Wrought Iron Bridge Works, LLC.

CONCLUDING REPORT
For
Cambria County Bridge 1
Including
Existing Member Field Verification Documentation, Revised
March 31, 2022

Project Summary:
Due to the north abutment being undermined from scour and beginning to fail, the historic Red Mill Road Bridge (Cambria County Bridge 1) needed to be removed on an emergency basis ahead of the completion of the Section 106 process.

Photograph 1. Red Mill Bridge, Cambria County (1999PR15998)
Damage to the north abutment in April 2021

Figure 1. Condition of north abutment in April of 2021. Provided by PA SHPO

Photograph 2. Red Mill Bridge, Cambria County (1999PR15998)
Damage to the north abutment in August 2021

Figure 2. Condition of north abutment in August of 2021. Provided by PA SHPO
Note: Due to an issue with permitting between the County and the Corps of Engineers, the bottom three courses of stone from the north abutment were not to be removed.

The goal being to avoid what occurred on August 21-22, 1888, when the prior, covered bridge was washed into the creek. It is believed that the abutments supporting the present bridge also supported the covered bridge, being made sometime before the Civil War.

Three options existed:

1. Demolition of the bridge and north abutment.
2. Removal of the superstructure with a crane, followed by careful disassembly.
3. Installation of falsework and disassembly in the reverse order or original assembly.

Disassembly utilizing falsework was selected as it minimized the strain on the compromised and deteriorated superstructure and reduced the environmental footprint (a crane would have required cutting many trees, to allow the bridge to be lifted intact, swung off the creek and creating a laydown area (landing site for the bridge to be disassemble off of the water).

The north end of the bridge was stabilized by clamping 'extenders' to the endposts that would transfer a portion of the superstructure's load off the abutment to the roadway itself, reducing risk of and potential effects to the superstructure in the event of a full collapse of the north abutment.

This was followed by the erection of the falsework. Once the falsework was erected, the trusses were disassembled from the ends towards the center (starting with the north end).

Once the first two northern panels (6 and 5) were disassembled, focus shifted to disassembling the unstable north abutment. The abutment was disassembled without harm to the original stones with the backs of the stones marked and a key prepared allowing for correct reassembly (shown below).

The truss disassembly continued and it was observed that the 2-3 panel constituted the initial 'box' of the assembly process (being six panels, the first truss section couldn't be in the exact middle). As such, when the north half of the truss was disassembled, work shifted to the south portal and headed north.

General observations regarding condition and design:

1. The most remarkable observation is that the bridge had no accident damage – none – from vehicular impact. This has not been previously encountered by any member of our team. However, evidence suggests a significant impact occurred with a stream borne object (possibly during one of the many floods). This may be the cause of the lower chord bends and the slight shift of the upper course of the south abutment.

2. The tension members are not work hardened. This means the bridge has not been repeatedly overloaded during its entire service life – another unusual finding.

3. All of the consequential damage seems to come from insufficient or incorrect preventative maintenance (especially paint prep and paint touch ups) and patchwork repair that (with the exception of floor beam 2) seems to have been implemented to nurse the bridge along as it neared the end of useful life, rather than restore it. There are areas of very localized, severe material loss. These are noted in the 2009 report but are actually much more consistent throughout the bridge, beyond where noted in 2009. This is unusual for a wrought iron structure. A longtime resident implied that little prep work was done by the painting contractors (many-many years ago). As such, certain areas tended to have the

paint fail quickly, this may explain the unusual localized areas of severe section loss. Whereas the majority of the upper truss work remains pristine, including factory machining marks and stampings.

This is in no way stated to imply that money wasn't spent. Examining the relatively new deck, stringers, and floor beam repairs, it's clear that a great deal of resources were expended in nursing the bridge along.

Figure 3. An upper pin with the nut unscrewed. Note the original stamping of 3.94 clearly visible on the pin. This stamping was present on all of the upper pins. Its meaning is presently unknown. For comparison Historicbridges.org has a photo of node WU2 (photo 21) which can be found here: https://historicbridges.org/bridges/browser/photosviewer.php?bridgebrowser=pennsylvania/redmill/&gallerynum=1&gallerysize=3 This was taken when the bridge was still open. The old paint/coatings seemed to create an appearance of pitting, which was not actually present.

The lower portion of the original iron work suffers the traditional salt damage with repairs of varying quality. The exception to this is the replacement floor beam #2 (one of the pieces that runs under and across the floor/roadway of the bridge and supports it) although made of welded rather than riveted construction it was well made. The remaining repairs were patches, reinforcements and welds. These held up poorly and caused secondary structural issues. Many of these repairs were incorrect in addition to being relatively short lived by their design. In some cases, the repairs added no structural strength. In others, they welded up the adjustment mechanisms (a truss bridge of this era is designed to be tuned, much like a guitar).

Although, these patches created problems, they did allow four the original floor beams to

survive. With the extent of the damage and prior repairs it probably makes sense to replace the floor beams, however enough of the original material survives to create accurate templates for correct replication to original spec. (rivet construction, etc.) including replacing the weld construction floor beam 2 with one of original design. The possible exception is floor beam five, which initial inspection suggests may be restorable.

The remainder of the structure can be economically restored to new condition. The loss is limited to localized sections. These can be addressed with minimal replacement of historic material. However, the amount of historic material preserved in the restored bridge may be governed by what the regulations of each use allow.

With a bit of research, the lost plaques can be replicated (possibly listing the original commissioners and date on one side and todays commissioners on the other).

4. Although all of the plaques are gone, the bridge has features unique to Variety Iron Works The most discernable being the slightly peaked struts (the components that run overtop of and across the roadway from vertical member to vertical member) and the cast iron spacers at the bottom of the tension verticals (L1 and L5). Additionally, the County seemed to use Variety Iron Works exclusively for their superstructure under county engineer Shoemaker's guidance from 1888 until 1891, building at least 6 bridges in the County during that time.

5. Nationally, eight bridges built by variety Iron Works remain. A feature observed on this bridge – the knee braces (also called lateral or sway braces, which are the small braces that run diagonally from the vertical members to the struts at the top of the bridge) are made of star iron (cruciform bars). This is a very late use of the material (more common on 1870s trusses) and only known Variety Iron Works bridge incorporating it. The other two PA Variety Iron Works bridges: the 1888 Valley Crossroad Bridge in McKean County and the 1890 Mennonite School Road Iron Bridge in Lancaster County both use angle iron for the knee braces.

6. Each side of the upper cord consists of two components each spanning two panels. It is formed into an integral unit, joined in the center with a series of rivet screws. These screws have the outward appearance or rivets but are threaded and secured with nuts. Thus, the design foretells the modern bolted connections, skipping over the field riveted gussets that followed pin connections.

Existing Member Field Verification Documentation:
The documentation of the bridge will be divided into Substructure and Superstructure

Substructure: North Abutment only.

Due to conditions, including weather, schedule of disassembly, a change order regarding the lower courses and safety concerns; minor adjustments were made in the documentary process.

Figure 4. North abutment showing undermining from and the dislodging of stonework (once the falsework was in place) showing the extent of the failure. Note: the abutment consists of two interconnected walls of ashlar sandstone set into soft mortar; the undermining/failure appears to extend to the inner wall, based on what can be seen in this image.

Figure 5. Per the contract (as modified to leave the bottom rows to comply with the Corp of Engineers request) the north abutment was disassembled in a manner which did not damage the stones and they were marked (on their non-exposed face) according to the key and placed on roadway easement, immediately to the north of the abutment location.

What follows are diagrams of the stone courses indicating their relative positions within the abutment. The courses are labeled from the top down. Each course is defined by a succeeding letter with the highest course being A and each stone within the course has a number beginning with 1. Each stone in the above image is match marked with its position in accordance with these diagrams on a non-exposed face.

Note, the effort was successful with the north abutment being disassembled with the stones unharmed and their positions marked. This allows the north abutment to be reassembled as it originally stood.

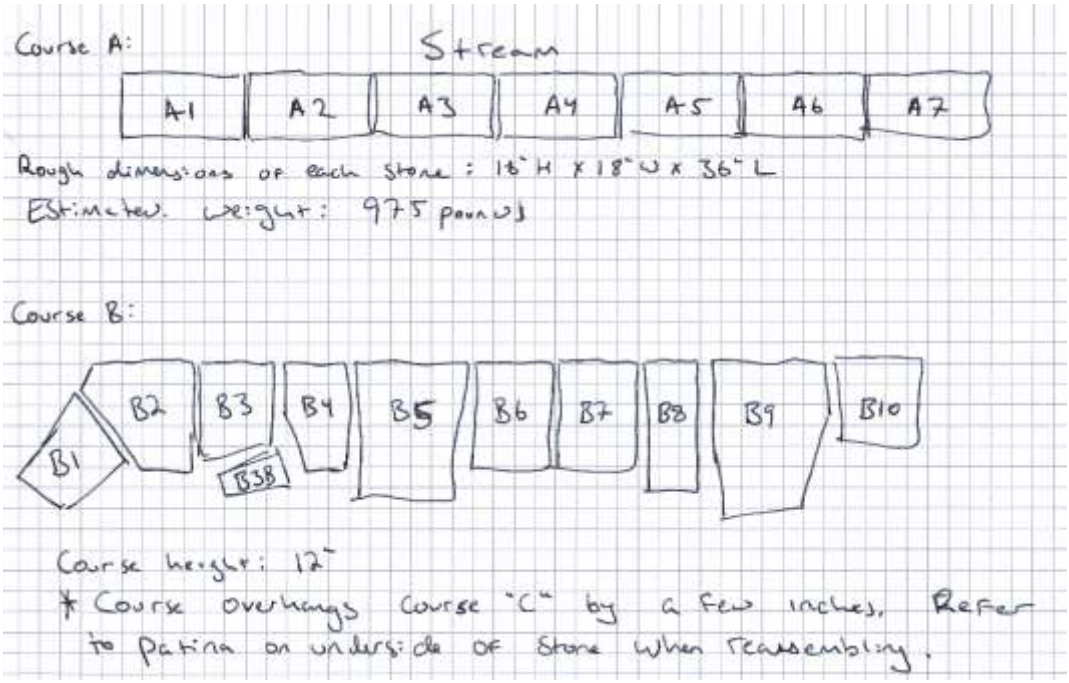


Figure 6. Top two stone courses of the north abutment.

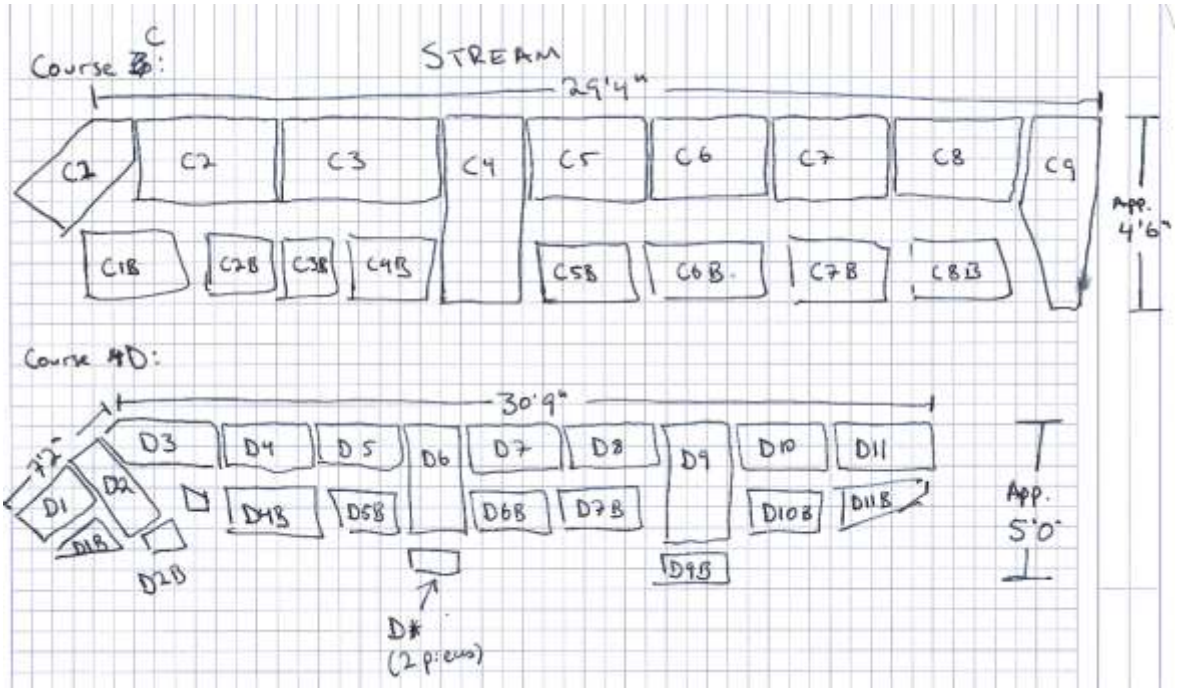


Figure 7. Third and fourth courses. Note the abutment becomes double row by the third row down (C) with tie stones C4, C9, D2, D6, and D9 connecting them. These tie stones is why the abutment did not collapse in spite of the extreme damage.

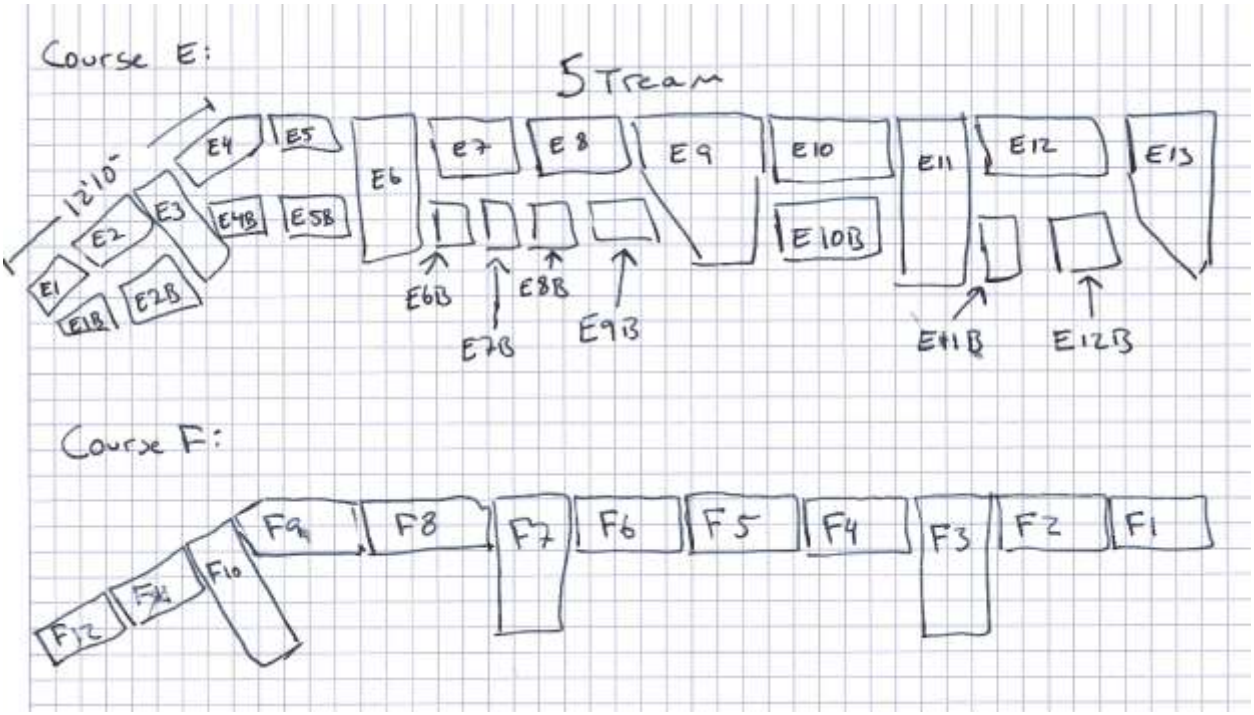


Figure 8. Rows E and F.

Figure 9. The south abutment does not appear to have been compromised, except for the upper row. This not noted but can be observed in the 2009 report..

Superstructure Documentation:

Figure 10. The conditions during disassembly were not conducive to good photo documentation.

The superstructure was photo documented in situ and as components once disassembled. Due to extreme weather, we recommend supplementing the photos herein with the photo documentation performed in prior reports and by Historicbridges.org:

https://historicbridges.org/bridges/browser/photosviewer.php?bridgebrowser=pennsylvania/redmill/&gallerynum=1&gallerysize=3

Marker paint (similar to those used in junkyards) was initially be used to aid in photographic documentation with tagging/stamping being added to the element for storage.

Each member was marked in relation its panel point position. Panel points correspond with the 2009 report. Panel point (node) numbers ascend from south to north (L0 – L6 & U1 – U5) with the base of the southern endpost is L0 and the base of the northern endpost is L6. Rather than upstream and downstream, East and West were used. East corresponding to the upstream side and west corresponding to the downstream side. Thus, for example, the upstream or east endpost resting on the north abutment is EL6.

UPSTREAM ELEVATION

Figure 11. Overall upstream elevation view from the 2009 report.

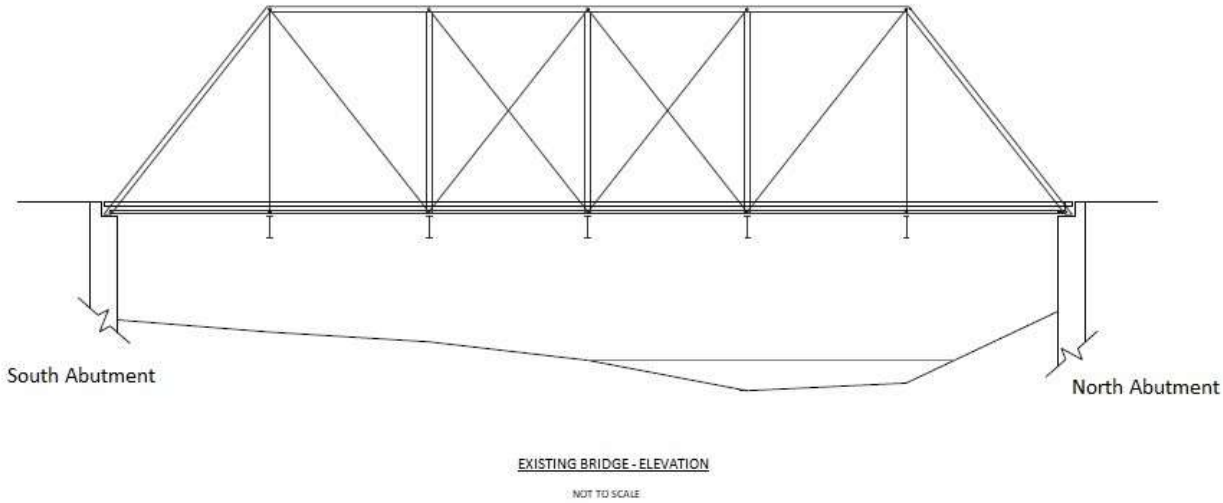


Figure 12. Existing Bridge Elevation diagram (2009) corresponding to Figure 1.

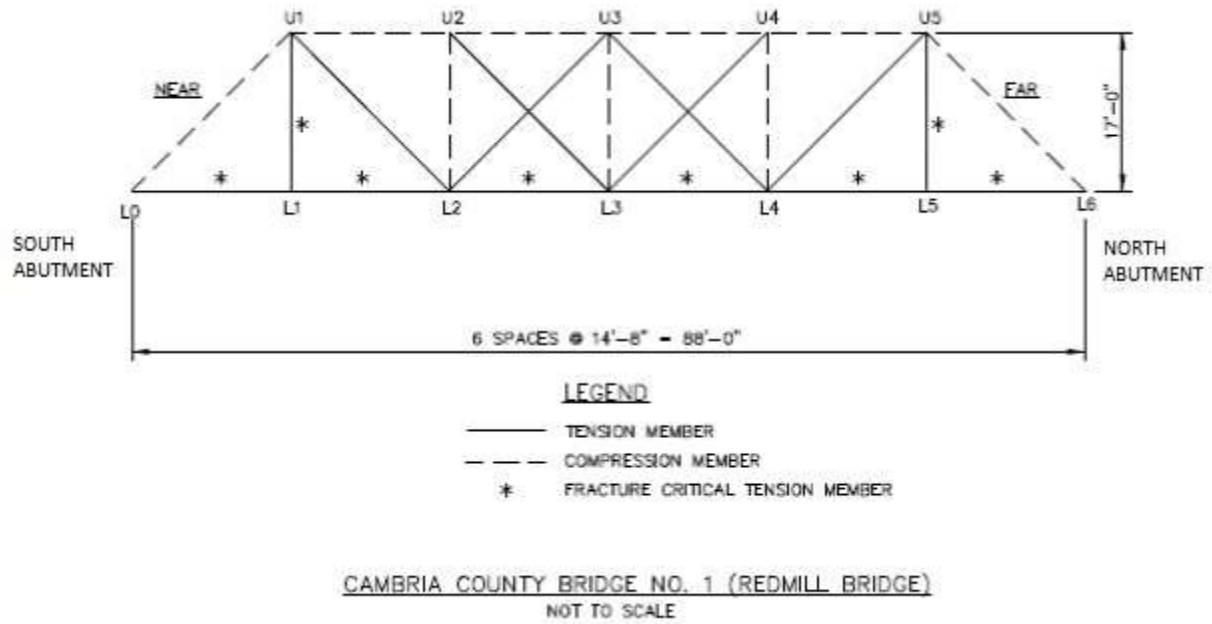


Figure 13. Schematic from 2009 report with 'NEAR' and 'FAR' defined relative to abutments with panel points indicated.

Small parts may only be marked with marker paint (similar to those used in junkyard). This is necessary where stamping and tagging are both impractical or harmful, such as the cast iron spacer blocks.

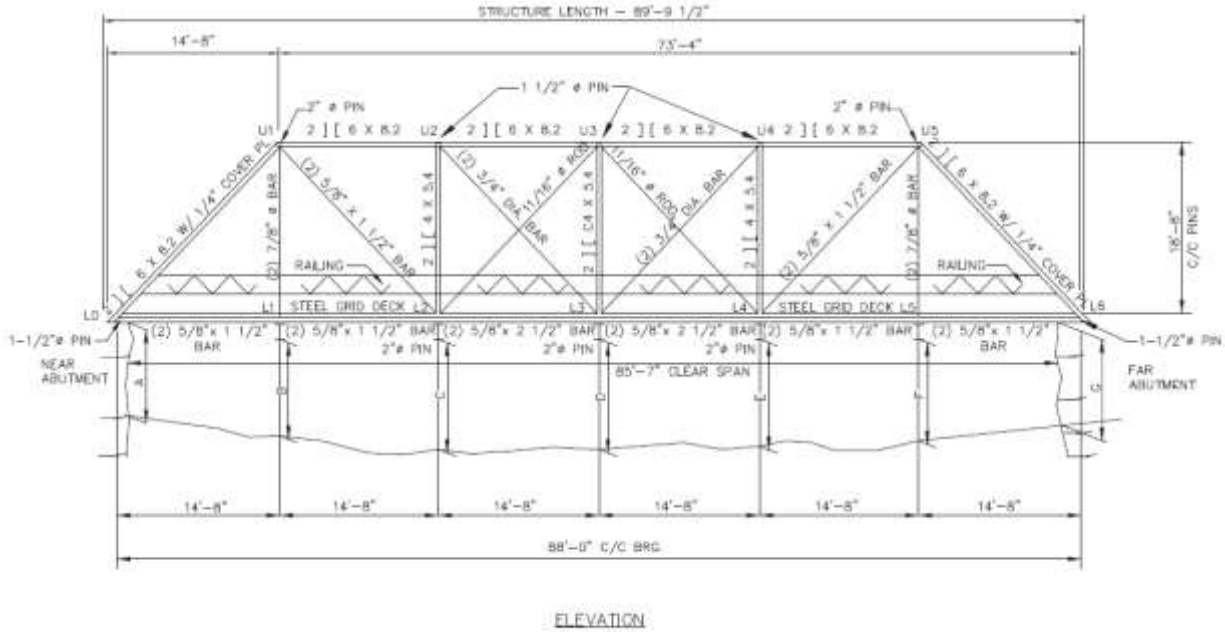
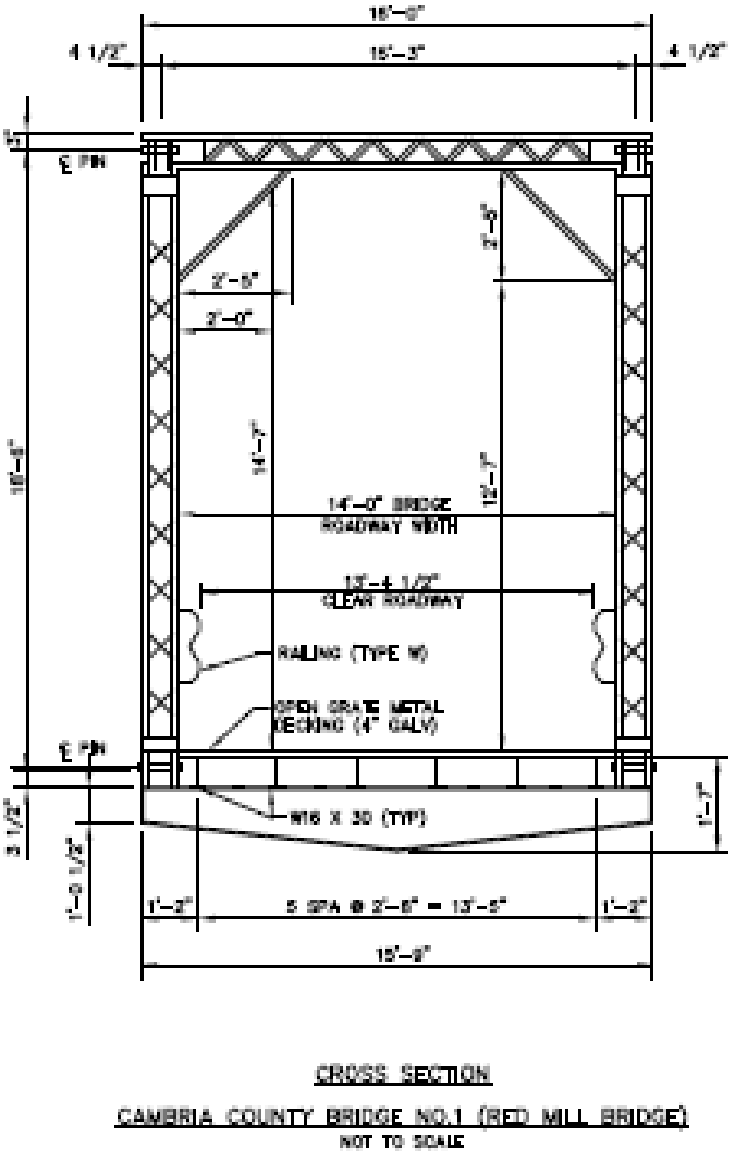


Figure 14. Detailed dimensions as measured for the 2009 report. The dimensions are unchanged and the superstructure had nominal deterioration since 2009. The emergency removal was due to a change in condition of the north abutment.



CROSS SECTION

CAMBRIA COUNTY BRIDGE NO.1 (RED MILL BRIDGE)

NOT TO SCALE

Figure 15. 2009 report cross section. Dimensions unchanged.

Table 1. Existing Member Documentation

Member ID	Member Type	Member Description	Function	Obsrved issues	Figure No.
EL0 - EU1	upstream south endpost	Dual U-channel with riveted top plate, intermitent riveted horizontal bottom straps, riveted flanges to attach feet	Compression	Full Section loss at bearing location and above and below lower portal mounting point on inner channel	16, 20, 21, 22, 24, 26
WL0- WU1	downstream south endpost	Dual U-channel with riveted top plate, intermitent riveted horizontal bottom straps, riveted flanges to attach feet	Compression	Full Section loss at bearing location and above and below lower portal mounting point on inner channel	16, 20, 23
EU1 - WU1	South portal	Riveted strap latice sandwiched with angle iron frame (including upper attachment), riveted plate lower attachments	Compression & Tension	Severe loss throughout angle iron including upper attachment , no noticable loss of lattice and lower attachments	10, 16, 17, 18, 19
EU1 - EU3	upstream south top chord	two chanels with cross lacing instead of a top plate. Intermittent lower ortoganal spacers. Solid top plates over pin connection points 1, 2, 3. Tenion member recievers and strut attachment above EU2 & EU3, tension recever and portal recever at EU1, pin reenforcement/splice plates on chanels at EU3, pin reenforcement at EU1	Compression	upper portal receiver plate at EU1 has significant loss. Top plates at EU2 and EU3 have moderate loss.	26, 65, 66
WU1 - WU3	downstream south top chord	two chanels with cross lacing instead of a top plate. Intermittent lower ortoganal spacers. Solid top plates over pin connection points 1, 2, 3. Tenion member recievers and strut attachment above EU2 & EU3, tension recever and portal recever at EU1, pin reenforcement/splice plates on chanels at EU3, pin reenforcement at EU1	Compression	upper cover plate at WU3 has loss, including minor hole	61, 62, 63

EU3 - EU5	upstream north top chord	two chanels with cross lacing instead of a top plate. Intermittent lower ortoganal spacers. Solid top plates over pin connection points 4 & 5. Tenion member recievers and strut attachment above EU4, tension recever and portal recever at EU5, pin reenforcement at EU5	Compressio n	top over plate at EU4 have loss, EU3 outer chanel has localized 100% loss at the splice plate (pin connecion for EU3 on other section of east/upstream upper cord).	58, 65, 66
WU3 - WU5	downstream north top chord	two chanels with cross lacing instead of a top plate. Intermittent lower ortoganal spacers. Solid top plates over pin connection points 4 & 5. Tenion member recievers and strut attachment above WU4, tension recever and portal recever at WU5, pin reenforcement at WU5	Compressio n		61, 62, 63
EU1 - EL1	tension vertical	vertical rods, square stock looped at top threaded at bottom	Tension	threaded forged bottoms destroyed due to thread loss and prior welded repairs	25, 26, 28 (representative)
WU1 - WL1	tension vertical	vertical rods, square stock looped at top threaded at bottom	Tension	threaded forged bottoms destroyed due to thread loss and prior welded repairs	27, 28 (representative)
EL1 - WL1	Floor beam 1	fishbelly design. angle iron frame surrounding and riveted to main flange plate with riveted central splice. Supported by tenion verticals. Secured to lower chord via U straps with cast iron spacers between.		All angle iron replaced with welded angle reenforcemens/replacements . Ends severely degraded and altered by prior repairs. Significant section loss to flange plate. Repair welds failing.	29, 30
EU2 - WU2	strut 2	Inverse fishbelly design. Angle iron riveted to both sides of the base of the central plate. Knee braces made of crusiform rod 9star iron) riveted to and extending from the bottom of the strut.		Top chord connection areas with section loss (non gradual). Star iron knees appear undamaged.	33, 34, 35

EU2 - EL2	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion.	38, 41, 46 (representative
WU2 - WL2	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion.	39, 42, 46 (representative)
EL2 - WL2	Floor beam 2	fishbelly design. angle iron frame surrounding and riveted to main flange plate with riveted central splice. Supported by tenion verticals. Secured to lower chord and compression vertical via U straps to pin.		Replacement member of all welded construction with similar basic appearance to original. U strap treading lost with nuts cut, crimped and welded into place.	31, 32
EU3 - WU3	strut 3	Inverse fishbelly design. Angle iron riveted to both sides of the base of the central plate. Knee braces made of crusiform rod (star iron) riveted to and extending from the bottom of the strut.		Top chord connection areas with section loss (non gradual). Moderate pack rust between angle iron and plate, condition of central plate unknown. Star iron knees appear undamaged.	47, 48, 49, 50
EL3 - WL3	Floor beam 3	fishbelly design. angle iron frame surrounding and riveted to main flange plate with riveted central splice. Supported by tenion verticals. Secured to lower chord and compression vertical via U straps to pin.		All angle iron replaced with welded angle reenforcemens/replacements . Ends severely degraded and altered by prior repairs. Significant section loss to flange plate. Repair welds failing.	36, 37
EU3 - EL3	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion.	44, 45, 46 (representative)
WU3 - WL3	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion.	40, 43, 46 (representative)

EU4 - EL4	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion. Additional torched hole for cable across roadway.	57, 58, 46 (representative)
WU4 - WU4	compression vertical	Paralel vertical U channels with riveted pin connections at the ends and staggered, rivted V lacing on each side.	Compressio n	loss at lower pin (additional damage from prior repairs). Loss on inner channel above and below knee brace mount, torched hole for guargrail with subsequent severe corrosion. Additional torched hole for cable across roadway.	55, 56, 57, 46 (representative)
EU4 - WU4	strut 4	Inverse fishbelly design. Angle iron riveted to both sides of the base of the central plate. Knee braces made of crusiform rod 9star iron) riveted to and extending from the bottom of the strut.		Top chord connection areas with section loss (non gradual). Severe pack rust between angle iron and plate, angle iron failing, condition of central plate unknown. Star iron knees appear undamaged.	53, 54
EL4 - WL4	Floor beam 4	fishbelly design. angle iron frame surrounding and riveted to main flange plate with riveted central splice. Supported by tenion verticals. Secured to lower chord and compression vertical via U straps to pin.		All angle iron replaced with welded angle reenforcemens/replacements . Ends severely degraded and altered by prior repairs. Significant section loss to flange plate. Repair welds failing.	51, 52
EL5 - WL5	Floor beam 5	fishbelly design. angle iron frame surrounding and riveted to main flange plate with riveted central splice. Supported by tenion verticals. Secured to lower chord via U straps with cast iron spacers between.		All angle iron replaced or reenforced with welded angle reenforcemens/replacements . Ends severely degraded and altered by prior repairs.	59, 60
EU5 - WU5	North portal	Riveted strap latice sandwiched with angle iron frame (including upper attachment), riveted plate lower attachments		Severe loss throughout angle iron including upper attachment , no noticable loss of lattice and lower attachments	17, 18, 19
EL5 - EU5	tension vertical	vertical rods, square stock looped at top threaded at bottom	Tension	threaded forged bottoms destroyed due to thread loss and prior welded repairs	28 (representative)
WL5 - WU5	tension vertical	vertical rods, square stock looped at top threaded at bottom	Tension	threaded forged bottoms destroyed due to thread loss and prior welded repairs	28 (representative)

EU5 - EL6	upstream north endpost	Dual U-channel with riveted top plate, intermitent riveted horizontal bottom straps, riveted flanges to attach feet	Compressio n	Full Section loss at bearing location and above and below lower portal mounting point on inner channel	69, 70
WU5 - WL6	downstream north endpost	Dual U-channel with riveted top plate, intermitent riveted horizontal bottom straps, riveted flanges to attach feet	Compressio n	Full Section loss at bearing location and above and below lower portal mounting point on inner channel. Possible minor pack rust between inner channel and top oplate at lower portal mounting location	68, 70
	dagonals	rods	tension	no to minimal loss observed	16, 25, 27, 38, 39, 61, 65, 66
	lower pins	lower pins		5% - 20% section loss observed at exposed locations	67 (representative)
	upper pins	upprr pins		undamaged	3 (representative) , 64 (representative)
	misc hardware and fittings	misc hardware and fittings		much, such as pin nuts and receivers reusable. Primary damage ue to modification from prior repairs	

Figure 16. Southern portal being lifted out. Note: while there was no impact damage observed, the portal had a surprising amount of section loss. This was likely due to some prior shortcuts with paint prep.

Figure 17. Both portals in Cutler, IN placed for documentation prior to storage.

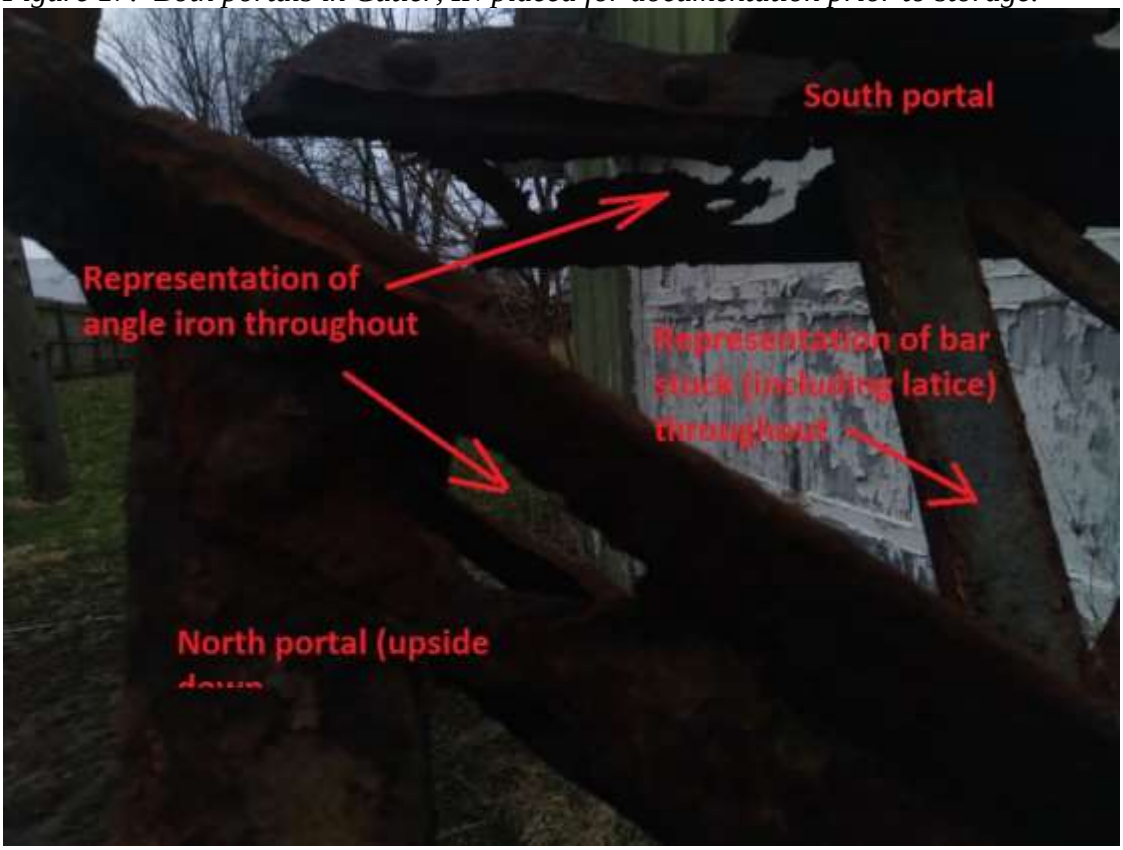


Figure 18. Portals angle iron with severe loss throughout lattice seems fine.

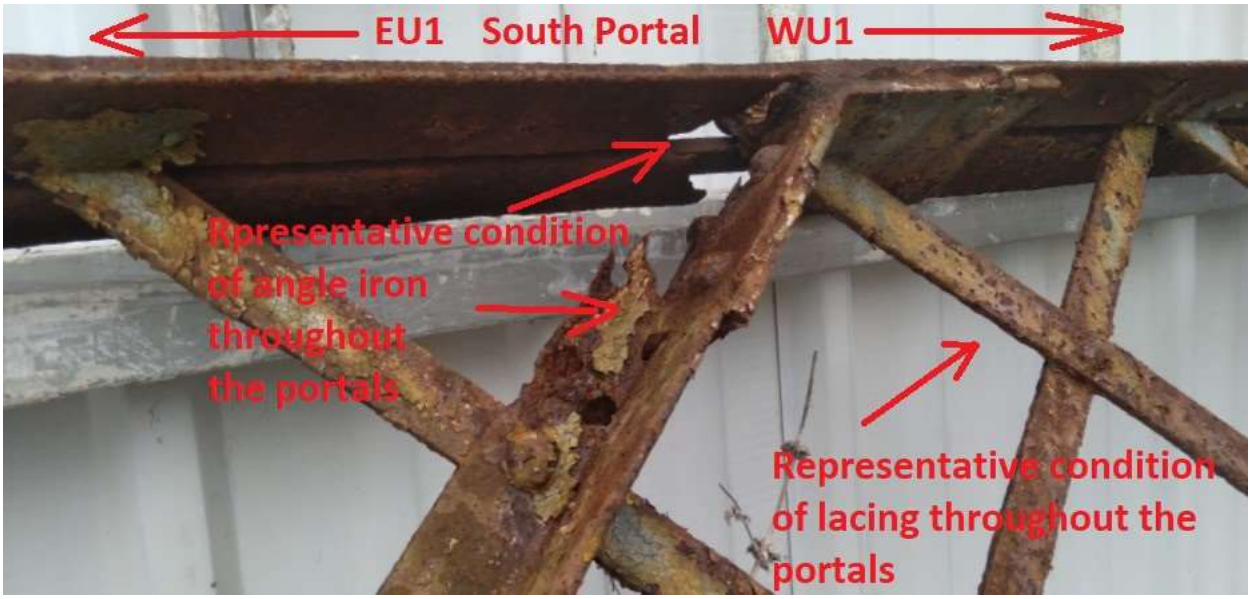


Figure 19. South portal, representative condition of material throughout.

The portals consist of an angle iron frames sandwiching a bar stock lattice with additional plates for reinforcement and the lower mounting points. The angle iron has severe loss throughout.

Figure 20. Southern lower endposts (EL0 & WL0). Beyond some section loss from the feet being covered in dirt for prolonged periods prior to closure, and losses in the portal's lower connections to the endposts being noted. the endposts maintained their integrity.

Figure 21. Southeast endpost

Figure 22. Southeast endpost

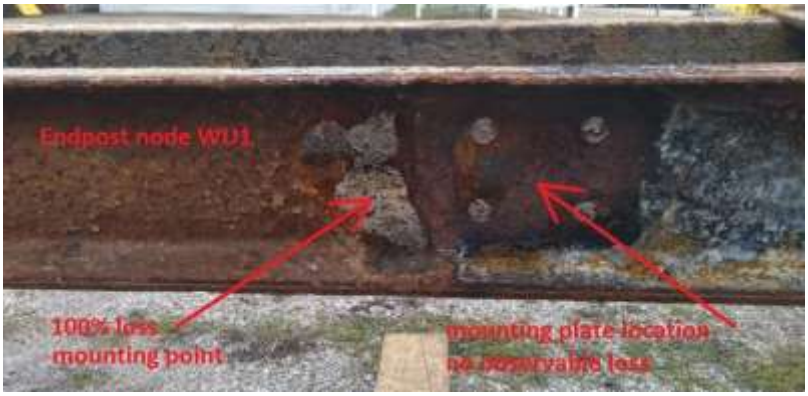


Figure 23. Lower portal brace mounting location on southwest endpost.

Figure 24. Lower portal brace mounting location on southeast endpost.

Figure 25. Node EL1 southeast tension vertical. Note that the bridge design does not use a pin at the base of the first (tension) vertical. The lower cord members are two panels long, being pinned at the bottom of the endpost and at the second node (panel point). The floor beam is spaced from and attached to the lower cord with two cast iron spacer blocks, each secured with inverted U-bolts. This is unique to Variety Iron Works bridges. This node can be viewed at Historicbridges.org (image 32 of 71) note the lower cord bend: https://historicbridges.org/bridges/browser/photosviewer.php?bridgebrowser=pennsylvania/redmill/&gallerynum=1&gallerysize=3 which was taken when the bridge was still open.

There are indications of a significant impact, which may have caused the superstructure to shift slightly to the west on the south abutment, this may have also caused the lower cord distortion. Possibly during the flood of 1977?

The vertical tension members at EL1, WL1, EL5 and WL5 are made of one inch square wrought iron rod. The tops are forge welded into loops to hang over the pins. The bottoms were forge welded to add/form

round threaded elements which accepted hex nuts, which in turn, held the floor beam and allowing for adjustment of tension/floor height. Unfortunately, all of these members had the nuts cut vertically (into a C-shape), smashed in place then welded to vertical rods. This was done at some point as 'maintenance' to ensure no loosening would occur. Unfortunately, this meant the truss was capable of further adjustment. This was likely due to lack of understanding of the function of the design. As a result, prior to disassembly, the members were no longer adjusted correctly, and could not be corrected. While the remaining portion of these rods has minimal to no section loss, the welded bottoms will need to be replicated to ensure known strength and correct function.

Figure 26. Node EU1 the top of the southeast tension vertical entering the connection between the endpost and the top cord. A minor design note: the two tension members are mounted along the floor beam at the top and across the floor beam at the bottom.

Figure 27. Node WL1. Similar to EL1

Figure 28. Bottom of tension vertical El5 shown as a representation of the alteration/deterioration on every vertical at EL1, WL1, EL5, WL5 and each floor beam to pin U strap at EL2, WL2, EL3, WL3, EL4 and WL4.

There are a total of five floor beams of two types (although all were similar). The two types are the beams attached to the tension verticals (beams connecting node EL1 to WL1 – beam 1, and EL5 to WL5 – beam 5) and the beams attached to the compression verticals (beams connecting node EL2 to WL2 – beam 2, EL3 to WL3 – beam 3 and EL4 to WL4 – beam 4). The primary difference being the connection of the lower cord.

Figure 29. Floor beam 1 east end. The top and bottom flanges are largely replaced and reinforcements added

Figure 30. Floor beam 1 west end.

Figure 31. Floor beam 2 (replacement), east end

Figure 32. Floor beam 2 (replacement), west end.

The bridge has three struts. The peaked, inverse fish belly design is a distinctive element of variety Iron Works through trusses. This bridge is unique as it has knees made of star iron (cruciform iron) attached. The struts contain the majority of the pack rust observed on the bridge. Strut 2 is in the best condition.

Figure 33. Strut 2 east end.

Figure 34. Strut 2 general image showing overall condition of southern angle iron.

Figure 35. Strut 2 west end

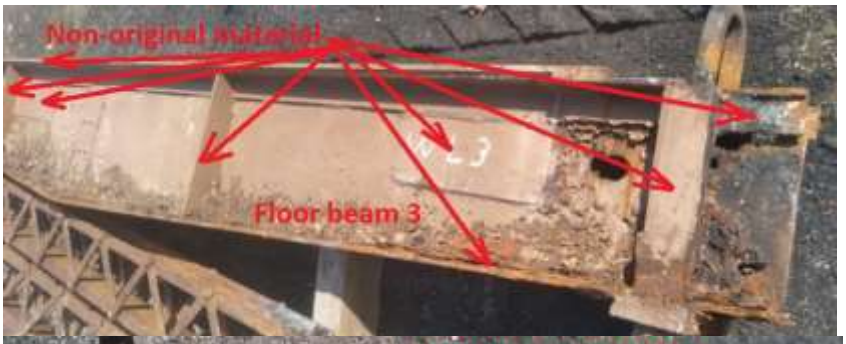


Figure 36. Floor beam 3 west end.

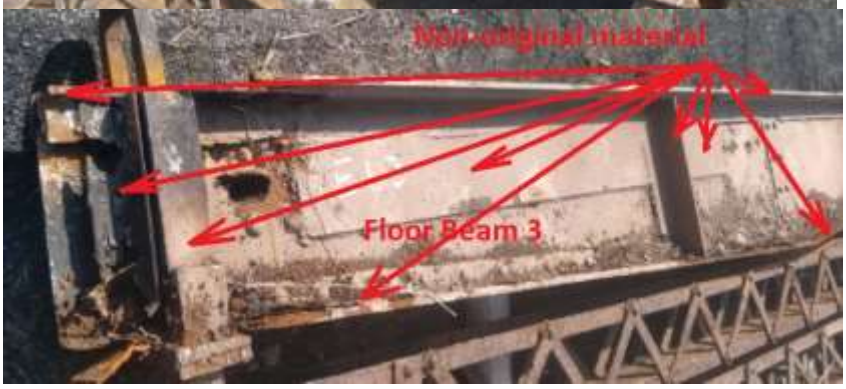


Figure 37. Floor beam 3, east end – note the extent of the patches

Figure 38. Node EL2

Figure 39. Node WL2 .

Figure 40. Node WL3

Figure 41. section loss on vertical W2 at knee attachment

Figure 42. section loss on vertical W2 at knee attachment.

The compression verticals had consistent deterioration. Significant loss at the lower pin connections and losses on the inner channel at the knee attachment and expanded section loss from previously torched holes for things such as guard rails.

Figure 43. Section loss on compression vertical W3 at knee connection.

Figures 44. Interesting 'bullseye' pattern around guardrail mounting hole above EL3.

Figure 45. Section loss on compression vertical E3 at knee connection.

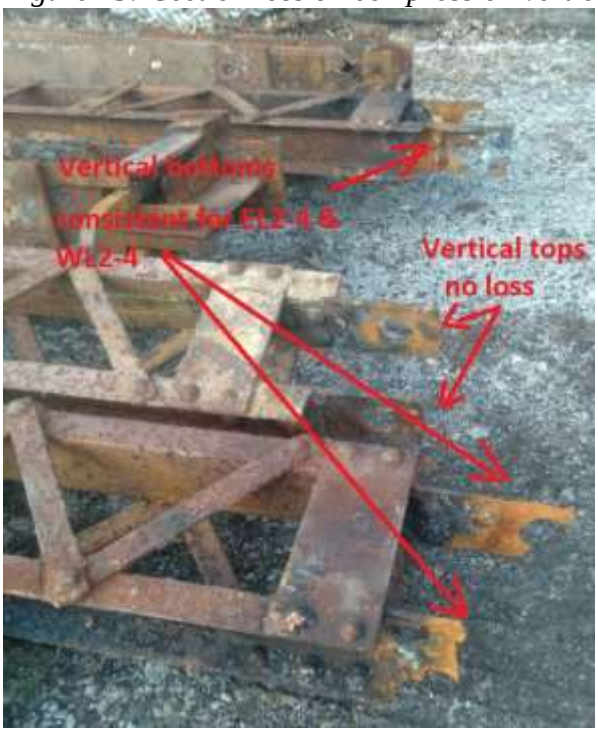


Figure 46. This image is representative of all of the compression vertical ends. The tops have no loss. The bottoms have nearly total loss. Note that the pin connection elements are riveted to and not part of the channels.

Figure 47. Deterioration of strut 3 east end (EU3).

Figure 48. Deterioration of strut 3 west strut mount.

Figure 49. Deterioration of strut 3 view of pack rust.

Figure 50. Deterioration of strut 3 east end (WU3).

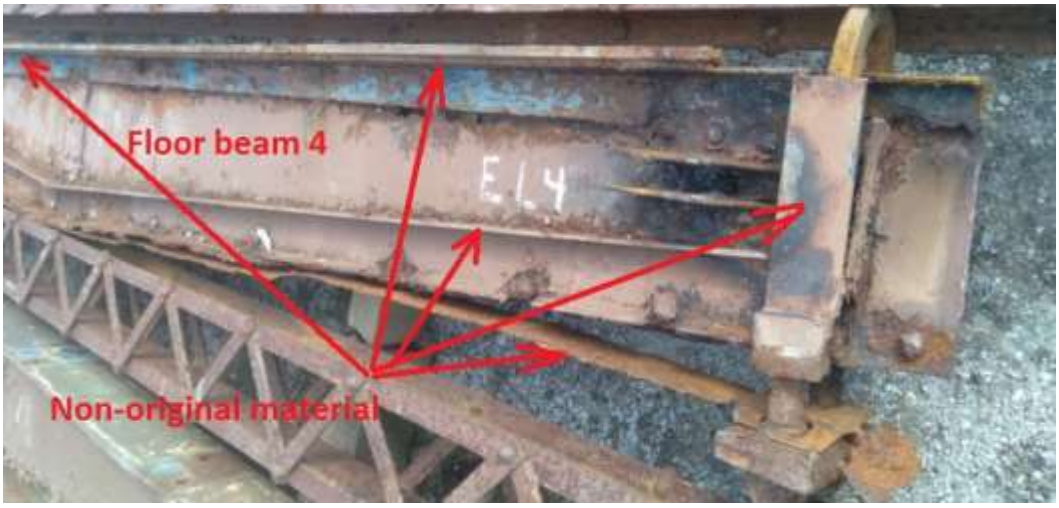


Figure 51. Floor beam 4.

Figure 52. Floor beam 4.

Figure 53. Deterioration of strut 4 west end (WU4).

Figure 54. Deterioration of strut 4 pack rust

Figure 55. Deterioration of west compression vertical 4. Non original guard rail mount hole.

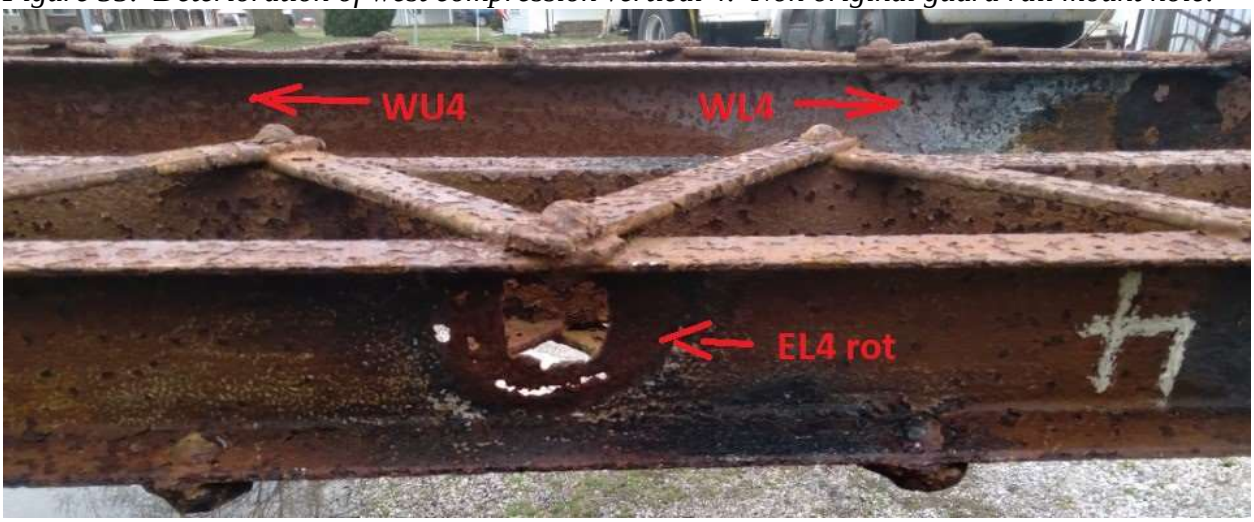


Figure 56. Deterioration of east compression vertical 4. Non original hole. (West compression vertical in the background).

Figure 57. Deterioration of west compression vertical 4 at knee brace mount. East vertical non original guard rail mount hole with subsequent expansion due to rot.

Figure 58. Pin EU4 being removed in preparation for lifting the northeast upper cord section. Note: the upper cord sections spanned two panels. This panel point is at mid length of the upper cord member, with the pin attaching it to the compression vertical and the diagonals.

Figure 59. Floor beam 5 east end.

Figure 60. Floor beam 5 west end (of the five floor beams, this retains the most original integrity and may be worth restoring rather than replicating.

The upper chords are interesting. Each piece spans two panels and they are joined via a bolted connection at U3 adjacent the pin. This created a single, integral top chord. An uncommon feature of period bridges with built-up top chords is the use of lattice in place of a cover plate, except at the panel points. As a result, there is no pack rust of any note on the top chord. The worst deterioration is the section loss within the channel at panel point EU3 (however on the element end not containing the pin connection. The connections have top plates and reinforcements. It is these plates, and one of the upper portal connection plates (EU1) that show some loss and deterioration.

Figure 61. West upper cord nodes WU1 & WU3

Figure 62. West upper cord nodes WU2 & WU4. Note the condition of the pin plates.

Figure 63. West upper cord nodes WU3 & WU5. Note, no rivets were removed, the smaller holes had rivet like bolts acting as connectors, allowing an integral upper cord.

Figure 64. A sample of the small components. Note the rivet like screw above pin WU2 in the image. These were used to connect the two halves of the upper cord rather than rivets. It's likely they were made from rivets. An interesting interim step prior to the use of field riveting. Also note the condition of the upper pins.

Figure 65. (below) east top chord EU5 left and EU1 right.

Figure 66. Eastern upper cord. Note the very localized corrosion. This and the internal nuts of the rivet like bolts can be observed in image 24 of 71 of the Historicbridges.org entry for this bridge:

Figure 67. Pins WL3 and EL3. Note the observed circumferential loss of material occurred where pin was exposed. The actual contact surfaces have no observed loss.

There little to no imagery of the tension members post disassembly. This is because he tension members are very long and slender and subject to damage (bending/distortion). As they all appear restorable the tension members were promptly stored within the compression members to minimize risk of damage. The general condition is unchanged from prior reports or image sets available on line. *https://historicbridges.org/bridges/browser/photosviewer.php?bridgebrowser=pennsylvania/redmill/&gallerynum=1&gallerysize=3*
The risk of removing and replacing these members cannot be justified for additional photo

documentation. The only portion of the tension members not visible in prior documentation were the connected ends. These can be seen throughout this report. There is no visible loss.

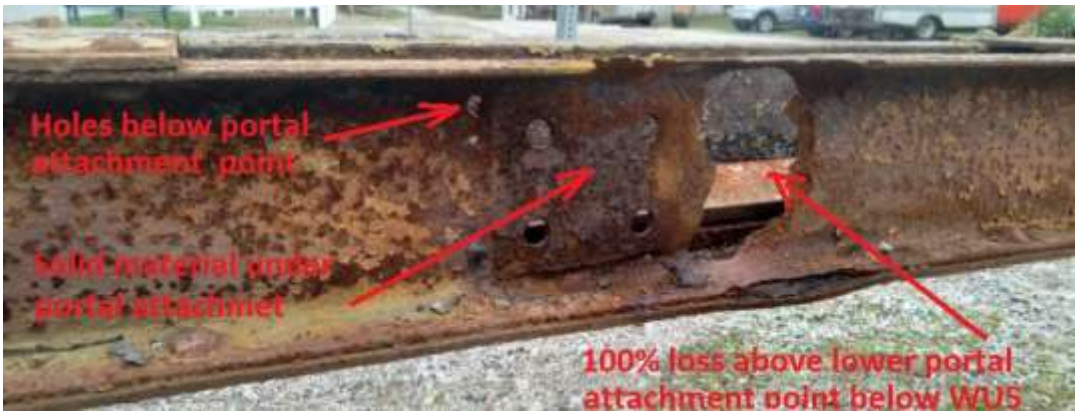


Figure 68. Northwest endpost showing deterioration abovelower portal connection location below WU5.

Figure 69. Endpost EU5 – EL6 showing deterioration around lower portal mount location.

Figure 70. North endpost bottoms showing moderate loss at channel ends.

Thank you for the opportunity to help rescue a piece of history.

If there are any questions, feel free to call at 609.636.3822.

Contractor Representative:

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Art Suckewer