Prepared for:
The Corporation of the Township of North Glengarry

CONDITION SURVEY AND OPTIONS REPORT
FRASIER ROAD BRIDGE
WSP NO.: 161-09722-00

NOVEMBER, 2016

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TABLE OF CONTENTS

APPENDICES

1. Introduction

WSP has been retained by the Corporation of the Township of North Glengarry to provide an investigation and prepare a Condition Survey and Options Report for the replacement / rehabilitation of Frasier Road Bridge. This Condition Survey and Options Report addresses the current condition of the structure along with different rehabilitation/replacement options and our recommendation.

2. Condition Survey of Existing Bridge

Frasier Road Bridge is located on Frasier Road approximately 0.5km south of Highway 34 in the North Glengarry Township. A key plan of the site location is provided in Appendix A.

The existing structure is a 13.6m span bridge with a concrete deck supported on steel I-Girders. The total width of the structure is 4.25m and the length of the deck is 14.10m (see Appendix B for photographs).

The structure is in very poor condition and specifically the following was observed:

1. The construction date is unknown, however, the structure is likely close to 70 years old and has approached its usable life span.
2. The structure and road are posted with load limit signs (5 tonnes) and warning signs, however they are physically open to the public and most likely utilized by farmers for access possibly with relatively heavy vehicles.
3. The 5 tonnes load limit currently installed appears to be adequate for the current conditions.
4. The 175mm thick concrete deck is a one way reinforced concrete slab with one layer of reinforcing at the bottom.
5. A portion of the concrete deck was lost due to disintegration at the northwest corner, possibly due to the movement at that location when the support under the girder was lost (see observation #9). A 20mm thick steel roadway plate, full width of roadway, over the deteriorated area has been installed. The installation of the steel plate is an adequate interim solution.
6. The concrete curb has been lost to disintegration at all 4 corners of the structure.
7. The deck is supported by five closely spaced stringers and two main beams along the edge; therefore the concrete deck is not subject to excessive stresses. As the deck has only bottom reinforcing, the top of the deck is still in relatively fair condition with the exception of the northwest corner. There are obvious signs of deterioration and aging on the top and underside of the 70 years old deck.
8. The steelwork, albeit old and exposed to some significant stress when the support at the northwest corner was lost (see observation # 9), appears to be still in reasonably good shape.
9. Concrete in the bearing seat under the north end of the west beam has disintegrated and at one point in time that end of the beam was unsupported which means the corner of the bridge was, to some degree, hanging unsupported until a repair strategy was implemented.
10. Concrete in the bearing seat under the north end of the east beam is in good condition.
11. Concrete under the south end of both beams has started to disintegrate however there is still 50% of support remaining.
12. A steel channel was bolted to each of the abutments and this channel supports the main girders. While the work was executed well, the channel size is relatively small and while sufficient to support the dead weight of the deck and steel, it is inadequate to support larger vehicles.
13. There is a concrete upstand on each abutment that supports the ends of the steel stringers. The upstands are in relatively good condition and are integral with the ballast walls and prop up the ballast walls to some degree.
14. The structure was built with concrete ballast walls. Remnants of these are still visible, however the concrete is completely broken up and disintegrated. The ballast walls are being held together by remnants of its original integrity, some reinforcing, friction of the fill and support offered by the concrete upstands.

15. The wing walls of the structure are an extension of the abutments and are in extremely poor condition and disintegrating.
16. The bridge has a larger than expected permanent sag of 60mm or so.
17. The structure in a location like this and with the limited use could be equipped with curb only and would then comply with commonly accepted MTO design guidelines for Low Volume Road and could do without a railing. Therefore, the steel railing present on the structure is a bonus to users as it provides an additional safety measure.

3. Summary of EA

In 2008, the Township retained McIntosh Perry Consulting Engineering Inc. to conduct a Schedule "B" Class Environmental Assessment for the Frasier Road Bridge Structure. As part of our work we have briefly reviewed the EA Report and summarized it as follows with only pertinent comments related to the structural aspects of the project:

1. The EA report was completed and the completion was advertised.
2. The rehabilitation of the structure was discounted on the basis of deterioration of the bridge that was defined as beyond repairs with an added argument that rehabilitation of the bridge would be a temporary solution and cost ineffective.
3. Bridge replacement was the chosen option.
4. A resolution was passed by the Township in 2008 to replace the bridge.
5. The bridge appraisal form dated 2007 on page 2 of Appendix B of the EA report contains a note that Totem Sims Hubicki has been commissioned by the township to design a replacement structure.
6. The bridge appraisal form dated 2007 on page 6 of Appendix B of the EA report contains a note that Totem Sims Hubicki have estimated costs of replacement of the structure at $ 525,000.
7. The report contains the 2008 Council resolution endorsing the bridge replacement option.
8. A letter from a local user was provided indicating that the existing structure accommodates his equipment but does not allow wider equipment of other farmers that has to take alternative routes. He recommended a bridge with minimum passable width of 5.5m to accommodate all farming equipment that would utilize the replacement structure.
9. The EA report does not contain any details of the proposed replacement structure and what the estimate was based on.
10. The EA report does not contain any details related to hydrology of the existing and replacement structure and does not even mention the issue. It needs to be noted that there is a record in the EA report in the form of a letter from a local resident that the water reached the top of road of the south approach and spilled over the road in a form of relief flow.

4. Summary of Geotechnical Investigation

In 2006 the Township retained Totem Sims Hubicki Associates to carry out a detailed inspection of the structure. As part of the inspection a geotechnical investigation was undertaken by Levac Robichaud Leclerc Associates Ltd. and a report of the geotechnical investigation is available. It was briefly reviewed and is summarized as follows:

1. The investigation does not address the potential of rehabilitating the structure and retaining the existing abutments.
2. Two boreholes were taken, Borehole 1 behind the south abutment and Borehole 2 behind the north abutment.
3. The road on the approaches has a 150mm or so layer of crushed stone underlain by fill which is a mix of silt, sand, gravel, clay and organics in a relatively loose state extending to around 2.4m below the road surface.

4. The fill is underlain with a layer of soft wet clay that was defined as an un-compactable clay with some consolidation noted as the shear strength increased with depth. The layer of clay was 4m thick in Borehole 1 and 2m thick in Borehole 2.
5. The clay is underlain by a layer of glacial till deposits which was confirmed to be 1.7m thick in Borehole 1. The thickness of till deposit was unconfirmed in Borehole 2 as the drill got hung up on a large boulder at a depth of 4.9m.
6. Bedrock refusal for Borehole 1 was encountered at a depth of 7.9m.
7. Ground water elevation was encountered slightly above the level of water in the creek.
8. The report excluded the possible use of traditional shallow foundation due to the potential of "severe" settlement of the structure due to clay deposit and a conclusion was reached that the use of shallow foundation would require removal of all clay and replacement with engineered fill which in turn is considered as impractical and extremely costly. Shallow foundations were not further discussed as they were not recommended.
9. Deep foundations in the form of piling to bedrock or caissons are recommended in the report.
10. The feasibility of driving the piles or caissons through the till that has apparent boulders and cobbles is limited in the report to recommendation of reinforcing the tips of piles or caissons for driving.
11. The report appears to be sufficient in details with respect to the replacement option of the structure.
12. Based on our review and this is not addressed in the geotechnical report, further geotechnical input (but not field work) and review will be required should a replacement of the structure with "spread footings" or reuse of the abutments be undertaken.

5. Available Options

The following are available Options:

1. Option 1: Do nothing
2. Option 2: Carry out minimum repairs and maintain the structure for 10 years.
3. Option 3: Carry out extensive repairs and maintain the structure for 30 years.
4. Option 4: Replace the structure with modular bridge and maintain it for 50 years.
5. Option 5: Replace the structure with custom bridge and maintain it for 75 years.

The merits, shortcomings and costs for each option are discussed as follows:

Option 1: Do Nothing

The Do Nothing option is unsustainable in the long run. It appears that the structure as it is, is likely used by larger farm vehicles. The users are likely aware of the main problems with the northwest corner and move to the opposite side when they travel over the bridge as the road configuration allows this.

This option can be sustained only until the rehabilitation/replacement in 2017 when the Option chosen by the Township is implemented. Should the project not materialize in 2017, a reassessment of the structure condition should be undertaken yearly. Alternatively, the structure could be permanently blocked with temporary concrete barriers placed across the approaches. The existing signage advising of a dangerous bridge and recommending an alternative route is appropriate and the signs that have been removed and stored on site should be reinstated for clear visibility and liability reasons. Tabs "Cars and pick-up trucks only" should be added under the load posting signs.

Option 2: Carry out minimum repairs and maintain the structure for 10 years.

The structure can be repaired to some degree and maintained for period of 10 years. The 10 year period would be dictated by ongoing deterioration of wing walls and ballast walls and potential for local failures of the deck, all of which will in practical terms remain in their deteriorated condition.

The work would consist of temporarily propping the steel beams at the three corners, other than the northeast, with a timber mat in the river bottom with a strong shoring post and then reconstructing the bearing seats by square removals, dowels installation, and recasting the concrete. The broken northwest corner of the deck will also be reconstructed however the steel road plate should be reinstalled. Temporary shoring posts will be removed.

The deteriorated concrete curb will remain unrepaired. The previously installed steel channels supporting the structure will remain.

The condition of the top and side of the wingwalls and the top of the ballast walls are in very poor condition but likely could be left unrepaired for 10 years. However there would be a degree of uncertainty and safety related concerns as the grass and dirt on the top of the severely dilapidated wingwalls could result in an inattentive operator slipping the vehicle off the side of the wingwalls. This issue is further exacerbated by the use of the bridge by larger farm machinery that may have the wheels spread larger than that of common highway vehicles.

Therefore, we suggest that as part of the work, removals of the top of the wingwalls and the ballast walls be undertaken with associated removal of the fill. Strong reinforced concrete “approach slabs” would be installed on top of the superstructure. This will alleviate the safety concerns as straight edges can be provided for the safe passage of vehicles and maintenance needs will be also reduced.

In this option the railing will remain as it is so there would be no benefit of allowing wider (than what the bridge allowed previously) farm vehicles crossing the structure.

Following this philosophy, the structure would be taken to a pre-failure condition and will likely remain in reasonable condition for use for 10 years.

Load posting is expected be significantly increased from 5 tonnes to 10 tonnes.

The estimated cost of the work carried out as per above will be $80,000 plus $5,000 engineering costs. See ***Appendix C*** for a cost breakdown.

Maintenance Requirements:

Minimum work would be undertaken to maintain the structure over a period of 10 years.

The maintenance will be in the form of visits to the site by the Township personnel following spring runoff. The general maintenance work will include:

1. Removal of loose concrete in the deck and ballast walls and then parging the areas with good quality proprietary fast setting patching material such as Eucospeed or Sika.
2. Repair approach road with gravel.
3. Repairs to railing in the form of welding maybe required as the railing may get damaged with the use by larger farm vehicles.
4. Maintain the signage
5. Potential punching failure of the deck could occur in the future, repairs utilizing steel plates may be required.

The estimated cost of maintenance repairs over 10 years is around $17,000 and costs of maintenance is included in the life cycle cost analysis.

Option 3: Carry out extensive repairs and maintain the structure for 30 years.

The work would consist of removing the concrete deck and wingwalls and ballast wall, while the stem of the abutments and concrete pedestals supporting the stringers will remain. The bearing seats will be repaired as per Option 2 above and the top section of the abutments will be reconstructed. The steel superstructure will remain and a new timber deck with a timber curb will be installed. With this option the overall width of the structure can be slightly increased to allow the use of wider farm vehicles if necessary, or they will overhang over the curb. The life span will be limited by longevity of the deck and future corrosion of structural steel which will likely limit the life span of the structure to 30 years.

The structure will likely require load posting in the range of 20 tonnes.

The estimated cost of the work carried out as per above will be $220,000 plus $30,000 engineering costs. See ***Appendix C*** for a cost breakdown.

Maintenance Requirements:

The maintenance will be in form of visits to the site by the Township personnel following spring runoff. The general maintenance work will include:

1. Powerwash the bearing seats to eliminate accumulation of gravel and dirt that would retain moisture.
2. Sweep the deck and blow off sand and gravel.
3. Roll on wood preservative on the deck surface every 5 years.
4. Repair approach road with gravel.
5. Maintain the signage.

The estimated cost of the maintenance over 30 years is in range of $40,000 and is included at values of $15,000 and $25,000 at 10 and 20 years horizons in the life cycle cost analysis.

Option 4: Replace the structure with modular bridge and maintain it for 50 years.

It needs to be noted that at this location the extremely poor soil conditions and water levels are factors that are of paramount importance on selecting the appropriate method of structural replacement that would allow replacing the structure at a reasonable cost. It also needs to be noted that there is a need to minimize the length of the structure to keep the costs down.

As it is unlikely that the existing hydraulic opening can be reduced, the actual modular bridge will need to be much longer than the existing allowing the bridge to be built supported on a pad within the approach fill as opposed to attempting to use a shorter bridge and deal with the extreme issues of constructing in the water and controlling the water as well as mitigating adverse environmental constraints.

Lessard String Bridge during Construction

The most suitable candidate for this location will be an 72' Lessard String Bridge. The bridge has a very similar width to the existing and is manufactured with a steel plate curb. According to the MTO Low Volume Roads policy, only a curb is required on the bridge given the low AADT and the low speed. The narrow bridge would not impede passage of wider farm vehicles as the steel curb should not provide an obstruction. The bridge would not have a railing however due to liability an appropriate signage advising users of lack of railing will be required especially considering that the existing bridge has a railing. A railing would be required on the bridge if pedestrian use is prevalent.

Lessard String Bridge

A serious issue was raised previously in the Geotechnical Report advising not to use spread footings due to potential settlement due to layer of the clay. We are not in agreement with the notion of not using spread footings for the Lessard Bridge as these bridges are actually intended for locations where settlement may occur. The designer would need to simply calculate how much settlement will occur in the future and simply build the bridge higher.

The foreseeable plan for this Option is as follows:

1. Remove deck and steelwork
2. Demolish the abutments, leaving majority of concrete in place and grade the embankments back.
3. Excavate approaches at new abutments location to the ground water level and not deeper (matching level of water in creek during construction).
4. Place a layer of structural fill.
5. Place steel bin abutments and fill the bins with gravel.
6. Cast bearing pads for the new bridge (or install precast bearing pads).
7. Construct timber crib or steel bins "ballast wall" components.
8. Install Lessard String Bridge.
9. Grade the approaches.

It needs to be noted that the 72 foot Lessard bridge superstructure depth is close to 16 inches (406mm) deeper than the existing bridge. Therefore, in order to maintain the soffit of the new bridge at the same elevation as the existing, the top of the bridge has to be 16 inches (406mm) higher than the existing road over the bridge. This will require the need to raise and taper the road on approaches accordingly. The existing road profile seems to be suited to increase the approaches grades; however the entrance to the field at the northeast will require reconstruction.

The bridge will meet CHBDC loading requirements and will not require a load posting. CHBDC loading is equivalent to the following:

One unit vehicle (Level 3) = 20 tonnes
Two unit vehicle (Level 2) = 45 tonnes
Three unit vehicle (Level 1) = 62.5 tonnes

These types of bridges have a tendency to flex more under heavy vehicles than custom bridges.

These types of structures are advertised with a 40 to 50 years life span; however at this location the life span of this structure can likely approach that of a very traditional bridge.

The structure may settle due to clay level, however no significant settlement should be expected and these will be easily accommodated as the structure will be in elevated position, while any loss in height that may occur will be greatly outweighed by the increase in width of the hydraulic opening.

The estimated cost of the work carried out as per above will be $350,000 plus $35,000 engineering costs. See ***Appendix C*** for a cost breakdown.

Maintenance Requirements:

The maintenance will be in form of visits to the site by the Township personnel following spring runoff. The general maintenance work will include:

1. Powerwash the bearing seats to eliminate accumulation of gravel and dirt that would retain moisture.
2. Spray paint with zinc rich paint the bearing and steelwork over the bearings every 5 years.
3. Sweep the deck and blow off sand and gravel.
4. Roll on paint coating on top of the deck every 10 years.
5. Repair approach road with gravel.
6. Maintain the signage.
7. Roll on penetrating concrete sealer on concrete surfaces of the bearing pads.

The estimated cost of the maintenance over 50 years is in range of $70,000 and is included at values of $10,000 and $15,000 and $20,000 and $25,000 at 10 and 20 and 30 and 40 years horizons in the life cycle cost analysis.

Option 5: Replace the bridge with custom bridge and maintain it for 75 years

This option is described in detail in the Environmental Assessment and dealt with in the Geotechnical Report. A simple concrete bridge on piled foundations (or caissons) was suggested and we agree that this is a type of structure that would be suitable for this location.

The EA assessment suggest budget of $525,000 in 2007 while the 2015 OSIM suggested budget of $800,000. These two numbers are similar when the 2007 costs are indexed to 2016. We believe that a traditional bridge on caissons or piles in this location will carry price tag approaching the $800,000 or possibly more in total construction and engineering costs subject to timing of construction (water levels) and choice of railing, wearing surface.

While we are not privy to the opinion of the Township on the matter of available budget, we do not condone expenditure of capital costs of this magnitude for a structure in this location, especially that other options are available.

The estimated cost of the work carried out as per above will be $715,000 plus $45,000 engineering costs. See ***Appendix C*** for a cost breakdown.

Maintenance Requirements:

The maintenance will be in form of visits to the site by the Township personnel following spring runoff. The general maintenance work will include:

1. Clean the deck of gravel and dirt.
2. Repair approach road with gravel.
3. Maintain the signage.
4. Powerwash the structure in the spring.
5. Roll on penetrating concrete sealer on exposed concrete surfaces every 10 years.
6. Repair railing as required.

The estimated cost of the maintenance over the life span of the structure is $ 10,000 per 10 years and is applied at all 10 years horizons in life cycle cost analysis, except the timing when a major rehabilitation is undertaken.

6. Structural Analysis

In order to validate the recommendations contained in this report, a structural analysis of the structure was undertaken as per CHBDC 2014. Assumptions of the steelwork strength was taken as specified in the Code for the expected age of structure, A 36 steel, which is the most likely steel utilized at the time of construction.

Reductions in load factors and dynamic effect were applied, as prescribed by the Code, to the analysis where applicable. If the existing structure is retained by the Township, the reductions applied will require a re-assessment of its condition every year (which should be done by Township by virtue of its OSIM program).

The basic structural system of this one lane bridge consists of two reinforced concrete abutments supporting a steel floor system that in turn supports a reinforced concrete deck. The steel floor system consists of two main beams/girders installed along the edge of the deck that in turn support transverse intermediate floor beams at the 1/3rd span locations forming three bays. Five equally spaced steel stringers span between the floor beams and abutments in each bay. The concrete deck rests on the stringers and main edge girders/beams. The structural system is a so called “single load path system” which means that failure of one of the only two main girders/beam utilized would lead to a failure/collapse of the structure.

Steel channel supports have been installed under the main girders/beams and bolted to the abutment faces at each abutment. Steel angle struts have also been added to the main girders/beams at the upper mid-height point on the girders/beams connecting them to each other. At the north abutment the supports was installed due to the complete loss of concrete under the bearing of the west girder. We assume that the support was also installed at the south abutment to account for future deterioration as there is a relatively good support of concrete still remaining there. The steel angles have provided some increased stability of the girders, especially at the northwest corner where a portion of the concrete deck above was lost. The support, as installed, has limited structural value at the north end and hence the load limitation imposed on the structure of 5 tonnes is appropriate in the short term. Said this, the actual signage advising of dangerous bridge and recommending alternative route is prudent and the signs that have been removed and stored off the roadway should be reinstated for clear visibility and liability reasons. The structure could be permanently posted at 5 tonnes in its current arrangement.

In its current arrangement, we assume that some farm vehicles cross the bridge at low speed and likely move to the east side to avoid the northwest deteriorated concrete and area where the loss of bearing seat was noted. It is very likely that a heavy vehicle such as a loaded gravel truck or heavy farm vehicle would damage the bridge beyond any repairs and possibly collapse the structure if it were to drive over the structure.

Based on the results of the analysis we have concluded the following:

1. The existing structure can carry only small vehicles such as pickup trucks up to 5 tonnes.
2. The existing structure can be retained only for a very short period of time.
3. The 5 tonnes load posting sign should be reinstated with addition of the tab: Cars and pick-up trucks only” on the existing structure
4. The structure if repaired as per Option 2 “Carry minimum repairs and maintain the structure for 10 years” will require posting of 10 tonnes.

5. The structure if repaired as per Option 3 “Carry out extensive repairs and maintain the structure for 30 years” will require load posting of 20 tonnes.
6. Options 4 and 5 do not require future load posting

7. Life Cycle Cost Analysis

A life cycle cost analysis has been completed in accordance to the *Part 1 – Present Value Analysis – Project Level of Structural Financial Analysis Manual, Ministry of Transportation, March 1990*. The life cycle cost analysis includes the capital costs along with the maintenance costs for each option above. The breakdown can be found in ***Appendix D***. The option with the best net present value is Option 4: Replace the structure with modular bridge and maintain it for 50 years.

8. Conclusions and Recommendations

Based on our review of the options above we recommend that the existing structure be replaced with a modular bridge as soon as possible and be maintained for 50 years (Option 4). A general arrangement drawing of Option 4 is provided in ***Appendix E***. The work of the rehabilitation/replacement should be undertaken in 2017.

Until the bridge is rehabilitated/replaced the existing signage advising of a dangerous bridge and recommending an alternative route is appropriate and the signs that have been removed and stored on site should be reinstated for clear visibility and liability reasons. Tabs “Cars and pick-up trucks only” should be added under the load posting signs.

Hopefully the provided document is sufficient in details for the Township to make most appropriate decision with respect to planning for the structure future.

We hope that the above fulfills your current requirements. If you have any questions or require any additional information please feel free to contact the undersigned.

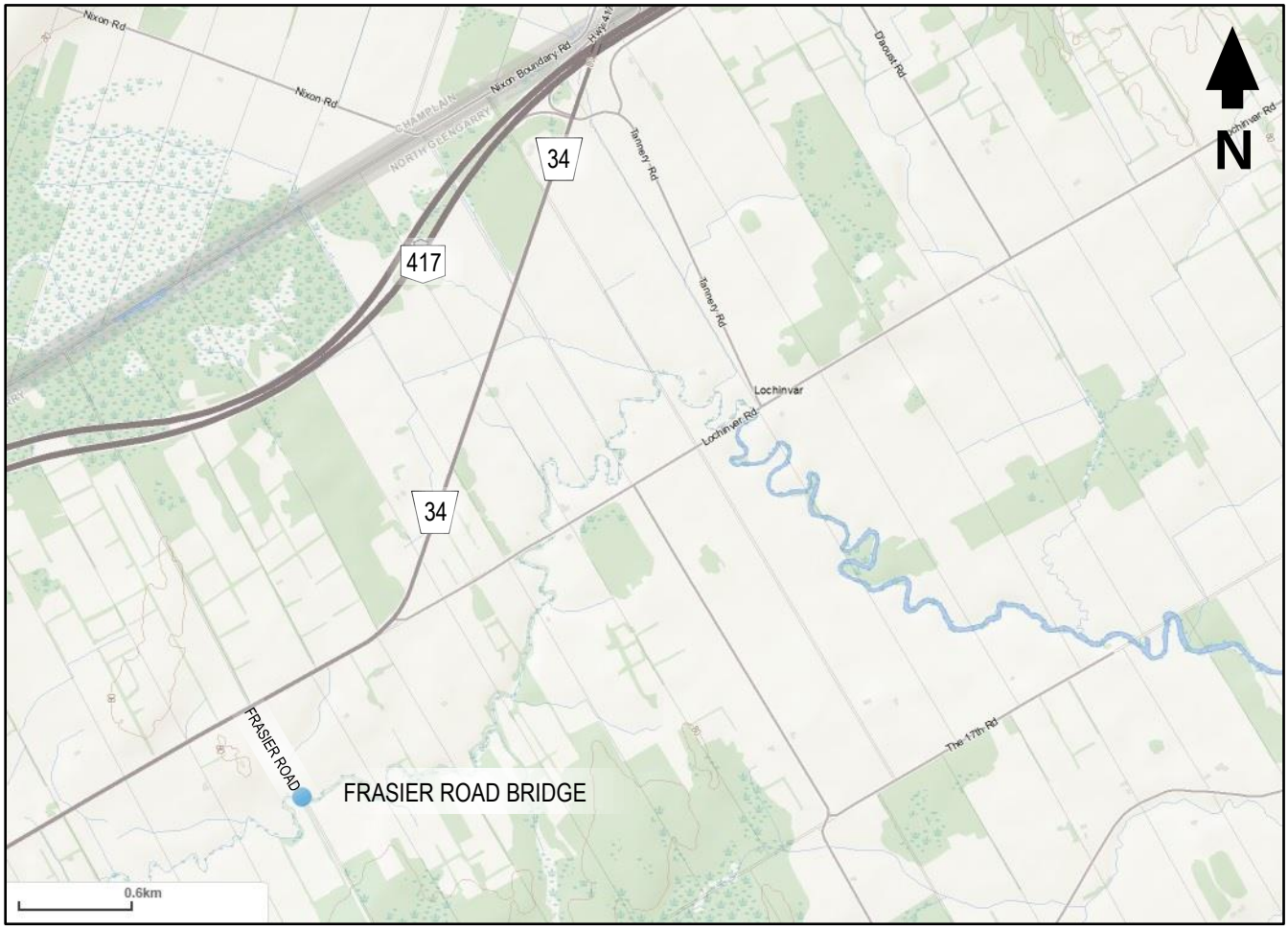
Respectfully submitted,

WSP

Felix Wasiewicz, P.Eng.
Manager of Engineering, Bridges

APPENDIX A
KEY PLAN

KEY PLAN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Nixon Rd
Nixon Boundary Rd
CHAMPLAIN
NORTH GLENGARRY
34
417
34
Tammery Rd
Tammery Rd
D'Aoust Rd
Lochinvar Rd
Lochinvar
N
FRASIER ROAD
FRASIER ROAD BRIDGE
The 17th Rd
0.6km

APPENDIX B
SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

Picture 1. West Elevation. Note noticeable sag of the bridge. The corner at the left now supported by channel bolted to abutment.

Picture 2. Overall view of top of the deck looking north.

Picture 3. Curb and deck broken off at northwest corner and steel plate was installed.

Picture 4. Heavy steel plate across the deck at the north end.

Picture 5. Completely disintegrating ballast walls in top of the road.

Picture 6. Steel channels were bolted to abutments to support the girders.

Picture 7. The northwest corner where bearing seat was lost and the end of girder is supported by channel. The other three corners have still residual bearing capacity.

Picture 8. Overall view of underside. Note sag in girder.

Picture 9. Disintegration of northwest wingwall.

Picture 10. Disintegration of southeast wingwall.

APPENDIX C
COST BREAKDOWN

Cost Estimate: Option 2 - Minimum Repairs

Item	Description	Unit	Qty.	Unit Cost	Price
1	Mobilize	LS	1	$ 6,000.00	$ 6,000.00
2	Access to Work Area, brush clearing	LS	1	$ 4,000.00	$ 4,000.00
3	Turbidity Curtains (upstream/downstream)	LS	1	$ 6,000.00	$ 6,000.00
4	Gravel Pads for Shoring	LS	1	$ 2,000.00	$ 2,000.00
5	Timber Pads for Shoring	LS	1	$ 3,000.00	$ 3,000.00
6	Shoring Posts	LS	1	$ 4,000.00	$ 4,000.00
7	Environmental Protection and Debis Contaiinment System	LS	1	$ 8,000.00	$ 8,000.00
8	Remove Concete in bearing seats, including sawcutting perimeter	LS	1	$ 5,000.00	$ 5,000.00
9	Dowel and reinforcing steel in bearing seats	LS	1	$ 2,500.00	$ 2,500.00
10	Cast concrete in bearing seats	LS	1	$ 6,000.00	$ 6,000.00
11	Remove steel road plate	LS	1	$ 500.00	$ 500.00
12	Add reinfrocing steel in deck	LS	1	$ 2,000.00	$ 2,000.00
13	Recast concrete in deck at the northwest corner	LS	1	$ 3,000.00	$ 3,000.00
14	Remove shoring and pads	LS	1	$ 3,000.00	$ 3,000.00
15	Reinstall steel plate on top of the deck	LS	1	$ 500.00	$ 500.00
16	Remove concrete in substructure and excavate fill for placement of "approach slab"	LS	1	$ 6,000.00	$ 6,000.00
17	Form and cast reinforced concrete "approach slabs"	LS	1	$ 6,000.00	$ 6,000.00
18	New narrow bridge and post loading signage	LS	1	$ 600.00	$ 600.00
19	Demobilize	LS	1	$ 4,000.00	$ 4,000.00
				Sub Total	$ 72,100.00
				15% Contingency	$ 10,815.00
				Total	**$ 82,915.00**

Cost Estimate: Option 3 - Extensive Repairs

Item	Description	Unit	Qty.	Unit Cost	Price
1	Mobilize	LS	1	$ 10,000.00	$ 10,000.00
2	Access to Work Area, brush clearing	LS	1	$ 6,000.00	$ 6,000.00
3	Turbidity Curtains (upstream/downstream)	LS	1	$ 6,000.00	$ 6,000.00
4	Gravel Pads for Shoring	LS	1	$ 2,000.00	$ 2,000.00
5	Timber Pads for Shoring	LS	1	$ 3,000.00	$ 3,000.00
6	Shoring Posts	LS	1	$ 4,000.00	$ 4,000.00
7	Environmental Protection and Debis Contaiinment System	LS	1	$ 10,000.00	$ 10,000.00
8	Remove Concete in bearing seats, including sawcutting perimeter	LS	1	$ 7,000.00	$ 7,000.00
9	Dowel and reinforcing steel in bearing seats	LS	1	$ 3,500.00	$ 3,500.00
10	Cast concrete in bearing seats	LS	1	$ 8,000.00	$ 8,000.00
11	Remove steel road plate and deliver to Township	LS	1	$ 1,500.00	$ 1,500.00
12	Sawcut and remove the concrete deck, curb and railing	LS	1	$ 20,000.00	$ 20,000.00
13	Clean and coat the top flanges of steelwork	LS	1	$ 5,000.00	$ 5,000.00
14	Install timber deck	LS	1	$ 30,000.00	$ 30,000.00
15	Install timber wearing boards	LS	1	$ 3,000.00	$ 3,000.00
16	Install timber curbs	LS	1	$ 5,000.00	$ 5,000.00
17	Remove concrete in wingwalls and ballast walls	LS	1	$ 15,000.00	$ 15,000.00
18	Reinforcing steel for wingwall and ballast wall reconstruction	LS	1	$ 5,000.00	$ 5,000.00
19	Form and cast concrete in "wingwalls and abutment"	LS	1	$ 30,000.00	$ 30,000.00
20	Place gravel surface on approaches and over abutments	LS	1	$ 5,000.00	$ 5,000.00
21	Remove shoring posts and pads	LS	1	$ 2,000.00	$ 2,000.00
22	New narrow bridge and post loading signage	LS	1	$ 600.00	$ 600.00
23	Demobilize	LS	1	$ 10,000.00	$ 10,000.00
				Sub Total	$ 191,600.00
				15% Contingency	$ 28,740.00
				Total	**$ 220,340.00**

Cost Estimate: Option 4 - Replace with Modular Bridge

Item	Description	Unit	Qty.	Unit Cost	Price
1	Mobilize	LS	1	$ 12,000.00	$ 12,000.00
2	Access to Work Area, brush clearing	LS	1	$ 8,000.00	$ 8,000.00
3	Turbidity Curtains (upstream/downstream)	LS	1	$ 6,000.00	$ 6,000.00
4	Environmental Protection and Debis Containment System	LS	1	$ 12,000.00	$ 12,000.00
5	Dewatering Excavation	LS	1	$ 10,000.00	$ 10,000.00
6	Remove steel road plate and deliver to Township	LS	1	$ 1,500.00	$ 1,500.00
7	Sawcut and remove the concrete deck, curb and railing	LS	1	$ 20,000.00	$ 20,000.00
8	Remove steelwork	LS	1	$ 10,000.00	$ 10,000.00
9	Remove concrete wingwalls, ballast walls and abutments.	LS	1	$ 8,000.00	$ 8,000.00
10	Repair top of old concrete that will be left in place	LS	1	$ 4,000.00	$ 4,000.00
11	Excavate for new steel bin abutments	LS	1	$ 2,000.00	$ 2,000.00
12	Supply and deliver steel bin abutments	LS	1	$ 20,000.00	$ 20,000.00
13	Install new steel bin substructure	LS	1	$ 10,000.00	$ 10,000.00
14	Install new steel bin ballast walls	LS	1	$ 5,000.00	$ 5,000.00
15	Install reinforced concrete transition slabs (bridge to abutments)	LS	1	$ 8,000.00	$ 8,000.00
16	Backfill the steel bins with gravel	LS	1	$ 4,000.00	$ 4,000.00
17	Place reinfroced concrete bearing pads for the new Lessard bridge	LS	1	$ 6,000.00	$ 6,000.00
18	Supply and deliver new Lessard modular bridge	LS	1	$ 90,000.00	$ 90,000.00
19	Install new Lessard String bridge	LS	1	$ 30,000.00	$ 30,000.00
20	Regrade and prepare the road on approaches including general grading	LS	1	$ 10,000.00	$ 10,000.00
21	Reconstruct field entrance at northeast	LS	1	$ 2,000.00	$ 2,000.00
22	Place gravel surface on approaches	LS	1	$ 10,000.00	$ 10,000.00
23	New narrow bridge signage	LS	1	$ 500.00	$ 500.00
24	Construct new embankments and rip rap at the creek shore	LS	1	$ 5,000.00	$ 5,000.00
25	Demobilize	LS	1	$ 10,000.00	$ 10,000.00
					$ -
				Sub-Total	$ 304,000.00
				15% Contingency	$ 45,600.00
				Total	**$ 349,600.00**

Cost Estimate: Option 5 - Replace with Concrete Bridge

Item	Description	Unit	Qty.	Unit Cost	Price
1	Mobilize	LS	1	$ 15,000.00	$ 15,000.00
2	Access to Work Area, brush clearing	LS	1	$ 10,000.00	$ 10,000.00
3	Turbidity Curtains (upstream/downstream)	LS	1	$ 6,000.00	$ 6,000.00
4	Environmental Protection and Debis Containment System	LS	1	$ 15,000.00	$ 15,000.00
5	Remove steel road plate and deliver to Township	LS	1	$ 1,500.00	$ 1,500.00
6	Sawcut and remove the concrete deck, curb and railing	LS	1	$ 20,000.00	$ 20,000.00
7	Remove steelwork	LS	1	$ 10,000.00	$ 10,000.00
8	Remove concrete wingwalls, ballast walls and abutments.	LS	1	$ 10,000.00	$ 10,000.00
9	Mobilize piling equipment	LS	1	$ 50,000.00	$ 50,000.00
10	Excavate for new substructure	LS	1	$ 5,000.00	$ 5,000.00
11	Dewatering of Structure Excavations	LS	1	$ 30,000.00	$ 30,000.00
12	Drive piles to bedrock	LS	1	$ 25,000.00	$ 25,000.00
13	Reinforcing steel	LS	1	$ 22,000.00	$ 22,000.00
14	Construct reinfroced concrete abutments	LS	1	$ 20,000.00	$ 20,000.00
15	Construct reinfroced concrete wingwalls	LS	1	$ 25,000.00	$ 25,000.00
16	Box beam prestressed girders (manufacture)	LS	1	$ 125,000.00	$ 125,000.00
17	Box beam prestressed girders (delivery)	LS	1	$ 15,000.00	$ 15,000.00
18	Box beam prestressed girders (installation)	LS	1	$ 30,000.00	$ 30,000.00
19	Bearings for the box beams	LS	1	$ 4,000.00	$ 4,000.00
20	Reinforced concrete topping	LS	1	$ 24,000.00	$ 24,000.00
21	Reinforced concrete curb	LS	1	$ 20,000.00	$ 20,000.00
22	Steel Railing	LS	1	$ 45,000.00	$ 45,000.00
23	Waterproofing	LS	1	$ 4,000.00	$ 4,000.00
24	Asphalt	LS	1	$ 15,000.00	$ 15,000.00
25	Grade the approaches	LS	1	$ 10,000.00	$ 10,000.00
26	Reconstruct field entrance at northeast	LS	1	$ 3,000.00	$ 3,000.00
27	Place gravel surface on approaches	LS	1	$ 5,000.00	$ 5,000.00
28	New narrow bridge signage	LS	1	$ 500.00	$ 500.00
29	Construct new embankments and rip rap at the creek shore	LS	1	$ 5,000.00	$ 5,000.00
30	Guiderails and End Treatments	LS	1	$ 12,000.00	$ 12,000.00
31	Demobilize	LS	1	$ 15,000.00	$ 15,000.00
					$ -
				Sub-Total	$ 597,000.00
				20% Contingency	$ 119,400.00
				Total	**$ 716,400.00**

APPENDIX D
LIFE CYCLE COST ANALYSIS

Life Cycle Cost Analysis

Present Value Analysis

Financial Analysis Conducted as per *Part 1 - Present Value Analysis - Poject Level of Structural Financial Analysis Manual,* Ministry of Transporation, March 1990.

Name of Structure:	**Fraiser Road Bridge**
Client	**Township of North Glengarry**
Number of Options Considered:	5
Discount Rate:	2%
Time Period:	100

TABLE OF NET PRESENT VALUE

DRAFT - September 16 ,2016		Present value	Residual Value	Net Present Value
OPTION	Option 1 - Do Nothing	$ -	$ -	$ -
	Option 2 - Repair	$ 974,021.23	$ (87,414.31)	$ 886,606.92
	Option 3 - Rehabilitation	$ 793,571.08	$ (34,370.16)	$ 759,200.92
	Option 4 - Deck Replacement	$ 725,949.62	$ (57,500.29)	$ 668,449.33
	Option 5 - New Bridge	$ 1,062,769.51	$ (83,541.62)	$ 979,227.89

REHABILITATION LIFECYCLES

Option 2 - Repair		
Repair Existing Bridge	$	87,915.00
Maintenance int 10 years	$	17,000.00
Replace at 10 years	$	761,400.00

Option 3 - Rehabilitation		
Rehabilitate Existing Bridge	$	250,340.00
Maintenance at 10 years	$	15,000.00
Maintenance at 20 years	$	25,000.00
Replace at 30 years	$	761,400.00

Option 4 - Deck Replacement		
Deck Replacement	$	384,600.00
Maintenance at 10 years	$	10,000.00
Maintenance at 20 years	$	15,000.00
Maintenance at 30 years	$	20,000.00
Maintenance at 40 years	$	25,000.00
Replace at 50 years	$	761,400.00

Option 5 - New Bridge		
Replace Existing Bridge	$	761,400.00
Maintenance at 10 years	$	10,000.00
Maintenance at 20 years	$	10,000.00
Maintenance at 30 years	$	10,000.00
Minor Rehabilitation at 35 years	$	46,741.50
Maintenance at 45 years	$	10,000.00
Maintenance at 55 years	$	10,000.00
Major Rehabilitation at 60 years	$	380,700.00
Maintenance at 70 years	$	10,000.00
Maintenance at 80 years	$	10,000.00
Replace at 90 year	$	761,400.00

Life Cycle Cost Analysis

Present Value Analysis (Page 1 of 2)

Financial Analysis Conducted as per *Part 1 - Present Value Analysis - Project Level of Structural Financial Analysis Manual*, Ministry of Transporation, March 1990.

Name of Structure: **Fraiser Road Bridge**
Client **Township of North Glengarry**

Life Cycle, n = **100** years
Discount rate, r = 2.0%

Sections	Description	Expected Service Life (N), years A	Expected Design Life (DL), years	Maintenance & Rehab cost, $/year B	Residual Years (See Note 1 below) C	Replacement Cost (c) D	Value at Year n E = D (1 + r)^(-C)	Differential Value F = E - D	Present Value of Residual Value G = F (1 + r)^(-n)
1	Do Nothing	0	0	-	0	$ -	$ -	$ -	$ -
2	Repair	10	100		90	$ 761,400	$ 128,114	$ (633,286)	$ (87,414)
3	Rehabilitation	30	100		20	$ 761,400	$ 512,400	$ (249,000)	$ (34,370)
4	Deck Replacement	50	100	-	40	$ 761,400	$ 344,831	$ (416,569)	$ (57,500)
5	New Bridge	75	100		80	$ 761,400	$ 156,171	$ (605,229)	$ (83,542)

Note 1: The value for *Residual Years* will be the greater of (i) Expected Service Life (N) minus Life Cycle (n) ***or*** (ii) Design Life (DL) plus Expected Service Life (N) minus Life Cycle (n).

Level 2 Analysis Results

Year	Option 1 - Do Nothing		Option 2 - Repair		Option 3 - Rehabilitation		Option 4 - Deck Replacement		Option 5 - New Bridge	
	Cost	Present Value	Cost	Present Value	Cost			Present Value	Cost	Present Value
0		$ -	$ 87,915.00	$ 87,915.00	$ 250,340.00	$ 250,340.00	$ 384,600.00	$ 384,600.00	$ 761,400.00	$ 761,400.00
5		$ -	$ 17,000.00	$ 15,397.42		$ -		$ -		$ -
10		$ -	$ 761,400.00	$ 624,613.20	$ 15,000.00	$ 12,305.22	$ 10,000.00	$ 8,203.48	$ 10,000.00	$ 8,203.48
15		$ -		$ -		$ -		$ -		$ -
20		$ -	$ 10,000.00	$ 6,729.71	$ 25,000.00	$ 16,824.28	$ 15,000.00	$ 10,094.57	$ 10,000.00	$ 6,729.71
25		$ -		$ -		$ -		$ -		$ -
30		$ -	$ 10,000.00	$ 5,520.71	$ 761,400.00	$ 420,346.77	$ 20,000.00	$ 11,041.42	$ 10,000.00	$ 5,520.71
35		$ -		$ -		$ -		$ -	$ 46,741.50	$ 23,372.04
40		$ -	$ 10,000.00	$ 4,528.90	$ 10,000.00	$ 4,528.90	$ 25,000.00	$ 11,322.26		$ -
45		$ -	$ 46,741.50	$ 19,173.21		$ -		$ -	$ 10,000.00	$ 4,101.97
50		$ -		$ -	$ 10,000.00	$ 3,715.28	$ 761,400.00	$ 282,881.33		$ -
55		$ -	$ 10,000.00	$ 3,365.04		$ -		$ -	$ 10,000.00	$ 3,365.04
60		$ -		$ -	$ 10,000.00	$ 3,047.82	$ 10,000.00	$ 3,047.82	$ 380,700.00	$ 116,030.61
65		$ -	$ 10,000.00	$ 2,760.51	$ 46,741.50	$ 12,903.02		$ -		$ -
70		$ -	$ 380,700.00	$ 95,185.51		$ -	$ 10,000.00	$ 2,500.28	$ 10,000.00	$ 2,500.28
75		$ -		$ -	$ 10,000.00	$ 2,264.58		$ -		$ -
80		$ -	$ 10,000.00	$ 2,051.10		$ -	$ 10,000.00	$ 2,051.10	$ 10,000.00	$ 2,051.10
85		$ -		$ -	$ 10,000.00	$ 1,857.74	$ 46,741.50	$ 8,683.36		$ -
90		$ -	$ 10,000.00	$ 1,682.61	$ 380,700.00	$ 64,057.12		$ -	$ 761,400.00	$ 128,114.24
95		$ -		$ -		$ -	$ 10,000.00	$ 1,524.00		$ -
100		$ -	$ 761,400.00	$ 105,098.30	$ 10,000.00	$ 1,380.33		$ -	$ 10,000.00	$ 1,380.33
Total Present Value:		$ -		$ 974,021.23		$ 793,571.08		$ 725,949.62		$ 1,062,769.51
Residual Value:		$ -		$ (87,414.31)		$ (34,370.16)		$ (57,500.29)		$ (83,541.62)
Net Present Value:		**$ -**		**$ 886,606.92**		**$ 759,200.92**		**$ 668,449.33**		**$ 979,227.89**

Life Cycle Cost Analysis

Present Value Analysis Back-up Information (Page 2 of 2)

Financial Analysis Conducted as per *Part 1 - Present Value Analysis - Project Level of Structural Financial Analysis Manual*, Ministry of Transporation, March 1990.

Name of Structure: **Fraiser Road Bridge**

Client **Township of North Glengarry**

Life Cycle, n = **100** years

Discount rate, r = **2.0%**

Initial Costs of work			**Maintain for**
Option 1 - Do Nothing	$	-	
Option 2 - Repair	$	87,915.00	10 years
Option 3 - Rehabilitation	$	250,340.00	30 years
Option 4 - Deck Replacement	$	384,600.00	50 years
Option 5 - New Bridge	$	761,400.00	75 years

Maintenance Requirements

Maintenance Requirements	None
Option 2 - Repair	$17,000 during 10 years
Option 3 - Rehabilitation	$15,000 at 10 years, $25,000 at 20 years
Option 4 - Deck Replacement	$10,000 at 10 years, $15,000 at 20 years, $20,000 at 30 years, $25,000 at 40 years
Option 5 - New Bridge	$10,000 per 10 years, except during Major Rehabiltiation

Assumptions

New Bridge will replace all strategies at the end of their service life

New Bridge Repair Strategy

Minor Rehabiltation at 35 years	$	46,741.50	$400/m2 of deck area
Major Rehabilitation at 60 years	$	380,700.00	50% of total cost
Replacement at 90 years	$	761,400.00	

Minor Rehabilitation

Deck Area	$	59.93
Structure Cost	$	23,970.00
Contingency	$	7,191.00
Traffic Cost	$	9,348.30
CA Cost	$	6,232.20
TOTAL	**$**	**46,741.50**

APPENDIX E
GENERAL ARRANGEMENT DRAWING

GENERAL SCOPE OF WORK:

- A. INSTALL TRAFFIC CONTROL SIGNS AND ROAD CLOSURE BARRICADES.
- B. IMPLEMENT AND MONITOR EROSION AND SEDIMENT CONTROL SYSTEM.
- C. REMOVE EXISTING S PIPE RAILS FROM EXISTING STRUCTURE.
- D. REMOVE EXISTING CONCRETE AND STEEL SUPERSTRUCTURE.
- E. REMOVE TOP OF EXISTING ABUTMENTS.
- F. EXCAVATE BEHIND EXISTING CONCRETE ABUTMENTS.
- G. IMPLEMENT AND MAINTAIN DEWATERING SYSTEM FOR EXCAVATION.
- H. CONSTRUCT NEW STEEL ABUTMENT BINS
- J. CONSTRUCT NEW CONCRETE BEARING PADS.
- K. CONSTRUCT NEW STEEL RETAINING WALL BINS (PURCHASED BY OWNER)
- L. INSTALL NEW MODULAR BRIDGE
- M. BACKFILL ABUTMENT AND RETAINING WALL BINS WITH GRANULAR 'B' AND CLEAR STONE.
- N. CONSTRUCT NEW CONCRETE APPROACH SLABS.
- P. INSTALL NEW STEEL STEEL BEAM GUIDERAIL ON STRUCTURE.
- Q. GRADE APPROACH ROADWAY AND TAPER TO HIGHER ELEVATION AT THE BRIDGE
- R. INSTALL NEW STEEL BEAM GUIDERAIL ON APPROACHES.
- S. INSTALL GEOTEXTILE AND RIP-RAP ON EMBANKMENTS.
- T. REMOVE ROAD CLOSURE BARRICADES.
- U. REMOVE TRAFFIC CONTROL MEASURES.

LIST OF STRUCTURAL DRAWINGS :

GENERAL NOTES:

1. CLASS OF CONCRETE:
   30 MPa (5% - 8% AIR ENTRAINMENT)
   ANCHOR BOLTS:
   ASTM F1554 GRADE 250 OR A36M
   Fy = 250MPa (GALV.)
2. CLEAR COVER TO REINFORCING STEEL:
   FOOTINGS - 100 ± 25mm
   REMAINDER - 70±20mm (UNLESS NOTED OTHER WISE)
3. ALL NEW REINFORCING STEEL: PREFIX 'C' DENOTES EPOXY COATED REINFORCING STEEL.
4. HOT DIP GALVANIZING SHALL BE IN ACCORDANCE WITH CAN/CSA-G164-M92 (R2003).
5. DESIGN CODE: CAN/CSA-S6-06, CANADIAN HIGHWAY BRIDGE DESIGN CODE.
6. THE CONTRACTOR SHALL VERIFY ALL DETAILS AND DIMENSIONS OF THE STRUCTURE PRIOR TO UNDERTAKING WORK.
7. THE SCOPE OF WORK ON THIS DRAWING IS PROVIDED FOR GENERAL INFORMATION ONLY AND SHALL NOT BE CONSTRUED AS EXHAUSTIVE.
8. ALL PLATFORMS REQUIRED FOR DEMOLITION AND ACCESS TO WORK AREAS TO BE CONSTRUCTED IN FULL CONFORMANCE WITH MINISTRY OF LABOUR REQUIREMENTS AND OCCUPATIONAL HEALTH AND SAFETY ACT. ALL SUBMISSIONS TO BE SIGNED AND SEALED BY DESIGN AND CHECK ENGINEERS LICENSED IN THE PROVINCE OF ONTARIO.
9. ALL ENVIRONMENTAL PROTECTION SYSTEMS TO BE FULLY (100%) EFFECTIVE IN PREVENTING CONTAMINATION OF ENVIRONMENT.
10. CONTRACTOR IS FULLY AND SOLELY RESPONSIBLE FOR SAFETY OF PEDESTRIAN AND VEHICULAR TRAFFIC, HIS WORKERS AND PUBLIC.
11. CONTRACTOR TO ASSURE STABILITY AND SAFETY OF ALL COMPONENTS AND TEMPORARY STRUCTURES IN ALL PHASES OF CONSTRUCTION.
12. ALL CONCRETE TO BE PLACED IN FULL CONFORMANCE WITH CSA A23.1 INCLUDING BUT NOT LIMITED WITH MIXING/DISPOSAL TIME LIMITATIONS AND FULL ADHERENCE TO COLD/HOT WEATHER PROTECTION REQUIREMENTS.
13. ANY CONCRETE NON-CONFORMING WILL BE REJECTED AND SHALL BE REMOVED FROM SITE.
14. ALL WELDING SHALL BE IN CONFORMANCE WITH CSA W59.
15. DEMOLITION STRUCTURE REMOVAL PROCEDURE TO BE SIGNED AND SEALED BY DESIGN AND CHECK ENGINEERS LICENSED IN THE PROVINCE OF ONTARIO.
16. THE BEARING SEAT ELEVATIONS AND LOCATIONS SHALL BE CONFIRMED TO SUIT THE MODULAR BRIDGE DESIGN.
17. ANY SCAFFOLDING OR DEBRIS CONTAINMENT SYSTEM THAT PROJECTS BELOW THE SOFFIT OF THE EXISTING OR NEW STRUCTURE SHALL NOT PREVENT THE PASSAGE OF WATER VESSELS.
18. ALL VESSELS NAVIGATING THE WATERWAY SHALL BE ALLOWED ACCESS THROUGH OR AROUND THE WORK SITE AT ALL TIMES DURING CONSTRUCTION AND SHALL BE ASSISTED AS NECESSARY. SIGNAGE STATING "CONSTRUCTION WORKS AHEAD" SHALL BE PLACED AND MAINTAINED 50 TO 100 METRES UPSTREAM AND DOWNSTREAM OF THE WORK SITE DURING ALL PERIODS OF CONSTRUCTION TAKING PLACE BETWEEN MAY 15 AND NOVEMBER 1 OF ANY YEAR.
19. INSTALL PILES OF GRANULAR, TCB OR OTHER DEVICES TO PHYSICALLY RESTRAIN ERRANT OR DISORIENTED VEHICLES FROM ENTERING OPEN EXCAVATION AT BOTH ENDS OF STRUCTURE.
20. THE SHOP DRAWINGS OF THE MODULAR BRIDGE, FORM PART OF THE CONTRACT.
21. IMMEDIATELY UPON AWARD, RETAIN CERTIFIED SURVEYOR THAT WILL FULLY AND UNEQUIVOCALLY ESTABLISH ALL PERMANENT ELEVATIONS FOR CONSTRUCTION OF ABUTMENT BINS AND INSTALLATION OF NEW BRIDGE TO SUIT NEW ROADWAY PROFILE.
22. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES , UNLESS SHOWN OTHERWISE. ELEVATIONS ARE SHOWN IN METRES.
23. THERE IS NO INTENT TO SHOW EVERY COMPONENT OF THE WORK ON THE CONTRACT DRAWINGS.
24. STEEL BIN ABUTMENTS AND RETAINING WALL ARE SHOWN SCHEMATICALLY. EXACT DIMENSIONS AND ELEVATIONS ARE PROVIDED IN ATTACHED DOCUMENTS PROVIDED BY MANUFACTURER (AIL).
25. CLEAR STONE SHALL BE PLACED UP TO THE GROUNDWATER LEVEL IN THE BINS TO AVOID COMPACTION IN THE WET.
26. FOR GEOTECHINCAL CONDITIONS REFER TO REPORT BY LEVAC ROBICHAUD LECLERC ASSOCIATES LTD.

IS	RE	DATE	DESCRIPTION

SEAL:

CLIENT: THE CORPORATION OF THE TOWNSHIP OF NORTH GLENGARRY

CLIENT REF. #:

PROJECT: FRASIER ROAD BRIDGE REPLACEMENT

PROJECT NO: 161-09722-00

DATE: NOV. 2016

WSP
300-2611 QUEENSVIEW DRIVE
OTTAWA (ONTARIO)
CANADA K2B 8K2
TELEPHONE: 613-829-2800 FAX: 613-829-8299
WWW.WSPGROUP.COM

TITLE: KEY PLAN

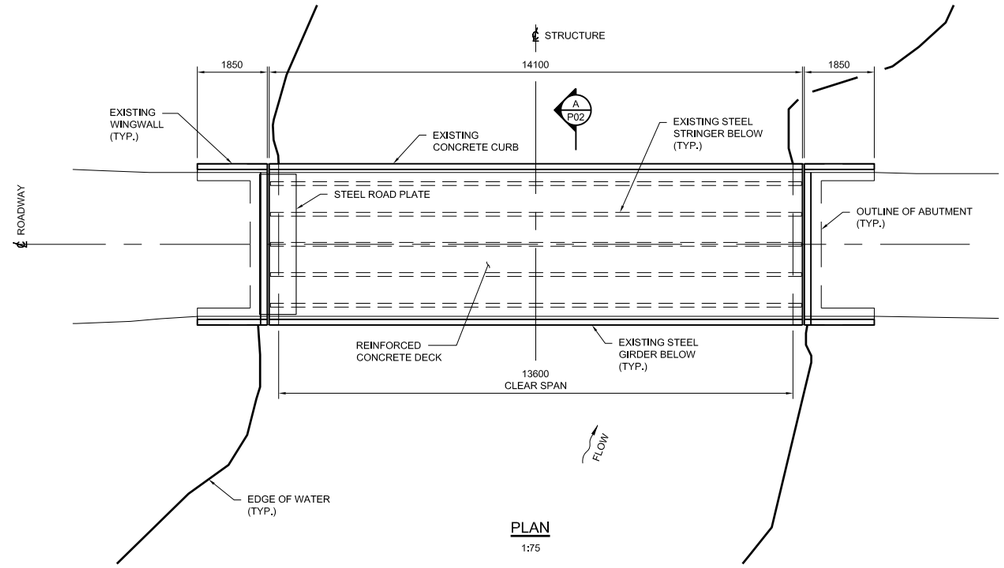
SHEET NUMBER: P01

SHEET #: 1 OF 3

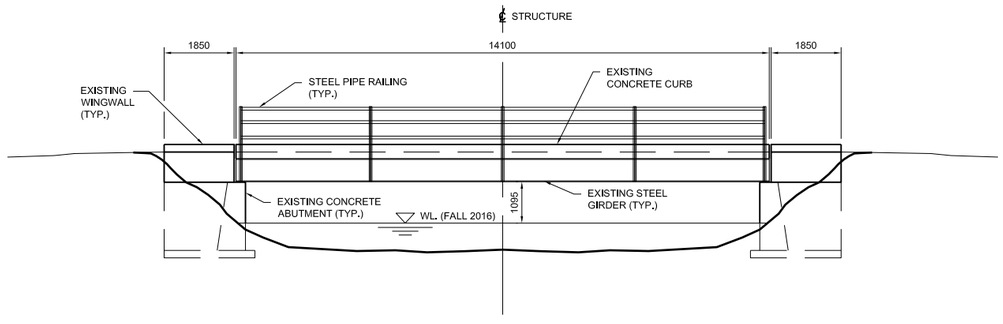
DESIGNED BY: FELIX WASIEWICZ
DRAWN BY: ADRIAN MEUNIER
CHECKED BY: JULIA MARSON
DISCIPLINE: STRUCTURAL

ISSUE: REV #

DATE OF:



PLAN
1:75



EAST ELEVATION
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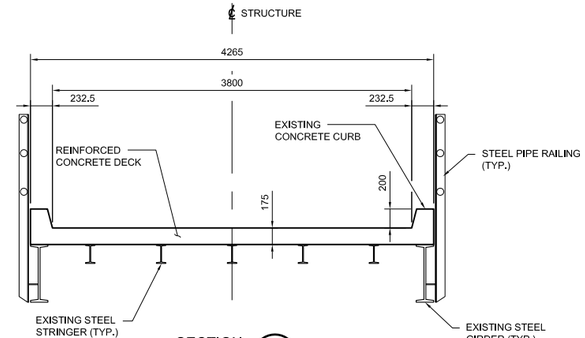

SECTION A P02
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IS	RE	DATE	DESCRIPTION

SEAL:

CLIENT:
THE CORPORATION OF THE TOWNSHIP OF NORTH GLENGARRY

CLIENT REF. #:

PROJECT:
FRASIER ROAD BRIDGE REPLACEMENT

PROJECT NO: 161-09722-00

DATE: NOV. 2016

WSP
300-2611 QUEENSVIEW DRIVE
OTTAWA (ONTARIO)
CANADA K2B 8K2
TELEPHONE: 613-829-2800 FAX: 613-829-8299
WWW.WSPGROUP.COM

TITLE:
GENERAL ARRANGEMENT EXISTING

SHEET NUMBER: P02

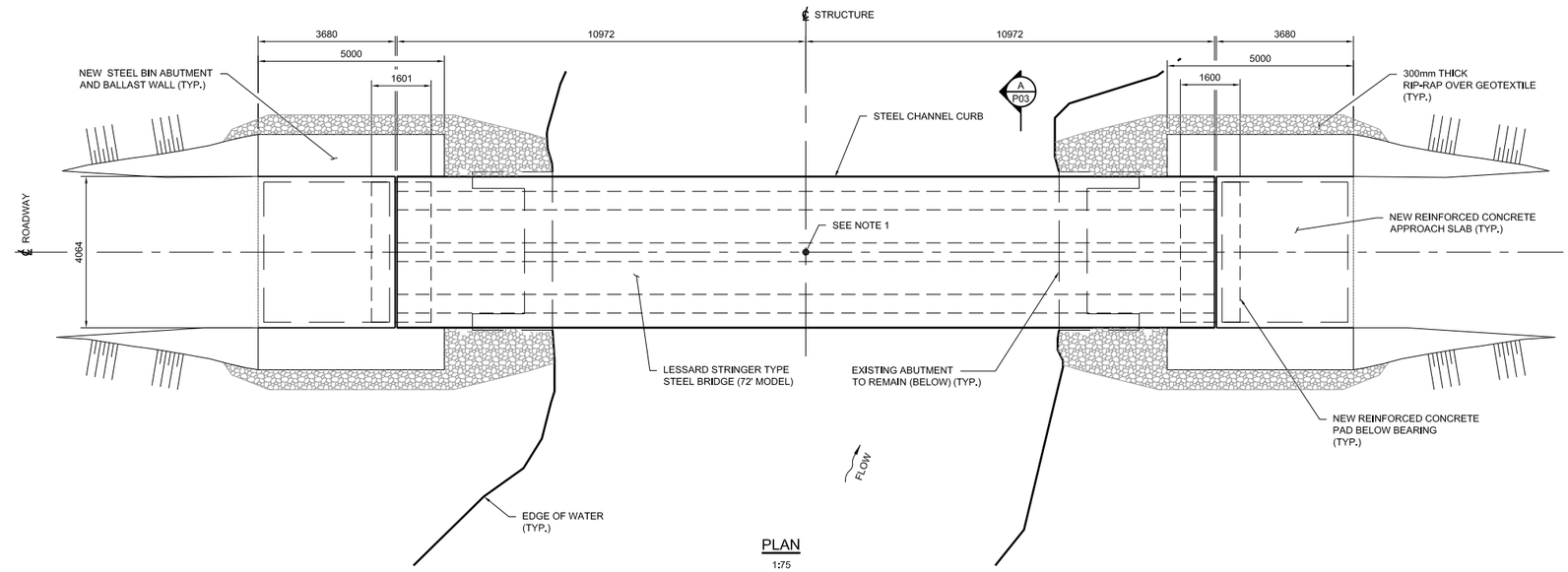
SHEET #: 2 OF 3

DESIGNED BY: FELIX WASIEWICZ
DRAWN BY: ADRIAN MEUNIER
CHECKED BY: JULIA MARSON
DISCIPLINE: STRUCTURAL

ISSUE:

REV #

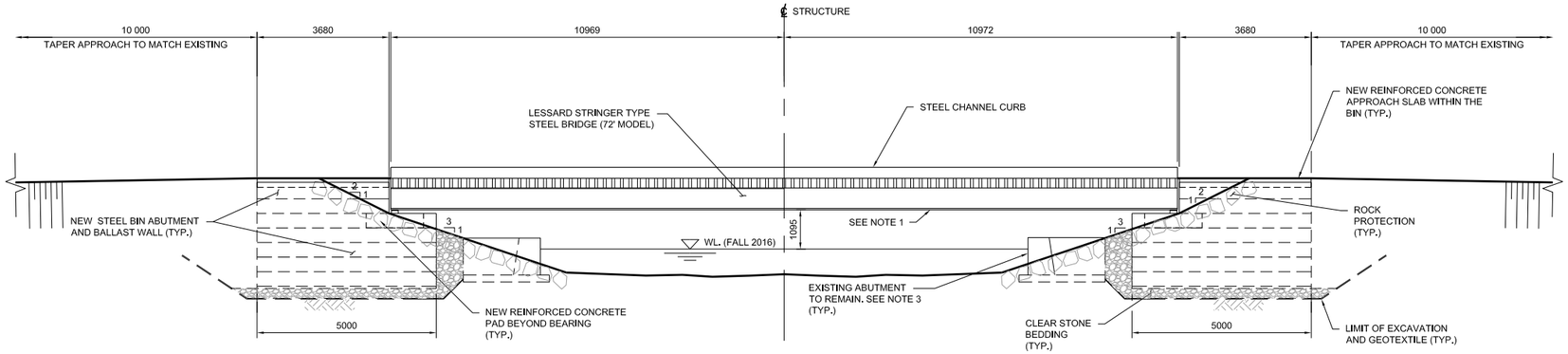
DATE OF:



PLAN
1:75

NOTES:

1. UNDERSIDE OF SUPERSTRUCTURE OF NEW STRUCTURE TO MATCH EXISTING. THE NEW DECK WILL BE APPROXIMATELY 400mm HIGHER THAN EXISTING.
2. CONCRETE RUBBLE FROM REMOVALS WITH ALL REINFORCING STEEL REMOVED MAY BE USED AS RIPRAP.
3. DEMOLISH THE ABUTMENT AND WINGWALL DOWN TO WATER LEVEL AT TIME OF CONSTRUCTION.



EAST ELEVATION
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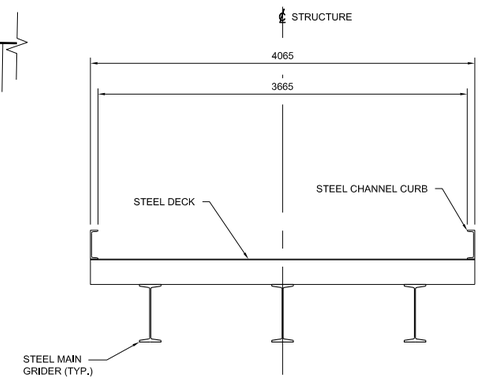

SECTION A P03
1:30

IS	RE	DATE	DESCRIPTION

SEAL:

CLIENT: THE CORPORATION OF THE TOWNSHIP OF NORTH GLENGARRY

CLIENT REF. #:

PROJECT: FRASIER ROAD BRIDGE REPLACEMENT

PROJECT NO: 161-09722-00

DATE: NOV. 2016

WSP
300-2611 QUEENSVIEW DRIVE
OTTAWA (ONTARIO)
CANADA K2B 8K2
TELEPHONE: 613-829-2800 FAX: 613-829-8299
WWW.WSPGROUP.COM

TITLE: GENERAL ARRANGEMENT PROPOSED NEW

SHEET NUMBER: P03

SHEET #: 3 OF 3

DESIGNED BY: FELIX WASIEWICZ
DRAWN BY: ADRIAN MEUNIER
CHECKED BY: JULIA MARSON
DISCIPLINE: STRUCTURAL
ISSUE: REV #
DATE OF: