Mossington Bridge Modifications

CONFIDENTIAL

Prepared for the Town of Georgina
Prepared by Doug Dixon & Associates Inc.

April 2024

Executive Summary

The Mossington Bridge is a heritage protected structure located in the Town of Georgina, Ontario. Originally built in 1912, it was cleaned and coated with reinforcement of some structural steel during a 2016 rehabilitation. Over the bridge's lifetime, individuals have climbed the steel truss members using the built-up members to reach the top chord.

In 2024 Doug Dixon and Associates was retained by the Town of Georgina to assess engineering solutions to prevent access to these members.

This study reviewed physical alternatives to deter access to climbing the truss. After reviewing several options, the recommended solution was found to be adding localized plates to several of the truss members. The plates will cover the truss members with lacing bars to prevent the existing lacing bars from being used as ladder rungs. The plates will remove occasional existing rivets from the existing truss members and replace with bolts to minimize the modification to the bridge.

The implementation of this solution is anticipated to deter anyone from climbing the truss members to jump into the water. The heritage impact is believed to be minimal as it uses steel and fabrication techniques similar to the original construction. In addition, the modifications are such that they could be "reversed" reinstating the original design at some point in the future is so desired.

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1. Background.

The Mossington Bridge, located on Hedge Road in the Town of Georgina (Town) Ontario, is a designated heritage structure. The bridge was originally erected in 1912, designed by Frank Barber of the County of York and built by the National Bridge Company. The single-lane bridge is a 28.6m single-span through truss bridge with a 150mm thick concrete deck, 3.8m wide. The bridge was rehabilitated in 2016 based on a design by Jewell Consulting Engineers,

Doug Dixon & Associates Inc. (DDA) reviewed the previous OSIM reports completed in 2016, 2018, 2020 and 2022 respectively. The 2016 OSIM report recommended a structural recoating and repair to existing steel and concrete which led to a 2016 rehabilitation. The 2018 OSIM report recommended a replacement to the existing approach railings which was additionally recommended in 2016 but not included in the rehabilitation scope.

DDA also briefly reviewed the 2015 Evaluation Report by Jewell Engineering and the 2023 Technical Review of the Mossington Bridge by Safe Roads Engineering. These documents were all provided by the Town.

2. Problem Statement.

The bridge spans over the Black River, and for years has attracted locals to the bridge to climb up the truss and jump into the water from the top chord. This has resulted in the Town of Georgina (Town) procuring Doug Dixon & Associates (DDA) to assess modifications to the bridge to deter individuals from climbing the superstructure.

Due to the Mossington Bridge being a heritage structure, the bridge is to be preserved, maintained, restored, and managed in accordance with its original design to the highest degree possible. To aid the Heritage Committee in its decisions, a Multi-Criteria Assessment (MCA) will be used for the evaluation of each alternative.

3. Criteria and Constraints.

To develop the evaluation categories for a preliminary review with the Town, a list of constraints and criteria was developed. The main constraint being that all solutions must provide a physical deterrent to individuals from climbing the truss members. The following list was the criteria established to evaluate each alternative:

a) Heritage Impact
    - Degree of alteration to original design & historical integrity.
    - Ability to “reverse” the change.
    - Compatibility with existing architectural style and materials.
    - Compliance with regulations under the Ontario Heritage Act.
    - Degree the existing bridges’ visual features are obscured.

b) Effectiveness
    - Positive ability to deter climbing behaviour.
    - Need to provide additional intervention for “enforcement.”

c) Costs
    - Capital cost (labour, materials)
    - Future maintenance costs.
d) Loads on structure (DL, Wind load)
    - Does the intended solution add significant loads/forces on the bridge and thereby reduce the load carrying capacity of the bridge or require extensive reinforcement.
e) Durability
    - Has the durability of the existing bridge been impacted in any way.
f) Maintainability
    - Is future maintenance of the bridge impacted such as the effectiveness of cleaning and coating of the steel or the ability to plough/store snow.
g) Environmental impact
    - Impacts on environment during and after construction.
h) Construction impact
    - Disruption to local traffic and duration of the disruption.

In the Multi-Criteria Assessment (MCA) some of the above common criteria were grouped together resulting in the following four (4) categories:

- Environmental;
- Technical;
- Social; and
- Cost.

4. Alternatives

During a 2024 investigation conducted by DDA on behalf of the Town, it was observed that individuals were climbing up the vertical truss members and central diagonal members. Having observed the method that was being used to access the truss and considering the criteria listed above, DDA developed 7 possible alternatives to deter climbing of the trusses. After the review of the 7 alternatives with the Town, three of the alternatives were removed as they had been reviewed and reported previously by others. The three removed did not provide a physical deterrent to individuals intent to climb the truss. The remaining 4 alternatives are identified below in this section.

4.1 Acrylic Barrier

Alternative 1 was an acrylic barrier along the span of the bridge as depicted in Figure 1.

Figure 1 – Acrylic barrier on the parapet of a bridge.

The acrylic barrier would be affixed to the railing and additional framing steel on the traffic side of the bridge at a height that people could not reach over. There would also be an additional acrylic barrier required on the exterior of the bridge as individuals could access the truss members from the abutments and bottom chords.

There are a number of disadvantages to using acrylic panelling. Given the small reserve load carrying capacity of the existing bridge (found in the 2015 Jewell Report), we believe the existing bridge is not able to carry the dead load from the acrylic panels combined with the large increase in lateral load from the wind loading on the panels.

To support the panels, additional steel framing will also be required, which will increase the dead load added to the bridge.

In addition, the panels are prone to graffiti as well as discolouration due to exposure to ultraviolet sunlight. Other methods can also be used by vandals to scratch or otherwise mark the surface of the acrylic panels. Wind blown debris/dust will also etch the acrylic panels.

To clean and coat the bridge in the future with acrylic panels would require additional care not to damage the panels during abrasive blast cleaning and coating. Alternatively, the panels could be removed however, this would significantly increase the cost of the cleaning and coating.

While the acrylic panels would not obscure the view of the heritage bridge, the secondary steel to frame/support the panels on the bridge would greatly distract from the heritage characteristics of the bridge. In addition, acrylic is not a “sympathetic” material from the “time of the original bridge construction” and would not be seen to “preserve” the historic character of the Mossington Bridge.

Maintaining the acrylic panels would also require the expenditure of additional funds. The panels would require seasonal washing (similar to windows) to remove splash from the roadway.

Capital construction cost for the acrylic panels is estimated to be the highest of the four alternatives considered.

Other advantages and disadvantages to the use of acrylic panels can be found in the Table in Appendix I.

4.2 Net / Mesh / Fence

The second alternative is similar to the first in methodology but varies in material. Instead of an acrylic barrier, a net / mesh / fence barrier system would be implemented on the traffic side of the bridge between the roadway and the trusses. This is depicted in Figure 2.

Figure 2 – Localized fencing around structural members

The net / mesh / fence would be affixed by a similar auxiliary steel framing system as the acrylic panels.

As with the acrylic barrier, to be fully effective, a second barrier would be required on the exterior of the truss; thereby "sandwiching" the truss members between two (2) layers of mesh/fence.

Mesh or fencing of various types have been used on bridges such as the Prince Edward Viaduct (PEV) in Toronto (also a designated heritage bridge) to prevent access. To have them considered suitable for use on the heritage bridge, the mesh/fence design generally needs to have architectural qualities. For example, the Prince Edward Viaduct combines stainless steel cable and 6mm diameter stainless steel rods in a design that is minimalist and does not detract from the heritage aspect of the PEV. Lighting is also used to raise the "quality" of the barrier. It should also be noted that the PEV barrier cost $10,000.00 per linear meter (in 2024 dollars).

To utilize a more economic approach, with chain link fence or similar, results in a utilitarian look. Such approach is anticipated to not be compatible with a heritage structure.

In addition, the lateral wind load on a chain link fence (or similar mesh) would be very similar to that for an acrylic panel. Ice accretion must be considered on the mesh. Ice accretion in the Town of Georgina area is such that the mesh must be considered as approximately 70% solid. This puts substantial lateral wind load on the bridge which it is not currently designed for.

DDA believes that lack of compatibility to the heritage character of the bridge and the additional lateral loading are the two most critical flaws with this alternative.

In addition, mesh can be damaged by vandals using bolt/wire cutters. Mesh also "filters" wind blown debris and traps it creating an unsightly appearance.

For future cleaning and coating of the bridge, the mesh and auxiliary support framing steel would not necessarily need to be removed as it would not be as prone to damage from abrasive blast cleaning as would be the acrylic panel alternative.

Capital construction cost for a mesh/fence system that is likely to be deemed appropriate for use on a heritage bridge would be similar to the previous alternative, being one of the most costly.

Other advantages and disadvantages to the possible use of a mesh/screen fencing alternative can be found in the Table in Appendix I.

4.3 Localized Additional Steel Plates

The third alternative involves the addition of 6.4mm (¼") thick steel plates locally overtop of the existing lacing bars on each vertical and the central diagonal members composed of built up members. This is shown in Figure 3 below. The plates would be placed strategically to provide an impediment to climbing the lattice bars on the built-up members.

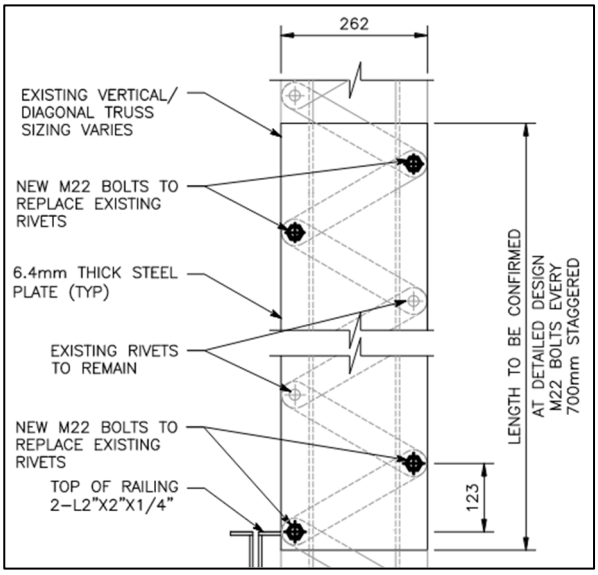


Figure 3 – Concept of localized plates added to the members prone to climbing.

Localized additional steel plating to cover the existing lacing bars and thereby deterring using the lacing bars as "ladder rungs" is one of the alternatives considered by DDA.

This alternative would add little additional deck load to the bridge with almost no perceivable increase in wind loading.

The steel plates and bolts are "heritage" compatible with the steel in the bridge in DDA's opinion. The proposed plating of portions of the verticals and midspan diagonal truss members is similar to reinforcing of steel members that has been completed in the recent rehabilitation.

The new plating would be painted to match the existing bridge colour (blue). This would result in this alternative not being noticeable to casual observers. The function of the members would not be revised and would remain 'true' to the original design.

The cost of implementing this alternative would be one of the least cost of the four alternatives considered. Budget pricing would be from $65,000 to $100,000 range.

In addition, construction could be completed in approximately five (5) to seven (7) working days. The bridge may also be able to be reopened to normal traffic each day during non-working hours. This construction duration is one of the shortest of the four alternatives considered. This will mitigate the impact of implementation to road users due to required detours.

This alternative is durable and cannot be easily damaged by vandals. Future cleaning and coating of the bridge would not be affected by the proposed additional plating. Abrasive blast cleaning and coating would take place as normal with no signification additional costs.

The additional plate would not facilitate any additional graffiti beyond that which the existing steel structure is prone to.

Other advantages and disadvantages to the implementation of this alternative are presented in the Table in Appendix I.

4.4 Localized Added Acrylic Plates

The fourth alternative evaluated is similar to the third but varies only in material. Instead of steel plates, acrylic sheets would be used.

The fitted sheets would extend in the same manner as the steel plates to ensure the members currently used to access the truss have an appropriate deterrent.

Similar to the above noted alternative, this alternative would replace the steel plate with acrylic plates. The advantage of using acrylic plates is that the transparency of the acrylic plates would not obscure the lacing bars.

DDA does have concerns that vandals could use devices to break the acrylic panels to gain access to the lacing bars and thereby climb the members.

In addition, the acrylic plates may be damaged in the future when the bridge is cleaned and recoated.

Other advantages and disadvantages to the implementation of this alternative is presented in the Table in Appendix I.

5. Multi Criteria Assessment

To analyze the four proposed alternatives, a multi criteria assessment was used to rank each alternative. Each alternative can have a maximum score of 57.5 and a minimum score of 11.5. These proposed alternative comparison through a multi criteria assessment

are shown in Appendix II. A summary of the rankings can be found below in Table 1 below.

Table 1. Multi Criteria Assessment Summary

Alternative	Ranking
Localized Additional Steel Plates on Climbing Members	50
Localized Acrylic Plates on Climbing Members	44
Net, Mesh, Fence Barrier	26
Acrylic Barrier	25

Based on the results of the ranking/evaluation completed by DDA the recommended alternative is the localized steel plates on the truss members used for climbing.

6. Recommended Alternative

The recommended alternative of localized additional 6.4mm (¼") thick steel plates over existing lacing bars would be implemented by removing existing rivets and replacing them with M22(7/8) bolts. A conceptual sketch of the recommended alternative is shown in Appendix III.

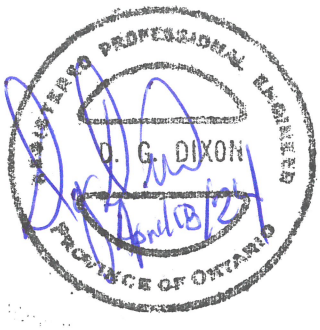
Select existing rivets would be removed staggering both sides. The spacings would be established during detailed design as required to secure the plate while ensuring the bolts could not be utilized to climb the members.

The plates would be affixed over the existing lacing to minimize modifications to the existing structure. There would be controlled gaps between the plates and rivets using a nut as a "spacer". The plates would be approximately 1500mm long starting at the existing railing height with both sides of the lacing bars covered to effectively deter climbing.

Due to the sizing of the steel, minimal additional weight is being added to the bridge. The steel and bolts will be coated with the same finish as the existing bridge to ensure compatibility with the design. Due to a material choice of steel, the sourcing can be completed without foreseeable difficulties.

The construction and assembly of the 24 plates on twelve (12) members (8 vertical members, 4 diagonals) would take approximately 5 days.

Report Prepared By:



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Appendix I

Mossington Bridge - Town of Georgina
Physical Barrier Study

No.	Proposed Strategy	Description	Pros	Cons
1	**Acrylic Barrier**	Add an acrylic pannel to the trusses of the bridge on both sides of the climbing members to an appropriate height that limits climbing.	-Does not hide structure -Can be reversed for heritage -Prevents climbing effectively	-Noticeable addition / change to the bridge -Medium cost to reverse -Style and materials do not "historically" match the bridge -Higher cost solution - both engineering design and construction -Adds significant loading to structure beyond design capacity. Structure would probably require additional reinforcement to resist wind load -Breakable / scratchable / prone to vandalism (Graffiti) - becomes a "blank canvas" -Requires removal for structure maintenance - cost -Higher construction impact to users (more time required to install) - detour for longer time -Yellow/discolour over time (typically for lower cost panels) due to UV exposure. -Can be damaged by vehicles -Collects debris
2	**Net / Mesh / Fence Barrier**	Add a barrier system to the exterior of the bridge on both sides of the climbing members to an appropriate height that limits climbing.	-Cost is low -Effectively prevents access to climbing members -Can be reversed for heritage -flexibility in design and material options	-Hides and changes portions of the structure, significantly modifying visuals -Option may increase climbing through new means (fence) -Not very compatible with structure style - significant heritage impact -Additional wind loading design consideration due to ice accreation. Due to this the bridge would probably require additional reinforcement to resist additional lateral loading. -Requires removal for structure maintenance -Higher construction impact to users (more time required to install) - detour for longer duration -Can be cut using bolt cutters -Can be damaged by vehicles -Collects debris from wind
3	**Localized Additional Steel Plates**	Add bolted steel plates (3/16") on "climbing" members to prevent access.	-Minimal loading added -Sympathetic with existing style and materials of the bridge (heritage preference) -Change can be reversed - Plus for heritage impact -No obscurance of scenery -Moderate cost - lowest cost for both engineering and capital cost -Effective in preventing climbing -No negative environmental impact -Colour would match existing -Durable solution -Short construction duration (approximately 5 working days) -Not easily damaged or altered	-Minor alteration to bridge (some minor heritage impact but similar to a repair) -Minor increase in area regarding corrosion protection -Removes some existing rivets with bolts but similar to reinforcing of the members -Needs to be removed for maintenance (coating)
4	**Localized Acrylic Sheets on climbing members**	Add bolted Acrylic Sheets on "climbing" members to prevent access.	-Least heritage impact -Change can be reversed - heritage impact minimal -Minimum loading added (light weight) -no obscurance of scenery -Moderate cost - more expensive then #3 -Effective in preventing climbing - equal to #3 -No negative environmental impact -Short construction duration (approximately 5 working days)	-Slight alteration to bridge design - some minor loss of heritage value but less than #3 due to transparency, however the material is not sympathetic with original. -Replaces some existing rivets with bolts -Prone to graffiti -May "yellow" with light exposure -Needs to be removed for maintenance (coating) -May requires a bushing between bolt and acrylic plate to avoid damage when torquing.

Appendix II

Option 1: Acrylic Barrier

Category	Multiplier	SubCategory	Description	Subcategory Percentage	Rating Scale 1	2	3	4	5	Rating
Environmental	**2**	Construction Impact to Nature	The level of disturbance to existing biota (flora and fauna) and water during construction and shortly after.	40%	Impact to water, flora, and fauna.	Impact to two of the three (water, flora, fauna).	Impact to either water, or flora, or fauna.	Minimal impact to water, flora, fauna.	no impact to water, flora, fauna.	5
		Long-term Impact to Nature	Degree of permanent alteration to existing biota (flora and fauna) and water after restoration time post construction.	60%	Signficiantly impacts both flora and fauna.	-	Some impact to either flora or fauna but not both.	-	Minimal to no impact.	3
									Sub Total:	7.6
Technical	**4**	Constructability	Degree of difficutly & special considerations during the cosntruction and maintenance phases.	10%	Very difficult to construct. Resources are limited. Longest construction duration.	Hard to construct. Resources are limited. Longer construction duration than average.	Moderately difficult to construct. Resources can be achieved. Construction duration is acceptable.	Easy to construct. Resources are attainable. Construction duration is better than average.	Very easy to construct. Resources are minimal. Minimal construction duration.	2
		Loading Impact to Structure	Degree the proposed solution impacts the load carrying capacity of the bridge.	30%	Significant loading added to the bridge where additional bracing will be required.	Loading added to the bridge where additional bracing may be required.	Loading added to bridge, no additional bracing required.	Minimal loading added to the bridge.	No loading added to the existing bridge.	1
		Durability	Durability of proposed solution and affects on bridge durability	15%	Proposed solution will require frequent upkeep and impacts existing bridges durability.	Proposed solution has durability concerns and may impact the existing bridges durability.	Proposed solution is moderately durable and minimally impacts bridge durability.	Proposed solution is durable and does not impact bridge.	Proposed solution increases durability and strengthens bridge.	2
		Reverse ability	Ability to undo changes and restore the bridge to its original state	15%	Solution is irreversible and would permanently alter the bridge.	Solution has limited reversibility, elements could be undone but overall leaving a significant impact on the bridge.	Solution is moderately reversible, allowing for changes to be made with reasonable effort but leaving some permanent alterations to the bridge.	Solution is largely reversible, with minimal permanent changes to the bridge.	Solution is highly reversible, allowing for modifications to be easily undone without leaving any lasting impact on the bridge.	3
		Effectiveness	Ability to deter/stop people from climbing superstructure	30%	Ineffective at stopping / Inadvertantly may cause more pedestrians to climb truss members.	Somewhat effective at deterring pedestrians from climbing truss members.	Moderately effective at deterring pedestrians from climbing truss members.	Very effective at deterring pedestrians from climbing truss members.	Completely deters anyone from clmbing truss members.	3
									Sub Total:	8.6
Social	**2.5**	Construction Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from construction.	Above average negative impact to stakeholders resulting from construction.	Average negative impact to stakeholders resulting from construction.	Below average negative impact to stakeholders resulting from construction.	No impact to stakeholders resulting from construction.	1
		Solution Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from solution.	Minor negative impact to stakeholders resulting from solution.	No impact to stakeholders resulting from solution.	Minor positive impact to stakeholders resulting from solution.	Major positive impact to stakeholders resulting from solution.	3
		Heritage Impact	Degree of changes to superstructure and surrounding structural features	30%	Major structural & historical reconfiguration.	Major structural reconfiguration. Minor heritage impact.	Structural reconfiguration. Minor heritage impact.	Minor structural reconfiguration. Minor heritage impact.	No structural or heritage reconfiguration.	2
		Compatibility	Compatibility with existing materials and architectural styles	30%	Solution is incompatible with the heritage bridge's historical and architectural character.	Solution has limited compatibility with the heritage bridge, incorporating elements that deter from the original design.	Solution is moderately compatible, material or design matches, however not both.	Solution is largely compatible, material / colour matches heritage bridge while respecting its historical and architectural significance.	Solution is highly compatible, complementing its original materials and design.	1
									Sub Total:	4.25
Cost	**3**	Capital Cost	Labour, materials, construction...	50%	Most expensive	-	-	-	Cheapest	2
		Maintenance Cost	Frequency of maintenance balanced with the cost for said mentenance averaged to a per year cost.	50%	High maintenance costs of options presented	Above average maintenance costs of options presented	Average maintenance costs of options presented	Below average maintenance costs of options presented	Lowest maintenance costs of options presented.	1
									Sub Total:	4.5

Total Score:	24.95

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Option 2: Net / Mesh / Fence Barrier

Category	Multiplier	SubCategory	Description	Subcategory Percentage	Rating Scale 1	2	3	4	5	Rating
Environmental	**2**	Construction Impact to Nature	The level of disturbance to existing biota (flora and fauna) and water during construction and shortly after.	40%	Impact to water, flora, and fauna.	Impact to two of the three (water, flora, fauna).	Impact to either water, or flora, or fauna.	Minimal impact to water, flora, fauna.	no impact to water, flora, fauna.	5
		Long-term Impact to Nature	Degree of permanent alteration to existing biota (flora and fauna) and water after restoration time post construction.	60%	Signficiantly impacts both flora and fauna.	-	Some impact to either flora or fauna but not both.	-	Minimal to no impact.	3
									Sub Total:	7.6
Technical	**4**	Constructability	Degree of difficutly & special considerations during the cosntruction and maintenance phases.	10%	Very difficult to construct. Resources are limited. Longest construction duration.	Hard to construct. Resources are limited. Longer construction duration than average.	Moderately difficult to construct. Resources can be achieved. Construction duration is acceptable.	Easy to construct. Resources are attainable. Construction duration is better than average.	Very easy to construct. Resources are minimal. Minimal construction duration.	3
		Loading Impact to Structure	Degree the proposed solution impacts the load carrying capacity of the bridge.	30%	Significant loading added to the bridge where additional bracing will be required.	Loading added to the bridge where additional bracing may be required.	Loading added to bridge, no additional bracing required.	Minimal loading added to the bridge.	No loading added to the existing bridge.	1
		Durability	Durability of proposed solution and affects on bridge durability	15%	Proposed solution will require frequent upkeep and impacts existing bridges durability.	Proposed solution has durability concerns and may impact the existing bridges durability.	Proposed solution is moderately durable and minimally impacts bridge durability.	Proposed solution is durable and does not impact bridge.	Proposed solution increases durability and strengthens bridge.	2
		Reverse ability	Ability to undo changes and restore the bridge to its original state	15%	Solution is irreversible and would permanently alter the bridge.	Solution has limited reversibility, elements could be undone but overall leaving a significant impact on the bridge.	Solution is moderately reversible, allowing for changes to be made with reasonable effort but leaving some permanent alterations to the bridge.	Solution is largely reversible, with minimal permanent changes to the bridge.	Solution is highly reversible, allowing for modifications to be easily undone without leaving any lasting impact on the bridge.	5
		Effectiveness	Ability to deter/stop people from climbing superstructure	30%	Ineffective at stopping / Inadvertantly may cause more pedestrians to climb truss members.	Somewhat effective at deterring pedestrians from climbing truss members.	Moderately effective at deterring pedestrians from climbing truss members.	Very effective at deterring pedestrians from climbing truss members.	Completely deters anyone from clmbing truss members.	1
									Sub Total:	7.8
Social	**2.5**	Construction Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from construction.	Above average negative impact to stakeholders resulting from construction.	Average negative impact to stakeholders resulting from construction.	Below average negative impact to stakeholders resulting from construction.	No impact to stakeholders resulting from construction.	1
		Solution Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from solution.	Minor negative impact to stakeholders resulting from solution.	No impact to stakeholders resulting from solution.	Minor positive impact to stakeholders resulting from solution.	Major positive impact to stakeholders resulting from solution.	1
		Heritage Impact	Degree of changes to superstructure and surrounding structural features	30%	Major structural & historical reconfiguration.	Major structural reconfiguration. Minor heritage impact.	Structural reconfiguration. Minor heritage impact.	Minor structural reconfiguration. Minor heritage impact.	No structural or heritage reconfiguration.	2
		Compatibility	Compatibility with existing materials and architectural styles	30%	Solution is incompatible with the heritage bridge's historical and architectural character.	Solution has limited compatibility with the heritage bridge, incorporating elements that deter from the original design.	Solution is moderately compatible, material or design matches, however not both.	Solution is largely compatible, material / colour matches heritage bridge while respecting its historical and architectural significance.	Solution is highly compatible, complementing its original materials and design.	1
									Sub Total:	3.25
Cost	**3**	Capital Cost	Labour, materials, construction...	50%	Most expensive	-	-	-	Cheapest	3
		Maintenance Cost	Frequency of maintenance balanced with the cost for said mentenance averaged to a per year cost.	50%	High maintenance costs of options presented	Above average maintenance costs of options presented	Average maintenance costs of options presented	Below average maintenance costs of options presented	Lowest maintenance costs of options presented.	2
									Sub Total:	7.5

Total Score:	26.15

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Option 3: Localized Additional Steel Plates

Category	Multiplier	SubCategory	Description	Subcategory Percentage	Rating Scale 1	2	3	4	5	Rating
Environmental	**2**	Construction Impact to Nature	The level of disturbance to existing biota (flora and fauna) and water during construction and shortly after.	40%	Impact to water, flora, and fauna.	Impact to two of the three (water, flora, fauna).	Impact to either water, or flora, or fauna.	Minimal impact to water, flora, fauna.	no impact to water, flora, fauna.	5
		Long-term Impact to Nature	Degree of permanent alteration to existing biota (flora and fauna) and water after restoration time post construction.	60%	Signficiantly impacts both flora and fauna.	-	Some impact to either flora or fauna but not both.	-	Minimal to no impact.	3
									Sub Total:	7.6
Technical	**4**	Constructability	Degree of difficutly & special considerations during the cosntruction and maintenance phases.	10%	Very difficult to construct. Resources are limited. Longest construction duration.	Hard to construct. Resources are limited. Longer construction duration than average.	Moderately difficult to construct. Resources can be achieved. Construction duration is acceptable.	Easy to construct. Resources are attainable. Construction duration is better than average.	Very easy to construct. Resources are minimal. Minimal construction duration.	4
		Loading Impact to Structure	Degree the proposed solution impacts the load carrying capacity of the bridge.	30%	Significant loading added to the bridge where additional bracing will be required.	Loading added to the bridge where additional bracing may be required.	Loading added to bridge, no additional bracing required.	Minimal loading added to the bridge.	No loading added to the existing bridge.	4
		Durability	Durability of proposed solution and affects on bridge durability	15%	Proposed solution will require frequent upkeep and impacts existing bridges durability.	Proposed solution has durability concerns and may impact the existing bridges durability.	Proposed solution is moderately durable and minimally impacts bridge durability.	Proposed solution is durable and does not impact bridge.	Proposed solution increases durability and strengthens bridge.	4
		Reverse ability	Ability to undo changes and restore the bridge to its original state	15%	Solution is irreversible and would permanently alter the bridge.	Solution has limited reversibility, elements could be undone but overall leaving a significant impact on the bridge.	Solution is moderately reversible, allowing for changes to be made with reasonable effort but leaving some permanent alterations to the bridge.	Solution is largely reversible, with minimal permanent changes to the bridge.	Solution is highly reversible, allowing for modifications to be easily undone without leaving any lasting impact on the bridge.	5
		Effectiveness	Ability to deter/stop people from climbing superstructure	30%	Ineffective at stopping / Inadvertantly may cause more pedestrians to climb truss members.	Somewhat effective at deterring pedestrians from climbing truss members.	Moderately effective at deterring pedestrians from climbing truss members.	Very effective at deterring pedestrians from climbing truss members.	Completely deters anyone from clmbing truss members.	5
									Sub Total:	17.8
Social	**2.5**	Construction Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from construction.	Above average negative impact to stakeholders resulting from construction.	Average negative impact to stakeholders resulting from construction.	Below average negative impact to stakeholders resulting from construction.	No impact to stakeholders resulting from construction.	2
		Solution Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from solution.	Minor negative impact to stakeholders resulting from solution.	No impact to stakeholders resulting from solution.	Minor positive impact to stakeholders resulting from solution.	Major positive impact to stakeholders resulting from solution.	4
		Heritage Impact	Degree of changes to superstructure and surrounding structural features	30%	Major structural & historical reconfiguration.	Major structural reconfiguration. Minor heritage impact.	Structural reconfiguration. Minor heritage impact.	Minor structural reconfiguration. Minor heritage impact.	No structural or heritage reconfiguration.	4
		Compatibility	Compatibility with existing materials and architectural styles	30%	Solution is incompatible with the heritage bridge's historical and architectural character.	Solution has limited compatibility with the heritage bridge, incorporating elements that deter from the original design.	Solution is moderately compatible, material or design matches, however not both.	Solution is largely compatible, material / colour matches heritage bridge while respecting its historical and architectural significance.	Solution is highly compatible, complementing its original materials and design.	5
									Sub Total:	9.75
Cost	**3**	Capital Cost	Labour, materials, construction...	50%	Most expensive	-	-	-	Cheapest	5
		Maintenance Cost	Frequency of maintenance balanced with the cost for said mentenance averaged to a per year cost.	50%	High maintenance costs of options presented	Above average maintenance costs of options presented	Average maintenance costs of options presented	Below average maintenance costs of options presented	Lowest maintenance costs of options presented.	5
									Sub Total:	15

Total Score:	50.15

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Option 4: Localized Acrylic Sheets on Climbing Members

Category	Multiplier	SubCategory	Description	Subcategory Percentage	Rating Scale 1	2	3	4	5	Rating
Environmental	**2**	Construction Impact to Nature	The level of disturbance to existing biota (flora and fauna) and water during construction and shortly after.	40%	Impact to water, flora, and fauna.	Impact to two of the three (water, flora, fauna).	Impact to either water, or flora, or fauna.	Minimal impact to water, flora, fauna.	no impact to water, flora, fauna.	5
		Long-term Impact to Nature	Degree of permanent alteration to existing biota (flora and fauna) and water after restoration time post construction.	60%	Signficiantly impacts both flora and fauna.	-	Some impact to either flora or fauna but not both.	-	Minimal to no impact.	3
									Sub Total:	7.6
Technical	**4**	Constructability	Degree of difficutly & special considerations during the cosntruction and maintenance phases.	10%	Very difficult to construct. Resources are limited. Longest construction duration.	Hard to construct. Resources are limited. Longer construction duration than average.	Moderately difficult to construct. Resources can be achieved. Construction duration is acceptable.	Easy to construct. Resources are attainable. Construction duration is better than average.	Very easy to construct. Resources are minimal. Minimal construction duration.	3
		Loading Impact to Structure	Degree the proposed solution impacts the load carrying capacity of the bridge.	30%	Significant loading added to the bridge where additional bracing will be required.	Loading added to the bridge where additional bracing may be required.	Loading added to bridge, no additional bracing required.	Minimal loading added to the bridge.	No loading added to the existing bridge.	5
		Durability	Durability of proposed solution and affects on bridge durability	15%	Proposed solution will require frequent upkeep and impacts existing bridges durability.	Proposed solution has durability concerns and may impact the existing bridges durability.	Proposed solution is moderately durable and minimally impacts bridge durability.	Proposed solution is durable and does not impact bridge.	Proposed solution increases durability and strengthens bridge.	3
		Reverse ability	Ability to undo changes and restore the bridge to its original state	15%	Solution is irreversible and would permanently alter the bridge.	Solution has limited reversibility, elements could be undone but overall leaving a significant impact on the bridge.	Solution is moderately reversible, allowing for changes to be made with reasonable effort but leaving some permanent alterations to the bridge.	Solution is largely reversible, with minimal permanent changes to the bridge.	Solution is highly reversible, allowing for modifications to be easily undone without leaving any lasting impact on the bridge.	5
		Effectiveness	Ability to deter/stop people from climbing superstructure	30%	Ineffective at stopping / Inadvertantly may cause more pedestrians to climb truss members.	Somewhat effective at deterring pedestrians from climbing truss members.	Moderately effective at deterring pedestrians from climbing truss members.	Very effective at deterring pedestrians from climbing truss members.	Completely deters anyone from clmbing truss members.	5
									Sub Total:	18
Social	**2.5**	Construction Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from construction.	Above average negative impact to stakeholders resulting from construction.	Average negative impact to stakeholders resulting from construction.	Below average negative impact to stakeholders resulting from construction.	No impact to stakeholders resulting from construction.	2
		Solution Impact to Community	Impact to vehicles, cyclists, pedestrians, local residents.	20%	Major negative impact to stakeholders resulting from solution.	Minor negative impact to stakeholders resulting from solution.	No impact to stakeholders resulting from solution.	Minor positive impact to stakeholders resulting from solution.	Major positive impact to stakeholders resulting from solution.	4
		Heritage Impact	Degree of changes to superstructure and surrounding structural features	30%	Major structural & historical reconfiguration.	Major structural reconfiguration. Minor heritage impact.	Structural reconfiguration. Minor heritage impact.	Minor structural reconfiguration. Minor heritage impact.	No structural or heritage reconfiguration.	3
		Compatibility	Compatibility with existing materials and architectural styles	30%	Solution is incompatible with the heritage bridge's historical and architectural character.	Solution has limited compatibility with the heritage bridge, incorporating elements that deter from the original design.	Solution is moderately compatible, material or design matches, however not both.	Solution is largely compatible, material / colour matches heritage bridge while respecting its historical and architectural significance.	Solution is highly compatible, complementing its original materials and design.	2
									Sub Total:	6.75
Cost	**3**	Capital Cost	Labour, materials, construction...	50%	Most expensive	-	-	-	Cheapest	4
		Maintenance Cost	Frequency of maintenance balanced with the cost for said mentenance averaged to a per year cost.	50%	High maintenance costs of options presented	Above average maintenance costs of options presented	Average maintenance costs of options presented	Below average maintenance costs of options presented	Lowest maintenance costs of options presented.	4
									Sub Total:	12

Total Score:	44.35

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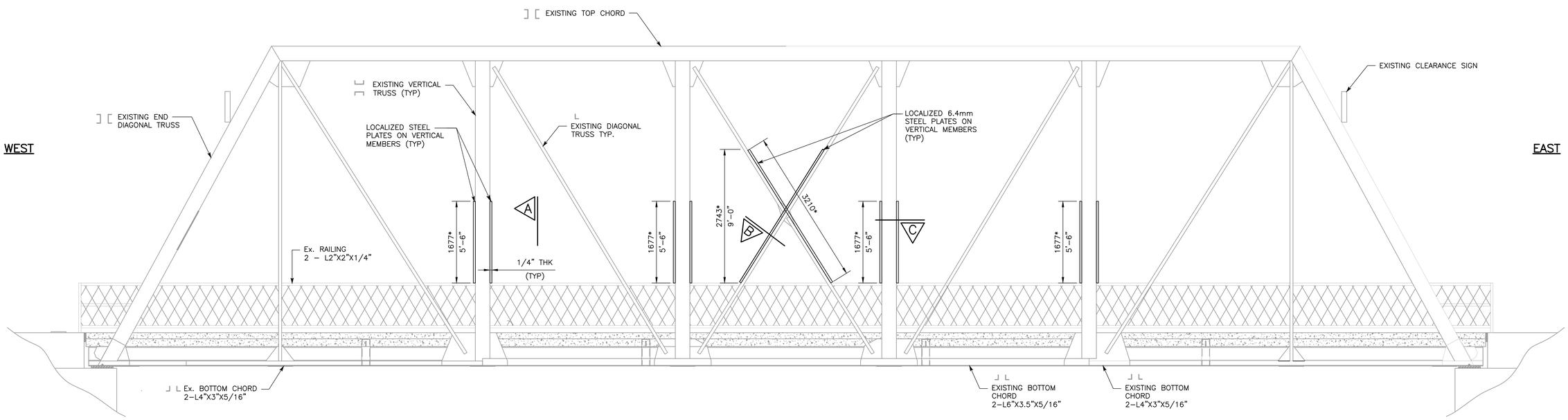
Appendix III

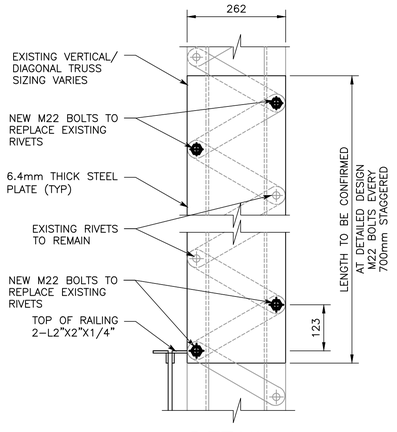


SOUTH ELEVATION – MEMBERS FOR MODIFICATION (TYP BOTH SIDES)

1:40

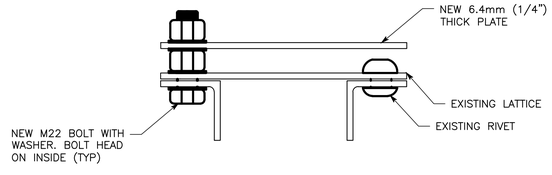
*LENGTH OF PLATE TO BE CONFIRMED DURING DETAILED DESIGN

WEIGHT ADDED PER BRACE	
VERTICAL BRACE	44kg
DIAGONAL BRACE	43kg



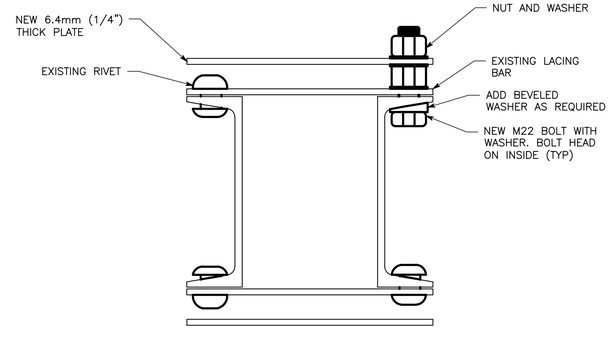
DETAIL A
PLATING PLAN VIEW

1:10



SECTION–B
DIAGONAL MEMBER

1:3



SECTION–C
VERTICAL MEMBER

1:3

METRIC
ALL DIMENSIONS SHOWN HERE ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

APPROVALS:

RELATED APPROVALS:

DOUG DIXON & ASSOCIATES INC

NO.	REVISIONS	BY	DATE
	ISSUED FOR REVIEW	DD	2024/04/10

DESIGNED	LK
DRAWN	NT
CHECKED	DD
APPROVED	DD
DATE	2024/04/10
SCALE	AS SHOWN

MOSSINGTON BRIDGE MODIFICATIONS

LOCALIZED PLATE DETAILS TO DETER CLIMBING

PROJECT NO. 24-216
SHEET NO. 1 OF 1 SHEETS
CONTRACT NO. T20-XXX

CAD FILE: X:\Projects\24-216 Mossington Bridge Retrofits\DDA CAD files\24-216-001.dwg
MODIFIED: 2024-04-10 8:46:28 AM ntrivedi
PLOTTED: 2024-04-10 8:47:17 AM Narmi Trivedi