Fracture Critical Bridge Inspection Report

NBI Bridge No.: 04085

Route U.S. 281 over S. CANADIAN RIVER
Canadian County

Prepared for:

Oklahoma Department of Transportation

Field Division 04

Inspection Date:

11/20/2013

Report Prepared By:

BURGESS & NIPLE, INC.

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Mr. Bob Rusch, P.E.
Bridge Engineer
Oklahoma Department of
Transportation
200 Northeast 21st Street
Oklahoma City, OK 73102-3204

Re: Fracture Critical Bridge Inspection Report
Structure No.: 0902 0000 X
NBI No.: 04085
US 281 over South Canadian River
ODOT Field Division 4, Canadian County

December 11, 2013

Dear Mr. Rusch:

Burgess & Niple (B&N) performed a fracture critical and routine inspection of the above referenced bridge on November 17 through 20, 2013. Route 281 is not a National Highway System (NHS) route. The bridge is a 40-span structure **(photos 1 and 2)** with spans numbered south to north and consisting of:

Spans 1 and 40:	36-foot long multi-beam approach spans
Spans 2-39:	100-foot long pony truss spans

The limits of the inspection were from the south abutment to the north abutment. Inspection team members included Dale E. Poorman, PE (Team Leader), Edward M. Cinadr, PE, Chris M. Villier, PE, Ryan J. Williamson, EI, Reed P. Case, EI and Roger L. Aker, CWI.

The bridge is currently open with no load restrictions. As per the latest load rating report date March 6, 2012, the bridge does not require a load posting.

This report includes appendices containing:

- Condition photographs
- Oklahoma DOT Bridge Inspection Form
- PONTIS element report
- CX letter
- Appendix A – Stringer Cope Cracks
- Appendix B – Stringer Connection Cracks
- Appendix C – Missing Stringer Rivets
- Appendix D – Stringer Loss
- Appendix E – Floor Beam Sweep
- Appendix F – Floor Beam Loss
- Appendix G – Floor Beam Cracks

The current and previous NBI ratings for the bridge are:

NBI Item	Previous Rating (2011)	Current Rating (2013)
NBI Item 58 (Deck)	5 = Fair	5 = Fair
NBI Item 59 (Superstructure)	4 = Poor	4 = Poor
NBI Item 60 (Substructure)	6 = Satisfactory	5 = Fair
NBI Item 61 (Channel)	6 = Bank Slumping	6 = Bank Slumping
Sufficiency Rating	36.6 (SD)	34.9 (SD)

The bridge is structurally deficient and functionally obsolete.

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:*

- Install stiff leg column support to end floor beams over pier 38.

An email discussing the CX and additional PX repair issues was sent to Mr. Wes Kellogg, PE and Mr. Chris Harlin, PE on November 21, 2013.

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

- Reinforce the damagedconcrete bridge railing in spans 1 and 40. Consider installing approach railing with transitions and terminations compliant with current standards in both approach roadways.
- Seal cracks in the asphalt wearing surface throughout the bridge.
- Install elastomeric pads or steel shims at missing locations on the supplemental pier beams over piers 1 and 39.
- During future inspections, compare lengths of cracks in stringer and floor beam webs with Appendix table values. Drill crack tips that grow significantly.
- Repair cracks in stringer connection angles by adding seat brackets below stringer.
- Repair section loss in stringer and floor beam webs where corrosion holes and/or heavy section loss exists with welded plates and/or angles.
- Move rotated shim plate at pier 26 stiff leg back into position and tack weld in place.
- Strengthen the horizontal shear planes of the end lower chord gusset plates. Monitor other previously strengthened crack locations for distress and further crack growth.
- Replace sheared rivets in the vertical connection, upper chord, and end post with bolts near west U1 in spans 31 and 37.
- Grind out notches and cuts in inboard flange and gusset plate at west U1L2, span 31. Consider strengthening member if further distress is noted.
- Consider removing pack rust and applying caulking and paint along vertical edges of end gusset plates to arrest/mitigate ongoing edge bowing.
- Consider cleaning and painting steel below deck within 5 feet of the joints.
- Add rip rap around pier 9 in the main channel to arrest/mitigate the ongoing scour. Consider adding rip rap at the base of the piers adjacent to the main channel, as well.

- Install full depth pressure relief joints on both approaches to mitigate ongoing effects of pavement pressure.

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

- Monitor pack rust and section loss in truss web members and end posts at railing connections.
- Monitor deck, joints, and end floor beams for further distress due to possible deck growth.
- Monitor spalls and corroding reinforcing steel in soffit for further deterioration.
- Monitor cracks at floor beam end copes for growth.
- Monitor fatigue prone stitch welds of angle strengthening at floor beam 0, span 2 for cracking.
- Monitor corrosion holes through the floor bracing system gusset plates for the development of cracks.
- Monitor bowed members near west U1, span 37 for distress.
- Monitor impact damage on upper chord and truss web members for additional misalignment and development of cracks.
- Monitor bowed gusset plates near bearings for distress.
- Monitor inboard lower chord section loss at floor system bracing connections, splices, and adjacent to stay/batten plates.
- Monitor bullet strike damage to east truss span 4 members/gusset plates.
- Monitor the cracking/spall at the east column capital, pier 3.
- Monitor the pack rust, pitting, and anchor bolts on truss bearings for further signs of distress throughout.

In addition to these recommendations, it is recommended that this structure remains on a 24-month Routine/Fracture Critical Inspection Frequency and a 24-month Other Special Inspection Frequency.

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.

Dale E. Poorman, PE
Team Leader

LICENSED PROFESSIONAL ENGINEER
Dale Edward Poorman
23197
OKLAHOMA
12-11-2013

Attachments

SIGNIFICANT FINDINGS are as follows:

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

- **PX** – Collision damage exists to the concrete railing in spans 1 and 40. One section of the bottom rail has been severed in span 1 and is no longer functional **(photo 3)**. The north most concrete post in span 40 is spalled and has cracked through at the base and the second post has spalling with exposed reinforcing steel **(photo 4)**. Four of the concrete posts for the west rail in span 40 are leaning outward and the deck is cracked on the outside edge of the posts.
- **FX** – Pack rust is typical between the metal bridge railing and the truss end posts and web members. No significant section loss was noted to the railing. Small cracks were also observed in the railing where the flange and web have been coped around the end post. Collision damage has caused minor bends in the steel railing at numerous locations. These conditions have not significantly affected the strength of the railing.
- None of the traffic safety items meet current standards for a non-National Highway System roadway.

NBI Item 58 – Deck (5 = Fair condition)

- **PX** – The asphalt wearing surface has unsealed longitudinal cracks throughout the spans **(photo 5)**.
- **FX** – The deck appears to be growing from the center of each truss span as evidenced by the distress in the floor system at the end floor beams (cracking and web rotation of the floor beams, cracks in the stringer connection angles, and broken rivet heads at the stringer connection angles). These conditions were observed in nearly all of the truss spans. Growth of the approach pavement has also affected the beam spans (specifically the pier beams); however, the expansion joints are not closed, though many of the truss expansion bearings are at or near their limits of movement. Evidence of significant approach pavement growth was noted at the deck/abutment backwall interface **(photo 6).**
- **FX** – Spalls exposing corroded reinforcing steel are common in the underside of the deck at the expansion joints **(photo 7)**. The spalls appear to be the result of deck drainage leaking through cracks in the deck adjacent to the joint.
- The deck is lifting adjacent to the floor beams due to pack rust on the top flange of the stringers and floor beams **(photo 8)**. This condition is worse at the end floor beams and is the result of deck drainage leaking through the expansion and deck joints. A transverse crack is common in the underside of the deck between 4 and 6 feet from the expansion joints as a result of the lifting deck. The riding surface is relatively smooth across the bridge in spite of the lifting at the floor beams.
- The void between floor beam 5, span 20, and floor beam 0, span 21, over pier 20 has been completely filled with asphalt from the top of the floor beam bottom flanges to the underside of the deck **(photo 9)**. The asphalt retains moisture which accelerates corrosion and section loss on the floor beams.
- The underside of the deck exhibits transverse cracks with light efflorescence. Spalls and deteriorated concrete exist in exterior stringer bays at isolated locations **(photo 10)**. Full

depth patches exist adjacent to many of the joints and along the east curb at isolated locations. At some locations, the timber formwork remains in place.

- The deck overhangs have cracks and isolated spalls with rust staining and efflorescence commonly observed.
- Many portions of the curbs exhibit spalls and/or cracking with corroding reinforcing steel, especially over the ends of the intermediate floor beams.

NBI Item 59 – Superstructure (4 = Poor condition)

Fracture Critical Member Rating Summary	
Floor Beams	4 = Poor condition
Pier Beams	4 = Poor condition
Truss Lower Chord	5 = Fair condition
Truss Web Members	5 = Fair condition

Steel Beams – (5 = Fair condition)

- **PX** – The connection angles for the beams to pier beam 39 are deformed due to the apparent pavement growth. The elastomeric bearings that were installed between each approach span beam and the supplemental pier beam are rotated and twisted. The bearing pad under beam 3 is no longer in place. At pier beam 1, bearings are missing at beams 1 through 4 over the supplemental pier beam and the steel bearing at beam 5 is heavily pack rusted **(photo 11)**.
- Patches of surface corrosion exists on the top flanges of exterior beams and on the end 1-3 feet of the beams.
- Exterior beams at both abutments have sheared anchor bolts at the bearings (the interior beam anchor bolts do not extend into the abutment seat concrete). This most likely is a result of pavement pressure from the approach roadway pushing the bridge deck; up to 3 1/4 inches of movement to the north was noted at the south abutment **(photo 12)**. The beam bearings at the north abutment are pushed to the south up to 2 1/4 inches also due to pavement pressure.

Stringers – (4 = Poor condition)

- **PX** – Cracks were observed in the web of numerous stringers at the top flange cope (see **Appendix A** for locations and lengths) **(photos 13 and 14)**. The cracks exist at the stringer connections to the end floor beams and exterior stringer connections to the interior floor beams. A few new cope cracks were found and some cracks have grown 1/8 inch to 1/4 inch since the last inspection. A definitive cause for the cracks could not be determined during the inspection; however, the force of an expanding deck and differential movements between the deck and floor beam during flexure of the floor beams are a

likely cause. The end floor beams do experience visible deflection during passage of truck loads.

- **PX** – Cracks in the stringer connection angles (see **Appendix B** for locations and lengths) and broken rivets (see **Appendix C** for locations) were observed at numerous locations at the end floor beams **(photos 15 and 16)**. The conditions were generally worse at the odd number floor beams where the expansion bearings/joints exist. The vertical cracks start at the top of the connection angle, propagating down through the angle leg adjacent to the floor beam web at the fillet. A few new connection angle cracks were found and some cracks have grown 1/8-inch to 1/4-inch since the last inspection. These cracks typically have a horizontal offset as if the floor beam web is being pushed away from the stringer. Broken rivets were always between the connection angle and the floor beam web and nearly always the top rivet of the connection angle **(photo 17)**. Typically the rivet shank is being pulled through the connection angle where the rivet heads have broken away. These conditions appear to be the result of the deck pushing against the ends of the floor beams. It is speculated that the joints above the fixed bearings are closed, causing all expansion to occur at the expansion floor beams. The fixed joints are paved over and this theory could not be confirmed visually.
- **PX** – Section loss, including corrosion holes, exists through the exterior stringers web at the end floor beams at numerous locations (see **Appendix D** for locations and sizes) **(photos 18 and 19)**. The deterioration is typically worst at stringer 5 and is due to deck drainage passing through the joints. Numerous through holes also have cracks extending from the holes due to very thin remaining web thickness adjacent to the holes.

[FCM] Floor Beams – (4 = Poor condition)

- **CX** – The end floor beams for the truss spans are twisted producing a sweep of the bottom flange away from the joint at most of the piers (see **Appendix E** for locations and dimensions) **(photo 20)**. The bottom flange sweep ranges from 3/16 inch to 7/8 inch. All of the end floor beams with previously noted sweep have been recently retrofitted with the addition of stiff leg columns at/near midspan of the floor beams except at pier 38. At pier 38, both floor beam 5, span 38, and floor beam 0, span 39 have 3/8-inch sweep away from the joint with no stiff leg installed **(photo 21)**. The floor beam top flange is bent towards the joint causing the bottom flange to have a sweep in the opposite direction. The floor beam distortion appears to be caused by the deck pushing against the top flanges of the floor beam and pack rust development at the joint armor pushing down and eccentrically on the floor beam top flange.
- **PX** – Active section loss is common on the floor beams under the expansion joints. Corrosion holes were observed through the web of the floor beams at several locations (see **Appendix F** for locations and dimensions) **(photo 22)**. Corrosion holes were also noted through the web at the top flange cope of the interior floor beams at numerous locations (see **Appendix F** for locations and dimensions) **(photo 23)**.
- **PX –** The stiff leg shim plate under floor beam 5, span 26 at pier 26 is rotating out from under the floor beam bottom flange. The stiff leg repairs are intended to catch the floor beam should it fail and do not need to be in contact with the floor beam.

- **FX** – Cracks were observed in the web of numerous floor beams at the top flange cope (see **Appendix G** for locations and lengths) **(photo 24)**. Horizontal cracks exist between the top flange and the top of the truss connection angles at the end floor beams. Many of these cracks have a horizontal offset between the faces of the crack with the top flange being pushed towards the joint. Cracks were also noted at the top flange cope of the intermediate floor beams at several locations **(photo 25)**. These cracks generally have not changed in length since the last inspection; however, some have grown up to approximately 3/4-inches.
- **FX** – Floor beam 0 of span 2 has been strengthened using an angle stitch welded to the web and bottom flange. This condition creates a category E fatigue prone detail at the termination of the welds at the end of the member. No signs of cracking or distress were observed at these locations.

[FCM] Pier Beams – (4 = Poor condition)

- **PX** – The pier beams at piers 1 and 39 have been retrofitted with a supplemental pier beam due to severe sweep and rotation as a result of approach pavement growth. These longitudinal forces act through the deck to distort the pier beam. The majority of the elastomeric pads between the supplemental pier beam and the beam bottom flange are missing, allowing the original pier beam to still carry the beam reactions **(photo 26)**. The supplemental pier beam currently acts as a catcher beam to support the beams should the original pier beam fail. No signs of distress from vehicular live loads were observed in either the original pier beam or the supplemental pier beam.
- At pier 1, the lower portion of the supplemental pier beam is rolled approximately 3 degrees to the south, and upper section is rolled approximately 1 degree south. This is likely an as-built condition and does not significantly affect the load carrying capacity of the supplemental pier beam **(photo 26)**.

Floor System Bracing– (5 = Fair condition)

- **FX** - Corrosion holes were observed at numerous floor system bracing gusset plates **(photo 27)**. The corrosion holes typically are less than 1 1/2-inch in diameter and occur adjacent to the interface with the floor beam bottom flange, though some of the holes are up to 1-foot long adjacent to the inboard flange of the bottom chord. The corrosion holes do not significantly affect the functionality of the bracing. Up to 1/2-inch thick pack rust with adjacent pitting is also common at the floor system bracing gusset plates.
- Many hanger rods which support the floor system bracing near their mid-lengths are broken due to repetitive loading/vibration.

Truss Upper Chord – (5 = Fair condition)

- **PX** – West U1U2, span 31, has multiple sheared rivets for the bottom lacing due to impact damage **(photo 28)**. No signs of local buckling were observed at this location.
- **FX** – West U1U2 in span 37 is bowed globally to the east 1/4 inch. This damage does not significantly affect the load carrying capacity of the member. Multiple rivet heads are also sheared off at the inboard bottom flange of U1U2 at this location with detached lacing bars.

- **FX** – Impact damage exists on the inboard flanges of the upper chord at several locations with the most severe noted under the Truss Web Members section below. The damage does not significantly affect the load carrying capacity of the members.
- Minor pack rust and laminating corrosion is forming on isolated upper chord gusset plates at the seams. The pack rust is typically 1/16-inch thick, up to 3/16 inch maximum, and section loss is minimal, 1/16 inch deep maximum **(photo 29)**.

[FCM] Truss Lower Chord – (5 = Fair condition)

- **PX** – Horizontal cracks were observed in the inboard truss gusset plate between the bearing pin and the end floor beam. All six locations noted during the previous Fracture Critical inspection have been strengthened with the addition of a welded steel angle on the inboard face; however, many of the previously noted cracks have grown significantly (up to approximately 2 3/4 inches) since the 2012 OS inspection. The following table includes locations of new cracks (shaded in yellow) and the strengthened locations **(photos 30, 31, and 32):**

Span	Truss	Panel Point	Length of Crack (in.)	Strengthened (Y/N)
2	East	L0	9 1/4	No
8	East	L0	5 1/2	Yes
14	West	L0	4 1/2	Yes
17	East	L5	8 1/2	Yes
19	West	L5	8 1/8	Yes
20	East	L0	3	No
24	East	L0	8	Yes
29	East	L5	6 1/4	No
33	East	L5	13	Yes

The distortion and cracks are a result of section loss and pack rust occurring between the gusset plate and the top edge of the lower chord channel. The crack is within the horizontal shear plane between the end post and the lower chord.

- **FX** – Lower chord gusset plates are typically bowed at L0 and L5 due to pack rust **(photo 33)**. The inboard gusset plate is bowed up to 1 inch between the end post and the lower chord with the outboard gusset plates typically bowed less than the inboard due to pack rust formation up to 7/8-inch thick. The end of the end post is in contact or near contact with the top of the lower chord making the likelihood of a buckling failure remote.
- **FX** – Corrosion of the lower chord is common at the floor beam/floor system bracing gusset plate connection **(photo 34)**. The corrosion has caused section loss of less than 1/4-inch to the inboard channel top flange. Corrosion also occurs around the inboard splice plates at L2 and L3 under the floor beams. The corrosion and resulting section loss is due to deck drainage passing through the deck joints above the interior floor beams and expansion joints.

- **FX** – Corrosion is common around the inboard splice plates at L2 and L3 and appears to be the result of deck drainage splashing over the edge of the deck **(photo 34)**. Pack rust is developing at the bottom flange splice, however, no significant distress was observed in the web splice plates.
- **FX** – Pack rust exists between the channels of the lower chord and the stay and batten plates. The corrosion has produced 1/8-inch deep section loss of the channel web for the lower chord beneath the stay and batten plates. The localized loss does not significantly affect the load carrying capacity of the member.
- Wear is evident in the truss pins and/or pin plates at L0 & L5. Up to 3/16-inch gaps were noted between the bottom of the pin and the pin hole at many end panel points. This is normal wear due to the repeated rotations that the end bearings undergo due to live load deflection.

[FCM] Truss Web Members – (5 = Fair condition)

- **PX/FX** – Vehicular collision damage was observed at numerous locations on the above deck truss members. The following are the most significant:
  - **FX** – Span 6, west U1L2 – Inboard flange of wide flange bent in 2 1/8-inch near U1 **(photo 35)**
  - **FX** – Span 31, west U1L2 – Inboard flange has a tear near U1 resulting in an approximate 50% loss of the flange **(photo 36)**. The adjacent gusset plate has two gouges measuring 1 7/8-inches deep at the upper chord and 1-inch deep at connection to U1L2. The 1 7/8-inch deep gouge occurs in the shear plane between the diagonals and upper chord and will affect the shear strength of the gusset plate. The 1-inch deep gouge occurs near the corner of the gusset plate and does not significantly affect the capacity of the gusset plate. The gusset plate is also bowed approximately 2 inches to the west due to the collision damage.
  - **PX** – Span 37, west U1L1 – U1L1 carries the floor beam reaction only. Two sheared rivet heads exist at the inboard gusset plate at U1 **(photo 37)**. The shank still exists through the rivet hole of the gusset plate and there is no sign of movement or distress from loading.
  - **FX** – Span 37, west U1L2 – A 5/16-inch long crack exists in the bottom edge of the inboard gusset plate between U1L1 and U1L2 near U1L2 **(photo 38)**. Inboard bottom flange is bent 1 inch near the railing.
- **FX** –Bullet strike damage exists at the gusset plate connection between east U2L3 and L2U3 in span 4. The bullet strikes exist on or near the rivet of the outboard gusset plate. This condition does not significantly affect the connection's capacity.
- Slight bows are typical in the horizontal edges of the L2 and L3 gusset plates. This appears to be an as-built condition as the verticals are approximately 9 7/8 inches deep and the diagonals are 10 inches deep with no fill plates utilized at the panel point connections.
- Pack rust up to 3/16-inch thick is common between the diagonals and the mid gusset plates with minimal section loss. Similar conditions exist at the bridge railing connections to the truss web members.

Truss End Posts – (5 = Fair condition)

- **PX** – Pack rust is common at the end post connection to the inboard gusset plate at the lower chord connection **(photo 33)**. Deck drainage which splashes over the curb travels down the end post promoting corrosion.
- **FX** – Pack rust is forming at many of the bridge railing to inboard end post channel connections. Up to 1/8-inch section loss was noted along effectively the full height of the inboard channel webs **(photo 39)**.
- **FX** – Vehicular collision damage exists at numerous locations. The following are the most significant:
  - Span 7, west L0U1 – Bent inboard channel bottom flange and edge damage to top cover plate at U1.
  - Span 37, west L0U1 – Three lacing bars are detached on the bottom face and the member is also bowed globally 1/4 inch to the west **(photo 40)**. The inboard bottom flange is bowed west 5/8 inch and up 2 3/4 inch, and is torn 1 3/8 inches wide over 4 1/4 inches in length at top railing.
  - Span 39, east L0U1 – Inboard flange bent down near U1.

Member Alignment – (4 = Poor condition)

- **CX** – End floor beams over pier 38 are twisted due to the deck pushing against the joint assembly, producing a sweep in the bottom flange between 3/16 and 7/8-inch out of alignment **(photo 21)**. The majority of the end floor beams exhibit a sweep and have been recently retrofitted with stiff leg columns with the exception of the end floor beams at pier 38.
- **FX** – West U1U2 in span 37 is bowed globally to the west 1/4 inch and west L0U1 in span 37 is bowed globally to the east 1/4 inch.
- **FX** – Several above deck truss members have local bends due to impact damage. The member misalignment does not significantly affect the load carrying capacity of the members.
- Pier beam sweep at piers 1 and 39 has been addressed by adding a supplemental pier beam. The sweep is a result of pavement growth of the unsealed concrete approach pavement.

Paint/Coating System – (4 = Poor condition)

- **PX** – Corrosion and minor to moderate section loss are occurring at many locations on the lower chord and floor system due to deck drainage passing through joints and splashing over the edge of the deck **(photos 19, 23 and 34)**. Widespread section loss and corrosion holes exist in the exterior stringers and end floor beams.
- Minor to moderate pack rust and minor section loss at the gusset plate seams are common on the above deck truss members with weathered and chalking paint throughout.

Load Deflection – (6 = Satisfactory condition)

- Slight deflections of the end floor beams were observed during passage of truck loads.
- The global live load response is adequate.

NBI Item 60 – Substructure (5 = Fair condition)

Abutments – (6 = Satisfactory condition)

- No significant deficiencies were noted in the abutments, except for bat guano on the bearing seats of both abutments and map cracking exposing a few reinforcing bars at the ends of the south abutment.

Piers – (5 = Fair condition)

- **FX** – A 1-inch maximum wide crack exists in the capital of the east column of pier 3 which is emanating from the span 2 bearing anchor bolt **(photo 41)**. The crack has led to a large portion of the column capital shifting to the south approximately 1 inch. The truss bearing appears to be adequately supported. A definitive cause of the crack could not be determined during the inspection.
- Vertical and horizontal cracks which mirror the reinforcing steel exist in the web walls and pier columns at several locations; these cracks may be an indication of Alkali-Silica Reactivity **(photo 42)**. Spalls exposing reinforcing steel exist in the face and corners of the web walls due to inadequate cover. The cracks and spalls are most prevalent on the south face of the piers and do not affect the load carrying capacity.
- Shallow spalls due to gunshot damage are typical on the columns and web walls of piers 1 through 8.
- The top one to three feet of the pier column foundation are exposed at many piers, generally in the floodplain north of the river and on some piers in the south floodplain **(photo 43)**. This may be indicative of general scour of the sandy soils and/or may be an as-built condition.

Bearings – (5 = Fair condition)

- **PX** – Elastomeric pads are missing at the supplemental pier beams under beams 1 through 4 at pier 1 and at beam 3 at pier 39 with heavy pack rust forming at beam 5, pier 1 **(photo 11)**. This condition limits the supplemental pier beams to act only as a catcher beam, available to carry the beams should the original pier beam fail.
- **FX -** Heavy pack rust with minor associated pitting is widespread on and between the bearing components, moreso at the expansion bearings. Much of this deterioration is caused by debris accumulating on and around the bearing seats.
- **FX** – Expansion bearings are rotated up to 3/4-inch towards the joint with pack rust filling the gap between the masonry plate and sole plate **(photo 44)**. The expansion bearings are generally centered on the masonry plate with no signs of recent movement observed, though many are in or near full expansion. The bronze sliding plate has slid slightly towards the center of the truss span and is fractured into pieces at a few locations. It is speculated that the bearings became frozen, and then rotated in expansion during warm weather, allowing pack rust to incrementally fill the gap between the plates.
- Approximately 25-percent of the anchor bolts are broken or have corroded through within the slotted holes of the truss expansion bearing assemblies **(photos 44 and 45)**. The remaining anchor bolts should be capable of resisting lateral forces on the truss spans.

The anchor bolts are failing due to a combination of shear, pack rust-induced tension, and corrosion.

NBI Item 61 – Channel and Channel Protection (5 = Bank Eroded condition)

Channel Scour – (5 = Fair condition)

- **PX** – Local scour exists around the columns at pier 9 (in river) with the river bed measured between 12 and 16 feet below the top of the pier foundation. Local scour of significant lesser depths were observed around the columns of piers 7 and 8 as well. The river bed and adjacent floodplain to the south of pier 9 consists of sand.

Embankment Erosion – (6 = Satisfactory condition)

- No significant erosion was observed. Heavy amounts of riprap are in place and performing at both abutments.

Debris – (6 = Satisfactory condition)

- A small amount of drift exists around the columns of the piers adjacent to the main channel (near pier 9). This drift likely does not significantly increase the scour risk.

Vegetation – (6 = Satisfactory condition)

- The banks are well vegetated north of pier 9 with large trees and vegetation in the floodplain. A few trees are encroaching on the truss near pier 1 in span 2.

NBI Item 72 – Approach (5 = Fair condition)

Approach Alignment – (8 = Very Good condition)

- The approaches are straight with no reduction in sight distances across the bridge.

Approach Roadway Condition – (5 = Fair condition)

- **PX** – The concrete approach roadway is overlaid with asphalt which has unsealed joints and cracks. Obvious signs of pavement growth were observed at the both abutment **(photo 6)**. This condition has caused longitudinal movement of the approach spans resulting in the severe sweep and rotation in the pier beams at piers 1 and 39.
- Cracks and patches exist in the approach roadway resulting in a relatively level yet rough riding surface with minor rutting in the wheel lines. A few moderately sized potholes exist in the south approach asphalt.

Approach Roadway Settlement – (5 = Fair condition)

- No significant settlement was observed.

NBI Item 113 – Scour Rating (5 = Calculated Scour Within Limits of Foundation)

- **PX –** Local scour was observed around piers 7 through 9. The scour hole at pier 9 measured 12 to 16 feet deep measured to the top of the column foundations.
- Riprap has been installed around the north abutment and a drift fence consisting of tripods composed of railroad rails and cable exists northwest of pier 38 **(photo 46)**.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 1 - Elevation looking northwest.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 2 - End view looking south.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 3 - Looking northeast at the east railing in span 1. Note: collision damage to railing severing portion of railing making this panel no longer effective.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 4 - Looking northeast at the east railing in span 40. Note: the end two concrete railing posts have collision damage.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 5 - Looking southeast at the deck in the southbound lane in span 19. Note: unsealed longitudinal cracks in wearing surface.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 6 - Looking southwest at span 1 intersection with the south abutment. Note: span 1 has moved 3 1/4 inches north with respect to the face of the abutment backwall.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 7 - Looking southwest at the deck soffit in span 5 at floor beam 0. Note: spalls with exposed corroded reinforcing steel exist in the deck underside full length of the floor beam.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 8 - Looking west at the deck in span 4 at floor beam 5. Note: pack rust between the deck and the floor beams is lifting the deck and causing cracks and spalls in the soffit.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 9 - Looking east between floor beam 5 of span 20 and floor beam 0 of span 21. Note: the void between the floor beams is completely filled with asphalt.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 10 - Looking north at the deck soffit in span 29. Note: typical areas of spalls with exposed reinforcing steel in the deck soffit.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 11 - Looking northeast at beam 5 in span 1 at pier 1. Note: heavy pack rust between bearing plates under beam 5.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 12 - Looking southwest at beam 1 at the south abutment. Note: the anchor bolts at beam 1 are sheared.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 13 - Looking northwest at stringer 1, south face of floor beam 5 in span 12. Note: 1 1/2-inch long crack in the web of the stringer at the top flange cope.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 14 - Looking east at stringer 5, north face of floor beam 0 in span 20. Note: 7/8-inch long crack in the stringer web at the top flange cope.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 15 - Looking southwest at stringer 3, north face of floor beam 0 in span 18. Note: 2 3/4-inch long vertical crack in the east connection angle.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 16 - Looking northeast at stringer 4 on the south face of floor beam 5 in span 39. Note: 4 5/8-inch long vertical crack in the west connection angle.

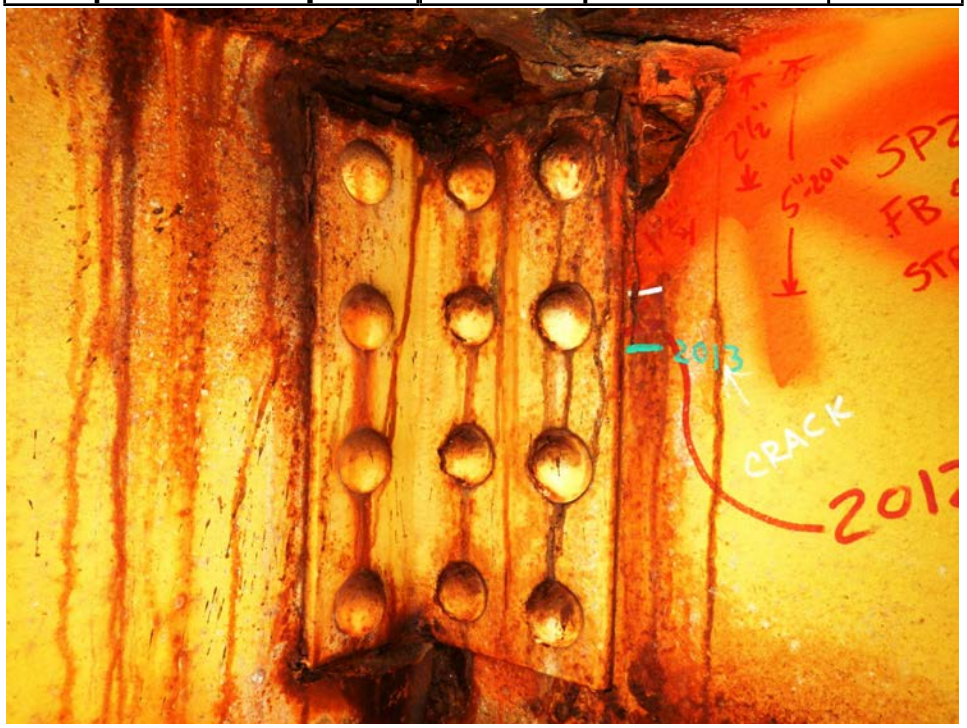
NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 17 - Looking southwest at stringer 2, north face of floor beam 0 in span 18. Note: popped rivet head with shank no longer in shear plane at stringer connection to floor beam.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 18 - Looking west at stringer 1, south face of floor beam 5 in span 25. Note: 2-inch vertical by 5/8-inch horizontal corrosion hole in the stringer web at the top flange cope with a 5/8-inch long vertical crack.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013



Photograph 19 - Looking east at stringer 5, south face of floor beam 5 in span 21. Note: 2 1/2-inch vertical by 1 1/2-inch horizontal corrosion hole in the stringer web at the top flange cope with a 3 7/8-inch long vertical crack.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 20 - Looking west at pier 22. Note: typical stiff leg retrofit to address floor beam sweeps.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 21 - Looking west along the floor beams at pier 38. Note: 3/8-inch sweep in the floor beam with no stiff leg retrofit.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 22 - Looking west between the end floor beams at pier 37. Note: active section loss in floor beam webs under joints.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 23 - Looking northeast at floor beam 4, span 16 at the east truss connection. Note: 3 1/2-inch vertical by 4 1/4-inch horizontal corrosion hole through the floor beam web at the connection to the truss.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 24 - Looking southeast at floor beam 0, span 38 at the east truss connection. Note: 9-inch long horizontal crack in the floor beam web with at 3/8-inch lateral offset.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 25 - Looking north at floor beam 1, span 14 at the east truss connection. Note: 7/16-inch crack in the floor beam web at the connection to the east truss.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 26 - Looking west at the pier beam at pier 1. Note: severe rotation of pier beam with supplemental pier beam installed.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 27 - Looking northwest at the floor system bracing gusset plate adjacent to floor beam 1 and the east truss in span 37. Note: typical through holes in lower lateral bracing gusset plate.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 28 - Looking north at west U1U2, span 31. Note: multiple sheared rivets for the bottom lacing due to impact damage.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 29 - Looking northeast at a typical upper chord end gusset plate. Note: common 3/8-inch thick pack rust between the gusset plate and truss web member.

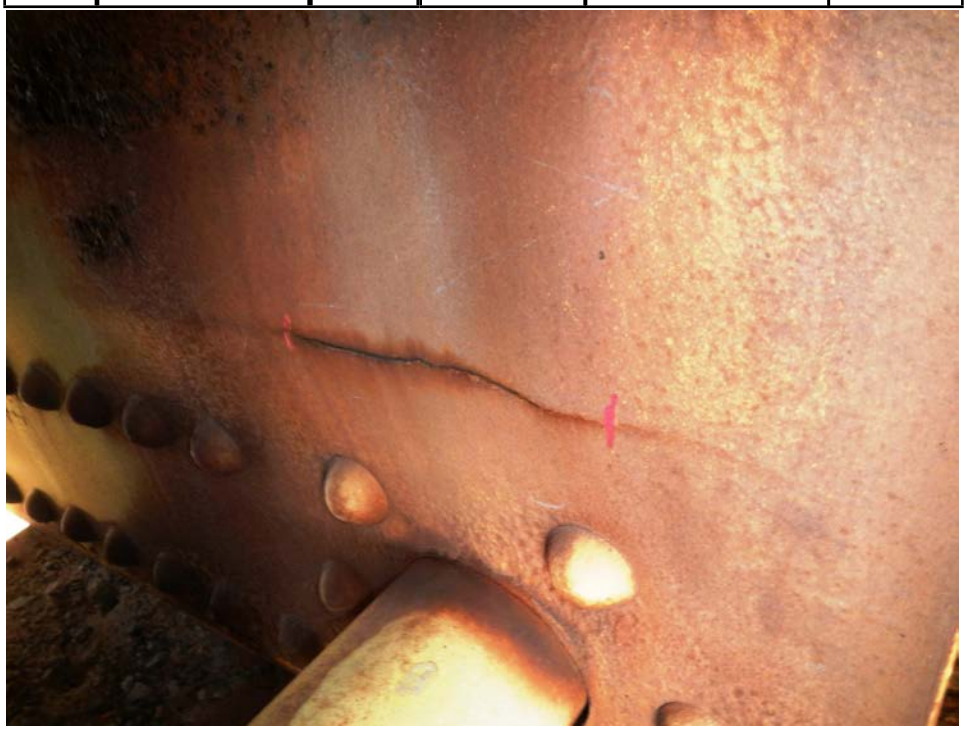
NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 30 - Looking east at east L0, span 8. Note: 5 1/2-inch long crack in L0 gusset plate at the top of the lower chord repaired with welded angle and plates.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 31 - Looking northwest at east L0, span 24. Note: 8-inch long horizontal crack in the inboard gusset plate.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013



Photograph 32 - Looking southwest at east L5, span 29. Note: 6 1/4-inch long horizontal crack in the inboard gusset plate.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 33 - Looking north at east L5, span 39. Note: inboard gusset plate is bowing 1-inch due to pack rust.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 34 - Looking east at the lower chord at east L2, span 2. Note: typical corrosion and section loss of the lower chord channels and splice plates under floor beams.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 35 - Looking south at west U1L2, span 6. Note: collision damage has bent the inboard flange of the diagonal 2 1/8 inches over a 30-inch length.

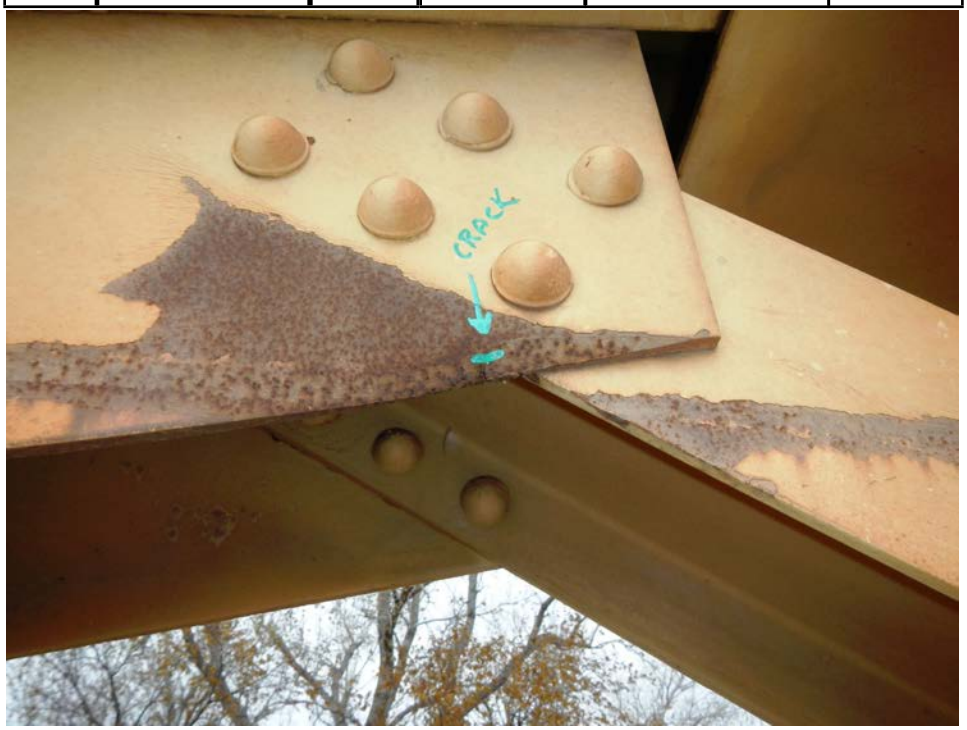
NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 36 - Looking south at west U1, span 31. Note: the inboard flange of U1L2 has a tear as a result of collision damage and the inboard gusset plate has two gouges.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 37 - Looking southwest at west U1, span 37. Note: general view of impact damage to truss.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013



Photograph 38 - Looking west at the gusset plate at west U1, span 37. Note: 5/16-inch crack in the inboard gusset plate adjacent to U1L2.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 39 - Looking southeast at east U1L0, span 34. Note: moderate pack rust between the bridge railing and the end post.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 40 - Looking west at the end post adjacent to the railing for west L0U1, span 37. Note: Three lacing bars detached on the bottom face of the end post.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 41 - Looking east at the east column at pier 3. Note: 1-inch wide crack in the capital of the column.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 42 - Looking southeast at the north face of pier 23. Note: vertical and horizontal cracks in the web wall.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 43 - Looking northeast at the east pier column foundation for pier 7. Note: up to 18-inch deep scour exposing the top of the foundation.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 44 - Looking west at the expansion bearing for span 35, west truss at pier 35. Note: the bearing is rocked 3/4-inches with pack rust between the sole plate and masonry plate, and the anchor bolt is broken.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 45 - Looking west at the east truss bearing for span 27 at L5. Note: heavy laminating corrosion resulting in loss of anchor bolts.

NBI #	Structure #	County	Fac. Carried	Fac. Intersected	Insp. Date
04085	0902 0000 X	Canadian	U.S. 281	S. CANADIAN RIVER	11/20/2013

Photograph 46 - Looking northwest at drift fence installed upstream (west) of pier 38.

OKLAHOMA DEPARTMENT OF TRANSPORTATION - Bridge Inspection Report

NBI No.: **04085** Structure No.: 0902 0000 X Local ID:-1 Suff. Rating: 34.9 SD Health Index : 62.9

IDENTIFICATION

Description:
38-100' PONY TRUSS & 2-36' I-BM. SPANS(BRIDGEPORT BR.)

1. State: Oklahoma 2. SHD District: Division 4
3. County Code: CANADIAN 4. Place Code: Unknown
Admin. Area: LT Snooper Truss
5. Inventory Route (Route On Structure) : 1 - 2 - 1 - 00281 - 0
6. Feature Intersected: S. CANADIAN RIVER
7. Facility Carried: U.S. 281 U.S. 281
9. Location: CADDO CANADIAN CL 11. Mile Post: 0.000 mi
13. LRS Inv. Route./ Subroute.: 0902HP0000 01
16. Latitude: 35 32 25.00 17. Longitude: 098 19 22.00
98. Border Br. Code: Unknown (P) % Resp. : 0 99. Border Br. #: Unknown

INSPECTION

Type	Insp Req.	Insp Done	Freq:	Insp. Date:	Next Insp.:
NBI:		Y	24	11/20/2013	11/20/2015
FC Freq.:	Y	Y	24	**11/20/2013**	**11/20/2015**
UW Freq.:	N	N	NA	**NA**	**NA**
OS Freq.:	Y	N	24	**11/2/2010**	**11/20/2014**

CLASSIFICATION

12. Base Hwy Network : On Base Network 20. Toll Facility: 3 On free road
21. Custodian: 01 State Highway Agency 22. Owner: 01 State Highway Agency
26. Functional Class: 06 Rural Minor Arteri 37. Historical Sig.: 2 Br eligible for NRHP
100. Defense Highway: 0 Not a STRAHNET h 101. Parallel Structure: No || bridge exists
102. Dir. of Traffic: 2 2-way traffic 103. Temp. Structure: Not Applicable (P)
104. Highway System: 0 Not on NHS 105. Fed. Land Hwy 0 N/A (NBI)
110. National Truck Network: 0 Not part of na 112. NBIS Length: Long Enough

STRUCTURE TYPE AND MATERIALS

43. Main Span Material and Design Type
Steel Truss-Thru
44. Approach Span Material and Design Type
Steel Stringer/Girder
45. No. of Spans Main Unit: 38 46. No. of Approach Spans: 2
107. Deck Type: 1 Concrete-Cast-in-Place
108A. Wearing Surface: 6 Bituminous
108B. Membrane: 8 Unknown
108C. Deck Protection: 8 Unknown

CONDITION

58. Deck: 5 Fair 59. Super.: 4 Poor 60. Sub.: 5 Fair
62. Culvert: N N/A (NBI) 61. Channel/Channel Protection: 6 Bank Slumping
Flowline Notes:
[2013] FL to top of curb = 30.1' measured @ pier 9 east column
[2011] FL to top of curb = 24.8' measured @ pier 9 east column

AGE AND SERVICE

27. Year Built: 1933 106. Year Reconstructed: Unknown
28A. Lanes on: 2 28B. Lanes Under: 0 19. Detour Length: 11.8 mi
29. ADT: 1100 30. Year of ADT: 2011 109. Truck ADT %: 16
42A. Type of Service on: 1 Highway
42B. Type of Service under: 5 Waterway

LOAD RATING AND POSTING

31. Design Load: 2 M 13.5 (H 15) 41. Posting status: A Open, no restriction
63. Op. Rating Method: 1 LF Load Factor-Tor Alt. Op. Rating Meth.: 1 LF Load Factor-To
64. Operating Rating (H / HS / 3-3): 24.4 36.3 66.6
66. Inventory Rating (H / HS / 3-3) : 14.5 21.8 39.9
65. Inv. Rating Method: 1 LF Load Factor-Tor Alt. Inv. Rating Meth.: 1 LF Load Factor-To
70. Posting: 5 At/Above Legal Loads Date Rated : 3/6/2012

GEOMETRIC DATA

10. Inv. Rte. Min. Vert. Clr.: 328.1 ft
32. Approach Roadway Width (W/ Shoulders): 30.0 ft
Deck Area: 102,364.8 sq. ft 33. Median: 0 No median
34. Skew: 0 35. Structure Flared: 0 No flare
47. Inv. Rte. Total Horiz. Clr.: 24.0 ft
48. Length Maximum Span: 100.1 ft 49. Structure Length: 3,937.0 ft
50A. Curb/Sdwlk Wdth L: 1.0 ft 50B. Curb/Sidewalk Width R: 1.0 ft
51. Width Curb to Curb: 24.0 ft 52. Width Out to Out: 26.0 ft
53. Minimum Vertical Clearance Over Bridge: 328.1 ft
54A/54B. Min. Vert. Underclearance : N Feature not hwy or RR 0.0 ft

	N/E			S/W		
Meas.	-1	-1	-1	-1	-1	-1
Post.	DO NOT U	DO NOT U	DO NOT U	DO NOT U	DO NOT U	DO NOT U

55A/55B. Minimum Lateral Undrclearance R: N Feature not hwy or RR 327.8 ft
56. Minimum Lateral Undrclearance L: 327.8 ft

PROPOSED IMPROVEMENTS

94. Bridge Cost: $6,781,689 75. Type of Work: 31 Repl-Load Capacity
95. Roadway Cost: $4,500,000 76. Lgth. of Improvment: 3,937.0 ft
96. Total Cost: $11,920,275 114. Future ADT: 1760
97. Year of Cost Est.: 2007 115. Year of Future ADT: 2031

NAVIGATION DATA

38. Navigation Control: Permit Not Required
39. Vertical Clearance: 0.0 ft 40. Horizontal Clearance: 0.0 ft
111. Pier Protection: 1 Not Required 116. Lift Bridge Vert. Clear.: 0.0 ft

APPRAISAL

36A. Bridge Rail: 0 Substandard 36C. Approach Rail: 0 Substandard
36B. Transition: 0 Substandard 36D. Approach Rail Ends: 0 Substandard
67. Str. Evaluation: 4 Minimum Tolerable 68. Deck Geometry: 4 Tolerable
69. Underclearance, Vertical and Horizontal: N Not applicable (NBI)
71. Waterway Adequacy: 4 Tolerable
72. Approach Alignment: 6 Equal Min Criteria
113. Scour Critical: 7 Countermeasures

200c. Temperature: 45
200d. Weather: CLEAR
201. Structural Steel ASTM Desig.: -1 -1
202. Waterproof Membrane : -1
Date Installed : 1/1/1901
203. Type Exp. Dev. : Sliding Plate
-
204. Type of Handrail: Steel Post and Rail
205. Material and Quantity : 10.0
208. Type of Abutment : Pedestal
Type of Foundation : Natural Foundation Matl.
209. Type of Pier / Found.: 2 Piers Yes
No Piling or Drilled Shaft
210. Foundation Elev. -1.0 -3.0
-3.0 -3.0 -1.0
211. Wear. Surf. Prot. System : None
Date Installed : 1/1/1901
213. Utilities Attached : -1
-1 -1 -1
-1 -1 -1

214a. Posted Weight Limit: NR
b. Posted Speed Limit : -1
c. Narrow/One Lane Bridge sign : -1
d. Vertical Clearance Sign: NO
Advanced Warning Sign : NO
Exisiting/Recommended Posting : -1 -1
Min./ Max Vert. Clearance : -1 -1
e. Navigation Lights : NO
Working/Not Working : NO
215. Overpass : C - US Highway
221. Substructure Cond. (U/W) : -
222. Fill over RCB: -1
223. Appr. Slab/Rdwy Cond.: Satisfactory
224. Critical Feature Type: 1
225. Paint Type : Red Lead Ready
Overcoat : 0
226. Date Painted: -1
227. Paint Coloring: Silver
233. Deck Forming: -
236. Deck Cleaning : -1
238. School Bus Rte: Current and Desired Route
240. Appr. Roadway Type: Concrete

243. Girder Spacing/Number : -1.0 / -1
244. Span Lengths :
-1 -1 -1
-1 -1 -1
-1 -1
245. Girder Depth : 48.000
246. Type of Overlay : AC Over
246. Overlay Thickness : 3.0
246. Overlay Date : 12/4/2003
246. Overlay Depth Changed > 1"? _
247. Protective Systems : 1: _
2: _ 3: _
4: _ 5: _
248. No. of Field Splices w/ Corrosion : -1
249. Scour Crit. POA exists?: _
250. Culvert Headwall Dist.: -1.0
254. Thru Truss Type : _
256. Chan. Profile Up/Down Stream?: _
257a. OkiePROS Auto. Truck Routing Yes
258. Plans w/ found. are in file at ODOT
259. Scour Eval. is in file at ODOT
263. Interchange at Intersection N
264. Interstate Milepoint -1.00

OKLAHOMA DEPARTMENT OF TRANSPORTATION - Bridge Inspection Report

NBI No.: **04085** Structure No.: 0902 0000 X Local ID:-1

Suff. Rating: 34.9 SD

Health Index : 62.9

Inspection Date:	11/20/2013	Reported By:	DPOORMAN
Invoice No.:	-1	Inspected With:	-1
		Agency :	

Dale Poorman

Digitally signed by Dale Poorman
DN: cn=Dale Poorman, o=Burgess Niple, Inc., ou, email=dale.poorman@burgessniple.com, c=US
Date: 2013.12.20 12:33:25 -05'00'

Structure / Inspection Notes

(38) 100-foot pony trusses with (2) 36-foot beam approach spans.
O/S Inspection Items: Inspect cracks in stringer web copes*, stringer connection angles*, floor beams web copes*, lower chord gusset plates above bearings* for growth; Stringer connections at end floor beams for additional loss or broken rivets*; Pier beams and supplemental pier beams at piers 1 and 39 for distress; Sweep in end floor beams where stiff leg repairs have not been installed*; Misalignment of WU1U2 sp 37; Stringer 5 section loss at end floor beams.
*(See attached tables to 04085(2013-11-20)FC.pdf for specific locations)

C X – Install stiff leg column support to end floor beams over pier 38. Email discussing C X issues was sent to Wes Kellogg and Chris Harlin on 11/21/2013.
PX – Reinforce the damaged concrete bridge railing in spans 1 and 40; Seal cracks in the asphalt wearing surface; Reinstall missing elastomeric pads/shims under beams at supplemental pier beams over piers 1 and 39; Drill crack tips in stringers and floor beams that grow significantly; Repair cracks in stringer connection angles by adding seat brackets below stringer; Repair section loss in stringer and floor beam webs where corrosion holes and/or heavy section loss exists; Reposition rotated shim plate at pier 26 stiff leg; Strengthen the horizontal shear planes of the end lower chord gusset plates at east L0 in spans 2 and 20 and east L5 in span 29; Replace sheared rivets in the vertical connection, upper chord, and end post at west U1 in spans 31 and 37; Grind out notches and cuts in inboard flange and gusset plate at west U1L2, span 31; Removing pack rust and caulk/paint along edges of end gusset plates; Cleaning and painting steel below deck within 5 feet of the joints; Add rip rap around pier 9; Install pressure relief joints in both approaches.
FX – Monitor: Pack rust/section loss in truss members at railing connections; Deck, joints, and end floor beams for further distress due to possible deck growth; Spalls/reinforcing in soffit spalls for further deterioration; Cracks at floor beam copes for growth; Stitch welds for strengthening angle at floor beam 0, span 2 for cracking; Corrosion holes through the floor bracing gusset plates for cracks; Bowed members near west U1, span 37 for distress; Impact damage on upper chord and truss web members for additional misalignment and development of cracks; Bowed gusset plates near bearings for distress; Lower chord section loss at floor system bracing connections, splices, and adjacent to stay/batten plates; Bullet strike damage to east truss span 4 members/gusse

Elm.	Env.	Description	Un.	Qty.	Qty.St. 1	% 1	Qty.St. 2	% 2	Qty.St. 3	% 3	Qty.St. 4	% 4	Qty.St. 5	% 5
12	4	Reinforced Concrete Deck	(SF)	94,488	0	0 %	0	0 %	94,488	100 %	0	0 %	0	0 %
107	4	Steel Open Girder Beam	(LF)	259	181	70 %	78	30 %	0	0 %	0	0 %	0	0 %
113	4	Steel Stringer/Floorbeam	(LF)	9,501	0	0 %	6,176	65 %	3,325	35 %	0	0 %	0	0 %
120	4	Steel Truss (Pony)	(LF)	7,600	0	0 %	4,940	65 %	2,660	35 %	0	0 %	0	0 %
152	4	Steel Floor Beam	(LF)	6,155	2	0 %	3,853	63 %	2,300	37 %	0	0 %	0	0 %
162	1	Steel Gusset Plate	(EA)	1,672	0	0 %	760	45 %	912	55 %	0	0 %	0	0 %
205	4	Reinforced Conc Column or Pile Extension	(EA)	78	0	0 %	77	99 %	1	1 %	0	0 %	0	0 %
215	4	Reinforced Conc Abutment	(LF)	49	25	50 %	25	50 %	0	0 %	0	0 %	0	0 %
301	4	Pourable Joint Seal	(LF)	495	0	0 %	0	0 %	495	100 %	0	0 %	0	0 %
310	1	Elastomeric Bearing	(EA)	4	4	100 %	0	0 %	0	0 %	0	0 %	0	0 %
311	4	Moveable Bearing (roller, sliding, etc.)	(EA)	86	0	0 %	61	71 %	25	29 %	0	0 %	0	0 %
313	4	Fixed Bearing	(EA)	84	0	0 %	84	100 %	0	0 %	0	0 %	0	0 %
330	4	Metal Bridge Railing	(LF)	7,600	0	0 %	7,220	95 %	380	5 %	0	0 %	0	0 %
331	1	Reinforced Conc Bridge Railing	(LF)	144	21	15 %	7	5 %	80	56 %	36	25 %	0	0 %
356	1	Steel Cracking/Fatigue	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
357	4	Pack Rust	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
359	1	Concrete Efflorescence	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
361	1	Scour	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
362	1	Superstructure Traffic Impact	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
363	4	Steel Section Loss	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
364	1	Steel Out-Of-Plane Compression Members	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
510	4	Wearing Surfaces	(SF)	94,488	75,590	80 %	9,449	10 %	9,449	10 %	0	0 %	0	0 %
515	4	Steel (Superstructure) Protective Coating	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
659	4	Soffit of Concrete Decks and Slabs	(EA)	1	0	0 %	0	0 %	1	100 %	0	0 %	0	0 %
763	1	Steel Pier Beam	(LF)	114	0	0 %	57	50 %	57	50 %	0	0 %	0	0 %
765	4	Steel Open Girder/Beam End (5 Ft.)	(LF)	100	0	0 %	80	80 %	20	20 %	0	0 %	0	0 %
777	4	Steel Stringer End (5 Ft.)	(LF)	9,501	0	0 %	4,751	50 %	4,751	50 %	0	0 %	0	0 %
909	4	Pourable Fixed Joint Seal	(LF)	495	0	0 %	0	0 %	495	100 %	0	0 %	0	0 %
965	4	Debris	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
969	1	Out-Of-Plane Distortion/Loading	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %

Additional Elements

Elem.	Element Notes (Include Size and Location of Deterioration
12	PX-Unsealed cracks in wearing surface; FX-Deck growing in each span causing rotation/sweep in floor beams; Spalls/deteriorated concrete in underside along curb line.
107	PX- Connection angles for the steel beams to pier beam 39 are deformed due to the pavement growth. Patches of surface corrosion exists on top flanges of exterior beams. Exterior beams at abutments have sheared anchor bolts.
113	PX- Cracks were observed in the web of numerous stringers at the top flange cope, see FC report for locations; Cracks in the stringer connection angles were observed at numerous locaations at the end floor beams, see FC report for locations; Severe section loss with corrosion holes exists through exterior stringer webs.
120	PX- West U1U2, span 31, has multiple sheared rivets from bottom lacing; FX- West U1U2, span 37, has 1/4" global bow eastward; Impact damage exists on the inboard flanges of the uppoer chord; Lower chord gusset plates are typical bowed at L0 and L5; Corrosion of lower chord is common at the floor beam/ lower lateral bracing gusset plate connection; Corrosion is common around inboard splice plates at L2 and L3; Pack rust exists between the stay, batten plates, and channels of the lower chord.
152	C X- End floor beams of truss spans have a sweep in the bottom flange, most of these are retrofitted with stiff legs except for those at pier 38; PX- Active section loss on floor beams at ends and under joints; Stiff leg shim plate under floor beam 5 at pier 26 is rotating out underneath the floorbeam bottom flange; FX-Numerous cracks in web between top flange and truss connection angle of end floor beams; Floor beam 0 of span 2 strengthened by stitch welding steel sections to the bottom flange.

Elem.	Element Notes (Include Size and Location of Deterioration
162	PX- Numerous horizontal cracks were observed in the inboard truss gusset plates above the bearings, see report for locations and crack lengths; FX-LC inboard gusset plates typically bowed at L0 and L5 due to pack rust; Gunshot damage to east truss outboard gusset plate at U2L3 and L2U3; 5/16" long crack in inboard gusset plate and 2 sheared rivet heads at west U1, span 37; 1' and 1 7/8" deep gouges in inboard gusset plate at west U1, span 31.
205	FX-East column pier 3 has 1" wide crack in seat. Gunshot damage typical in piers 1 through 8. Cracks and spalls in web wall.
215	Accumulations of bat guano on bearing seats.
301	Previously noted spalls at elastomeric headers have been patched with asphalt.
310	PX- The elastomeric bearings that were installed between each approach span beam and the sister pier beam are rotated and twisted. The bearing pad under beam 3 is no longer in place. At pier beam 1, bearings are missing at beams 1 through 4 over the supplemental pier beam and the steel bearing at beam 5 is heavily pack rusted
311	FX-Truss bearings frozen, rotated towards joint with pack rust under bearing on face towards span.
313	No significant deficiencies.
330	FX- Pack rust is typical between the metal bridge railing, truss end posts and web members. Small cracks were observed in the railing where the flange and web have been coped.
331	PX- Severe collision damage exists to the concrete railing in spans 1 and 40, the north most concrete post in span 40 is spalled and cracked through at the base.
356	PX- Numerous cracks in stringer copes at end floor beams and a few in exterior stringers at interior floor beams; Numerous cracks in end floor beams at truss connection copes and a few in interior floor beams at truss connection copes. Numerous cracks in stringer connection angles and popped rivet heads on stringer connection angles at end floor beams. Cracks are worse at end floor beams over expansion bearings.
357	PX- Pack rust and loss causing cracks in lower chord gusset plate; FX- Pack rust is causing a bow in the lower chord gusset plates at end floorbeams.
359	Light efflorescence noted in deck underside.
361	PX - Local scour at pier 9 is 12 to 16 feet below the top of the cassion.
362	PX-Collision damage to end posts, upper chord, verticals and diagonals at numerous locations; West truss U1L2 span 31 has 50% of inboard flange cut.
363	PX- Corrosion holes through stringer webs, floor beam webs at numerous locations; FX- Corrosion of the lower chord has caused section loss on inboard top flange.
364	FX- West truss U1U2 and L0U1 in span 37 is bowed globally to the west. Several above deck truss members have local bends due to impact damage.
510	PX-Unsealed cracks in wearing surface; FX-Deck growing in each span causing rotation/sweep in floor beams; Spalls/deteriorated concrete in underside along curb line.
515	PX- Corrosion and minor to moderate section loss at many locations on the lower chord and floor system. Minor to moderate pack rust and minor section loss is common on gusset plate seems. Deck truss members show weathered and chalking paint.
659	FX - Spalls with exposed rebar at joints and isolated locations. Several full depth patches at joints and along east curb. Transverse cracks with efflorescence.
763	PX- The pier beams at piers 1 and 39 have been retrofitted with a supplemental pier beam due to severe sweep and roatation. Load primarilly carried by original pier beams with supplemental pier beam acting as a catcher beam.
765	Corrosion on the top flange of the end 1-3ft of each floor beam is common.
777	PX-Numerous web cope cracks, cracks in connection angles, corrosion holes/significant thinning of web mostly at end floor beams.
909	Joints paved over
965	A small amount of drift exists around the columns of pier 9.
969	C X: Sweep noted in floor beams over pier 38. Previous floor beam sweep has been repaired by adding stiff leg details. Pier beams sweep has been repaired by adding sister pier beams.

Poorman, Dale

From: Poorman, Dale
Sent: Thursday, November 21, 2013 10:43 PM
To: WKellogg@ODOT.ORG; charlin@odot.org
Cc: Cinadr, Ed
Subject: Bridge 04585 Recommended Repairs
Attachments: NBI 04085 Recommended Repairs.pdf

Wes/Chris,

During our inspection of the above referenced bridge we found two floor beams (both over pier 38) with a sweep of 3/8”. It appears that this information was obtained during the 2011 FC inspection but was omitted from the report.

The attached document also identifies:

- Stringer ends with significant section loss which are recommended to have welded plate repairs over the web.
- Horizontal cracks in the gusset plates over the bearings. These cracks were not observed in the 2011 inspection and are due to section loss and pack rust. The cracks which were repaired have grown in length up to 2 3/4".
- Broken rivet heads where the shank no longer extends through the shear plane between the floor beam web and the stringer connection.

Please contact me should you have any questions or comments. These issues will be discussed in the forthcoming fracture critical report.

Dale E. Poorman, PE
Burgess & Niple, Inc.
5085 Reed Road, Columbus, Ohio 43220
office – 1-800-282-1761 ext. 1364
mobile – 614-849-2278

RECOMMENDATIONS FOR REPAIR

Floor beams with sweep which have not been repaired with stiff leg retrofit exist at the following locations:

Span	Floor Beam	Over Pier	Sweep
38	5	38	3/8
39	0	38	3/8

Stringer loss needing welded plate repair:

Span	Stringer	Floor Beam/Face	Condition	Photo
10	5	0 north face	1/2” diameter corrosion hole with 1/8” deep average loss of web full height of web adjacent to the connection angle	Photo 1
16	5	0 north face	1/2” vertical x 1 1/2” horizontal corrosion hole, 5/8” long vertical crack and 1/8” deep average loss of web full height of web adjacent to the connection angle	Photo 2
21	5	5 south face	2 1/2” vertical x 1 1/2” horizontal corrosion hole with 3 7/8” long	Photo 3
18	5	0 north face	2 1/2” vertical x 1 1/2” horizontal corrosion hole with 3/16” deep loss of web over 7” vertical adjacent to the connection angle	Photo 4
24	5	0 north face	2” vertical x 10 1/2” horizontal corrosion hole in bottom of web with 3/8” to 1/4” deep loss full height of web adjacent to the connection angle	Photo 5
25	5	5 south face	1/8” deep average loss of web full height of web adjacent to the connection angle	Photo 6
31	5	5 south face	1 1/2” vertical x 1” horizontal and 1 1/4” vertical x 1” horizontal corrosion holes with 1/8” loss full height of web adjacent to the connection angle	Photo 7
36	5	0 north face	2 1/2” vertical x 1 1/4” horizontal corrosion hole with 7/8” long crack, 1/4” loss over 3” and 1/8” loss over the remainder of the web	Photo 8
38	5	0 north face	2” vertical x 3/4” horizontal corrosion hole with 1/8” deep loss of web full height of web adjacent to the connection angle	Photo 9
39	5	1 south face	1 1/16” long vertical crack with 1/8” deep loss of web full height of web adjacent to the connection angle	Photo 10

The stringers are 18” deep with a 5/16” thick web.

Horizontal cracks in the inboard gusset plate above the bearings exist at the following locations:

Span	Panel Point	Truss	Condition	Photo
2	L0	East	9 1/4” long crack	Photo 11
20	L0	East	3” long crack	Photo 12
29	L0	East	6 1/4” long crack	Photo 13

These cracks were not noted during the 2011 fracture critical inspection. Similar horizontal cracks which were repaired were observed to have grown up to 2 3/4” in length.

Broken rivet heads where the rivet shank is no longer effectively within the shear plane between the connection angle and the floor beam web exists at the following locations:

Span	Stringer	Floor Beam/Face	Condition	Photo
6	2	0 north face	1 rivet	
6	3	0 north face	1 rivet	
11	3	5 south face	2 rivets	Photo 14
14	2	0 north face	2 rivets	Photo 15
18	2	0 north face	2 rivets	Photo 16
25	4	5 south face	1 rivet	
38	2	0 north face	1 rivet	Photo 17
38	3	0 north face	1 rivet	

Photo 1

Photo 2

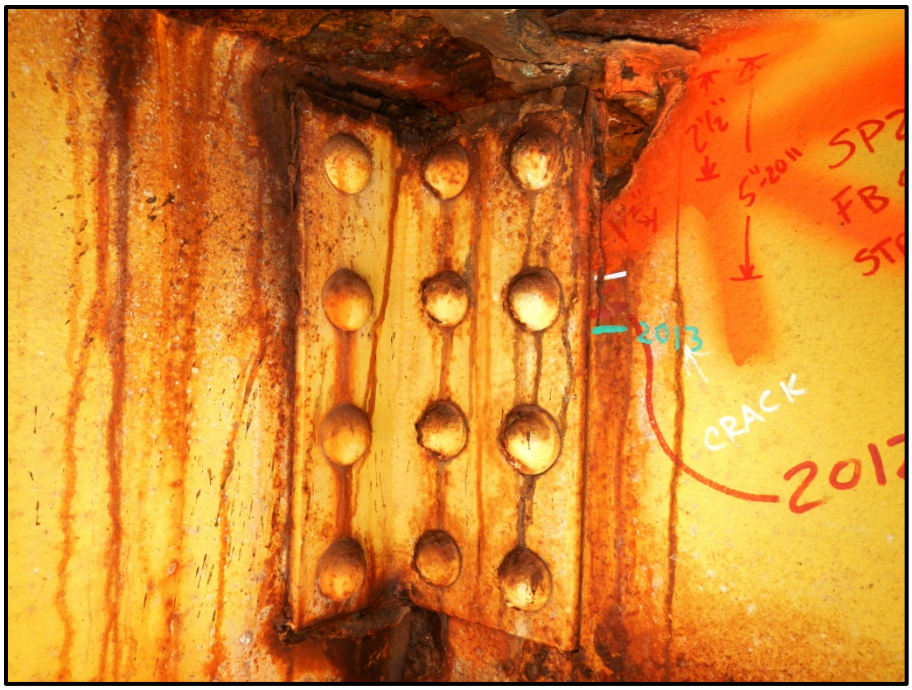


Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

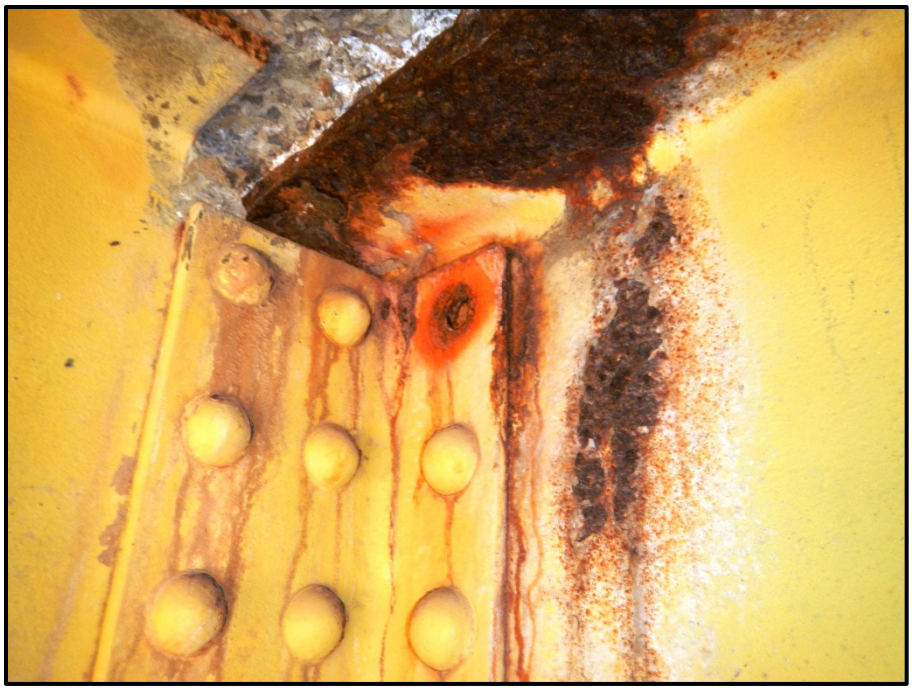


Photo 15

Photo 16

Photo 17

Appendix A: Stringer Cope Cracks

Span	Floor Beam	Floor Beam Face	Stringer	Length (in.)	Comment
2	0	North	5	7/8	
2	2	South	1	3/8	
2	4	South	1	1/8	
2	5	South	1	3/8	
3	0	North	1	1 1/4	
3	**0**	**North**	**5**	**1/2**	**1/8" growth**
3	5	South	1	3/8	
4	0	North	1	3/8	
4	2	South	5	1/4	
4	5	South	5	1 1/2 (drilled)	
5	0	North	5	1/2	
6	**2**	**North**	**1**	**1/8**	**New crack**
6	3	North	1	1/4	
7	0	North	5	2 1/4	
7	**5**	**South**	**1**	**1/2, 3/8**	**Two diagonal cracks**
7	5	South	5	3/4	
8	5	South	1	1 1/8	
9	1	North	1	1/4	
9	3	North	1	1/8	3/8" no growth from previous paint mark
9	3	South	1	3/8	
10	2	North	1	5/8	
10	5	South	5	7/8	
11	0	North	5	9/16	
12	**5**	**South**	**1**	**1 1/2**	**1-1/2" long crack splits into multiple cracks (up to 1-1/2" additional length, others 3/16" long).**
13	**5**	**South**	**5**	**5/8**	**1/8" growth**
14	**0**	**North**	**5**	**1 3/8**	**1/8" growth and 1/4" corrosion hole**
14	5	South	1	1 1/4	
15	0	North	1	1/8, 1/8	
16	4	North	5	1/2	
16	**5**	**South**	**5**	**1/4**	**New crack**
17	0	North	5	1	
17	3	North	1	1/16	
18	0	North	1	1/2	
18	2	South	1	3/8	
18	5	South	1	3/4	
19	0	North	5	1/2	
19	5	South	3	1/4	
19	**5**	**South**	**5**	**1-1/4**	**1/4" growth**
20	1	North	5	1/8	
20	2	North	1	1/2	
20	2	South	1	3/4	
20	4	North	5	1/8	
20	5	South	1	1/8	

* Bolded and highlighted rows show new or changed comments.

Appendix A: Stringer Cope Cracks

Span	Floor Beam	Floor Beam Face	Stringer	Length (in.)	Comment
21	**0**	**North**	**5**	**7/8**	**1/8" growth**
21	**3**	**North**	**1**	**1/8**	**New crack**
21	4	South	1	1/8	
23	**1**	**South**	**5**	**3/16**	**New crack**
25	0	North	5	3/4	
25	2	South	1	1/4	
26	3	North	1	3/16	
26	5	South	1	2 1/2	
27	1	North	1	3/8	
27	**1**	**South**	**1**	**3/8**	**New crack**
27	**1**	**South**	**5**	**1/4**	**1/8" growth**
27	2	South	1	3/16	
28	1	North	1	3/16	
28	2	North	1	5/8	
28	2	South	1	1/4	
28	**2**	**North**	**1**	**1/2**	**New crack**
28	5	South	1	5/8	
30	1	South	5	1/2	
30	4	North	5	1/2	On east face of stringer, crack measures 1/4"
31	2	North	1	1/4	
32	2	South	1	1/4	
32	4	South	1	1/4	
32	5	South	1	1/4	
32	**0**	**North**	**5**	**1/2**	**New crack**
33	**2**	**South**	**1**	**1/8**	**New crack**
33	5	South	1	1 1/8	
34	1	South	1	1/4	
34	2	South	1	1/4	
34	5	South	1	1/2	
35	0	North	1	1/2	
35	4	South	1	1/8	
36	2	South	1	3/4	
36	**0**	**North**	**1**	**1/4**	**New crack**
37	0	North	5	1/2	
37	3	North	1	1/4	
38	2	North	1	3/4	
38	2	South	1	5/8	
38	5	South	1	1/2	
39	**1**	**North**	**1**	**1/8**	**New crack**
39	1	South	1	1/2	
39	3	South	1	3/8	

* Bolded and highlighted rows show new or changed comments.

Appendix B: Stringer Connection Cracks

Span	Floor Beam	Floor Beam Face	Stringer	Stringer Face	Length (in.)	Comment
2	0	North	2	West	3 1/4	
3	5	South	4	West	2 1/2	
4	0	North	2	West	3	
5	5	South	3	East	3 1/4	
8	0	North	3	West	3 1/2	
9	**5**	**South**	**3**	**East**	**1 1/4**	**New crack**
9	5	South	3	West	3 1/2	
10	0	North	3	West	3	
12	0	North	2	East	3	
13	5	South	4	East	4	
15	5	South	4	West	3 5/8	
17	5	South	4	East	4 3/4	
18	**0**	**North**	**3**	**East**	**2 3/4**	**1/4" growth**
18	0	North	4	East	2 3/4	
22	0	North	1	East	3 3/4	
22	0	North	3	East	3 1/2	
22	0	North	4	East	2 3/4	
23	5	South	4	West	3 1/2	
24	0	North	2	West	2 3/4	
24	0	North	3	East	4	
24	0	North	3	West	4	
24	0	North	4	East	3 1/4	
25	5	South	2	West	3 1/4	
25	5	South	3	West	4 1/2	
25	5	South	4	West	3 1/2	
25	5	South	5	West	6	
26	0	North	2	East	2 3/4	
26	0	North	2	West	3 1/4	
26	0	North	3	East	5 3/8	
26	0	North	3	West	2 3/8	
26	**0**	**North**	**4**	**East**	**3 1/2**	**1/4" growth**
27	5	South	3	East	2 1/2	
27	5	South	3	West	3 3/4	
27	5	South	4	West	4 1/4	
28	0	North	2	East	4	
28	0	North	3	East	3 3/4	
29	5	South	3	West	4	
29	5	South	4	East	1 1/2	
30	0	North	2	East	5 5/8	
30	0	North	3	East	4 1/2	
30	0	North	4	East	3 1/2	
30	**1**	**South**	**5**	**West**	**9/16**	**New crack**
31	5	South	4	East	3 3/4	

* Bolded and highlighted rows show new or changed comments.

Appendix B: Stringer Connection Cracks

Span	Floor Beam	Floor Beam Face	Stringer	Stringer Face	Length (in.)	Comment
31	5	South	4	West	6 1/8	
33	5	South	3	West	4	
33	5	South	4	West	7	
34	0	North	2	East	3 1/2	
34	0	North	2	West	2	
34	0	North	3	West	2 1/4	
34	5	South	5	West	4 1/2	
35	5	South	3	West	4 1/4	
35	5	South	4	West	4	
36	0	North	2	West	2 7/8	
36	0	North	3	West	2	
36	0	North	4	East	4	
38	0	North	2	West	2 1/8	
38	0	North	3	West	2 1/2	
39	**5**	**South**	**4**	**West**	**4 5/8**	**1/8" growth**

* Bolded and highlighted rows show new or changed comments.

Appendix C: Missing Stringer Rivets

Span	Floor Beam	Floor Beam Face	Stringer	Number	Comment
2	0	North	2	1	All shanks still in shear plane unless noted otherwise.
2	0	North	3	2	
4	0	North	2	1	
4	1	South	2	1	
4	3	South	3	1	
5	1	North	2	1	
5	1	North	3	1	
5	2	North	2	1	
5	5	South	4	1	
6	0	North	2	2	East rivet shank no longer in shear plane.
6	0	North	3	1	East rivet shank no longer in shear plane.
6	1	North	2	1	
6	2	North	2	2	
7	1	North	2	1	
7	2	North	2	2	
7	2	North	3	1	
7	5	South	3	2	
7	5	South	4	2	
8	0	North	2	2	
8	0	North	3	1	Rivet shank is welded to connection angle
8	1	North	2	1	
9	1	North	2	2	
9	4	South	4	1	
9	5	South	4	2	
10	0	North	2	2	
10	0	North	3	1	
10	1	North	2	2	
10	1	North	3	2	
10	4	South	4	1	
11	1	North	2	1	
11	4	South	4	2	
11	5	South	3	2	Both shanks not in shear plane.
11	5	South	4	2	
12	0	North	3	2	
12	0	North	4	1	
13	2	North	2	2	
14	0	North	2	2	Both shanks not in shear plane.
15	5	South	3	2	
15	5	South	4	1	
16	0	North	2	2	
16	**0**	**North**	**3**	**1**	
17	5	South	4	1	
18	0	North	2	2	Both shanks not in shear plane.

* Bolded and highlighted rows show new or changed comments.

Appendix C: Missing Stringer Rivets

Span	Floor Beam	Floor Beam Face	Stringer	Number	Comment
18	0	North	3	1	
18	4	South	3	1	
20	0	North	1	1	
20	0	North	2	1	
22	**0**	**North**	**2**	**2**	**Previously only 1**
22	0	North	3	1	
23	2	North	2	1	
23	4	North	4	1	
24	0	North	2	2	
24	4	South	4	2	
25	2	North	2	1	
25	5	South	4	1	Shank not in shear plane.
26	0	North	2	1	
28	**1**	**North**	**2**	**1**	
29	1	North	2	2	
30	0	North	3	1	
31	5	South	3	2	
32	0	North	2	2	
32	0	North	3	1	
33	1	North	2	1	
33	5	South	3	1	
34	0	North	3	1	
34	1	North	2	1	
34	1	North	3	1	
35	2	North	2	2	
35	4	South	4	1	
35	5	South	3	2	
35	5	South	4	1	
36	0	North	2	1	
36	0	North	3	1	
36	1	North	2	2	
36	1	North	3	2	
36	4	South	3	1	
37	1	North	2	1	
37	2	North	2	1	
37	5	South	3	2	
37	5	South	4	1	
38	0	North	2	2	Shank no longer in shear plane, east connection angle.
38	0	North	3	2	Shank no longer in shear plane, east connection angle.
38	1	North	2	1	
39	5	South	3	1	

* Bolded and highlighted rows show new or changed comments.

Appendix D: Stringer Loss

Span	Floor Beam	Floor Beam Face	Stringer	Description
2	0	North	1	3/4" diameter
4	0	North	5	1 1/4" diameter with 1/4"crack
5	**5**	**South**	**5**	**1" diameter with horizontal crack, 1/2"L, and vertical crack, 3/8"L**
6	**0**	**North**	**1**	**1-1/2 " diameter with vertical crack, 3/4"**
6	**0**	**South**	**5**	**1 3/8" diameter, 1/4" vertical crack**
9	1	South	5	2 1/4" x 1"
9	**5**	**South**	**1**	**2 3/4"H x 1" with 3/8" vertical crack and 3/8" diagonal crack**
9	**5**	**South**	**5**	**1" x 1 1/4" with 1/8" crack.**
10	**0**	**North**	**5**	**1/2" diameter hole with 3"H x 3/16", 4"H x 1/8", and 3"H x 1/16" pitting extending below the hole**
11	5	South	5	5/8" diameter with 7/8" long crack
12	**0**	**North**	**1**	**1" diameter with 1/4" vertical crack.**
12	**0**	**North**	**5**	**1-1/8"H x 5/8"**
12	**1**	**North**	**5**	**1"H x 3/4"W**
13	5	South	1	1 1/2"x 5/8" with 1/8" loss over top half of web depth, outboard face (20% total web loss).
15	5	South	5	7/8" diameter at cope & 1" diameter below connection angle
16	0	North	5	4-1/4"H x 1-1/2" hole with two cracks (5/8" & 1/4")
17	4	North	5	2 1/2" x 1" with 3/8" long crack
17	**5**	**South**	**1**	**Two holes: 1 1/2"W x 1/2"H and 1/2"H hole with 5/8" crack**
17	5	South	5	2 1/4"H x 1" with 1/2" long crack
18	**0**	**North**	**5**	**2 1/2"H x 1"W hole with 3/16" pitting for 7"H**
19	**5**	**South**	**1**	**1/2" hole with 3/4" crack**
19	5	South	5	7 1/2"W x 4"H
20	0	North	5	1 1/4" diameter
21	5	South	1	1 1/4" x 1/4"
21	**5**	**South**	**5**	**2 1/2"H x 1 1/2"W with 3-7/8" long crack**
22	0	North	1	2" x 1/2"
23	5	South	5	2 3/4"H x 1/2"W
24	**0**	**North**	**1**	**1"H x 1/2" W with 3/16" max pitting over 6" below hole**
24	**0**	**North**	**5**	**10 1/2"W x 2"H with 1/16-1/8" remaining full height at edge of connection angle**
24	5	South	5	1" diameter
25	**2**	**North**	**5**	**1/2" diameter**
25	**5**	**South**	**1**	**2"H x 5/8"W with 5/8" crack**
25	**5**	**South**	**5**	**1/8" section loss, full height.**
26	0	North	1	1/2" diameter
26	0	North	5	2" x 1/2"
27	**5**	**South**	**1**	**3"H X 1"W with 1" horizontal crack and 3/16" vertical crack**
29	**4**	**South**	**5**	**5/8" dia corrosion hole in stringer cope**

* Bolded and highlighted rows show new or changed comments.

Appendix D: Stringer Loss

Span	Floor Beam	Floor Beam Face	Stringer	Description
29	**5**	**South**	**5**	**1 1/2"H X 1"W with two cracks, 1" crack extends cope to hole & 1" crack below hole**
30	0	North	5	1 1/2" x 1 1/2"
31	5	South	5	1 1/2" H x 1" W & 1 1/4" H x 1" W
34	3	South	5	3" H x 3/4" W
34	4	South	5	1" x 1 1/4"
35	5	South	5	5" W X 1 3/4" H
36	**0**	**North**	**5**	**2-1/2" H x 1-1/4" W with 7/8" vertical crack. Also, 1/4" pitting for 3" H and 1/8" pitting for remaining height. Approx 50% section loss to this location. Heavy rivet head loss on stringer connection rivets on outside face due to laminating corrosion. Additional corrosion hole is 3" W x 1-1/4"H in lower web of stringer.**
38	**0**	**North**	**5**	**2"H x 3/4"H hole at cope with 1/8" average (3/16" max) section loss full height on outboard face**
38	**5**	**South**	**5**	**1 1/2"H X 4 1/2"W below connection angle and 1/2" cope crack**
39	0	North	5	1/4" X 1/2"
39	**1**	**South**	**5**	**1/2"H x 1/4"W hole within 1-1/16" crack at cope, also 1/8" average full height section loss.**
39	5	South	1	1" diameter with 1/2" crack

* Bolded and highlighted rows show new or changed comments.

Appendix E: Floor Beam Sweep

Span	Floor Beam	North / South	Sweep	Stiff Leg	Comment
1	pier 1			N	Sister pier girder added due to severe sweep
2	0			N	
2	5			N	
3	0	North	1/2	Y	
3	5	South	1/4	Y	
4	0	North	1/4	Y	
4	5	South	1/4	Y	
5	0	North	3/4	Y	
5	5			N	
6	0			N	
6	5	South	1/2	Y	
7	0	North	1/2	Y	
7	5			N	
8	0	North	1/4	Y	
8	5	South	1/2	Y	
9	0	North	3/8	Y	
9	5			N	
10	0			N	
10	5	South	1/2	Y	
11	0	North	5/8	Y	
11	5	South		N	
12	0	North	1/4	Y	
12	5	South	5/8	Y	
13	0	North	1/2	Y	
13	5	South	3/16	Y	
14	0	North	5/8	Y	
14	5	South	1/2	Y	
15	0	North	5/8	Y	
15	5	South	3/16	Y	
16	0	North	3/16	N	No change. No stiff leg at floor beam.
16	5	South	3/4	Y	
17	0	North	1/2	Y	
17	5	South	1/4	Y	
18	0	North	5/16	Y	
18	5	South	3/4	Y	
19	0	North	5/8	Y	
19	5			N	
20	0			N	
20	5	South	7/8	Y	
21	0	North	5/8	Y	

* Bolded and highlighted rows show new or changed comments.

Appendix E: Floor Beam Sweep

Span	Floor Beam	North / South	Sweep	Stiff Leg	Comment
21	5	North		N	
22	0	North	1/4	Y	
22	5	South	1/8	N	No stiff leg at floor beam.
23	0	North	1/2	Y	
23	5			Y	
24	0	North	1/4	Y	
24	5	South	3/4	Y	
25	0	North	3/8	Y	
25	5			N	
26	0	North	3/8	Y	
26	5	South	1/2	Y	
27	0	North	3/4	Y	
27	5	South	5/8	Y	
28	0	North	1/2	Y	
28	5	South	3/4	Y	
29	0	North	3/4	Y	
29	5			N	
30	0			N	
30	5	South	7/8	Y	
31	0	North	1/2	Y	
31	5			N	
32	0			N	
32	5	South	3/4	Y	
33	0	North	3/8	Y	
33	5			N	
34	0			N	
34	5	South	3/4	Y	
35	0	North	1/2	Y	
35	5			N	
36	0			N	
36	5	South	5/8	Y	
37	0	North	1/2	Y	
37	5			N	
38	0			N	
38	**5**	**South**	**3/8**	**N**	**CX - Add Stiff Leg**
39	**0**	**North**	**3/8**	**N**	**CX - Add Stiff Leg**
39	5			N	
40	pier 39				Sister pier girder added due to severe sweep

* Bolded and highlighted rows show new or changed comments.

Appendix F: Floor Beam Loss

Span	Floor Beam	Location	Comment
3	**5**	**Between stringers 3 and 4**	**1 1/2" diameter**
4	0	At stringer 4	14" L x 1" H
5	5	Between stringers 3 and 4	2" H x 1" W
5	5	Between stringers 1 and 2	3/4" diameter and 1" H x 2" W
6	0	Between stringers 3 and 4	1" H x 14" W
6	**0**	**Between stringers 1 and 2**	**6" W x 1-1/4" H**
7	2	At E Truss	1/2" U-shaped corrosion hole with crack.
11	**5**	**Between stringers 4 and 5**	**5 through holes, 4"Hx1-1/2" and four 3/8" diameter**
11	**5**	**Near stringer 3**	**4 1/2" W x 1 1/2" H**
12	0	Near stringer 4	1.5" W x 1" H, 3.5" W x 3/4" H, 2.5" W x 1" H
12	3	At E Truss	1" H x 1/2" W
15	3	At E Truss	9/16" diameter with 1/4" corrosion crack
15	4	At E Truss	1/2"W x 1/4"H corrosion hole in floor beam cope.
15	5	Between stringers 1 and 2	6" W x 2" H
16	**4**	**East truss**	**3-1/2"H x 4-1/4"W**
18	**2**	**At E Truss**	**1"H x 5/8"W, with 3/4" crack, with 1/4" diameter corrosion hole.**
22	**5**	**Near stringer 4**	**1-1/2" W x 3/4" H in lower web**
23	**0**	**At E truss**	**1-1/8" H x 5/8" W in lower web**
24	0	Between stringer 1 & west truss	3/4" diameter in lower web
25	**2**	**At E Truss**	**2 5/8" H x 1 3/4" W corrosion hole in floor beam cope**
26	**3**	**At E Truss**	**1/2" corrosion hole in floor beam cope**
27	**0**	**Between stringer 1-2**	**1-3/4"W x 1"H**
27	1	At W Truss	2" diam.
27	2	At E Truss	1 1/4" H x 1" W
28	3	At stringer 5	4" H x 3/4" W
29	**5**	**Between stringers 2-3**	**2-1/4" W x3/4" H**
37	**5**	**Between stringers 4 and 5**	**3/4" H X 2" W, multiple holes (3/4"H x 12"W)**
38	0	At east truss connection	1 1/4" H x 3/4" W
38	0	Between stringers 4 and 5	3 corrosion holes between: 1" H x 5" W, 1" H x 1" W, 1" H x 1 1/2" W

* Bolded and highlighted rows show new or changed comments.

Appendix G: Floor Beam Cracks

Span	Truss	Floor Beam	Length (inch)
2	**East**	**0**	**2 1/4**
2	West	5	1 3/8
3	East	5	3 1/8
3	**West**	**5**	**1 1/2**
4	East	0	5
4	West	0	3
5	**West**	**3**	**1/4**
5	East	5	3
5	West	5	1
6	East	0	8
6	West	0	1 1/4
7	West	0	7/8
7	East	5	3
7	West	5	1 5/8
8	East	0	6 1/8
8	West	0	3 7/8
9	East	5	3
9	West	5	2 1/2
10	East	0	6 5/8
10	West	0	3
11	East	5	3
11	West	5	2 1/2
12	East	0	1 7/8
12	West	0	1 11/16
13	East	5	2 1/2
13	West	5	1 1/4
14	East	0	5 7/16
14	West	0	2 9/16, 1 5/8
14	East	1	7/16
15	**East**	**5**	**4 3/4 with 3/16 lateral offset**
15	**East**	**3**	**1/4**
16	East	0	3 3/4
16	West	0	3 5/8
16	East	1	1/2
16	West	1	1/2
17	**East**	**4**	**3/8**
17	West	4	1/2
17	East	5	3
17	West	5	3 1/8
18	East	0	5 1/8

Span	Truss	Floor Beam	Length (inch)
18	West	0	3 3/8
18	**East**	**2**	**3/4**
19	**East**	**5**	**1 3/8**
19	West	5	2 1/8
20	East	0	6 3/8
20	West	0	1 3/4
20	East	2	1/8
21	East	5	1 1/4
21	West	5	1 5/8
22	East	0	3 3/4 with 5/16 lateral offset in web
22	West	0	5 1/4
22	West	1	3/8
23	East	5	4
23	West	5	3/4
24	East	0	4
24	West	0	4 5/8
24	**East**	**1**	**3/4**
24	East	2	5/8
25	East	5	6 1/4
26	East	0	4 1/4
26	West	0	2 1/4
27	East	5	1 1/4
28	East	2	3/16
29	East	4	3/8
29	**East**	**5**	**Two cracks: 4 7/8 & unk (continues under connection angle)**
29	West	5	5/8
30	East	0	1 5/8
30	West	0	5/8
30	**West**	**1**	**3/8**
30	East	2	1
31	East	5	4 1/4
31	**West**	**5**	**1**
32	East	0	2
32	West	0	5/8
33	East	3	1/8 with 3/8 dia corrosion hole
33	East	5	3 1/4

* Bolded and highlighted rows show new or changed comments.

Appendix G: Floor Beam Cracks

Span	Truss	Floor Beam	Length (inch)
34	East	0	2
35	East	3	1/4
35	East	5	2 3/4
35	West	5	3 1/8
36	East	0	2 1/4
36	West	0	1 3/8
36	West	1	3/8
37	East	5	2
37	West	5	1 3/4
38	**East**	**0**	**9 with 3/8 lateral offset**
38	West	0	3 1/2
38	West	1	3/8
38	**East**	**2**	**9/16 vertical with 1/4 horizontal**
38	West	4	1/8
39	**West**	**1**	**1/8**
39	**East**	**4**	**1/4**
39	West	4	1/4
39	East	5	3
39	West	5	1 1/2

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