



Christian County Commission

100 West Church St, Room 100
Ozark, MO 65721

SCHEDULED

MEETING ATTACHMENTS (ID # 5429)

Meeting: 02/01/24 10:00 AM

Department: County Clerk

Category: Meeting Items

Prepared By: Madi Hires Raines

Initiator: Madi Hires Raines

Sponsors:

DOC ID: 5429

Meeting Attachments

ATTACHMENTS:

- 01 FEB 2024 GREEN BRIDGE - FRACTURE CRITICAL BRIDGE INSPECTION REPORT (PDF)

**Fracture Critical
Bridge Inspection Report**

**Bridge No. 2490003
Christian County, Missouri
Smyrna Road over Finley River**



**Prepared by H.W. Lochner, Inc.
January 2024**

LOCHNER

Comprehensive Fracture Critical Bridge Inspection Report

1. General Information

Bridge Number: 2490003

County: Christian

Facility Carried: Smyrna Road

Facilities Intersected: Finley River

Load Posting: 5 Tons

Year Built: 1912

Dates of Fracture Critical Inspection: 6-26-2023, 6-27-2023, and 6-28-2023

Inspectors: Josh Gamage, P.E.; Thomas Ballard, & Koby Hesse

Affiliation: H.W. Lochner, Inc.

Date of Last Fracture Critical Inspection: June 2021

Average Daily Traffic: 300

Number of Lanes: 1

Bridge Roadway Width: 11'-10"

2. Fracture Critical Member Information and Layout

2.1. General Bridge Information

Bridge 2490003 is a 281 ft. long, six span bridge built in 1912. The bridge has a main single 119 ft. long pin connected steel thru truss span over the river (Span 4). The bridge has three 32 ft. long steel two-girder / floor beam / stringer spans on the north approach (Spans 1 to 3). The bridge has two 32 ft. long steel two-girder / floor beam / stringer spans on the south approach (Spans 5 and 6). The Smyrna Road Bridge is located about 3 miles northeast of Ozark, MO. (**see Figure 1, Location of Bridge 2490003, in the Appendix**). The bridge carries one lane of two-way traffic down the center of the bridge. There are no sidewalks or median on the bridge. The bridge is posted at 5 Tons.

The main focus of this fracture critical inspection is the superstructure of all five approach spans (Spans 1 to 3, Spans 5 to 6) and the superstructure of the main thru truss over the river (Span 4) (**see Figure 2, Plan View of Bridge 2490003, in the Appendix**). The bridge deck is asphalt on corrugated metal stay-in-place forms for one lane of traffic.

Bridge 2490003 is considered a fracture critical bridge because it contains fracture critical members. A fracture critical member (FCM) is defined as a steel member in tension or with a tension element whose failure would probably cause a portion of, or the entire bridge, to collapse.

The fracture critical members on this bridge are:

Three - 32 ft. north approach steel Two-Girder / Floor Beam / Stringer spans (Spans 1 to 3):

- main two girders

119 ft. main span steel Thru Truss span (Span 4):

- lower chord members
- diagonal members
- select vertical members
- floor beams

Two - 32 ft. south approach steel Two-Girder / Floor Beam / Stringer spans (Spans 5 to 6):

- main two girders

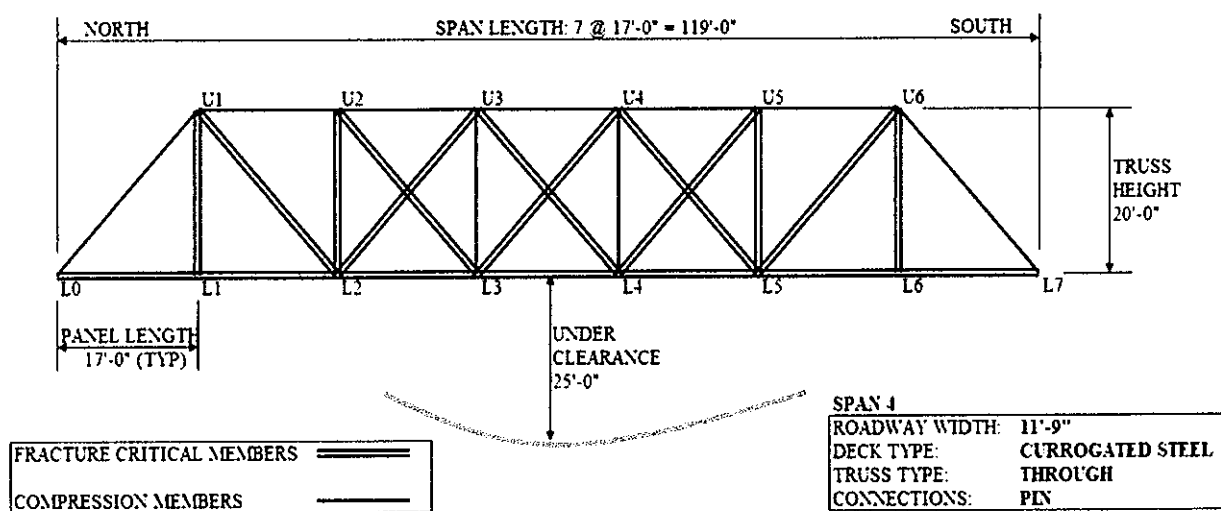
The steel stringers in all the spans are not fracture critical members. The floor beams in the five approach spans are not fracture critical members because the spacing of these floor beams is less than 14 ft.

There are multiple stringers and floor beams in poor or severe condition on this bridge. See **Figure 3, Condition of Floor System, in the Appendix**, for a layout and condition of the stringers and floor beams that comprise the floor system of the bridge.

2.2. Plan and Member Labels

In the approach two-girder spans, the girders are labeled as G1 (east girder) and G2 (west girder).

In the thru truss span, the trusses are labeled as either the East Truss or the West Truss. The labeling of the truss span floor beams is from north to south, beginning with Floor Beam 0 located at the north end of the truss span (Bent 4). Truss members are labeled using the panel point numbers from the top and bottom chord (i.e., U2 – L3 for the member that runs from upper chord panel point U2 to lower chord panel point L3). See figure below for the labeling of the truss. The labeling of the stringers in the truss span is from east (Stringer No. 1) to west (Stringer No. 9).



Elevation View of Main Thru Truss Span (Span 4)

3. Inspection Methods

3.1 Methods of Access

The two-girders and the floor beams in the approach spans (Spans 1 to 3, Spans 5 to 6) were accessed using a 16 ft. ladder from the ground below.

The lower chord, gusset plates, floor beams, and stringers of the main truss span (Span 4) were inspected by hanging a 24 ft. long x 2 ft. wide scaffold pick board from the bridge railing and inspecting along the length of the members. The top of the lower chord was inspected from the top of the deck by foot.

The truss upper chord and the upper portions of the truss diagonals and verticals were inspected using a 19 ft. electric scissor manlift (Genie Model No. GS-1930) that was delivered and picked up from the bridge site. The lower portions of the truss diagonals and verticals were inspected from the top of the deck by foot.

3.2 Method of Cleaning

Dirt and debris were removed from the fracture critical members using small bristled brushes and small scrapers. Isolated areas of pack rust were removed with a rock hammer.

3.3 Method of Inspection

After cleaning, the members were visually inspected for signs of distress and potential fatigue problems. Defects, problem areas, and potential issues were recorded in the field using a digital camera.

4. Inspection Results

Specific details regarding each individual fracture critical member can be found in the attached **Fracture Critical Inspection Report Spreadsheet**.

4.1 Fracture Critical Members

4.1.1 Two-Girder Spans, Spans 1 to 3 (North Approach Spans)

Girders

The two main girders, G1 and G2, have minor to moderate surface rusting and pitting throughout, and minor section loss.

Defects include:

- Span 1, G1 and G2 have 1/8" section loss to the top flange for the center half of the span.
- Span 1, G2 web has heavy pitting with 1/8" deep x 9" high x 7' long section loss at Bent 1

4.1.2 Two-Girder Spans, Spans 5 to 6 (South Approach Spans)

Girders

The two main girders, G1 and G2, have minor to moderate surface rusting and pitting throughout, and minor section loss. Girder 2 is in worse condition than Girder 1.

4.1.3 Thru Truss, Span 4

The main span thru truss has fair alignment. The main span truss members have heavy surface rust throughout. It has numerous welds to the lower chord and vertical members for utility and handrail attachments.

Thru Truss Lower Chord

The lower chord members have satisfactory alignment and most of the eyebars are taut. There is moderate pitting and pack rust, and minor section loss on the eyebars at the bearing devices.

There are rail posts welded to the lower chord members and utility attachments welded to the lower chord members, which is a flawed detail (**see photo below**).

Most of the pins in the lower chord have heavy surface rust but are in fair condition. The pins at L0 on both trusses are in poor condition with 1/8 to 3/16" pitting (**see photo below**).



Thru Truss: Rail post welded to lower chord



Thru Truss, West Truss, L0: Pin has 3/16" deep pitting on 1/4 of the pin circumference for 2/3 pin length

Thru Truss Diagonals

The diagonals have heavy surface rust and minor pitting throughout. Most diagonal eybar members are estimated to have 10% section loss due to pitting throughout the member. On the East Truss, L2-U3 was retrofitted with an additional wire rope member, which is functioning adequately.

Similar to the lower chord, the diagonals have forged eyebars which have the potential for cracking. However, no problems were observed during this inspection.

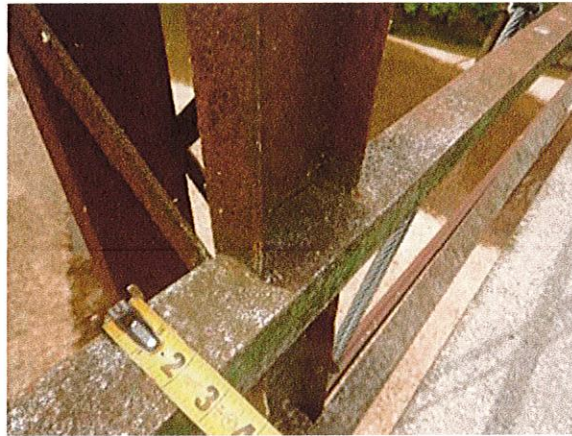
Thru Truss Verticals

Most of the vertical members are in fair condition, except the bottom of the verticals are in poor condition.

The verticals at L1-U1 and L6-U6 are eyebar members with heavy surface rust and about 10% section loss.

The verticals at L2-U2, L3-U3, L4-U4, and L5-U5 are built-up members with heavy surface rust, pitting, and pack rust at the lower chord connection. The pack rust is found between the vertical to floor beam connection plate and the floor beam. Several of the connection plates are bulging due to pack rust. The bottom of these verticals typically have 20% section loss.

The bridge rail is welded to the verticals, which is a flawed detail (**see photo below**).



Thru Truss: Bridge rail welded to vertical

Thru Truss Floor Beams

The floor beams have heavy surface rust and moderate pitting throughout. Several of the floor beams have heavy section loss at the ends of the members. The section loss is occurring on the floor beam webs at the edge of the clip angle that connects the floor beam to the vertical's hanger plates. The top and bottom flanges of several floor beams have heavy section loss within 4 ft. of each end (**see photos below**).

Due to the advanced section loss in their webs, the floor beams are considered to be in serious condition.



Floor Beam 1, East End, North Face:
Serious section loss in web next to
connection plate



Floor Beam 3, East End: 40% section loss
to bottom flange

4.2 Non-Fracture Critical Members

4.2.1 Two-Girder Spans, Spans 1 to 3 (North Approach Spans)

Floor Beams

The floor beams in Spans 1 to 3 are at approximately 8 ft. centers, and they transfer the load from the stringers to the main two exterior girders.

The floor beams are in poor condition, with heavy surface rust throughout and pack rust at the member ends. **A few floor beams are in serious condition due to extensive section loss:**

Span 1:

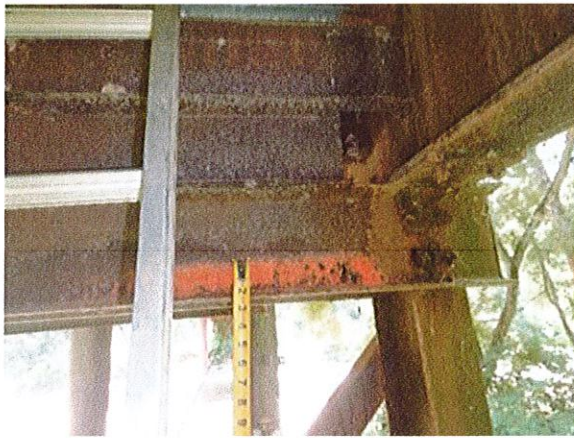
- **Floor Beam 3: the bottom flange has 50% section loss for 2 ft. at the west end; the top flange has 1/4" thickness remaining at the center half of the beam**

Span 2:

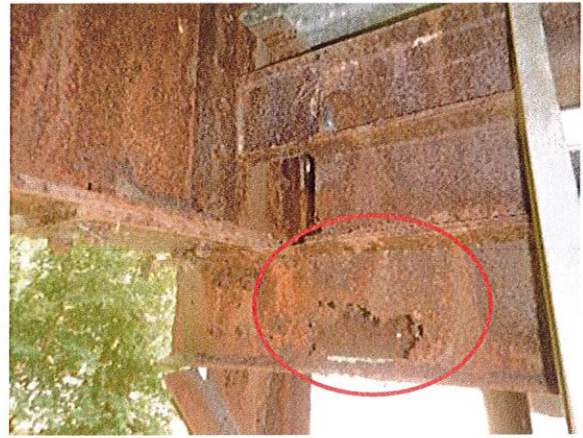
- **Floor Beam 2, west end: center member of the 3-member stack has corrosion hole in web, web crippling for 3 ft.; the lower member has moderate (1/8") section loss to top flange and bottom flange for 5 ft.**
- **Floor Beam 2, east end: 50% section loss to bottom flange for 3 ft.; 3 in. web height has 1/16" section loss for 3 ft.**

Span 3:

- **Floor Beam 0 (at Bent 3), west end, north face: the lower member of the 3-member stack has 2 1/2" x 18" area of holes in web**
- **Floor Beam 0 (at Bent 3), east end, north and south faces: the lower member of the 3-member stack has 50% section loss**



Span 3, Floor Beam 0 (at Bent 3), West End, North Face: Holes on lower member



Span 3, Floor Beam 0 (at Bent 3), East End, North Face: 50% section loss to member

Stringers

There are seven lines of stringers in Spans 1 to 3. In each span, the stringers are continuous over Floor Beams 1 and 3, and non-continuous at Floor Beam 2.

In Span 1, there is a helper stringer added next to Stringer No. 4.

The stringers are in poor condition overall, with heavy surface rust and pack rust throughout. **A few stringers are in serious condition due to extensive section loss:**

Span 1:

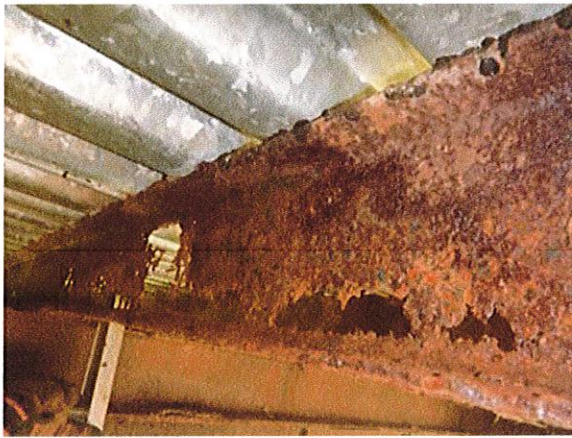
- Stringer No. 3: **2.5" tall x 15" hole in web with serious section loss to bottom flange over Floor Beam 3. 2" x 14" hole in web with serious section loss to top flange about 1.5' south of Floor Beam 3.** Stringer does not bear at Floor Beam 3.
- Stringer No. 5: **1/8" section loss to bottom flange for south half of member**

Span 2:

- **Stringer No. 4: 80% section loss to web and bottom flange for south half of member**

Span 3:

- **Stringer No. 4: 100% section loss to web at north end of member**
- **Stringer No. 5: 50% section loss in member for full length**



Span 3, Panel 1, Stringer No. 4: Large holes
rusted thru web



Span 2, Panels 3 and 4, Stringer No. 4:
80% section loss to web and bottom flange

4.2.2 Two-Girder Spans, Spans 5 to 6 (South Approach Spans)

Floor Beams

The floor beams in Span 5 are at approximately 8 ft. centers. The floor beams in Span 6 are at approximately 6.4 ft. centers. These floor beams transfer the load from the stringers to the main two exterior girders.

Most of the floor beams in Spans 5 and 6 are in fair condition, with heavy surface rust throughout and areas of minor pack rust. One floor beam is in serious condition due to extensive section loss:

Span 6:

- **Floor Beam No. 3: 50% section loss to the top flange is typical, 75% section loss to top flange for 12" length about 30" from West Girder.**

Stringers

There are seven lines of stringers for most of Spans 5 to 6 (there are only 5 lines of stringers at the south-most panel of Span 6).

In Span 6, there is a helper stringer added next to Stringer No. 4.

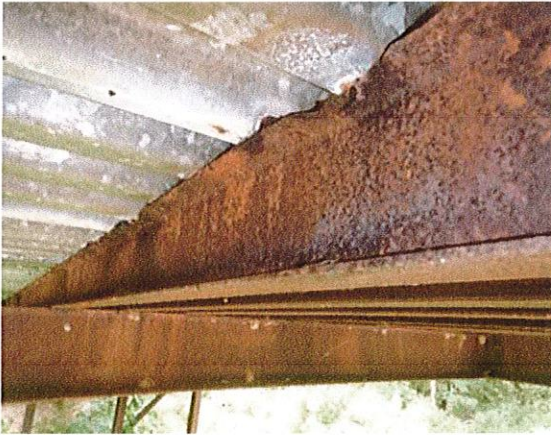
The stringers are in poor condition overall, with heavy surface rust and pack rust throughout. **A few stringers are in serious condition due to extensive section loss:**

Span 5:

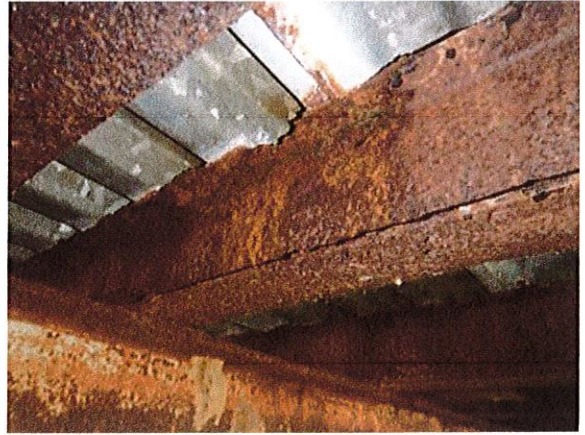
- **Stringer No. 1: top flange has 70% section loss in Panel 2**
- **Stringer No. 3: top flange has ¼" section remaining near midspan of Panel 3; top flange has 50% section loss at midspan of Panel 4**
- **Stringer No. 4: 80% section loss to web and top flange, 50% section loss to bottom flange at midspan of Panel 2; 50% section loss to top flange at midspan of Panel 4**

Span 6:

- **Stringer No. 3: 80% section loss to top flange for 8" length just south of Floor Beam 1**



Span 5, Panel 2, Stringer No. 1: 70% section loss to top flange

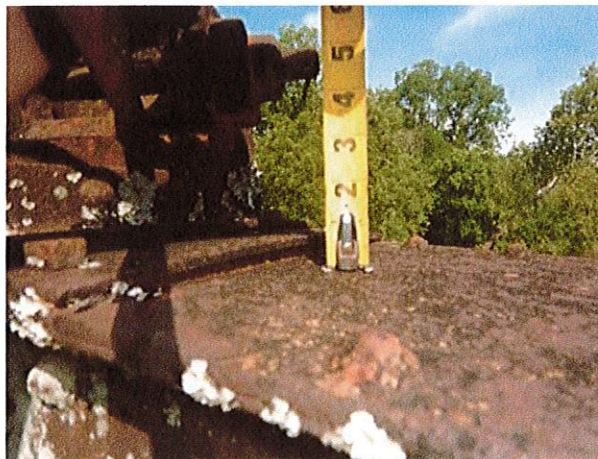


Span 6, Panel 1, Stringer No. 3: 80% section loss to top flange just south of Floor Beam 1

4.2.3 Thru Truss (Span 4)

Thru Truss Upper Chord

The upper chord is in fair condition overall. The upper chord members have heavy surface rusting and minor pitting throughout. There is minor to moderate pack rust jacking between the top chord and the lateral strut connection plate (**see photo below**). There is minor rippling in the top chord between the top cover plate and the channel members.



Thru Truss, West Truss: Minor pack rust jacking between upper chord and lateral strut connection plate

The upper chord pins are in satisfactory condition with moderate surface rust and minor pitting.

Thru Truss Stringers

There are seven I-shaped steel interior stringers and two channel shaped exterior stringers spanning between each of the floor beams in the thru truss span. The stringers are simple span between the floor beams.

The majority of the exterior stringers (Stringer Nos. 1 and 9) are in serious condition due to extensive section loss.



Span 4, Panel 3, Stringer No. 1: 100% section loss to web, serious section loss to flanges



Span 4, Panel 5, Stringer No. 1: heavy pack rust and serious section loss to stringer

Most of the interior stringers are in fair to poor condition with heavy surface rust and moderate pack rust. **However, there are several interior stringers that are in serious condition due to extensive section loss:**

Panel 2 (L1-L2):

- Stringer No. 6 top flange has $\sim\frac{1}{4}$ " section remaining at midspan

Panel 3 (L2-L3):

- **Stringer No. 4 has 100% section loss to web and heavy section loss to flanges near south end**
- **Stringer No. 6 has 90% section loss to web and heavy section loss to flanges at south end**

Panel 4 (L3-L4):

- **Stringer No. 6 has 70% section loss to web and moderate section loss to flanges at north end**
- Stringer No. 5 has heavy pack rust and heavy section loss to flanges

Panel 5 (L4-L5):

- Stringer No. 4 has 40% section loss to flanges and web at north end

Panel 7 (L6-L7):

- **Stringer No. 4 has 70% section loss near midspan; and 40% section loss to web at south end**

- Stringer No. 5 has ~1/4" top and bottom flange section remaining for full length
- **Stringer No. 6 has 80% section loss to web and ~3/16" top and bottom flange section remaining for 5' length at midspan; and 30% overall section loss at south end**
- **Stringer No. 8 has 50% section loss to web at south end**



Span 4, Panel 3, Stringer No. 4: Web rusted out near south end



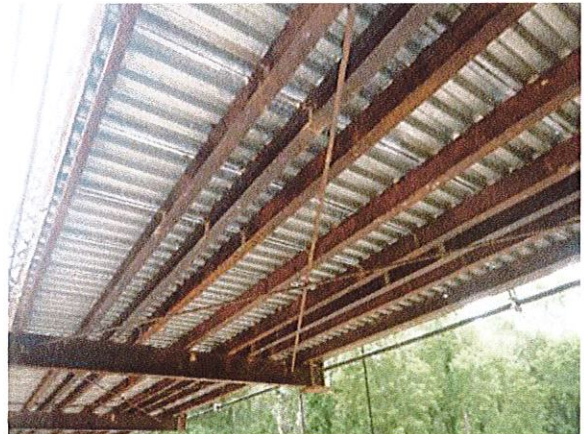
Span 4, Panel 7, Stringer No. 6: 80% section loss to web, 3/16" flange thickness remaining

4.2.4 Deck

The deck is comprised of corrugated metal stay-in-place forms topped with asphalt. The deck is in good condition overall. The corrugated metal is in good condition with small pockets of minor rust at some of the seams. The asphalt surface has minor to moderate cracking.



Typical asphalt deck surface

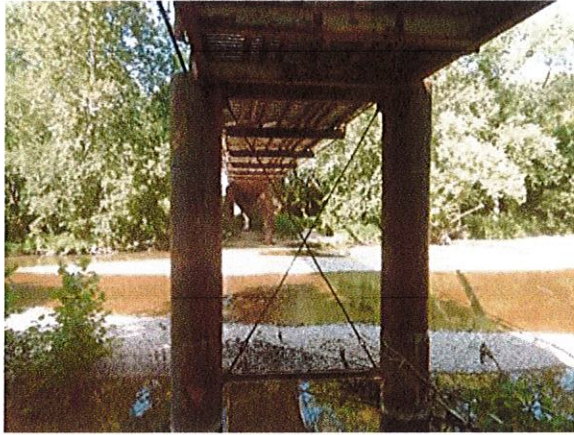


Typical corrugated metal stay-in-place deck forms

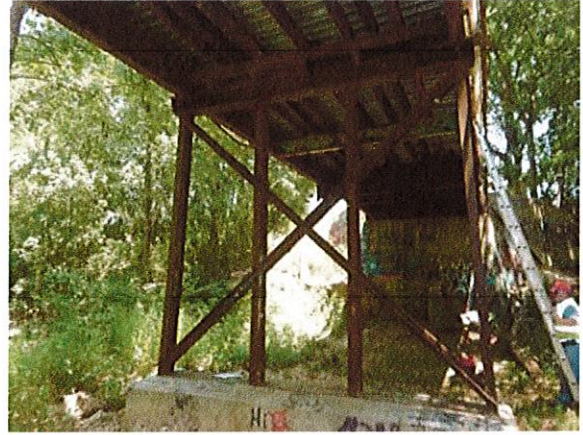
4.2.5 Intermediate Bents (Piers)

Intermediate Bent 4 and Bent 5 support the main thru truss span and are comprised of two steel caissons filled with concrete. These piers are in satisfactory condition overall.

Intermediate Bent 2, Bent 3, and Bent 6 are supports in the north and south approach spans. These piers are comprised of four steel piles with heavy steel X-bracing and a steel cap beam at the top. The steel piles are encased in concrete at the ground line (**see photos below**). These piers are in fair condition, as some of the steel piles have minor section loss at the bottom. Pile 3 at Bent 3 is bent out of plane just over 1 in.



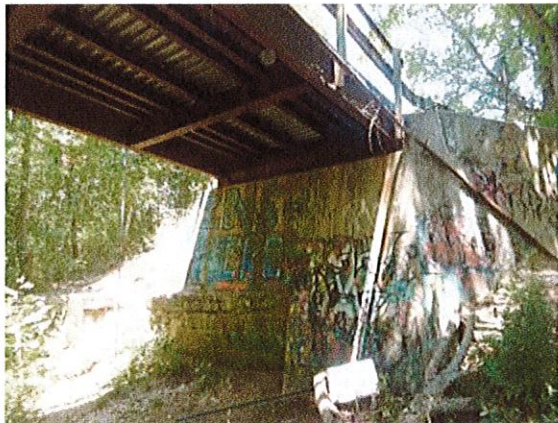
Bent 5
(Bent 4 is similar)



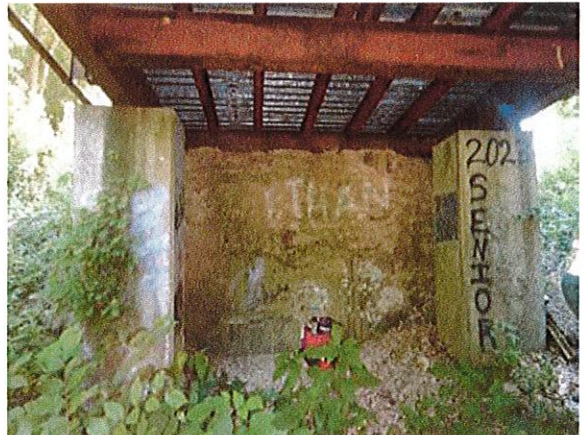
Bent 2
(Bents 3 and 6 are similar)

4.2.6 End Bents (Abutments)

The End Bent 1 (north abutment) concrete breastwall abutment is in satisfactory condition with minor cracking (**see photo below**). End Bent 7 (south abutment) is in fair condition overall. End Bent 7 has severe disintegration on the original concrete abutment, but two concrete columns in good condition have been added a few feet in front of the original south abutment to carry the vertical load from the Span 6 superstructure (**see photo below**).



Bent 1 (north abutment): Satisfactory condition



Bent 7 (south abutment): Original concrete abutment has heavy wear; concrete columns added in front to carry load from superstructure

5. Summary and Recommendations

The fracture critical members of this structure are in poor condition due to section loss in the main load carrying members of the bridge superstructure.

No fatigue cracks were observed in the tension areas of fracture critical members at the time of this inspection. No cracks were observed at the forged eyebars for the Thru Truss lower chord or diagonal members during this inspection.

In the Two-Girder Spans, Spans 1 to 3 (North Approach Spans), the two main girders—which are fracture critical members—are in fair condition with moderate surface rusting, pitting, and minor section loss.

In the Two-Girder Spans, Spans 5 to 6 (South Approach Spans), the two main girders-- which are fracture critical members--are in fair condition with moderate surface rusting, pitting, and minor section loss.

In the Thru Truss Span, Span 4, the fracture critical members are the lower chord, the diagonals, the verticals, and the floor beams. The lower chord members are in fair condition overall, but the lower chord members at the bearing devices are in poor condition due to pack rust and section loss. The diagonal members are in fair condition overall, but the bottoms of the diagonals are in poor condition due to pack rust and section loss at the floor connections. The vertical members are in fair condition overall, but the bottom of the verticals are in poor condition due pack rust and section loss at the floor connections. Most of the floor beams are in poor condition, but Floor Beam No. 1 is in serious condition due to section loss at the end of this member.

There are several non-fracture critical members in the North Approach Spans, Spans 1 to 3, that are in serious/severe condition due to advanced section loss—see the red members in **Figure 3, Condition of Floor System, in the Appendix.**

There are several non-fracture critical members in the South Approach Spans, Spans 5 to 6, that are in serious/severe condition due to advanced section loss-- see the red members in **Figure 3, Condition of Floor System, in the Appendix.**

There are several non-fracture critical members in the Thru Truss Span, Span 4, that are in serious/severe condition due to advanced section loss. This includes the majority of the exterior stringers, and multiple interior stringers. See the red members in **Figure 3, Condition of Floor System, in the Appendix.**

We believe the section loss in the stringers throughout the bridge is the most significant defect on this bridge and places the bridge at high risk for sudden failure. After discussion with the MoDOT Bridge Management Engineer, it was decided that a bridge closure recommendation was warranted for this structure.

This bridge has reached the end of its service life, and we recommend that this bridge be closed to traffic. Repairs of the stringers and floor beams would be difficult to achieve and are not recommended. Bridge replacement is recommended. By closing the Smyrna Road crossing of the Finley River, the additional travel for a detour to the west is about 7 miles, and a detour to the east is about 8 miles.

We understand that the replacement bridge for this crossing is in the design phase and construction on a replacement bridge may begin as soon as summer 2024, but the schedule is dependent upon right-of-way negotiations.

NBIS Item No. 59 – Superstructure

SUPERSTRUCTURE CONDITION RATING – 2

We recommend the superstructure condition rating be lowered from 3 (serious condition) to 2 (critical condition) and **we recommend closing this bridge to traffic due to severe section loss observed in multiple stringers and a few floor beams.**

Most of the fracture critical members are in poor condition with heavy surface rust, moderate pack rust, and section loss. In the main Thru Truss (Span 4), Floor Beam No. 1 is in serious condition due to heavy section loss at the end of this member.

There are several non-fracture critical members in serious condition throughout the entire bridge due to advanced section loss. This includes Floor Beam 0 in Span 3 (located at Bent 3), and several stringers in the North Approach Spans and South Approach Spans. In the main Thru Truss (Span 4), a majority of the exterior stringers and multiple interior stringers are in serious condition due to advanced section loss.

Inspection Team Leader: Josh Gamage, PE



Appendix

Bridge 2490003

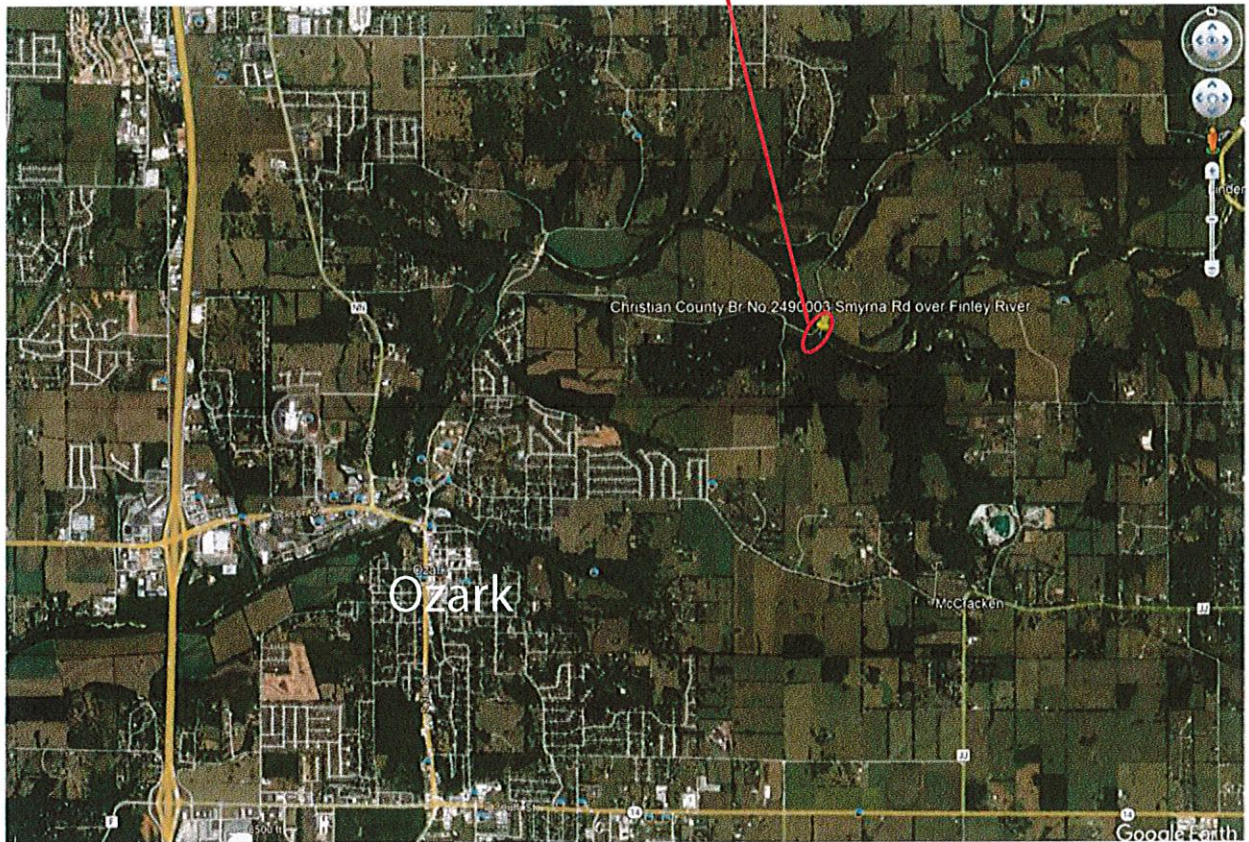


Figure 1: Location of Bridge 2490003 (Smyrna Road Bridge)

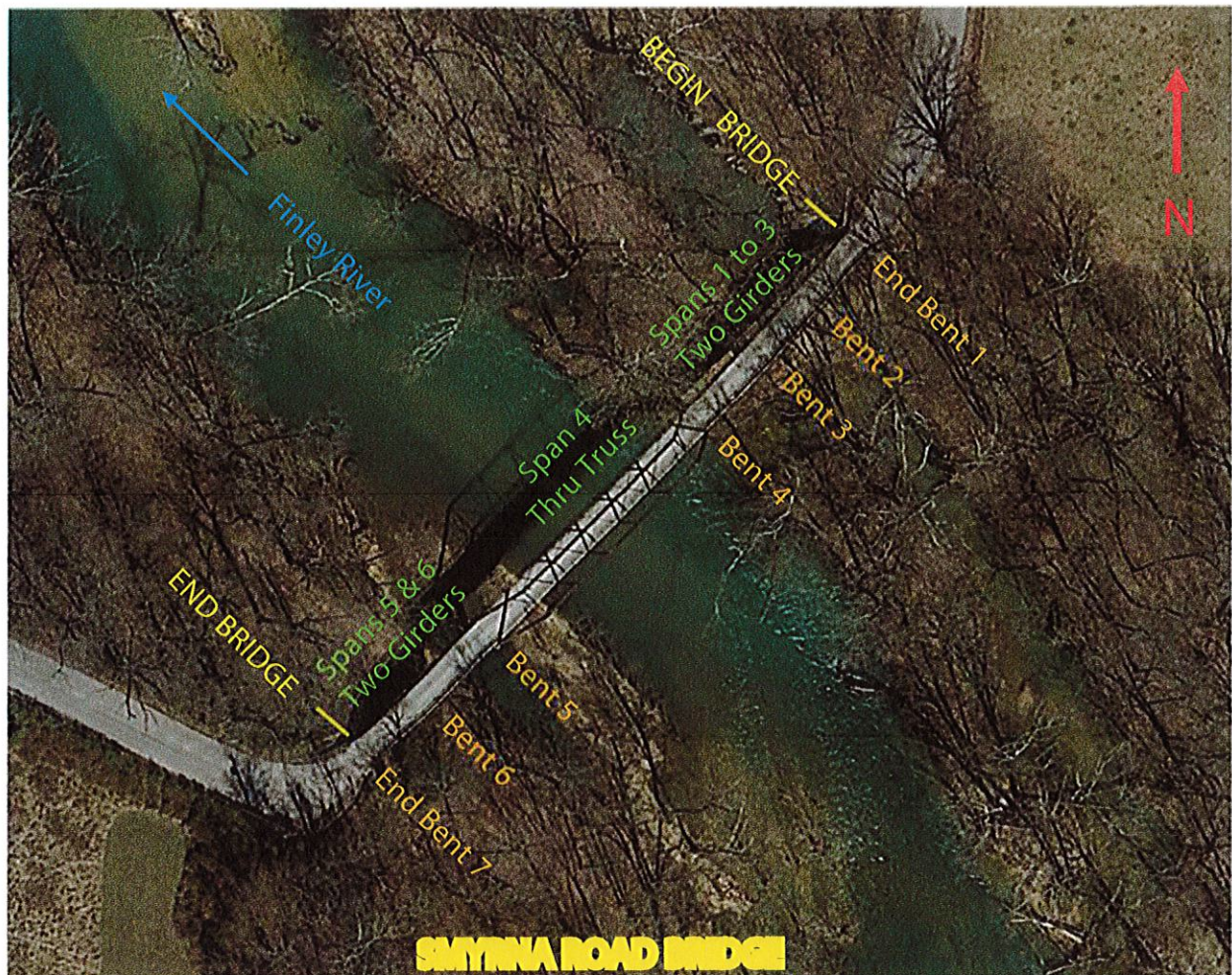
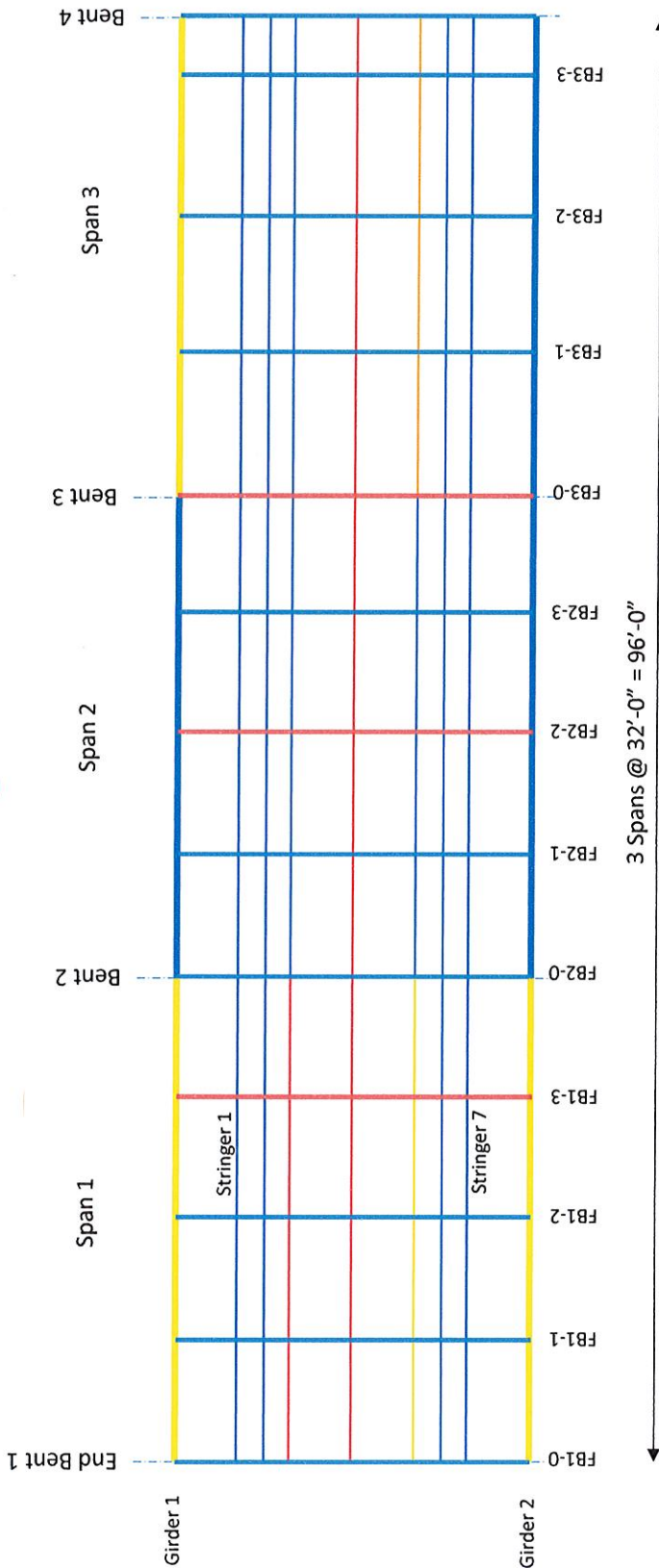


Figure 2: Plan View of Bridge 2490003 (Smyrna Road Bridge)



North Approach Spans (Spans 1, 2, and 3) -- Floor System

Figure 3: Condition of Floor System

Christian County Bridge No. 2490003
Smyrna Road over Finley River

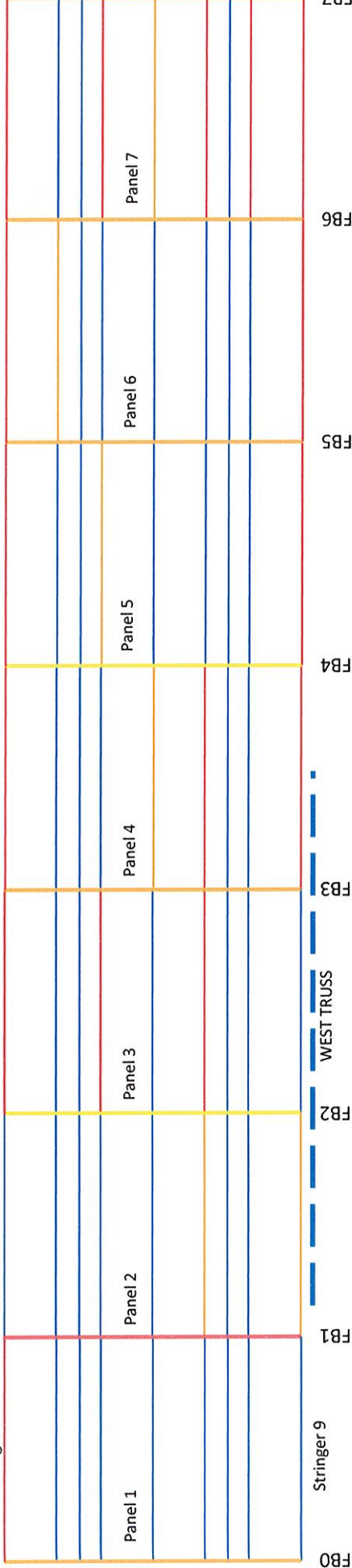
MAH
Lochner
1/24/2024



Bent 4

Stringer 1

EAST TRUSS



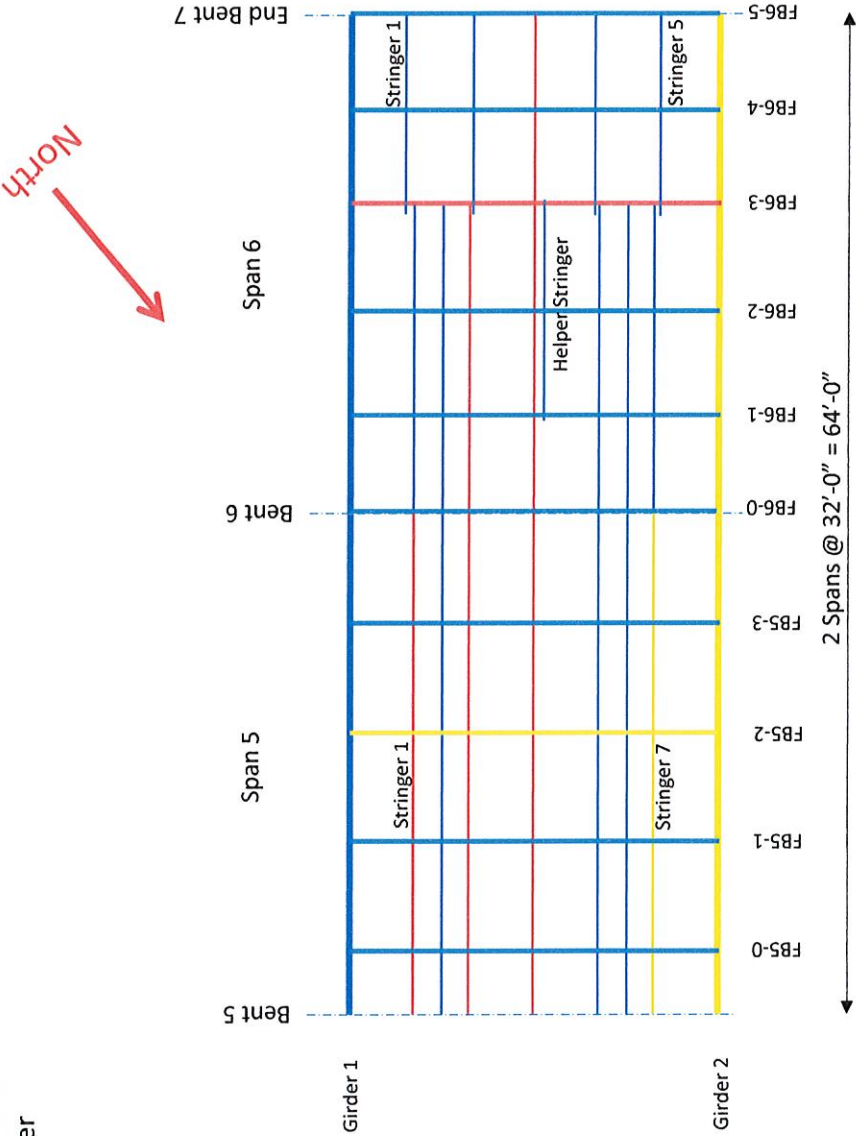
7 Panels @ 17'-0" = 119'-0"

LEGEND:

- SATISFACTORY CONDITION
- FAIR CONDITION
- POOR CONDITION
- SEVERE CONDITION

Thru Truss Span (Span 4) – Floor System

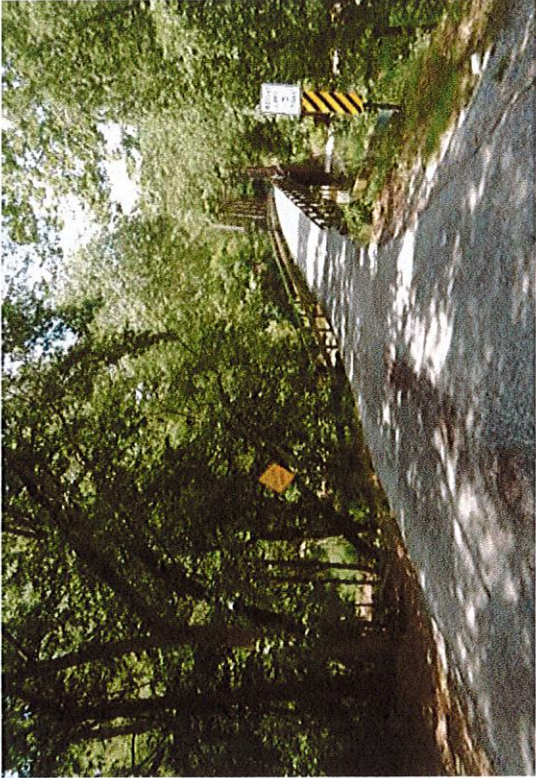
Figure 3: Condition of Floor System



South Approach Spans (Spans 5 and 6) -- Floor System

Figure 3: Condition of Floor System

GENERAL PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
	PHOTO 1 Roadway looking south		PHOTO 2 Roadway looking north
	PHOTO 3 Advance warning signs		PHOTO 4 Elevation looking west at Span 4 (thru truss)

SPANS 1 TO 3 (TWO-GIRDER SPANS) PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner: MO

CHRISTIAN COUNTY,
MO

Inspectors:

JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE



PHOTO 5 Elevation looking west at Spans 1 to 3 (two girder spans)



PHOTO 7 SPAN 1, FLOOR BEAM 2: Hanger rods used to support floor beam

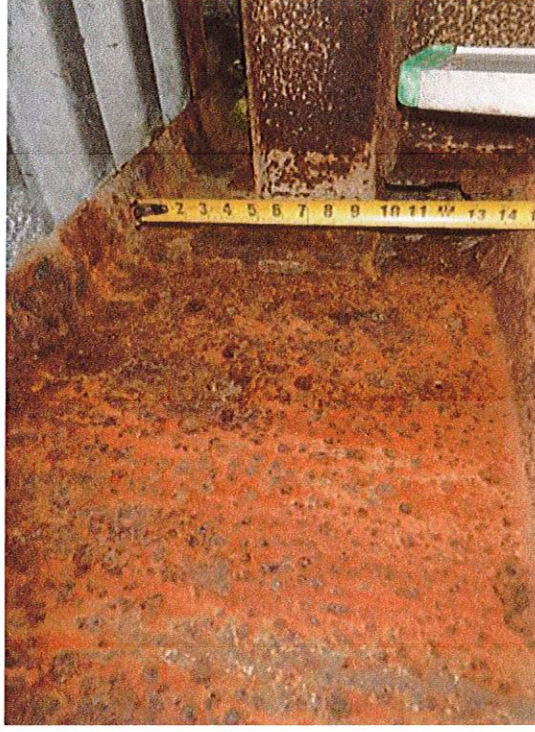


PHOTO 6 SPAN 1, WEST GIRDER, NEAR BENT 1: Heavy pitting with section loss for 7' length (9" height x 1/8" deep)



PHOTO 8 SPAN 1, FLOOR BEAM 3: 50% section loss to bottom flange for west 2' ; 1/4" average thickness remaining for top flange for center half of floor beam

SPANS 1 TO 3 (TWO-GIRDER SPANS) PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
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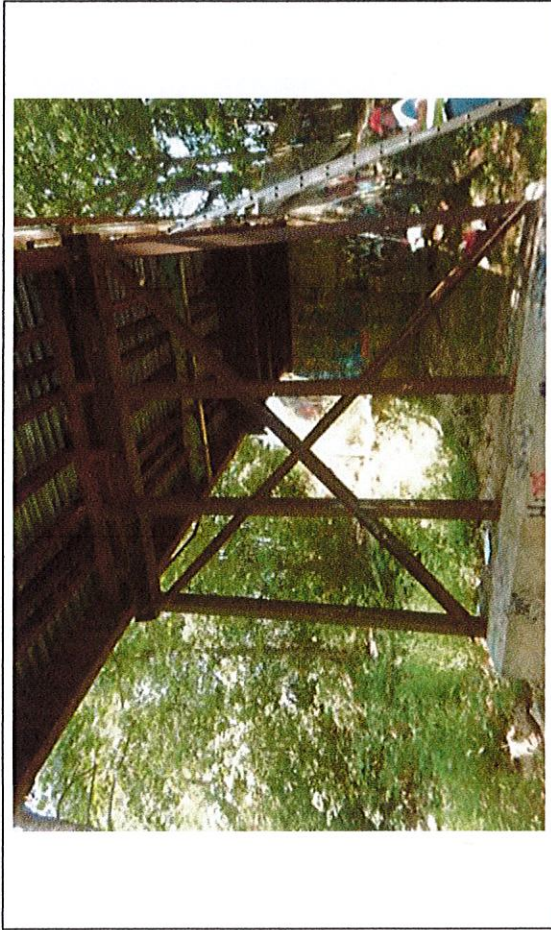


PHOTO 9 SPAN 2 AND SPAN 1: Typical superstructure

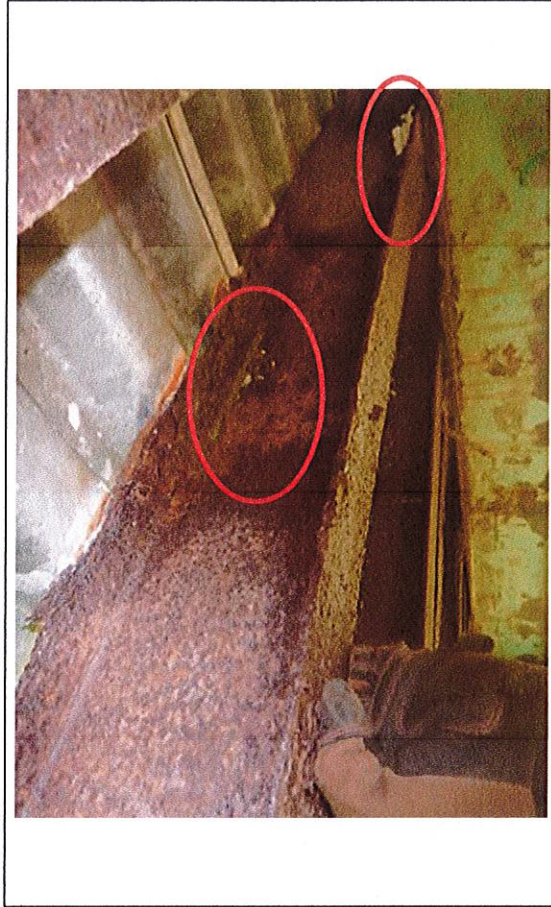


PHOTO 10 SPAN 1, STRINGER 3: 2" x 14" hole top of web & 100% top flange sect. loss starting 16" S. of FB 3; 2.5" x 15" hole bot. of web & 100% top flange sect. loss over FB 3



PHOTO 11 SPAN 2, FLOOR BEAM 2: Center member (spacer member) has large corrosion hole at west end

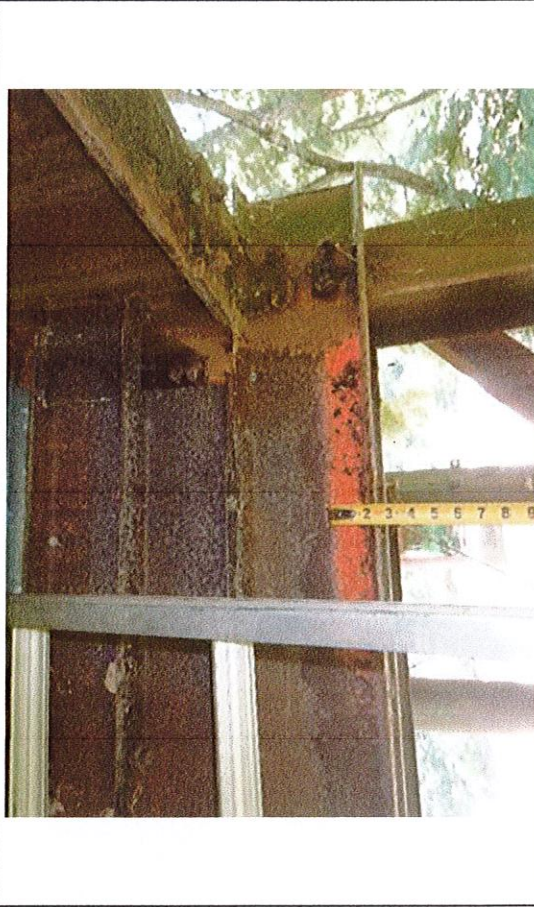


PHOTO 12 BENT 3 CAP, WEST END: 2.5" x 18" long corrosion hole in web

SPANS 1 TO 3 (TWO-GIRDER SPANS) PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner: MO

CHRISTIAN COUNTY,
MO

Inspectors:

JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE



PHOTO 13 SPAN 2, STRINGER 4: 80% section loss to web and bottom flange



PHOTO 14 BENT 3 CAP, EAST END: 50% section loss to cap (typical north and south cap member)



PHOTO 15 BENT 3, PILE 3: Pile is bent 1 1/8" out of plane

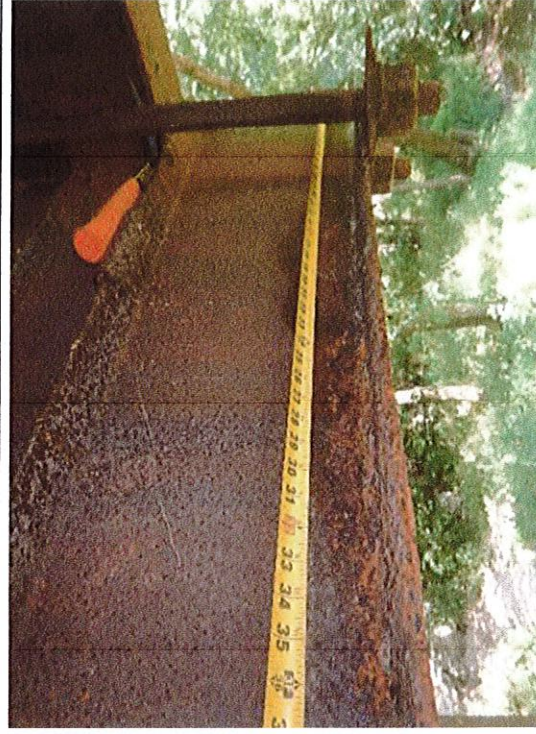


PHOTO 16 SPAN 2, FLOOR BEAM 2: 50% section loss to lower member bottom flange for east 3' of member

SPANS 1 TO 3 (TWO-GIRDER SPANS) PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner: MO

CHRISTIAN COUNTY,

Inspectors:

JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE



PHOTO 17 SPAN 3, PANEL 1, STRINGER 4: 80% section loss to member



PHOTO 18 SPAN 3, PANELS 3 & 4, STRINGER 5: 50% section loss in member



PHOTO 19 BENT 4: Missing pin at top of bent X bracing

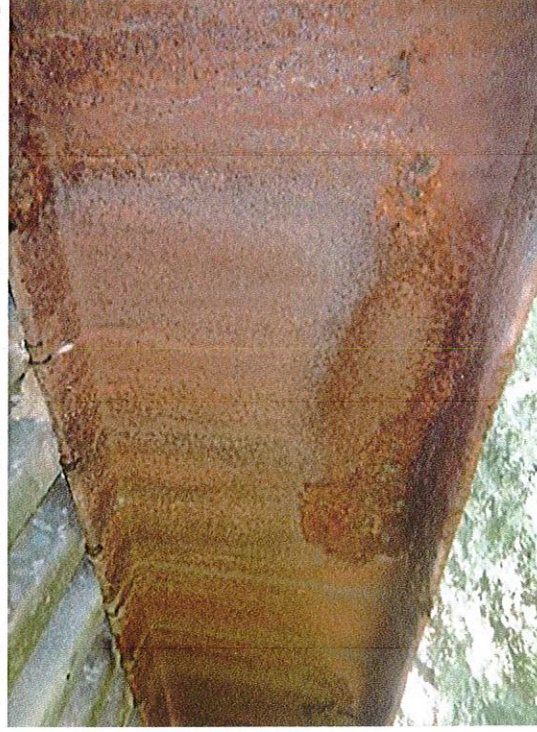


PHOTO 20 SPAN 2, WEST GIRDER: Intermittent locations of 6" tall x 1/8" deep section loss to web

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner:

CHRISTIAN COUNTY,
MO

Inspectors:

JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE

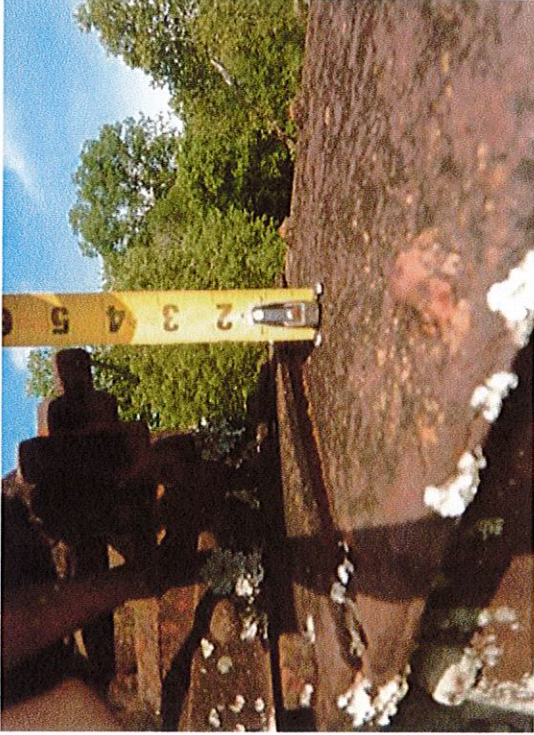


PHOTO 21 SPAN 4, UPPER CHORD: Typical minor pack rust jacking at upper chord panel points



PHOTO 23 SPAN 4: Typical minor rippling of upper chord cover plate



PHOTO 22 SPAN 4, EAST TRUSS, L2-U3: Wire rope sister member added



PHOTO 24 SPAN 4: Railing welded to vertical member (typical)

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner: MO

CHRISTIAN COUNTY,
MO

Inspectors:

JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE



PHOTO 25 SPAN 4: Railing member welded to lower chord (typical)

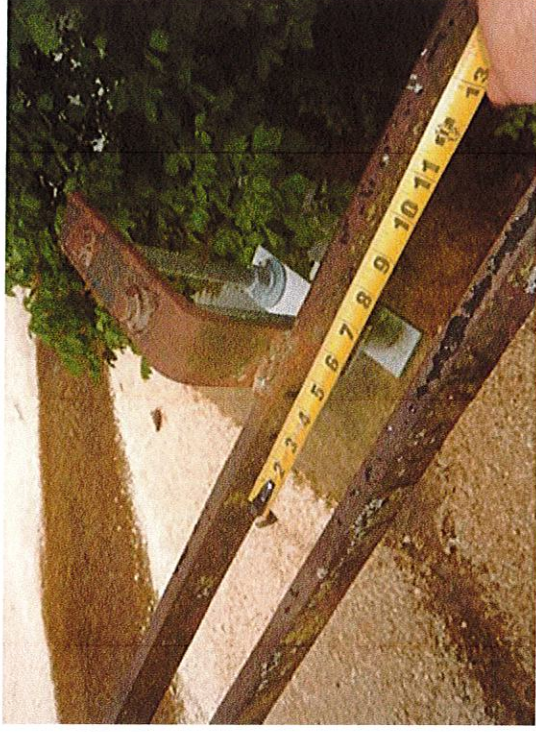


PHOTO 26 SPAN 4: Utility attachment welded to lower chord (typical)

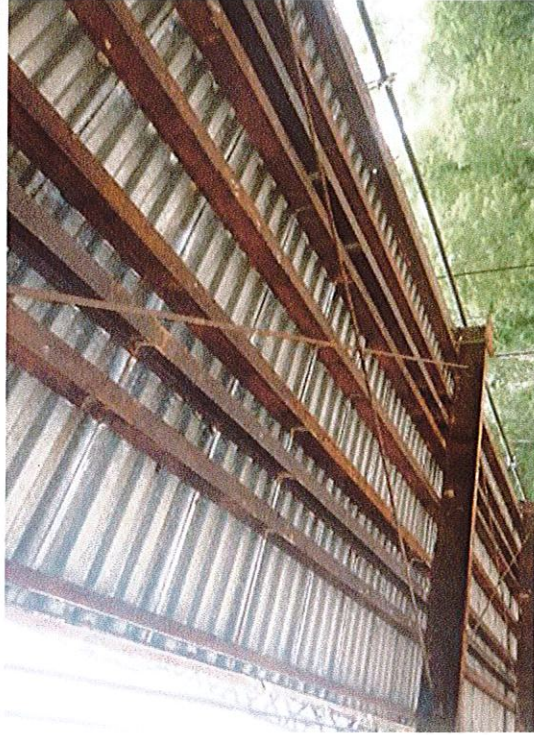


PHOTO 27 SPAN 4: Typical flooring system (9 stringers typical)



PHOTO 28 SPAN 4, PANEL 1, STRINGER 1: Severe corrosion and section loss in stringer

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.

Inspection Date: JUNE 2023

Owner: MO

CHRISTIAN COUNTY,

Inspectors: JOSH GAMAGE, PE
TOM BALLARD
KOBY HESSE

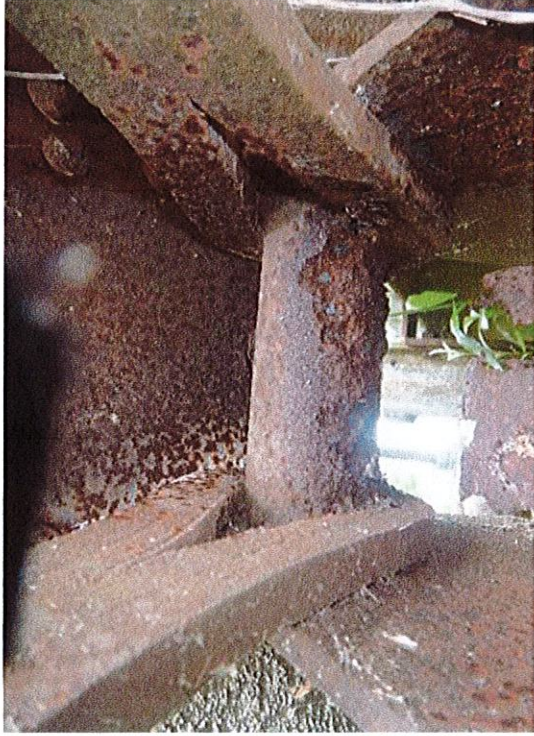


PHOTO 29 SPAN 4, WEST TRUSS, LO: Pin has 3/16" deep pitting on 1/4" of the pin circumference for 2/3 of pin length



PHOTO 30 SPAN 4, FLOOR BEAM 1, EAST END, SOUTH FACE: Heavy section loss in web at end of clip angle connection



PHOTO 31 SPAN 4, FLOOR BEAM 1, EAST END, NORTH FACE: Heavy section loss in web at end of clip angle connection

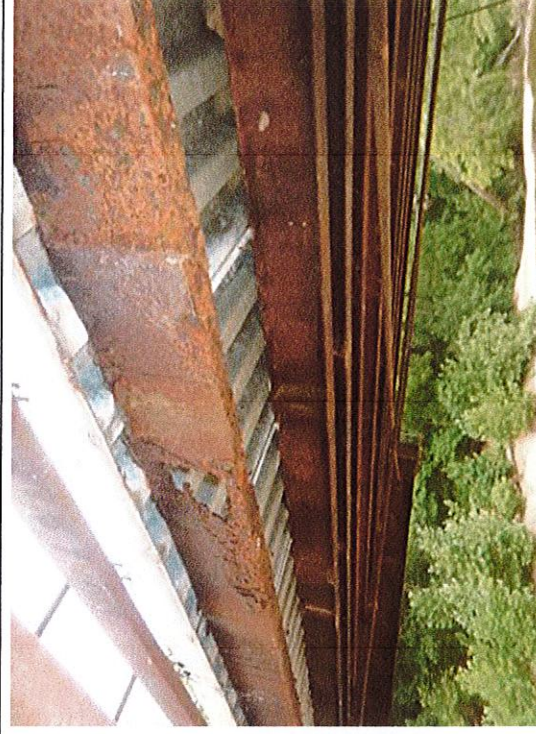


PHOTO 32 SPAN 4, PANEL 3, STRINGER 1: Severe section loss in stringer

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
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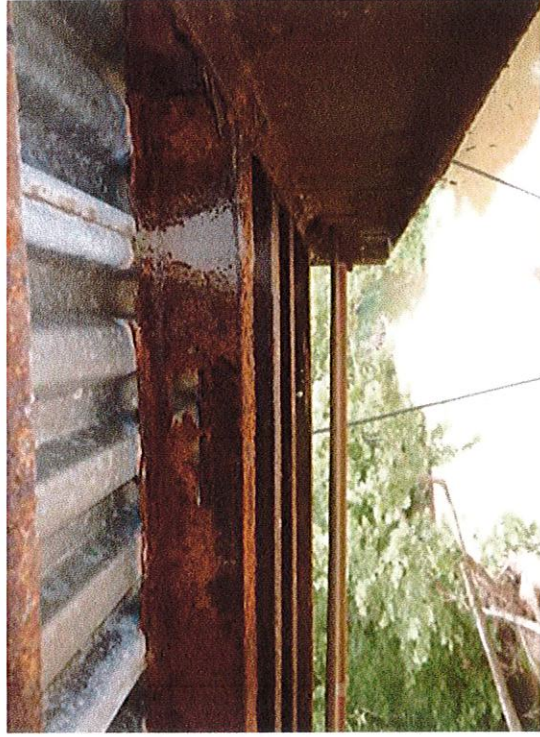


PHOTO 33 SPAN 4, PANEL 3, STRINGER 4: Severe section loss in stringer

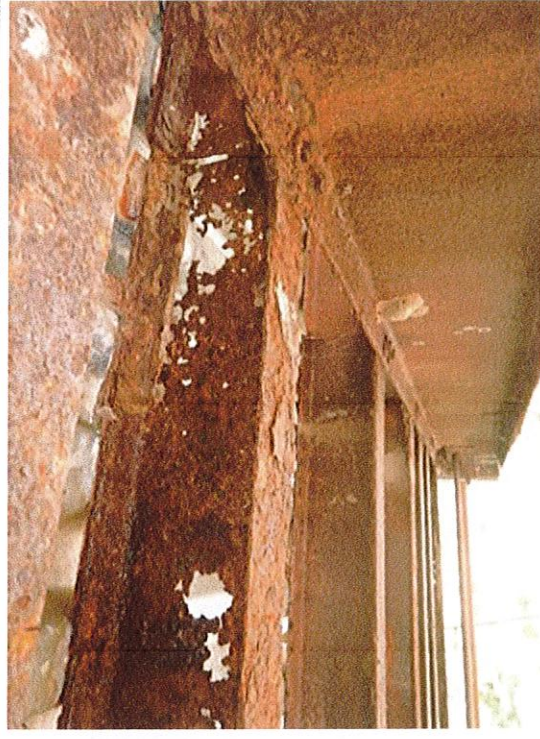


PHOTO 34 SPAN 4, PANEL 3, STRINGER 6: Severe section loss in stringer

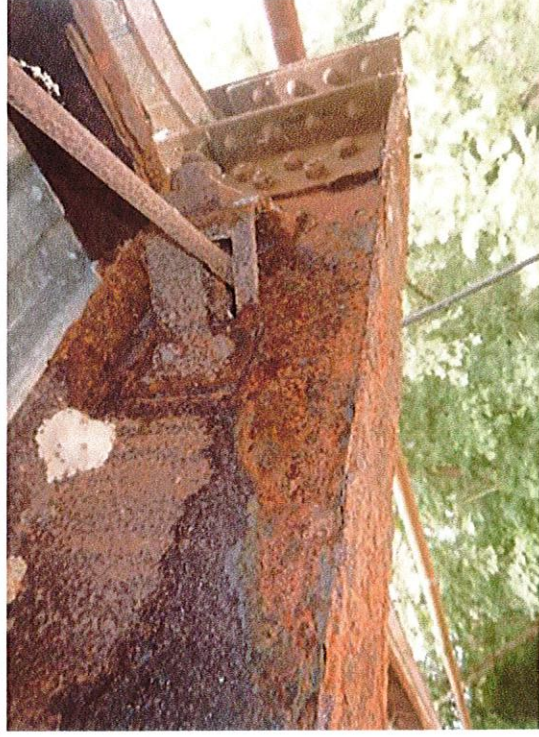


PHOTO 35 SPAN 4, FLOOR BEAM 3, EAST END: Bottom flange has 40% section loss, web has 1/8" section loss



PHOTO 36 SPAN 4, PANEL 4, STRINGER 1: Severe section loss in stringer

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
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PHOTO 37 SPAN 4, PANEL 4, STRINGER 9: Severe section loss in stringer

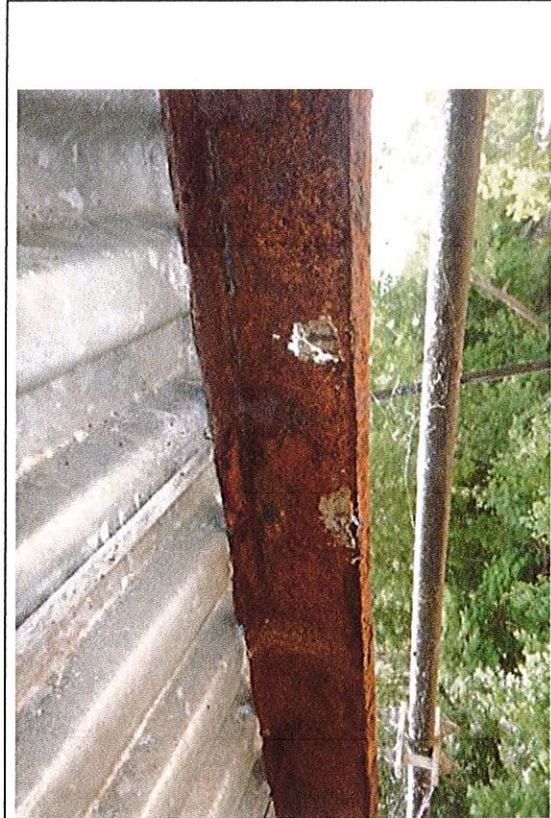


PHOTO 38 SPAN 4, PANEL 5, STRINGER 9: Severe section loss in stringer

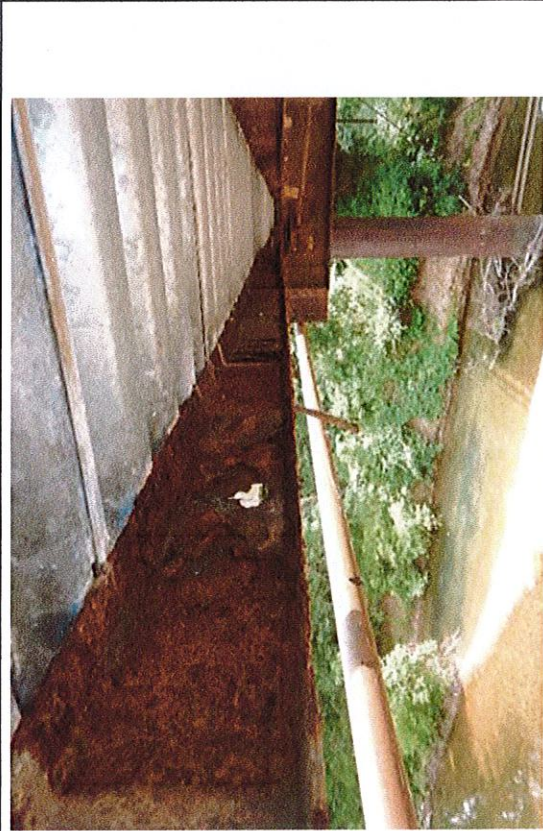


PHOTO 39 SPAN 4, PANEL 5, STRINGER 1: Severe section loss in stringer

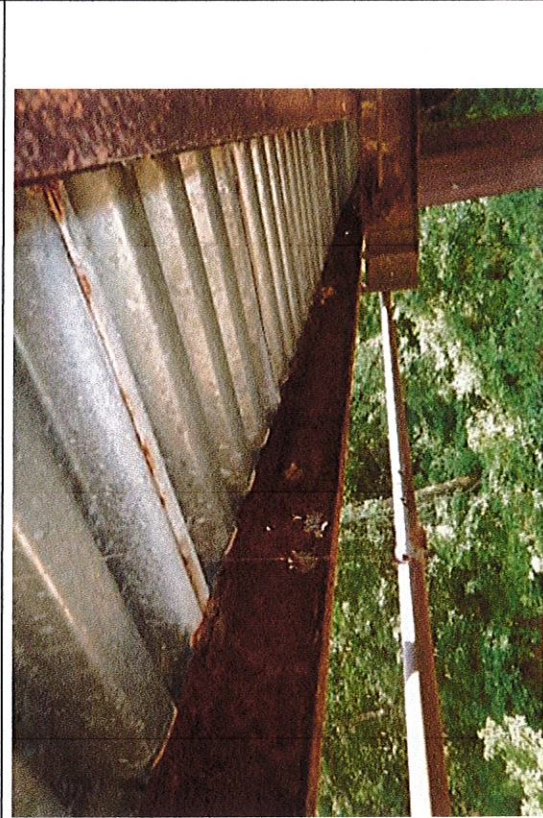
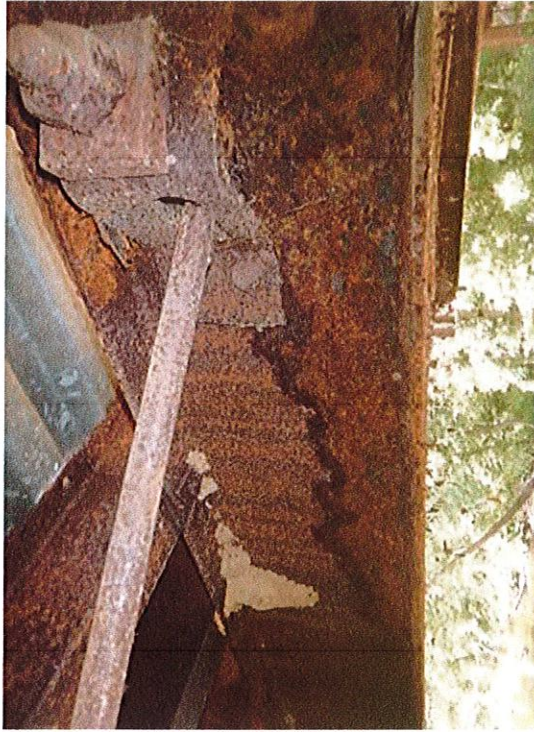
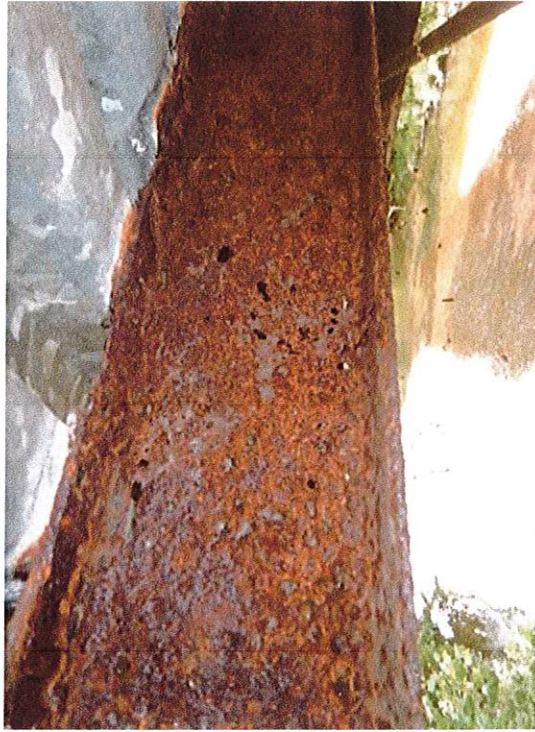


PHOTO 40 SPAN 4, PANEL 6, STRINGER 1: Severe section loss in stringer

SPAN 4 THRU TRUSS PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
	PHOTO 41 SPAN 4, PANEL 7, STRINGER 1: Severe section loss in stringer		
	PHOTO 42 SPAN 4, FLOOR BEAM 6: 4' length at each end of floor beam--web has 5" height of 3/16" deep section loss; bottom flange has 3/16" deep section loss		
	PHOTO 43 SPAN 4, PANEL 7, STRINGER 9: Severe section loss in stringer		
	PHOTO 44 SPAN 4, PANEL 7, STRINGER 6: Severe section loss in stringer		

SPANS 5 TO 6 (TWO-GIRDER SPANS) PHOTOS

Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
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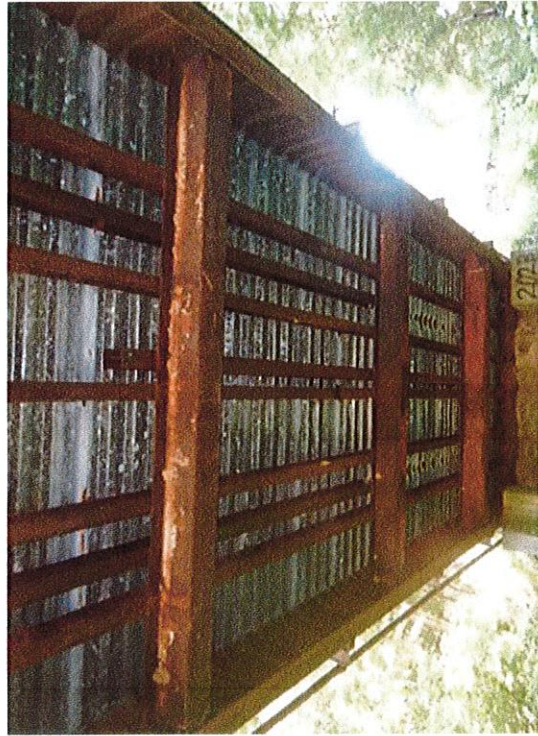


PHOTO 45 SPAN 6: Typical superstructure of Span 6 (Span 5 is similar)



PHOTO 46 SPAN 6, FLOOR BEAM 3: 50%-75% section loss to top flange about 30" from West Girder

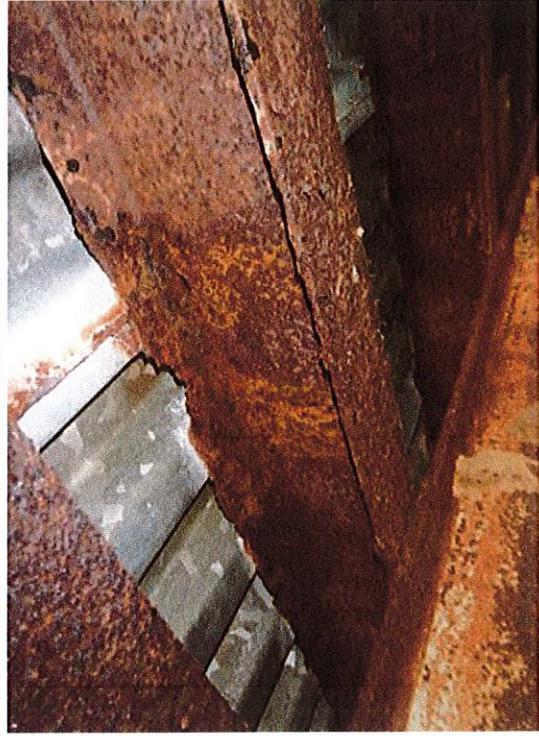


PHOTO 47 SPAN 6, PANEL 1, STRINGER 3: 80% section loss to top flange just south of Floor Beam 1

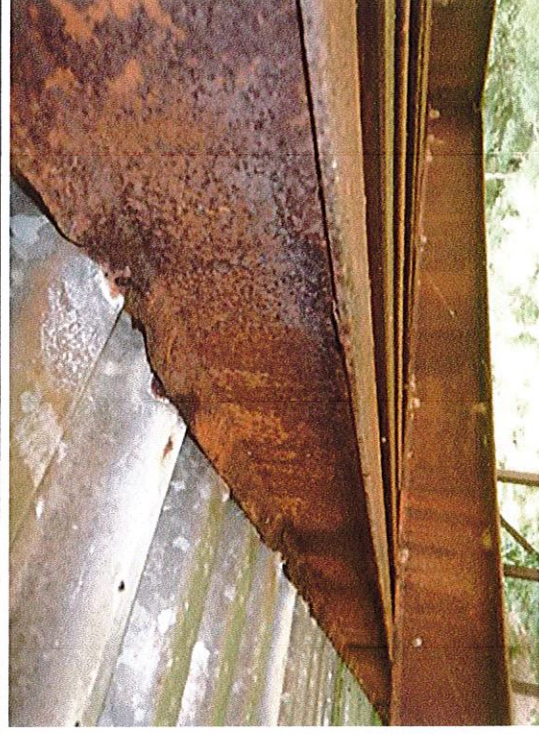
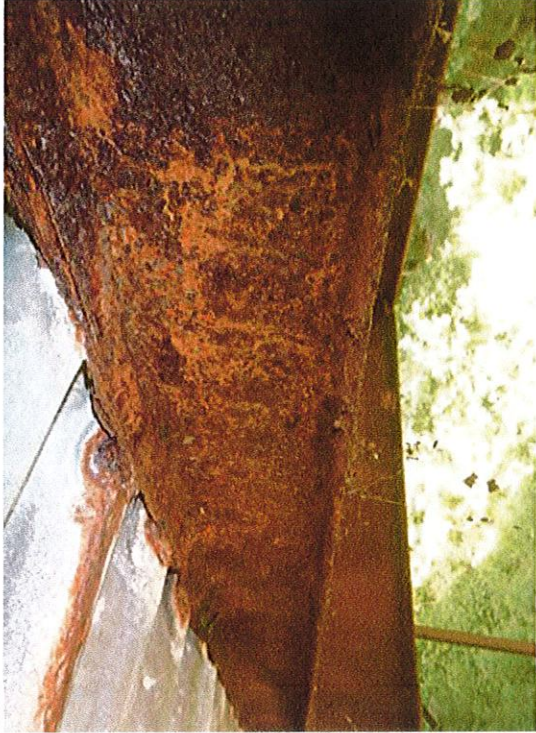


PHOTO 48 SPAN 5, PANEL 2, STRINGER 1: 70% section loss to top flange

SPANS 5 TO 6 (TWO-GIRDER SPANS) PHOTOS

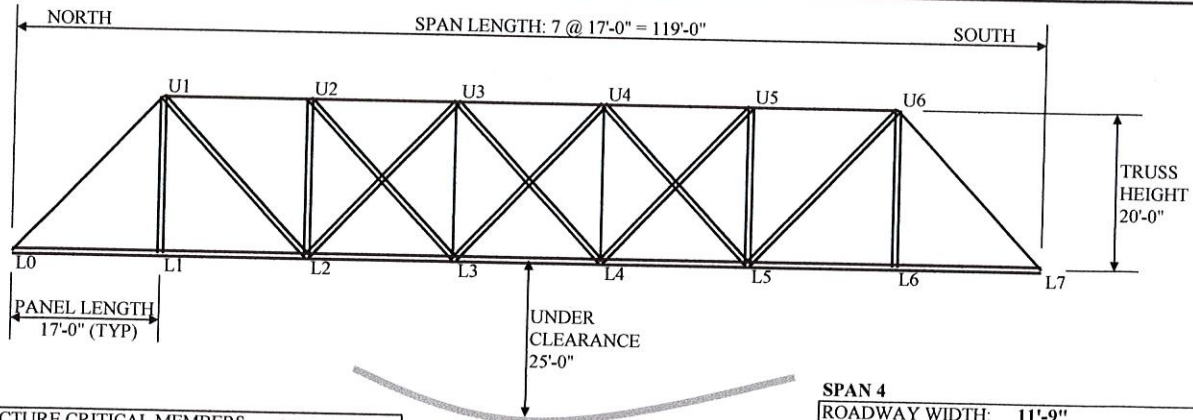
Bridge: 2490003, SMYRNA RD.	Inspection Date: JUNE 2023	Owner: CHRISTIAN COUNTY, MO	Inspectors: JOSH GAMAGE, PE TOM BALLARD KOBY HESSE
			
	PHOTO 49 SPAN 5, PANEL 2, STRINGER 4: 80% section loss to top flange and web, 50% section loss to bottom flange at center 3' of panel		



MISSOURI DEPARTMENT OF TRANSPORTATION
FRACTURE CRITICAL INSPECTION REPORT

STRUCTURE NUMBER: 2490003
FEDERAL ID: 20153

DISTRICT:	SW	YEAR BUILT:	1912	INSPECTION DATE:	06/28/23
COUNTY:	CHRISTIAN	STRUCTURE STATUS:	P-POSTLOAD	INSPECTION FREQUENCY:	24 MONTHS
FACILITY CARRIED:	SMYRNA RD	APPROVED POSTING:	5 TONS	INSPECTOR:	Lochner
FEATURE INTERSECTED:	FINLEY RVR	FIELD POSTING:	5 TONS	LATITUDE:	37° 2' 13.51"
LOCATION:	S18 T27 R20W	LAYOUT DIRECTION:	NORTH-TO-SOUTH	LONGITUDE:	93° 10' 16.44"



FRACTURE CRITICAL MEMBERS
COMPRESSION MEMBERS

SPAN 4
ROADWAY WIDTH: 11'-9"
DECK TYPE: CURROGATED STEEL
TRUSS TYPE: THROUGH
CONNECTIONS: PIN

STRUCTURE CONDITION RATINGS

[58] DECK:	7
[59] SUPERSTRUCTURE:	2
[60] SUBSTRUCTURE:	5
[61] CHANNEL PROTECTION:	6
[113] SCOUR ASSESSMENT:	8

**FRACTURE CRITICAL MEMBER
ACCESS METHODS**

	CLIMB	LADDER	BORESCOPE	MANLIFT	SNOOPER	OTHER
LOWER CHORD	X					X
DIAGONALS	X	X				
VERTICALS	X	X				
FLOORBEAMS		X	X			

NOTES:

This structure takes approximately 3.5 hours of inspection time. Traffic control is needed with a 28' ladder or suspended scaffold (county closed road).

Repairs made to deck and superstructure 5/2015 (Great River Engineering and Joe Warren Construction) @ north approach spans

repairs made to superstructure and substructure steel in 2017

INSPECTOR RECOMMENDATIONS:

make repairs to lower stacked channel at Bent 3

PRIMARY TRUSS MEMBERS

	MEMBER	FRACTURE CRITICAL	DESCRIPTION	SIZE
LOWER CHORD	L0-L1	YES	2 eye bars	5/8"x 2"
	L1-L2	YES	2 eye bars	5/8"x 2"
	L2-L3	YES	2 eye bars	3/4"x 2-1/2"
	L3-L4	YES	2 eye bars	1-1/8" x 2-1/4"
	L4-L5	YES	2 eye bars	3/4" x 2-1/2"
	L5-L6	YES	2 eye bars	5/8" x 2"
	L6-L7	YES	2 eye bars	5/8" x 2"
DIAGONALS	L0-U1	NO	built up riveted	*
	U1-L2	YES	2 eye bars	5/8" x 2"
	L2-U3	YES	eye bar	5/8" round w/ turn buckle
	U2-L3	YES	2 eye bars	5/8" x 1.5"
	L3-U4	YES	eye bar	1" x 1" square w/ turn buckle
	U3-L4	YES	eye bar	1" x 1" square w/ turn buckle
	L4-U5	YES	2 eye bars	5/8" x 1.5"
VERTICALS	U4-L5	YES	eye bar	5/8" x round w/ turn buckle
	L5-U6	YES	2 eye bars	5/8" x 2"
	U6-L7	NO	built up riveted	*
	L1-U1	YES	eye bar	1" x 1" square
	L2-U2	YES	2 channels w/ lacing	\$
	L3-U3	NO	2 channels w/ lacing	#
	L4-U4	NO	2 channels w/ lacing	#
FLOORBEAMS	L5-U5	YES	2 channels w/ lacing	\$
	L6-U6	YES	eye bar	1" x 1" square
	F0	YES		
	F1	YES	rolled beam	S12 x 31.8
	F2	YES	rolled beam	S12 x 31.8
	F3	YES	rolled beam	S12 x 31.8
	F4	YES	rolled beam	S12 x 31.8
UPPER CHORD	F5	YES	rolled beam	S12 x 31.8
	F6	YES	rolled beam	S12 x 31.8
	F7	YES	rolled beam	S12 x 31.8
	U1-U2	NO	built up riveted	*
	U2-U3	NO	built up riveted	*
	U3-U4	NO	built up riveted	*
	U4-U5	NO	built up riveted	*
	U5-U6	NO	built up riveted	*

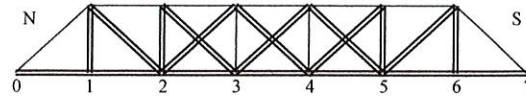
* 2- C6x10.5, with continous cover plate-1/4" x 12", 1-3/8" x 13-3/4" lacing on the bottom
\$ 2- C5 x 6.7, 1-3/8" x 13-3/8" lacing
2- C4 x 5.4, 1-3/8" x 13-3/8" lacing



MISSOURI DEPARTMENT OF TRANSPORTATION
FRACTURE CRITICAL INSPECTION REPORT

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COUNTY:	CHRISTIAN	STRUCTURE STATUS:	P-POSTLOAD	INSPECTION FREQUENCY:	24 MONTHS
FACILITY CARRIED:	SMYRNA RD	APPROVED POSTING:	5 TONS	INSPECTOR:	Lochner
FEATURE INTERSECTED:	FINLEY RVR	FIELD POSTING:	5 TONS	LATITUDE:	37° 2' 13.51"
LOCATION:	S18 T27 R20W	LAYOUT DIRECTION:	NORTH-TO-SOUTH	LONGITUDE:	93° 10' 16.44"



MEMBER CONDITIONS: LOWER CHORD

TYPICAL CONDITIONS:	Lower chords are tight and functioning as designed. Utility attachments are welded to outside eyebar member of west truss lower chord. Handrail is welded to inside eyebar members near center panel of lower chord, west truss. Light surface rust throughout.
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	EAST TRUSS	WEST TRUSS
L0-L1*	pack rust and pitting at L0, initial section loss, bearing shifted 1-3/4" on rollers, both eye bars are tight. L0 east to L1 west lateral bracing has minor section loss at L0 east.	pack rust at bearing plate and eye bar w/ initial section loss at L0, guardrail post and utility welded to both chords, both eye bars are tight
L1-L2*	guardrail posts welded to inside chord on all east chords.	Pitting at pin, pin and hanger plates appear rotated upward to outside
L2-L3*		
L3-L4*		
L4-L5*		
L5-L6*	pitting, outer chord bent close to L6	
L6-L7*	outer eye bar at L6 initial section loss and pack rust	pack rust between connection plate and eye bar at L7, some pack rust around eye bars

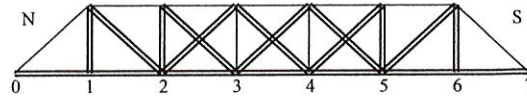
* = FRACTURE CRITICAL MEMBER



**MISSOURI DEPARTMENT OF TRANSPORTATION
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MEMBER CONDITIONS: DIAGONALS

TYPICAL CONDITIONS:	Heavy surface rust
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	EAST TRUSS	WEST TRUSS
L0-U1	Pitting with 20% section loss to end post. Bearing pin has moderate section loss.	rust and pitting, some pack rust between channel and cover plate with 20% section loss to end post. Bearing pin has moderate section loss.
U1-L2*	both eye bars are tight, rusting and pitting with 10% section loss	both eye bars are tight, rusting and pitting with 10% section loss
L2-U3*	eye bars replaced with wire cable in 2017, functioning as intended	rusting and pitting with 10% section loss. Counter is slightly loose.
U2-L3*	both eye bars are tight, rusting and pitting with 10% section loss	rusting and pitting with 10% section loss.
L3-U4*	eye bar is tight, rusting and pitting with 10% section loss	rusting and pitting with 10% section loss.
U3-L4*	eye bar is tight, rusting and pitting with 10% section loss	eye bar is tight, rusting and pitting with 10% section loss
L4-U5*	both eye bars are tight, rusting and pitting with 10% section loss	outside eyebar is tight, rusting and pitting with 10% section loss. Inside eyebar is slightly loose.
U4-L5*	rusting and pitting with 10% section loss	rusting and pitting with 10% section loss
L5-U6*	both eye bars are tight, rusting and pitting with 10% section loss	both eye bars are tight, rusting and pitting with 10% section loss
U6-L7	light rust and pitting with 20% section loss to end post	rust and pitting with 20% section loss to end post

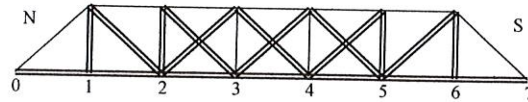
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LOCATION:	S18 T27 R20W	LAYOUT DIRECTION:	NORTH-TO-SOUTH	LONGITUDE:	93° 10' 16.44"



MEMBER CONDITIONS: VERTICALS

TYPICAL CONDITIONS:	guardrail is welded to verticals, heavy rust and minor pitting
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	EAST TRUSS	WEST TRUSS
L1-U1*	bar is tight with surface rust with 10% section loss	bar is tight with surface rust, pack rust between eye bar and pin, +/- 1/8" section loss (10% section loss)
L2-U2*	rust and pitting, guardrail welded to this member with 20% section loss	heavy surface rust and pitting, pack rust between connection plate and floor beam with minor bulging and 20% section loss. Guardrail is welded to this member.
L3-U3	rust and pitting, guardrail welded to this member with 20% section loss	Surface rust and pitting, utility bracket welded at L3. New floor beam hanger installed in 2017; configuration adds restraint to lower panel point with 20% section loss. Guardrail is welded to this member.
L4-U4	rust and pitting, guardrail welded to this member, pack rust between vertical plate connection and the floor beam with 20% section loss	Surface rust and pitting with 20% section loss. Vertical to floorbeam connection plate has 50% section loss at L4 pin. Guardrail is welded to this member.
L5-U5*	rust and pitting, guardrail welded to this member, light pack rust at connection plate with 20% section loss	Heavy rust and pitting with 20% section loss. Vertical to floorbeam connection plate has 25% section loss at L5 pin. Guardrail is welded to this member.
L6-U6*	bar is tight with surface rust, pin pitting at L6 with 10% section loss	bar is tight, surface rust, +/- 1/2" bend in bar 8 feet above deck, section loss and pitting in pin and eye bars with 10% section loss. Guardrail is welded to this member.

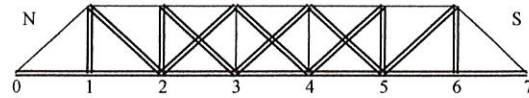
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MEMBER CONDITIONS: UPPER CHORD

TYPICAL CONDITIONS:	Heavy surface rust with some pitting. Minor rippling of top cover plate.
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	EAST TRUSS	WEST TRUSS
U1-U2	connection plate bent out, keeper pin is only partially in pin at U1	
U2-U3		
U3-U4	pack rust between connection plate at U3	pack rust at connection plate at U4, bolts on outside of connection plate are loose, section loss on bolt heads
U4-U5	pack rust between connection plate at U4	keeper pin half in at U4
U5-U6	only half of keeper pin in place at U6	keeper pin half in at U6

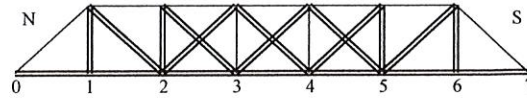
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FEDERAL ID: 20153

DISTRICT:	SW	YEAR BUILT:	1912	INSPECTION DATE:	06/28/23
COUNTY:	CHRISTIAN	STRUCTURE STATUS:	P-POSTLOAD	INSPECTION FREQUENCY:	24 MONTHS
FACILITY CARRIED:	SMYRNA RD	APPROVED POSTING:	5 TONS	INSPECTOR:	Lochner
FEATURE INTERSECTED:	FINLEY RVR	FIELD POSTING:	5 TONS	LATITUDE:	37° 2' 13.51"
LOCATION:	S18 T27 R20W	LAYOUT DIRECTION:	NORTH-TO-SOUTH	LONGITUDE:	93° 10' 16.44"



MEMBER CONDITIONS: FLOORBEAMS

TYPICAL CONDITIONS:	Heavy surface rust is typical. Pack rust with section loss is common at connections with verticals.
F0*	bolt for bent column lateral brace missing
F1*	very heavy section loss in narrow strip of web at edge of clip angle connection
F2*	1/16" section loss typical on bottom flange, heavy section loss in narrow strip of web at edge of clip angle connections
F3*	1/16" section loss typical on bottom flange, pack rust typical on top flange; bottom flange has 40% section loss at east end; web has 1/8" section loss at east end
F4*	section loss to web near east end of member
F5*	heavy section loss to top and bottom flange at eastmost 4' of floorbeam
F6*	heavy section loss to all floor beam elements within 4' of each end
F7*	east end stringer has 50% section loss of bottom flange, 50% section loss of floor beam top flange; west end light surface rust, accumulated debris

* = FRACTURE CRITICAL MEMBER

MEMBER CONDITIONS: TRUSS STRINGERS

TYPICAL CONDITIONS:	There are nine stringers per panel typically. The exterior stringers in most panels have serious section loss and little remaining capacity. Panel 3: Stringers 4 and 6 have serious section loss. Panel 4: Stringer 6 has serious section loss. Panel 7: Stringers 4, 5, 6 and 8 have serious section loss.
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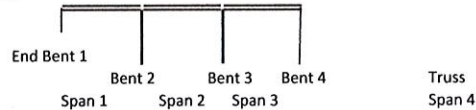


MISSOURI DEPARTMENT OF TRANSPORTATION
FRACTURE CRITICAL INSPECTION REPORT

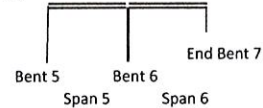
STRUCTURE NUMBER: **2490003**
FEDERAL ID: **20153**

DISTRICT:	SW	YEAR BUILT:	1912	INSPECTION DATE:	06/29/21
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FACILITY CARRIED:	SMYRNA RD	APPROVED POSTING:	5 TONS	INSPECTOR:	Lochner
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North Approach



South Approach



FRACTURE CRITICAL MEMBERS	=====
NON-FRACTURE CRITICAL MEMBERS	=====

MEMBER CONDITIONS: GIRDER & FLOOR BEAM

Span 1	Floor beam at abutment has pack rust. Both girders at abutment bearing have pack rust and moderate section loss. Heavy surface rust throughout. Middle floor beam has been retrofitted in 2017. Girders have 1/8" section loss on top flange on interior half. West girder at Bent 1 has heavy pitting with section loss 9" height x 1/8" deep x 7' length.
Span 2	Minor section loss of girder webs. 24" long x 1.5" high hole in spacer under floor beam, west end of Floor Beam 2. 1/8" section loss at west end of Floor Beam 2. Bent 3, Pile 3 is 1 1/8" out of plane. Span 2, Stringer 4, Panels 3 & 4 has failed.
Span 3	Middle floor beam has been retrofitted in 2017. Heavy section loss to east girder near Bent 4.
Span 5	Bent 6 lower brace connection encased in concrete, tight surface rust, some channels replaced in 2017. Floor Beam 2 pack rust at east end. West girder top flange has 10% section loss near midspan. West girder bottom flange has 3" width x 1/8" section loss at FB 3. At Bent 3, the lowest member of the 3 member stack has 50% section loss due to corrosion hole at east end.
Span 6	End Bent 7 has many spalls with excessive deterioration, but seems solid despite spalls--appears to just be an unreinforced gravity wall. Concrete columns have been constructed in front of end bent to provide additional support.