Concrete Cantilever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abutment Foundation Type:</td>
<td>Cast-in-Place Concrete Piles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pier Type:</td>
<td>Concrete Solid Wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pier Foundation Type:</td>
<td>Cast-in-Place Concrete Piles</td>
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<td></td>
</tr>
<tr>
<td>NHS:</td>
<td>Yes for I-96 EB; No for Billwood Hwy</td>
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<td></td>
</tr>
<tr>
<td>Act 51 Participation:</td>
<td>No</td>
<td></td>
<td></td>
</tr>
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</table>

I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>No. Spans:</th>
<th>3</th>
<th>Year Constructed:</th>
<th>1962</th>
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</thead>
<tbody>
<tr>
<td>Overall Length:</td>
<td>302.5 ft</td>
<td>Year Painted:</td>
<td>1987</td>
</tr>
<tr>
<td>O/O Deck Width:</td>
<td>35.5 ft</td>
<td>Year Overlay:</td>
<td>2001</td>
</tr>
<tr>
<td>Clear Road Width</td>
<td>32.5 ft</td>
<td>Design Live Load:</td>
<td>HS-20+Mod</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. Traffic Lanes:</td>
<td>2</td>
</tr>
<tr>
<td>Superstructure Type:</td>
<td>Steel Plate Girder with Pin and Hangers</td>
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</tbody>
</table>
### Bridge Details

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
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<tbody>
<tr>
<td>Bridge Barrier Type:</td>
<td>Type 4 Barrier</td>
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<tr>
<td>Abutment Type:</td>
<td>Concrete Cantilever</td>
</tr>
<tr>
<td>Abutment Foundation Type:</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>Pier Type:</td>
<td>Concrete Solid Wall</td>
</tr>
<tr>
<td>Pier Foundation Type:</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>NHS:</td>
<td>Yes for I-96 WB; No for Billwood Hwy</td>
</tr>
<tr>
<td>Act 51 Participation:</td>
<td>No</td>
</tr>
</tbody>
</table>

### Structure Condition

The structures were last inspected in 2015 per the NBIS inspection reports on file. Bergmann Associates has reviewed and rated the superstructure and substructure elements as part of this project and the comparison of inspection ratings is below.

#### I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>NBI Item Number</th>
<th>58a</th>
<th>58b</th>
<th>58</th>
<th>59</th>
<th>60 (Abut)</th>
<th>60 (Pier)</th>
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<tbody>
<tr>
<td>Current NBI Rating</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Proposed NBI Rating</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
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#### I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>NBI Item Number</th>
<th>58a</th>
<th>58b</th>
<th>58</th>
<th>59</th>
<th>60 (Abut)</th>
<th>60 (Pier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current NBI Rating</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Proposed NBI Rating</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

#### B01 of 23151, Deck Top Surface (NBI Item 58a)

Condition: Fair
- Concrete overlay with open transverse, diagonal, and longitudinal cracks throughout. A few cracks are sealed with epoxy.
- There is a saw cut joint over Pier 1.
- There are deck scuppers present on the bridge.
- Short longitudinal cracks and small concrete spalls in deck adjacent to joints.
- Heavy map cracking throughout lanes in Span 3.

#### B01 of 23151, Deck Bottom Surface (NBI Item 58b)

Condition: Fair
- Transverse, diagonal, and longitudinal cracks throughout, most with efflorescence.
- There are deck downspouts present on the bridge.
- Several areas of minor delamination.
- Several full depth patches scattered throughout all spans.
- Concrete spalls with exposed reinforcement in Bays 1 and 3 near Abutment B.
- Tight map cracking throughout all bays in Span 1.
### B01 of 23151, Superstructure (NBI Item 59)

**Condition:** Fair

- High load hit scrapes on the bottom flanges of all beams over Billwood Hwy in Span 1.
- Heavy rust on fascia beams at pin & hangers at Pier 1 and Pier 2.
- Heavy rust and minor loss of section on fascia beams at bottom of vertical stiffeners.
- Hole in stiffener on Beam 1S in Span 2, 1st vertical stiffener west of P&H at Pier 2.
- Loss of section at bottom of stiffener on Beam 2 in Span 2 near P&H at Pier 2.
- Exterior face of Beam 1 at P&H 1 has pitting on the web.
- Small horizontal crack (3” long) on Beam 1s in Span 3 near Abutment B.
- Repaired crack at stiffener/web connection on Beam 1s, in Span 1 near Abutment A.
- Minor loss of section on a few beam ends and cross braces.
- Several cross brace to web connections near Abutment B are rusty with loss of section.
- Several vertical stiffeners are bent.
- Light rust throughout bridge.
- Paint system is chalking throughout bridge; Paint system failure only in localized areas.

### B01 of 23151, Substructure (Abutments) (NBI Item 60)

**Condition:** Fair

- Concrete spalls with exposed reinforcement under Beams 3S & 4S on Abutment A.
- Several areas of delamination on face of Abutment A and backwall of Abutment B.
- Several rusty full height vertical cracks and horizontal cracks scattered throughout.
- Abutment B backwall has water staining from leaking joint above.
- Several areas of concrete spalls with exposed reinforcement throughout Abutment B.
- One open vertical crack beneath Beam 1S on Abutment B.
- Several areas of delamination and small spalls in southeast slopewall.
- Large voids with exposed fill in slope protection at Abutment B.

### B01 of 23151, Substructure (Piers) (NBI Item 60)

**Condition:** Fair

- A few tight vertical cracks (some with efflorescence) on face of piers; they don’t extend all the way to the top of the pier.

### I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

#### B02 of 23151, Deck Top Surface (NBI Item 58a)

**Condition:** Fair

- Concrete overlay with open transverse, diagonal, and longitudinal cracks throughout. A few cracks are sealed with epoxy.
- There is a saw cut joint over Pier 2.
- There are deck scuppers present on the bridge.
- Several scuppers have settled slightly and are surrounded by delaminated concrete.
- Short longitudinal cracks and small concrete spalls in deck adjacent to joints.
- Several concrete patches adjacent to expansion joint over Pier 1.
- One scupper on south side of Span 3 is filled with debris.
### B02 of 23151, Deck Bottom Surface (NBI Item 58b)

**Condition:** Fair

- Transverse, diagonal, and longitudinal cracks throughout, most with efflorescence.
- Several full depth patches scattered throughout all spans.
- Several areas of minor deterioration.
- A few concrete spalls, some with exposed reinforcement.
- There are deck downspouts present on the bridge.
- Areas of tight map cracking scattered throughout.

### B02 of 23151, Superstructure (NBI Item 59)

**Condition:** Fair

- Heavy rust on fascia beams at pin & hangers at Pier 1 and Pier 2.
- Minor section loss on web of Beam 1S near P&H at Pier 2.
- Heavy rust and section loss on fascia beams and stiffeners at bottom of vertical stiffeners.
- Hole (3"x2") in stiffener on Girder 1S in Span 3, 9th vertical stiffener from east abutment.
- Hole (3/8" dia) in stiffener on Beam 1S in Span 2, 2nd vertical stiffener east of Pier 1.
- Beam 2S appears to be rotated slightly to the north (out of plumb).
- Deterioration to steel adjacent to deck joints.
- Light rust throughout bridge.
- Paint system is chalking throughout bridge; Paint system failure only in localized areas.

### B02 of 23151, Substructure (Abutments) (NBI Item 60)

**Condition:** Fair

- Large area of delamination on face of Abutment A under Beam 2S.
- Several rusty full height vertical cracks scattered throughout.
- Abutment B backwall is 2" forward of slopewall.
- Area of map cracking and delamination under Beam 1S at Abutment B.
- Lots of debris built-up around bearings near slopewalls.
- Several areas of concrete patches from previous repair work.
- Repair under Beam 4S at Abutment A is delaminated and cracked behind anchor bolt.
- Large voids with exposed fill in slope protection at Abutment B.

### B02 of 23151, Substructure (Piers) (NBI Item 60)

**Condition:** Fair

- A few tight vertical cracks (some with efflorescence) on face of piers; they don't extend all the way to the top.
- Concrete spall with exposed reinforcement at top of west face of Pier 1, in extended portion of pier.
1.3 Site Issues
This site had heavy traffic along I-96 EB & WB during the scoping inspection. The site issues which may impact design and construction include:

<table>
<thead>
<tr>
<th>ADT:</th>
<th>21,057</th>
<th>Year: 2007</th>
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</thead>
<tbody>
<tr>
<td>AADT:</td>
<td>40,300</td>
<td>Year: 2015</td>
</tr>
<tr>
<td>% Comm:</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

Maintaining Traffic Options:
- Part width construction on I-96 EB & WB (Epoxy Overlay Option)
- Staged Construction (Temporary Crossovers, Detours, Widening, etc) (Deep Overlay and Bridge Replacement Options)
- Billwood Hwy below I-96 will need to be closed periodically.
- Signs should be placed along the river informing marine traffic of bridge work.

Site Constraints/Issues:
- All piers are located within the Grand River.
- Bridge shoulders are narrow, so traffic will need to be reduced to 1 lane on each bridge. (Epoxy Overlay Options)
- Bridge clear width is narrow and cannot maintain enough width to rehab or reconstruct the bridge part-width. Therefore, a stage construction is proposed for any 3R or 4R work.
- Work under the bridge will need to be done using barges.
- Limited access to the east bank of the river.

1.4 Repair Recommendation
Based on the condition of the overall bridge, condition of the bridge deck, application of the Bridge Deck Preservation Matrix, and geometric needs, the following repair options were considered for this site:

I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>Option 1 (Epoxy Overlay (CPM))</th>
<th>$1,256,000</th>
<th>2024 $'s (Incl. PE&amp;CE)</th>
</tr>
</thead>
</table>

The recommended option shown below will yield a fix life of 10 to 15 years.
- Deck epoxy overlay
- Deck patching (full depth and surface repairs)
- Drill arrest holes at horizontal crack on Beam 1s in Span 3 near Abutment B.
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Substructure patching at Abutment A & Abutment B (2 locations at Abutment A requiring a temporary support: Beam 3S and Beam 4S)
- Substructure crack sealing (1 location at Abutment B)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace all deck joint devices at Abutment A, Pier 1, Pier 2, and Abutment B
- Reseal abutment end joints at Abutment A and Abutment B
- New pressure relief joints (PRJ’s) at east and west approaches
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Part Width)

**Option 2 (Deep Concrete Overlay)**

$5,026,000  
2024 $’s (Incl. PE&CE)

The recommended option shown below will yield a fix life of 20 to 25 years.

- Deep concrete overlay (including railing and joint replacements)
- Deck patching (full depth repairs)
- Pin and Hanger Replacement (All Beams at both Piers, Temporary Supports Included)
- Drill arrest holes at horizontal crack on Beam 1s in Span 3 near Abutment B.
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Substructure patching at Abutment A and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 3S and Beam 4S)
- Concrete surface coat all substructure units, barriers and deck fascia
- Substructure crack sealing (1 location at Abutment B)
- New pressure relief joints (PRJ’s) at east and west approaches
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- Replace approach slab at west abutment; HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Temporary Crossovers to I-96 WB (B02-23151))

**Option 3 (Bridge Replacement)**

$21,499,000  
2024 $’s (Incl. PE&CE)

The recommended option shown below will yield a fix life of 60+ years.

- Multi-Span Bridge Replacement
- Demolition of Existing Bridge
- Approach work
- Maintenance of traffic (Temporary Crossovers to I-96 WB (B02-23151))

**I-96 WB over Grand River & Billwood Hwy (B02 of 23151)**

**Option 1 (Epoxy Overlay)**

$916,000  
2024 $’s (Incl. PE&CE)

The recommended option shown below will yield a fix life of 10 to 15 years.

- Deck epoxy overlay
- Deck patching (full depth and surface repairs)
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Miscellaneous steel repairs (1 location) (replacing two missing bolts at cross frame connection on Beam 2S at Pier 1W)
- Substructure patching at Abutment A, Pier 1, and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 1S and Beam 4S)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace all deck joint devices at Pier 1 and Pier 2
- Reseal abutment end joints at Abutment A and Abutment B
- Replace pressure relief joints (PRJ’s) at east and west approaches
- Replace guardrail anchorage (1 location in NW quadrant)
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Part Width)

**Option 2 (Deep Concrete Overlay)**

$8,101,000 2024 $’s (Incl. PE&CE)

The recommended option shown below will yield a fix life of 20 to 25 years.

- Deep concrete overlay (including railing and joint replacements)
- Deck patching (full depth repairs)
- Pin and Hanger Replacements (All beams at both Piers, Temporary Supports Included)
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Miscellaneous steel repairs (1 location) (replacing two missing bolts at cross frame connection on Beam 2S at Pier 1W)
- Substructure patching at Abutment A, Pier 1, and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 1S and Beam 4S)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace pressure relief joints (PRJ’s) at east and west approaches
- Replace guardrail anchorage (1 location in NW approach)
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- Replace approach slab at west abutment; HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Temporary Widening & Part Width Construction)

**Option 3 (Bridge Replacement)**

$21,331,000 2024 $’s (Incl. PE&CE)

The recommended option shown below will yield a fix life of 60+ years.

- Multi-Span Bridge Replacement
- Temporary Bridge Widening on Existing Bridge for Maintenance of Traffic in Stage 1
- Demolition of Existing Bridge
• Approach work
• Maintenance of traffic (Temporary Crossovers to I-96 EB (B01-23151))

If this bridge project can be combined with a corridor roadway project on I-96, Bridge Replacement (Option 3) is recommended option because it has the longest anticipated fix life, would help limit future standalone bridge projects at this location and because it would take full advantage of the traffic control staging necessary at this site.

The deep deck overlay (Option 2) is not recommended due to the subsequently large maintenance of traffic costs. The bridge repair work cost is almost half the cost of the traffic control work needed to maintain two lanes of I-96 EB and WB traffic over the bridges. Therefore, it is not cost effective at all to complete the deep deck overlay repair work.

The epoxy overlay option (Option 1) is recommended if funds are not available for bridge replacement (Option 3) or if an I-96 corridor project is not planned in the near future. Given the overall condition of the entire deck surface, the epoxy overlay option will improve the condition of the bridges and will be a sufficient repair until the next major I-96 corridor project.

1.5 Local Agency Needs and Requests

The following agencies where contacted to gather input for this project. Future needs and requests received for the area include:

- Eaton County Road Commission (stated that they would like some tree clearing along Billwood Hwy that is located in MDOT's right-of-way)
- Eaton County Drain Commissioner (no response)
- Windsor Township (no response)
- Tri-County Regional Planning Commission (no response)
## 2.0 Field Site Review Findings

Bergmann Associates performed the scoping inspection of Structure **B01 of 23151** (SN 2310) located in Windsor Township, Eaton County on 1/9/2017.

The bridge components are identified as follows:

- The beams are labeled 1 to 4 from south to north.
- Abutment A is located at the west end and Abutment B is located at the east end.
- The Piers are labeled 1 to 2 from west to east.

The components are labeled to coincide with current NBIS reports and, where possible, record plans. Below is a description of the data for this bridge.

### I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Spans</td>
<td>3</td>
</tr>
<tr>
<td>Overall Length</td>
<td>399.5 ft</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>1962</td>
</tr>
<tr>
<td>O/O Deck Width</td>
<td>35.5 ft</td>
</tr>
<tr>
<td>Year Painted</td>
<td>1987</td>
</tr>
<tr>
<td>Clear Road Width</td>
<td>32.5 ft</td>
</tr>
<tr>
<td>Year Overlay</td>
<td>2001</td>
</tr>
<tr>
<td>Design Live Load</td>
<td>HS-20+Mod</td>
</tr>
<tr>
<td>No. Traffic Lanes</td>
<td>2</td>
</tr>
<tr>
<td>Superstructure Type</td>
<td>Steel Plate Girder with Pin and Hangers</td>
</tr>
<tr>
<td>Bridge Barrier Type</td>
<td>Type 4 Barrier</td>
</tr>
<tr>
<td>Abutment Type</td>
<td>Concrete Cantilever</td>
</tr>
<tr>
<td>Abutment Foundation Type</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>Pier Type</td>
<td>Concrete Solid Wall</td>
</tr>
<tr>
<td>Pier Foundation Type</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>NHS</td>
<td>Yes for I-96 EB; No for Billwood Hwy</td>
</tr>
<tr>
<td>Act 51 Participation</td>
<td>No</td>
</tr>
</tbody>
</table>

### I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Spans</td>
<td>3</td>
</tr>
<tr>
<td>Overall Length</td>
<td>302.5 ft</td>
</tr>
<tr>
<td>Year Constructed</td>
<td>1962</td>
</tr>
<tr>
<td>O/O Deck Width</td>
<td>35.5 ft</td>
</tr>
<tr>
<td>Year Painted</td>
<td>1987</td>
</tr>
<tr>
<td>Clear Road Width</td>
<td>32.5 ft</td>
</tr>
<tr>
<td>Year Overlay</td>
<td>2001</td>
</tr>
<tr>
<td>Design Live Load</td>
<td>HS-20+Mod</td>
</tr>
<tr>
<td>No. Traffic Lanes</td>
<td>2</td>
</tr>
<tr>
<td>Superstructure Type</td>
<td>Steel Plate Girder with Pin and Hangers</td>
</tr>
<tr>
<td>Bridge Barrier Type</td>
<td>Type 4 Barrier</td>
</tr>
<tr>
<td>Abutment Type</td>
<td>Concrete Cantilever</td>
</tr>
<tr>
<td>Abutment Foundation Type</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>Pier Type</td>
<td>Concrete Solid Wall</td>
</tr>
<tr>
<td>Pier Foundation Type</td>
<td>Cast-in-Place Concrete Piles</td>
</tr>
<tr>
<td>NHS</td>
<td>Yes for I-96 WB; No for Billwood Hwy</td>
</tr>
<tr>
<td>Act 51 Participation</td>
<td>No</td>
</tr>
</tbody>
</table>
2.1 Approaches
The approach pavement and shoulders are concrete at the west approaches and HMA at the east approaches. A summary of the approach deterioration/deficiencies is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Approach Condition: Fair
- Map cracking in concrete at west approach.
- Tight cracks in shoulder and curb and gutter at west approach.
- Southwest curb and gutter has shallow spalls.
- Open cracks and spalls located along Ref Line B, some with cold patch repairs.
- Approach and shoulder pavement is raveling at east approach.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Approach Condition: Fair
- Map cracking in concrete at west approach.
- Tight cracks in shoulder and curb and gutter at west approach.
- North shoulder at west approach has concrete spalls filled with cold patch.
- Open cracks and spalls located along Ref Line B, some with cold patch repairs.
- Impact damage to northeast approach guardrail (approx. 40’ long).
- Approach and shoulder pavement is raveling at east approach.

2.2 Deck Top Surface
The original decks were resurfaced and the joints and barriers were replaced in 2001. The top surface of the deck is documented in the field sketches located in Appendix B and the extent of the deterioration and repair quantities are calculated in Appendix C. A summary of deterioration is provided below.

<table>
<thead>
<tr>
<th>B01 of 23151, Deck Top Surface (NBI Item 58a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition: Fair</td>
</tr>
<tr>
<td>- Concrete overlay with open transverse, diagonal, and longitudinal cracks throughout. A few cracks are sealed with epoxy.</td>
</tr>
<tr>
<td>- There is a saw cut joint over Pier 1.</td>
</tr>
<tr>
<td>- There are deck scuppers present on the bridge.</td>
</tr>
<tr>
<td>- Short longitudinal cracks and small concrete spalls in deck adjacent to joints.</td>
</tr>
<tr>
<td>- Heavy map cracking throughout lanes in Span 3.</td>
</tr>
</tbody>
</table>

Table 1. Summary of Deck Surface Deterioration As Measured (B01 of 23151)

<table>
<thead>
<tr>
<th>SPAN</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(square feet)</td>
<td>3863</td>
<td>4260</td>
<td>3863</td>
<td>11986</td>
</tr>
<tr>
<td>Delamination:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spall:</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Previous Patch:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total:</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>% of Deck Area:</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>
I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Deck Top Surface (NBI Item 58a)

Condition: Fair

- Concrete overlay with open transverse, diagonal, and longitudinal cracks throughout. A few cracks are sealed with epoxy.
- There is a saw cut joint over Pier 2.
- There are deck scuppers present on the bridge.
- Several scuppers have settled slightly and are surrounded by delaminated concrete.
- Short longitudinal cracks and small concrete spalls in deck adjacent to joints.
- Several concrete patches adjacent to expansion joint over Pier 1.
- One scupper on south side of Span 3 is filled with debris.

Table 2. Summary of Deck Surface Deterioration As Measured (B02 of 23151)

<table>
<thead>
<tr>
<th>SPAN</th>
<th>(square feet)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck Area</td>
<td></td>
<td>2890</td>
<td>3300</td>
<td>2890</td>
<td>9080</td>
</tr>
<tr>
<td>Delamination</td>
<td></td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Spall</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Previous Patch</td>
<td></td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>% of Deck Area</td>
<td></td>
<td>0%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

2.3 Deck Bottom Surface

The bottom surface of the deck is documented in the field sketches located in Appendix B and the extent of the deterioration and repair quantities are calculated in Appendix C. A summary of deterioration is provided below.

B01 of 23151 Deck Bottom Surface (NBI Item 58b)

Condition: Fair

- Transverse, diagonal, and longitudinal cracks throughout, most with efflorescence.
- There are deck downspouts present on the bridge.
- Several areas of minor delamination.
- Several full depth patches scattered throughout all spans.
- Concrete spalls with exposed reinforcement in Bays 1 and 3 near Abutment B.
- Tight map cracking throughout all bays in Span 1.

Table 3. Summary of Deck Surface Deterioration As Observed/Estimated (B01 of 23151)

<table>
<thead>
<tr>
<th>SPAN</th>
<th>(square feet)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck Area</td>
<td></td>
<td>3863</td>
<td>4260</td>
<td>3863</td>
<td>11986</td>
</tr>
<tr>
<td>Delamination</td>
<td></td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spall</td>
<td></td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Previous Patch</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
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<td>0</td>
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<td>6</td>
</tr>
<tr>
<td>% of Deck Area</td>
<td></td>
<td>0%</td>
<td>0%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>
I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Deck Bottom Surface (NBI Item 58b)

Condition: Fair
- Transverse, diagonal, and longitudinal cracks throughout, most with efflorescence.
- Several full depth patches scattered throughout all spans.
- Several areas of minor deterioration.
- A few concrete spalls, some with exposed reinforcement.
- There are deck downspouts present on the bridge.
- Areas of tight map cracking scattered throughout.

Table 4. Summary of Deck Surface Deterioration As Observed/Estimated (B02 of 23151)

<table>
<thead>
<tr>
<th>SPAN (square feet)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck Area:</td>
<td>2890</td>
<td>3300</td>
<td>2890</td>
<td>9080</td>
</tr>
<tr>
<td>Delamination:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spall:</td>
<td>5</td>
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<td>14</td>
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<tr>
<td>Previous Patch:</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Total:</td>
<td>5</td>
<td>9</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>% of Deck Area:</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
<td>0%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

2.4 Deck Fascia
The deck fascia was visually inspected on both sides of the bridge. A summary of deterioration is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Deck Fascia Condition: Fair
- Concrete patches along fascia from previous repair work.
- Scattered horizontal and vertical cracks throughout, some with efflorescence.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Deck Fascia Condition: Fair
- Concrete patches along fascia from previous repair work.
- Scattered horizontal and vertical cracks throughout, some with efflorescence.
- A few small concrete spalls scattered throughout.

2.5 Deck Joints
The deck joints were observed during the top side deck inspection as well as during the deck underside inspection. B01 of 23151 has a hot poured rubber joint and a strip seal expansion joint at both abutments, a sealed construction joint at Pier 1, and a strip seal expansion joint at Pier 2. B02 of 23151 has hot poured rubber joints at both abutments, a strip seal expansion joint at Pier 1, and a sealed construction joint at Pier 2. A summary of deterioration is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Deck Joint Condition: Poor
- Short longitudinal cracks in deck adjacent to joints.
· Expansion joints are full of debris and have gouges in the rails.
· Pourable joints at the reference lines have loss of adhesion and are leaking.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Deck Joint Condition: Poor

· Pourable joints at the references lines have either loss of adhesion or are missing.
· Deck joints are leaking causing deterioration to steel members below.
· Anchorage is exposed in outside lane at Pier 1 expansion joint.
· Short longitudinal cracks in deck adjacent to joints.
· Expansion joints are full of debris and have gouges in the rails.

2.6 Bridge Railings

The bridge railings were inspected during the deck sounding operations. The north and south railings are Type 4 concrete barrier. A summary of deterioration is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Bridge Railing Condition: Fair

· Concrete surface coating is peeling throughout.
· Full height vertical cracks spaced approximately 5’ to 10’ apart, some with efflorescence.
· Map cracking in upper portions of barrier near joints.
· Impact scrapes on barrier scattered throughout.
· Most delineators are either damaged or missing.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Bridge Railing Condition: Fair

· Concrete surface coating is peeling throughout. Span 1 is in the worst condition.
· Full height vertical cracks spaced approximately 5’ to 10’ apart, some with efflorescence.
· Map cracking in upper portions of barrier near joints.
· Impact scrapes on barrier scattered throughout.
· Guardrail anchorage in northeast quadrant has impact damage.
· Most delineators are either damaged or missing.

2.7 Superstructure

2.7.1 Beams

Beams 1 through 4 are steel plate girders and are considered fracture critical. The Detailed Beam Report documents each beam end and is included in Appendix D. A summary of the deterioration is included below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151, Superstructure (NBI Item 59) Condition: Fair

· High load hit scrapes on the bottom flanges of all beams over Billwood Hwy in Span 1.
· Heavy rust on fascia beams at pin & hangers at Pier 1 and Pier 2.
· Heavy rust and minor loss of section on fascia beams at bottom of vertical stiffeners.
• Hole in stiffener on Beam 1S in Span 2, 1st vertical stiffener west of P&H at Pier 2.
• Loss of section at bottom of stiffener on Beam 2 in Span 2 near P&H at Pier 2.
• Exterior face of Beam 1 at P&H 1 has pitting on the web.
• Small horizontal crack (3" long) on Beam 1S in Span 3 near Abutment B.
• Repaired crack at stiffener/web connection on Beam 1S, in Span 1 near Abutment A.
• Minor loss of section on a few beam ends and cross braces.
• Several cross brace to web connections near Abutment B are rusty with loss of section.
• Several vertical stiffeners are bent.
• Light rust throughout bridge.
• Paint system is chalking throughout bridge; Paint system failure only in localized areas.

### I-96 EB over Grand River & Billwood Hwy (B01 of 23151, Superstructure (NBI Item 59))

**Condition:** Fair

- Heavy rust on fascia beams at pin & hangers at Pier 1 and Pier 2.
- Minor section loss on web of Beam 1S near P&H at Pier 2.
- Heavy rust and section loss on fascia beams and stiffeners at bottom of vertical stiffeners.
- Hole (3"x2") in stiffener on Girder 1S in Span 3, 9th vertical stiffener from east abutment.
- Hole (3/8" dia) in stiffener on Beam 1S in Span 2, 2nd vertical stiffener east of Pier 1.
- Beam 2S appears to be rotated slightly to the north (out of plumb).
- Deterioration to steel adjacent to deck joints.
- Light rust throughout bridge
- Paint system is chalking throughout bridge; Paint system failure only in localized areas.

### 2.7.2 Cross Frames/Diaphragms & Other Secondary Members

There are steel cross frames in all spans. Lower lateral bracing is present on B01 of 23151 in Bays 1 and 3 in Spans 1 and 3. A summary of deterioration is provided below.

**I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Diaphragm Condition: Fair**

- Cross frames and lateral bracing have minor scattered surface rusting.

**I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Diaphragm Condition: Fair**

- Cross frames and lateral bracing have minor scattered surface rusting.
- Lateral bracing connection on Beam 2S at Pier 1W is missing 2 bolts at the bottom gusset plate connection.
2.7.3 Bearings
B01 of 23151 has rocker bearings at Abutment A and Pier 2 that allow for expansion; Pier 1 has fixed pedestal bearings, which allow for rotation; and Abutment B has fixed plate bearings, which allow for rotation. B02 of 23151 has rocker bearings at Piers 1 and 2 that allow for expansion and fixed plate bearings at the abutments, which allow for rotation. The bearings were inspected as part of the beam end inspection. Detailed information can be found in Appendix B. A summary of the deterioration is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Bearing Condition: Fair
- Heavy rust with minor loss of section on most abutment bearings.
- Corrosion around anchor bolts on fascia pier bearings.
- Light rust on all pier bearings.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Bearing Condition: Fair
- Heavy rust with minor loss of section on most abutment bearings.
- Light rust on all pier bearings.

2.7.4 Pin & Hangers
There are pin & hangers located in Span 2 near Piers 1 and 2. The Detailed Beam Report documents each pin & hanger condition and is included in Appendix D. A summary of deterioration is provided below.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151), Pin and Hanger Condition: Fair
- Heavy rust on fascia beams at pin & hangers.
- The gap between beam ends was appropriate for the temperatures during inspection.
- Pin & hangers appear to be operating as intended.

I-96 WB over Grand River & Billwood Hwy (B02 of 23151), Pin and Hanger Condition: Fair
- Heavy rust on fascia beams at pin & hangers.
- The gap between beam ends was appropriate for the temperatures during inspection.
- Pin & hangers appear to be operating as intended.
2.8 **Substructures**

2.8.1 **Abutments**

The cantilever type abutments are supported on cast-in-place concrete piles. These bridges are scour critical, since the calculated scour depth is below the bottom of the abutment footings. The abutment footings are located above normal water level. Detailed information can be found in Appendix B. A summary of the deterioration is provided below.

<table>
<thead>
<tr>
<th>I-96 EB over Grand River &amp; Billwood Hwy (B01 of 23151 ) , Substructure (Abutments) (NBI Item 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition: Fair</td>
</tr>
<tr>
<td>• Concrete spalls with exposed reinforcement under Beams 3S &amp; 4S on Abutment A.</td>
</tr>
<tr>
<td>• Several areas of delamination on face of Abutment A and backwall of Abutment B.</td>
</tr>
<tr>
<td>• Several rusty full height vertical cracks and horizontal cracks scattered throughout.</td>
</tr>
<tr>
<td>• Abutment B backwall has water staining from leaking joint above.</td>
</tr>
<tr>
<td>• Several areas of concrete spalls with exposed reinforcement throughout Abutment B.</td>
</tr>
<tr>
<td>• One open vertical crack beneath Beam 1S on Abutment B.</td>
</tr>
<tr>
<td>• Several areas of delamination and small spalls in southeast slopewall.</td>
</tr>
<tr>
<td>• Large voids with exposed fill in slope protection at Abutment B.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I-96 EB over Grand River &amp; Billwood Hwy (B01 of 23151 ) , Substructure (Abutments) (NBI Item 60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition: Fair</td>
</tr>
<tr>
<td>• Large area of delamination on face of Abutment A under Beam 2S.</td>
</tr>
<tr>
<td>• Several rusty full height vertical cracks scattered throughout.</td>
</tr>
<tr>
<td>• Abutment B backwall is 2” forward of slopewall.</td>
</tr>
<tr>
<td>• Area of map cracking and delamination under Beam 1S at Abutment B.</td>
</tr>
<tr>
<td>• Lots of debris built-up around bearings near slopewalls.</td>
</tr>
<tr>
<td>• Several areas of concrete patches from previous repair work.</td>
</tr>
<tr>
<td>• Repair under Beam 4S at Abutment A is delaminated and cracked behind anchor bolt.</td>
</tr>
<tr>
<td>• Large voids with exposed fill in slope protection at Abutment B.</td>
</tr>
</tbody>
</table>

2.8.2 **Piers**

The solid wall piers are founded on cast-in-place concrete piles. The piers were originally constructed for a future superstructure widening in the median. These bridges are scour critical, since the calculated scour depth is below the bottom of the pier footings. A scour inspection was not completed as part of this bridge scoping project, due to the river being covered in ice. The latest Bridge Safety Inspection Report lists that no scour or exposed footings have been reported since 2003. Detailed information can be found in Appendix B. A summary of the deterioration is provided below.
### I-96 EB over Grand River & Billwood Hwy (B01 of 23151, Substructure (Piers) (NBI Item 60))

**Condition:** Fair

- A few tight vertical cracks (some with efflorescence) on face of piers; they don’t extend all the way to the top.

### I-96 EB over Grand River & Billwood Hwy (B01 of 23151, Substructure (Piers) (NBI Item 60))

**Condition:** Fair

- A few tight vertical cracks (some with efflorescence) on face of piers; they don’t extend all the way to the top.
- Concrete spall with exposed reinforcement at top of west face of Pier 1, in extended portion of pier.

---

### 2.9 Site Issues

#### 2.9.1 Maintaining Traffic

The MDOT Work Zone Safety and Mobility Policy has been established to improve safety and mobility in work zones by reducing congestion and traffic incidents, and must be implemented on all state trunkline work zones. Based upon existing traffic data and analysis of the construction zone closures, the travel time delay, volume to capacity (v/c) ratio and level of service thresholds should be reviewed with respect to the Work Zone Safety and Mobility Policy.

**Preventive Maintenance Work:** I-96 EB & WB are two lane bridges with very narrow shoulders. For the preventive maintenance work option, each bridge will need to be reduced to one lane of traffic. This will result in a significant impact to the flow of traffic along I-96. Possible mitigation of these impacts could be done by limiting bridge work to short closure windows during off peak times and using high early strength concrete for patching, joint replacements, and other concrete work.

Billwood Highway under I-96 will require closures during deck patching and any steel replacement or painting work overhead. Access to the river from the east banks is very limited, therefore traffic along Billwood Hwy will likely be impacted by work taking place in the river.

The Grand River is navigable at this location and there is a marina located just downstream of the bridges. Therefore, marine traffic should be maintained by placing signs along the banks of the river warning of bridge work ahead.

**3R and 4R Bridge Work:** Due to the construction durations associated with the work proposed for the deep concrete overlay and bridge replacement option, it will not be feasible to maintain one lane of I-96 traffic in each direction for the duration of work. In addition, there will not be enough room to maintain traffic for part width construction on the existing bridges. Therefore, a staging option with temporary crossovers, ramp detours and temporary bridge and road widening will be necessary to complete these bridge work options. See Appendix C for a sketch of the traffic control scheme.
Two lanes in each direction of I-96 will need to be maintained during the concrete overlay and bridge replacement options. Currently, the existing bridges do not have enough clear width to carry 4 lanes of traffic. Therefore, temporary widening of the bridge and roadway will need to be completed to maintain traffic. Due to the I-96 EB bridge (B01-23151) being scour critical and rated a 3 in the BSIR report, no widening of the substructure can be achieved. Therefore, only I-96 WB bridge (B02-23151) will be able to be widened to maintain traffic.

Staging for maintenance of traffic for the **deep concrete overlay option** will be as follows:

- **Prestage:** Temporary widen I-96 WB bridge (B02-23151) by 22’ to meet an overall clear width of 54.5’ and support two lanes of traffic in each direction. I-96 WB roadway will need to be widened approximately 17’ to maintain two lanes in each direction separated by temporary concrete barrier. Temporary crossovers will need to be constructed to bring two I-96 EB traffic lanes to I-96 WB and then back to EB. The temporary crossover will start just east of Lansing Road and then merge back to eastbound in the tangent section east of Creyts Road where the median is narrowed. The temporary crossovers located east of Lansing Road within the wide median were designed with an alignment meeting the minimum radii. All temporary crossovers were laid out according to R-113-C and R-107-H.

- **Stage 1** – Close and full detour the EB Lansing Rd traffic to I-96 EB Ramp using local roads. Another option to consider is to place a temporary median turnaround to have the EB traffic on Lansing Rd make a U-turn and use the WB Lansing Rd traffic ramp from Lansing Rd to I-96 EB. Shift I-96 EB traffic to I-96 WB and construct I-96 EB (B01-23151) bridge.

- **Stage 2** – Shift I-96 EB traffic back to EB traffic and open EB Lansing Rd traffic to I-96 EB Ramp. Shift I-96 WB traffic to the temporary widened portion of I-96 WB and construct I-96 WB Bridge (B02-23151) using a part-width construction.

- **Stage 3** – Remove temporary crossovers and temporary pavement.

Staging for maintenance of traffic for the **bridge replacement option** will be as follows:

- **Prestage:** Temporary widen I-96 WB bridge (B02-23151) by 22’ to meet an overall clear width of 54.5’ and support two lanes of traffic in each direction. I-96 EB & WB roadway will need to be widened approximately 17’ to maintain two lanes in each direction separated by temporary concrete barrier. Temporary crossovers will need to be constructed to bring two I-96 EB traffic lanes to I-96 WB and then back to EB for Stage 1. Another set of temporary crossovers will need to be created to bring two I-96 WB traffic lanes to I-96 EB and then back to I-96 WB for Stage 2. The temporary crossovers will start just east of Lansing Road and then merge traffic back in the tangent section east of Creyts Road where the median is narrowed. The temporary crossovers located east of Lansing Road within the
wide median were designed with an alignment meeting the minimum radii. All temporary crossovers were laid out according to R-113-C and R-107-H.

- **Stage 1** – Close and full detour the EB Lansing Rd traffic to I-96 EB Ramp using local roads. Another option to consider is to place a temporary median turnaround to have the EB traffic on Lansing Rd make a U-turn and use the WB Lansing Rd traffic ramp from Lansing Rd to I-96 EB. Shift I-96 EB traffic to I-96 WB and construct I-96 EB (B01-23151) bridge.

- **Stage 2** – Shift I-96 EB traffic back to EB traffic and open EB Lansing Rd traffic to I-96 EB Ramp. Shift I-96 WB traffic to I-96 EB and construct the I-96 WB (B02-23151) bridge. The I-96 WB ramp to Lansing Rd will be closed and traffic will be detoured using another exit, local roads and highway.

- **Stage 3** – Shift I-96 WB traffic back to I-96 WB. Re-open I-96 WB ramp to Lansing road.

- **Stage 4**: Remove all temporary crossovers and pavements.

Realignment of one or both bounds of I-96 for the bridge replacement option could be investigated during the design phase as a possible option to build one or both bridges off line while maintaining traffic on the existing bridges. This would avoid the need to temporarily widen the WB I-96 bridge and may offer a cost savings on MOT versus the option described above. The feasibility of realigning I-96 was not investigated in detail as part of this bridge scoping report.

For both deep concrete overlay and bridge replacement options, Billwood Highway traffic will be fully detoured using local roads. Consideration should also be given to local events.

<table>
<thead>
<tr>
<th>ADT</th>
<th>21,057</th>
<th>Year 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>40,300</td>
<td>Year 2015</td>
</tr>
<tr>
<td>% Comm</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

**Site Constraints/Issues:**

- All piers are located within the Grand River.
- Bridge shoulders are narrow, so traffic will need to be reduced to 1 lane on each bridge. (Epoxy Overlay Option)
- Bridge clear width is narrow and cannot maintain enough width to rehab or reconstruct the bridge part-width. Therefore, a stage construction is proposed for any 3R or 4R work.
- Work under the bridge will need to be done using barges.
- Limited access to the east bank of the river.
2.9.2 Geometrics

I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>Existing deck cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Out to Out Width:</td>
</tr>
<tr>
<td>Existing Clear Width:</td>
</tr>
<tr>
<td>No Lanes &amp; Width:</td>
</tr>
<tr>
<td>Shoulder Width:</td>
</tr>
<tr>
<td>Existing Deck Cross Slope:</td>
</tr>
</tbody>
</table>

Required deck cross section for the work proposed is based on the following:

- Road Classification: Interstate
- ADT: 21,057 (2007)
- Speed Limit: 70 mph (posted)
- Required Clear Width: 32'-6" (maintain existing width, 3R), 53'-8" (4R)

I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>Existing deck cross section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Out to Out Width:</td>
</tr>
<tr>
<td>Existing Clear Width:</td>
</tr>
<tr>
<td>No Lanes &amp; Width:</td>
</tr>
<tr>
<td>Shoulder Width:</td>
</tr>
<tr>
<td>Existing Deck Cross Slope:</td>
</tr>
</tbody>
</table>

Required deck cross section for the work proposed is based on the following:

- Road Classification: Interstate
- ADT: 21,057 (2007)
- Speed Limit: 70 mph (posted)
- Required Clear Width: 32'-6" (maintain existing width, 3R), 53'-8" (4R)

The existing deck width can be maintained for the epoxy overlay option, since it is considered Preventative Maintenance work. However, for the concrete overlay or bridge replacement option, the existing bridge will no longer meet the clear width requirements. Due to the I-96 EB bridge over Grand River and Billwood Hwy being scour critical, no widening can be accomplished to the substructures to allow for the sufficient clear width. Therefore, a design exception will be required for the deep concrete overlay option. For the bridge replacement option, the bridge will be designed to meet all clear width requirements.
2.9.3  Vertical Clearance

I-96 EB over Grand River & Billwood Hwy (B01 of 23151 )

<table>
<thead>
<tr>
<th>Minimum Field Measured Vertical Clearance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured over Billwood Hwy:</td>
<td>13'-6&quot; (measured at center, south fascia)</td>
</tr>
<tr>
<td>Roadway Classification (Billwood Hwy):</td>
<td>Local Road (non-NHS)</td>
</tr>
</tbody>
</table>

**Required Minimum Vertical Clearance**

- For 3R bridge projects: 14'-0"
- For 4R bridge projects: 14'-0"

I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>Minimum Field Measured Vertical Clearance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured over Billwood Hwy:</td>
<td>15'-0&quot; (measured at center, south fascia)</td>
</tr>
<tr>
<td>Measured over Billwood Hwy:</td>
<td>14'-11&quot; (measured at center, north fascia)</td>
</tr>
<tr>
<td>Roadway Classification (Billwood Hwy):</td>
<td>Local Road (non-NHS)</td>
</tr>
</tbody>
</table>

**Required Minimum Vertical Clearance**

- For 3R bridge projects: 14'-0"
- For 4R bridge projects: 14'-0"

The existing vertical clearance can be maintained for the epoxy overlay option, since it is considered Preventative Maintenance work. However, if the concrete overlay option is selected, B01 of 23151 will no longer meet the vertical clearance requirement. Consequently, a design exception will be required for the concrete overlay work on B01 of 23151. The lowering of Billwood Hwy is not feasible due to the close proximity of the Grand River. The bridge replacement option will meet all vertical clearance requirements.

2.9.4  Sight Distance

Sight distance due to horizontal or vertical curves is not an issue at this structure.

2.9.5  Load Capacity

<table>
<thead>
<tr>
<th>Existing Bridge Design Loading:</th>
<th>HS-20+Mod (per MDOT Report 44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Bridge Load Rating Status:</td>
<td>Unposted</td>
</tr>
</tbody>
</table>

| Minimum Design Loading for Proposed Work: | HS-20 |

2.9.6  Signs

The following signs are attached to the bridge.

- Sign attached to the south fascia beam of B01 of 23151 over Billwood Hwy indicating a vertical clearance of 13'-6"
- Sign attached to the north fascia beam of B02 of 23151 over Billwood Hwy indicating a vertical clearance of 13'-6"
2.9.7 Speed Limit
The posted speed limit on I-96 EB & WB is 70 mph. The posted speed limit on Billwood Hwy is 45 mph.

2.9.8 Grand River
The Grand River runs from south to north mainly under Span 2 of both bridges. These bridges are classified as scour critical. Piers 1 and 2 of both bridges are located within the river. Previous inspections have found no noticeable scour or exposed footings. During the field review, scour probing was not completed due to the river being iced over.

All precautions shall be taken to avoid debris falling into the river during construction activities. MDEQ and USACE permits may be needed at this location. The majority of the work on the underside of the bridges will need to be done using barges in the river.

2.9.9 Utilities
Based on Site Visit:
- Overhead lines parallel to Billwood Hwy over Span 1 of both bridges
- Gas line parallel to Billwood Hwy under Span 1 of both bridges

Additional utilities within the ROW may be present and could conflict with the recommended construction option, so a utility survey should be performed during the design phase.

2.10 Local Agency Needs
The following agencies where contacted to gather input for this project. Future needs and requests received for the area include:

- Eaton County Road Commission (stated that they would like some tree clearing along Billwood Hwy that is located in MDOT’s right-of-way)
- Eaton County Drain Commissioner (no response)
- Windsor Township (no response)
- Tri-County Regional Planning Commission (no response)

2.11 Material Testing
No material testing was performed as part of this scoping project nor is it recommended for this structure.
3.0 Rehabilitation Options

A construction cost estimate was developed for each option based on the condition of the overall bridge, condition of the bridge deck, application of the Bridge Deck Preservation Matrix and geometric needs. The following repair options were completed using the current MDOT Bridge Scoping Cost Estimate Worksheet and are summarized below. Costs include contingency, mobilization, inflation, and PE&CE costs. Road approach work and traffic control costs are also included in the estimates.

I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

<table>
<thead>
<tr>
<th>Repair Option</th>
<th>Cost of Repair Construction, CE &amp; PE Cost</th>
<th>Year of Repair</th>
<th>Deck Matrix Fix Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Epoxy Overlay</td>
<td>$1,256,000</td>
<td>2024</td>
<td>10-15 years</td>
</tr>
<tr>
<td>Deep Concrete Overlay</td>
<td>$5,026,000</td>
<td>2024</td>
<td>20-25 years</td>
</tr>
<tr>
<td>Bridge Replacement</td>
<td>$21,499,000</td>
<td>2024</td>
<td>60+ years</td>
</tr>
</tbody>
</table>

* Recommended Option

I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

<table>
<thead>
<tr>
<th>Repair Option</th>
<th>Cost of Repair Construction, CE &amp; PE Cost</th>
<th>Year of Repair</th>
<th>Deck Matrix Fix Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Epoxy Overlay</td>
<td>$916,000</td>
<td>2024</td>
<td>10-15 years</td>
</tr>
<tr>
<td>Deep Concrete Overlay</td>
<td>$8,101,000</td>
<td>2024</td>
<td>20-25 years</td>
</tr>
<tr>
<td>Bridge Replacement</td>
<td>$21,331,000</td>
<td>2024</td>
<td>60+ years</td>
</tr>
</tbody>
</table>

* Recommended Option

I-96 EB over Grand River & Billwood Hwy (B01 of 23151)

Option 1 (Epoxy Overlay (CPM)) $1,256,000 2024 $’s (incl. PE&CE)

The recommended option shown below will yield a fix life of 10 to 15 years.
- Deck epoxy overlay with Deck patching (full depth and surface repairs)
- Drill arrest holes at horizontal crack on Beam 1s in Span 3 near Abutment B.
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Substructure patching at Abutment A & Abutment B (2 locations at Abutment A requiring a temporary support: Beam 3S and Beam 4S)
- Substructure crack sealing (1 location at Abutment B)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace all deck joint devices at Abutment A, Pier 1, Pier 2, and Abutment B
- Reseal abutment end joints at Abutment A and Abutment B
- New pressure relief joints (PRJ’s) at east and west approaches
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Part Width)
### Option 2 (Deep Concrete Overlay)

| Cost | $5,026,000 | 2024 $'s (Incl. PE&CE) |

The recommended option shown below will yield a fix life of 20 to 25 years.

- Deep concrete overlay (including railing and joint replacements)
- Deck patching (full depth repairs)
- Pin and Hanger Replacement (All Beams at both Piers, Temporary Supports Included)
- Drill arrest holes at horizontal crack on Beam 1s in Span 3 near Abutment B.
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Substructure patching at Abutment A and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 3S and Beam 4S)
- Concrete surface coat all substructure units, barriers and deck fascia
- Substructure crack sealing (1 location at Abutment B)
- New pressure relief joints (PRJ's) at east and west approaches
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- Replace approach slab at west abutment; HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Temporary Crossovers to I-96 WB (B02-23151))

### Option 3 (Bridge Replacement)

| Cost | $21,499,000 | 2024 $'s (Incl. PE&CE) |

The recommended option shown below will yield a fix life of 60+ years.

- Multi-Span Bridge Replacement
- Demolition of Existing Bridge
- Approach work
- Maintenance of traffic (Temporary Crossovers to I-96 WB (B02-23151))

### I-96 WB over Grand River & Billwood Hwy (B02 of 23151)

### Option 1 (Epoxy Overlay)

| Cost | $916,000 | 2024 $'s (Incl. PE&CE) |

The recommended option shown below will yield a fix life of 10 to 15 years.

- Deck epoxy overlay with Deck patching (full depth and surface repairs)
- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)
- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin & hangers)
- Clean and coat steel bearings (all bearings = 16 locations)
- Miscellaneous steel repairs (1 location) (replacing two missing bolts at cross frame connection on Beam 2S at Pier 1W)
- Substructure patching at Abutment A, Pier 1, and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 1S and Beam 4S)
- Concrete surface coat all substructure units, barriers and deck fascia
- Replace all deck joint devices at Pier 1 and Pier 2
- Reseal abutment end joints at Abutment A and Abutment B
- Replace pressure relief joints (PRJ's) at east and west approaches
- Replace guardrail anchorage (1 location in NW quadrant)
- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports
- HMA overlay of approach at east abutment
- Scour Countermeasures (Riprap) at Piers 1 and 2
- Maintenance of traffic (Part Width)

<table>
<thead>
<tr>
<th>Option 2 (Deep Concrete Overlay)</th>
<th>$8,101,000</th>
<th>2024 $'s (Incl. PE&amp;CE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The recommended option shown below will yield a fix life of 20 to 25 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Deep concrete overlay (including railing and joint replacements)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Deck patching (full depth repairs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pin and Hanger Replacements (All beams at both Piers, Temporary Supports Included)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Intermediate Stiffener Replacements (7 locations along exterior of fascia beams)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Partial painting of structural steel (exterior and bottom of fascia beams and locations adjacent to Pier 1 and Pier 2 pin &amp; hangers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Clean and coat steel bearings (all bearings = 16 locations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Miscellaneous steel repairs (1 location) (replacing two missing bolts at cross frame connection on Beam 2S at Pier 1W)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Substructure patching at Abutment A, Pier 1, and Abutment B (2 locations at Abutment A requiring a temporary support: Beam 15 and Beam 4S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Concrete surface coat all substructure units, barriers and deck fascia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Replace pressure relief joints (PRJ’s) at east and west approaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Replace guardrail anchorage (1 location in NW approach)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Place additional riprap at Abutment B and remove and replace slope paving at Abutment A for temporary supports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Replace approach slab at west abutment; HMA overlay of approach at east abutment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Scour Countermeasures (Riprap) at Piers 1 and 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maintenance of traffic (Temporary Widening &amp; Part Width Construction)</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 3 (Bridge Replacement)</th>
<th>$21,331,000</th>
<th>2024 $'s (Incl. PE&amp;CE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The recommended option shown below will yield a fix life of 60+ years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Multi-Span Bridge Replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Temporary Bridge Widening on Existing Bridge for Maintenance of Traffic in Stage 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Demolition of Existing Bridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Approach work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maintenance of traffic (Temporary Crossovers to I-96 EB (B01-23151))</td>
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</tr>
</tbody>
</table>

### 3.1 Vertical Stiffener Replacement

The cost estimates for Option 1 and Option 2 include a quantity for seven Vertical Stiffener Replacements on each bridge. Currently, only two of the stiffeners on each bridge have holes through the them near the bottom flange of the beam. The remaining five are set aside for miscellaneous stiffener replacements. Since the recommended work is not scheduled to be completed until 2024, the deterioration will only increase over time. Over the next few bridges
inspection cycles, as holes or areas with loss of section are noticed on different stiffeners, there will be extra quantity set aside to replace these newly deteriorated stiffeners.

3.2 Partial Painting
The cost estimates for Option 1 and Option 2 include a quantity for Partial Painting of steel beams. This quantity includes the exterior and bottom faces of the fascia beams, as well as the full perimeter of the beams for a length of 16' adjacent to the pin and hangers at Pier 1 and Pier 2. A quantity was originally calculated to repaint all the structural steel on both bridges, since the current paint system is 30 years old and is showing its age. However, these large quantities almost doubled the painting costs. It was determined that only the areas where the existing paint system has completely failed would be repainted.

3.3 Abutment Repairs
Abutment repairs are recommended at Abutment A on both bridges. These repairs will require the use of temporary supports, which will need to be placed on the abutment footing. Therefore, the concrete slope paving will need to be removed, excavation, backfill, and replacing the concrete slope paving will need to occur as part of the abutment repair operation. The cost estimates for Option 1 and Option 2 include quantities for Slope Protection Repairs (concrete slope paving). The unit price for this pay item has been increased to account for the excavation and backfill that will need to occur.

3.4 Joint Replacements
The cost estimates for Option 1 and Option 2 include quantities for replacing all joints. The construction joints at Pier 1 (B01 of 23151) and Pier 2 (B02 of 23151) are included in the quantity for full joint removal and replacement. All the construction joints at the abutments will be resealed. For B01 of 23151, instead of replacing the abutment expansion joints at their current locations above the abutments, a short sliding slab and sleeper slab could be installed to move the joint away from the abutment. This option will add cost to the project, but would help to reduce the amount of deterioration below due to a leaking joint. (This sliding slab option was not included in the recommended options at this time.)

3.5 Contractor Water Access
The cost estimates for Option 1 and Option 2 include a quantity for Contractor Water Access. Since a large portion of the proposed work will be done over the river, with the contractor needing to utilize barges, the work will be more expensive than the standard unit prices listed in the estimate. Contractor water access was added to the estimate as a lump sum item costing $35,000.

3.6 Pin and Hanger Replacement
The Deep Concrete Overlay option (Option 2) includes replacing all pin and hangers on the bridge. The pin and hangers at both piers are in fair to good condition. However, the fascia beam ends have minor to moderate corrosion and leakage from the deck joints and will continue to deteriorate the elements. Because the expansion joint replacement is already part of the proposed work, replacement of the pin and hangers are also recommended at this time due to ease of access.
4.0 Recommendations

The existing steel girder bridges were built in 1962 and a concrete overlay was applied in 2001. The bridges will be approximately 62 years old at the time of the proposed project. In general, the deck surfaces are in good to fair condition, however due to the condition of the existing steel beams, scour critical substructures, expansion joint condition and continuous preventative maintenance needs, Bridge Rehabilitation should be the minimum fix type considered for these bridges.

Both the proposed bridge replacement and deck overlay options include an intensive and costly maintenance of traffic scheme due to the narrow width of the existing bridges and the need to maintain two lanes of traffic in each direction on I-96 throughout construction. The traffic control will utilize a large temporary crossover spanning across the 300-foot wide median east of the I-96 bridges. Temporary roadway widening and bridge widening will also need to be completed to maintain two lanes of I-96 traffic in each direction during the completion of the bridge work. Given the associated maintenance of traffic costs, consideration should be given to Bridge Replacement for these structures over a Deep Overlay in order to take full advantage of the maintenance of traffic and to minimize future maintenance work needs on the bridges that would involve standalone bridge projects and traffic impacts to I-96.

Due to the large traffic control costs, it is recommended that Bridge Replacement only be considered if it can be combined with an I-96 corridor roadway project in order to utilize the maintenance of traffic efficiently and to avoid any throwaway work in the future. Bridge Replacement will provide a 60+ year fix life, meet all standard criteria for bridge width and clearance, and provide long-term, lower maintenance elements for the bridge compared to the other options considered. Bridge Replacement is a higher repair option that what is recommended in the Bridge Deck Preservation Matrix based on deck deterioration percentages measured in field. However, replacement adheres to MDOT’s goal to preserve and maintain their bridges in a continually good condition and would help limit the need for future standalone bridge projects. Consideration to possibly realign one or both bounds of I-96 for the proposed bridge replacement option can be further investigated during design phase. This would allow a possible option to build one or both bridges off line while maintaining I-96 traffic on the existing bridges. This would reduce MOT costs significantly because it would possibly avoid any need to temporarily widen the WB I-96 bridge, detour local roads and construct temporary crossovers.

If funds are not available or a proposed I-96 corridor project is not planned in the near future, the Epoxy Overlay option (Option 1) is recommended. Given the overall condition of the entire deck surface, the epoxy overlay option will improve the condition of the bridges and will be a sufficient repair until the next major I-96 corridor project. The bridge work will provide a 10 to 15 year fix life which aligns with the Bridge Deck Preservation Matrix based on the deck deterioration percentages measured in the field. In addition, replacing the deck expansion joints is necessary to continue to maintain joints to prevent future deterioration of the superstructure and substructure units.

The deep concrete overlay is an option that was considered if funds weren’t available to replace the bridges. However, the cost of the maintenance of traffic is almost double the cost of bridge repair work that needs to be completed. Therefore, it is not economically feasible to complete the deep deck overlay repair work. The deep overlay option is not recommended.
Appendix A: Photos
Appendix A

List of Photographs and Descriptions

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Photo 98: Billwood Hwy under I-96 WB (B02)
Appendix B: Field Notes & Sketches
GENERAL SITE INSPECTION SHEET

Date: 1/9/2017
Structure: 23151-B01
By: MCW
Sheet: 1 of 1

Bergmann
associates

General Site Inspection Checklist

☐ Note speed limit for all roadways (over and under bridge)
☐ Over roadway or railway configuration
☐ Under roadway, railway, waterway, etc configuration
☐ Note slope condition and if any erosion is present
☐ Note bridge drainage features and any other utilities or ITS components
☐ Note guardrail, walls, fences or other significant features
☐ Note nearby buildings and other structures
☐ Show any sidewalk ramps, driveways, or intersections in the area

North Arrow

General Site Sketch

# BROKEN CONC. SLOPE PAVING HAS Voids Btwn Peices
**EROSION @ Culvert in SW Quad Near Billwood High School

Abut A

Abut B

B01-23151 Bldg E over Grand Riv
GENERAL BRIDGE ELEVATION INSPECTION SHEET

Date: 1/9/2017
Structure: 23151-BOX

Bergmann

General Bridge Elevation Inspection Checklist

☐ Measure bridge under clearance
☐ Note all fascia signage (and photo how attached)
☐ Note posted vertical clearance

☐ Note substructure and under roadway, railway, waterway, etc configuration
☐ Note any high load hits to the fascias

General Bridge Elevation Sketch

(Looking South)

(Looking North)
Deck Top Surface Inspection Checklist

- Measure lane, shoulder, and sidewalk widths, and curb height
- Note barrier type and take dimensions
- Note condition of joints
- Note modifications to the deck overlay, widening, etc.
- Note approach pavement type and condition
- Note approach drainage features and condition
- Note approach guardrail condition

- Can presence of slag agg be det.? (Marked)

Deck Top Surface Sketch

- Bridge approach curb + gutter
- Tunnel portal trim west and east approach

- 1/2" CRACKS AT DECK/APPR JOINT
- 1/16" CRACKING - BRIDGE APPR PVT
- NO BRIDGE APPR DRAINAGE
- NO SLAG AGG

Looking WEST

Total Deterioration: 0 Sft
Date: 7/9/2017
Structure: 23151-B01

Deck Top Surface Inspection Checklist
- Measure lane, shoulder, and sidewalk widths, and curb height
- Note barrier type and take dimensions
- Note condition of joints
- Note modifications to the deck (overlay, widening, etc)
- Note approach pavement type and condition
- Note approach drainage features and condition
- Note approach guardrail condition
- Can presence of slag agg be det.

Deck Top Surface Sketch

Looking: West

Total Deterioration: 0 Sft
Deck Top Surface Inspection Checklist

- Measure lane, shoulder, and sidewalk widths, and curb height
- Note barrier type and take dimensions
- Note condition of joints
- Note modifications to the deck (overlay, widening, etc)
- Note approach pavement type and condition
- Note approach drainage features and condition
- Note approach guardrail condition

- Can presence of slag agg be det?

Deck Top Surface Sketch

- HWY MAP CRACKS ALONG LANE LINES (THR)
  - Pot Holes located along
  - REF LINE B; COLD PATCH
  - HOT MURBED RUBBER REPAIRS

- CONC SURFACE COATING IS PEALING, VRT CRK FULL HT -5'-10' (THR), IMPACT CRACKS THROUGHOUT; DELINERED DAMAGED/REMOVED

- CLIFFER DRained SP @ -15'-6'
- THR OVER RIVER

- PAN FOR LABELING PURPOSES

Looking W  

Total Deterioration: 0 Sft
Deck Underside Inspection Checklist
- Note utilities on the bridge, and how they are attached
- Note any false decking
- Note condition of diaphragms
- Note condition of deck fascia
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges)
- Sketch drawn looking down from the sky

Deck Underside Sketch
- No utilities on bridge
- No false decking
- Diaphragms OK
- Deck fascias OK
- HLH scrapes on all BMs over Bellwood HWY (BM 12 has rust)
- Paint failure in local areas
- HLH scrapes BM
- BM flanges (TOP)
- All BMs have minor tight map cracks

Total Deterioration: 0 Sft
DECK UNDERSIDE INSPECTION SHEET

Date: 09-5AN-2017
Structure: 23151-B01

Deck Underside Inspection Checklist

- Note utilities on the bridge, and how they are attached
- Note any false decking
- Can presence of slag agg be det.
- Note condition of diaphragms
- Note condition of deck fascia - fair, 1/4" spalled, repaired areas
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges) - fair, 5/16" loss on fascia covers

Sketch drawn looking down from the sky

Deck Underside Sketch

- Note utilities on the bridge, and how they are attached
- Note any false decking
- Can presence of slag agg be det.
- Note condition of diaphragms
- Note condition of deck fascia - fair, 1/4" spalled, repaired areas
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges) - fair, 5/16" loss on fascia covers

Sketch drawn looking down from the sky

Looking east

Total Deterioration: 0 Sft
Deck Underside Inspection Checklist

- Note utilities on the bridge, and how they are attached
- Note any false decking
- Can presence of slag agg be det.?
- Note condition of diaphragms
- Note condition of deck fascia
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges)
- Sketch drawn looking down from the sky

Deck Underside Sketch

- No utilities under the bridge
- No false decking
- Dia / Cross Bracing / Lateral Bracing are in good cond w/ surface rusting
- No high load hit/ bridges over water
- Paint flaking @ several areas
- No clear aggregate cannot be determined
- Leaching throughout the deck U/S

Total Deterioration: 6 Sft
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- Sketch in diaphragms and stiffeners
- Note areas of section loss
- Any structural modifications or repairs?
- Note bearing & sole plate condition
- Note any bearing movement or deformation
- Note any bulging of elastic pad
- Are beam ends in contact
- Note any floating or vibration
- Note any cracking in beam
- Note if beam ends are out of plumb

- Stiffeners placed @ 5'-0" spacing
- Surface rusting / Paint flaking at bottom planks
- Beam not in alignment

- No movement
- No beam ends in contact
- No vibrations @ Abut End
### Pin & Hanger Inspection Measurement and Sketches

- Sketch in ciaphrags/stiffeners
- Measure, pint opening
- Note any rotation in link plate
- Dimension A, B, C on Sketch
- Structure modifications or repairs
- Note all areas of section loss
- Note any pack rust behind the link plate
- Note if any members are out of plumb

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<th>Beam#</th>
<th>Pier #</th>
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<th>BOTTOM FLANGE</th>
<th>STIFFENER</th>
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<th>PIN PLATE THICKNESS</th>
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<td>2</td>
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<tr>
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<tr>
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<td></td>
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</tr>
</tbody>
</table>

- Pitting on web

### Circle Pin and Hanger Orientation

- S: SPANDED, CONTREVER
- C: CANTLEVER
- SUSPENDED

- Jt. Opening: 0 in. Link Pl. Rotation: 0 in.
- Jt. Opening: 0 in. Link Pl. Rotation: 0 in.
- Jt. Opening: 0 in. Link Pl. Rotation: 0 in.
Pin & Hanger Inspection Measurement and Sketches

- Sketch in diaphragms/stiffeners
- Measure joint opening
- Note any rotation in link plate
- Dimension A, B, C on Sketch
- Structure modifications or repairs
- Note all areas of section loss
- Note any paint rust behind the link plate
- Note if any members are out of plumb.

<table>
<thead>
<tr>
<th>P&amp;H #</th>
<th>Beam#</th>
<th>Pier #</th>
<th>Span#</th>
<th>WEB</th>
<th>BOTTON FLANGE</th>
<th>STIFFENER</th>
<th>LINK PLATE THICKNESS (in.)</th>
<th>PIN PLATE THICKNESS (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
<td>Original</td>
<td>Measured</td>
<td>Original</td>
</tr>
<tr>
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<td>2</td>
<td>2</td>
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<td>1.91&quot;</td>
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<td>Measured</td>
<td>Original</td>
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<td>2</td>
<td>2</td>
<td>0.36&quot;</td>
<td>2.01&quot;</td>
<td>Original</td>
<td>Measured</td>
<td>Original</td>
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**HORIZONTAL STIFFENER APPX 1'-6" FROM TOP FLANGE IN ONE SIDE OF BEAM WEB.**

Date: 9/17

Structure: 301

<table>
<thead>
<tr>
<th>Pier/Abut</th>
<th>LER</th>
<th>SPANS</th>
<th>WEB Thickness (in.)</th>
<th>LOSS</th>
<th>BOTTOM FLANGE Thickness (in.)</th>
<th>LOSS</th>
<th>P&amp;M Dim</th>
<th>Bearing Condition</th>
<th>Any other Comment</th>
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</tr>
<tr>
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<td>B</td>
<td>3</td>
<td>0.409</td>
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<tr>
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<td>B</td>
<td>3</td>
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<td>B</td>
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</tr>
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</tr>
</tbody>
</table>

* Lateral bracing in fascia bays
* Crows frame in good cond
* Very minimal rotation of OCR trimmaway

* Pack of rusting of stiffeners @ fascia ends
<table>
<thead>
<tr>
<th>Abutment Inspection Checklist</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Note any settlement, lat. movement, rotation</td>
<td>Note any undermining of the bearings</td>
</tr>
<tr>
<td>Note exposed rebar &amp; material defects</td>
<td>Note any evidence of deck joint leakage</td>
</tr>
<tr>
<td>Note flexural, shear cracking &amp; crack widths</td>
<td>Note condition of end diaphragms</td>
</tr>
<tr>
<td>Structure modifications? (widening, patching, etc)</td>
<td>Note slope protection type and condition</td>
</tr>
</tbody>
</table>

**Abutment Sketch**

- No settlement (rotation)
- Exposed rebar of abut (5 at 7) under beam 60 ft.
- No undermining of bearings
- End dia. is good and piles are firm
- Abutment is free from vegetation and erosion
- Slope of back wall is in good condition
- Skid marks of abutment under

**Total Deterioration: 36 Sft**
Date: 1-9-17
Structure: 23151-B01

Pier Inspection Checklist

☐ Note any settlement, lat. Movement, rotation
☐ Note exposed rebar & material defects
☐ Note flexural, shear cracking & crack widths
☐ Structure modifications? (widening, patching, etc)

☐ Note any undermining of the bearings
☐ Note condition of end diaphragms
☐ Note any evidence of deck joint leakage

Pier Sketch

Total Deterioration: 0 Sft
Date: 1-9-17
Structure: 23151-B01

<table>
<thead>
<tr>
<th>Pier Inspection Checklist</th>
<th>Pier Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Note any settlement, lat. Movement, rotation</td>
<td>Pier 1 (Looking East)</td>
</tr>
<tr>
<td>□ Note exposed rebar &amp; material defects</td>
<td></td>
</tr>
<tr>
<td>□ Note flexural, shear cracking &amp; crack widths</td>
<td></td>
</tr>
<tr>
<td>□ Structure modifications? (widening, patching, etc)</td>
<td></td>
</tr>
<tr>
<td>□ Note any undermining of the bearings</td>
<td></td>
</tr>
<tr>
<td>□ Note condition of end diaphragms</td>
<td></td>
</tr>
<tr>
<td>□ Note any evidence of deck joint leakage</td>
<td></td>
</tr>
</tbody>
</table>

Total Deterioration: 0 Sft
PIER INSPECTION SHEET

Date: 1-7-17  By: KAH  Pier: 2  Sheet: 1 of 2

Structure: 23151-B01

Pier Inspection Checklist

- Note any settlement, lat. Movement, rotation
- Note exposed rebar & material defects
- Note flexural, shear cracking & crack widths
- Note any undermining of the bearings
- Note any evidence of deck joint leakage
- Note condition of end diaphragms
- Note any evidence of deck joint leakage

Pier Sketch

Span 2 GSB, slab, bridging, etc.

Total Deterioration: 0 Sft
<table>
<thead>
<tr>
<th>Pier Inspection Checklist</th>
<th>Pier Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note any settlement, lat. Movement, rotation</td>
<td>Pier 2: Looking (W/E)</td>
</tr>
<tr>
<td>Note exposed rebar &amp; material defects</td>
<td>Total Deterioration: 0 Sft</td>
</tr>
<tr>
<td>Note flexural, shear cracking &amp; crack widths</td>
<td></td>
</tr>
<tr>
<td>Structure modifications? (widening,patching,etc)</td>
<td></td>
</tr>
<tr>
<td>Note any undermining of the bearings</td>
<td></td>
</tr>
<tr>
<td>Note condition of end diaphragms</td>
<td></td>
</tr>
<tr>
<td>Note any evidence of deck joint leakage</td>
<td></td>
</tr>
</tbody>
</table>
Date: 1/9/2017
Structure: 23151-B01
By: [Name]
Abut: B

Abutment Inspection Checklist

☐ Note any settlement, lat. Movement, rotation
☐ Note exposed rebar & material defects
☐ Note flexural, shear cracking & crack widths
☐ Structure modifications? (widening, patching, etc.)
☐ Note any undermining of the bearings
☐ Note any evidence of deck joint leakage
☐ Note condition of end diaphragms
☐ Note slope protection type and condition

Total Deterioration: 47 Sft
General Site Inspection Checklist

- Note speed limit for all roadways (over and under bridge)
- Over roadway or railway configuration
- Under roadway, railway, waterway, etc configuration
- Note slope condition and if any erosion is present
- Note bridge drainage features and any other utilities or ITS components
- Note guardrail, walls, fences or other significant features
- Note nearby buildings and other structures
- Show any sidewalk ramps, driveways, or intersections in the area

General Site Sketch

B02-33045 (I-496 WB over Red Cedar)

North Arrow

Abut A

Abut B

96 EB over Red Cedar

496
GENERAL BRIDGE ELEVATION INSPECTION SHEET

Date: 1-9-17
Structure: 23151-Box

Bergmann

By: KAH

GENERAL BRIDGE ELEVATION INSPECTION CHECKLIST

☐ Measure bridge underclearance
☐ Note all fascia signage (and photo how attached)
☐ Note posted vertical clearance
☐ Note substructure and under roadway, railway, waterway, etc configuration
☐ Note any high load hits to the fascias

GENERAL BRIDGE ELEVATION SKETCH

See next sheet

North Fascia (Looking South)

South Fascia (Looking North)
DECK TOP SURFACE INSPECTION SHEET

Date: 1/9/2020
Structure: 23151-B02

Bergmann
associates

By: [Name]
Span: 1
Sheet: 1 of 3

Deck Top Surface Inspection Checklist

- Measure lane, shoulder, and sidewalk widths, and curb height
- Note barrier type and take dimensions
- Note condition of joints
- Note modifications to the deck (overlay, widening, etc)
- Note approach pavement type and condition
- Note approach drainage features and condition
- Note approach guardrail condition
- Can presence of slag agg be det?

Deck Top Surface Sketch

Loss of Adhesion

[Sketch of deck surface with various measurements and annotations]

Typical Deck Measurements

Looking

Total Deterioration: 0 Sft
## Deck Top Surface Inspection Checklist

- Measure lane, shoulder, and sidewalk widths, and curb height
- Note barrier type and take dimensions
- Note condition of joints
- Note modifications to the deck (overlay, widening, etc)
- Note approach pavement type and condition
- Note approach drainage features and condition
- Note approach guardrail condition
- Can presence of slag agg be det.

## Deck Top Surface Sketch

![Deck Top Surface Sketch]

Looking W

Total Deterioration: 0 Sft
Date: 1/9/2017  
Structure: 23151-B02  
By: MCLJ  
Span: 2  
Sheet: 3 of 3

Deck Top Surface Inspection Checklist

☐ Measure lane, shoulder, and sidewalk widths, and curb height
☐ Note barrier type and take dimensions
☐ Note condition of joints
☐ Note modifications to the deck (overlay, widening, etc.)
☐ Note approach pavement type and condition
☐ Note approach drainage features and condition
☐ Note approach guardrail condition  ☐ Can presence of slag agg be det.?

Deck Top Surface Sketch

Total Deterioration: 0 Sft
Deck Underside Inspection Checklist

- Note utilities on the bridge, and how they are attached
- Note any false decking
- Can presence of slag agg be det.
- Note condition of diaphragms
- Note condition of deck fascia
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges)
- Sketch drawn looking down from the sky

Deck Underside Sketch

Sketch of the deck undersite with various annotations and measurements.

Total Deterioration: 5 Sft
Date: 1-9-2017
Structure: 23151-B02

Deck Underside Inspection Checklist

- Note utilities on the bridge, and how they are attached
- Note any false decking
- Can presence of slag agg be det?
- Note condition of diaphragms
- Note condition of deck fascia
- Note high-load-hit damage on the beams
- Note paint condition (steel bridges)

Sketch drawn looking down from the sky

Deck Underside Sketch

- Underdrain outlet attached to beam
- Hairline transverse cracks
- Decks fascia - 2 shaft of spalled concrete
- Following applies to all spans
- Fascia transverse stiffness severe angled at bottom flanges at web portion needs to be checked

Total Deterioration: 9 SFL

Span 3 Looking
Deck Underside Inspection Checklist

- [ ] Note utilities on the bridge, and how they are attached
- [ ] Note any false decking
- [ ] Can presence of slag agg be det.? No
- [ ] Note condition of diaphragms - C/F good
- [ ] Note condition of deck fascia
- [ ] Note high-load-hit damage on the beams
- [ ] Note paint condition (steel bridges) - Fair, little rusted on fascia 91d

Sketch drawn looking down from the sky

Deck Underside Sketch

Total Deterioration: 0 Sf

Span 3 Looking West/NP
<table>
<thead>
<tr>
<th>BS #</th>
<th>Pier #</th>
<th>Beam #</th>
<th>9-17</th>
<th>802-1352</th>
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<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>1</td>
<td>0.36</td>
<td>1.302</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>1</td>
<td>0.404</td>
<td>1.276</td>
</tr>
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<td>3</td>
<td>A</td>
<td>1</td>
<td>0.408</td>
<td>1.249</td>
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<tr>
<td>4</td>
<td>A</td>
<td>1</td>
<td>0.397</td>
<td>0.258</td>
</tr>
</tbody>
</table>

Note: Beam ends are at bearings (typ).
### Pin & Hanger Inspection Measurement and Sketches

**Sketch in diaphragms/stiffeners** □ Measure lintel opening □ Note any rotation in link plate □ Dimension A, B, C on Sketch □ Structure modifications or repairs □ Note all areas of section loss □ Note any peck rust behind the link plate □ Note if any members are out of plumb.

<table>
<thead>
<tr>
<th>P&amp;H #</th>
<th>Beam #</th>
<th>Pier #</th>
<th>Span #</th>
<th>Web Thickness (in.)</th>
<th>Web Loss</th>
<th>Bottom Flange Thickness (in.)</th>
<th>Bottom Flange Loss</th>
<th>Stiffener</th>
<th>Link Plate Thickness (in.)</th>
<th>Pin Plate Thickness (in.)</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Original</td>
<td>Measured</td>
<td>%</td>
<td>Height (Start-End)</td>
<td>Original</td>
<td>Measured</td>
<td>%</td>
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<td>1L</td>
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<td>2</td>
<td>0.367 in</td>
<td>0.367 in</td>
<td>0%</td>
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<td>1.234 in</td>
<td>1.234 in</td>
<td>0%</td>
</tr>
<tr>
<td>1R</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0.367 in</td>
<td>0.367 in</td>
<td>0%</td>
<td>Start: 0, End: 0</td>
<td>1.234 in</td>
<td>1.234 in</td>
<td>0%</td>
</tr>
<tr>
<td>2L</td>
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<td>2</td>
<td>0.367 in</td>
<td>0.367 in</td>
<td>0%</td>
<td>Start: 0, End: 0</td>
<td>1.234 in</td>
<td>1.234 in</td>
<td>0%</td>
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<td>1</td>
<td>2</td>
<td>0.367 in</td>
<td>0.367 in</td>
<td>0%</td>
<td>Start: 0, End: 0</td>
<td>1.234 in</td>
<td>1.234 in</td>
<td>0%</td>
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<tr>
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<tr>
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<td></td>
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<td>Start: 0, End: 0</td>
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<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td>Start: 0, End: 0</td>
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<td>4R</td>
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<td></td>
<td>Start: 0, End: 0</td>
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</tr>
</tbody>
</table>

*Only beam 2S is rotated (others are not nearly rotated as much)*

---

**Circle Pin and Hanger Orientation**

1. L - Left
2. R - Right
3. L - Left
4. R - Right
5. L - Left
6. R - Right
7. L - Left
8. R - Right

- Jt. Opening 1 1/2 in
- Link Pl. Rotation 2 1/2 in
- Jt. Opening 1 1/2 in
- Link Pl. Rotation 2 1/2 in
- Jt. Opening 1 1/2 in
- Link Pl. Rotation 2 1/2 in
- Jt. Opening 1 1/2 in
- Link Pl. Rotation 2 1/2 in
## Pin & Hanger Inspection Measurement and Sketches

- Sketch in diaphragms/stiffeners
- Measure joint opening
- Note any rotation in link plate
- Dimension A, B, C on Sketch
- Structure modifications or repairs
- Note all areas of section loss
- Note any pock rust behind the link plate
- Note if any members are out of plumb

### Web

<table>
<thead>
<tr>
<th>P&amp;H #</th>
<th>Beam #</th>
<th>Pier #</th>
<th>Span #</th>
<th>Thickness (in)</th>
<th>Loss</th>
<th>Thickness (in)</th>
<th>Loss</th>
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<tbody>
<tr>
<td></td>
<td>303</td>
<td>2</td>
<td>2</td>
<td>Original</td>
<td>Measured</td>
<td>% Height (Start-End)</td>
<td>Length (Start-End)</td>
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<td>1L</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0.316”</td>
<td>1.24”</td>
<td>0.516”</td>
<td>1.724”</td>
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<tr>
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<td>4</td>
<td>2</td>
<td>2</td>
<td>0.39”</td>
<td>1.150”</td>
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<td>2</td>
<td>0.38”</td>
<td>1.214”</td>
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<tr>
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<td>2</td>
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<td>1.122”</td>
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<td></td>
<td>1/8” section loss on web</td>
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<td></td>
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<tr>
<td>4L</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4R</td>
<td></td>
<td></td>
<td></td>
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### Bottom Flange

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<th>Pier #</th>
<th>Span #</th>
<th>Thickness (in)</th>
<th>Loss</th>
<th>Thickness (in)</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2</td>
<td>2</td>
<td>Original</td>
<td>Measured</td>
<td>% Width (Start-End)</td>
<td>Length (Start-End)</td>
</tr>
<tr>
<td>1L</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1.24”</td>
<td>0.516”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1R</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1.150”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2L</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1.214”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2R</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1.122”</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sketches

- Circle Pin and Hanger Orientation
- JT Opening
- Link PI Rotation
- Suspended
- Cantilever
- Span

---

*Note: Measurements and specifications are approximate and subject to accuracy of measurement tools and conditions.*
<table>
<thead>
<tr>
<th>Pier/Ab #</th>
<th>Span</th>
<th>WEB</th>
<th>BOTTOM FLANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>THICKNESS (in.)</td>
<td>THICKNESS (in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Original</td>
<td>Measured</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>B</td>
<td>3</td>
</tr>
</tbody>
</table>

Bearing Condition: Marked for separating on bearings (typ.)

Comments: Any other comments related to the survey report.
Abutment Inspection Checklist

☑ Note any settlement, lat. Movement, rotation: none
☑ Note exposed rebar & material defects: none
☑ Note flexural, shear cracking & crack widths
☑ Structure modifications? (widening, patching, etc)
☑ Note any undermining of the bearings
☑ Note any evidence of deck joint leakage
☑ Note condition of end diaphragms: good condition
☑ Note slope protection type and condition: very good

Abutment Sketch

[Sketch with annotations: 4x3 cracks, 100% complete, no settlement, etc.]

Total Deterioration: 13 Sft
**PIER INSPECTION SHEET**

**Structure:** 23151-B02

**Date:** 1-9-17

**By:** KAH

**Pier:** 1

**Sheet:** 1 of 2

### Pier Inspection Checklist

- Note any settlement, lat. Movement, rotation **None**
- Note exposed rebar & material defects
- Note flexural, shear cracking & crack widths
- Structure modifications? (widen, patch, etc)

- Note any undermining of the bearings **No**
- Note condition of end diaphragms
- Note any evidence of deck joint leakage

**Pier Sketch**

- Piers were constructed for future superstructure widening.

- Deck joints are leaking (majority of rust/pack rust). Section loss is below joints at P+H locations.

**Total Deterioration:** 4 Sft
<table>
<thead>
<tr>
<th>Pier Inspection Checklist</th>
<th>Pier Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Note any settlement, lat. Movement, rotation</td>
<td></td>
</tr>
<tr>
<td>□ Note exposed rebar &amp; material defects</td>
<td></td>
</tr>
<tr>
<td>□ Note flexural, shear cracking &amp; crack widths</td>
<td></td>
</tr>
<tr>
<td>□ Structure modifications? (widening, patching, etc)</td>
<td></td>
</tr>
<tr>
<td>□ Note any undermining of the bearings</td>
<td></td>
</tr>
<tr>
<td>□ Note condition of end diaphragms</td>
<td></td>
</tr>
<tr>
<td>□ Note any evidence of deck joint leakage</td>
<td></td>
</tr>
</tbody>
</table>

Total Deterioration: 0 Sft
**Date:** 1-9-17  
**Structure:** 23151-R02  
**By:** KAH  
**Sheet:** 1 of 2

### Pier Inspection Checklist

- [ ] Note any settlement, lat. Movement, rotation
- [ ] Note exposed rebar & material defects
- [ ] Note flexural, shear cracking & crack widths
- [ ] Structure modifications? (widening, patching, etc)

- [ ] Note any undermining of the bearings
- [ ] Note condition of end diaphragms
- [ ] Note any evidence of deck joint leakage

---

**Pier Sketch**

Total Deterioration: 0 Sft
**Pier Inspection Checklist**

- Note any settlement, lat. Movement, rotation
- Note exposed rebar & material defects
- Note flexural, shear cracking & crack widths
- Note any undermining of the bearings
- Note condition of end diaphragms
- Note any evidence of deck joint leakage
- Structure modifications? (widening, patching, etc.)
- Note any evidence of deck joint leakage

**Pier Sketch**

![Pier Sketch](image)

**Total Deterioration:** 0 Sft
ABUTMENT INSPECTION SHEET

Date: 1-9-17
Structure: 23151-B02

Abutment Inspection Checklist

☑ Note any settlement, lat. Movement, rotation
☑ Note exposed rebar & material defects
☑ Note flexural, shear cracking & crack widths
☑ Structure modifications? (widening, patching, etc)
☑ Note any undermining of the bearings
☑ Note any evidence of deck joint leakage
☑ Note condition of end diaphragms
☐ Note slope protection type and condition

Abutment Sketch

Total Deterioration: 6 Sft
Appendix C: Calculations
Deck Patching - Shallow and Full Depth

<table>
<thead>
<tr>
<th>Span</th>
<th>Area (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Total Area 6.00 sft
Double 12.00 sft
Say Full Depth 10 sft
Say Partial Depth 10 sft

Abutment Repair

<table>
<thead>
<tr>
<th>Abutment</th>
<th>Area (sft)</th>
<th>Temp Col</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>36.00</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>47</td>
<td>0</td>
</tr>
</tbody>
</table>

Subtotal 83.00 sft Assumed
Total 83.00 sft Assumed
Double 166.00 sft
Depth 0.5 ft Round up to the nearest 5 cft

Repair Area 85 cft

Abutment Crack Sealer

<table>
<thead>
<tr>
<th>Abutment</th>
<th>Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.00</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
</tr>
</tbody>
</table>

Subtotal 5.00
Total 5.00 ft

Joint Replacement

Deck Width 35.50 ft
Skew 30.00 deg

<table>
<thead>
<tr>
<th>Location</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abutment A</td>
<td>40.99</td>
</tr>
<tr>
<td>Pier 1</td>
<td>40.99</td>
</tr>
<tr>
<td>Pier 2</td>
<td>40.99</td>
</tr>
<tr>
<td>Abutment B</td>
<td>40.99</td>
</tr>
<tr>
<td>Subtotal =</td>
<td>163.97</td>
</tr>
</tbody>
</table>

Total 164 ft (roundup to nearest foot)
Hot Poured Joint Replacement

<table>
<thead>
<tr>
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<th>Length</th>
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<tbody>
<tr>
<td>Abutment A</td>
<td>40.99</td>
</tr>
<tr>
<td>Abutment B</td>
<td>40.99</td>
</tr>
</tbody>
</table>

Subtotal = 81.98

Total = 82 ft (roundup to nearest foot)

New Pressure Relief Joints (Bridge currently does not have any)

<table>
<thead>
<tr>
<th>Location</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abutment A</td>
<td>24.00</td>
</tr>
<tr>
<td>Abutment B</td>
<td>24.00</td>
</tr>
</tbody>
</table>

Subtotal = 48.00

Total = 48 ft (roundup to nearest foot)

Slope Paving Repairs

Abut A: Need to remove/replace to place temp support under Beams 3S & 4S.
Estimate: 24 Syd Assume 10' x 10' surface area

Abut B: 10 Syd Riprap patching

Epoxy Overlay

Clear Roadway
Length 32.5 ft

Area 12983.75 ft
1442.64 syd SYD

SAY: 1445

Deep Overlay & Removal of Concrete Wearing Surface

Clear Roadway width 32.50 ft
Length 399.50 ft

Area 12985 Sft

Bridge Replacement

Existing Bridge Length 399.50 ft
Existing Bridge Width (o/o) 32.46 ft
Proposed Bridge Length 400.00 ft
Proposed Bridge Width (o/o) 56.92 ft

Demolition Area 12970 Sft
Proposed Bridge Area 22770 Sft
Structural Steel Repairs (Stiffener Replacements)
- Known locations: 2 Ea
- Miscellaneous locations: 5 Ea
- TOTAL 7 Ea

Clean and Coat Steel Bearing
- Abutment A: 4 Ea
- Pier 1: 4 Ea
- Pier 2: 4 Ea
- Abutment B: 4 Ea
- TOTAL 16 Ea

Pin and Hanger Replacement
- Total 8 Ea (Replace All P&H's, 4 Beams at 2 P&H Lines)

Cross Frame Replacement
- 0 Ea

Partial Painting
Coat Exterior & Bottom of Fascia Beams
- No of Beams: 2
- Beam Perimeter: 10.64 ft
- Length of Painting: 335.50 ft
- Total: 8206.82 Sft

Entire Bridge
- No of Beams: 4
- Beam Perimeter: 19.77 ft
- Length of Painting: 399.50 ft
- Total: 36332.86 Sft
- Cost: $12.00 /Sft
- TOTAL: $435,995.00

8' in each direction from Pin & Hangers
- No of Locations: 8
- Beam Perimeter: 19.77 ft
- Length of Painting: 16.00 ft
- Total: 2910.27 Sft

TOTAL: 11120.00 Sft
**Concrete Surface Coating (Superstructure)**

- Bridge Length: 399.50 ft
- Perimeter of Deck Fascia: 2.58 ft
- Perimeter of Bridge Barrier: 7.33 ft
- Total Area of Coating: 7918.36 sq ft
- Superstructure Total: 880.00 syd

**Concrete Surface Coating (Superstructure)**

- *Pier 1&2 Walls*
  - Pier Width: 50.50 ft
  - Pier Length: 3.00 ft
  - Pier Height: 18.00 ft (Top of Pier 1 to Top of Water EL)
  - Total Area of Pier: 4242.00 sq ft
  - Pier Total: 480.00 syd

- *Abutment Walls*
  - Backwall Height: 7.77 ft
  - Backwall Width: 35.80 ft
  - Abutment Stem Width: 74.17 ft
  - Abutment Stem Height: 2.08 ft
  - Wingwall Step Widths: 56.35 ft
  - Wingwall Step Height: 7.77 ft
  - # of Backwalls/Abutment Stem: 2.00 ea
  - # of Wingwalls: 4.00 ea
  - Total Area of Abut/Bckl/WW: 2615.27 sq ft
  - Abutment Total: 300.00 syd
  - Substructure Total: 780.00 syd

**Scour Countermeasures**

- *Replace Riprap around both Piers for Scour Countermeasures*
  - Width of Riprap: 10.00 ft
  - Length of Pier: 50.50 ft (2 ft on each side extra)
  - Width of Pier: 6.00 ft (1.5ft on each side extra)
  - # of Piers: 2.00 ea
  - Total Riprap: 260 Syd
  - $Riprap/Sft: 45.00
  - LSUM of Riprap: $11,700.00
Approach Pavement, 12" RC for Deep Deck Overlay
Out-to-Out Width 32.46 ft
Length 40.00 ft
Area 2597 Sft

Approach Pavement, 12" RC for Bridge Replacement
Out-to-Out Width 56.92 ft
Length 40.00 ft
Area 4553 Sft

Approach Curb and Gutter
Length 18.00 ft
Quadrants 4.00
Total 72 ft

Guardrail Anchorage to Bridge
Quadrants 4.00

HMA Overlay at East Approach
Out-to-Out Width 35.5 ft
Length 20.00 ft
Area 1420 Sft

MOT Cost Estimate for Deep Deck Overlay
For Two Bridges $2,965,000.00
For One Bridge $1,482,500.00

MOT Cost Estimate for Bridge Replacement
For Two Bridges $5,410,000.00
For One Bridge $2,705,000.00
Deck Patching - Shallow and Full Depth

<table>
<thead>
<tr>
<th>Span</th>
<th>Area (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Area 14.00 sq ft
Double 28.00 sq ft
Say Full Depth 10 sq ft
Say Partial Depth 20 sq ft

Pier Repair
Recommend temp supports where delam is near the top of the pier cap near possible bearing location.

<table>
<thead>
<tr>
<th>Pier</th>
<th>Deterioration</th>
<th>Temp Col</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (East Face)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 (West Face)</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2 (East Face)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 (West Face)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Subtotal 4.00 sq ft Assumed
Double 8.0 sq ft
Depth 0.5 ft Round up to the nearest 5 cft

Repair Area 5 cft

Abutment Repair

<table>
<thead>
<tr>
<th>Abutment</th>
<th>Area (sq ft)</th>
<th>Temp Col</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13.00</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Subtotal 19.00 sq ft Assumed
Double 38.0 sq ft
Depth 0.5 ft Round up to the nearest 5 cft

Repair Area 20 cft

Joint Replacement

Deck Width 35.50 ft
Skew 0.00 deg

<table>
<thead>
<tr>
<th>Location</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pier 1</td>
<td>35.50</td>
</tr>
<tr>
<td>Pier 2</td>
<td>35.50</td>
</tr>
</tbody>
</table>

Subtotal = 71.00

Total 71 ft (roundup to nearest foot)

Hot Poured Joint Replacement

Deck Width 35.50 ft
Skew 0.00 deg

<table>
<thead>
<tr>
<th>Location</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abutment A</td>
<td>35.50</td>
</tr>
<tr>
<td>Abutment B</td>
<td>35.50</td>
</tr>
</tbody>
</table>

Subtotal = 71.00

Total 71 ft (roundup to nearest foot)
Pressure Relief Joint Replacement

<table>
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<th>Length</th>
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<tbody>
<tr>
<td>Abutment A</td>
<td>24.00</td>
</tr>
<tr>
<td>Abutment B</td>
<td>24.00</td>
</tr>
</tbody>
</table>

Subtotal = 48.00

Total 48 ft (roundup to nearest foot)

Slope Paving Repairs

Abut A: Remove & replace in order to place temp support under Beams 1S & 4S.
Estimate: 24 Syd Assume 10’ x 10’ surface area
Abut B: 10 Syd Riprap patching

Epoxy Overlay

Clear Roadway 32.5 ft
Length 302.50 ft
Area 9831.25 ft
1092.36 Syd SAY: 1095

Deep Overlay & Removal of Concrete Wearing Surface

Clear Roadway width 32.50 ft
Length 302.50 ft
Area 9835 Sft

Bridge Replacement

Existing Bridge Length 302.50 ft
Existing Bridge Width (o/o) 35.50 ft
Proposed Bridge Length 305.00 ft
Proposed Bridge Width (o/o) 56.92 ft
Demolition Area 10740 Sft
Proposed Bridge Area 17360 Sft
Structural Steel Repairs (Stiffener Replacements)
- Known locations: 2 Ea
- Miscellaneous locations: 5 Ea
- TOTAL 7 Ea

Clean and Coat Steel Bearing
- Abutment A: 4 Ea
- Pier 1: 4 Ea
- Pier 2: 4 Ea
- Abutment B: 4 Ea
- TOTAL 16 Ea

Miscellaneous Steel Repair
- 1 Ea

Pin and Hanger Replacement
- Total 8 Ea (Replace All P&H's, 4 Beams at 2 P&H Lines)

Partial Painting
- Coat Exterior & Bottom of Fascia Beams
  - No of Beams: 2
  - Beam Perimeter: 8.30 ft
  - Length of Painting: 238.50 ft
  - Total: 4554.11 Sft
  - Entire Bridge No of Beams: 4
  - Beam Perimeter: 15.27 ft
  - Length of Painting: 302.50 ft
  - Total: 21249.36 Sft

8' in each direction from Pin & Hangers
- No of Locations: 8
- Beam Perimeter: 15.27 ft
- Length of Painting: 16.00 ft
- Total: 2247.87 Sft

- TOTAL: 6805.00 Sft
- Cost: $12.00 /Sft
- TOTAL: $254,993.00
Concrete Surface Coating (Superstructure)

- Bridge Length: 302.50 ft
- Perimeter of Deck Fascia: 2.58 ft
- Perimeter of Bridge Barrier: 7.33 ft
- Total Area of Coating: 5995.75 sq ft
- Superstructure Total: 670.00 sqyd

Concrete Surface Coating (Superstructure) - *Pier 1&2 Walls

- Pier Width: 50.50 ft
- Pier Length: 3.00 ft
- Pier Height: 18.00 ft (Top of Pier 1 to Top of Water EL)
- Total Area of Pier: 4242.00 sq ft
- Pier Total: 480.00 sqyd

Concrete Surface Coating (Superstructure) - *Abutment Walls

- Backwall Height: 7.77 ft
- Backwall Width: 35.80 ft
- Abutment Stem Width: 74.17 ft
- Abutment Stem Height: 2.08 ft
- Wingwall Step Widths: 56.35 ft
- Wingwall Step Height: 7.77 ft
- # of Backwalls/Abutment Stem: 2.00 ea
- # of Wingwalls: 4.00 ea
- Total Area of Abut/Bckl/WW: 2615.27 sq ft
- Abutment Total: 300.00 sqyd
- Substructure Total: 780.00 sqyd

Scour Countermeasures

- *Replace Riprap around both Piers for Scour Countermeasures

- Width of Riprap: 10.00 ft
- Length of Pier: 50.50 ft (2 ft on each side extra)
- Width of Pier: 6.00 ft (1.5 ft on each side extra)
- # of Piers: 2.00 ea
- Total Riprap: 260 Syd
- $Riprap/Sft: 45.00
- LSUM of Riprap: $11,700.00
### Approach Pavement, 12” RC
- **Out-to-Out Width**: 32.5 ft
- **Length**: 40.00 ft
- **Area**: 2600 sq ft

### Approach Pavement, 12” RC for Bridge Replacement
- **Out-to-Out Width**: 56.92 ft
- **Length**: 40.00 ft
- **Area**: 4553 sq ft

### Approach Curb and Gutter
- **Length**: 18.00 ft
- **Quadrants**: 4.00
- **Total**: 72 ft

### Guardrail Anchorage to Bridge
- **Quadrants**: 3.00

### Repair Guardrail Damage in NW quadrant
- **Quadrant**: 1

### HMA Overlay at East Approach
- **Out-to-Out Width**: 35.5 ft
- **Length**: 20.00 ft
- **Area**: 1420 sq ft

### MOT Cost Estimate for Deep Deck Overlay
- **For Two Bridges**: $2,965,000.00
- **For One Bridge**: $1,482,500.00

### MOT Cost Estimate for Bridge Replacement
- **For Two Bridges**: $5,410,000.00
- **For One Bridge**: $2,705,000.00

### Temporary Widen I-96 WB Bridge for Stage 1 Construction
- **Bridge Length**: 302.50 ft
- **Widened Portion**: 22 ft
- **Total Bridge Widening (Temp)**: 6655 sq ft
Appendix D: Detailed Beam Report
# DETAILED BEAM SURVEY REPORT

## By: Structure No. B01-23151

<table>
<thead>
<tr>
<th>Chk’d:</th>
<th>Facility Carried: I-96 EB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>Facility Intersected: Grand River</td>
</tr>
</tbody>
</table>

## NOTES
- **italics** = Measurements Italized Indicate Values Were Actually Field Measured.
- **normal** = Measurements Not Italized Indicate Values Were Noted Typical To Another Beam/Pin&Hanger.
- *1 = Loss Measurements Are Taken Between Plan Value and Field Loss Value.
- *2 = Field Good Measurements May Vary From Plan. If Field Loss is Greater Than Plan Value, Assumed No Loss.

### % Loss Chart

<table>
<thead>
<tr>
<th>Original (inches)</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
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<tbody>
<tr>
<td>0.250</td>
<td>0.225</td>
<td>0.200</td>
<td>0.175</td>
<td>0.150</td>
<td>0.125</td>
<td>0.100</td>
<td>0.075</td>
<td>0.050</td>
<td>0.025</td>
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<td>0.375</td>
<td>0.338</td>
<td>0.300</td>
<td>0.263</td>
<td>0.225</td>
<td>0.186</td>
<td>0.150</td>
<td>0.113</td>
<td>0.075</td>
<td>0.038</td>
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<tr>
<td>0.500</td>
<td>0.450</td>
<td>0.400</td>
<td>0.350</td>
<td>0.300</td>
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<tr>
<td>0.625</td>
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<td>0.438</td>
<td>0.375</td>
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<td>0.525</td>
<td>0.450</td>
<td>0.375</td>
<td>0.300</td>
<td>0.225</td>
<td>0.150</td>
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<td>0.610</td>
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<td>0.500</td>
<td>0.400</td>
<td>0.300</td>
<td>0.200</td>
<td>0.100</td>
</tr>
</tbody>
</table>

### Abutment/Pier: Abut A

| Span: Span 1 | Beam Type: Steel Beams |

<table>
<thead>
<tr>
<th>Beam</th>
<th>WEB</th>
<th>BOTTOM FLANGE</th>
<th>STIFFENER</th>
<th>Pack Rust (Brg)</th>
<th>Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THICKNESS (in.)</td>
<td>LOSS MEASUREMENTS (in.)</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
<td>LOSS FLANGE WIDTH (in.)</td>
</tr>
<tr>
<td></td>
<td>Plan Field Good</td>
<td>Field Loss</td>
<td>Height (Start - End)</td>
<td>Length (Start - End)</td>
<td>Plan Field Good</td>
</tr>
<tr>
<td>1</td>
<td>0.375</td>
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<td>1.296</td>
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<tr>
<td>2</td>
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<td>0.411</td>
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<td>1.312</td>
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</tr>
<tr>
<td>3</td>
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<td>0%</td>
<td>1.287</td>
<td>0%</td>
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<td>0.396</td>
<td>0%</td>
<td>1.302</td>
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</table>

### Abutment/Pier: Abut B

| Span: Span 3 | Beam Type: Steel Beams |

<table>
<thead>
<tr>
<th>Beam</th>
<th>WEB</th>
<th>BOTTOM FLANGE</th>
<th>STIFFENER</th>
<th>Pack Rust (Brg)</th>
<th>Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THICKNESS (in.)</td>
<td>LOSS MEASUREMENTS (in.)</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
<td>LOSS FLANGE WIDTH (in.)</td>
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<tr>
<td></td>
<td>Plan Field Good</td>
<td>Field Loss</td>
<td>Height (Start - End)</td>
<td>Length (Start - End)</td>
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<tr>
<td>1</td>
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<td>2</td>
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</table>

### % Loss Chart

- **italics** = Measurements Italized Indicate Values Were Actually Field Measured.
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- *2 = Field Good Measurements May Vary From Plan. If Field Loss is Greater Than Plan Value, Assumed No Loss.

## Repair

9/27/2017 Page 1
## DETAILED BEAM SURVEY REPORT

### Beam Survey Report Details
- **By:** Structure No. B02-23151
- **Chk'd:** Facility Carried: I-96 WB
- **Date:** Facility Intersected: Grand River

### Abutment/Pier: Abut A
#### Span: Span 1
#### Beam Type: Steel Beams

### Abutment/Pier: Abut B
#### Span: Span 3
#### Beam Type: Steel Beams

### Beam Survey Table

<table>
<thead>
<tr>
<th>Beam</th>
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<th>Span</th>
<th>Beam Type</th>
<th>WEB</th>
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<th>STIFFENER</th>
<th>Pack Rust</th>
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<tbody>
<tr>
<td></td>
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<td>Span 1</td>
<td>Steel Beams</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
<td>LOSS MEASUREMENTS (in.)</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
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<tr>
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<td>Abut B</td>
<td>Span 3</td>
<td>Steel Beams</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
<td>LOSS MEASUREMENTS (in.)</td>
<td>THICKNESS (in.)</td>
<td>% LOSS*1</td>
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### Notes
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# Detailed Pin & Hanger Report

## Pier 1

<table>
<thead>
<tr>
<th>Beam</th>
<th>Span</th>
<th>WEB</th>
<th>TAPER</th>
<th>TAPER</th>
<th>WEB</th>
<th>LOSS (in.)</th>
<th>BOTTOM FLANGE</th>
<th>P&amp;H Dimensions</th>
<th>Joint Opening (in.)</th>
<th>Link Plate</th>
<th>PIN Plate</th>
<th>Repair Work</th>
</tr>
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<tbody>
<tr>
<td>1L</td>
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<td>0%</td>
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<tr>
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</tbody>
</table>

## Notes

- **% Loss**: Measurements in italic indicate values were actually field measured.
- **Normal**: Measurements not italicized indicate values were noted typical to another beam or hanger.
- **% Loss**: Loss measurements are taken between plan value and field loss value.
- **% Loss**

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| Pier 2

<table>
<thead>
<tr>
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<th>TAPER</th>
<th>WEB</th>
<th>LOSS (in.)</th>
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<tbody>
<tr>
<td>1L</td>
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## Notes

- **% Loss**: Loss measurements are taken between plan value and field loss value.
- **% Loss**

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<table>
<thead>
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<th>% Loss Chart</th>
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<tbody>
<tr>
<td>0%</td>
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<td>0.01</td>
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**NOTES**

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- Loss measurements are taken between plan value and field loss value.
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- Loss is in low stress area; however beam end repair included. Location should be investigated further by load rating unit.
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<table>
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<tr>
<th>Beam</th>
<th>Span</th>
<th>WEB</th>
<th>BOTTOM FLANGE</th>
<th>P&amp;H Dimensions</th>
<th>LINK PLATE</th>
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---

### Pier 2

<table>
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<th>Beam</th>
<th>Span</th>
<th>WEB</th>
<th>BOTTOM FLANGE</th>
<th>P&amp;H Dimensions</th>
<th>LINK PLATE</th>
<th>PIN PLATE</th>
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</tr>
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</table>

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Known Stiffener Replacements = 4
Miscellaneous Stiffener Replacements = 10
P&H Replacement (Deep Concrete Overlay Option Only) = 16
Appendix E: Lab Test Reports (N/A)
Appendix F: Preliminary Estimates
**NEW BRIDGE**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost (w/o PE)</th>
<th>Total (w/o PE)</th>
<th>Unit Cost (w/ PE)</th>
<th>Total (w/ PE)</th>
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<tbody>
<tr>
<td>Deck Replacement</td>
<td>ft</td>
<td>12,210.0</td>
<td>$32.00 /ft</td>
<td>$390,720</td>
<td>$32.00 /ft</td>
<td>$427,280</td>
</tr>
<tr>
<td>Superstructure Replacement</td>
<td>ft</td>
<td>12,210.0</td>
<td>$64.00 /ft</td>
<td>$781,680</td>
<td>$64.00 /ft</td>
<td>$950,480</td>
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<tr>
<td>New Deck</td>
<td></td>
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<tr>
<td>Primary Work Activity: Prop Deck</td>
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<tr>
<td>Mile</td>
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<td>Superstructure Length</td>
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<td>$781,680</td>
<td>$64.00 /ft</td>
<td>$950,480</td>
</tr>
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<td>$427,280</td>
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**NEW SUPERSTRUCTURE**

<table>
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<tr>
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<tbody>
<tr>
<td>Deck Replacement</td>
<td>ft</td>
<td>12,210.0</td>
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<td>ft</td>
<td>12,210.0</td>
<td>$64.00 /ft</td>
<td>$781,680</td>
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**ROAD WORK**

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<th>Unit Cost (w/o PE)</th>
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<th>Total (w/ PE)</th>
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<tr>
<td>Truck Repair</td>
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**RELATED ROAD/TRAFFIC CONSTRUCTION BUDGET**

<table>
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<tr>
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<th>Unit</th>
<th>Quantity</th>
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<tr>
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**SUMMARY**

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<tr>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost (w/o PE)</th>
<th>Total (w/o PE)</th>
<th>Unit Cost (w/ PE)</th>
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<tr>
<td>Total New Price</td>
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<td>$1,838,000</td>
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### ROAD WORK

**Region**
- University Region

**Fiscal Year**
- 2024

**Ex Deck Area**
- 16,799 SFT

**Structure ID**
- 2011

**Engineer**
- KAH

**Location**
- I-96 WB over Grand River & Billwood Hwy

**Prop Deck Area**
- 17,361 SFT

**Bridge ID**
- B02 of 23151

**Primary Work Activity**
- Bridge Rehabilitation

#### Temporary Bridge Widening
- **Width**: 22ft
- **Cost**: $270.00/SFT
- **Total Cost**: $1,796,850

#### Temporary Traffic Signals
- **Cost**: $22,000.00/set
- **Total Cost**: $22,000.00

#### Part Width Construction
- **LSUM Cost**: $60,000.00

#### Utilities
- **LSUM Cost**: $60,000.00

#### Guardrail Anchorage to Bridge (<40')
- **Cost**: $1,600.00/quad
- **Total Cost**: $4,800.00

#### Approach Pavement, 12" RC
- **Cost**: $16.00/SFT
- **Total Cost**: $72,853.00

#### Contractor Water Access
- **Cost**: $35,000.00
- **Total Cost**: $35,000.00

#### Scour Countermeasures
- **Cost**: $11,700.00
- **Total Cost**: $11,700.00

#### Articulating Concrete Block System (ACB)
- **Cost**: $120.00/SYD
- **Total Cost**: $120.00

#### Deck Drain Extensions
- **Cost**: $500.00/EA
- **Total Cost**: $500.00

#### Thrie Beam Railing retrofit
- **Cost**: $40.00/FT
- **Total Cost**: $40.00

#### Joint, Pressure Relief, 4 Inch
- **Cost**: $65.00/FT
- **Total Cost**: $3,120.00

#### Expansion or Construction Joints (includes removal)
- **Cost**: $550.00/FT
- **Total Cost**: $550.00

#### Crack Sealer
- **Cost**: $5.00/FT
- **Total Cost**: $5.00

#### Slope Protection repairs (riprap)
- **Cost**: $140.00/SYD
- **Total Cost**: $1,400.00

#### Slope Protection repairs (concrete slope paving)
- **Cost**: $200.00/SYD
- **Total Cost**: $4,800.00

#### Abutment repair (measured x 2)
- **Cost**: $265.00/CFT
- **Total Cost**: $5,300.00

#### Pier replacement
- **Cost**: $80.00/CFT
- **Total Cost**: $80.00

#### Pier repair (measured x 2)
- **Cost**: $265.00/CFT
- **Total Cost**: $265.00

#### Concrete Surface Coating (Superstructure)
- **Cost**: $16.00/SYD
- **Total Cost**: $10,720.00

#### Cutting Beam Ends, Simple Span
- **Cost**: $1,000.00
- **Total Cost**: $1,000.00

#### Pin & Hanger replacement (includes temporary supports)
- **Cost**: $7,000.00/EA
- **Total Cost**: $56,000.00

#### Partial Painting (includes clean & coat)
- **Cost**: $24.00/SFT
- **Total Cost**: $163,320.00

#### Vertical Stiffener Replacement ($4800 bolted, $6800 welded)
- **Cost**: $6,000.00/EA
- **Total Cost**: $33,600.00

#### PCI Beam End Repair ($2700-$5400 per beam end)
- **Cost**: $4,600.00/EA
- **Total Cost**: $4,600.00

#### High Load Hit Repair (PCI Beam)
- **Cost**: $250.00/SFT
- **Total Cost**: $250.00

#### Deep Overlay (includes joint repl & hydro; add bridge rail if req'd)
- **Cost**: $37.00/SFT
- **Total Cost**: $363,895.00

#### Shallow Overlay (includes joint repl & hydro; add bridge rail if req'd)
- **Cost**: $35.00/SFT
- **Total Cost**: $35.00

#### Epoxy Overlay
- **Cost**: $32.00/SYD
- **Total Cost**: $35,040.00

#### Healer Sealer
- **Cost**: $22.00/SYD
- **Total Cost**: $22.00

#### Removal of Concrete Wearing Course (latex) or HMA Overlay
- **Cost**: $2.00/SFT
- **Total Cost**: $19,670.00

#### HMA Overlay with WP membrane (add bridge rail if req'd)
- **Cost**: $5.50/SFT
- **Total Cost**: $5.50

#### HMA Cap (no membrane, add bridge rail if req'd)
- **Cost**: $1.50/SFT
- **Total Cost**: $1.50

#### Full Depth Patch
- **Cost**: $100.00/SFT
- **Total Cost**: $1,000.00

#### Concrete Deck Patch (includes hand chipping)
- **Cost**: $35.00/SFT
- **Total Cost**: $700.00

#### Other
- **Cost**: $32.00/SFT
- **Total Cost**: $32.00

#### 22' ft of width for Temp Widening
- **Cost**: $270.00/SFT
- **Total Cost**: $727,990.00

#### Over Water
- **Cost**: $40.00/SFT
- **Total Cost**: $40.00

#### Precast 3-sided Culvert or 4-sided Box Culvert
- **Cost**: $350.00/SFT
- **Total Cost**: $350.00

#### Multiple Spans, Steel (as above)
- **Cost**: $245.00/SFT
- **Total Cost**: $4,253,200.00

#### University Region
- **Bridge Replacement**:
  - **Cost**: $55,000 (7%)
  - **Total**: $485,000
  - **Total**: $1,276,000

  - **Cost**: $559,000 (40%)
  - **Total**: $1,978,000
  - **Total**: $5,209,000

  - **Cost**: $508,000 (10%)
  - **Total**: $1,184,000
  - **Total**: $3,184,000

  - **Cost**: $462,000 (10% - 20%)
  - **Total**: $1,076,000

#### Other
- **Cost**: $916,000
- **Total**: $838,000

#### 2311
- **Cost**: $19,508,000
- **Total**: $19,508,000

#### Other
- **Cost**: $388,568
- **Total**: $388,568

#### RELATED ROAD/TRAFFIC CONSTRUCTION BUDGET
- **Cost**: $3,241,870
- **Total**: $8,485,983

### STRUCTURE CONSTRUCTION BUDGET

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<th>Work Class</th>
<th>Unit Cost (w/o PE)</th>
<th>Unit Cost (w/ PE)</th>
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## Item Description
### University Bridge Scoping
#### I-96 over the Grand River and Billwood Hwy
#### MOT Costs

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>2017 Unit Price</th>
<th>Total</th>
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<td>1600</td>
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<tr>
<td>4010024</td>
<td>Culv End Sect, 24 inch</td>
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<tr>
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<td>$12,960.00</td>
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**Total:** $2,964,079.65  
Contingency (10%): $296,407.97  
**Project Total:** $3,260,487.62  

*Payment for "Minor Traf Devices" included with overall project estimate*
### University Bridge Scoping
#### I-96 over the Grand River and Billwood Hwy

#### MOT Costs

**Bridge Replacement**

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Item Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>2017 Unit Price</th>
<th>Total</th>
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<td>1600</td>
<td>$ 69.94</td>
<td>$ 111,904.00</td>
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<tr>
<td>4010024</td>
<td>Culv End Sect, 24 inch</td>
<td>Ea</td>
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<td>$ 615.38</td>
<td>$ 2,461.52</td>
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**Total** $5,946,541.05

Contingency (10%) $540,594.64

**Project Total** $5,405,946.41

*Payment for “Minor Traf Devices” included with overall project estimate*
Appendix G: Existing Plan Sheets
Appendix H: Current NBIS Report
### NBI INSPECTION

**Inspector Name**
Janiene DeVinney

**Agency / Company Name**
MDOT University Region

**Insp. Freq.**
24

**Insp. Date**
07/30/2015

---

**GENERAL NOTES**
Clearance posted 13'-6".

---

#### DECK

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<tr>
<th>Date</th>
<th>Notes</th>
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<tbody>
<tr>
<td>07/11</td>
<td>Concrete overlay with open diagonal and longitudinal cracks throughout. Some cracks have been sealed with epoxy. Small spalls at the joints. Milled areas. (07/15)</td>
</tr>
<tr>
<td>07/13</td>
<td>Concrete overlay with several open map and diagonal cracks in all spans. Some cracks have been sealed with epoxy. 1st ft spill at saw cut. (07/11)</td>
</tr>
<tr>
<td>07/15</td>
<td>Concrete overlay with open random, diagonal and longitudinal cracking throughout. Some cracks have been sealed with epoxy. Small spalls at the joints. Water ponding on the south shoulder. Milled areas of the surface throughout. (07/13)</td>
</tr>
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#### Expansion Joints

<table>
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<th>Notes</th>
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<tr>
<td>07/11</td>
<td>Strip seal joints with cracks adjacent. Joint 4w: 2 ft spill and delam area and heavy gouges in the joint rail. Joint 2w: filled with debris, cracks adjacent, gouges in steel. (07/15)</td>
</tr>
<tr>
<td>07/13</td>
<td>Strip seal joints with transverse cracking in the surrounding concrete. Joint 2w has a 2 ft spill/delam area and heavy gouges in the joint rail. Joint 3w has 3 ft area of delam and spalling, the joint is leaking through the spalled area. (07/13)</td>
</tr>
<tr>
<td>07/15</td>
<td>West strip seal with tight cracks in adjacent concrete header. Joint 3w strip seal with open cracks and 3 ft spill and delam in adjacent concrete, leaking. Tight cracks adjacent to expansion joint at east reference. (07/11)</td>
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</tbody>
</table>

#### Other Joints

<table>
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<th>Date</th>
<th>Notes</th>
</tr>
</thead>
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<tr>
<td>07/13</td>
<td>Pourable end joints with loss of adhesion, cracking and spalling. Both of the end joints are leaking. A sealed construction joint at the west set of P&amp;H's has open cracks and a 2 ft area of spalling. (07/13)</td>
</tr>
<tr>
<td>07/15</td>
<td>West pourable end joint, loss of adhesion and leaking. Saw cut at west set of P&amp;Hs has open cracks and 1 st spill adjacent. Saw cut sealed with HPR. East reference has open raveling and no filler. (07/11)</td>
</tr>
</tbody>
</table>

#### Railings

<table>
<thead>
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<th>Date</th>
<th>Notes</th>
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<tbody>
<tr>
<td>07/15</td>
<td>Concrete barriers with leaching vertical cracking throughout. Leaching horizontal and map cracked areas in the upper parts of the barriers near the joints. Light traffic impact scrapes. (07/15)</td>
</tr>
<tr>
<td>07/11</td>
<td>Concrete barriers with leaching vertical cracking throughout. Both barriers have leaching horizontal and map cracked areas in the upper parts of the barrier near the joints. Both joints also have light traffic impact scrapes and marks throughout. (07/13)</td>
</tr>
<tr>
<td>07/11</td>
<td>Concrete barrier with several leaching vertical cracks spaced 3-4 feet apart. Areas of light scaling. Concrete surface coat peeling in large areas. (07/11)</td>
</tr>
</tbody>
</table>

#### Sidewalks or Curbs

<table>
<thead>
<tr>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/15</td>
<td>(07/15)</td>
</tr>
<tr>
<td>07/13</td>
<td>(07/13)</td>
</tr>
<tr>
<td>07/11</td>
<td>(07/11)</td>
</tr>
</tbody>
</table>

#### Deck Bottom

<table>
<thead>
<tr>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/15</td>
<td>Leaching transverse, map, longitudinal, and diagonal cracks. Areas of minor delam. Few full depth patches in all spans. Delam and STS span 3 w near backwall. (07/15)</td>
</tr>
<tr>
<td>07/13</td>
<td>Leaching transverse, map, longitudinal, and diagonal cracks. Few full depth patches in all spans. Delam and STS span 3 w near backwall. (07/13)</td>
</tr>
<tr>
<td>07/11</td>
<td>Leaching transverse, map, longitudinal, and diagonal cracks. Few full depth patches in all spans. Delam and STS span 3 w near backwall. (07/11)</td>
</tr>
</tbody>
</table>
7. Deck (SIA-58)
Top surface: Concrete overlay with open diagonal and longitudinal cracks throughout. Some cracks have been sealed with epoxy. Small spalls at the joints. Milled areas. Bottom surface: Leaching transverse, map, longitudinal, and diagonal cracks. Areas of minor delam. Few full depth patches in all spans. Delam and STS span 3w near backwall. Fascias: Leaching cracks. (07/15)
Surface: Concrete overlay with open random, diagonal and longitudinal cracking throughout. Some cracks have been sealed with epoxy. Small spalls at the joints. Water ponding on the south shoulder. Milled areas of the surface throughout. Bottom: Leaching transverse, map, longitudinal, and diagonal cracks. Few full depth patches in all spans. Delam and STS span 3w near backwall. Leaching vertical and map cracked areas near the joints in the fascias. (07/13)
STS in fascias at joints. Leaching vertical and random cracks in fascias. Surface: Concrete overlay with several open map and diagonal cracks in all spans. Some cracks have been sealed with epoxy. 1stf spall at saw cut. Bottom: Leaching transverse, map, longitudinal, and diagonal cracks. Few full depth patches in all spans. Delam and STS span 3w near backwall. (07/11)
Surface drains with extensions in the shoulders, some are plugged. (07/15)
Surface drains with extensions in the shoulders, some are plugged. Down spouts in the east approach shoulders, S/E quad drain is plugged. (07/13)
Surface drains with extensions, few clogged. (07/11)

8. Drainage
Surface drains with extensions in the shoulders, some are plugged. (07/15)
Surface drains with extensions in the shoulders, some are plugged. Down spouts in the east approach shoulders, S/E quad drain is plugged. (07/13)
Surface drains with extensions, few clogged. (07/11)

SUPERSTRUCTURE

9. Stringer (SIA-59)
Steel I beams with cross braces. Minor LOS at a few beam ends, cross braces and fascia beams at bottom of vertical stiffeners. Beam 1s span 3w vertical deflection in bottom flange 10' from pier 2w on south side of web. Repaired crack in stiffener/web connection: span 1w beam 1s at abutment 4" crack; span 3w beam 1s at abutment 3" horizontal crack. Span 3w bay 2s: bolts have been replaced on diaphragms 3,4,5. HLH beam 1s span 1w - stiffeners buckled, minor HLH rusty scrapes on all other beams in span 1w. Poor quality weld in beam 4s span 2w west end of coverplate - bottom flange. Light rust at splice plates. Vertical crossbracing web connections on beams 2,4s span 3w near east abutment are rusty with LOS. Moderate to heavy rust on fascia beam ends at P&Hs. Beam 4s span 2w has negative camber. Vertical stiffeners on fascias are distorted. Welds on the lateral bracing in bay 1s have been ground for inspection. (07/15)
Steel I beams with cross braces. Minor LOS at a few beam ends, cross braces and bottom of fascia beams at vertical stiffeners. Beam 1s span 3w vertical deflection in bottom flange 10 feet from pier 2w on south side of web. Repaired- crack in stiffener/web connection: SP1W BM1S @ abutment 4 in crack; SP3w BM 1S @ abutment 3 in horizontal crack. SP 3w bay 2S: bolts loose have been replaced on diaphragms 3,4,5. Rust on stiffener/web connection fascia beams. HLH in beams 1s span 1w - stiffener buckled in same area, minor HLH marks (rusty scrapes) on all other beams in span 1w. Poor quality weld in beam 4s span 2w west end of coverplate - bottom flange. Light rust at splice plates. Vertical crossbracing web connections in beams 2,4s span 3w near east abutment - rusty with LOS. Moderate to heavy rust on fascia beam ends at P&Hs. Welds on the lateral bracing in bay 1s have been ground for inspection. (07/13)
Steel I beams with cross braces. Minor LOS at a few beam ends, cross braces and bottom of fascia beams at vertical stiffeners. Beam 1s span 3w vertical deflection in bottom flange 10 feet from pier 2w on south side of web. Repaired- crack in stiffener/web connection: SP1W BM1S @ abutment 4 in crack; SP3w BM 1S @ abutment 3 in horizontal crack. SP 3w bay 2S: bolts loose on diaphragms 3,4,5. Rust on stiffener/web connection fascia beams. HLH in beams 1s span 1w - stiffener buckled in same area, minor HLH marks on all other beams in span 1w. Poor quality weld in beam 4s span 2w west end of coverplate - bottom flange. Light rust at splice plates. Vertical crossbracing web connections in beams 2,4s span 3w near east abutment - rusty with LOS. Moderate to heavy rust on fascia beam ends at P&Hs. (07/11)

10. Paint (SIA-59A)
Light rust throughout. Moderate to heavy rust at P&Hs and abutment bearings. Areas of flaking and peeling. Chalking with loss of pigment. (07/15)
Light rust throughout. Moderate to heavy rust at P&Hs and abutment bearings. (07/13)
Light rust throughout. Moderate to heavy rust at P&Hs and abutment bearings. Areas of flaking and peeling throughout. (07/11)
### 11. Section Loss

<p>| | | |</p>
<table>
<thead>
<tr>
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<td>2</td>
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</tbody>
</table>

Minor LOS at a few beam ends, cross braces and fascia beams at bottom of vertical stiffeners. Vertical cross brace to web connections on beams 2, 4s span 3w near east abutment are rusty with LOS. (07/15)

Minor LOS at a few beam ends, cross braces and bottom of fascia beams at vertical stiffeners. Less than 10%. (07/13)

Minor LOS at a few beam ends, cross braces and bottom of fascia beams at vertical stiffeners. (07/11)

### 12. Bearings

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<table>
<thead>
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</tbody>
</table>

Moderate to heavy rust with minor LOS on abutment bearings. West abutment bearings have fretting rust. Light rust on pier bearings. (07/15)

Moderate to heavy rust on abutment bearings. Light rust on pier bearings. (07/13)

Moderate to heavy rust on abutment bearings. Light rust on pier bearings. (07/11)

### SUBSTRUCTURE

#### 13. Abutments

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<table>
<thead>
<tr>
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<td>5</td>
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</tr>
</tbody>
</table>

West: Few rust stained vertical cracks with delam and several horizontal rusty cracks. 9sft STS, areas of delam - bearing areas are ok. Vertical cracks in backwalls. East: few vert cracks; delam with STS in backwall. Delam and spalls in SE wingwall. (07/15)

West: few rust stained vertical cracks/delam and several horizontal rusty cracks, 9sft STS with areas of delam areas, delam areas are extending under the bearings. Open vertical cracks in backwalls. East: few vert cracks; 20sft delam with STS in backwall. (07/13)

West: few rust stained vertical cracks and several horizontal rusty cracks, 9sft STS with areas of delam areas(not under bearings). Open vertical cracks in backwalls. East: few vert cracks; 20sft delam with STS in backwall. (07/11)

#### 14. Piers

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<thead>
<tr>
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</tbody>
</table>

Few leaching vertical cracks. (07/15)

Few leaching vertical cracks in both piers. (07/13)

Few leaching vertical cracks in both piers. (07/11)

#### 15. Slope Protection

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<thead>
<tr>
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</tbody>
</table>

Vegetation growing through concrete pads on west slope. Recycled concrete with areas of fill exposed on east side. (07/15)

Vegetation growing through concrete pads on west slope. Recycled concrete pieces with large areas of fill exposed on east side. (07/13)

Vegetation growing through concrete pads on west slope. Recycled concrete pieces with large areas of fill exposed on east side. (07/11)

#### 16. Channel

<p>| | | |</p>
<table>
<thead>
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<td>7</td>
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</tbody>
</table>

Banks well vegetated. Debris in channel at south end of pier 2w. Water is 6’ - 8’ deep between the piers. (07/15)

Banks well vegetated. Minor debris in channel. Water 6-8 feet deep between the piers. (07/13)

Banks well vegetated. Minor debris in channel. (07/11)

#### 17. Scour Inspection

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<tbody>
<tr>
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Minor scour. (07/15)

(07/13)

(07/11)

### APPROACH

#### 18. Approach Pavement

<p>| | | |</p>
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<thead>
<tr>
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<td>6</td>
<td>6</td>
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</tbody>
</table>

West - concrete with transverse cracks. East - bit with bit filled and open spalls; open cracks and raveling at reference line. (07/15)

West - concrete with tight transverse cracks. East - bit with 1 sft spall and open cracks and raveling at reference line. (07/13)

West - concrete with tight transverse cracks. East - open cracks and raveling at reference line. (07/11)

#### 19. Approach Shoulders Sidewalks

<p>| | | |</p>
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<tr>
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<td>7</td>
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</tbody>
</table>

West - concrete with curb and gutter. Tight transverse cracks, SW curb has shallow spalls. East - open cracks and raveling at reference line. (07/15)

West - concrete with tight transverse cracks. East - open cracks and raveling at reference line. (07/13)

West - Concrete with few transverse cracks. East - bit. Concrete curb and gutter. (07/11)
20. Approach Slopes
Trees, weeds and brush. (07/15)
Trees, weeds and brush. (07/13)
Weeds and brush. (07/11)

21. Utilities
Underground gas and fiber optic placards near bottom of west slope. Power lines directly over span 1w. (07/15)
Underground gas and fiber optic placards near bottom of west slope. Power lines directly over span 1w. (07/13)
Underground gas and fiber optic placards near bottom of west slope. Power lines directly over span 1w. (07/11)

22. Drainage Culverts
Downspouts in east quads. (07/15)
Downspouts in east quads. (07/13)

MISCELLANEOUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>36A. Bridge Railings</td>
<td>1</td>
<td>71. Water Adequacy</td>
<td>8</td>
</tr>
<tr>
<td>36B. Transitions</td>
<td>1</td>
<td>72. Approach Alignment</td>
<td>8</td>
</tr>
<tr>
<td>36C. Approach Guardrail</td>
<td>1</td>
<td>Temporary Support</td>
<td>0 No Temporary Supports</td>
</tr>
<tr>
<td>36D. Approach Guardrail Ends</td>
<td>1</td>
<td>High Load Hit (M)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Special Insp. Equipment</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Underwater Insp. Method</td>
<td>1</td>
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</table>

False Decking (Timber) Removed to Complete Inspection
N/A - No False Decking

Critical Feature Inspections (SIA-92)

<table>
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<tr>
<th>Freq</th>
<th>Date</th>
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<tbody>
<tr>
<td>15</td>
<td>04/18/2016</td>
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</tbody>
</table>
**Bridge History, Type, Materials**

- **Year Built**: 1962
- **Year Reconstructed**: 1987
- **Year Future ADT**: 2018
- **Year of Cost Estimate**: 2009
- **Year Overlay**: 2007
- **Year of ADT**: 2009
- **Year of Cost Estimate**: 1991

**Structure Dimensions**

- **Lanes On**: 2
- **ADT**: 2057

**Route Carried By Structure (ON Record)**

- **General: 2A - Lanes On**: 2
- **Year Future ADT**: 2018
- **Freeway: 29 - ADT**: 21057
- **Year of ADT**: 2007
- **32 - Appr Roadway Width**: 41.99
- **32A/B - Ap Ptv Type/Width**: 6
- **42A - Service Type On**: 1
- **47L - Left Horizontal Clear**: 33.1
- **53 - Min Vert Clr Ov Deck**: 99
- **54B - Left Horiz Clearance**: 99
- **100 - STRAIGHT**: 1
- **102 - Traffic Direct**: 1
- **109 - Truck %**: 16
- **110 - Truck Network**: 1
- **114 - Future ADT**: 24047
- **115 - Year Future ADT**: 2018

**Route Under Structure (UNDER Record)**

- **General: 5A - Record Type**: 1
- **Year of Cost Estimate**: 1991
- **32A/B - Ap Ptv Type/Width**: 6
- **42A - Service Type On**: 1
- **47L - Left Horizontal Clear**: 33.1
- **53 - Min Vert Clr Ov Deck**: 99
- **54B - Left Horiz Clearance**: 99
- **100 - STRAIGHT**: 1
- **102 - Traffic Direct**: 1
- **109 - Truck %**: 16
- **110 - Truck Network**: 1
- **114 - Future ADT**: 24047
- **115 - Year Future ADT**: 2018

**Inspection Data**

- **07/30/2015**: Y
- **11 - Mile Point**: 0

**Structure Appraisal**

- **36A - Bridge Railing**: 1
- **36B - Rail Transition**: 1
- **36C - Approach Rail**: 1
- **36D - Rail Termination**: 1
- **67 - Structure Evaluation**: 5
- **68 - Deck Geometry**: 4
- **69 - Underclearance**: 3
- **71 - Waterway Adequacy**: 8
- **72 - Approach Alignment**: 8
- **103 - Temporary Structure**: 5
- **113 - Scour Criticality**: 3

**Proposed Improvements**

- **75 - Type of Work**: 0
- **76 - Length of Improvement**: 0
- **94 - Bridge Cost**: 0
- **95 - Roadway Cost**: 0
- **96 - Total Cost**: 0
- **97 - Year of Cost Estimate**: 0

**Load Rating and Posting**

- **31 - Design Load**: 6
- **41 - Open, Posted, Closed**: A
- **63 - Fed Oper Rtg Method**: 6
- **64F - Fed Oper Rtg Load**: 2.14
- **64MA - Mich Oper Rtg Method**: 6
- **64MB - Mich Oper Rtg**: 1.12
- **64MC - Mich Oper Truck**: 18
- **65 - Inv Rtg Method**: 6
- **66 - Inventory Load**: 1.28
- **70 - Posting**: 6
- **141 - Posted Loading**: A
- **193 - Overload Class**: R

---

**University (6) / Eaton (23) Bridge Information**

- **I-96 EB**: 42.67 / -84.6459
- **MDOT Structure ID**: 231235100B010
- **Latitude / Longitude**: Fair Condition(5)

---

**Form 1717A (01/2002) Printed on 09/30/2016 Page 1 of 1**
## MICHIGAN DEPARTMENT OF TRANSPORTATION

### SAFETY INSPECTION REPORT - AASHTO ELEMENTS

<table>
<thead>
<tr>
<th>Facility</th>
<th>Latitude / Longitude</th>
<th>MDOT Structure ID</th>
<th>Structure Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-96 EB</td>
<td>42.67 / -84.6459</td>
<td>23123151000B010</td>
<td>Fair Condition(5)</td>
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</table>

<table>
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<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Owner</th>
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<tbody>
<tr>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>399.93 / 35.76</td>
<td>Region: University(6)</td>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Built / Recon. / Paint / Ovly.</th>
<th>TSC</th>
<th>Operational Status</th>
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<tbody>
<tr>
<td>2.1 MI W OF INGHAM CO LIN</td>
<td>1962 / 1987 / 2001</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<tr>
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<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
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</thead>
<tbody>
<tr>
<td>University(6) / Eaton(23)</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / GLOH</td>
<td>3 SC - Unstable</td>
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### NBI INSPECTION

<table>
<thead>
<tr>
<th>Inspector Name</th>
<th>Agency / Company Name</th>
<th>Insp. Freq.</th>
<th>Insp. Date</th>
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<tbody>
<tr>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
<td>24</td>
<td>07/30/2015</td>
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</table>

### AASHTO ELEMENTS

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<thead>
<tr>
<th>Element Number</th>
<th>Element Name</th>
<th>Total Quantity</th>
<th>Unit</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Severe</th>
<th>(English Units)</th>
</tr>
</thead>
</table>

#### Decks/Slabs

- **800** Conc Deck - Black Bars: 14302 sq.ft, Total: 2657, Good: 11440, CS1: 205, CS2: 19%, CS3: 0%, CS4: 0%
- **810** Conc Deck - Top Surface: 14302 sq.ft, Total: 2857, Good: 11440, CS1: 5, CS2: 20%, CS3: 0%, CS4: 0%
- **811** Conc Deck - Btm Surface: 14302 sq.ft, Total: 2662, Good: 11440, CS1: 200, CS2: 19%, CS3: 0%, CS4: 0%
- **812** Reinf Conc Fascia: 800 ft, Total: 0, Good: 796, CS1: 4, CS2: 0%, CS3: 0%, CS4: 0%

#### Joints

- **300** Strip Seal Exp Joint: 125 ft, Total: 0, Good: 123, CS1: 2, CS2: 0%, CS3: 0%, CS4: 0%
- **301** Pourable Joint Seal: 82 ft, Total: 0, Good: 21, CS1: 41, CS2: 0%, CS3: 50%, CS4: 24%

#### Superstructure

- **107** Steel Girder / Beam: 1600 ft, Total: 1150, Good: 200, CS1: 250, CS2: 72%, CS3: 12%, CS4: 0%
- **515** Steel Protective Coating: 41250 sq.ft, Total: 0, Good: 0, CS1: 40870, CS2: 0%, CS3: 99%, CS4: 1%

- **161** Steel P&H Assembly: 8 each, Total: 0, Good: 4, CS1: 4, CS2: 0%, CS3: 50%, CS4: 0%

- **826** Beam End Deterioration: 3 (EA), Total: 0, Good: 3, CS1: 0, CS2: 0%, CS3: 100%, CS4: 0%

#### Bearings

- **311** Movable Bearing: 8 each, Total: 0, Good: 4, CS1: 4, CS2: 0%, CS3: 50%, CS4: 0%

- **313** Fixed Bearing: 8 each, Total: 0, Good: 4, CS1: 4, CS2: 0%, CS3: 50%, CS4: 0%

#### Substructure

- **210** Reinf Conc Pier Wall: 118 ft, Total: 114, Good: 4, CS1: 0, CS2: 97%, CS3: 3%, CS4: 0%
<table>
<thead>
<tr>
<th>Facility</th>
<th>Feature</th>
<th>Length / Width</th>
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<th>MDOT Structure ID</th>
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</tr>
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<tbody>
<tr>
<td>I-96 EB</td>
<td>Reinf Conc Abutment</td>
<td>85 ft</td>
<td>39%</td>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / GLOH</td>
<td>3 SC - Unstable</td>
<td>A Open, no restriction(A)</td>
<td>42.67 / -84.6459</td>
<td>23123151000B010</td>
<td>Fair Condition(5)</td>
</tr>
<tr>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>331 Conc Bridge Railing</td>
<td>800 ft</td>
<td>67%</td>
<td>University(6) / Eaton(23)</td>
<td>3 Steel / 02 Stringer/Girder</td>
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<td>23123151000B010</td>
<td>Fair Condition(5)</td>
</tr>
<tr>
<td></td>
<td>Reinf Conc Approach Slab</td>
<td>708 sq.ft</td>
<td>96%</td>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / GLOH</td>
<td>3 SC - Unstable</td>
<td>A Open, no restriction(A)</td>
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<td>23123151000B010</td>
<td>Fair Condition(5)</td>
</tr>
</tbody>
</table>

**Other Elements**

- **215**: Reinf Conc Abutment - 85 ft, 33 in, 11 ft, 41 in, 0 in
  - 39% 13% 48% 0%
- **321**: Reinf Conc Approach Slab - 708 sq.ft, 683 in, 24 in, 1 in, 0 in
  - 96% 3% 0% 0%
- **331**: Conc Bridge Railing - 800 ft, 536 in, 264 in, 0 in, 0 in
  - 67% 33% 0% 0%
### MICHIGAN DEPARTMENT OF TRANSPORTATION

**STR 2310**

<table>
<thead>
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<tbody>
<tr>
<td>2.1 MI W OF INGHAM CO LIN</td>
<td>1962 / / 1987 / 2001</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<table>
<thead>
<tr>
<th>Region / County</th>
<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>University(6) / Eaton(23)</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / GLOH</td>
<td>3 SC : Unstable</td>
</tr>
</tbody>
</table>

#### WORK RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Inspector Name</th>
<th>Agency / Company Name</th>
<th>Insp. Freq.</th>
<th>Insp. Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
<td>24</td>
<td>07/30/2015</td>
</tr>
</tbody>
</table>

#### RECOMMENDATIONS & ACTION ITEMS

<table>
<thead>
<tr>
<th>Recommendation Type</th>
<th>Priority</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Brush Cut</td>
<td>H</td>
<td>Cut and spray brush, cut enough for reachall clearance.</td>
</tr>
<tr>
<td>Joint Repair</td>
<td>H</td>
<td>Reseal joints.</td>
</tr>
<tr>
<td>Deck Patching</td>
<td>H</td>
<td>Concrete patch deck at joints</td>
</tr>
<tr>
<td>Zone Paint</td>
<td>H</td>
<td>Clean and spot paint bottom of vertical stiffeners along fascia girders.</td>
</tr>
<tr>
<td>Substr Repair</td>
<td>M</td>
<td>Patch west abutment.</td>
</tr>
<tr>
<td>Super Repl.</td>
<td>M</td>
<td>Replace super and widen.</td>
</tr>
<tr>
<td>Other</td>
<td>M</td>
<td>Scale north fascia over Billwood.</td>
</tr>
</tbody>
</table>

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INSPECTION PROCEDURES

1. Schedule with Reachall Unit and University Region Bridge Engineer. 2. Review previous inspection reports, plans, highlighted drawing of FC elements, and MiBRIDGE for any Request for Action reports. 3. Inspect structure from west to east using right lane closure and reachall. 4. Inspect the tension areas of the main girders, pin & hangers, and Type 1 gusset plate connections.

The eastbound on-ramp requires yield signing. Place the first sign, road work ahead, immediately after the adjacent bridge over the railroad.

SPAN CONFIGURATION

Bridge Type: Appr Span Type
Main Span: Appr Span
# of Main Spans: 0
# of Appr Span: 0
Lanes On: 0
Lanes Under: 0
47L-Left Horizontal Clear (ft): 47R-Right Horizontal Clear (ft)
54B-Left Underclearance (ft in): 54D-Right Underclearance (ft in)

NBIS RATINGS & COMMENTS (Latest Inspection Ratings Transferred from BSIR)

Stringer (SIA-59):
Paint (SIA-59A):

FRACTURE CRITICAL ELEMENTS

FC Element
Tension Areas of Main Girder

Element Location
Spans 1-3, Lower Flange
Inspection Comments
Fair - Crevice corrosion at base of vertical stiffeners along fascias with section loss on stiffeners and girder web at many locations, especially along the north fascia. Span 1W, N Fascia, near thickened flange has extra weld material. Span 2W, N Fascia has poor weld at thickend flange area. Span 2W, near E P&H, G2S, Vertical stiffener has heavy section loss near base. Span 1W Bay 1S, poor weld on diagonal cross framing. Span 1W, South Fascia, Lateral bracing connection 3W, poor weld to girder. N Fascia Girder, 2nd Vert Stiffener from E P&H, Poor Vertical weld to web. Span 2W, Girder 1S, Hole in first vertical stiffener north of P&H 1E.

FC Element
Pin and Hangers

Element Location
Span 2, Suspended Span
Inspection Comments
Fair - Chrome on many of the pins is flaking or completely missing. Surface rust with light scaling on pin ends. Link plates have minor areas of coating failure and corrosion. Measured each P&H and center to center is 39”. Moderate corrosion on web and flanges adjacent to the P&Hs, especially at exterior/fascia surfaces.

**FC Element**

Type 1 Gusset

- **Element Location**: Spans 1-3, Lateral Bracing connection to Vertical Stiffener
- **Inspection Comments**: Good - There are intersecting welds at the lateral bracing gusset plate connections to the web and vertical stiffener. These welds occur in the tension zones. There are also welded gusset plate connections to web for lateral bracing without the vertical stiffener (type 2W). These are located near the bottom flanges of the main girders. There are few poor welds some crack indications in welds were located in connection plates to cross frames.

**MISCELLANEOUS FIELD NOTES**

There are two small 4” x 4” steel plates welded to the top of the bottom flange at Span 1W, Girder 2S, located adjacent to the 11th vertical stiffener west of Pier 1W. This may have been used for a previous research project but should be monitored for cracking due to the location of the welds. Several areas scaled with rock pick hammer to address locations where failure was imminent.

(04/16)

Lateral Bracing - Fair Condition. Bolts tightened and some replaced throughout structure in 2013. Span 2N, Girder 1W, Hole in first vertical stiffener north of P&H 1S.  
(05/15)

Height Posting 13’6” for Billwood.

(04/14)

**Traffic Control**

- Y, Comments: Right lane closure, yield at on-ramp

**Special Equipment**

- 4 Reach All, Comments: Deploy from single side.

**Photographs**

**RECOMMENDATIONS AND ACTION ITEMS**

**Recommendation**

- **Clean and Paint**
  - **Priority**: H
  - **Comments**: Zone paint primary girders.

**Recommendation**

- **Non-Destr Testg**
  - **Priority**: M
  - **Comments**: Schedule UT during 2017.
Several areas scaled with rock pick hammer to address locations where failure was imminent. Additional scaling over the roadway and river will be necessary during subsequent years. The region bridge crew should provide assistance.
SCOUR CRITICAL BRIDGE ACTION PLAN

MICHIGAN DEPARTMENT OF TRANSPORTATION

Plan of Action Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Phone</th>
<th>Email</th>
<th>Last Modified Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
<td>517-719-5924</td>
<td><a href="mailto:devinneyj@michigan.gov">devinneyj@michigan.gov</a></td>
<td>11/26/2012</td>
</tr>
<tr>
<td>Marilyn Hansen</td>
<td>University Region</td>
<td>517-750-0423</td>
<td><a href="mailto:hansenm@michigan.gov">hansenm@michigan.gov</a></td>
<td>12/04/2008</td>
</tr>
<tr>
<td>Greg Perkowski</td>
<td>MDOT University Region</td>
<td>517-749-6887</td>
<td><a href="mailto:perkowskig@michigan.gov">perkowskig@michigan.gov</a></td>
<td></td>
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<tr>
<td>Terry Johnson</td>
<td>MDOT</td>
<td>517-750-0423</td>
<td><a href="mailto:johnsonte@michigan.gov">johnsonte@michigan.gov</a></td>
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</table>

Scour Vulnerability

<table>
<thead>
<tr>
<th>Item</th>
<th>Scour Criticality</th>
<th>Source of Item</th>
<th>Waterway Adequacy</th>
<th>Level I Assessment</th>
<th>Level II Analysis</th>
<th>Executive Summary Scour Evaluation</th>
<th>Last Modified Date</th>
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<tbody>
<tr>
<td>113</td>
<td>3</td>
<td></td>
<td>8</td>
<td>N</td>
<td>N</td>
<td>11/12/2010</td>
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</tbody>
</table>

Scour calculations were performed on the 100 and 500 year flood events. The total scour depth at Abutment A was 6.7 feet (EL 830.3) for the 100 year event and 11.3 feet (EL 825.7) for the 500 year. The total scour depth at Abutment B was 5.8 feet (EL 822.2) and 9.7 feet (EL 818.3) respectively. The total scour depth at Pier 1 was 18.7 feet (EL 805.7) and 19.6 feet (EL 804.6) respectively. The total scour depth at Pier 2 was 18.2 feet (EL 808.0) and 19.4 feet (EL 806.8) respectively.

The bottom of footing elevation is 845.35 at Abutment A, 824.0 at the piers, and 843.86 at Abutment B.

Based on 1995 Scour Analysis.

Calculated Values

<table>
<thead>
<tr>
<th>Scour Analysis Event Frequency</th>
<th>25 year</th>
<th>50 year</th>
<th>100 year</th>
<th>500 year</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Anticipated Surface Elevation (ft)</td>
<td>841.25</td>
<td>842.2</td>
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<tr>
<td>Distance Below Bottom chord (ft)</td>
<td>12.15</td>
<td>11.2</td>
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<tr>
<td>Anticipated Flow (cubic ft/sec)</td>
<td>8710.0</td>
<td>10000.0</td>
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<tr>
<td>Anticipated Pressure Flow (Y/N)</td>
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Substructure Information

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<tr>
<th>Foundation</th>
<th>Normally in Water</th>
<th>Normal Water Depth (ft)</th>
<th>In Water (100 yr)</th>
<th>Footing Type</th>
<th>Depth Known</th>
<th>Soil Type</th>
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<tbody>
<tr>
<td>Abutment A</td>
<td>N</td>
<td>N/A</td>
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<td>Non Cohesive</td>
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<tr>
<td>Abutment B</td>
<td>N</td>
<td>N/A</td>
<td></td>
<td>Non Cohesive</td>
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<tr>
<td>Pier 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Pier 2</td>
<td></td>
<td></td>
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Countermeasure Recommendations

O Only Monitoring Required
O Structural/Hydraulic Countermeasures Considered

Countermeasure Comments

Monitoring Program

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### Recommended Monitoring Requirements

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency/Amount</th>
<th>Comments</th>
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<tr>
<td>O Regular Inspection</td>
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<tr>
<td>O Other Special Inspection</td>
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<tr>
<td>O Underwater Inspection</td>
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<tr>
<td>O Stream Bed Cross Sections</td>
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<tr>
<td>O Monitoring Devices (Fixed, Sonar, etc.)</td>
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<tr>
<td>O Flood Monitoring - Initiate monitoring when any of the following occur</td>
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<tr>
<td>O NOAA Flood Warning (This includes both Flash Flood and Flood Warnings)</td>
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<tr>
<td>O Flow Information</td>
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<td>O Discharge</td>
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<td>O Rainfall</td>
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<td>O WS Elevation</td>
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<td>Measured from</td>
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<td>O Pressure Flow</td>
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<tr>
<td>O Debris Accumulation</td>
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### Items to Watch During Monitoring

#### Foundation

<table>
<thead>
<tr>
<th>Item</th>
<th>Items to Watch</th>
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<tbody>
<tr>
<td>Abutment A</td>
<td></td>
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<tr>
<td>Abutment B</td>
<td></td>
</tr>
<tr>
<td>Pier 1</td>
<td></td>
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<tr>
<td>Pier 2</td>
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### Inspection Summary

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<tr>
<th>Type</th>
<th>Latest Date Completed</th>
<th>Current Frequency</th>
<th>Inspector</th>
<th>Agency</th>
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<tr>
<td>Routine</td>
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<td>24</td>
<td>DEVINNEYJ</td>
<td>MDOT University Region</td>
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<tr>
<td>Underwater Cross Section</td>
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<td>Scour Inspection</td>
<td>07/24/2003</td>
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<td>Marilyn Hansen</td>
<td>University Region</td>
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<tr>
<td>High Flow Monitoring</td>
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</table>

### BRIDGE CLOSURE

#### Conditions To Consider Bridge Closure

- O Water Surface Elevation
- O Overtopping of Road or Structure
- O Pressure Flow
- X High Debris Accumulation
- X Observed Structure Movement/Settlement
- O Loss of Scour Countermeasures

### Contacts Responsible for BRIDGE CLOSURE
## DETOUR ROUTE

**Possible Detour Route**


### Bridges/Culverts on Detour Route

<table>
<thead>
<tr>
<th>Detour Bridge Numbers</th>
<th>Feature Intersected</th>
<th>Load Limitations</th>
<th>Scour Rating</th>
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<tbody>
<tr>
<td>2305</td>
<td>GRAND RIVER</td>
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<td>2304</td>
<td>GRAND RIVER</td>
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</table>

### SCOUR INSPECTIONS

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<thead>
<tr>
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<th>Freq</th>
<th>Inspector</th>
<th>Agency</th>
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<tbody>
<tr>
<td>07/24/2003</td>
<td>SCOUR</td>
<td>24</td>
<td>Marilyn Hansen</td>
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<td></td>
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<tr>
<td>07/30/2015</td>
<td>ROUTINE</td>
<td>24</td>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

**Recommendations**

- Brush Cut: High
- Joint Repair: High
- Deck Patching: High
- Zone Paint: High
- Substr Repair: Medium
- Super Repl: Medium

**Scour Evaluation**

- pier 2: top of footing exposed on East side. after the 2003 inspection report, no scour or exposed footings have been reported.

### HIGH FLOW EVENTS

No Recorded High Flow Events
Rating Considers Field Condition of Members: No
Deterioration:

Most Recent Year Construct / Reconstruct / Overlay: 1962

History of work that impacts Load rating:
1969 railing replacement; 1981 LMC overlay, 1986 P&H replacement; 2001 railing replacement, deep overlay

Superstructure Component: 3 Steel
Beam fy: 32.0 ksi
Beam f/c / fb: ksi
Composite: Yes
Number of Beams: 4
Shop Drawings Verified: Yes

Size of Beams/Beam #’s and spans: 90” Plate Girders span 1-3 (126.0’ - 142.0’ - 126.0’)

Deck: Thickness (in.): 11.0
Fy / fc*: 40.0 / 3.0 ksi
Deck Design Load > H15: Yes

Wearing Surface: Mat’l: Conc Ovrl
Thickness (in.): 1.2
Unit Weight (pcf.): 150.0

Barrier: Type / Weight (plf.):
T 4 Det1 / 494.0
T 4 Det1 / 494.0

Sidewalk: Width / Thick (in.):
/
/
/

Clear Roadway (ft.): 32.5

Additional Loads:
Web stiff verts: 2ea x7”x7.5”x0.38”x490pcf/4.0’=34plf;
Web stiff long: 4”x0.38”x490pcf=5plf; lateral brace: 17”x2x14.5pcf/23.3’=21plf; from steel shops: CF1: 880lbs; CF2: 500lbs; CF3: 820plf; CF4, CF5: 1100lbs

Unique Factors That Affect Capacity:
LLDF for interior girders calculated using 1994 AASHTO Guide specifications
Orig deck + flange = 9.2”, Average overlay = 3”, min add’l overlay = 1.875”; Use 11” deck with 1.2” overlay.

Analyzed By: Cliff Elling
Date: 06/12/2012
## Facility Information

**Facility**
- I-96 EB
- GRAND RIV & BILLWOOD HWY

**Location**
- 2.1 Mi W OF INGHAM CO LIN
- Built / Recon. / Paint / Ovly.

**Material / Design**
- University(6) / Eaton(23)
- 3 Steel / 02 Stringer/Girder

### Version or Other
- Virtis 6.3.1 AASHTO engine; LFD Pin and Hanger Check version 2.4

### Rating Considers Field Condition of Members
- No

### Controlling component and failure mode
- Span 1 at support, Typ Int, Design Shear Steel

## Inventory Coding

<table>
<thead>
<tr>
<th>NBI Item 63- Operating Rating Method</th>
<th>6 LFR in Rating Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBI Item 64F- Federal Operating Rating</td>
<td>2.14</td>
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<tr>
<td>MDOT Item 64MA- Michigan Operating Method</td>
<td>6 LFR in Rating Factor</td>
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<td>MDOT Item 64MB- Michigan Operating Rating</td>
<td>1.12</td>
</tr>
<tr>
<td>MDOT Item 64MC- Michigan Operating Truck</td>
<td>18</td>
</tr>
<tr>
<td>NBI Item 65- Inventory Rating Method</td>
<td>6 LFR in Rating Factor</td>
</tr>
<tr>
<td>NBI Item 66- Federal Inventory Rating</td>
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<tr>
<td>NBI Item 41- Structure Open Posted Closed</td>
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<tr>
<td>NBI Item 70- Bridge Posting</td>
<td>5 5 - 100% or more</td>
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<tr>
<td>NBI Item 141- Posted Loading</td>
<td></td>
</tr>
<tr>
<td>MDOT Item 193A- Michigan Overload Class</td>
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</tr>
<tr>
<td>MDOT Item 193C- Overload Status</td>
<td>R-Gage Restricted to 8-ft</td>
</tr>
</tbody>
</table>

## Analysis Details

**Assigned Tier:** No Tier Assigned

**Verified No Tier:** No

**The above structure was analyzed using:**

**Version or Other:**

**Rating Considers Field Condition of Members:**

**Controlling component and failure mode:**

**Span 1 at support, Typ Int, Design Shear Steel**

**Analyzed By:** Cliff Elling
**Date:** 06/12/2012

**Checked By:** Scott Buchholz
**Date:** 07/03/2012
<table>
<thead>
<tr>
<th>Facility</th>
<th>Latitude / Longitude</th>
<th>MDOT Structure ID</th>
<th>Structure Condition</th>
</tr>
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<td>I-96 EB</td>
<td>42.67 / -84.6459</td>
<td>23123151000B010</td>
<td>Fair Condition(5)</td>
</tr>
<tr>
<td>Feature</td>
<td>Length / Width</td>
<td>Owner</td>
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<tr>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>399.93 / 35.76</td>
<td>Region: University(6)</td>
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<tr>
<td>Location</td>
<td>Built / Recon. / Paint / Ovly.</td>
<td>TSC</td>
<td>Operational Status</td>
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<td>2.1 MI W OF INGHAM CO LIN</td>
<td>1962 / / 1987 / 2001</td>
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<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / GLOH</td>
<td>3 SC - Unstable</td>
</tr>
</tbody>
</table>

No inspections available for bridge key 23123151000B010
General Notes:

- Posted clearance 13' 6".

### Deck

#### 1. Surface (SIA-58A)
- 13' 6" concrete overlay with open diagonal and transverse cracks. Areas of delam and spalls around the drain openings. (07/15)
- Concrete overlay with open random, diagonal, and transverse cracks throughout. Some cracks are sealed with epoxy. Areas of delam and spalling around the drain openings. (07/13)
- Concrete overlay. Open map, diagonal, transverse cracks throughout. Few are sealed with epoxy. (07/11)

#### 2. Expansion Joints
- Strip seal joint with small STS and cracks adjacent - anchorage is exposed outside lane. (07/15)
- Strip seal joints with small STS and cracking in the surrounding concrete, these areas are near the joint anchorage. (07/13)
- Strip seal with a few tight cracks and shallow STS adjacent. (07/11)

#### 3. Other Joints
- Pourable end joints with loss of adhesion, missing seal, spalls and leaking. Pourable construction joint near pier 2W with cracks and small spalls adjacent. (07/15)
- Pourable end joints with loss of adhesion, missing filler and leaking. Spalling in both joints. (07/13)
- Pourable end joint at west reference line, seal sinking, loss of adhesion, small spalls and leaking. East reference line has open cracks, spalls and raveling. (07/11)

#### 4. Railings
- Vertical, leaching cracks. Areas of shallow scaling. Light traffic impact marks. Concrete surface coat is faded and peeling. (07/15)
- Vertical, leaching cracks spaced 3 to 4 feet apart. Areas of shallow scaling. Concrete surface coat is peeling. Both barriers have light traffic impact marks. (07/13)
- Vertical, leaching cracks spaced 3 to 4 feet apart. Areas of shallow scaling. Concrete surface coat is peeling. (07/11)

#### 5. Sidewalks or Curbs
- (07/15)
- (07/13)
- (07/11)

#### 6. Deck Bottom Surface (SIA-58B)
- Leaching transverse, diagonal, and map cracks. Several full depth patches. Small areas of delam in most spans. Span 2W bay 3S has 24 sft STS. (07/15)
- Leaching transverse, diagonal, map and random cracks. Several full depth patches. Small areas of delam in most spans. Span 2W bay 3S has 24 sft STS. (07/13)
- Leaching transverse, diagonal, map and random cracks. Several full depth patches. Small areas of delam in most spans. Span 2W bay 3S has 24 sft STS. (07/11)
7. Deck
(SIA-58)

Top surface: Concrete overlay with open diagonal and transverse cracks. Areas of delam and spalls around the drain openings. Bottom surface: Leaching transverse, diagonal, and map cracks. Several full depth patches. Small areas of delam in most spans. Span 2w bay 3s has 24 sft STS. Span 1w bay 3s has 3sft STS. Fascias: Leaching cracks, few areas of delam and spalls. (07/15)

Surface: Concrete overlay with open random, diagonal and transverse cracks throughout. Some cracks are sealed with epoxy. Areas of delam and spalling around the drain openings. Bottom: Leaching transverse, diagonal, map and random cracks. Several full depth patches. Small areas of delam in most spans. Span 2w bay 3s 24sft STS. Span 1w bay 3s has 3sft STS. (07/13)

Leaching vertical and random cracks in fascias. Surface: Concrete overlay. Open map, diagonal, transverse cracks throughout, few are sealed with epoxy. Bottom: Leaching transverse, diagonal, map and random cracks. Several full depth patches. Small areas of delam in most spans. Span 2w bay 3s 24sft STS. Span 1w bay 3s has 3sft STS. (07/11)

8. Drainage

Deck drains with extensions. Several drains have delam and spalls around the openings. 2 drains have missing top grates due to spalled concrete. Some drains are plugged with vegetation growth. (07/15)

Deck drains with extensions. Several drains have delam and spalling around the openings. 2 drains have missing top grates due to spalling concrete. (07/13)

Surface drains at both rails with extensions. (07/11)

SUPERSTRUCTURE

9. Stringer
(SIA-59)

Steel I beams with cross braces. Light rust throughout. Moderate to heavy rust at P&Hs. Few loose diaphragm bolts were replaced or tightened. Beam end contact: span 2w beam 2s at west set of P&H. Minor LOS on a few beam ends and fascia beams at bottom of vertical stiffeners. (07/15)

Steel I beams with cross braces. Light rust throughout. Moderate to heavy rust at P&Hs. Few loose diaphragm connection bolts with rust streaking: span 3W, bay 2S and span 1W bay 3S. Beam end contact: span 2W beam 2S at west set of P&H. Less than 10% LOS on a few beam ends and bottom of fascia beams at vertical stiffeners. (07/13)

Steel I beams with cross braces. Light rust throughout. Moderate to heavy rust at P&Hs. Few loose diaphragm connection bolts: span 3W, bay 2S and span 1W bay 3S. Beam end contact: span 2W beam 2S at west set of P&H. Less than 10% on a few beam ends and bottom of fascia beams at vertical stiffeners. (07/11)

10. Paint
(SIA-59A)

Light freckled rust, peeling paint and chalking with loss of pigment. Moderate to heavy rust at P&Hs and base of vertical stiffeners. (07/15)

Light freckled rust, peeling paint and chalking throughout. Moderate to heavy rust at P&Hs and base of vertical stiffeners. (07/13)

Light freckled rust, peeling paint and chalking throughout. Moderate to heavy rust at P&Hs and base of vertical stiffeners. (07/11)

11. Section Loss

Minor LOS on a few beam ends and fascia beams at bottom of vertical stiffeners. (07/15)

Less than 10% on a few beam ends and bottom of fascia beams at vertical stiffeners. (07/13)

Less than 10% on a few beam ends and bottom of fascia beams at vertical stiffeners. (07/11)

12. Bearings

Heavy rust and minor LOS on east abutment bearings. Light to moderate rust on other bearings. (07/15)

Heavy rust on east abutment bearings. Light to moderate rust on other bearings. West abutment repaired at bearings. (07/13)

Heavy rust on east abutment bearings. Light to moderate rust on other bearings. West abutment repaired at bearings. (07/11)

SUBSTRUCTURE

07/11 07/13 07/15
13. Abutments (SIA-60)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
<th>Region / County</th>
<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
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<tbody>
<tr>
<td>West</td>
<td>42.6707 / -84.6449</td>
<td>2.1 MI W OF INGHAM CO LIN</td>
<td>University(6)</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / MSF5</td>
<td>Stable w/in footing</td>
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<tr>
<td>East</td>
<td>302.82 / 35.76</td>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>Eaton(23)</td>
<td></td>
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</table>

Vertical cracks. West has repaired areas under all bearings -repair under beam 4s is cracked & delaminated behind anchor bolt. East abutment: 5sft area of rusty delam bay 2s; leaching map cracks and delam near bearing 1s, 1sft spall in top at bearing 1s - not undermined. Leaching vertical cracks in backwalls. Fill leaching through backwall to abutment joints. (07/15)

Vertical cracks. West has repaired areas under all bearings. West abutment repair under beam 4s is cracking back towards the anchor bolts. East abutment: 4sft area of rusty delam between bearings 2&3S; leaching map cracks and delam near bearing 1S, 1sft spall in top of east abutment at bearing 1s- not undermined. Leaching vertical cracks in backwalls. (07/13)

Vertical cracks. West has repaired areas. East abutment: 4sft area of rusty delam between bearings 2&3S; leaching map cracks near bearing 1S. 1sft spall in top of east abutment at bearing 1s- not undermined. Leaching vertical cracks in backwalls. (07/11)

14. Piers (SIA-60)

<table>
<thead>
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<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
<th>Region / County</th>
<th>Material / Design</th>
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<td>Eaton(23)</td>
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</table>

Few leaching, vertical cracks. Pier 1w has a 6 sft STS and delam near top, south of bearing 1s on extended portion of pier. (07/15)

Few leaching, vertical cracks in both piers. Pier 1w has a 6 sft area of shallow spalling and delam near top (on extended portion of pier, away from bearings). (07/13)

Few leaching, vertical cracks in both piers. Pier 1w has a 6 sft area of shallow spalling and delam near top (on extended portion of pier, away from bearings). Logs and minor debris at pier 2w. (07/11)

15. Slope Protection

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
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<th>Material / Design</th>
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</tbody>
</table>

West slope has concrete pads and minor vegetation. East slope has recycled concrete with exposed areas. (07/15)

West slope has concrete pads. East slope has recycled concrete pieces with large areas of ground exposed. (07/13)

West slope has concrete pads. East slope has recycled concrete pieces with large areas of ground exposed. (07/11)

16. Channel (SIA-61)

<table>
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<th>Region / County</th>
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</table>

Banks well vegetated. (07/15)

Banks well vegetated. Water around the piers 4 - 7 feet deep (07/13)

Banks well vegetated. Logs and minor debris at pier 2w. (07/11)

17. Scour Inspection

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
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Minor scour at piers. (07/15)

(07/13)

(07/11)

APPROACH

07/11 07/13 07/15

18. Approach Pavement

<table>
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<tr>
<th>Feature</th>
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<th>Region / County</th>
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<td>Eaton(23)</td>
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</table>

West: concrete with a few open transverse cracks, settled <3/4". East: bit with open cracks, raveling and spalls at reference line. (07/15)

West: Concrete with a few open transverse cracks, west is low 1/2 to 3/4 on an inch. East: Bit with open cracks, raveling and 4sft spall at reference line. (07/13)

West: Concrete with a few open transverse cracks. East: Bit with open cracks, raveling and 2sft spall at reference line. (07/11)

19. Approach Shoulders Sidewalks

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<th>Region / County</th>
<th>Material / Design</th>
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<td></td>
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</tbody>
</table>

West: concrete with few tight cracks; spalls and minor settlement in NW quad. East: bit with concrete curb and gutter. (07/15)

West - Concrete with few tight cracks and 1sft spall in NW quad. East - Bit with concrete curb and gutter. (07/13)

West - Concrete with few tight cracks and 1sft spall in NW quad. East - Bit with concrete curb and gutter. (07/11)

20. Approach Slopes

<table>
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<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
<th>Region / County</th>
<th>Material / Design</th>
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<td>Eaton(23)</td>
<td></td>
<td></td>
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</table>

Trees, brush and weeds. (07/15)

Trees, brush and weeds. (07/13)

Weeds and brush. (07/11)

21. Utilities

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Location</th>
<th>Region / County</th>
<th>Material / Design</th>
<th>Last NBI Inspection</th>
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<td>Eaton(23)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Under ground gas and fiber optics markers at base of west slope protection. Powerlines over span 1w. (07/15)

Under ground gas and fiber optics markers at base of west slope protection. Powerlines over span 1w. (07/13)

Under ground gas and fiber optics markers at base of west slope protection. Powerlines over span 1w. (07/11)

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MICHIGAN DEPARTMENT OF TRANSPORTATION

STR 2311 BRIDGE SAFETY INSPECTION REPORT B02-23151

<table>
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<th>Facility</th>
<th>Latitude / Longitude</th>
<th>MDOT Structure ID</th>
<th>Structure Condition</th>
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<td>302.82 / 35.76</td>
<td>Owner</td>
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<td>TSC</td>
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<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<tr>
<td>Region / County</td>
<td>Material / Design</td>
<td>Last NBI Inspection</td>
<td>Scour Evaluation</td>
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<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / MSF5</td>
<td>5 Stable w/in footing</td>
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22. Drainage
Culverts
Downspouts in east quads. (07/15)
(07/13)
Downspouts in the east quads. (07/11)

MISCELLANEOUS

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<th>Item</th>
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<th>Rating</th>
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<td>71. Water Adequacy</td>
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<tr>
<td>36B. Transitions</td>
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<td>72. Approach Alignment</td>
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<tr>
<td>36C. Approach Guardrail</td>
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<td>Temporary Support</td>
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<td>36D. Approach Guardrail Ends</td>
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<td>High Load Hit (M)</td>
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<td>Special Insp. Equipment</td>
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<td>Underwater Insp. Method</td>
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False Decking (Timber) Removed to Complete Inspection
N/A - No False Decking

Critical Feature Inspections (SIA-92)

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<td>92B. Underwater</td>
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<td>92C. Other Special</td>
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<td>202 - Year Painted</td>
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## Inspection Data

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<td>58 - Deck Rating</td>
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<td>58A/B - Deck Surface/Bottom</td>
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## Route Carried By Structure

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<td>102 - Traffic Direct</td>
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<td>109 - Truck %</td>
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<tr>
<td>110 - Truck Network</td>
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</tr>
<tr>
<td>114 - Future ADT</td>
<td>24047</td>
</tr>
<tr>
<td>115 - Year Future ADT Freeway</td>
<td>2018</td>
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## Route Under Structure

<table>
<thead>
<tr>
<th>Route Under Structure (UNDER RECORD)</th>
<th>Value</th>
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<tbody>
<tr>
<td>2A - Lanes Under</td>
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<tr>
<td>29 - ADT</td>
<td>500</td>
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<tr>
<td>30 - Year of ADT</td>
<td>1991</td>
</tr>
<tr>
<td>42B - Service Type Under</td>
<td>6</td>
</tr>
<tr>
<td>47L - Left Horizontal Clear</td>
<td>50.71</td>
</tr>
<tr>
<td>47R - Right Horizontal Clear</td>
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<tr>
<td>54A - Left Feature</td>
<td>H</td>
</tr>
<tr>
<td>54B - Left Underclearance</td>
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</tr>
<tr>
<td>54D - Right Feature</td>
<td>H</td>
</tr>
<tr>
<td>54D - Right Clearance</td>
<td>14/6</td>
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<tr>
<td>109 - Truck %</td>
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<tr>
<td>110 - Truck Network</td>
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<tr>
<td>114 - Future ADT</td>
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## Proposed Improvements

<table>
<thead>
<tr>
<th>Proposed Improvements</th>
<th>Value</th>
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<tbody>
<tr>
<td>75 - Type of Work</td>
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</tr>
<tr>
<td>76 - Length of Improvement</td>
<td>94</td>
</tr>
<tr>
<td>94 - Bridge Cost</td>
<td></td>
</tr>
<tr>
<td>95 - Roadway Cost</td>
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</tr>
<tr>
<td>96 - Total Cost</td>
<td></td>
</tr>
<tr>
<td>97 - Year of Cost Estimate</td>
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## Load Rating and Posting

<table>
<thead>
<tr>
<th>Load Rating and Posting</th>
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<tbody>
<tr>
<td>31 - Design Load</td>
<td>6</td>
</tr>
<tr>
<td>41 - Open, Posted, Closed</td>
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</tr>
<tr>
<td>63 - Fed Opc Gry Method</td>
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<tr>
<td>64F - Fed Oper Trg Load</td>
<td>78.04</td>
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<tr>
<td>64A - Mich Oper Trg Method</td>
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<td>64MB - Mich Oper Trg Method</td>
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<td>65 - Inv Rtg Method</td>
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<td>66 - Inventory Load</td>
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<tr>
<td>70 - Posting</td>
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<tr>
<td>141 - Posted Loading</td>
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<tr>
<td>193 - Overload Class</td>
<td>A</td>
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</table>
# MICHIGAN DEPARTMENT OF TRANSPORTATION

## SAFETY INSPECTION REPORT - AASHTO ELEMENTS

<table>
<thead>
<tr>
<th>STR 2311</th>
<th>Facility</th>
<th>Latitude / Longitude</th>
<th>MDOT Structure ID</th>
<th>Structure Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I-96 WB</td>
<td>42.6707 / -84.6449</td>
<td>23123151000B020</td>
<td>Fair Condition(5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Owner</th>
<th>Region: University(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>302.82 / 35.76</td>
<td></td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Built / Recon. / Paint / Ovly.</th>
<th>TSC</th>
<th>Operational Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 MI W OF INGHAM CO LIN</td>
<td>1962 / / 1987 / 2001</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region / County</th>
<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>University(6) / Eaton(23)</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / MSF5</td>
<td>5 Stable w/in footing</td>
</tr>
</tbody>
</table>

## NBI INSPECTION

<table>
<thead>
<tr>
<th>Inspector Name</th>
<th>Agency / Company Name</th>
<th>Insp. Freq.</th>
<th>Insp. Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
<td>24</td>
<td>07/30/2015</td>
</tr>
</tbody>
</table>

## AASHTO ELEMENTS

### (English Units)

<table>
<thead>
<tr>
<th>AASHTO ELEMENTS</th>
<th>Element Number</th>
<th>Element Name</th>
<th>Total Quantity</th>
<th>Unit</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Severe</th>
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<tbody>
<tr>
<td><strong>Element Name</strong></td>
<td><strong>CS1</strong></td>
<td><strong>CS2</strong></td>
<td><strong>CS3</strong></td>
<td><strong>CS4</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Decks/Slabs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>800 Conc Deck - Black Bars</td>
<td>10828</td>
<td>sq.ft</td>
<td>2133</td>
<td>8660</td>
<td>35</td>
<td>0</td>
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<tr>
<td>810 Conc Deck - Top Surface</td>
<td>10828</td>
<td>sq.ft</td>
<td>2156</td>
<td>8660</td>
<td>12</td>
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<tr>
<td>811 Conc Deck - Btm Surface</td>
<td>10828</td>
<td>sq.ft</td>
<td>2145</td>
<td>8660</td>
<td>23</td>
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<td>812 Reinf Conc Fascia</td>
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<td>ft</td>
<td>0</td>
<td>602</td>
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<td>0</td>
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<td><strong>Joints</strong></td>
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<td>300 Strip Seal Exp Joint</td>
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<td>301 Pourable Joint Seal</td>
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<td>ft</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>66</td>
<td></td>
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<td><strong>Superstructure</strong></td>
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<tr>
<td>107 Steel Girder / Beam</td>
<td>1208</td>
<td>ft</td>
<td>1058</td>
<td>0</td>
<td>150</td>
<td>0</td>
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<td>515 Steel Protective Coating</td>
<td>23150</td>
<td>sq.ft</td>
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<td>0</td>
<td>23150</td>
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<td>825 Steel Diaphragm/Cross Frame</td>
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<td>3</td>
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<td>826 Beam End Deterioration</td>
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<td><strong>Bearings</strong></td>
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<td>311 Movable Bearing</td>
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<td>313 Fixed Bearing</td>
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<td>8</td>
<td>0</td>
<td>0</td>
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</table>

Loose bolts: span 2w bay 2s pier 2w, span 1w bay 3s, span 3w bay 1s.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Length / Width</th>
<th>Owner</th>
<th>Location</th>
<th>Built / Recon. / Paint / Ovly.</th>
<th>TSC</th>
<th>Operational Status</th>
<th>Region / County</th>
<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
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<tbody>
<tr>
<td>210</td>
<td>104 ft</td>
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<td>I-96 WB</td>
<td>2016</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
<td>University(6)</td>
<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / MSF5</td>
<td>5 Stable w/in footing</td>
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<tr>
<td>215</td>
<td>72 ft</td>
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<td>GRAND RIV &amp; BILLWOOD HWY</td>
<td>1962 / / 1987 / 2001</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
<td>Eaton(23)</td>
<td>3 Steel / 02 Stringer/Girder</td>
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<td>5 Stable w/in footing</td>
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<tr>
<td>321</td>
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<td>2.1 MI W OF INGHAM CO LIN</td>
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<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<td>5 Stable w/in footing</td>
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<tr>
<td>331</td>
<td>606 ft</td>
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<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<td>5 Stable w/in footing</td>
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<tr>
<td>Facility</td>
<td>Latitude / Longitude</td>
<td>MDOT Structure ID</td>
<td>Structure Condition</td>
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<tr>
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<tr>
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<td></td>
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<thead>
<tr>
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<th>Length / Width</th>
<th>Owner</th>
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<tr>
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<td>302.82 / 35.76</td>
<td>Region: University(6)</td>
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</table>

<table>
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<th>TSC</th>
<th>Operational Status</th>
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<tbody>
<tr>
<td>2.1 MI W OF INGHAM CO LIN</td>
<td>1962 / / 1987 / 2001</td>
<td>Lansing(17)</td>
<td>A Open, no restriction(A)</td>
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<tr>
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<th>Material / Design</th>
<th>Last NBI Inspection</th>
<th>Scour Evaluation</th>
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<tbody>
<tr>
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<td>3 Steel / 02 Stringer/Girder</td>
<td>07/30/2015 / MSF5</td>
<td>5 Stable w/in footing</td>
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**WORK RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>Inspector Name</th>
<th>Agency / Company Name</th>
<th>Insp. Freq.</th>
<th>Insp. Date</th>
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</thead>
<tbody>
<tr>
<td>Janiene DeVinney</td>
<td>MDOT University Region</td>
<td>24</td>
<td>07/30/2015</td>
</tr>
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</table>

**RECOMMENDATIONS & ACTION ITEMS**

<table>
<thead>
<tr>
<th>Recommendation Type</th>
<th>Priority</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Brush Cut</td>
<td>H</td>
<td>Cut and spray brush for reachall clearance.</td>
</tr>
<tr>
<td>Joint Repair</td>
<td>H</td>
<td>Seal both end joints and saw cut.</td>
</tr>
<tr>
<td>Deck Patching</td>
<td>H</td>
<td>Patch spalls at strip seal, construction joint and deck drains.</td>
</tr>
<tr>
<td>Zone Paint</td>
<td>M</td>
<td>Beam ends and bottom flange/vertical stiffener connections.</td>
</tr>
<tr>
<td>Substr Repair</td>
<td>H</td>
<td>Patch west abutment bearing 4s - temp support required. Patch east abutment beam 1s and bay 3s.</td>
</tr>
<tr>
<td>Super Repl.</td>
<td>M</td>
<td>Super replace and widen.</td>
</tr>
<tr>
<td>Other</td>
<td>H</td>
<td>Scale north fascia over Billwood.</td>
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</tbody>
</table>
## FRACTURE CRITICAL SPECIAL INSPECTION

<table>
<thead>
<tr>
<th>Inspector Name</th>
<th>Agency / Company Name</th>
<th>Insp. Freq.</th>
<th>Insp. Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Bouvy</td>
<td>Bridge Field Services</td>
<td>15</td>
<td>04/19/2016</td>
</tr>
</tbody>
</table>

### INSPECTION PROCEDURES

1. Schedule with Reachall Unit and University Region Bridge Engineer. 2. Review previous inspection reports, plans, highlighted drawing of FC elements, and MiBRIDGE for any Request for Action reports. 3. Inspect structure from west to east using right lane closure and reachall. 4. Inspect the tension areas of the main girders, pin & hangers, and Type 1 gusset plate connections.

### SPAN CONFIGURATION

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Appr Span Type</th>
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</thead>
<tbody>
<tr>
<td>Main Span</td>
<td>Appr Span</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># of Main Spans</th>
<th># of Appr Span</th>
<th>Lanes On</th>
<th>Lanes Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>47L-Left Horizontal Clear (ft)</th>
<th>47R-Right Horizontal Clear (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft. in.</td>
<td>ft. in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>54B-Left Underclearance (ft in)</th>
<th>54D-Right Underclearance (ft in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft. in.</td>
<td>ft. in.</td>
</tr>
</tbody>
</table>

### NBIS RATINGS & COMMENTS (Latest Inspection Ratings Transferred from BSIR)

- **Stringer (SIA-59):**
- **Paint (SIA-59A):**

### FRACTURE CRITICAL ELEMENTS

#### FC Element

- Tension Areas of Main Girder
  - **Element Location:** Spans 1-3, Lower Flange
  - **Inspection Comments:** Fair - Crevice corrosion at base of vertical stiffeners along fascias with section loss on stiffeners and girder web at many locations, especially along the north fascia. Girder ends in contact at P&H 1W, Girder 2S. This gap is not the same as the other girders. Span 3W, Girder 1S, 9th vertical stiffener from east abutment, 3" x 2" hole in stiffener. Span 2W, Girder 1S, 2nd vertical stiffener east of Pier 1W, 3/8" diameter hole in stiffener.

#### FC Element

- Pin and Hangers
  - **Element Location:** Span 2, Suspended SPan
  - **Inspection Comments:** Fair - Chrome on many of the pins is flaking or completely missing. Surface rust with light scaling on pin ends. Link plates have minor areas of coating failure and corrosion. Measured each P&H and center to center is 48". Moderate corrosion on web and flanges adjacent to the P&Hs, especially at exterior/fascia surfaces.
RFC Element
Type 1 Gusset
Element Location
Spans 1-3, Lateral bracing Connections
Inspection Comments
Good - There are intersecting welds at the lateral bracing gusset plate connections to the web and vertical stiffener. These welds occur in the tension zones. There are also welded gusset plate connections to web for lateral bracing without the vertical stiffener (type 2W). These are located near the bottom flanges of the main girders. There are few poor welds but no cracks were located. Some welds are cracked at gusset to crossframe.

MISCELLANEOUS FIELD NOTES
Missing and incorrect size bolts at bottom cross frame connection to Girder 2S over Pier 1W. Span 1W, Girder 2S, Interior Cross Frame connection has 6 loose bolts. Loud hammering noise present at Bay 2S near P&H 1W, there is a gap between the bottom deck surface above the end diaphragm. The expansion joint rail also sounds loose at this location. No change in west abutment condition described in 1/07/2016 Devinney RFA. (04/16)

Crossframe connection bolts in end spans were tightened and/or replaced. (05/15)
Height Posting 13’-6” for Billwood Crossframe connection bolts in end spans were tightened and/or replaced. (04/14)

Traffic Control Y Comments: Single Lane Closure
Special Equipment 4 Reach All Comments: Deploy from one side.
Photographs N

RECOMMENDATIONS AND ACTION ITEMS
Recommendation
Clean and Paint
Priority Comments
H Zone paint primary girders.

Recommendation
Steel Repairs
Priority Comments
L Repair vertical stiffeners.

Recommendation
Non-Destr Testg
Priority Comments
M UT pins during 2017.
OTHER SPECIAL INSPECTION

Inspector Name: Jeff Rehmann
Agency / Company Name: MDOT-University Region
Insp. Freq.: 6
Insp. Date: 07/25/2016

PROCEDURES
Inspect delaminated area through bearing 4s in west abutment.

SPAN CONFIGURATION

Bridge Type: Appr Span Type
Main Span: Appr Span
# of Main Span: 0
Lanes On: 0
47L-Left Horizontal Clear (ft): ft.
47R-Right Horizontal Clear (ft): ft.
54B-Left Underclearance (ft in): in.
54D-Right Underclearance (ft in): in.

ELEMENTS LOCATON
West abutment delamination at bearing 4s. (07/16)

INSPECTION COMMENTS
West abutment at bearing 4s: Crack and delam through bearing area, previously repaired. Abutment is accessible from Billwood Highway. (07/16)

Per RFA Committee recommendation, Other, Special inspection should be performed in 6 months to document any changes to the abutment deterioration. This report entered to "start the clock" for this inspection. (01/16)

Traffic Control: N
Comments:
Special Equipment: Comments:
Photographs: N

MICHIGAN DEPARTMENT OF TRANSPORTATION
STR 2311
OTHER SPECIAL INSPECTION REPORT [SIA #92-C]
B02-23151

Facility: I-96 WB
Latitude / Longitude: 42.6707 / -84.6449
MDOT Structure ID: 23123151000B020
Structure Condition: Fair Condition

Feature: GRAND RIV & BILLWOOD HWY
Length / Width: 302.82 / 35.76
Owner: Region: University

Location: 2.1 Mi W OF INGHAM CO LIN
TSC: Lansing(17)
Operational Status: A Open, no restriction

Region / County: Material / Design
Region: University / Eaton
Last NBI Inspection: 07/30/2015 / MSF5
Scour Evaluation: 5 Stable w/in footing

RECOMMENDATIONS AND ACTION ITEMS
<table>
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<td>5 Stable w/in footing</td>
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</table>

No plan available for bridge key 23123151000B020
### Rating Considers Field Condition of Members: No

#### Deterioration:

#### Most Recent Year Construct / Reconstruct / Overlay:

#### History of work that impacts Load rating:

### Superstructure Component:

<table>
<thead>
<tr>
<th>Beam fy: ksi</th>
<th>Beam f'c / fb: ksi</th>
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<tr>
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### Composite:

<table>
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### Number of Beams:

<table>
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### Shop Drawings Verified:

<table>
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### Size of Beams/Beam #’s and spans:

### Deck: Thickness (in.):

<table>
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### Deck Design Load > H15:

<table>
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### Wearing Surface: Mat'l:

<table>
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<th>Thickness (in.):</th>
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### Unit Weight (pcf.):

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<th>LEFT</th>
<th>CENTER</th>
<th>RIGHT</th>
</tr>
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### Barrier: Type / Weight (plf.):

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### Sidewalk: Width / Thick (in.):

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### Clear Roadway (ft.):

### Additional Loads:

### Unique Factors That Affect Capacity:

### Analyzed By: Date:
A full load rating summary is not available for bridge key 23123151000B020

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### NEW INVENTORY CODING

| NBI Item 63- Operating Rating Method | 1 LFR in US tons |
| NBI Item 64F- Federal Operating Rating | 78.043 / 64 |
| MDOT Item 64MB- Michigan Operating Rating | 90.0 |
| NBI Item 65- Inventory Rating Method | 1 LFR in US tons |
| NBI Item 66- Federal Inventory Rating | 45.966 / 38 |
| NBI Item 41- Structure Open Posted Closed | A A Open, no restriction |
| NBI Item 70- Bridge Posting | 5 5 - 100% or more |
| NBI Item 141- Posted Loading | |
| MDOT Item 193A- Michigan Overload Class | A |
| MDOT Item 193C- Overload Status | R-Gage Restricted to 8-ft |
REQUEST FOR ACTION

Submitted By
Janiene DeVinney
Agency / Company Name
MDOT University Region
RFA#
02311-01072016
RFA Date
01/07/2016

Problems/Comments
West abutment at bearing 4s: Crack and delam through bearing area, previously repaired. Abutment is accessible from Billwood Highway. Temporary support will be necessary for repairs. (Janiene DeVinney 01/07/2016)

IMMEDIATE ACTION
No immediate actions noted.

INTERMEDIATE ACTION

Request For
Temporary Supports
Contact/User
Christopher Idusuyi
Agency/Company Name
MDOT Bridge Field Services
Review Date
01/25/2016
Priority
3
Complete Date

No. of Locations
Engineering Costs ($)
Temp. Repair Costs ($)
Perm. Repair Costs ($)
Estimate Date

Comments
West abutment at bearing 4s: Crack and delam through bearing area, previously repaired. Abutment is accessible from Billwood Highway. Temporary support will be necessary for repairs. (Janiene DeVinney 01/07/2016)
At west abutment, under beam's bearing 4S there is a crack extending under the bearing plate, and the crack is about 1/16” wide and with pockets of delamination in the wall. At beam 1-S. there is a crack extending under the bearing plate, and the size crack is less .025”. PRJ is highly recommended. I will recommend that the Region inspect the west abutment within the next 6 months and if the delamination progress, temporary support(s) will be installed. (Christopher Idusuyi 01/26/2016)

Request For
PRJ Installation
Contact/User
Jason DeRuyver
Agency/Company Name
MDOT - Bridge Maintenance
Review Date
03/15/2016
Priority
3
Complete Date
05/04/2016

No. of Locations
Engineering Costs ($)
Temp. Repair Costs ($)
Perm. Repair Costs ($)
Estimate Date

Comments
Please evaluate PRJ installations at both WB and EB structures. (Andrew Bouvy 01/27/2016)
This will be discussed at the University Region Spring Meeting (Jason DeRuyver 03/15/2016)
I-96 WB PRJ installed on both approaches using Emseal BEJS. (Jason DeRuyver 05/18/2016)

FINAL ACTION COMPLETED

Comment
RFA Complete
No

RFA COMMITTEE

Review Required
Yes
Committee Review Date
01/27/2016
Estimated Repair Date

Comments
RFA Committee recommends PRJ installation and monitoring to be performed in 6 months. Other, Special inspection entered to start the clock. (Andrew Bouvy 01/27/2016)

SUPPORTING IMAGES

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Appendix I: Local Agency Input
Jake – see below. Can you please file with the other response?

**Please note my new Direct Dial number**

Mario J. Quagliata, PE
PROJECT MANAGER

Bergmann Associates
architects // engineers // planners
7050 W. Saginaw Highway // Suite 200
Lansing, Michigan 48917
mquagliata@bergmannpc.com // www.bergmannpc.com

From: Matt Hannahs [mailto:mhannahs@eatoncountyroad.com]
Sent: Friday, January 20, 2017 2:00 PM
To: Quagliata, Mario <mquagliata@bergmannpc.com>
Subject: RE: MDOT Bridge Notice

Mario,

I spoke with our foreman for this area. Other than maybe some tree clearing along Billwood within the MDOT right of way, we don’t have any particular needs at this location. Will we get a chance to review the preliminary plans?

Mathew Hannahs, P.E.
Assistant County Engineer
Eaton County Road Commission
1112 Reynolds Road
Charlotte, MI 48813
(517) 543-1630 Ext. 207

From: Quagliata, Mario [mailto:mquagliata@bergmannpc.com]
Sent: Thursday, January 12, 2017 10:24 AM
To: Matt Hannahs
Subject: RE: MDOT Bridge Notice

Hi Matt,

The bridges in Eaton County are EB & WB I-96 over the Grand River (see below). These bridges also span over Billwood Hwy on the north side of the river. The other bridges in this scoping package are in Ingham County, and are not near the county line.
We are in the process of inspecting the bridges now and don’t have work recommendations at this point. But, I would expect it would be some sort of bridge rehab or PM. We will also be evaluating 4R type work for comparison purposes in the bridge scoping report. So if we could document any needs the county has, that would help.

As a citizen of the county and nearby resident, I have to say great work on the recent projects along St. Joe. They have turned out great!

Thanks,
Mario
**Please note my new Direct Dial number**

Mario J. Quagliata, PE
PROJECT MANAGER
From: Matt Hannahs [mailto:mhannahs@eatoncountyroad.com]
Sent: Thursday, January 12, 2017 9:36 AM
To: Quagliata, Mario <mquagliata@bergmannpc.com>
Subject: MDOT Bridge Notice

Mario,

We received a letter related to MDOT bridge design requesting local needs at those location. I can’t find the second page showing which bridges are included in this request. Could you remind me which ones they are.

What is the scope of the bridge work? Are these full replacement, widening, rehab, PM? That will help us decide the type of request, if any, we would include.

Thank you.

Mathew Hannahs, P.E.
Assistant County Engineer
Eaton County Road Commission
1112 Reynolds Road
Charlotte, MI 48813
(517) 543-1630 Ext. 207
Appendix J: Site Review Procedures
The purpose of this visit is to locate areas of deterioration, determine feasible repair options, determine associated approach work, determine maintenance of traffic options, and to ascertain quantities. Areas that have been repaired or modified from original construction were also noted. The following describes the typical content and methods of inspection employed during the site review of I-96 EB & WB over Grand River.

1.0 Approaches
Approaches were inspected visually for general condition and typical photographs were taken. Structures, facilities, utilities and features adjacent to the bridge were noted and photographed. Signs of settlement at the interface with the bridge decks were investigated and recorded where present.

2.0 Deck
The top and bottom surfaces of the decks as well as all fascias were inspected. Concrete debris, if found around the bridge, was inspected for presence of slag aggregate. Evidence of Alkali Silica Reaction (ASR) was investigated in the deck and barrier concrete.

2.1 Top Surface
The top surface of the decks were inspected for delamination by chain drag sounding and cracks and spalls were identified visually. Areas of deterioration were delineated with spray chalk, measured, mapped and photographed. Measurements of the lane, shoulder, and barrier were made. Access to the decks was made possible through the use of lane closures with one lane maintained over the bridges at all times.

2.2 Bottom Surface
The bottom surface of the decks were inspected visually from the reach-all truck, shoulders, and abutment embankments. The decks were divided into spans, and occurrence of cracks, spalls, corrosion staining, dampness, or efflorescence was noted for each area. Representative photos of the underside of the decks for each span of the structures were taken. Cracking severity, areas of previous repairs, or where false decking is in place was noted on the field sketches.

2.3 Deck Fascia
The deck fascia were inspected visually from the reach-all truck and shoulders for cracks, spalls, and other deterioration.

2.4 Joints
Joints were inspected from the top and bottom side of the decks. General condition of the joints was noted, including debris accumulation, condition or absence of joint seal material, and leaking as evidenced by moisture staining and accumulation of debris below the joint. Photos were taken looking down each joint line. This inspection was done in coordination with the deck sounding traffic control operations.

2.5 Barrier
The condition of the barrier was inspected visually and soundings were complete with the use of a chipping hammer. Delamination and spalls were marked with...
the use of spray chalk while typical vertical cracking and abrasions were noted through visual inspection. Typical deterioration was noted and photographed. The barriers were also measured for height and width as well as evaluated against current standards. This inspection was done in coordination with the deck sounding traffic control operations.

3.0 Superstructure

3.1 Beams
Access to beam ends at the abutments was achieved by access from the embankment. Steel beam thickness measurements were taken for the bottom flange and web, and at any other areas of significant deterioration, using a D-meter. The dimensions of the deteriorated area of the beam ends were measured, sketched, and recorded. Beams over continuous supports were visually inspected and if no deterioration was seen, measurements were not taken. Lane or shoulder closures were not required for access to the abutment beam ends for this structure due to the offset from Billwood Hwy.

3.2 Cross Frames and Lateral Bracing
Access to cross frames and lateral bracing adjacent to beam ends was achieved by access from the embankment at the abutments. Steel thickness measurements were taken only if significant corrosion was observed. Cross frames and lateral bracing away from the beam ends were inspected visually from the reach-all truck, shoulders, and other accessible areas near the bridge. The lateral bracing was inspected for cracks in fatigue sensitive locations (near the connections to the beam webs). The lateral bracing was also checked for looseness.

3.3 Bearings
Bearings were observed visually and typical photographs were taken to document type and general condition. Access was either visual from the embankment, or by reach-all truck at the piers. Elastomeric pads were inspected for deformation, bulging, cracking, and movement under the beam. Steel bearing assemblies were investigated for abnormal rotation, alignment, and section loss. Lane or shoulder closures were not required for inspection of these elements at the abutments. The bearings at Piers 1 and 2 were inspected using the reach-all truck which was parked in the lane closure used for the deck sounding operations.

3.4 Pin and Hanger Connections
P&H connections were accessed by extension ladder, and typical photographs were taken to document general condition. Thickness measurements were taken at the pin and link plates, as well as any other areas of significant deterioration, with the D-meter. Rotation, alignment, and section loss was investigated at each location. The dimensions and deteriorated areas of the beam end were measured, sketched, and recorded. Lane or shoulder closures were not required for inspection of these elements due to the offset of the P&H’s from the freeway.
4.0 Substructure

4.1 Abutments
Abutments, wingwalls, and backwalls were inspected for delamination by hammer sounding; general condition, including spalls and cracks, was observed visually. The abutments were checked for rotation with a level. Areas of deterioration were marked, measured, sketched, and photographed. Traffic control was not required for inspection of these elements.

4.2 Slope Protection
The condition of the embankment slope protection was observed visually and photographed; areas of settlement/movement, vegetation, and cracking were noted and photographed. Traffic control was not required for inspection of these elements.

4.3 Piers
All surfaces of the pier were inspected for delamination by hammer sounding; general condition, including spalls and cracking, was observed visually. Areas of deterioration were marked, measured, sketched, and photographed. Access to the pier was by reach-all truck, which was parked in the lane closure used for the deck sounding operations.

5.0 Site Issues

5.1 Maintenance of Traffic
The sites were observed, including adjacent streets and features, to determine how traffic could be maintained during bridge rehabilitations or reconstruction projects. The volume of traffic permitted informed judgements to be made on the feasibility of part width construction and detours, including possible detour routes.

5.2 Geometrics
The structures were inspected for geometric parameters that could hinder or restrict vehicular traffic or that might not meet current MDOT/FHWA standards. Parameters applicable to vehicular traffic include lane/shoulder width, vertical curve sight distance, and bridge span length over the facility below.

Speed limits for each facility associated with the crossing were recorded if signage was present.

5.3 Vertical Clearance
The vertical clearances were measured at the center of road at each fascia using a laser measurer. Actual minimum vertical clearance may be less than what is measured in the field due to the cross slope of the facility under the bridge and the longitudinal grade of the bridge beams.
5.4 Utilities
Utilities carried by the bridge, passing under or over the bridge, or located adjacent to the bridge, were noted and photographed.

5.5 Signs
Signs attached to the bridge were noted and photographed. The type of sign connection to the bridge was also noted where applicable.