Fracture Critical Bridge Inspection Report

NBI Bridge No.: 16159

Route U.S. 81 over UP R.R. UNDER
Kingfisher County

Prepared for:

Oklahoma Department of Transportation

Field District 04

Inspection Date:

7/24/2024

Report Prepared By:

BURGESS & NIPLE, INC.

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Engineers ■ Surveyors ■ Planners

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Mr. Wes Kellogg, P.E.
Field Service Engineer
Oklahoma Department of Transportation
200 Northeast 21st Street
Oklahoma City, OK 73102-3204

Re: Nonredundant Steel Tension Member Bridge Inspection Report
Structure No.: 3704 0543EX
NBI No.: 16159
Local ID: 024
US 81 Northbound over Union Pacific Railroad
Kingfisher County, Field Division 4

August 22, 2024

Dear Mr. Kellogg:

Burgess & Niple (B&N) performed a nonredundant steel tension member and routine inspection of the above referenced bridge on July 24, 2024. The bridge is a six-span structure **(photos 1 and 2)** with a steel pier beam at pier 3. Spans are numbered south to north and consist of:

Span 1:	30-foot-long steel multi beam simple span
Span 2:	44-foot-long steel multi beam simple span
Spans 3 and 4:	57-foot-long steel multi beam continuous over pier 3
Span 5:	42-foot-long steel multi beam simple span
Span 6:	35-foot-long steel multi beam simple span

The bridge is on a horizontal curve with the beams being straight between piers.

The limits of the inspection were from the south abutment to the north abutment. A nonredundant steel tension member pier beam exists at pier 3, straddling the single track of the Union Pacific Railroad. The bridge crosses the Union Pacific Railroad at railroad milepost 373.72 with crossing ID: 595413M. Inspection team members included Drew Appler, P.E (team leader)., Jarrett Shafer, E.I., Jacob Olsen E.I., and Chance Miller

As per the latest load rating report the bridge does not require a load posting. Vertical clearance is 25 feet 0 inches (NBI 16167 controls at 23 feet 3 inches) and lateral clearance is 18 feet 7 inches.

This report includes appendices containing:

- Significant Findings
- Truss/NSTM Bridge Rating Form
- Condition photographs
- Oklahoma DOT Bridge Inspection Form/BrM element report

The current and previous NBI ratings for the bridge are:

NBI Item	Current Rating (2024)	Previous Rating (2023)
NBI Item 58 (Deck)	5 = Fair	5 = Fair
NBI Item 59 (Superstructure)	4 = Poor	4 = Poor
NBI Item 60 (Substructure)	5 = Fair	5 = Fair
Sufficiency Rating	53.3 (SD)	53.3 (SD)

The bridge is structurally deficient.

RECOMMENDED ACTIONS, in order of decreasing priority, are as follows:

Priority Code **CX** – *Bridge condition is bad enough that there is a possibility of failure of a major structural component if repairs are not completed within the next few days.*

- No CX repair items are required.

Priority Code **PX** – *Bridge condition is such that immediate repair is not necessary but should be completed within the next several weeks or months.*

- Install seats under beams where vertical cracks exist in beam connection angles to the pier beam at pier 3:
    - Beam 2, span 4 east connection angle to south face of pier beam (10 1/4-inch-long and 2-inch-long cracks).
    - Beam 3, span 3 east connection angle to south face of pier beam (13 5/8-inch-long crack).
    - Beam 4, span 3 west connection angle to south face of pier beam (14 1/4-inch-long crack).
- Upgrade the bridge and approach railing, transitions, and terminations to meet current National Highway System standards.
- Perform full-depth patch of deck at locations where spalls in the soffit have compromised the bridge railing post anchorage bolts embedment.
- Replace the two damaged railing posts in span 2 near pier 1. *(disregard if bridge railing is upgraded).*
- Abrasively clean and paint steel bridge railing. *(disregard if bridge railing is upgraded).*
- Investigate condition of concrete deck (cores) at locations where asphalt patches exist to determine if deck repair is needed and to what extent.
- Reseal the fixed and expansion joints (removal of asphalt patches along joints may reveal concrete deterioration to extent that joint replacement is required.
- Backfill and armor the eroded area behind and around the northeast wingwall.
- Remove and patch deteriorated and delaminated concrete in the abutments and seal bearing seats with CIM 1000.
- Remove and patch deteriorated and delaminated concrete in the piers, apply FRP wrap to patched areas and seal bearing seats with CIM 1000.
- Replace the beam 4, span 2 canister bearing at pier 2 due to corrosion hole and crack in canister.
- Remove the extruded lead plugs at the anchor studs through the masonry plate of the canister bearings to allow expansion of the bearings.

- Install shim plates where beams are lifted from the canister bearing at beam 2, span 1 at pier 1, beam 2, span 5 at pier 5 and beam 4, span 6 at pier 5.
- Repave approaches to provide a smooth riding surface onto and off of the bridge.

Priority Code **FX** – *Bridge condition is such that repair should not be necessary any time soon, monitor during future inspections.*

- Monitor the deck adjacent to the joints for further deterioration. Consider full depth repair along and near joints where cracking and discoloration are present.
- Monitor the beam 1, span 4 connection to the pier beam at pier 3 for crack growth.
- Monitor the alignment of beam 1, span 2 (1 1/4 inches to the east with stringline between bearings) and the distress in the beam web at the midspan diaphragm where bent from collision damage.
- Monitor the painted over 1/4-inch-deep section loss in the bottom flange of the pier beam under beam 2 at pier 3.

In addition to these recommendations, it is recommended that this structure be inspected on a 12-month Routine/ Nonredundant Steel Tension Member inspection frequency and a 12-month Other/Special inspection frequency. The frequency was changed after the 2022 nonredundant steel tension member inspection due to the discovery of cracks in the beam connection angles to the pier beam at pier 3.

Other/Special Inspection Items include:

- Beam connection angles to the pier beam at pier 3 (railroad flagger required):
    - Beam 1 northwest connection angle (1 1/2-inch-long crack)
    - Beam 2 southeast connection angle (10 1/4-inch-long and 2-inch-long cracks, 11 3/4-inch total length)
    - Beam 3 southeast connection angle (14-inch-long crack)
    - Beam 4 southwest connection angle (14 1/4-inch-long crack)
- Beam 1, span 2 misalignment from collision (1 1/4 inches to the east with stringline between bearings).
- Beam 4, span 2 canister bearing at pier 2 with corrosion hole and crack in canister.

Observed fatigue prone details are as follows:

- Category E – Welded partial-length cover plates exist on the bottom flange of beam 5 in span 1, beams 1 and 2 in span 6 and each beam in spans 3 and 4.

We thank you for the opportunity to provide our engineering services. Please contact me if you have any questions or comments.

Sincerely,

BURGESS & NIPLE, INC.

Drew Appler, PE
Team Leader

Attachments

8/22/2024

SIGNIFICANT FINDINGS are as follows:

NBI Item 36 – Traffic Safety (5 = Fair condition)

- **PX** – The traffic safety features for the bridge railing, transitions, approach guardrail and guardrail terminations do not meet current standards for a National Highway System roadway.
  - Bridge railing – the metal bridge railing consisting of a steel channel supported by steel posts with safety curb is obsolete **(photo 3)**. Missing bolts between the east bridge rail and post exists near pier 4 and west rail above pier 2 **(photo 4).**
  - Approach railing – the w-beam rail is too low and blockouts are not installed between the posts and rail **(photo 2)**. The average height of the approach railing above the roadway is 22 inches. The top of the approach railing is currently required to be 27 inches above the roadway surface.
  - Transitions - the approach railing at all four transitions is not attached to the bridge railing leaving the end of the bridge railing inadequately protected **(photo 2)**. The approach railing also has insufficient post spacing, blockouts are not installed, and the railing is not strengthened with either nested rails or thrie-beam at the transitions
  - Terminations – the buffered ends for the w-beam railing terminations do not meet current standards. Flared ends exist at a break in the southeast approach railing **(photo 5)**.
- **PX** – Spalls exposing the embedded anchorage for the lower connection of the bridge rail posts exist adjacent to the joints at the piers **(photos 6 and 7)**. The U-bolt anchor bars are exposed at these locations and are no longer adequately embedded into the deck. A bolted repair observed at the west overhang for span 3 at pier 2 does not restore the original embedment strength of the U-bolt and is not sufficient to be considered a permanent repair.
- **PX** – Two posts for the west bridge railing in span 2 near pier 1 have significant damage from a vehicle exiting the southbound bridge **(photo 3)**. The posts are still connected to the bridge rail and deck at the time of the inspection.
- **PX** – The east approach railing near the south abutment exhibits a 6-inch-diameter hole through the w-beam rail at the timber post connection **(photo 8)**.
- **PX** – The bridge railing is corroded with section loss forming at isolated locations **(photo 3)**. This section loss has not significantly affected the strength of the railing.
- Traffic lane striping is beginning to fade.

NBI Item 58 – Deck (5 = Fair condition)

Driving Surface – (5 = Fair condition)

- **PX** – Numerous asphalt and concrete patches exists in the asphalt wearing surface along the deck and expansion joints and along the roadway centerline where a paving construction joint exists **(photos 9, 10 and 11)**. Densely spaced 1/16-inch-wide map cracks adjacent to the patches exist in span 1 near the fixed joint at pier 1 and in isolated locations along the roadway centerline. The paving construction joint is a common location where deck drainage leaks through the asphalt. Multiple applications of patch

material exist at many patch locations, suggesting that the concrete deck may be deteriorating underneath. Less than 5% of the overlay/deck surface has been patched.

- Shallow spalls with exposed reinforcing steel exist at isolated locations in the face of both curbs **(photo 12)**. The spalls are due to shallow cover over the reinforcing steel.
- The edge of the deck is supported by the backwall and abuts the approach slab (the edge of the approach slab is also assumed to be supported on the backwall). The deck is offset longitudinally away from the embankment 1 3/8 inches at the north abutment and 5/16 inch at the south abutment **(photo 13)**. This offset has not changed since the 2021 inspection when first documented and may be an indication of approach pavement growth.
- Minor rutting in the wheel lines and weathering of the asphalt overlay exist throughout the bridge **(photo 11)**.
- No deck drains exist on the bridge.

Soffit – (5 = Fair condition)

- **PX** – Large spalls exposing the railing connection anchorages exist at the fixed and expansion joints **(photo 7)**. These spalls have significantly compromised the railing attachment to the deck.
- **FX** – Discolored concrete, and cracks with efflorescence and corrosion stains exist in the deck soffit along the fixed and expansion joints and along the roadway centerline **(photo 14)**. These locations tend to exist below patching in the driving surface.
- Formwork from a full-depth patch exists at the midspan deck control joint in span 3 between beams 3 and 4.
- Spalls with exposed reinforcing steel exist in the underside of the deck between beams 2 and 3 at pier 2 in span 2, at the pier beam at pier 3, and adjacent to the north abutment backwall in span 6 **(photo 15)**. The spalls appear to be due to corrosion of the reinforcing steel and promoted by deck drainage leaking through the expansion joint.
- Map cracking exists in the soffit near the piers with corrosion stains from the reinforcing steel chair feet.

Joints – (5 = Fair condition)

- **PX** – The poured seal expansion joints at piers 2 and 4 originally were finger joints with a trough that have been retrofitted to be poured seal expansion joints.
    - Pier 2 – Adhesion failure exists between the poured seal and armor, and isolated areas of missing seal material were observed in the east lane **(photo 16)**. The joint header consisting of elastomeric concrete placed above the remnants of the finger joint is spalled along the joint opening in the east lane and near the roadway centerline. Corrosion stains from the finger joint exists along the edges of the elastomeric concrete header.
    - Pier 4 – The poured seal is missing in the majority of the lanes **(photo 17)**. The elastomeric concrete header is cracked and spalled exposing the retrofitted finger joint. The asphalt wearing surface adjacent to the header is cracking and spalling with isolated areas of corrosion stains from the finger joint.

A missing anchor bolt for the expansion joint exists at beam 4, span 4 at pier 4 **(photo 18)**.

- **PX** – The poured seal fixed joints exist at both abutments and piers 1, 3, and 5. Both abutments are skewed 60 degrees while the piers are normal to the roadway centerline. Piers 1 and 5 are linked to allow longitudinal movement of the superstructure with no opening of the joint. The beams at pier 3 frame into the pier beam with no evidence of a strap plate over the pier beam.
    - South Abutment – Minor edge spalls and patches exists in the asphalt wearing surface along the joint with evidence of leakage **(photo 19)**. No obvious signs of seal damage were observed.
    - Pier 1 – The joint header has been replaced with concrete **(photo 20)**. The concrete header is cracked and spalled at the roadway centerline with multiple asphalt patches in the header at this location. The poured seal exhibits adhesive failure in isolated areas throughout with evidence of leakage on the pier cap below.
    - Pier 3 (over pier beam) – Parallel cracks and asphalt patches exist in the asphalt wearing surface along the joint and are most prominent in the east lane **(photo 21)**. The joint seal exhibits some tears and is partially paved over. Corrosion of the pier beam top flange indicates that leakage through the seal has occurred.
    - Pier 5 – Multiple asphalt patches exists over the joint. Parallel cracks exist in the asphalt wearing surface along the joint. A concrete patch exists in the south header near the centerline. The majority of the seal is covered in asphalt and exhibits moderate debris impaction where visible.
    - North Abutment – Multiple asphalt patches exist in the wearing surface along the joint with evidence of past leakage **(photo 22)**. Isolated areas of the seal exhibit signs of debonding from the header.
- Deck control joints with poured seals exist at midspan in spans 3 and 4. These spans are continuous with the pier beam at pier 3.
    - Span 3 deck control joint – A full-depth concrete patch exists in the right lane of along the joint**.** Shallow spalls, and cracks exist in the asphalt wearing surface adjacent to the joint and an asphalt patch exists adjacent to the full-depth concrete patch.
    - Span 4 deck control joint – Minor edge spalls along joint and asphalt patches partially covering the joint.

NBI Item 59 – Superstructure (4 = Poor condition)

Nonredundant Steel Tension Member Rating Summary	
Pier Beams	5 = Fair condition

Steel Beams – (4 = Poor condition)

- **PX** – Vertical cracks up to 14 1/4 inches long exist in the bottom of the beam connection angles to the pier beam web at pier 3 at the locations noted in the table below.

Pier Beam Face	Beam No.	Connection Angle	Crack Length – Comment	photo
North	1	West	**FX** – 1 1/2 inches – Several additional paint cracks exist in the connection angle.	**23**
North	2	East	**PX** – 11 3/4 inches total – 10 1/4-inch-long crack beginning at the bottom of the connection angle with an adjacent 2-inch-long vertical crack initiating 9 3/4 inches from the bottom of the connection angle.	**24**
South	3	East	**PX** – 14 inches – 3/8-inch growth from previously noted 13 5/8-inch-long crack. An offset exists across the crack at the bottom of the connection angle, and the leg adjacent to the pier beam exhibits a 1/16-inch-wide gap.	**25**
South	4	East	**PX** – 14 1/4 inches – crack has grown at least 1 inch based on Magnetic Particle testing. Paint crack extends 7 inches from previous crack measurement, steel crack termination could not be positively confirmed.	**26**
South	5	West	Crack has been welded and beam seat added. 5 3/4-inch-long crack was previously noted in the connection angle.	**27**
South	5	East	Crack has been welded and beam seat added. 6 1/4-inch-long crack was previously noted.	**28**

The cracks were first observed during the 8/21/2022 fracture critical inspection and exist along the fillet of the angle through the leg adjacent to the pier beam web. All but one crack is on the south face of the pier beam (face towards approaching traffic). The beam connections facing approaching traffic receives a greater force from moving loads. As the span deflects, a downward inertia in the span is produced along with a slight ramping effect at the pier beam, amplifying the impact load on these connections. Two 24-inch-long connection angles exist between the beam and pier beam webs and the top and bottom flanges are not continuous at the pier beam. The cracks have reduced the total connection angle depth at each beam a maximum of 30% (beam 4 controls). Cracking of the connection angles were not observed on the adjacent southbound bridge.

- **FX** – **Member Alignment** – The beam 1, span 2 bottom flange is bent east 1 1/4 inches at the 1/4 point of the span based on a stringline measurement between midspan and the pier 1 bearing **(photo 29)**. The beam is misaligned due to vehicular collision from a vehicle launching from the southbound bridge. An offset of 1 5/16 inches measured from a stringline extending between bearings was noted in 2020. Beam 1 is mostly bent between pier 1 and the intermediate diaphragm at midspan of span 2. Horizontal paint cracks due to bending of the beam web exists in the west face of the web at the midspan diaphragm. No signs of movement or distress were noted at the top flange connection to the deck or at the bearings at piers 1 and 2. Minor scrape marks exist on the bottom flange and web of beam 1 in span 1.
- Pack rust induced cracks exist in the welds between the end diaphragm connection angles and the beam web at the following locations:

Location	Note	photo
Span 2, beam 3 over pier 1	1 3/8-inch-long horizontal crack	
Span 2, beam 1 over pier 2	2 1/2-inch-long horizontal crack	**30**
Span 2, beam 2 over pier 2	2 1/4-inch-long horizontal crack	
Span 4, beam 1 over pier 4	2 5/8-inch-long horizontal crack	**31**
Span 5, beam 1 over pier 4	2 3/4-inch-long horizontal crack	**32**
Span 5, beam 2 over pier 5	2 1/4-inch-long horizontal crack	
Spans 5, beam 3 over pier 5	8-inch-long vertical crack (2-inch growth) and full-length horizontal crack	**33**
Span 5, beam 5 over pier 5	6 1/2-inch-long vertical crack and 2 5/8-inch-long horizontal crack.	
Span 6, beam 1 over pier 5	8 1/4-inch-long vertical crack	
Span 6, beam 5 over pier 5	9-inch-long vertical crack and 4-inch-long horizontal crack. These cracks are new for 2024.	**34**

  Pack rust is promoted by deck drainage passing through the poured seal joints. The end diaphragms do not significantly affect the load carrying capacity of the bridge.
- Bird nests, bird droppings and moist debris exist on the beams **(photos 23, 26 and 28)**.
- Welded partial-length cover plates exist on the bottom flange of beam 5 in span 1, beams 1 and 2 in span 6 and each beam in spans 3 and 4 **(photo 35)**. The shop-welded cover plates terminate near the quarter points of the spans with tapered ends. Similar cover plates likely exist on the top of the top flange. No cover plates exist in spans 2 and 5. The cover plate terminations are a category E fatigue prone detail. No cracks or signs of distress were observed at the terminations.
- Span 5, beam 3 at pier 4 exhibits a cracked weld measuring 1 5/8 inches long at the sole plate to bottom flange interface for the canister bearing **(photo 36)**.
- The diaphragms exhibit corrosion of the top flange and pack rust up to 1/2 inch thick between the top flange and the deck **(photo 37)**. Minor distortion of the diaphragm top flange due to the pack rust is common.

- Section loss up to 1/8 inch deep with corrosion exists in the top flange of the beams at the piers. The loss typically extends for 2 feet from the joint. Painted over section loss up to 1/8 inch deep is common in the bottom of the web and bottom flange of the beams under the joints at the substructure units.

[NSTM] Pier Beams – (5 = Fair condition)

- **FX** – Painted over section loss between 1/8 to 1/4 inch deep exists in the top and flanges of the pier beam at pier 3. Section loss of the bottom flange is most prevalent in the north face of the pier beam under beam 2. The top flange of the pier beam at pier 3 exhibits corrosion with minor section loss throughout its entire length **(photo 15)**. Pack rust is common between the top flange and the deck due to leaking joints **(photos 7 and 38)**.
- Bird nests, bird droppings and moist debris exist on the pier beam bottom flange **(photos 27 and 28)**.

Paint/Coating System – (6 = Satisfactory condition)

- The superstructure was painted in April 2004 using an inorganic zinc-epoxy-urethane paint system. Protective coating on the top flange of the beams, diaphragms and pier beam under the joints are failing with active surface corrosion and pack rust occurring **(photo 37)**.
- The west edge of beam 1, span 2 near pier 1 has missing paint due to collision damage. A similar condition exists on the bottom flange and web of beam 1, span 1.

Load Deflection – (7 = Good condition)

- No significant deflections were observed under live load. Vibration was observed under heavy live load likely caused by pack rust lifting the beams from the bearings.
- Shim plates have been added at several locations between the bearings and the beams, eliminating the noise noted during previous inspections due to impact onto the bearings.
- Piers feel longitudinal movement under truck loads.

NBI Item 60 – Substructure (5 = Fair condition)

Abutments – (5 = Fair condition)

- **PX** – Erosion up to 4 feet deep exists behind the northeast wingwall exposing the wingwall/abutment pile cap for 31 inches vertically **(photo 39)**. This condition has not significantly changed since the 2014 inspection. No deck drains or curb outlets exist on the structure to alleviate the deck drainage at the corners of the structure; however, the superelevation slopes downward to the west making erosion at the east side unusual. The abutment is noted to be supported by concrete piles with no exposure of the piles observed.
- **PX** – Isolated shallow spalls and widespread delaminations with up to 1/16-inch-wide horizontal and vertical cracks exist in the vertical face of the breastwall of both abutments **(photo 40)**. The cracks appear to align with the reinforcing steel. Vertical

cracks up to 1/32 inch wide are typical in the backwall of both abutments. The north abutment has two isolated spalls up to 2 feet long and 2 inches deep with exposed corroding reinforcing steel **(photo 41)**. Cracks in the east extension of the south abutment appear to have been sealed with epoxy.

- Vegetation is growing through joints and cracks in the slope wall on both embankments **(photo 42)**.
- The south slope wall has a 1-inch-wide crack along the top of the embankment with bulging up 5 inches. The crack was sealed and has reopened **(photo 43)**. This is likely a result of inward movement of the abutment from pavement pressure as seen by deck overshooting the backwall. The slope wall beneath pier 1 exhibits a longitudinal crack due to settlement of the slope wall.
- The retaining wall between the bridges is leaning away from the embankment relative to the ends of the wingwalls.
    - South retaining wall is leaning 3 1/2 inches north **(photo 44)**.
    - North retaining wall is leaning 1 1/4 inches south.

  These measurements have not changed since the 2021 inspection. It is likely that the retaining wall is supported on a spread footing, isolated from the pile supported abutments.
- Bearing pedestals for both abutments exhibit cracking and scaling with popouts and rust staining consistent with deck drainage passing through the joint **(photo 45)**. The north abutment bearing pedestals exhibit a delamination at the southeast corner at beam 4 and a 1-foot-diameter spall with exposed reinforcing steel in the west face at beam 5. The spall does not affect the stability of the bearing.

Piers – (5 = Fair condition)

- **PX** – Horizontal cracks with adjacent delaminations and rust stains exist along the top and bottom edges of the cap with most severe deterioration noted between beams 1 and 4 in piers 2 and 4 **(photo 46)**. The deterioration is a result of deck drainage passing through the expansion joints.
- **PX** – Cracks with adjacent delaminations and rust stains exist along the vertical and hoop steel in the columns with most severe deterioration noted in the columns of piers 2 and 4 **(photo 47)**. Column 1, pier 2 and column 2, pier 4 exhibits 3-foot vertical by 1-foot horizontal by 2-inch-deep spall exposing the vertical and hoop reinforcing steel. A few of the cracks appear to have been sealed. The cracks are due to corrosion of the reinforcing steel promoted by deck drainage passing through the expansion joints. The deterioration is more severe in column 1 as a result of the superelevation of the deck directing drainage towards the west curb.
- **PX** – Map cracks and scaling concrete are typical in the bearing pedestals with isolated locations of spalls in the vertical face **(photos 48 and 49)**. No undermining of the bearings was observed. The deterioration is due to deck drainage passing through the joints and are most prevalent at piers 2 and 4. Shallow cover exists over the reinforcing steel at the spall locations.

- Vertical cracks exist in the top of the pier 3 column radiating from the fixed bearings for the pier beam **(photo 50)**.

Bearings – (5 = Fair condition)

- **PX** – The beam 4, span 2 bearing at pier 2 has a corrosion hole developing through the canister with an adjacent crack along the stiffener **(photo 51)**. Canister bearings typically exhibit 1/8-inch-deep section loss at the contact points with the sole and masonry plates due to wear and corrosion. These typical losses do not significantly affect the bearing capacity.
- **PX** – The lead plugs around the anchor studs are raised above the surface of the masonry plate, inhibiting the expansion of the bearings **(photos 48 and 49)**. This is a result of corrosion of the steel anchor rods.
- **PX** – Lifting of the beam from the canister bearing was noted at:
  - Beam 2, span 1 at pier 1 – beam lifted 1/16 inch with shim plate added.
  - Beam 2, span 5 at pier 5 – beam lifted 1/16 inch **(photo 52)**
  - Beam 4, span 6 at pier 5 – beam lifted 1/16 inch.

  The lifting of the beams is likely caused by heavy pack rust between bearing components of adjacent beams. Beam 3, span 2 at pier 2 was previously noted to be lifted from the bearing but this condition was not observed during the 2024 inspection.
- Pack rust up to 1 inch thick between the bearing components is common at the canister bearings as well as a few of the fixed bearings at abutments **(photo 53)**.
- The canister expansion bearings at piers 1, 2, 4 and 5 exhibit small horizontal offsets of 1/4 inch average and rotations of 6 degrees or less at 96 degrees F. The beam 4, span 5 bearing at pier 4 is 7 degrees rotated in expansion; however, the canister is nearly centered under the bearing stiffener. The bearings at pier 4 are typically not directly under the bearing stiffener. The beams may have lifted off the bearing resulting in the canister rolling out of position. These rotations or offsets are not currently significant.
- Lead bearing pads typically are distorted and extruding from underneath the bearings at the abutments and pier beam **(photos 45 and 50)**. The abutments are heavily skewed while piers 1 and 5 are normal to the bridge, causing a rocking effect to the fixed bearings. Flowering anchor nuts exist on a few of the abutment bearings.
- Beam 4 fixed bearing at the north abutment exhibits two cracked beveled washers.

NBI Item 72 – **Approach** (5 = Fair condition)

Approach Roadway Condition – (5 = Fair condition)

- **PX** – The asphalt roadway at the south approach slab exhibits reflection cracks along the pressure relief joint **(photo 54)**. Settlement exists at the end of the approach slab up to 3/4-inch max in the left lane. The south approach roadway also exhibits several longitudinal and transverse cracks near the south approach slab which are likely attributed to settlement.

- Both approach slabs have an asphalt wearing surface. Asphalt patches exist along the paving construction joint at the roadway centerline in both approach slabs **(photo 7)**. Alligator cracking exists in the north approach slab in the east wheel line of the east lane.
- The approach roadway typically exhibits longitudinal and transverse cracking **(photo 10)**. The longitudinal cracking in the wheel path is load-related deterioration due to the higher concentration of truck traffic and occurs primarily in the right lane.

Approach Roadway Settlement – (5 = Fair condition)

- **PX** – The south approach roadway has minor settlement near the approach slab **(photo 53)**. The settlement is approximately 3/4 inch and is more prevalent in the west lane as indicated by tire skid marks on the approach slab.

Truss/NSTM Bridge Rating Form

NBI	16159
Structure	3704 0543EX
County	Kingfisher
Division	4

Facility Carried
U.S. 81 NB
Feature Intersected
Union Pacific Railroad

NBI Item #	2024	2023
36 - Traffic Safety	5, PX	5, PX
58 - Deck	5, PX	5, PX
a. Driving Surface	5, PX	5, PX
b. Soffit	5, PX	5, PX
c. Joints	5, PX	5, PX
59 - Superstructure*	4, PX	4, PX'
a. Beams	4, PX	4, PX'
b. Stringers**	N/A	N/A
c. Floor Beams	N/A	N/A
d. Pier Beams	5, FX	5, FX
e. Floor Bracing System	N/A	N/A
f. Truss Upper Chord***	N/A	N/A
g. Truss Lower Chord***	N/A	N/A
h. Truss Web Members	N/A	N/A
i. Truss End Posts	N/A	N/A
j. Truss Bracing	N/A	N/A
k. Paint/Coating	6	6
l. Load Deflection	7	7
60 - Substructure****	5, PX	5, PX
a. Abutments	5, PX	5, PX
b. Piers	5, PX	5, PX
c. Bearings	5, PX	5, PX
61 - Channel & Channel Protection	N/A	N/A
a. Flowline Stability	N/A	N/A
b. Channel Bank Damage	N/A	N/A
c. Debris	N/A	N/A
d. Vegetation	N/A	N/A
Approach Roadway	5, PX	5, PX
a. Approach Roadway Condition	5, PX	5, PX
b. Approach Roadway Settlement	5, PX	5, PX
113 - Scour	0	0
Flowline/Notes	N/A	N/A

Rating	Description (For 36, 58, 59, 60, 72)
N/A	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION - no problems noted.
7	GOOD CONDITION - some minor problems.
6	SATISFACTORY CONDITION - structural elements show some minor deterioration
5 (FX,PX)	FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4 (PX)	POOR CONDITION - advanced section loss, deterioration, spalling or scour.
3 (PX,CX)	SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2 (CX)	CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1 (CX)	IMMINENT FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION - out of service - beyond corrective action.

* - Members with fatigue cracks in compression zones (top flange stringer copes, clip angles, etc.) are to be coded as a 5 unless the crack turns toward a tension zone, then code 3.

* - Members with fatigue cracks in tension zones (cover plate ends, etc.) are to be coded as a 3.

** - Includes connection angles.

*** - Includes gusset plates. Missing rivets in connections are coded as a 3.

**** - Elements with superficial cracking are coded as 6, spalls with exposed rebar 5, spalls with exposed rebar with section loss 4.

Rating	Description (For 61)
N/A	NOT APPLICABLE
9	There are no noticeable or noteworthy deficiencies which affect thecondition of the channel.
8	Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.
7	Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor damage. Banks and/or channel have minor amounts of drift.
6	Bank is beginning to slump. River control devices and embankment protection have widespread minor damage. There is minor stream bed movement evident. Debris is restricting the channel slightly.
5	Bank protection is being eroded. River control devices and/or embankment have major damage. Trees and brush restrict the channel.
4	Bank and embankment protection is severely undermined. River control devices have severe damage. Large deposits of debris are in the channel.
3	Bank protection has failed. River control devices have been destroyed. Stream bed aggradation, degradation or lateral movement has changed the channel to now threaten the bridge and/or approach roadway.
2	The channel has changed to the extent the bridge is near a state ofcollapse.
1	Bridge closed because of channel failure. Corrective action may putback in light service.
0	Bridge closed because of channel failure. Replacement necessary.

Bridge not over waterway.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 1 - Looking southwest at the bridge elevation.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 2 - Looking north at the bridge end view. Note: approach railing is low especially at the transition. Approach railing is neither attached to nor stiffened at the bridge rail.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 3 - Looking north along the west bridge railing from the south abutment. Note: railing consists of a steel channel supported by steel posts. Two posts nearest the south abutment have impact damaged. Railing coating has failed.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 4 - Looking west at the west bridge railing above pier 2. Note: missing bolts between the rail and post.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 5 - Looking southeast at the southeast approach railing. Note: break in railing has flared end treatment.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 6 - Looking up at the underside of the east overhang at pier 1. Note: soffit is spalled and anchorage for the railing posts is exposed and separating from the deck.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 7 - Looking northeast at the underside of the west overhang adjacent to the pier beam at pier 3. Note: heavy spalling with exposed anchor U-bolts for steel railing posts with up to 50% section loss. Corrosion of the pier beam top flange.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 8 - Looking north at the south east approach rail. Note: end is corroded and incorrectly lapped.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 9 - Looking southeast at the driving in span 6. Note: asphalt patches in the driving surface.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 10 - Looking east along the fixed joint at pier 5. Note: asphalt and concrete patches in the driving surface and along the joint.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 11 - Looking south at the driving surface from the north approach. Note: patches in the asphalt overlay along the roadway centerline and joints. Minor rutting in the wheel lines and weathering of the asphalt overlay.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 12 - Looking east at the east curb in span 5. Note: spalls with exposed reinforcing steel due to shallow cover.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 13 - Looking east at the north abutment backwall near beam 1. Note: 1 3/8-inch longitudinal offset between end of deck and abutment backwall.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 14 - Looking north at underside of span 6 between beams 2 thru 4. Note: discolored concrete and pattern cracking in soffit.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 15 - Looking southeast at the pier beam at pier 3 between beams 2 and 3. Note: spalling adjacent to the pier beam flange with exposed and corroded reinforcing steel. Corrosion reactivating where painted over pitting exists in the underside of the pier beam top flange.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 16 - Looking east along the expansion joint over pier 2. Note: spalling at the centerline of the east travel lane, the joint seal has failed in this area. Spalling of the elastomeric covering the original finger joint plates.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 17 - Looking east at the joint over pier 4. Note: Looking west at the pourable joint seal above pier 4. Note: seal is missing along the west travel lane and partially along the west half of the east lane.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 18 - Looking up at the underside of span 4, beam 4 at the west face of pier 4. Note: missing expansion joint anchor bolt.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 19 - Looking southeast along the fixed joint over the south abutment. Note: minor edge spalls and patches exists in the asphalt wearing surface along the joint with evidence of leakage.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 20 - Looking east at the fixed joint over pier 1. Note: joint header has been replaced with concrete with multiple asphalt patches at the roadway centerline. Poured seal exhibits adhesive failure in isolated areas throughout with evidence of leakage on the pier cap below.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 21 - Looking east along the fixed joint over the pier beam at pier 3. Note: parallel cracks and asphalt patches exist in the asphalt wearing surface along the joint and are most prominent in the east lane. The joint seal exhibits some tears and is partially paved over.

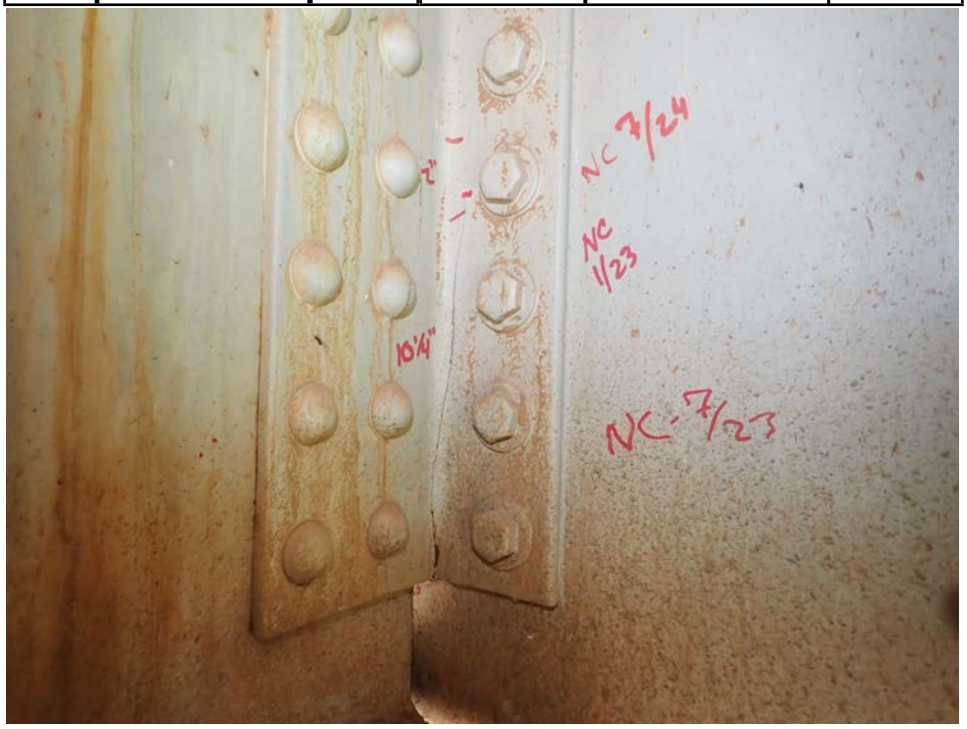
NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 22 - Looking southeast along the joint over the north abutment. Note: multiple asphalt patches exist along the joint. Isolated areas of the seal exhibit signs of debonding from the header.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

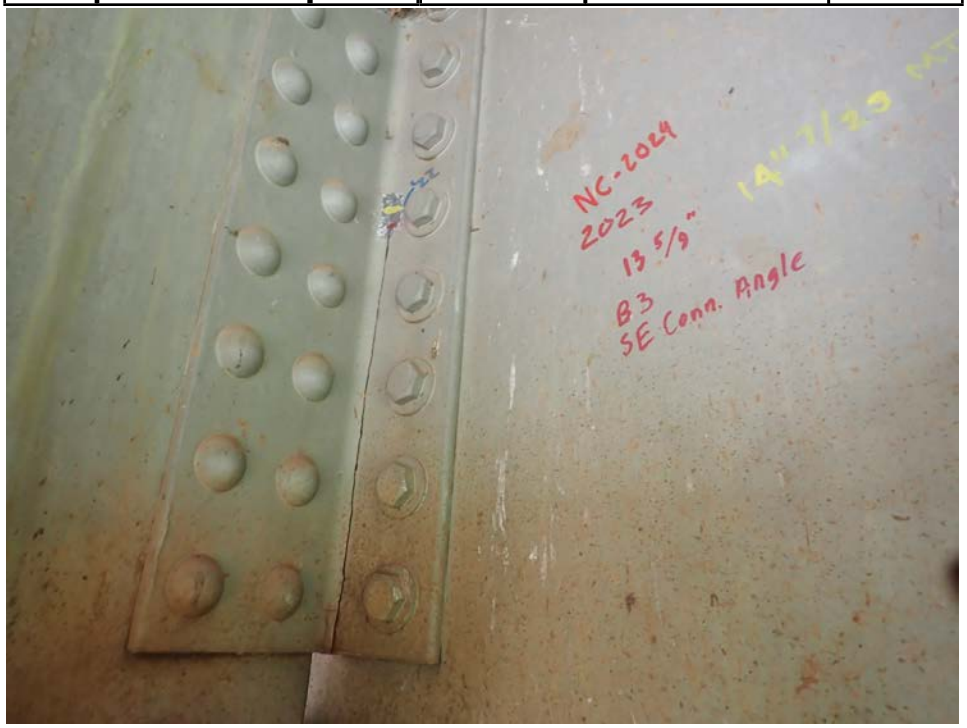
Photograph 23 - Looking southeast at the beam 1, span 4 connection angle to the pier beam at pier 3. Note: 1 1/2-inch-long vertical crack at the bottom of the connection angle. Bird droppings on beam bottom flange.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024



Photograph 24 - Looking southeast at the beam 2, span 4 connection angle to the pier beam at pier 3. Note: 11 3/4-inch-long crack and 2-inch-long paint crack.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024



Photograph 25 - Looking northwest at the beam 3 connection angle to the pier beam at pier 3. Note: 14-inch-long crack along the bottom of the connection angle.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 26 - Looking northwest at the beam 4 connection angle to the pier beam at pier 3. Note: 14 1/4-inch-long crack in connection angle (1-inch growth) with additional 7-inch-long paint crack. Soil from bird nests on beam bottom flange.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 27 - Looking northeast at the beam 5 connection angle to the pier beam at pier 3. Note: crack welded in connection angle and beam seat welded to the pier beam web. Bird nests along top flange and soil on bottom flange of pier beam.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 28 - Looking northwest at the beam 5 connection angle to the pier beam at pier 3. Note: crack welded in connection angle and beam seat welded to the pier beam web. Soil and bird droppings on the beam and pier beam bottom flange.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 29 - Looking north along the beam 1, span 2, near the 1/4 span. Note: 1 1/4-inch global sweep to the east.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 30 - Looking northwest at beam 1, span 2, over pier 2. Note: 2 1/2-inch-long horizontal crack in weld.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 31 - Span 4, beam 1 over pier 4. Note: 2 5/8-inch-long horizontal crack in weld.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 32 - Looking west at beam 1, span 5 over pier 4. Note: 2 3/4-inch-long horizontal crack in weld.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 33 - Looking northeast at beam 3, span 5 at pier 5. Note: 8-inch-long vertical crack and full length horizontal crack in the weld.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 34 - Looking southeast at beam 5, span 6 at pier 5. Note: 9-inch-long vertical crack and 4-inch-long horizontal crack in the weld.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 35 - Looking up at beam 4, span 4 at the 1/4-span location. Note: welded cover plate tapered end termination.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 36 - Looking south at the beam 3, span 5 canister bearing at pier 4. Note: 1 5/8-inch-long horizontal crack in the weld between the beam bottom flange and sole plate.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 37 - Looking southwest at beam 1 over pier 1. Note: pack rust between the beam and diaphragm top flange and the deck. Paint stencil notes IZEU paint applied April, 2004.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 38 - Looking east at the west deck edge over pier beam 3. Note: pack rust and active corrosion in the pier beam top flange with spalling of the deck.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 39 - Looking south at end of the northeast wingwall. Note: erosion has exposed the top of the pile cap for 31 inches vertically. The abutment is supported by concrete piles.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 40 - Looking southwest at the south abutment breastwall between beams 3 and 4. Note: 1/16-inch-wide vertical and horizontal cracks with delaminations throughout.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 41 - Looking northwest at the north abutment breastwall between beams 1 and 3. Note: spall with exposed reinforcing steel. Horizontal crack along the top reinforcing steel in the face of the breastwall.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 42 - Looking north at the north embankment slope wall. Note: vegetation growing through the joints and cracks.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 43 - Looking west at the south embankment slope wall in the median. Note: previously sealed crack has reopened.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 44 - Looking northwest along the south embankment retaining wall in the median. Note: wall has rotated 3 1/2 inches north relative to the wingwall.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 45 - Looking north at the beam 4, span 6 bearing pedestal at the north abutment. Note: cracks and scaling concrete in the bearing pedestal. Popouts exposing aggregate and rust stains exist in the face of the pedestal. Lead bearing pad is extruding.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 46 - Looking northeast at pier 2. Note: pier exhibits cracking and delaminations.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 47 - Looking north at column 2, pier 4. Note: 2-foot-vertical by full-width spall with exposed corroded reinforcing hoop steel.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 48 - Looking east at the beam 3 canister bearings at pier 2. Note: light scaling of the concrete. Lead plugs over the anchor studs are extruded and inhibit movement of the canister.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 49 - Looking east at the beam 4, span 2 canister bearing at pier 2. Note: bearing pedestal exhibits cracking and delaminations. Lead plugs over the anchor studs are extruded and inhibit movement of the canister.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 50 - Looking northeast at column 2 at pier 3. Note: vertical cracks in column radiating from the bearing. Extruding lead bearing pad under the fixed bearing.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 51 - Looking east at the beam 4, span 2 canister bearing at pier 2. Note: corrosion hole in bottom of bearing with crack between canister and stiffener.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 52 - Looking northwest at the beam 2, span 5 canister bearing at pier 5. Note: beam is lifted from the canister bearing 1/16 inch.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 53 - Looking north at the beam 4, span 5 canister bearing at pier 5. Note: 1-inch-thick pack between bearing pedestal and the masonry plate. Corrosion exists at the contact point between the canister and masonry and sole plates.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
16159	3704 0543EX	Kingfisher	U.S. 81	UP R.R. UNDER	7/24/2024

Photograph 54 - Looking south at the south approach. Note: cracks in the asphalt at the end of the approach slab.

Oklahoma Dept. of Transportation - Bridge Inspection Report

NBI No.:	Structure No.:	Local ID:	Suff. Rating:	
16159	3704 0543EX	024	53.30	SD

IDENTIFICATION

Bridge Description:

30ft.,44ft.,2-57ft.,42ft.,35ft. I-BM. SPANS WITH 2-1.5ft. SAFETY CURBS SKEW. VARIES

1. State: Oklahoma
2. Division: Division 4
3. County: KINGFISHER
4. City: Unknown
Admin Area: Unknown
5a. On/Under: Route On Structure
5b. Kind of Hwy: U.S. Hwy
5c. Lvl of Srvc: Mainline
5d. Route No.: 00081
5e. Dir. Sufx: N/A (NBI)
7. Facility Carried U.S. 81
6. Feat. UP R.R. UNDER
9. 5.3 MI N JCT SH 33
11. Mile Post: 5.470 mi
13. LRS / Sub Rte: 3700004H / 00
16. Latitude: 35° 55' 52.94"
17. Longitude: 097° 54' 58.00"
98. Border Unknown (P)
% Responsible: 0.00
99. Border Brdg #: Unknown

INSPECTION

Type	Insp. Req.	Insp. Done	Freq.	Insp. Date	Next Insp.
NBI:		1	12 months	7/24/2024	07/24/2025
FC:	Y	1	12 months	7/24/2024	7/24/2025
UW:	N	0		NA	NA
OS:	Y	0	12 months	1/15/2024	1/24/2025

CLASSIFICATION

12.Base Hwy Net.: On Base Network
20. Toll Facility: On free road
21. Custodian: State
22. Owner: State
26. Function Class: 02 Rural Other Princ
37. Historical Sig.: Not eligible for NRHP
100. Def. Hwy: On STRAHNET
101. Parallel Str.: Right of || bridge
102. Traffic Dir.: 1-way traffic
103. Temp. Str.: Not Applicable (P)
104. Hwy System: On the NHS
105. Fed Land Hwy: N/A (NBI)
110. Defense Hwy: On STRAHNET
112. NBIS Length: Long Enough

STRUCTURE TYPE AND MATERIALS

43a/b. Main Span: Steel / Stringer/Girder
44a/b. Appr. Span: Unknown / Unknown (P)
45. # of Main Spans: 6
46. # of Appr. Spans: 0
107. Deck Type: Concrete-Cast-in-Place
108a. Wearing Surface: Bituminous
108b. Membrane: Unknown
108c. Deck protection: Unknown

CONDITION

58.Deck: 5 Fair
59.Sup.: 4 Poor
60.Sub: 5 Fair
62.Culvert: N/A (NBI)
61.Chan./Chan. Prot.: N/A (NBI)

Flowline Notes:

N/A

AGE AND SERVICE

19. Detour Length: 0.1 mi
27. Year Built: 1964
28a/b. Lanes on/und: 2 / 0
29. ADT: 2,500
30. Year of ADT: 2022
42a/b. Type of Svc on/und: Highway / Railroad
106. Year Reconst,:
109. Truck ADT: 25%

LOAD RATING AND POSTING

31. Design Load MS 18 (HS 20)
41. Post. Status: A Open, no restriction
70. Posting: 5 At/Above Legal Loads
Date Rated 08/12/2020
63.Op / 65.Inv. Rating Meth.: 1 LF Load Factor / 1 LF Load Factor

	H	HS	3-3	EV3	SHV
64. Operating Rating (tons):	38.00	52.00	85.00	43.00	48.00
66. Inventory Rating (tons):	23.00	31.00	51.00	26.00	

GEOMETRIC DATA

10. Vert. Clearance: 99.99 ft
32. Appr Rwy Width: 38.00 ft
33. Median: No median
34. Skew: 60.00°
35. Struct. Flared: No flare
47Horizontal Clr: 30.00 ft
48. Length Max Span: 57.09 ft
49. Struct. Length: 265.09 ft
50a. Curb/Sdwlk Width L: 1.50 ft
50b. Curb/Sdwlk Width R: 1.50 ft
51. Width Curb to Curb: 30.00 ft
52. Width Out to Out: 33.00 ft
Deck Area: 8,751.06 sq. ft
53. Min.Vert.Cl.Ovr Brg: 99.99 ft
54a.Min.Vt.Undclr.Ref. R Railroad beneath
54b. Min. Vert. Undclr.: 23.25 ft
55a. Min.Lat.Undclr.Ref: R Railroad beneath
55. Min.Lat.Underclr. R: 18.58 ft
56. Min.Lat.Underclr. L: 0.00 ft

APPRAISAL

36a. Brdg Rail: 0 Substandard
36b. Transition: 0 Substandard
36c. Appr. Rail: 0 Substandard
36d. Appr.Rail Ends: 0 Substandard
67. Str Evaluation: 4 Minimum Tolerab
68. Deck Geom.: 4 Tolerable
69. Vert./Horiz. Undclr: 7 Above Minimum
71. Waterway Adeq: N Not applicable
72. Appr. Alignment: 8 Equal Desirable Crit
113. Scour Critical: N Not Over Waterway

PROPOSED IMPROVEMENT

94. Bridge Cost: $818,346
95. Roadway Cost: $1,350,271
96. Total Cost: $2,291,369
97. Yr.of Cost Est.: 2015
75. Type of Work: 31 Repl-Load Capacity
76. Lngth of Improvement: 336.7 ft
114. Future ADT: 4,000
115. Yr.of Future ADT: 2042

NAVIGATION DATA

38. Nav. Control: NA-no waterway
39. Vert. Clearance: 0.0 ft
40. Horiz. Clearance: 0.0 ft
111. Pier Protect.: Not Applicable (P)
116. Lift Bridge Vert. Clr.: 0.0 ft

OKLAHOMA ITEMS

200c. Temperature: 94
200d. Weather: Clear
201. Struc.Stl. ASTM Desig.: A36 / 20
202. Waterprf.Membrane: -1
Date Installed: 01/01/1901
203. Type Exp. Device: Pourable
204. Type of Railing: Metal Railing (other)
205. Material Quantity: 1,050.00
208a. Type of Abutment: Skeleton
b. Type of Found.: Concrete Piling
209. Type of Pier/Found.: 2 / No
Spread Footing
210. Foundation Elev.: -1.00 -1.00 -1.00 -1.00 -1.00
211. Wear.Surf.Prot.Sys: None
Date Installed: 11/08/2011
211c. Silane Reapplied
211d. Date :
213. Utilities Attached:

214a. Posted Weight Limit: NR
b. Posted Speed Limit: N
c. Narrow/1way Brdg Sign: No
d. Vertical Clr. Sign: No
Adv. Warning Sign: No
e. Navigation Lights?: No
Working/Not Working: No
215. Overpass: U.S. HIGHWAY
218. Functionally Obsolete : -
220. Bridge Redecked
221. Substr.Cond.(U/W):
222. Fill Over RCB:
223. Appr.Slab/Rwy Cond.: 3
225. Paint Type/Ovrct: Inorganic Zinc 3Coat Sys
N/A
226. Date Painted: 2004
227. Paint Color: Gray
233. Deck Forming: Conventional Forming
238. School Bus Rte.: Current & Desired route
240. Appr. Rwy Type.: Asphalt/Bituminous
243. Grdr Spacing/No.: / 5

244. Span Lengths: 30 44 57 57 42 35
245. Girder Depth: 2.75
246a. Type of Ovelay: AC Overlay
b. Overlay Thickness: 4.00
c. Overlay Date: 03/24/2008
d. Ovly Depth Changed >1":
247. Protective Systems:
248. # Field Splices w/ Corrosion:
249. Scour Crit. POA Exists?:
250. Headwall:
258. Plans w/Found.in ODOT File
259. Scour Eval. in ODOT File:
263. Interchange at Intersection: No
264. Interstate Milepoint: -1.00

Oklahoma Dept. of Transportation - Bridge Inspection Report

NBI No.:	Structure No.:	Local ID:	Suff. Rating:	
16159	3704 0543EX	024	53.30	SD

Inspection Date: 7/24/24 Drew Appler

Invoice No.: Submittal 145b Inspected With: -1

James A Appler Digitally signed by James A Appler
Date: 2024.10.03 08:33:57 -04'00'

BRIDGE NOTES:

The bridge is a 6-span structure numbered south-to-north:
Span 1 - 30-foot-long steel multi beam.
Span 2 - 44-foot-long multi beam.
Spans 3 and 4 - 57-foot-long steel multi beam.
Span 5 - 42-foot-long steel multi beam.
Span 6 - 35-foot-long steel multi beam.

Bridge 16167 SB controls vertical clearance.
The bridge crosses the Union Pacific Railroad at railroad milepost 373.72 with crossing ID: 595413M.

Other/Special Inspection Items include:
- Beam connection angles to the pier beam at pier 3 (railroad flagger required):
  - Beam 1 northwest connection angle (1 1/2-inch-long crack)
  - Beam 2 southeast connection angle (10 1/4-inch-long and 2-inch-long cracks, 11 3/4-inch total length)
  - Beam 3 southeast connection angle (14-inch-long crack)
  - Beam 4 southwest connection angle (14 1/4-inch-long crack)
- Beam 1, span 2 misalignment from collision (1 1/4 inches to the east with stringline between bearings).
- Beam 4, span 2 canister bearing at pier 2 with corrosion hole and crack in canister.

INSPECTION NOTES: **7/24/24**

PX' – Highly Recommended Action.
- Install seats under beams with connection angle cracks at south face of pier beam at beams 2 through 4.

PX
- Upgrade bridge railing and approach railing including transitions and terminations.
- Clean and paint bridge railing.
- Replace two damaged railing posts near pier 1.
- Reform deck where railing post anchorages are compromised by spalls.
- Investigate condition of concrete deck (cores) where asphalt patches exist.
- Replace fixed and expansion joints.
- Backfill and armor eroded area behind NE wingwall.
- Remove and patch deteriorated and delaminated concrete in piers and abutments and seal bearing seats with CIM 1000.
- Remove trees and vegetation growing through slope wall and seal joints.
- Remove extruded lead plugs at canister bearings.
- Install shim plates where beams are lifted from canister bearing at beam 2, span 1 at pier 1, beam 3, span 2 at pier 2 and beam 4, span 6 at pier 5.
- Repave approaches to provide a smooth riding surface onto and off of bridge .

FX
- Monitor deck adjacent to joints for further deterioration.
- Monitor alignment of beam 1, span 2 (1 5/16 inches to east) and distress in beam web at midspan diaphragm.
- Monitor pack rust induced cracks in diaphragm connection angle welds.
- Monitor painted over 1/4-inch deep section loss in bottom flange of pier beam under beam 2 at pier 3.

ELEMENT CONDITION STATE DATA

Elem. / Env	Description	Unit	Total Qty	% 1	Qty. 1	% 2	Qty. 2	% 3	Qty. 3	% 4	Qty. 4
12 / 4	Re Concrete Deck	sq.ft	7,953.00	0%	0.00	0%	0.00	100%	7,953.00	0%	0.00
	PX - (Asphalt overlay on deck) Size and number of asphalt patches has significantly increased since 2014 inspection suggesting deterioration of the top surface of the concrete deck. Concrete and asphalt patches exist along the joints and bridge centerline with discolored concrete in the soffit at these locations. - Shallow spalls with exposed reinforcing steel in face of both curbs at isolated locations. - Deck overshoots N abutment backwall 1 3/8in.										
510 / 4	Wearing Surfaces	sq.ft	7,953.00	64%	5,089.92	31%	2,465.43	5%	397.65	0%	0.00
	PX - Asphalt patches along roadway centerline, edge of pavement and along joints. - Minor rutting in the wheel lines. Asphalt is weathered.										
107 / 4	Steel Opn Girder/Beam	ft	1,025.00	75%	769.00	25%	256.00	0%	0.00	0%	0.00
	FX - Member Alignment - Beam 1, span 2 bottom flange is bent east 1 1/4in at 8ft from pier 1 due to vehicular collision from vehicle launched off southbound bridge. Horizontal paint cracks in beam 1, span 2 web at midspan diaphragm. - Shop-welded partial-length cover plates in positive moment regions.										
515 / 4	Steel Protective Coating	sq.ft	14,000.00	0%	0.00	100%	14,000.00	0%	0.00	0%	0.00
	- IZEU applied in 4/2004. - Surface corrosion and pack rust on beams and pier beam top flange, and diaphragms top flange at joints.										
205 / 4	Re Conc Column	each	8.00	0%	0.00	63%	5.00	38%	3.00	0%	0.00
	PX - Cracks with adjacent delaminations and rust stains along vertical and hoop reinforcing steel; most severe in columns of piers 2 and 4. - Vertical cracks in top of pier 3 columns radiating from pier beam bearing.										
215 / 4	Re Conc Abutment	ft	150.00	18%	27.00	57%	85.00	25%	38.00	0%	0.00

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PX - Erosion 4ft deep behind NE wingwall exposing 31in of wingwall foundation/abutment breastwall vertically (no significant change since 2014).
PX - Isolated shallow spalls, delaminations and 1/16-inch wide cracks in abutments breastwall. N abutment has spalls with exposed corroded reinforcing along bottom of breastwall.
- Vegetation growing through slope wall joints and cracks.
- S slope wall bulging 5in with 1in wide crack near abutment.
- Bearing pedestals have cracking; Beam 4 pedestal at N abutment has 1 ft diameter spall that does not affect bearing.
- Retaining wall between bridges rotated away embankment 3 1/2in at S abutment and 1 1/4in at N abutment.

234 / 4	Re Conc Pier Cap	ft	131.00	0%	0.00	62%	81.00	38%	50.00	0%	0.00

PX - Horizontal cracks and delaminations along top and bottom reinforcing steel of caps between beams 1 and 4, most severe at piers 2 and 4.
PX - Cracks and scaling occur in most bearing pedestals.

301 / 4	Pourable Joint Seal	ft	60.00	0%	0.00	0%	0.00	0%	0.00	100%	60.00

Exists at piers 2 and 4
PX - Pier 2 joint has adhesion failure and areas of missing seal in E lane.
PX - Pier 4 joint has seal missing in across both lanes.
- Elastomeric concrete header spalled exposing remnants of original finger joint.

311 / 4	Moveable Bearing	each	40.00	0%	0.00	20%	8.00	80%	32.00	0%	0.00

Canister bearings at piers 1, 2, 4 and 5.
PX - Beam 4, span 2 at pier 2 has corrosion hole with crack in canister along stiffener.
PX - Beam 2, span 1 at pier 1 and beam 4, span 6 at pier 5 are lifted off canister bearings up to 1/16in.
PX - Lead plugs around anchor studs are extruded inhibiting movement.
- Pack rust between bearing components is common.
- Canisters exhibit 1/8in section loss from corrosion and wear at contact points with sole and masonry plates.

313 / 4	Fixed Bearing	each	12.00	0%	0.00	83%	10.00	17%	2.00	0%	0.00

Fixed bearings at abutments.
- Pack rust under few fixed bearings.
- Bearing pads are typically extruding slightly.
- Cracked beveled washers at beam 4, span 6 at N abutment.

321 / 4	Re Conc Approach Slab	sq.ft	2.00	0%	0.00	100%	2.00	0%	0.00	0%	0.00

PX - Cracks in asphalt S approach roadway at end of approach slab along pressure relief joint.
PX - South approach roadway and edge of approach slab settled causing ramp onto bridge.
- Both approach slabs have patches along longitudinal construction joint in asphalt at roadway centerline.

330 / 4	Metal Bridge Railing	ft	532.00	0%	0.00	90%	478.00	10%	54.00	0%	0.00

PX - Railing does not meet current standards for NHI roadway.
PX - Spalls in soffit exposing/debonding bridge rail post anchorage.
PX - 2 rail post severely damaged in west rail near pier 1.
PX - Isolated areas of section loss due to corrosion.
PX - Missing bolts in E railing near pier 3.

919 / 4	St.(Rail) Prot. Coat	sq.ft	2,400.00	0%	0.00	0%	0.00	0%	0.00	100%	2,400.00

PX - The paint is failing and the railing is corroding.

859 / 4	Soffit	each	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00

PX - Spalls exposing/debonding embedded bridge railing posts connections to the deck exist in the soffit near the joints.
FX - Discolored concrete and cracks with efflorescence and corrosion stains at joints.
Spalls with exposed reinforcing steel along joints.

863 / 4	Steel Pier Beam	ft	49.00	0%	0.00	100%	49.00	0%	0.00	0%	0.00

FX - Painted over loss up to 1/4 inch deep in top and bottom flanges.
- Debris on bottom flange.

865 / 4	St.Open Gird End(5Ft	ft	300.00	0%	0.00	67%	200.00	32%	97.00	1%	3.00

PX - Vertical cracks in connection angles to pier beam not observed in previous inspections
- FX - Beam 1 NW connection angle (1 1/2in crack)
- PX - Beam 2 NE connection angle (10 1/4in and 2in cracks, 11 3/4in total length)
- PX - Beam 3 SE connection angle (14in crack - 3/8in growth for 2024)
- PX - Beam 4 SE connection angle (14 1/4in crack - 1in growth for 2024)
- Repaired with seat - Beam 5 SW connection angle (5 3/4in crack welded over), SE connection angle (6 1/4in crack welded over)

- Cracks in end diaphragm welds at piers 1, 2, 4 and 5.
- Crack (1 5/8in) between beam 3, span 5 sole plate and bottom flange at pier 4.
- Minor loss and reactivation of corrosion in top flange at piers.
- Bird nests and debris on flanges.
- Section loss to top flange under joints.

870 / 4	Concrete Wingwall	each	4.00	100%	4.00	0%	0.00	0%	0.00	0%	0.00

PX - Erosion up to 4 feet deep exists behind the NE wingwall exposing the wingwall foundation/breastwall 31 inches (abutment supported by concrete piles).

909 / 4	Pourable Fix Jt.Seal	ft	297.00	0%	0.00	0%	0.00	0%	0.00	100%	297.00

Fixed joints at abutments (skewed 60 degrees) and piers 1, 3 and 5. Deck control joints at midspan of spans 3 and 4.
PX - S abutment has evidence of leakage with spalls/asphalt patches along joint.
PX - Pier 1 joint header replaced with concrete, spalled and patched with asphalt at roadway centerline.
PX - Pier 3 over pier beam is leaking with parallel cracks in asphalt along joint.
PX - Pier 5 has multiple asphalt patches and a concrete patch along joint.
PX - N abutment has multiple asphalt patches, areas of seal debonded and evidence of leakage.
- Deck control joints have full depth concrete patch over pier 3 and asphalt patches adjacent to the joints.

956 / 4	St. Cracking/Fatigue	each	1.00	0%	0.00	0%	0.00	0%	0.00	100%	1.00

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- PX - Beam 4 SE connection angle (14 1/4in crack - 1in growth for 2024)
- Repaired with seat - Beam 5 SW connection angle (5 3/4in crack welded over), SE connection angle (6 1/4in crack welded over)

- Cracks in end diaphragm welds at piers 1, 2, 4 and 5.
- Crack (1 5/8in) between beam 3, span 5 sole plate and bottom flange at pier 4.

957 / 4	Pack Rust Smart Flag	each	1.00	0%	0.00	100%	1.00	0%	0.00	0%	0.00

- Pack rust between beam top flange and deck at joints.
- Pack rust up to 1in between bearing components.
- Cracks in end diaphragm welds at piers 1, 2, 4 and 5 due to pack rust.

962 / 4	Super.Traffic Impact	each	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00

FX - Member Alignment - Beam 1, span 2 bottom flange is bent east 1 1/4in at 8ft from pier 1 due to vehicular collision from vehicle launched off southbound bridge.

963 / 4	Steel Section Loss SF	each	1.00	0%	0.00	100%	1.00	0%	0.00	0%	0.00

FX - Painted over loss up to 1/4 inch deep in top and bottom flanges.

968 / 4	Erosion SF	each	1.00	0%	0.00	100%	1.00	0%	0.00	0%	0.00

PX - Erosion up to 4 feet deep exists behind the NE wingwall (abutments and wingwalls supported by concrete piles).

974 / 4	Straight Gird.Diaphr	each	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00

- Diaphragms exhibit corrosion of the top flange and pack rust up to 1/2 inch thick between the diaphragm top flange and deck causing minor distortion in the top flange.