
# 2019 BIENNIAL STRUCTURE INSPECTION PROGRAM

Township of South Stormont – September 2019

Keystone Bridge Management Corp.

Your Bridge Asset Management Specialist

# Contents

## Executive Summary

Keystone Bridge Management Corp. was retained by the Township of South Stormont to provide bridge assessments for all its bridges and large culverts. A total of 22 structures were evaluated of which 9 were bridges and 13 were culverts.

The structure inventory ranges in age from nearly new to 69 years old and represents 1,861 square metres of plan surface area. The average age of South Stormont structures is 31 years.

The asset value of all bridges and culverts on a full replacement cost basis is of the order of $11.2 million.

Approximately $2.4 million is required in capital investment to continue to maintain the structural inventory in good serviceable condition for the next six years. Four culverts are identified for replacement. Two bridges are nominated for a comprehensive rehabilitation.

In the next 20 years there will be a need to replace about $3M in bridge and culvert assets.

The bridges are presently depreciating at a rate of $110K per year. They retain about 67% of their new value. In the absence of capital investment, the bridges will retain 36% of their new value in 20 years. The bridges have lost 7.3% in value due to deterioration. The ideal long-term investment in bridges is $100K annually.

The culvert assets are depreciating at a rate of $50K per year. They currently retain about 43% of their new value. Without capital investment, the culverts will retain 15% of their new value in 20 years. The recommended on-going expenditure for culverts is greater than $60K annually.

A total of 59.1% of the inspected structures have a Bridge Condition Index greater than 70. The remaining structures have BCI values between 57.1 and 70. South Stormont is 20.9% behind the MTO's goal of maintaining at least 80% of its structures with a BCI greater than or equal to 70.

# Introduction

This is the first biennial cycle of bridge and large culvert assessments by Keystone Bridge Management (KBM) on behalf of the Township of South Stormont. Since 2006 KBM has continuously improved and developed new features and reports that better characterize the condition of bridge and large culvert inventories. It is now our pleasure to present these improved reports on the present condition and outlook of the Township of South Stormont bridge and large culvert assets.

Biennial inspection of bridges and culverts with a span equal to or exceeding 3.0 metres is mandated by provincial statute in Ontario. 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.

All the structures were inspected over four days in the period between July 5th and August 21st, 2019. Water levels and weather conditions were mostly ideal for the inspection field work. However, high water levels in the St. Lawrence River limited the substructure view of the Shaver Bridge.

Provided herein are detailed capital needs, maintenance needs, individual bridge depreciations to date, forecast inventory depreciation, and the bridge condition index, for all the inspected structures. The estimated remaining service life and replacement cost is detailed for each structure. The individual inspection reports (134 pages) are bound with this Report.

The following network level reports are appended to this Summary Report and are further described and explained herein:

1. Statistical Report
2. Bridge List
3. Culvert List
4. Capital Needs
5. Maintenance List
6. Structure Replacement Cost & Estimated Remaining Service Life Report
7. Culvert Replacement Cost Report
8. Bridge Parabolic & Straight-Line Depreciation
9. Bridge Depreciation Forecast
10. Bridge Depreciation Forecast with Recommended Capital Investment
11. Bridge Average Depreciation with Investment Scenarios
12. Depreciation Forecast – Culverts
13. Average Culvert Depreciation with Investment Scenarios
14. Recommended Investigations
15. Performance Deficiencies
16. BCI Report
17. Bridge Images Report (On digital medium only)

## Structure Summary Statistics

A snapshot one-page **Structure Summary Statistics Report** immediately follows this Summary Report. The Structure Age Histogram shows that the South Stormont structures have a reasonably even age distribution. Six structures are new or have been replaced in the past 20 years. The average age of South Stormont structures is 31.0 years. There is one structure that is more than 60 years old. It is 69 years old.

The Structure Deck Area Histogram demonstrates that most of the structures have less than 100 square metres of plan area. The largest structure has a plan area of 207 square metres. The average plan area is 85 square metres. The total plan area of structural assets is 1,861 square metres. Bridges with more than 600 square metres of deck surface are considered large bridges. South Stormont has no large bridges.

The Structure Deck Area per Age Histogram is a hybrid of the previous two histograms. It is a key piece of asset management information because this chart presents the age and size-weighted picture of the structure inventory. The plot shows a variable unbalanced distribution. About 6.3% of the deck area is greater than 50 years old. About 34.1% of the deck area has been renewed in the past 20 years. This is a renewal rate of 1.7% per year. A rate of at least 1% per year renewal is critical for a sustainable inventory. Fortunately, South Stormont has been able to exceed the minimum renewal rate.

## Bridge and Culvert Lists

A printout of the client's bridges and culverts is provided. This printout clarifies what are considered as bridges and which structures are deemed culverts. Culverts are defined as an opening through the embankment, and by definition, have soil cover.

Bridges typically have no cover, although certain bridges may have had their riding surface elevated by infilling between the curbs. The Bridge List identifies nine structures that are considered bridges by the Township of South Stormont. The remaining 13 structures on the inventory are culverts

The bridge management analysis differentiates between bridges and culverts and this is further explained later in this Summary Report.

## Capital Needs Report

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.

Where capital needs call for structure replacement, the replacement cost of the existing structure is considered. Typically, the capital cost for replacement exceeds the replacement-in-kind cost, especially for bridges with functional deficiencies such as inadequate road platform or that impede conveyance of the channel they are crossing. Keystone almost always recommends concrete culverts to replace corrugated steel ones, and this is reflected in the capital estimates.

The Capital Needs for The Township of South Stormont are summarized in a separate report, included in the Network Reports section 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 **$2,411,000** is the projected capital need from the present to 2024.

There are 14 Capital Projects identified over the six-year planning period to 2024. Four culverts are recommended for replacement. Two bridges are scheduled for a comprehensive rehabilitation.

The distribution of capital needs is depicted in two different graphs at the end of the Capital Needs Report. The first graph shows the inventory needs and a line of “best fit” that describes the average needs over the planning period. The average six-year outlook is about $400K in capital per year.

The second graph breaks down the capital expenditures between bridges and culverts. Culvert needs predominate over bridge needs.

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.

Please note the capital estimates provided are very approximate by nature. 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. Culvert replacement cost estimates are premised on replacement with a similar sized culvert, but typically concrete culverts are chosen over steel.

## Bridge Maintenance

Detailed maintenance needs are captured in the **Bridge Maintenance Report** in the Network Reports section of this Report.

Maintenance needs shown in red font are considered the most urgent.

Some of the more common maintenance needs identified are:

- Removal of brush and trees
- Removal of obstructions in stream channels

The Township of South Stormont is providing appropriate maintenance to most of the structures inspected.

The maintenance list is provided to guide additional maintenance work that will help maintain the life and serviceability of the structures, and in some instances, improve safety. These maintenance items are duplicated in the individual structure reports.

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.

Removal of obstructions in stream channels is mentioned in the Maintenance Report. Brushing out improves air circulation around structures and this is an important maintenance activity. South Stormont should be more proactive controlling brush around its structures.

A common rule of thumb is to spend 1% of the replacement value per annum on structure maintenance. In practise, few municipalities spend even 0.1% of replacement value on bridge and large culvert maintenance. The most responsible division of capital and maintenance expenditures is elusive. Suffice to say that a productive and skilled maintenance crew can achieve significant reductions in capital needs while maximising the serviceability and service life of those structures they maintain.

## Estimated Remaining Service Life and Replacement Costs

The estimated remaining service life (ERSL) and the replacement cost are vital asset management intelligence. These values are provided in a network level report.

### Estimated Remaining Service Life

The structures are ordered based on the ERSL. The newest structures top the list. The structures at the bottom of the list, have effectively no or very little remaining service life. Those structures that have a formally identified capital need have the recommended program year identified. All structures with less than ten years of estimated remaining service life are identified on the capital program.

The ERSL is calculated based on the deemed life of the structure, and present age. This is modified by an algorithm that recognizes the actual condition of the structure. Old bridges in very good condition automatically have their lives extended. Newer structures in exceptionally poor condition have their life expectancy reduced. Recently rehabilitated bridges have their lives extended by not less than ten years. Thereafter, engineering judgement is applied to arrive at the listed ERSL.

### Replacement Cost

The replacement costs are premised on replacement in kind. Typically, when a bridge is replaced, it is replaced with an improved structure type, and often to improved design criteria. Hence the replacement costs are not a reliable indicator of actual replacement costs. However, it is a very useful parameter for asset management purposes, particularly when assessing the level of asset depreciation.

The replacement cost considers numerous factors and is computed by an algorithm. The factors are listed below:

- Structure type
- Plan area of bridge (Overall length by overall width)
- Skew (cost increased by 10% if skew angle > 0)
- Symmetry (cost increased by 10% if irregular or unsymmetrical)
- Size (a discount factor is applied as the size increases)

- Aspect ratio (A very wide bridge has a lower unit cost)
- Allowance for existing structure removal

The base replacement cost is factored by an allowance for design costs and contingencies.

The culvert replacement costs are calculated separately, and this is explained later in this report.

### Summary Results

The end of the report summarizes the remaining service life and replacement cost data. The estimated total replacement cost for the Township of South Stormont bridges and culverts is $11,018,000. The average replacement cost per structure is nominally $500K.

A graph forecasts the future costs for structure replacement by decade. In the next 20 years, there is a forecast requirement to replace almost $3M in structure assets. The Township needs to strategize on how best to prepare for this significant road structure renewal cost.

### Caveat

The estimated remaining service life is a guideline only. Rehabilitation can extend the life of a structure by 20 to 50 years. In some instances, the ERSL may be optimistic, especially for steel culverts.

The estimated replacement costs are a reasonable indication of actual replacement in-kind costs. However, there are numerous other considerations that influence replacement costs. Chief among these are market conditions, challenging foundation conditions, and traffic management requirements.

We welcome our clients actual cost experiences for structure replacements. This helps us better calibrate our estimating models.

## Culvert Replacement Cost Report

The Culvert Replacement Cost Report is generated based on a complex algorithm within KBMS that considers parameters such as depth of cover, skew, water depth, road width, and presence of guide rail. The estimated replacement cost is generated for both a corrugated steel and concrete box type culvert.

Concrete culverts lag steel culverts by 2 to 11. Keystone's experience indicates that only shallow cover smaller diameter steel culverts in shallow water can be justified over concrete culverts on a life-cycle cost basis. The estimated life-cycle costs for both steel and concrete culverts is provided. The more favourable life-cycle cost is highlighted in green. In only three instances does a steel culvert have a slight life-cycle cost advantage over its concrete counterpart.

The estimated cost to replace all the Township of South Stormont culverts, in kind,[1] is $3,523,000.

[1] Similar material and functionality

## Bridge Replacement Costs

From the previous two network level reports it is easily deduced that the replacement value of only the bridges is $7,495,000.

## Bridge Depreciation

Included in the Network Reports section of this Report is the **Parabolic & Straight-Line Depreciation Report** for all the bridges. The large culverts are not included in this report.

The New Value of each bridge is premised on the geometry and deemed unit price of the main components and summing the individual values. The costs of foundations are not included. Foundations are very expensive bridge components that may cost from $100K to $1,000K per bridge foundation unit. The deemed unit prices are relative, and not necessarily reflective of current actual costs. Dollar values are current as opposed to historical values used in accounting practise.

Depreciation is premised on the actual age of each bridge component. So, for example if a bridge has replacement components such as expansion joints or new barrier walls, the depreciation of these components is based on their year of installation rather than the age of the original bridge. In some instances, judgement was required to establish the installation date of replacement and original bridge components.

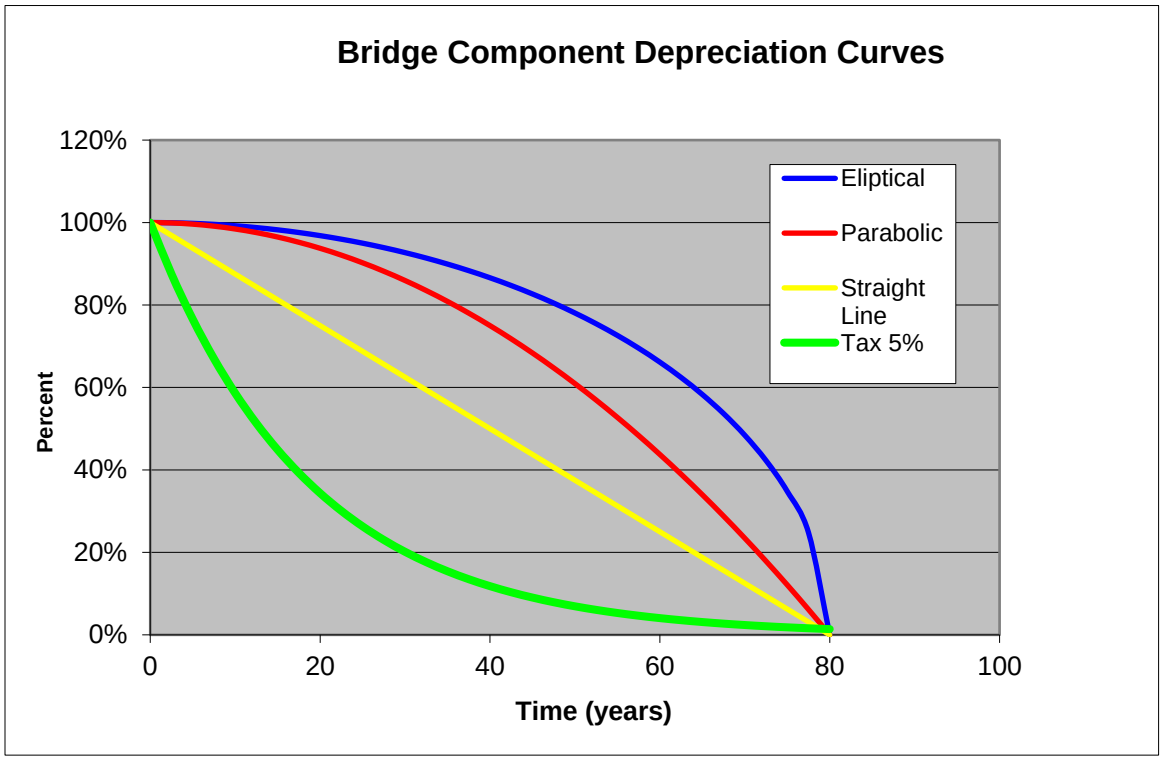



**Figure 1. Examples of four depreciation functions for a bridge component with an 80-year deemed service life.**

The loss in relative value of a bridge due to Defects and Damage is shown as a percentage, and actual cost. For example, at the top of the first page of the report the North Lunenburg Bridge has lost 3.7% of its deemed New Value due to Defects and Damage assessed at the time of inspection. One percent damage devalues a component by five percent. Therefore, a component that is 20% damaged has lost all its value. Ten percent defects to a component is equivalent to one percent damage.

The Present Value (book value) of a bridge is expressed in terms of how much of the original value is retained after considering Depreciation, Defects and Damage. Depreciation is calculated as Parabolic or Straight-Line (S/L). With a parabolic depreciation function, only 25% of the depreciation takes place in the first half of the component's life. Parabolic depreciation sustains a bridge's value in the early part of its life. Straight-line depreciation is probably a more realistic and conservative approach to describing the current book value of a bridge. Examples of four depreciation functions are illustrated in Figure 1. on the previous page.

The previously cited bridge (31-170) was constructed in 2008. The deemed New Value of the bridge is shown as $540,306. If parabolic depreciation is assumed, the bridge still retains 92.9% of its original deemed value. The Straight-Line depreciated value of the bridge is 79.5% of the new value.

The most telling part of this report is the bottom line. The deemed new value of all the bridge components is approximately $4.4M. The loss in value to the assets due to Defects and Damage is assessed as 7.3% or $320K. The total depreciated value of the bridge inventory is 73.0% of the deemed New Value if parabolic depreciation is assumed. Similarly, for straight-line depreciation the value has declined to 56.8% of the original deemed New Value.

Where the depreciation has reduced the value of a bridge by more than half, it is highlighted in amber in the report.

Assuming a 100 year write down period for bridges, it is a desirable goal to maintain the entire bridge inventory at nominally 50% depreciation or better if Straight Line Depreciation is adopted. Similarly, for Parabolic Depreciation, it is desirable to maintain the level of depreciation at or above 67%.

Depending on the choice of Depreciation function, The Township of South Stormont is ahead of target by 6.8% or 6.0% respectively. These numbers are much better than most rural municipalities in Ontario.

When the depreciation due to defects and damage exceeds 25% the number is highlighted in yellow. There are no bridges where defects and damage account for more than 25% of the depreciation.

There is a significant disparity between the estimated full replacement value of the bridge assets ($8.7M explained earlier in this report) and the value generated in the Parabolic & Straight-Line Depreciation Report. The principal reason for this is because the cost of the bridge foundations is not included in the depreciation calculations, and the deemed unit values of components is possibly too low. Also, the estimated replacement costs consider traffic management, design and contingency costs, whereas the deemed new values in the Depreciation Report do not.

Continued and somewhat greater strategic investment in rehabilitation and renewal will improve the depreciation numbers. Those structures with more than 10% Damage/Defects should be prioritized for rehabilitation.

## Bridge Depreciation Forecast

In the Network Reports Section of this report is a forward-looking graphical representation of the projected depreciation of the inspected bridge components. The aggregate value of the inspected components is shown in terms of the Original Value as 100 percent, the Present Depreciated percentage level (Now), and the Forecast Depreciated percentage level in five-year increments extending 20 years hence.

The Depreciated percentage is calculated based on the deemed value, deemed life, and age of each bridge component. Once Defects or Damage is identified on a component, the Defects and/or Damage is assumed to grow at 0.5% per year non-compounded. Thus, a sidewalk that presently has 5% scaling (a Defect), is assumed to have 7.5% scaling in another five years time.

Examining the mauve bars in the graph, the Original Value expressed as 100% has declined to 78% retained value considering only parabolic depreciation. A further 27 percentage points of depreciation is forecast over the following 20 years.

Contrast this against the scenario of straight-line depreciation including on-going growth of defects and damage. This is represented by the light green bars in the graph. The Original percentage declines to 56% retained value with a further 33 percentage points decline in the next 20 years.

The projected average depreciation is 1.5 percent per year. Accepting an actual replacement cost of $7.5M for only the bridge assets, the forecast depreciation loss in terms of replacement value is nominally $110K per year. Hence an annual capital expenditure of not less than this amount is required just to maintain the bridge inventory at present levels of depreciation.

## Bridge Depreciation Forecast with Recommended Capital Investment

Immediately following the **Depreciation Forecast** in the Network Reports, is a similar looking chart as the Depreciation Forecast. However, this second chart demonstrates the effects of investing the recommended Capital Needs into the bridge inventory. It is very clear that investing the recommended Capital expenditures helps increase the value of the bridges, and improves the depreciation outlook.

It is very important to understand this chart speaks only to bridges. The culverts are discussed separately in the sections following.

The premise for this chart is as follows. The recommended capital investments from the Capital Needs Report are grouped in five-year groupings. Hence all the recommended capital needs for bridges from the present to five years out is grouped, and so on and so on for 6 to 10-year needs, 11 to 15-year needs, and 16 to 20-year needs. The Capital is deemed to be spent exactly as recommended. The recapitalization of the bridge inventory offsets the depreciation.

The graph shows that the recommended capital spending for the first five years improves the depreciation. Thereafter the spending is insufficient to keep up with depreciation.

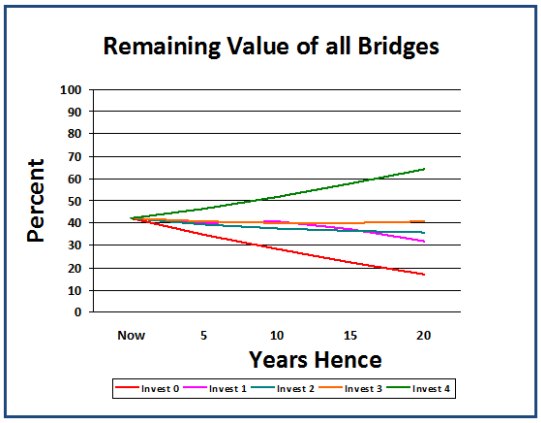
The deemed depreciated value is factored by the Estimated Replacement Value for all the bridges. Hence the recapitalization is applied against the Estimated Total Replacement Value rather than the deemed values utilized for calculating relative depreciation.

One further premise requires explanation. The graph is premised on one dollar of capital investment off sets one dollar of depreciation. This is reasonable when the replacement values of bridges include all the associated sundry costs of a bridge replacement in kind. Realistically, one dollar of capital may only offset eighty cents of depreciation.

In summary, this **Bridge Depreciation Forecast with Recommended Capital Investment** demonstrates that the recommended expenditures in the Capital Needs Report will, if followed exactly, greatly improve the level of depreciation in the first ten years, and thereafter depreciation will outpace capital renewal.

## Average Bridge Depreciation with Investment Report

In the Network Reports Section immediately following the previous chart is a related chart that tests various investment strategies and their impact on long term depreciation. This chart is named the **Average Bridge Depreciation with Investment Report.** An example is depicted on the following page.




As the title suggests, this chart considers the Average Depreciation. In the previous two charts, four different types of depreciation assumptions are provided. In this chart, the four assumptions are averaged. The resulting average is shown as a red line captioned as "**Invest 0**". For the Township of South Stormont, the average level of depreciation is about 67% of New Value and is projected to decline to 36% of New Value in 20 years in the absence of capital investment.

Superimposed on the Zero Investment scenario are four other colour coded investment scenarios labelled **Invest 1** to **Invest 4**. The **Invest 1** scenario models the effect of following the Capital Needs Report exactly as recommended. The average investment is $44K per year for 20 years.

Examining the chart, and in particular, the green line that represents this investment scenario, it is shown that the recommended capital expenditure will improve the retained value to 69% in 5 years. Thereafter the retained value declines to 45% of new value in the following 15 years.

The three other investment scenarios correspond to investing 0.75%, 1.0%, and 1.5% of the replacement cost of the bridge inventory annually. It is evident that only a long-term investment of at least 1.0% to 1.5% of the replacement value annually will maintain the bridge assets at desirable depreciation levels. The Township of South Stormont should commit to spending not less than $100K per year on their bridges for the foreseeable future.

## Culvert Depreciation Forecast

A chart showing forecast **Culvert Depreciation** is provided in the Network Reports. Culverts are treated very differently than bridges and this is explained next.

The new or Original Value of culverts is based on their replacement value. The replacement value of a culvert calculation was explained earlier in this report. Basically, the replacement value considers the costs of excavating the road surface, providing water control, removal of the existing culvert, and replacement in kind of the existing culvert. The costs include backfill and restoring the pavement structure of paved roads. The estimated cost to replace in kind the entire South Stormont culvert inventory is $3,523,000. This works out to $270,000 per culvert.

Straight-line depreciation is utilized to depreciate the culverts. Since the culvert conduit is only part of the cost of the entire replacement cost, it was deemed that only simple depreciation without considering the effects of defects and damage was the more appropriate depreciation model. Depreciation is based on the assumption of a 100-year life for concrete culverts and a 35-year life for corrugated steel and timber culverts. The assumed life is adjusted in the calculations to the estimated remaining service life.

The culverts are individually depreciated based on their age, condition and construction. The chart shows that the retained value of the culverts is about 43% of their Original or new value. In the absence of capital investment, the culverts will depreciate a further 28% in 20 years, or 1.4% per year.

Since the entire cost of culvert replacement is considered, then like the bridges, a dollar invested in culvert replacement yields a dollar improvement in the depreciated values. The depreciated value changes from $1.52M to $528K in 20 years. This is nominally $50K per year. Thus, a minimum annual capital expenditure of $50K per year is required just to maintain the present depreciated value of the culverts.

Previously it was noted the average cost of a culvert in South Stormont is $270K. At a $50K annual rate of depreciation, not less than one culvert on average should be programmed for replacement every five years, to maintain the current retained value. In actuality, a more aggressive replacement rate is required to address immediate needs.

## Average Culvert Depreciation with Investment

A second chart that examines five different investment scenarios for culverts is also provided. Based on the Capital Needs Report, it was identified that about $1.54M is required for culvert needs between the present and 2026.

The first, or null investment scenario shows that the depreciated value of the culverts will decline from 43% retained value to 15% retained value over 20 years.

The **Invest 1** scenario models the impact of capital investment following exactly the Capital Needs Report recommendations for culverts. This average level of expenditure of $77K per year for 20 years results in the retained value of the culverts improving to 76% in five years, and thereafter declining to 59% after 20 years.

The **Invest 2**, **Invest 3** and **Invest 4** scenarios correspond to spending 0.75%, 1.0%, and 1.5% of the replacement value of the culverts annually. The chart confirms that a long-term annual

average expenditure of approximately $60K per year (1.5% of replacement value) is required for culvert renewal in South Stormont Township.

## Recommended Investigations Report

Biennial inspection of bridges as mandated by OSIM (Ontario Structure Inspection Manual) provides a cost-effective means of inspecting and reporting on the general condition of a bridge. Where, in the opinion of the Engineer, additional investigation is required, it is prescribed as part of the Inspection Report.

The one-page **Recommended Investigations Report** included with the Network Reports indicates that there are no recommended special investigations.

## 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. Included in the Network Reports is a two-page **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. Bridges and culverts with numerous performance deficiencies, such as the Shaver Bridge should be prioritized for rehabilitation or replacement.

The more common performance deficiencies in South Stormont relate to guide rail and delineators.

Performance Deficiencies require risk management strategizing by the owner.

## Bridge Condition Index

The calculation of BCI requires inspection following the OSIM Excellent-Good-Fair-Poor (EGFP) rating system. Up to 55 structural elements are considered in the calculation.

Keystone follows its proprietary Triple-D approach instead of the EGFP method of rating a bridge. To translate the Triple-D method to EGFP the following approach is observed. Anything considered Damaged in Triple-D format is mapped 1:1 as Poor in EGFP format. All bridge components transition from Excellent to Good in a straight-line decay function over a 20-year period. Thus, a new component becomes 10% Excellent and 90% Good after ten years of service. The determination of Fair is based on the percent Defects and considers the percent Damage loosely following OSIM philosophy and is performed following an algorithm implicit to KBMS. The percent Good is determined as 100% less the percent Excellent, Fair, and Poor. Excellent, Good, Fair, and Poor are weighted 1.00, 0.75, 0.40, and 0.0 respectively in the BCI calculations following the published MTO methods of July 2009.

The calculated BCI information is provided in the included report of the same name. Where the BCI is between 60 and 70 the index is printed in green font. Where the BCI is between 50 and 60 it is shown in orange font. Below 50 the BCI is shown in red font

Nine of the 22 inspected structures, or 40.9% have a BCI less than 70. Conversely, 59.1% of the structures have a BCI exceeding 70. The MTO's goal is to maintain at least 80% of its

structures with a BCI greater than or equal to 70. On this account, the Township of South Stormont is 20.9% behind this metric.

The lowest BCI of 57.1 is for Beckstead Road Culvert. Extensive heavy corrosion is mainly responsible for the low BCI value.

In summary, the BCI is a useful measure of the overall condition of common bridges and culverts but is still highly variable and dependent on the judgement of the individual bridge inspector. The BCI calculations could easily be ten points less if determined by others essentially because of the ambiguity and lack of consistency in differentiating between Fair and Poor in strict OSIM methodology inspections.

## Traffic Barriers

Many consultants point out that traffic barrier systems such as railings on bridges and guiderail on embankments do not conform to current codes. Keystone avoids doing this.

The reasoning for this goes as follows. MTO has always recognized that a railing system constructed to the relevant standards of that time can remain in service for as long as that system is maintained in good serviceable condition, up until a major rehabilitation. Hence Keystone refrains from identifying traffic barriers that may not conform to the present standards or codes. It is still the responsibility of the owner to maintain the barriers in good serviceable condition.

Where a traffic barrier is substantially deteriorated to the point where maintenance repair is no longer a reasonable option, then Keystone recommends replacement. Such replacement would of course be designed and constructed to the latest standards.

There are many situations where structures (mostly culverts) are not protected by barriers. Keystone has recommended a review of the guiderail warrants for those situations where the client may have excessive liability by maintaining the status quo.

## Bridge Image Report

A Bridge Image Report is provided with the digital data but not included with the printed reports. This seven-page report catalogues all the photos by structure ID, date, image number and caption. In some instances, the photo caption is truncated on the inspection reports. The full caption is available on the Bridge Image Report.

All the images are available in slightly compressed format in individual folders for each structure with the digital data provided as part of the assignment. We will retain the original images for not less than two years and they can be provided upon request.

## Triple-D Inspections

The individual bridge inspection reports are bound 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.

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.

### Tombstone Data

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

- Name of the bridge in large bold font
- The road the structure is on
- The Owner identification alpha-numeric (Site ID)
- The type of bridge or culvert
- Name of the Owner
- Year of original construction per legacy information or our estimate.
- Length of the Bridge per legacy information or our measurement
- Width of the Structure per legacy information or our measurement
- Number of spans
- The span arrangement is shown in metres for bridges only.
- The main significant feature under the bridge
- The main feature the structure is crossing
- The name of the feature the structure is crossing
- Structure Location information

## Inspection Summary Data

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.

This is followed by summary comments for the structure, recommended additional investigations, and recommended capital works.

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.

## Vital Statistics

On the bottom left of the front page of each inspection report is vital information that includes:

- Estimated Replacement Value
- Estimated Remaining Service Life
- Rehabilitation Year and Estimated Rehabilitation Cost (if applicable)

## Bridge Condition

The bottom left of the front page provides a compelling graphical indication of the condition of the bridge with four key indicators:

- Bridge Condition Index
- Retained Value assuming Parabolic Depreciation
- Retained Value assuming Straight-Line Depreciation
- Loss of Structure Value due to Defect & Damage

These four indicators viewed together provide a very complete indication of the health and overall depreciation of the structure.

## Component Inspection Information

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.

## Remark

A remark field is populated from voice recorded comments generated when assessing the component.

## 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.

## 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.

A 10% markup for contractor mobilization and general site work is surcharged to the base estimate. The Contract Administration & Contingencies is a straight 20% markup. 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. Following these the Estimated Remaining Service Life and Estimated Replacement Cost is provided.

## Inspection Images

All 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 reduced images are available in digital format, in separate folders for each structure.

Also made available in digital format is a report indicating all the bridge image numbers and captions. In some instances, the caption is truncated due to lack of space on the printed report page. Reference to the Inspection Images Report will provide the full text of the caption.

## Digital Copy

This entire report is reproduced in PDF format together with all the image files and will be made available through Dropbox or similar cloud services. Individual inspection reports are included in their own folder together with reduced images.

The original images are available on request, as well. The folder names correspond to the date of inspection. Keystone will maintain one copy of the original images on their file server for two years following the date of inspection.

# 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.

## Decision Support

The information provided by Keystone should only be considered as a starting point in determining the fate of any given structure. Considerably more effort is required to meaningfully arrive at conclusive determinations respecting the management of any bridge or culvert. Keystone is a strong advocate of planning studies and life-cycle costing to establish a sound business case for all capital investments. As such, the information provided herein should only be considered as decision support information. Ultimately, the Owner must make the final determination for any of the recommendations given.

## Other Caveats

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 additional 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. The comments provided are meant to augment the inspection observations. They are not intended to capture every nuance observed.
9. 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

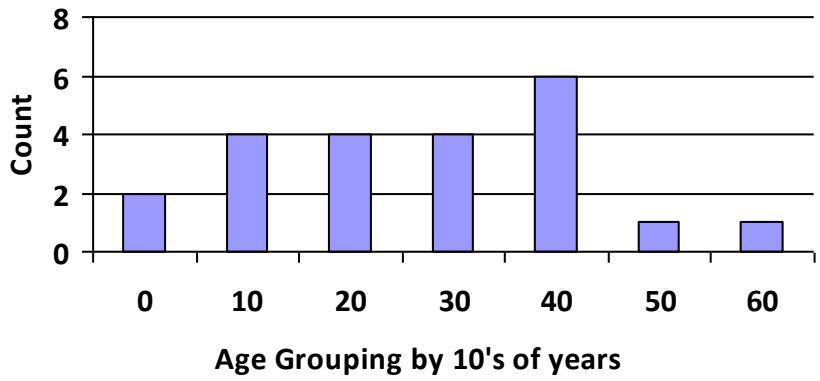
Keystone Bridge Management Corp. is pleased to report on the condition of the Township of South Stormont vehicle bridges and large culverts. Should there be any lingering concerns or additional information required with respect to this assignment, then Keystone will be happy to respond.

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 Township of South Stormont 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.

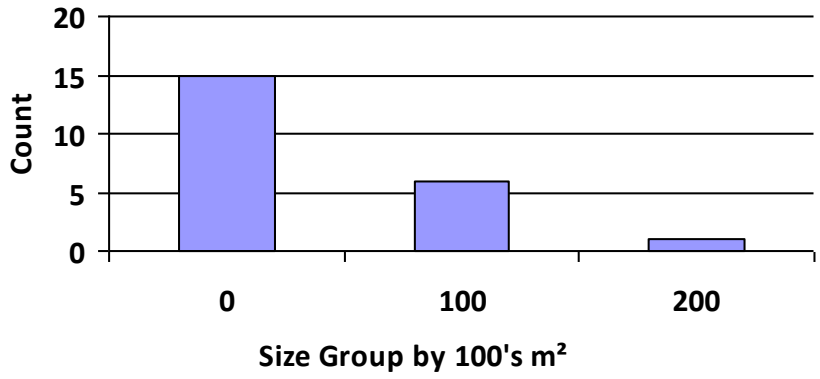
# Structure Summary Statistics

## Structure Age Histogram



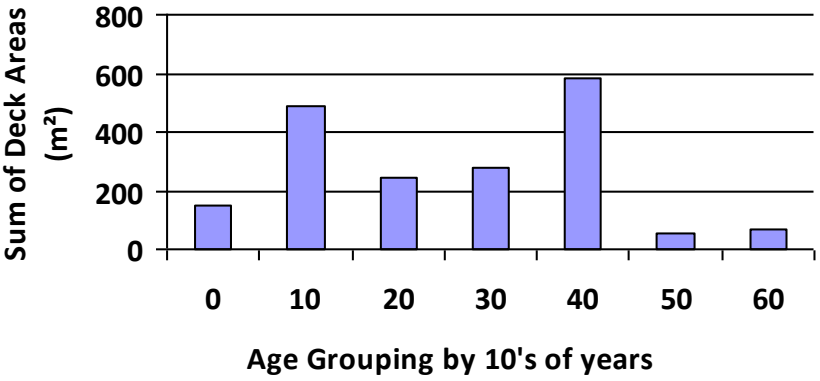

| | |
|---|---|
| Average Age | 31.0 |
| Youngest Age | 1 |
| Oldest Age | 69 |
| **Structure Count** | **22** |

## Structure Deck Area Histogram




| | |
|---|---|
| Average Deck Area | 85 **m²** |
| Min Deck Area | 29 **m²** |
| Max Deck Area | 207 **m²** |
| **Total Deck Area** | **1,861** m² |

## Structure Deck Area by Age Histogram




| | |
|---|---|
| Deck area < 20 yrs old | 634 **m²** |
| Deck area < 50 yrs old | 1743 **m²** |
| Deck area > 50 yrs old | 118 **m²** |

# Bridge List

| Bridge ID | Name | Route | Length | Width | Spans | Const Yr |
|---|---|---|---|---|---|---|
| 31-170 | North Lunenburg Bridge | North Lunenburg Road | 8.7 | 9.3 | 1 | 2008 |
| 31-175 | Valade Road Bridge | Valade Rd. | 21.4 | 6.3 | 1 | 1978 |
| 31-181 | Red Bridge | Lefebvre Road | 19.6 | 6.4 | 1 | 1978 |
| 31-182 | McMillan Bridge | Delaney Road | 21.8 | 9.5 | 1 | 2009 |
| 31-186 | Kennedy Bridge | Delaney Road | 11.3 | 9.0 | 1 | 2006 |
| 31-187 | Campbell Bridge | McPhail Road | 13.3 | 10.1 | 1 | 1988 |
| 31-208 | Race Track Bridge | Barlow Road | 5.6 | 5.1 | 1 | 1985 |
| 31-303 | Shaver Bridge | Shaver Road | 13.4 | 5.0 | 1 | 1950 |
| 31-A21 | Johnson Bridge | Morgan Road | 11.6 | 8.5 | 1 | 2007 |

**Total # of Bridges 9**

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

# Culvert List

| Culvert ID | Name | Route | Length | Span | Cells | Const Yr |
|---|---|---|---|---|---|---|
| C31-167 | North Lunenburg Road Culvert | North Lunenburg Road, W | 16.5 | 3.7 | 1 | 1978 |
| C31-169 | North Lunenburg Road Culvert | North Lunenburg Road, W | 21.9 | 5.8 | 1 | 1974 |
| C31-A01 | Goldfield Road Culvert | Goldfield Road | 22.1 | 3.8 | 1 | 2018 |
| C31-A02 | Hunters Road Culvert | Hunters Road | 21.8 | 3.8 | 1 | 1976 |
| C31-A03 | Otto Road Culvert | Otto Road | 17.2 | 3.6 | 1 | 2013 |
| C31-A06 | Beckstead Road Culvert | Beckstead Road | 14.7 | 3.6 | 1 | 1980 |
| C31-A08 | Anderson Road Culvert | Anderson Road | 12.2 | 4.2 | 1 | 1960 |
| C31-A10 | Finch-Osnabruck Boundary Rd Culve | Finch-Osnabruck Boundar | 12.4 | 3.9 | 1 | 1995 |
| C31-A12 | Cooper Road Culvert | Cooper Road | 21.7 | 4.8 | 1 | 1994 |
| C31-A13 | Wilburn Road Culvert | Wilburn Road | 11.2 | 3.5 | 1 | 1990 |
| C31-A15 | MacRae Road Culvert | MacRae Road | 18.2 | 3.3 | 1 | 1985 |
| C31-A16 | Northfield Road Culvert | Northfield Road | 15.3 | 3.6 | 1 | 1990 |
| C31-A18 | O'Keefe Road Culvert | O'Keefe Road | 17.2 | 3.2 | 1 | 1975 |

**Total # of Culverts 13**

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

# Capital Needs Report

**Year** ***2019***

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| 31-303 | Shaver Bridge | Shaver Road | Abut Repairs | $24,000 |

| | |
|---|---|
| **Sum for Year** | ***$24,000*** |
| **Percentage of Grand Total** | ***1.0%*** |

**Year** ***2020***

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| C31-167 | North Lunenburg Road Culvert | North Lunenburg Road, West | New Conc Culvert | $327,000 |
| C31-A10 | Finch-Osnabruck Boundary Rd Culvert | Finch-Osnabruck Boundary Rd | Topping Slab | $72,000 |
| C31-A18 | O'Keefe Road Culvert | O'Keefe Road | Guide rail | $48,000 |

| | |
|---|---|
| **Sum for Year** | ***$447,000*** |
| **Percentage of Grand Total** | ***18.5%*** |

## Year *2021*

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| 31-181 | Red Bridge | Lefebvre Road | Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail | $308,000 |
| 31-187 | Campbell Bridge | McPhail Road | Guide Rail | $47,000 |
| C31-A02 | Hunters Road Culvert | Hunters Road | New Conc Culvert | $316,000 |
| C31-A12 | Cooper Road Culvert | Cooper Road | Guide Rail | $36,000 |

| | |
|---|---|
| **Sum for Year** | ***$707,000*** |
| **Percentage of Grand Total** | ***29.3%*** |

## Year *2022*

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| 31-175 | Valade Road Bridge | Valade Rd. | Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail | $319,000 |
| 31-208 | Race Track Bridge | Barlow Road | B/Wall, Guide Rail | $110,000 |
| 31-A21 | Johnson Bridge | Morgan Road | WP&P | $66,000 |

| | |
|---|---|
| **Sum for Year** | ***$495,000*** |
| **Percentage of Grand Total** | ***20.5%*** |

## Year *2023*

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| C31-A15 | MacRae Road Culvert | MacRae Road | Concrete floor liner | $36,000 |

| | |
|---|---|
| **Sum for Year** | ***$36,000*** |
| **Percentage of Grand Total** | ***1.5%*** |

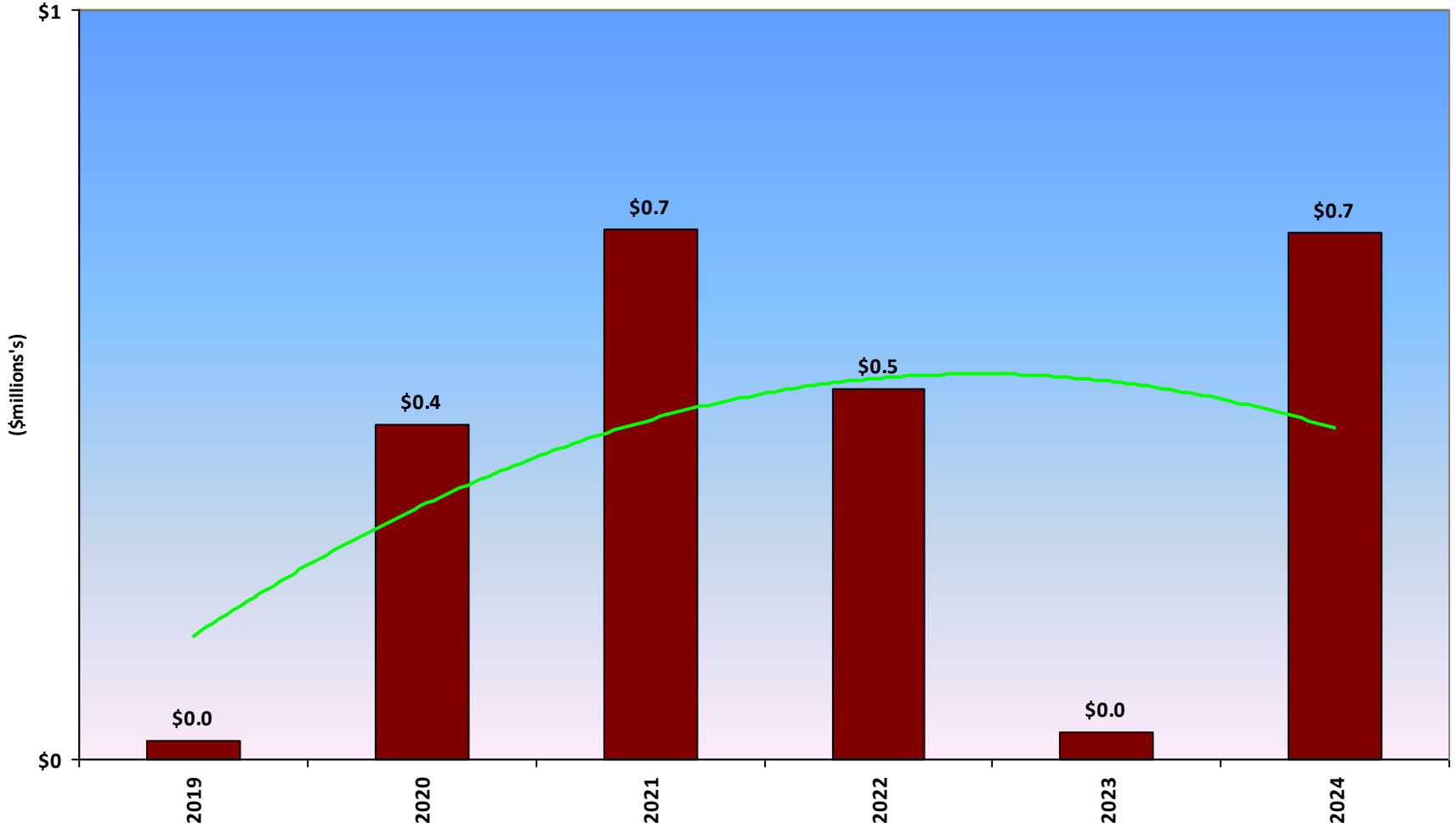
## Year *2024*

| Structure ID | Name | Route | Work | Cost |
|---|---|---|---|---|
| C31-169 | North Lunenburg Road Culvert | North Lunenburg Road, West | New Conc Culvert | $446,000 |
| C31-A06 | Beckstead Road Culvert | Beckstead Road | New Conc Culvert | $256,000 |

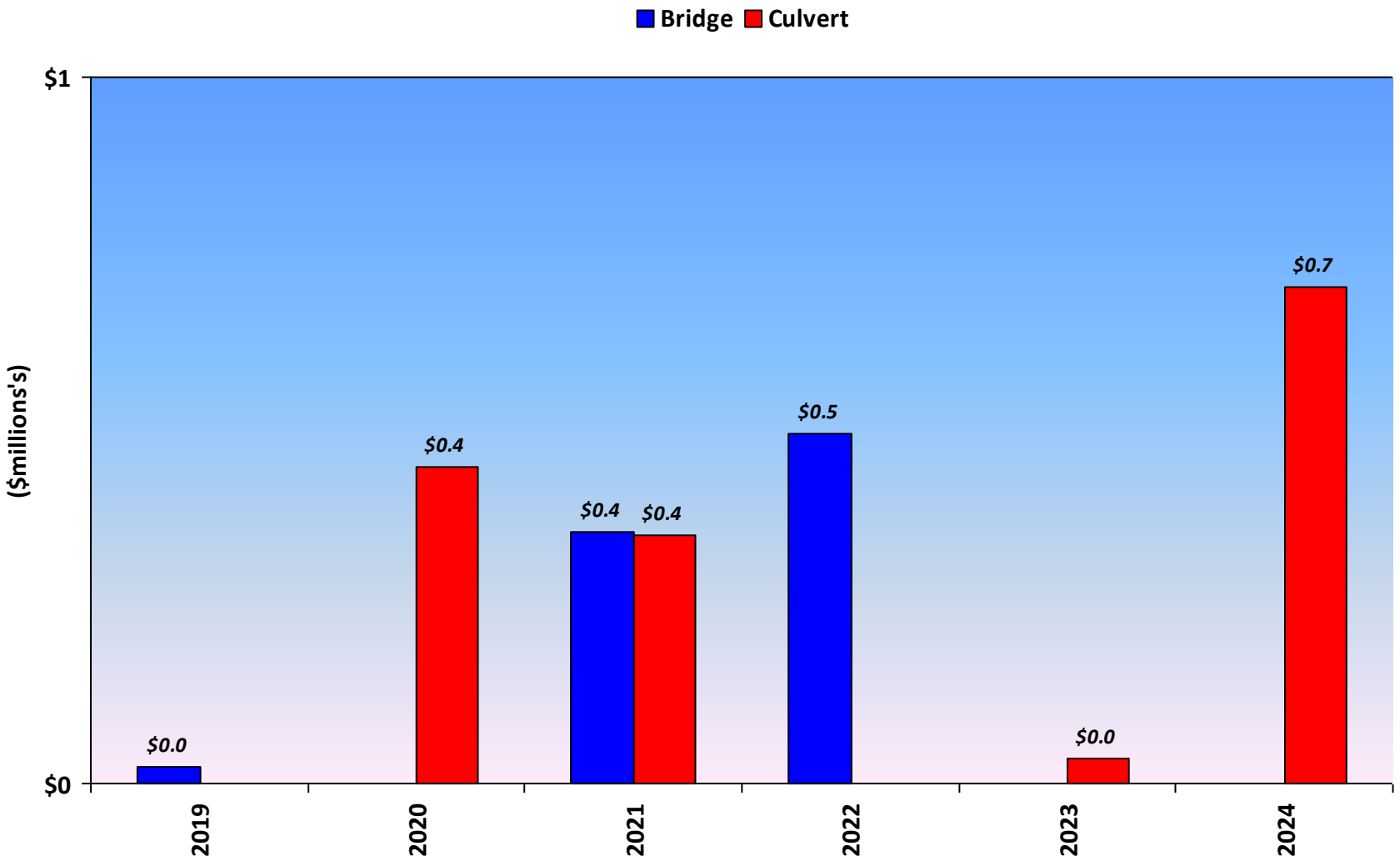
| | |
|---|---|
| **Sum for Year** | ***$702,000*** |
| **Percentage of Grand Total** | ***29.1%*** |

## Total Capital Needs (m's) $2,411,000 Over 6 Years

## Capital Expenditure by Year



# Capital Expenditure by Structure Type



# Bridge Maintenance Report

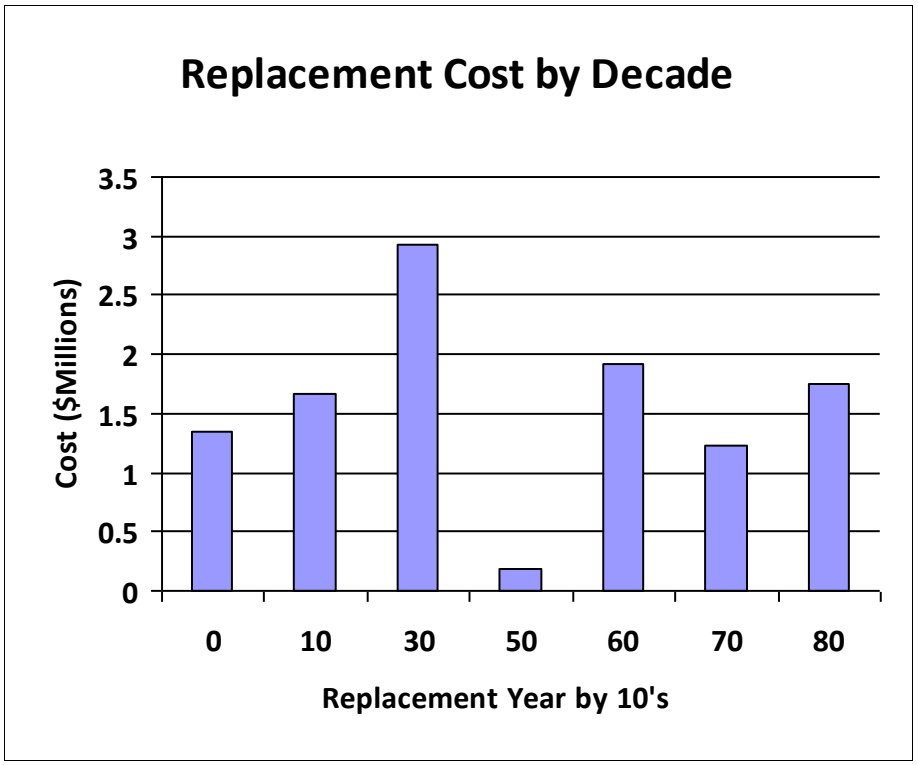
| Bridge ID | Name | Road | Component | Maintenance |
|---|---|---|---|---|
| 31-175 | Valade Road Bridge | Valade Rd. | Embankment | Remove Brush/Trees |
| *Heavy brush around wing walls.* | | | | |
| 31-181 | Red Bridge | Lefebvre Road | Delineator | Add Signs |
| *Delineators at SW & NE corners. Signs at NW & SE are missing.* | | | | |
| | | | Embankment | Remove Brush/Trees |
| *Trees & brush require brushing out. Wild parsnip present.* | | | | |
| 31-182 | McMillan Bridge | Delaney Road | Delineator | Add Signs<br>Straighten Sign |
| *Delineator in the SW is missing. Sign in NE is bent.* | | | | |
| | | | Embankment | Remove Brush/Trees |
| *Trees & brush around wing walls & under bridge should be cleared. Erosion at ends of curbs. Wild parsnip noted on embankments. Stone protection against abutment walls.* | | | | |
| 31-186 | Kennedy Bridge | Delaney Road | Delineator | Adjust Height |
| *Signs are located at the ends of wing walls. Signs are set too low.* | | | | |
| 31-187 | Campbell Bridge | McPhail Road | Steel Beam on Wood Post | Spot post replacement |
| *Many vehicle strikes. Four posts on north side of bridge damaged from vehicle impact, post anchors weakened from collision. Buried end treatments at all ends. Timber posts have varying degrees of decay, several posts require replacement.* | | | | |
| | | | Delineator | Adjust Height |
| *Delineators at the ends of guide rail. Signs are set too low.* | | | | |
| C31-A08 | Anderson Road Culvert | Anderson Road | Embankment | Remove Brush/Trees |
| *Heavy vegetation growth. No guide rail or delineators at this site. Brush & trees at south end should be cleared.* | | | | |

| Bridge ID | Name | Road | Component | Maintenance |
|---|---|---|---|---|
| C31-A10 | Finch-Osnabruck Boundary Rd Culvert | Finch-Osnabruck Boundary Rd | Water Channel | Remove Obstructions |
| | West end of culvert partially blocked by fallen trees. Aggradation against the north wall inside barrel. Stagnant water | | | |
| C31-A12 | Cooper Road Culvert | Cooper Road | Embankment | Remove Brush/Trees |
| | *Thick vegetation at culvert ends. Wild parsnip present. Tree in the SE corner should be cut back.* | | | |
| C31-A13 | Wilburn Road Culvert | Wilburn Road | Water Channel | Remove Obstructions |
| | *Stagnant flow. Large downed tree limb inside barrel.* | | | |
| | | | Embankment | Remove Brush/Trees |
| | *Steep embankments. Wild parsnip present.* | | | |
| C31-A18 | O'Keefe Road Culvert | O'Keefe Road | Embankment | Remove Brush/Trees |
| | *Thick brush. Wild parsnip. Dry stone retaining wall in NW is partially failed.* | | | |

# Structure Replacement Costs

| Bridge ID | Name | Estimated Remaining Service Life | Program Year | Estimated Replacement Cost |
|---|---|---|---|---|
| 31-A21 | Johnson Bridge | 88 | 2022 | $485,000 |
| 31-182 | McMillan Bridge | 80 | | $1,267,000 |
| 31-170 | North Lunenburg Bridge | 79 | | $682,000 |
| 31-186 | Kennedy Bridge | 77 | | $552,000 |
| 31-187 | Campbell Bridge | 69 | 2021 | $1,577,000 |
| C31-A12 | Cooper Road Culvert | 65 | 2021 | $334,000 |
| 31-208 | Race Track Bridge | 56 | 2022 | $182,000 |
| 31-175 | Valade Road Bridge | 39 | 2022 | $992,000 |
| 31-181 | Red Bridge | 39 | 2021 | $925,000 |
| C31-A01 | Goldfield Road Culvert | 39 | | $250,000 |
| C31-A03 | Otto Road Culvert | 34 | | $543,000 |
| C31-A08 | Anderson Road Culvert | 31 | | $222,000 |
| 31-303 | Shaver Bridge | 16 | 2019 | $833,000 |
| C31-A16 | Northfield Road Culvert | 16 | | $194,000 |
| C31-A10 | Finch-Osnabruck Boundary Rd Culvert | 11 | 2020 | $243,000 |
| C31-A13 | Wilburn Road Culvert | 11 | | $146,000 |
| C31-A18 | O'Keefe Road Culvert | 11 | 2020 | $250,000 |
| C31-A15 | MacRae Road Culvert | 6 | 2023 | $213,000 |
| C31-169 | North Lunenburg Road Culvert | 5 | 2024 | $357,000 |
| C31-A06 | Beckstead Road Culvert | 5 | 2024 | $219,000 |
| C31-A02 | Hunters Road Culvert | 2 | 2021 | $274,000 |
| C31-167 | North Lunenburg Road Culvert | 1 | 2020 | $278,000 |

| Bridge ID | Name | Estimated Remaining Service Life | Program Year | Estimated Replacement Cost |
|---|---|---|---|---|




| | |
|---|---|
| **Total Replacement Cost** | **$11,018,000** |
| **Average Replacement Cost** | **$500,818** |
| **Total Deck Area** | **1861 $m^2$** |

# Culvert Replacement Cost

| Culvert ID | Name | Existing Culvert Type | Common Costs | Total Cost Concrete Replacement | Total Cost Steel Replacement | Existing Culvert Replacement Cost | Life-Cycle Cost Concrete Replacement | Life-Cycle Cost Steel Replacement |
|---|---|---|---|---|---|---|---|---|
| C31-167 | North Lunenburg Road Culvert | Soil-Steel Structure | $157,200 | $327,000 | $278,000 | $278,000 | $330,900 | $339,200 |
| C31-169 | North Lunenburg Road Culvert | Soil-Steel Structure | $170,900 | $446,000 | $357,000 | $357,000 | $451,400 | $435,500 |
| C31-A01 | Goldfield Road Culvert | Soil-Steel Structure | $130,400 | $282,000 | $250,000 | $250,000 | $285,400 | $305,000 |
| C31-A02 | Hunters Road Culvert | Soil-Steel Structure | $147,500 | $316,000 | $274,000 | $274,000 | $319,800 | $334,300 |
| C31-A03 | Otto Road Culvert | Soil-Steel Structure | $257,900 | $657,000 | $543,000 | $543,000 | $664,900 | $662,500 |
| C31-A06 | Beckstead Road Culvert | Soil-Steel Structure | $130,500 | $256,000 | $219,000 | $219,000 | $259,100 | $267,200 |
| C31-A08 | Anderson Road Culvert | Concrete Culvert | $110,500 | $222,000 | $189,000 | $222,000 | $224,700 | $230,600 |
| C31-A10 | Finch-Osnabruck Boundary Rd | Soil-Steel Structure | $153,500 | $278,000 | $243,000 | $243,000 | $281,300 | $296,500 |
| C31-A12 | Cooper Road Culvert | Concrete Culvert | $141,300 | $334,000 | $274,000 | $334,000 | $338,000 | $334,300 |
| C31-A13 | Wilburn Road Culvert | Soil-Steel Structure | $84,300 | $161,000 | $146,000 | $146,000 | $162,900 | $178,100 |
| C31-A15 | MacRae Road Culvert | Soil-Steel Structure | $116,900 | $246,000 | $213,000 | $213,000 | $249,000 | $259,900 |
| C31-A16 | Northfield Road Culvert | Soil-Steel Structure | $107,900 | $224,000 | $194,000 | $194,000 | $226,700 | $236,700 |
| C31-A18 | O'Keefe Road Culvert | Soil-Steel Structure | $153,300 | $273,000 | $250,000 | $250,000 | $276,300 | $305,000 |

Estimated cost is based on a new culvert of similar size.

Recorded values, Length, Width, Height, Fill Depth, # Lanes Over, Water Depth are used in the calculations.

Typical culvert works (dewatering, traffic, etc.) are estimated and totalled for each structure.

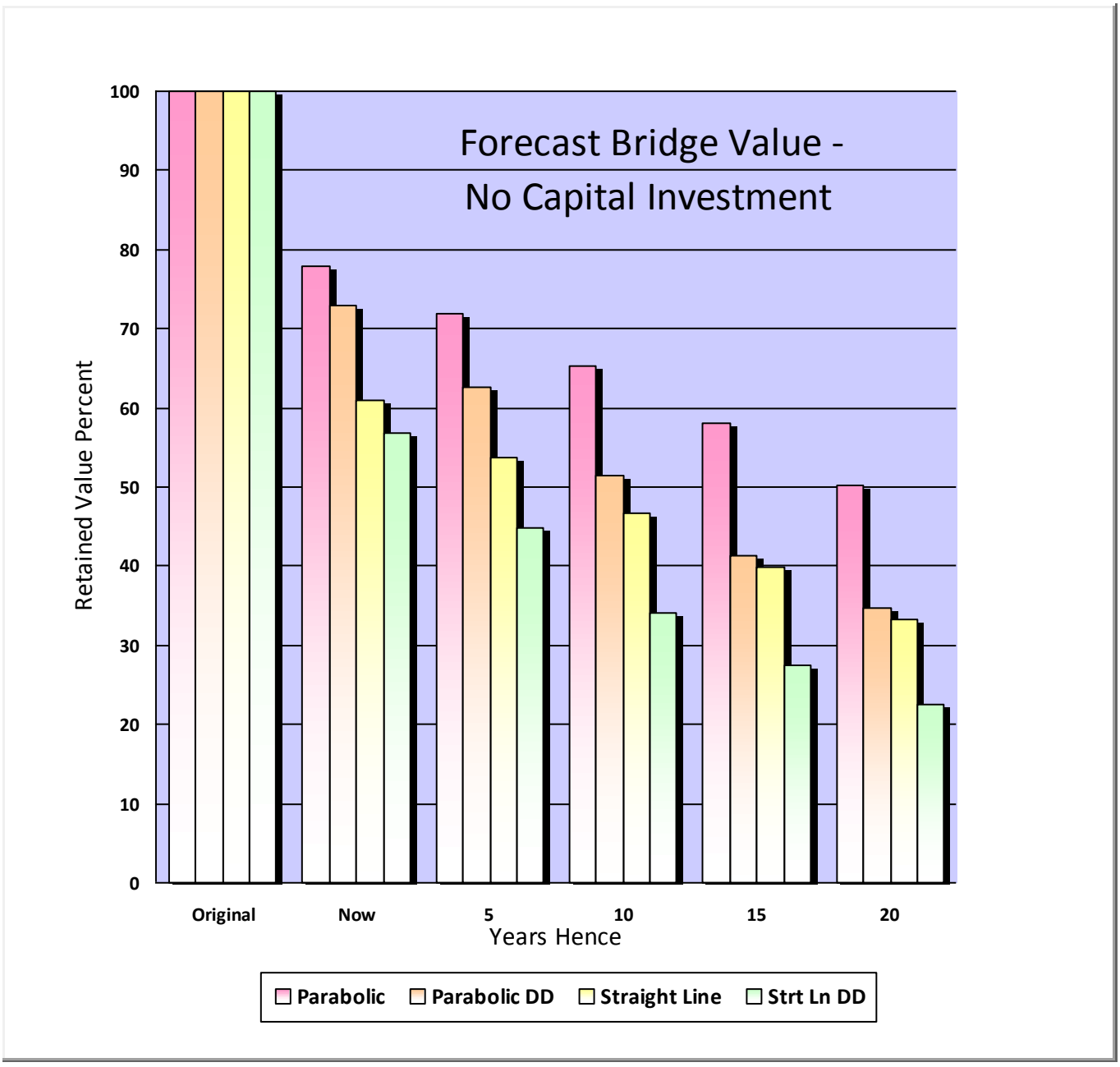
| | |
|---|---|
| Total Number of Timber Structures: | 0 |
| Total Number of Steel Structures: | 11 |
| Total Number of Concrete Structures: | 2 |
| Total Cost of Culvert Replacement Based on Similar Size and Type: | $3,523,000 |

# Parabolic & Straight Line Depreciation

**(Does not include culverts)**

| Name | Bridge ID | Built | Value (New) | Damage/Defects | | Present Val (Parab) | | Present Val (S/L) | |
|---|---|---|---|---|---|---|---|---|---|
| North Lunenburg Bridge | 31-170 | 2008 | $540,306 | 3.7% | $19,834 | 92.9% | $501,938 | 79.5% | $429,500 |
| Valade Road Bridge | 31-175 | 1978 | $716,328 | 15.1% | $108,120 | 44.4% | $317,783 | 27.2% | $194,899 |
| Red Bridge | 31-181 | 1978 | $639,499 | 12.5% | $79,783 | 48.3% | $308,972 | 28.2% | $180,472 |
| McMillan Bridge | 31-182 | 2009 | $840,578 | 1.8% | $14,768 | 94.9% | $797,674 | 81.5% | $685,065 |
| Kennedy Bridge | 31-186 | 2006 | $413,867 | 0.3% | $1,213 | 93.6% | $387,330 | 77.5% | $320,784 |
| Campbell Bridge | 31-187 | 1988 | $362,980 | 3.5% | $12,555 | 70.7% | $256,557 | 47.7% | $173,191 |
| Race Track Bridge | 31-208 | 1985 | $145,168 | 7.6% | $11,059 | 70.6% | $102,521 | 49.6% | $72,036 |
| Shaver Bridge | 31-303 | 1950 | $278,029 | 16.9% | $47,037 | 46.0% | $127,963 | 37.1% | $103,097 |
| Johnson Bridge | 31-A21 | 2007 | $430,692 | 5.6% | $24,129 | 90.0% | $387,506 | 74.8% | $322,012 |
| **Grand Total** | | | **$4,367,447** | **7.3%** | **$318,498** | **73.0%** | **$3,188,244** | **56.8%** | **$2,481,056** |

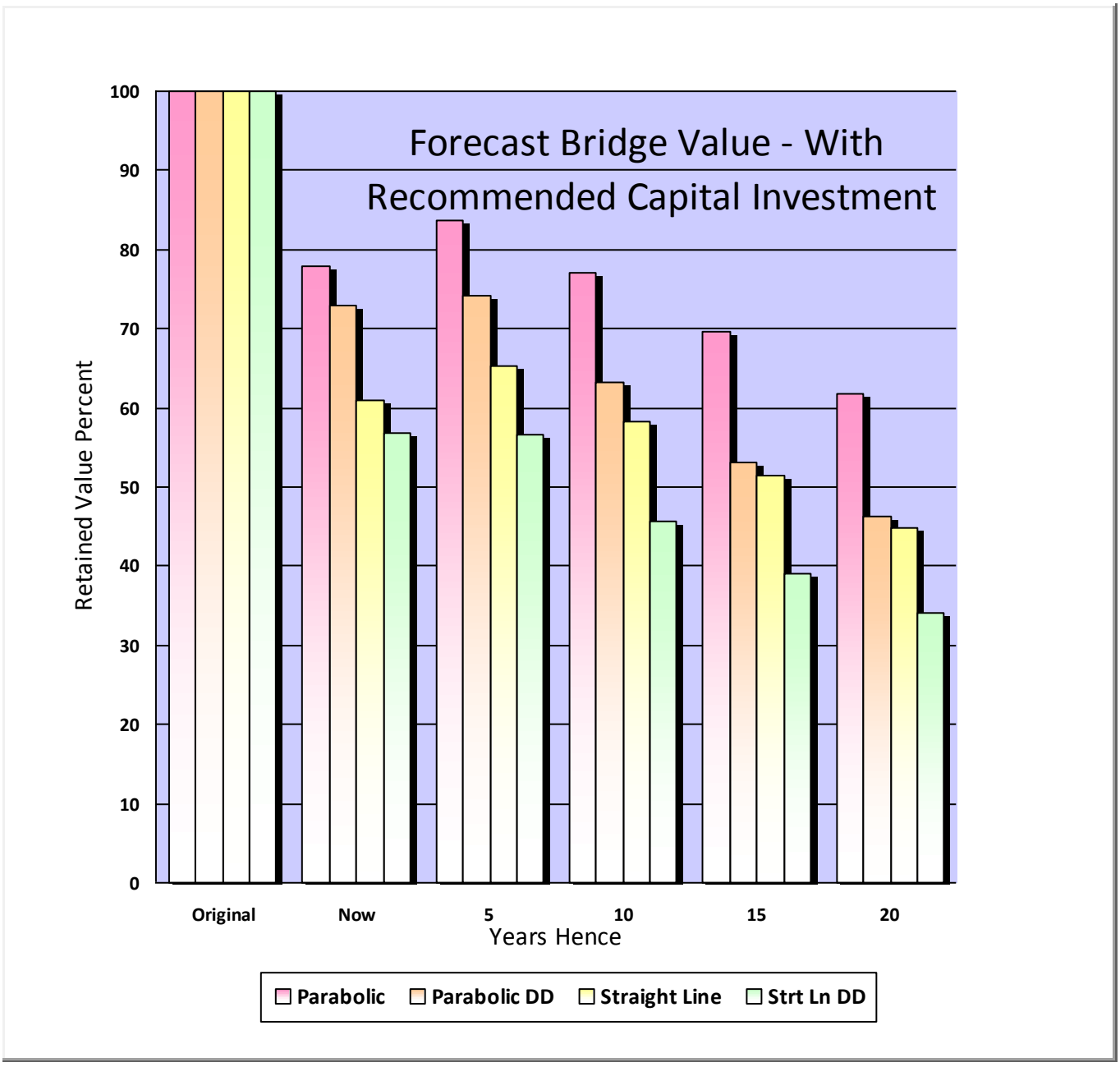
# Bridge Depreciation Forecast 1




## Legend

Parabolic: Parabolic Depreciation not including effects of Defects & Damage
Parabolic DD: Parabolic Depreciation including effects of Defects & Damage
Straight Line: Straight-Line Depreciation not including effects of Defects & Damage
Strt Ln DD: Straight-Line Depreciation including effects of Defects & Damage

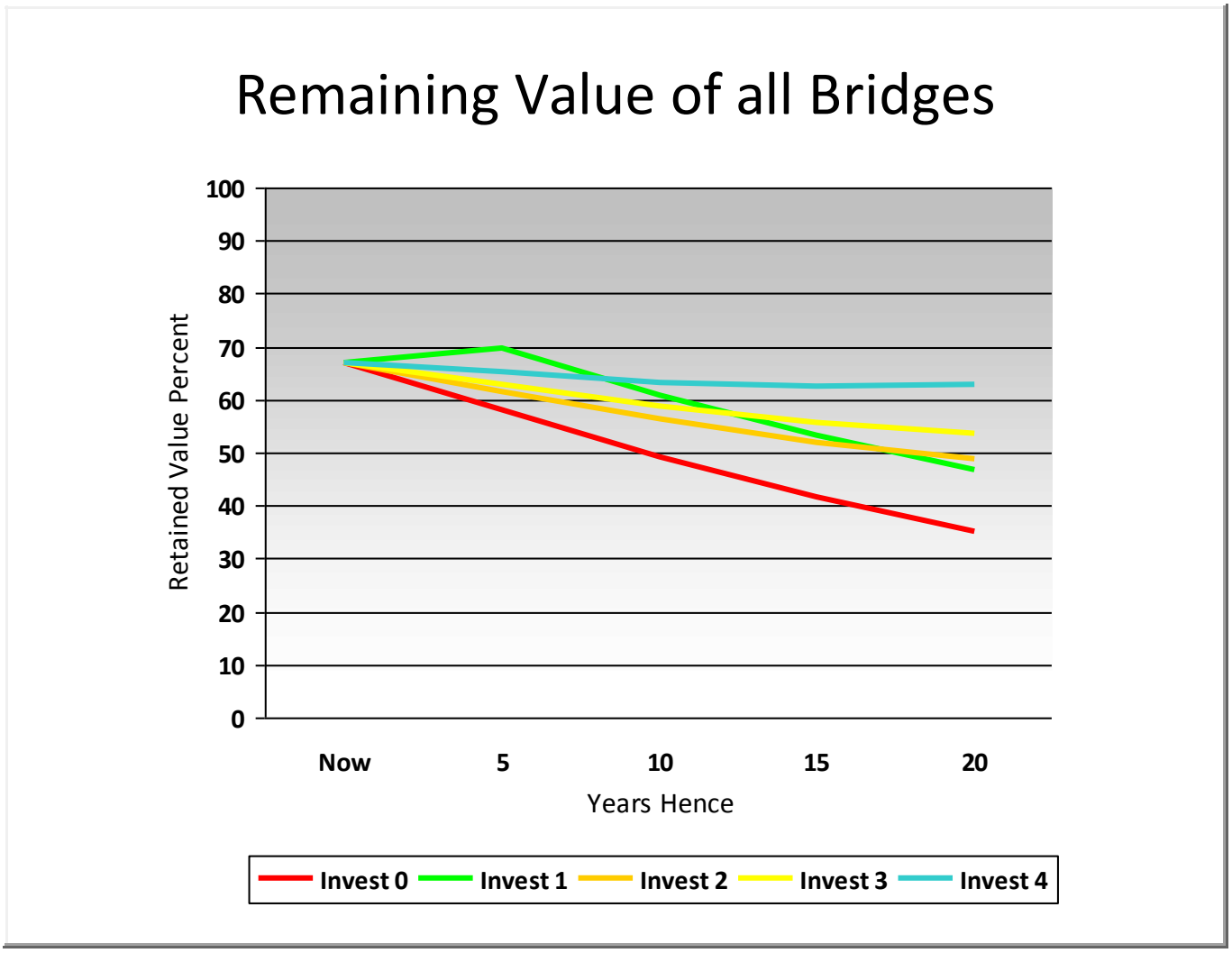
# Bridge Depreciation Forecast 2



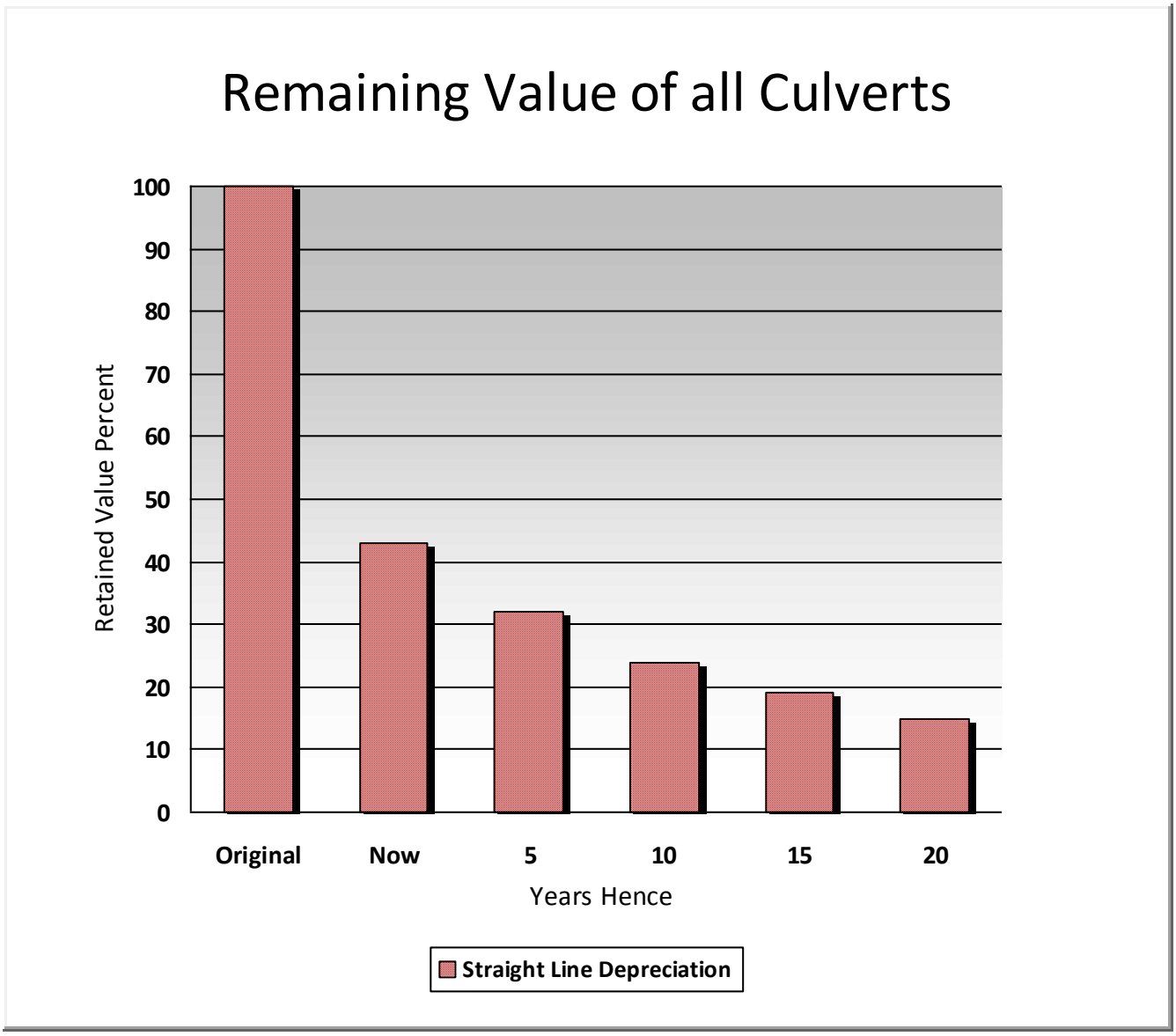

## Legend

Parabolic: Parabolic Depreciation not including effects of Defects & Damage
Parabolic DD: Parabolic Depreciation including effects of Defects & Damage
Straight Line: Straight-Line Depreciation not including effects of Defects & Damage
Strt Ln DD: Straight-Line Depreciation including effects of Defects & Damage

# Average Bridge Depreciation with Investment



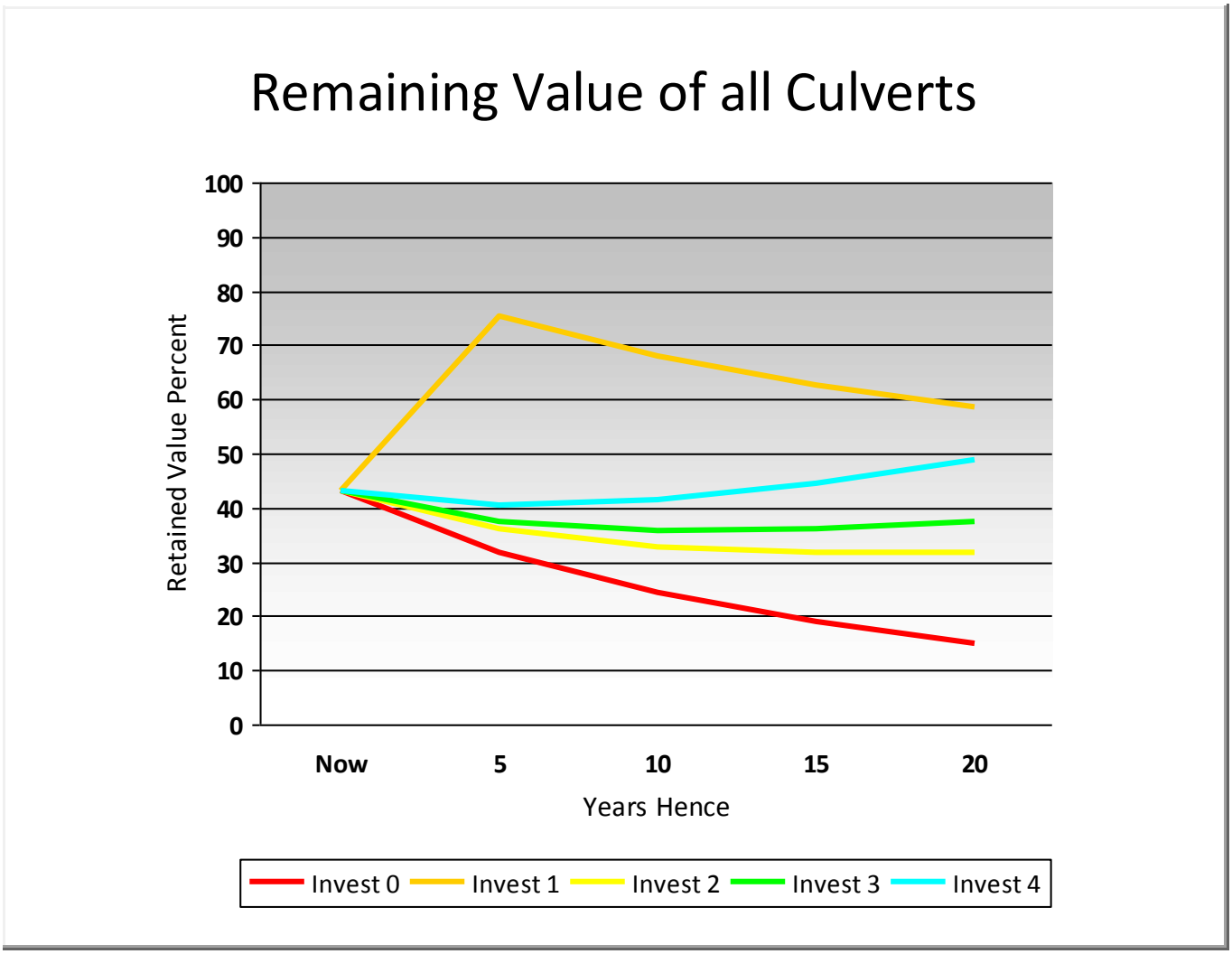

| Key | Investment Description | Annual Amount |
|---|---|---|
| Invest 0 | No Investment | $0 |
| Invest 1 | Recommended Capital (Average) | $44,000 |
| Invest 2 | 0.75% Replacement Value | $52,500 |
| Invest 3 | 1.0% Replacement Value | $70,000 |
| Invest 4 | 1.5% Replacement Value | $105,000 |




## Original & Depreciated Values

| Original | Now | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|
| $3,523,000 | $1,523,891 | $1,127,491 | $861,321 | $674,263 | $527,637 |

# Average Culvert Depreciation with Investment




| Key | Investment Description | Annual Amount |
|---|---|---|
| Invest 0 | No Investment | $0 |
| Invest 1 | Recommended Capital (Average) | $77,000 |
| Invest 2 | 0.75% Replacement Value | $30,000 |
| Invest 3 | 1.0% Replacement Value | $40,000 |
| Invest 4 | 1.5% Replacement Value | $60,000 |

# Recommended Investigations

| Bridge ID | Name | Deck Condition Survey | Enhanced Inspection | Underwater Investigation | Ice Inspection | Boat Inspection | Structure Evaluation | Load Posting | Planning Study |
|---|---|---|---|---|---|---|---|---|---|

*No Recommended Investigations*

# Performance Deficiencies Report

| Bridge ID | Name | Component | Deficiency |
|---|---|---|---|
| 31-175 | Valade Road Bridge | Delineator | Missing |
| | | X- Joint Conventional | Leaking |
| 31-181 | Red Bridge | Delineator | Missing |
| | | Embankment | Toxic Weeds |
| | | Steel Beam on Wood Post | Weakened |
| 31-182 | McMillan Bridge | Embankment | Toxic Weeds |
| 31-186 | Kennedy Bridge | Delineator | Inadequate Height |
| 31-187 | Campbell Bridge | Delineator | Inadequate Height |
| | | Steel Beam on Wood Post | Weakened |
| 31-208 | Race Track Bridge | Steel Post & Guide Rail | Weakened |
| 31-303 | Shaver Bridge | Water Channel | Lacking Freeboard |
| | | Delineator | Obscured |
| | | Steel Sliding Plate | Uneven Bearing |
| C31-167 | North Lunenburg Road Culvert | Circular CS Plate Pipe | Settlement |
| C31-A02 | Hunters Road Culvert | CS Plate Pipe Arch | Load Carrying Capacity |
| | | Embankment | Toxic Weeds |
| C31-A06 | Beckstead Road Culvert | CS Plate Pipe Arch | Insufficient Barrel Length |
| | | Embankment | Toxic Weeds |
| C31-A12 | Cooper Road Culvert | Embankment | Toxic Weeds |
| | | Steel Beam on Wood Post | Inadequate Height |
| C31-A13 | Wilburn Road Culvert | Embankment | Toxic Weeds |
| | | CS Plate Pipe Arch | Insufficient Barrel Length |
| | | Water Channel | Obstructed |
| C31-A15 | MacRae Road Culvert | Embankment | Over-steepened |

# Bridge Condition Index Report

| Bridge ID | Name | BCI | Program Year |
|---|---|---|---|
| 31-170 | North Lunenburg Bridge | **84.7** | |
| 31-175 | Valade Road Bridge | **71.6** | 2022 |
| 31-181 | Red Bridge | **70.3** | 2021 |
| 31-182 | McMillan Bridge | **86.6** | |
| 31-186 | Kennedy Bridge | **83.6** | |
| 31-187 | Campbell Bridge | **73.0** | 2021 |
| 31-208 | Race Track Bridge | **74.1** | 2022 |
| 31-303 | Shaver Bridge | **74.5** | 2019 |
| 31-A21 | Johnson Bridge | **83.4** | 2022 |
| C31-167 | North Lunenburg Road Culvert | **64.4** | 2020 |
| C31-169 | North Lunenburg Road Culvert | **60.3** | 2024 |
| C31-A01 | Goldfield Road Culvert | **98.8** | |
| C31-A02 | Hunters Road Culvert | **61.9** | 2021 |
| C31-A03 | Otto Road Culvert | **92.5** | |
| C31-A06 | Beckstead Road Culvert | **57.1** | 2024 |
| C31-A08 | Anderson Road Culvert | **74.5** | |
| C31-A10 | Finch-Osnabruck Boundary Rd Culvert | **58.2** | 2020 |
| C31-A12 | Cooper Road Culvert | **73.8** | 2021 |
| C31-A13 | Wilburn Road Culvert | **57.5** | |
| C31-A15 | MacRae Road Culvert | **64.8** | 2023 |
| C31-A16 | Northfield Road Culvert | **60.3** | |
| C31-A18 | O'Keefe Road Culvert | **62.5** | 2020 |

**Total Number of Structures 22**

| BCI < 50: | BCI Between 50 and 60: | BCI Between 60 and 70: | BCI Above 70: |
|---|---|---|---|
| 0 | 3 | 6 | 13 |
| Percent: 0 | 13.6% | 27.3% | 59.1% |

# Bridge Inspection Report

## *North Lunenburg Bridge*

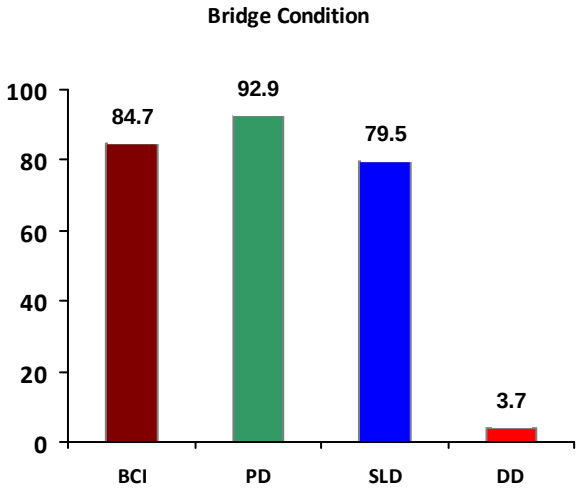
| | |
|---|---|
| **Road Name:** | *North Lunenburg Road West* |
| **Site ID:** | *31-170* |
| **Structure Type:** | *Conc Rigid Frame Precast* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2008* |
| **Length:** | *8.7 m* |
| **Width:** | *9.3 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *7.9* |
| **Feature Under:** | *Navigable Channel* |
| **Crossing:** | *Raisin River* |
| **Location:** | *100 m West of County Road 12* |

| | | | |
|---|---|---|---|
| **AADT:** | *200* | **Latitude:** | *45.06769300* |
| **Lanes:** | *2* | **Longitude:** | *-74.96798700* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *8.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*The current condition of this bridge is good. Topping slab has open cracks, no delaminations at this time. It may be beneficial to seal the cracks in the topping slab to prevent the acceleration of damage to the deck.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*No Capital Works Recommendations*

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** ***$682,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***79 Years***

## Component Inspection Information

**Unprotected BSRC Deck (1)**
***Topping Slab***
Length: ***8.7 m***
Width: ***8.5 m***
Height: ***0.15 m***

Defects 25.0% **Minor Scaling**
Damage **1.0%** **Moderate Cracking, Minor Impact**
Maintenance **None**
Capital Rec. **None**
***Wide open longitudinal & transverse cracks in deck surface. Surface is scaled. No delaminations found. Some minor damage at deck ends from plow.***

---

**Soffit (1)**
***Deck Soffit***
Length: ***8.7 m***
Width: ***8.5 m***
Height:

Defects **1.0%** **Minor Staining**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Some minor leach stains at precast joints.***

---

**Asphalt Wear Surf (1)**
***Appr Wear Surface***
Length: ***10 m***
Width: ***8.5 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition. Asphalt padding next to deck ends due to minor settlement.***

---

**Conc Curb (2)**
***Approach Curb***
Length: ***9.2 m***
Width: ***0.4 m***
Height: ***0.25 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition, steel guide posts anchored to top of curbs. Approach curbs located on wing walls.***

---

**Conc Curb (2)**
***Curbs***
Length: ***8.7 m***
Width: ***0.4 m***
Height: ***0.25 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition, steel thrie beam posts anchored to top of curbs.***

---

**Steel Post & Guide Rail (4)**
***Approach Barrier***
Length: ***6 m***
Width:
Height: ***0.72 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition, located on approaches. Eccentric loader end treatments at the SE & NW.***

---

## Component Inspection Information

**Thrie Beam G/R (2)**
*Barrier*
Length: *8.7 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Satisfactory condition. Steel post & thrie beam on bridge.*

---

**RC Abutment Wall (2)**
*Precast Wall*
Length:
Width: *9.3 m*
Height: *1.5 m*

Defects **0.0%**
Damage **1.0%** **Minor Spalling**
Maintenance **None**
Capital Rec. **None**
*Precast walls have some minor parging repairs. 3-sided sections were placed on top of concrete abutment walls without proper bearing, the stress is causing spalling at the base of the precast walls.*

---

**RC Abutment Wall (2)**
*Abutment Stem*
Length:
Width: *9.3 m*
Height: *3.2 m*

Defects **1.0%** **Minor Leaching Cracks**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Small abutment walls supporting the precast 3-sided sections. Walls are in good condition, some leaching cracks.*

---

**RC Wing Walls (4)**
*Wing Walls*
Length: *9.2 m*
Width:
Height: *1.88 m*

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

---

**Water Channel (1)**
*Channel*

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

---

**Embankment (4)**
*Embankment*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Bell attached to north side of structure. Well groomed on north side, thick vegetation growth on south side..*

---

Image 30

North elevation

Image 23

East approach

Image 24

West approach

Image 25

Guide rail on wing walls

Image 26

Thrie beam on deck

Image 27

Exposed concrete deck

Image 28

South channel

Image 29

North channel

Image 31

East abutment wall

Image 32

West abutment wall

Image 33

Soffit (typical)

Image 34

South elevation

# Bridge Inspection Report

## *Valade Road Bridge*


| | |
|---|---|
| **Road Name:** | *Valade Rd.* |
| **Site ID:** | *31-175* |
| **Structure Type:** | *Prestressed Solid Slab* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1978* |
| **Length:** | *21.4 m* |
| **Width:** | *6.3 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *21.4* |
| **Feature Under:** | *Navigable Channel* |
| **Crossing:** | *Raisin River* |
| **Location:** | *0.1 km East of County Road 18, Con 6 Lot 19* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.09048100* |
| **Lanes:** | *1* | **Longitude:** | *-74.83533100* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *4.1 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

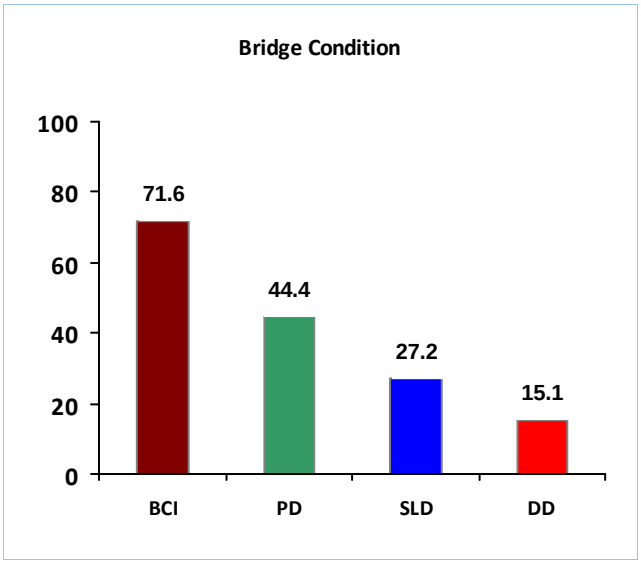
*Topping slab and joints are due for replacement, curbs & barrier system should be installed to prevent the water runoff at deck edges that is damaging the exterior girders. Recommend new asphaltic plug joints.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail*




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$992,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *39 Years*

**Rehabilitation Year and Estimated Cost:** *2022 $319,000*

## Component Inspection Information

**Unprotected BSRC Deck (1)**
***Topping Slab***
Length: ***21.4 m***
Width: ***6.3 m***
Height:

Defects 50.0% **Moderate Scaling**
Damage 5.0% **Moderate Delamination, Moderate Cracking**
Maintenance **None**
Capital Rec. **None**
***Many wide cracks & delaminations. Surface is scaled throughout. Deck does not have proper drainage. Evidence of several core samples from deck.***

---

**Soffit (1)**
***Deck Soffit***
Length: ***21.4 m***
Width: ***6.3 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Soffit is underside of box girders. See girder notes.***

---

**X- Joint Conventional (2)**
***Expansion Joints***
Length: ***6.3 m***
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **Replace in 2 years** **Perf Def: Leaking**
***Joints are partially paved over. Joints are leaking.***

---

**Steel Beam on Wood Post (**
***Guide Rail***
Length: ***87.5 m***
Width:
Height: ***0.8 m***

Defects **0.0%**
Damage 15.0% **Moderate Impact, Moderate Decay**
Maintenance **None**
Capital Rec. **Replace in 2 years**
***Numerous areas of impact damage. Posts have moderate to major decay in top surface. Several timber spacer blocks are missing.***

---

**RC Box (5)**
***Girders***
Length: ***21.4 m***
Width: ***1.2 m***
Height: ***0.7 m***

Defects **0.5%** **Minor Leaching Cracks, Minor Leaching/Seepage**
Damage **1.0%** **Moderate Delamination, Moderate Spalling**
Maintenance **None**
Capital Rec. **Repair in 2 years**
***Mostly good condition with the exception of the exterior corners & the exterior face of the exterior girders. Lack of drainage from the deck & the leaking expansion joints have damaged the exterior girders. Minor delaminations on bottom of girders at east end due to leaking joint.***

---

**RC Abutment Wall (2)**
***Abutment Stem***
Length:
Width: ***6.3 m***
Height: ***1.7 m***

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

---

## Component Inspection Information

**RC Ballast Wall (2)**
***Ballast Wall***
Length: ***6.3 m***
Width:
Height: ***0.85 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**RC Wing Walls (4)**
***Wing Walls***
Length: ***2.9 m***
Width:
Height: ***1.2 m***

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

---

**Laminated Rubber Brg (28)**
***Abutment Bearings***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
**Partial Inspection**
***Limited views of bearings, visible bearings were in good condition.***

---

**Water Channel (1)**
***Channel***

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

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove Brush/Trees**
Capital Rec. **None**
***Heavy brush around wing walls.***

---

**Delineator (4)**
***Signs***
Length:
Width:
Height:

Defects **0.0%**
Damage 25.0% **Minor Missing**
Maintenance **None**
Capital Rec. **None**
**Perf Def: Missing**
***Delineator at the SW end of guide rail is missing.***

---

## Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✓ | m² | 20.0 | $500 | $10,000 |
| *Deck Concrete Overlay* | ✓ | m² | 134.8 | $350 | $47,187 |
| *Deck Replacement* | ✗ | m² | 134.8 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✓ | m | 45.4 | $1,500 | $100,200 |
| *Expansion Joint* | ✓ | m | 12.6 | $3,000 | $37,800 |
| *Waterproof & Pave* | ✗ | m² | 134.8 | $200 | $0 |
| *Bearing Replacement* | ✗ | Count | 10.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✓ | m | 80.0 | $200 | $24,000 |

*Other Work* $0

| | |
|---|---|
| **Structural Items Subtotal** | **$219,000** |
| **Mobilization General Sitework 10%** | **$22,000** |
| **Estimated Traffic Management & Civil Items** | **$25,000** |
| **Contract Admin & Contingencies 20%** | **$53,000** |
| **Total Rehabilitation Cost Estimate** | ***$319,000*** |

**Recommended Capital Work Summary**

**Recommended Capital Year** **2022**

***Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail***

**Inspection Comments**

***Topping slab and joints are due for replacement, curbs & barrier system should be installed to prevent the water runoff at deck edges that is damaging the exterior girders. Recommend new asphaltic plug joints.***

Image 65


South elevation

Image 56


West approach

Image 57

West expansion joint

Image 58


East approach

Image 59


East expansion joint

Image 60


Deck surface

Image 61


North guide rail on deck

Image 62

NE guide rail on approach

Image 63

NE guide rail post decay

Image 64

South channel

Image 66


South exterior spalling

Image 67

East abutment wall

Image 68

Soffit typ (girder bottoms)

Image 69

West abutment wall

Image 70

North channel

Image 71

North elevation

Image 72

SW exterior spalling

# Bridge Inspection Report

## *Red Bridge*

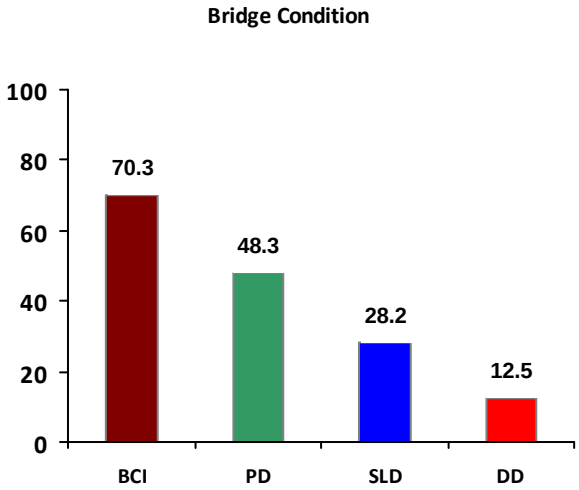
| | |
|---|---|
| **Road Name:** | *Lefebvre Road* |
| **Site ID:** | *31-181* |
| **Structure Type:** | *Prestressed Solid Slab* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1978* |
| **Length:** | *19.6 m* |
| **Width:** | *6.4 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *19.6* |
| **Feature Under:** | *Water* |
| **Crossing:** | *Raisin River* |
| **Location:** | *0.15 km North of County Rd 18, Con 6 Lot 7* |


| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.10995300* |
| **Lanes:** | *2* | **Longitude:** | *-74.77310700* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *5.2 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*This bridge is due for a major rehabilitation. Joints & barrier system are driving the need for rehab. Poor drainage from bridge is damaging exterior girders.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail*

**Estimated Replacement Value:** *$925,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *39 Years*

**Rehabilitation Year and Estimated Cost:** *2021 $308,000*

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**RC Topping Slab (1)**
*Deck Surface*
Length: *19.6 m*
Width: *6.4 m*
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Assumed concrete topping slab on top of box girders. Deck is covered with asphalt. Evidence of recent deck condition survey in asphalt. No proper drainage from deck runoff is off the edges of bridge.*

---

**Soffit (1)**
*Deck Soffit*
Length: *19.6 m*
Width: *6.4 m*
Height:

Defects **0.0%**
Damage 5.0% **Minor Fire Spalls**
Maintenance **None**
Capital Rec. **None**
*Soffit is the bottom of box girders. North end is stained (no spalling) due to fire pit under bridge.*

---

**Asphalt Wear Surf (1)**
*Wear Surface*
Length: *19.6 m*
Width: *5.2 m*
Height:

Defects **0.0%**
Damage 5.0% **Moderate Cracking**
Maintenance **None**
Capital Rec. **None**
*Numerous random cracks. Evidence of recent condition survey.*

---

**X- Joint Conventional (2)**
*Expansion Joints*
Length: *6.4 m*
Width:
Height:

Defects **0.0%**
Damage 10.0% **Major End Dam Breakage, Major Plow Gouging**
Maintenance **None**
Capital Rec. **Replace in 2 years**
*Joint seals are over compressed. Tops of both ballast walls have major damage from winter plow. Armouring also has minor plow scrapes.*

---

**Steel Beam on Wood Post (**
*Guide Rail*
Length: *42.5 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage 10.0% **Major Decay, Moderate Impact**
Maintenance **None**
Capital Rec. **Replace in 2 years** **Perf Def: Weakened**
*Guide rail has many collision scrapes. One post is completely severed at NE end. 47 m (E) + 38 m (W)*

---

**RC Box (7)**
*Girders*
Length: *19.6 m*
Width: *0.9 m*
Height: *0.7 m*

Defects **5.0%** **Moderate Staining, Minor Rust Staining**
Damage **1.0%** **Minor Delamination, Minor Fire Spalls**
Maintenance **None**
Capital Rec. **None**
*Delaminated area on bottom of west girder. Spall on exterior of west girder. Lack of drainage from deck is causing damage to exterior girders. Staining on underside of girders at north end evident of camp fires under bridge.*

---

## Component Inspection Information

**RC Abutment Wall (2)**
***Abutment Stem***
Length:
Width: ***6.4 m***
Height: ***2.7 m***

Defects 20.0% **Moderate Scaling, Minor Graffiti**
Damage **1.0%** **Minor Delamination, Minor Spalling**
Maintenance **None**
Capital Rec. **None**
***Abutments tops were recast. NW corner has spalls & delaminated areas under girder. Old walls have moderate scaling.***

---

**RC Ballast Wall (2)**
***Ballast Wall***
Length:
Width: ***6.4 m***
Height: ***0.8 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Not Inspected**
Capital Rec. **None**
***Unable to view.***

---

**RC Wing Walls (4)**
***Wing Walls***
Length: ***1.8 m***
Width:
Height: ***1.4 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Laminated Rubber Brg (2)**
***Abutment Bearings***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Partial Inspection**
Capital Rec. **None**
***Only visible at corners of abutments, no concerns noted.***

---

**Water Channel (1)**
***Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Stream well centered under bridge.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove Brush/Trees**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Trees & brush require brushing out. Wild parsnip present.***

---

## Component Inspection Information

| | | |
|---|---|---|
| **Delineator (4)** | Defects **0.0%** | |
| ***Signs*** | Damage 50.0% **Moderate Missing** | |
| **Length:** | Maintenance **Add Signs** | |
| **Width:** | Capital Rec. **None** | **Perf Def: Missing** |
| **Height:** | ***Delineators at SW & NE corners. Signs at NW & SE are missing.*** | |

# Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✓ | m² | 20.0 | $500 | $10,000 |
| *Deck Concrete Overlay* | ✓ | m² | 125.4 | $350 | $43,904 |
| *Deck Replacement* | ✗ | m² | 125.4 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✓ | m | 43.6 | $1,500 | $94,800 |
| *Expansion Joint* | ✓ | m | 12.8 | $3,000 | $38,400 |
| *Waterproof & Pave* | ✗ | m² | 125.4 | $200 | $0 |
| *Bearing Replacement* | ✗ | Count | 14.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✓ | m | 80.0 | $200 | $24,000 |

*Other Work* $0

| | |
|---|---|
| **Structural Items Subtotal** | **$211,000** |
| **Mobilization General Sitework 10%** | **$21,000** |
| **Estimated Traffic Management & Civil Items** | **$25,000** |
| **Contract Admin & Contingencies 20%** | **$51,000** |
| **Total Rehabilitation Cost Estimate** | ***$308,000*** |

**Recommended Capital Year** **2021**

**Recommended Capital Work Summary**

***Misc Concrete Repairs, O'Lay, B/Wall, X-Jnt, Guide Rail***

**Inspection Comments**

***This bridge is due for a major rehabilitation. Joints & barrier system are driving the need for rehab. Poor drainage from bridge is damaging exterior girders.***

Image 40


West elevation

Image 26


South approach

Image 27

North approach

Image 28

North expansion joint

Image 29

West guide rail on deck

Image 30

South expansion joint

Image 31


Asphalt on deck

Image 32


West channel

Image 33


East channel

Image 34

NW guide rail impact damage

Image 35


NE guide rail post severed

Image 36


North abutment wall

Image 37


Soffit typ (girder bottoms)

Image 38


South abutment wall

Image 39


East elevation

Image 41

NW corner typ damage at corners

Image 42


North soffit fire damage

Image 43


West exterior girder delamination

# Bridge Inspection Report

## *McMillan Bridge*

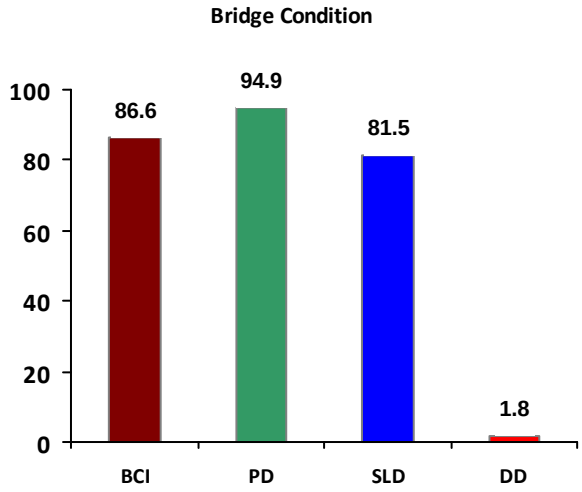

| | |
|---|---|
| **Road Name:** | *Delaney Road* |
| **Site ID:** | *31-182* |
| **Structure Type:** | *Slab on Steel Girder* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2009* |
| **Length:** | *21.8 m* |
| **Width:** | *9.5 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *19.2* |
| **Feature Under:** | *Navigable Channel* |
| **Crossing:** | *Raisin River* |
| **Location:** | *0.5km North of County Rd 18, Lot 1, Concession 6,* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Current condition of this bridge is good, minor maintenance recommended at this time.*

| | | | |
|---|---|---|---|
| **AADT:** | *22* | **Latitude:** | *45.12453600* |
| **Lanes:** | *2* | **Longitude:** | *-74.76022500* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *8.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$1,267,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***80 Years***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

| | | |
|---|---|---|
| **Unprotected BSRC Deck (1)** | Defects **10.0%** | **Minor Scaling, Minor Scrapes/Gouging** |
| ***Deck Surface*** | Damage **0.1%** | **Minor Cracking** |
| Length: ***21.8 m*** | Maintenance **None** | |
| Width: ***9.5 m*** | Capital Rec. **None** | |
| Height: ***0.23 m*** | ***Most of tining has been lost. Minor plow gouging at north end. Transverse cracks at north end. Scaling of exposed concrete surface.*** | |

| | |
|---|---|
| **Soffit (1)** | Defects **0.0%** |
| ***Deck Soffit*** | Damage **0.0%** |
| Length: ***21.8 m*** | Maintenance **None** |
| Width: ***8.4 m*** | Capital Rec. **None** |
| Height: | ***Pristine.*** |

| | |
|---|---|
| **Approach Slab (2)** | Defects **0.0%** |
| ***Approach Slab*** | Damage **0.0%** |
| Length: ***6 m*** | Maintenance **None** |
| Width: ***9.5 m*** | Capital Rec. **None** |
| Height: | ***Tining has mostly worn off. Surface treatment extends partially on to approach slabs.*** |

| | |
|---|---|
| **Asphalt Wear Surf (1)** | Defects **0.0%** |
| ***Appr Wear Surface*** | Damage **0.0%** |
| Length: ***10 m*** | Maintenance **None** |
| Width: ***9.5 m*** | Capital Rec. **None** |
| Height: | ***Surface treatment on approaches to bridge.*** |

| | | |
|---|---|---|
| **Conc Curb (2)** | Defects **2.0%** | **Minor Scaling** |
| ***Curbs*** | Damage **0.5%** | **Minor Cracking** |
| Length: ***29.2 m*** | Maintenance **None** | |
| Width: ***0.59 m*** | Capital Rec. **None** | |
| Height: ***0.15 m*** | ***Curbs have a very poor finish. Many transverse cracks in top of curbs. Curb on SE wing wall appears to be in the worst condition.*** | |

| | | |
|---|---|---|
| **Steel Beam on Steel Post (2** | Defects **0.0%** | |
| ***Guide Rail*** | Damage **0.0%** | |
| Length: ***102.4 m*** | Maintenance **None** | |
| Width: | Capital Rec. **None** | |
| Height: ***0.72 m*** | ***Eccentric loader end treatment at all guide rail ends. Erosion at corners of bridge have exposed guide rail posts next to end walls. 94.20 m (W) + 110.60 m €*** | |

## Component Inspection Information

**Steel Beam (20)**
*Diaphragms*
Length: *2.1 m*
Width: *0.165 m*
Height: *0.31 m*

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

---

**Thrie Beam G/R (2)**
*Barrier*
Length: *29.2 m*
Width:
Height: *0.69 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Thrie beams are mounted on the bridge curbs, condition.is good.*

---

**Steel-Fabricated (5)**
*Girders*
Length: *19.6 m*
Width: *0.292 m*
Height: *0.84 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Girders are in good condition. Ends of girders are nicely coated.*

---

**RC Abutment Wall (2)**
*Abutment Stem*
Length:
Width: *9.3 m*
Height: *3.65 m*

Defects **1.0%** **Minor Graffiti, Minor Scaling**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Some areas of poor segregation of concrete on north wall. Graffiti on both walls mainly south. Rip rap against walls.*

---

**RC Ballast Wall (2)**
*Ballast Wall*
Length:
Width: *9.3 m*
Height: *0.58 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Not Inspected**
Capital Rec. **None**
*Semi-integral abutments.*

---

**RC Wing Walls (4)**
*Wing Walls*
Length: *5.3 m*
Width:
Height: *2.6 m*

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

---

## Component Inspection Information

**Laminated Rubber Brg (10)**
***Abutment Bearings***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Water Channel (1)**
***Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Water moving well under bridge.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%** **Moderate Erosion**
Damage **0.0%**
Maintenance **Remove Brush/Trees**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Trees & brush around wing walls & under bridge should be cleared. Erosion at ends of curbs. Wild parsnip noted on embankments. Stone protection against abutment walls.***

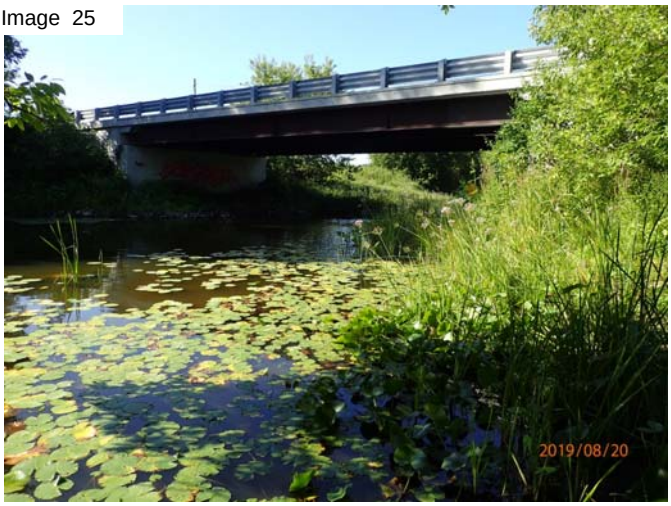
---

**Delineator (2)**
***Signs***
Length:
Width:
Height:

Defects **0.0%**
Damage 30.0% **Moderate Missing, Minor Impact**
Maintenance **Add Signs, Straighten Sign**
Capital Rec. **None**
***Delineator in the SW is missing. Sign in NE is bent.***

---

Image 25




East elevation

Image 14

North approach

Image 15

South approach

Image 16

SE guide rail on approach

Image 17

East thrie beam on deck

Image 18


East channel

Image 19


Deck surface

Image 20

West channel

Image 21

North end deck cracking

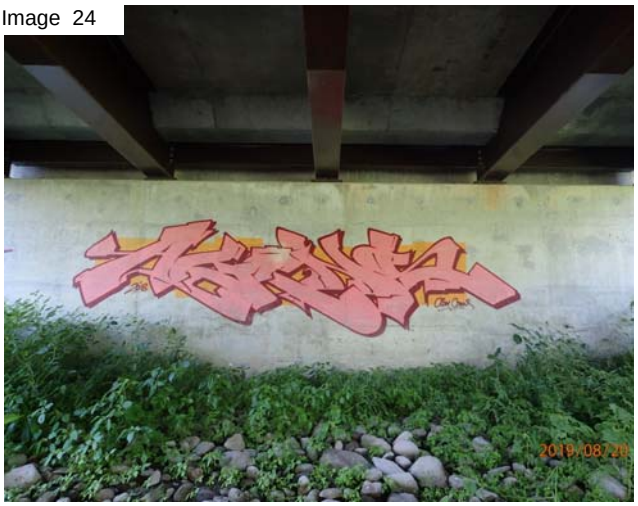
Image 22

North abutment wall

Image 23


Soffit typ

Image 24



South abutment wall

# Bridge Inspection Report

## *Kennedy Bridge*

| | |
|---|---|
| **Road Name:** | *Delaney Road* |
| **Site ID:** | *31-186* |
| **Structure Type:** | *Precast Arch* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2006* |
| **Length:** | *11.3 m* |
| **Width:** | *9 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *11* |
| **Feature Under:** | *Water* |
| **Crossing:** | *North Raisin River* |
| **Location:** | *75m South of McPhail Rd, Lot 1 Concession 7,* |

| | |
|---|---|
| **Inspection Date:** | *July-05-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Structure is in overall good condition. The approach guide rail will need updating within 10 years.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

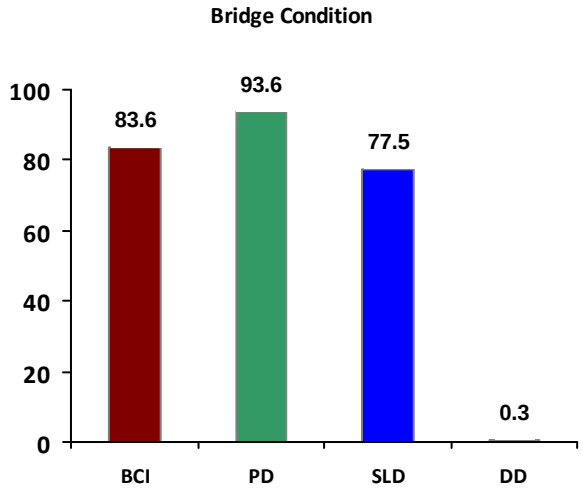
*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$552,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***77 Years***


| | | | |
|---|---|---|---|
| **AADT:** | *200* | **Latitude:** | *45.14623900* |
| **Lanes:** | *2* | **Longitude:** | *-74.77131600* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *7.6 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**Precast Concrete Arch (1)**
*Conduit*
Length: *11 m*
Width: *9 m*
Height: *3.1 m*

Defects **0.5%** **Minor Graffiti, Minor Formed Patches**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Overall very good condition. Graffiti on the south wall. Small repair in soffit, likely due to handling spall.*

---

**RC Topping Slab (1)**
*Deck Surface*
Length: *11.3 m*
Width: *9 m*
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Covered with asphalt, suspect no problems on deck.*

---

**Asphalt Wear Surf (1)**
*Wear Surface*
Length: *11.3 m*
Width: *7.6 m*
Height:

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

---

**Conc Curb (2)**
*Curbs*
Length: *11.8 m*
Width: *0.4 m*
Height: *0.1 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Good condition. Thrie beam posts secured to curb tops.*

---

**Steel Beam on Steel Post (4**
*Guide Rail*
Length: *24.5 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage **1.0%** **Minor Impact**
Maintenance **None**
Capital Rec. **None**
*Buried ends in the NE & SW, eccentric loader end treatment in the NW & SE. Several areas of impact damage to approach guide rail.*

---

**Thrie Beam G/R (2)**
*Barrier*
Length: *11 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Good condition. Thrie beam over bridge, secured to steel posts.*

---

## Component Inspection Information

| | |
|---|---|
| **RC Wing Walls (4)**<br>***Wing Walls***<br>Length: ***7 m***<br>Width: ***0.25 m***<br>Height: ***2.4 m*** | Defects **1.0%** **Minor Scaling**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Good condition. Some light scaling on the SW wall.*** |
| **Headwall (2)**<br>***Head Wall***<br>Length: ***11.3 m***<br>Width:<br>Height: ***1 m*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Headwalls have varied height. West headwall has small area of damage, appears to have been done at time of construction.*** |
| **Water Channel (1)**<br>***Channel*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Good condition.*** |
| **Embankment (4)**<br>***Embankment*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Large stone protection at ends of wing walls. Embankments are in good condition.*** |
| **Delineator (4)**<br>***Signs***<br>Length:<br>Width:<br>Height: | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **Adjust Height**<br>Capital Rec. **None** **Perf Def: Inadequate Height**<br>***Signs are located at the ends of wing walls. Signs are set too low.*** |

Image 23


West elevation

Image 15


South approach

Image 16


North approach

Image 17

NW guide rail system

Image 18

Thrie beam over bridge typ

Image 19

East channel

Image 20

West channel

Image 21

Impact damage NW end

Image 22

NW wing wall typ

Image 24

North abutment wall

Image 25

South abutment wall

Image 26

Soffit (typical)

Image 27


Small repaired area in soffit

Image 28

East elevation

# Bridge Inspection Report

## *Campbell Bridge*


| | |
|---|---|
| **Road Name:** | *McPhail Road* |
| **Site ID:** | *31-187* |
| **Structure Type:** | *Concrete Rigid Frame CIP* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1988* |
| **Length:** | *13.3 m* |
| **Width:** | *10.1 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *12* |
| **Feature Under:** | *Water* |
| **Crossing:** | *North Raisin River* |
| **Location:** | *5km East of Hwy. 138, Lot 1, Concession 7 & 8,* |

| | | | |
|---|---|---|---|
| **AADT:** | *960* | **Latitude:** | *45.14823400* |
| **Lanes:** | *2* | **Longitude:** | *-74.77434500* |
| **Skew:** | *20 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *8.8 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *July-05-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

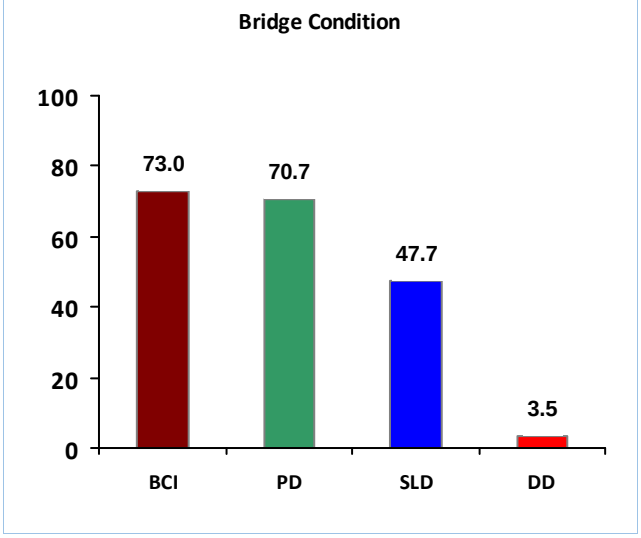
*Bridge is in very good condition. Lack of proper drainage from bridge will likely result in damage to soffit on the south side. Guide rail has many areas of collision damage due to the curved road alignment at bridge. Buried end treatments do not meet the current standards. Due to the damage and performance deficiencies recommend the guide rail be replaced within two years.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Guide Rail*




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** ***$1,577,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***69 Years***

**Rehabilitation Year and Estimated Cost:** ***2021 $47,000***

## Component Inspection Information

**RC Topping Slab (1)**
*Deck Surface*
Length: *13.3 m*
Width: *10.1 m*
Height:

Defects **0.0%**
Damage **0.1%** **Minor Cracking**
Maintenance **None**
Capital Rec. **None**
*Covered with skim coat of asphalt. Shoulder areas are exposed. Chain drag in 2019 detected no delaminations. Crack noted in NW corner. Tining is present on exposed deck.*

---

**Soffit (1)**
*Deck Soffit*
Length: *12 m*
Width: *10.1 m*
Height:

Defects **0.0%**
Damage **0.5%** **Minor Delamination, Minor Cracking**
Maintenance **None**
Capital Rec. **None**
*Overall very good condition. Some cracking in soffit. Minor delaminated areas along south edge. Lack of proper drainage from deck is causing damage at south edge.*

---

**Asphalt Wear Surf (1)**
*Wear Surface*
Length: *13.3 m*
Width: *6.5 m*
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Satisfactory condition. Thin skim coat on deck.*

---

**Steel Beam on Wood Post (**
*Guide Rail*
Length: *40 m*
Width:
Height: *0.5 m*

Defects **0.0%**
Damage 10.0% **Moderate Impact, Moderate Decay**
Maintenance **Spot post replacement**
Capital Rec. **None** **Perf Def: Weakened**
*Many vehicle strikes. Four posts on north side of bridge damaged from vehicle impact, post anchors weakened from collision. Buried end treatments at all ends. Timber posts have varying degrees of decay, several posts require replacement.*

---

**RC Abutment Wall (2)**
*Abutment Stem*
Length:
Width: *10.1 m*
Height: *2.3 m*

Defects **5.0%** **Minor Leaching Cracks, Minor Honeycomb, Minor Graffiti**
Damage **0.5%** **Minor Cracking**
Maintenance **None**
Capital Rec. **None**
*Overall good condition. Some vertical moderate cracks. Minor leaching cracks. Small pocket honeycomb on east wall. West wall is stained on lower portion. Graffiti on west wall. Founded on bedrock.*

---

## Component Inspection Information

**RC Wing Walls (4)**
***Wing Walls***
Length: ***6 m***
Width:
Height: ***1.4 m***

Defects **0.1%** **Minor Leaching/Seepage**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Overall good condition. Some leaching at exterior knee joints.***

---

**Rip Rap (4)**
***Channel Armour***

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

---

**Water Channel (1)**
***Channel***

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

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Wild parsnip is present. Some tree growth near wing walls.***

---

**Delineator (4)**
***Signs***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **Adjust Height**
Capital Rec. **None** **Perf Def: Inadequate Height**
***Delineators at the ends of guide rail. Signs are set too low.***

---

# Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✘ | m² | 0.0 | $500 | $0 |
| *Deck Concrete Overlay* | ✘ | m² | 134.3 | $350 | $0 |
| *Deck Replacement* | ✘ | m² | 134.3 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✘ | m | 37.3 | $1,500 | $0 |
| *Expansion Joint* | ✘ | m | 20.2 | $3,000 | $0 |
| *Waterproof & Pave* | ✘ | m² | 134.3 | $200 | $0 |
| *Bearing Replacement* | ✘ | Count | 0.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✓ | m | 80.0 | $200 | $24,000 |

*Other Work* $0

| | |
|---|---|
| **Structural Items Subtotal** | **$24,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$5,000** |
| **Contract Admin & Contingencies 20%** | **$8,000** |
| **Total Rehabilitation Cost Estimate** | ***$47,000*** |

**Recommended Capital Work Summary** **Recommended Capital Year** **2021**

***Guide Rail***

**Inspection Comments**

***Bridge is in very good condition. Lack of proper drainage from bridge will likely result in damage to soffit on the south side. Guide rail has many areas of collision damage due to the curved road alignment at bridge. Buried end treatments do not meet the current standards. Due to the damage and performance deficiencies recommend the guide rail be replaced within two years.***

Image 8


South elevation

Image 1


East approach

Image 2


West approach

Image 3


Barrier system north side

Image 4

North channel

Image 5


South channel

Image 6

Asphalt on deck

Image 7

Typ decay in post tops

Image 9

East abutment wall

Image 10

Soffit (typical)

Image 11

West abutment wall

Image 12

North elevation

Image 13


Delams soffit south side

Image 14


SW corner detail

# Bridge Inspection Report

## *Race Track Bridge*


| | |
|---|---|
| **Road Name:** | *Barlow Road* |
| **Site ID:** | *31-208* |
| **Structure Type:** | *Slab on Steel Girder* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1985* |
| **Length:** | *5.6 m* |
| **Width:** | *5.12 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *5.1* |
| **Feature Under:** | *Water* |
| **Crossing:** | *South Raisin River* |
| **Location:** | *1km East of County Rd 33. Lot 17, Concession 4.* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.05443800* |
| **Lanes:** | *1* | **Longitude:** | *-74.80034900* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *50 km/h* | **Road Width:** | *4.84 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

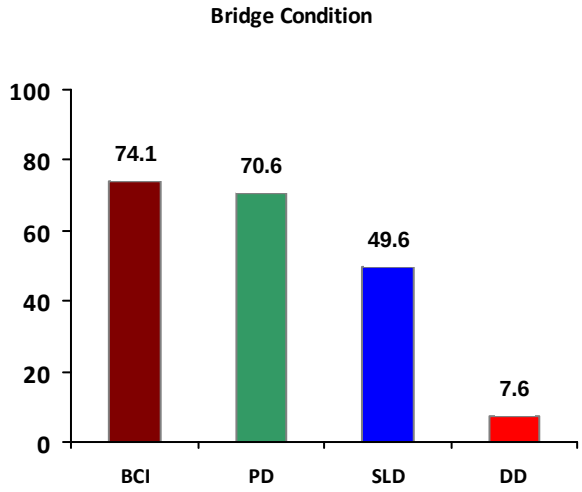
*With the exception of the curbs and barrier system this small bridge is performing well. New curbs and barrier are needed.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*B/Wall, Guide Rail*




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$182,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *56 Years*

**Rehabilitation Year and Estimated Cost:** *2022 $110,000*

## Component Inspection Information

**Soffit (1)**
*Deck Soffit*
Length: *5.62 m*
Width: *5.12 m*
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Satisfactory condition.*

**Timber Wear Surface (1)**
*Wear Surface*
Length: *5.62 m*
Width: *5.12 m*
Height:

Defects **0.0%**
Damage **2.0%** **Minor Wear, Minor Gouging**
Maintenance **None**
Capital Rec. **None**
*Partially covered with gravel, west side is exposed. Top of exposed timbers have minor damage from winter plow.*

**Armouring (2)**
*Expansion Joints*
Length: *5.12 m*
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None** **Not Inspected**
Capital Rec. **None**
*Covered with gravel.*

**Timber Curb (2)**
*Curbs*
Length: *5.62 m*
Width: *0.14 m*
Height: *0.16 m*

Defects **10.0%** **Moderate Bowed/Warped**
Damage 10.0% **Moderate Breakage**
Maintenance **None**
Capital Rec. **Replace in 2 years**
*Curb on east side is mostly missing. West side is comprised of 3 2x8 boards. Boards have pulled up at north end.*

**Steel Post & Guide Rail (4)**
*Approach Barrier*
Length: *15.6 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage 30.0% **Moderate Impact**
Maintenance **None**
Capital Rec. **Replace in 1 year** **Perf Def: Weakened**
*Many impact strikes on flex beam. Post spacing not up to standard. 15.2 m (N) + 16.0 m (S)*

**Steel Beam on Wood Post (**
*Guide Rail*
Length: *5.6 m*
Width:
Height: *0.72 m*

Defects **0.0%**
Damage 20.0% **Moderate Impact, Major Decay**
Maintenance **None**
Capital Rec. **Replace in 1 year**
*Major collision damage to both sides of guide rail barrier. Timber posts have major decay in top surface. Post spacing is not up to standard.*

## Component Inspection Information

**Steel-Fabricated (7)**
***Girders***
Length: ***5.1 m***
Width: ***0.205 m***
Height: ***0.31 m***

Defects **2.0%** **Minor Tarnishing**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Girder ends are embedded in concrete abutment walls.***

---

**RC Abutment Wall (2)**
***Abutment Stem***
Length:
Width: ***6.7 m***
Height: ***1.94 m***

Defects **5.0%** **Moderate AAR Cracking, Minor Honeycomb, Minor Erosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Minor honeycomb in the NW face, small pocket of erosion in the SE face. Exterior edges have AAR open cracking.***

---

**RC Wing Walls (4)**
***Wing Walls***
Length: ***1.55 m***
Width:
Height: ***1.1 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Rip Rap (1)**
***Slope Protection***
Length:
Width:
Height:

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

---

**Water Channel (1)**
***Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Accumulation of stones at the west upstream side of bridge. Minor scour at south abutment. Water moving well under bridge.***

---

**Embankment (4)**
***Embankment***

Defects **5.0%** **Minor Erosion**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Embankments at the corners of the bridge are slipping down into channel.***

---

## Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✘ | m² | 0.0 | $500 | $0 |
| *Deck Concrete Overlay* | ✘ | m² | 28.7 | $350 | $0 |
| *Deck Replacement* | ✘ | m² | 28.7 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✓ | m | 29.6 | $1,500 | $52,800 |
| *Expansion Joint* | ✘ | m | 10.2 | $3,000 | $0 |
| *Waterproof & Pave* | ✘ | m² | 28.7 | $200 | $0 |
| *Bearing Replacement* | ✘ | Count | 14.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✓ | m | 80.0 | $200 | $24,000 |

*Other Work* $0

| | |
|---|---|
| **Structural Items Subtotal** | **$77,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$5,000** |
| **Contract Admin & Contingencies 20%** | **$18,000** |
| **Total Rehabilitation Cost Estimate** | ***$110,000*** |

**Recommended Capital Year** **2022**

**Recommended Capital Work Summary**

***B/Wall, Guide Rail***

**Inspection Comments**

***With the exception of the curbs and barrier system this small bridge is performing well. New curbs and barrier are needed.***

Image 8

East elevation

Image 1

South approach

Image 2

North approach

Image 3

East guide rail on bridge

Image 4

SE guide rail impact damage

Image 5

East channel

Image 6


West channel

Image 7

Gravel on timber deck

Image 9


South abutment wall

Image 11

Soffit typ

Image 12


North abutment wall

Image 13


West guide post decay

# Bridge Inspection Report

## *Shaver Bridge*

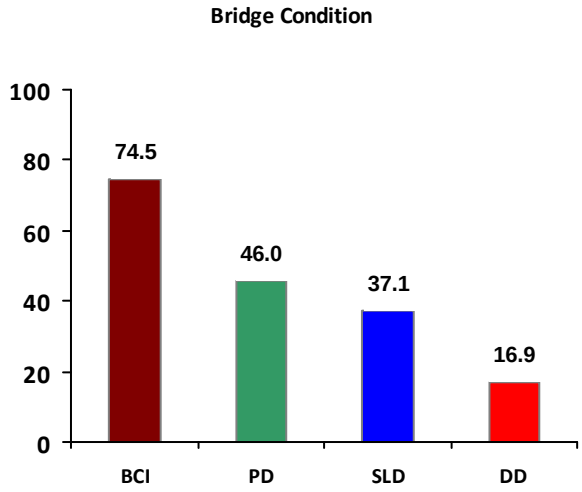

| | |
|---|---|
| **Road Name:** | *Shaver Road* |
| **Site ID:** | *31-303* |
| **Structure Type:** | *Truss-Half Through* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1950* |
| **Length:** | *13.4 m* |
| **Width:** | *5 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *12.2* |
| **Feature Under:** | *Water* |
| **Crossing:** | *Hoople Creek* |
| **Location:** | *0.8km N of Colonial Rd, Lot 12 & 13, Concession 11* |

| | | | |
|---|---|---|---|
| **AADT:** | *200* | **Latitude:** | *45.01440800* |
| **Lanes:** | *1* | **Longitude:** | *-74.95646600* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *4.7 m* |
| **Trucks** | | **Load Posting:** | *10 tonne* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Construction year was estimated at 1950. This bridge is unsafe due to the loss of support under the south bearings. Bridge bearing in SE corner is of major concern, loss of concrete in SE corner has left bearing unstable, SW similar but not as bad. Condition of bridge was brought to owners attention, immediate repairs are needed.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Abut Repairs*

**Estimated Replacement Value:** ***$833,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***16 Years***

**Rehabilitation Year and Estimated Cost:** ***2019 $24,000***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**Unprotected BSRC Deck (1)**
***Deck Surface***
Length: ***13.35 m***
Width: ***5.1 m***
Height: ***0.18 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Some granular materials from approaches have migrated onto deck.***

---

**Soffit (1)**
***Deck Soffit***
Length: ***13.35 m***
Width: ***5.04 m***
Height: ***0.175 m***

Defects **0.5%** **Minor Leaching/Seepage**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Strip Seal (2)**
***Expansion Joints***
Length: ***5 m***
Width:
Height:

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

---

**Conc Curb (2)**
***Curbs***
Length: ***13.35 m***
Width: ***0.15 m***
Height: ***0.15 m***

Defects **0.1%** **Minor Leaching Cracks**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Some minor leaching cracks.***

---

**Steel Beam on Steel Post (2**
***Guide Rail***
Length: ***31 m***
Width:
Height: ***0.72 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Guide rail is overgrown with vegetation. Guide rail on bridge is attached to new verticals supports attached to the exterior deck curb fascia & floor beams.***

---

**Top Chord (2)**
***Top Chord***
Length: ***9.2 m***
Width: ***0.08 m***
Height: ***0.08 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

## Component Inspection Information

**Bottom Chord (2)**
***Bottom Chord***
Length: ***13.3 m***
Width: ***0.08 m***
Height: ***0.08 m***

Defects **0.0%**
Damage **2.0%** **Moderate Deformation**
Maintenance **None**
Capital Rec. **None**
***Damaged in several locations. Built up angle sections.***

---

**Diagonal/Post/Hangar (12)**
***Diagonals/Hangars***
Length: ***3.1 m***
Width: ***0.07 m***
Height: ***0.07 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Stringers (36)**
***Steel Stringer***
Length: ***6.7 m***
Width: ***0.04 m***
Height: ***0.25 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

**Bailey Bottom Bracing (6)**
***Bracing***
Length: ***6.7 m***
Width: ***0.06 m***
Height: ***0.08 m***

Defects **0.0%**
Damage **2.0%** **Moderate Deformation**
Maintenance **None**
Capital Rec. **None**
***Several bent members.***

---

**Steel Floor Beam (6)**
***Connections***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition. Limited view of several connections due to high water.***

---

**Steel Floor Beam (2)**
***Floor Beams***
Length: ***5.23 m***
Width: ***0.082 m***
Height: ***0.53 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition. Limited view due to high water.***

---

## Component Inspection Information

**RC Abutment Wall (2)**
*Abutment Stem*
Length:
Width: *5.04 m*
Height: *1.2 m*

Defects **0.0%**
Damage 30.0% **Moderate Disintegration, Critical Disintegration**
Maintenance **None**
Capital Rec. **None**
*South abutment has major disintegration, north abutment minor disintegration. Loss of support at SE corner under bearing is very concerning.*

---

**RC Ballast Wall (2)**
*Ballast Wall*
Length:
Width: *5.04 m*
Height: *0.67 m*

Defects **0.0%**
Damage **2.0%** **Moderate Disintegration**
Maintenance **None**
Capital Rec. **None**
*Disintegration noted at south end.*

---

**RC Wing Walls (4)**
*Wing Walls*
Length: *2.3 m*
Width: *0.3 m*
Height: *0.43 m*

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

---

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

Defects **0.0%**
Damage 50.0% **Critical Section Loss**
Maintenance **None**
Capital Rec. **None**
**Perf Def: Uneven Bearing**
*SE bearing has lost approximately 50% of bearing due to disintegration of the old south abutment. Debris & vegetation cover east bearings.*

---

**Water Channel (1)**
*Channel*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
**Perf Def: Lacking Freeboard**
*Open channel, debris on floor members indicate water levels can be high at this location.*

---

**Embankment (2)**
*Embankment*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
*Thick vegetation at bridge wing walls.*

---

## Component Inspection Information

| | | |
|---|---|---|
| **Load Posting (4)** | Defects **0.0%** | |
| ***Signs*** | Damage **0.0%** | |
| **Length:** | Maintenance **None** | |
| **Width:** | Capital Rec. **None** | |
| **Height:** | ***Bridge posted with 10 tonne limit. Signs located at end of south guide rail. Road is dead end so no signs on north side.*** | |
| **Delineator (4)** | Defects 70.0% **Moderate Obstructed** | |
| ***Signs*** | Damage **0.0%** | |
| **Length:** | Maintenance **None** | |
| **Width:** | Capital Rec. **None** | **Perf Def: Obscured** |
| **Height:** | ***Four delineators at ends of guide rail. Signs at north end & at SW are engulfed with vegetation.*** | |

# Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✘ | m² | 0.0 | $500 | $0 |
| *Deck Concrete Overlay* | ✘ | m² | 67.0 | $350 | $0 |
| *Deck Replacement* | ✘ | m² | 67.0 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✘ | m | 37.4 | $1,500 | $0 |
| *Expansion Joint* | ✘ | m | 10.0 | $3,000 | $0 |
| *Waterproof & Pave* | ✘ | m² | 67.0 | $200 | $0 |
| *Bearing Replacement* | ✘ | Count | 0.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✘ | m | 80.0 | $200 | $0 |

*Other Work*

*Abut Repairs* $10,000

| | |
|---|---|
| **Structural Items Subtotal** | **$10,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$0** |
| **Contract Admin & Contingencies 20%** | **$4,000** |
| **Total Rehabilitation Cost Estimate** | ***$24,000*** |

**Recommended Capital Year** **2019**

**Recommended Capital Work Summary**

***Abut Repairs***

**Inspection Comments**

***Construction year was estimated at 1950. This bridge is unsafe due to the loss of support under the south bearings. Bridge bearing in SE corner is of major concern, loss of concrete in SE corner has left bearing unstable, SW similar but not as bad. Condition of bridge was brought to owners attention, immediate repairs are needed.***

Image 42


East elevation

Image 35

South approach

Image 36

North approach

Image 37

NE guide rail

Image 38

East side truss panel

Image 39

Exposed concrete deck

Image 40


East channel

Image 41


West channel

Image 44


SE bearing

Image 45


SE bearing loss support

Image 46


South abutment wall

Image 48

Soffit south end

Image 49


North abutment wall

Image 50


Damaged bottom chord east side

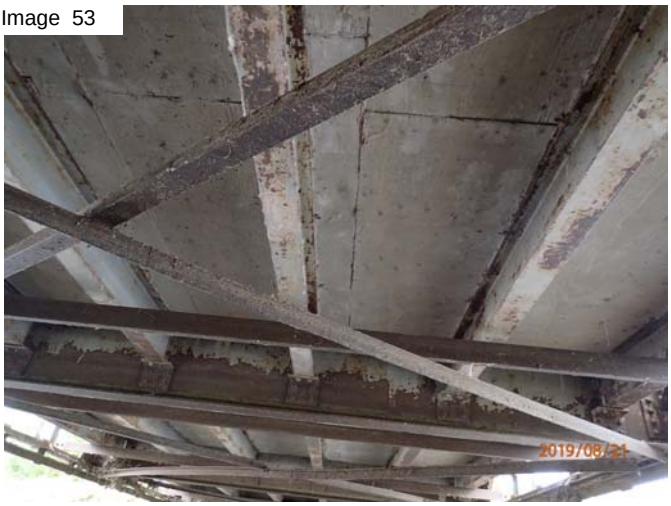
Image 51


Damaged bottom chord west side

Image 52


SW bearing

Image 53




Soffit at north end

Image 54


North abutment wall

# Bridge Inspection Report

## *Johnson Bridge*

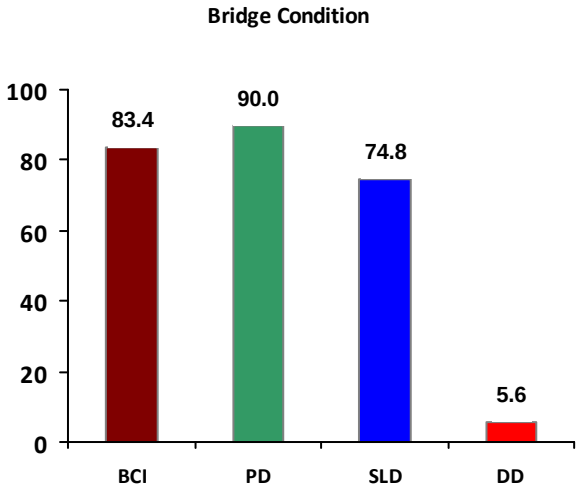
| | |
|---|---|
| **Road Name:** | *Morgan Road* |
| **Site ID:** | *31-A21* |
| **Structure Type:** | *Precast 3 Sided RF* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2007* |
| **Length:** | *11.6 m* |
| **Width:** | *8.5 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *10.7* |
| **Feature Under:** | *Water* |
| **Crossing:** | *Hoople Creek* |
| **Location:** | *2 km North of Dafoe Road* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.01670300* |
| **Lanes:** | *2* | **Longitude:** | *-75.01049200* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *50 km/h* | **Road Width:** | *6 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Nice small bridge in good condition. Deck is polished and has wide longitudinal cracks, no delaminations at this time. Waterproof and paving in the near future should be considered.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*WP&P*

**Estimated Replacement Value:** ***$485,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***88 Years***

**Rehabilitation Year and Estimated Cost:** ***2022 $66,000***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

| | |
|---|---|
| **RC Topping Slab (1)** | Defects 50.0% **Moderate Polished** |
| ***Deck Surface*** | Damage **1.0%** **Moderate Cracking** |
| Length: ***11.58 m*** | Maintenance **None** |
| Width: ***8.5 m*** | Capital Rec. **None** |
| Height: | ***Longitudinal cracks notable. Deck surface polished. Chain drag did not find delaminations.*** |
| **Soffit (1)** | Defects **1.0%** **Minor Leaching/Seepage** |
| ***Deck Soffit*** | Damage **0.0%** |
| Length: ***11.58 m*** | Maintenance **None** |
| Width: ***8.5 m*** | Capital Rec. **None** |
| Height: | ***Overall good condition. East & west precast sections are leaking at precast joints. Wet areas on fascia.*** |
| **Asphalt Wear Surf (1)** | Defects **0.0%** |
| ***Appr Wear Surface*** | Damage **1.0%** **Minor Potholing** |
| Length: ***6 m*** | Maintenance **None** |
| Width: ***8.5 m*** | Capital Rec. **None** |
| Height: | ***Minor potholes in south approach.*** |
| **RC Parapet (2)** | Defects **0.0%** |
| ***Barrier*** | Damage **0.0%** |
| Length: ***25.71 m*** | Maintenance **None** |
| Width: ***0.4 m*** | Capital Rec. **None** |
| Height: ***0.9 m*** | ***New parapet has the old railing system attached to exterior, assumed for aesthetics. Condition of new parapet is good.*** |
| **Steel Beam on Steel Post (4** | Defects **0.0%** |
| ***Guide Rail*** | Damage **0.1%** **Minor Impact** |
| Length: ***17.75 m*** | Maintenance **None** |
| Width: | Capital Rec. **None** |
| Height: | ***Guide rail connection at SW corner has minor impact damage at the connection to bridge. Eccentric loader end treatment at all ends of guide rail.*** |
| **RC Abutment Wall (2)** | Defects **0.0%** |
| ***Abutment Stem*** | Damage **0.0%** |
| Length: | Maintenance **None** |
| Width: ***9.31 m*** | Capital Rec. **None** |
| Height: ***2.8 m*** | ***Good condition.*** |

## Component Inspection Information

**RC Wing Walls (4)**
***Wing Walls***
Length: ***7 m***
Width:
Height: ***1.67 m***

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

---

**Spread Footing (2)**
***Abutment Foundation***
Length: ***1 m***
Width: ***9.4 m***
Height: ***1.2 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Good condition. Some rock protection against footings.***

---

**Water Channel (1)**
***Channel***

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

---

**Embankment (4)**
***Embankment***

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

---

## Capital Needs Cost Estimate Break-Down

| Item | Req'd | Units | Quantity | Unit Price $ | Estimated Cost |
|---|---|---|---|---|---|
| *Misc Concrete Repairs* | ✘ | m² | 0.0 | $500 | $0 |
| *Deck Concrete Overlay* | ✘ | m² | 98.6 | $350 | $0 |
| *Deck Replacement* | ✘ | m² | 98.6 | $2,000 | $0 |
| *Barrier Wall Replacement* | ✘ | m | 35.6 | $1,500 | $0 |
| *Expansion Joint* | ✘ | m | 17.0 | $3,000 | $0 |
| *Waterproof & Pave* | ✓ | m² | 98.6 | $200 | $19,720 |
| *Bearing Replacement* | ✘ | Count | 0.0 | $5,000 | $0 |
| *Approach Guide Rail* | ✘ | m | 80.0 | $200 | $0 |

*Other Work* $0

| | |
|---|---|
| **Structural Items Subtotal** | **$20,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$25,000** |
| **Contract Admin & Contingencies 20%** | **$11,000** |
| **Total Rehabilitation Cost Estimate** | ***$66,000*** |

**Recommended Capital Work Summary** **Recommended Capital Year** **2022**

***WP&P***

**Inspection Comments**

***Nice small bridge in good condition. Deck is polished and has wide longitudinal cracks, no delaminations at this time. Waterproof and paving in the near future should be considered.***

Image 99

West elevation

Image 92

South approach

Image 93

NE guide rail

Image 94

North approach

Image 95

West barrier wall

Image 96

Exposed concrete deck

Image 97

West channel

Image 98

East channel

Image 100

South abutment wall

Image 101

North abutment wall

Image 102

Soffit (typical)

Image 103

East elevation

# Culvert Inspection Report

## *North Lunenburg Road Culvert*

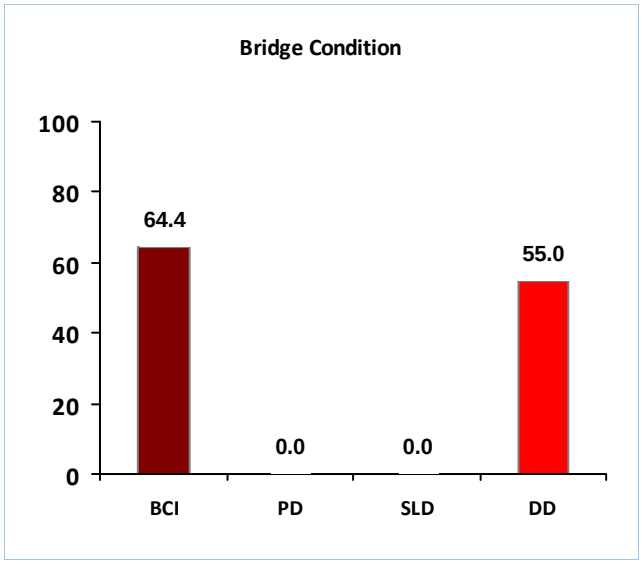
| | |
|---|---|
| **Road Name:** | *North Lunenburg Road, West* |
| **Site ID:** | *C31-167* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1978* |
| **Length:** | *16.5 m* |
| **Width:** | *3.7 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.7* |
| **Feature Through** | *Water* |
| **Crossing:** | *Raisin River* |
| **Location:** | *500m East of County Road 14* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.05002900* |
| **Lanes:** | *2* | **Longitude:** | *-75.02128600* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.5 m* | **H2O Depth:** | *0.3 m* |

| | |
|---|---|
| **Inspection Date:** | *August-01-19* |
| **Inspector:** | *Harold Kleywegt, P.Eng.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Culvert is severely perforated and starting to fail. Should be replaced on an urgent basis.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*New Conc Culvert*

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$278,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *1 Years*

**Year of Replacement and Cost:** *2020 $327,000*

## Component Inspection Information

**Circular CS Plate Pipe (1)**
***Conduit***
Length: ***16.5 m***
Width: ***3.7 m***
Height: ***3.7 m***

Defects **10.0%** **Moderate Corrosion**
Damage 10.0% **Critical Perforation, Major Section Loss**
Maintenance **None**
Capital Rec. **Replace in 1 year** **Perf Def: Settlement**
***Bottom of culvert has severe perforations along most of its length.***

---

**Asphalt Wear Surf (1)**
***Wear Surface***
Length: ***3.7 m***
Width: ***6 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Two transverse cracks along sides of culvert suggest road settlement from failing culvert.***

---

**Water Channel (1)**
***Outlet Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Part of agricultural drain with uniform bottom width of about 3.5 to 4 m and 1.5:1 side slopes.***

---

**Water Channel (1)**
***Conduit Channel***

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

---

**Water Channel (1)**
***Inlet Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Part of agricultural drain with uniform bottom width of about 3.5 to 4 m and 1.5:1 side slopes.***

---

**Embankment (4)**
***Embankment***

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

---

## Capital Needs Cost Estimate Break-Down

| | | | |
|---|---|---|---|
| *Cost of asphalt removal:* | $4,700 | *Cost of waterproofing:* | $15,300 |
| *Cost of dewatering:* | $26,000 | *Cost of road replace:* | $39,000 |
| *Cost erosion control:* | $5,000 | *Cost of SBGR:* | $21,000 |
| *Cost of excavation:* | $32,000 | *Cost for seeding:* | $500 |
| *Cost of existing structure removal:* | $2,000 | | |
| *Installation Cost for Similar Size Concrete:* | $98,000 | | |

*New Concrete Culvert* ✓

| | |
|---|---|
| **Structural Items Subtotal** | **$258,000** |
| **Mobilization General Sitework 10%** | **$15,000** |
| **Estimated Traffic Management & Civil Items** | **$14,000** |
| **Contract Admin & Contingencies 20%** | **$55,000** |
| **Total Rehabilitation Cost Estimate** | ***$327,000*** |

**Recommended Capital Work Summary**

***New Conc Culvert***

**Recommended Capital Year** **2020**

**Inspection Comments**

***Culvert is severely perforated and starting to fail. Should be replaced on an urgent basis.***

Image 64

North elevation

Image 59

West approach

Image 60

East approach

Image 61

Asphalt on deck

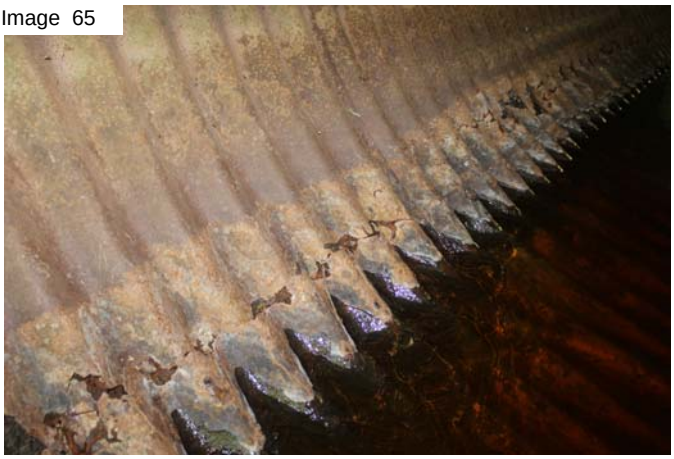
Image 62

South channel

Image 63

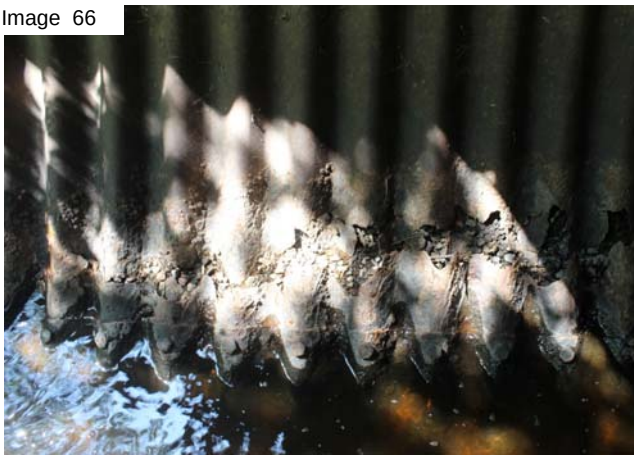
North channel

Image 65



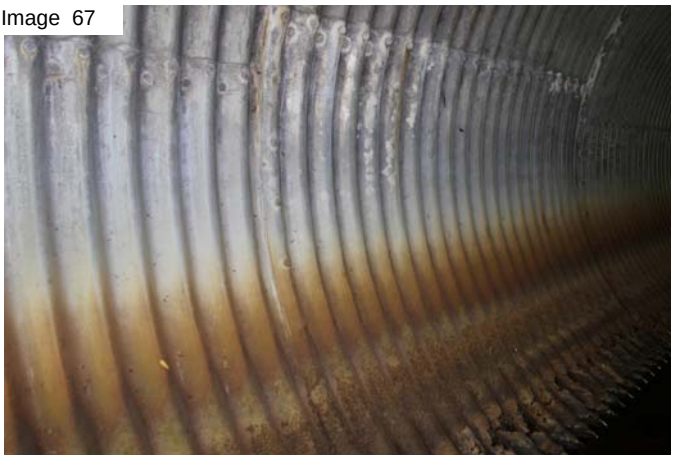
East wall perforation

Image 66



East wall perforation

Image 67



East wall

Image 68

West wall

Image 69

Culvert obvert

Image 70

West wall perforation

Image 71

East wall perforation

Image 72

West wall perforation south inlet

Image 73

South channel

Image 74

100m Downstream

# Culvert Inspection Report

## *North Lunenburg Road Culvert*

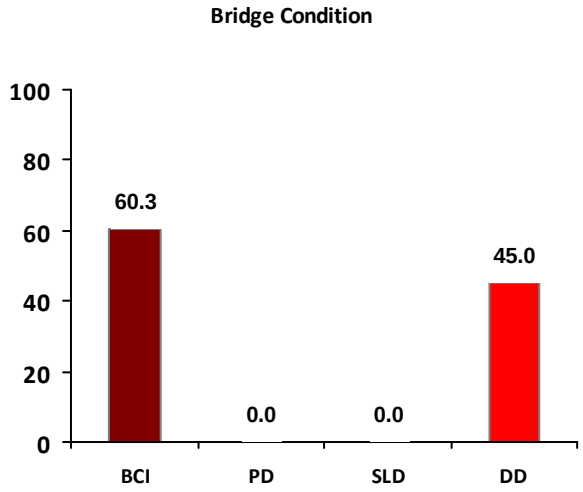
| | |
|---|---|
| **Road Name:** | *North Lunenburg Road, West* |
| **Site ID:** | *C31-169* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1974* |
| **Length:** | *21.9 m* |
| **Width:** | *5.8 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *1 @ 5.8* |
| **Feature Through** | *Water* |
| **Crossing:** | *Raisin River* |
| **Location:** | *1.2km West of County Road 12* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.06463600* |
| **Lanes:** | *2* | **Longitude:** | *-74.98129800* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *6.7 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.3 m* | **H2O Depth:** | *0.5 m* |

| | |
|---|---|
| **Inspection Date:** | *August-01-19* |
| **Inspector:** | *Harold Kleywegt, P.Eng.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Culvert is in reasonable serviceable condition with possibly 5 to 10 years of remaining service life. Culvert over-sized.*




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*New Conc Culvert*

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$357,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *5 Years*

**Year of Replacement and Cost:** *2024 $446,000*

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***21.9 m***
Width: ***5.8 m***
Height: ***3.7 m***

Defects 40.0% **Moderate Corrosion**
Damage 5.0% **Moderate Section Loss, Minor Deformation/Bulging**
Maintenance **None**
Capital Rec. **None**
***Corroded with full loss of galvanizing in bottom .8 m of culvert. Upper part of culvert in generally good condition, with good shape. Settlement of about 0.3 m from middle to ends. Invert slightly low compared to downstream channel. Bolt line cracking in obvert reported by others.***

---

**Gravel Surface (1)**
***Wear Surface***
Length: ***4 m***
Width: ***6.7 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Well graded. Shallow cover over culvert.***

---

**Water Channel (1)**
***Outlet Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Appears to be part of agricultural drain, with uniform cross section of 4 m bottom width and 1.5:1 side slopes.***

---

**Water Channel (1)**
***Conduit Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Power boat moored inside culvert and resting on bottom.***

---

**Water Channel (1)**
***Inlet Channel***

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

---

**Embankment (1)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Significant tree growth. Stable slopes.***

---

## Capital Needs Cost Estimate Break-Down

| | | | |
|---|---|---|---|
| *Cost of asphalt removal:* | $0 | *Cost of waterproofing:* | $31,800 |
| *Cost of dewatering:* | $69,000 | *Cost of road replace:* | $14,400 |
| *Cost erosion control:* | $5,000 | *Cost of SBGR:* | $21,000 |
| *Cost of excavation:* | $32,000 | *Cost for seeding:* | $500 |
| *Cost of existing structure removal:* | $3,000 | | |
| *Installation Cost for Similar Size Concrete:* | $166,000 | | |

*New Concrete Culvert* ✓

| | |
|---|---|
| **Structural Items Subtotal** | **$357,000** |
| **Mobilization General Sitework 10%** | **$15,000** |
| **Estimated Traffic Management & Civil Items** | **$14,000** |
| **Contract Admin & Contingencies 20%** | **$75,000** |
| **Total Rehabilitation Cost Estimate** | ***$446,000*** |

**Recommended Capital Work Summary**

**Recommended Capital Year** **2024**

***New Conc Culvert***

**Inspection Comments**

***Culvert is in reasonable serviceable condition with possibly 5 to 10 years of remaining service life. Culvert over-sized.***

Image 48

West elevation

Image 44

North approach

Image 45

South approach

Image 46

West channel

Image 47

Deck surface

Image 49

West inlet boat

Image 50

North wall bulge

Image 51

North wall

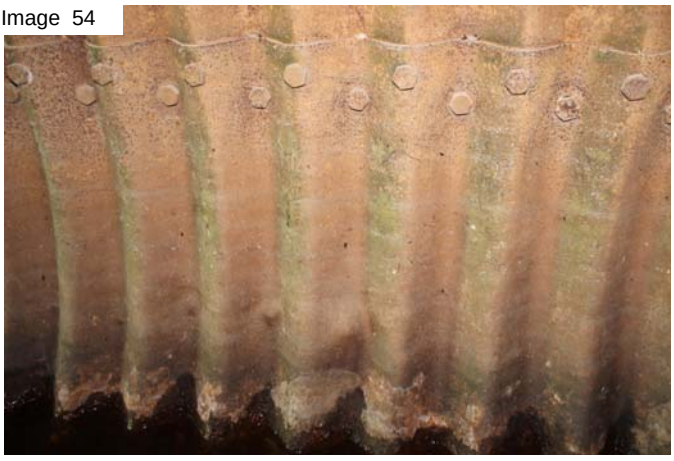
Image 52

South wall

Image 53

Culvert obvert

Image 54



South wall bulge

Image 55

East channel

Image 56

East elevation

Image 57

50m downstream of structure

Image 58

100m downstream of structure

# Culvert Inspection Report

## *Goldfield Road Culvert*

| | |
|---|---|
| **Road Name:** | *Goldfield Road* |
| **Site ID:** | *C31-A01* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2018* |
| **Length:** | *22.1 m* |
| **Width:** | *3.8 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.8* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *250m North of Hunter Road* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*New polymer coated pipe arch culvert. No delineators or guide rail were installed at this site.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

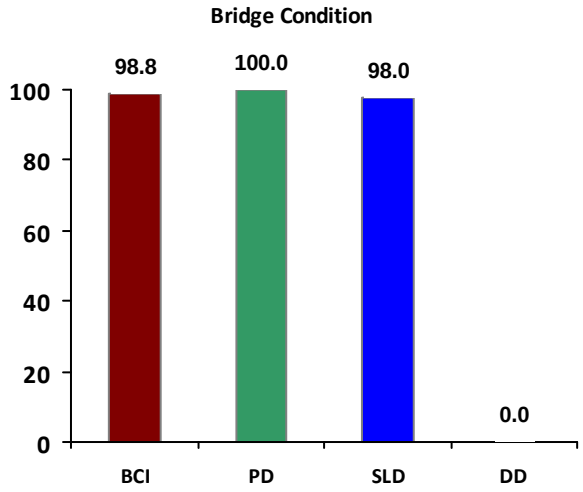
*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$250,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***39 Years***


| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.09991400* |
| **Lanes:** | *2* | **Longitude:** | *-75.11402400* |
| **Skew:** | *15 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *7 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *1.2 m* | **H2O Depth:** | *0.3 m* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***22.1 m***
Width: ***3.8 m***
Height: ***2 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***New culvert. Culvert has polymer coating. Several areas at east exterior had touch up repairs to coating. Bottom of barrel has river stones installed.***

---

**Gravel Surface (1)**
***Wear Surface***
Length: ***3.7 m***
Width: ***6.2 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***New gravel surface.***

---

**Small Culv Ret Wall (4)**
***Inlet/Outlet Walls***
Length: ***1.5 m***
Width:
Height: ***0.8 m***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Small sheet pile type retaining walls at culvert ends.***

---

**Water Channel (1)**
***Conduit Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***No flow at time of inspection 2019. River stones installed through barrel.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Rip rap stones on embankments. Ditch culvert in the NW quadrant.***

---

Image 114


East elevation

Image 110


North approach

Image 111


South approach

Image 112

Gravel over culvert

Image 113

East channel

Image 115


South wall

Image 116


North wall

Image 117


Culvert obvert

Image 118

West channel

Image 119


West elevation

# Culvert Inspection Report

## *Hunters Road Culvert*

| | |
|---|---|
| **Road Name:** | *Hunters Road* |
| **Site ID:** | *C31-A02* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1976* |
| **Length:** | *21.8 m* |
| **Width:** | *3.8 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.8* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *60m West of Goldfield Rd South* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Date of construction is likely 1990's not 1976. This culvert has an obvious crimp line along lower barrel walls, walls are easily penetrated with pick hammer in this area. Programming for replacement of this culvert should be started. Plan on replacing this culvert within two years.*

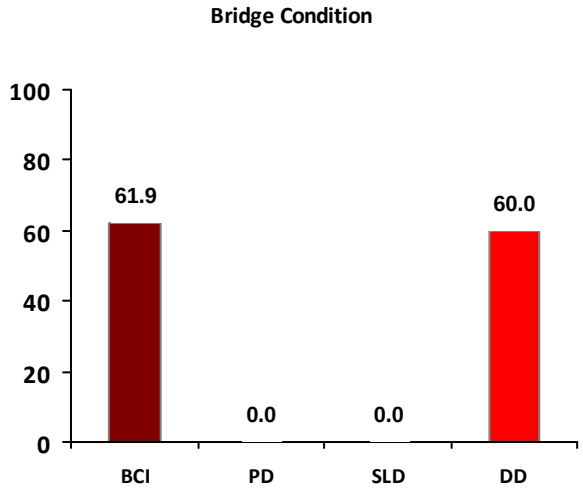
**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*New Conc Culvert*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.09765100* |
| **Lanes:** | *2* | **Longitude:** | *-75.11300400* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6.2 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.8 m* | **H2O Depth:** | *0.3 m* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$274,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *2 Years*

**Year of Replacement and Cost:** *2021 $316,000*

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***21.8 m***
Width: ***3.8 m***
Height: ***2.29 m***

Defects 20.0% **Minor Corrosion, Moderate Corrosion, Major Corrosion**
Damage 10.0% **Major Crimping, Moderate Perforation**
Maintenance **None**
Capital Rec. **Replace in 10 years** **Perf Def: Load Carrying Capacity**
***Date of construction is most likely incorrect. This culvert has a crimping line in both walls. Perforations are present or the walls can easily be penetrated with pick hammer along this crimp line.***

---

**Asphalt Wear Surf (1)**
***Wear Surface***
Length: ***3.8 m***
Width: ***6.2 m***
Height:

Defects **0.0%**
Damage **1.0%** **Minor Cracking**
Maintenance **None**
Capital Rec. **None**
***Some edge cracking along pavement shoulders.***

---

**Water Channel (1)**
***Conduit Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Upstream & downstream overgrown with vegetation very little flow in channel at time of inspection.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Wild parsnip present. Thick vegetation on embankments. No guide rail or delineators at this site.***

---

## Capital Needs Cost Estimate Break-Down

| | | | |
|---|---|---|---|
| *Cost of asphalt removal:* | $4,200 | *Cost of waterproofing:* | $8,300 |
| *Cost of dewatering:* | $27,000 | *Cost of road replace:* | $35,000 |
| *Cost erosion control:* | $5,000 | *Cost of SBGR:* | $21,000 |
| *Cost of excavation:* | $26,000 | *Cost for seeding:* | $300 |
| *Cost of existing structure removal:* | $2,000 | | |
| *Installation Cost for Similar Size Concrete:* | $106,000 | | |

*New Concrete Culvert* ✓

| | |
|---|---|
| **Structural Items Subtotal** | **$249,000** |
| **Mobilization General Sitework 10%** | **$15,000** |
| **Estimated Traffic Management & Civil Items** | **$14,000** |
| **Contract Admin & Contingencies 20%** | **$53,000** |
| **Total Rehabilitation Cost Estimate** | ***$316,000*** |

**Recommended Capital Work Summary**

**Recommended Capital Year** **2021**

***New Conc Culvert***

**Inspection Comments**

***Date of construction is likely 1990's not 1976. This culvert has an obvious crimp line along lower barrel walls, walls are easily penetrated with pick hammer in this area. Programming for replacement of this culvert should be started. Plan on replacing this culvert within two years.***

Image 125

South elevation

Image 120

West approach

Image 121

East approach

Image 122

Asphalt over culvert

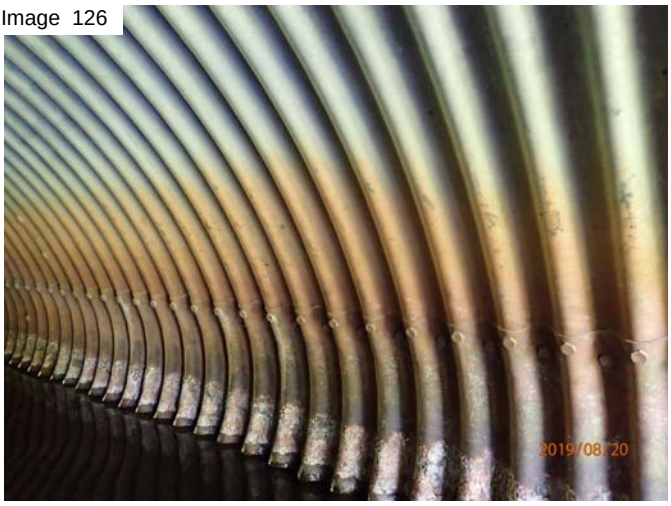
Image 123

North channel

Image 124

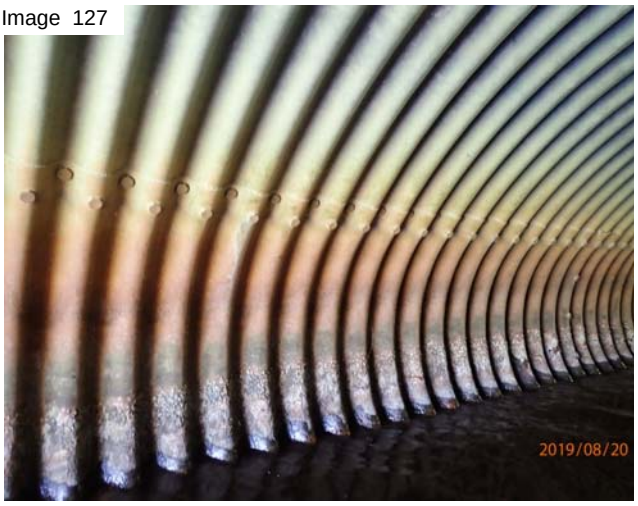
South channel

Image 126




East wall

Image 127




West wall

Image 128

Culvert obvert

Image 129

Crimping with perforations wall

Image 130


West wall defined crimping & perforations

Image 131

North elevation

# Culvert Inspection Report

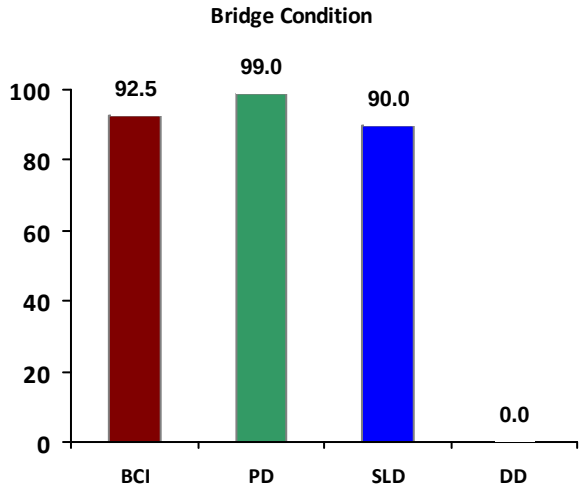
## *Otto Road Culvert*

| | |
|---|---|
| **Road Name:** | *Otto Road* |
| **Site ID:** | *C31-A03* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *2013* |
| **Length:** | *17.2 m* |
| **Width:** | *3.6 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.6* |
| **Feature Through Crossing:** | *Water* |
| **Location:** | *4 km West of County Road 14* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**
*Steel box culvert is performing well.*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.07514200* |
| **Lanes:** | *2* | **Longitude:** | *-75.07406800* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.8 m* | **H2O Depth:** | *0.3 m* |




**Recommended Investigations:**
*No Special Investigations Recommended*

**Recommended Capital Works:**
*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$543,000***
***Estimated replacement value is based on replacement in kind***
**Estimated Remaining Service Life:** ***34 Years***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

| | |
|---|---|
| **CS Plate Arch (1)**<br>***Conduit***<br>Length: ***3.55 m***<br>Width: ***17.2 m***<br>Height: ***1.42 m*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Steel box culvert polymer coating on concrete footings. Culvert is performing well. Several bolts missing.*** |
| **Asphalt Wear Surf (1)**<br>***Wear Surface***<br>Length: ***3.55 m***<br>Width: ***6.5 m***<br>Height: | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Good condition.*** |
| **Steel Beam on Steel Post (4**<br>***Guide Rail***<br>Length: ***57.6 m***<br>Width:<br>Height: | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Extruder end treatment at all four ends of guide rail.<br>82.7m (SW) + 46.7m (NW) + 75.9m (NE) +25.1m (SE)*** |
| **Thrie Beam G/R (2)**<br>***Barrier***<br>Length: ***14 m***<br>Width:<br>Height: | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Small section of thrie beam attached to timber posts locally over culvert. Good condition.*** |
| **Rip Rap (4)**<br>***Channel Armour*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Rip rap placed at culvert ends.*** |
| **Water Channel (1)**<br>***Conduit Channel*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Channel is overgrown. Stagnant water inside culvert.*** |

## Component Inspection Information

| | |
|---|---|
| **Embankment (2)** | Defects **0.0%** |
| ***Embankment*** | Damage **0.0%** |
| | Maintenance **None** |
| | Capital Rec. **None** |
| | ***Wild parsnip.*** |

| | |
|---|---|
| **Delineator (4)** | Defects **0.0%** |
| ***Signs*** | Damage **0.0%** |
| **Length:** | Maintenance **None** |
| **Width:** | Capital Rec. **None** |
| **Height:** | ***Delineators located at ends of guide rail.*** |

Image 138

South elevation

Image 132

West approach

Image 133

East approach

Image 134

NE guide rail on approach

Image 135

North thrie beam over culvert

Image 136

Asphalt over culvert

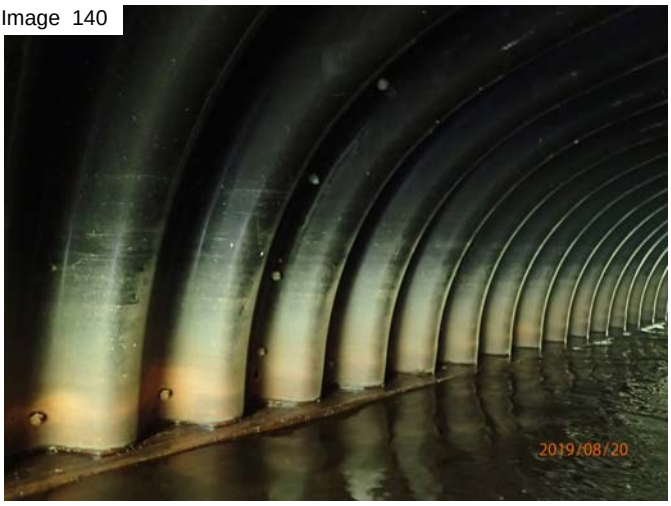
Image 137

South channel

Image 139


East wall

Image 140




West wall

Image 141


Culvert soffit

Image 142

North channel

Image 143

North elevation

# Culvert Inspection Report

## *Beckstead Road Culvert*

| | |
|---|---|
| **Road Name:** | *Beckstead Road* |
| **Site ID:** | *C31-A06* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1980* |
| **Length:** | *14.7 m* |
| **Width:** | *3.6 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.6* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *2 km East of County Road 11* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Construction year was estimated at 1980. Current condition is satisfactory. Lower half of barrel walls has moderate to severe section loss, culvert has approximately 5 years of remaining service life.*

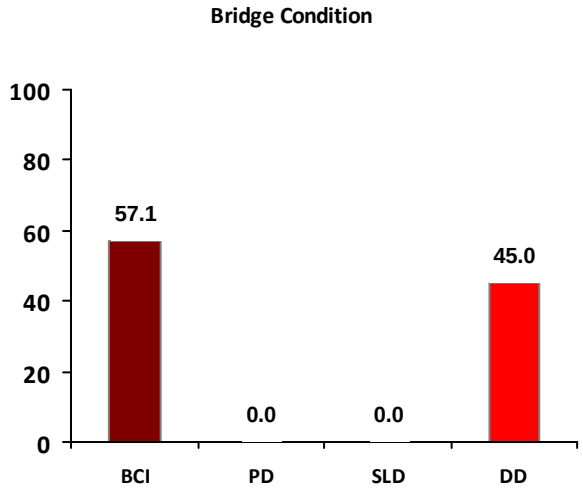
**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*New Conc Culvert*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.04875100* |
| **Lanes:** | *2* | **Longitude:** | *-75.06475000* |
| **Skew:** | *20 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.4 m* | **H2O Depth:** | *0.3 m* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$219,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *5 Years*

**Year of Replacement and Cost:** *2024 $256,000*

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***14.7 m***
Width: ***3.6 m***
Height: ***2.29 m***

Defects 60.0% **Minor Corrosion, Moderate Corrosion, Major Corrosion**
Damage **3.0%** **Minor Section Loss**
Maintenance **None**
Capital Rec. **None** **Perf Def: Insufficient Barrel Length**
***Overall barrel condition is satisfactory. Walls above bolt line have minor corrosion, below bolt line walls have moderate to major corrosion with some section loss. Length of culvert is inadequate for road platform, also cover over barrel is minimal. Approximately 500mm of silt has built up inside barrel.***

---

**Asphalt Wear Surf (1)**
***Wear Surface***
Length: ***3.6 m***
Width: ***6 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Surface treatment over culvert, condition is good.***

---

**Water Channel (1)**
***Conduit Channel***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Channel is overgrown with vegetation both upstream & downstream channels.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Steep embankments due to culvert being too short. Wild parsnip present.***

---

**Delineator (2)**
***Signs***
Length:
Width:
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Sign in the NE & SW.***

---

## Capital Needs Cost Estimate Break-Down

| | | | |
|---|---|---|---|
| *Cost of asphalt removal:* | $4,000 | *Cost of waterproofing:* | $13,200 |
| *Cost of dewatering:* | $26,000 | *Cost of road replace:* | $33,200 |
| *Cost erosion control:* | $5,000 | *Cost of SBGR:* | $21,000 |
| *Cost of excavation:* | $17,000 | *Cost for seeding:* | $300 |
| *Cost of existing structure removal:* | $1,000 | | |
| *Installation Cost for Similar Size Concrete:* | $69,000 | | |

*New Concrete Culvert* ✓

| | |
|---|---|
| **Structural Items Subtotal** | **$199,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$14,000** |
| **Contract Admin & Contingencies 20%** | **$43,000** |
| **Total Rehabilitation Cost Estimate** | ***$256,000*** |

**Recommended Capital Year** **2024**

**Recommended Capital Work Summary**

***New Conc Culvert***

**Inspection Comments**

***Construction year was estimated at 1980. Current condition is satisfactory. Lower half of barrel walls has moderate to severe section loss, culvert has approximately 5 years of remaining service life.***

Image 148

North elevation

Image 144


West approach

Image 145


East approach

Image 146


Asphalt over culvert

Image 147

North channel

Image 149


East wall

Image 150

West wall

Image 151

Culvert obvert

Image 152

East wall close up corrosion

Image 153

South channel

Image 154

South elevation

# Culvert Inspection Report

## *Anderson Road Culvert*

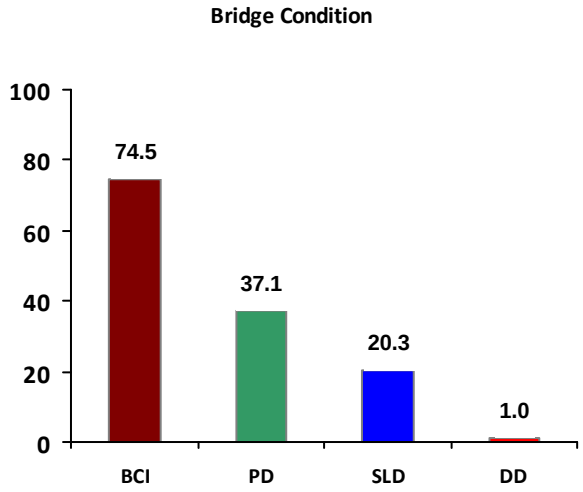
| | |
|---|---|
| **Road Name:** | *Anderson Road* |
| **Site ID:** | *C31-A08* |
| **Structure Type:** | *Concrete Culvert* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1960* |
| **Length:** | *12.2 m* |
| **Width:** | *4.2 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.7* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *2 km East of Aultsville Road* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Construction year was estimated at 1960. This concrete culvert is in good condition. Consider adding delineators to identify culvert.*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *44.97936300* |
| **Lanes:** | *2* | **Longitude:** | *-75.03533900* |
| **Skew:** | *5 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6.2 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.4 m* | **H2O Depth:** | *0 m* |




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$222,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***31 Years***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

| | |
|---|---|
| **CIP RF Open Ftg Culv (1)**<br>***Conduit***<br>Length: ***12.2 m***<br>Width: ***4.2 m***<br>Height: ***1.5 m*** | Defects **2.0%** **Minor Scaling**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Overall condition is good. Approximately 500mm of cover over culvert. Minor scaling on walls. Minor scaling on soffit, some damp areas at soffit ends. Scour in the SW corner has undermined footing slightly, see image.*** |
| **Asphalt Wear Surf (1)**<br>***Wear Surface***<br>Length: ***4.2 m***<br>Width: ***6.2 m***<br>Height: | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Surface treatment, satisfactory condition.*** |
| **Water Channel (1)**<br>***Conduit Channel*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **None**<br>Capital Rec. **None**<br>***Dry at time of inspection, 2019. Overgrown upstream & downstream.*** |
| **Embankment (4)**<br>***Embankment*** | Defects **0.0%**<br>Damage **0.0%**<br>Maintenance **Remove Brush/Trees**<br>Capital Rec. **None**<br>***Heavy vegetation growth. No guide rail or delineators at this site. Brush & trees at south end should be cleared.*** |

Image 121

North elevation

Image 117


West approach

Image 118


East approach

Image 119

Wearing surface over culvert

Image 120

North channel

Image 122


East wall

Image 123

West wall

Image 124

Soffit (typical)

Image 125

SW corner footing under cut

Image 126

South elevation

Image 127

South channel

# Culvert Inspection Report

## *Finch-Osnabruck Boundary Rd Culvert*

| | |
|---|---|
| **Road Name:** | *Finch-Osnabruck Boundary Rd* |
| **Site ID:** | *C31-A10* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1995* |
| **Length:** | *12.4 m* |
| **Width:** | *3.9 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.9* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *30 m North of County Rd 14* |

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.13739300* |
| **Lanes:** | *2* | **Longitude:** | *-75.02494800* |
| **Skew:** | *20 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *7.3 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.3 m* | **H2O Depth:** | *0.5 m* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

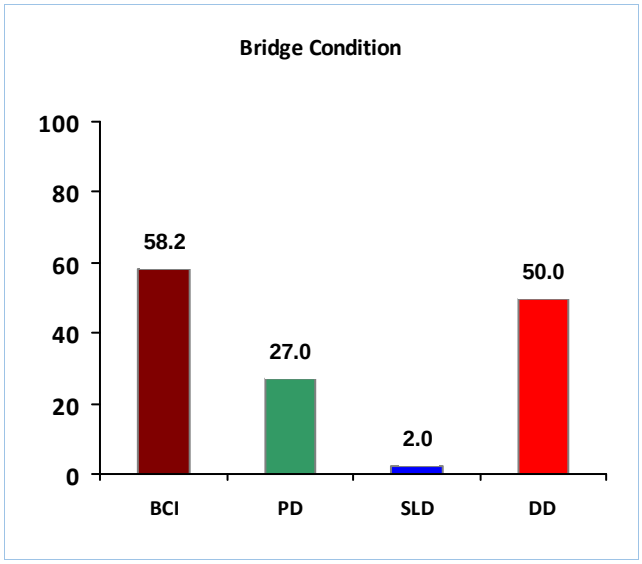
*Construction year was estimated at 1995. Inadequate cover may be contributing to cusping. A topping slab is recommended to better distribute wheel loads, alternatively add an additional 0.3 m cover.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Topping Slab*




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$243,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *11 Years*

**Rehabilitation Year and Estimated Cost:** *2020 $72,000*

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***12.4 m***
Width: ***3.9 m***
Height: ***2.69 m***

Defects 50.0% **Minor Corrosion, Moderate Corrosion**
Damage 5.0% **Minor Section Loss, Moderate Cusping**
Maintenance **None**
Capital Rec. **None**
***Generally in good condition. Minor to moderate corrosion over lower half of barrel. Bevelled ends.***

---

**Asphalt Wear Surf (1)**
***Wear Surface***
Length: ***3.9 m***
Width: ***7.3 m***
Height:

Defects **0.0%**
Damage **2.0%** **Minor Cracking**
Maintenance **None**
Capital Rec. **None**
***Several random cracks.***

---

**Steel Beam on Wood Post (**
***Guide Rail***
Length: ***24 m***
Width:
Height: ***0.72 m***

Defects **0.0%**
Damage **1.0%** **Minor Impact**
Maintenance **None**
Capital Rec. **None**
***Eccentric loader end treatment in the NW corner. Guide rail is satisfactory at this time.***
***29m (W), 19m (E)***

---

**Water Channel (1)**
***Conduit Channel***

Defects **2.0%** **Minor Aggradation**
Damage **2.0%** **Minor Debris Obstruction**
Maintenance **Remove Obstructions**
Capital Rec. **None**
***West end of culvert partially blocked by fallen trees. Aggradation against the north wall inside barrel. Stagnant water inside barrel.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Satisfactory condition.***

---

# Capital Needs Cost Estimate Break-Down

| | |
|---|---|
| *Other Work* | |
| *Topping Slab* | $50,000 |
| **Structural Items Subtotal** | **$50,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$0** |
| **Contract Admin & Contingencies 20%** | **$12,000** |
| **Total Rehabilitation Cost Estimate** | ***$72,000*** |

**Recommended Capital Year** **2020**

**Recommended Capital Work Summary**

***Topping Slab***

**Inspection Comments**

***Construction year was estimated at 1995. Inadequate cover may be contributing to cusping. A topping slab is recommended to better distribute wheel loads, alternatively add an additional 0.3 m cover.***

Image 103

East elevation

Image 97

North approach

Image 98

South approach

Image 99

West guide rail

Image 100

Asphalt over culvert with flexural cracking

Image 101

East channel

Image 104


North wall

Image 105


South wall

Image 106

Culvert obvert with obvious cusping

Image 107

West channel

Image 108


West elevation

Image 109


West inlet debris

# Culvert Inspection Report

## *Cooper Road Culvert*

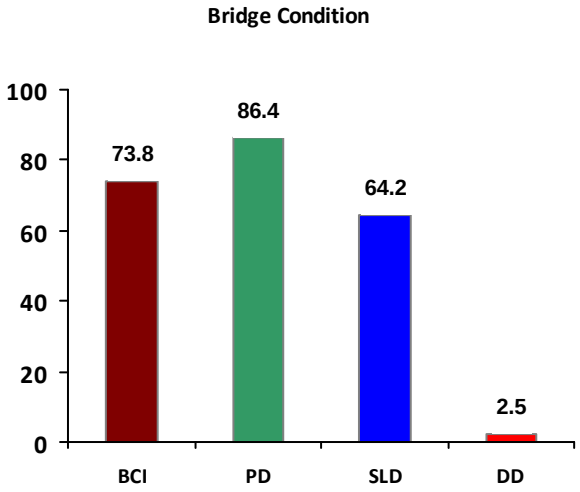
| | |
|---|---|
| **Road Name:** | *Cooper Road* |
| **Site ID:** | *C31-A12* |
| **Structure Type:** | *Concrete Culvert* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1994* |
| **Length:** | *21.7 m* |
| **Width:** | *4.8 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *4.8* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *2 km West of County Road 12* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*This culvert is in good condition. Guide rail over culvert is due for replacement.*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.08249500* |
| **Lanes:** | *2* | **Longitude:** | *-75.00437100* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *6 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.5 m* | **H2O Depth:** | *0.3 m* |




**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Guide Rail*

**Estimated Replacement Value:** ***$334,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***65 Years***

**Rehabilitation Year and Estimated Cost:** ***2021 $36,000***

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**Precast RF Box Culvert (1)**
***Conduit***
Length: ***21.7 m***
Width: ***4.2 m***
Height: ***1.8 m***

Defects **5.0%** **Minor Scaling, Minor Staining**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Condition of interior is good. Walls are lightly scaled. Minor stains around precast joints in soffit.***

**Asphalt Wear Surf (1)**
***Wear Surface***
Length: ***4.7 m***
Width: ***6 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Asphalt on approaches is in poor condition, asphalt over culvert is satisfactory.***

**Steel Beam on Wood Post (**
***Guide Rail***
Length: ***20 m***
Width:
Height: ***0.5 m***

Defects **0.0%**
Damage 5.0% **Major Decay**
Maintenance **None**
Capital Rec. **Replace in 2 years** **Perf Def: Inadequate Height**
***Guide rail is too low to be an effective traffic barrier. Timber posts have major decay in top surface. Major vegetation growth around guide rail.***

**Water Channel (1)**
***Conduit Channel***

Defects **5.0%** **Minor Aggradation**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Little flow at time of inspection. Aggradation noted at SE end & along east wall inside barrel.***

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove Brush/Trees**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Thick vegetation at culvert ends. Wild parsnip present. Tree in the SE corner should be cut back.***

# Capital Needs Cost Estimate Break-Down

| | |
|---|---|
| *Other Work* | |
| *Guide Rail* | $20,000 |
| **Structural Items Subtotal** | **$20,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$0** |
| **Contract Admin & Contingencies 20%** | **$6,000** |
| **Total Rehabilitation Cost Estimate** | ***$36,000*** |

**Recommended Capital Work Summary** **Recommended Capital Year** **2021**

***Guide Rail***

**Inspection Comments**

***This culvert is in good condition. Guide rail over culvert is due for replacement.***

Image 11

South elevation

Image 1

East approach

Image 2

West approach

Image 3

South guide rail

Image 4

Asphalt over culvert

Image 5

North channel

Image 6


North elevation

Image 7


West wall

Image 8


East wall

Image 9


Soffit (typical)

Image 10


South channel

# Culvert Inspection Report

## *Wilburn Road Culvert*

| | |
|---|---|
| **Road Name:** | *Wilburn Road* |
| **Site ID:** | *C31-A13* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1990* |
| **Length:** | *11.2 m* |
| **Width:** | *3.5 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.5* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *0.5 km West of County Road 12* |

| | |
|---|---|
| **Inspection Date:** | *August-21-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Construction Year was estimated at 1990. Culvert is in satisfactory condition at this time. Major corrosion and bolt line cracks were identified, planning for replacement of this culvert in a 10-15 year timeframe should be started.*

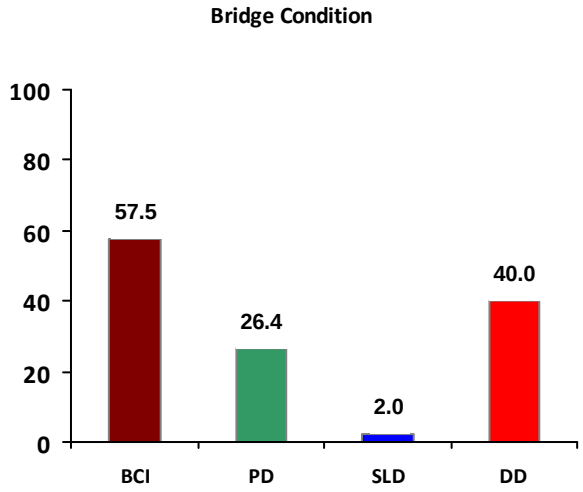
**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*No Capital Works Recommendations*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.08254500* |
| **Lanes:** | *1* | **Longitude:** | *-74.98669300* |
| **Skew:** | *0 °* | **Orientation:** | *E-W* |
| **Speed:** | *80 km/h* | **Road Width:** | *4 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *1.2 m* | **H2O Depth:** | *0.2 m* |




**Estimated Replacement Value:** *$146,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *11 Years*

BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

**CS Plate Pipe Arch (1)**
***Conduit***
Length: ***11.2 m***
Width: ***3.5 m***
Height: ***2 m***

Defects 60.0% **Minor Corrosion, Moderate Corrosion, Major Corrosion**
Damage **2.0%** **Minor Section Loss, Minor Bolt Line Crack'g**
Maintenance **None**
Capital Rec. **None** **Perf Def: Insufficient Barrel Length**
***Barrel walls have light corrosion above bolt line seam, below seam corrosion is moderate to major with minor section loss. Bolt line cracks were noted in the west wall, (approximately 2m length). Minor impact type damage at south end. Culvert length is insufficient for road platform.***

---

**Gravel Surface (1)**
***Wear Surface***
Length: ***3.5 m***
Width: ***4 m***
Height:

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Narrow gravel road, dead end. Loose gravel.***

---

**Water Channel (1)**
***Conduit Channel***

Defects **0.0%**
Damage **1.0%** **Minor Debris Obstruction**
Maintenance **Remove Obstructions**
Capital Rec. **None** **Perf Def: Obstructed**
***Stagnant flow. Large downed tree limb inside barrel.***

---

**Embankment (4)**
***Embankment***

Defects **0.0%**
Damage **0.0%**
Maintenance **Remove Brush/Trees**
Capital Rec. **None** **Perf Def: Toxic Weeds**
***Steep embankments. Wild parsnip present.***

---

Image 16

South elevation

Image 12

East approach

Image 13

West approach

Image 14

Gravel surface over culvert

Image 15

South channel

Image 17


West wall

Image 18


East wall

Image 19


Barrel obvert

Image 20


Bolt line cracks west wall

Image 21

North channel

Image 22

North elevation

# Culvert Inspection Report

## *MacRae Road Culvert*

| | |
|---|---|
| **Road Name:** | *MacRae Road* |
| **Site ID:** | *C31-A15* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1985* |
| **Length:** | *18.2 m* |
| **Width:** | *3.3 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.3* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *1.5km north of Dixon Road* |


| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.10873800* |
| **Lanes:** | *2* | **Longitude:** | *-74.96583200* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *5.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.8 m* | **H2O Depth:** | *0.4 m* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

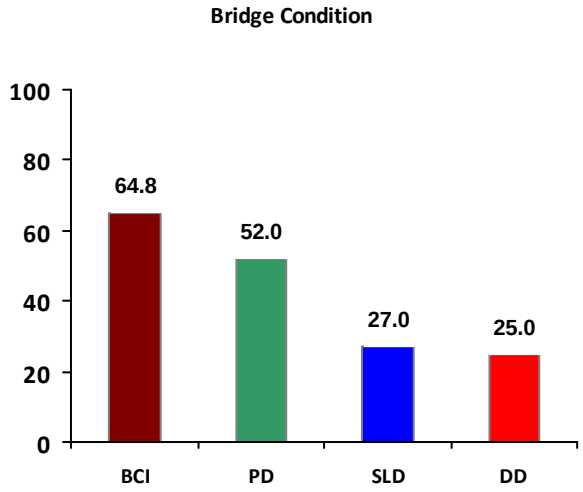
*Construction year was estimated at 1995. Perforations were noted in barrel wall and floor. A concrete floor liner may be an appropriate repair strategy for this culvert due to the perforations being low in floor or walls. Without liner this culvert will need replacement in 5 - 10 year timeframe. Floor liner would add 20 years to life of culvert.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Concrete floor liner*




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$213,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *6 Years*

**Rehabilitation Year and Estimated Cost:** *2023 $36,000*

## Component Inspection Information

| | | |
|---|---|---|
| **Circular CS Pipe (1)** | Defects 30.0% | **Minor Corrosion, Moderate Corrosion** |
| ***Conduit*** | Damage **2.0%** | **Minor Perforation** |
| Length: ***18.2 m*** | Maintenance **None** | |
| Width: ***3.3 m*** | Capital Rec. **Replace in 5 years** | |
| Height: ***2.3 m*** | ***Lower third of barrel has moderate corrosion. Perforations at normal waterline at the east end. Random perforations along seams of barrel.*** | |
| **Gravel Surface (1)** | Defects **0.0%** | |
| ***Wear Surface*** | Damage **0.0%** | |
| Length: ***3.3 m*** | Maintenance **None** | |
| Width: ***5.5 m*** | Capital Rec. **None** | |
| Height: | ***Gravel road over culvert.*** | |
| **Water Channel (1)** | Defects **0.0%** | |
| ***Conduit Channel*** | Damage **0.0%** | |
| | Maintenance **None** | |
| | Capital Rec. **None** | |
| | ***Channel is open & moving through culvert. Remains of old bridge abutments west of culvert.*** | |
| **Embankment (2)** | Defects **0.0%** | |
| ***Embankment*** | Damage **0.0%** | |
| | Maintenance **None** | |
| | Capital Rec. **None** | **Perf Def: Over-steepened** |
| | ***No guide rail or delineators at this site. Steep embankments.*** | |

# Capital Needs Cost Estimate Break-Down

*Other Work*

| | |
|---|---|
| *Concrete floor liner* | $20,000 |

| | |
|---|---|
| **Structural Items Subtotal** | **$20,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$0** |
| **Contract Admin & Contingencies 20%** | **$6,000** |
| **Total Rehabilitation Cost Estimate** | ***$36,000*** |

**Recommended Capital Work Summary**

**Recommended Capital Year** **2023**

***Concrete floor liner***

**Inspection Comments**

***Construction year was estimated at 1995. Perforations were noted in barrel wall and floor. A concrete floor liner may be an appropriate repair strategy for this culvert due to the perforations being low in floor or walls. Without liner this culvert will need replacement in 5 - 10 year timeframe. Floor liner would add 20 years to life of culvert.***

Image 89


West elevation

Image 84


North approach

Image 85


South approach

Image 87

East channel

Image 88


West channel

Image 90


North wall

Image 91


South wall

Image 92

Culvert obvert

Image 93


Through barrel from west

Image 94


North wall mid length wall perforations

Image 95


East channel

Image 96


East elevation

# Culvert Inspection Report

## *Northfield Road Culvert*

| | |
|---|---|
| **Road Name:** | *Northfield Road* |
| **Site ID:** | *C31-A16* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1990* |
| **Length:** | *15.3 m* |
| **Width:** | *3.6 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.6* |
| **Feature Through** | *Water* |
| **Crossing:** | |
| **Location:** | *1 km North of County Road 18* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Construction year was estimated at 1990. Delineators should be installed to identify culvert. Current condition of this steel pipe arch culvert is satisfactory.*

**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

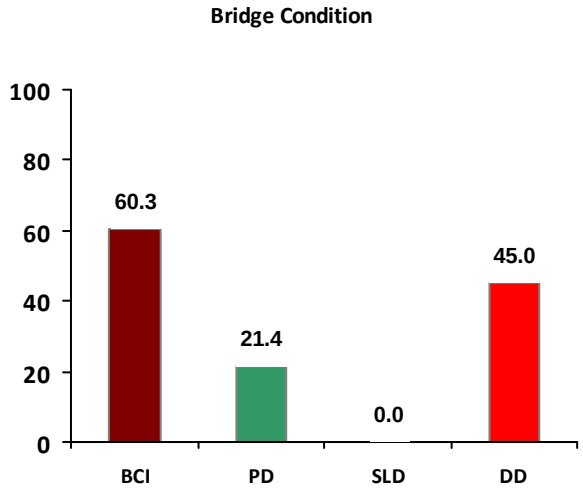
*No Capital Works Recommendations*

**Estimated Replacement Value:** ***$194,000***

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** ***16 Years***

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.07444300* |
| **Lanes:** | *2* | **Longitude:** | *-74.93634500* |
| **Skew:** | *0 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *7.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *0.6 m* | **H2O Depth:** | *0.3 m* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

## Component Inspection Information

| | |
|---|---|
| **CS Plate Pipe Arch (1)** | Defects 40.0% **Minor Corrosion, Moderate Corrosion, Moderate Plate Lapping Reversed** |
| ***Conduit*** | Damage 5.0% **Minor Section Loss, Moderate Cusping** |
| Length: ***15.3 m*** | Maintenance **None** |
| Width: ***3.6 m*** | Capital Rec. **None** |
| Height: ***2.29 m*** | ***Light corrosion at high water line & below. Moderate corrosion with minor section loss at normal water line. Obvert of culvert has reverse curvature (cusping), and incorrect plate lapping.*** |
| **Gravel Surface (1)** | Defects **0.0%** |
| ***Wear Surface*** | Damage **0.0%** |
| Length: ***3.6 m*** | Maintenance **None** |
| Width: ***7.5 m*** | Capital Rec. **None** |
| Height: | ***Gravel road over culvert.*** |
| **Water Channel (1)** | Defects **0.0%** |
| ***Conduit Channel*** | Damage **0.0%** |
| | Maintenance **None** |
| | Capital Rec. **None** |
| | ***Stagnant water at time of inspection. High water level appears to be half way up the barrel wall.*** |
| **Embankment (4)** | Defects **0.0%** |
| ***Embankment*** | Damage **0.0%** |
| | Maintenance **None** |
| | Capital Rec. **None** |
| | ***No guide rail or delineators at this site. Thick vegetation at culvert ends. Dry stone retaining walls at culvert ends hard to see due to thick vegetation.*** |

Image 83

East elevation

Image 73

North approach

Image 74

South approach

Image 75

Gravel over culvert

Image 76

West channel

Image 77

East channel

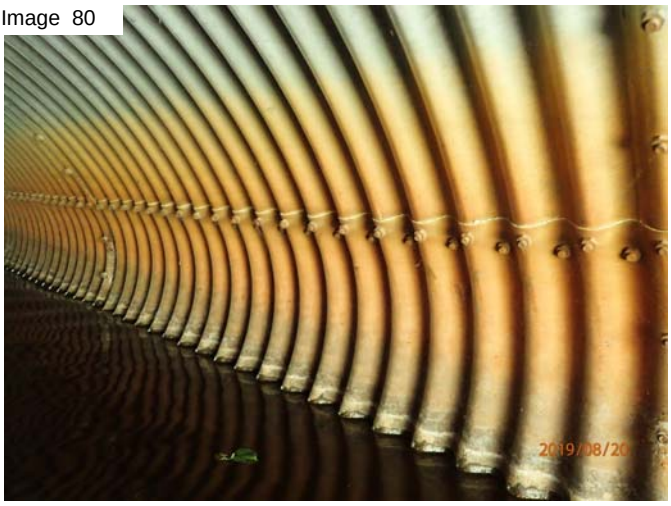
Image 78

West elevation

Image 79


North wall

Image 80




South wall

Image 81


Culvert obvert

Image 82


Through barrel from west

# Culvert Inspection Report

## *O'Keefe Road Culvert*

| | |
|---|---|
| **Road Name:** | *O'Keefe Road* |
| **Site ID:** | *C31-A18* |
| **Structure Type:** | *Soil-Steel Structure* |
| **Owner:** | *Township South Stormont* |
| **Built:** | *1975* |
| **Length:** | *17.2 m* |
| **Width:** | *3.2 m* |
| **Spans:** | *1* |
| **Span Arrange:** | *3.2* |
| **Feature Through Crossing:** | *Water* |
| **Location:** | *1km South of Myers Road* |

| | |
|---|---|
| **Inspection Date:** | *August-20-19* |
| **Inspector:** | *Steve Reid, C.E.T.* |
| **Assistant:** | *Seamus Fisher, Eng Student* |

**Comments:**

*Age of this culvert should be verified, more likely constructed in 90's not 1975. Culvert is in satisfactory condition at this time. Guide rail protection should be updated within 2 years.*

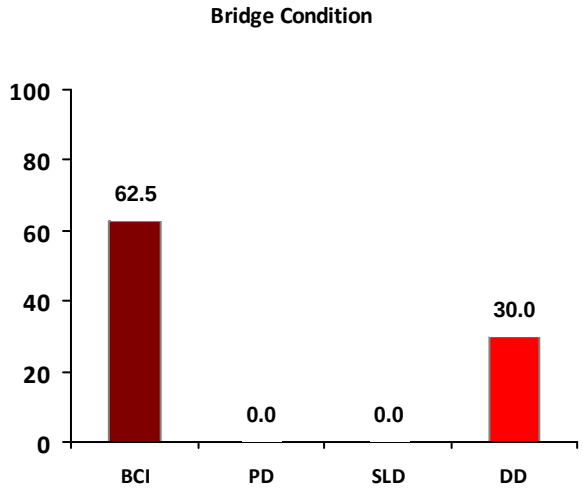
**Recommended Investigations:**

*No Special Investigations Recommended*

**Recommended Capital Works:**

*Guide rail*

| | | | |
|---|---|---|---|
| **AADT:** | *N/A* | **Latitude:** | *45.11210600* |
| **Lanes:** | *2* | **Longitude:** | *-74.83444100* |
| **Skew:** | *20 °* | **Orientation:** | *N-S* |
| **Speed:** | *80 km/h* | **Road Width:** | *5.5 m* |
| **Trucks** | | **Load Posting:** | *No Posting* |
| **Fill:** | *1.2 m* | **H2O Depth:** | *0.5 m* |




BCI = Bridge Condition Index MTO Calculation

PD = Parabolic Depreciation
% retained value

SLD = Straight Line Depreciation
% retained value

DD = Defects and Damage
% loss of retained value

**Estimated Replacement Value:** *$250,000*

***Estimated replacement value is based on replacement in kind***

**Estimated Remaining Service Life:** *11 Years*

**Rehabilitation Year and Estimated Cost:** *2020 $48,000*

## Component Inspection Information

**Circular CS Pipe (1)**
*Conduit*
Length: *17.2 m*
Width: *3.2 m*
Height: *2.1 m*

Defects 40.0% **Moderate Corrosion, Major Corrosion**
Damage **2.0%** **Minor Section Loss**
Maintenance **None**
Capital Rec. **None**
***Date of construction should be verified, unlikely this culvert was constructed in 1975. Bottom third of culvert has moderate to major corrosion with some minor section loss.***

---

**Asphalt Wear Surf (1)**
*Wear Surface*
Length: *3.2 m*
Width: *5.5 m*
Height:

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

---

**Steel Beam on Wood Post (**
*Guide Rail*
Length: *30.5 m*
Width:
Height: *0.8 m*

Defects **0.0%**
Damage 5.0% **Major Decay**
Maintenance **None**
Capital Rec. **Replace in 2 years**
***Many posts have major decay. Ends are not properly buried. Sections of flex beam badly corroded. Guide rail system requires renewal.***

---

**Water Channel (1)**
*Conduit Channel*

Defects **0.0%**
Damage **0.0%**
Maintenance **None**
Capital Rec. **None**
***Stagnant flow, no water in upstream or downstream, barrel has 600mm stagnant water inside. Channel bottom stones.***

---

**Embankment (4)**
*Embankment*

Defects **0.0%**
Damage 5.0% **Moderate Local Instability**
Maintenance **Remove Brush/Trees**
Capital Rec. **None**
***Thick brush. Wild parsnip. Dry stone retaining wall in NW is partially failed.***

---

# Capital Needs Cost Estimate Break-Down

*Other Work*

*Guide rail* $30,000

| | |
|---|---|
| **Structural Items Subtotal** | **$30,000** |
| **Mobilization General Sitework 10%** | **$10,000** |
| **Estimated Traffic Management & Civil Items** | **$0** |
| **Contract Admin & Contingencies 20%** | **$8,000** |
| **Total Rehabilitation Cost Estimate** | ***$48,000*** |

**Recommended Capital Work Summary**

**Recommended Capital Year** **2020**

***Guide rail***

**Inspection Comments**

***Age of this culvert should be verified, more likely constructed in 90's not 1975. Culvert is in satisfactory condition at this time. Guide rail protection should be updated within 2 years.***

Image 49


West elevation

Image 44


North approach

Image 45


South approach

Image 46


East guide rail

Image 47


Asphalt over culvert

Image 48


West channel

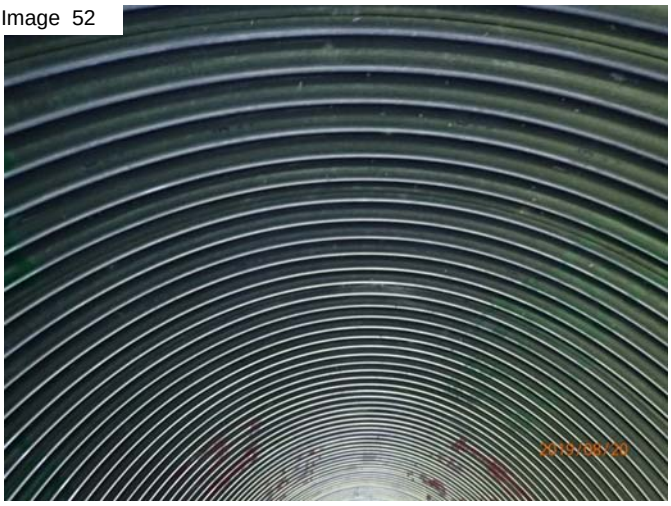
Image 50


North wall

Image 51


South wall

Image 52



Culvert obvert

Image 53


North wall corrosion at water line

Image 54


East channel

Image 55

East elevation