2016 Bridge Inspections

Town of Gananoque

- June 2016 –

Keystone Bridge Management Corp.

Contents

Introduction

Keystone Bridge Management Corp. was retained by the Town of Gananoque to provide assessments for all of its bridges. The field work was completed on May 5, 2016 by Messrs. John Landry, and Steve Reid, C.E.T. Also assisting was Cole Zanchetta, a third year civil engineering student. A total of nine bridges were inspected of which three were road bridges and the remainder pedestrian bridges.

Biennial inspection of bridges and culverts with a span equal to or exceeding 3.0 metres is mandated by provincial statute in Ontario. The legislation is found in the Public Transportation and Highway Improvement Act. Most municipalities in Ontario comply with this legal requirement. Municipalities seeking provincial funding for structure capital improvements are required to demonstrate their bridges receive a biennial inspection. Increasingly, the government is expecting municipalities to have an asset management plan as well.

A biennial bridge inspection is prescribed to follow the Ontario Structure Inspection Manual, OSIM. However the regulations (O.Reg.104/97) allow variations from OSIM where:

(a) the variation is not a marked departure from the Ontario Structure Inspection Manual; and
(b) the variation does not adversely affect the safety and mobility of people and goods. O. Reg. 472/10, s. 2.

Keystone Bridge Management Corp. has created a significant improvement to conventional OSIM reporting. Keystone's proprietary approach complies with the spirit and intent of the Regulation, but takes bridge inspection and management an order of magnitude beyond that contemplated in OSIM. Keystone has eliminated most of the subjectivity associated with the Excellent, Good, Fair, Poor rating system of OSIM. Keystone utilizes a deterministic depreciation model to describe the transition of a bridge from excellent to fair, and supplements this by noting damage and defects in components at the time of inspection. This approach complements modern asset management practises. It is something that OSIM on its own cannot do.

Capital Needs

The capital needs were estimated with an estimating tool contained in the Keystone Bridge Management System. This utility covers common items that include deck replacement, expansion joint replacement, barrier wall replacement, waterproofing and paving. The utility provides guidance for traffic management costs. All costs are marked up 20% to account for contingencies and engineering. Contract administration costs are not included.

The Capital Needs for the Town of Gananoque are summarized in a separate included report appended at the end of this Report.

The **Capital Needs Report** is organized from the most immediate needs to the less immediate needs by the Recommended Year sub-headings. Two capital needs pictures are graphically presented at the end of the Report. A Grand Total of **$4,916,000** is the projected capital need from the present to 2020.

The capital needs identify two structures that ideally should be replaced in the next five years or so. This is described further in the following sub-headings.

The King Street Pedestrian Bridge is also discussed further.

Rail to Trail Bridge

This bridge is located immediately upstream of the dam. It consists of three spans of a railway bridge that was converted to pedestrian use. The girder ends at the piers and abutments are exhibiting severe corrosion with perforation. The west end of this bridge is experiencing web crippling of the girders and is slowly failing.

The bridge is still safe for pedestrian use but could “settle” due to girder web failure, and result in alarm to the public. It would be prudent for the Town to not risk losing the public’s confidence in this trail bridge by replacing it before the girder webs fail much further.

Hudson Bridge

The Hudson Bridge was load tested in 2014. Further information regarding this bridge is provided in the load testing report.

The Hudson Bridge is exhibiting severe corrosion and rust perforation of its primary structural components such as the floor beams and truss compression members. As it continues to corrode it is becoming increasingly structurally unreliable. It should not be relied on to carry traffic of any description after 2030. Until then it can be managed by load posting. However, the Town is assuming some risk by continuing to maintain the bridge open to traffic. Ideally the bridge should be taken out of service and replaced with a modern bridge. The recommended year of 2020 is flexible and represents a reasonable time for the Town to respond and obtain funding for a replacement bridge.

The historical attributes of this bridge could be retained by repurposing the bridge as a pedestrian bridge. However the bridge would require significant reworking and restoration before it is repurposed as anything other than a museum artifact.

King Street Pedestrian Bridge

This bridge is located immediately downstream of the King Street Bridge. It is a two span railway through-plate girder bridge repurposed as an exceptionally wide pedestrian bridge.

The wood deck of this bridge experienced a punching type failure from a maintenance vehicle the past winter. Further investigation of the failure revealed decay of the deck planking and it is suspected that the supporting wood stringers are also experiencing scattered decay.

It is recommended to plan on replacing the timber deck by 2018.

The remainder of the bridge has been largely neglected and is in a state of very poor repair. There are gaping holes from corrosion in parts of the bridge's floor system. When this level of severe corrosion is visible from standing beneath the bridge, one has to wonder how severe the corrosion is in other less visible areas of the bridge.

The Town should close this bridge in the winter so that further salt exposure can be reduced.

This bridge deserves a very comprehensive detailed inspection to more fully assess the condition of inaccessible areas of the bridge. Only a detailed assessment such as this can be relied on to better determine the fate of the bridge.

In the absence of better information, it is recommended that the Town plan on closing the King Street Pedestrian Bridge by not later than 2025.

The capital needs groupings in the Capital Needs Report suggests relative priority, but other considerations such as traffic demand, risk of failure, and combining projects should also be considered to establish actual priorities.

The capital estimates provided are very approximate. Environmental considerations, difficult foundations, dewatering requirements, and traffic management costs can be very significant variables that can only be estimated accurately at the preliminary design stage.

Bridge Maintenance

Detailed maintenance needs are captured in the **Bridge Maintenance Report** appended at the end of this Report.

Bridge cleaning is widely recognized as an important maintenance activity. Ideally spring maintenance should include a thorough sweeping of the bridges' horizontal

surfaces, and power washing of the bridge seats especially where expansion joints are open or the seal is compromised. Early sweeping removes brine laden winter sand from the bridge decks. This greatly helps forestall the onset of corrosion of the reinforcing steel. Expansion joints should be cleaned of debris caught inside the gaps in the spring and fall of each year.

The Hudson Bridge is in urgent need of a very thorough cleaning in order to reduce the present rate of corrosion.

Performance Deficiencies

The various components in and around a structure all have a purpose or functionality. Where the purpose or functionality is compromised, it is recorded as a performance deficiency. Appended at the end of this report is a Performance Deficiencies Report.

These deficiencies are often difficult or expensive to remedy. Ideally, a replacement structure should address the present performance deficiencies. These deficiencies should be reviewed when prioritizing the capital program.

Performance Deficiencies require risk management strategizing by the owner.

Triple-D Inspections

The individual bridge inspection reports are provided separately from this Summary Report. The reports are a slight departure from OSIM Reports in that the field inspection effort is directed at identifying deterioration and performance issues as explained below.

Keystone's approach to Bridge Management is fundamentally different from all others anywhere in the world. Keystone models bridge assets in terms of their **D**epreciation, **D**efects, and **D**amage. This "**Triple-D**" approach is unique to Keystone, and is the soundest and most reliable method ever conceived to accurately ascertain or predict the condition of a bridge.

The "**Triple-D**" approach is imbedded in a highly sophisticated MS Access database application developed by Keystone. The design of the database easily facilitates porting the data to any other application, and is highly customizable to any client.

Every bridge is modeled in terms of its components. Each component has a life expectancy and value based on its material and geometric properties. As a bridge ages, the components depreciate in accordance with a simple depreciation function that is client specified. Either a straight-line or parabolic depreciation function is recommended. The overall depreciation of a structure is expressed in terms of the sum of the depreciation of all the components.

This deterministic approach to assessing the condition of a bridge provides an extremely reliable, reproducible and predictable approach to stating the condition of not only a bridge, but an entire bridge inventory.

Imagine a municipality that was incorporated in 1900. Every year on its anniversary it builds an identical bridge, for 100 years running until 2000. For simplicity, presume each bridge is constructed of only one component, and the deemed life of that component is exactly 100 years. From this example, it is easy to see that the oldest bridge constructed in 1901 has completely depreciated and now has zero value. Whereas, the centennial bridge constructed in 2000 would on its completion retain its full value. If straight line depreciation is assumed, the centennial bridge would be depreciated to 91% of its original value in 2009. In 2001, the depreciation of the entire bridge inventory of 100 bridges would be 50% assuming straight-line depreciation. It is this simple straight-forward approach that Keystone has adopted.

Defects are any relatively benign but unintended changes to a bridge that cannot be attributed to normal wear and tear, or aging. Mild to moderate scaling of a concrete surface is an example of a **D**efect. Early alkali-aggregate reactivity in concrete is another example of a **D**efect. **D**amage is any change to a structure that reduces the section properties or intended performance of a structural component. **D**amage includes spalling, delamination, disintegration or severe cracking of concrete; plastic deformation or gouging of steel, or decay of timber.

Defects and **D**amage are detected, quantified, qualified and recorded when the bridge is inspected. The **D**epreciated value of a component is adjusted to account for **D**efects or **D**amage. Keystone recommends that any component that is more than 20% **D**amaged is considered as fully **D**epreciated. Ten percent **D**efects is equal to one percent **D**amage.

The concept of **D**efects and **D**amage is very easily understood and applied as compared to the more traditional subjective ratings of Excellent, Good, Fair or Poor. Consequently, the information resulting from bridge inspections is an order of magnitude more reliable and accurate.

Understanding the Inspection Forms

Inspection reports are headed **Bridge Inspection Report or Culvert Inspection Report**. In the top-right of each form is a general arrangement photograph of the structure taken on the day of inspection.

In the top-left box is basic tombstone data as follows:

- Name of the bridge in large bold font
- The type of bridge or culvert

- The road the structure is on
- Name of the Owner
- Structure Location Information
- The Owner specified Structure Identification Number (Site ID)
- District
- Year of original construction per legacy information.
- Length of the Bridge per legacy information
- Width of the Structure per legacy information
- Number of spans
- The span arrangement is shown in metres for bridges only.

In the next box down is recorded the date of inspection, principal inspector, assistant inspector, the weather for the entire day, and the approximate temperature range on the day of inspection.

In the small box under the General Arrangement photograph is shown the AADT per legacy information, (or updated as the case may be), the number of available traffic lanes crossing the structure, the structure skew angle in degrees, and the general direction of the road that crosses the structure, for example E-W means East to West. Accompanying this information are the Latitude and Longitude at the centre of the structure expressed in decimal degrees. Also include is data where applicable or available for the road width, percent trucks, and any load posting.

The Component Inspection Information is recorded next. The number of components varies based on the complexity of the structure. In the left column for each component is listed:

- Component name in bold with the component count in parenthesis.
- The general category for the component in Italics.
- The Length, Width, Diameter, & Height of the component in metres based on legacy information, or field measure, and as appropriate.

Please note that measurements for substructure items are approximate only.

The second column of the Component Inspection Information captures the actual field inspection information for each component. Information is generally recorded on an exception basis. If there are no annotations it can be safely assumed that the component is generally in satisfactory condition for its age. The following sub-headings explain in detail the inspection information:

Defects

Defects are relatively benign changes to a bridge component that cannot be attributed to simple aging. They result from a material Defect or lack of required maintenance. The

amount of Defects is estimated to the nearest five percent based on visual inspection of all similar components included in the component count. For example, bridges have typically four wing walls, so the estimated defects are applied over all four wing walls. The Defects are characterized with a qualifying comment that is computer generated from drop-down lists in the Keystone Bridge Management System. Where Defects exceed 10% they are highlighted in Yellow.

Damage

Damage is any change to a structure that alters its structural form, strength, or function. Damage may result from untended Defects. The Damage is estimated and reported analogous to Defects, except a level of accuracy of plus or minus 2% or better is maintained. Where Damage equals 5% to 10% it is highlighted in Amber. When Damage is equal to or greater than 10% it is highlighted in Red.

Red and amber flags appear to the right if damage is considered as critical or major respectively. This way an otherwise small amount of damage is brought to attention if the severity warrants it.

Maintenance

Maintenance recommendations are selected from a component specific drop-down menu in the Keystone Bridge Management System. Up to two maintenance recommendations can be selected and reported.

Capital Recommendation

Capital Recommendations are selected from a list of three options; Do Nothing, Repair, or Replace. The number of years in the future the Capital investment should take place is based on the inspector's best judgement, without considering the optimal timing for a comprehensive rehabilitation or replacement.

Performance

If a component has a functional impairment, this may be noted in the Performance comment. The Performance comment is created through a context sensitive drop-down menu. The performance comment only appears when a performance defect has been identified.

Note

Where the above categories are insufficient to capture the inspection information, Keystone adds an unlimited comment at the bottom of the second column.

Capital Needs Cost Estimate Breakdown

At the end of each Inspection Report is a section titled as per the above.

Capital costs estimates are automatically generated by the Keystone Bridge Management System for standard items which include:

- Deck Replacement
- Deck Concrete Overlay (O'Lay)
- Barrier Wall Replacement (B/Wall)
- Waterproof & Pave (WP&P)
- Expansion Joint (X-Jnt)

Unit prices for the above work are based on MTO and client supplied data and extensions are based on geometric data residing in the KBMS database. The unit costs are indicated on the form.

The Contract Administration & Contingencies is a straight 20% mark-up. The Estimated Traffic Management & Civil Items is usually included and is based on experience and the nature of the capital work.

Recommendations for additional investigations are included on the same page as the Capital Needs. A summary comment regarding the structure is included under the Inspection Comments heading.

At the bottom of the last page of each inspection report the BCI number, Straight-Line Depreciation percentage and Parabolic Depreciation percentage is expressed.

Inspection Images

All of the photographs taken at the time of inspection are displayed six per page in the section immediately following the Inspection Report. The Image Number is displayed in the top-left corner of each photo. A brief caption is provided below each photo. For a more detailed look at a photo, the original images are available upon request for a period of two years after the inspection.

Digital Copy

This entire report is reproduced in PDF format on a DVD disc shipped with this report. Individual inspection reports are included in their own folder together with reduced images.

Limitations

Keystone Bridge Management Corp. endeavours to provide valuable bridge asset management services that help its clients to prioritize and fund their bridge and large culvert capital and maintenance needs. Furthermore we advise of structural performance deficiencies and attendant risks. In short, we help our clients sustain the life of their road structure inventory commensurate with economic and risk management considerations.

Keystone provides these services in a fiercely competitive business environment. Our business value in terms of completing a routine biennial bridge inspection is to provide a competent highly experienced lead inspector and a student assistant. Our explicit attitude for the field work is “it takes as long as it takes.” The Client needs to understand however the following caveats with respect to the reporting provided herein:

1. Field measurements are only to an accuracy that reasonably supports depreciation modelling of the structure and should not be relied upon for any other purpose.
2. The inspection is mostly visual in nature and thus components of the structure that are not reasonably accessible due to depth of water, height, and the like will have a compromised assessment.
3. Ambient lighting and debris can hide or disguise defects and damage.
4. Heavy traffic will preclude a thorough inspection of deck surfaces.
5. Latent defects are not normally discoverable in a routine inspection.
6. There will always be inherent subjectivity when assessing defects and damage.
7. Cost estimates are based on average historical information and are not necessarily current or suitable for local conditions.
8. Where in our opinion the conventional visual inspection is insufficient to adequately and responsibly assess the structure we will recommend follow-up investigations such as boat or ice access inspections, bridge deck condition surveys, and other enhanced inspection methods.

Closing

Keystone Bridge Management Corp. is pleased to report on the condition of the Town of Gananoque vehicle and pedestrian bridges. Should there be any lingering concerns or additional information required with respect to this assignment, then Keystone will be happy to respond.

We trust the services rendered are complete, and in full keeping with the Terms of Reference. It is Keystone's sincerest desire that the recommendations stemming from this work will be helpful to the Town of Gananoque in keeping their structural inventory, safe, sound, serviceable, and sustainable. Keystone strives to help you get the most out of your road structure assets.

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

Bridge Inspection Report

Black (Snappers) Bridge

Truss-Pony
Gananoque Waterfront Trail
Town of Gananoque
Gananoque River
Gananoque Waterfront Trail 400m north of Nalon Rd.

Site ID **1**
District
Built **1924**
Length **36 m**
Width **6.2 m**
Spans **1**

Span Arrangement (m's) **36**
Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.33887200**
Lanes	**0**	**Longitude**	**-76.17497200**
Skew	**0 °**	**Orient**	**N-S**
Speed	**0 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Timber Wear Surface (1)
Wear Surface
Length: ***36 m***
Width: ***1 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Plank on tie wear surface is in good overall condition. Little change 2016.

Timber Post Timber Rail (2)
Railings
Length: ***36 m***
Width:
Height: ***1.5 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Railings are secure and in good condition.

Diagonal/Post/Hangar (20)
Diagonals
Length:
Width: ***0.24 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove debris**
Capital Rec. **None**
Debris collected at bottom chord gussets.

Component Inspection Information

Diagonal/Post/Hangar (10)
Hangars
Length:
Width: ***0.24 m***
Height: ***3.5 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove debris**
Capital Rec. **None**
Debris collected at gussets at bottom chord.

Half Through or Pony (2)
Bottom Chord
Length: ***36 m***
Width:
Height: ***0.48 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove debris** **Partial Inspection**
Capital Rec. **None**
Good condition except for debris at gusset locations.

Half Through or Pony (2)
Top Chord
Length: ***36 m***
Width:
Height: ***0.48 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Good condition given age.

Steel Floor Beam (7)
Floor Beams
Length: ***5.8 m***
Width:
Height: ***0.84 m***

Defects **2.0%** **Minor Corrosion**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
Floor beams appear to be in good condition. Could not be fully inspected 2016.

Stringers (24)
Stringers
Length: ***5.8 m***
Width:
Height: ***0.51 m***

Defects **2.0%** **Minor Corrosion**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
Stringers appear to be in good condition. Minor loss of coating.

RC Abutment Wall (2)
Abutment Stem
Length: ***7.35 m***
Width:
Height: ***3.75 m***

Defects 40.0% **Moderate AAR Cracking, Minor Leaching/Seepage, Moderate Graffiti**
Damage **4.0%** **Minor Disintegration, Minor Delamination**
Maintenance **None**
Capital Rec. **None**
Age related deterioration. Disintegration encroaching on south bearings, most notably the SE corner.

Component Inspection Information

RC Ballast Wall (2)
Ballast Wall
Length: *7.35 m*
Width:
Height: *1.05 m*

Defects **2.0%** **Minor AAR Cracking**
Damage **0.0%**
Maintenance **Repair Damage** **Partial Inspection**
Capital Rec. **None**
Timber blocking at both deck ends is decayed and requires replacement as a maintenance item.

RC Wing Walls (4)
Wing Walls
Length: *4.2 m*
Width:
Height: *3.15 m*

Defects 40.0% **Moderate AAR Cracking, Minor Leaching/Seepage**
Damage **1.0%** **Moderate Disintegration, Minor Delamination**
Maintenance **None**
Capital Rec. **None**
Similar condition as abutments.

Steel Sliding Plate (4)
Abutment Bearings
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove debris**
Capital Rec. **None**
Debris around bearings should be removed. Disintegration of abutment wall encroaching on bearings.

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
No concerns.

Embankment (2)
Embankment

Defects **10.0%** **Moderate Erosion**
Damage **0.0%**
Maintenance **Slope revetment**
Capital Rec. **None** **Perf Def: Over-steepened**
Southeast timber retaining wall has failed. Excessive erosion should be repaired. Timber retaining wall in other corners beginning to deteriorate.

Delineator (4)
Signs
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **Replace Sign**
Capital Rec. **None**
Missing one delineator in SW corner.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	223.2	$350	$0
Deck Replacement	✘	m²	223.2	$2,000	$0
Barrier Wall Replacement	✘	m	60.0	$1,500	$0
Expansion Joint	✘	m	12.4	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	0.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work

Retaining Walls $40,000

Structural Items Subtotal	**$40,000**
Mobilization General Sitework 10%	**$10,000**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$10,000**
Total Rehabilitation Cost Estimate	***$60,000***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✓	✘	✘	✘

Recommended Capital Year **2017**

Recommended Capital Work Summary

Retaining Walls

Inspection Comments

Thorough cleaning of bottom chord of truss and bearing seat required. Plan for replacing timber retaining walls in all four corners. Replace timber blocking at both ballast walls.

Bridge Condition Index: 59.6 **Parabolic Depreciation: 5.8 %** **Straight Line Depreciation: 4.1 %**

Estimated Replacement Value: $2,114,000 **Estimated Remaining Service Life: 28 Years**

Image 85

East elevation

Image 81

South approach

Image 82

North approach

Image 83

Upstream channel west

Image 84

Downstream channel east

Image 86

Typ deck

Image 87

West truss

Image 88

Rotted timber south end

Image 89

Typical panel point debris

Image 90

East truss

Image 91

Rotted timber north ballast

Image 92

Typical rust on northeast diagonal

Image 93

Erosion southeast corner

Image 94

Southeast wing wall

Image 95

Soffit

Image 96

North abutment wall

Image 97

South abutment wall

Image 98

Delamination at southeast bearing

Bridge Inspection Report

Wood Bridge

Timber Beam
Gananoque Waterfront Trail
Town of Gananoque
Ditch
Gananoque Waterfront Trail
250m north of Nalon Rd

Span Arrangement (m's) **5.8**
Feature Under **Water**

Site ID **2**
District
Built **2004**
Length **5.8 m**
Width **1.22 m**
Spans **1**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.33768100**
Lanes	**0**	**Longitude**	**-76.17521700**
Skew	**0 °**	**Orient**	**E-W**
Speed	**0 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Timber-Sawn (1)
Deck Surface
Length: ***5.8 m***
Width: ***1.22 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Secure, no concerns.

Timber Post Timber Rail (2)
Railings
Length: ***5.8 m***
Width:
Height: ***1.1 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Secure, no concerns.

Treated Sawn Timber (2)
Girders
Length: ***5.8 m***
Width: ***0.25 m***
Height: ***0.25 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Girders are presumed cedar logs and are in reasonable condition.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	7.1	$350	$0
Deck Replacement	✘	m²	7.1	$2,000	$0
Barrier Wall Replacement	✘	m	29.8	$1,500	$0
Expansion Joint	✘	m	2.4	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	4.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work $0

Structural Items Subtotal	**$0**
Mobilization General Sitework 10%	**$0**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$0**
Total Rehabilitation Cost Estimate	***$0***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✘	✘	✘	✘

Recommended Capital Work Summary

Recommended Capital Year **0**

Inspection Comments

No concerns. Little change in 2016.

Bridge Condition Index: 85.0 **Parabolic Depreciation: 86.7 % Straight Line Depreciation: 63.9 %**

Estimated Replacement Value: $87,000 **Estimated Remaining Service Life: 15 Years**

Image 101

South elevation

Image 99

West approach

Image 100

East approach

Image 102

Typical deck

Image 103

Typical soffit

Image 104

Typical abutment and bearing

Bridge Inspection Report

Hudson Bridge

Truss-Through
Machar St
Town of Gananoque
Gananoque River
Machar St. 100m east of River St.

Site ID **3**
District
Built **1911**
Length **39.1 m**
Width **5.2 m**
Spans **1**

Span Arrangement (m's) **39.1**
Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.33072800**
Lanes	**1**	**Longitude**	**-76.16758100**
Skew	**0 °**	**Orient**	**E-W**
Speed	**50 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Timber-Laminated (1)
Deck Surface
Length: ***39.1 m***
Width: ***3.9 m***
Height:

Defects 20.0% **Moderate Checking**
Damage 30.0% **Moderate Wear, Major Wear**
Maintenance **Local repair**
Capital Rec. **Replace in 1 year**

Timber has major rutting, allowing screws and steel spacers to protrude through deck. Recommend placing asphalt padding until deck can be replaced.

Soffit (1)
Deck Soffit
Length: ***39.1 m***
Width: ***4 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**

Laminated timber on steel tie deck. Lack of waterproofing is allowing water to reach steel stringers below deck surface.

Thrie Beam G/R (2)
Railings
Length: ***39.1 m***
Width:
Height: ***0.7 m***

Defects **0.0%**
Damage **1.0%** **Minor Impact**
Maintenance **None**
Capital Rec. **None**

Good condition, secure. Approach guiderail in NE corner has impact damage.

Component Inspection Information

Bottom Chord (2)
Bottom Chord
Length: ***39.1 m***
Width:
Height: ***0.1 m***

Defects 100.0% **Moderate Corrosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Eye bars have uniform tension. Reasonable condition given age. One eye bar in SE corner damaged (bent) from handling.

Diagonal/Post/Hangar (4)
Diagonals/Hangars
Length: ***0.25 m***
Width: ***0.2 m***
Height:

Defects 100.0% **Moderate Corrosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Perf Def: Connection
Load test completed in 2014. Under loading all hangars receive tension.

Through (2)
Top Chord
Length: ***39.1 m***
Width: ***4.5 m***
Height: ***2.5 m***

Defects 95.0% **Moderate Corrosion, Major Corrosion**
Damage 5.0% **Moderate Perforation**
Maintenance **None**
Partial Inspection
Capital Rec. **None**
Perforations located in web and top flange of end diagonals.

Through (2)
Portal
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Good.

Steel Floor Beam (6)
Floor Beams
Length: ***5 m***
Width:
Height: ***0.69 m***

Defects 95.0% **Moderate Corrosion**
Damage 5.0% **Minor Perforation, Moderate Section Loss**
Maintenance **None**
Partial Inspection
Capital Rec. **None**
Perforations noted on two west most floor beams. A boat inspection is recommended to review condition of all floor beams from close up.

Steel Floor Beam (49)
Steel Deck Ties
Length: ***6.5 m***
Width:
Height: ***0.27 m***

Defects **5.0%** **Minor Corrosion**
Damage **0.0%**
Maintenance **None**
Partial Inspection
Capital Rec. **None**
These members are part of the deck system and a retrofit to the bridge. No concerns noted.

Component Inspection Information

Stringers (3)
Stringers
Length: ***39.1 m***
Width:
Height: ***0.6 m***

Defects **10.0%** **Moderate Corrosion**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
These are not original to the bridge. corrosion caused by lack of waterproofing on deck.

RC Abutment Wall (2)
Abutment Stem
Length: ***5 m***
Width: ***0.2 m***
Height: ***1.4 m***

Defects **5.0%** **Minor Leaching cracks, Minor Scaling**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Abutments have light scaling and leaching cracks.

RC Ballast Wall (2)
Ballast Wall
Length: ***5 m***
Width:
Height: ***1 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
No concerns.

Steel Sliding Plate (4)
Abutment Bearings
Length:
Width:
Height:

Defects 90.0% **Moderate Corrosion**
Damage 10.0% **Moderate Section Loss**
Maintenance **Power Wash**
Capital Rec. **None** **Perf Def: Seizing**
Severely corroded. Debris around bearings is increasing rate of corrosion in bearings and end Diagonals.

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Deep channel with current.

Embankment (2)
Embankment

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Well vegetated.

Component Inspection Information

Delineator (4)	Defects **0.0%**
Signs	Damage **0.0%**
Length:	Maintenance **None**
Width:	Capital Rec. **None**
Height:	***In place. Cautionary load posting sign in place at both ends.***

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	203.3	$350	$0
Deck Replacement	✘	m²	203.3	$2,000	$0
Barrier Wall Replacement	✘	m	63.1	$1,500	$0
Expansion Joint	✘	m	10.4	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	0.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work

Replace $3,000,000

Structural Items Subtotal	**$3,000,000**
Mobilization General Sitework 10%	**$300,000**
Estimated Traffic Management & Civil Items	**$10,000**
Contract Admin & Contingencies 20%	**$662,000**
Total Rehabilitation Cost Estimate	***$3,972,000***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✓	✓	✓	✓

Recommended Capital Year **2020**

Recommended Capital Work Summary

Replace

Inspection Comments

The floor system and end diagonals are corrosion perforated and can not be cost effectively repaired. Bridge requires black and white legal load posting signs with a supporting load limit bylaw. Immediate cleaning of bottom chords required. Further investigation and documentation recommended. Without major repairs it will probably be necessary to close the bridge to traffic in about eight years.

Bridge Condition Index: 62.7 **Parabolic Depreciation: 33.4 % Straight Line Depreciation: 21.8 %**

Estimated Replacement Value: $2,401,000 **Estimated Remaining Service Life: 5 Years**

Image 114

North elevation

Image 105

East approach

Image 106

West approach

Image 107

South elevation

Image 108

West floor beam perforation

Image 109

West abutment wall

Image 110

Typical soffit

Image 111

West deck end

Image 112

Pitted truss northwest end diagonal

Image 113

Perforated truss northwest end diagonal

Image 115

Screws protruding through deck

Image 116

Perforated web in northeast diagonal

Image 117

East deck end

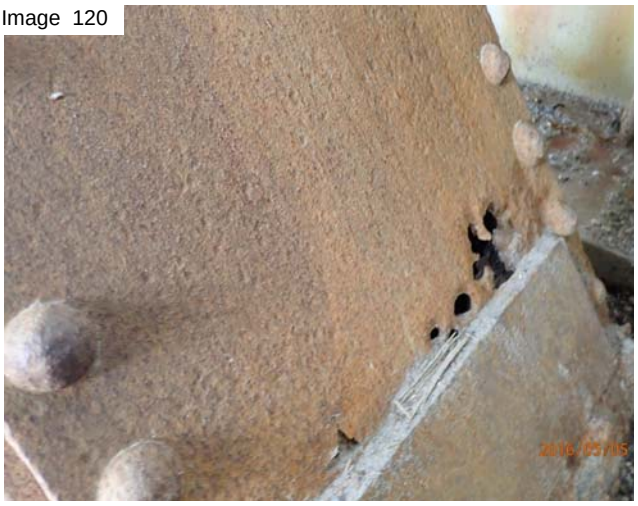
Image 118

Typical deck

Image 119

East abutment wall

Image 120



Perforated web in southeast diagonal

Image 121

East soffit view

Image 122

Downstream channel

Image 123

Northeast guardrail

Bridge Inspection Report

Rail to Trail Bridge

Timber Beam
Gananoque Waterfront Trail
Town of Gananoque
Gananoque River
Gananoque Waterfront Trail
150m east of River St

Site ID **4**
District
Built **1920**
Length **31.6 m**
Width **1.8 m**
Spans **3**

Span Arrangement (m's) **10.1,9.5,10.1**
Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.32848600**
Lanes	**0**	**Longitude**	**-76.16688900**
Skew	**0 °**	**Orient**	**E-W**
Speed	**0 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Timber-Sawn (1)
Deck Surface
Length: ***31.6 m***
Width: ***4 m***
Height: ***0.2 m***

Defects **0.0%**
Damage 30.0% **Major Decay, Moderate Decay**
Maintenance **None**
Capital Rec. **Replace in 1 year**
Timber 8" x 8" railroad ties display severe decay.

Timber Wear Surface (1)
Wear Surface
Length: ***31.6 m***
Width: ***1.8 m***
Height:

Defects **0.0%**
Damage 5.0% **Minor Wear**
Maintenance **None**
Capital Rec. **Replace in 1 year**
Some damage down middle from unknown source. Old railroad ties are decaying and supporting vegetation growth.

Wood Post Wood Rail (2)
Barrier
Length: ***31.6 m***
Width:
Height: ***1.4 m***

Defects **0.0%**
Damage 5.0% **Moderate Decay**
Maintenance **Replace Bracing**
Capital Rec. **None**
Cleats supporting rakers exhibit decay and require spot replacement. Railing system is secure.

Component Inspection Information

Steel-Rolled (6)
Girders
Length: ***31.6 m***
Width:
Height: ***0.6 m***

Defects 88.0% **Moderate Corrosion**
Damage 12.0% **Critical Section Loss, Critical Perforation**
Maintenance **None** **Partial Inspection**
Capital Rec. **Repair in 1 year** **Perf Def: Sagging**
The girder ends at the abutments and piers are severely corroded with perforations and web crippling. See images.

RC Abutment Wall (2)
Abutment Stem
Length: ***3.9 m***
Width:
Height: ***2 m***

Defects **2.0%** **Minor Scaling, Minor Leaching/Seepage**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
No concerns.

RC Shaft (2)
Pier Column/Shaft
Length: ***3.9 m***
Width:
Height: ***3 m***

Defects **2.0%** **Minor Scaling, Minor Leaching/Seepage**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
No Concerns.

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Deep channel with current.

Embankment (2)
Embankment

Defects **5.0%** **Moderate Erosion**
Damage **0.0%**
Maintenance **Slope revetment**
Capital Rec. **None**
Stable, groomed, with some local erosion. An old timber retaining wall in NW quadrant has failed.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	56.9	$350	$0
Deck Replacement	✘	m²	56.9	$2,000	$0
Barrier Wall Replacement	✘	m	55.6	$1,500	$0
Expansion Joint	✘	m	3.6	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	0.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work

Replace $500,000

Structural Items Subtotal	**$500,000**
Mobilization General Sitework 10%	**$50,000**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$110,000**
Total Rehabilitation Cost Estimate	***$660,000***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✓	✘	✘	✓	✓	✓	✘

Recommended Capital Year **2017**

Recommended Capital Work Summary

Replace

Inspection Comments

Bridge girders are severely corroded at ends and may settle or fail with little warning. Ties are increasingly decayed. Highly recommend a more thorough review with a boat inspection in order to assure continued public safety. Should consider closing this bridge for public use by 2020.

Bridge Condition Index: 50.6 **Parabolic Depreciation: 2.0 %** **Straight Line Depreciation: 0.9 %**

Estimated Replacement Value: $699,000 **Estimated Remaining Service Life: 4 Years**

Image 140

North elevation

Image 124

West approach

Image 125

East approach

Image 126

Upstream channel north

Image 127

Downstream channel south

Image 128

Typical deck

Image 129

Northeast girder end

Image 130

East soffit

Image 131

North face of east pier

Image 132

Typical rotted tie

Image 133

Perforated girder on west pier

Image 134

West girder end

Image 135

Typical pier

Image 136

South face of west pier girders

Image 137

West abutment wall

Image 138

Southeast retaining wall

Image 139

East girder ends at abutment wall

Image 141

Northwest embankments

Bridge Inspection Report

Power Canal Ped Bridge

Slab on Steel Girder
Gananoque Waterfront Trail
Town of Gananoque
Intake Channel
Gananoque Waterfront Trail
30m south of Park St

Site ID **5**
District
Built **2015**
Length **9 m**
Width **2.1 m**
Spans **1**

Span Arrangement (m's) **1 @ 9**
Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.32806700**
Lanes	**0**	**Longitude**	**-76.16583300**
Skew	**0 °**	**Orient**	**N-S**
Speed	**0 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Concrete Wear Surface (1)
Wear Surface
Length: ***9.4 m***
Width: ***1.7 m***
Height: ***0.8 m***

Defects **0.0%** **Checking**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
New 2015.

Square Tube Rail & Post (2
Barrier
Length: ***9.4 m***
Width:
Height: ***1.1 m***

Defects **10.0%** **Minor Corrosion, Minor Tarnishing**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
Pedestrian barrier recycled from previous design.

Steel-Rolled (2)
Girders
Length: ***9 m***
Width:
Height: ***0.3 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
New steel girders installed in 2015.

Component Inspection Information

CIP RC Slope Paving (2) ***Channel Lining***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***This refers to bridge supports. No concerns.***	**Partial Inspection**
Water Channel (1) ***Channel***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***Power canal. Swift water and exceptionally high at time of inspection.***	
Embankment (2) ***Embankment***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***Groomed city park.***	

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	18.9	$350	$0
Deck Replacement	✘	m²	18.9	$2,000	$0
Barrier Wall Replacement	✘	m	33.0	$1,500	$0
Expansion Joint	✘	m	4.2	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	4.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work $0

Structural Items Subtotal	**$0**
Mobilization General Sitework 10%	**$0**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$0**
Total Rehabilitation Cost Estimate	***$0***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✘	✘	✘	✘

Recommended Capital Work Summary **Recommended Capital Year**

Inspection Comments

Structure replaced in 2015. No concerns.

Bridge Condition Index: 81.4 **Parabolic Depreciation: 72.5 % Straight Line Depreciation: 53.9 %**

Estimated Replacement Value: $96,000 **Estimated Remaining Service Life: 60 Years**

Image 148

East elevation

Image 143

North approach

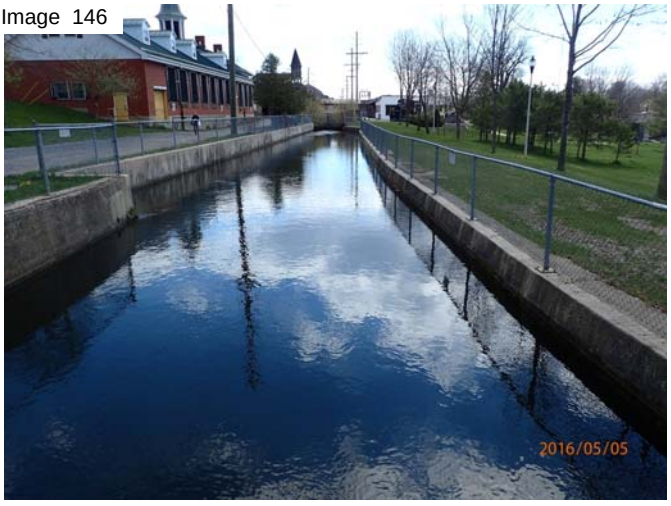
Image 144

South approach

Image 145

Upstream channel west

Image 146



Downstream channel east

Image 147

Typical deck

Image 149

West elevation

Image 150

Typical soffit

Image 151

Bent railing segment

Image 152

Typical railing

Bridge Inspection Report

King Street Bridge

Slab on Steel Girder
King St. East
Town of Gananoque
Gananoque River
King St. East 120m south of Park St.

Site ID **6**
District
Built **1930**
Length **51.1 m**
Width **13.2 m**
Spans **1**

Span Arrangement (m's) **16.8, 17.6, 16.8**
Feature Under **Water**

Insp Date	**May 5, 2016**		
Inspector	**John Landry, EIT**		
Assistant	**Steve Reid, C.E.T.**		
Weather	**Mostly Over Cast with some Sunny Periods**		
Low/High	**10 °c** **17 °c**		

AADT	**0**	**Latitude**	**44.32703300**
Lanes	**2**	**Longitude**	**-76.16455600**
Skew	**0 °**	**Orient**	**N-S**
Speed	**50 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Protected ECRC Deck (1)
Deck Surface
Length: ***53 m***
Width: ***13.2 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
See wearing surface.

Soffit (1)
Deck Soffit
Length: ***51.1 m***
Width: ***13.2 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Partial Inspection
Good condition, some paint over-spray. Little Change 2016.

Concrete Wear Surface (1)
Wear Surface
Length: ***51.1 m***
Width: ***9.1 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Perf Def: Polished
Tinning has been worn away along wheel paths. Polishing occurring.

Component Inspection Information

X- Joint Conventional (4)
Expansion Joints
Length: ***13.2 m***
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove Debris**
Capital Rec. **None**
Good condition. Silty debris in seal.

Sidewalk (2)
Sidewalks
Length: ***51.1 m***
Width: ***1.7 m***
Height:

Defects **2.0%** **Minor Pop-outs, Minor Abrasion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
No concerns.

Open Parapet-Decorative (2
Barrier
Length: ***60 m***
Width:
Height: ***1.1 m***

Defects **5.0%** **Insignificant AAR Cracking**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Some faint AAR present.

Steel-Rolled (10)
Girders
Length: ***51.1 m***
Width:
Height: ***0.78 m***

Defects **1.0%** **Minor Corrosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Girders coated during 2006 rehab. Some edge rust has reappeared.

RC Abutment Wall (2)
Abutment Stem
Length:
Width: ***14.75 m***
Height: ***5 m***

Defects 20.0% **Moderate Scaling, Moderate Shallow Patches**
Damage **1.0%** **Moderate Delamination**
Maintenance **None**
Capital Rec. **None**
Scaling occurring around water line.

RC Ballast Wall (2)
Ballast Wall
Length:
Width: ***14.75 m***
Height: ***1 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Not Inspected**
Capital Rec. **None**
Not accessible.

Component Inspection Information

RC Wing Walls (4)
Wing Walls
Length:
Width:
Height:

Defects 20.0% **Moderate Scaling**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
No concerns.

Partial Inspection

RC Shaft (2)
Pier Column/Shaft
Length:
Width: ***14.75 m***
Height: ***5 m***

Defects 25.0% **Moderate Scaling, Moderate Shallow Patches**
Damage **2.0%** **Moderate Disintegration, Minor Delamination**
Maintenance **None**
Capital Rec. **None**
Pockets of delamination occurring on piers.

Laminated Rubber Brg (40)
Pier Bearings
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Not accessible during inspection. Appear to be in good condition.

Not Inspected

Laminated Rubber Brg (20)
Abutment Bearings
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
No concerns noted.

Partial Inspection

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Channel low at time of inspection.

Embankment (2)
Embankment

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Groomed.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	674.5	$350	$0
Deck Replacement	✘	m²	674.5	$2,000	$0
Barrier Wall Replacement	✘	m	75.1	$1,500	$0
Expansion Joint	✘	m	26.4	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	20.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work $0

Structural Items Subtotal	**$0**
Mobilization General Sitework 10%	**$0**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$0**
Total Rehabilitation Cost Estimate	***$0***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✘	✘	✘	✘

Recommended Capital Work Summary **Recommended Capital Year** **0**

Inspection Comments

Structure is in good condition.

Bridge Condition Index: 74.7 **Parabolic Depreciation: 24.6 % Straight Line Depreciation: 18.5 %**

Estimated Replacement Value: $3,283,000 **Estimated Remaining Service Life: 44 Years**

Image 194

West elevation

Image 183

South approach

Image 184

South expansion joint

Image 185

South pier expansion joint

Image 186

Downstream channel east

Image 187

North pier expansion joint

Image 188

North expansion joint

Image 189

North approach

Image 190

Plaques on northwest end

Image 191

Typical deck

Image 192

Upstream channel west

Image 193

Typical sidewalk and railing

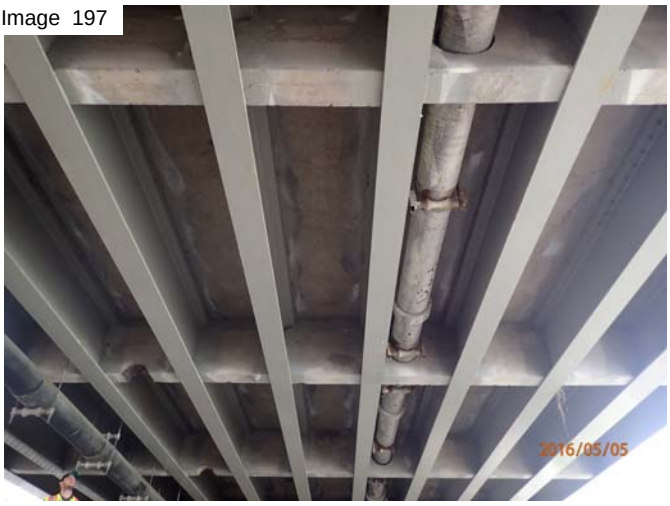
Image 195

South abutment wall

Image 196

South face of south pier

Image 197



South span soffit

Image 198

West face of south pier

Image 199

North face of south pier

Image 200

Centre span soffit

Image 201

South face of north pier

Image 202

North face north pier

Image 203

North abutment wall

Image 204

North span soffit

Image 205

Typical bearing

Image 207

East elevation

Bridge Inspection Report

King Street Pedestrian Bridge

Plate Girder-Half Through	Site ID	**7**
Gananoque Waterfront Trail	District	
Town of Gananoque	Built	**1927**
Gananoque Waterfront Trail	Length	**71.9 m**
Immediately downstream of King Street	Width	**7.7 m**
	Spans	**2**

Span Arrangement (m's) **35.4, 36.5**

Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.32715300**
Lanes	**0**	**Longitude**	**-76.16421000**
Skew	**0 °**	**Orient**	**N-S**
Speed	**0 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Timber Wear Surface (1)
Wear Surface
Length: ***71.9 m***
Width: ***7 m***
Height:

Defects **0.0%**
Damage **2.0%** **Moderate Decay**
Maintenance **Local repair**
Capital Rec. **None**

Bridge deck has a number of decayed planks. Repair locally as a maintenance item. Structure experienced punch through failure at north end of north span. Hole from punch through covered by plywood sheets. Recommend limiting structure to pedestrians only. Wood stringers are expected to be starting to decay.

Steel-Fabricated (2)
Girders
Length: ***71.9 m***
Width:
Height: ***3 m***

Defects 50.0% **Moderate Corrosion**
Damage 12.0% **Moderate Section Loss**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**

Exterior faces of girders are 80 % loss of coating and showing rust. Interior surfaces above deck properly coated.

Component Inspection Information

Steel Floor Beam (0)
Floor Beams
Length:
Width:
Height:

Defects 90.0% **Major Corrosion**
Damage 10.0% **Critical Section Loss**
Maintenance **None**
Capital Rec. **None**
Partial Inspection
Not possible to assess full condition.

Stringers (2)
Stringers
Length: ***71.9 m***
Width:
Height: ***0.6 m***

Defects 80.0% **Moderate Corrosion**
Damage 10.0% **Critical Perforation, Major Section Loss**
Maintenance **None**
Capital Rec. **Repair in 1 year**
The stringers at the east end of the bridge have very large perforated areas of the web. The stringers are correspondingly weakened.

RC Abutment Wall (2)
Abutment Stem
Length:
Width: ***7.7 m***
Height: ***2 m***

Defects 50.0% **Moderate Leaching/Seepage, Moderate AAR Cracking**
Damage **2.0%** **Moderate Disintegration**
Maintenance **None**
Capital Rec. **None**
Abutments have moderate leaching and AAR cracking.

Mass Concrete Pier (1)
Pier Column/Shaft
Length: ***9 m***
Width: ***2.5 m***
Height: ***4 m***

Defects **0.0%**
Damage 10.0% **Major Disintegration**
Maintenance **None**
Capital Rec. **None**
Not Inspected
Not possible to inspect properly due to high water. MRC 2010 report indicates significant undercutting at base of pier.

Pot Bearing (8)
Abutment Bearings
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Appear to be functional. Certainly adequate for present use. No change 2016.

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Rapids under bridge.

Component Inspection Information

Embankment (2)	Defects **0.0%**
Embankment	Damage **0.0%**
	Maintenance **Remove Brush/Trees**
	Capital Rec. **None**
	Extremely dirty under west span. Infilling is preventing good air circulation under west span.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	553.6	$350	$0
Deck Replacement	✘	m²	553.6	$2,000	$0
Barrier Wall Replacement	✘	m	95.9	$1,500	$0
Expansion Joint	✘	m	15.4	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	8.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work

Replace timber deck $170,000

Structural Items Subtotal	**$170,000**
Mobilization General Sitework 10%	**$17,000**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$37,000**
Total Rehabilitation Cost Estimate	***$224,000***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✓	✘	✘	✘	✓	✘	✓

Recommended Capital Year **2018**

Recommended Capital Work Summary

Replace timber deck

Inspection Comments

Underside of bridge is severely corroded and dirty. Not possible to inspect fully due to height. Advanced and severe corrosion of certain areas of the bridge means a very thorough arms reach inspection will be needed to fully gauge condition and remaining useful life as a pedestrian bridge. Deck should only be replaced if Town is committed to repairing the structural steel floor system. May need to consider closing and removing this bridge as the most economical long term solution. Bridge should be closed in the winter to stop application of de-icing salt.

Bridge Condition Index: 47.5 Parabolic Depreciation: 0.0 % Straight Line Depreciation: 0.0 %

Estimated Replacement Value: $4,065,000 **Estimated Remaining Service Life: 5 Years**

Image 169

West elevation

Image 163

South approach

Image 164

North approach

Image 165

Typical deck

Image 166

Upstream channel west

Image 167

Downstream channel east

Image 168

Patched hole in deck

Image 170

North abutment wall

Image 171

Perforated West floor beam at north end

Image 172

North span soffit

Image 173

Perforated gusset plate on west side

Image 174

North face of pier

Image 175

Perforated gusset plate on west side worth of pier

Image 176

Typical decayed deck board

Image 177

South face of pier

Image 178

South span soffit

Image 179

South abutment wall

Image 180

Detached cross brace in south span

Image 181

Typical cross brace gusset plate

Image 182

Typical debris and corrosion on floor beam

Bridge Inspection Report

Water Street Swing Bridge

Plate Girder-Half Through	Site ID	**8**
Water Street	District	
Town of Gananoque	Built	**1894**
Gananoque River	Length	**36.8 m**
Adjacent St. Lawrence River	Width	**4 m**
	Spans	**1**

Span Arrangement (m's) **2 @ 18**

Feature Under **Navigable Channel**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.32547900**
Lanes	**1**	**Longitude**	**-76.15939800**
Skew	**0 °**	**Orient**	**E-W**
Speed	**40 km/h**	**Road Width**	
Truck		**Load Posting**	

Component Inspection Information

Concrete Wear Surface (1) — Defects **2.0%** **Minor Abrasion**

Turn Table — Damage **0.0%**

Length: ***4 m*** — Maintenance **None**

Width: ***3.7 m*** — Capital Rec. **None**

Height:

Wear associated with age occurring.

Steel-Fabricated (2) — Defects **0.0%**

Girders — Damage **0.5%** **Minor Impact**

Length: ***36.8 m*** — Maintenance **None**

Width: — Capital Rec. **None**

Height: ***2.5 m***

Coated since 2000 and appear to be in good condition. Some vehicle damage to interior rakers supporting the top flange.

Steel Floor Beam (7) — Defects **3.0%** **Minor Corrosion**

Floor Beams — Damage **0.0%**

Length: ***5 m*** — Maintenance **None**

Width: — Capital Rec. **None**

Height: ***0.8 m***

Corrosion appearing despite coating.

Component Inspection Information

Stringers (6)
Stringers
Length: ***36.8 m***
Width:
Height: ***0.6 m***

Defects **3.0%** **Minor Corrosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Evidence of corrosion through coating.

RC Wing Walls (4)
Wing Walls
Length:
Width: ***3 m***
Height: ***4 m***

Defects 25.0% **Moderate AAR Cracking, Moderate Shallow Patches**
Damage **3.0%** **Moderate Disintegration**
Maintenance **None**
Capital Rec. **None**
Masonry in generally good condition. Reinforced concrete has significant deterioration. SE corner worst

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Stone Masonry Abutment (2
Abutment Stem
Length:
Width: ***7 m***
Height: ***4 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
Some pointing is missing, but generally in good condition.

Stone Masonry Pier (1)
Pier Column/Shaft
Length: ***5 m***
Width: ***5 m***
Height: ***3 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
Pier was rehabilitated around 2000 and is in good condition as far as could be seen from shore. Little change in 2016.

Rocker or Roller Bearing (1
Pier Bearings
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
The rollers for the turn table appear to be functional.

Water Channel (1)
Channel

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Deep navigable channel.

Component Inspection Information

Embankment (2)

Embankment

Defects **0.0%**

Damage **0.0%**

Maintenance **None**

Capital Rec. **None**

Stable.

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	147.2	$350	$0
Deck Replacement	✘	m²	147.2	$2,000	$0
Barrier Wall Replacement	✘	m	60.8	$1,500	$0
Expansion Joint	✘	m	8.0	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	4.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work $0

Structural Items Subtotal	**$0**
Mobilization General Sitework 10%	**$0**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$0**
Total Rehabilitation Cost Estimate	***$0***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✓	✘	✘	✘

Recommended Capital Work Summary **Recommended Capital Year** **0**

Inspection Comments

Navigation lighting should be considered for this bridge. Bridge has a legal 24-24-32 tonne posting that is appropriate and should not need updating. Bridge was coated after 2010. Structural steel has a few minor perforations and other corrosion damage that has been generally halted with the coating system. Little change 2016.

Bridge Condition Index: 71.1 Parabolic Depreciation: 0.0 % Straight Line Depreciation: 0.0 %

Estimated Replacement Value: $1,175,000 Estimated Remaining Service Life: 28 Years

Image 216

South elevation

Image 208

West approach

Image 209

East approach

Image 210

East deck end

Image 211

West deck end

Image 212

Typical concrete deck

Image 213

Typical steel deck

Image 214

Bent interior rakers on north side wall

Image 215

Typical side wall and railing on south side

Image 217

West abutment wall

Image 218

Pier with rotation system

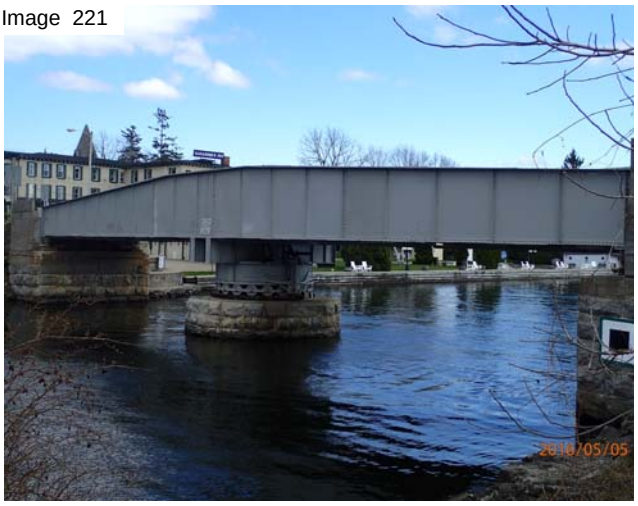
Image 219

East span soffit

Image 220

Typical roller for rotating system

Image 221



North elevation

Image 222

East abutment wall

Image 223

Typical wing wall

Bridge Inspection Report

Power Canal Dam Bridge

Slab on Steel Girder
Gananoque Waterfront Trail
Town of Gananoque
Gananoque River
55 meters north of Tanner st.

Site ID **9**
District
Built **2015**
Length **41.8 m**
Width **3.65 m**
Spans **4**

Span Arrangement (m's) **3.7,6.5,3.4,3.7**
Feature Under **Water**

Insp Date	**May 5, 2016**
Inspector	**John Landry, EIT**
Assistant	**Steve Reid, C.E.T.**
Weather	**Mostly Over Cast with some Sunny Periods**
Low/High	**10 °c** **17 °c**

AADT	**0**	**Latitude**	**44.32776300**
Lanes	**0**	**Longitude**	**-76.16635400**
Skew	**0 °**	**Orient**	**N-S**
Speed	**0 km/h**	**Road Width**	**3.65 m**
Truck		**Load Posting**	

Component Inspection Information

Unprotected BSRC Deck (1)
Deck Surface
Length: ***41.8 m***
Width: ***3.65 m***
Height: ***0.08 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
New concrete deck 2016.

Soffit (1)
Deck Soffit
Length: ***41.8 m***
Width: ***3.65 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
New steel deck pan.

Ped Steel Post & Panel (2)
Railings
Length: ***41.8 m***
Width:
Height: ***1.1 m***

Defects **10.0%** **Minor Tarnishing, Minor Corrosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
Original pedestrian railing recycled.

Component Inspection Information

Steel-Rolled (16) ***Girders*** Length: ***17.3 m*** Width: Height: ***0.3 m***	Defects **10.0%** **Minor Corrosion** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***Girders appear to be of reclaimed material.***
RC Abutment Wall (2) ***Abutment Stem*** Length: ***3.6 m*** Width: Height: ***3.5 m***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***North abutment refaced in 2015.***
RC Column (3) ***Pier Column/Shaft*** Length: ***3.6 m*** Width: Height: ***3.5 m***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***refaced 2015.***
Water Channel (1) ***Channel***	Defects **0.0%** Damage **0.0%** Maintenance **None** Capital Rec. **None** ***No concerns.***

Capital Needs Cost Estimate Break-Down

Item	Req'd	Units	Quantity	Unit Price $	Estimated Cost
Misc Concrete Repairs	✘	m²	0.0	$300	$0
Deck Concrete Overlay	✘	m²	152.6	$350	$0
Deck Replacement	✘	m²	152.6	$2,000	$0
Barrier Wall Replacement	✘	m	65.8	$1,500	$0
Expansion Joint	✘	m	7.3	$3,000	$0
Waterproof & Pave	✘	m²	80.0	$100	$0
Bearing Replacement	✘	Count	32.0	$5,000	$0
Approach Guiderail	✘	m	80.0	$200	$0

Other Work $0

Structural Items Subtotal	**$0**
Mobilization General Sitework 10%	**$0**
Estimated Traffic Management & Civil Items	**$0**
Contract Admin & Contingencies 20%	**$0**
Total Rehabilitation Cost Estimate	***$0***

Rec'd Investigations	Deck Condion Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
	✘	✘	✘	✘	✘	✘	✘	✘

Recommended Capital Work Summary **Recommended Capital Year** **0**

Inspection Comments

Structure replaced in 2015.

Bridge Condition Index: 88.3 **Parabolic Depreciation: 72.4 % Straight Line Depreciation: 64.4 %**

Estimated Replacement Value: $826,000 **Estimated Remaining Service Life: 69 Years**

Image 159

East elevation

Image 153

North approach

Image 154

South approach

Image 155

Upstream channel west

Image 156

Downstream channel east

Image 157

Typical deck

Image 158

Typical railing

Image 160

North span soffit

Image 161

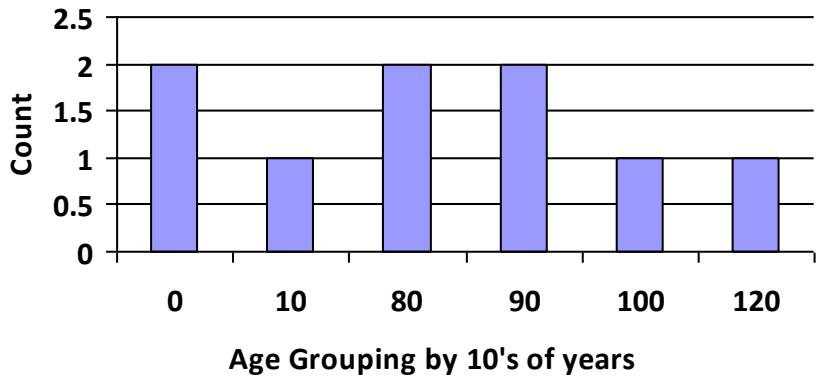
South span soffit

Image 162

Old south pier

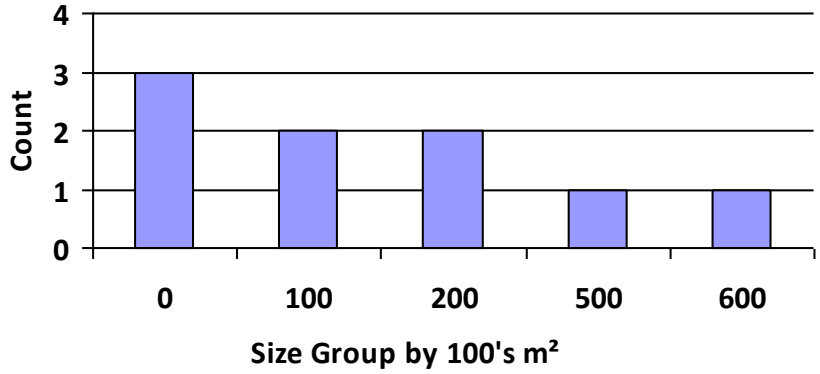
Structure Summary Statistics

Structure Age Histogram



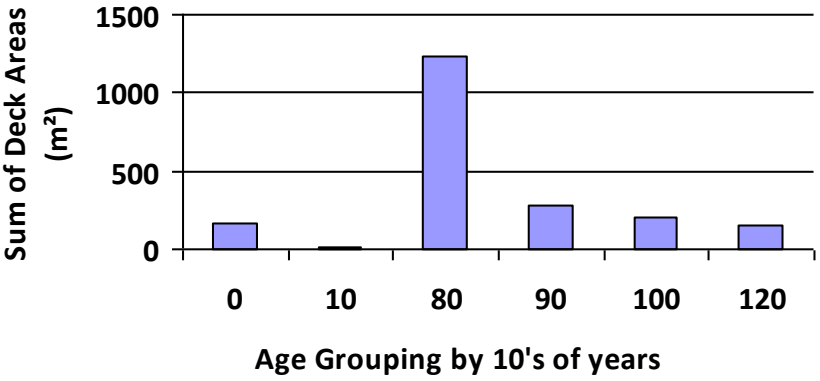
Average Age	67
Youngest Age	1
Oldest Age	122
Structure Count	**9**

Structure Deck Area Histogram



Average Deck Area	226 **m²**
Min Deck Area	7 **m²**
Max Deck Area	675 **m²**
Total Deck Area	**2,037** m²

Structure Deck Area per Age Histogram



Deck area < 20 yrs old	179 **m²**
Deck area < 50 yrs old	179 **m²**
Deck area > 50 yrs old	1859 **m²**

Bridge List

Bridge ID	Name	Route	Length	Width	Spans	Const Yr
1	Black (Snappers) Bridge	Gananoque Waterfront T	36.0	6.2	1	1924
2	Wood Bridge	Gananoque Waterfront T	5.8	1.2	1	2004
3	Hudson Bridge	Machar St	39.1	5.2	1	1911
4	Rail to Trail Bridge	Gananoque Waterfront T	31.6	1.8	3	1920
5	Power Canal Ped Bridge	Gananoque Waterfront T	9.0	2.1	1	2015
6	King Street Bridge	King St. East	51.1	13.2	1	1930
7	King Street Pedestrian Bridge	Gananoque Waterfront T	71.9	7.7	2	1927
8	Water Street Swing Bridge	Water Street	36.8	4.0	1	1894
9	Power Canal Dam Bridge	Gananoque Waterfront T	41.8	3.7	4	2015

Those bridges where the span is highlighted in amber are not subject to the Ontario Statute for biennial inspection.

Capital Needs Report

Year ***2017***

Structure ID	Name	Route	Work	Cost
1	Black (Snappers) Bridge	Gananoque Waterfront Trail	Retaining Walls	$60,000
4	Rail to Trail Bridge	Gananoque Waterfront Trail	Replace	$660,000

Sum for Year	***$720,000***
Percentage of Grand Total	***14.6%***

Year ***2018***

Structure ID	Name	Route	Work	Cost
7	King Street Pedestrian Bridge	Gananoque Waterfront Trail	Replace timber deck	$224,000

Sum for Year	***$224,000***
Percentage of Grand Total	***4.6%***

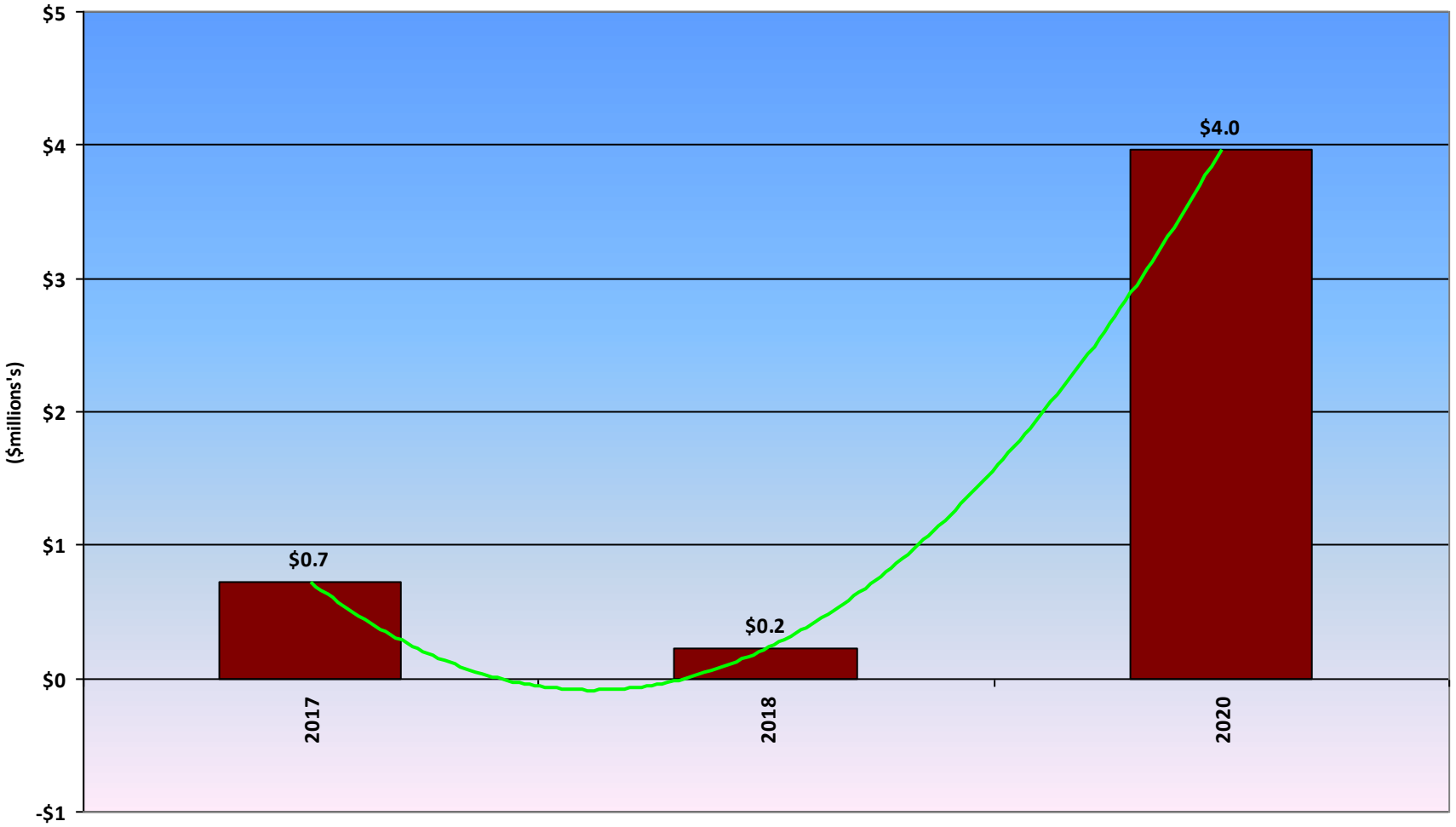
Year ***2020***

Structure ID	Name	Route	Work	Cost
3	Hudson Bridge	Machar St	Replace	$3,972,000

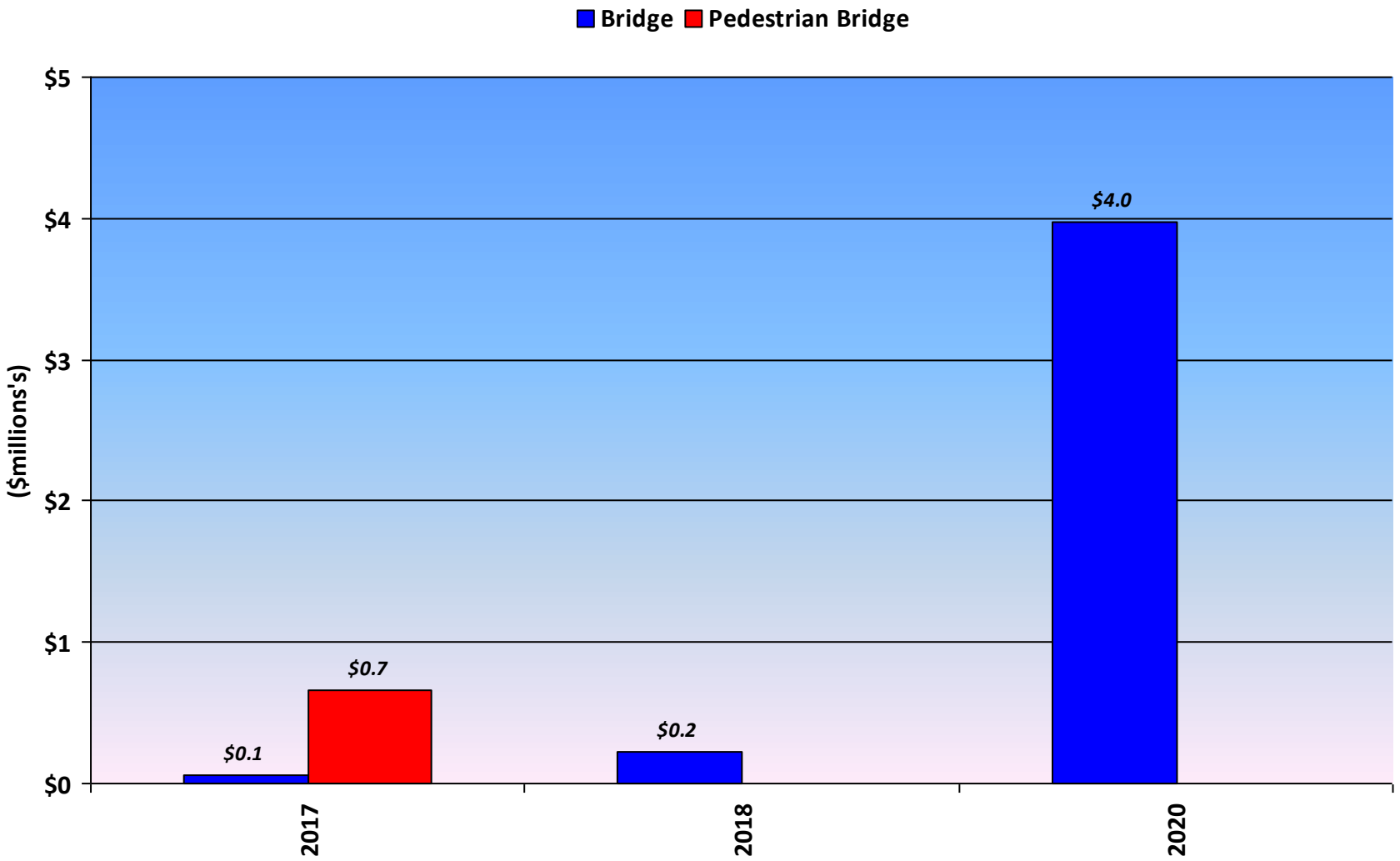
Sum for Year	***$3,972,000***
Percentage of Grand Total	***80.8%***

Total Capital Needs (m's) $4,916,000 Over 4 Years

Capital Expenditure by Year



Capital Expenditure by Structure Type



Bridge Maintenance Report

Bridge ID	Name	Road	Component	Maintenance
1	Black (Snappers) Bridge	Gananoque Waterfront Trail	Diagonal/Post/Hangar	Remove debris
	Debris collected at bottom chord gussets.			
			Delineator	Replace Sign
	Missing one delineator in SW corner.			
			Diagonal/Post/Hangar	Remove debris
	Debris collected at gussets at bottom chord.			
			Half Through or Pony	Remove debris
	Good condition except for debris at gusset locations.			
			Embankment	Slope revetment
	Southeast timber retaining wall has failed. Excessive erosion should be repaired. Timber retaining wall in other corners beginning to deteriorate.			
			RC Ballast Wall	Repair Damage
	Timber blocking at both deck ends is decayed and requires replacement as a maintenance item.			
			Steel Sliding Plate	Remove debris
	Debris around bearings should be removed. Disintegration of abutment wall encroaching on bearings.			
3	Hudson Bridge	Machar St	Timber-Laminated	Local repair
	Timber has major rutting, allowing screws and steel spacers to protrude through deck. Recommend placing asphalt padding until deck can be replaced.			
			Steel Sliding Plate	Power Wash
	Severely corroded. Debris around bearings is increasing rate of corrosion in bearings and end Diagonals.			
4	Rail to Trail Bridge	Gananoque Waterfront Trail	Embankment	Slope revetment
	Stable, groomed, with some local erosion. An old timber retaining wall in NW quadrant has failed.			
			Wood Post Wood Rail	Replace Bracing
	Cleats supporting rakers exhibit decay and require spot replacement. Railing system is secure.			

Bridge ID	Name	Road	Component	Maintenance
6	King Street Bridge	King St. East	X- Joint Conventional	Remove Debris
	Good condition. Silty debris in seal.			
7	King Street Pedestrian Bridge	Gananoque Waterfront Trail	Embankment	Remove Brush/Trees
	Extremely dirty under west span. Infilling is preventing good air circulation under west span.			
			Timber Wear Surface	Local repair
	Bridge deck has a number of decayed planks. Repair locally as a maintenance item. Structure experienced punch through failure at north end of north span. Hole from punch through covered by plywood sheets. Recommend limiting structure to pedestrians only. Wood stringers are expected to be starting to decay.			

Schedule D
KEY PLAN

Attached to this Schedule is the Key Plan for the 2018 OSIM Inspections

LEGEND

LOCATIONS OF BRIDGES

BLACK (SNAPPERS) BRIDGE

WOOD BRIDGE

HUDSON BRIDGE

RAILS TO TRAILS BRIDGE

POWER CANAL DAM BRIDGE

KING STREET BRIDGE

POWER CANAL PEDESTRIAN BRIDGE

KING STREET PEDESTRIAN BRIDGE

WATER STREET SWING BRIDGE

Queen Street
Stone Street North
J A Breman Road
Alberta Street
Booth Street
Ann Street
Cemetery Road
Charles Street North
Emma Street
Nalon Road
Crosby Road
Maple St
Beaver Road
Fourth Street
Oak Street
River Street
Third Street
Victoria Avenue
Machar Street
Second Street
Brock Street
Park Street
Garfield Street
First Street
Birch Street
Elm Street
Hickory Street
Centre Street
Tanner Street
King Street West
Dempster Street
Steel Street
Ontario Street
Hillside Drive
Maple Street
Osborne Street
Birch Alley
Windsor Street
Princess Street
Church Street
Bay Street
Georgiana Street
Henrietta Street
Havelock Alley
Jane Alley
Troy Alley
William Street North
Forsyth Street
North Street
North Alley
Brock Street
James Street
Garden Street
Herbert Street
Talbot Place
Wilson Drive
King Street East
Carmichael Drive
Coopers Alley
Pine Street
Churchill Drive
Elmwood Drive
MacDonald Drive
Maplecroft Court
Arthur Street
Conner Drive
Oak Alley
Spruce Alley
Cedar Alley
Ash Alley
Manse Alley
South Alley
William Street South
Elizabeth Drive
Adelaide Street
Cowan Alley
Charles Street South
Wellington Street South
Stone Street South
Arthur Street
John Street
South Street
Mill Street
Main Street
Market Street
Clarence Street
Water Street
St Lawrence Street
Kate Street

THE CORPORATION OF THE TOWN OF
GANANOQUE
Canadian Gateway to the 1000 Islands

DATE:	SCALE:
JUNE 2018	N.T.S

DRAWING NAME:
SCHEDULE "D"
KEY PLAN