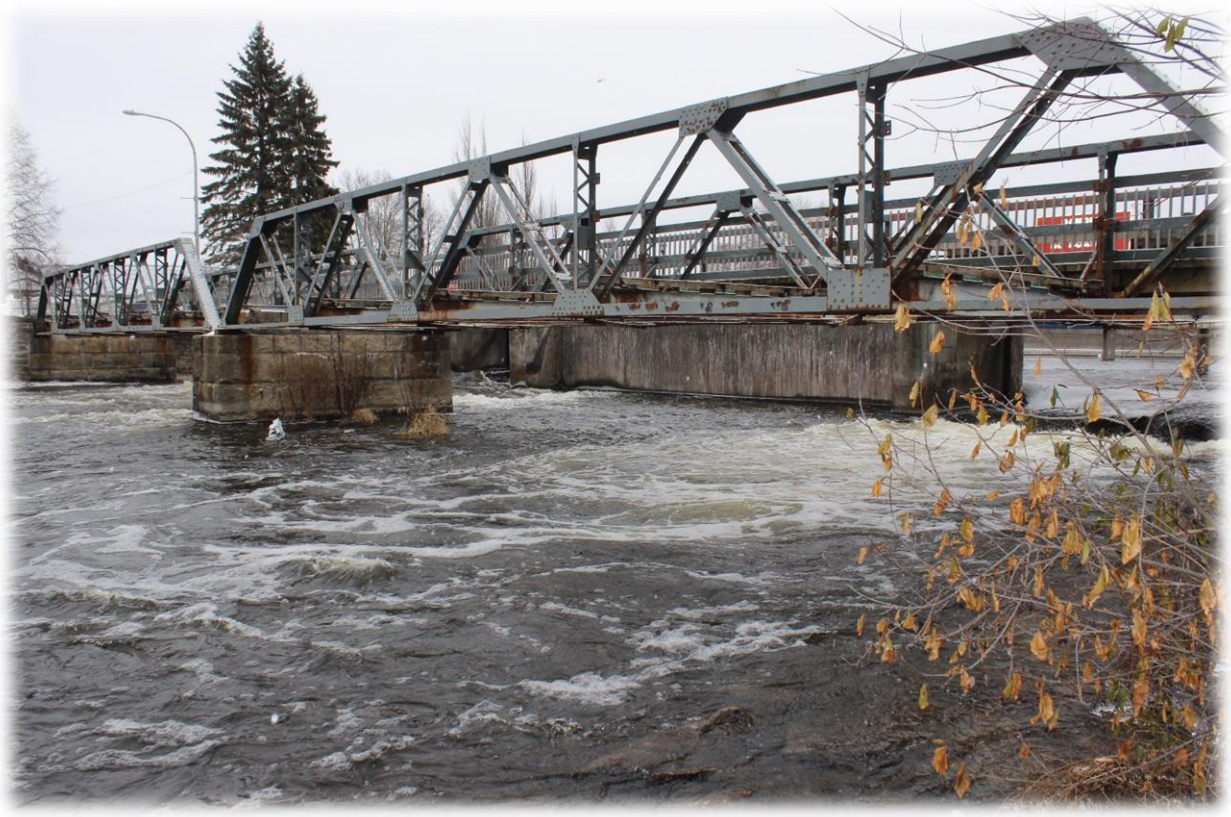

CONFEDERATION DRIVE BRIDGE ASSESSMENT & OPTIONS REPORT

Town of Smiths Falls – January 2020

Keystone Bridge Management Corp.

Your Bridge Asset Management Specialist

Contents

1. Executive Summary

The Confederation Drive Bridge has served the Town of Smiths Falls from about 1904 until its abrupt closure in 2015.

The bridge has severe corrosion of the structural steel below the deck level. Although, much of the lower structural steel was replaced around 1986, the steel that wasn't replaced has continued to corrode such that the safety of the bridge was compromised.

The existing bridge possesses heritage value. The bridge is however, not known to have been designated as a heritage bridge.

Replacement of the bridge with a modern truss capable of carrying full highway traffic loading was costed. A new pedestrian only bridge was evaluated. Refurbishment of the existing bridge and cloning the existing bridge were considered.

The cost of restoring the existing bridge to a good serviceable condition is very difficult to estimate because of numerous uncertainties. Further inspection and engineering are required before a reliable estimate can be generated.

Rounded Class D cost estimates that include environmental assessment, engineering, and contingency costs are summarized as follows on a first cost and life-cycle cost basis:

Table 1. Rounded First Cost and Life-Cycle Costs for Four Options

Option	Description	First Cost	LCC Cost
1	Modern Combined Pedestrian and Traffic Bridge	**$ 2,500,000 – 3,000,000**	**$ 2,600,000 - 3,100,000**
2	New Pedestrian Bridge	**$ 850,000**	**$ 900,000**
3	Refurbish Existing Bridge	**$ 1,500,000**	**$ 1,700,000**
4	Clone Existing Bridge	**$ 1,400,000**	**$ 1,450,000**

Duplicating the existing bridge is anticipated to be the least risk and least cost alternative that restores both light vehicle traffic and pedestrian movements across the bridge.

2. Introduction

The Confederation Drive Bridge is a single lane twin span Warren type pony truss constructed in or about 1904. The spans have a nominal length of 23.8 m each, and a centre to centre truss spacing of 5.33 m. The bridge crosses the original channel of the Rideau River immediately north of the Rideau Canal locks in Smiths Falls.

The bridge has a 1.37 m wide pedestrian path on the upstream side that is believed to be original to the bridge. The presence of the pedestrian pathway is somewhat remarkable for the era the bridge was constructed. The riveted construction and general age-related deterioration strongly suggest the walkway is part of the original bridge construction.

The available historic records for the bridge are incomplete. The bridge received a comprehensive rehabilitation circa 1986. The rehabilitation accomplished:

- Replacement of the timber stringer deck with a prestressed laminated creosoted timber deck.
- Replacement of all the steel floor beams.
- Replacement of select bottom chord structural steel, particularly all the chord members on the south truss.
- Reconstruction of the pedestrian walkway with salvaged timber from the deck.
- Reconstruction of the truss verticals on the upstream side.
- Some masonry work was included at the abutments and pier as part of the work.

The drawings for the 1986 rehabilitation document a PUC lighting cable and a Parks Canada power duct located under the bridge sidewalk deck.

Prior to the 1986 rehabilitation, the bridge deck consisted of 10 lines of 4” x 12” timber stringers lapped on the floor beams, supporting 3-1/2” x 8” timber plank decking. The sidewalk deck was carried on three 4” x 8” timber stringers. Before 1986, all the structural connections were steel rivets. The 1986 rehabilitation introduced 20 mm diameter high-strength steel bolts where rivets were replaced.

The railings on the sidewalk before the 1986 rehabilitation show three sized 3” x 6” wood rails.

In 2015 the bridge was closed as a result of structural concerns identified during a routine biennial inspection. There is mention of a 2011 “Load Assessment Report” which would indicate that the capacity of the bridge was being monitored. The timber deck was removed from the bridge in late 2015 as a safety precaution. Images from 2015 show a 7-tonne single truck load limit on the bridge.

The bridge has been barricaded and remained out-of-service since 2015.

Keystone Bridge management was requested to provide an assessment of the Confederation Drive Bridge and provide strategic advice for the future of the crossing.

3. Condition of Bridge in 2018

The bridge was inspected by the writer on December 5, 2018. Assisting him was Steve Reid, C.E.T. The main bridge components were reasonably visible although some fresh powdery snow was present. Frozen debris resting on the horizontal gusset plates at the panel points obscured the conditions at these locations. The bridge was accessed from the pedestrian pathway, and by climbing out in select

locations with a safety harness. The bridge was also viewed with binoculars from the banks. Images from the inspection are appended to this report. The underside of the bridge, pier and abutments could not be reasonably inspected due to the fast-flowing cold water.

The following salient points arise from the inspection:

1. The bottom chord areas of both trusses have incurred severe corrosion with localized areas of critical section loss due to the presumed application of de-icing salt on the bridge.
2. The vertical paired gusset plates at the lower panel points appear to have a systemic crevice corrosion type feature on the inboard gussets. The worst example is pictured in appended Image 5.
3. There is significant and critical section loss of the bottom chord angles at the SE bearing of the east truss, see Image 7. This is of concern as this member was intended to be replaced in 1986. It is clear from this that unprotected or poorly protected steel in this environment has less than 30 years of service life.
4. One bottom lateral bracing member is severed, see Image 3.
5. The outriggers supporting the pedestrian walkway were only inspected at one location. A perforation at this location pictured in Image 9 means that a more comprehensive inspection of the outriggers is warranted.
6. The principal masonry of the abutments and pier is in good condition.
7. The truss components above the level of the former bridge deck are in good condition.

4. Uncertainties

Debris resting on the horizontal gussets, together with the congested nature of the panel point locations means there is lingering uncertainty as to the condition of the ends of the bottom chords, truss diagonals and verticals and floor beam ends. A follow-up inspection that includes a very thorough cleaning of the lower panel point locations is necessary to more fully ascertain the condition of the bottom chord areas of the truss.

5. Certainties

It is abundantly clear that all the inboard vertical gusset plates require replacement. It is very likely that all the bottom chord members that were not replaced in 1986 should be replaced if the bridge is to be returned to service. It is evident that the bridge is salvageable.

6. Future of the Bridge

There are numerous options for returning the bridge to service, including:

- Reconditioning the existing bridge
- Replacing the existing bridge
- Restoring the crossing to accommodate vehicle traffic
- Restoring the crossing for active transportation only.

The costs of these options will have a very significant bearing on the final disposition of the existing bridge.

7. Technical Feasibility

The existing bridge can be restored to its nearly original state, with an estimated single truck load capacity of 20 to 25 tonnes. It will be possible to maintain all the top chords of the bridge intact, and possibly 30% to 50% of the weight of structural steel below deck level may be salvageable. It is possible to rehabilitate the bridge in place, but it would be preferred to temporarily relocate the trusses so they can be partly dismantled and reassembled on the banks. In-situ rehabilitation would be prohibitively expensive because of temporary support requirements and environmental enclosure for lead containment.

It is possible to replace the bridge with a modern single lane unrestricted loading bridge. A modern bridge would be heavier and the present masonry abutments and pier may not be salvageable.

It is equally possible to replace the bridge with a modern truss type pedestrian only bridge. A suitable pedestrian bridge would have a 3.0 m deck width that is primarily designed for active transportation, but able to carry light service vehicles such as a pickup truck.

8. Service Considerations

There are numerous service considerations that the Town must grapple with in deciding the fate of the crossing. Chief among these are:

- Is vehicle traffic desired or necessary at the bridge?
- Will an active transportation bridge be maintained with de-icing salt?
- If the present bridge is restored for active transportation only, is it desirable to retain the cantilevered pedestrian walkway on the upstream side of the bridge?
- Should the pedestrian walkway of a vehicle bridge be repositioned to the downstream side?

9. Sub-Options

If the present truss bridge is retained there are several additional considerations that will impact the longevity and cost.

The bridge has always had a timber deck. The original bridge was designed with lapped 4” x 12” timber stringers and transverse planks. This was replaced with a creosote treated prestressed laminated timber deck. Unfortunately, or fortunately, depending on perspective, creosote is not a permissible timber treatment option any longer. It will be possible to replace the deck with a steel stringer and steel grating option. It may also be possible to replace the deck with prefabricated wood deck panels. A reinforced concrete deck could also be substituted for a timber deck, but this would significantly reduce the load capacity of the bridge.

A conventional preservative treated replacement timber deck will have a service life of 20 to 25 years. A concrete deck would have a minimum service life of 50 years. There is little experience with prefabricated wood deck panels, however up to 30 years of service life can be expected depending on how well the wood is protected.

Galvanizing the structural steel of the bridge will ensure another minimum of 50 years of service. Ideally all the structural steel below the deck of the bridge should be galvanized to obtain the maximum life of the superstructure. That, or the Town should forego de-icing salt.

A new pedestrian bridge in the form of a 3.0 m wide prefabricated truss is an economical replacement bridge consideration. The standard configuration for these bridges is unpainted atmospheric corrosion (ACR) resistant steel. However, if de-icing salts are utilized on the ACR steel, it will corrode very quickly. The preferred approach is to specify a galvanized steel pedestrian truss. The cost premium for the galvanizing is nominally 20%.

10. Heritage Considerations

There is no knowledge of the Confederation Drive Bridge as being officially designated a heritage bridge.

The website "historicbridges.org" features the bridge. It rates the bridge as a 6 out of 10 and 7 out of 10 historical rating on a national and local rating respectively. By comparison, the Bascule railroad bridge over the Rideau Canal, also in Smiths Falls merits 8 & 9 ratings respectively.

The massive cut limestone blocks for the bridge abutments and pier may well pre-date the present bridge. It would serve the Town well to complete some historical research on the bridge.

The aforementioned website has the following to say about the Confederation Drive Bridge:

> **This bridge is an uncommon example of a multi-span pony truss. Pony truss bridges tend to be single span structures more often. The bridge is traditionally composed, and overall retains decent historic integrity with no severe alterations, although it was noted that prior repairs had replaced some rivets with bolts. It is not known if the cantilevered sidewalk on the bridge is original, or if it was added.** *(Most likely original-author)*
>
> **Although the construction date for many of Ontario's rivet-connected truss bridges is unknown (at least to HistoricBridges.org), this bridge appears to be a very old surviving example of a rivet-connected truss bridge. Earlier truss bridges were typically pin-connected. The more rigid rivet-connected truss bridge represented an advancement in bridge construction.**
>
> **For a small city, Smiths Falls has an impressive collection of heritage bridges, encompassing a wide variety of structure types including stone arch, fixed plate girder, bascule plate girder, plate girder swing, and this pony truss bridge. Despite this variety, this is the only example of a truss bridge. As such, this bridge is an important contributor to the unique variety of bridges here. This is why it is of great concern that a report recommended demolition and replacement of this bridge on the basis that it could not be rehabilitated to carry full legal loads. It is hoped that plans to demolish and replace this bridge will be halted. Instead, this bridge could be rehabilitated for light vehicular use, something that should be both feasible and cost-effective. This is not the main road through town, and it is not apparent that a lot of heavy trucks need to use this road. Another solution would be to preserve the bridge for pedestrian use. This could be done while building a new vehicular bridge next to this bridge, closing the crossing to motor vehicles permanently, or relocating the reusing the bridge elsewhere. Whatever the case, to maintain the unique collection of bridges in Smiths Falls, and to preserve this attractive pony truss, demolition needs to be reconsidered.**

11. Parks Canada – Rideau Canal

As part of the deliberations, we were tasked with meeting with staff from the Parks Canada - Rideau Canal office in Smiths Falls. The following points are key take-aways from the meeting:

1. Parks Canada looks forward to seeing the Confederation Bridge addressed.
2. The bridge is an important pedestrian link, and very helpful to canal operations if it can carry light vehicle traffic.
3. A single lane bridge is sufficient for Canal purposes.
4. A wider pedestrian walkway that better satisfies accessibility standards is desired.
5. A replacement or refurbished bridge should be constructed of "noble" materials; that is iron (steel), timber, and stone masonry.
6. A timber bridge deck is strongly favoured over a steel grating type deck.
7. Creosoted timber is not approved by Parks Canada.
8. Visual improvement of the present bridge railings is welcome.
9. Temporary removal of the bridge for off-site reworking is very acceptable.
10. Parks Canada places a very high value on maintaining fidelity to the original bridge construction design details.
11. Parks Canada recommended development of a conceptual plan for approval to expedite their approval process. Approval is governed by the Impact Assessment Act.

12. Environmental Assessment Approvals

Environmental approvals for projects follow the Municipal Class Environmental Assessment (MCEA) protocols. The processes are currently in a state of flux. Much of the change is easing the burden of satisfying the approval process.

Typically bridge rehabilitation projects are treated as a Schedule A+ project. However, there are some exceptions for designated Heritage Bridges. The Confederation Bridge is not to the best of anyone's knowledge a designated bridge, however its historical status should not be ignored. The proposed changes to the MCEA moves Heritage Bridges to an A+ category after heritage issues are addressed.

All that being said, a rehabilitation of the existing bridge should proceed as a Schedule A+ project. The process is straight forward and will have little impact on schedule and cost.

A bridge replacement that results in a significant change in use or capacity will trigger a Schedule B or C environmental assessment. This can take a year or more to complete and be costly. A recent Schedule C assessment for a Mississippi River Bridge replacement cost approximately $200,000. This value has been carried forward in preparing the estimates for a new and improved bridge, see Appendix 1.

12.1 Lead Contamination

Recent testing has revealed that there are high concentrations of lead in the paint system of the bridge. Lead is a known toxin, and cleaning and recoating the bridge may prove very costly if preparatory work for repainting the bridge is conducted on site.

13. Aesthetic Considerations

The present grey paint colour of the bridge is utilitarian and made even less attractive with the peeling paint condition. Some thought to the most appropriate paint colour, consistent with the surroundings is merited.

The present wood balusters on the pedestrian walkway beg for architectural enhancement.

Flower boxes or some form of live greenery on the bridge will make the bridge stand out more.

14. Structural Fatigue

Structural members that have excessive heavy load cycles in tension can fail from fatigue. Welds are often an originating location for a fatigue crack. The Confederation Bridge is not a strong candidate for fatigue failure because:

a) Most of the primary tension members have been replaced;
b) There are no welds;
c) There is some redundancy with the paired bottom chord members.

15. Risks

The precise condition of the bridge below the deck level is only partly known. A very detailed and highly documented inspection under fair weather and water conditions is required to achieve a complete as possible understanding of the condition of the bridge below deck level. Even then, there may be hidden deterioration that can only be revealed as the bridge is dismantled.

16. Cost Estimating

A Class D estimate of costs for various options for replacement and refurbishment has been prepared. A Class D estimate is a preliminary estimate based on conceptual plans and is typically within plus or minus 25% of the final cost. There is very little cost experience with truss type bridges, and this makes it exceedingly difficult to develop a reliable estimate. The following sources were referenced to aid in the production of estimates:

- Published cost functions for bridge structures
- Information from recent prefabricated pedestrian truss installations
- Interviewing a local bridge contractor
- In-house estimating tools
- Personal experience

Four main options were costed, and these are described next. The costs are detailed in Appendix 1.

16.1 New Bridge – Low

This is a modern single-lane truss designed for full highway loading, constructed with a conventional concrete deck. The bridge would have a similar appearance as the present bridge but would be constructed of all new materials. It would have an accessible pedestrian walkway separated from vehicle traffic. New abutments and piers are presumed necessary. A bridge such as this is expected to have a

100-year life and require one major rehabilitation at its half-life. The "Low" moniker means this is the lowest anticipated cost for this type of bridge.

A single-lane single-span 25 metre truss, the Keene Bridge was recently installed to replace an older truss bridge near Peterborough. The cost of this project was nominally $1,000,000. This project is the most fitting comparable recent project. Utilizing this cost as a benchmark, it is expected that a similar upgrade of the Confederation Bridge would cost not less than $1,800,000.

A rehabilitation cost of $600,000 at the half-life mark of the bridge was utilized in the life-cycle costing calculations.

16.2 New Bridge – High

This bridge is identical to the previous bridge, except the cost estimate is at the high end of expected cost. A value of $2,200,000 was the high-end estimate.

16.3 Pre-Fab Pedestrian Truss

A pedestrian truss bridge would consist of a prefabricated park bridge with a timber deck. It would be able to carry light service vehicles such as a pickup truck. Only modest reworking of the existing masonry abutments and pier would be required to install a pedestrian truss.

A new prefabricated twin span truss type pedestrian bridge with atmospheric corrosion resistant (ACR) steel on reworked existing foundations can be purchased and installed for about $500,000. A hot-dip galvanized version of the same bridge will add about $100,000 to the cost. The non-galvanized option will have an estimated life of 50 years if it is maintained without salt. It is recommended to only consider a galvanized option. This can be expected to have a life of 75 years. A bridge such as this requires re-decking about every 25 years. Re-decking and associated costs are estimated at $50,000 per occurrence.

16.4 Refurbishment

Refurbishment of the existing bridge requires temporary removal and dismantling of the existing trusses, replacement of about 50% of the structural steel, reassembly, reinstatement and the installation of a new timber deck. It is strongly encouraged to galvanize at least the lower half of the bridge in order to preserve and protect this steel from salt corrosion. The cost of galvanizing has been carried in the estimate.

Minor reworking of the existing abutments and pier will be required for the refurbishment option. It will be necessary to paint the galvanized steel to maintain the historical original look of the bridge.

The refurbishing costs for restoring the existing bridge are very difficult to estimate. There are numerous uncertainties that compound the difficulty of estimating the work. Choices of material and required design life of the completed work will all greatly impact the final cost. If the work is designed such that it can be handled by a local contractor, this will yield savings.

An allowance of $100,000 was budgeted for lead abatement and the associated mitigation measures.

A reasonable budget to refurbish the bridge to its original strength and utility is very coarsely estimated as $1,000,000. This would allow for lifting the bridge off the substructure, partial dismantling,

replacement of gusset plates and bottom chord members, placing the bridge back on its substructure, and putting back a timber framed deck. Refurbishment would extend the life of the present bridge by 50 years although one additional timber deck replacement would be required.

16.5 Clone – (Replace exactly in Kind)

This replace in kind option consists of creating a replica of the existing bridge to the greatest extent possible. The structural steel sections of the present bridge would be faithfully reproduced, and galvanized and painted. High strength bolts would however replace the rivets of the original bridge. The lacing, tie plates, and gusset plate appearance would be retained. The casual observer would not be able to differentiate the refurbished option from the replace in kind option.

The clone bridge could be set in place as the existing bridge is removed, and this would achieve savings in crane mobilization, and accelerate the project schedule.

The first cost of a reproduction of the existing bridge is estimated as $1,100,000.

The clone option is expected to have a 100-year life before replacement and require re-decking every 25 years. The substructure considerations would be the same as the refurbishment option.

16.6 Re-decking

For the pedestrian bridge, and both the refurbish and clone options it is presumed a timber bridge deck will be specified. The maximum reasonable life of a timber deck is approximately 25 years, with a sacrificial wear surface. For simplicity of cost modelling, an allowance of $50,000 per re-decking was adopted for the pedestrian bridge option, and double this for the refurbish and clone options.

16.7 Environmental Assessment

An environmental assessment (EA) for a new bridge can be very costly. A Schedule C study required for a new traffic bridge requires preliminary design of alternatives. The cost can be up to $200,000 for a sensitive crossing such as that over the Rideau River, based on recent experience for a bridge over the Mississippi River in Carlton Place. An EA cost of $200,000 was assumed for the replacement with a new modern truss bridge option.

An assessment such as this is not required for simple refurbishment of a bridge. If the bridge is replaced with a pedestrian bridge, then it is anticipated a less onerous process will be appropriate. It is suggested about $75,000 be budgeted for an environmental assessment for a new pedestrian bridge.

There is no known precedent for how a cloned bridge would be treated under the MCEA. The assumption carried forward is that it would be equivalent to a Schedule A+ project.

16.8 Design & Contract Administration

Design and construction administration cost burdens were assumed at 15% of the first cost of construction. This is a commonly used assumption.

16.9 Contingency Costs

A standard contingency amount of 10% was added to all the estimates except the refurbishment option, where 20% was used. The refurbishment option has the highest cost risk and was thus accorded double the contingency percentage.

16.10 Life-Cycle Costing

Life-cycle costing (LCC) was employed to ensure a fair comparison of all options. The costs over a hundred-year period were considered, including replacement in the 100th year where appropriate. A discount rate of 5% was utilized in the LCC analysis.

Life cycle costing acknowledges that a $100 in your pocket today is worth more than the same $100 several years hence. The change in perceived value of the $100 over time is referred to as the discount rate (**i**). The present value (**P**) of a future expenditure (**F**), is given by the formula:

$$P = F/(1+i)^n$$

where **n** is the number of years in the future. The life-cycle cost ensures an "apple to apple" comparison of projects that have very different future cost profiles.

All summary costs are presented on a first cost and LCC basis.

17. Cost Summary

The costs of the four main options are detailed in Appendix 1 at the end of the narrative, and summarized in Table 1 below:

Table 2. Summary of Estimated Life-Cycle Costs for 4 Options

Option	Description	First Cost	LCC Cost
1a	New Combined Pedestrian and Traffic Bridge Low Estimate	**$ 2,503,000**	**$ 2,570,000**
1b	New Combined Pedestrian and Traffic Bridge High Estimate	**$ 3,009,000**	**$ 3,084,000**
2	New Pedestrian Bridge	**$ 847,000**	**$ 888,000**
3	Refurbish Existing Bridge	**$ 1,506,000**	**$ 1,661,000**
4	Clone Existing Bridge	**$ 1,397,000**	**$ 1,448,000**

17.1 Discussion

A pedestrian only bridge is the most economical option as a replacement for the Confederation Bridge. A pedestrian bridge would be a prefabricated and galvanized truss with a timber walkway. It would be wide enough and strong enough to carry light service vehicles such as a pick-up truck mounted snow plough. The first cost is nominally $850,000, and the 100-year life-cycle cost is nominally $890,000.

The next most favourable option is to replicate the existing bridge. A clone would reproduce the existing bridge with complete fidelity to the existing structural section shapes. It would however be fully galvanized and over-coated with paint. The pedestrian walkway would be widened slightly so that it satisfies modern accessibility standards. The bridge would have a timber deck that requires replacement at 25-year intervals. The present stone masonry abutments and piers would not be altered. The bridge would not be able to carry full highway loads and would be posted with an estimated 20 tonne load limit. The clone bridge would be indistinguishable from the present bridge to most observers. The estimated first cost is nominally $1,400,000 and has a corresponding life-cycle nominal cost of $1,450,000.

Refurbishing the existing bridge is close in cost to cloning it. This option has the greatest risk sensitivity. Although the risk is considered in the cost estimates, there is still a large possible margin of error. The refurbished bridge is anticipated to have a nominal first cost of $1,500,000, and a life-cycle nominal cost of $1,700,000.

A new modern bridge is estimated to cost between $2,500,000 and $3,000,000 on a first cost basis. The life cycle cost is about $70,000 more. A modern bridge as estimated would still have only one lane of bi-directional traffic.

18. Practical Considerations

A contractor will require a work area near the bridge at both approaches. A 30 metre by 30 metre footprint at each end of the bridge for a contractor lay-down area would be ideal.

19. Next Steps

Should this report give sufficient confidence that refurbishment or cloning of the existing bridge is worthwhile of pursuit as an option then the following additional engineering work is recommended:

1. Complete a very detailed inspection of the structural steel after a thorough cleaning.
2. Measure all the bridge components so that an as-built record of the bridge can be recorded in drawings.
3. Perform a structural evaluation premised on the bridge being fully restored, so that the ultimate capacity of the bridge is known, and so that deck replacement options can be properly assessed.
4. Research similar recent projects to obtain a more precise cost estimate of the work. It will be worthwhile to expend some effort on pre-planning this project to better scope out the costs of the refurbishment option, as these costs are the most difficult to predict.

Consideration should also be given to funding:

a) Research into the historical significance of the bridge
b) Determine if a heritage designation should be given to the bridge.
c) Hiring a landscape architect so that any reworking of the bridge is sympathetic to the surroundings and to ensure that the completed work is attractive to the public and visitors alike.

20. Closing

Keystone Bridge Management Corp. is very pleased to provide this assessment and options report on the condition and future of the Town of Smiths Falls Confederation Drive Bridge. Should there be any lingering concerns or additional information required with respect to this assignment, then Keystone will be happy to respond.

Keystone strives to help you get the most out of your road and park structure assets.

Harold Kleywegt, P.Eng.
Managing Director
Keystone Bridge Management Corp.

21. Appendix 1 Estimate of 4 Options

Option	Alternative	Construction Cost	Design & CA @ 15%	Permits LS	EA	Lead Abatement	Sub Total	Conting-ency %	TOTAL
			Cost Breakdown						
1a	Bridge-Low	$ 1,800,000	$ 270,000	$ 5,000	$ 200,000	$ -	$ 2,275,000	10	**$ 2,502,500**
1b	Bridge- High	$ 2,200,000	$ 330,000	$ 5,000	$ 200,000	$ -	$ 2,735,000	10	**$ 3,008,500**
2	Prefab Ped Bridge	$ 600,000	$ 90,000	$ 5,000	$ 75,000	$ -	$ 770,000	10	**$ 847,000**
3	Refurbish	$ 1,000,000	$ 150,000	$ 5,000	$ -	$ 100,000	$ 1,255,000	20	**$ 1,506,000**
4	Replace-in-kind	$ 1,100,000	$ 165,000	$ 5,000	$ -	$ -	$ 1,270,000	10	**$ 1,397,000**

Option	Full Description
1a	New Combined Pedestrian and Traffic Bridge Low Range
1b	New Combined Pedestrian and Traffic Bridge High Range
2	New Pedestrian Bridge
3	Refurbish Existing Bridge
4	Replace with Duplicate Bridge

21.2 LCC Breakdown Options 1 – 2

Bridge Low			
Activity	**Year**	**Cost**	**LCC**
Construct	2020	$ 2,502,500	$ 2,502,500
Rehab	2070	$ 600,000	$ 52,322
Replace	2120	$ 2,502,500	$ 19,030
		$ 5,605,000	**$ 2,573,852**
Bridge High			
Activity	**Year**	**Cost**	**LCC**
Construct	2020	$ 3,008,500	$ 3,008,500
Rehab	2070	$ 600,000	$ 52,322
Replace	2120	$ 3,008,500	$ 22,878
		$ 6,617,000	**$ 3,083,700**
Ped Bridge (Galvanized)			
Activity	**Year**	**Cost**	**LCC**
Construct	2020	$ 847,000	$ 847,000
Redeck	2045	$ 50,000	$ 14,765
Redeck	2070	$ 50,000	$ 4,360
Replace	2095	$ 847,000	$ 21,812
Redeck	2120	50000	$ 380
		$ 1,844,000	**$ 888,317**

21.1 LCC Breakdown Options 3 - 4

Refurbish Bridge			
Activity	**Year**	**Cost**	**LCC**
Refurbish	2020	$ 1,506,000	$1,506,000
Redeck	2045	$ 100,000	$ 29,530
Replace	2070	$ 1,397,000	$ 121,824
Redeck	2095	$ 100,000	$ 2,575
Redeck	2120	$ 100,000	$ 760
		$ 3,203,000	**$1,660,689**
Duplicate Bridge			
Activity	**Year**	**Cost**	**LCC**
Duplicate	2020	$ 1,397,000	$1,397,000
Redeck	2045	$ 100,000	$ 29,530
Redeck	2070	$ 100,000	$ 8,720
Redeck	2095	$ 100,000	$ 2,575
Reconstruct	2120	$ 1,397,000	$ 10,623
		$ 3,094,000	**$1,448,449**

22. Appendix 2 Inspection Images

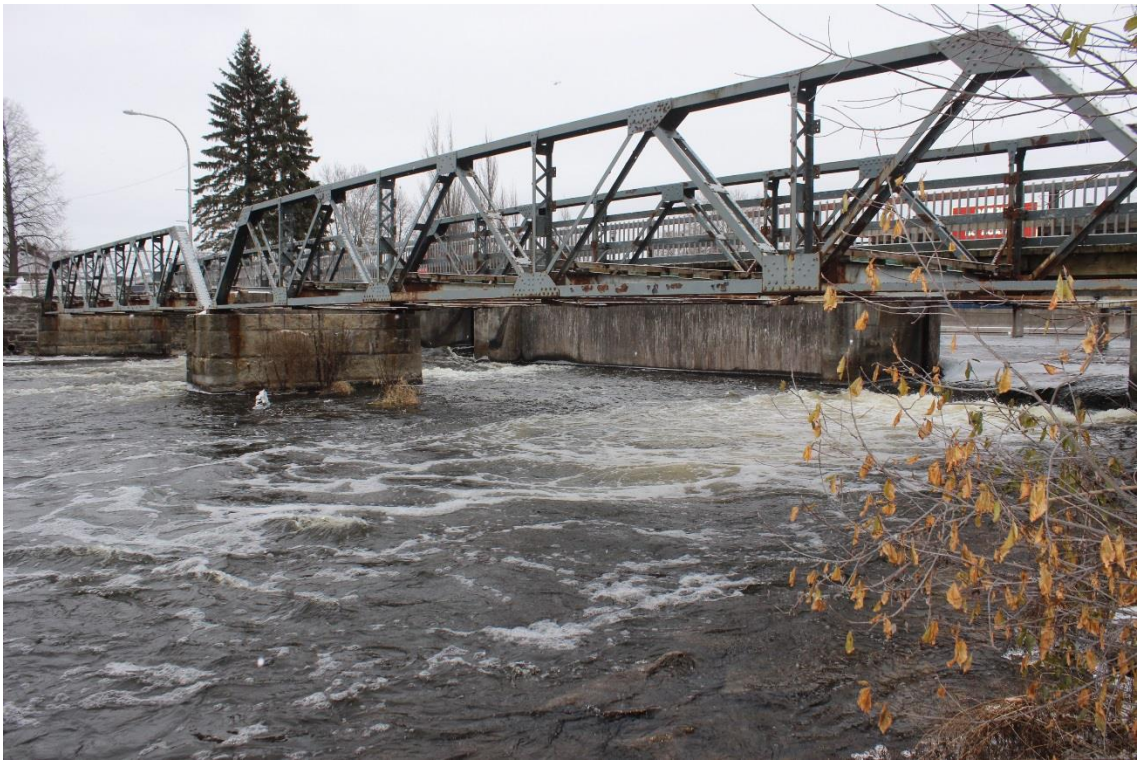

Image 1. Downstream elevation from west bank

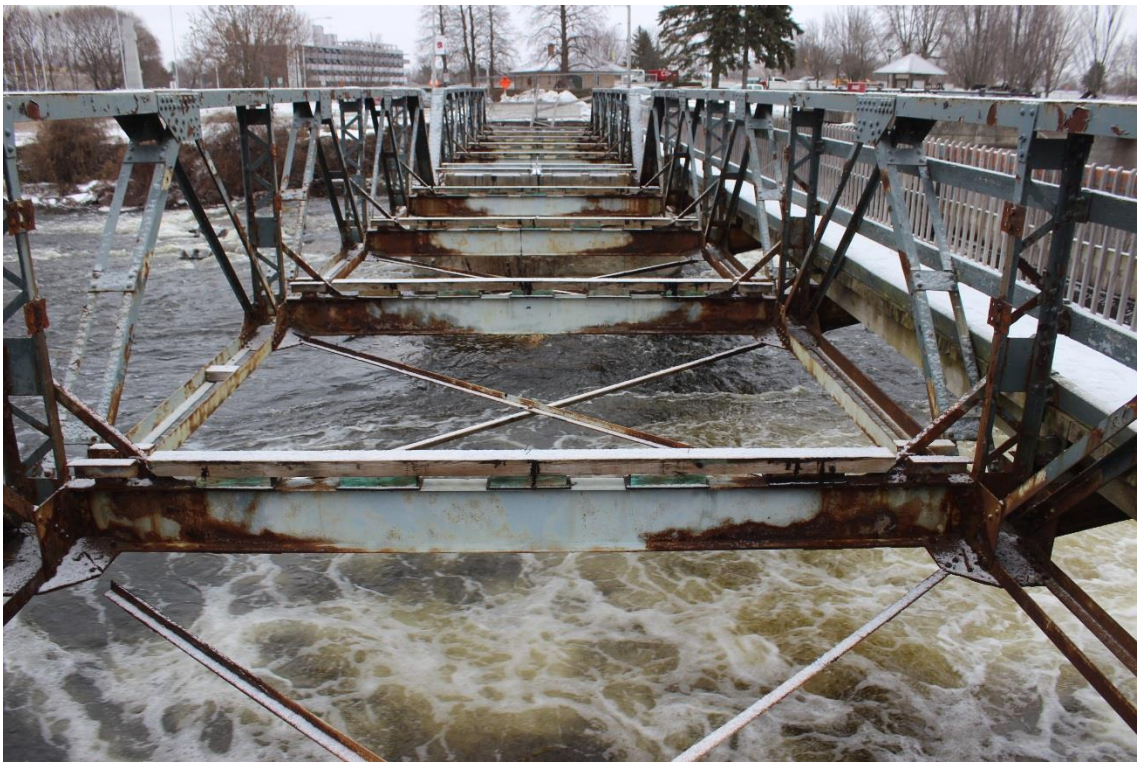

Image 2. Looking east along trusses from west abutment

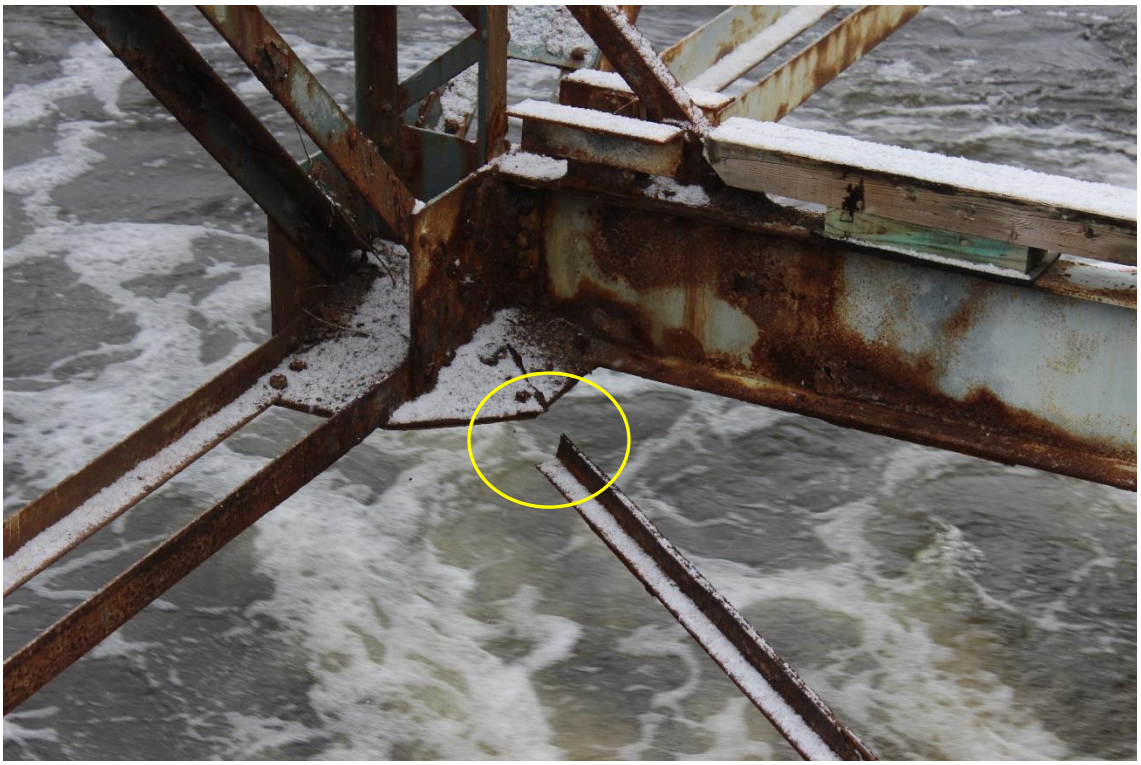

Image 3. **West truss panel point 1 downstream severed diagonal brace**

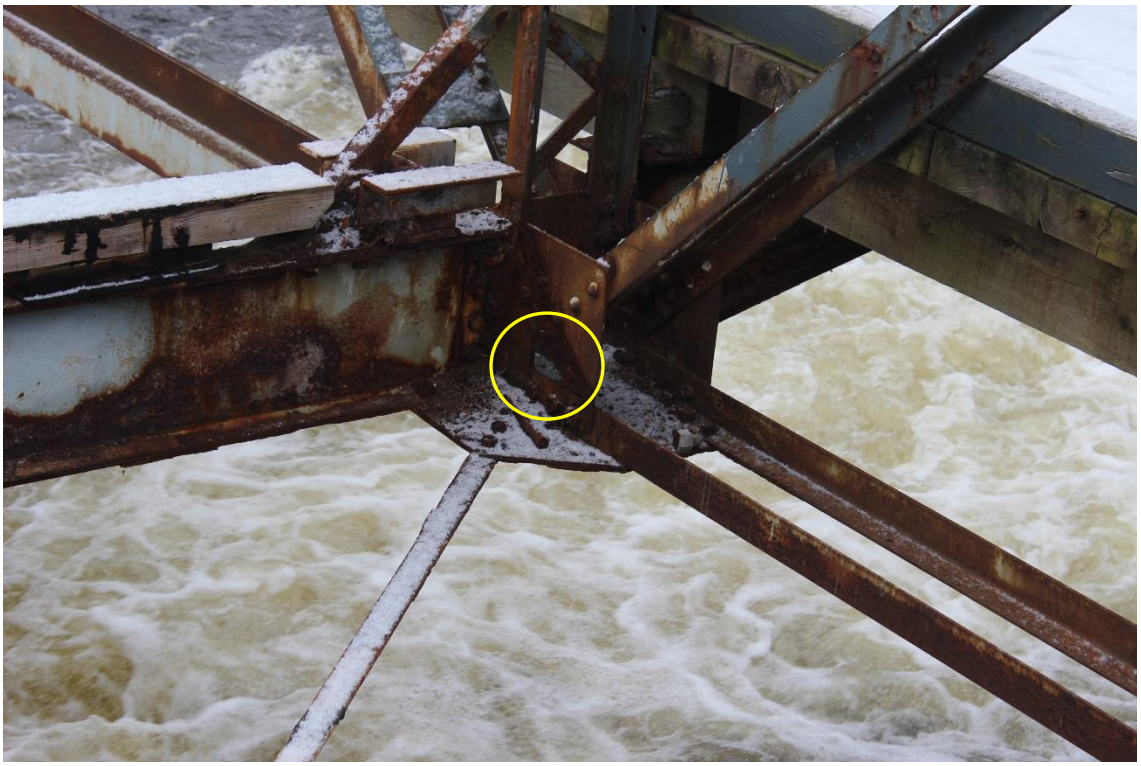

Image 4. **West truss panel point 1 upstream perforated gusset plate**

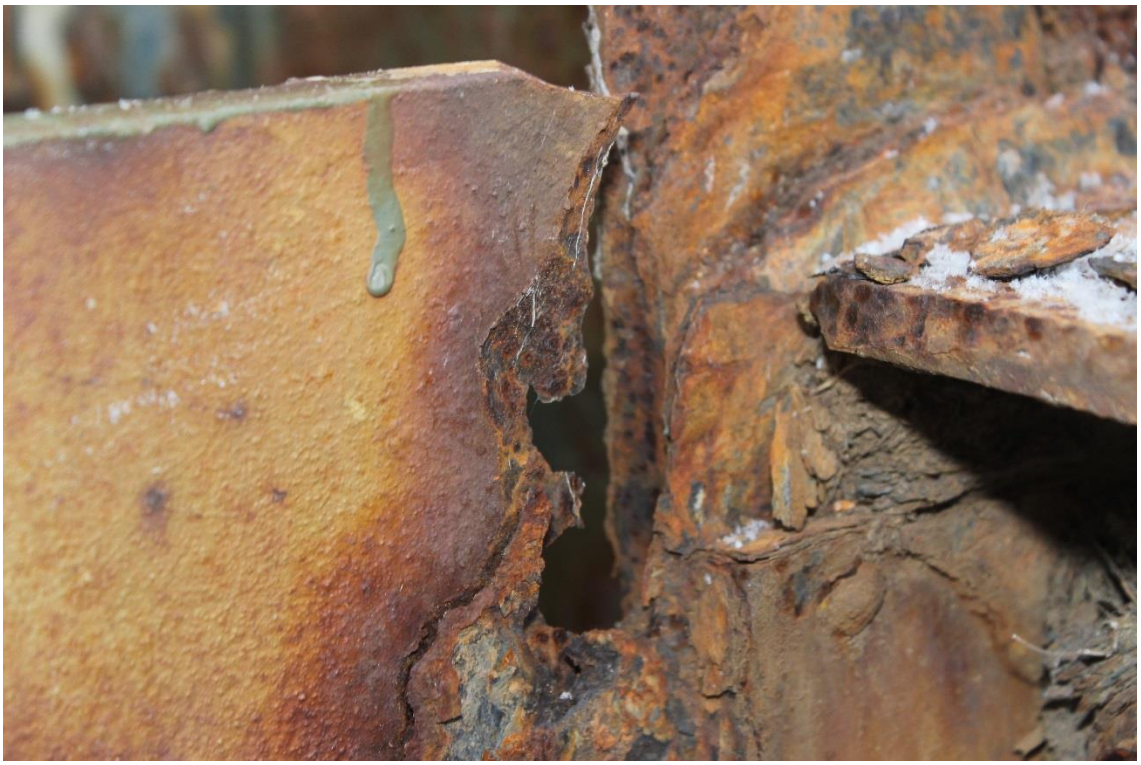

Image 5. **East truss panel point 4 upstream perforated gusset plate**

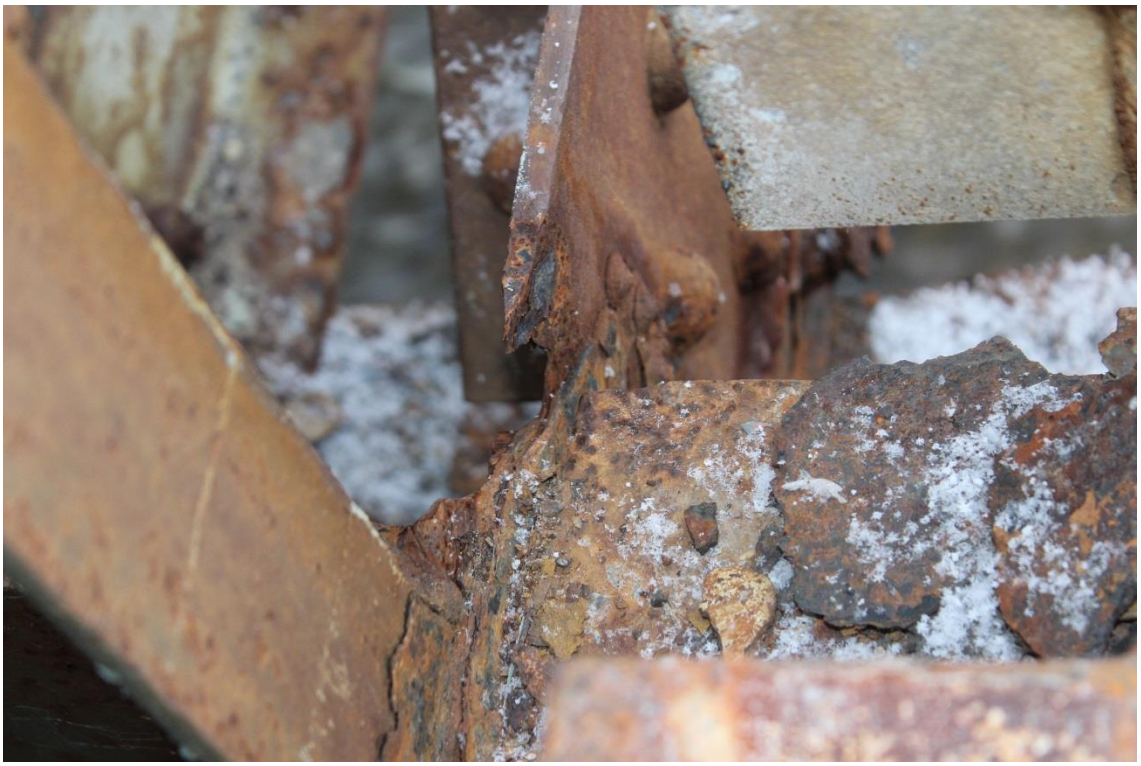

Image 6. **East truss panel point 4 upstream perforated gusset plate**

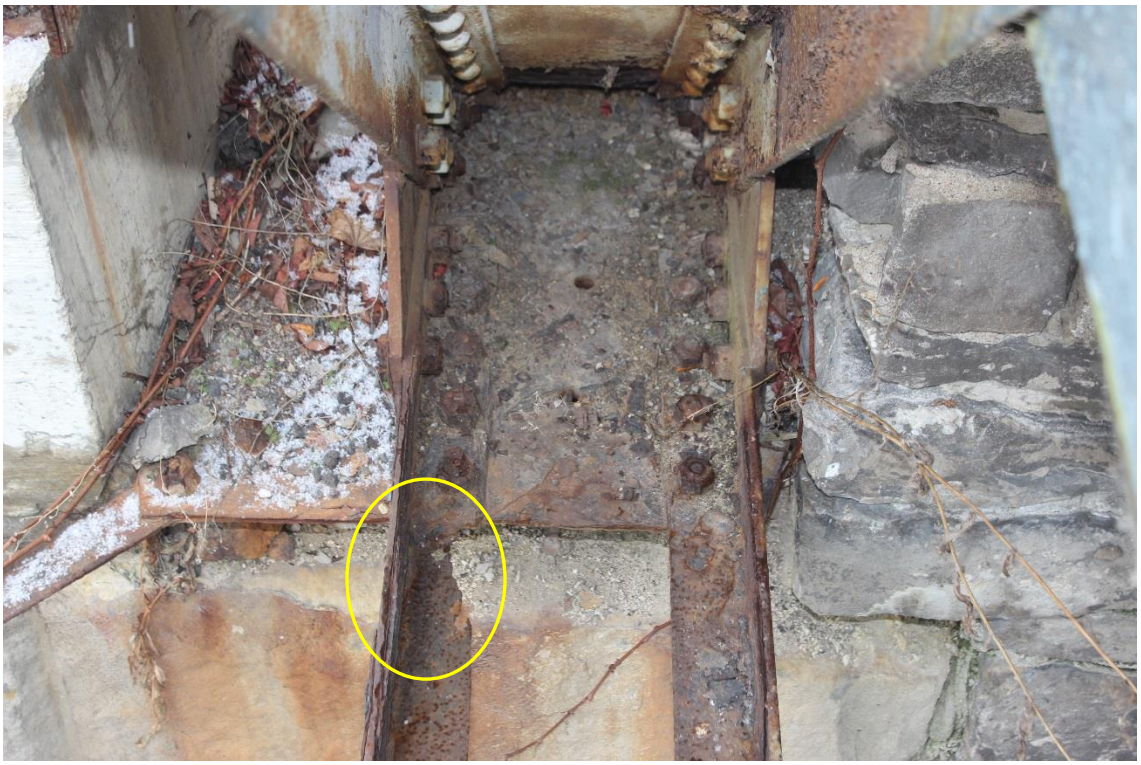

Image 7. **Perforation, severe corrosion bottom chord east truss SE bearing area**

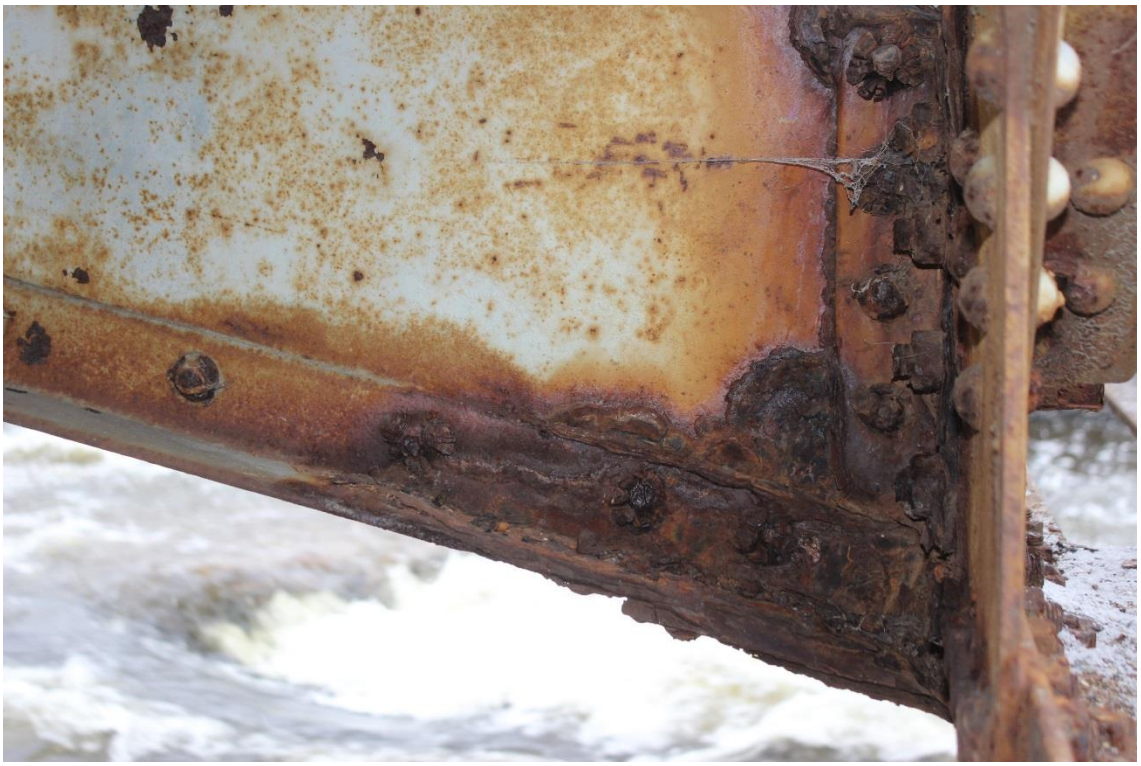

Image 8. **Corrosion of sidewalk outrigger panel point 4 east truss**

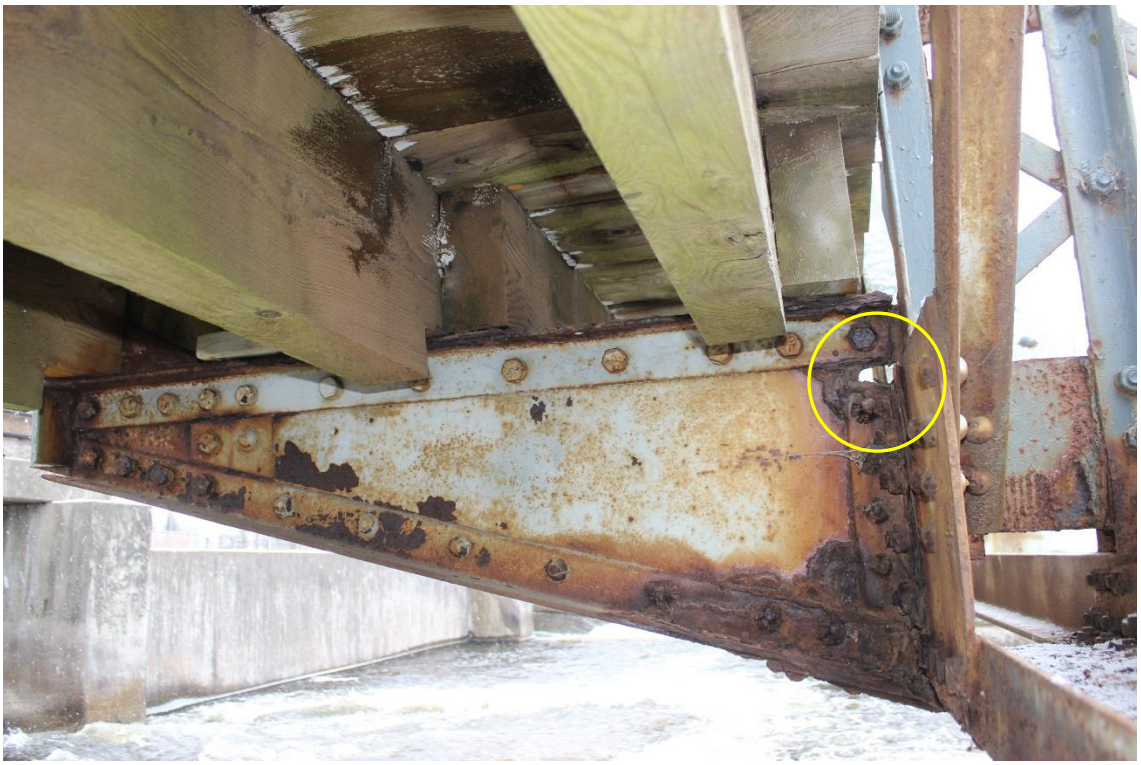

Image 9. **Minor perforation sidewalk outrigger panel point 4 east truss**

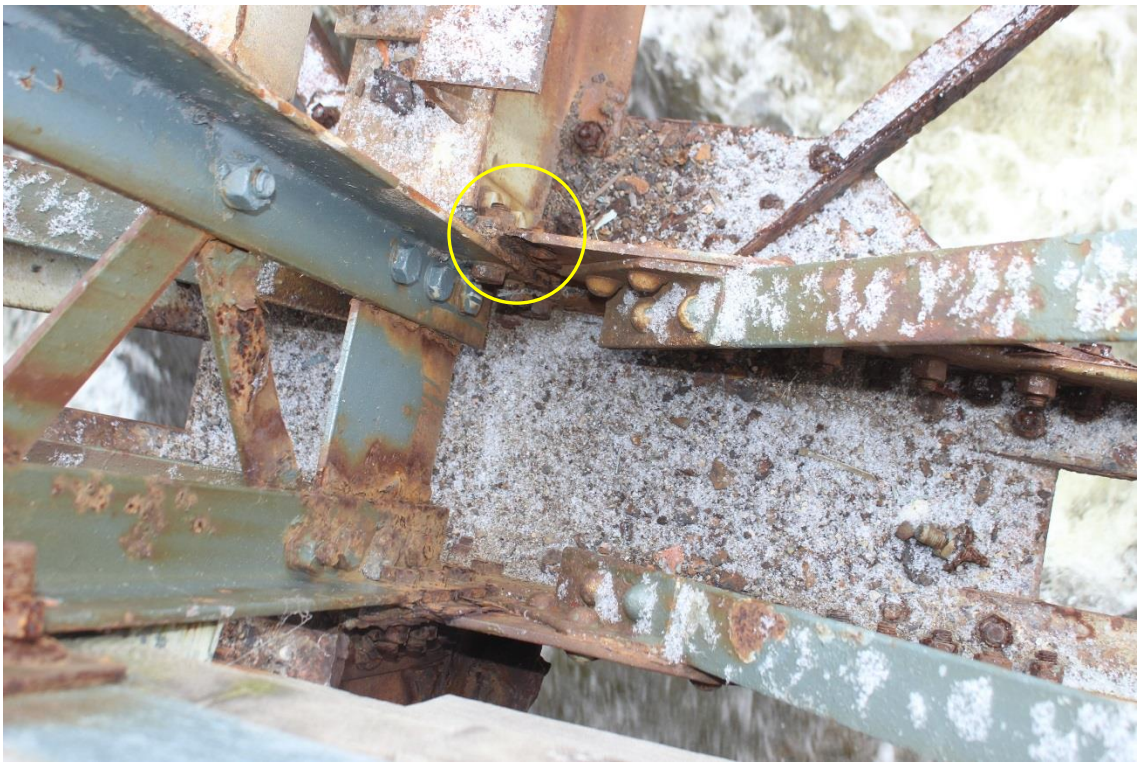

Image 10. **Typical panel point east truss upstream side with gusset thinning**

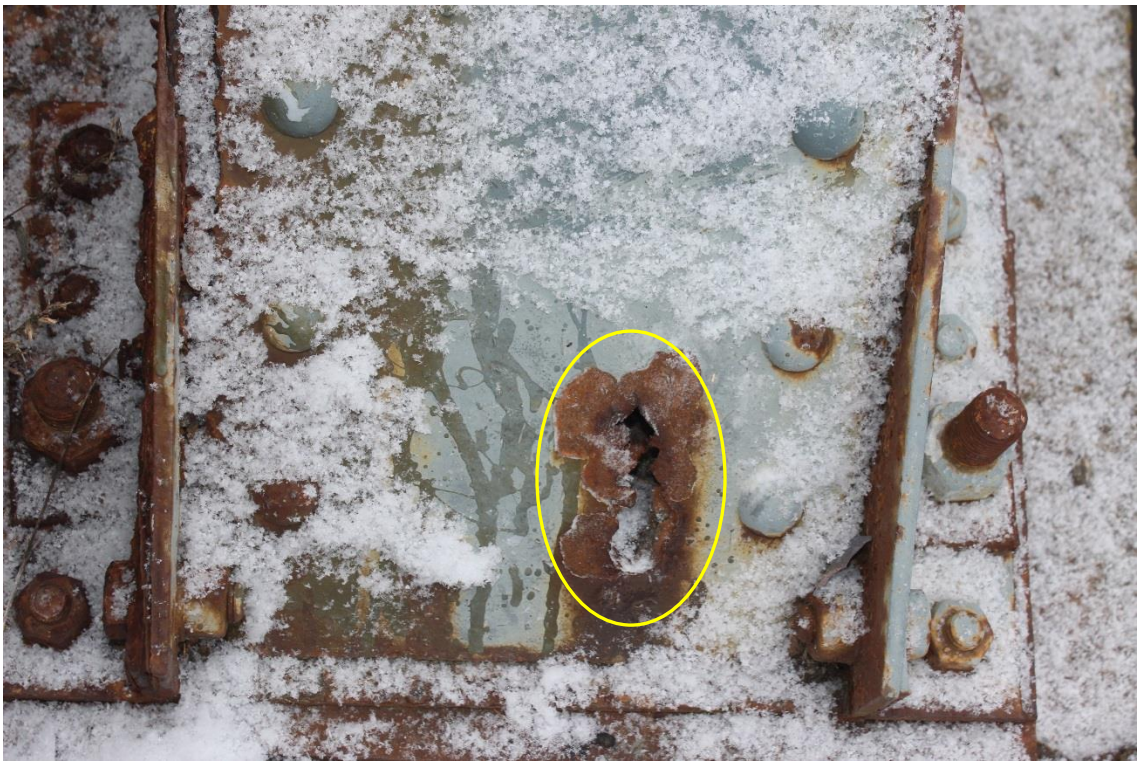

Image 11. Perforation of end diagonal cover plate NE bearing west truss

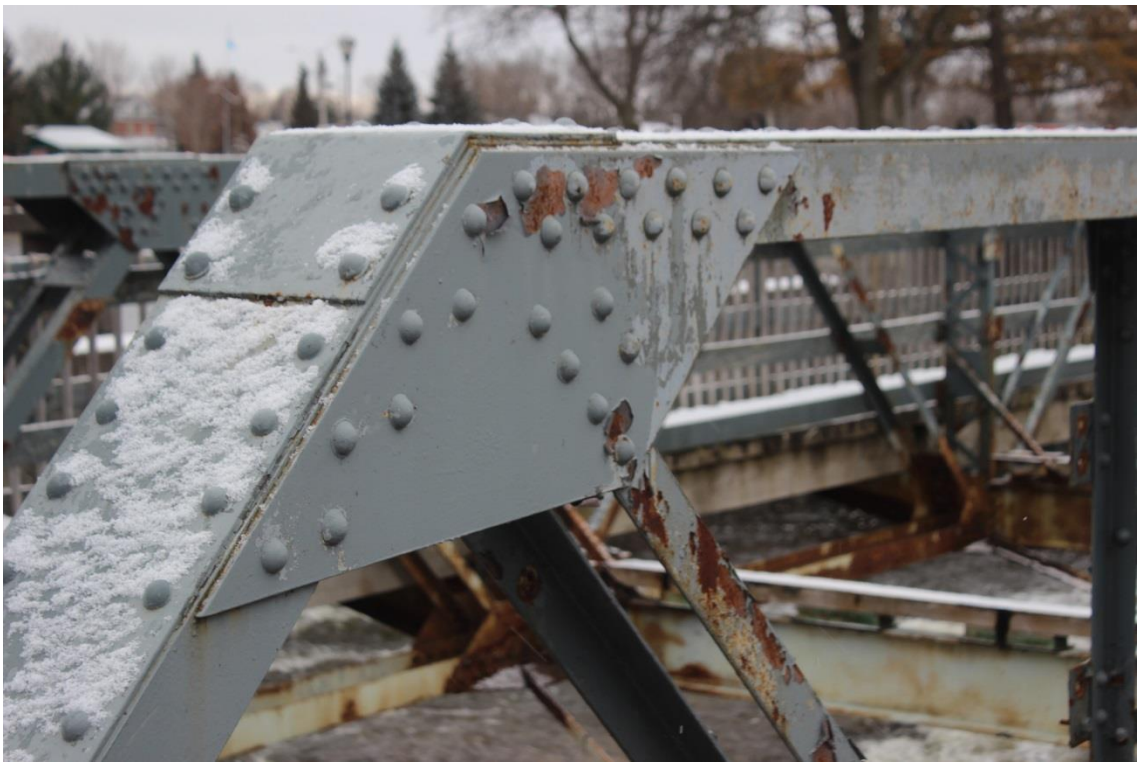

Image 12. Top chord east end gusset of east truss in NE corner

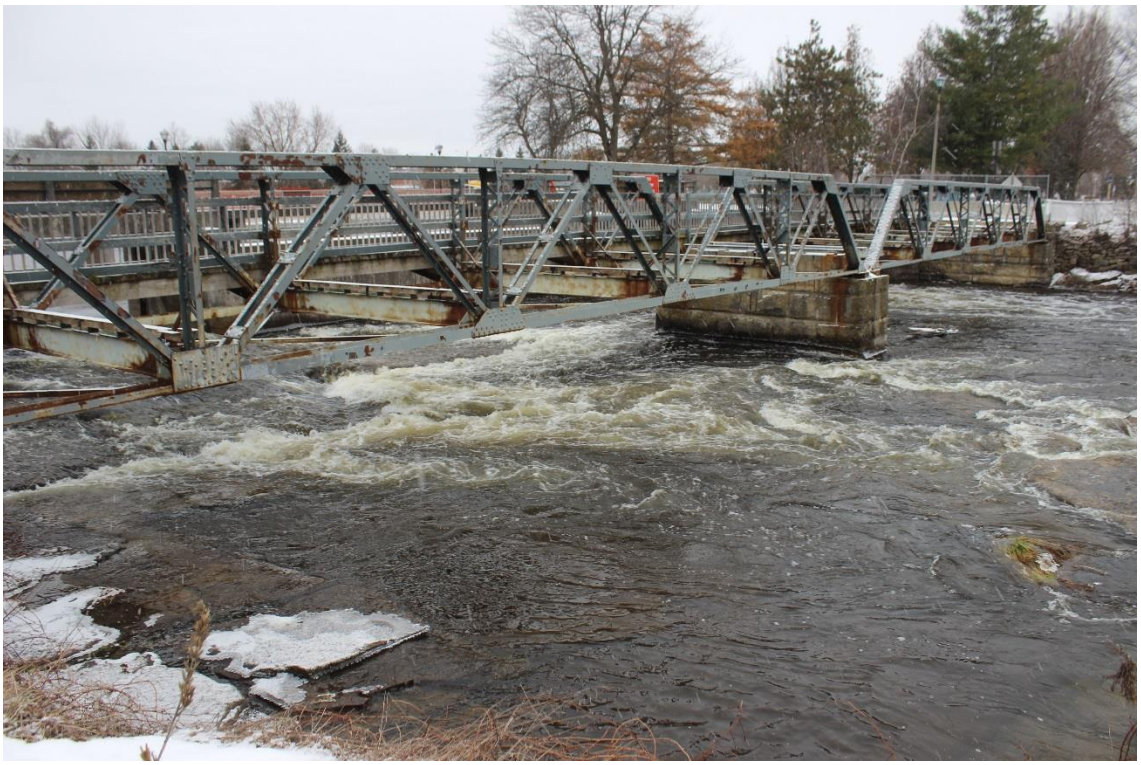

Image 13. Downstream elevation view from east bank

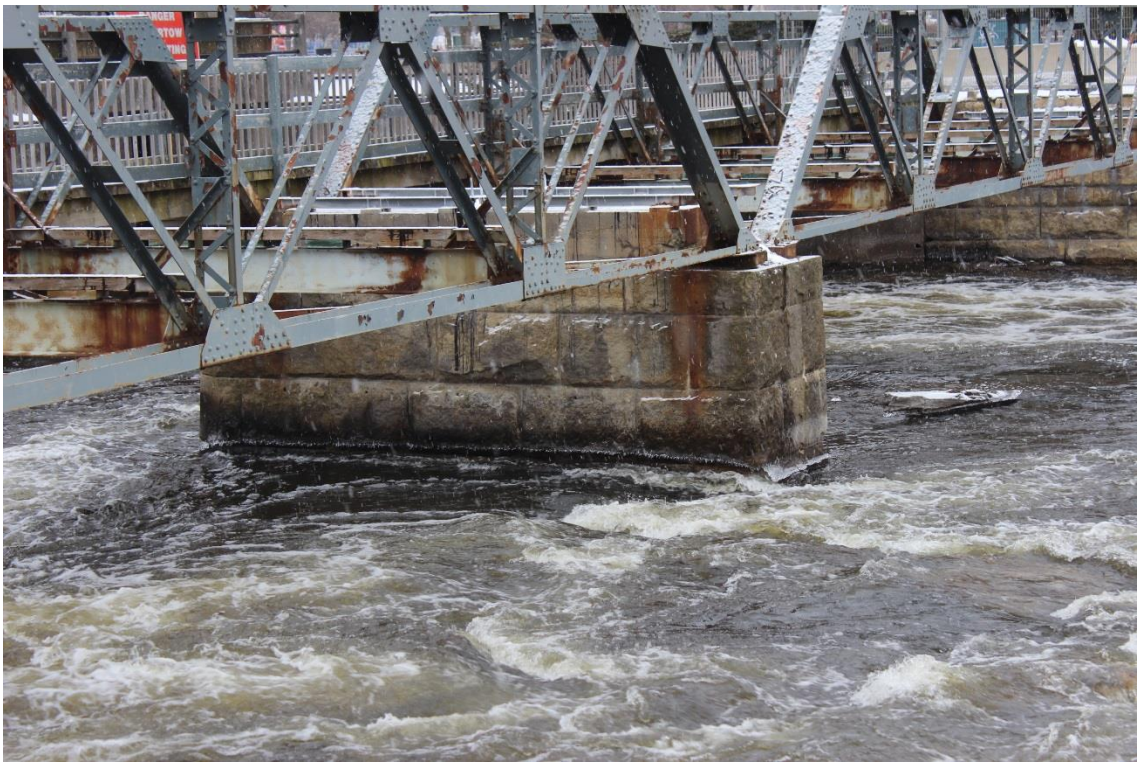

Image 14. East face of pier viewed from east bank

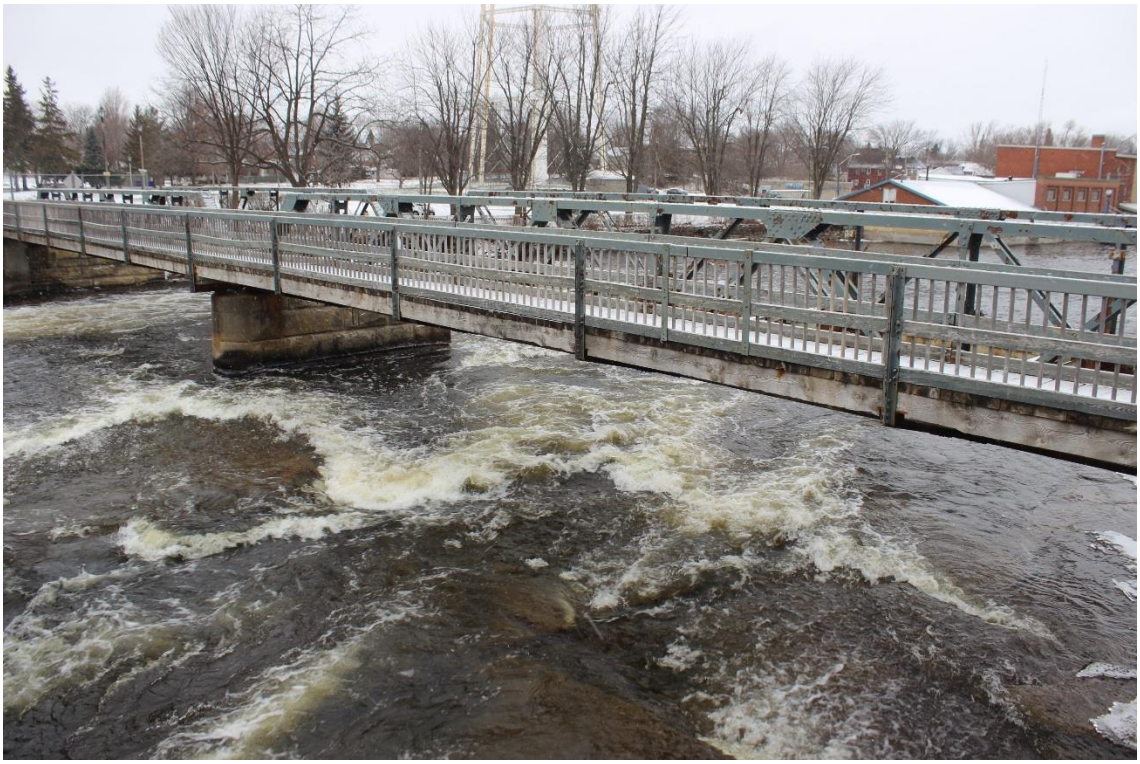

Image 15. Upstream elevation with walkway in foreground, from east bank

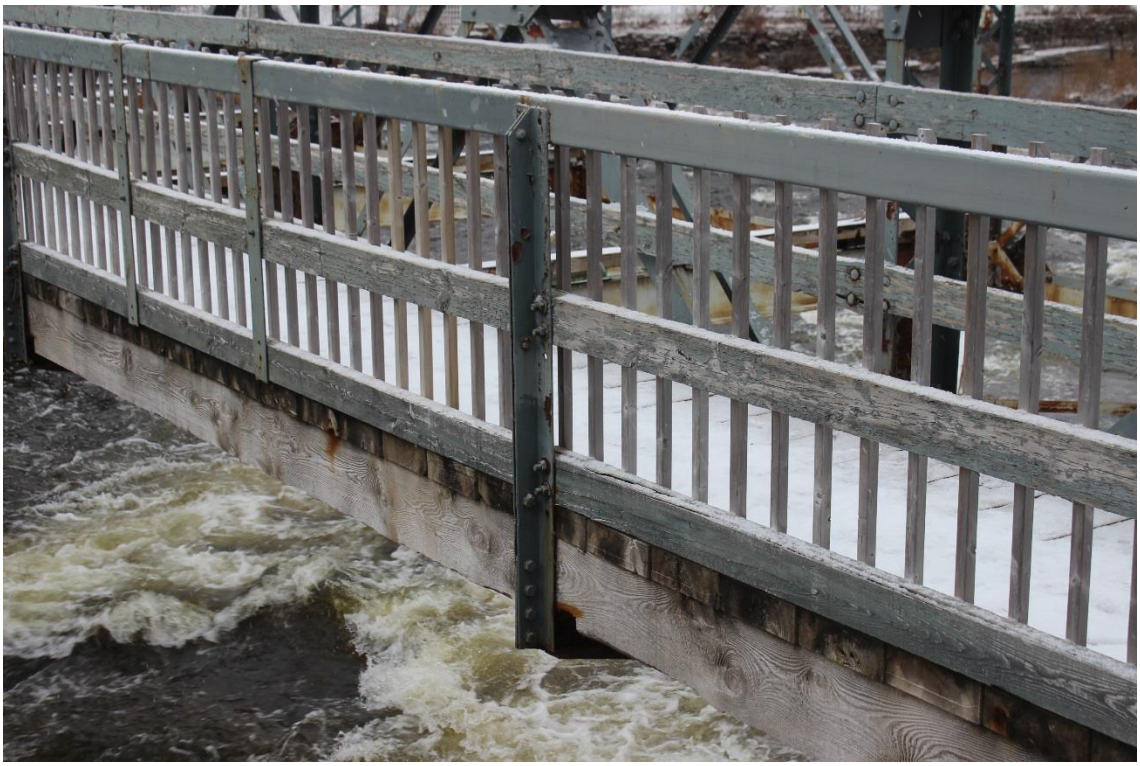

Image 16. Post and railing detail for walkway, east end of east truss

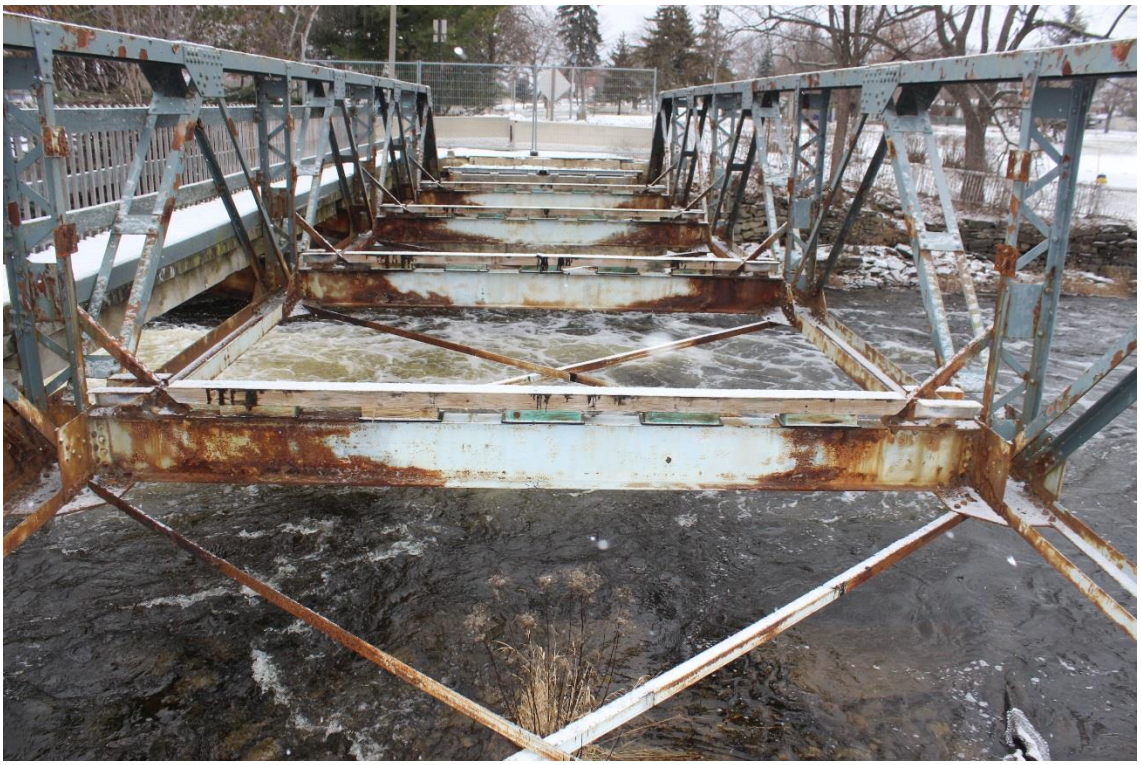

Image 17. West truss viewed from pier

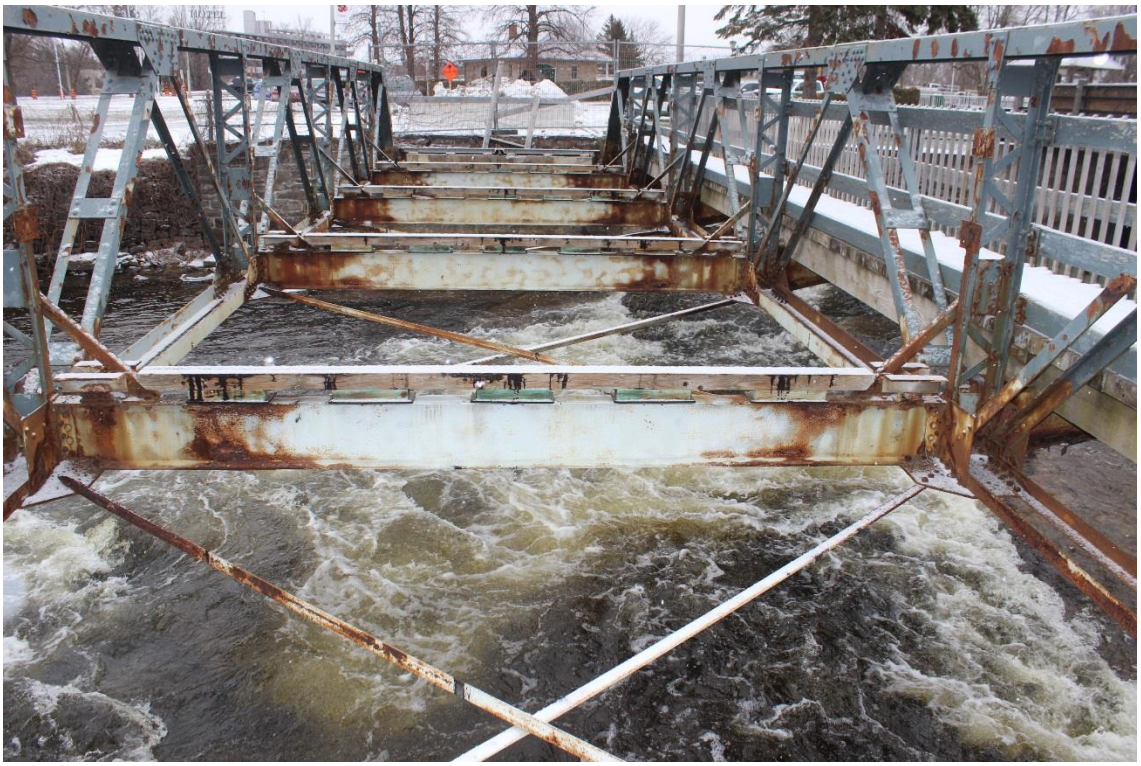

Image 18. East truss viewed from pier

Image 19. Panel point 4, downstream east truss with rivets & high-strength bolts

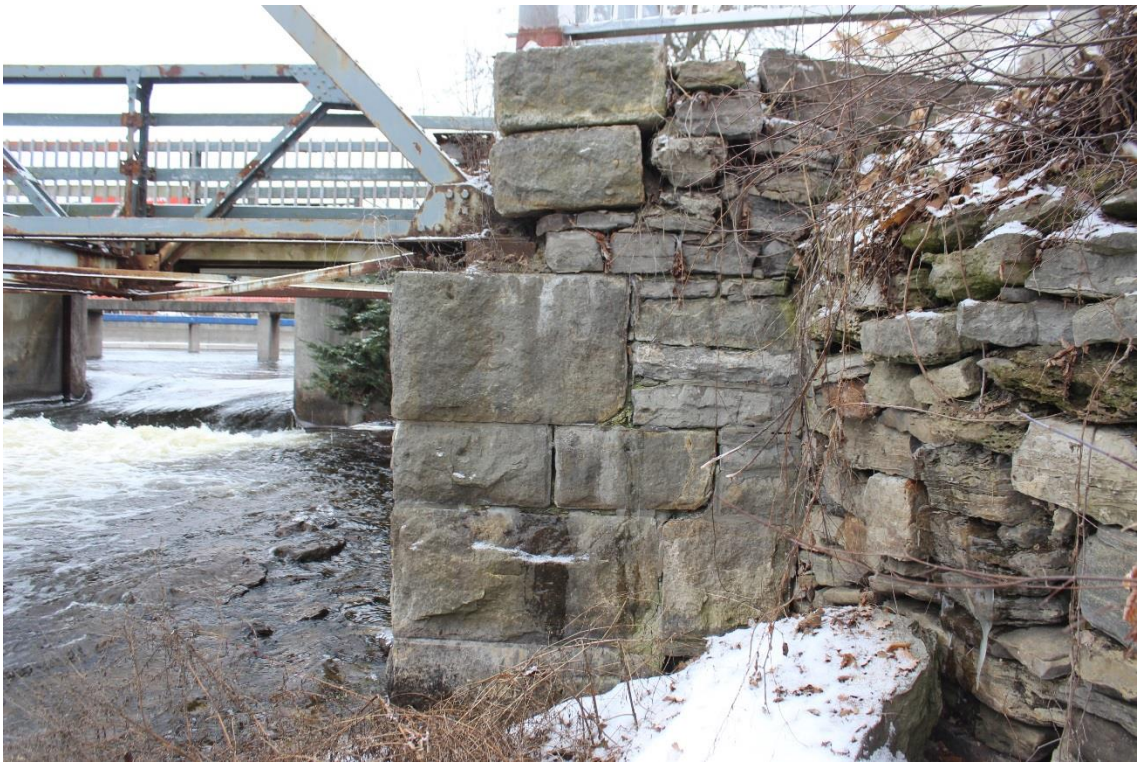

Image 20. West abutment north face