

2020 IN-DEPTH & FRACTURE CRITICAL BRIDGE INSPECTION REPORT

ERI-6-2884

SFN: 2202344

Vermilion, Ohio

PID No.: 93095



Prepared For:

Ohio Department of Transportation, District 3
906 Clark Avenue
Ashland, Ohio 44805

December 2020



Christian Lunt
12/14/2020



TABLE OF CONTENTS

| | |
|--|-----------|
| INTRODUCTION..... | 1 |
| Bridge Description | 1 |
| Construction and Maintenance History..... | 2 |
| Inspection Procedure and Access | 4 |
| Condition and Element Level Rating and Guidelines | 5 |
| DECK (58)..... | 6 |
| Item 12 – Reinforced Concrete Deck..... | 6 |
| Item 805 – Wearing Surface – Monolithic Concrete (58.01) | 9 |
| Item 300 – Strip Seal Expansion Joint (58.02) | 11 |
| Item 330 – Metal Bridge Railing | 12 |
| Item 815 – Drainage | 15 |
| Non-Inventoried Superstructure Items | 17 |
| SUPERSTRUCTURE (59) | 18 |
| Item 113 – Steel Stringer | 18 |
| Item 120 – Steel Truss | 21 |
| Item 152 – Steel Floor Beam | 29 |
| Item 162 – Steel Gusset Plate | 32 |
| Item 311 – Movable Bearing & Item 313 – Fixed Bearing..... | 34 |
| Protective Coating System (59.01)..... | 37 |
| Non-Inventoried Superstructure Items | 39 |
| SUBSTRUCTURE (60) | 41 |
| Item 215 – Reinforced Concrete Abutment | 41 |
| Item 830 – Abutment Backwall..... | 43 |
| Non-Inventoried Substructure Items..... | 44 |
| APPROACHES..... | 46 |
| Item 321 – Reinforced Concrete Approach Slab..... | 46 |
| Non-Inventoried Approach Items | 48 |
| CHANNEL (61)..... | 51 |
| General Appraisal | 52 |
| REPAIR & MAINTENANCE RECOMMENDATIONS | 52 |

Introduction

Bridge Description

ERI-6-2284 (SFN 2202344), also known as the Liberty Avenue Bridge, carries vehicular and pedestrian traffic over the Vermilion River (**Photo 1**). The bridge is approximately 248 feet long overall and was opened to traffic in 1928. See **Figure 1** for the bridge location.

The General Elevation and Transverse Section are shown on **Figures 2 & 3**.

The Liberty Avenue Bridge is composed of two through-truss lines spanning 243 feet. The superstructure consists of floorbeams spaced at 27 feet and stringers spaced at 3'-10 1/2"±. Ten stringers carry U.S. Route 6 (Liberty Avenue) and four stringers carry the north and south sidewalks (two carrying the north sidewalk and two carrying the south sidewalk). The superstructure sits on reinforced concrete abutments. The reinforced concrete deck is 7 1/2" thick and has a compressive strength of 4.5 ksi based on the 1986 replacement date. The roadway is 35'-0" from face to face of guardrail.

Following FHWA definitions, all tension members of the trusses are classified as fracture critical. Furthermore, the truss floor beams, and west approach floorbeams are fracture critical because their spacing is greater than 14 feet.¹

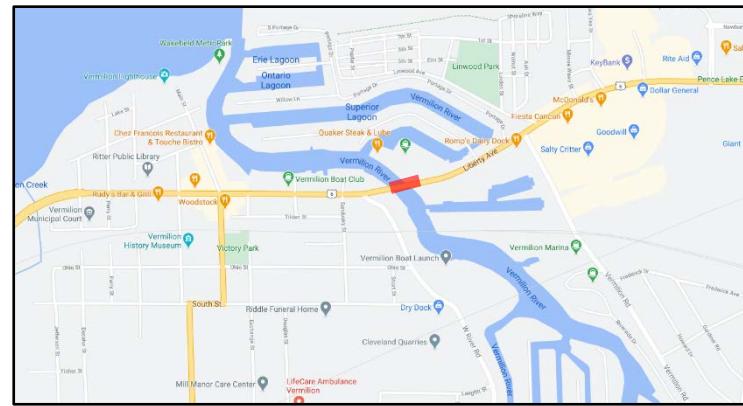


FIGURE 1 – LOCATION MAP



PHOTO 1 – ELEVATION LOOKING SOUTH

¹ Fracture Critical Inspection Techniques for Steel Bridge, Publication No. FHWA NHI 02-037, FHWA & National Highway Institute, p. 4.2.2, January 2002.

Construction and Maintenance History

The following is a summary of significant events in the history of the Liberty Avenue Bridge:

- 1928: Bridge opened to traffic.
- 1986: Bridge received major rehabilitation consisting of the following activities:
 - Deck Repairs
 - Replaced deck and sidewalk
 - Converted floorbeams to be composite with the deck
 - Replaced scuppers
 - Repaired pedestrian railing
 - Replaced the guardrail with deep beam railing
 - Replaced the Forward Abutment compression seal
 - Replaced the Rear Abutment joint with strip seal
 - Superstructure Repairs
 - Replaced the end floorbeams
 - Replaced nine deck stringers and two sidewalk stringers
 - Rehabilitated bearings, including anchor bolt replacement
 - Modified truss to increase vertical clearance
 - Supplemented the rocker bearings with elastomeric bearing pads at the rear abutment
 - Replaced bearing anchor bolts, lower lateral bracing
 - Replaced several below deck connections sidewalk cantilever tension bolts
 - Painted the superstructure steel
 - Substructure Repairs
 - Replaced the abutment backwalls
 - Raised the abutment seats, and patched the abutment barrels and wingwalls
 - Approach Repairs
 - Replaced sidewalks at all corners of the bridge
 - Replaced approach slabs, approach guardrail, portions of the pedestrian railing, and west approach drainage.
- 2014: Bridge received minor rehabilitation consisting of the following activities:
 - Approach Repairs
 - Replaced portions of the northeast, northwest, and southeast approach sidewalks
 - Replaced the guardrail end terminal assemblies
 - Replaced pedestrian railing on the retaining wall at the southeast corner
 - Deck Repairs
 - Installed new guardrail
 - Tightened loose post caps on the pedestrian railing
 - Replaced angles of the bottom pedestrian railing connection to the posts
 - Performed curb repairs
 - Superstructure Repairs
 - Painted steel with OZEU protective coating system
 - Added angles to gusset plate edges (**Table 1**)
 - Substructure Repairs
 - Sealed abutment seats

| Gusset Plate Edge Stiffening | | | |
|------------------------------|----------------|------------------|----------------------|
| Truss | Panel Point | Gusset Plate | Edge of Gusset Plate |
| North & South | U ₁ | Inside & Outside | East |
| North & South | U ₂ | Inside & Outside | West |
| North & South | U ₇ | Inside & Outside | East |
| North & South | U ₈ | Inside & Outside | West |
| South | L ₄ | Inside | East & West |
| South | L ₅ | Inside | East & West |
| South | L ₆ | Inside | East & West |

Table 1 – Locations of Angles Added to Gusset Plate Edges, 2014 Minor Rehabilitation

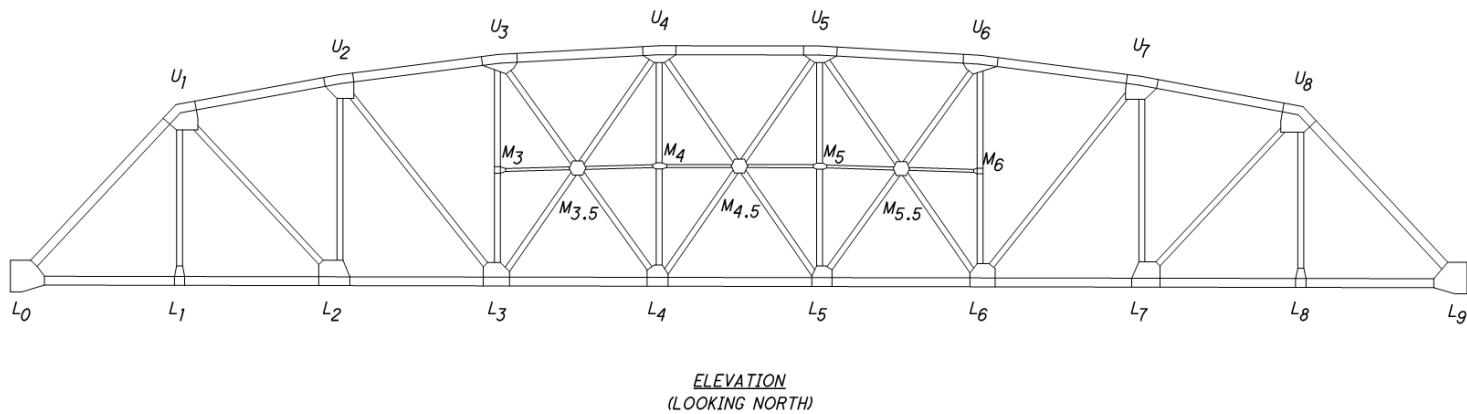


Figure 2

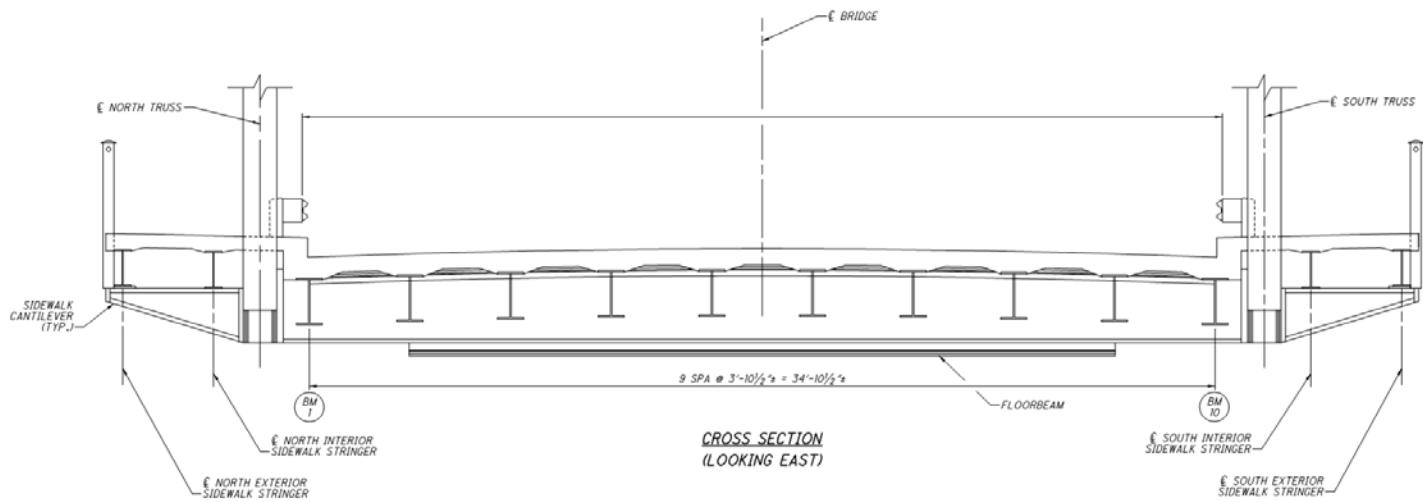


Figure 3

Inspection Procedure and Access

Pennoni performed an in-depth and fracture critical inspection of this structure from September 13 - 17, 2020. Personnel included Christian Lunt PE, and Andrew Kustec EI. The above deck superstructure inspection access was achieved via a 45' manlift with traffic control provided by AWP. The below deck superstructure inspection was accessed via a pontoon platform with step ladders. The deck inspection and recording of deficiencies is based on FHWA Long-Term Bridge Performance (LTBP) Program Protocols, Version 1. (See Publication No. FHWA-HRT-16-007, January 2016 for further information.)

A copy of the ODOT AssetWise Bridge Inspection Report is included in **Appendix A**. Additionally, **Appendix B** contains a summary of condition states and the significant findings of the deck, superstructure, and substructure elements.

Condition and Element Level Rating and Guidelines

Ohio and National Bridge Inspection Standards (NBIS) guidelines for evaluating the condition of bridges have been developed to promote uniformity of bridge inspections performed by different teams over time. **Table 2** contains the bridge inspection rating matrix established by the Federal Highway Administration (FHWA) and ODOT. In this report, individual item conditions will be discussed based on the ODOT rating guidelines for individual items. The Summary Items: General Appraisal, Deck, Superstructure, Substructure, Approach Summaries and Protective Coating System ratings will follow the NBIS system.

Table 2 – ODOT and NBIS Condition Rating Guidelines

| Individual Items (ODOT) | Summary Items (NBIS) | Condition | Guidelines |
|-------------------------|----------------------|------------------|--|
| 1-Good | 9 | Excellent | No problems noted: no section loss, general deterioration. |
| | 8 | Very Good | |
| | 7 | Good | Some minor problems. |
| 2-Fair | 6 | Satisfactory | Structural elements show some minor deterioration. |
| | 5 | Fair | Structural elements show deterioration but are sound. |
| 3-Poor | 4 | Poor | Advance widespread deficiencies or a likely reduction to capacity. Usually, the load path appears to be affected for primary members or there are obvious structural changes since the as-built condition that are advanced. |
| | 3 | Serious | Poor condition <i>and</i> local failures possible. |
| 4-Critical | 2 | Critical | Serious condition <i>and</i> unless closely monitored it may be necessary to close the bridge until corrective action is taken. |
| | 1 | Imminent Failure | Critical <i>and</i> major deterioration is affecting stability. Bridge or lane(s) shall be closed to traffic, but corrective action may put bridge back into light service. |
| | 0 | Failed | Imminent Failure <i>and</i> out of service, beyond corrective action. |

This inspection was performed in accordance with the following documents:

1. Bridge Inspection Manual, Ohio Department of Transportation (ODOT), Revised 2014 (v.8)
2. Bridge Inspector's Reference Manual (BIRM), U.S. Department of Transportation, Revised 2012
3. Manual for Bridge Evaluation, 3rd Edition, American Association of State Highway and Transportation Officials (AASHTO), Published 2018 with 2019 interims
4. National Bridge Inspection Standards, U.S. Department of Transportation, 2004

Deck (58)

The deck is in *SATISFACTORY* condition, or a 6 on the NBIS condition rating guidelines.

Item 12 – Reinforced Concrete Deck

The Reinforced Concrete Deck, replaced in 1986, is in *SATISFACTORY* condition. Transverse and longitudinal cracks were found throughout the top surface. Crack widths were classified as hairline width, generally measuring up to 0.03" wide (**Photo 2**). The pattern of transverse cracks closely matches the floorbeams below with some additional partial length transverse cracks between the floorbeams. A 3' L x 3' W delamination and a 1' L x 1' W spall (**Photo 3**) was found in the center lane near the forward abutment. The longitudinal cracking on the top of the deck is scattered throughout and does not appear to be related to the stringer framing below. Deck findings including transverse cracks in the sidewalks are shown on the Deck Location Plan in **Appendix B**. At the bottom of the deck there are isolated transverse and longitudinal hairline cracks scattered throughout. There are various hairline cracks with leakage and efflorescence (**Photo 4**). There are also minor spalls and delaminations at various haunches (**Photo 5**). There is a spall approximately 6'-0" long with one exposed reinforcing bar on the underside at the rear abutment (**Photo 6**).

Item 12 Reinforced Concrete Deck Element Level Quantities

| Total Quantity (sq. ft.) | State 1 | State 2 | State 3 | State 4 |
|--------------------------|---------|---------|---------|---------|
| 8931 | 0 | 8629 | 302 | 0 |

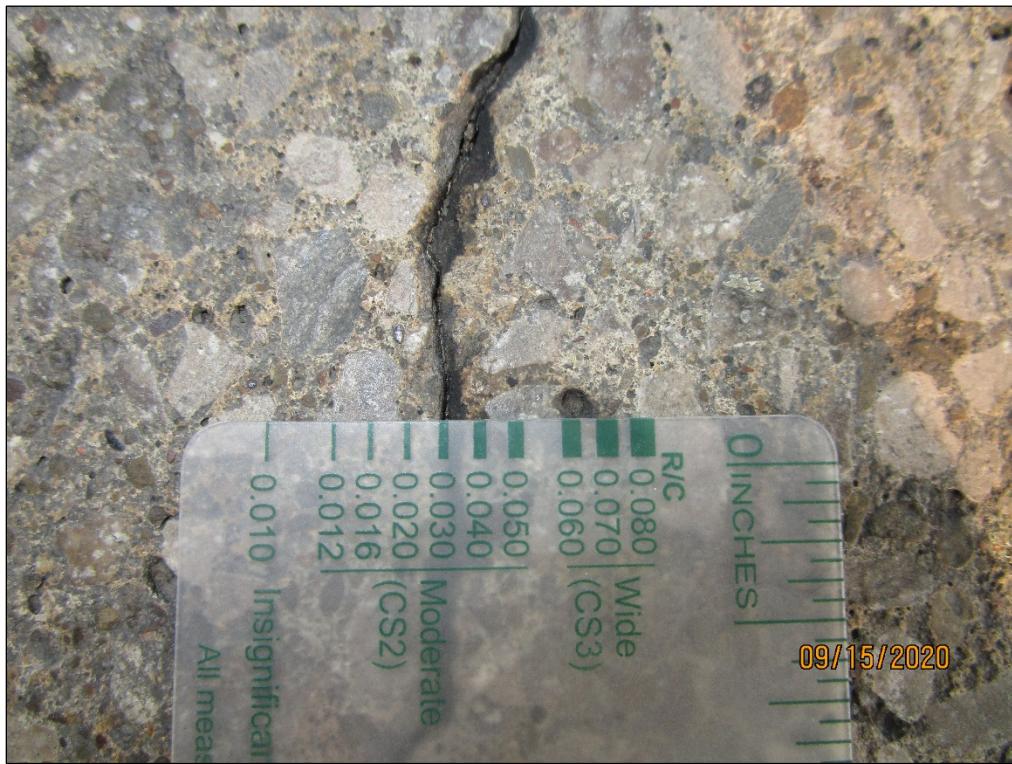


PHOTO 2 - TRANSVERSE CRACK IN DECK, 0.030" WIDE



PHOTO 3 – 1'X1' SPALL IN DECK, CENTER LANE, FORWARD ABUTMENT



PHOTO 4 – HAUNCH SPALL AND TRANSVERSE CRACK WITH EFFLORESCENCE, STRINGER 1, FLOORBEAM 9



PHOTO 5 – HAUNCH SPALL, STRINGER 10, BETWEEN FLOORBEAMS 7 & 8



PHOTO 6 – SPALL ON UNDERSIDE OF DECK NEAR REAR ABUTMENT, FLOORBEAM 0

Item 805 – Wearing Surface – Monolithic Concrete (58.01)

The Wearing Surface is in **SATISFACTORY** condition, or a **6** on the NBIS condition rating guidelines. There is a grid pattern of transverse and longitudinal cracking present. There has been an increase in hairline transverse cracks since the 2018 inspection. The wearing surface skid-resistance grooves are noticeably worn along the wheel paths, especially along the eastbound lane and the westbound left turn lane (**Photo 7**). The wearing surface skid-resistance grooves are also filled with sealer. There are small spalls along the length of the expansion joints (**Photo 8**).

Item 805 Wearing Surface Element Level Quantities

| Total Quantity (sq. ft.) | State 1 | State 2 | State 3 | State 4 |
|--------------------------|---------|---------|---------|---------|
| 8683 | 0 | 8283 | 400 | 0 |



PHOTO 7 – TYPICAL WEAR OF SKID-RESISTANCE GROOVES IN WHEEL PATH AND TRANSVERSE CRACK



PHOTO 8 – SMALL SPALLS IN DECK ALONG EXPANSION JOINT, REAR ABUTMENT

Item 300 – Strip Seal Expansion Joint (58.02)

The Expansion Joints are in **POOR** condition, or a **4** on the NBIS condition rating guidelines. The expansion joint at the Rear Abutment measures $\frac{3}{8}$ " between the steel retainers, comparable to the 2016 and 2018 measurement (**Photo 8**). This joint is completely closed with no deficiencies noted in the armor. The Forward Abutment compression seal is torn for the entire length with spalls along the bridge deck side (**Photo 9**).

Item 300 Strip Seal Expansion Joint Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 108 | 0 | 57 | 12 | 39 |



PHOTO 9 – TORN COMPRESSION SEAL WITH DECK SPALLS, FORWARD ABUTMENT

Item 330 – Metal Bridge Railing

The Bridge Railing is in *GOOD* condition. The DBR railing posts have areas of light corrosion on the bases (**Photo 10**). Five of the rail mounted reflectors are broken (**Photo 11**). Section loss with a perforation was found on the backside of the tubular steel backup (**Photo 12**). There is minor impact damage to the south guardrail (**Photo 13**). The pedestrian hand railing consists of steel posts supporting panels with top and bottom railing with pickets and has scattered deficiencies throughout. Ten of the brackets that attach the railing panels to the posts are cracked. Moisture has entered the posts under the caps (tightened during in the 2012 rehabilitation project), partially filling the posts. Five approach railing posts have vertical cracks along the section seams due to the trapped water freezing inside the post (**Photo 14**). The railing post connection assemblies below the sidewalk deck have advanced section loss in areas, however these connections are believed to be redundant as the posts are structurally encased in the sidewalk deck. Painted over section loss is present on the bottom of the pickets in isolated areas. Chipped paint is also present in isolated areas with some active corrosion.

Item 330 Metal Bridge Railing Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 497 | 467 | 30 | 0 | 0 |



PHOTO 10 – CORROSION TO RAIL POST BASE PLATE



PHOTO 11 – BROKEN REFLECTOR



PHOTO 12 – ACTIVE CORROSION WITH PERFORATION ON BACKSIDE OF STEEL BACKUP, SOUTH TRUSS NEAR L9.



PHOTO 13 – IMPACT DAMAGE TO GUARDRAIL, SOUTH FACE



PHOTO 14 – VERTICAL CRACK IN SIDEWALK RAILING POST, SOUTHWEST APPROACH

Item 815 – Drainage

Drainage is in *GOOD* condition. Minor debris within and around the scupper was observed on the north curb (**Photo 15**). All drainpipe entrances are open and allow water to flow through. The plastic drainpipe at the northeast corner has been shortened since the 2018 inspection, it is possible that the cracked coupling broke and the pipe extension was removed since the previous inspection (**Photo 16**). Areas with minor ponding and debris are present along the south curb near the Rear Abutment (**Photos 13 & 17**).

Item 815 Drainage Element Level Quantities

| Total Quantity (each) | State 1 | State 2 | State 3 | State 4 |
|-----------------------|---------|---------|---------|---------|
| 12 | 10 | 2 | 0 | 0 |



PHOTO 15 – TYPICAL SCUPPER WITH PARTLY CLOGGED INLET AND DEBRIS



PHOTO 16 – SHORTENED DRAINPIPE ON THE NORTHEAST CORNER



PHOTO 17 – MINOR PONDING ALONG THE SOUTH CURB NEAR THE REAR ABUTMENT

Non-Inventoried Superstructure Items

Curbs and Sidewalks

The curbs and sidewalks are in *GOOD* condition. Typical hairline transverse cracking exists on the sidewalks between the railing posts and the blockouts in the deck for the truss (**Photo 18**). Where truss members pass through the sidewalk deck, several steel covers are loose with others having isolated active corrosion. The curb on the southeast corner is spalled and delaminated near the joint seal (**Photo 19**). See the Deck Location Plan in **Appendix B** for crack locations.



PHOTO 18 – TYPICAL TRANSVERSE HAIRLINE CRACKS ON SIDEWALK NEAR TRUSS BLOCKOUT



PHOTO 19 – SPALL AND DELAMINATED CURB ON SOUTHEAST CORNER

Superstructure (59)

The superstructure is in *FAIR* condition overall, or a 5 on the NBIS condition rating guidelines. Superstructure findings are shown in Appendix B.

Item 113 – Steel Stringer

The stringers are in *GOOD* condition with no major deficiencies. The exterior stringers under the roadway deck have active corrosion on the top of the top flange at the abutments (Photo 20). Pitting up to $3/16$ " deep is present in isolated areas on the bottom flange and webs of the roadway stringers (Photos 21 & 22). A few bent bottom flanges are present at stringer to floorbeam connections (Photo 23). The stringers supporting the sidewalks have scattered pitting with some isolated perforations (Photo 24).

Item 113 Steel Stringer Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 2430 | 2386 | 42 | 2 | 0 |



PHOTO 20 – ACTIVE CORROSION TO INSIDE EDGE OF EXTERIOR STRINGER TOP FLANGE, STRINGER 1, PANEL 9



PHOTO 21 – BOTTOM FLANGE OF STRINGER WITH PITTING, STRINGER 10, PANEL 7



PHOTO 22 – BOTTOM FLANGE AND WEB PAINTED OVER PITTING, STRINGER 1, PANEL 7



PHOTO 23 – BOTTOM FLANGE BENT AT FLOORBEAM CONNECTION, FLOORBEAM 5 AND STRINGER 6, PANEL 6



PHOTO 24 – PAINTED OVER PITTING ON SIDEWALK STRINGER, NORTH SIDE, PANEL 7

Item 120 – Steel Truss

The steel truss is in *FAIR* condition. Deteriorations are listed by member type.

Item 120 Steel Truss Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 486 | 27 | 378 | 81 | 0 |

Lower Chord

The lower chord has painted over pitting and loss of section is typical on the exposed web plates (**Photo 25**). Pack rust between the built-up plates is present from L₂ through L₇ with several locations now exhibiting active corrosion (**Photo 26**). This pack rust in the middle five panels occurs here and not at the end panels because the interior plates are $\frac{3}{8}$ -inch thick, much less than the $\frac{5}{8}$ -inch thickness threshold to prevent pack rust formation. In isolated areas the pack rust and associated section loss has become advanced and created perforations, with the estimated maximum section loss approximately 8%. (**Photo 27**).

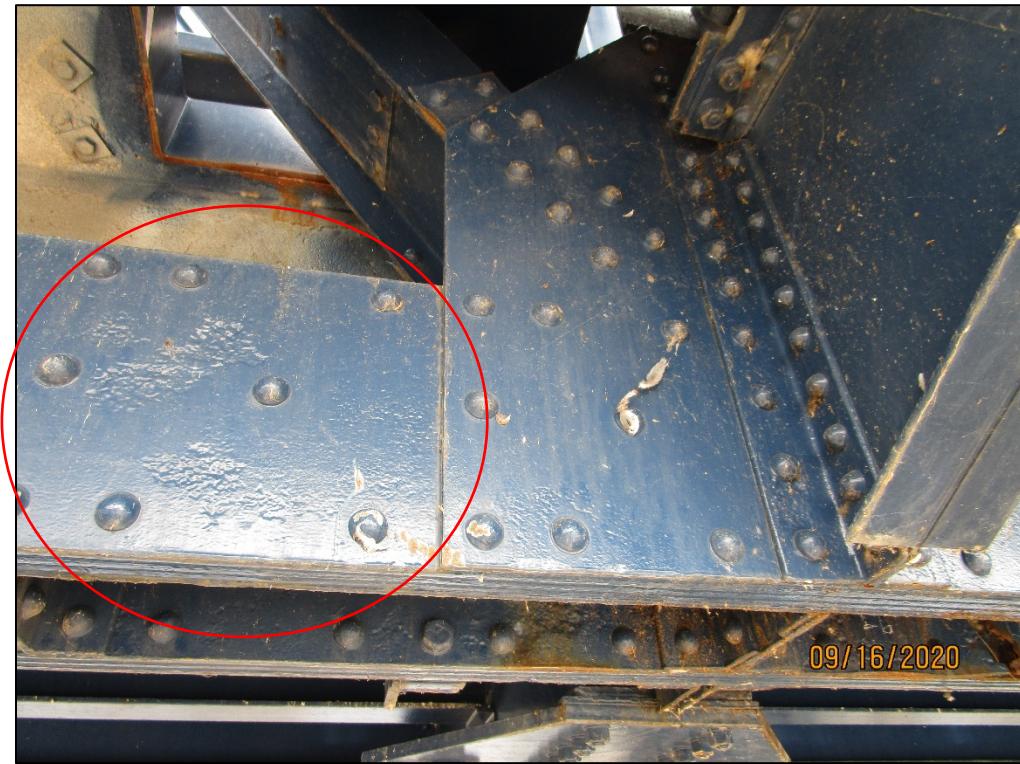


PHOTO 25 – TYPICAL LOWER CHORD PAINTED OVER PITTING

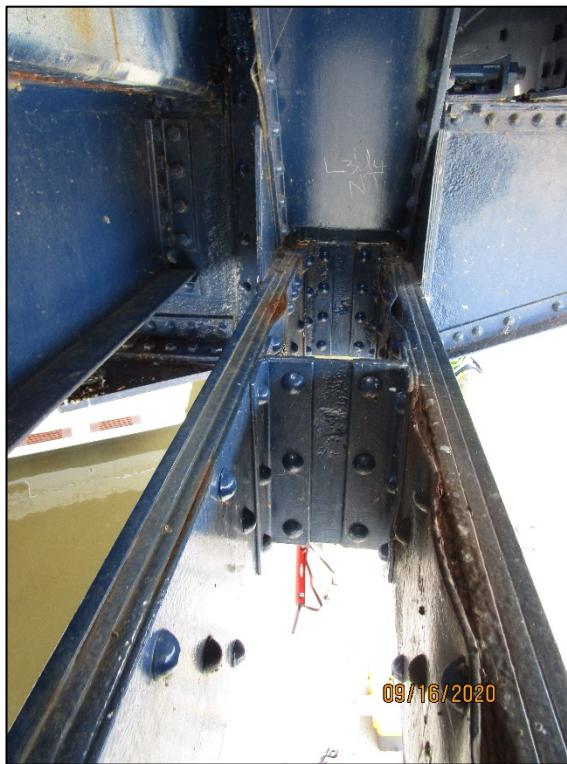


PHOTO 26 – LOWER CHORD, ACTIVE PACK RUST > $\frac{1}{2}$ ", PANEL 4, NORTH TRUSS



PHOTO 27 – LOWER CHORD WEB PLATE PERFORATION, L6, SOUTH TRUSS

Upper Chord

The Upper Chord exhibits typical painted over pitting on the bottom flange angles gussets (Photo 28). Minor arrested pitting is also present to the web plates in isolated areas. The top flange plate and angle are dented in isolated areas, likely due handling during transportation or erection (Photo 29). The top chord and end post diagonals have up to five pairs of bent lacing bars (Photo 30). See Table 3 for bent lacing bar summary. The end posts have minor pitting in the splash zone with some active corrosion (Photo 31).

| Panel | No. of Bent Lacing Bars | |
|-------------------------------|-------------------------|-------------|
| | North Truss | South Truss |
| L ₀ U ₁ | 2 | 0 |
| U ₁ U ₂ | 2 | 1 |
| U ₂ U ₃ | 3 | 0 |
| U ₃ U ₄ | 5 | 4 |
| U ₄ U ₅ | 3 | 4 |
| U ₅ U ₆ | 5 | 6 |
| U ₆ U ₇ | 6 | 4 |
| U ₇ U ₈ | 2 | 0 |
| U ₈ L ₉ | 6 | 0 |
| Total | 34 | 19 |

Table 3 – Upper Chord Bent Lacing Bar Summary



PHOTO 28 – UPPER CHORD PAINTED OVER PITTING TO BOTTOM FLANGE, U3, NORTH TRUSS



PHOTO 29 – BENT UPPER TOP FLANGE PLATE, U1U2 @ U2, NORTH TRUSS



PHOTO 30 – TYPICAL BENT LACING BARS, LOU1, NORTH TRUSS



PHOTO 31 – TYPICAL ACTIVE CORROSION TO END POST IN SPLASH ZONE, SOUTH TRUSS

Diagonals

The diagonals exhibit typical painted over pitting and section loss, advanced in areas. This is most common at the web and flanges in the splash zone (Photos 32 & 33). Fill plates have section loss, up to 100% in areas, and pack rust between the flanges and the lower gussets. Some pack rust is reactivating. Various flanges are wavy for up to 12" (Photo 34). There is bird droppings and nest debris on various diagonals (Photo 35).



PHOTO 32 – PAINTED OVER PITTING WITH PERFORATION, U2L3, SOUTH TRUSS



PHOTO 33 – PAINTED OVER PITTING, U2L3, SOUTH TRUSS



09/17/2020

PHOTO 34 – WAVY DIAGONAL FLANGE, U4L5, NORTH TRUSS



09/17/2020

PHOTO 35 – TYPICAL BIRD DROPPINGS AND DEBRIS, L5, SOUTH TRUSS

Verticals

Verticals exhibit typical painted over pitting at the lower vertical ends in the splash zone (Photo 36 & 37). Perforations were found in the web of L₆U₆ North. These were in similar condition to the 2018 inspection. Repairs were made to several verticals with advanced section loss.



PHOTO 36 – PAINTED OVER PITTING, L1U1, NORTH TRUSS



PHOTO 37 – HOLES AND PAINTED OVER PITTING, L2U2, NORTH TRUSS

Item 152 – Steel Floor Beam

The floorbeams are in *GOOD* condition. Painted over pitting on the web and top and bottom flanges is typical at the floorbeam ends adjacent to the lower gusset plate connections (**Photos 38, 39, & 40**). Pack rust behind floorbeam connection angles is also reactivating. Pinhole perforations are present in the bottom flanges of Floorbeams 2 and 5, both adjacent to the north lower lateral gusset plates. The cantilever floorbeam extensions supporting the sidewalks also have painted over pitting with isolated perforations (**Photos 41 & 42**). Floorbeam 0 at the rear abutment has active corrosion along the top flange where the deck is spalled (**Photo 6**).

Item 152 Steel Floor Beam Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 374 | 326 | 42 | 6 | 0 |



PHOTO 38 – TYPICAL PAINTED OVER PITTING, FLOORBEAM 4, SOUTH END



PHOTO 39 – ACTIVE CORROSION AT FLOORBEAM END & GUSSET, FLOORBEAM 3, NORTH END



PHOTO 40 – ACTIVE CORROSION AT FLOORBEAM END, FLOORBEAM 1, SOUTH TRUSS



PHOTO 41 – PAINTED OVER PITTING WITH PINHOLE, FLOORBEAM 4 SIDEWALK CANTILEVER, SOUTH TRUSS



PHOTO 42 – PAINTED OVER PITTING WITH HOLE, FLOORBEAM 4 SIDEWALK CANTILEVER, SOUTH TRUSS

Item 162 – Steel Gusset Plate

Gusset Plates are in FAIR condition. All gusset plates are $\frac{1}{2}$ " thick. Eight upper gusset plates are bowed up to $\frac{3}{16}$ " along the unbraced edge of the gusset plates. Lower gusset plates typically have minor bowing due to pack rust behind the plates. Lower gusset plates have minor to moderate arrested pitting with occasional perforations (Photo 43). Perforations, up to $\frac{3}{4}$ " high x 2" wide, were found on the interior gusset plates at L₂ North, L₄ South, L₅ South and L₆ South with surrounding pitting (Photos 44 & 45). These areas of section loss affect the shear planes as well as the Whitmore widths of the diagonal connections. Several upper and lower gusset plates have had angles bolted to the edges of the plates for stiffening.

Item 162 Steel Gusset Plate Element Level Quantities

| Total Quantity (each) | State 1 | State 2 | State 3 | State 4 |
|-----------------------|---------|---------|---------|---------|
| 84 | 36 | 19 | 26 | 3 |



PHOTO 43 – TYPICAL PAINTED OVER PITTING



PHOTO 44 – PAINTED OVER PITTING AND PERFORATION, L2, INSIDE GUSSET, NORTH TRUSS



PHOTO 45 – PAINTED OVER PITTING, L6, INSIDE GUSSET, SOUTH TRUSS

Item 311 – Movable Bearing & Item 313 – Fixed Bearing

Bearings are in FAIR condition. Minor pitting is typical on the bearings. The fixed bearings at the forward abutment have active corrosion around the pins and pin nuts (Photo 46). Several anchor bolt nuts are not seated. (Note: This is not considered to be a problem.) At the rear abutment, the north rocker is tilted toward the backwall 16° degrees and the south rocker is tilted toward the backwall 13° degrees (Photo 47). Also, the north and south elastomeric bearing pads are deformed $1\frac{3}{16}$ " and $1\frac{5}{16}$ " respectively toward the backwall (Photo 48). There is a $2\frac{3}{8}$ " gap between the rear abutment backwall and truss at the north bearing (Photo 49) and a $2\frac{3}{4}$ " gap at the south bearing. It was 65 degrees during the measurements.

Item 311 Movable Bearing Element Level Quantities

| Total Quantity (each) | State 1 | State 2 | State 3 | State 4 |
|-----------------------|---------|---------|---------|---------|
| 2 | 0 | 0 | 2 | 0 |

Item 313 Fixed Bearing Element Level Quantities

| Total Quantity (each) | State 1 | State 2 | State 3 | State 4 |
|-----------------------|---------|---------|---------|---------|
| 2 | 0 | 2 | 0 | 0 |



PHOTO 46 – FIXED BEARING AT FORWARD ABUTMENT, SOUTH TRUSS



PHOTO 47 – ROCKER BEARING WITH ACTIVE CORROSION, REAR ABUTMENT, SOUTH TRUSS



PHOTO 48 – DEFORMED ELASTOMERIC BEARING, REAR ABUTMENT, NORTH TRUSS



PHOTO 49 – 2 3/8" GAP FROM REAR ABUTMENT BACKWALL AND TRUSS

Protective Coating System (59.01)

The paint system is in **Good** condition and is rated as a **7** on the modified protective coating rating system. Scattered areas of active corrosion exist throughout with isolated locations of re-activating pack rust, especially at the bearing gussets. Local protective coating failure is also present on the unpainted exterior deck stringer tops adjacent to edge spalls. Chipped paint is present on the truss end posts. Excessive pigeon droppings are present inside the upper chord, diagonals, and on the lower lateral bracing gussets (**Photos 50 & 51**).

Element Inspection Items

Element Item #113 – Steel Stringer, Sub-Item 515 Steel Protective Coating

Item 515 Steel Stringer Protective Coating Element Level Quantities

| Total Quantity (sf) | State 1 | State 2 | State 3 | State 4 |
|---------------------|---------|---------|---------|---------|
| 19776 | 19756 | 20 | 0 | 0 |

Element Item #120 – Steel Truss, Sub-Item 515 Steel Protective Coating

Item 515 Steel Truss Protective Coating Element Level Quantities

| Total Quantity (sf) | State 1 | State 2 | State 3 | State 4 |
|---------------------|---------|---------|---------|---------|
| 18235 | 17935 | 300 | 0 | 0 |

Element Item #152 – Steel Floor Beam, Sub-Item 515 Steel Protective Coating

Item 515 Steel Floor Beam Protective Coating Element Level Quantities

| Total Quantity (sf) | State 1 | State 2 | State 3 | State 4 |
|---------------------|---------|---------|---------|---------|
| 3983 | 3947 | 36 | 0 | 0 |

Element Item #162 – Steel Gusset Plate, Sub-Item 515 Steel Protective Coating

Item 515 Steel Gusset Plate Protective Coating Element Level Quantities

| Total Quantity (sf) | State 1 | State 2 | State 3 | State 4 |
|---------------------|---------|---------|---------|---------|
| 5040 | 4960 | 80 | 0 | 0 |



PHOTO 50 – TYPICAL PIGEON DROPPINGS ON LOWER LATERAL BRACING



PHOTO 51 – TYPICAL PIGEON DROPPINGS ON DIAGONALS NEAR UPPER CHORD

Non-Inventoried Superstructure Items

Alignment

The alignment of primary structural members is in *GOOD* condition.

Lateral Bracing

The lateral bracing is in *GOOD* condition. The lower lateral bracing ties and gusset plates have been replaced and are in good condition. Minor deficiencies to the lower lateral bracing members are a slightly bent rod in Panel 7 and a broken hanger in Panel 9 (**Photo 52**).

The upper later bracing also is in *GOOD* condition. The angles that form upper lateral bracing members are sagging due to self-weight but appear to be functioning as designed (**Photo 53**).



PHOTO 52 – BROKEN HANGER, PANEL 9



PHOTO 53 – TYPICAL UPPER LATERAL BRACING SAG

Sway Bracing

The sway bracing is in *SATISFACTORY* condition (**Photo 54**). Typical deficiencies throughout the sway bracing includes arrested pitting of the connection angles connecting to the gussets with isolated perforations. There is impact damage to the sway bracing at panel point 2 (**Photo 55**). Minor deficiencies to the sway bracing include scattered pitting and dented flanges of the struts and diagonals as well as pack rust at the top and bottom connection plates in the portals.



PHOTO 54 – SWAY BRACING, LOOKING WEST



PHOTO 55 – IMPACT DAMAGE TO FLANGE, PANEL POINT 2

Substructure (60)

The substructure is in *FAIR* condition overall, or a **5** on the NBIS condition rating guidelines.

Item 215 – Reinforced Concrete Abutment

The Abutments are in *FAIR* condition. The Rear Abutment has isolated areas of minor spalling with a single reinforcing bar exposed and delaminations (Photo 56). The Forward Abutment also has several areas of delaminations and spalls and cracks with efflorescence (Photos 57 & 58). The 2016 In-Depth inspection documented that the Rear Abutment was leaning $\frac{3}{4}$ " over 4 feet to the north and leaning away from the river $\frac{3}{8}$ " horizontally per four feet vertically. It has been noted on previous inspection reports that these observations likely are attributed to formwork and finishing variations, however continued observation during future inspections is warranted.

Item 215 Reinforced Concrete Abutment Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 109 | 0 | 98 | 11 | 0 |



PHOTO 56 – SPALL WITH EFFLORESCENCE, REAR ABUTMENT



PHOTO 56 – PATCHED JOINT WITH EFFLORESCENCE AND SPALL WITH EXPOSED REINFORCING, FORWARD ABUTMENT



PHOTO 58 – DELAMINATION AND SPALL WITH EXPOSED REINFORCING, FORWARD ABUTMENT

Item 830 – Abutment Backwall

The backwalls are in *GOOD* condition. Both backwalls have scattered hairline map cracking with isolated delaminated areas at the tops of the backwalls. There is one vertical CS3 crack on the rear abutment near the middle (**Photo 59**).

Item 830 Abutment Backwall Element Level Quantities

| Total Quantity (ft.) | State 1 | State 2 | State 3 | State 4 |
|----------------------|---------|---------|---------|---------|
| 109 | 107 | 1 | 1 | 0 |



PHOTO 59 – VERTICAL CRACK NEAR MIDDLE OF REAR ABUTMENT

Non-Inventoried Substructure Items

Wingwalls

The Wingwalls are in FAIR condition. The two 1'x4" spalls with exposed reinforcing steel at the Southwest Wingwall have not changed since the 2018 inspection. There are three full height CS3 vertical cracks and two full height CS2 vertical cracks in the southeast wingwall (**Photos 60, 61 & 62**). There is map cracking with some minor efflorescence on southwest wingwall.



PHOTO 60 – CS3 VERTICAL CRACK ON SOUTHEAST WINGWALL



PHOTO 61 – CS3 VERTICAL CRACK ON SOUTHEAST WINGWALL



PHOTO 62 – CS3 VERTICAL CRACK ON SOUTHEAST WINGWALL

Approaches

The Approaches are in *GOOD* condition, or a 7 on the NBIS condition rating guidelines.

Item 321 – Reinforced Concrete Approach Slab

The approach slabs are in *GOOD* condition. Both approach slabs have minor corner spalling along the compression seal joints. The west approach slab has a failed compression seal (**Photos 63 & 64**) and minor cracking, spalls and delaminations on the north curb. The rear approach slab is raised slightly in relation to the deck, expansion joint and backwall creating a small bump. The east approach slab is in good condition with a spall and delamination on the south curb (**Photo 65**).

Item 321 Reinforced Concrete Approach Slab Element Level Quantities

| Total Quantity (sq. ft.) | State 1 | State 2 | State 3 | State 4 |
|--------------------------|---------|---------|---------|---------|
| 1467 | 1424 | 16 | 27 | 0 |



PHOTO 63 – REAR APPROACH SLAB (LOOKING NORTH)



PHOTO 64 – REAR APPROACH SLAB WITH FAILED COMPRESSION SEAL AND SPALLS



PHOTO 65 – FORWARD APPROACH SLAB (LOOKING SOUTH)

Non-Inventoried Approach Items

Approach Pavement

The asphalt approach pavement is in *FAIR* condition. Both approaches have sealed cracks throughout (Photos 66 & 67). The west approach has a small bump between the pavement and the approach slab and a deteriorating pothole patch, 14" wide x 15" long, in the right westbound lane at the approach slab. The east approach has a pothole, 12" wide x 6" long x 1" deep, in the right westbound lane at the approach slab and a small 3" wide x 3' long x 1" deep pothole in the left wheel path in the right westbound lane.



PHOTO 66 - WEST APPROACH WEARING SURFACE



PHOTO 67 - EAST APPROACH WEARING SURFACE

Approach Guardrail

The approach guardrail is in *FAIR* condition. A few isolated guardrail posts have loose bolts and timber blocks. Loose end bearing plates exist at the end terminal assemblies.

Embankment

The approach embankments are well vegetated and in *FAIR* condition. The northeast and northwest sidewalks have minor settlement with longitudinal cracking and diagonal cracks around posts (**Photo 68**). The northeast sidewalk has a small area of undermining at the face of the wingwall. The southeast sidewalk has minor settlement with vegetation growth between sidewalk and curb and 21" of undermining (**Photo 69**).



PHOTO 68 – SIDEWALK SETTLEMENT AT NORTHWEST APPROACH



PHOTO 69 – EROSION OF SOUTHEAST EMBANKMENT UNDER SIDEWALK

Warning Signs

The overhead signs mounted to the end portals are in *GOOD* condition with no deficiencies noted.

Sign Supports Signs

The overhead sign supports are in *GOOD* condition with no deficiencies noted.

Utilities

The 1¹/₂" diameter electrical conduit on the south edge of deck is broken in various locations and has some broken hangers.

Land Use

Private docks are below the structure along both shorelines of the Vermilion River. Small watercraft are being stored along both abutment barrels and on top of both abutment seats (**Photo 56**). At the Rear Abutment, random debris is being stored on the abutment seat (**Photo 70**).



PHOTO 70 – RANDOM DEBRIS ON REAR ABUTMENT SEAT

Channel (61)

The Channel is in **GOOD** condition, or a **7** on the NBIS condition rating guidelines

Scour (61.01)

The scour is in **GOOD** condition, or a **7** on the NBIS condition rating guidelines. The abutment foundations are protected with sheet piling walls and are in stable condition.

Alignment

The Channel Alignment is in **GOOD** condition.

Protection

Bank Protection is in **FA/R** condition. An erosion gully is present running from the sheet pile wall to the Rear Abutment (**Photo 71**).



PHOTO 71 – EROSION IN FRONT OF REAR ABUTMENT

Hydraulic Opening

Hydraulic Opening is in **GOOD** condition. The channel is dredged regularly for pleasure craft and small commercial fishing boats.

General Appraisal

Based on the inspection findings from the 2020 In-Depth and Fracture Critical Member Inspection, the ERI-6-2884 bridge is in **FAIR** condition overall, or a **5** on the NBIS condition rating guidelines. The overall rating is based on the condition of the Deck, Superstructure, and Substructure. The complete ODOT AssetWise Bridge Inspection Report can be found in [Appendix A](#).

Repair & Maintenance Recommendations

Repair and maintenance recommendations have been prioritized based on the following categories:

| <u>PRIORITY LEVEL</u> | <u>Description</u> | <u>Timeframe</u> |
|-----------------------|--|---------------------------------|
| CRITICAL | <ul style="list-style-type: none"> – Immediate action is required. Integrity of the structure or public safety is in jeopardy. | (Within 7 Days) |
| HIGH PRIORITY | <ul style="list-style-type: none"> – Complete work as soon as possible. Serious structural deficiency exists to a primary bridge element that if not correct could jeopardize the structure or public safety. | (Within 6 Months) |
| PRIORITY | <ul style="list-style-type: none"> – Review work plan and re-prioritize schedule. Advanced deficiency exists to a primary members or appurtenance that may lead to further deterioration or compromise public safety if no corrected. | (Within 1 to 2 Years) |
| SCHEDULE | <ul style="list-style-type: none"> – Add to scheduled work. Minor but noteworthy deficiencies exist to a primary member or appurtenance that may become more serious if left unaddressed for an extended period of time. | (Add to Schedule) |
| PROGRAM | <ul style="list-style-type: none"> – Add to programmed work. Minor deficiencies exist to a primary or secondary member or appurtenance that may lead to a noteworthy defect if left unaddressed for an extended period of time. | (When Funds are Available) |
| ROUTINE | <ul style="list-style-type: none"> – As per the existing maintenance schedule. Non-structural condition exists that does not affect public safety and occurs overtime with normal use of the structure. | (Within Next Maintenance Cycle) |

The following repair and maintenance item recommendations for the ERI-6-2884 bridge are as follows:

CRITICAL: None

HIGH PRIORITY: None

PRIORITY: Metal Bridge Railing

- Replace portions of guardrail damaged from vehicle impacts

Approach Slabs

- Patch potholes at both approach slab/approach pavement transition.

SCHEDULE: Deck

- Patch deteriorated curbs.

Substructure

- Patch spalled and delaminated areas at both abutments.
- Monitor vertical cracks on southeast wingwalls.

PROGRAM: Superstructure

- Replace rear abutment expansion joint.
- Reset rocker bearings and elastomeric bearings at rear abutment.

ROUTINE: Deck

- Place fill material under erosion on southeast sidewalk.
- Clean scuppers of debris and vegetation.
- Clear debris from both abutment seats to aid in inspection access.

Appendix A

ODOT AssetWise Bridge Inspection Report

Ohio Bridge Inspection Summary Report

ERI-00006-2893 (2202344)

2: District 03 79716 - VERMILION (ERI & LOR county)
 21: Major Maint A/B 01 - State Highway Agency /
 225 Routine Main A/B 04 - City or Municipal Highway Agency /
 221 Inspection A/B 01 - State Highway Agency /
 220: Inv. Location ERI

5A: Inventory Route 1 00006
 7: Facility On USR 6
 6: Feature Ints VERMILION RIVER
 9: Location .60 MI W LOR. CO. LINE

| Condition | | Structure Type | |
|--|--|----------------------------------|---|
| 58: Deck | 6 - Satisfactory Condition | 43: Bridge Type | 3 - Steel 10 - Truss - Thru N- Not Applicable |
| 58.01 Wearing Surface | 6 - Satisfactory (1-10% distress) | 45: Spans Main / Approach | 1 / 0 |
| 58.02 Joint | 4- Poor (heavy leaking, offset) | 107: Deck Type | 1 - Concrete Cast-in-Place |
| 59: Superstructure | 5 - Fair Condition | 408: Composite Deck | N - Non-composite Construction |
| 59.01 Paint & PCS | 7 - Good (1-5% corr.) | 414A Joint Type 1 | 8 - Elastomeric Strip Seal |
| 60: Substructure | 5 - Fair Condition | 414B: Joint Type 2 | 3 - Compression Seal |
| 61: Channel | 7 | 108A: Wearing Surface | 1 - Monolithic Concrete (concurrently placed with structural deck) |
| 61.01 Scour | 7 - Good | | N- Not Applicable |
| 62: Culverts | N - Not Applicable | 422: WS Date | 01/01/1986 |
| 67.01 GA | 5 | 423: WS Thick (in) | 1.0 |
| Appraisal | | 482: Protective Coating | |
| Sufficiency Rating | 45.1 SD/FO 2 - FO | 5 - Paint System OZEU | |
| 36: Rail, Tr, Gd, Term Std | 1 1 1 1 | 483: PCS Date | 09/01/2012 |
| 72: Approach Alignment | 6 - Equal to present minimum criteria | 453: Bearing Type 1 | 2 - Rockers & Bolsters |
| 113: Scour Critical | 9 - Foundations above flood waters | 455: Bearing Type 2 | N - None |
| 71: Waterway Adequacy | 8 - Bridge Above Approaches | 528: Foundn: Abut Fwd | 5 - Timber Piles |
| | | 533: Foundn: Abut Rear | 5 - Timber Piles |
| Geometric | | 536: Foundn: Pier 1 | |
| 48: Max Span Length (ft) | 243.0 | N - None (Such as most Culverts) | |
| 49: Structure Length (ft) | 248.1 | 539: Foundn: Pier 2 | N - None (Such as most Culverts) |
| 52: Deck Width, Out-To-Out (ft) | 36.0 | Age and Service | |
| 424: Deck Area (sf) | 8931.0 | 27: Year Built/ 106 Rehab | 1928 / 1986 |
| 32: Appr Roadway Width (ft) | 40.0 | 42A: Service On | 5 - Highway-pedestrian |
| 51: Road Width, Curb-Curb (ft) | 35.0 | 42B: Service Under | 5 - Waterway |
| 50A: Curb/SW Width: Left (ft) | 6 | 28A: Lanes on | 03 |
| 50A: Curb/SW Width: Right (ft) | 6 | 28B: Lanes Under | 00 |
| 34: Skew (deg) | 0 | 19: Bypass Length | 16 |
| 33: Bridge Median | 0 - No median | 29: ADT | 15119 |
| 54B: Min Vert Underclearance (ft) | 0 | 109: % Trucks (%) | 3 |
| 336A: Min Vert Clrnce IR Cardinal (ft) | 14.66 | Inspections | |
| 336B: Min V Clr IR Non-Cardinal (ft) | 0 | 90: Routine Insp. | 12 Months 09/13/2020 |
| 578: Culvert Length (ft) | 0 | 92A: FCM Insp. | Y 24 Months 09/13/2020 |
| Load Posting | | 92B: Dive Insp. | N 0 Months |
| 41: Op/Post/Closed | A - Open | 92C: Special Insp. | N 0 Months |
| 70: Posting | 5 - Equal to or above legal loads | 92D: UBIT Insp. | N Months |
| 70.01: Date | | 92E: Drone Insp. | |
| 70.02: Sign Type | | Inspector | Lunt,Christian |
| 734: Percent Legal (%) | 135 | | |
| 704: Analysis Date | 07/01/2010 | | |
| 63: Analysis Method | 7 - Allowable Stress (AS) rating reported by rating factor (RF) method using MS18 loading. | | |

Inspector: Christian Lunt
Inspection Date: 09/13/2020

Structure Number: 2202344
Facility Carried: USR 6

Bridge Inspection Report

Element Inspection

| | Environment | Total Quantity | Units | Condition State 1 | Condition State 2 | Condition State 3 | Condition State 4 | |
|--|-------------|----------------|---------|---|-------------------|-------------------|-------------------|--|
| 12 - Reinforced Concrete Deck | 3 - Mod. | 8931 | sq. ft. | 0 | 8629 | 302 | 0 | |
| | | | | Panels 1-4 and 7-9 have hairline map cracking. Panel 5 has hairline transverse cracks. Cracks with efflorescence were found in Panel 1 between Stringers 2 and 3, Panel 5 between stringers 8 and 9, Panel 6 between Stringers 1 and 4, Panel 7 between Stringers 1 and 2, Panel 7 between Stringers 3 and 5, Panel 7 between Stringers 6 and 8, panel 8 between stringers 2 and 3, and panel 9 between stringers 1 and 2. Cracks with moisture were found in panel 6 between Stringers 4 and 5, Panel 7 between stringers 6 and 8, and panel 7 between stringers 9 and 10. There is a ~6'-0" long spall on the deck underside with one exposed reinforcing bar. This is adjacent to floorbeam 0. | | | | |
| | | | | There are various minor spalling and delaminations to haunches. None have exposed reinforcing. | | | | |
| | | | | There are three spalls with cracking on the north edge of the deck and two locations on the south edge of deck including between L0 and L1. | | | | |
| | | | | See photo(s): 1,2,3 | | | | |
| 805 - Wearing Surface - Monolithic Concrete | | 8683 | sq. ft. | 0 | 8283 | 400 | 0 | |
| | | | | There are a few small spalls (2-3" x 3" and a 3" x 6") at east end along lane line for westbound and turn lanes. The deck sounds good. Longitudinal crack lines in westbound lane, 22 ft of turn lane between L8 and L9, and 81 ft of eastbound lane between L6 and L9. Typical transverse cracks over floorbeams up to 1/16" wide. Westbound lane has deformations in the wearing surface. 2019: W.S. looks to have been sealed w/ HMWM. Grooves for monolithic wearing surface are worn throughout. | | | | |
| | | | | 2020: There are a few small spalls present on east end. There are also small spalls along the expansion joint seals on both ends. | | | | |
| 113 - Steel Stringer | 3 - Mod. | 2430 | ft. | 2386 | 42 | 2 | 0 | |
| | | | | Stringer 1 - Pitting on bottom flange and web for 5 ft in Panel 5 near center towards L5. Pitting on bottom flange and web for 11 ft and two holes (1/2" x 1/8" and pin size) at L6 in Panel 7. Active rust of the top flange at 3 ft from forward abutment to 8 ft away and on inside edge of top flange in panel 9. Bent bottom flange in Panel 7 at L6. Stringer 6 - Bent bottom flange in Panel 6 at L5. Stringer 7 - Bent bottom flange in Panel 6 at L5. Stringer 9 - Bent bottom flange in panel 8 at L7. | | | | |
| | | | | Stringer 10 - Active rust of the top flange from rear abutment to 6 ft away. Pitting on bottom flange and web for 6 ft in Panel 7 near L6. Bent top flange in Panel 8 at L7. Many stringers are not seated on support angles. Many of the stringer support angles are bent and some have section loss or holes. Stringer connections to floorbeams were analyzed, and it showed that the support angles are not necessary for load capacity (probably used for erection of stringers). | | | | |
| | | | | See photo(s): 1,2,3 | | | | |

Inspector: Christian Lunt
Inspection Date: 09/13/2020

Structure Number: 2202344
Facility Carried: USR 6

Bridge Inspection Report

Element Inspection

Inspector: Christian Lunt
Inspection Date: 09/13/2020

Structure Number: 2202344
Facility Carried: USR 6

Bridge Inspection Report

Element Inspection

| Element ID | Quantity | Mod. | Length | ft. | Width | in. | Thickness | in. |
|------------------------------------|----------|------|---|---------|-------|-----|-----------|-----|
| 152 - Steel Floor Beam | 3 | Mod. | 374 | ft. | 326 | 42 | 6 | 0 |
| | | | Several floorbeam-to-vertical connection plates are bent at the top or bottom due to pack rust. Pitting and section loss at floorbeam ends and their connections to verticals - up to 20% loss. Some connection angles have holes at very top or bottom (do not seem to affect the connection capacity). Floorbeams 2 and 5 (both at north end) have holes in bottom flange at connection to lower lateral bracing plate. Minor active rust at various floorbeam connections. | | | | | |
| | | | See photo(s): 7 | | | | | |
| 515 - Steel Protective Coating | | | 3983 | sq. ft. | 3947 | 36 | 0 | 0 |
| | | | There is some active corrosion at the ends of floorbeams. | | | | | |
| Element ID | Quantity | Mod. | Length | ft. | Width | in. | Thickness | in. |
| 162 - Steel Gusset Plate | 3 | Mod. | 84 | each | 36 | 19 | 26 | 3 |
| | | | Gusset Plates - Upper gusset plates have no section loss and no bows. Lower gusset plates have bows in gusset plates at L1 N, L2 N, L2 S, L3 N, L4 N, L4 S, L5 N, L5 S, L6 N, L6 S, L7 N, L7 S, L8 N, and L8 S. All plates are 1/2" thick, and L7 N outside plate is the only one with bow greater than the thickness. All bows due to pack rust except L1N, L8 N, and L8 S which appears to be due to slight misalignment of members. Two holes (one near top and another in middle) in L4S inside gusset plate. 1/2" hole in L5S inside gusset plate. Hole in L6S inside gusset plate. Deep painted over pitting in plates at L4 S, L5 S and L6 S have deep pitting and up to 50% section loss over 30-50% of the plate area. L2 S has painted over pitting and 20% section loss. All other gusset plates have minor painted over pitting with less than 10% section loss. Angles have been added to gusset plate edges at U1 N&S, U2 N&S, U7 N&S, U8 N&S, L4 S, L5 S, and L6 S. M4M5 North outside gusset has a bow on top edge. Connection plates at mid-height of Verticals U3L3, U4L4, U5L5 and U6L6 have been removed from the element level quantities since they connect secondary members to truss members. | | | | | |
| 515 - Steel Protective Coating | | | 5040 | sq. ft. | 4960 | 80 | 0 | 0 |
| | | | There is some active corrosion mainly on the bottom gusset plates where water infiltration is happening from the deck. | | | | | |
| 215 - Reinforced Concrete Abutment | 3 | Mod. | 109 | ft. | 0 | 98 | 11 | 0 |
| | | | Rear Abutment: Leans approximately 3/4" to north and 3/8" away from river for every 4 ft vertical. This may be an as-built condition. This appears unchanged since the previous inspection. Seat has minor delaminations at front edge along many portions of the rear abutment. There is one small spall with one exposed reinforcing bar. | | | | | |
| | | | Forward Abutment: Leans approximately 3/8" to towards river for every 4 ft vertical. This appears unchanged since previous inspection. Seat has minor cracks with large delaminated area in center section. Seat has minor delaminations at the front edge in the center (between and not close to the bearings) of forward abutment. There are several small spalls with one exposed reinforcing bar in each near the middle of the wall. | | | | | |
| | | | See photo(s): 1,2,3,6 | | | | | |

Inspector: Christian Lunt
Inspection Date: 09/13/2020

Structure Number: 2202344
Facility Carried: USR 6

Bridge Inspection Report

Element Inspection

| Element ID | Count | Length | Width | Thickness | Condition | Deficiency Type | Deficiency Description |
|---|----------|--------|-------|-----------|-----------|-----------------|---|
| 300 - Strip Seal Expansion Joint | 3 - Mod. | 108 | ft. | 0 | 57 | 12 | 39 |
| | | | | | | | <p>Rear Expansion Joint - Expansion joint has 3/8" gap between the steel retainers (closed). Elastomeric joint seal has fallen out for 6 feet at curbs. The remaining joint seal is broken and loose. Spalling in concrete around expansion joint.</p> <p>Compression seal at rear abutment has spalls in concrete and seal is misaligned. 2019: seal completely gone (see photo), heavy clanking under traffic. Forward Expansion Joint - Compression seal has spalls in concrete and seal is misaligned. There are punctures in seal at eastbound lane</p> <p>2020: Seal is gone at rear abutment and joint is closed. There are small spalls along length of expansion plates. Compression seal at forward abutment is torn, bulging, and misaligned. There are punctures in eastbound lane.</p> <p>See photo(s): 4,5</p> |
| 311 - Movable Bearing | 3 - Mod. | 2 | each | 0 | 0 | 2 | 0 |
| | | | | | | | <p>Minor active rust at pin nuts. Southeast anchor nut at north bearing forward abutment is loose. Northeast anchor nut is missing at south bearing forward abutment. Southeast and southwest anchor nuts at south bearing forward abutment are loose. Northwest anchor nut at south bearing rear abutment is loose. Minor pitting on bearings where debris and water gets through at curb.</p> <p>Rear Abutment: North rocker bearing has a tilt toward backwall of 19.5 degrees at 80 degrees (15.85 degrees at 72 degrees in 2014). South rocker bearing at rear abutment has a tilt toward backwall of 17.0 degrees at 80 degrees (12.5 degrees at 72 degrees in 2014). Rear abutment elastomeric bearings have 1.375" deformation towards backwall (was 1.25" in 2014).</p> <p>2020: Rear rockers were at 16 deg. (north brg.) and 13 deg. (south brg.) expanded at 65 deg. F. The elastomeric bearing pads were deformed 1 3/16" (north) and 1 5/16" (south). There is a 2 3/8" gap between the backwall and the truss at the north bearing and 2 3/4" gap at south bearing.</p> <p>See photo(s): 8,9,10,11</p> |
| 313 - Fixed Bearing | 3 - Mod. | 2 | each | 0 | 2 | 0 | 0 |
| | | | | | | | <p>Fixed bearings have some active corrosion around the pins and pin nuts.</p> <p>See photo(s): 12</p> |

Inspector: Christian Lunt
Inspection Date: 09/13/2020

Structure Number: 2202344
Facility Carried: USR 6

Bridge Inspection Report

Element Inspection

| Element ID | Element Description | 3 - Mod. | 1467 | sq. ft. | 1424 | 16 | 27 | 0 |
|---|---|----------|------|---------|------|----|----|---|
| 321 - Reinforced Concrete Approach Slab | Rear Approach Slab (West) - Minor (3 in x 18 ft) spalls in westbound lanes along compression seal. Minor spall (5 in x 5 in) in westbound lane near compression seal. Delamination (2.25 ft x 5 ft) in eastbound lane along lane line and approximately 5 ft from compression seal. Cracks, spalls, and delaminations for 6 ft of north curb. Forward Approach Slab (East) - 3 in x 20 ft spall in westbound lanes along compression seal. 6 in x 12 ft spall in eastbound lane along compression seal. Cracks, spalls, and delaminations along north curb and for 2.5 ft of south curb. See photo(s): 6,7 | 3 - Mod. | 1467 | sq. ft. | 1424 | 16 | 27 | 0 |
| 330 - Metal Bridge Railing | There is minor impact damage on the south side and various reflectors are broken off. See photo(s): 8 | 3 - Mod. | 497 | ft. | 467 | 30 | 0 | 0 |
| 815 - Drainage | There is minor debris in a couple scuppers. See photo(s): 9 | 3 - Mod. | 12 | each | 10 | 2 | 0 | 0 |
| 830 - Abutment Backwall | Minor cracks present with one CS3 crack at rear abutment. Small delaminations near top north side of rear abutment and top south end of forward abutment. See photo(s): 4,5 | 3 - Mod. | 109 | ft. | 107 | 1 | 1 | 0 |

ERI-00006-2893 _ (2202344)

| | | | | | |
|--|--|--|------------------------------------|---------------------------------|------------------------|
| ODOT District: 03 | Major Maint: 01 - State Highway Agency | Facility Carried: USR 6 | Traffic On: 5 - Highway-pedestrian | Date Built: 07/01/1928 | Rehab Date: 01/01/1986 |
| Routine Maint: 04 - City or Municipal Highway Agency | Feature Inters: VERMILION RIVER | Location: ERI | Traffic Under: 5 - Waterway | Insp. 01 - State Highway Agency | Insp A: |
| FIPS Code: 79716 - VERMILION (ERI & LOR county) | | | .60 MI W LOR. CO. LINE | Insp | Insp B: |
| Inspector Lunt,Christian | | Inspection Date 09/13/2020 12:00:00 AM | Reviewer Lunt,Christian | | |

Inspector Comments - Deck and Approach**Deck****Floor/Slab (SF)**

Panels 1-4 and 7-9 have hairline map cracking. Panel 5 has hairline transverse cracks. Cracks with efflorescence were found in Panel 1 between Stringers 2 and 3, Panel 5 between stringers 8 and 9, Panel 6 between Stringers 1 and 4, Panel 7 between Stringers 1 and 2, Panel 7 between Stringers 3 and 5, Panel 7 between Stringers 6 and 8, panel 8 between stringers 2 and 3, and panel 9 between stringers 1 and 2. Cracks with moisture were found in panel 6 between Stringers 4 and 5, Panel 7 between stringers 6 and 8, and panel 7 between stringers 9 and 10.

Edge of Floor/Slab (LF)

Spalls with cracking noted at 3 locations along the north edge of deck, 2 locations along the south edge of deck, and along most of south edge between L0 and L1. Active leaking to stringer 10 at rear abutment and stringer 1 at forward abutment.

Bridge Wearing Surface (SF)

There are a few small spalls (2-3" x 3" and a 3" x 6") at east end along lane line for westbound and turn lanes. The deck sounds good. Longitudinal crack lines in westbound lane, 22 ft of turn lane between L8 and L9, and 81 ft of eastbound lane between L6 and L9. Typical transverse cracks over floorbeams up to 1/16" wide. Westbound lane has deformations in the wearing surface. 2019: W.S. looks to have been sealed w/ HMWM. Grooves for monolithic wearing surface are worn throughout.

Curbs/Sidewalk (LF)

Several spalls on curbs are present. Hole in north curb between L5 and L6. Typical hairline transverse cracks originating at pedestrian rail posts, guardrail posts and truss members on sidewalks. There is ponding on the north sidewalk next to the truss members at L6. Minor active rust at truss member cover plates and sidewalk. L3 north truss, L6 north truss and L3 south truss have loose cover plates. Fascia stringer at L6 on the north sidewalk has a small hole in bottom flange. L3 north truss sidewalk cantilever has a small hole in the web. L5 south truss sidewalk cantilever has two holes in the web. L6 south truss has impact damage to sidewalk cantilever. Approach sidewalks have long cracks and settlement at northeast and northwest corners. Southeast approach sidewalk has settlement.

Bridge Railing (LF)

DBR Railing - Paint transfer along westbound lane and some in eastbound lane. Minor active rust at connections on posts and base plates. 3 reflectors are broken off of steel tube. Small section of north truss tube rail has small rust spots forming. A few areas with chipped paint. Pedestrian Railing (Informational; not part of rating): Several bolts missing at top rail connection to posts. Typical section loss at bottom of vertical rails up to 50%. Several pipe rail collars at post connections are broken. Several vertical rails are bent. Concrete end posts have minor cracks. Sprinkler hose is loose on south railing and south railing has missing flower boxes. L8 south truss post connection to sidewalk cantilever has holes in west side. Chipped paint in some areas. Loose post caps were tightened with the 2012 project, at least one (NW Approach SW) is loose now..

Deck Drainage (EA)

Minor ponding and debris at curbs. All scuppers are open, with only one partially filled with debris at grating. One scupper horizontal pipe connection is cracked.

Expansion Joint (LF)

Rear Expansion Joint - Expansion joint has 3/8" gap between the steel retainers (closed?). Elastomeric joint seal has fallen out for 6 feet at curbs. The remaining joint seal is broken and loose. Spalling in concrete around expansion joint. Compression seal at rear abutment has spalls in concrete and seal is misaligned. 2019: seal completely gone (see photo), heavy clanking under traffic. Forward Expansion Joint - Compression seal has spalls in concrete and seal is misaligned. There are punctures in seal at eastbound lane

2020: Rear rockers were at 16 deg. (north brg.) and 13 deg. (south brg.) expanded at 65 deg. F. The elastomeric bearing pads were deformed 1 3/16" (north) and 1 5/16" (south). There is a 2 3/8" gap between the backwall and the truss at the north bearing and 2 3/4" gap at south bearing.

Approach

Approach Wearing Surface (EA)

Rear Approach - Sunken asphalt in westbound lane at approach slab. Cracks and a few small potholes. Several cracks on rear approach have been sealed. The joint between rear approach slab and asphalt wearing surface has spalls in asphalt wearing surface and some have been patched. Forward Approach - Several cracks on forward approach have been sealed. 2019: two large potholes @ junct. w/ appr. slab (one each lane). Couple other small areas.

Approach Slab (SF)

Rear Approach Slab (West) - Minor (3 in x 18 ft) spalls in westbound lanes along compression seal. Minor spall (5 in x 5 in) in westbound lane near compression seal. Delamination (2.25 ft x 5 ft) in eastbound lane along lane line and approximately 5 ft from compression seal. Cracks, spalls, and delaminations for 6 ft of north curb. Forward Approach Slab (East) - 3 in x 20 ft spall in westbound lanes along compression seal. 6 in x 12 ft spall in eastbound lane along compression seal. Cracks, spalls, and delaminations along north curb and for 2.5 ft of south curb.

Approach Embankment (EA)

Minor erosion at northeast, northwest and southwest corners. Hole under sidewalk at northeast corner 30" horizontal depth starting at face of wingwall. The northeast and northwest approach sidewalks have long cracks with settlement up to 1" at the guardrail posts and cracked curbs. The southeast approach sidewalk has settlement at the curb but no cracks.

Approach Guardrail (EA)

The post bolts are loose at the first post off of the northwest and southwest corners of the bridge. The end terminal assemblies at the northwest and southwest approaches have loose bearing plates. First timber post off northeast approach has a loose timber block. Paint transfer on guardrail.

Inspector Comments - General Appraisal

Superstructure

Stringers (LF)

Stringer 1 - Pitting on bottom flange and web for 5 ft in Panel 5 near center towards L5. Pitting on bottom flange and web for 11 ft and two holes (1/2" x 1/8" and pin size) at L6 in Panel 7. Active rust of the top flange at 3 ft from forward abutment to 8 ft away and in panel 9 on inside edge of top flange. Bent bottom flange in Panel 7 at L6. Stringer 6 - Bent bottom flange in Panel 6 at L5. Stringer 7 - Bent bottom flange in Panel 6 at L5. Stringer 9 - Bent bottom flange in panel 8 at L7. Stringer 10 - Active rust of the top flange from rear abutment to 6 ft away. Pitting on bottom flange and web for 6 ft in Panel 7 near L6. Bent top flange in Panel 8 at L7. Many stringers are not seated on support angles. Many of the stringer support angles are bent and some have section loss or holes. Stringer connections to floorbeams were analyzed, and it showed that the support angles are not necessary for load capacity (probably used for erection of stringers).

Floorbeams (LF)

Several floorbeam-to-vertical connection plates are bent at the top or bottom due to pack rust. Pitting and section loss at floorbeam ends and their connections to verticals - up to 20% loss. Some connection angles have holes at very top or bottom (do not seem to affect the connection capacity). Floorbeams 2 and 5 (both at north end) have holes in bottom flange at connection to lower lateral bracing plate. Minor active rust at floorbeam connections.

Truss Verticals (EA)

Verticals have pitting with section loss in splash zone. Plates have been welded to the vertical webs in the splash zone at L8U8 North, L8U8 South, and L2U2 South. U6L6 North has a hole on the south side in the splash zone. Minor pitting on sections outside of the splash zone.

Truss Diagonals (EA)

Diagonals - Fill plates at diagonals and lower gusset plates have section loss and some fill plates are bent due to pack rust. There is deep pitting and holes in the web of diagonals in splash zone at L6U5 north truss, L4U5 South, and L3U4 South. L6U7 South and L7U8 South have section loss and holes in the web at the bottom of the diagonals. Plates have been added to diagonal webs in the splash zone at U2L3 South, U4L5 South and U5L6 South. There is pitting and section loss in web of diagonals in splash zone. Minor pitting and section loss in diagonals above splash zone. Minor pitting at connections.

Truss Upper Chord (EA)

Minor pitting in webs. Pitting and section loss at connections to portals and sway bracing. Dents in top flange of upper chord at U1U2 N, U3U4 S, U5U6 N, U6U7 S and U8U9 S likely from construction. Active rust at small hole in web U6U7. Several bent lacing bars. Bottom flanges at U2 S and U5 N have 1/4" offset likely from construction. End Posts - Pitting along railing splash zone for L0U1 and U8L9 for both trusses. Several lacing bars are bent. Minor active rust at web to flange connections. Paint scraped in a few locations. Batten plates have section loss with holes at L0U1 N and U8L9 S. Minor pitting with section loss and some pack rust.

Truss Lower Chord (EA)

Minor pitting and section loss except at connections. Minor active rust at some connections. Holes in lower chord diaphragm web plates at: L2L3 N, L3L4 S, L4L5 N, L5L6N, and L6L7 S. Lower Chord has section loss from pack rust (up to 1 1/2") in Panels 4, 5 and 6. Several diaphragm connection angles have pack rust causing distortion in the angles and minor active rust. Hole in diaphragm at L7 N. Bends in angles behind bearings likely due to construction or rehab. Minor section loss in lower chord where water and debris get in at curbs.

Truss Gusset Plate (EA)

Upper gusset plates have no section loss and no bows. Lower gusset plates have bows in gusset plates at

L1 N, L2 N, L2 S, L3 N, L4 N, L4 S, L5 N, L5 S, L6 N, L6 S, L7 N, L7 S, L8 N, and L8 S. All plates are 1/2" thick, and L7 N outside plate is the only one with bow greater than the thickness. All bows due to pack rust except L1N, L8 N, and L8 S which appears to be due to slight misalignment of members. Two holes (one near top and another in middle) in L4S inside gusset plate. 1/2" hole in L5S inside gusset plate. Hole in L6S inside gusset plate. Deep pitting in plates at L4 S, L5 S and L6 S have deep pitting and up to 50% section loss over 30-50% of the plate area. L2 S has pitting and 20% section loss. All other gusset plates have minor pitting with less than 10% section loss. Angles have been added to gusset plate edges at U1 N&S, U2 N&S, U7 N&S, U8 N&S, L4 S, L5 S, and L6 S. M4M5 North outside gusset has a bow on top edge. Connection plates at mid-height of Verticals U3L3, U4L4, U5L5 and U6L6 have been removed from the element level quantities since they connect secondary members to truss members. All pitting is typically painted over and not active.

Lateral Bracing (EA)

Lower Lateral Bracing - One rod bent in Panel 7 near L6, South. One broken center connection hanger in Panel 7, and one bent center connection hanger in Panel 9. Upper Lateral Bracing - minor deformation in connection plates due to pack rust.

Sway Bracing (EA)

Minor pitting and section loss. Connection plates have minor deformation due to pack rust. Connections to truss have pitting and section loss. Panel 2 has minor gouges in lower diagonal at north truss, a bent flange on lower brace, and a bent flange at the south center lower diagonal. Panel 3 has pack rust at lower center gusset. Panel 2 has minor gouges in lower diagonal at north truss. Panel 5 has a bent flange on north center lower diagonal and bent north diagonal gusset. Panel 7 has a bent flange on lower brace over westbound lane and a bent flange on the north upper diagonal. Panel Point 6 north has a hole in angle connection to upper chord. Sway brace connection to U8 south truss has hole in web of the top brace. Sway brace connection to U3 south truss has hole in web of the top brace. Sway brace connection angle has hole at U3 S and U5 S. Web section losses at lower connection to truss for all lower locations. End portals - Minor pitting and section loss.

Bearing Devices (EA)

Minor active rust at pin nuts. Southeast anchor nut at north bearing forward abutment is loose. Northeast anchor nut is missing at south bearing forward abutment. Southeast and southwest anchor nuts at south bearing forward abutment are loose. Northwest anchor nut at south bearing rear abutment is loose. Minor pitting on bearings where debris and water get through at curb. Rear Abutment: North rocker bearing has a tilt toward backwall of 19.5 degrees at 80 degrees (15.85 degrees at 72 degrees in 2014). South rocker bearing at rear abutment has a tilt toward backwall of 17.0 degrees at 80 degrees (12.5 degrees at 72 degrees in 2014). Rear abutment elastomeric bearings have 1.375" deformation towards backwall (was 1.25" in 2014).

Protective Coating System (LF)

A few locations with chipped paint or paint scrapes on end posts, diagonals and railing posts. Local overspray or dripped paint present. Minor active rust at connections and bearing pin nuts. L8U8 south has a 6' area that appears to have been sandblasted and painted without cleaning all the sand off. PCS applied in 2012 (513-11).

Utilities (LF)

Light on bridge is working. There is a cracked cover on the photo electric control. Electric conduit runs down south truss interior sidewalk stringer - one of the clamps is disconnected. There is a light at forward abutment that is no longer connected to the electric - conduit and wires are severed. Utility box south side of rear abutment has broken conduit and frayed wires. Watering hoses for flower boxes on bridge originate at northeast corner of bridge. One hose runs along forward abutment to south end. Both hoses

go up the wingwalls to the pedestrian railing and run along pedestrian railing to all flower boxes on their respective side. 2019: water hoses hanging down over water, pulled up over sidewalk post so boats can access water.

Substructure

Abutment Walls (LF)

Rear Abutment: Leans approximately 3/4" to north and 3/8" away from river for every 4 ft vertical. This may be an as-built condition. Breastwall has delaminations, minor spalls, and cracking with efflorescence. Seat has minor delaminations at front edge along many portions of the rear abutment. 33.5 SF spall/delamination. Forward Abutment: Leans approximately 3/8" to towards river for every 4 ft vertical. Breastwall has cracks with efflorescence, delaminations, and 2 small spalls with exposed reinforcing. Seat has minor cracks with large delaminated area in center section. Seat has minor delaminations at the front edge in the center (between and not close to the bearings) of forward abutment. 65 SF spall/delamination.

Backwalls (LF)

Minor cracks present. Small delaminations near top north side of rear abutment and top south end of forward abutment.

Wingwalls (EA)

Rear Abutment: Minor map cracking and delaminations with efflorescence. Spalls with exposed rebar on side of wall facing bearings. 2.75 SF delamination southwest wingwall. Forward Abutment: Southeast wingwall has mural. Southeast wingwall has map cracking and a few small delaminations. Northeast wingwall has minor cracks and 3 SF delamination.

Slope Protection (EA)

Rear abutment - Several deep ruts leading to sheet piling, away from abutment. Forward abutment has a few small ruts at abutment face.

Culvert

Inspector Comments - Waterway

Waterway Adequacy

Channel

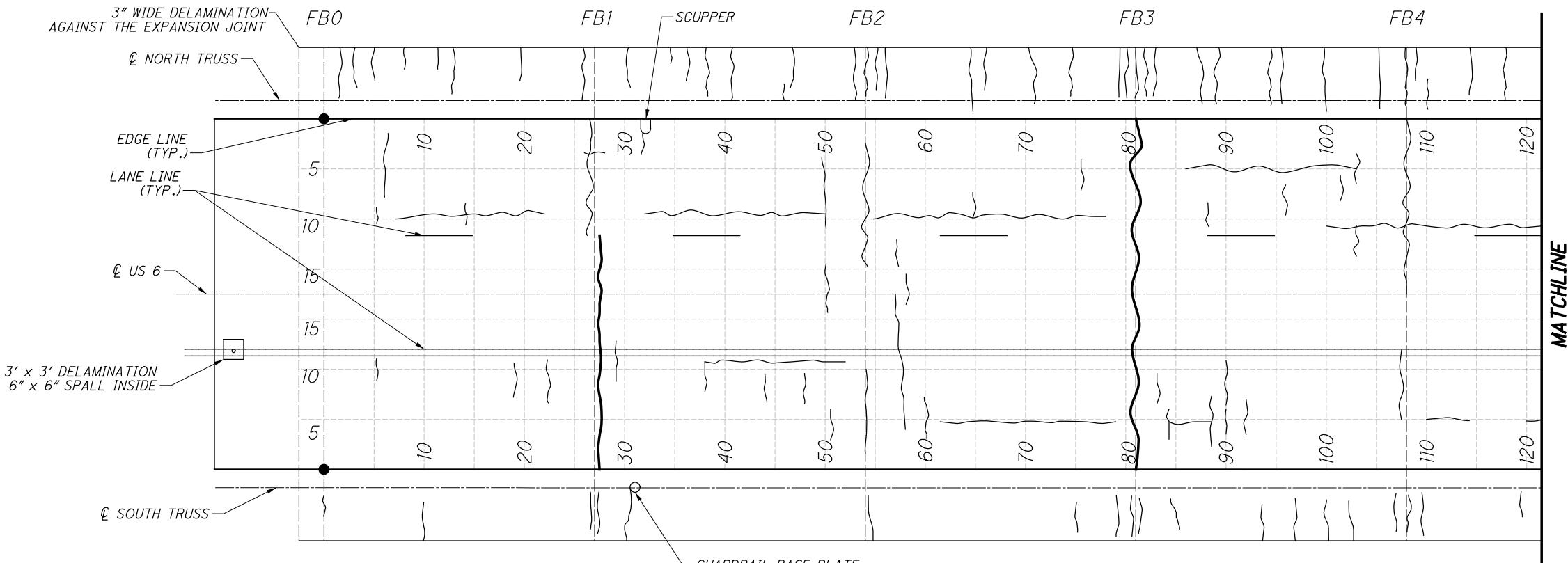
Channel Protection (LF)

Rear - Sheet piling sloped 1:36 (1.40 degrees) toward water. 10-15% section loss where ruts in slope meet sheet piling. (NOTE: This may be an as-built condition.) There is a hole in the sheet piling at near the bridge centerline. There is 6" from top of sheet piling to ground behind sheet piling. Forward - Sheet piling at sloped 1:38 (1.45 degrees) toward water. (NOTE: This may be an as-built condition.) Minor section loss north end.

Scour Critical

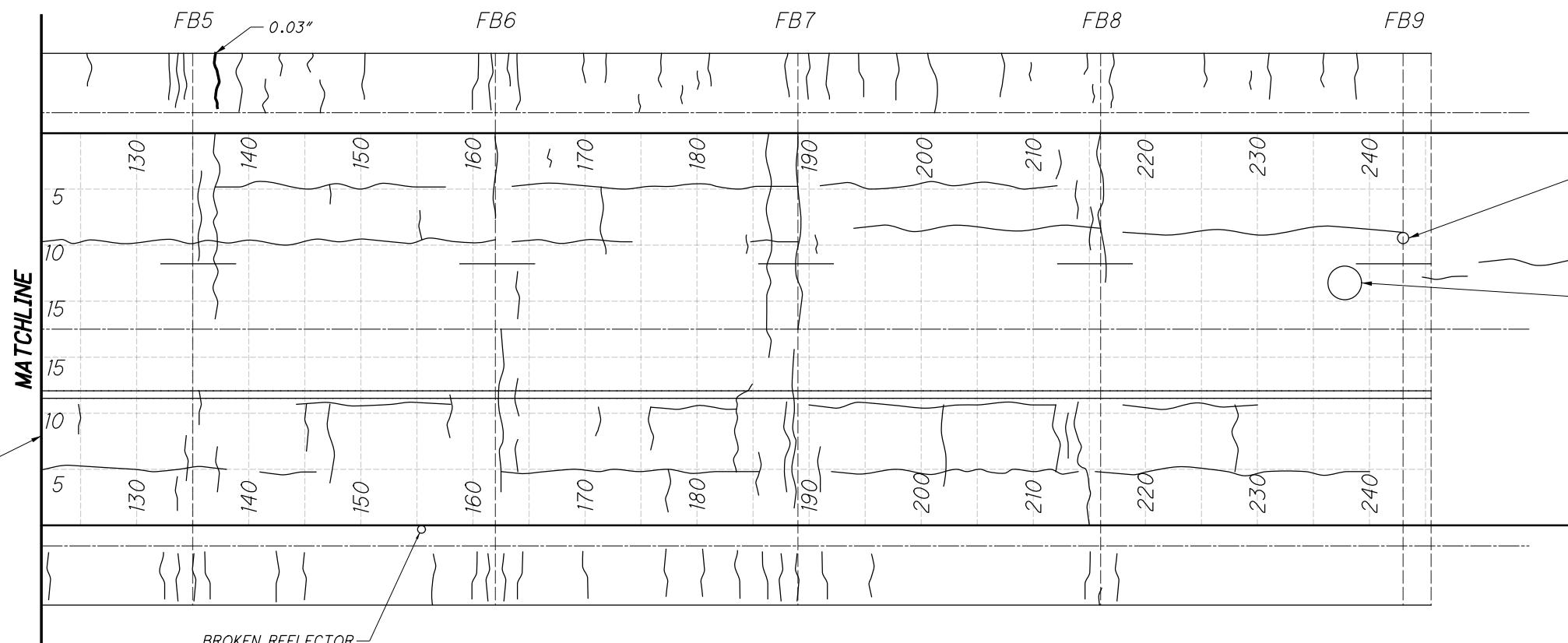
Appendix B

Deck, Superstructure & Substructure Findings

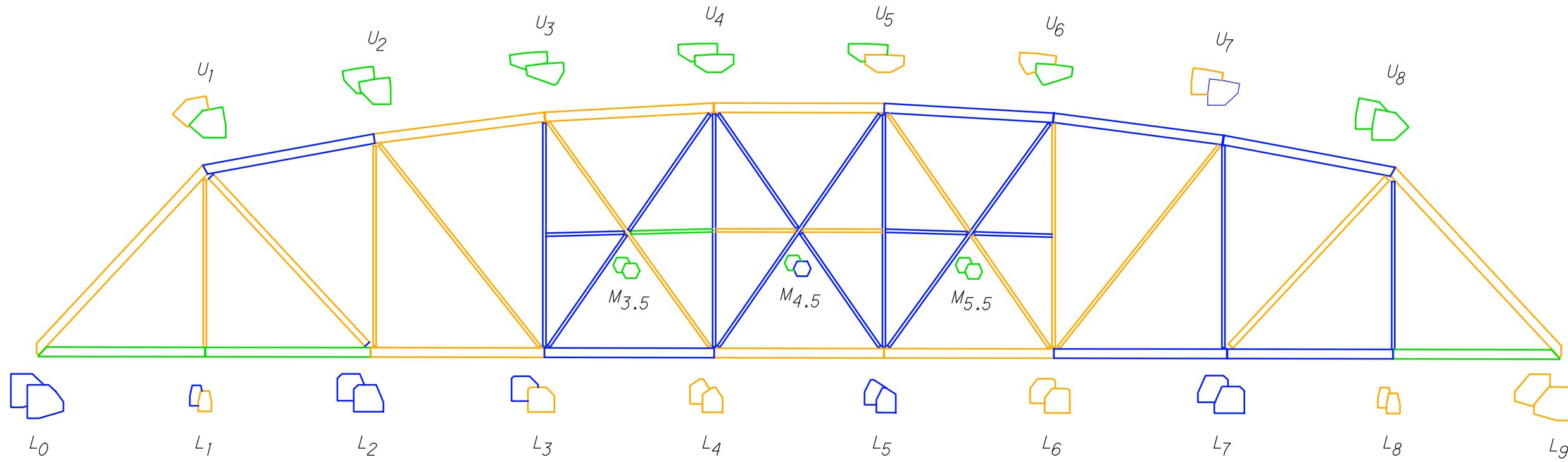


NOTE

DOCUMENTATION OF DECK CRACK LOCATIONS AND WIDTH BASED ON PORTIONS OF THE LONG-TERM BRIDGE PERFORMANCE (LTBP) PROGRAM PROTOCOLS, JANUARY 2016. SEE PUBLICATION NO. FHWA-HRT-16-007 FOR FURTHER DISCUSSION.



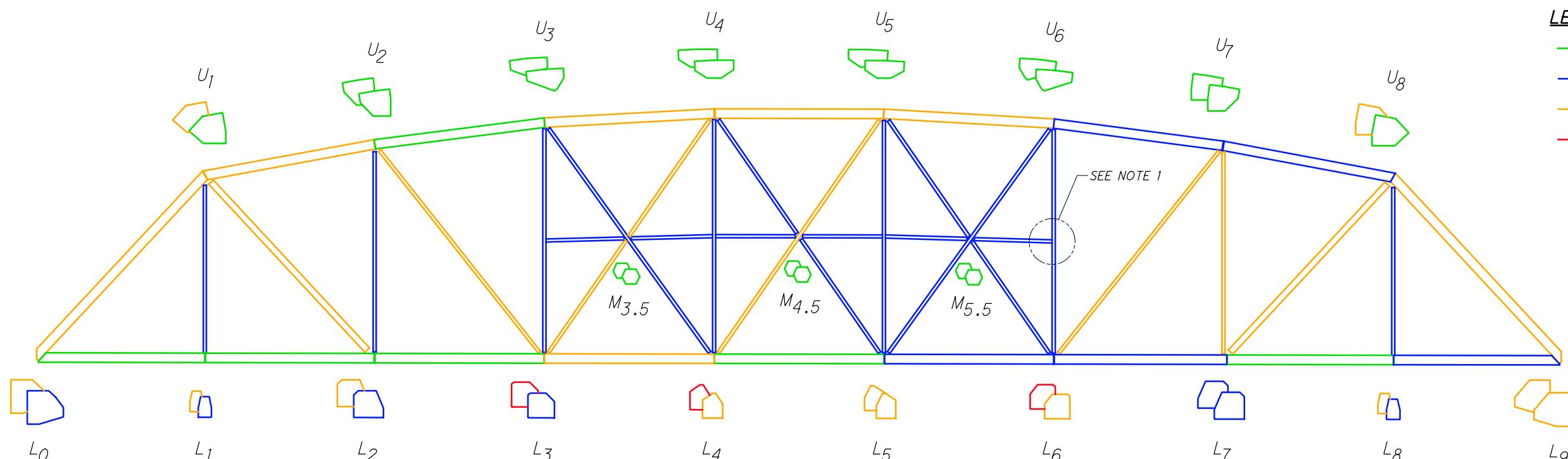
ERI-6-2884
OVER VERMILION RIVER
DECK CRACK LOCATION
PLAN
B-1



NORTH TRUSS
(LOOKING NORTH)

LEGEND

- CS1
- CS2
- CS3
- CS4

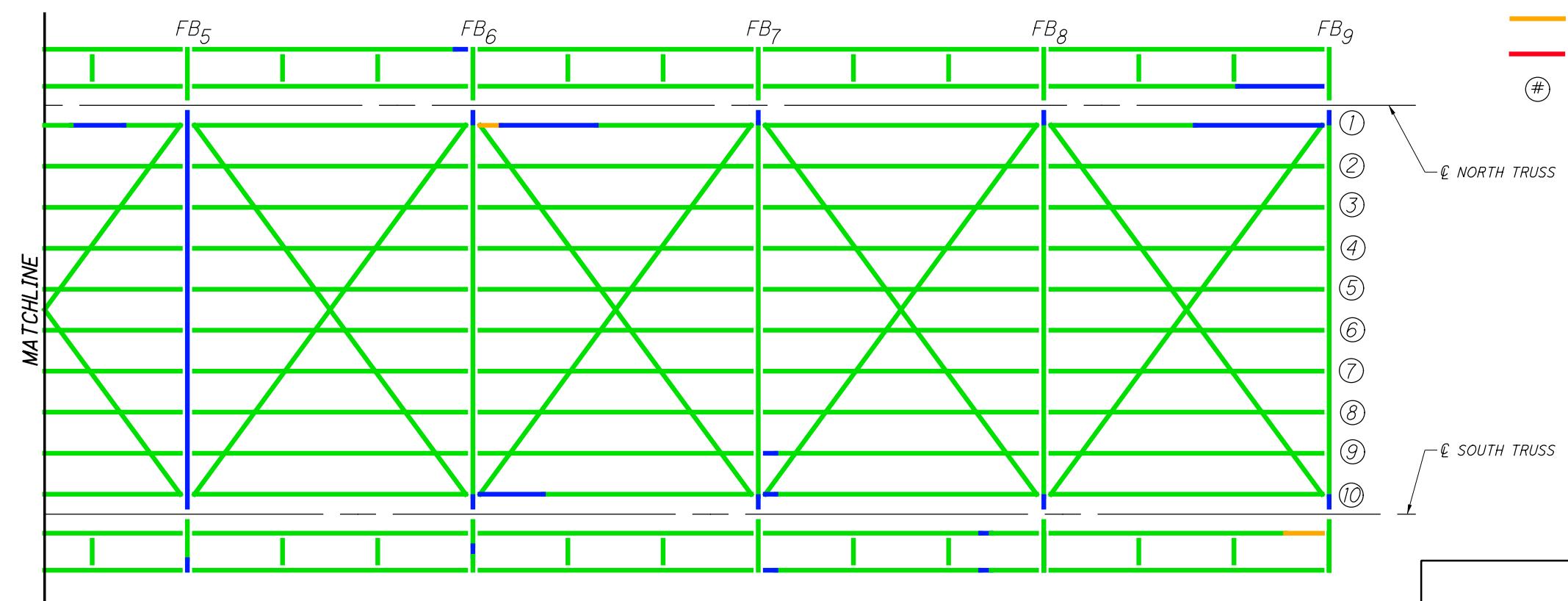
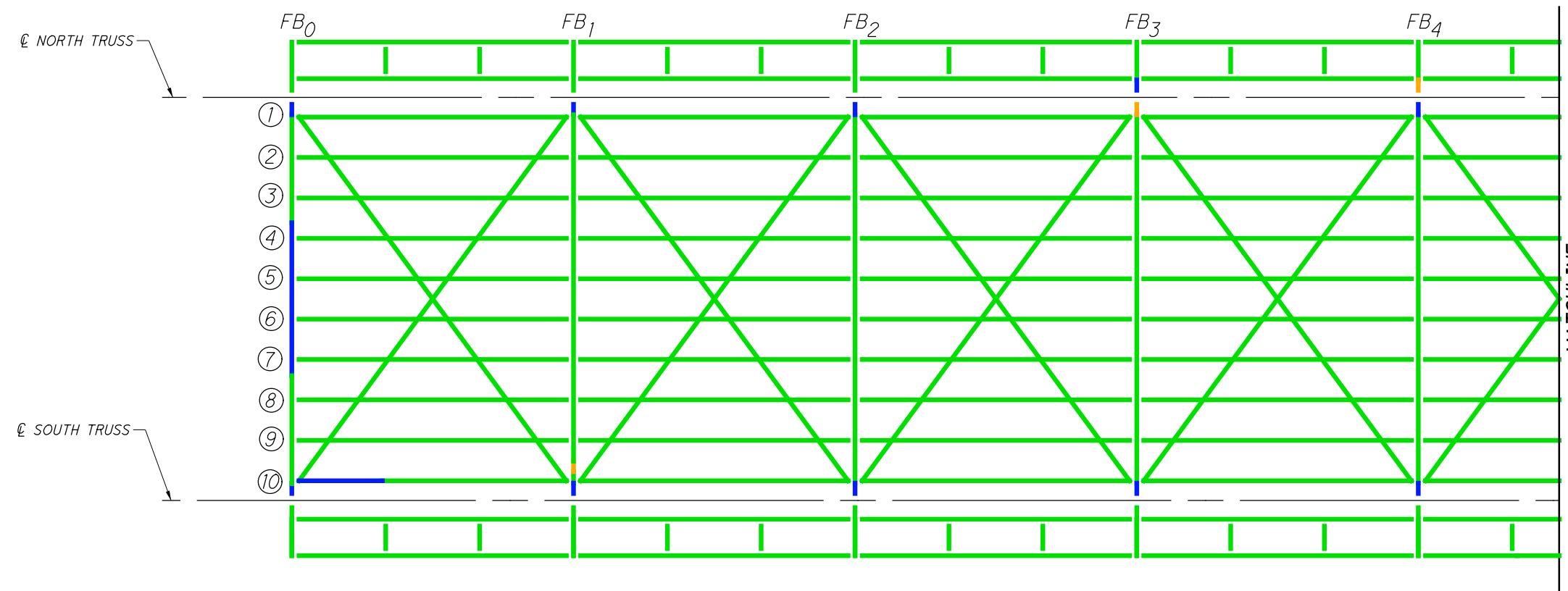


SOUTH TRUSS
(LOOKING NORTH)

NOTES

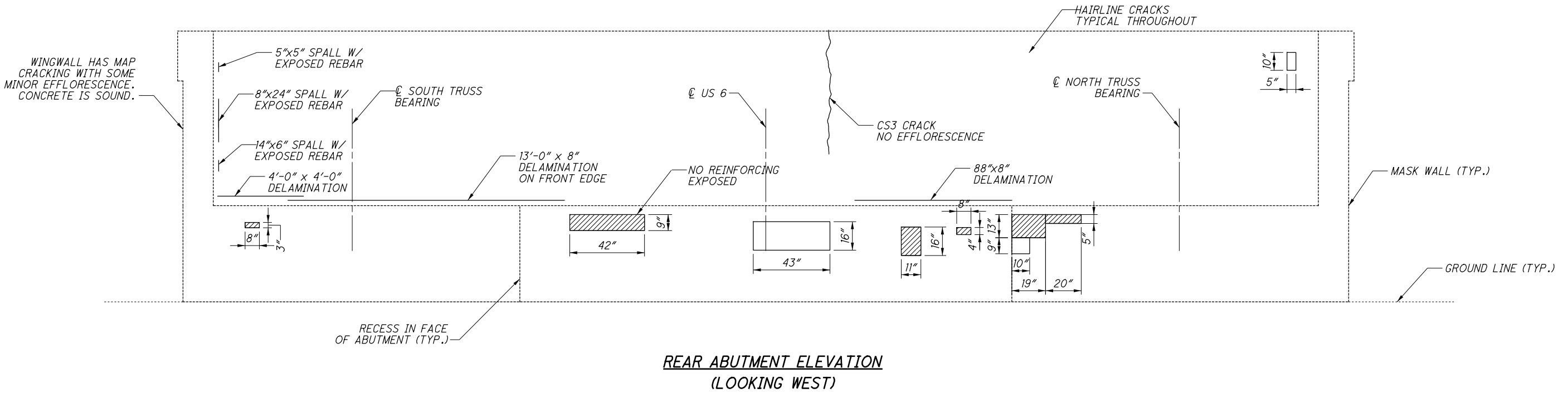
1. CONDITION STATES FOR THE MID HEIGHT GUSSET PLATES OF U_3L_3 , U_4L_4 , U_5L_5 , AND U_6L_6 ARE NOT INCLUDED IN THE ELEMENT LEVEL INSPECTION BECAUSE THEY ARE NOT PRIMARY STRUCTURAL CONNECTIONS.

ERI-6-2884
OVER VERMILION RIVER
TRUSS MEMBER
CONDITION STATE SCHEMATIC
B-2



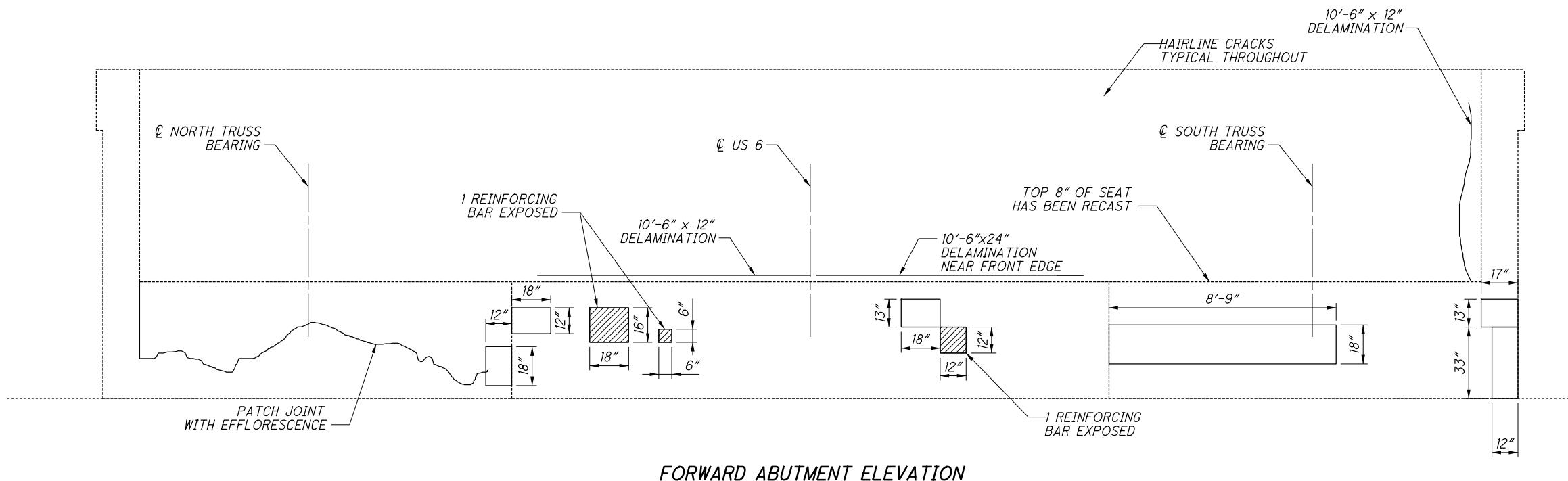
FRAMING PLAN

ERI-6-2884
OVER VERMILION RIVER
FLOOR SYSTEM
CONDITION STATE SCHEMATIC
B-3

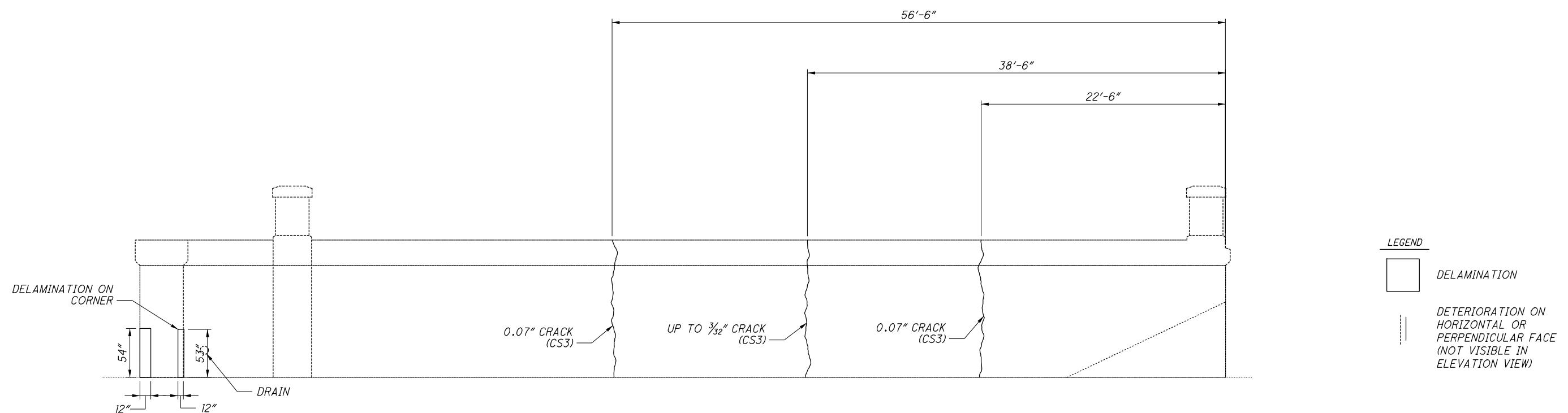


LEGEND

- DELAMINATION
- ▨ SPALL
- DETERIORATION ON HORIZONTAL OR PERPENDICULAR FACE (NOT VISIBLE IN ELEVATION VIEW)



ERI-6-2884
OVER VERMILION RIVER
ABUTMENT DETERIORATION
SCHEMATIC
B-4



SOUTHEAST WINGWALL
(LOOKING NORTH)

ERI-6-2884
OVER VERMILION RIVER
WINGWALL DETERIORATION
SCHEMATIC
B-5