



# Appendix B. Field Investigation Report

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**Route 19 over Current River (Br. G0804)  
Rehabilitation / Replacement Concept Study  
Report of Field Investigation**

**MoDOT Project No.: J9P3305**

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Prepared by:  
**HDR Engineering, Inc.**

Site Work:  
**August 6 - 7, 2019**



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## Table of Contents

<b>General Information</b> .....	<b>1</b>
Bridge Description .....	1
<b>Results of Field Investigation</b> .....	<b>6</b>
Deck and Barrier.....	6
Superstructure .....	8
Substructure .....	10
<b>Summary</b> .....	<b>13</b>
Recommendations.....	13

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## General Information

The scope of this field investigation was to gather information on the existing bridge sufficient to be used to estimate remaining life, repair needs, and rehabilitation costs. The information was gathered visually from the ground, the roadway and the adjacent pedestrian bridge. Binoculars were used intermittently as deemed appropriate to obtain more detailed information readily attainable. The scope of work was set to be conducted in a one-day site visit.

The field investigation was performed August 6<sup>th</sup>, 2019 and August 7<sup>th</sup>, 2019 by a field crew consisting of Brian Zeiger, PE with HDR Engineering, Inc. and Terry Stowell with Olsson Associates. The bridge was accessed on foot from the north approach, via a local access road under the north end span, and from the south approach. No equipment was used for access. The bridge was open to traffic at all times for this field investigation.

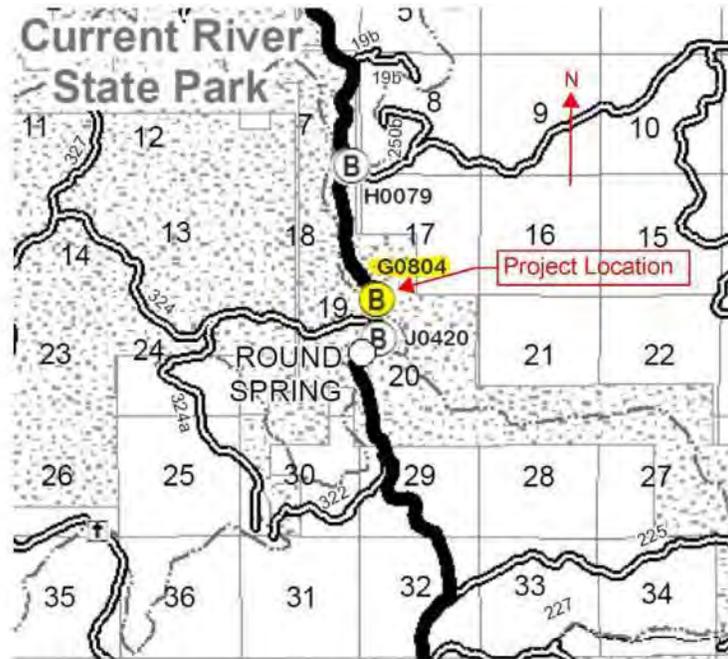
As a condition of the overall scope of the project it was assumed that the bridge will need a new deck for all options and therefore the deck was excluded from the investigation. General photos of the deck and rail were included for information only.

## Bridge Description

The bridge over the Current River (G0804) was built in 1924, has (60'-130'-130'-130'-60') filled arch spans with 34' filled deep abutments. The bridge has ratings of deck -5, superstructure-5 substructure-6, and has an 18' roadway. The bridge is posted for centerline only. Several of the overhang supports have significant deterioration. The deck between the arch walls is supported by the fill between the arch walls. The bridge is over the Current River within the National Park. There are trails, canoe rental businesses and canoe access to the river close by. There is a pedestrian / utility bridge located just downstream and parallel to G0804. The overall bridge elevation is shown looking southwest in the following photograph.



Elevation of Bridge

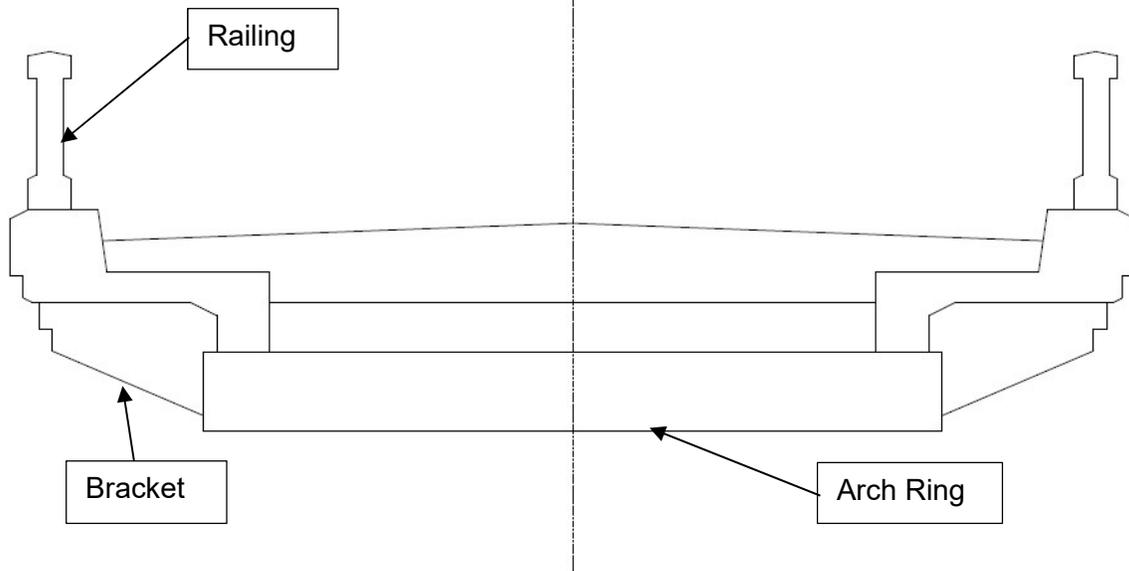


Location Map

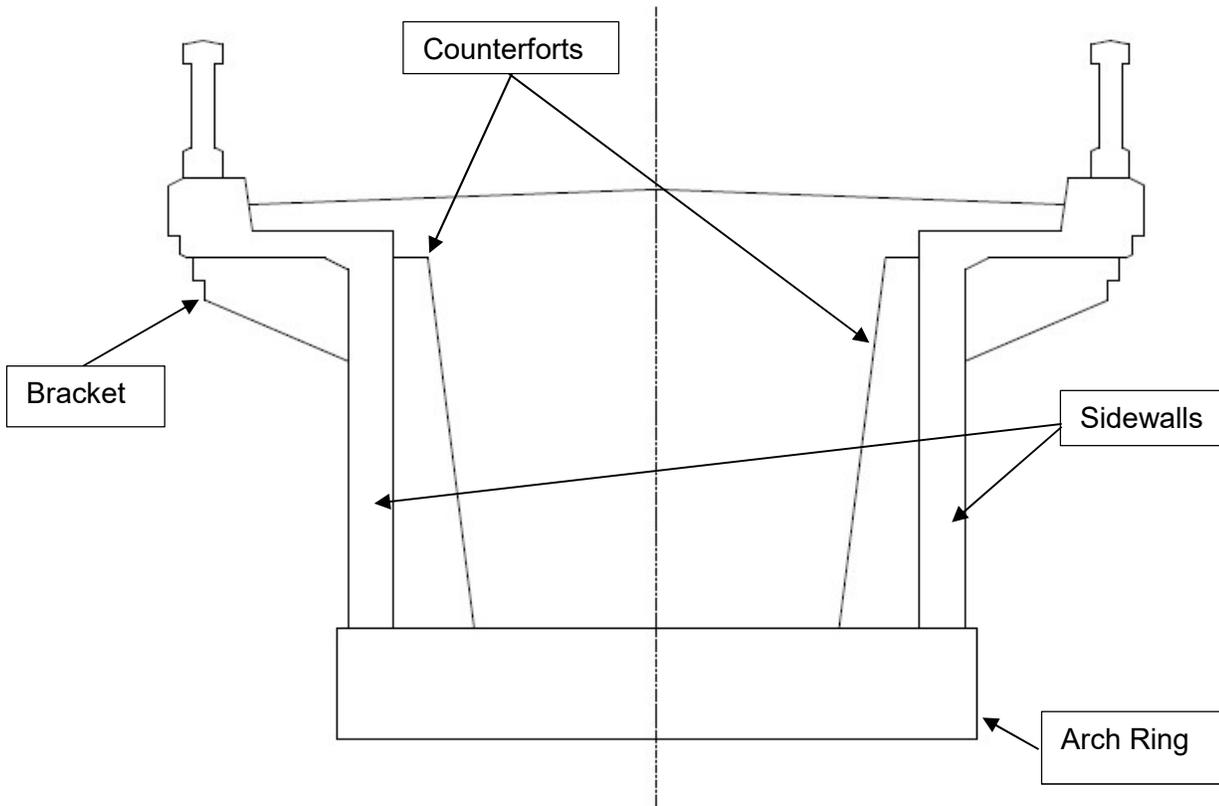


Aerial Photograph

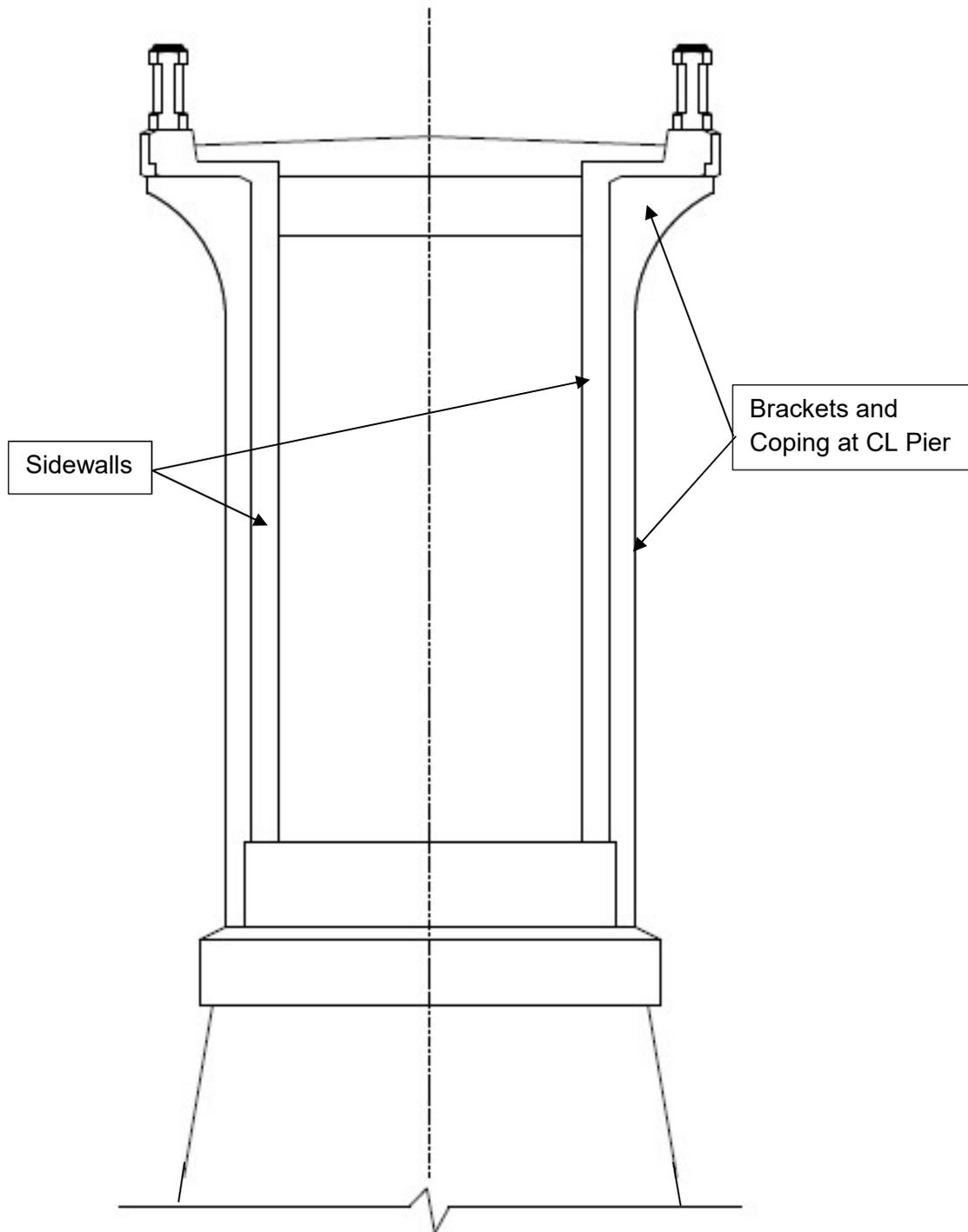




Typical Section at Midspan of Arch



Typical Section at Counterforted Sidewall



Typical Section at Pier

# Results of Field Investigation

## Deck and Barrier

The scope of services for this project listed the project condition that the deck and barrier would be replaced under any of the rehabilitation scenarios developed for this project. The deck and barriers were therefore excluded from analysis during the site visit. However, a cursory observation was made for informational purposes. The following photographs show various areas of collision damage and deflection of the rails, the cracking of the asphalt wearing surface of the roadway and small deck spalls that were observed during the site visit.



Collision Damage to the Railing



Condition of Wearing Surface



Deck Spall

## Superstructure

The superstructure of the bridge consists of five spans of filled spandrel arches. The fill material is from local sources with drains and drainage materials installed at the bases of the arch rings at the piers. The side walls have joints at the bracket locations and are either cantilevered walls or have counterforts install for support. Refer back to the typical sections for views of these details.

In general the arches are in good condition with areas of spalling and staining, primarily from leakage at the vertical joints in the sidewalls and the brackets. This leakage appears to be due in large part to the failure of the joint material between sections of the sidewall. The brackets supporting the deck cantilevers are heavily deteriorated throughout the structure. Several locations exhibit loss of up to 40% of the bracket area under the deck. Heavy spalling with exposed reinforcing steel is also prevalent.

One additional observation on the superstructure was the differential lateral movement between the sidewall sections. The section of sidewall over the pier that extends to each joint is either connected from side to side with a floor beam or there are counterforts on the pier side of the joint. The wall that is on the opposite side of the joint is not likewise supported and appears to have deflected outward on the order of  $\frac{3}{4}$ " per side. This results in a face of barrier dimension approximate  $1\frac{1}{2}$ " wider than over the pier.

The following photographs represent examples of these superstructure observations.



Spalling and Staining on Arch Ring



Leakage from Sidewall Joints



Heavy Deterioration with Loss of Bracket Support Area



Differential Alignment of Barrier at Joints Adjacent to Pier

## Substructure

The substructure elements are in generally fair condition. There are areas of scaling, staining, and deterioration on most substructure members. No obvious signs of settlement were observed. The abutments generally exhibit the spalling cracking and delamination on the outstanding corners and adjacent to the vertical joints. The piers exhibit the same types of deterioration and additionally scaling on the piers was observed and indications of scour holes at piers 3 and 4. The following photographs highlight the typical deterioration of the substructure elements.



Typical Spalling at Abutment Corners



Cracking and Delamination at Abutments



Scaling Along Pier Foundations



Spalling on Pier Surfaces



Scour Hole at Pier 3



Scour Hole at Pier 4

## Summary

The bridge is in generally fair condition with consistent areas of deterioration throughout the elements. Most of this deterioration is due to poor drainage of the fill material and failure of the expansion joint filler in the vertical joints of the brackets and sidewalls.

## Recommendations

Based on the observations of this site visit, rehabilitation of this structure should include the following items:

- Replacement of the barrier and the wearing surface.
- Improvement of the drainage system for the arch fill material.
- Replacement of the joint filler in the sidewalls.
- Repair or replacement of the numerous deteriorated brackets.
- Concrete repair and possible chloride remediation at deteriorated concrete areas and areas of high chloride levels in walls, piers and arches.
- Fill and protection of the observed scour holes

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# STRUCTURAL REHABILITATION CHECKLIST

Bridge No.: **G0804**

Job No.: **J9P3305**

Route: **MO 19**

Over: **Current River**

County: **Shannon**

Date of Field Check: **August 6, 2019**

\* \* \* Please include photographs for all items that apply. \* \* \*

1

**OVERLAY**

- \* Type of existing overlay:  None  Asphalt  Low Slump  Silica Fume  Latex  Epoxy  Other: \_\_\_\_\_
- \* Existing overlay thickness: 5-7 "      \* Year overlay was applied: 2010  Unknown
- \* % of overlay repaired or patched: \_\_\_\_\_ %      \* Replace overlay:  Yes  No
- \* Notes: Asphalt wearing surface width along concrete cantilever curb of 4' on each side and earth fill in center.

Picture # **Pic: 001**

2A

**DECK REPAIRS** (Deck repair quantities are required even if a Deck Test request has been ordered for this structure.)

- \* Half-sole repairs: \_\_\_\_\_ sq. ft.      \* Full-depth repairs: \_\_\_\_\_ sq. ft.  
(round up to the nearest 50 sq. ft.)      (round up to the nearest 25 sq. ft.)
- \* Slab edge repairs: \_\_\_\_\_ lin. ft.      \* Superstructure repair (Unformed): \_\_\_\_\_ sq. ft.  
(covers the outer 4" of the slab edge)      (covers the remaining slab cantilever beyond the outer 4")
- \* Clean & seal slab edge: \_\_\_\_\_ lin. ft.      \* Cantilever replacement: 1204 lin. ft.  
(in lieu of edge repairs)
- \* Total surface hydro demolition bridge deck:  Yes  No      \* Full deck replacement (redeck):  Yes  No  Optional  
(half-sole and full depth repair quantities still required)
- \* Deck repairs with voided tube replacement:  Yes  No      \* Superstructure replacement:  Yes  No  Optional  
(if applicable)      \* Full bridge replacement:  Yes  No  Optional  
\_\_\_\_\_ sq. ft.      (Deck repair quantities required for cost comparison of alternatives)
- \* How were the quantities obtained?  Visual  Bridge Inspection Report  Sounded  Other \_\_\_\_\_
- \* Notes: \_\_\_\_\_

Picture #

**DECK REPAIRS CONT.**

**\* ISSUES \ PROBLEMS WITH PRECAST PRESTRESSED DECK PANELS**

Spans	Location in Span						Deterioration		Describe
	At Panel Jt.	Btwn (mid) Panel Jt.	End	Mid	End	Type	Amount		
_____	<input type="checkbox"/>	_____	sq. ft.	_____					
_____	<input type="checkbox"/>	_____	sq. ft.	_____					
_____	<input type="checkbox"/>	_____	sq. ft.	_____					
_____	<input type="checkbox"/>	_____	sq. ft.	_____					
_____	<input type="checkbox"/>	_____	sq. ft.	_____					
_____	<input type="checkbox"/>	_____	sq. ft.	_____					

\* Notes: \_\_\_\_\_  
 \_\_\_\_\_

*(Deterioration may include water saturation, efflorescence, rust staining, cracking, spalling, exposed steel, disintegration of panel edges at joints, etc. Typically observed at or near panel joints. The location and "Type" of deterioration should be recorded.)*

Picture #

**APPROACH SLABS**

- \* Is there a bridge approach slab in place?  Yes  No \* Type:  Concrete  Asphalt  Other \_\_\_\_\_
- \* Is there a rdwy. approach pavement in place?  Yes  No \* Type:  Concrete  Asphalt  Other \_\_\_\_\_
- \* Is the approach slab sinking at the end bent?  N/A  Yes  No \_\_\_\_\_
- \* Are repairs needed to the bridge approach slab driving surface?  Yes  No \_\_\_\_\_  
*(Typically a roadway item but will be reported to district on the Bridge Memorandum.)*

\* Notes: \_\_\_\_\_  
 \_\_\_\_\_

Picture #

4

**SLAB DRAINS**

\* Is the drainage system working adequately?  Yes  No

\* Recommendations: Provide drains during rehabilitation or replacement of existing bridge.

\* Notes: No deck drains in place.

Picture # **Pic: 002**

5

**CURBS & RAILS**

\* Existing curb (left side):  Safety Barrier Curb  Curb/parapet  Blockouts  Thrie Beam  Baluster  Steel Channel

Other \_\_\_\_\_  Handrail  Fence \_\_\_\_\_

\* Does curb need repair  Yes  No \* Curb repair 602 lin. ft.

\* Remove hand rail  Yes  No \* Add curb blockout  Yes  No

\* Existing curb (right side):  Safety Barrier Curb  Curb/parapet  Blockouts  Thrie Beam  Baluster  Steel Channel

Other \_\_\_\_\_  Handrail  Fence \_\_\_\_\_

\* Does curb need repair  Yes  No \* Curb repair 602 lin. ft.

\* Remove hand rail  Yes  No \* Add curb blockout  Yes  No

\* Existing median curb: Type: N/A Width \_\_\_\_\_ " Height \_\_\_\_\_ "

\* Does curb need repair  Yes  No \* Curb repair \_\_\_\_\_ lin. ft.

\* Approach rail attachment:  None  Not attached  4 Hole  5 Hole  Turn-down  Other \_\_\_\_\_

\* If the existing handrails will be removed, does the local maintenance supervisor wish to keep them?  Yes  No

Storage address: location: \_\_\_\_\_

address: \_\_\_\_\_

city: \_\_\_\_\_ state: \_\_\_\_\_ zip: \_\_\_\_\_

\* Notes: Total of 1204 lin. ft. of concrete baluster bridge rail.

Picture # **Pic: 003, 004**

6

**EXPANSION DEVICES**

Bent	Type	Recommendations	Gap Left	Gap Right	Temperature & Other Info
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____
_____	_____	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____ "	_____ "	_____

\* Notes: **N/A**

Picture #

7

**BEARINGS**

Bent	Coating	Recommendations	Notes (indicate which bearings at each bent)
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____
_____	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	_____

\* Notes: **N/A**

Picture # (Provide Pictures of Each Bearing)

8

**COATING SYSTEM (PAINT)**

\* Existing coating system: N/A  green  gray  other \_\_\_\_\_

\* Date last coated: \_\_\_\_\_ \* Is existing coating peeling?  Yes (Overcoat is not an option)  No

\* Coating recommendation:  Blast clean & recoat all steel  Clean & overcoat all steel  
 Blast clean & recoat only at joint locations  Blast & recoat at joint locations and clean & overcoat all other steel

Note: Pull off test required for overcoat (Calcium Sulfonate) option. Bridge Division will request pull off tests.

\* Notes: **N/A**

Picture #

**SUPERSTRUCTURE REPAIRS** (Repairs needed not previously stated.)

**Concrete Slab Superstructure or Girder:** (above the bearings) \_\_\_\_\_  
 (Example: Deck solid slabs, voided slabs, box girder,  
 deck girders & prestressed girders) \_\_\_\_\_

**Steel:** (Example: Beams, stringers, girders, diaphragms, cross-frames, misc. steel)

Member	(Check all that apply) (Attach pictures)		Describe & Locate
_____	<input type="checkbox"/> Section Loss _____ %	<input type="checkbox"/> Cracks _____ in.	_____
_____	<input type="checkbox"/> Section Loss _____ %	<input type="checkbox"/> Cracks _____ in.	_____
_____	<input type="checkbox"/> Section Loss _____ %	<input type="checkbox"/> Cracks _____ in.	_____
_____	<input type="checkbox"/> Section Loss _____ %	<input type="checkbox"/> Cracks _____ in.	_____

**Notes:** **The HDR field investigation report describes typical deterioration found. Further analysis has shown that areas that could be considered Superstructure will be encased behind new construction during a rehabilitation due to needed widening.**

Picture # **Pic: 005, 006**

**SUBSTRUCTURE REPAIR**

Bent	Formed Repair	Unformed Repair	Seal Concrete Beam Cap Bts.	Coat Exposed Pile @ Int. Pile Cap Bts.	Describe (Beam, Backwall, Wing, etc.)
<b>1</b>	<b>110</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
<b>2</b>	<b>170</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
<b>3</b>	<b>130</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
<b>4</b>	<b>190</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
<b>5</b>	<b>140</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
<b>6</b>	<b>110</b> sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____

\* Does the structure need graffiti protection?  No  Bottom 8' of Concrete  End Bents  Other \_\_\_\_\_

\* Notes: \_\_\_\_\_

Picture # **Pic: 007, 008, 009**

11

**SIGNS, SIGNALS &/OR LIGHTING ATTACHED TO STRUCTURE**

\* Are there signs attached directly to this structure?  Yes  No quantity \_\_\_\_\_ location \_\_\_\_\_

\* Describe proposed work to be done to signs. \_\_\_\_\_

\* Are there signals attached directly to this structure?  Yes  No quantity \_\_\_\_\_ location \_\_\_\_\_

\* Describe proposed work to be done to signals. \_\_\_\_\_

\* Is there aviation lighting attached to this structure?  Yes  No  N/A  Red \_\_\_\_\_  Green \_\_\_\_\_  
qnty. qnty.

\* Is there navigational lighting attached to this structure?  Yes  No  N/A  Red \_\_\_\_\_  Green \_\_\_\_\_  
qnty. qnty.

\* Is there roadway lighting attached to this structure?  Yes  No  N/A

\* Describe proposed work to be done to lighting. \_\_\_\_\_

\_\_\_\_\_

\* Notes: \_\_\_\_\_

Picture #

12

**UTILITIES ATTACHED TO STRUCTURE**

Type			Qty.	Size	Owner	Condition			
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove

\* Notes: **Utilities on adjacent ped bridge.** \_\_\_\_\_

\_\_\_\_\_

Picture # **Pic: 010**

13

**CATHODIC PROTECTION SYSTEM**

\* Is there a cathodic system on this structure?  Yes  No  Remove  Do not alter  Abandon in place (grooved system)

\* Is it on and working?  Yes  No  Unknown \_\_\_\_\_

\* Notes: \_\_\_\_\_  
 \_\_\_\_\_

Picture #

14

**CHANNEL ALIGNMENT, SLOPE PROTECTION & SCOUR**

\* Is channel aligned to bridge opening?  Yes  No Describe \_\_\_\_\_

\* Is drift a continual problem?  Yes  No Describe & Locate High water drift on south bank affecting pier 4

\* Is erosion a problem?  Yes  No Describe & Locate Erosion around substructure units on South bank

\* Describe slope protection in place. Little of original slope protection in place around Abutment 6

Scour	At Footing	At Piling	Depth	Bent	Recommendation
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>Est 8'</u>	<u>4</u>	
	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<u>3</u>	<u>See MoDOT UW Insp. Report Dated 07/26/2016</u>

\* Describe needed work. Remove drift up and down stream. Level elevation under bridge. Fill scour holes with type II rip rap

Picture # **Pic: 011, 012**

15

**TRAFFIC LANES**

\* Number of lanes striped: on structure 1 under structure 0

\* Shoulder width:  None on structure 4 ft. 4 ft. under structure 0 ft 0 ft  
 (left) (right) (left) (right)

\* Sidewalk widths: on structure 0 ft 0 ft under structure 0 ft 0 ft  
 (left) (right) (left) (right)

\* Median width: on structure 0 under structure 0

\* Proposed improvements for lanes/shoulders/sidewalks: \_\_\_\_\_  
 \_\_\_\_\_

Picture # **Pic: 013**

16

**GENERAL AREA CONDITIONS**

\* Primary area:  Commercial  Industrial  Residential  Agricultural  Military  Other Nat Waterway Park

\* Posted speed limit on structure: 35 mph

\* Posted load on structure: \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

Single Unit: \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

Semi (tractor/trailer): \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

\* Are both signs in place?

Yes  No

\* Do pedestrians and/or bicyclists regularly use this structure?  Yes  No  Undetermined

\* Notes: Posted at S-4. Ped bridge adjacent to structure Posted as single lane centerline use only.

Picture # **Pic: 014, 015**

17

**MAINTENANCE**

\* What work has been done to this structure that may not be reflected on existing bridge plans? \_\_\_\_\_

Depth of roadway overlay surface along CL bridge  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Picture #

18

**ADDITIONAL FIELD NOTES**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Picture #

19

**STAGING / DETOUR**

\* **Traffic Control:**  Close structure     Stage construction on structure     Cross over traffic to adjacent structure     Detour

Other option **Build an offset alignment or staged construction on structure.**

\* **Define probable detour route.** **Detour estimate at 55+ miles.**

\_\_\_\_\_  
\_\_\_\_\_

20

**PERSONS ASSISTING WITH CHECKLIST**

Name **Brian Zeiger, PE** Title **Senior Bridge Engineer, HDR Engineering** Ph. ( **913** ) **302** - **8931**

Name **Terry Stowell** Title **CA Field Operations, Olsson Assoc.** Ph. ( **816** ) **604** - **9888**

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (     ) - \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (     ) - \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (     ) - \_\_\_\_\_

21

**REQUIRED SIGNATURES**

*I have reviewed the information on this checklist and believe it to be as accurate as possible.*

Name \_\_\_\_\_ Date \_\_\_\_\_  
*Transportation Project Manager*

Name \_\_\_\_\_ Date \_\_\_\_\_  
*District Bridge Engineer*

The structural rehabilitation checklist indicates how the bridge is functioning and aging.

All deterioration should be noted, even if it is known that the work will not be completed under the proposed project.

Send **NEW** Structural Rehabilitation Checklist by email

To: "Bridge Survey Processor"

Cc: Structural Project Manager or Structural Resource Manager

Pic. 001: Typical view of pavement, north end shown.



Pic. 002: Typical leakage from sidewall joints



Pic. 003: West barrier, Span (2-3)



Pic. 004: West barrier, Span (4-5)



Pic. 005: Spalling along corner of arch ring, Span (4-5) east face



Pic. 006: Spalling along corner of arch ring, Span (4-5) east face



Pic. 007: Cracking and delamination, Abutment 1 west side



Pic. 008: Spalled and deteriorated concrete, Pier 3 west face



Pic. 009: Spalling and delamination on pilaster, Pier 2 east side



Pic. 010: Utilities on adjacent pedestrian / utility crossing



Pic. 011: Scour hole at Pier 3



Pic. 012: Scour hole at Pier 4



Pic. 013: Roadway over bridge looking north



Pic. 014: Pedestrian / utility crossing east of highway, looking south



Pic. 015: Reduction to single lane with yield sign, south end of bridge



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Rehabilitation / Replacement Concept Study  
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**MoDOT Project No.: J9P3305**

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Prepared by:  
**HDR Engineering, Inc.**

Site Work:  
**August 7, 2019**



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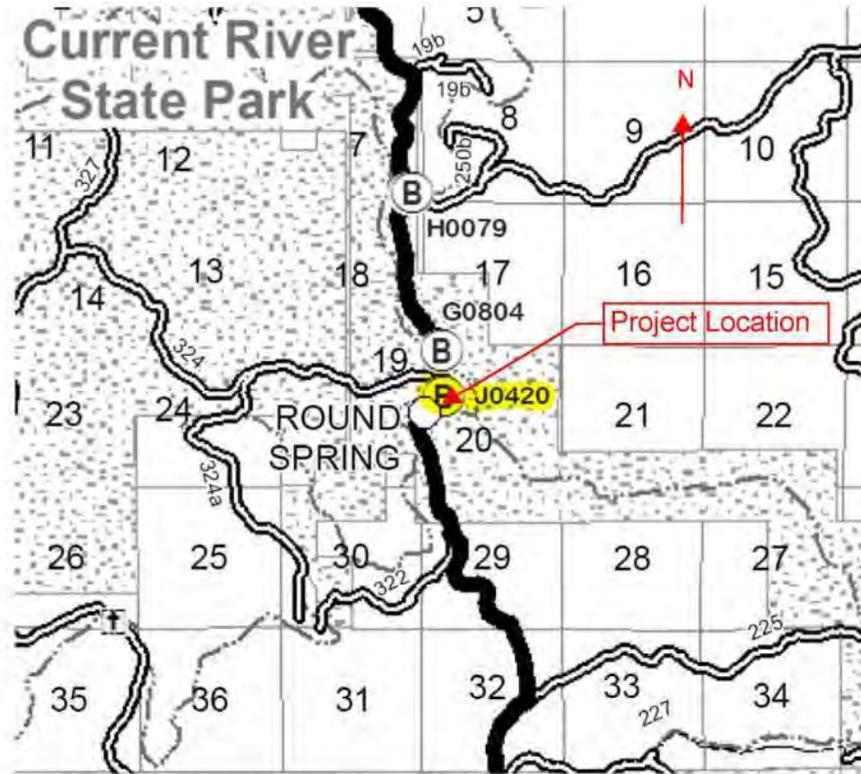
As a condition of the overall scope of the project it was assumed that the bridge will need a new deck for all options and therefore the deck was excluded from the investigation. General photos of the deck and rail were included for information only.

## Bridge Description

The bridge over Spring Valley (J0420) was built in 1930, is 523 feet long and has 7- 52' arch deck girder approach spans (3 on one end and 4 on the other) with a 155' spandrel arch main span. The bridge has ratings of deck – 4, superstructure – 5 and substructure – 6, and has a 20' roadway. The bridge is not posted. The deck is in poor condition. The bridge goes over and next to campgrounds, park service buildings, roads, springs, caves and trails.



Elevation of Bridge

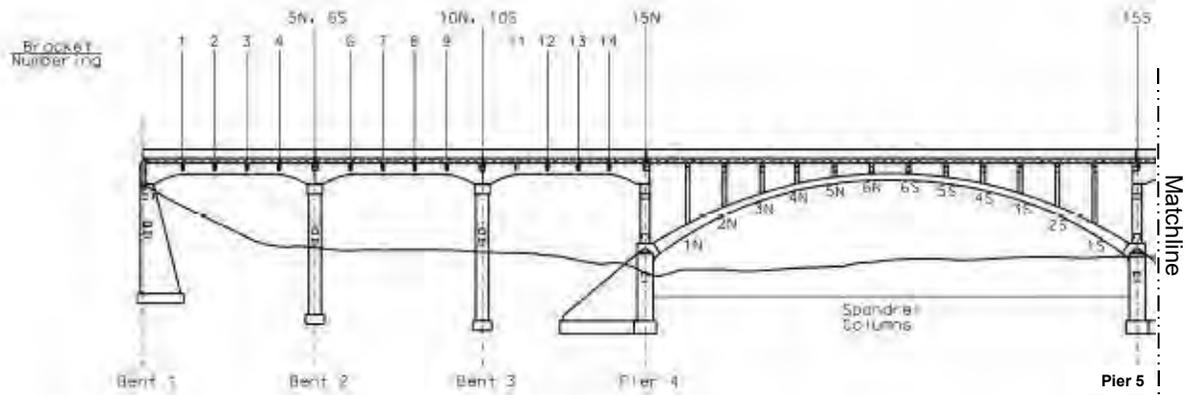


Location Map

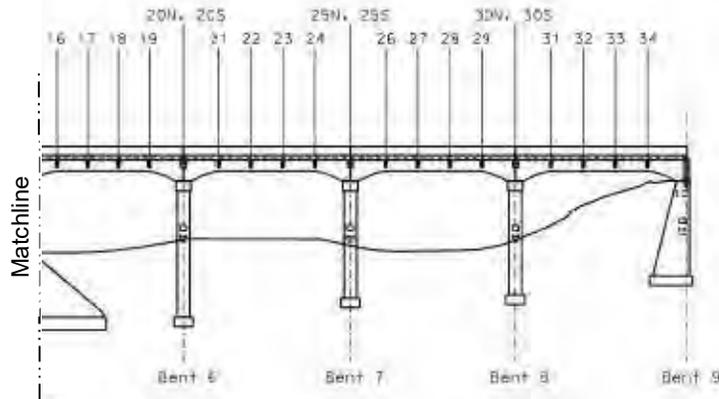


Aerial Photograph

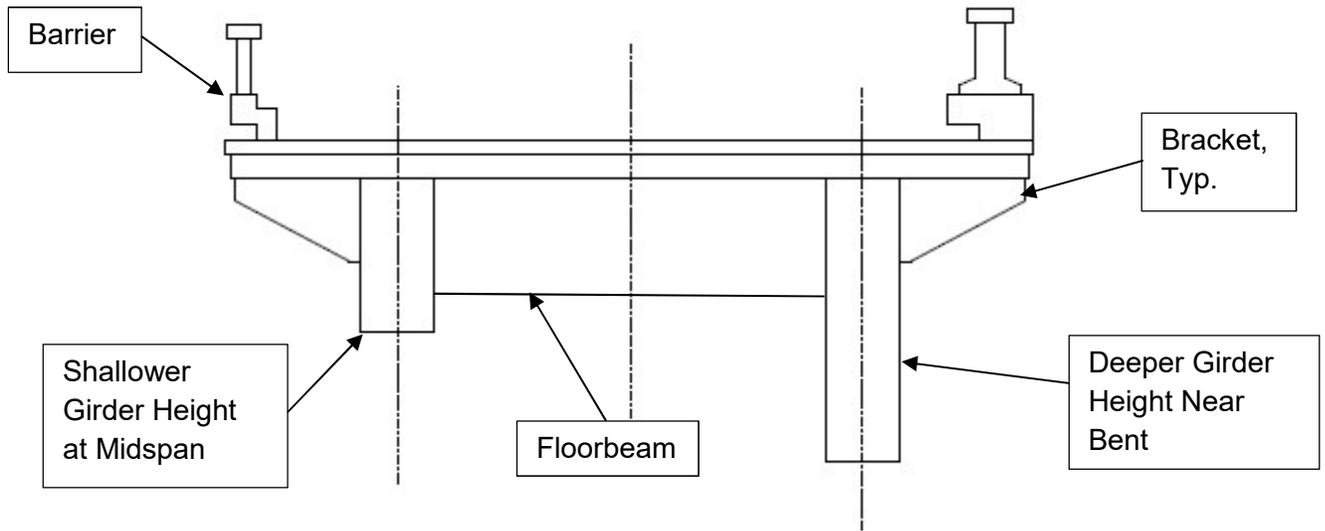
North



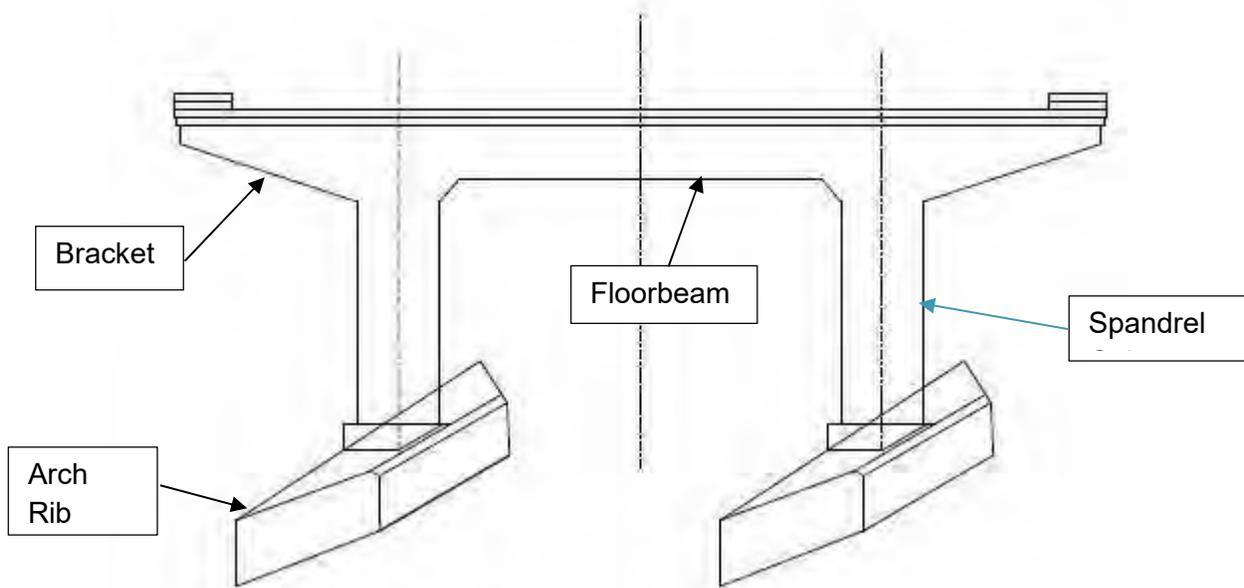
South



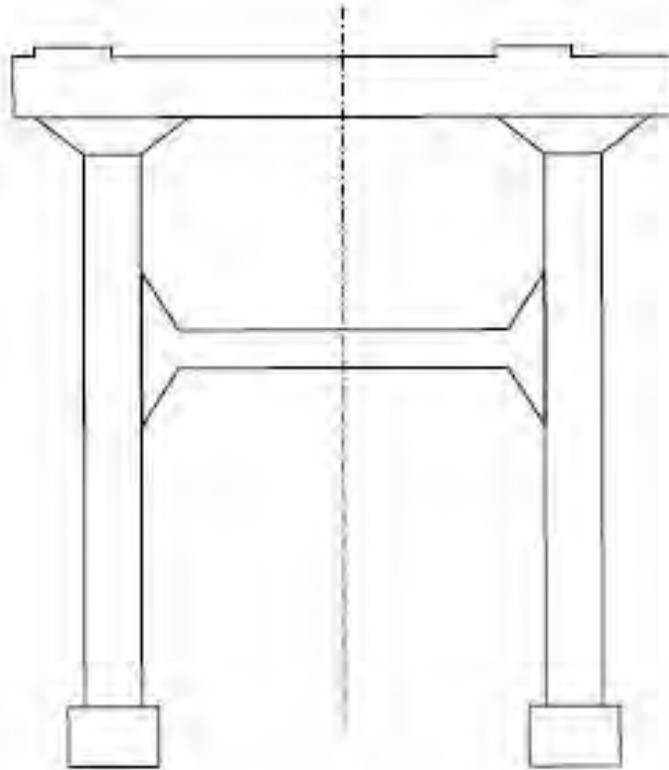
Elevation of Bridge  
(Bent, spandrel column and bracket numbering shown)



Typical Section – Girder Spans



Typical Section Through Arch Span  
(Perpendicular to Spandrel Bent)



Typical Elevation of Intermediate Bent

# Results of Field Investigation

## Deck and Barrier

The scope of services for this project listed the project condition that the deck and barrier would be replaced under any of the rehabilitation scenarios developed for this project. The deck and barriers were therefore excluded from analysis during the site visit. However, a cursory observation was made for informational purposes. The following photographs show various areas of collision damage and deflection of the rails, the spalling of the asphalt wearing surface of the roadway, heavy deterioration at the deck drains, and overall views of the wearing surface and deck expansion joints.



Collision Damage to the Railing



Condition of Wearing Surface



Heavy Deterioration of the Deck at Existing Drains



Typical Slab Expansion Joint

## Superstructure

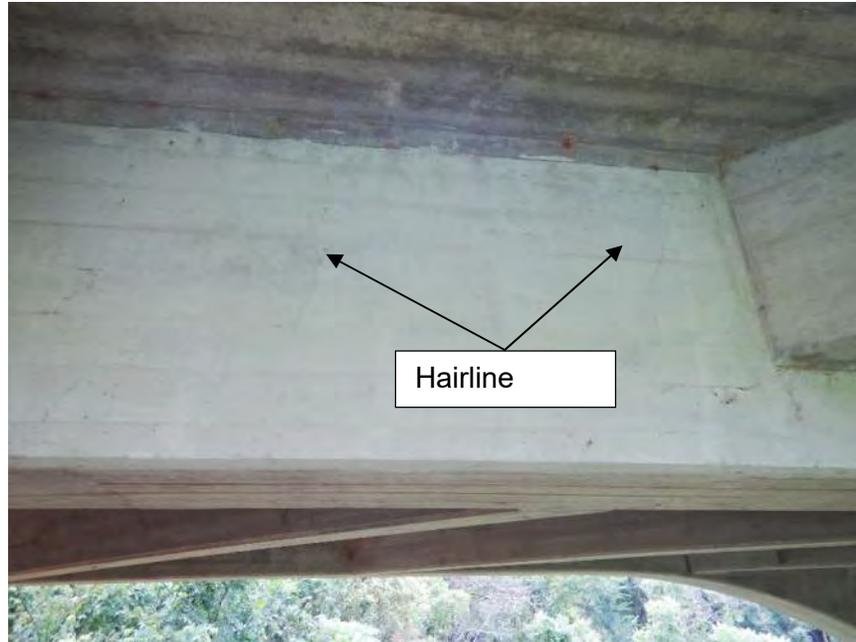
The superstructure of the bridge consists of three units. Unit 1 is three spans of concrete girders with floorbeams, Unit 2 is an open spandrel arch span and Unit 3 is four spans of concrete girders with floorbeams. The arch span includes multiple spandrel bents composed of columns, cap beams and overhang brackets. Refer back to the typical sections for views of these details.

In general the concrete girders of Units 1 and 3 and the arch ribs of Unit 2 are in good condition with areas of spalling, hairline cracking, delamination and staining, primarily from drainage from the deck. The brackets supporting the deck cantilevers are deteriorated throughout the structure.

The arch spandrel columns and cap beams exhibit several areas of spalling, cracking and delamination. Additionally there is some drift caught up on the west arch rib at the north end of the span indicating inundation of this area during a high flow event. There is also spalling with exposed rebar on several locations of the arch lateral bracing.

The bridge is on a 45 degree skew and is exhibiting lateral movement of the girders relative to the substructure due to the sharp skew. Previous retrofit projects have included the installation of brackets to keep the girders in line with the bearings. The girders are tight against these brackets. At Bent 9 there appears to have been an attempt to raise the east girder and realign the upper bearing plate with the girder. A jacking block had been added to the girder to facilitate this modification.

The following photographs represent examples of these superstructure observations.



Typical Hairline Cracks in Girders



Typical Delamination on Girders



Typical Deterioration of Brackets



Typical Girder Restraint Bracket



East Girder at Bent 9



Deterioration of Floorbeams at Intermediate Bents



Spalling and Delamination of Arch Ribs



Drift in Structure



Typical Deterioration on Spandrel Columns



Typical Deterioration on Spandrel Capbeams



Lateral Bracing Between the Arch Ribs

## Substructure

The substructure elements are in generally fair condition. There are areas of scaling, staining, and deterioration on most substructure members. No obvious signs of settlement were observed. The abutments generally exhibit the spalling cracking and delamination on the backwalls and wings. The intermediate bents have numerous areas of cracking with spalling and exposed reinforcing steel. The following photographs highlight the typical deterioration of the substructure elements.



Typical Spalling at Abutment



Deterioration of Intermediate Bent Columns



Deterioration of Intermediate Bent Cap Beams

## Summary

The bridge is in generally fair condition with consistent areas of deterioration throughout the elements. Most of this deterioration is due to drainage from the open curb drains of the deck allowing drainage to fall on the superstructure and substructure members

## Recommendations

Based on the observations of this site visit, rehabilitation of this structure should include the following items:

- Replacement of the deck, barrier and the wearing surface. Replacement of the deck will require replacement of the concrete deck girders and possibly the floorbeams over the spandrel arch.
- Include a drainage system in the rehabilitation or replacement.
- Repair or replace of the numerous deteriorated brackets.
- Repair the numerous areas of cracking, spalling and delamination in the superstructure and substructure.
- Concrete repair and possible chloride remediation at deteriorated concrete areas and areas of high chloride levels.
- Stabilization of the lateral displacement of the girders due to the 45 degree skew.
- Fill observed scour hole and provide protection for the pier.

# STRUCTURAL REHABILITATION CHECKLIST

Bridge No.: **J0420**

Job No.: **J9P3305**

Route: **MO 19**

Over: **Spring Valley**

County: **Shannon**

Date of Field Check: **August 7, 2019**

\* \* \* Please include photographs for all items that apply. \* \* \*

1

**OVERLAY**

\* Type of existing overlay:  None  Asphalt  Low Slump  Silica Fume  Latex  Epoxy  Other: \_\_\_\_\_

\* Existing overlay thickness:   1"   "                      \* Year overlay was applied:   2010    Unknown

\* % of overlay repaired or patched: \_\_\_\_\_ %                      \* Replace overlay:  Yes  No

\* Notes: **Deck replacement incorporated into rehab**

Picture # **Pic: 001**

2A

**DECK REPAIRS** (Deck repair quantities are required even if a Deck Test request has been ordered for this structure.)

\* Half-sole repairs: \_\_\_\_\_ sq. ft.                      \* Full-depth repairs: \_\_\_\_\_ sq. ft.  
(round up to the nearest 50 sq. ft.)                      (round up to the nearest 25 sq. ft.)

\* Slab edge repairs: \_\_\_\_\_ lin. ft.                      \* Superstructure repair (Unformed): \_\_\_\_\_ sq. ft.  
(covers the outer 4" of the slab edge)                      (covers the remaining slab cantilever beyond the outer 4")

\* Clean & seal slab edge: \_\_\_\_\_ lin. ft.                      \* Cantilever replacement: \_\_\_\_\_ lin. ft.  
(in lieu of edge repairs)

\* Total surface hydro demolition bridge deck:  Yes  No                      \* Full deck replacement (redeck):  Yes  No  Optional  
(half-sole and full depth repair quantities still required)

\* Deck repairs with voided tube replacement:  Yes  No                      \* Superstructure replacement:  Yes  No  Optional  
(if applicable)                      (Deck repair quantities required for cost comparison of alternatives)

\_\_\_\_\_ sq. ft.                      \* Full bridge replacement:  Yes  No  Optional

\* How were the quantities obtained?  Visual  Bridge Inspection Report  Sounded  Other \_\_\_\_\_

\* Notes: **Deck replacement incorporated into rehab**

Picture # **Pic: 002**

**DECK REPAIRS CONT.**

**\* ISSUES \ PROBLEMS WITH PRECAST PRESTRESSED DECK PANELS**

Spans	Location in Span					Deterioration		Describe
	At Panel Jt.	Btwn (mid) Panel Jt.	End	Mid	End	Type	Amount	
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____				
_____	<input type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____				
_____	<input type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____				
_____	<input type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____				
_____	<input type="checkbox"/>	<input type="checkbox"/>	sq. ft.	_____				

\* Notes: N/A

*(Deterioration may include water saturation, efflorescence, rust staining, cracking, spalling, exposed steel, disintegration of panel edges at joints, etc. Typically observed at or near panel joints. The location and "Type" of deterioration should be recorded.)*

Picture #

**APPROACH SLABS**

- \* Is there a bridge approach slab in place?  Yes  No \* Type:  Concrete  Asphalt  Other \_\_\_\_\_
- \* Is there a rdwy. approach pavement in place?  Yes  No \* Type:  Concrete  Asphalt  Other \_\_\_\_\_
- \* Is the approach slab sinking at the end bent?  N/A  Yes  No \_\_\_\_\_
- \* Are repairs needed to the bridge approach slab driving surface?  Yes  No \_\_\_\_\_  
*(Typically a roadway item but will be reported to district on the Bridge Memorandum.)*

\* Notes: \_\_\_\_\_

Picture #

4

**SLAB DRAINS**

\* Is the drainage system working adequately?  Yes  No

\* Recommendations: Provide drains during rehabilitation or replacement of existing bridge.

\* Notes: \_\_\_\_\_  
\_\_\_\_\_

Picture # **Pic: 002**

5

**CURBS & RAILS**

\* Existing curb (left side):  Safety Barrier Curb  Curb/parapet  Blockouts  Thrie Beam  Baluster  Steel Channel  
 Other \_\_\_\_\_  Handrail  Fence \_\_\_\_\_

\* Does curb need repair  Yes  No \* Curb repair \_\_\_\_\_ lin. ft.

\* Remove hand rail  Yes  No \* Add curb blockout  Yes  No

\* Existing curb (right side):  Safety Barrier Curb  Curb/parapet  Blockouts  Thrie Beam  Baluster  Steel Channel  
 Other \_\_\_\_\_  Handrail  Fence \_\_\_\_\_

\* Does curb need repair  Yes  No \* Curb repair \_\_\_\_\_ lin. ft.

\* Remove hand rail  Yes  No \* Add curb blockout  Yes  No

\* Existing median curb: Type: N/A Width \_\_\_\_\_ " Height \_\_\_\_\_ "

\* Does curb need repair  Yes  No \* Curb repair \_\_\_\_\_ lin. ft.

\* Approach rail attachment:  None  Not attached  4 Hole  5 Hole  Turn-down  Other \_\_\_\_\_

\* If the existing handrails will be removed, does the local maintenance supervisor wish to keep them?  Yes  No

Storage address: location: \_\_\_\_\_

address: \_\_\_\_\_

city: \_\_\_\_\_ state: \_\_\_\_\_ zip: \_\_\_\_\_

\* Notes: Barrier replacement incorporated into rehab  
\_\_\_\_\_

Picture # **Pic: 003**

6

**EXPANSION DEVICES**

Bent	Type	Recommendations	Gap Left	Gap Right	Temperature & Other Info
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	
		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	"	"	

\* Notes: **Expansion gaps have been overlaid with asphalt**

Picture # **Pic: 001**

7

**BEARINGS**

Bent	Coating	Recommendations	Notes (indicate which bearings at each bent)
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	
	<input type="checkbox"/> CLEAN & OVERCOAT <input type="checkbox"/> BLAST CLEAN & RECOAT	<input type="checkbox"/> USE-IN-PLACE <input type="checkbox"/> REPAIR <input type="checkbox"/> RESET <input type="checkbox"/> REPLACE	

\* Notes: **N/A**

Picture # (Provide Pictures of Each Bearing)

8

**COATING SYSTEM (PAINT)**

\* Existing coating system: N/A  green  gray  other \_\_\_\_\_

\* Date last coated: \_\_\_\_\_ \* Is existing coating peeling?  Yes (Overcoat is not an option)  No

\* Coating recommendation:  Blast clean & recoat all steel  Clean & overcoat all steel  
 Blast clean & recoat only at joint locations  Blast & recoat at joint locations and clean & overcoat all other steel

Note: Pull off test required for overcoat (Calcium Sulfonate) option. Bridge Division will request pull off tests.

\* Notes: **N/A**

Picture #

**SUPERSTRUCTURE REPAIRS** (Repairs needed not previously stated.)

**Concrete Slab Superstructure or Girder:** (above the bearings) \_\_\_\_\_  
 (Example: Deck solid slabs, voided slabs, box girder,  
 deck girders & prestressed girders) \_\_\_\_\_

**Steel:** (Example: Beams, stringers, girders, diaphragms, cross-frames, misc. steel)

Member (Check all that apply) (Attach pictures)	Describe & Locate	
_____ <input type="checkbox"/> Section Loss _____ % <input type="checkbox"/> Cracks _____ in.	_____	
_____ <input type="checkbox"/> Section Loss _____ % <input type="checkbox"/> Cracks _____ in.	_____	
_____ <input type="checkbox"/> Section Loss _____ % <input type="checkbox"/> Cracks _____ in.	_____	
_____ <input type="checkbox"/> Section Loss _____ % <input type="checkbox"/> Cracks _____ in.	_____	

**Notes:** **The HDR field investigation report describes typical deterioration found. Further analysis has shown that a widening and rehabilitation will need to replace the superstructure.**

Picture # Pic: 004, 005, 006, 007, 008, 009

**SUBSTRUCTURE REPAIR**

Bent	Formed Repair	Unformed Repair	Seal Concrete Beam Cap Bts.	Coat Exposed Pile @ Int. Pile Cap Bts.	Describe (Beam, Backwall, Wing, etc.)
_____	_____ sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
_____	_____ sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
_____	_____ sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
_____	_____ sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____
_____	_____ sq. ft.	_____ sq. ft.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	_____

\* Does the structure need graffiti protection?  No  Bottom 8' of Concrete  End Bents  Other \_\_\_\_\_

\* Notes: **The HDR field investigation report describes typical deterioration found. A rehabilitation will replace all substructure except the arch footings.**

Picture # Pic: 010, 011

11

**SIGNS, SIGNALS &/OR LIGHTING ATTACHED TO STRUCTURE**

\* Are there signs attached directly to this structure?  Yes  No quantity \_\_\_\_\_ location \_\_\_\_\_

\* Describe proposed work to be done to signs. \_\_\_\_\_

\* Are there signals attached directly to this structure?  Yes  No quantity \_\_\_\_\_ location \_\_\_\_\_

\* Describe proposed work to be done to signals. \_\_\_\_\_

\* Is there aviation lighting attached to this structure?  Yes  No  N/A  Red \_\_\_\_\_  Green \_\_\_\_\_  
qnty. qnty.

\* Is there navigational lighting attached to this structure?  Yes  No  N/A  Red \_\_\_\_\_  Green \_\_\_\_\_  
qnty. qnty.

\* Is there roadway lighting attached to this structure?  Yes  No  N/A

\* Describe proposed work to be done to lighting. \_\_\_\_\_

\_\_\_\_\_

\* Notes: \_\_\_\_\_

Picture #

12

**UTILITIES ATTACHED TO STRUCTURE**

Type			Qty.	Size	Owner	Condition			
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove
<input type="checkbox"/> Conduit	<input type="checkbox"/> Pipeline	<input type="checkbox"/> Other	_____	_____	_____	<input type="checkbox"/> Repaint	<input type="checkbox"/> Repair	<input type="checkbox"/> Replace	<input type="checkbox"/> Remove

\* Notes: **None** \_\_\_\_\_

\_\_\_\_\_

Picture #



16

**GENERAL AREA CONDITIONS**

\* Primary area:  Commercial  Industrial  Residential  Agricultural  Military  Other Nat Waterway Park

\* Posted speed limit on structure: 35 mph

\* Posted load on structure: \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

Single Unit: \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

Semi (tractor/trailer): \_\_\_\_\_ tons @ \_\_\_\_\_ mph  NA

\* Are both signs in place?

Yes  No

\* Do pedestrians and/or bicyclists regularly use this structure?  Yes  No  Undetermined

\* Notes: \_\_\_\_\_  
\_\_\_\_\_

Picture #

17

**MAINTENANCE**

\* What work has been done to this structure that may not be reflected on existing bridge plans? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Picture #

18

**ADDITIONAL FIELD NOTES**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Picture #

19

**STAGING / DETOUR**

\* **Traffic Control:**  Close structure     Stage construction on structure     Cross over traffic to adjacent structure     Detour

Other option **Build an offset alignment or use temporary bridge.**

\* **Define probable detour route.** **Detour estimate at 55+ miles.**

\_\_\_\_\_  
\_\_\_\_\_

20

**PERSONS ASSISTING WITH CHECKLIST**

Name **Brian Zeiger, PE** Title **Senior Bridge Engineer, HDR Engineering** Ph. ( **913** ) **302** - **8931**

Name **Terry Stowell** Title **CA Field Operations, Olsson Assoc.** Ph. ( **816** ) **604** - **9888**

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (    ) -

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (    ) -

Name \_\_\_\_\_ Title \_\_\_\_\_ Ph. (    ) -

21

**REQUIRED SIGNATURES**

*I have reviewed the information on this checklist and believe it to be as accurate as possible.*

Name \_\_\_\_\_ Date \_\_\_\_\_  
*Transportation Project Manager*

Name \_\_\_\_\_ Date \_\_\_\_\_  
*District Bridge Engineer*

The structural rehabilitation checklist indicates how the bridge is functioning and aging.

All deterioration should be noted, even if it is known that the work will not be completed under the proposed project.

Send **NEW** Structural Rehabilitation Checklist by email

To: "Bridge Survey Processor"

Cc: Structural Project Manager or Structural Resource Manager

Pic. 001: Typical view of surface over bridge deck



Pic. 002: Typical deck condition below curb openings



Pic. 003: Bridge barrier rail with misalignment



Pic. 004: Hairline cracks in girder, Span )1-2) west girder shown



Pic. 005: Deterioration of cap beam cantilever



Pic. 006: Typical deterioration of spandrel capbeams



Pic. 007: Spalling near center of arch rib, east rib



Pic. 008: Spalling of arch rib, west rib near south thrust block



Pic. 009: Typical deterioration of spandrel column



Pic. 010: Vertical cracking in column, Bent 3 shown



Pic. 011: Spalling and cracking on column, Bent 6 shown



Pic. 012: Scour hole at Pier 4



Pic. 013: Roadway over bridge looking north

