



In-depth Fracture Critical and Routine Inspection Report

Structure: K-18-R
Crossing: Arkansas River
Route: US 50 Business East-Bound
County: Pueblo
State: Colorado



Prepared for:
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Transportation, HQ Staff Bridge
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Inspection Date:
March 11, 2014

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Executive Summary

Stantec Consulting Services Inc. (Stantec) performed an in-depth fracture critical and routine inspection of the US 50 Business route truss bridge K-18-R, owned, maintained, and operated by the Colorado Department of Transportation (CDOT) from March 11, 2014 to March 14, 2014. The deck and superstructure remain in Poor Condition (FHWA Items 58 and 59 = 4). Evidence of continued corrosion and increases in section loss to fracture critical members, with reference to the 2012 inspection, were observed but not to an extent to significantly alter previous recommendations for repair and maintenance. It is believed that timely maintenance and rehabilitation of the structure may arrest much of the ongoing deterioration and extend the life of the bridge.

The corrosion and deterioration of K-18-R are concentrated at the exterior (left and right) members, most notably on the top flanges of Stringers A and H, left and right portions of the floorbeams, lower lateral bracings and their gusset plate connections, and lower chord splice batten and stay plates. These problem areas stem from poor drainage, debris collection and deck deterioration allowing moisture to collect and corrode the aforementioned members. This corrosion ultimately reduces the cross section of the steel members, weakening them and lowering the overall capacity of the structure.

Along with corrosion and section loss to steel members of the truss, the nested rocker bearing assemblies which are designed to allow the structure to expand and contract during variations of temperature and load are no longer functioning. The current condition of the bearings is likely due to infiltration of dirt and debris from the once failed expansion joint at Abutment 2 which has caused the retaining bars to corrode and fail, in-turn allowing the individual rockers to move out of alignment. The current fixed condition of the bearings causes the truss members to absorb expansions and contractions of the structure adding additional stress and fatigue to these members and likely shortening the lifespan of the structure.

It is recommended that the bridge receive a new load rating based on the reduced section properties of the exterior stringers, floorbeams, portions of the lower chords, lower lateral bracings and gusset plates as stated in the report and detailed within the sketches in Appendix D. Some consideration in the rating should also be given to the poor condition of the deck where areas of spalling concrete, corroded reinforcement and saturated conditions justify a lower compressive strength value and reduced composite action contribution.

To prolong the life of structure K-18-R, the continued corrosion of the steel members must be mitigated. It is recommended that the deck drains along the east side of the structure be opened (paved over at present) and that all drains be retrofitted with extensions to divert water, dirt and debris away from floor system members. The cracking in the asphalt surface should be repaired either by milling down to concrete deck, placing a waterproof membrane and re-

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overlay or by sealing all cracks and potholes. This will limit the amount of water infiltration through the deck and will direct it through the intended drains and away from the steel floor system. A thorough cleaning of the lower chord panel points and splices, lower lateral bracing gusset plates and all other portions of the structure collecting debris will further lessen the ongoing corrosion and extend the life of the structure. Abutment 1 and 2 bearing seats should also be cleaned of dirt and debris to limit further deterioration of the bearings and floorbeams at these locations.

In order to significantly extend the life of the structure, major rehabilitation must be performed. Ultimately, it is recommended that a full deck replacement be performed to halt moisture infiltration through to the stringers and floorbeams. During this process, all steel truss members will need to be cleaned and painted to arrest continued corrosion. Although all steel truss members need a thorough cleaning and painting, the lower chord panel points should take priority. Steel members with significant section loss, as noted in the report, will need to be wholly or partially replaced.

Lower chord rivets with section loss to the rivet head to the degree that the rivet is no longer adequately restrained within its connecting member should be replaced with high strength bolts. Refer to the list of rivets for replacement and respective locations within Appendix D. Several gusset plates to the lower lateral bracings and lower chord splice plates with significant section loss should be considered for replacement during rivet replacement.

The nested rocker bearing assemblies at Abutment 2 will also need to be repaired or replaced in order to return the ability of expansion and contraction to the structure.

It is recommended that the corrosion mitigation maintenance be performed within the next 12 to 18 months to protect the structure from further significant corrosion damage. Regular monitoring of debris accumulation and cleaning should be performed until rehabilitation is completed. The full rehabilitation of the structure is recommended to be completed over the next 1 to 2 years. Further recommendations for maintenance and repairs are listed in the attached PONTIS report, Appendix C.

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1.0 INTRODUCTION

This report contains the results of a full, hands-on, in-depth fracture critical and routine inspection performed by Stantec Consulting Services (Stantec), on Structure No. K-18-R over the Arkansas River located in Pueblo County, Colorado which is owned, maintained, and operated by the Colorado Department of Transportation (CDOT). The inspection was performed on March 11, 2014 through March 14, 2014. The weather conditions during the inspection consisted of primarily fair temperatures in the mid-50s and sunshine. The purpose of this inspection was to obtain information pertaining to the present condition of the entire structure and the truss members inaccessible by traditional inspection equipment including the lower chords, upper chords, floorbeams, stringers, lower lateral bracings, and deck underside. Recommendations for further engineering investigation and repairs are also provided in this report.

Sketches of the structure are provided within Appendix A. Photographs of the structure are included within Appendix B. The PONTIS report and tally sheets for the painted steel members are included in Appendix C. Appendix D contains a detailed sketch of the section loss to the lower cord and the rivet replacement schedule. Detailed field notes for the floor system are in Appendix E and a memo regarding a previous special inspection on Floorbeam 4 is within Appendix F.

1.1 DESCRIPTION OF STRUCTURE

The structure is a 286 foot, single-span, painted steel fracture critical through truss bridge supported by reinforced concrete abutments at the north and south (see photos on pages 1 and 2 of Appendix B). The bridge was constructed in 1924 and consists of 16 panels each 17 feet 6 inches in length. The deck of the structure consists of reinforced concrete with an asphalt overlay placed atop 8 parallel steel stringers (A through H). The stringers are supported by transverse floorbeams which connect to the lower chord and vertical members at each panel point (0 to 16). The structure originally carried both east and westbound traffic; it has since been supplemented by a parallel 2-span reinforced concrete structure to the east and only carries eastbound traffic at present.

1.2 INSPECTION PROCEDURE

Climbing techniques were used by a four-person team meeting the National Bridge Inspection Standards (NBIS) requirements for inspection of in-service bridges. All Occupational Safety and Health Administration (OSHA) standards for fall protection/work at height as well as Society of Professional Rope Access Technicians (SPRAT) standards for rope access were adhered to for the inspection of the structure.

The inspection was performed in accordance with NBIS criteria for a fracture critical inspection. A visual and tactile inspection was performed on 100% of the exterior surface of each fracture critical member, each upper truss member, each floor system element, and all other routinely

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inspected elements. Many times, this included removing debris from the lower chord panel points to observe the underlying conditions of the steel in these areas. The main purpose of the inspection was to observe and record any damage or deterioration and the existing conditions at each element. Specifically, the elements were inspected for signs of section loss due to corrosion, distress, deterioration, movement, and impending failure.

2.0 INSPECTION RESULTS

The following provides a general description of the conditions noted during the inspection. A detailed account of each floor system member and deck underside can be found within Appendix E. Typical photographs of defective elements are located within Appendix B.

Conditions referring to degree of corrosion are listed in the form of R1 to R4 corresponding to the PONTIS Manual for condition of Painted Steel Elements. Refer to this manual for definitions of R1, R2, R3 and R4 corrosion.

The quantity of each element found in each condition state has been tabulated into PONTIS Tally Sheets for ease of determining areas of worst condition. These tally sheets are located within Appendix C.

2.1 FLOOR SYSTEM

The floor system as a whole is in poor condition as noted by the advanced section loss in some areas and heavy deterioration of the underside of the concrete deck. The worst case corrosion is primarily located near the deck drains on both trusses at the panel points. The lower chord splice plates experience some of the worst corrosion to the rivet heads. A rivet replacement schedule is located within Appendix D and a detailed account of each floor system member is included in Appendix E.

2.1.1 Lower Chord

The lower chords have peeling paint and Light R1 to R1 corrosion full length with additional corrosion up to R4 at splice connections, floorbeam connections, and locations with horizontal gusset plates where the lower lateral bracings frame in (see photos on pages 3 to 9 of Appendix B). These areas collect debris and moisture from the roadway and typically have R4 corrosion with 50% or more section loss to connecting rivet heads.

Isolated areas of R2 to R4 laminating corrosion of the lower chord top angles exist where debris has accumulated causing up to 5/8 inch section loss. The worst case lower chord top angle section loss was observed within Panel 10 of the right truss and Panel 12 of the left truss. Detailed measurements of section loss were recorded at these locations and are included in the cross-sectional sketches within Appendix D.

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2.1.2 Truss Connections

Most of the truss connections to the lower chord have Light R1 to R2 corrosion (see photos on pages 10 to 12 of Appendix B). Some of the corrosion at the connections has pack rust up to 3/8 inch which distorts the plates. There are areas at the truss connections that have heavy debris that retain moisture and promote corrosion. The worst case is at the splice at Panel Point 10 on the right truss with 1/8 inch laminating corrosion and 30% to 80% section loss to the rivet heads. Many splice plates experience similar corrosion, up to R4, with heavy to severe section loss to the rivet heads.

2.1.3 Lower Lateral Bracing & Gusset Plates

The lateral bracing configuration connects the lower lateral bracings and gusset plates to the lower chords at even-numbered panel points. Gusset plates and lower lateral bracings at odd-numbered panel points connect to the center of the floorbeams. The connections at the center of the floorbeams typically have minor chalking of the paint system with little to no corrosion or deterioration.

Lower lateral bracing connections to the lower chord at even number floorbeams typically exhibit some of the worst corrosion found within the floor system (see photos on pages 12 to 16 of Appendix B). These connections are located along the exterior sides of the bridge at deck drains where moist conditions exist. The horizontal gusset plates collect dirt, debris and moisture contributing to heavy R4 corrosion, pack rust and numerous perforations in the gusset plates. In some locations, most notably at Panel Points 2, 6, 10 and 14, the corrosion and perforations have reduced the section and strength of the lower lateral bracing connections by more than 50%. This weakened condition along with a deteriorating concrete deck, acting as a diaphragm, present a notable weakened system under lateral loading of the bridge.

2.1.4 Floorbeams

The floorbeams typically exhibit R1 to R2 corrosion with up to R4 corrosion at most ends of the top flanges (see photos on pages 16 to 20 of Appendix B). Webs, top flanges and bottom flanges at the lower lateral bracing gusset plate connections experienced the worst corrosion with pack rust distorting plates and severe section loss to many rivet heads. In spots, the rust to the top flange has expanded up to 1 inch lifting the deck and leaving little to no remaining section to the end 4 feet to 5 feet of the top flange of the beam. The most notable corrosion has occurred at Floorbeam 4. This floorbeam has heavy R4 throughout the top flange. A detailed report on Floorbeam 4 can be found in the letter dated February 4, 2013 in Appendix F.

2.1.5 Stringers

The exterior Stringers A and H typically have R1 to R4 corrosion in the top flanges with up to 100% section loss to the 1/4 inch flange thickness (see photos on pages 20 to 26 of Appendix B). In spots, rust in the top flanges have expanded up to 1 inch lifting the deck and leaving little to no

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remaining section to the top flange of the member. Interior Stringers B to G are typically in better condition with Light R1 to R1 corrosion and isolated instances of R3 to R4 (see Tally Sheets for condition states and affected member lengths in Appendix C).

2.1.6 Clip Angles

The angles that connect the stringers to the floorbeams are in satisfactory condition. Typical corrosion and pack rust of exterior stringer clip angles is contributing to deformation of the bearing clip angles themselves and minor loss of stringer bearing area. This condition is particularly evident at stringers in Panel Points 3, 4, 14, and 15 (see photos on page 27 of Appendix B).

There are (7) rivets that have been replaced with bolts at connections to Floorbeams 2 and 10. The bolts are tight and appear to be functioning as designed.

2.2 UPPER CHORDS, VERTICAL & DIAGONAL MEMBERS

The upper chord members have typical Light R1 to R1 throughout with heavier corrosion, up to R2, at the bases of upper chord members L0M1 and M15L16 of both trusses. The majority of the vertical and diagonal members have minor corrosion isolated near the base of the roadway up 15 feet. The corrosion near the roadway is likely due to traffic spray during wet conditions (see photos on pages 27 to 35 of Appendix B). The following lists conditions observed at specific locations of the truss upper chord, vertical and diagonal members:

- There is Light R1 to R2 corrosion on webs, flanges, battens, lattices, and channels of both trusses on members L1M1, M1L2, L2M3, L2M3, U2L4, L4U4, L4M5, L5M5, L7M7, L11M11, M11L12, L12U12, and L12U14 and on the right truss member L2U2.
- Diagonal member U4L6 of the right truss has a crack through the rivet hole in the bottom inside flange due to vehicle impact to this member. There is no evidence of continued deterioration.
- There are moderate deformations due to vehicle impact in members L7M7 and M7L8 of the right truss and in members L11M11, L13M13 and U14L16 of the left truss.
- There are very minor dings in members L3M3 and L15M15 of the right truss and in members L1M1 and U8L10 of the left truss.
- The vertical member L6U6 of the right truss has an area of isolated section loss, up to 3/16 inch, to the web near the underside of deck.
- The vertical member L15U15 of the right truss has isolated pitting on the web with up to 50% section loss located between the deck and its connection at L15.

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- Vertical L5M5 of the left truss has a 1 inch long tear in the southwest flange near M5 gusset connection, painted over with no propagation since painting.
- Minor pack rust formation in the gusset plate connections to the vertical and diagonal members with distortion up to 1/8 inch.

2.3 BEARINGS

The rocker nests at Abutment 2 have failed. Large amounts of debris from the previously failed expansion joint above have accumulated along the bearing seats and contributed to significant corrosion of the bearing elements. The retaining bars, which maintain alignment of the individual rockers, have corroded and broken away allowing the rockers in each nest to misalign at different angles from 0 to 45 degrees. The misaligned rocker nests are essentially fixed leaving the truss to absorb expansion and contraction of its members. Sole plates at the east and west bearings are off-center from masonry plates by approximately 2 inches and 1 3/4 inches respectively. This suggests the truss is locked in a state of expansion (see photos on pages 36 to 39 of Appendix B).

The Abutment 1 pin bearings have some R1 corrosion on the truss portion but R2 corrosion on the masonry and sole plates. The pack rust formation between the masonry plate and clip angles is causing minor distortion of the clip angles' bottom legs. There is no evidence of rotation of the bearings at this time (see photos on pages 35 and 36 of Appendix B).

2.4 ABUTMENTS

There is typical water staining on each abutment. Abutment 1 has a spall with exposed reinforcing behind Floorbeam 0. Debris infiltration has deposited up to 3 feet of dirt behind Floorbeam 16 at Abutment 2 due to a once failed expansion joint above. Abutment 2 also has a large crack at the right corner of Abutment 2 at the junction with the channel protection.

2.5 DECK (UNDERSIDE)

The surfaces of the reinforced concrete deck underneath the bridge generally exhibit transverse cracking with heavy efflorescence stalactites. The exterior Bays A and G have greater deterioration including open corrosion spalling with exposed reinforcing steel with 50% to 100% section loss of the bottom reinforcing mat commonly observed. Several areas have received full-depth repairs noted by plywood forms along the deck bottom. Many plywood forms have either fallen or been removed while some forms still remain in place (see photos on pages 39 to 42 of Appendix B).

2.6 ROADWAY ELEMENTS

The roadway elements are in fair condition. There are unsealed cracks in the asphalt overlay that allow moisture penetration through the deck contributing to advanced deterioration of the

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concrete deck and steel elements below. The traffic rails have minor impact damage and the pedestrian rails have areas of heavy corrosion. The curbs and sidewalks have areas of spalling and cracking.

2.6.1 Asphalt Overlay

There are transverse, longitudinal, and pattern cracking throughout the asphalt overlay. Most of this cracking has areas of potholes forming. These cracks are not sealed and are open approximately 1/4 inch with several cracks open up to 3/4 inch. Several small patched areas are cracking again. There is spider web cracking around the perimeter of a pothole near Joint 9 in the west lane that is partially patched and cracking again (see photos on pages 42 to 44 of Appendix B).

2.6.2 Rails

The galvanized flex-beam rail and posts along the roadway have some minor scrapes and dents. The worst case is on the east rail near Abutment 2. The approach rail at the northwest consists of a flex-beam rail on timber posts with buried termination. (2) posts are missing block-outs and the termination and transition to bridge rail do not meet AASHTO standards. There is no rail installed at the southwest (see photo on page 44 of Appendix B)

The pedestrian rail on the right overhang has Light R1 throughout with some peeling paint. There are several areas with heavier rust, up to R4 corrosion with perforations. Many cover plates at the top rail connections have rusted through at bolts creating sharp edged protrusions. There is (1) cover plate missing near Panel Point 12 with a 3 inch diameter knife edged perforation in the rail (see photos on page 45 of Appendix B).

2.6.3 Curbs & Sidewalk

The 6 foot 6 inch wide sidewalk on the right has large shrinkage cracks with minor surface holes due to poor concrete. Some joints have very minor spalls, the largest being a 1 foot x 3 inch opening at Joint 11. Longitudinal cracks and some small spalls exist on the top of the right curb, especially above Panel 12. Both of the curbs above Panels 11 and 12 have deterioration along the edges. There is minor concrete disintegration in the right curb above Panel 13. Sand buildup exists along the sidewalk near the roadway (see photos on pages 46 and 47 of Appendix B).

3.0 CONCLUSIONS & RECOMMENDATIONS

The poor condition of the truss floor system including exterior stringers, floorbeams, portions of the lower chords, lower lateral bracing ends and gusset plates, and the rocker nest expansion bearings has advanced from the previous inspection conducted in 2012 but not at such a rate to significantly alter previous repair and maintenance recommendations. Due to the section loss of these members, it is recommended that the bridge receive a new load rating based on the

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reduced section properties as stated in the report and detailed within the attached appendices. Some consideration in the rating should also be given to the poor condition of the deck where areas of spalling concrete, corroded reinforcement and saturated conditions justify a lower compressive strength value and reduced composite action contribution.

To prolong the life of structure K-18-R, the continued corrosion of the steel members must be mitigated. It is recommended that the deck drains along the east side of the structure be opened (paved over at present) and that all drains be retrofitted with extensions to divert water, dirt and debris away from floor system members. The cracking in the asphalt surface should be repaired either by milling down to concrete deck, placing a waterproof membrane and re-overlay or by sealing all cracks and potholes. This will limit the amount of water infiltration through the deck and will direct it through the intended drains and away from the steel floor system. A thorough cleaning of the lower chord panel points and splices, lower lateral bracing gusset plates and all other portions of the structure collecting debris will further lessen the ongoing corrosion and extend the life of the structure. Abutment 1 and 2 bearing seats should also be cleaned of dirt and debris to limit further deterioration of the bearings and floorbeams at these locations.

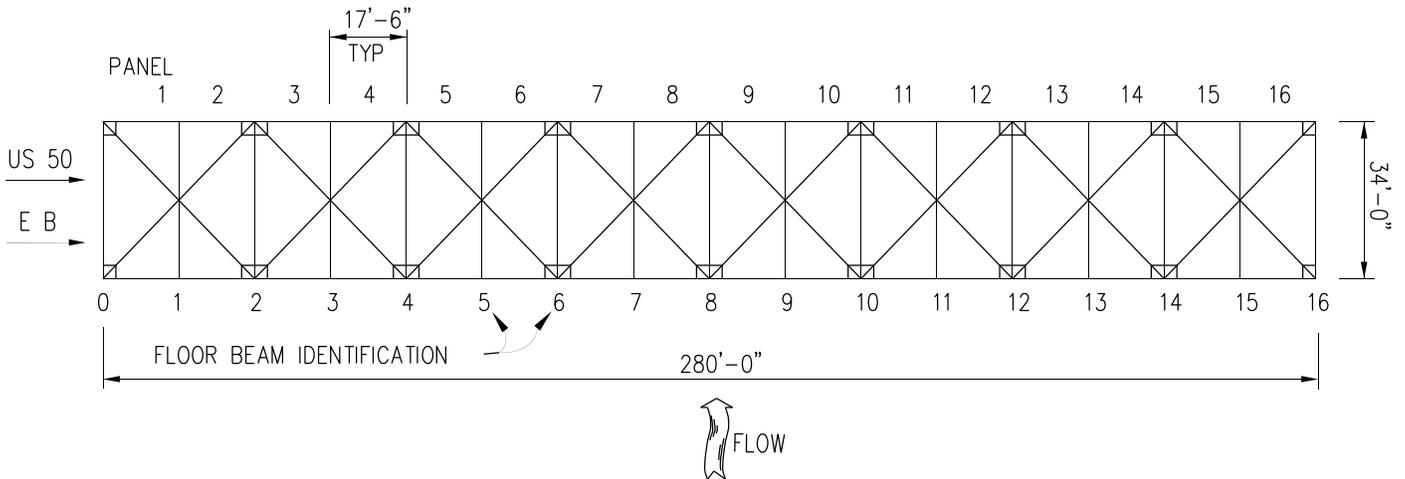
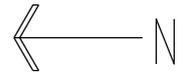
In order to significantly extend the life of the structure, major rehabilitation must be performed. Ultimately, it is recommended that a full deck replacement be performed to halt moisture infiltration through to the stringers and floorbeams. During this process, all steel truss members will need to be cleaned and painted to arrest continued corrosion. Although all steel truss members need a thorough cleaning and painting, the lower chord panel points should take priority. Steel members with significant section loss, as noted in the report, will need to be wholly or partially replaced.

Lower chord rivets with section loss to the rivet head to the degree that the rivet is no longer adequately restrained within its connecting member should be replaced with high strength bolts. Refer to the list of rivets for replacement and respective locations within Appendix D. Several gusset plates to the lower lateral bracings and lower chord splice plates with significant section loss should be considered for replacement during rivet replacement.

The nested rocker bearing assemblies at Abutment 2 will also need to be repaired or replaced in order to return the ability of expansion and contraction to the structure.

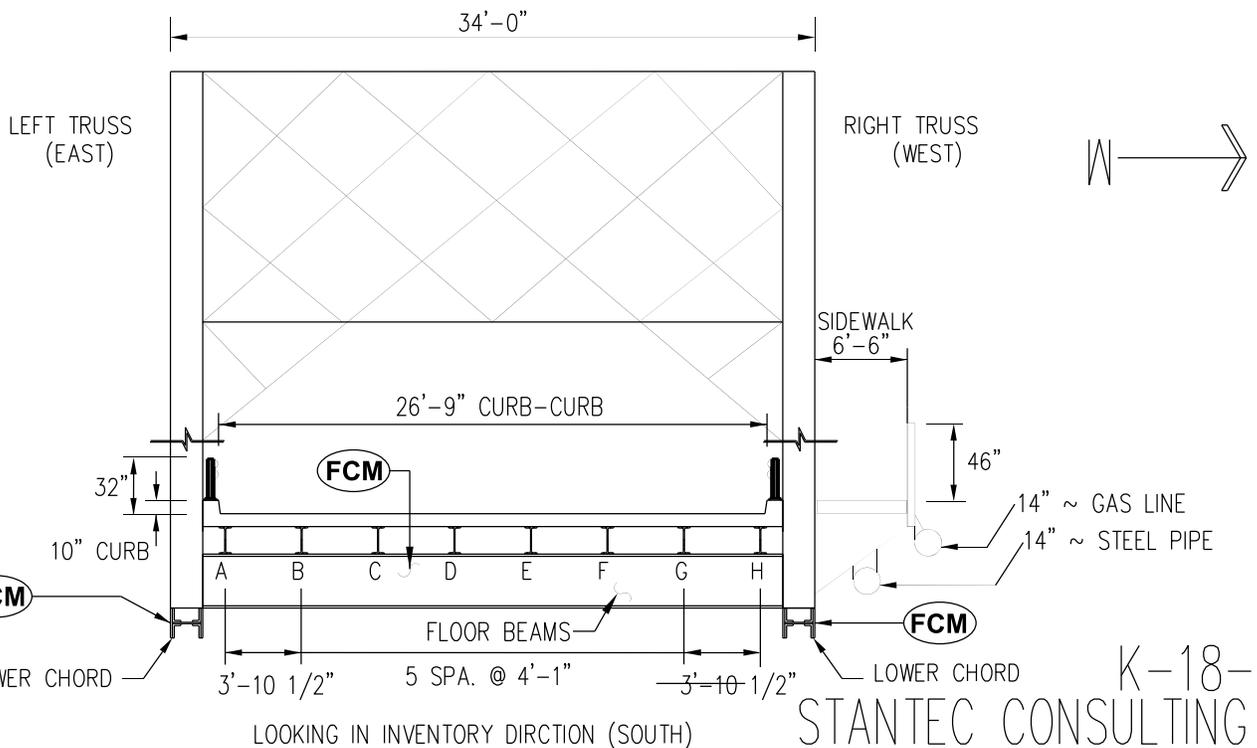
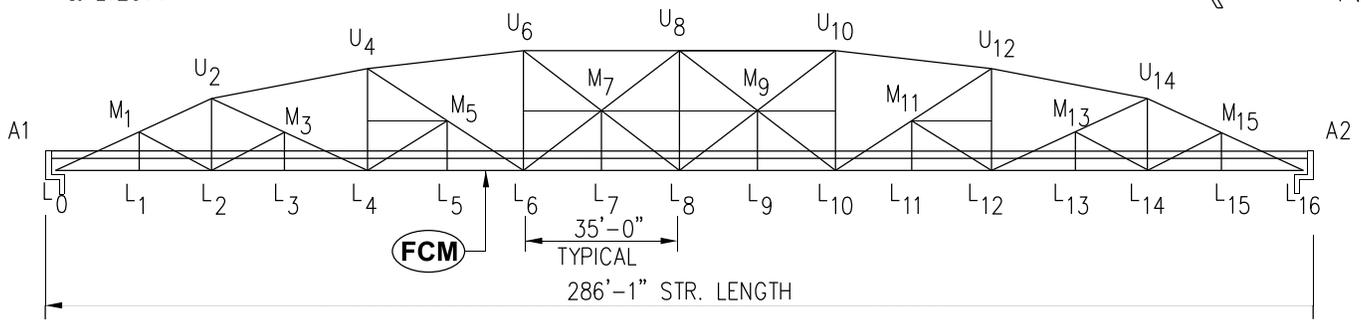
It is recommended that the corrosion mitigation maintenance be performed within the next 12 to 18 months to protect the structure from further significant corrosion damage. Regular monitoring of debris accumulation and cleaning should be performed until rehabilitation is completed. The full rehabilitation of the structure is recommended to be completed over the next 1 to 2 years. Further recommendations for maintenance and repairs are listed in the attached PONTIS report, Appendix C.

Appendix A – Sketch



FCM: DIAGONALS
U2L4, U4L6, U6L8, L6U8,
U8L10, L8U10, L10U12,
& L12U14

VERTICALS
L2U2, L4U4, L6U6, L8U8,
L10U10, L12U12, & L14U14



Appendix B – Photographs

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Roadway looking south



Elevation looking east

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General looking south



Vertical clearance sign at north portal bracing signaling clearance restriction of 13 ft 6 inches

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Lower chord condition typical in most bays with spotty Light R1 corrosion, paint system primarily intact



Lower chord splice at Panel Point 4 of the Right Truss (West) with heavy debris along top web splice plate and near 100% section loss to rivet heads

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Lower chord splice at Panel Point 4 of the Left Truss (East) with heavy debris cleaned showing corrosion and section loss to top interior plates and rivets



Lower chord splice at Panel Point 8 of the Left Truss (East) with heavy debris cleaned showing corrosion and section loss to top interior plates and rivets

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Inboard lower chord splice plate at Panel Point 8 of the Left Truss with top angle bottom row rivet, 3rd from south, with loss of head and popping out



Lower chord splice at Panel Point 8 showing 100% loss of head to rivet which is popping out

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Lower chord splice at Panel Point 8 of the Right Truss (East) with heavy debris, corrosion and section loss to top interior plates and rivet heads



Left Truss lower chord splice near Panel Point 12 with up to 0.25 inch pitting and section loss to base of top angle interior splice plates

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Lower chord near Panel Point 12 showing worst case section loss to top angles of the Left Truss (detailed on sketches in Appendix D)



Lower chord near Panel Point 10 showing worst case section loss to top angles of the Right Truss (detailed on sketches in Appendix D)

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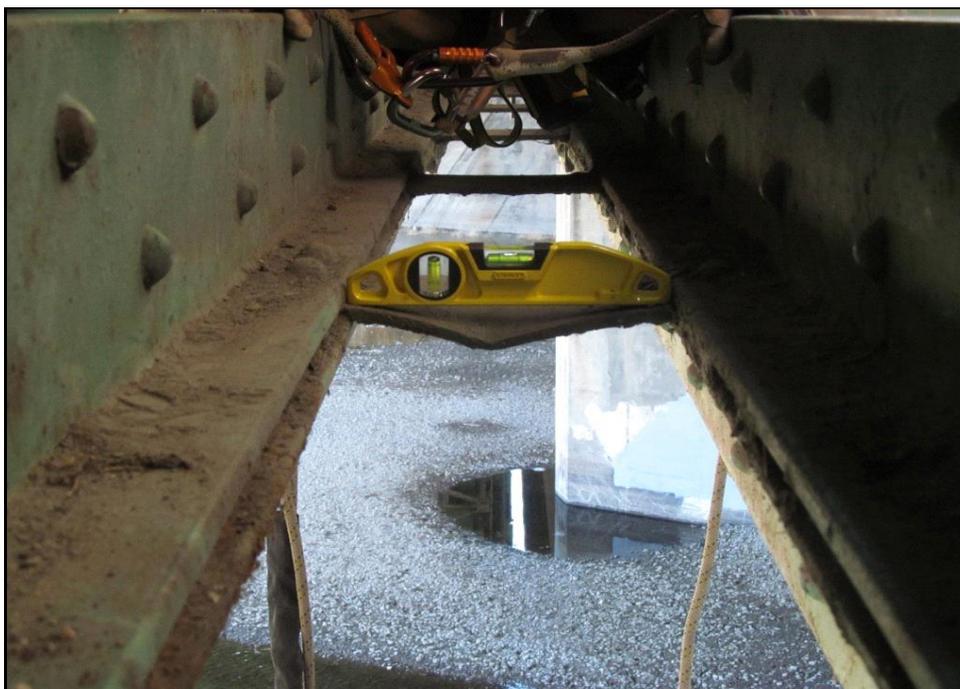
Close-up of section loss through detailed section of Right Truss lower chord top outboard angle where UT thickness measurements were taken



Close-up of pack rust formation between top and bottom angles through detailed section of Right Truss lower chord near Panel Point 10

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Typical distortion of various lower chord web batten plates



Typical pack rust formation between lower chord angles and plates at various locations

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Typical pack rust formation between lower chord and gusset connections to vertical and diagonal truss members



Pack rust formation and flange deformations at various plate connections between floorbeams and verticals or diagonals

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Corrosion and section loss to gusset plates typical at floorbeam to vertical and diagonal members



R4 corrosion with perforation to inboard flange of Vertical L4M4 at connection to Floorbeam 4

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Crack in inboard bottom flange of Diagonal U4L6 at rivet connection to lower chord gusset plate



Panel Point 6 lower lateral bracing gusset to the Left Truss showing light to moderate corrosion of plate and laterals with R4 corrosion of (1) rivet head

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Typical pack rust separating vertical legs of lower lateral bracing angles, Panel Point 0, Right Truss



Pack rust with 100% section loss of lower lateral bracing angle top legs, Right Truss within Bay 3, Floorbeam 2

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Lower lateral bracing angle top legs with pack rust and corroded steel removed, Right Truss within Bay 3, Floorbeam 2



Lower lateral bracing, Bay 3, Left Truss with pack rust removed revealing 100% section loss to top legs of angles

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Lower lateral bracing gusset to Floorbeam 4, Right Truss with pack rust distorting plate up to 1 inch out of plane



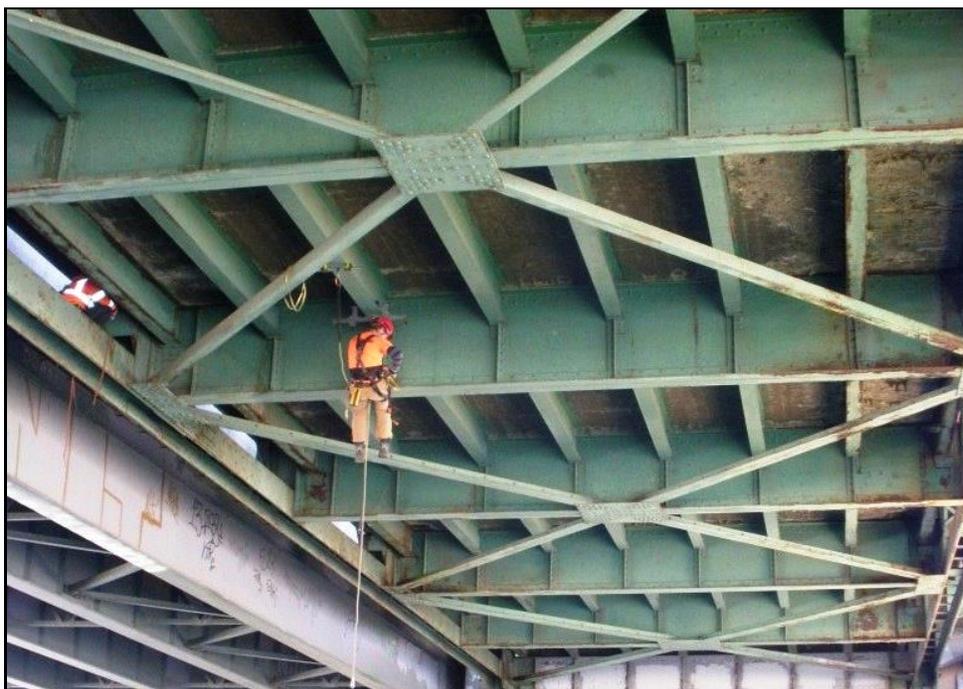
Corrosion perforations, section loss of rivet heads and pack rust separation of bracing angles at Left Truss, Bay 14, Floorbeam 14

Structure Number: **K-18-R**
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Inspection Date: **3/11/2014**



Corrosion and perforations through gusset plate at Left Truss lower chord and Floorbeam at Panel Point 4



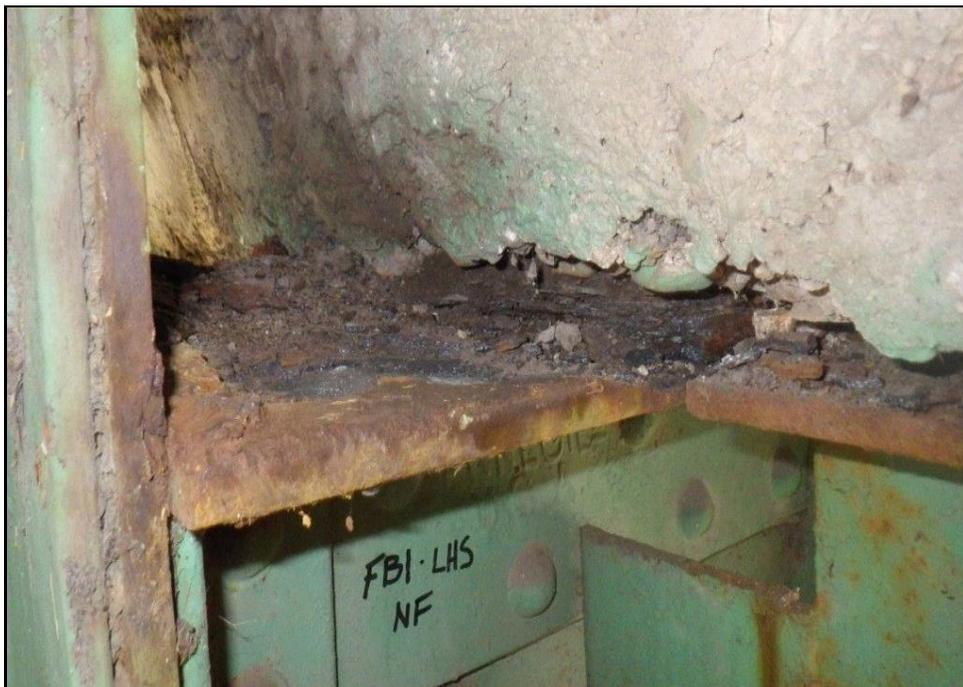
Overview of floor system and deck soffit showing typical floorbeam, stringer and deck soffit deterioration in exterior bays

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Typical floorbeam condition through interior Stringer Bays C-E



Pack rust and laminating corrosion with deck lift, top flange of Floorbeam 1 at Stringer A, Typical of many floorbeam top flanges

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
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Inspection Date: **3/11/2014**



Floorbeam 4, Bay A, top flange with nearly 100% section loss (worst-case floorbeam corrosion)



Close-up of section loss to Floorbeam 4, Bay A, top flange (worst-case floorbeam corrosion)

Structure Number: **K-18-R**
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Floorbeam 4, Bay A, corrosion and section loss to bottom flange (worst-case floorbeam corrosion)



Floorbeam 4, Bay G showing corrosion of the floorbeam web and bottom flange (worst-case floorbeam corrosion)

Structure Number: **K-18-R**
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Floorbeam 6 north face, Bay A showing R2 corrosion of top surface of bottom flange with R4 corrosion of (1) rivet head



0.5 inch deck lift in Bay 1 over Stringer 1H

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



R4 corrosion of Stringer 3H top flange



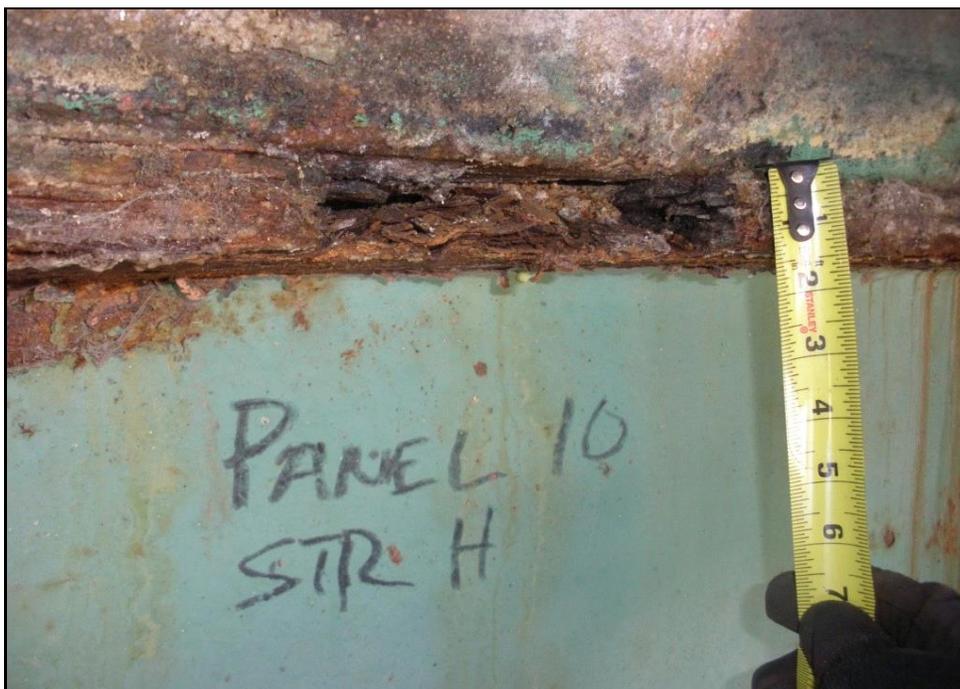
R4 with near 100% section loss to top flange of Stringer 7A

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



R4 with near 100% section loss to top flange of Stringer 8H



R4 with near 100% section loss to top flange of Stringer 10H causing deck lift

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



R3-R4 corrosion of Stringer 12G top flange



Perforations through web of Stringer 1H near bottom flange

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



R2-R3 corrosion of Stringer 2H web



Perforations through web of Stringer 5A near bottom flange

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



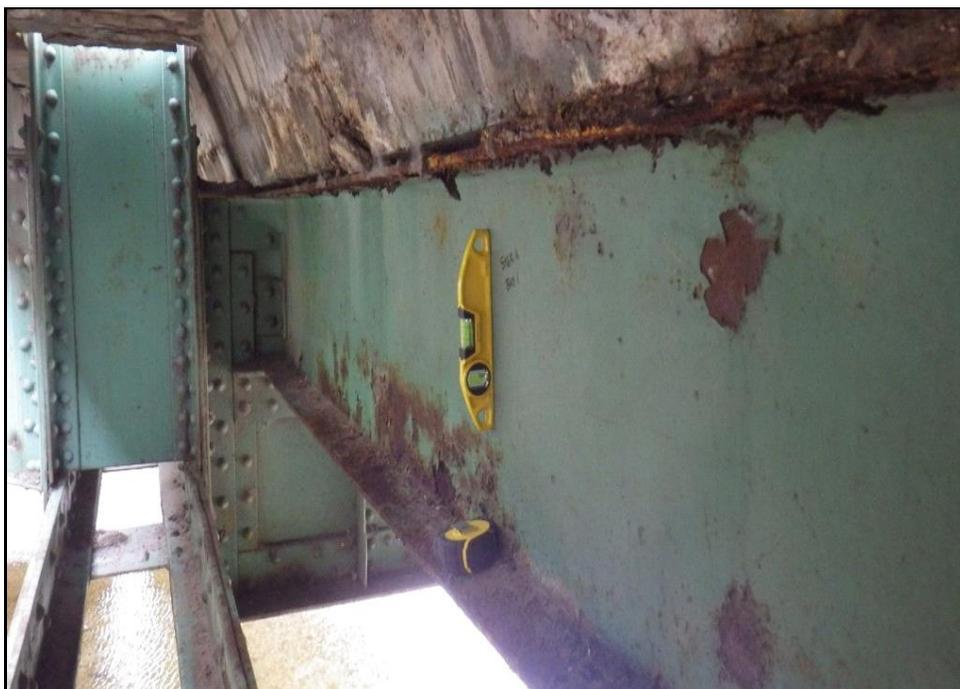
R4 corrosion and perforation in web of Stringer 9A near bottom flange



Perforation through web of Stringer 15H near bottom flange

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Partial rotation of Stringer 1A due to laminating corrosion and pack rust of the top flange



Slight buckling of Stringer 16G web

Structure Number: **K-18-R**
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Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**

Inspection Date: **3/11/2014**



Stringer 4H clip angle to Floorbeam 4 showing corrosion and pack rust between the clip angle bearing and stringer bottom flange



Overview of truss upper chords and bracings showing typical peeling paint and R1 corrosion

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Typical upper chord web with spotty R1 corrosion throughout



Typical peeling paint with R1 corrosion of upper chord bottom flanges

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



General view through interior of upper chord box



Impact to top flange of Left Truss upper chord L16M15 at south portal

Structure Number: **K-18-R**
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Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Deck impacting Left Truss upper chord at A1, typical at all four corners



Typical upper chord gusset connection to verticals and diagonals

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
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Inspection Date: **3/11/2014**



Gusset plate connection between Right Truss Vertical L3M3 and diagonals with pack rust distorting plate 0.125 inch



Left Truss gusset plate at U14 with R1 corrosion

Structure Number: **K-18-R**
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Typical vertical member with spotty R1 corrosion



Typical increased corrosion of vertical and diagonal members within 10 feet of the deck surface

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Impact damage to Vertical L7M7 of the Right Truss



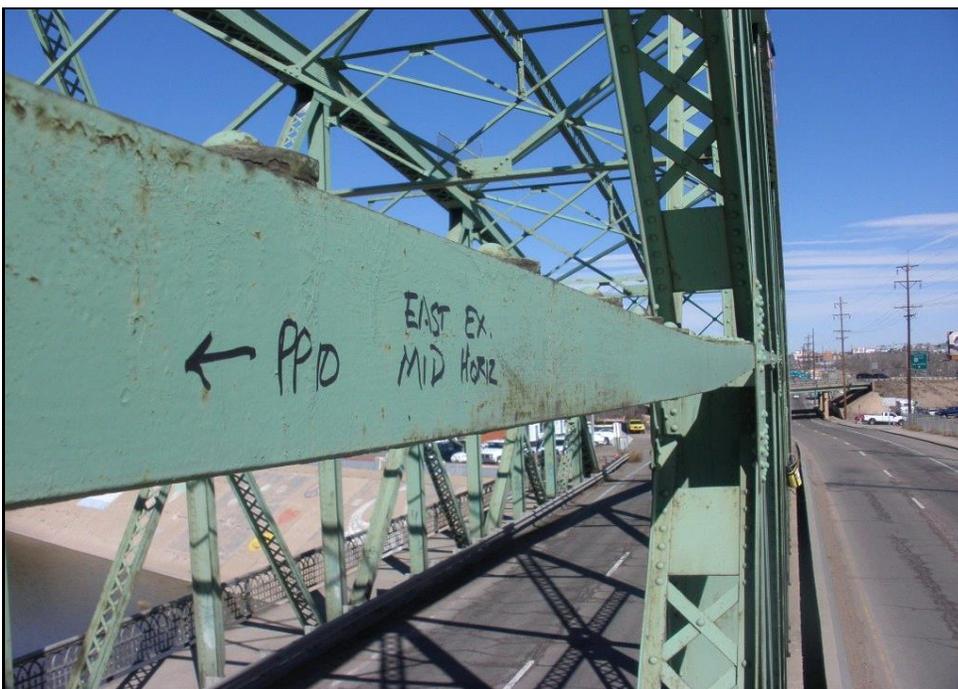
Impact damage to Diagonal M7L8

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



1 inch tear in southwest flange of Left Truss Vertical L5M5 near M5 connection



Left Truss Horizontal M9M10 bent slightly out of plane

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Overview of truss upper lateral bracings showing spotty R1 corrosion



Overview of Left Truss fixed bearing at Abutment 1 showing R1 corrosion with pack rust formation and deflection of clip angle legs, no visible rotation

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Overview of Right Truss fixed bearing at Abutment 1 showing R1 corrosion with pack rust formation and deflection of clip angle legs, no visible rotation



Overview of the Right Truss rocker nest expansion bearing at Abutment 2

Structure Number: **K-18-R**
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Feature Intersected: **Arkansas River**

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Rocker nest sole plate is approximately 1.75 inches off-center from the masonry plate suggesting the truss is locked in a state of expansion



Debris from once failed joint at Abutment 2 causing loss of rocker retainer bars, misalignment and corrosion of rockers

Structure Number: **K-18-R**
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Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Overview of Left Truss rocker nest expansion bearing at Abutment 2



Rocker nest sole plate is approximately 2 inches off-center from the masonry plate suggesting the truss is locked in a state of expansion

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Missing bolt at rocker retainer bar causing south rocker to lay over out of alignment



Deck soffit within Bay 1 between Stringers G and H with significant spalling and exposure of reinforcing

Structure Number: **K-18-R**
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Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Deck soffit of Bay 2 between Stringers G and H showing previous full-depth deck patches with plywood forming in-place and perimeter spalling



Deck soffit of Bay 2 between Stringers A and B showing previous full-depth deck patch with perimeter spalling and exposure of reinforcing

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Deck soffit of Bay 4 between Stringers A and B with cracking and active leakage



Deck soffit of Bay 12G with transverse cracking and heavy efflorescence stalactites

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

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Inspection Date: **3/11/2014**



Typical deck soffit condition around drain openings



Transverse and tightly spaced pattern cracking with impending potholes in north approach asphalt

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Asphaltic plug joint at south approach with minor rutting and crack transverse to roadway open 0.25 inch wide



Ravelling of asphalt deck overlay typical near curbs

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Cracking and potholing in asphalt deck overlay, typical throughout



Northwest approach rail with two posts missing timber blockouts

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Metal pedestrian rail at west with corrosion of top rail splice plates leaving sharp edges



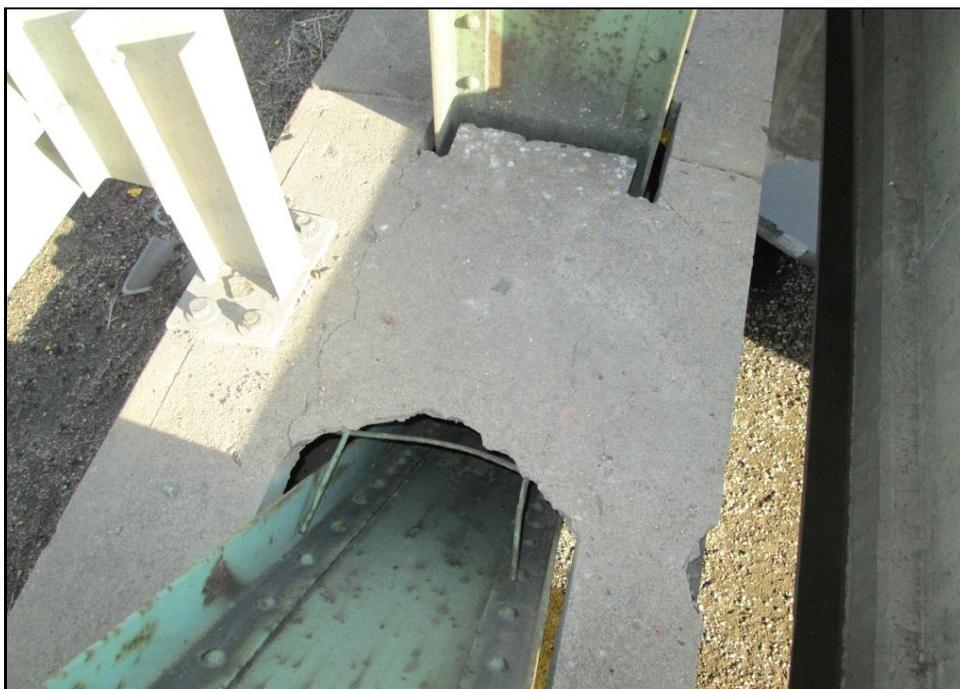
West pedestrian rail top rail with missing splice cover plate and corrosion perforation of welded splice

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
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Spalling and disintegration of west concrete curb near Panel Point 11



Typical cracking in concrete sidewalk and spall with exposed reinforcing near Panel Point 10 of the East Truss, typical at multiple locations

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
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Inspection Date: **3/11/2014**



Saw-cut concrete sidewalk along the east deck edge with spalling and exposed reinforcing



Channel looking upstream

Structure Number: **K-18-R**
Facility Carried: **US 50 Business**
Feature Intersected: **Arkansas River**

Owner: **Colorado Department of Transportation**
Inspection Date: **3/11/2014**



Channel looking downstream

Appendix C – PONTIS Report & Tally Sheets

Colorado Department of Transportation
Inspection of Bridge Fracture Critical Members
Memorandum Compliance checklist

Structure Number: K-18-R Review Date: _____

Fracture critical member documentation:

Is the structure folder marked with the FRACTURE CRITICAL stamp?	YES	NO
Are the fracture critical members identified on the sketch using the FCM symbol and member description?	YES	NO
Is there a Fracture Critical Inspection sheet in the folder identifying the fracture critical members?	YES	NO

Fracture critical member inspection:

Was a fracture critical inspection performed? If NO, Why:	YES	NO
--	-----	----

Was non-destructive testing (NDT), other than visual, performed on a fracture critical member during the inspection? If YES, Please notify the CDOT Program Manager of what method of NDT was used and what member was tested. Note the testing in the inspection report.	YES	NO
---	-----	----

Was the fracture critical member inspection entered into Pontis correctly?	YES	NO
--	-----	----

If there were there any significant defects, were they brought to the Program Managers attention?	YES	NO
---	-----	----

N/A

Reviewed by: _____

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C

Mile Post (ON)11: 1.136 mi

Bridge Name: K-18-R Inspection Date: 3/11/2014 Sufficiency Rating: 47.2 SD

NBI Reporting ID:	K-18-R
Rgn/Sectn 2E/2M:	24
Trans Region 2T	04
County Code 3:	101
PUEBLO	
Place Code 4:	62000
PUEBLO	
Rte.(On/Under)5A:	1
Signing Prefix 5B:	2
Level of Service 5C:	1
Directional Suffix 5E:	0
Feature Intersected 6:	
ARKANSAS RIVER	
Facility Carried 7:	
US 50 BUS EBND	
Alias Str No.8A:	
BRIDGE ENTERPRISE LIST	
Prll Str No. 8P	
K-18-FF	
Location 9:	
IN PUEBLO	
Max Clr 10:	13.8 ft
BaseHiway Net12:	0
IrsinvRout 13A	0000000000
IrrsubRout No13B:	00
Latitude 16:	38d 15' 18"
Longitude 17:	104d 36' 25"
Range18A:	64
Township18B:	64
Section18C:	1
Detour Length 19:	0.6 mi
Toll Facility 20:	3
Custodian 21:	1
Owner 22:	1
Functional Class 26:	16
Year Built 27:	1924
Lanes on 28A:	2
Lanes Under 28B:	0
ADT 29:	10,050
Year of ADT 30:	2007
Design Load 31:	2
Apr Rdwy Width 32:	25.0 ft
Median 33:	1
Skew 34:	0.00 °
Structure Flared 35:	0
Sfty Rail 36a/b/c/d:	0 0 0 0
Rail ht36h:	32 "in"

Hist Signif 37:	1
Posting status 41:	A
Service on/un 42A/B:	5 5
Main Mat/Desgn 43A/B:	3 10
Aprr Mat/Desgn 44A/B:	0 0
Main Spans Unit 45:	1
Approach Spans 46:	0
Horiz Clr 47:	26.8 ft
Max Span 48:	278.5 ft
Str Length 49:	286.1 ft
Curb Wdth L/R 50A/B:	0.0 ft 6.5 ft
Width Curb to Curb 51:	26.8 ft
Width Out to Out 52:	40.5 ft
Deck Area:	11,587.1 sq. ft
Min Clr Ovr Brdg 53:	13.84
Min Undrclr Ref 54A:	N
Min Undrclr 54B:	13.7 ft
Min Lat Clrnce Ref R 55A:	N
Min Lat Undrclr R 55B:	0.0 ft
Min Lat Undrclr L 56:	0.0 ft
Deck 58:	4
Super 59:	4
Sub 60:	5
Channel/Protection 61:	8
Culvert 62:	N
Oprting Rtg Method 63:	2 AS Allowable
Operating Rating 64:	50.0
Inv Rtg Method 65:	2
Inventory Rating 66:	34.1
Asph/Fill Thick 66T:	004 "in"
Str. Evaluation 67:	4
Deck Geometry 68:	2
Undrclr Vert/Hor 69:	N
Posting 70:	5
Waterway Adequacy 71:	9
Approach Alignment 72:	8
Type of Work 75A:	31
Work Done By 75B:	1
Length of Improvment 76:	319.2 ft
Insp Team Indicator 90B:	Stantec
Inspector Name 90C:	BLOCKF
Frequency 91:	12 months
FC Frequency 92A:	12
UW Frequency 92B:	
SI Frequency 92C:	
FC Inspection Date 93A:	3/11/2014

UW Inspection Date 93B:	
SI Date 93C:	2/1/2013
Bridge Cost 94:	\$ 5,617,920
Roadway Cost 95:	\$ 1,404,480
Total Cost 96:	\$ 7,022,400
Year of Cost Estimate 97:	2014
Brdr Brdg Code/% 98A/B:	
Border Bridge Number 99:	
Defense Highway 100:	0
Parallel Structure 101:	R
Direction of Traffic 102:	1
Temporary Structure 103:	
Highway System 104:	0
Fed Lands Hiway 105:	0
Year Reconstructed 106:	0000
Deck Type 107:	1
Wearing Surface 108A:	6
Membrane 108B:	0
Deck Protection 108C:	0
Truck ADT 109:	5 %
Trk Net 110:	0
Pier Protection 111:	1
NBIS Length 112:	Y
Scour Critical 113:	U
Scour Watch 113M:	
Future ADT 114:	12,360
Year of Future ADT 115:	2027
CDOT Str Type 120A:	STT
CDOT Constr Type 120B:	0.
Inspection Indic 122A:	
Inspection Trip 122AA:	
Inspection Schedule ID:	12M MAY B11, F_5
Maintenance Patrol 123:	19
Expansion Dev/Type124:	P
Brdg Rail Type/Mod 125A/B:	H 2
Posting Trucks 129A/B/C:	0 0 0
Str Rating Date 130:	6/1/1979
Special Equip 133:	SPB5151
Vert Clr N/E 134A/B/C:	U 13.83 13.83
Vert Clr S/W 135A/B/C:	X 13.83 13.83
Vertical Clr Date:	5/5/1905
Weight Limit Color: 135:	0
Str Billing Type:	U
Userkey 1 - System:	ONSYS
Userkey 7-Update Indic:	

Inspector Name: BLOCKF

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C

Mile Post (ON)11: 1.136 mi

Element Inspection Report

Elm/Env	Description	Units	Total Qty	% in 1	CS 1	% in 2	CS 2	% in 3	CS 3	% in 4	CS 4	% in 5	CS 5
13/1	Unp Conc Deck/AC Ovl	(SF)	11,587	0 %	0	0 %	0	100 %	11,587	0 %	0	0 %	0
113/1	Paint Stl Stringer	(LF)	2,176	48 %	1,047	10 %	212	11 %	246	9 %	192	22 %	479
121/1	P/Stl Thru Truss/Bot	(LF)	560	0 %	0	48 %	269	29 %	160	18 %	102	5 %	29
126/1	P/Stl Thru Truss/Top	(LF)	560	0 %	0	0 %	0	88 %	490	13 %	70	0 %	0
152/1	Paint Stl Floor Beam	(LF)	510	0 %	0	0 %	0	44 %	225	31 %	159	25 %	126
215/1	R/Conc Abutment	(LF)	82	76 %	62	12 %	10	12 %	10	0 %	0	0 %	0
306/1	Asphaltic Plg Exp Jt	(LF)	27	100 %	27	0 %	0	0 %	0	0 %	0	0 %	0
308/1	Constr Non Exp Jt	(LF)	615	86 %	530	14 %	85	0 %	0	0 %	0	0 %	0
311/1	Moveable Bearing	(EA)	2	0 %	0	0 %	0	100 %	2	0 %	0	0 %	0
313/1	Fixed Bearing	(EA)	2	0 %	0	100 %	2	0 %	0	0 %	0	0 %	0
325/1	Slope Prot/Berms	(EA)	2	100 %	2	0 %	0	0 %	0	0 %	0	0 %	0
326/1	Bridge Wingwalls	(EA)	4	100 %	4	0 %	0	0 %	0	0 %	0	0 %	0
334/1	Metal Rail Coated	(LF)	858	65 %	561	0 %	0	33 %	286	1 %	10	0 %	1
338/1	Conc Curbs/SW	(LF)	572	70 %	400	26 %	150	4 %	22	0 %	0	0 %	0
357/1	Pack Rust Smart Flag	(EA)	66	0 %	0	0 %	0	100 %	66	0 %	0	0 %	0
359/1	Soffit Smart Flag	(EA)	1	0 %	0	0 %	0	0 %	0	100 %	1	0 %	0
362/1	Traf Impact SmFlag	(EA)	10	0 %	0	100 %	10	0 %	0	0 %	0	0 %	0
371/1	Traff Imp Dck SmFlag	(LF)	32	0 %	0	100 %	32	0 %	0	0 %	0	0 %	0
501/1	Channel Cond	(EA)	1	100 %	1	0 %	0	0 %	0	0 %	0	0 %	0
502/1	ChannProtMatCond	(EA)	1	100 %	1	0 %	0	0 %	0	0 %	0	0 %	0
504/1	BankCond	(EA)	1	100 %	1	0 %	0	0 %	0	0 %	0	0 %	0
520/1	AppRdAlign	(EA)	1	100 %	1	0 %	0	0 %	0	0 %	0	0 %	0
530/1	Approach Guardrail A	(EA)	1	100 %	1	0 %	0	0 %	0	0 %	0	0 %	0

Elem/Env	Description	Element Notes
13/1	Unp Conc Deck/AC Ovl	Asphalt overlay previously noted as 2 inches of asphalt near Abutment 1 to 6 inches near Abutment 2. No documentation of substrate repair prior to 2000 overlay. Transverse, longitudinal and pattern cracking in asphalt throughout, most with areas of impending potholes. Cracks are all unsealed, open up to 3/4 inch wide. Several small patched areas throughout, most are re-forming into potholes. Pothole with spider web cracking around hole near Joint 9 in the west lane has been partially patched with patch deteriorating. See Element 359.

Colorado Department of Transportation

Structure Inspection and Inventory Report (English Units)

Elem/Env	Description	Element Notes
113/1	Paint Stl Stringer	The exterior stringers (A and H) have R1 to R4 corrosion of the top flanges with up to 100% loss of section of the ¼ inch flange thickness. In spots, rust to the top flanges has expanded up to 1 inch lifting the deck and leaving little to no remaining section to the top flange of the member. Interior stringers (B to G) are typically in better condition with isolated light R1 to R1 corrosion. The angles that connect the stringers to the floor beams are in satisfactory condition. Typical corrosion and pack rust of exterior stringer clip angles is contributing to downward deflection of clip plate and minor loss of stringer bearing area. This condition is particularly evident at stringers in Panels 3, 4, 14, and 15. There are (7) rivets that have been replaced with bolts at connections to Floorbeam 2 and Floorbeam 10. The bolts are tight and appear to be functioning as designed.
121/1	P/Stl Thru Truss/Bot	The lower chords with their batten plates have peeling paint and Light R1 to R1 corrosion full length with additional corrosion up to R4 mostly concentrated at: 1) floor beam connection plates; 2) rivet heads at low chord splice locations; 3) batten splice plates and rivet heads; and especially 4) locations with flat horizontal gusset plates where diagonal bracings frame in. These latter areas collect debris and moisture from the roadway and typically have R4 corrosion with 50% or more section loss to connecting rivet heads along with plate distortion and pack rust up to 3/4 inch. Lower lateral bracings and gusset plate connections typically have perforations due to collection of debris and moisture from deck drains, most notably those are located at Panel Points 2, 4, 6, 10 and 14. (2) areas of the lower chord were measured in detail with the use of ultrasonic thickness meters, Left Truss within Panel 12, Right Truss within Panel 10. Up to 5/8 inch section loss was observed to the horizontal legs of the top angles (see sketches).
126/1	P/Stl Thru Truss/Top	Spotty Light R1 to R1 corrosion of all vertical, diagonal, upper chord and bracing members throughout most of their top and side surface areas. More concentrated R1 to R2 corrosion on members from the deck surface up approximately 15 feet. Flaking rust & minor section loss on some where debris was retained, i.e. end posts (panels). Minor pack rust at a few gusset connections with distortion of the steel gussets up to 1/8 inch. Vertical L5M5 of the left truss with 1 inch long tear in southwest flange near M5 gusset connection, painted over, no propagation since painting. Some impacts/bent members near roadway surface (see Element 362).
152/1	Paint Stl Floor Beam	The floor beams typically exhibit R2 to R4 corrosion in the top flange especially for the first 8 feet at each end with up to 100% section loss to the 1/4 inch top flange. Floorbeam 4 is worst-case with heavy R4 of the top flange across the full length of the beam. R1 to R2 corrosion is more typical in the web and bottom flange of all floorbeams. In spots, the rust to the top flange has expanded up to 1 inch lifting the deck and leaving little to no remaining section to the affected portion of the top flange of the beam.
215/1	R/Conc Abutment	Spall with exposed rebar in Abutment 1 backwall behind Floorbeam 0 and spalling along top of Abutment 1 backwall at joint with deck due to movement. Both abutments are stained from drainage through expansion joints. Sand and debris accumulation up to 3 ft tall on Abutment 2 seat due to poor joint. Heavy crack at west corner of Abutment 2 at junction with channel protection.
306/1	Asphaltic Plg Exp Jt	New asphaltic plug joint above Abutment 2 placed prior to 2012 inspection. Asphalt beginning to rut in wheel lines. Crack in asphalt through joint, transverse to roadway, open up to 1/4 inch wide.
308/1	Constr Non Exp Jt	Joints at floor beams covered with asphalt, most with transverse cracking. Most joint filler material in sidewalk is missing or loose.
311/1	Moveable Bearing	Rocker nest expansion bearings at Abutment 2, FAILED - R2- R3 corrosion of both, both are jammed due to debris and rust. Retaining bars are broken loose and completely missing from the west bearing inboard face, and at the south rocker of the east bearing causing ½ inch displacement of rockers. Significant corrosion of steel rockers due to dirt, debris and trash accumulation around the bearings. Rocker nest sole plates of the east and west bearings are off-center from the masonry plates by approximately 2 inches and 1.75 inches, respectively suggesting the truss is locked in a state of expansion.

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Elem/Env	Description	Element Notes
313/1	Fixed Bearing	The Abutment 1 pin bearings have some R1 corrosion on the truss portion, and R2 corrosion of the masonry and sole plates. Pack rust formation causing distortion of clip angle bottom legs. There is no evidence of rotation of the bearings at this time.
325/1	Slope Prot/Berms	Concrete slope paving, continuous upstream and downstream. Few cracks, most have been sealed.
326/1	Bridge Wingwalls	The northwest wingwall has a 2 ft. long x 1 ft. high x 6 inch deep rockpocket with exposed rebar and deterioration at interface with the slope paving.
334/1	Metal Rail Coated	Pedestrian rail on west overhang has light surface rust throughout with some peeling paint. Several cover plates at top rail welded joints have corroded through at bolts creating sharp edged protrusions, (1) cover plate is missing near Panel Point 12 with 3 inch diameter knife edged corrosion hole in rail. Galvanized flex-beam rail & posts along roadway have some scrapes and dents, worst is on east rail at Abutment 2.
338/1	Conc Curbs/SW	6½ ft. wide sidewalk on the west side has large shrinkage cracks, some mudball holes & very minor spalling at some joints, with a 1 ft. x 3 inch opening at Joint 11. Minor disintegration of west curb in Panel 13. Sand buildup along walk near roadway. Some longitudinal cracks on top of east curb, and some small spalls (especially Panel 12). Deterioration along edges of both curbs in Panels 11 & 12.
357/1	Pack Rust Smart Flag	Rust pack (¼ inch to 1½ inch) is common at many locations of floor beam to lower chord connections, along exterior stringer top flanges (lifting the deck), lower chord splice plates and lateral bracing connection areas, especially below drains at L2, L6, L10, and L14. Some R3-R4 corrosion and perforations up to 4.5 inches to many horiz. gusset plates connecting lateral bracing to floorbeams.
359/1	Soffit Smart Flag	Numerous areas of spalling up to 3 inches deep with R2 to R4 corrosion of reinforcing steel, typical of most exterior bays A and G, with the worst unrepaired spalls exhibiting 50% to 100% section loss to the exposed reinforcement. Several full depth repairs performed in previous years performing only marginally well to poor as cracking, efflorescence and continued corrosion in un-replaced reinforcing steel accelerates the deterioration. Heavy map cracking & transverse cracking with heavy efflorescence / thick stalactites and near total saturation also in exterior bays, especially panels 12 through 16. Spalls with exposed rebar below sidewalk portion at various locations throughout.
362/1	Traf Impact SmFlag	Truss members bent moderately: Right truss; base of diagonal U4L6, vertical M7L7, and diagonal M7L8. Left truss; vertical M11L11, vertical M13L13, and end post U14L16. Truss members with very minor dings: Right truss; vertical L3M3, and vertical M15L15. Left truss; vertical M1L1, and diagonal U8L10. IMP-??/??/??, ISP-06/03/02, REP-00/00/00.
371/1	Traff Imp Dck SmFlag	Minor impact damage to east rail near Abutment 2. IMP-10/03/95, ISP-06/03/02, REP-00/00/00
501/1	Channel Cond	Arkansas River. Good alignment. Contained by large concrete trapezoidal sloped channel banks. Flowing several feet deep during 2012 and 2014 inspections. Check dam approximately 400 ft. downstream, and protected from major floods by the Pueblo Reservoir & dam about 8 miles upstream.
502/1	ChannProtMatCond	Concrete slope paving extends both directions from bridge. Some sealed cracks.
504/1	BankCond	Steep concrete paving has no problems. Several buildings and businesses along banks.

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C _

Mile Post (ON)11: 1.136 mi

Elem/Env	Description	Element Notes
520/1	AppRdAlign	Tight pattern cracking with potholes forming and visible voids beneath asphalt at Abutment 1. Previous cracking and potholing at south abutment patched with repair to asphaltic plug joint in 2012 (see Element 306). Minor rutting in wheel lines.
530/1	Approach Guardrail A	Flex beam rail on timber and steel posts at northwest, concrete jersey barrier at northeast and southeast approaches. No approach rail at southwest - Flexbeam rail at northwest buried at termination, two timber post connections missing blockouts.

Maintenance Activity Summary

MMS Activity	Description	Recommended	Status	Target Year	Est Cost
353.08	Br Dk Rpr	5/10/2012	-1	2015	1000

Seal cracks in asphalt surface of the bridge deck and approaches.

**354.02	Misc Br Wk	9/12/2012	-1	2014	330000
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Consider full deck replacement (in conjunction with full truss clean and paint, Activity 355.01, and nested rocker bearing replacement, Activity 357.03). Replace corroded top flanges in all A and H stringer lines, or replace entire member in kind. Similar reconditioning maintenance needed for 8 feet of the left and right ends of each floor beam.

352.02	Debris	5/6/2009	-1	2014	500
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Remove dirt and debris from both abutment seats.

**357.03	Bearings	8/2/2007	-1	2014	75000
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Rehabilitate fixed bearings at Abutment 1 and replace or re-build bearings at Abutment 2.

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C _

Mile Post (ON)11: 1.136 mi

Maintenance Activity Summary

MMS Activity	Description	Recommended	Status	Target Year	Est Cost
154.01	Surface	3/11/2014	_	2016	10000

Fill voids in asphalt at Abutment 1 and repave approaches.

355.01	Cln & Pnt	6/3/2002	-1	2014	500000
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Clean and paint all structural steel.

353.04	Br Dk Rpr	9/12/2012	-1	2014	400
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Patch potholes and low points in asphalt surface. Restore proper drainage flow along west curb where ponding occurs between Panel Points 8 to 10.

354.02	Strengthen	5/6/2009	-1	2014	10000
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Strengthen Panel 16 Stringers (Most notably, Stringer G) that are becoming distorted from a lack of vertical stiffeners.

354.99	Replace	3/11/2014	_	2016	25000
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Replace rivets as noted and listed in Appendix D of written report dated March 11, 2014.

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C _

Mile Post (ON)11: 1.136 mi

Maintenance Activity Summary

MMS Activity	Description	Recommended	Status	Target Year	Est Cost
152.00	Rehab Elem	3/11/2014	_	2016	5000

Patch spalling and cracking concrete at both abutments.

399.00	Eng Wk	9/12/2012	-1	2013	500
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In recognition of the poor condition of certain floor system members, particularly the exterior stringers that lie nearly under the wheel line, and in certain floor beams like Floorbeam 4, it is recommended that the bridge be re-load rated as based on the reduced section properties as stated in the report (see detailed sketch in Appendix D of written report dated March 11, 2014). Some consideration in the rating should also be given to the poor condition in the deck where areas of spalling concrete, corroded reinforcement and saturated conditions justify a lower compressive strength value and reduced composite action contribution.

306.07	Railing	3/11/2014	_	2015	2500
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Remove and replace sharp, corroded top rail splice cover plates along metal pedestrian rail at west.

Bridge Notes

An in-depth fracture critical inspection of the truss and floor system along with a routine inspection of the remaining bridge elements was performed on March 11 through March 14, 2014 by Frank Block, Matt Bialowas, Steve Stanley, and Don Cressman of Stantec Consulting Services using climbing inspection techniques. The exterior painted steel elements have debris buildup and poor drainage leading to active, progressive corrosion of the members with significant section loss to affected portions of the members (see additional report).

Colorado Department of Transportation
Structure Inspection and Inventory Report (English Units)

Highway Number (ON) 5D: 050C _

Mile Post (ON)11: 1.136 mi

Inspection Notes

Date: 3/11/2014 Temperature: 45°
Time: 12:15PM
Weather: Cloudy, Wind

Scope:

NBI: Element: Underwater: Fracture Critical: Other: Type: Regular NBI

Team Leader Inspection Check-off:

- FCM's
- Posting Signs
- Essential Repair Verification
- Vertical Clearance
- Stream Bed Profile

Inspection Team:

Inspection Date: 03/11/2014

Inspector: BLOCKF

Inspector (Team Leader)

CDOT PONTIS BRIDGE INSPECTION TALLY SHEET

Hwy: 50 Bus

Structure: K-18-R

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			Member Designation																Total Qty of Member by CS						
Elem No	Element Name	Unit/Span	CS	A	B	C	D	E	F	G	H		A	B	C	D	E	F	G	H		CS 2	CS 3	CS 4	CS 5
113	Stringers Pntd	16/15	2			4	2	2	2					2	5	5	5	5	5			37			
Member qty: <u>17</u> Lf/Ea			3			10								5	5				4				24		
			4	8	5					5				10					3				31		
			5	9	12					12	17		17								17			84	
113	Stringers Pntd	14/13	2											2	2	2	2	2				10			
Member qty: <u>17</u> Lf/Ea			3		12	15	15	15	15	15											6		93		
			4	9	5	2	2	2	2	2	5								3	5			37		
			5	8							12		17						14	6			57		
113	Stringers Pntd	12/11	2			2	2	2	2						2	2	2	2	5			21			
Member qty: <u>17</u> Lf/Ea			3		3									5					7	3			18		
			4		4					7			7	6						3			27		
			5	17	10					10	17		10	6							11			81	
113	Stringers Pntd	10/9	2			2	2	2	2	1				2	2	4	2	2	2			23			
Member qty: <u>17</u> Lf/Ea			3		11			1		3				3	3		4	2	1				28		
			4	1	6									3	3			2	2	7			24		
			5	16							17		17								10			60	
113	Stringers Pntd	8/7	2		3	2	2	2	2	2				2	3	2	2	2	4			28			
Member qty: <u>17</u> Lf/Ea			3							3				2	2			2	2				11		
			4	6							5									2			13		
			5	11							12		17								15			55	

CDOT PONTIS BRIDGE INSPECTION TALLY SHEET

Hwy: 50 Bus

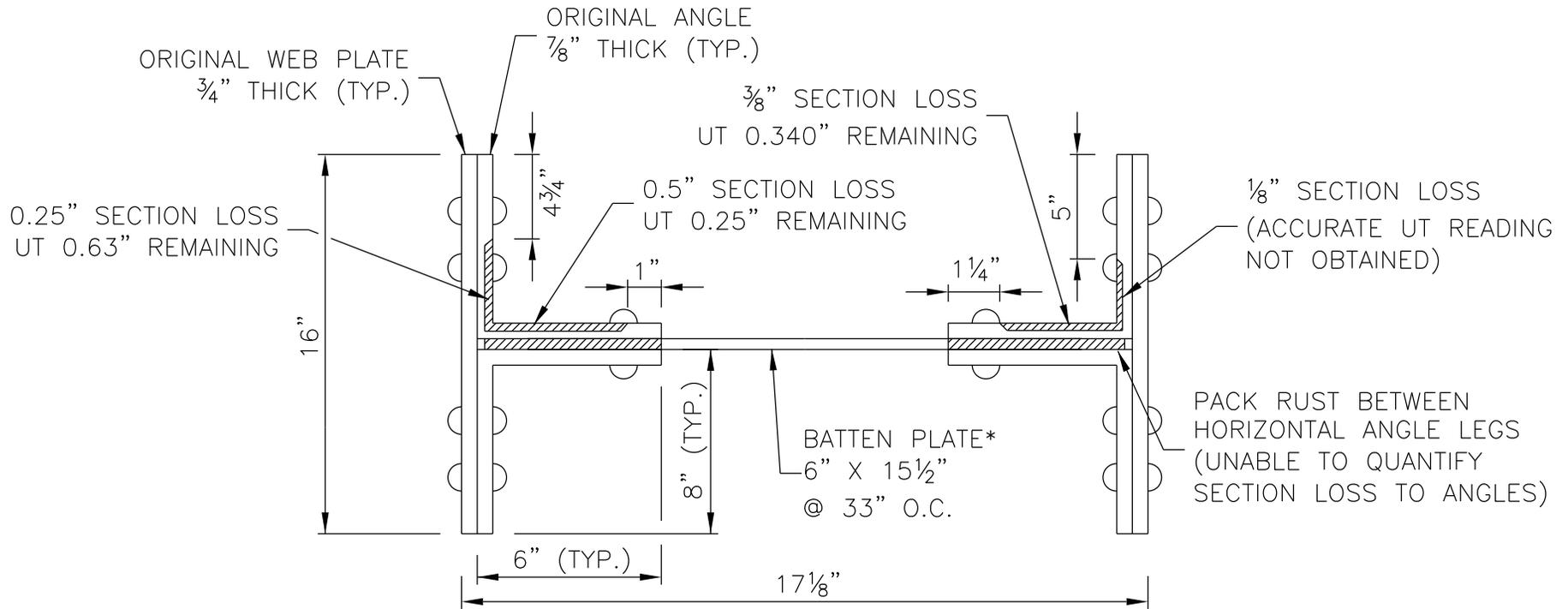
Structure: K-18-R

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			Member Designation																	Total Qty of Member by CS				
Elem No	Element Name	Unit/Span	CS	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	CS 2	CS 3	CS 4	CS 5
152	Ptd. Stl. Flr Beam	EA	2																		0			
Member qty: <u>30</u> Lf/Ea 30' x 17 = 510'			3	15	12	25	12	11	14	12	13	20	9	10	6		22	8	12	24		225		
			4	15	11	5	6	10	10	9	13	6	11	9	13	10	6	9	10	6			159	
			5		7		12	9	6	9	4	4	10	11	11	20	2	13	8				126	
121	Ptd. Stl. Low Chd.	Panel	2	17	17	17	17	15	17	16	17	17	17	17	17	17	17	17	17		269			
Member qty: <u>17.5</u> Lf/Ea 17.5' x 16 x 2 = 560'			3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10			160		
			4	4	8	2	8	8	8	8	8	8	8	4	4	4	8	4	8				102	
			5	4		6		2		1				4	4	4		4					29	
126	Ptd. Stl. Up Chd.	Panel	2																		0			
Member qty: <u>17.5</u> Lf/Ea 17.5' x 16 x 2 = 560'			3		35	35	35	35	35	35	35	35	35	35	35	35	35	35				490		
			4	35															35				70	
			5																				0	
			2																		0			
Member qty: <u> </u> Lf/Ea			3																			0		
			4																				0	
			5																				0	
			2																		0			
Member qty: <u> </u> Lf/Ea			3																			0		
			4																				0	
			5																				0	
			2																		0			

Appendix D – Section Loss to Lower Chord & Rivet Replacement Schedule

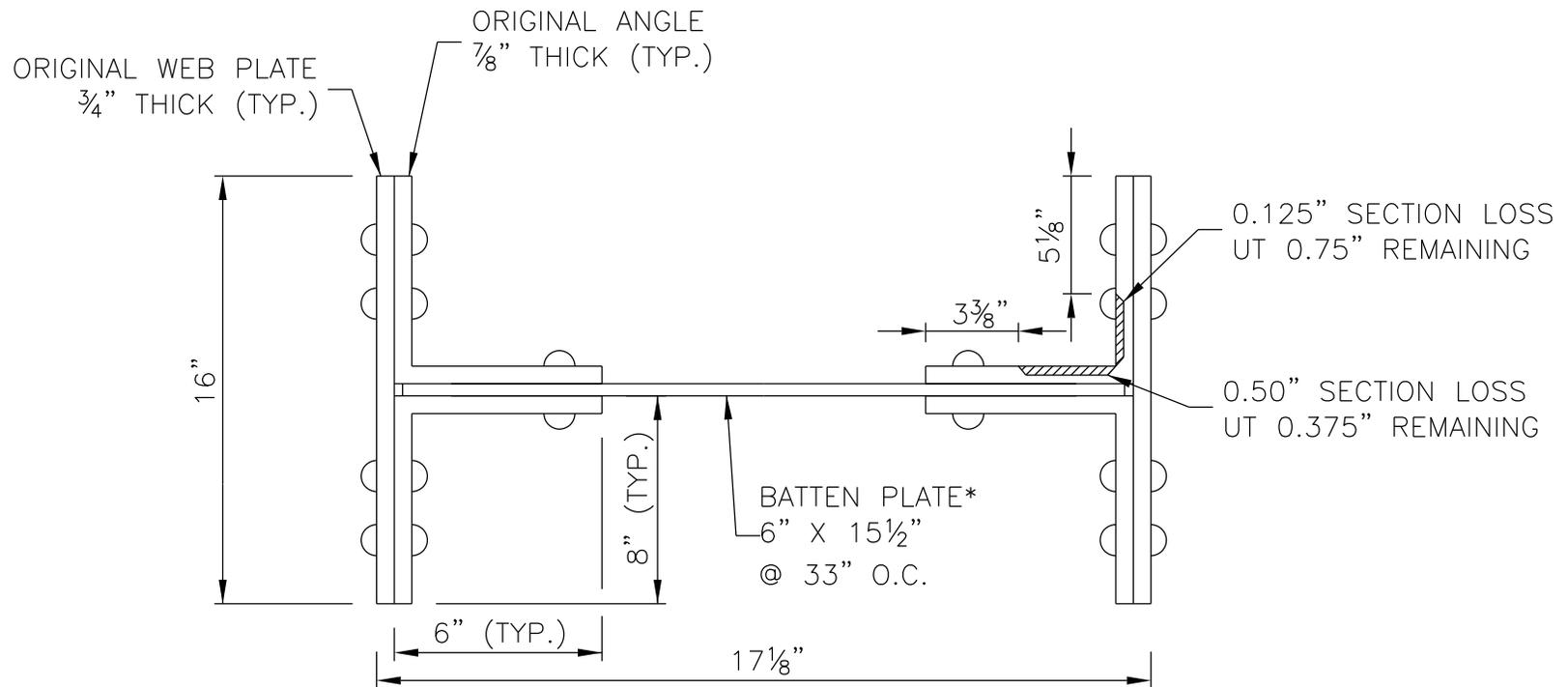
WORST-CASE SECTION LOSS, RIGHT TRUSS LOWER CHORD
 BAY 10, 32 INCHES NORTH OF PANEL POINT 10



NOTE: SECTION LOSS IN CROSS SECTION SHOWN
 DEPICTS 12" LONG AFFECTED SECTION
 OF LOWER CHORD

*SECTION OF BATTEN SHOULD BE NEGLECTED
 FOR RATING PURPOSES

WORST-CASE SECTION LOSS, LEFT TRUSS LOWER CHORD
 BAY 12, 32 INCHES NORTH OF PANEL POINT 12



NOTE: SECTION LOSS IN CROSS SECTION SHOWN
 DEPICTS 16" LONG AFFECTED SECTION
 OF LOWER CHORD

*SECTION OF BATTEN SHOULD BE NEGLECTED
 FOR RATING PURPOSES.

Rivet Replacement Schedule					
Truss	Panel Point	Distance N/S*	Associated Truss Members	Number of Rivets For Replacement	Additional Recommended Actions
Right	0	0	Lower Lateral Bracing Gusset	17	
Left	2	0	Lower Lateral Bracing Gusset	58	Replace gusset, lateral, and all associated rivets
Right	2	0	Lower Lateral Bracing Gusset	58	Replace gusset, lateral, and all associated rivets
Left	4	0	Lower Chord Splice	38	
Right	4	0	Lower Chord Splice	30	
Right	4	0	Floorbeam to Lower Lateral Bracing Gusset Plate	58	Sandblast LLB gusset, Floorbeam bottom flange & Lower Chord and evaluate for replacement
Left	6	2'/0'	Lower Chord Splice	70	
Left	6	0	Lower Lateral Bracing Gusset	58	Sandblast LLB gusset, Floorbeam bottom flange & Lower Chord and evaluate for replacement
Right	6	0	Lower Lateral Bracing Gusset	58	Replace gusset plate
Right	6	0	Lower Chord Splice	56	
Left	7	0	Top of Floorbeam to Vertical at Lower Chord	2	
Left	8	2'/0'	Lower Chord Splice	72	
Left	8	0	Floorbeam to Lower Lateral Bracing Gusset Plate	6	
Right	8	0	Lower Chord Splice	66	Sandblast top web splice and evaluate for replacement
Right	8	0	Diagonal M7L8	1	Replace missing rivet near lower chord connection
Right	8	0/4'	Lower Chord Batten Plate	2	
Right	9	0	Top of Floorbeam to Vertical at Lower Chord	2	
Left	10	0	Lower Chord Splice	58	Sandblast top web splice and
Left	10	0	Lower Lateral Bracing Gusset	58	Replace gusset plate (50% loss)
Right	10	0	Lower Lateral Bracing Gusset	5	
Right	10	0/2'	Lower Chord Splice	66	Sandblast top web splice and evaluate for replacement
Left	12	0'/2'	Lower Lateral Bracing Gusset	58	Replace gusset plate
Right	12	0/2'	Lower Chord Splice	20	
Left	14	0	Lower Lateral Bracing Gusset	58	Replace gusset, lateral, and all associated rivets
Right	14	0	Lower Lateral Bracing Gusset	58	Replace gusset plate
Left	15	0	Floorbeam to Lower Chord	2	
Right	15	0	Top Floorbeam to Vertical	2	
Right	16	0	Lower Lateral Bracing Gusset	30	Replace gusset plate

Total: 1067

*Distance measured in feet north or south from the identified panel point

Appendix E – Detailed Floor System Field Notes

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
GP & LLB	0	The right and left truss gussets have R3 corrosion on plates and section loss to rivet heads (17) total need replacement. Pack rust between the vertical legs of the lower lateral bracings is causing 1 ¼ inch separation of the angles at the right truss and 1 inch separation of the angles at the left truss. The horizontal leg of the lower lateral bracing at the right truss has a 1 inch diameter perforation at the gusset connection.	
FLOORBEAM	0	Abutment 1 – The top and bottom flanges have R2 corrosion for 3 feet at each end. The bottom flange has R1 corrosion over its remaining length.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____

DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	1	There is a 2 foot x 2 foot spall with exposed and corroded reinforcing with 50% to 100% section loss near the left truss. The left exterior deck near Stringer A has (2) full-depth repair areas with plywood forms still in place. Right edge of deck has rock pockets and appears to have been very poor concrete originally. Bay G has severe spalling, 7 foot x 3 foot 6 inch x up to 5 inches deep spalling near Floorbeam 1 with 50% to 100% section loss to lower transverse and longitudinal reinforcement. There is also a 6 feet x 2 feet spall at Abutment 1 with 50% to 100% loss of section to reinforcing. Timber formwork remains in all bays between Stringers A and H with perimeter halo spalls and exposed reinforcing. The joint at A1 has been repaired at some point within the structure's lifespan.	
STRINGER	1	Stringer A has R4 corrosion 3/4 inch pack rust lifting the deck off the top flange and rotating the stringer. Stringer H has R4 corrosion with 1/4 inch section loss at the base of the web and (6) 1 inch diameter perforations extending 5 feet from its bearing at Floorbeam 0. Stringer H also has R4 laminating corrosion on the top flange for 6 feet at the north and south ends with up to 1 inch deck lift and 1/2 inch deck lift at mid-span. Most of the bearing clip angles to each floorbeam have pack rust up to 1/2 inch.	
FLOORBEAM	1	The top flange has 4 feet ± of R4 corrosion on the ends. The bottom flange has 4 feet ± of R2 corrosion on the ends. The web has spotty R1 to R2 corrosion, especially near the ends.	
LOWER CHORD	1	The left and right truss gusset plates have R1 to R2 corrosion and minor pack rust between plates and lower chords causing 3/8 inch separation of the outside at the bottom and also between lower chord cover plates and top legs of angles. Vertical L1M1 right and left truss has R1 to R2 corrosion on the web.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____

DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	2	There is a 2 foot x 3 foot full-depth repair in Bay A with 30 SF of spalling with exposed and corroded reinforcing adjacent to repair. Bay B has a 3 foot 4 inch x 1 foot spall with exposed and corroded reinforcing. There is a 1/32 inch transverse cracks in Bays B through D with efflorescence and active leakage. Bay F has a 2 feet x 1.5 feet spall with reinforcing exposed. Bay G has 15 feet x 4 feet full-depth repair. Vertical portion on right edge of deck has rock pockets and appears to have been poorly placed or too stiff at the time of construction. Visible areas of concrete between plywood forms have deterioration consisting of full bay width spalls up to 3 inches deep with exposure and 80%-100% section loss to the bottom reinforcing mat.	
STRINGER	2	Stringer A is thrusting out of the vertical plane up to 3/4 inch. Stringers A and G have R1 to R3 corrosion on the top flanges and R1 corrosion on bottom flanges and webs. Minor rust pack is associated with the bearing clip angles of exterior Stringers A, B, G and H. (2) rivet heads at Stringers C and D and one at Stringer E web connection clip angles to the web of Floorbeam 2 have broken off and have been replaced with through-bolts. Stringer H has 14 feet of R4 corrosion and 3 feet of R3 corrosion on the top flange lifting the deck up to 3/4 inch. Interior Stringers B through F have little to no signs of corrosion except for isolated portions of their top flanges with very Light R1.	
GP & LLB	2	(Drains at this location) - Deck drains are located within Panel 3 at Floorbeam 2 between Stringers A-B and G-H draining directly upon the lower lateral bracing gusset plates and their connections to the floorbeam and lower chord. The right and left truss gussets both have R4 corrosion with large perforations in the plates up to 7 1/2 inches x 4 1/2 inches and the worst case at the north side of Floorbeam 2. The connections to the lower chord and floorbeam have R3 to R4 corrosion with minor section loss to rivet heads along with pack rust formation. Pack rust formation between the angles of the lower lateral bracings has caused deflection and separation up to 2 1/2 inches. Hammering revealed 100% section loss in the vertical leg for the top 3 inches of the 5 inch x 5 inch x 1/2 inch angle approximately 3 feet away from Floorbeam 2 in Panel 3 at right, similar condition at left. Gussets, lower lateral bracing, and associated rivets, (116) total, need replacement at these locations. The right truss has 100% section loss over a 10 inch portion of the lateral bracing angle vertical legs.	
FLOORBEAM	2	The top flange has 3 feet of R4 corrosion on left end and 10 feet of R3 to R4 corrosion on right end. The left end of the bottom flange has R3 corrosion for 4 feet and the right end has R3 to R4 corrosion for 2 feet and R2 to R3 corrosion for 8 feet with minor section loss section to rivet heads. The web has R1 to R2 corrosion.	
LOWER CHORD	2	The left and right truss Diagonals M1L2/L2M3 have spotty R1 corrosion on battens, lattices and channels. The Verticals L2U2 have R1 corrosion on webs and angles with minor pack rust at gusset connections. The left and right truss lower chords have Light R1 to R1 corrosion with pack rust distorting plates at connections to verticals at Panel Point 1. Left truss Member L2M3 has pack rust at the interior gusset plate at the connection with Floorbeam 2 top flange with an 8 inch x 4 inch area of R4 corrosion. The batten plate beneath L2U2 is compressed and bulging up to 1/2 inch.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	3	4 feet x 4 feet patch and 18 SF of severely spalled concrete (nearly full depth in Bay A) around drains with exposed and corroded reinforcing with up to 50% section loss in Bays A and G at Floorbeam 2. 4 foot x 3 foot patch in Bay A and 10 SF of spalling with 30% to 70% loss of section to the exposed rebar. Bay B has hairline to 1/32 inch cracks with minor efflorescence. The north half of Bay F has unconsolidated concrete with exposed and corroded reinforcing with 10% section loss.	
STRINGER	3	The webs of Stringers A and H have R1 to R2 corrosion. Pack rust formations up to ¼ inch at the bearing clip angles of exterior Stringers A, B, G and H with the worst case at the connections to Floorbeam 3. (2) rivet heads at Stringers C and D and (1) at Stringer E bearing clip angles to the web of Floorbeam 2 have broken off and have been replaced with through-bolts. Stringer H has 7 feet of R4 corrosion with 100% section loss at Floorbeam 2. R1 to R3 corrosion along with an additional 3 feet of R4 corrosion exist along the remaining length with ½ inch deck lift. Interior Stringers B through G show little to no signs of corrosion.	
FLOORBEAM	3	The ends of top flanges have R2 to R3 corrosion for 4 feet. There is R4 corrosion to the left 1 foot of the top flange with up to 50% section loss and laminating steel lifting the deck up 1 inch. The ends of the bottom flanges have R1 corrosion.	
LOWER CHORD	3	The left and right truss gusset plates have R1 corrosion and minor rust pack between plates and lower chords causing 3/8 inch separation on the outside at the bottom and also between lower chord cover plates and top leg of angles. Left and right truss member L2M3 has light R1 corrosion on web. The right exterior gusset plate at Member L3U3 has pack rust with distortion up to 3/8 inch.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____

DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	4	Bay A has a 9 SF area of delamination and (2) spalls, 3 foot x 1 foot and 1 foot x 1 foot near Floorbeam 4. Cracking with efflorescence and active leaking through Bays A and G. Bay G has a 1 foot x 1 foot spall with exposed and corroded reinforcing in east overhang near Floorbeam 3 and a 6 foot x 4 foot full depth repair in Bay G. There is a total of 4 SF of spalled concrete, up to 1 inch deep with exposed and corroded (R4) reinforcing in Bay G. 6 foot x 4 foot patch with formwork still in place in Bay G.	
STRINGER	4	Stringer A top flange has full length R4 corrosion with section loss up to 50% and the top flange of H has 5 feet of R4 at Floorbeam 4 with areas of 100% section loss. Deck lift up to 1 inch. There is R1 to R3 corrosion on the remainder of top flanges of Stringers A and H with webs having Light R1 to R1 and bottom flange of Stringer H with R1 to R2 corrosion. Minor pack rust is at the bearing clip angles to Floorbeams 3 and 4. Bearing clip angle to Stringer A at Floorbeam 4 is beginning to deflect downward ½ inch due to pack rust in top flange. Stringer E has Light R1 on flange and web and Stringer F has R1 to R2 corrosion on bottom flange and Light R1 on the web. Stringer G has R1 corrosion in both of the top and bottom flanges for 5 feet at each end.	
GP & LLB	4	The right and left truss gusset plates both have R4 corrosion with perforations. The left side has (2) perforations, 8 inches x 8 inches and 3 inches x 3 inches. The clip angles have R4 corrosion with 60% to 100% loss of section to rivet heads. (58) total rivets need to be replaced at the right truss lower lateral bracing gusset plate connection. Heavy rust pack exists at all connections including ¾ inch separation at the right truss lateral and ¼ inch separation of vertical legs of the left truss lateral. There is up to 1 inch of pack rust causing distortion to the lower lateral bracing gusset plate to Floorbeam 4 at the right end.	
FLOORBEAM	4	The top flange has R3 to R4 corrosion over the entire 30 feet with near 100% section loss (1/10 inch to 1/8 inch remaining) to top flange over 10 feet at right and 4 feet at left with less than 30% section loss over the remainder (knife edge). The bottom flange has R4 corrosion for 2 feet ± on the left end with 50% to 90% section loss of rivet heads near gusset. The right side has R3 corrosion at end for 2 feet on the bottom flange. The web has R2 for 4 feet on ends with R2 to R3 corrosion on the final 1 foot at the right.	
LOWER CHORD	4	Left and right truss outside gusset plates have Light R1 corrosion with spotty R2 corrosion inside and minor rust pack between plates. Outside splice plates have R1 corrosion. Top inside splice plates have heavy R3 corrosion with 50% to 100% section loss to rivet heads in bottom row. Top batten splice plates have heavy R3 with 70% to 100% section loss to rivet heads. Left and right truss members U2L4/L4U4 have R1 to R2 corrosion on web plate and R1 corrosion on flanges. Left and right truss member L4M5 has R1 corrosion on battens, lattices and channels. L4U4 flange has R4 perforation at right truss 3 inches. The left and right truss splice plates for the lower chord web have section loss up to 100% to (16) rivet heads along with R4 corrosion to plates themselves. (38) total rivets need replacement at the left truss and (30) rivets need replacement at the right truss lower chord splices.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	5	Bay A has a 2 foot x 2 foot area of cracking and efflorescence. (2) 1 foot x 1 foot spalls in Bay A and a 3 SF area of delamination in Bay B near Floorbeam 4. There is a 2 foot x 2 foot area of spalled concrete in Bay G with exposed and corroded (R4) reinforcing. Also within Bay G, there is a patched, full depth concrete repair. The repaired area has a full perimeter halo spall with exposed and corroded (R3) reinforcing. There is saturated concrete with cracking, efflorescence, and rust staining in Bays E through G.	
STRINGER	5	Stringers A and H have R2 to R3 corrosion on top flanges with Stringer A having additional R4 corrosion for 4 feet at each end and Stringer H having 8 feet of R4 corrosion with 100% section loss over 2 feet at Floorbeam 4. Deck lift of approximately ½ inch along Stringers A and H. Approximately 2 feet of R2 to R3 corrosion exists on webs and bottom flanges at the ends of Stringers A and H. Stringer A has a 1 inch and a 2 inch diameter perforation through the base of the web, 3 feet from Floorbeam 5. There is R2 to R3 corrosion on Stringers A, F, G and H bearing clip angles to floorbeams with minor pack rust at bearing points.	
FLOORBEAM	5	The top flange has R4 corrosion for 4 feet on the left end and R4 corrosion for 7 feet on the right end with up to 50% section loss. The bottom flange shows R2 corrosion on the ends. The web has Light R1 to R1 corrosion, especially at the bearing area for Stringer H.	
LOWER CHORD	5	Left and right truss connection plates have R1 corrosion with rust pack between plates causing ¼ inch separation. Vertical L5M5, left and right trusses, have R1 corrosion on webs and flanges. Right truss vertical L4U4 has a 3 inch diameter perforation through the inboard flange at its connection with Floorbeam 4. Right truss diagonal L4M5 has R1 with spotty Light R1 to R1 corrosion along lattice and flanges.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	6	Bays A and G each have a 2 foot x 3 foot area of spalled concrete near mid-span with exposed and corroded (R3) reinforcing. There is cracking with efflorescence and active leakage throughout Bays A and G.	
STRINGER	6	Stringer A top flange has R4 corrosion for 10 feet along the middle of the member and Stringer H has R4 corrosion for 6 feet with the remaining lengths having R1 to R3 corrosion. Stringers A and H have R1 to R2 corrosion of their webs and bottom flanges along with R1 corrosion on bearing clip angles with minor rust pack. Laminations of the top flanges have contributed to 3/4 inch deck lift. Bearing clip angle for Stringer H to Floorbeam 6 has 1/2 inch pack rust. The bottom flange of Stringer E has distortion 1/4 inch out of plane over 1 foot length near the center of the member, likely from construction. Interior Stringers B through G have Light R1 corrosion at top flange edges exposed from deck lift.	
GP & LLB	6	(Drain at this location) – The right truss gusset plate has R4 corrosion with an 8 inch x 4 inch perforation hole. The right truss clip angle has R1 to R4 corrosion with 90% section loss of (3) rivet heads in the bottom leg, and 60% section loss of (2) rivet heads in the vertical leg. The right side has 100% section loss in the vertical leg at the clip angle with 60% to 90% section loss of (2) rivet heads. All (58) rivets should be replaced at each end and the gusset plate should be replaced at the right end. The left truss gusset plate has R4 corrosion. The connection clip angle on left truss has R4 corrosion with 60% section loss of (2) rivet heads. The right and left truss lateral clip angles have 50% section loss of (1) rivet head, and have heavy pack rust between the gusset plates and all connections causing the plates to bulge. The right and left truss laterals have moderate pack rust between the vertical leg and very end of clip angles causing 1/4 inch to 1/2 inch separation.	
FLOORBEAM	6	The top flange has R4 corrosion for 5 feet on the left end and 6 feet on the right end. The bottom flange has R3 to R4 corrosion for 5 feet on the left end. The right bottom flange has R3 corrosion on both legs for 5 feet on each end with 1/4 inch section loss at gusset and 100% section loss of (3) rivet heads in the bottom leg connection to gusset. The right end of the web has R2 corrosion for 4 feet and the left end has R2 corrosion for 3 feet.	
LOWER CHORD	6	Left and right trusses both have R1 corrosion on outside splice and gusset plates, R1 to R2 corrosion on inside top splice plates with 50% to 90% loss of most rivet heads in bottom row and 1/8 inch section loss on plates. (56) rivets on the right truss splice and (70) rivets on the left truss splice need replacement. There is pack rust between floor beam connection angles and gusset with up to 1/2 inch at the left floorbeam to gusset connection. U4L6 of the right truss has a crack through the rivet hole in bottom inside flange due to vehicle impact to this member with little to no continued deterioration from previous inspections. The vertical member L6U6 has an area of isolated section loss to web near the underside of deck up to 3/16 inch section loss.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	7	Bay A has a 2 foot x 2 foot area of delamination and spalls with efflorescence. Bay A has a 1 SF and Bay G has a 6 SF area of spalled concrete around deck drains with exposed and corroded (R3) reinforcing. Bay G has 4 foot x 2 foot delamination and spall with up to 100% section loss to the exposed transverse reinforcing around the deck drain. There is a 4 foot x 2 foot x 3 inch deep spall in Bay G.	
STRINGER	7	Stringer A top flange has 15 feet of R4 corrosion. Stringer H top flange has 12 feet of R4 corrosion. R2 to R3 corrosion exist along remainder of each with R1 to R2 along webs and bottom flanges near Floorbeam 6 and at mid-span. Deck lift at Stringer A up to 1 inch and at Stringer H up to ½ inch. Bearing clip angles on Stringer A at both floorbeams are pushed down ¼ inch due to pack rust. Interior Stringers B through G show little to no signs of corrosion.	
FLOORBEAM	7	The top flange has R3 to R4 corrosion for 11 feet on the left end with up to 50% section loss. The right end top flange has 5 feet of R3 corrosion. The bottom flange at the left end has R2 corrosion. The bottom flange at the right end has Light R1 corrosion. The corrosion on the left end extends to the middle of the floorbeam. There are (8) drilled holes, (4) on the north side and (4) on the south side at the left end in the bottom flange. These holes are likely due to construction and insignificant. The right end of the web has R1 corrosion and the left end has R2 corrosion. The connection plate to the vertical L7M7 has R4 corrosion with up to 50% section loss toward the top of the floorbeam at the left end with (2) missing rivets that need replacement (also noted in lower chord, Bay 7 notes).	
LOWER CHORD	7	Left and right truss connection plates to lower chords have R1 to R2 corrosion with minor pack rust causing 1/8 inch separation at (1) location at right. L7M7 on the left and right trusses have R1 corrosion on the web and flange angles. Left truss vertical L7M7 has 60% section loss to filler plate with (2) missing rivets at connection to the top flange of Floorbeam 7.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	8	(6) 1 SF spalls with exposed and corroded reinforcing in Bay A along Stringer A. Bay B has minor hairline cracks with light efflorescence. There is up to 4 SF of cracking and delamination in Bay G near Floorbeam 8. There is a 16 foot long crack with associated delamination and spalling with exposed and corroded (R4) reinforcing in Bay G.	
STRINGER	8	Stringers A and H have R3 to R4 corrosion of top flanges including laminating R4 corrosion over the middle 3 feet with deck lift up to 3/4 inch. Stringer A has a 2 inch x 1 inch perforation in top flange near mid-span on exterior side. Stringer A also exhibits R2 corrosion full length along the bottom flange and web. Stringer H has heavy R2 corrosion on the exterior web for 1 foot. The top flange of Stringer H has 2 feet of nearly 100% section loss on exterior edge near mid-span. Interior Stringers B through G show little to no signs of corrosion.	
GP & LLB	8	The right and left truss gusset plates and clip angles both have minor debris accumulation with R1 to R2 corrosion with pack rust between plates and flanges. Laterals have Light R1 corrosion on ends.	
FLOORBEAM	8	The top flange has R4 corrosion for 2 feet and R3 for 3 feet at each end. The left and right ends of the bottom flange have R3 corrosion with 50% section loss of rivet heads at each end. (6) rivets need to be replaced at the floorbeam's connection to the lower lateral bracing gusset plate connection at the left end. There is R1 corrosion on both ends of the web. There is also isolated R2 corrosion in the web of the floorbeam cantilever at the right end.	
LOWER CHORD	8	Left and right trusses both have R1 corrosion on outside splice and gusset plates and R3 corrosion on inside top splice plates with 50% to 90% loss of most rivet heads in bottom row and 1/8 inch section loss on plates. (1) rivet is popping out at the left truss. (1) rivet is missing from the built-up member M7L8 at Panel Point 8 that needs replacement. (72) total rivets need replacement at the left lower chord splice. The right lower chord splice needs (66) rivets replaced as well. There are (2) rivets that need replacement in the right lower chord batten plate. There is debris at Panel Point 8.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	9	Bay A has 10 SF of delamination. There is some minor cracking with efflorescence in Bays B through D. Bays E and F have 5 SF each of minor spalling, one with exposed reinforcing and minor corrosion (Light R1) to reinforcing. This spalling is likely due to a very punky concrete surface. Bay G has a 1 foot diameter x 1 inch deep spall with exposed and corroded (R4) reinforcing. In addition to the spall, there are (2) areas of delamination at mid-span of Bay G, one at 16 SF and one at 8 SF, both near Floorbeam 9.	
STRINGER	9	Stringer A has R4 corrosion with 80% to 100% section loss for 14 feet and R3 corrosion for the remainder. Stringer H has R4 corrosion to top flange over 10 feet and R3 corrosion for the remainder. Both exterior Stringers A and H have up to 5/8 inch deck lift and R2 corrosion on bottom flanges with minor pack rust at bearing clip angles. The web of Stringer A has (2) areas of R3 to R4 corrosion measuring 6 inches x 3 inches with up to ¼ inch section loss, a 1 inch diameter perforation located 4 feet from Floorbeam 8 and a 1/2 inch perforation at approximately mid-span. Stringers B through C have R2 corrosion of the top flange for 3 feet each. Interior Stringers D through G show little to no signs of corrosion.	
FLOORBEAM	9	The top flange has R3 to R4 corrosion for 3 feet on the left end. The top flange has R3 to R4 corrosion on the north side for 4 feet and the south side for 7 feet on the right end. The bottom flange has R1 to R3 corrosion for 3 feet on the right end. The web has spotty R1 corrosion on the left end and R1 to R2 corrosion with section loss on the right end. The connection plate to L9M9 on the right truss has (2) rivets with 100% section loss that need to be replaced on floorbeam connection plate above the top flange and R4 to top flange with up to 85% section loss.	
LOWER CHORD	9	Left and right trusses have Light R1 corrosion on the flange angles and web plate. Light pack rust exists between the connection plate and lower cord. The right truss vertical L9M9 has paint loss and R1 corrosion of the web and internal flanges with minor pack rust between the internal flange and gusset to lower chord. There is R2 to R3 laminating corrosion to the top legs of the interior faces of the angles with up to 1/32 inch section loss.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____

DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	10	Bay A has 1/32 inch to 1/16 inch wide cracks for the full width. The deck drain in Bay A has delamination around the perimeter and the drain appears to be plugged. There are (2) cracks, up to 1/32 inch wide, with efflorescence in Bay B. Bay G has a 4 foot x 2 foot deck repair with perimeter halo spalling with exposed and corroded (R4) reinforcing around this repair. There are minor spalls with exposed and corroded (R3) reinforcing around the deck drain in Bay B.	
STRINGER	10	Stringers A and H have R4 laminating corrosion to top flange with 50% to 100% section loss over approximately 16 feet of their 17 foot length. The deck is lifted up to 1 inch from rust buildup along corroded top flanges of exterior Stringers A and H. The webs of Stringers A and H have R1 to Heavy R2 corrosion with rust pack between bearing clip angles to floorbeams. The exterior channel next to Stringer A is impacted and out of plane 5 inches and no longer holds any load. The damage appears to be from construction likely when the sidewalk was removed. Stringer B has 6 feet of R2 corrosion on top flange and R1 corrosion for remainder. Stringer B bearing clip angle has ¼ inch pack rust. Stringer E clip angle to Floorbeam 10 has had two rivets replaced with bolts. The bolts are tight. Interior Stringers C through G show little to no signs of corrosion.	
GP & LLB	10	(Drain at this location) – The right and left truss gusset plates have R1 to R2 corrosion with pack rust between plates and bottom flange angles, laterals and bearing clip angles. The left truss gusset for the lower lateral bracing has 50% section loss to the plate. Rivets on gusset plate to lower chord clip angle have 70% section loss at the right truss, (5) of these rivets need to be replaced. Both laterals have Light R1 to R1 corrosion. (58) rivets and the gusset plate need to be replaced at the left lower lateral bracing gusset plate connection.	
FLOORBEAM	10	The top flange has R3 to R4 corrosion for 4 feet on left end and 5 feet on the right end with up to 50% section loss near the end. The bottom flange has R1 to R2 corrosion for 2 feet ± at each end. The beam web has R1 to R2 corrosion for 4 feet on both ends.	
LOWER CHORD	10	Left truss has R3 to R4 corrosion on the web and interior splice plates with areas of pitting up to ¼ inch and 30% to 80% loss of rivet heads, (10) rivets need to be replaced here. Light R1 corrosion on right truss with ¼ inch pack rust between chord top flange angles and the diagonal M9L10 and on the gusset plate. The right truss has significant debris accumulation within Panel Point 10 with R2 to R3 corrosion on interior surfaces of top flanges with pitting and 1/8 inch + laminating corrosion and 30% to 80% section loss of rivet heads to the vertical and horizontal legs of the bottom chord angles. (66) of these rivets need to be replaced. There is also laminating corrosion between the horizontal legs of the top and bottom angles.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	11	Bay A has 4 SF of delamination. Less transverse cracking and heavy efflorescence (stalactites up to 3 inches in Bay A) in Bays A, B, G and H. Full depth deck repair, 4 foot x 4 foot, with plywood formwork still in place in Bay G. Bay G also has 10 SF of cracking and delamination with efflorescence near Floorbeam 11.	
STRINGER	11	Stringer A has laminating R4 corrosion with 50% to 100% section loss of the top flange for 5 feet at mid-span lifting the deck 1 inch. Stringer H has laminating corrosion with 100% section loss on the outer edge of the top flange over 11 feet lifting the deck 1¼ inch. The webs and bottom flanges of Stringers A and H exhibit R1 to R3 corrosion. Stringer B also has R4 corrosion of its top flange for 6 feet at mid-member with 60% section loss. Stringer C is starting to flex with slight out-of-plane rotation in web at coping. (2) rivets have been replaced with bolts at Stringer E connection to Floorbeam 10. Interior Stringers C through G show little to no signs of corrosion.	
FLOORBEAM	11	The top flange has 3 feet of R4 corrosion on left end with up to 50% section loss and 9 feet of R3 corrosion on the right end with 3 feet of R4 corrosion. The bottom flange has 5 feet of R2 corrosion at the ends with R1 corrosion over the remaining length. The beam web has R1 with spotty R2 corrosion over 3 feet at the right end.	
LOWER CHORD	11	Connection plates to lower cords have minor pack rust causing slight separation between plates of both trusses. The splice plate on the left truss at Panel Point 10 has R3 to R4 corrosion with up to 40% section loss and 40% to 90% section loss to the rivet heads. There is R1 corrosion on web plates and flange angles; in addition, the right truss has spotty R2 corrosion on the web of the vertical with 1/16 inch section loss. The lower chord splice of the right truss near Panel Point 10 has heavy debris accumulation with R2 to R3 corrosion with up to 20% section loss of the top web splice and interior surfaces of the top flanges with 30% to 90% section loss of rivet heads. The left and right truss verticals L11M11 have R1 to R2 corrosion of the web with 1/16 inch section loss.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	12	There is heavy efflorescence and stalactites (up to 4 inches) with active leakage from transverse cracks in exterior Bays A and G. Bays B and F have hairline cracking with light to moderate efflorescence.	
STRINGER	12	Exterior Stringers A and H have R3 to R4 corrosion over full length of top flanges lifting the deck ¼ inch. Stringers B and G have R1 to R4 corrosion along the entire length of the top flanges. Stringer B also has 9 feet of R3 to R4 corrosion, 8 feet of R1 to R2 corrosion, and 9 feet of R2 corrosion along the bottom flange. The exterior web of Stringer H has R2 corrosion for 6 feet along its length with an additional 1 foot of R2 to R3 corrosion at Floorbeam 11. There is minor pack rust at nearly all bearing clip angles. Stringers C through F have Light R1 to the top flanges.	
GP & LLB	12	Gussets at both trusses have R3 corrosion on the south side and R1 to R2 corrosion on the north side. There is pack rust between the plate and the flange angles with minor section loss, up to 1/16 inch. The laterals have only spotty R1 corrosion with R1 to R2 corrosion on the horizontal leg of the clip angle to the lower chord. (58) rivets and the gusset plate need to be replaced at the left truss.	
FLOORBEAM	12	The beam has R4 corrosion on the top flange at the left end for 3 feet changing to R3 corrosion for 6 feet. The top flanges at the right have 6 feet of R4 corrosion and R3 corrosion for 4 feet. The bottom flange has R1 to R3 corrosion for the full length. The web of the floorbeam has Light R1 to R1 corrosion for 10 feet at right throughout with 2 feet of R2 at the left end.	
LOWER CHORD	12	The left side has ¼ inch section loss on inside splice plates with 60% to 100% loss of rivet heads. Bottom angle legs of lower chord have section loss with 90% to 100% of (11) rivet heads and 50% on remaining (3) rivet heads. (20) rivets in total need to be replaced here. The right truss has section loss that is similar. Diagonals and vertical members at this connection have spotty R1 to light R2 corrosion. The right truss has light debris accumulation along the top of the lower chord web angles and batten plates with associated R2 to R3 corrosion on top of horizontal legs of the top angles. Isolated Light R1 to R1 corrosion throughout. There is R3 to R4 corrosion with up to ½ inch pitting for 16 inches at 32 inches from Panel Point 12 in Bay 12 on the left side. There is a 1 inch diameter perforation through the batten plate near Panel Point 12.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	13	There is cracking with heavy efflorescence, stalactites (up to 4 inches), and active leakage in exterior Bays A and G. Bay A has a 4 SF area of delamination. There are (5) locations of cracking with efflorescence in Bay B. Pattern cracking with light to moderate efflorescence exists in Bay F.	
STRINGER	13	Stringers A and H have R3 to R4 corrosion over full length of top flanges, lifting the deck 3/4 inch. Stringer A has R1 to R2 corrosion throughout web and R2 corrosion throughout the bottom flange. Stringer B has R1 corrosion for 3 feet in the top flange near Floorbeam 12. Stringer G has R2 to R4 corrosion along the entire length of the top flange and R1 corrosion along the bottom flange. The bottom flange and web of Stringer H have R2 corrosion for 6 feet and R3 corrosion for 11 feet. Stringers C through F show Light R1 in the bottom flanges towards Floorbeam 13.	
FLOORBEAM	13	The top flange has R4 corrosion for 6 feet at left and right with up to 40% section loss with R2 to R3 corrosion for the remainder of the top flange. The bottom flange has R1 to R2 corrosion at the ends, primarily R2 for 4 feet at right, and isolated areas of R1 corrosion along remainder. The floorbeam web has Light R1 corrosion throughout with 1.5 feet of R2 at the left end.	
LOWER CHORD	13	Spotty R1 to R2 corrosion on battens, cover plates and angles with some 1/4 inch pack rust between plates. Left truss has 70% to 90% section loss in rivet heads at connection to lower chord angles near Floorbeam 12 at diagonal L12U14. Right truss splice connection with heavy debris accumulation, 1/8 inch section loss to top surface of web splice and interior surfaces of the lower chord top flanges with 60% to 100% section loss to rivet heads. The batten plate closest to Panel Point 13 is deformed downward up to 1 inch. There are deformations in the angles and cover plates due to pack rust beneath Panel Point 13 with section loss up to 1/2 inch to top interior angle splice plate on left side.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	14	Saturated concrete with cracking, efflorescence stalactites and light scale in Bays A, B, F, G and H. 13 SF affected in Bay B. 5 SF of spalled concrete with exposed and corroded (R4) reinforcing outside of Stringer H. 2 SF of delamination and spalls with exposed and corroded (R4) reinforcing in Bay G. (Note: Bay 14 is over the pedestrian walkway, where deteriorated concrete can fall onto walkway).	
STRINGER	14	Stringers A and H have R1 to R4 corrosion on the top flange with nearly 100% section loss on exterior edges, and R1 to R3 corrosion on web and rust pack between bottom flange and bearing clip angle with deck lift up to ¼ inch. Interior Stringers B through G have full length R1 to R3 corrosion on the top flange. Stringer B has an additional 3 feet of R3 to R4 corrosion at Floorbeam 13 with R2 corrosion and pack rust at the bearing clip angle to Floorbeam 13.	
GP & LLB	14	(Drain at this location) – R4 corrosion with perforations exist through the lateral bracing gusset plates on both trusses and the ends of the diagonal bracing angles in the Panel 14 side due to the deck drains. The left truss lower lateral bracing gusset plate within Panel 15 has R4 corrosion with (2) perforations measuring 2 inches in diameter and 5 inches x 3 inches. The right truss lower lateral bracing gusset plate has a 2 inch by 5 inch perforation. Gusset plate clip angle and bottom flange connections to the lower chord and floorbeam have R3 to R4 corrosion with 10% to 80% section loss of rivet heads with pack rust formation. Pack rust has formed between the angles of the lower lateral bracing forcing up to 1 ½ inch separation of the steel angles. There is a perforation in the horizontal leg up to 1 inch in diameter and (2) perforations in the vertical leg 14 inches x 2 inches and 8 inches x 2 inches in the lower lateral bracing at the left connection. All rivets, (116) total, and both gusset plates need to be repalced at Panel Point 14.	
FLOORBEAM	14	There is R2 to R3 corrosion for 4 feet at the right end of the top flange. The left end has R2 to R4 corrosion for 6 feet. The bottom flange has R4 corrosion with up to 5/16 inch loss of section to the horizontal leg of the angle and 3/16 inch of the vertical leg of the bottom flange angle due to dirt and moisture falling through the drain and retained on the gusset plates along the bottom flange. The bottom flange has R2 to R3 corrosion for 1 foot at the right end. The bottom flange is beginning to bulge at lower lateral bracing gusset plate connection due to pack rust.	
LOWER CHORD	14	There is R1 corrosion at the right truss and R1 to R4 corrosion and pack rust in isolated spots on battens, lattices, channels and gusset connection plates on left the left truss. Verticals and diagonals have similar corrosion to lower cord without the gusset connections.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	15	Exterior Bays A and G have heavy scale and transverse cracking with efflorescence and stalactites. The stalactites in Bay A are up to 8 inches long. Bay B has cracks with moderate efflorescence. There is a 3 feet x 3 feet delamination in Bay G along with 2 foot x 1 foot x 2 inch deep spall with exposed and corroded (R4) reinforcing with 75% section loss.	
STRINGER	15	Stringers A and H have full length R4 corrosion with laminating steel to the top flanges with up to 1 ½ inch deck lift at Stringer A and up to 1 inch at Stringer H. Stringers A, B and C have R1 to R2 corrosion in bottom flange with minor pack rust at bearing clip angles. Stringer B has R1 to R2 corrosion in top flange for 16 feet. Stringer G has isolated R1 corrosion for 1 foot in the top flange at Floorbeam 14 and R2 corrosion for 6 feet in the top flange at Floorbeam 15. Stringer G has a 4 ½ inch x 2 inch perforation in the web, 5 feet from Floorbeam 14. Interior Stringers D through F show little to no signs of corrosion.	
FLOORBEAM	15	The top flange has R4 corrosion for 7 feet at each end with 50% to 80% section loss. The bottom flange has R2 to R3 corrosion for 5 feet on the right and R1 corrosion for the remainder. Isolated areas of R2 corrosion of the web near the right end. The filler plate to the floorbeam at the left truss connection has R4 corrosion with up to 50% section loss and 100% section loss to (2) rivets that need to be replaced at both ends.	
LOWER CHORD	15	3/8 inch ± pack rust between angles and cover plates on the lower cord members. (1) batten plate is bent.	

CDOT K-18-R (US 50B OVER ARKANSAS RIVER)

TRUSS: E / W

INSPECTOR: _____
DATE: _____

MEMBER	PP / BAY	COMMENTS	PHOTO #
DECK	16	Bays A, B, F, G and H have transverse cracks with heavy efflorescence including stalactites up to 8 inches long. There is also some light scale in these bays.	
STRINGER	16	Stringers A and H have R2 to R4 corrosion on the top exterior flanges with up to 100% section loss due to moisture infiltration from the failing joint at A2. The deck has lifted 3/8 inch due to pack rust. Stringers B and G have R4 corrosion for 12 feet along their top flanges contributing to deck lift. Stringer G has slight buckling of the web throughout the middle 2/3 of the member with 3/8 inch out of plane bulging. Interior Stringers C through F show little to no signs of corrosion.	
GP & LLB	16	There is R1 to R3 corrosion to the gusset plates along with up to 1 3/4 inches of pack rust between vertical legs of bracing and 30% to 70% loss of section to rivet heads. (30) rivets and teh gusset plate at the right end need to be replaced. Pack rust exists between the lower lateral bracing angles at the connection to the left truss L16 gusset with up to 1 1/2 inches of separation of the angles. The vertical legs of the angles at the left gusset have (2) 2 inch diameter R4 perforations.	
FLOORBEAM	16	The beam has R1 to R3 corrosion on the bottom flange and R1 corrosion on backside of the web due to more than 3 feet of dirt buildup between the floorbeam and the abutment back wall. The floorbeam clip angle connection to the bearing on the left has pack rust on the horizontal portion of the clip reducing bearing area by 25%. There is a 1 inch distortion due to this pack rust on the right side.	
LOWER CHORD	16	The left and right truss lower chords have R1 corrosion and minor pack rust between lower chord angle and plate members. The left truss lower chord has 1 SF of R2 corrosion of the lower chord gusset plate connection to Floorbeam 16. There is pack rust with distortion up to 1/2 inch at the connection to the floorbeam on the right side.	

Appendix F – Special UT Inspection, Floorbeam 4, 2013



Stantec Consulting Services Inc.
2000 South Colorado Boulevard Suite 2-300
Denver CO 80222
Tel: (303) 758-4058
Fax: (303) 758-4828

Stantec

DATE: February 4, 2013

TO: Lynn Crowell, PE
Bridge Inspection Engineer
CDOT Staff Bridge
4201 East Arkansas Ave., Room 107
Denver, Colorado 80222

FROM: Ryan Nataluk, PE
Stantec Consulting Services Inc.

RE: Ultrasonic Thickness Measurements, Floorbeam 4, Structure K-18-R, US 50 Business, PO #: 221406551

Dear Lynn,

As requested by the Colorado Department of Transportation (CDOT), a special investigation of corrosion related section loss to Floorbeam 4 of CDOT structure K-18-R in Pueblo, Colorado over the Arkansas River was conducted by Stantec Consulting Services Inc. (Stantec) on February 1, 2013. This investigation was in response to observations made by Stantec of severe section loss to the top flange of Floorbeam 4 as reported during the last fracture critical hands-on inspection of the floor system in September 2012. The scope of the investigation consisted of taking ultrasonic thickness measurements along top flange, bottom flange and the web of Floorbeam 4 at specified locations in order to better quantify any section loss present. Measurement locations were based on the following criteria:

- 4 locations every foot on the top flange, until the section loss is <10%
- 4 locations every foot on the bottom flange, until the section loss is <10%
 - The first measurement on the flanges shall be as close to the edge of the leg as possible, the second shall be as close as possible to the inside of the leg. The purpose and intent of this is to find and document the area of least remaining section
- 4 locations every foot on the web for 5 feet on each end of the floor beam (equal spacing)
- Find an area with little to no deterioration and take measurements for baseline thickness purposes

Stantec collected the thickness measurements utilizing two separate *Dakota Ultrasonics Model MMX-6* testing units, capable of measuring through coatings to achieve extremely accurate base steel readings. Access to Floorbeam 4 was performed by using advanced rope access and climbing techniques. The attached tables and electronic files contain all of the data collected during the investigation and figures outlining each measurement location.

RE: Ultrasonic Thickness Measurements, Floorbeam 4, Structure K-18-R, US 50 Business, PO #: 221406551

Thank you for allowing Stantec to assist you and CDOT with this special inspection. If you have any questions or if you require any additional information regarding the investigation performed and data collected, please do not hesitate to contact Frank Block, PE or myself at (303) 758-4058.

Sincerely,



Ryan Nataluk, PE
Project Manager

CC: Project Files



Stantec

K-18-R FLOORBEAM 4

ULTRASONIC THICKNESS MEASUREMENT LOCATION
PLAN AND ELEVATION.

TOP FLANGE MEASUREMENTS

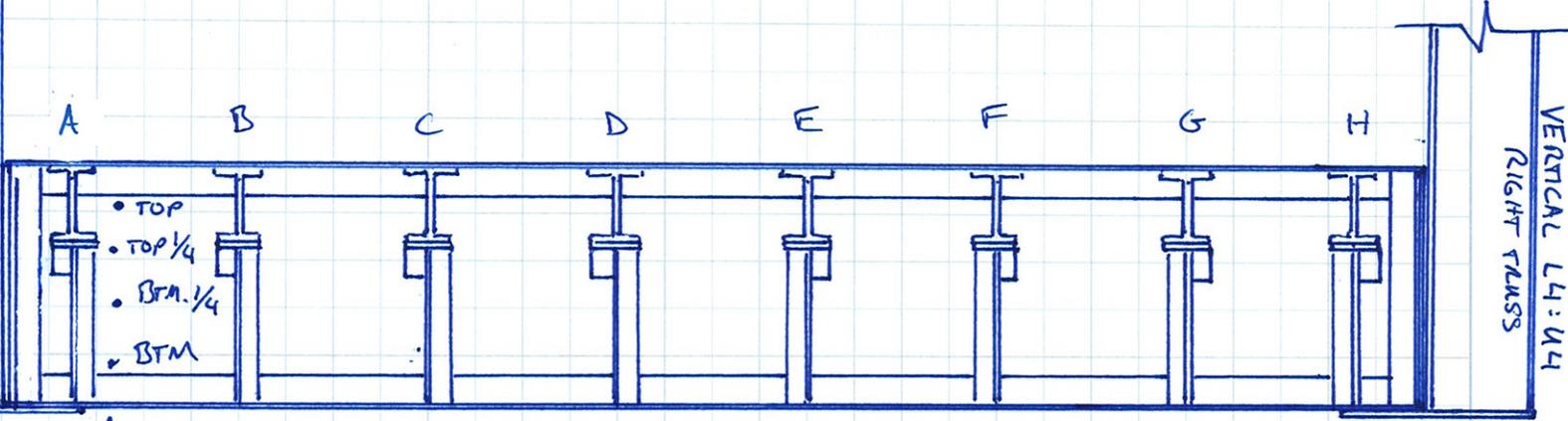
- S. EXTERIOR →
- S. INTERIOR →
- N. INTERIOR →
- N. EXTERIOR →



PLAN
FLOORBEAM TOP FLANGE
(LOOKING DOWN)

Designed by:

SMYLA
VERTICAL LEFT
M: 47



VERTICAL RIGHT TRUSS
L4: U4

↑ WEB MEASUREMENTS

ELEVATION
FLOORBEAM 4 LOOKING SOUTH

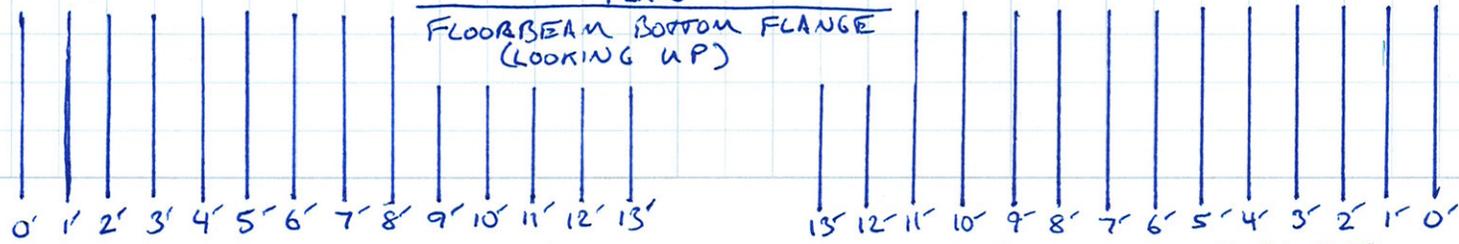
Checked by:

BOTTOM FLANGE MEASUREMENTS

- N. EXTERIOR →
- N. INTERIOR →
- S. INTERIOR →
- S. EXTERIOR →



PLAN
FLOORBEAM BOTTOM FLANGE
(LOOKING UP)



LEFT TRUSS MEASUREMENTS
(NOTED LT. ON TABLE)

RIGHT TRUSS MEASUREMENTS
(NOTED RT. ON TABLE)

Ultrasonic Thickness Measurements

Pueblo 50 Bus Truss K-18-R, Floorbeam 4

Dist. From Right or Left Truss (ft)	Top Flange				Bottom Flange				Web			
	N. Interior	N. Exterior	S. Interior	S. Exterior	N. Interior	N. Exterior	S. Interior	S. Exterior	Top	Top 1/4	Bottom 1/4	Bottom
Lt. 0	0.199	0.240	0.238	0.256	0.250	0.250	0.363	0.531	N/A*	N/A*	N/A*	N/A*
Lt. 1	0.230	0.210	0.238	0.170	0.663	0.619	0.619	0.499	0.318	0.319	0.317	0.314
Lt. 2	0.236	0.180	0.488	0.173	0.663	0.675	0.397***	0.606	0.316	0.316	0.317	0.315
Lt. 3	0.545	0.212	0.561	0.161	0.668	0.679	0.619	0.601	0.315	0.320	0.315	0.314
Lt. 4	0.556	0.235	0.594	0.189	0.665	0.672	0.652	0.606	0.314	0.319	0.314	0.316
Lt. 5	0.260	0.237	0.235	0.231	**	**	**	**	**	**	**	**
Lt. 6	0.235	0.199	0.236	0.196	**	**	**	**	**	**	**	**
Lt. 7	0.416	0.204	0.410	0.206	**	**	**	**	**	**	**	**
Lt. 8	0.560	0.213	0.571	0.240	**	**	**	**	**	**	**	**
Lt. 9	0.510	0.348	0.530	0.396	**	**	**	**	**	**	**	**
Lt. 10	0.585	0.385	0.618	0.401	**	**	**	**	**	**	**	**
Lt. 11	0.548	0.436	0.583	0.531	**	**	**	**	**	**	**	**
Lt. 12	0.465	0.563	0.597	0.493	**	**	**	**	**	**	**	**
Lt. 13	0.576	0.498	0.586	0.521	**	**	**	**	**	**	**	**
Rt. 0	0.211	0.203	0.231	0.181	0.228	0.199	0.199	0.310	N/A*	N/A*	N/A*	N/A*
Rt. 1	0.239	0.243	0.278	0.216	0.305	0.235	0.386	0.407	0.316	0.306	0.314	0.290
Rt. 2	0.217	0.206	0.239	0.188	0.671	0.656	0.614	0.597	0.317	0.320	0.319	0.317
Rt. 3	0.232	0.226	0.410	0.157	0.627	0.456***	0.618	0.606	**	**	**	**
Rt. 4	0.237	0.242	0.323	0.194	**	**	**	**	**	**	**	**
Rt. 5	0.269	0.125	0.244	0.100	**	**	**	**	**	**	**	**
Rt. 6	0.237	0.239	0.245	0.191	**	**	**	**	**	**	**	**
Rt. 7	0.238	0.189	0.244	0.219	**	**	**	**	**	**	**	**
Rt. 8	0.245	0.212	0.247	0.176	**	**	**	**	**	**	**	**
Rt. 9	0.322	0.298	0.461	0.261	**	**	**	**	**	**	**	**
Rt. 10	0.330	0.243	0.584	0.433	**	**	**	**	**	**	**	**
Rt. 11	0.613	0.376	0.619	0.486	**	**	**	**	**	**	**	**
Rt. 12	0.602	0.451	0.581	0.462	**	**	**	**	**	**	**	**
Rt. 13	0.605	0.491	0.550	0.481	**	**	**	**	**	**	**	**

* Web thicknesses at 0' were not measurable due to built-up plates and angle connections to the lower chord at these locations.

** Visual inspection and comparison with conditions at previously measured locations suggests less than 10% section loss.

*** Measurement performed at area of isolated pitting.

Structure Number: **K-18-R**
Facility Carried: **US 50 BUSINESS**
Feature Intersected: **ARKANSAS RIVER**

Owner: **CDOT**
Inspection Date: **2/1/2013**



Typical condition of floorbeam connection and deterioration with corrosion to end
4 to 6 feet of floorbeam (each face, each end)



Typical condition of floorbeam top flange from 0 to 8 feet at each end of floorbeam

Structure Number: **K-18-R**
Facility Carried: **US 50 BUSINESS**
Feature Intersected: **ARKANSAS RIVER**

Owner: **CDOT**
Inspection Date: **2/1/2013**



Close-up of inherent laminations in leg of top flange angle from active corrosion



Close-up of inherent laminations in leg of top flange angle from active corrosion

Structure Number: **K-18-R**
Facility Carried: **US 50 BUSINESS**
Feature Intersected: **ARKANSAS RIVER**

Owner: **CDOT**
Inspection Date: **2/1/2013**



Active leakage from construction joint in deck above floorbeam top flange



Right truss vertical (L4U4) at L4 connection with Floorbeam 4 with perforation