THE TOWNSHIP OF BONFIELD

BRIDGE MANAGEMENT STUDY REPORT (DRAFT)

6 BRIDGES / 10 CULVERTS

DECEMBER 2022

Report Submitted By:

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Appendices

1.0 INTRODUCTION

The Township of Bonfield (the Township) has retained HP Engineering to perform inspections and develop a bridge management study for 16 structures owned and maintained by the Township.

Each structure in the Township's inventory was visually inspected using the Ministry of Transportation of Ontario's (MTO) Structure Inspection Manual. HP Engineering has entered the data from the inspections into individual inspection forms. The data for each structure present visual observations, suggested rehabilitation, further required investigation and budget cost information. Refer to the appendices for individual inspection sheets for bridges and culverts.

The following report summarizes the suggested rehabilitation / replacement costs, engineering investigation costs and replacement values for each structure based on benchmark budget costs.

Appendix A presents summary tables for all structures. The structures are listed in numerical order of structure number, and the rehabilitation / replacement costs (determined from benchmark budget costs) for each structure.

2.0 STRUCTURE INSPECTIONS

A total of 16 structures owned and maintained by the Township were visually inspected in accordance with the MTO Structure Inspection Manual. The inspections were performed during the early summer of 2022.

For each structure, components were screened for visual signs of deterioration. The components were then given a rating (on the inspection forms) using the MTO extent and severity method, whereby the components are proportioned (in units of m^2, %, m, etc.) based on their observed conditions (excellent, good, fair, poor). This provides quantitative data as to the extent of the observed deterioration for each component. Explanatory statements accompany each of the components' ratings where deemed applicable by the inspector.

The inspection forms also provide information regarding suggested engineering investigation and repairs and associated budgetary estimates of expected costs. Suggested engineering investigations are subdivided based on time of need. Repairs and associated budgetary estimates are subdivided based on time of need. The basis of selection for budget costs is further discussed in Section 3.0 of this report.

Photographs of each inspected structure are included with the inspection sheets including a minimum of 2 photographs for each structure (approach and elevation). Additional photographs depicting the details of the structure, observed defects or deterioration have also been included.

Individual inspection forms for the structures are included as an attachment where the structures are separated into alphabetical order.

3.0 DETERMINATION OF COSTS

3.1 Repair, Rehabilitation and Replacement

Given the cursory information obtained during the visual inspections and without the benefit of detailed design information, it is impractical to develop detailed cost estimates for each structure. For these reasons, benchmark budget costs were developed for categories of repair, rehabilitation and replacement. Traditionally, benchmark costs do not necessarily provide accurate costs for individual repairs /

replacement, but have proven to provide sufficient accuracy for global budgeting purposes when dealing with a large number of structures.

For the purpose of this study, benchmark costs for the rehabilitation and replacement of structures are based on maintaining the existing width, length and alignment of each structure. However, the costs to replace the existing structures with structures meeting current geometric standards are included for comparison. For this purpose, an overall roadway width of 10 metres was used for both bridges and culverts. More accurate costs for each structure would be provided upon further engineering study and design based on exact repair, rehabilitation and replacement needs (including change in geometry). The following benchmark costs have been established for this study following the requirements of the inspection forms.

Bridge and Culvert Replacement Costs

Budget costs for the replacement of bridges are usually based on the deck surface area of individual structures (m^2). Therefore, benchmark replacement costs for this study were determined using the following unit costs including approaches, administration and design costs, based on the spans of individual bridges and taking into account approach roadway costs (which do not vary with bridge span). In addition, the varying widths of bridges were taken into account to provide more realistic unit costs and to avoid large discrepancies in the replacement cost between bridges of different lengths, but similar surface areas.

Total Bridge Replacement Unit Costs		
Bridge Length (m)	**Width (m)**	**Unit Replacement Cost ($/m^2)**
3-10	<10 m	$8,000.00
	≥10 m	$7,500.00
10-20	<10 m	$7,500.00
	≥10 m	$6,500.00
20-30	<10 m	$6,500.00
	≥10 m	$5,500.00
>30	<10 m	$5,500.00
	≥10 m	$4,500.00

In the case of culverts, the plan area (or deck surface area) used in the calculation was ('length of spans' + 1 m) x ('width of roadway' + 1 m). The purpose of using the Total Bridge Replacement Unit Costs table for culverts is to normalize the replacement cost figures. Although culverts are generally less expensive to construct than bridges, it is generally accepted that the expected life span is approximately 50% of a bridge. It is valid therefore, on a life cycle cost basis, to utilize the Total Bridge Replacement Unit Costs table for all structures, whether they are bridge type or culvert type.

Bridge Repair / Rehabilitation Costs

For budgeting purposes, costs for the rehabilitation of bridges are typically expressed as a percentage of the total replacement costs. Rehabilitation costs for this study are separated into four categories as presented in the table below (including administration and design costs).

Bridge Rehabilitation Costs		
Category		**% of Replacement Cost**
1.	Major Bridge Rehabilitation	50-60
2.	Minor Bridge Rehabilitation	25-50
3.	Major Item Repair	5-25
4.	Minor Item Repair	5 or less

Culvert Repair / Rehabilitation Costs

It is generally not practical to undertake major rehabilitation work to culvert crossings where significant deterioration or deficiencies exist in the metal liner (barrel). Culvert replacement is normally planned in these circumstances. Repair work identified generally included repairs to the inlet and outlet structures such as headwalls, cut-off walls, retaining walls, restoration of backfill, slope protection at the culvert ends and installation / upgrading of guiderail. In the case of concrete barrels, some repair work to the barrels may be included if the opening is large enough to permit construction access.

Approach Roadway Repair / Rehabilitation Costs

For this study, approaches are considered to be 30m of roadway from the centre of each individual culvert (60 m total per culvert) and 6m of roadway from the end of the deck for each individual bridge (12m total per bridge). Repair / rehabilitation costs for approach roadways have been separated into three categories as presented in the table below (including administration and design costs).

Separate costs for Approach Roadway Repair / Rehabilitation have been included for Bridge Rehabilitation. For structure replacement costs and repairs, the approach roadway repair / rehabilitation costs have been included in the recommended work costs if applicable.

Approach Roadway Repair/Rehabilitation Costs		
Category		**Cost**
1.	Capital Projects (Partial / Complete Paving, Guiderail)	$40,000.00
2.	Minor Repairs / Maintenance (Crack Sealing, Surface Sealing, Guiderail Repairs)	$14,000.00
3.	Crack Sealing Only	$7,000.00

Construction Detour Costs

Several alternatives exist to maintain the flow of traffic when a bridge or culvert undergoes major rehabilitation or replacement. These include the construction of a detour structure adjacent to the existing structure, a detour route around (avoiding) the structure, and the staging of the construction to allow traffic on the structure during construction. The construction of a detour structure is the most costly option and is usually recommended only when the other options are not possible. The detour route is the least expensive option, but is often not practical due to the length of the detour route and the inconvenience to residents near the structure. The most frequently recommended option is the staging of rehabilitation work to allow the passage of traffic.

Since most bridge projects would consist of rehabilitation and not replacement, the staging of work would be the most frequently used option to maintain traffic during construction. Therefore, the benchmark costs for detours are based on staging of the work as per the following. These costs are based on additional costs incurred from staging of the work during construction (extra effort, time). Traffic control costs would be separate from detour costs and are presented later in this section.

Detour During Construction Costs		
Category		**Cost**
1.	Detour - Minor Rehabilitation / Major Rehabilitation of Bridges Less than 10m Long / Culvert Replacement	$30,000.00
2.	Detour - Major Rehabilitation / Bridge Replacement	$100,000.00

Traffic Control Costs

In addition to performing the work in stages to accommodate traffic, the safety of traffic passing on the bridge or over the culvert during construction must also be ensured. The costs of traffic control during staged projects would be as follows:

Traffic Control Costs		
Category		**Cost**
1.	Traffic Control- Minor Rehabilitation	$30,000.00
2.	Traffic Control - Major Rehabilitation	$50,000.00

Utilities / Right of Way Costs

Most bridge or culvert rehabilitation / replacement projects do not require substantial expenses for the installation or modification of existing utilities. Similarly, most of these projects do not require an increase in right of way. Therefore, specific benchmark budget costs for these items were not developed.

Environmental Study Costs

Since bridge or culvert replacements / rehabilitations typically do not involve a change in alignment or a reduction in clearances under the structure, these projects usually fall under the Schedule A or A+ Environmental Assessment for Ontario Highways. This type of environmental assessment does not require detailed environmental and mitigation plans, but typically requires written application with, and permission from, the appropriate environmental agencies (Ontario Ministry of Natural Resources, Ontario Ministry of the Environment, Local Conservation Authorities (Permit To Take Water). Therefore, the benchmark budget cost for environmental study would be as follows (based on the requirement of Schedule A or A+ Environmental Assessment):

Environmental Study Costs		
Category		**Cost**
1.	Bridge / Culvert Replacement, Minor and Major Rehabilitation	$9,500.00

Other Costs

Any other costs not specified in the above (site specific requirements) are deemed to be covered in the total benchmark costs. Therefore, no specific amount for other work is specified in this report.

Contingency Costs

The benchmark costs used for budgeting purposes are based only on information obtained from visual inspections. Because of this, contingency allowances are already built into the benchmark costs. Therefore, specific amounts for contingencies will not be included in this report.

Recommended Replacement Costs

For the purposes of this report, when a structure (bridge or culvert) replacement has been recommended, all associated costs (approaches, detours, traffic control, utilities, right of way, environmental studies and contingency) have been included in the replacement cost provided in the 'Repair and Rehabilitation Required' table on the inspection forms.

3.2 Engineering Investigation

Further engineering investigation is recommended for several of the bridges and culverts as indicated on individual inspection forms. Benchmark budget costs for engineering investigation work are presented in the table below:

Engineering Investigation			
Category		**Type of Structure**	**Cost**
1.	Detailed Inspection / Rehabilitation Study - Full Bridge	Truss	$27,500.00
		Others	$22,000.00
		Traffic Barrier Only *	$5,500.00
2.	Detailed Deck Condition Survey	Exposed Deck	$5,500.00
		Asphalt Paved Deck	$8,800.00
		Concrete Culvert with Height of Fill Less than 500 mm **	$5,500.00
3.	Structure Evaluation	Truss	$16,500.00
		Others	$11,000.00
4.	Underwater Investigation	All Bridges	$11,000.00

* Requirements for traffic barriers on bridges and culverts were determined using the Canadian Highway Bridge Design Code, MTO Standards and good engineering practice. The evaluation of existing traffic barriers was based on assumed values of AADT and good engineering practice. For structures with existing approach guiderail, a review of the required approach / leaving end length of guiderail and end treatments (as per the MTO's Roadside Safety Manual) was not carried out.

** Deck condition survey on concrete culvert includes cores with no corrosion potential survey. Deck condition surveys on concrete culverts with a height of fill greater than 500 mm are not practical.

The benchmark budget costs for a Structure Evaluation and Detailed Deck Condition Survey would be reduced to 50% of that shown in the table above when any one these are performed simultaneously with a Detailed Inspection / Rehabilitation Study.

Other investigations such as fatigue and seismic investigations would be included with the Detailed Inspection and Structure Evaluation (respectively), if deemed necessary by the engineer. Detailed coating condition surveys are typically only required where a failure of coating systems have occurred other than normal deterioration. A DART (Deck Assessment by Radar Technology) survey is not a commonly used investigation method. Detailed deck condition surveys are the most commonly used method of deck inspection. Therefore, individual costs for the various types of investigation described above are not provided.

4.0 BRIDGE CONDITION INDICES (BCI)

Bridge Condition Index (BCI) values were derived using MTO's standard methods as outlined in their document entitled '*Bridge Condition Index, an Overall Measure of Bridge Condition*' (July 2009). Based on this document, we utilize an excel spreadsheet (developed based on the parameters outlined in the document) that, after inputting the inspection data for each element (condition ratings), automatically calculates the BCI value.

With the calculated BCI values for each structure, an *overall* picture of the general condition of the Municipality's structures inventory as a whole can then be presented by summarizing BCI ranges (good, fair, poor) and counting the overall percentage of structures in each category. This is the methodology that the MTO currently utilizes and it is generally an effective tool to determine where the Township stands in terms of the overall condition and maintenance needs for their structure inventory. This information can be used to compare the overall condition of various structures, to assist in prioritizing structures for future rehabilitation and assist in the funding application process.

The BCI ranges that are normally included in this summary table are as follows:

- Good (BCI Range 70-100); for this range, maintenance is not usually required with the next five years.
- Fair (BCI Range 60-70); for this range, maintenance work is usually required / scheduled within the next five years. Carrying out work within this timeframe (next five years) is typically considered the ideal time to get the most out of bridge spending.
- Poor (BCI Less than 60); for this range, maintenance work is usually required / schedule with the next year.

For the Township's inventory (10 structures total), the current summary of BCI ranges is presented as follows (individual structure BCI values are presented in the tables in ***Appendix A***):

BCI Range	***Number of Structures in Range***	***Percent of Structures in Range***
70-100	2 (bridges) / 3 (culverts) / 5 total	31.2
60-70	2 (bridges) / 2 (culverts) / 4 total	25.0
Less than 60	2 (bridges) / 5 (culverts) / 7 total	43.8

5.0 ROUTINE MAINTENANCE

As part of the Township's overall bridge management program, a program of routine maintenance should be implemented and up-kept for all structures. Maintaining this program will assist in minimizing the potential for premature deterioration of structural elements; and, when combined with a program of bridge rehabilitation, will assist in maximizing the useful service life of the Township's structure inventory.

Overall routine maintenance needs will vary depending on the type of structure, location, traffic volumes, winter maintenance procedures (sanding vs. salting, etc.), size of the structure, vintage and previous maintenance / rehabilitation carried out on the structure in the past. The following presents a general summary of routine maintenance operations that are considered applicable for the structures present within the Township's inventory:

- Periodic bridge cleaning; this would include power-washing of all components exposed to roadway traffic and areas where debris accumulation is prevalent. This would include asphalt wearing surfaces, expansion joint gaps, edges of roadway, bearing seats, truss bottom chords, etc. Typically this operation would be carried out on an annual basis, most likely each spring after winter sanding / salting operations have ceased; however, in some cases (i.e. gravel approach roadways, etc.), an increase in the number of cleanings per year may be required.

- Concrete spot repairs; this would generally include localized patching of small concrete spalls and delaminations located in areas within the roadway splash zones (top of deck, curbs, expansion joint block-outs, etc.). Completing these repairs will assist in preventing accelerated deterioration of concrete in these areas by reducing the ingress of chlorides, etc. There is no specific timing for these types of repairs and they are generally performed on an as-needed basis.

- Steel spot repairs / spot coating; this would generally include localized touch-ups to steel coatings located in areas within the roadway splash zones (truss bottom chords, exterior floor beams / stringers, etc.) as well as localized spot repairs in areas of appreciable section loss / corrosion. There is no specific timing for these types of repairs and they are generally performed on an as-needed basis.

- Clearing of debris in waterway; this would include clearing of trapped debris in the vicinity of the structure (upstream / downstream). This operation would typically be carried out on an annual basis, after the spring run-off period.

- Asphalt surface repairs / rout and seal; this would include cold patch asphalt repairs, routing and sealing of wide cracks in asphalt. This operation would typically be carried out an annual basis, after winter clearing operations have ceased.

- Re-grading of approach roadways (gravel roadway surfaces); this would include placing and grading fresh granular material on roadway surfaces. The timing of this work would depend on the overall volume and type of traffic typically traversing the roadway (truck haul route, summer cottage traffic route, etc.). Typically this work would be carried out on an annual or bi-annual basis.

- Bridge deck drainage; this would include maintaining existing deck drains free of debris and maintaining them in an un-plugged condition. This operation would typically be carried out an annual basis, after winter clearing operations have ceased.

- Clearing of debris / vegetation from approach guiderail; this would involve removing debris and vegetation from in front of approach guiderail. Although this is mainly a safety measure (to ensure proper performance of the guiderail), it also assists in prolonging the lifespan of the guiderail (accumulation of debris can accelerate rot on wooden posts, corrosion on steel guiderail, etc.).

- Surface sealing of exposed concrete surfaces; this would include cleaning and applying a concrete sealer on concrete surfaces exposed within the splash zone (exposed concrete decks, curbs, sidewalks and barrier walls); this operation is not typically required on an annual basis and would typically be completed in 3-5 year intervals. Sealing concrete surfaces periodically assists in minimizing the migration of chlorides into the concrete.

6.0 ASSET MANAGEMENT INFORMATION

As previously mentioned, all structures were visited and inspected in conformance with the requirements of the Ontario Structure Inspection Manual (2008 Revision). Based on the results of the inspections, repair / rehabilitation needs and budgetary costs for these were identified. In addition, additional engineering inspections and studies were also recommended.

Although OSIM inspections (generally performed every 2 years) are a useful screening tool to identify upcoming bridge maintenance needs and costs, these inspections solely rely on visual evidence of deterioration and do not take into account the age (life cycles) of individual structures, nor do they take into account the potential for hidden deterioration (which could be revealed with further investigations such as detailed bridge condition surveys, rehabilitation studies, etc.).

In order to provide the Township with a more useful planning tool for structure maintenance, rehabilitation and replacement, all of the information gathered from the OSIM inspections was summarized in an Asset Information Summary table.

Asset Management Summary

This set of tables presents basic asset information for the structures such as structure name, type of structure and basic geometry. The replacement value for each structure (based on current and widened geometry, in the case where the width of the existing structures are deficient) is also provided. These values are presented in 2022 dollars. The BCI calculated for each structure is also provided.

The BCI values were calculated using the method established by the Ministry of Transportation of Ontario. This method takes into account the quantities for poor, fair, good and excellent for each of the elements and determines the cost of the rehabilitation needs. The BCI is determined by dividing the remaining value of the bridge (value of the bridge less cost of the rehabilitation needs) by its initial value (in new condition).

7.0 DISCUSSION

This Bridge Management Asset Study was developed to provide the Township of Bonfield with the necessary information required to project budgets and set priorities for future bridge and culvert rehabilitation / replacement programs. The attached inspection sheets should be updated accordingly as repairs and rehabilitations are carried out.

Replacement, rehabilitation and engineering investigation budget costs were provided for 16 of the Township's structure based on visual biennial inspections performed by HP Engineering (during the early summer of 2022).

The costs for individual structures are presented on inspection forms and were based on benchmark costs developed for this study. These should be used for budgeting purposes only. More accurate cost estimates for each structure's needs would be provided based on more detailed scopes of work developed during the design engineering stages.

The estimated replacement value of the Township's bridge and culvert inventory (based on 16 structures in the inventory) is approximately ***7.53*** million dollars. The estimated value of all the bridges and culverts (based on *16* structures in the inventory) if reconstructed to current geometric standards would be approximately ***9.53*** million dollars.

Immediate repair / rehabilitation costs for the 16 structures inspected are estimated to be a total of approximately ***361*** thousand dollars broken down as ***151*** and ***210*** thousand dollars for bridges and culverts respectively. Similarly, the longer term repair / rehabilitation costs (1-5 years) for the 16 structures inspected are estimated to be a total of approximately ***2.295*** million dollars broken down as ***409*** thousand dollars and ***1.886*** million dollars for bridges and culverts respectively. The 6-10 year repair / rehabilitation costs for the 16 structures inspected are estimated to be a total of approximately ***1.4*** million dollars broken down as ***1.11*** million dollars and ***290*** thousand dollars for bridges and culverts respectively.

The costs associated with recommended further Engineering Investigations for the 16 structures inspected was estimated to be a total of approximately ***250*** thousand dollars broken down as ***125*** thousand dollars for each of bridges and culverts. It is noted that the majority of the costs associated with these recommended further Engineering Investigations are related to deficient and / or non-existing barriers over the structures and on the approaches to the structures.

Respectfully Submitted,
December 14, 2022

ENGINEERING
HP ENGINEERINC INC.

Tashi Dwivedi, P.Eng.
Principal

APPENDIX A

ASSET MANAGEMENT SUMMARY

APPENDIX A-1

BRIDGES
(6 STRUCTURES)

Appendix A : Asset Information Summary - Bridges

Site No	Bridge Name	Bridge Type	Year Built (Age)	Year of Last Rehab	Number of Spans	Total Length (Parallel to Roadway) (m)	Width (Perpendicular to roadway) (m)	Roadway Width (m)	Existing Surface Area (m^2)	Replacement Cost - Existing Geometry ($000)	Replacement Cost - Current Geometric Standards ($000)	BCI	Benchmark Budget Costs				Prioritization of Major / Minor Capital Work							
													Rehabilitation Costs ($000)			Engineering Investigation Costs ($000)	Prioritize Year of Need - Major/Minor Capital Works	Estimated Major / Minor Capital Work Expenditure per Year ($000)					
													< 1 year	1-5 Years	6-10 Years	Normal		2023	2024	2025	2026	2027	2028	Total ($000)
01	Maple Road Bridge	Concrete Girder	1917	1989	1	11.10	5.00	4.30	56	416	772	60	0	0	586	20.0	3			606.0				606.0
02	Sunnyside Road Bridge	Concrete Rigid Frame	1982	-	1	12.50	9.40	7.10	118	881	999	72	103	0	0	20.0	5					123.0		123.00
07	Boxwell Road Bridge	Concrete Girder	1916	-	1	7.20	4.60	4.40	33	265	551	57	0	0	524	30.0	2		554.0					554.0
08	Trunk Road Bridge	Concrete Rigid Frame	1930 (est.)	-	1	3.60	6.00	5.50	22	173	284	37	0	409	0	35.0	1	444.0						444.00
10	Pine Lake Road Bridge	Concrete Rigid Frame	1983	-	1	13.28	9.70	8.70	129	966	950	68	24	0	0	15.0	4				39.0			39.0
12	Line 3 North Road Bridge	Steel Girder	Unknown	-	1	16.00	8.40	7.15	134	1,008	1,170	75	24	0	0	5.0	6						29.0	29.00
TOTALS										**3,709**	**4,725**		**151**	**409**	**1,110**	**125**		**444**	**554**	**606**	**39**	**123**	**29**	**1795**

NOTES:

1. BCI as calculated by HP Engineering.

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APPENDIX A-2

CULVERTS
(10 STRUCTURES)

Appendix A-2 : Asset Information Summary - Culverts

Culvert No.	Culvert Name	Culvert Type	Year Built (Age)	Year of Last Rehab	Number of Barrels	Total Length (Parallel to Roadway) (m)	Width (Perpendicular to roadway) (m)	Roadway Width (m)	Existing Surface Area (m^2)	Replacement Cost - Existing Geometry ($000)	Replacement Cost - Current Geometric Standards ($000)	BCI	Benchmark Budget Costs				Prioritization of Major / Minor Capital Work								
													Rehabilitation Costs ($000)			Engineering Investigation Costs ($000)	Prioritize Year of Need - Major/Minor Capital Works	Estimated Major / Minor Capital Work Expenditure per Year ($000)							
													< 1 Year	1-5 Years	6-10 Years	Normal		2023	2024	2025	2026	2027	2028	2029	Total ($000)
03	Grand Desert Road Culvert	Concrete Arch	2009	-	1	9.28	5.52	4.75	59	443	735	74	24	0	0	5.0	7						29		29
04	Grand Desert Road Culvert	CSP	1970 (est)	-	1	3.00	27.40	7.80	35	282	330	23	0	452	0	20.0	1	472							472
05	Boundry Road Culvert	CSP	1980 (est)	-	2	4.00	11.90	6.20	36	288	413	69	57	0	0	5.0	8						62		62
06	Boxwell Road Culvert	Horizonral Ellipse CSP	1970 (est)	-	1	4.60	14.10	7.00	45	358	462	24	0	528	0	20.0	3			548					548
09	McNutt Road Culvert	Horizonral Ellipse CSP	1989	-	2	8.20	16.40	8.50	87	699	759	69	24	0	0	5.0	6					29			29
11	Grand Desert Road Culvert	CSP	1980 (est)	-	1	1.00	8.40	6.50	15	120	165	31	0	0	290	20.0	9							310	310
13	Trunk Road Culvert	Horizonral Ellipse CSP	2017	-	2	10.20	21.30	8.30	104	781	801	74	57	0	0	5.0	5					62			62
14	Trout Pond Road Culvert	Horizonral Ellipse CSP	1970 (est)	-	1	2.40	8.70	6.60	26	207	281	29	0	377	0	20.0	2		397						397
15	Development Road Culvert	Horizonral Ellipse CSP	2019	-	1	3.55	21.30	6.80	35	284	375	75	48	0	0	5.0	10							53	53
16	Development Road Culvert	Horizonral Ellipse CSP	1980 (est)	-	1	4.90	22.50	6.60	45	359	487	58	0	529	0	20.0	4				549				549
TOTALS										**3,821**	**4,807**		**210**	**1,886**	**290**	**125.0**		**472**	**397**	**548**	**549**	**91**	**91**	**363**	**2511**

NOTES:

1. BCI as calculated by HP Engineering.

ATTACHMENT 1

OSIM INSPECTION REPORTS & BCI FORMS

BRIDGES

Structure Condition Summary Form

Structure Name Maple Road Bridge
Structure Number 01
Date of Inspection June 03, 2022
Project No. 22035
Consultant HP Engineering Inc.

Element Group	Element Name	Unit (Qty.)	Unit Price (MTO)	Total Element Quantity	Element Qty. in Excellent Condition (1.00)	Element Quantity in Good Condition (0.75)	Element Quantity in Fair Condition (0.4)	Element Quantity in Poor Condition (0)	Total Replacement Value (TRV)	Current Element Value (CEV)	Element Condition Index	Performance Deficiency	Maintenance Need
Abutment	Abutment Walls	Sq.m	900.00	24.70	0.00	15.70	7.00	2.00	22230	13118	59	14	08
	Wingwalls	Sq.m	350.00	6.72	0.00	5.55	0.67	0.50	2352	1551	66	00	08
Approaches	Wearing Surface	Sq.m	6.00	258.00	0.00	229.00	25.00	4.00	1548	1091	70	00	12
Barriers	Barrier/ Parapet Walls	Sq.m	100.00	24.20	0.00	0.00	14.20	10.00	2420	568	23	00	08
Beams / Main	Girders	Sq.m	200.00	70.29	0.00	51.69	17.60	1.00	14058	9162	65	00	08
Decks	Soffit - Thick Slab	Sq.m	350.00	79.92	0.00	50.49	26.65	2.78	27972	16985	61	00	08
	Wearing Surface	Sq.m	25.00	47.73	0.00	46.00	1.00	0.73	1193	873	73	00	02, 15
									71773	**43345**			

Bridge Condition Index (BCI) **60**

I_t	0	Importance Factor for Traffic
I_c	0	Importance Factor for Economic Impacts
I_w	0	Importance Factor for Bridge Width
I_p	0	Importance Factor for Bridge Profile or Alignment

Bridge Sufficiency Index (BSI) **60**

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 01**

INVENTORY DATA:

Structure Name	Maple Road Bridge		
Main Hwy/Road #	_____ On ■ Under ☐	Crossing Type:	Navigable Water ☐ Non- Navigable Water ■ Rail ☐ Road ■ Ped ☐ Other ☐
Road Name:	Maple Road		
Structure Location	200m west of trunk road , Lot 10, Con 8 Bonfield Ontario over Kaibuskong River		
Latitude	46° 14' 20.4" N	Longitude	79° 9' 7.7" W
Owner(s)	Township of Bonfield	Heritage Designation	Not Cons. ■ Cons./Not App. ☐ List/Not Desig. ☐ Desig./not List ☐ Desig. & List ☐
MTO Region	Northeastern	Road Class:	Freeway ☐ Arterial ☐ Collector ☐ Local ■
MTO District	Sudbury	Posted Speed	50 km/h No. of Lanes 1
Old County	Nipissing	AADT	_____ % Trucks _____
Geographic Twp.	Bonfield	Special Routes	Transit ☐ Truck ☐ School ☐ Bicycle ☐
Structure Type	Concrete Slab on Concrete Girders	Detour Length Around Structure	_____ (km)
Total Deck Length	11.1 (m)	Fill on Structure	_____ (m)
Overall Str. Width	5 (m)	Skew Angle	_____ (Degrees)
Total Deck Area	55.5 (m^2)	Direction of Structure	E-W
Roadway Width	4.3 (m)	No. of Spans	1 (m)
Span Lengths	11.1 (m)		

HISTORICAL DATA

Year Built	1917	Last Biennial Inspection	August 6, 2020
Current Load Limit	_____ (tonnes)	Last Bridge Master Inspection	_____
Load Limit By-Law #	_____	Last Evaluation	_____
By-Law Expiry Date	_____	Last Underwater Inspection	_____
Min. Vertical Clearance	_____ (m)	Last Condition Survey	_____

Rehabilitation History: (Date / Description)

- 1988-1989 Rehabilitation

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 01**

FIELD INSPECTION INFORMATION	
Date of Inspection:	June 03, 2022
Inspector:	Tashi Dwivedi, P.Eng., HP Engineering
Others in Party:	Nicholas Brown, HP Engineering
Equipment Used:	Digital camera, measuring tape, hammer
Weather:	Sunny
Temperature:	20 ºC

ADDITIONAL INVESTIGATION REQUIRED	Priority			Estimated Cost
	None	Normal	Urgent	
Detailed Deck Condition Survey:	X			$
Bridge Rehabilitation / Replacement Study:		X		$ 20,000.00
Detailed Coating Condition Survey:	X			$
Underwater Investigation:	X			$
Fatigue Investigation:	X			$
Seismic Investigation:	X			$
Structural Evaluation:	X			$
Load Posting - Estimated Load			Total Cost	**$ 20,000.00**

Special Notes:

A rehabilitation / replacement study is recommended due to the age of the structure and the condition of the soffit and girders; it is recommended that the structure be replaced in 6-10 years.
Approach Barrier length appears to be substandard and should be further reviewed. Approach barrier end treatments and connections to structure are substandard and should be replaced with code compliant components. Narrow diagonal cracks observed on concrete girders adjacent to abutments. Light undermining noted at both abutments. Small spall with exposed corroded reinforcement at intermediate girder west end.

Next Detailed Inspection:	June 2024

Suspected Performance Deficiencies

00	None	06	Bearing not uniformly loaded/unstable	12	Slippery surfaces
01	Load carrying capacity	07	Jammed expansion joint	13	Flooding/channel blockage
02	Excessive deformations (deflections & rotation)	08	Pedestrian/vehicular hazard	14	Undermining of foundation
03	Continuing settlement	09	Rough riding surface	15	Unstable embankments
04	Continuing movements	10	Surface ponding	16	Other
05	Seized bearings	11	Deck drainage		

Maintenance Needs

01	Lift and swing bridge maintenance	07	Repair of structural steel	13	Erosion control at bridges
02	Bridge cleaning	08	Repair of bridge concrete	14	Concrete sealing
03	Bridge handrail maintenance	09	Repair of bridge timber	15	Rout and seal
04	Painting steel bridge structures	10	Bailey bridges maintenance	16	Bridge deck drainage
05	Bridge deck joint repair	11	Animal/pest control	17	Other
06	Bridge bearing maintenance	12	Bridge surface repair		

BRIDGE **Site No.: 01**

ELEMENT DATA							
Element Group:	Approaches				**Length:**	4 m	
Element Name:	Barrier				**Width:**	-	
Location:	NE, NW, SE & SW of Structure				**Height:**	-	
Material:	Steel				**Count:**	4	
Element Type:	Steel Flex Beam on Wood Posts				**Total Quantity:**	16 m	
Environment:	Severe				**Not Inspected:**	☐	
Protection System	Hot-Dip Galvanized					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
m	-	8	4	4		08	-
Comments:	Wood posts are weathered with some checks. Dent from vehicular impact at northwest barrier. Approach Barrier length appears to be substandard and should be reviewed. Some posts of the current barrier are loose. Approach barrier end treatments and connections to structure are substandard and should be replaced with code compliant components.						
None ☐	6 – 10 years ☐	< 1 year ■	Urgent ☐				

Element Group:	Approaches				**Length:**	30 m	
Element Name:	Wearing Surface				**Width:**	4.3 m	
Location:	East & West of Structure				**Height:**	-	
Material:	Asphalt				**Count:**	2	
Element Type:	Wearing Surface				**Total Quantity:**	258 m²	
Environment:	Severe				**Not Inspected:**	☐	
Protection System	None					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
m²	-	229	25	4		-	12
Comments:	Narrow longitudinal cracks with light to moderate ravelling throughout. Potholes observed on east approach. Gravel covering on west approach and abrasions noted on the east approach.						
None ☐	1 – 5 years ■	< 1 year ☐	Urgent ☐				

Element Group:	Accessories				**Length:**	-	
Element Name:	Signs				**Width:**	-	
Location:	NE, NW, SE, SW of Structure				**Height:**	-	
Material:	Steel				**Count:**	4	
Element Type:	Hazard Signs				**Total Quantity:**	4	
Environment:	Severe				**Not Inspected:**	☐	
Protection System	Hot-Dip Galvanized					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
Each	-	2	2	-		-	18
Comments:	Abrasions observed on the Northeast signs and Northwest sign is rotated.						
None ☐	1 – 5 years ☐	< 1 year ■	Urgent ☐				

BRIDGE **Site No.: 01**

Element Group:	Barrier	**Length:**	11.1 m
Element Name:	Parapet Wall	**Width:**	0.16 m
Location:	North & South of Structure	**Height:**	1.09 m
Material:	Concrete	**Count:**	2
Element Type:	Cast-in-Place Concrete	**Total Quantity:**	24.2 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	-	14.2	10	-	08

Comments: Traffic barrier is substandard and should be replaced with a code compliant barrier. Spalls at top of wall, minor scaling, medium to wide longitudinal and transverse cracks and minor spalls observed on barrier. Moderate to severe scaling and spalls noted on base o end columns. Spalls throughout the base of the North barrier.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Deck	**Length:**	-
Element Name:	Drainage System	**Width:**	-
Location:	North & South Edges of Structure	**Height:**	-
Material:	Plastic	**Count:**	4
Element Type:	Plastic Drain Pipes	**Total Quantity:**	4
Environment:	Moderate	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
Each	-	4	-	-	-	02

Comments: Debris accumulation at all drains that require cleaning.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

Element Group:	Deck	**Length:**	11.1 m
Element Name:	Wearing Surface	**Width:**	4.3 m
Location:	Top of Deck	**Height:**	-
Material:	Asphalt	**Count:**	1
Element Type:	Wearing Surface	**Total Quantity:**	47.73 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	46	1	0.73	-	02 & 15

Comments: Medium to wide transverse crack observed at west approach and light raveling throughout. Sand/gravel on north and south sides that require cleaning.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

BRIDGE **Site No.: 01**

Element Group:	Decks	**Length:**	11.1 m
Element Name:	Soffit - Thick Slab (Exterior)	**Width:**	-
Location:	Underside	**Height:**	1.1m
Material:	Concrete	**Count:**	2
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	24.42 m²
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	14.42	10	-	-	-

Comments: Narrow cracks and light scaling observed throughout.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Decks	**Length:**	11.1 m
Element Name:	Soffit - Thick Slab (Interior)	**Width:**	5 m
Location:	Underside	**Height:**	-
Material:	Concrete	**Count:**	1
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	55.5 m²
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	36.07	16.65	2.78	-	08

Comments: Interior has moderate to locally severe scaling, narrow transverse cracks and damp stains. Delaminations noted on west end.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Beams/MLE's	**Length:**	9.2 m
Element Name:	Girder	**Width:**	0.37 m
Location:	Underside of Structure	**Height:**	0.77 m
Material:	Concrete	**Count:**	4
Element Type:	Concrete Beams	**Total Quantity:**	70.29 m²
Environment:	Moderate	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	51.69	17.60	1.0	-	08

Comments: Previous repairs to underside of girder observed. Small spalls at soffit girder interface and light with locally moderate scaling throughout. Small spall with exposed corroded reinforcement at intermediate girder west end. Narrow diagonal cracks on interior beams at supports to abutment walls. Cracks should be monitored. Stalactites noted on exterior girders.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

BRIDGE **Site No.: 01**

Element Group:	Abutments	**Length:**	1.6 m
Element Name:	Wingwalls	**Width:**	-
Location:	NE, NW, SE & SW of Structure	**Height:**	2.1 m
Material:	Concrete	**Count:**	4
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	6.72 m^2
Environment:	Benign	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m^2	-	5.55	0.67	0.5	-	08

Comments: Narrow longitudinal and transverse cracks, damp stains, and moss growth. Small spalls at northeast, southeast and southwest.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Abutments	**Length:**	5 m
Element Name:	Abutment Walls	**Width:**	-
Location:	East & West	**Height:**	2.47 m
Material:	Concrete	**Count:**	2
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	24.7 m^2
Environment:	Benign	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m^2	-	15.7	7	2	14	08

Comments: Localized area of moderate scaling and minor transverse cracks throughout. Scour at east abutment wall. Light undermining noted at both abutments.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Foundations	**Length:**	-
Element Name:	Foundations (below ground level)	**Width:**	-
Location:	Below Abutments	**Height:**	-
Material:	Unknown	**Count:**	-
Element Type:	Unknown	**Total Quantity:**	-
Environment:	Benign	**Not Inspected:**	■

Protection System	-				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
N/A	-	-	-	-	-	-

Comments: No evidence of instability, moderate scaling noted on exposed east footing.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

BRIDGE **Site No.: 01**

Element Group:	Embankment and Streams	**Length:**	-
Element Name:	Embankments	**Width:**	-
Location:	NE / NW / SE / SW	**Height:**	-
Material:	Native	**Count:**	-
Element Type:	Embankment	**Total Quantity:**	-
Environment:	Moderate	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
%	-	100	-	-	-	-

Comments: Embankments are **m**oderately sloped, well vegetated and appear stable.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Embankment and Streams	**Length:**	-
Element Name:	Streams and Waterways	**Width:**	-
Location:	Below Main Span	**Height:**	-
Material:	Native	**Count:**	-
Element Type:	Stream	**Total Quantity:**	-
Environment:	Benign	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
%	-	100	-	-	-	-

Comments: Moderate volume and high flow from south to north with no visible obstructions noted in the stream at the time of inspection.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 01**

REPAIR AND REHABILITATION REQUIRED		Priority			Estimated Cost
Element	**Repair and Rehabilitation Required**	**6 - 10 Years**	**1 - 5 Years**	**< 1 year**	
Barrier (Approaches)	Replace guiderail		X		$ -
Barrier (Deck)	Replace Deck Barrier		X		$ -
Abutments	Abutment Walls		X		$ -
Deck Soffit	Concrete repairs		X		$ -
Structure	Replace Structure	X			$ 416,000.00
					$ -
					$ -
					$ -
					$ -
				Total Cost	**$ 416,000.00**

ASSOCIATED WORK	Comments	Estimated Cost
Approaches		
Detours		$ 100,000.00
Traffic Control		$ 60,000.00
Utilities		
Right of Way		
Environmental Study		
Other		$ 10,000.00
Contingencies		
	Total Cost	**$ 170,000.00**

JUSTIFICATION

Photo 1 Structure from east approach

Photo 2 Structure from west approach

Photo 3 East approach from centre of structure

Photo 4 West approach from centre of structure

Photo 5 North elevation

Photo 6 South elevation

Photo 7 Moderate scaling, tire rutting and gravel accumulation in approach wearing surface (Typical)

Photo 8 Typical approach barrier at northeast corner with collision damage

Photo 9 Substandard connection at northwest approach barrier (Typical)

Photo 10 Moderate to severe scaling along base of north parapet wall

Photo 11 Medium to wide transverse crack noted on parapet wall (Typical)

Photo 12 Light scaling on interior deck soffit

Photo 13 Narrow crack on girder

Photo 14 Moderate to severe scaling, narrow cracks and delamination noted on deck soffit

Photo 15 West underside of Structure

Photo 16 Stalactites observed on previous concrete repairs at girders

Photo 17 Narrow longitudinal and transverse cracks, damp stains and moos grown at wingwalls (Typical)

Structure Condition Summary Form

Structure Name Sunnyside Road Bridge
Structure Number 02
Date of Inspection June 03, 2022
Project No. 22035
Consultant HP Engineering Inc.

Element Group	Element Name	Unit (Qty.)	Unit Price (MTO)	Total Element Quantity	Element Qty. in Excellent Condition (1.00)	Element Quantity in Good Condition (0.75)	Element Quantity in Fair Condition (0.4)	Element Quantity in Poor Condition (0)	Total Replacement Value (TRV)	Current Element Value (CEV)	Element Condition Index	Performance Deficiency	Maintenance Need
Abutment	Abutment Walls	Sq.m	900.00	58.28	0.00	56.28	2.00	0.00	52452	38709	74	00	02
	Wingwalls	Sq.m	350.00	57.66	0.00	55.66	2.00	0.00	20181	14891	74	00	02
Approaches	Curb and Gutters	m	25.00	7.92	0.00	2.00	4.42	1.50	198	82	41	00	08
	Wearing Surface	Sq.m	6.00	426.00	0.00	341.00	75.00	10.00	2556	1715	67	09	12
Barriers	Barrier/ Parapet Walls	Sq.m	100.00	62.50	0.00	60.70	1.60	0.20	6250	4617	74	08	02
	Hand Railings	m	100.00	46.00	0.00	46.00	0.00	0.00	4600	3450	75	08	00
Decks	Deck Top - Thick Slab	Sq.m	350.00	88.75	0.00	83.75	5.00	0.00	31063	22684	73	00	00
	Soffit - Thick Slab	Sq.m	350.00	147.50	0.00	122.00	25.50	0.00	51625	35595	69	00	00
	Wearing Surface	Sq.m	25.00	88.75	0.00	58.75	25.00	5.00	2219	1352	61	09	12
Sidewalks/ Curbs	Curbs	Sq.m	40.00	15.63	0.00	10.63	4.00	1.00	625	383	61	00	02, 08
	Sidewalks and Medians	Sq.m	150.00	30.63	0.00	25.13	5.00	0.50	4595	3127	68	00	02, 08
									176363	126603			

Bridge Condition Index (BCI) **72**

I_t	0	Importance Factor for Traffic
I_c	0	Importance Factor for Economic Impacts
I_w	0	Importance Factor for Bridge Width
I_p	0	Importance Factor for Bridge Profile or Alignment

Bridge Sufficiency Index (BSI) **72**

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 02**

INVENTORY DATA:

Structure Name	Sunnyside Road Bridge		
Main Hwy/Road #	_____ On ■ Under ☐	Crossing Type:	Navigable Water ☐ Non- Navigable Water ■ Rail ☐ Road ■ Ped ☐ Other ☐
Road Name:	Sunnyside Road		
Structure Location	100m west of Mark street , Lot 9, Con 8 Bonfield Ontario over Kaibuskong River		
Latitude	46° 13' 55.7" N	Longitude	79° 8' 56.6" W
Owner(s)	Township of Bonfield	Heritage Designation	Not Cons. ■ Cons./Not App. ☐ List/Not Desig. ☐ Desig./not List ☐ Desig. & List ☐
MTO Region	Northeastern	Road Class:	Freeway ☐ Arterial ☐ Collector ☐ Local ■
MTO District	Sudbury	Posted Speed	50 km/h No. of Lanes 2
Old County	Nipissing	AADT	_____ % Trucks _____
Geographic Twp.	Bonfield	Special Routes	Transit ☐ Truck ☐ School ☐ Bicycle ☐
Structure Type	Concrete Rigid Frame	Detour Length Around Structure	_____ (km)
Total Deck Length	12.5 (m)	Fill on Structure	_____ (m)
Overall Str. Width	9.4 (m)	Skew Angle	_____ (Degrees)
Total Deck Area	117.5 (m^2)	Direction of Structure	East / West
Roadway Width	7.1 (m)	No. of Spans	1 (m)
Span Lengths	12.5 (m)		

HISTORICAL DATA

Year Built	1982	Last Biennial Inspection	August 6, 2020
Current Load Limit	_____ (tonnes)	Last Bridge Master Inspection	_____
Load Limit By-Law #	_____	Last Evaluation	_____
By-Law Expiry Date	_____	Last Underwater Inspection	_____
Min. Vertical Clearance	_____ (m)	Last Condition Survey	_____

Rehabilitation History: (Date / Description)

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 02**

FIELD INSPECTION INFORMATION	
Date of Inspection:	June 03, 2022
Inspector:	Tashi Dwivedi, P.Eng., HP Engineering
Others in Party:	Nicholas Brown, HP Engineering
Equipment Used:	Digital camera, measuring tape, hammer
Weather:	Sunny
Temperature:	18 °C

ADDITIONAL INVESTIGATION REQUIRED	Priority			Estimated Cost
	None	Normal	Urgent	
Detailed Deck Condition Survey:		X		$ 15,000.00
Bridge Rehabilitation / Replacement Study:		X		$ 5,000.00
Detailed Coating Condition Survey:	X			$
Underwater Investigation:	X			$
Fatigue Investigation:	X			$
Seismic Investigation:	X			$
Structural Evaluation:	X			$
Load Posting - Estimated Load			Total Cost	**$ 20,000.00**

Special Notes:

Rehabilitation/replacement study is for traffic barrier only.
A detailed deck condition survey is recommended due to the age of the structure.
Approach barrier end treatments and connections to structure are substandard and should be replaced with code compliant components. Deck barrier does not meet current standard and should be replaced with a code compliant traffic barrier. Wide longitudinal crack observed at centreline of deck wearing surface. Wide transverse cracks observed on both approaches and deck wearing surface.

Next Detailed Inspection:	June 2024

Suspected Performance Deficiencies

00	None	06	Bearing not uniformly loaded/unstable	12	Slippery surfaces
01	Load carrying capacity	07	Jammed expansion joint	13	Flooding/channel blockage
02	Excessive deformations (deflections & rotation)	08	Pedestrian/vehicular hazard	14	Undermining of foundation
03	Continuing settlement	09	Rough riding surface	15	Unstable embankments
04	Continuing movements	10	Surface ponding	16	Other
05	Seized bearings	11	Deck drainage		

Maintenance Needs

01	Lift and swing bridge maintenance	07	Repair of structural steel	13	Erosion control at bridges
02	Bridge cleaning	08	Repair of bridge concrete	14	Concrete sealing
03	Bridge handrail maintenance	09	Repair of bridge timber	15	Rout and seal
04	Painting steel bridge structures	10	Bailey bridges maintenance	16	Bridge deck drainage
05	Bridge deck joint repair	11	Animal/pest control	17	Other
06	Bridge bearing maintenance	12	Bridge surface repair		

BRIDGE **Site No.: 02**

ELEMENT DATA							
Element Group:	Approaches				**Length:**	32 m (E), 23 m (W)	
Element Name:	Barrier				**Width:**	-	
Location:	NE, NW, SE & SW of Structure				**Height:**	-	
Material:	Steel				**Count:**	4	
Element Type:	Steel Flex Beam on Wood Posts				**Total Quantity:**	110 m	
Environment:	Severe				**Not Inspected:**	☐	
Protection System	Hot-Dip Galvanized					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
m	-	98	10	2		08	-
Comments:	Approach barrier end treatments and connections to deck barrier are substandard and should be replaced with code compliant end treatments and connections. Generally in good condition with few checks and weathering of wood posts. One rotted post at northwest. Small dent to steel barrier on north side at west. Broken post at southeast approach; replace damages timber posts.						
None ☐	1 – 5 years ☐	< 1 year ■	Urgent ☐				

Element Group:	Approaches				**Length:**	6 m	
Element Name:	Curbs				**Width:**	0.13 m	
Location:	East & West of Structure				**Height:**	0.2 m	
Material:	Concrete				**Count:**	4	
Element Type:	Curb				**Total Quantity:**	7.92 m^2	
Environment:	Severe				**Not Inspected:**	☐	
Protection System	None					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
Each	-	2.0	4.42	1.5		-	08
Comments:	Small spalls and abrasions noted throughout. Significant abrasion at northwest corner.						
None ☐	1 – 5 years ■	< 1 year ☐	Urgent ☐				

Element Group:	Approaches				**Length:**	-	
Element Name:	Drainage System				**Width:**	-	
Location:	Northeast of Structure				**Height:**	-	
Material:	Cast Iron				**Count:**	1	
Element Type:	Catch Basin				**Total Quantity:**	1	
Environment:	Severe				**Not Inspected:**	■	
Protection System	None					**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**			
Each	-	-	1	-		-	02
Comments:	Limited inspection, could not inspect the catch basin. Rating based on comments from previous inspection report. Municipal drain on east approach is completely blocked and overgrown.						
None ☐	1 – 5 years ☐	< 1 year ■	Urgent ☐				

BRIDGE **Site No.: 02**

Element Group:	Approaches	**Length:**	30 m
Element Name:	Wearing Surface	**Width:**	7.1 m
Location:	East & West of Structure	**Height:**	-
Material:	Asphalt	**Count:**	2
Element Type:	Wearing Surface	**Total Quantity:**	426 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	341	75	10	09	12

Comments: Large centerline longitudinal crack and medium to wide transverse cracks throughout both approaches. Potholes noted on both approaches.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Barrier	**Length:**	12.5 m
Element Name:	Parapet Wall (Interior)	**Width:**	-
Location:	North & South Sides of Structure	**Height:**	1.25 m
Material:	Concrete	**Count:**	2
Element Type:	Cast-in-Place Concrete	**Total Quantity:**	31.25 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	31.05	0.1	0.1	08	02

Comments: Narrow transverse and map cracks, damp stains and efflorescence noted. Barrier is substandard and should be replaced with a code compliant traffic barrier. Large spall was observed on top face of north wall. Graffiti noted on both walls.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

Element Group:	Barrier	**Length:**	12.5 m
Element Name:	Parapet Wall (Exterior)	**Width:**	-
Location:	North & South Sides of Structure	**Height:**	1.25 m
Material:	Concrete	**Count:**	2
Element Type:	Cast-in-Place Concrete	**Total Quantity:**	31.25 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	29.65	1.5	0.1	08	-

Comments: Exterior of barrier wall is generally in good condition with some light scaling and a few narrow cracks with efflorescence observed. Barrier is substandard and should be replaced with a code compliant traffic barrier.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

BRIDGE **Site No.: 02**

Element Group:	Barrier	**Length:**	11.5 m
Element Name:	Hand Railing	**Width:**	-
Location:	North & South Sides of Structure	**Height:**	-
Material:	Steel	**Count:**	4
Element Type:	Double Railing	**Total Quantity:**	46 m
Environment:	Severe	**Not Inspected:**	☐

Protection System	Hot-Dip Galvanized				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m	-	46	-	-	08	-

Comments: Generally in good condition with rust stains on northwest and southwest rails. Barrier is substandard and should be replaced with a code compliant traffic barrier.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

Element Group:	Sidewalks/Curbs	**Length:**	12.5 m
Element Name:	Sidewalk	**Width:**	2.3 m
Location:	North Side of Structure	**Height:**	0.15 m
Material:	Concrete	**Count:**	1
Element Type:	Cast-in-Place Concrete	**Total Quantity:**	30.63 m²
Environment:	Severe	**Not Inspected:**	■

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	25.13	5	0.5	-	02, 08

Comments: Limited inspection due to sand covered on sidewalk. Rating based on visible portion and comments from previous inspection report. Medium transverse cracks, moderate scaling, small spalls on face of sidewalk and abrasions from snow removal equipment noted.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

Element Group:	Sidewalks/Curbs	**Length:**	12.5 m
Element Name:	Curbs	**Width:**	1.1 m
Location:	South Side of Structure	**Height:**	0.15 m
Material:	Concrete	**Count:**	1
Element Type:	Cast-in-Place Concrete	**Total Quantity:**	15.63 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	10.63	4	1	-	02, 08

Comments: Generally in good to fair condition with medium transverse cracks, abrasions, and small spalls from snow removal equipment. Debris accumulation observed on curb.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

BRIDGE **Site No.: 02**

Element Group:	Deck	**Length:**	-
Element Name:	Drainage System	**Width:**	-
Location:	North Side of Structure	**Height:**	-
Material:	Steel	**Count:**	1
Element Type:	Metal drain pipes	**Total Quantity:**	1
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
Each	-	1	-	-	-	-

Comments: Deck drain at north is in good condition.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Deck	**Length:**	12.5 m
Element Name:	Wearing Surface	**Width:**	7.1 m
Location:	Top of Deck	**Height:**	-
Material:	Asphalt	**Count:**	1
Element Type:	Wearing Surface	**Total Quantity:**	88.75 m²
Environment:	Severe	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	58.75	25	5	09	12

Comments: Wide centerline longitudinal crack and medium longitudinal and transverse cracks throughout. Abrasions noted on the wearing surface.

None ☐ 1 – 5 years ■ < 1 year ☐ Urgent ☐

Element Group:	Deck	**Length:**	12.5 m
Element Name:	Deck Top (Covered)	**Width:**	7.1 m
Location:	Top of Deck	**Height:**	-
Material:	Concrete	**Count:**	1
Element Type:	Thick Slab	**Total Quantity:**	88.75 m²
Environment:	Moderate	**Not Inspected:**	■

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	83.75	5	-	-	-

Comments: Condition of deck top based on condition of wearing surface and deck soffit.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

BRIDGE **Site No.: 02**

Element Group:	Decks	**Length:**	12.5 m
Element Name:	Soffit - Thick Slab (Exterior)	**Width:**	-
Location:	North & South Underside of Structure	**Height:**	1.2 m
Material:	Concrete	**Count:**	2
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	30 m²
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	20	10	-	-	-

Comments: Narrow longitudinal and transverse cracks, efflorescence and damp stains noted. Stained map cracks noted on soffit slab.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Decks	**Length:**	12.5 m
Element Name:	Soffit - Thick Slab (Interior)	**Width:**	9.4 m
Location:	Underside of Structure	**Height:**	-
Material:	Concrete	**Count:**	1
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	117.5 m²
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	102	15.5	-	-	-

Comments: Generally in good condition with area of several narrow longitudinal cracks with origins at the abutment walls noted.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Abutments	**Length:**	4.65 m
Element Name:	Wingwalls	**Width:**	-
Location:	NE, NW, SE, & SW of Structure	**Height:**	3.1 m
Material:	Concrete	**Count:**	4
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	57.66 m²
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
m²	-	55.66	2	-	-	02

Comments: Generally in good condition with narrow cracks with efflorescence and damp stains noted. Graffiti observed on southeast wall.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

BRIDGE **Site No.: 02**

Element Group:	Abutments	**Length:**	9.4 m
Element Name:	Abutment Walls	**Width:**	-
Location:	East & West of Structure	**Height:**	3.1m
Material:	Concrete	**Count:**	2
Element Type:	Cast-In-Place Concrete	**Total Quantity:**	58.28 m²
Environment:	Benign	**Not Inspected:**	☐

Protection System	None				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
m²	-	56.28	2	-	-	02

Comments: Full vertical height narrow to medium crack at centre of each abutment wall extending part way into soffit. Graffiti on both abutments.

None ☐ 1 – 5 years ☐ < 1 year ■ Urgent ☐

Element Group:	Foundations	**Length:**	-
Element Name:	Foundations (below ground level)	**Width:**	-
Location:	Below Structure	**Height:**	-
Material:	Unknown	**Count:**	-
Element Type:	Unknown	**Total Quantity:**	-
Environment:	Benign	**Not Inspected:**	■

Protection System	Unknown				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
N/A	-	-	-	-	-	-

Comments: No evidence of foundation instability / settlement noted at the time of inspection.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Embankment and Streams	**Length:**	-
Element Name:	Embankments	**Width:**	-
Location:	NE, NW, SE, & SW of Structure	**Height:**	-
Material:	Native	**Count:**	4
Element Type:	Embankment	**Total Quantity:**	4
Environment:	Benign	**Not Inspected:**	☐

Protection System	Rock Protection				**Performance Deficiencies**	**Maintenance Needs**
Units	**Excellent**	**Good**	**Fair**	**Poor**		
each	-	4	-	-	-	-

Comments: Moderate to steep slope, well vegetated and appear stable with rocks for slope protection at base of embankment.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 02**

Element Group:	Embankment and Streams	**Length:**	-
Element Name:	Slope Protection	**Width:**	-
Location:	NE, NW, SE, & SW of Structure	**Height:**	-
Material:	Rocks	**Count:**	4
Element Type:	Slope Protection	**Total Quantity:**	4
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
each	-	-	4	-	-	-

Comments: Generally in fair condition. Few rocks on slope, mainly at base.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

Element Group:	Embankment and Streams	**Length:**	-
Element Name:	Streams and Waterways	**Width:**	-
Location:	Below Structure	**Height:**	-
Material:	Native	**Count:**	-
Element Type:	Stream	**Total Quantity:**	-
Environment:	Benign	**Not Inspected:**	☐
Protection System	None		

Units	Excellent	Good	Fair	Poor	Performance Deficiencies	Maintenance Needs
All	-	All	-	-	-	-

Comments: High volume and low flow from south to north with no visible obstructions.

None ■ 1 – 5 years ☐ < 1 year ☐ Urgent ☐

MUNICIPAL STRUCTURE INSPECTION FORM

BRIDGE **Site No.: 02**

REPAIR AND REHABILITATION REQUIRED		Priority			Estimated Cost
Element	**Repair and Rehabilitation Required**	**6 - 10 Years**	**1 - 5 Years**	**< 1 year**	
Barrier	Install a code compliant barrier			X	$ 55,000.00
Approach	Install code compliant end treatments & Connections			X	$ 48,000.00
				Total Cost	**$ 103,000.00**

ASSOCIATED WORK	Comments	Estimated Cost
Approaches		
Detours		
Traffic Control		
Utilities		
Right of Way		
Environmental Study		
Other		
Contingencies		
	Total Cost	**$**

JUSTIFICATION

Photo 1 Structure from east approach

Photo 2 Structure from west approach

Photo 3 East approach from centre of structure

Photo 4 West approach from centre of structure

Photo 5 North elevation

Photo 6 South elevation