

**OHIO DEPARTMENT OF TRANSPORTATION
2018 IN-DEPTH BRIDGE INSPECTION REPORT**

**LIBERTY AVENUE OVER VERMILION RIVER
BRIDGE No. ERI-6-2284**

SFN: 2202344



DECEMBER 2018

PREPARED BY:

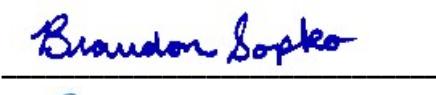
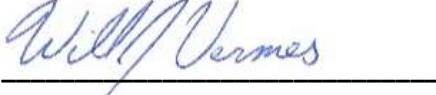


1655 W. Market Street, Suite 355 | Akron, OH 44313

Liberty Avenue Bridge over Vermilion River

2018 In-Depth Bridge Inspection Report

Bridge No. ERI-6-2884
SFN 2202344

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LIBERTY AVENUE BRIDGE OVER VERMILION RIVER
BRIDGE No. ERI-6-2284

2018 IN-DEPTH BRIDGE INSPECTION REPORT

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APPENDIX A – 2018 BRIDGE INSPECTION FIELD REPORT

APPENDIX B – DECK, SUPERSTRUCTURE & SUBSTRUCTURE FINDINGS

I. INTRODUCTION

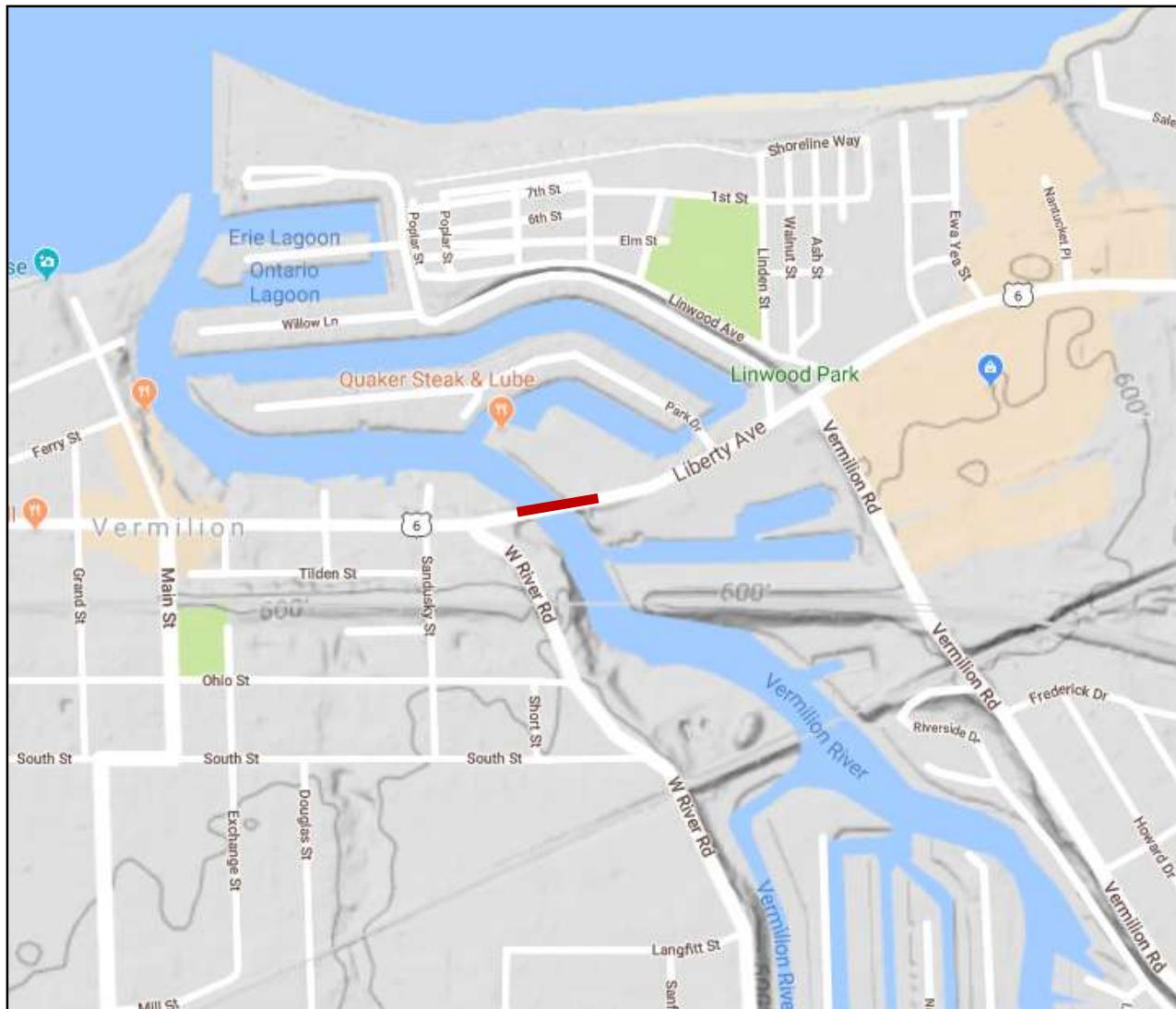


Figure 1 – Liberty Avenue Bridge Location Map.

Bridge Description

ERI-6-2284 (SFN 2202344), also known as the Liberty Avenue Bridge, carries vehicular and pedestrian traffic over the Vermilion River (**Photos 1 & 2**). The bridge is approximately 248 feet long overall and was opened to traffic in 1928. 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 $3'-10\frac{1}{2}''\pm$. 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 $7\frac{1}{2}''$ 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 being fracture critical. Furthermore, the truss floor beams and west approach floor beams are fracture critical because their spacing is greater than 14 feet.¹



Photo 1 – Elevation Looking North

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



Photo 2 – West End View

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**

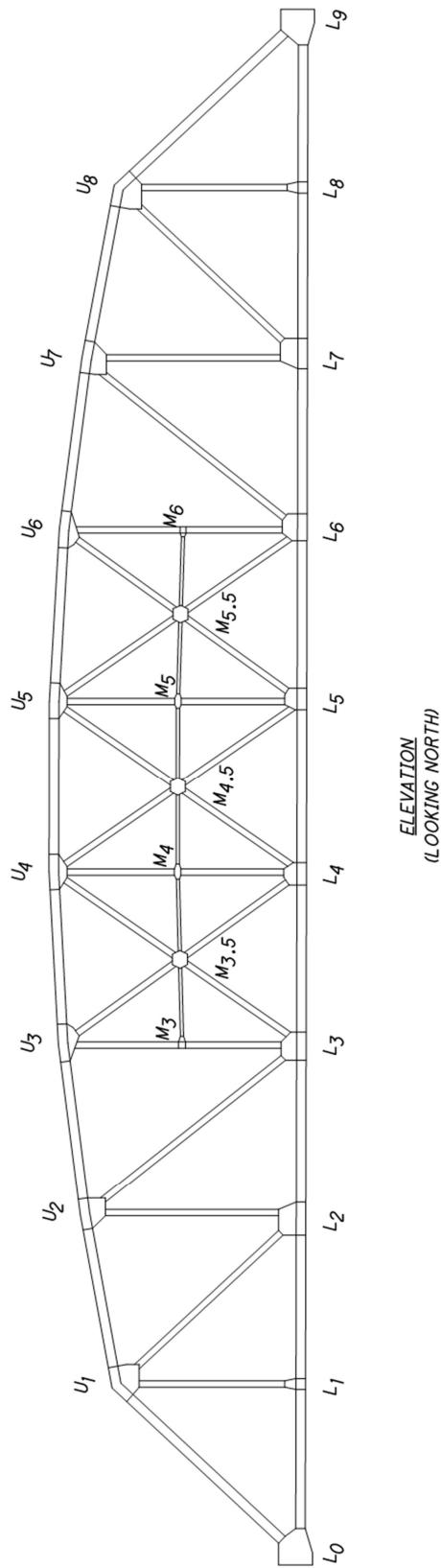


Figure 2

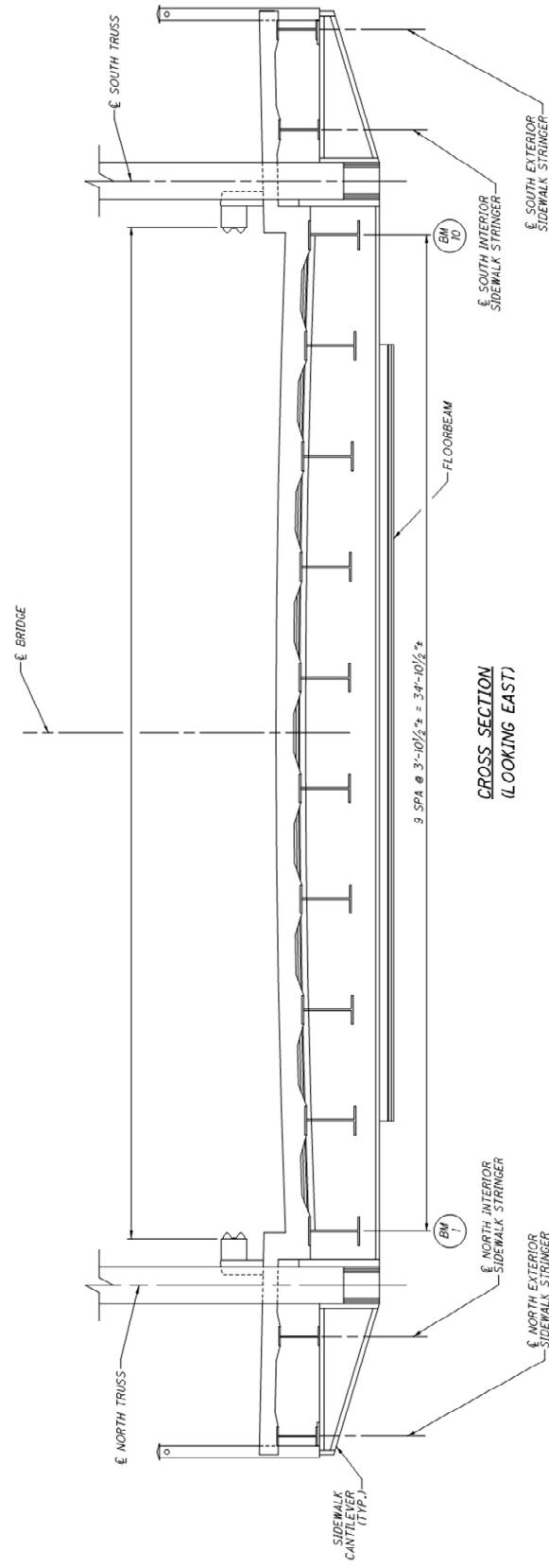


Figure 3

Inspection Procedure

Pennoni performed an in-depth inspection of this structure from September 11 through September 14, 2018. Personnel included William J. Vermes PE, Dale E. Arnold PE, and Brandon P. Sopko PE. The superstructure inspection access was achieved via manlift with traffic control and pontoon platform with step ladders (**Photo 3**). 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 Bridge Inspection Field Report (BIFR) is included in **Appendix A**. Additionally, **Appendix B** contains a summary of condition states and the significant findings of the deck, substructure and substructure elements.

Condition & Element Level Rating 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 and at different times. Table 2 contains the bridge inspection rating matrix established by the Federal Highway Administration (FHWA), using a 0-Failure through 9-Excellent scale, and used by the Ohio Department of Transportation (ODOT). In this report, component conditions will generally be discussed based on the ODOT rating guidelines for individual components, 1-Good through 4-Critical. The General Appraisal, the Deck, Superstructure, Substructure, Channel and Approach Summaries, and the Protective Coating System rating will follow the NBIS/ODOT 0 through 9 rating scale.

Additionally, this bridge inspection was performed in accordance with the following documents:

- *Manual of Bridge Inspection*, Ohio Department of Transportation, 2014.
- *Manual for Condition Evaluation of Bridge, 2nd Edition*, American Association of State Highway and Transportation Officials (AASHTO), 2011.
- *Bridge Inspector's Reference Manual (BIRM)*, U.S. Department of Transportation, revised December 2012.

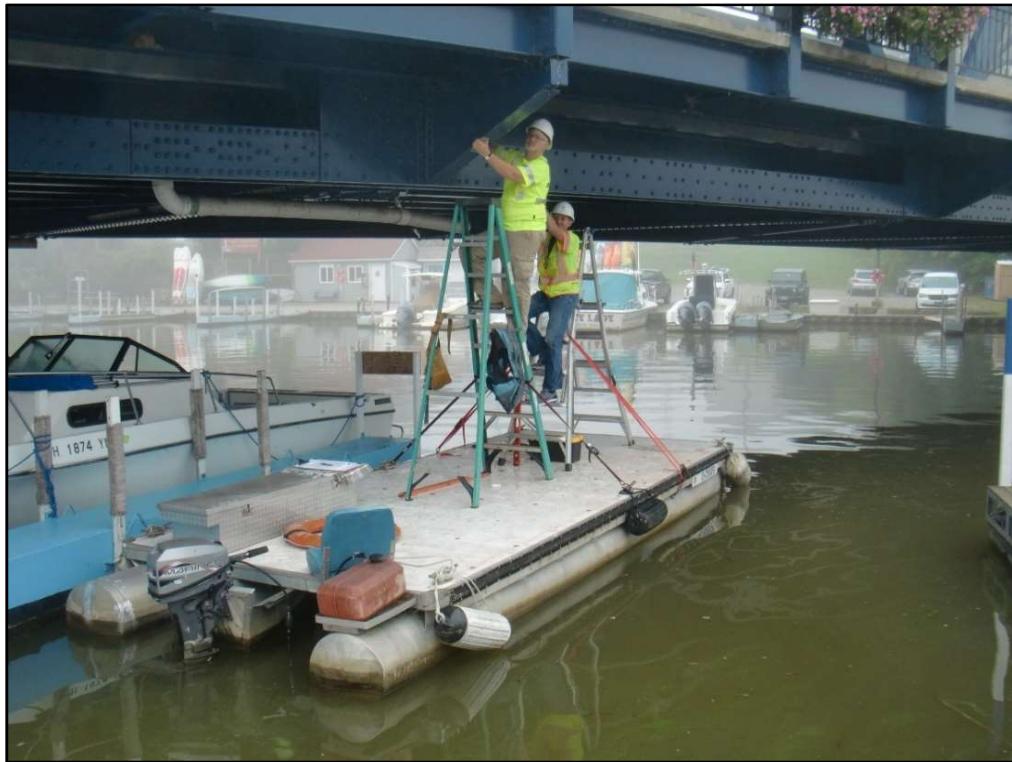


Photo 3 – Lower Chord & Floor System Inspection with a Pontoon Boat & Step Ladders

RATING		CONDITION	RATING GUIDELINES
ODOT	NBIS		
1 – Good	9	Excellent	
	8	Very Good	No problems noted.
	7	Good	Some minor problems present.
2 – Fair	6	Satisfactory	Structural elements show some minor deterioration.
	5	Fair	All primary structural elements are sound but have minor section loss, deterioration spalling or scour.
3 – Poor	4	Poor	Advanced section loss, deterioration, spalling or scour.
	3	Serious	Loss of section, deterioration, spalling or scour has seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
4 – Critical	2	Critical	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
	1	Imminent Failure	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structural stability. Bridge is closely monitored is closed to traffic but corrective action may put bridge back into light service.
	0	Failure	Out of Service, beyond corrective action.

Table 2 – ODOT & NBIS Condition Rating Guidelines.

II. DECK

The deck is in ***Satisfactory*** Condition, or **6** on the NBIS condition rating guidelines. Deck findings are shown in **Appendix B**. Condition findings of individual deck items are as follows:

Floor

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 0.025" wide (**Photo 4**). The pattern of transverse cracks closely matches the floorbeams below with some additional partial length transverse cracks between the floorbeams. A 3' long, 3' wide delamination 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 are shown on the Deck Location Plan in **Appendix B**. On the bottom of the floor, isolated transverse and longitudinal hairline cracks were scattered throughout. Occasionally cracks were found with leakage and efflorescence (**Photo 5**).

<i>Element Level Quantities – Floor</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
7,938 SF		7,641 SF	297 SF	



Photo 4 – 0.025" Wide Transverse Crack in Deck, Near Floorbeam 3



Photo 5 – Typical Transverse Crack in Underside of Deck with Efflorescence

Edge of Floor

The edge of the deck is in **Good** condition. For inventory purposes, the edge of the sidewalk deck and edge of roadway deck are counted once per side. Isolated spalls and delaminations are present on the edge of the roadway deck (**Photo 6**).

Element Level Quantities – Edge of Floor				
Total Quantity	CS 1	CS 2	CS 3	CS 4
496 LF	466 LF	30 LF		



Photo 6 – Typical Corner Spall and Delamination, Edge of Roadway Deck

Wearing Surface

The concrete wearing surface is in **Good** condition with a grid pattern of transverse and longitudinal cracking is present. See *Floor* commentary for discussion on deck cracking. The wearing surface skid-resistance grooves are noticeably worn along the wheel paths, especially along the eastbound lane and the westbound left turn lane (**Photos 7**). The wearing surface skid-resistance grooves are also filled with sealer (**Photo 8**).

Element Level Quantities – Wearing Surface				
Total Quantity	CS 1	CS 2	CS 3	CS 4
8,683 SF		8,293 SF	390 SF	

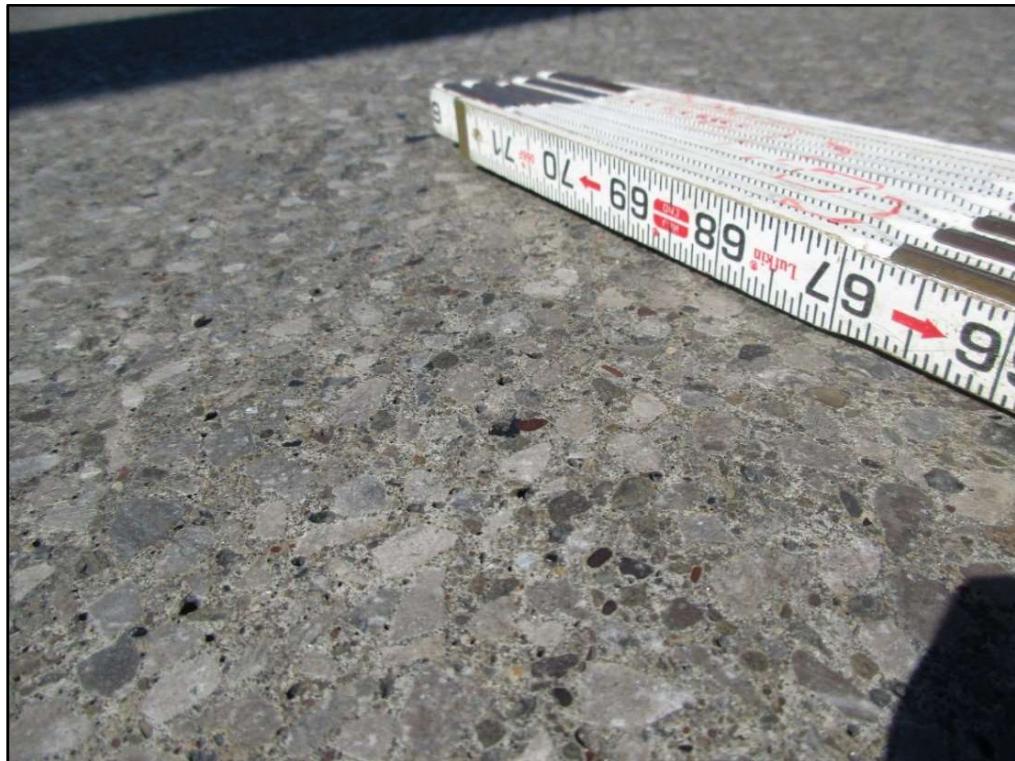


Photo 7 – Common Wear of Skid-Resistance Grooves



Photo 8 – Deck Sealer Within Skid-Resistance Grooves

Curbs & 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 9). Where truss members pass through the sidewalk deck, several steel covers are loose with others having isolated active corrosion.

<i>Element Level Quantities – Curbs & Sidewalks</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
496 LF	391 LF	104 LF	1 LF	



Photo 9 – Typical Transverse Cracking in Sidewalk

Railing

The railings are in **Good** condition. The DBR railing posts have areas of light corrosion on the bases. Five of the rail mounted reflectors are broken. Section loss with a perforation was found on the backside of the tubular steel backup (**Photo 10**). 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 (**Photo 11**). 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 12**). The railing post connection assemblies below the sidewalk deck have advanced section loss in areas (**Photo 13**), however these connections are believed to be redundant as the posts are structurally encased in the sidewalk deck. Section loss is present on the bottom of the pickets in isolated areas. Chipped paint is also present in isolated areas.

Element Level Quantities – Railing				
Total Quantity	CS 1	CS 2	CS 3	CS 4
496 LF	466 LF	30 LF		



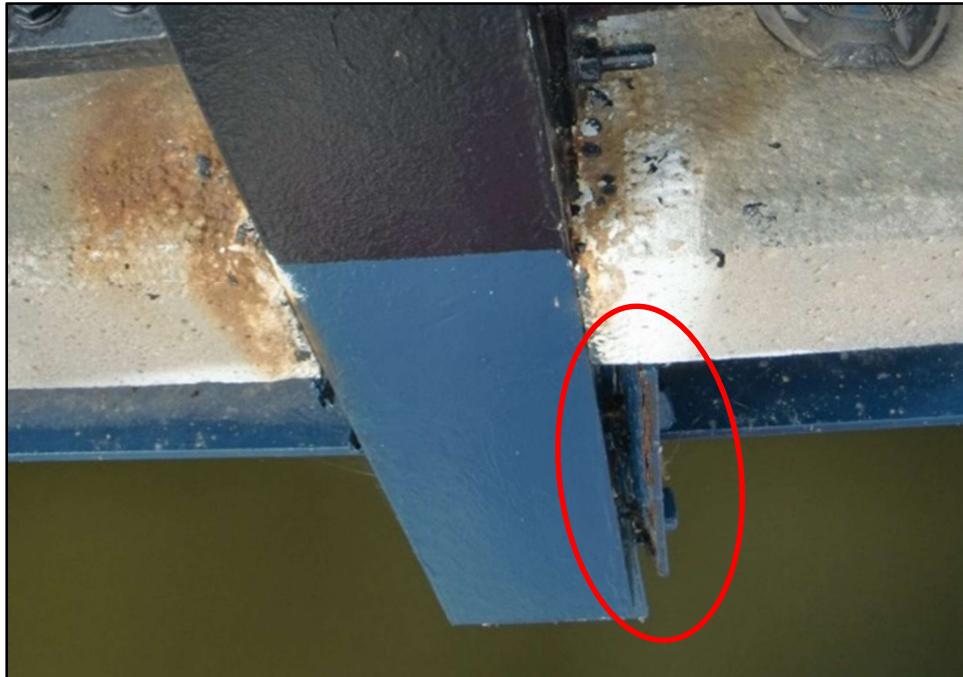
**Photo 10 – Active Corrosion with Perforation, Railing Tubular Steel Backup,
near L9 South**



Photo 11 – Typical Cracked Railing Bracket, South Rail



**Photo 12 – Vertical Crack in Railing Post
(Circled), Southwest Approach**



**Photo 13 – Advanced Section Loss to Abandoned Railing
Post Connection Assembly (Circled)**

Drainage

The drainage is in **Good** condition. No clogs or debris within the drain pipes were observed. Some debris is present within one north curb scupper collector (**Photo 14**), however all drain pipes entrances are open. The plastic drain pipe at the northeast corner has a cracked coupling (**Photo 15**). Areas with minor ponding and debris are present along the south curb near the Rear Abutment (**Photo 16**).

<i>Element Level Quantities – Drainage</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
12	10	2		



Photo 14 – Partly Clogged Scupper Inlet, North Curb



Photo 15 – Cracked Drain Pipe Coupling, Northeast Corner



Photo 16 – Minor Ponding & Debris Along Edge of Deck, Southwest Curb

Expansion Joint

The expansion joints are in **Poor** condition. The expansion joint at the Rear Abutment measures $\frac{3}{8}$ " between the steel retainers, comparable to the 2016 measurement. No deficiencies were noted in the armor. The compression seal between the approach slab and the backwall at the rear abutment is described in the approach slab section. The Forward Abutment compression seal is torn for the entire length (**Photo 17**).

Element Level Quantities – Expansion Joint				
Total Quantity	CS 1	CS 2	CS 3	CS 4
108 LF		61 LF	12 LF	35 LF

Lighting

The lighting is in **Good** condition with no deficiencies noted.



**Photo 17 – Torn Compression Seal Joint,
Forward Abutment**

III. SUPERSTRUCTURE

The superstructure is in **Fair** condition, or **5** on the NBIS condition rating guidelines. Superstructure findings are shown in **Appendix B**. Condition findings of individual superstructure items are as follows:

Alignment of Members

The alignment of primary superstructure members is **Good**.

Element Level Quantities – Alignment				
Total Quantity	CS 1	CS 2	CS 3	CS 4
1	1			

Stringers

The stringers are in **Good** condition. The exterior stringers under the roadway deck have active corrosion on the top of the top flange at the abutments (**Photo 18**). Pitting up to $3/16$ " deep is present in isolated areas on the bottom flange of the roadway stringers (**Photos 19 and 20**). A few bent bottom flanges are present at stringer to floorbeam connections. The stringers supporting the sidewalks have scattered pitting with some isolated perforations (**Photo 21**).

Element Level Quantities – Stringers				
Total Quantity	CS 1	CS 2	CS 3	CS 4
2,430 LF	2,395 LF	33 LF	2 LF	



Photo 18 – Top Flange Active Corrosion, Stringer 1, Panel 9



Photo 19 – Bottom Flange Pitting, Stringer 1, Panel 5



Photo 20 – Bottom Flange Pitting with Perforations, Stringer 1, Panel 7



Photo 21 – Typical Web Perforations (Circled), Exterior Sidewalk Stinger

Floorbeams & Floorbeam Connections

The floor beams are in **Good** condition. Arrested pitting on the web and top and bottom flanges is typical at the floorbeams ends adjacent to the lower gusset plate connections (**Photos 22, 23 & 24**). Pack rust behind floorbeam connection angles is also reactivating. Perforations are present in the bottom flanges of Floorbeams 2 and 5, both adjacent to the north lower lateral gusset plates (**Photo 25**). The cantilever floorbeam extensions supporting the sidewalks also have arrested pitting with isolated perforations (**Photo 26**).

<i>Element Level Quantities – Floorbeams</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
373 LF	353 LF	20 LF		



Photo 22 – Pitting with Edge Hole in Connection Angle, Floorbeam 1 at L1 South



**Photo 23 – Pitting to Web,
Floorbeam 1 at L₁ South**



Photo 24 – Typical Pitting to Floorbeam End & Bottom Flange Angle, Near Truss Connection



**Photo 25 – Pitting with Pinholes to Bottom Flange, Floorbeam 5
at North Lower Lateral Brace Connection Plate**



**Photo 26 – Web Pitting (Circled) with Perforation (at Arrow),
Floorbeam Sidewalk Cantilever End, L5 North**

Verticals

The top chord is in **Fair** condition. Arrested pitting is typical at the lower vertical ends in the splash zone. Perforations were found in the web of L₆U₆ North (**Photo 27**). Repairs were made to several verticals with advanced section loss.

Element Level Quantities – Verticals				
Total Quantity	CS 1	CS 2	CS 3	CS 4
16		12	4	

Diagonals

The diagonals are in **Fair** condition. Arrested pitting and section loss, advanced in areas, is typical to the web and flanges in the splash zone (**Photos 28 & 29**). 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. Repairs were made to several verticals with advanced section loss in the splash zone.

Element Level Quantities – Diagonals				
Total Quantity	CS 1	CS 2	CS 3	CS 4
20		10	10	



Photo 27 – Web Pitting & Perforations, L₆U₆ North



Photo 28 – Section Loss to Flanges with Pack Rust Behind Fill Plate, L₃U₄ South at L3S



Photo 29 – Web Pitting with Perforation, U₅L₆ North, Near L₆ North

Upper Chord

The upper chord is in **Fair** condition. Arrested pitting is typical on the bottom flange angles gussets (**Photo 30**). 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 31**). The top chord and end post diagonals have up to five pairs of bent lacing bars (**Photo 32**). The end posts have minor pitting in the splash zone (**Table 3**).

<i>Element Level Quantities – Upper Chord</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
18	1	6	11	



Photo 30 – Pitting to Bottom Flange Angle, U4U5 South



Photo 31 – Dented Top Flange Plate and Angle, U₁U₂ North



Photo 32 – Typical Bent Lacing Bar, U₈L₉ North

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

Lower Chord

The lower chord is in **Fair** condition. Arrested pitting and loss of section is typical on the exposed web plates (**Photo 33**). Pack rust between the built-up plates is present from L₂ through L₇ with several locations now exhibiting active corrosion (**Photo 34**). 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 35**).

<i>Element Level Quantities – Lower Chord</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
18	8	6	4	



Photo 33 – Typical Lower Chord Pitting

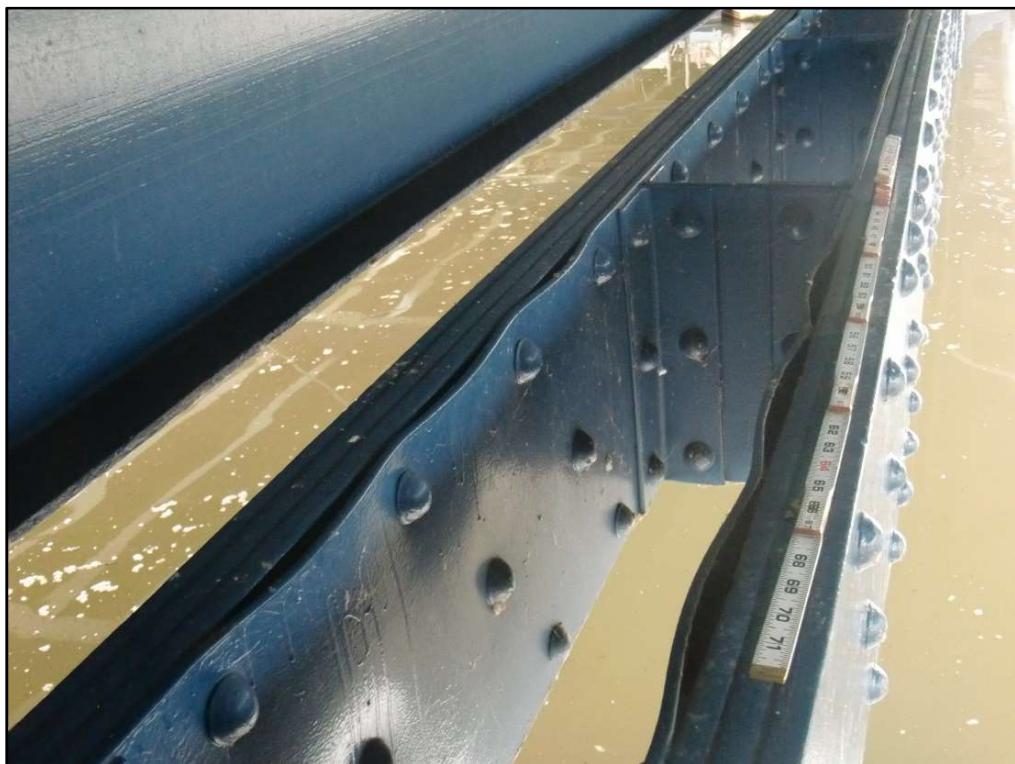


Photo 34 – Typical Lower Chord Pack Rust, L₂ to L₇



Photo 35 – Lower Chord Web Plate Perforation, L₂L₃ North

Truss Gusset Plates

The 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. Perforations, up to $\frac{3}{4}$ " high x 2" wide, were found on the interior gusset plates at L₄ South, L₅ South and L₆ South with surrounding pitting (**Photos 36, 37 & 38**). 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.

<i>Element Level Quantities – Truss Gusset Plates</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
84	36	25	21	2



Photo 36 – Typical Scattered Minor Pitting, L6 North Exterior Gusset Plate

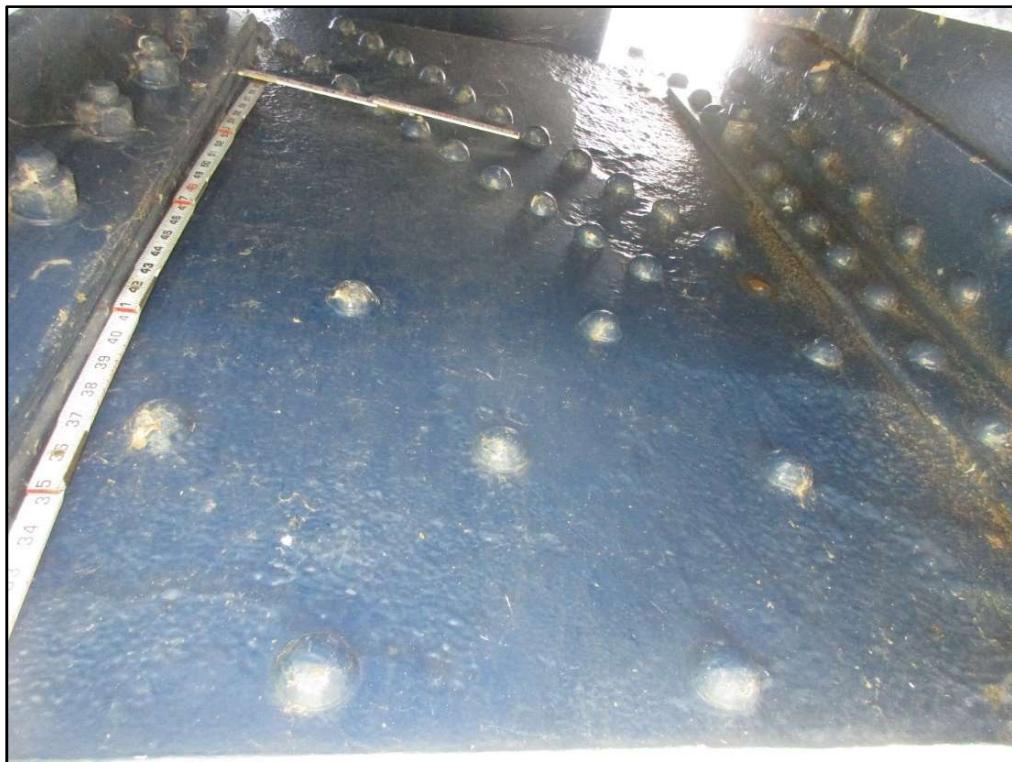


Photo 37 – Pitting with Perforations, L6 South Interior Gusset Plate



Photo 38 – Perforation at Top of Interior Gusset Plate, L4 South

Lateral Bracing

The lower 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 39**).

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 40**).

<i>Element Level Quantities – Lateral Bracing</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
32	24	4		



Photo 39 – Broken Lower Lateral Bracing Rod Hanger, Panel 7



Photo 40 – Typical Upper Lateral Bracing Sag

Sway Bracing

The sway bracing is in **Fair** condition. Typical deficiencies throughout the sway bracing includes arrested pitting of the connection angles connecting to the gussets with isolated perforations (**Photo 41**). 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 42**).

<i>Element Level Quantities – Sway Bracing</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
8		1	7	



Photo 41 – Typical Pack Rust Behind Sway Bracing Gusset



Photo 42 – Minor Web Pitting, East Portal

Bearing Devices

The 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. 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 14° degrees (**Photo 43**). Also, the north and south elastomeric bearing pads are deformed 1" and $1\frac{1}{16}$ " respectively toward the backwall. This over-expansion as measured at 70° F, and is similar to that observed at 20° F in January 2018.

<i>Element Level Quantities – Bearing Devices</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
4		2	2	



Photo 43 – Expanded Rocker Bearing,
Lo South at 75° F

Protective Coating System

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 (Photo 44). 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 manure is present inside the upper chord and on the lower lateral bracing gussets (Photo 45).

<i>Element Level Quantities – Protective Coating System</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
3,289 LF	3,229 LF	60 LF		



Photo 44 – Common Local Protective Coating System Failure & Reactivating Pack Rust Failure, Bearing Gusset Plates



Photo 45 – Typical Pigeon Manure Pile, Lower Lateral Bracing Gusset Plate

IV. SUBSTRUCTURE

The substructure is in **Fair** condition, or **5** on the NBIS condition rating guidelines. Condition findings of individual substructure items are as follows:

Abutment Walls

The abutments are in **Fair** condition. The Rear Abutment has isolated areas of minor popouts along edges of patches and scaling patches (**Photo 46**). The Forward Abutment also has several areas of delaminations (**Photo 47**). 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. These observations likely are attributed to formwork and finishing variations, however continued observation during this and future inspections is warranted.

<i>Element Level Quantities – Abutment Walls</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
109 LF		109 LF		

Backwalls

The backwalls are in **Good** condition. Both backwalls have scattered hairline map cracking with isolated delaminated areas at the tops of the backwalls.

<i>Element Level Quantities – Backwalls</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
109 LF	107 LF	2 LF		

Wingwalls

The turnback wingwalls are **Fair** condition. Scattered hairline map cracking with efflorescence is present on the wingwalls with small delaminations. A mural has been painted on the southeast wingwall.

<i>Element Level Quantities – Wingwalls</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
4		4		



Photo 46 – Scaling Below New Abutment Seat, Rear Abutment



Photo 47 – Delamination Below New Abutment Seat, Forward Abutment

Scour

The abutment foundations are protected with sheet piling walls and are in stable condition.

<i>Element Level Quantities – Scour</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
2	2			

Slope Protection

The slope protection is in **Fair** condition. An erosion gully is present running from the abutment wall to the slope protection at the Rear Abutment (**Photo 48**).

<i>Element Level Quantities – Slope Protection</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
2	1	1		



Photo 48 – Erosion Gully, Rear Abutment

IV. CHANNEL

The channel is in **Good** condition, or 7 on the NBIS condition rating guidelines. Condition findings of individual channel items are as follows:

Alignment

The channel alignment is in **Good** condition.

<i>Element Level Quantities – Alignment</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
200 LF	200 LF			



Photo 49 – Hole in Sheet Pile Wall, Rear Abutment

Protection

The channel protection consists of sheet pile walls along both banks and is in **Good** condition. Both walls are leaning inward very slightly. A 6" long hole is present at the top of the Rear Abutment sheet pile (**Photo 49**).

<i>Element Level Quantities – Protection</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
200 LF		195 LF	5 LF	

Hydraulic Opening

The hydraulic opening is in **Good** condition. The channel is dredged regularly for pleasure craft and small commercial fishing boats. During this inspection, the channel under the bridge was scanned with a depth finder and was found to vary from 9 to 13 feet deep.

<i>Element Level Quantities – Hydraulic Opening</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
2	2			

V. APPROACHES & GENERAL ITEMS

The approaches are in ***Satisfactory*** condition, or **6** on the NBIS condition rating guidelines. Condition findings of individual approach items and general items are as follows:

Approach Pavement

The approach pavement is in ***Fair*** condition. Both approaches have sealed cracks throughout. 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 (**Photo 50**). The East Approach has a pothole, 12" wide x 6" long x 3" deep, in the right westbound lane at the approach slab (**Photo 51**).

<i>Element Level Quantities – Approach Wearing Surface</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
2		2		

Approach Slabs

The reinforced concrete 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 (**Photo 52**) 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 (**Photo 53**).

<i>Element Level Quantities – Approach Slabs</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
1467 SF	1426 SF	16 SF	25 SF	



Photo 50 – Deteriorating Approach Wearing Surface Patch, West Approach

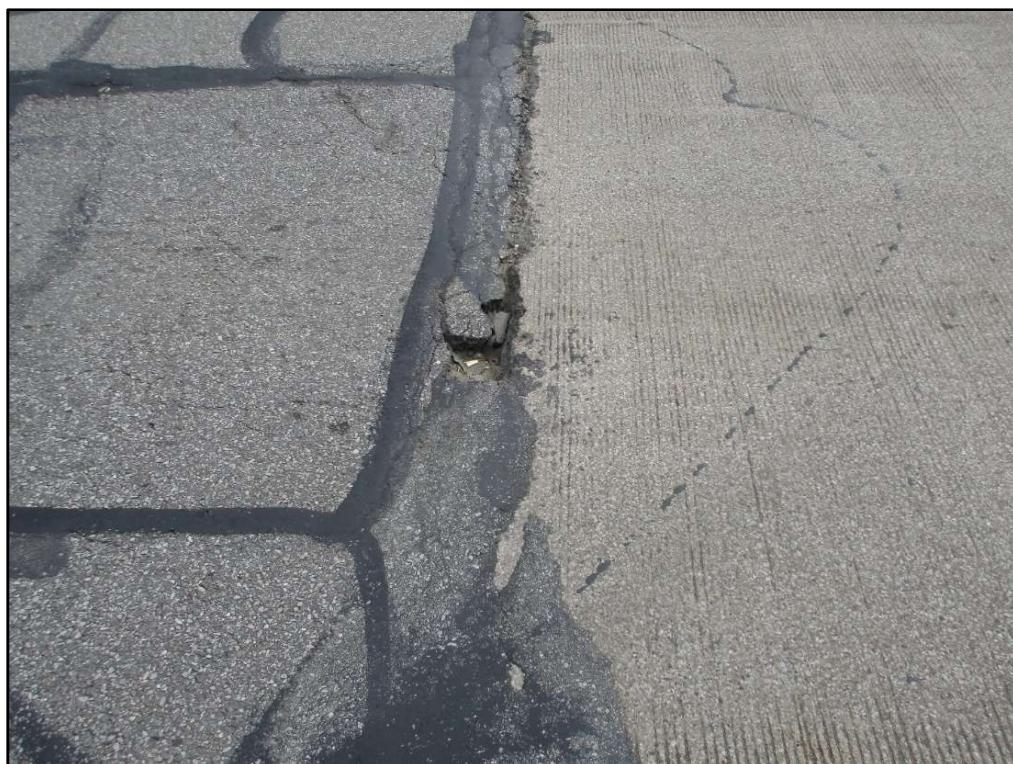


Photo 51 –East Approach Pothole



Photo 52 – Torn Compression Seal, Rear Approach



Photo 53 – Uneven Approach-to-Floor Transition, Rear Approach

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 54**). 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 (**Photo 55**).

Element Level Quantities – Embankment				
Total Quantity	CS 1	CS 2	CS 3	CS 4
4	1	3		



Photo 54 – Typical Approach Sidewalk Settlement (Northwest Approach Sidewalk shown)



Photo 55 – Settlement & Vegetation, Southeast Approach Sidewalk

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.

<i>Element Level Quantities – Guardrail</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
4	2	2		

Signs

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

<i>Element Level Quantities – Signs</i>				
Total Quantity	CS 1	CS 2	CS 3	CS 4
3	3			

Sign Supports

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

Element Level Quantities – Sign Supports				
Total Quantity	CS 1	CS 2	CS 3	CS 4
3	3			

Utilities

The 1¹/₂" diameter electrical conduit on the south edge of deck is broken in places and has broken hangers (**Photo 56**).

Element Level Quantities – Utilities				
Total Quantity	CS 1	CS 2	CS 3	CS 4
1,065 LF	1,055 LF	10 LF		



Photo 56 – Broken Electrical Conduit & Hanger

Land Use

Private docks are below the structure along both shorelines of the Vermilion River. Small Watercraft is being stored along both abutment barrels and on top of both abutment seats (**Photo 57**). At the Rear Abutment, flammable containers and charcoal grills are being stored on the abutment seat and near the truss superstructure (**Photo 58**).



Photo 57 – Private Watercraft Stored on Forward Abutment Seat



Photo 58 – Flammable Material & Charcoal Grills Stored on Rear Abutment Seat

VII. SUMMARY & RECOMMENDATIONS

The Liberty Avenue Bridge over the Vermilion River ERI-6-2884) is in ***Fair*** condition, or **5** on the NBIS rating guideline (Table 2, Page 9). The complete Bridge Inspection Report Form is included in **Appendix A**. Per PID 93095, recommended repairs and maintenance tasks will be included as part of the **2020 In-Depth Inspection Report**.

APPENDIX A

2018 BRIDGE INSPECTION FIELD REPORT



Liberty Avenue Bridge over Vermilion River
2018 In-Depth Bridge Inspection Report
Ohio Department of Transportation, District 3

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
BRIDGE INSPECTION FIELD REPORT

Structure File Number: 2202344

Inventory Bridge Number: ERI 00006 28.840

Bridge Type: 3 - STEEL/4 - TRUSS/4 - THRU

Sufficiency Rating: 42.6

Date Built: 7/1/1928

District: 03 Place Code (FIPS): VERMILION

USR 6 over VERMILION RIVER

Type of Service on: HIGHWAY-PEDESTRIAN

Key: "Qty" = Quantity for Element Level inspection; "(LF)" = Linear Feet; "(SF)" = Square Feet; "(EA)" = Each or count; "CR" = 1-4 Condition Rating or average of worst span unless Summary item 9-0, then the average of entire bridge influenced by the bold boxes; "TR" = Transition Rating or weighted average of condition states; "d" = dedicated or specific chart and guidance, all others use Material specific chart/guidance; "C" = condition prefix; "N" = NBIS rating

Inspection Procedures

Used pontoon platform boat from Vermilion Port Authority with 8-foot step ladder strapped to deck for access to lower chord and floor system.

Used 4 ft level to check lean of abutments (i.e. x" in direction over the 4 feet vertical).

2016 - 3/4" to north and 3/8" away from river for rear abutment and 3/8" towards river for forward abutment.

Comments

APPROACH

c1. Approach Wearing Surface

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.

c2. Approach Slabs

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.

c4. Embankment

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.

c5. Guardrail

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.

DECK

c7.1 Floor/Slab

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

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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.

c7.2 Edge of Floor/Slab

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.

c8. Wearing Surface

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.

Grooves for monolithic wearing surface are worn throughout.

c9. Curb/Sidewalk/Walkway

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.

c11. Railing

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..

c12. Drainage

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Type of Service on: HIGHWAY-PEDESTRIAN

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.

c13. Expansion Joint

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.

Forward Expansion Joint - Compression seal has spalls in concrete and seal is misaligned. There are punctures in seal at eastbound lane

SUPERSTRUCTURE

c17. Stringers

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. 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).

c18. Floorbeams

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.

c19. Truss Verticals

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.

c20. Truss Diagonals

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

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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.

c21. Truss Upper Chord

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.

c22. Truss Lower Chord

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.

c23. Truss Gusset Plate

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.

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c24. Lateral Bracing

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.

c25. Sway Bracing

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.

c26. Bearing Devices

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).

c30. Protective Coating System

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).

SUBSTRUCTURE

c33. Abutment Walls

Rear Abutment: Leans approximately 3/4" to north and 3/8" away from river for every

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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.

c39. Backwalls

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

c40. Wingwalls

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.

c43. Slope Protection

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

CHANNEL

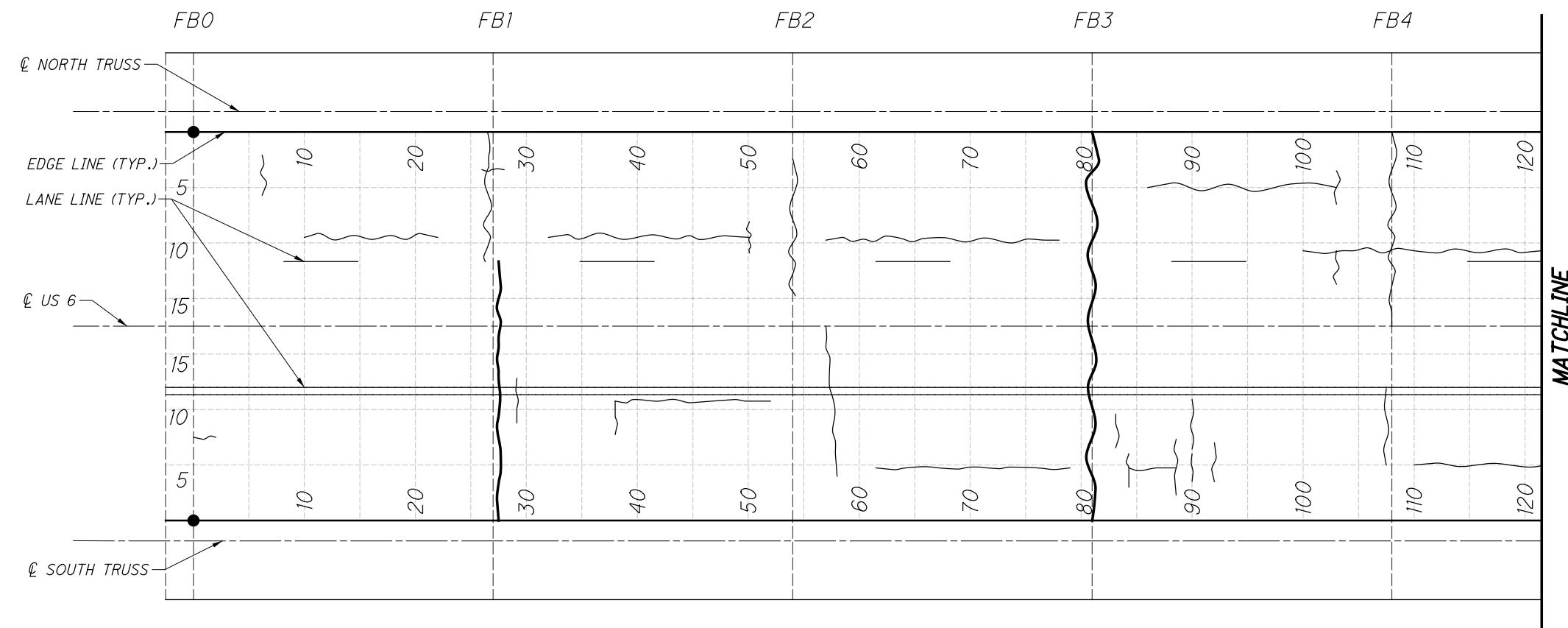
c52. Protection

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.

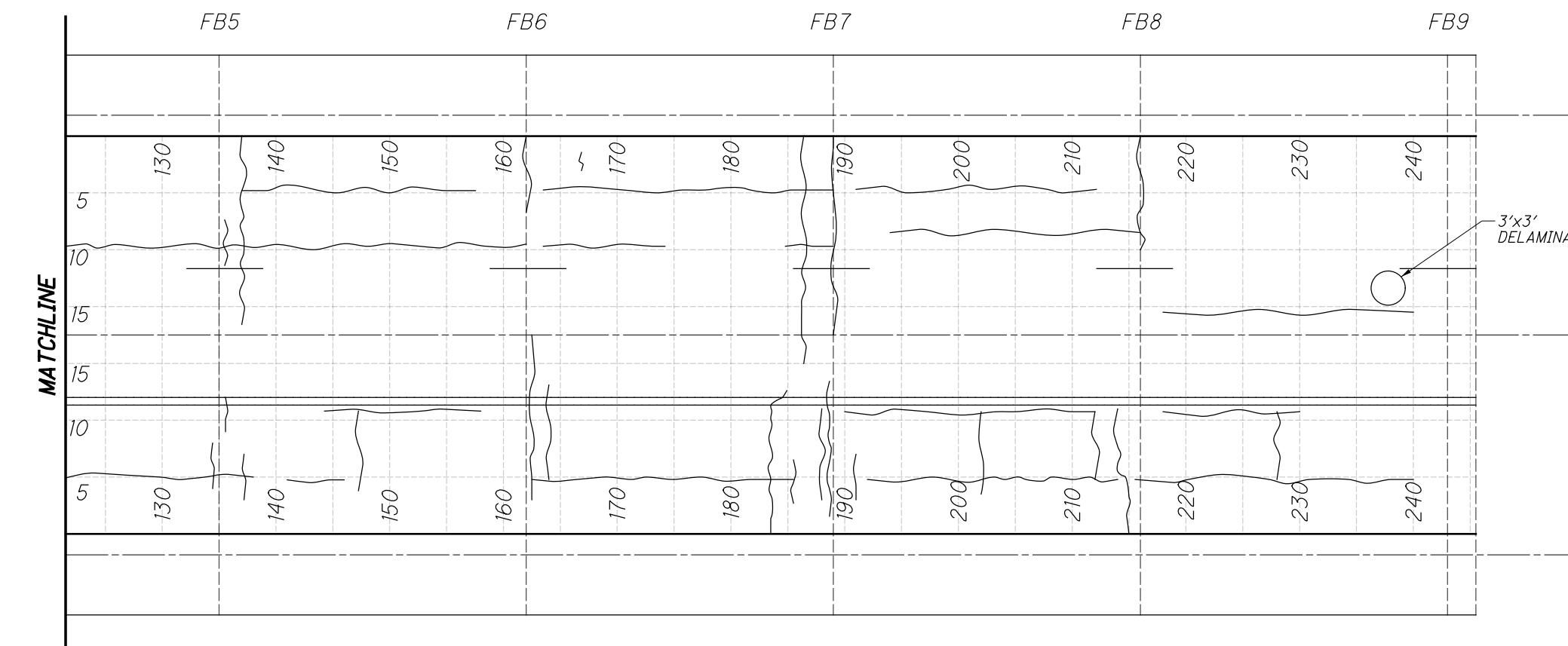
APPENDIX B

DECK, SUPERSTRUCTURE & SUBSTRUCTURE FINDINGS



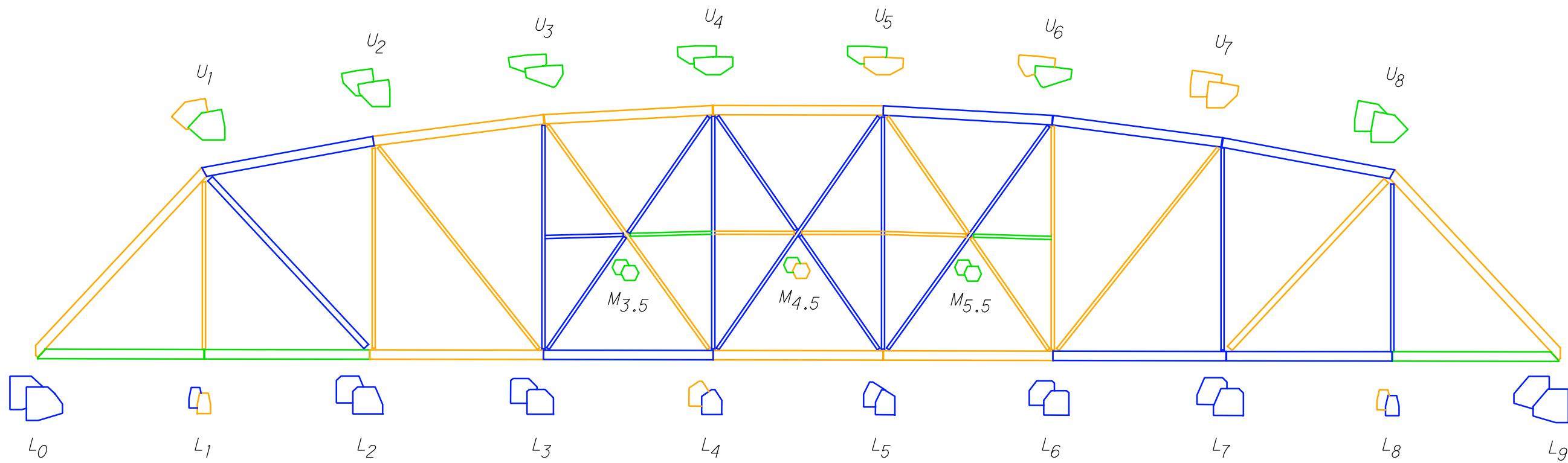
NOTE

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.

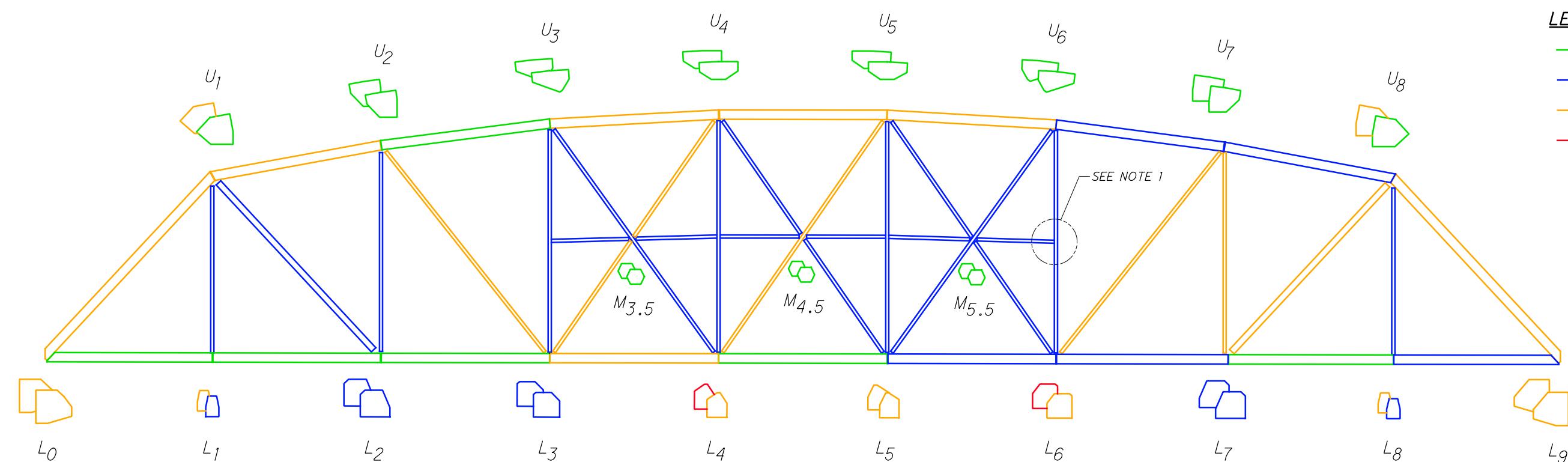


DECK PLAN

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



NORTH TRUSS
(LOOKING NORTH)

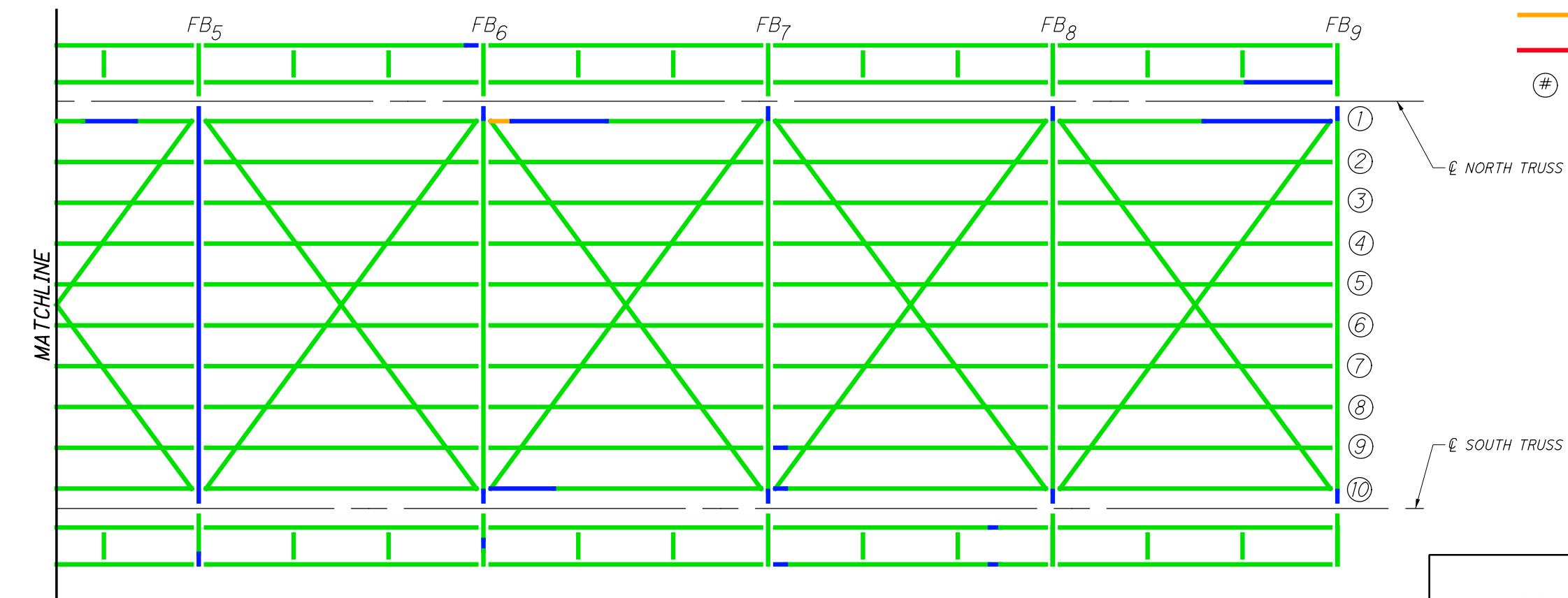
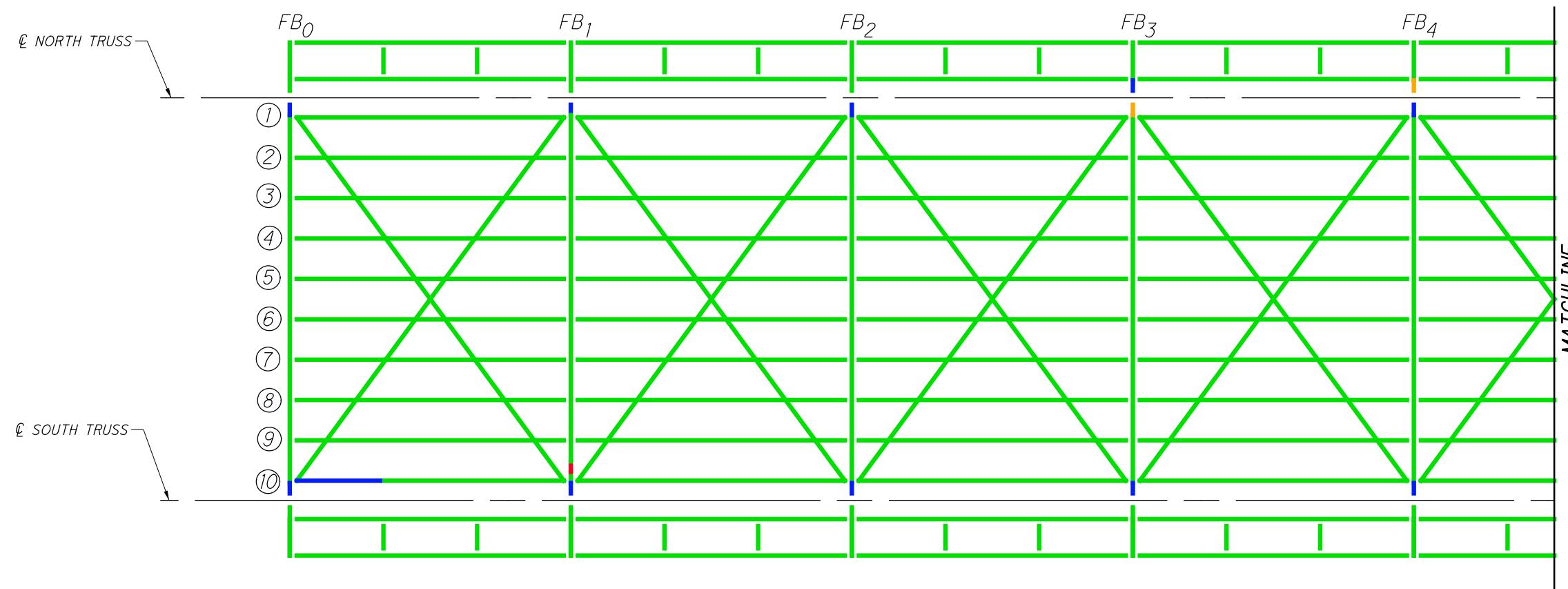


SOUTH TRUSS
(LOOKING NORTH)

NOTES

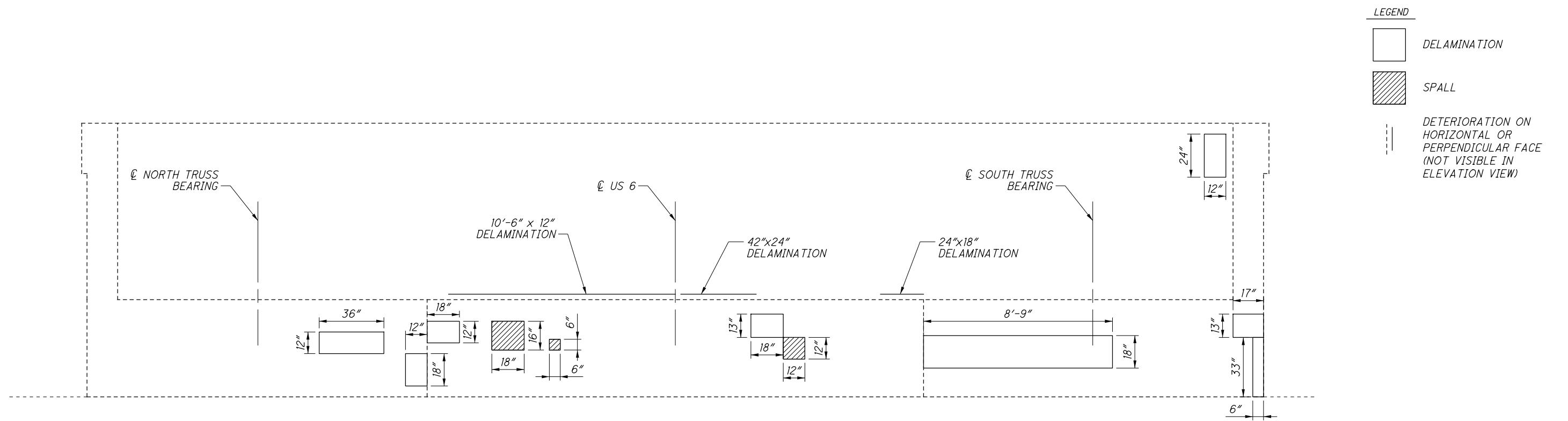
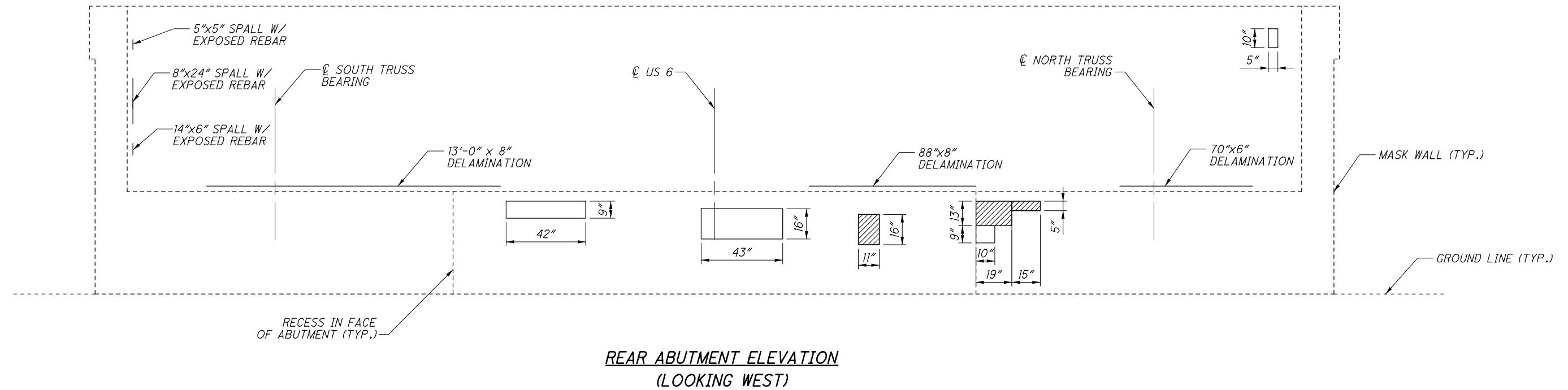
1. CONDITION STATES FOR THE MID HEIGHT GUSSET PLATES OF U_3L_3 , U_4L_4 , U_5L_5 , AND U_6L_6 ARE NOT INCLUDED IN THE ELEMENT LEVEL INSPECTION BECAUSE THEY ARE NOT PRIMARY STRUCTURAL CONNECTIONS.

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



FORWARD ABUTMENT ELEVATION
(LOOKING EAST)

ERI-6-2884
OVER VERMILION RIVER
ABUTMENT DETERIORATION
SCHEMATIC