2017 BRIDGE & LARGE CULVERT BIENNIAL INSPECTIONS

Town of Kingsville

Keystone Bridge Management Corp.

Your Bridge Asset Management Specialist

Contents

Executive Summary

Keystone Bridge Management Corp. was retained by the Town of Kingsville to provide bridge assessments for all its bridges and large culverts. A total of 61 structures were evaluated of which 38 were considered bridges and 23 were culverts.

The structure inventory ranges in age from nearly new to 99 years old and represents 5,060 square metres of plan surface area. The asset value on a full replacement cost basis is of the order of $28.4 million.

The average age of Kingsville structures is 41.3 years.

Approximately $3 million is required in capital investment to continue to maintain the structural inventory in good serviceable condition for the next ten years. There is a back log of $1M in immediate capital needs.

In the period from 20 years hence to 40 years hence there will be a need to replace almost $13M in road structure assets.

The bridge assets are presently depreciating at a rate of nearly $290K per year. They retain about 46% of their new value. In the absence of capital investment, the bridges will retain 14% of their new value in 20 years. The bridges have lost 4.6% in value due to deterioration.

The culvert assets are depreciating at a rate of $140K per year. They currently retain about 66% of their new value. Without capital investment, the culverts will retain 30% of their new value in 20 years.

A total of 91.8% of the inspected structures have a Bridge Condition Index greater than 70. The remaining five structures have BCI values between 56.6 and 70. The Ministry of Transportation Ontario's goal is to maintain 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 Town of Kingsville. 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 Town of Kingsville road structure and park bridge 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 in the period between August 21 and August 25, 2017. Water levels had receded in all the streams, and access to the structures was generally not limited by water depth. In most respects, conditions were ideal for visual inspection.

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

Structure Summary Statistics

A snap-shot one-page **Structure Summary Statistics Report** immediately follows this Summary Report. The Structure Age Histogram shows that the Kingsville structures are very well distributed. The largest group of bridges are 15 structures constructed 40 to 50 years ago. Twelve structures are new or have been replaced in the past 20 years. The average age of Kingsville structures is 41.3 years. The oldest structure is estimated to be 99 years old.

The Structure Deck Area Histogram demonstrates that all 61 structures are comparatively small and all have less than 500 square metres of plan area. Fifty-seven of the structures have less than 200 square metres plan area. The largest structure has a plan area of 400 square metres. The average plan area is 83 square metres. The total plan area of structural assets is 5,060 square metres.

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 very balanced distribution. This is a favourable finding. Twenty-six percent of the deck area is greater than 50 years old. This latter cohort will have the greatest influence on capital needs.

Bridge and Culvert Lists

A print out of the client's bridges and culverts is provided. This print out 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 38 structures that are considered bridges. The remaining 23 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.

The Capital Needs for The Town of Kingsville 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 **$3,044,000** is the projected capital need from the present to 2027.

There are 15 Capital Projects identified over the 10-year planning period to 2027. 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 next 10 years. The Town of Kingsville has $1M in immediate capital needs. It is uncertain that these needs can be funded in 2018. It will be up to Kingsville to further prioritize these needs.

The second graph breaks down the capital expenditures between bridges and culverts.

Six structures are recommended for replacement in the next ten years.

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.

Two Year Priority Report

To help municipalities prioritize their immediate capital needs, Keystone provides a **Two-Year Priority Report**. Each structure on the list has been assigned a relative importance and the need has been assigned a relative urgency. Important structures with the most urgent needs are ranked first, with the recommended year taking precedence.

The importance of a structure is typically related to the volume of traffic it carries. The urgency of the need reflects the risk associated with not acting.

The Remarks column in the report offers additional guidance and rationale.

Keystone's most pressing concern is the severely perforated Mill Creek Scratch Wigle Creek Culvert, ID 503. This is followed by the deteriorated and functionally deficient Road 10 Bridge Patterson Drain, ID 014. Municipalities should make their own assessments of relative priority based on all their competing needs.

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. Kingsville has no urgent maintenance needs.

Some of the more common maintenance needs identified are:

- Replace or straighten delineator signs
- Removing brush and debris
- Concrete repairs

The Town of Kingsville 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.

A common rule of thumb is to spend 1% of the replacement value per annum on structure 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. Two structures at the bottom of the list, Road 10 Bridge Patterson Drain, and the Mill Creek Scratch Wigle Drain Culvert, have effectively no remaining service life.

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. 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 Town of Kingsville bridges and large culverts is $28,418,000. The average replacement cost per structure is $465,869.

A graph forecasts the future costs for structure replacement by decade. In the period from 20 to 40 years hence, there is a forecast requirement to replace almost $13M in structure assets. The Town needs to strategize on how best to prepare for this very significant road structure renewal cost. Timely rehabilitation of some of these structures may prolong their service life.

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 will be optimistic.

The estimated replacement costs are a reasonable indication of actual replacement 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.

The estimated cost to replace all The Town of Kingsville culverts, in kind,[1] is $9,255,000.

Bridge Replacement Costs

From the previous two network level reports it is easily deduced that the replacement value of only the bridges is $19,163,000.

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.

[1] Similar material and functionality

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.

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 bridge components.

The loss in relative value of a bridge due to Defects and Damage is shown as a percentage, and actual cost. For example, near the top of the first page of the report the Hughes Drain Bridge ID 003 has lost 5.5% 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.

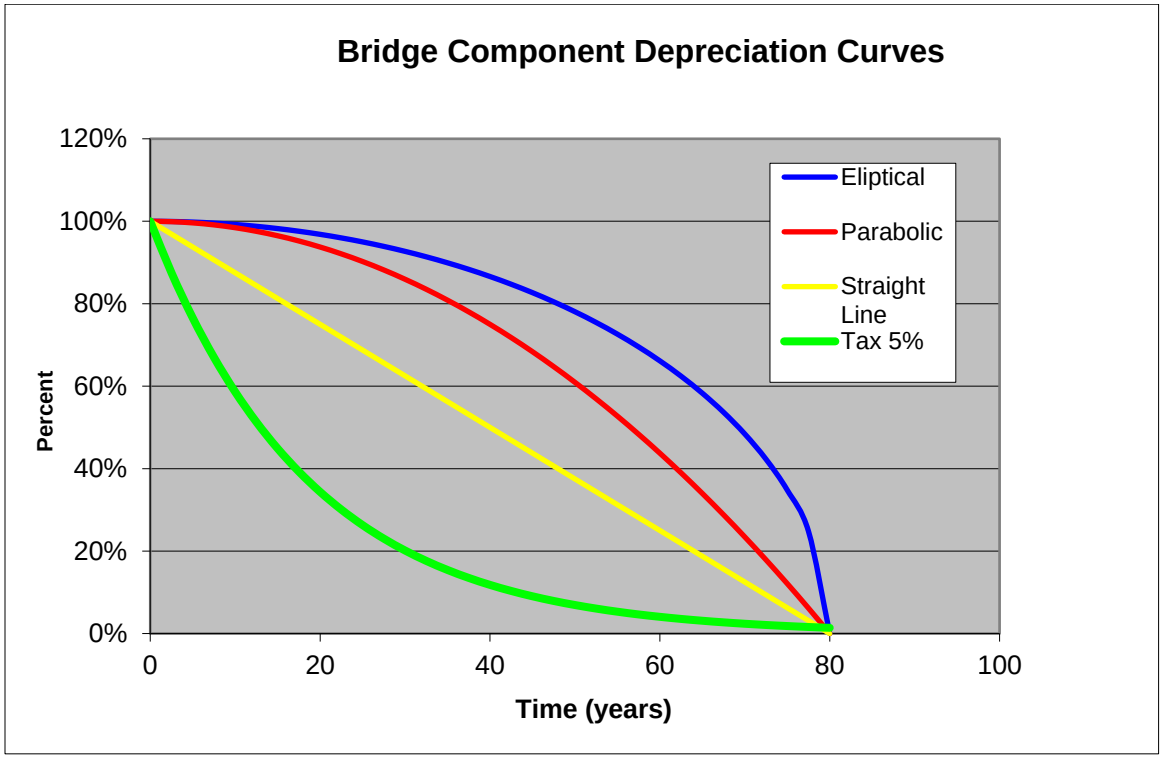


Figure 1. Examples of four depreciation functions for a bridge component with an 80-year deemed service life.

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 components 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 preceding page.

The Road 11 Belle River Bridge ID 020 was constructed in 1990. The deemed New Value of the bridge is shown as $521,085. If parabolic depreciation is assumed, the bridge still retains 80.2% of its original deemed value. The Straight-Line depreciated value of the bridge is 57.6% of the new value.

The most telling part of this report is the bottom line. The deemed new value of all the bridge assets is approximately $10.5M. The loss in value to the assets due to Defects and Damage is assessed as 4.6% or $482K. The total depreciated value of the bridge inventory is 52.8% of the deemed New Value if parabolic depreciation is assumed. Similarly, for straight-line depreciation the value has declined to 34.1% 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 Town of Kingsville is behind target by 15.9% or 14.2% respectively. These numbers are comparable to many other rural municipalities in Ontario.

When the depreciation due to defects and damage exceeds 25% the number is highlighted in yellow. There is only one bridge where defects and damage account for more than 25% of the depreciation. These structures are identified on the capital program.

There is a significant disparity between the estimated full replacement value of the bridge assets ($19.2M 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 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 (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 56% retained value considering only parabolic depreciation. A further 33 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 34% retained value with a further 27 percentage points decline in the next 20 years.

The projected average depreciation is approximately 1.5 percent per year. Accepting an actual replacement cost of $19.2M for only the bridge assets, the forecast depreciation loss in terms of replacement value is nominally $290,000 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 greatly 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 of 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. Interestingly, the graph shows that the recommended capital investment will very effectively hold the current levels of 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.

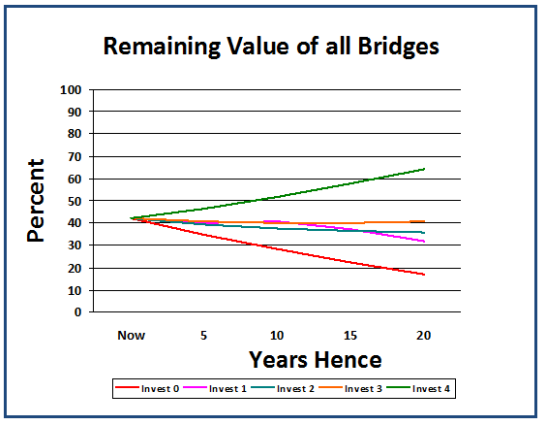
One further premise requires explanation. The graph is premised on one dollar of capital investment off sets one dollar of depreciation. This is reasonable when the replacement values of bridges include all the associated sundry costs of a bridge replacement in kind. However, one dollar of capital may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



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 Town of Kingsville, the average level of depreciation is about 46% of New Value and is projected to decline to 14% of New Value in 20 years in the absence of capital investment.

Superimposed on the Zero Investment scenario is four other colour coded investment scenarios labelled Invest 1 to Invest 4. The Invest 1 scenario is the recommended capital investments per year. The average investment is $94K per year.

Examining the chart, and in particular, the green line that represents this investment scenario, it is shown that the recommended capital expenditure will slightly improve the retained value to 34% in 20 years time.

The Invest 4 scenario expenditure of $200K per year shows 44% retained value after 20 years. Clearly an annual expenditure of more than $200K is required to maintain healthy levels of depreciation. The Town of Kingsville should commit to spending on average at least $300K per year on its bridges to offset depreciation.

However, the average investment will need to be front-end loaded to address the immediate capital needs identified earlier. Capital investment of $300K per annum in the medium to long term will sustain the bridges in a relatively satisfactory level of repair, and ensure that future generations inherit a well maintained and sustainable bridge inventory.

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 Kingsville culvert inventory is $9,255,000. This works out to $400,000 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 66% of their Original or new value. In the absence of capital investment, the culverts will depreciate a further 30% in 20 years, or 1.5% 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 $6.1M to $3.4M in 20 years. This is nominally $140K per year. Thus, a minimum annual capital expenditure of $140K 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 Kingsville is $400K. At a $140K annual rate of depreciation, one culvert on average should be programmed for replacement every 2.8 years, to maintain the current retained value.

The culvert depreciation graph demonstrates that Kingsville has invested heavily in culvert renewal, thus the present retained value is at a very enviable 66%.

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 $1,160K is required for culvert needs between the present and 2027.

The five investment scenarios correspond to no investment, spending $58K per year for 20 years, $60K, $70K, and $140K per year. The chart confirms that an annual average expenditure of $60K per year is sufficient to maintain an acceptable level of depreciation over the next 20 years.

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.

A one-page **Recommended Investigations Report** has been included with the Network Reports.

Bridge deck condition investigations (BDI's) are recommended for all structures identified as requiring comprehensive rehabilitation. Three bridges are recommended for a BDI. The ideal time for a BDI is two years before the planned rehabilitation.

Four structures should have a structural evaluation. These bridges have a dead load surcharge of fill on their decks. It is unlikely that they were designed for this load condition. A structural evaluation may result in the need for a load posting.

Two structures would benefit from an ice inspection. Three structures are recommended for a planning study.

The Road 11 Bridge over the Ruscom River has four recommended investigations and merits a thorough review by a structural engineer.

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 **Performance Deficiencies Report**.

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

Performance Deficiencies require risk management strategizing by the owner.

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

Only five of the inspected structures, or 8.2% have a BCI less than 70. Conversely, 91.8% 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 Town of Kingsville is 11.8% ahead of this metric.

The lowest BCI of 56.6 is for the Mill Creek Scratch Wigle Drain Culvert. This culvert is recommended for replacement in 2018.

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 19-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 provided 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 together with 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

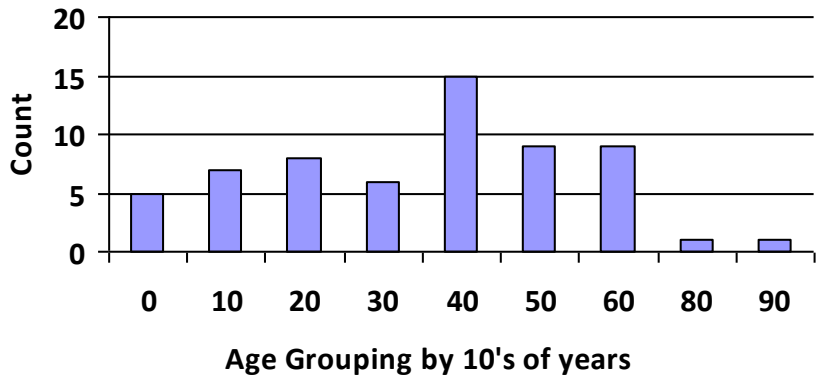
Keystone Bridge Management Corp. is pleased to report on the condition of the Town of Kingsville vehicle bridges and large culverts. Should there be any lingering concerns or additional information required with respect to this assignment, then Keystone will be happy to respond.

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 Town of Kingsville 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.

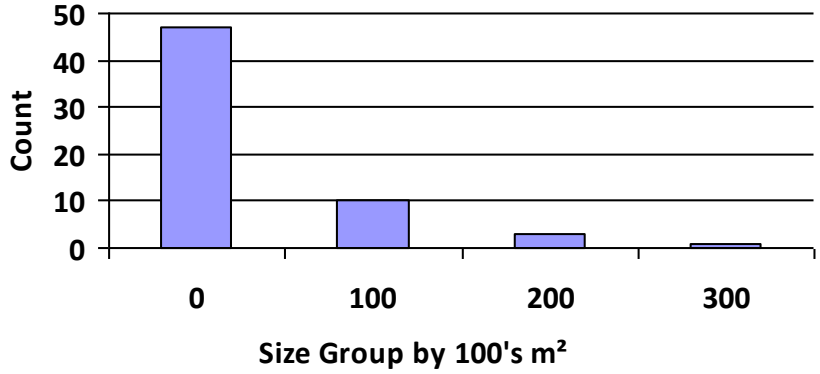
Structure Summary Statistics

Structure Age Histogram



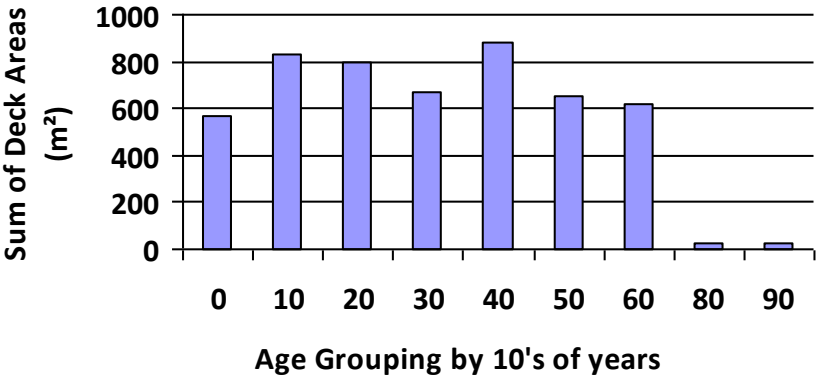
Average Age	41.3
Youngest Age	2
Oldest Age	99
Structure Count	**61**

Structure Deck Area Histogram



Average Deck Area	83 **m²**
Min Deck Area	15 **m²**
Max Deck Area	400 **m²**
Total Deck Area	**5,060** m²

Structure Deck Area by Age Histogram



Deck area < 20 yrs old	1396 **m²**
Deck area < 50 yrs old	3739 **m²**
Deck area > 50 yrs old	1321 **m²**

Bridge List

Bridge ID	Name	Route	Length	Width	Spans	Const Yr
001	Ruscom River Bridge	Road 8 East	7.7	6.6	1	1960
002	Ferry Drain Bridge	Road 8 East	3.8	9.2	1	1960
003	Hughs Drain Bridge	Road 8 East	4.2	8.3	1	1950
004	Lovelace Outlet Drain Bridge	Road 8 East	4.9	8.1	1	1972
006	Orton Sideroad Drain	Road 7 East	4.9	7.8	1	1960
007	East Bridge Orton Drain	Road 7 East	4.9	10.8	1	1968
010	West Wigle Creek Bridge	Road 2 West	6.9	9.2	1	1960
012	Cameron Sideroad Bridge	Cameron Sideroad	4.9	8.1	1	1955
013	Rd 10 Bridge Ruscom River	Road 10	10.3	9.0	1	1960
014	Rd 10 Bridge Patterson Drain	Road 10	3.9	7.4	1	1918
016	Rd 10 Bridge Belle River	Road 10	10.3	9.7	1	1966
017	Rd 10 Bridge Jackson Drain	Road 10	6.8	8.8	1	1965
018	Rd 11 Bridge Ruscom River	Road 11	12.3	9.2	1	1970
019	Rd 11 Bridge Paterson Drain	Road 11	6.1	8.1	1	1950
020	Rd 11 Bridge Belle River	Road 11	13.7	9.3	1	1990
022	Rd 8 E Bridge Upcott Drain	Road 8 East	6.1	9.2	1	1970
023	Inman Sideroad Bridge Upcott Drain	Inman Side Rd	4.2	7.9	1	1954
024	Rd 3 W Bridge E Branch 47 Drain	Road 3 West	5.5	8.8	1	1970
025	Rd 3 W Bridge Centre Branch 47 Drain	Road 3 West	6.5	8.5	1	1955
026	Rd 3 W Bridge Nelson Drain	Road 3 West	5.2	9.1	1	1970
027	Rd 3 W Bridge W Townline Drain	Road 3 West	4.5	9.1	1	1970
028	Rd 2 W Bridge Wigle Creek	Road 2 West	14.9	10.8	1	1960
029	Rd 8 W Bridge Mulcaster Drain	Road 8 West	4.3	10.0	1	1970
030	Rd 5 W Bridge W Townline Drain	Road 5 West	5.0	9.9	1	1960
031	Centre Ave Bridge	Centre Ave.	18.3	3.7	1	1990
032	Cedar Island Bridge	Cedar Island Road	32.2	7.8	3	1957
033	Kratz Rd Bridge	Road 3 West	5.0	9.3	1	1970
034	Rd 5 W Bridge Centre Branch 47th Dra	Road 5 West	5.6	8.8	1	1970
035	Rd 6 W Bridge Central Branch 47th Dr	Road 6 West	5.2	9.8	1	1970
036	S Talbot Rd Bridge Tully Drain	South Talbot Road	5.3	15.5	1	1975
039	N Talbot Rd Bridge Burstyn Drain	North Talbot Road	3.8	14.8	1	1980
040	N Talbot Rd Bridge Tomengo Drain	North Talbot Road	3.7	8.6	1	1955

Bridge ID	Name	Route	Length	Width	Spans	Const Yr
043	N Talbot Rd Bridge Upcott Drain	North Talbot Road	5.8	11.6	1	1950
048	Lakeside Park Bridge 1	Trail	7.1	2.4	2	2000
049	Lakeside Park bridge 2	Trail	16.1	3.4	3	1950
050	Mill Creek Bridge	Trail	18.7	1.5	1	1990
051	Frank Remark Trail Ped Bridge	Frank Remark Trail	5.0	3.0	2	1990
052	Jasperson Lane Bridge	Jasperson Lane	5.2	15.0	1	1970

Total # of Bridges 38

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
005	Orton Drain Culvert	Graham Sideroad	20.2	3.6	1	1970
008	Lane Drain	Road 2 East	42.5	6.8	1	2005
009	Division Rd Drain	Road 2 East	50.0	5.0	1	1980
011	Billings Drain	Road 11	20.1	5.2	1	2009
015	Rd 10 Culvert Orton Drain	Road 10	18.3	7.3	1	1980
021	Rd 8 E Culvert Orton Drain	Road 8 East	10.7	6.2	1	2004
037	Rd 9 W Culvert	Road 9 West	13.6	4.9	1	1990
038	N Townline Drain W Culvert	North Talbot Road	41.3	3.3	1	2003
041	Newman Kay Drain Culvert	North Talbot Road	13.6	4.3	1	1980
042	Maddox Drain Culvert	North Talbot Road	13.0	4.9	1	1970
044	S Talbot Rd Culvert	South Talbot Road	13.1	3.6	1	1995
045	Old No. 5 Drain S Talbot Rd.	South Talbot Road	13.5	3.0	1	1995
046	Old No. 5 Drain S Talbot Rd	South Talbot Road	6.6	3.9	1	1930
047	Boose Drain Culvert Rd 6 East	Road 6 East	37.7	10.6	1	1990
053	Sandy Brook Way Culvert	Sandy Brook Way	20.0	3.0	1	2010
054	Sandybrook Way Steel Culvert	Sandybrook Way	16.2	12.0	1	2015
055	Rd 3 East Culvert	Road 3 East	33.6	3.3	1	2015
056	Queen St. Culvert	Queen St.	38.0	4.6	1	2000
500	Irwin Drain Culvert Rd 11	Road 11	25.4	3.5	1	2000
501	Mill Creek Culvert	Prince Albert Road	20.4	4.6	1	2011
502	Mill Creek Culvert Division Rd	Divison Road	26.8	3.3	1	1985
503	Mill Creek Scratch Wigle Drain Culver	McCallum Drive	21.6	3.7	1	1980
504	W 7th Conc Rd Drain Culvert	McCain Sideroad	15.5	3.9	1	2000

Total # of Culverts 23

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

Capital Needs Report

Year ***2018***

Structure ID	Name	Route	Work	Cost
005	Orton Drain Culvert	Graham Sideroad	Concrete repairs	$36,000
014	Rd 10 Bridge Patterson Drain	Road 10	Replace Bridge	$302,000
018	Rd 11 Bridge Ruscom River	Road 11	WP&P, X-jnt, Replace Distribution Slab	$259,000
042	Maddox Drain Culvert	North Talbot Road	Concrete repairs	$24,000
503	Mill Creek Scratch Wigle Drain Culvert	McCallum Drive	New Conc culvert	$359,000

Sum for Year	***$980,000***
Percentage of Grand Total	***32.2%***

Year *2019*

Structure ID	Name	Route	Work	Cost
024	Rd 3 W Bridge E Branch 47 Drain	Road 3 West	Misc concrete repairs, O'Lay, WP&P, B/Wall, Size premium	$208,000
032	Cedar Island Bridge	Cedar Island Road	Misc concrete repairs, Approach railing	$48,000
052	Jasperson Lane Bridge	Jasperson Lane	Misc concrete repairs, O'Lay, WP&P, B/Wall, Approach GR, Widen structure	$329,000

Sum for Year	***$585,000***
Percentage of Grand Total	***19.2%***

Year *2020*

Structure ID	Name	Route	Work	Cost
025	Rd 3 W Bridge Centre Branch 47 Drain	Road 3 West	O'Lay, WP&P, Curb Replacement, Size premium	$169,000
030	Rd 5 W Bridge W Townline Drain	Road 5 West	Misc concrete repairs, Soffit Repairs	$42,000
046	Old No. 5 Drain S Talbot Rd	South Talbot Road	Replace with Concrete Culvert	$330,000

Sum for Year	***$541,000***
Percentage of Grand Total	***17.8%***

Year *2021*

Structure ID	Name	Route	Work	Cost
026	Rd 3 W Bridge Nelson Drain	Road 3 West	New concrete box culvert	$342,000

Sum for Year	***$342,000***
Percentage of Grand Total	***11.2%***

Year *2022*

Structure ID	Name	Route	Work	Cost
050	Mill Creek Bridge	Trail	Replace I beam cross caps, New timber deck	$24,000

Sum for Year	***$24,000***
Percentage of Grand Total	***0.8%***

Year *2023*

Structure ID	Name	Route	Work	Cost
051	Frank Remark Trail Ped Bridge	Frank Remark Trail	Replace	$164,000

Sum for Year	***$164,000***
Percentage of Grand Total	***5.4%***

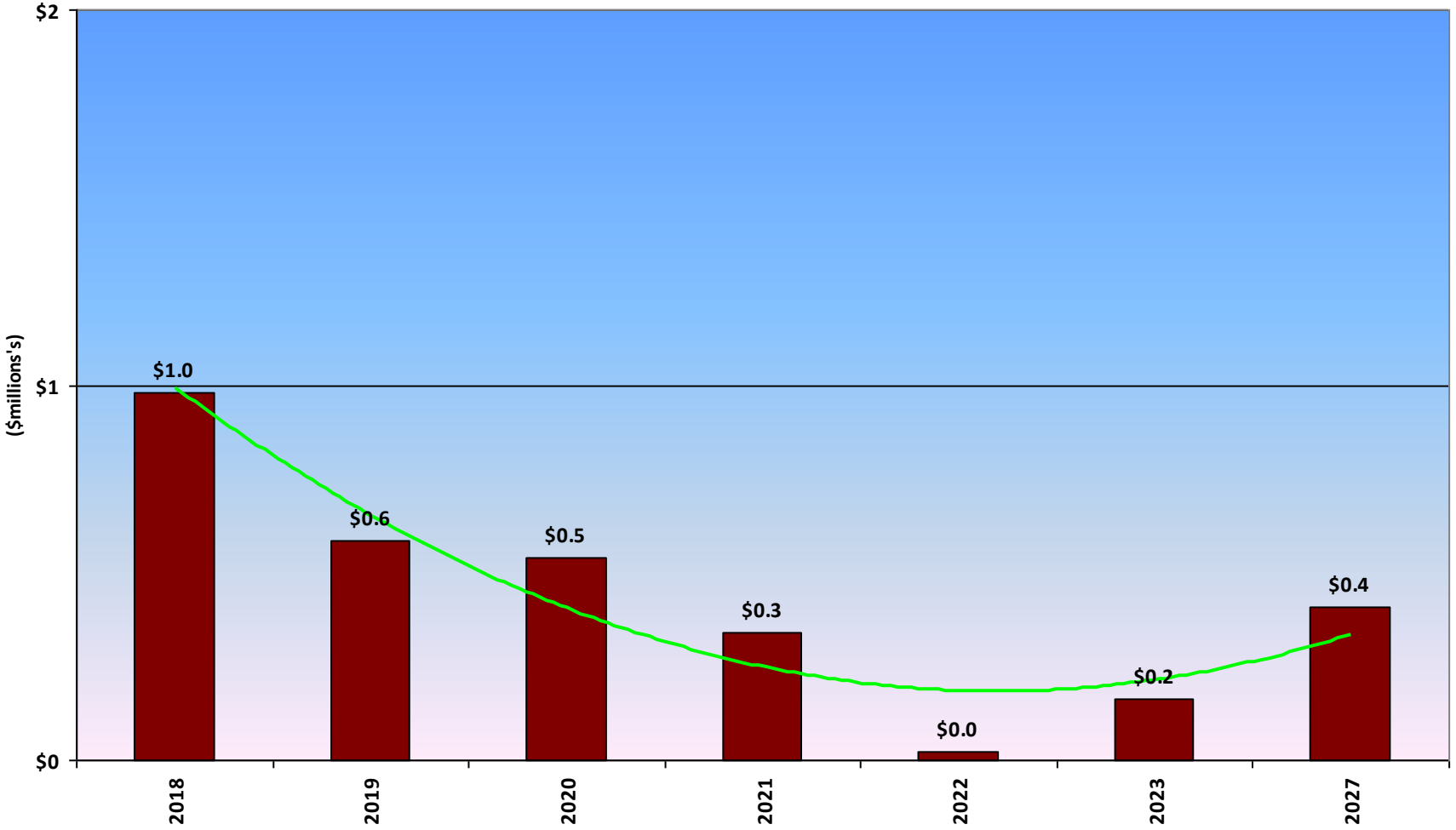
Year ***2027***

Structure ID	Name	Route	Work	Cost
502	Mill Creek Culvert Division Rd	Divison Road	New Conc culvert	$408,000

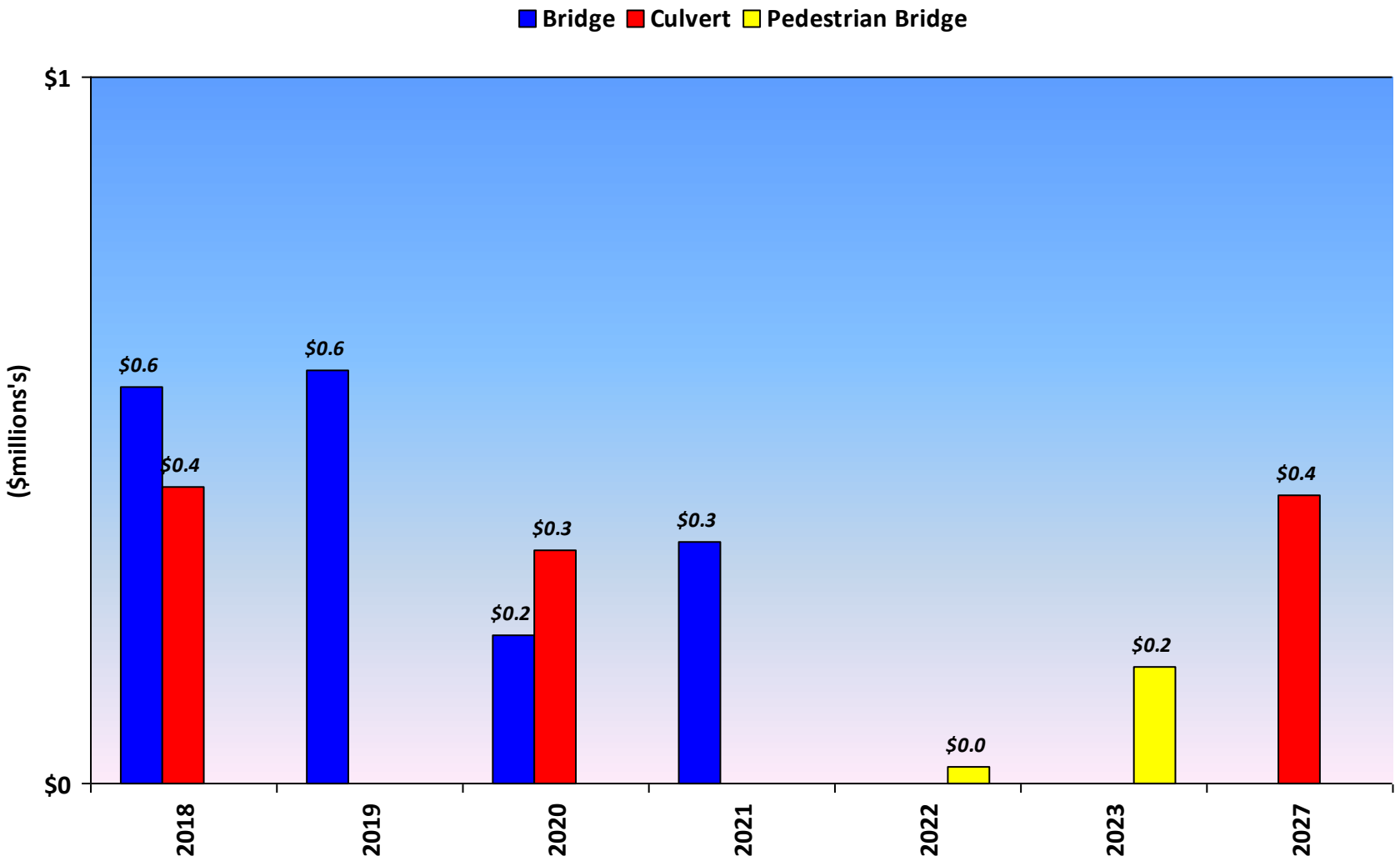
Sum for Year	***$408,000***
Percentage of Grand Total	***13.4%***

Total Capital Needs (m's) $3,044,000 Over 10 Years

Capital Expenditure by Year



Capital Expenditure by Structure Type



2 Year Priority Report

Priority	Estimate	Bridge ID	CapYear	Remark
1	$359,000.00	503 Mill Creek Scratch Wigle	2018	Culvert walls are perforated and backfill material is spilling in through perforated areas. If the water levels rise above the perforation line, loss of fill material will increase. Culvert needs immediate replacement as it is at risk of failure under the westbound lane. Regular monitoring of this structure and the pavement in the WBL should be maintained until time of culvert replacement.
2	$302,000.00	014 Rd 10 Bridge Patterson Dr	2018	Bridge is old and suffering from extensive defects and damage. The current width is not adequate for the travelled road. Recommend replacing this bridge with a precast box culvert within 2 years.
3	$24,000.00	042 Maddox Drain Culvert	2018	Construction year was estimated at 1970. Culvert ends are suffering from major disintegration. The interior of the culvert is in good condition. The disintegrating ends appearance is ugly but not effecting culvert function. Geodetic bench mark and attached telephone cables may be lost due to the disintegration at culvert ends. No delineators marking culvert.
4	$36,000.00	005 Orton Drain Culvert	2018	Construction year was estimated at 1970. All 3 exposed ends have major disintegration with exposed rebars, this appearance looks bad but structurally the culvert is fine. Repairs to end would help appearance but are not necessary for these culverts to function as intended. Interior condition is very good.
5	$259,000.00	018 Rd 11 Bridge Ruscom Rive	2018	Construction year was estimated at 1970. The extensive leaching between the girders suggests compromised or no distribution slab. Approximately 500mm of fill has been added to the bridge deck. Recommend a structural evaluation given the added dead load to this bridge. A load restriction may be warranted. Girder damage may make this bridge not economical to repair. Bridge should be programmed for immediate rehabilitation or replacement within 10-20 years.
6	$329,000.00	052 Jasperson Lane Bridge	2019	Construction year was estimated at 1970. Bridge is to narrow for road platform. Exterior deck and walls have major disintegration and are in need repairs. Guide rail has extensive damage and needs replacement. Major rehabilitation of this structure is required within the next few years. Deck condition survey is recommended to determine condition of deck top prior to rehabilitation. Consider widening structure and improve road alignment.

Priority	Estimate	Bridge ID	CapYear	Remark
7	$48,000.00	032 Cedar Island Bridge	2019	Bridge was rehabbed in 1993, new girders, deck, bearings, pier caps, and concrete repairs to abutments and piers. Bridge is currently in good condition. Some minor repairs to sidewalk and retaining walls are needed also the railings on approaches will need to be replaced within a couple of years.
8	$208,000.00	024 Rd 3 W Bridge E Branch 4	2019	Construction age was estimated at 1970. Deck repairs with waterproofing and paving will stabilize soffit deterioration.

Estimated 2 Year Need ***$1,565,000.00***

Bridge Maintenance Report

Bridge ID	Name	Road	Component	Maintenance
001	Ruscom River Bridge	Road 8 East	Delineator	Replace Sign

Sign in the NW is missing.

Bridge ID	Name	Road	Component	Maintenance
002	Ferry Drain Bridge	Road 8 East	Delineator	Add Signs

Located at the NE and SW, consider adding delineators to all corners given tall curb height.

Bridge ID	Name	Road	Component	Maintenance
003	Hughs Drain Bridge	Road 8 East	Steel Post & Guide Rail	Repair Minor Damage

End treatments at NE and SE are both damaged from vehicle impact. Guide rail appears to be a hazard for wide farm equipment.

Bridge ID	Name	Road	Component	Maintenance
004	Lovelace Outlet Drain Bridge	Road 8 East	Delineator	Add Signs

Located in the NE and SW. Consider adding signs in the NW and SE.

Bridge ID	Name	Road	Component	Maintenance
005	Orton Drain Culvert	Graham Sideroad	Delineator	Add Signs

No delineators at culvert consider adding signs.

Bridge ID	Name	Road	Component	Maintenance
006	Orton Sideroad Drain	Road 7 East	Delineator	Replace Sign

2 signs on the north side have been damage from vehicle impact. Signs need to be replaced.

Bridge ID	Name	Road	Component	Maintenance
007	East Bridge Orton Drain	Road 7 East	Delineator	Straighten Sign

Signs are at ends of wingwalls. SW sign is leaning.

Bridge ID	Name	Road	Component	Maintenance
013	Rd 10 Bridge Ruscom River	Road 10	Delineator	Adjust Height

Delineators at ends of parapet walls. Sign in the NE is too low and obscured by vegetation.

Bridge ID	Name	Road	Component	Maintenance
014	Rd 10 Bridge Patterson Drain	Road 10	Delineator	Straighten Sign Replace Sign
	Signs leaning and multiple vehicle impacts.			
017	Rd 10 Bridge Jackson Drain	Road 10	Delineator	Straighten Sign
	Sign in the SW is leaning otherwise all intact.			
			Embankment	Remove Brush/Trees
	Make shift erosion control in the SW (steel beam section held in place with steel posts driven into ground). Trees in the NW should be brushed back.			
020	Rd 11 Bridge Belle River	Road 11	Embankment	Remove Brush/Trees
	Heavy vegetation around bridge corners. Gas and telephone utilities noted on the north side.			
022	Rd 8 E Bridge Upcott Drain	Road 8 East	Delineator	Add Signs
	Delineators in the NE and SW. Consider adding signs at ends of all wingwalls.			
023	Inman Sideroad Bridge Upcott Drain	Inman Side Rd	Delineator	Replace Sign
	1 sign missing in the NW corner.			
024	Rd 3 W Bridge E Branch 47 Drain	Road 3 West	Soffit	Repair Damage
	Large areas of spalling on soffit, notably at north and south ends. Recommend concrete repairs to soffit. Telephone utility attached to the south side.			
025	Rd 3 W Bridge Centre Branch 47 Drain	Road 3 West	Conc Curb	Re & Re Concrete
	Major disintegration on the south curb, north curb also disintegrating but not as severe as south. Recommend minor concrete repairs to curbs.			

Bridge ID	Name	Road	Component	Maintenance
032	Cedar Island Bridge	Cedar Island Road	X- Joint Conventional	Remove Debris
Minor spalls in end dams and ballast walls along the length of armouring. Seals are full of debris, no evidence the joints are leaking.				
033	Kratz Rd Bridge	Road 3 West	Conc Curb	Re & Re Concrete
Curbs have major disintegration, west curb is the most severe. Wide cracks in exterior face of both curbs. Concrete repairs would be a benefit.				
			Embankment	Remove Brush/Trees
Thick brush on east side should be cleared. Embankment material partially sliding down at bridge corners.				
035	Rd 6 W Bridge Central Branch 47th Drain	Road 6 West	RC Abutment Wall	Re & Re Concrete
Spalls around wall drains east wall. Scaling from high water mark down.				
			Embankment	Place rip-rap
Erosion at the NW wingwall. Rip rap should be placed at this location.				
			Delineator	Add Signs
Located at the NE, NW, and SE. Recommend delineator installed at the SW corner.				
039	N Talbot Rd Bridge Burstyn Drain	North Talbot Road	Delineator	Replace Sign
				Straighten Sign
Sign in SW is missing, sign in NW is leaning.				
041	Newman Kay Drain Culvert	North Talbot Road	Delineator	Replace Sign
				Straighten Sign
1 Sign in NW corner, sign has some impact damage and is leaning. Assume sign in SW corner is missing.				
042	Maddox Drain Culvert	North Talbot Road	CIP RF Box Culvert	Repair Damage
Both exterior ends have major disintegration. The interior of the culvert is good. One small spall in soffit noted due to lack of cover over reinforcing bars. Geodetic bench mark in the NW corner may soon be lost due to the disintegration on culvert end. Telephone cables detached and hanging off east end this should be repaired.				

Bridge ID	Name	Road	Component	Maintenance
048	Lakeside Park Bridge 1	Trail	Approach Slab	Repair Damage
Approach slabs have settled. North slab has wide crack in middle due to settlement. Asphalt padding has been added at both approaches due to the settlement. Void noted under north slab.				
			Water Channel	Remove Obstructions
Debris caught up on the upstream pier wall.				
			Steel Tube Rail & Post	Repair Minor Damage
Post anchors are loose due to delaminated concrete at anchor locations.				
050	Mill Creek Bridge	Trail	Timber-Sawn	Local repair
Satisfactory condition. Decay on first few boards of both approach spans.				
051	Frank Remark Trail Ped Bridge	Frank Remark Trail	Water Channel	Remove Obstructions
Debris is caught up on upstream side (east) between barrels. Water was flowing through both cells.				
053	Sandy Brook Way Culvert	Sandy Brook Way	Embankment	Remove Brush/Trees
Rip rap stones at culvert ends. Brushing out at the south end is required.				
055	Rd 3 East Culvert	Road 3 East	Timber Post & Guide Rail	Local repair
Located over south end. Small area with impact damage. Extruder end treatments at both ends.				
502	Mill Creek Culvert Division Rd	Divison Road	Timber Post & Guide Rail	Local repair
Guide rail posts on east side may become unstable due to loss of material over culvert/under sidewalk which is where posts are anchored. This problem should be addressed with sidewalk.				

Bridge ID	Name	Road	Component	Maintenance
502	Mill Creek Culvert Division Rd	Divison Road	Embankment	Remove Brush/Trees

Heavy vegetation growth at ends of culvert needs to be brushed back. Erosion at east end under sidewalk.

			Sidewalk	Repair Damage

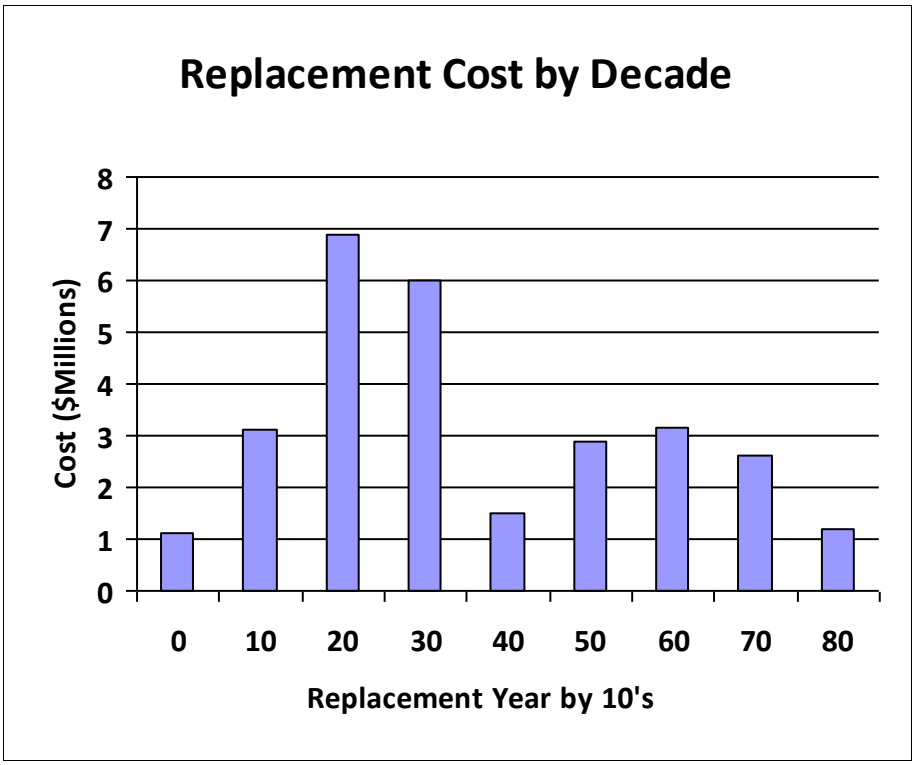
Sidewalk on east side has settled due to the loss of fill material below at culvert ends, this problem needs to be addressed.

Structure Replacement Costs

Bridge ID	Name	Estimated Remaining Service Life	Estimated Replacement Cost
053	Sandy Brook Way Culvert	83	$393,000
011	Billings Drain	82	$791,000
008	Lane Drain	78	$695,000
021	Rd 8 E Culvert Orton Drain	77	$347,000
038	N Townline Drain W Culvert	76	$428,000
020	Rd 11 Bridge Belle River	73	$1,133,000
044	S Talbot Rd Culvert	68	$188,000
045	Old No. 5 Drain S Talbot Rd.	68	$197,000
028	Rd 2 W Bridge Wigle Creek	63	$1,559,000
037	Rd 9 W Culvert	63	$318,000
047	Boose Drain Culvert Rd 6 East	63	$714,000
048	Lakeside Park Bridge 1	63	$166,000
009	Division Rd Drain	53	$635,000
015	Rd 10 Culvert Orton Drain	53	$364,000
029	Rd 8 W Bridge Mulcaster Drain	53	$324,000
041	Newman Kay Drain Culvert	53	$281,000
032	Cedar Island Bridge	50	$1,276,000
043	N Talbot Rd Bridge Upcott Drain	48	$593,000
005	Orton Drain Culvert	43	$246,000
039	N Talbot Rd Bridge Burstyn Drain	43	$409,000
042	Maddox Drain Culvert	43	$237,000
036	S Talbot Rd Bridge Tully Drain	38	$628,000
004	Lovelace Outlet Drain Bridge	35	$324,000
022	Rd 8 E Bridge Upcott Drain	33	$462,000
024	Rd 3 W Bridge E Branch 47 Drain	33	$398,000
027	Rd 3 W Bridge W Townline Drain	33	$321,000
033	Kratz Rd Bridge	33	$371,000
034	Rd 5 W Bridge Centre Branch 47th Dra	33	$446,000
035	Rd 6 W Bridge Central Branch 47th Dr	33	$406,000
054	Sandybrook Way Steel Culvert	33	$780,000
055	Rd 3 East Culvert	33	$260,000

Bridge ID	Name	Estimated Remaining Service Life	Estimated Replacement Cost
007	East Bridge Orton Drain	31	$440,000
031	Centre Ave Bridge	30	$1,164,000
016	Rd 10 Bridge Belle River	29	$619,000
501	Mill Creek Culvert	29	$678,000
017	Rd 10 Bridge Jackson Drain	28	$510,000
001	Ruscom River Bridge	23	$495,000
002	Ferry Drain Bridge	23	$260,000
006	Orton Sideroad Drain	23	$312,000
010	West Wigle Creek Bridge	23	$536,000
012	Cameron Sideroad Bridge	23	$352,000
013	Rd 10 Bridge Ruscom River	23	$584,000
025	Rd 3 W Bridge Centre Branch 47 Drain	23	$470,000
026	Rd 3 W Bridge Nelson Drain	23	$420,000
030	Rd 5 W Bridge W Townline Drain	23	$427,000
040	N Talbot Rd Bridge Tomengo Drain	23	$240,000
056	Queen St. Culvert	23	$480,000
504	W 7th Conc Rd Drain Culvert	23	$222,000
023	Inman Sideroad Bridge Upcott Drain	22	$266,000
003	Hughs Drain Bridge	18	$475,000
019	Rd 11 Bridge Paterson Drain	18	$419,000
049	Lakeside Park bridge 2	18	$533,000
500	Irwin Drain Culvert Rd 11	18	$234,000
018	Rd 11 Bridge Ruscom River	13	$763,000
050	Mill Creek Bridge	13	$98,000
052	Jasperson Lane Bridge	13	$600,000
502	Mill Creek Culvert Division Rd	8	$292,000
051	Frank Remark Trail Ped Bridge	7	$135,000
046	Old No. 5 Drain S Talbot Rd	3	$213,000
014	Rd 10 Bridge Patterson Drain	0	$229,000
503	Mill Creek Scratch Wigle Drain Culvert	0	$262,000

Bridge ID	Name	Estimated Remaining Service Life	Estimated Replacement Cost



Total Replacement Cost	**$28,418,000**
Average Replacement Cost	**$465,869**
Total Deck Area	**5060 m^2**

Culvert Replacement Cost

Culvert ID	Name	Culvert Type	Sub-Total Concrete	20% CA + Contingency Concrete	Total Cost of Concrete Replacement	Sub-Total Steel	20% CA + Contingency Steel	Total Cost of Steel Replacement
005	Orton Drain Culvert	Concrete Culvert	$186,000	$41,000	$246,000	$133,000	$31,000	$183,000
008	Lane Drain	Concrete Culvert	$526,000	$116,000	$695,000	$287,000	$68,000	$408,000
009	Division Rd Drain	Concrete Culvert	$481,000	$106,000	$635,000	$272,000	$64,000	$384,000
011	Billings Drain	Concrete Culvert	$599,000	$132,000	$791,000	$337,000	$80,000	$477,000
015	Rd 10 Culvert Orton Drain	Concrete Culvert	$275,000	$61,000	$364,000	$176,000	$41,000	$245,000
021	Rd 8 E Culvert Orton Drain	Concrete Culvert	$263,000	$58,000	$347,000	$214,000	$48,000	$288,000
037	Rd 9 W Culvert	Concrete Culvert	$241,000	$53,000	$318,000	$191,000	$43,000	$258,000
038	N Townline Drain W Culvert	Concrete Culvert	$324,000	$72,000	$428,000	$193,000	$45,000	$270,000
041	Newman Kay Drain Culvert	Concrete Culvert	$213,000	$47,000	$281,000	$166,000	$38,000	$225,000
042	Maddox Drain Culvert	Concrete Culvert	$179,000	$40,000	$237,000	$135,000	$31,000	$184,000
044	S Talbot Rd Culvert	Concrete Culvert	$142,000	$32,000	$188,000	$107,000	$25,000	$146,000
045	Old No. 5 Drain S Talbot Rd.	Concrete Culvert	$149,000	$33,000	$197,000	$110,000	$25,000	$150,000
046	Old No. 5 Drain S Talbot Rd	Concrete Culvert	$161,000	$36,000	$213,000	$140,000	$32,000	$188,000
047	Boose Drain Culvert Rd 6 East	Concrete Culvert	$541,000	$119,000	$714,000	$316,000	$74,000	$444,000
053	Sandy Brook Way Culvert	Concrete Culvert	$297,000	$66,000	$393,000	$234,000	$53,000	$317,000
054	Sandybrook Way Steel Culvert	Soil-Steel Structure	$715,000	$158,000	$945,000	$578,000	$130,000	$780,000
055	Rd 3 East Culvert	Soil-Steel Structure	$293,000	$65,000	$387,000	$187,000	$44,000	$260,000
056	Queen St. Culvert	Soil-Steel Structure	$513,000	$113,000	$677,000	$349,000	$80,000	$480,000
500	Irwin Drain Culvert Rd 11	Soil-Steel Structure	$253,000	$56,000	$334,000	$170,000	$39,000	$234,000

Culvert ID	Name	Culvert Type	Sub-Total Concrete	20% CA + Contingency Concrete	Total Cost of Concrete Replacement	Sub-Total Steel	20% CA + Contingency Steel	Total Cost of Steel Replacement
501	Mill Creek Culvert	Soil-Steel Structure	$604,000	$133,000	$797,000	$505,000	$113,000	$678,000
502	Mill Creek Culvert Division Rd	Soil-Steel Structure	$309,000	$68,000	$408,000	$212,000	$49,000	$292,000
503	Mill Creek Scratch Wigle Drain Culvert	Soil-Steel Structure	$272,000	$60,000	$359,000	$191,000	$44,000	$262,000
504	W 7th Conc Rd Drain Culvert	Soil-Steel Structure	$216,000	$48,000	$286,000	$163,000	$37,000	$222,000

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:	8
Total Number of Concrete Structures:	15
Total Cost of Culvert Replacement Based on Similar Size and Type:	$9,255,000

Parabolic & Straight Line Depreciation

(Does not include culverts)

Name	Bridge ID	Built	Value (New)	Damage/Defects		Present Val (Parab)		Present Val (S/L)	
Ruscom River Bridge	001	1960	$157,820	3.9%	$6,124	24.6%	$38,866	12.8%	$20,148
Ferry Drain Bridge	002	1960	$143,168	1.3%	$1,879	35.2%	$50,344	20.2%	$28,871
Hughs Drain Bridge	003	1950	$475,556	5.5%	$26,149	72.6%	$345,467	56.1%	$266,884
Lovelace Outlet Drain Bridge	004	1972	$161,018	0.2%	$295	56.3%	$90,679	35.3%	$56,844
Orton Sideroad Drain	006	1960	$134,659	1.5%	$2,019	41.8%	$56,344	23.7%	$31,918
East Bridge Orton Drain	007	1968	$211,721	3.5%	$7,497	48.5%	$102,667	28.6%	$60,504
West Wigle Creek Bridge	010	1960	$280,358	0.3%	$914	74.6%	$209,250	63.5%	$178,091
Cameron Sideroad Bridge	012	1955	$128,549	0.8%	$1,025	29.6%	$38,032	16.2%	$20,776
Rd 10 Bridge Ruscom River	013	1960	$340,658	2.0%	$6,668	36.4%	$123,981	20.8%	$70,942
Rd 10 Bridge Patterson Drain	014	1918	$118,961	39.9%	$47,482	0.0%	$0	0.0%	$0
Rd 10 Bridge Belle River	016	1966	$474,651	1.2%	$5,820	51.5%	$244,625	30.8%	$146,133
Rd 10 Bridge Jackson Drain	017	1965	$207,509	0.0%	$0	50.9%	$105,589	30.3%	$62,954
Rd 11 Bridge Ruscom River	018	1970	$370,496	8.1%	$29,850	45.7%	$169,295	25.1%	$93,105
Rd 11 Bridge Paterson Drain	019	1950	$199,022	6.3%	$12,511	17.0%	$33,905	7.4%	$14,723
Rd 11 Bridge Belle River	020	1990	$521,085	1.2%	$6,171	80.2%	$417,957	57.6%	$299,943
Rd 8 E Bridge Upcott Drain	022	1970	$201,399	1.1%	$2,180	55.2%	$111,237	33.9%	$68,278
Inman Sideroad Bridge Upcott Drain	023	1954	$145,681	4.8%	$6,949	26.0%	$37,927	12.4%	$18,008
Rd 3 W Bridge E Branch 47 Drain	024	1970	$225,340	7.2%	$16,263	45.4%	$102,345	26.2%	$59,056

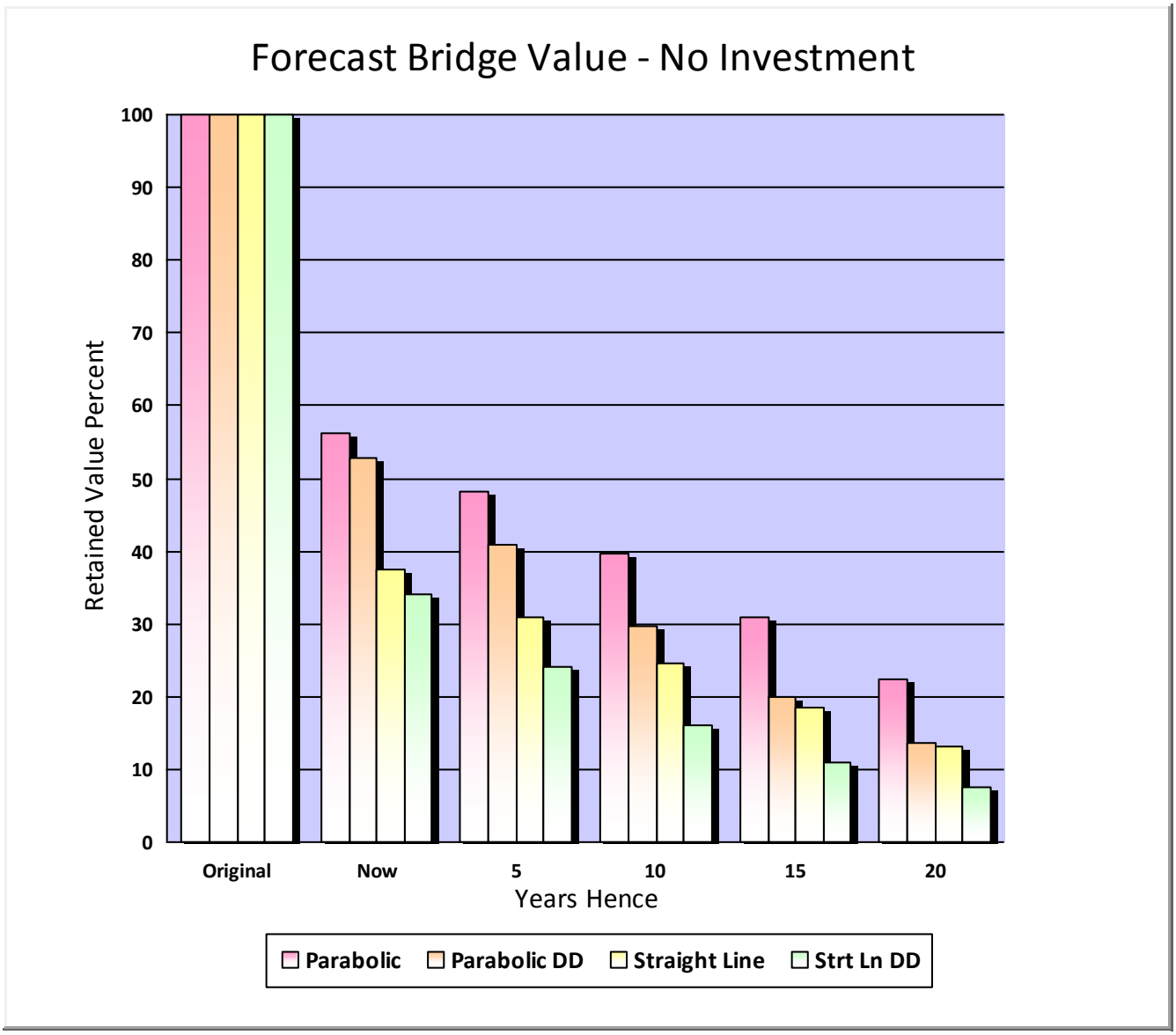
(Does not include culverts)

Name	Bridge ID	Built	Value (New)	Damage/Defects		Present Val (Parab)		Present Val (S/L)	
Rd 3 W Bridge Centre Branch 47 Drain	025	1955	$333,227	11.3%	$37,623	28.0%	$93,337	12.9%	$42,896
Rd 3 W Bridge Nelson Drain	026	1970	$139,934	11.0%	$15,402	43.3%	$60,567	26.6%	$37,282
Rd 3 W Bridge W Townline Drain	027	1970	$255,031	1.0%	$2,545	59.1%	$150,685	36.6%	$93,396
Rd 2 W Bridge Wigle Creek	028	1960	$534,770	0.0%	$0	37.0%	$197,655	21.2%	$113,288
Rd 8 W Bridge Mulcaster Drain	029	1970	$299,818	0.6%	$1,922	56.7%	$169,950	36.7%	$109,996
Rd 5 W Bridge W Townline Drain	030	1960	$295,242	3.0%	$8,890	40.9%	$120,616	22.7%	$67,120
Centre Ave Bridge	031	1990	$724,348	8.1%	$58,583	73.6%	$533,332	49.4%	$357,775
Cedar Island Bridge	032	1957	$1,038,173	2.5%	$25,900	67.8%	$703,741	47.3%	$491,561
Kratz Rd Bridge	033	1970	$154,906	7.3%	$11,310	56.6%	$87,710	34.7%	$53,747
Rd 5 W Bridge Centre Branch 47th Drain	034	1970	$344,456	8.7%	$30,051	51.6%	$177,612	29.0%	$100,042
Rd 6 W Bridge Central Branch 47th Drain	035	1970	$282,016	14.8%	$41,664	44.3%	$124,891	22.1%	$62,361
S Talbot Rd Bridge Tully Drain	036	1975	$271,456	1.3%	$3,604	52.0%	$141,170	32.4%	$88,072
N Talbot Rd Bridge Burstyn Drain	039	1980	$326,078	0.3%	$1,107	73.5%	$239,608	49.7%	$162,122
N Talbot Rd Bridge Tomengo Drain	040	1955	$102,766	10.8%	$11,068	23.4%	$24,035	11.6%	$11,898
N Talbot Rd Bridge Upcott Drain	043	1950	$264,340	4.2%	$11,061	45.2%	$119,425	31.3%	$82,761
Lakeside Park Bridge 1	048	2000	$57,748	4.3%	$2,479	80.8%	$46,680	60.0%	$34,626
Lakeside Park bridge 2	049	1950	$155,118	5.3%	$8,234	8.4%	$13,004	3.4%	$5,271
Mill Creek Bridge	050	1990	$33,079	12.5%	$4,132	63.3%	$20,953	40.9%	$13,517

(Does not include culverts)

Name	Bridge ID	Built	Value (New)	Damage/Defects		Present Val (Parab)		Present Val (S/L)	
Frank Remark Trail Ped Bridge	051	1990	$135,184	0.9%	$1,200	82.2%	$111,132	60.5%	$81,814
Jasperson Lane Bridge	052	1970	$285,480	8.8%	$25,170	51.0%	$145,687	29.0%	$82,895
Grand Total			**$10,530,820**	**4.6%**	**$481,742**	**52.8%**	**$5,560,301**	**34.1%**	**$3,589,619**

Bridge Depreciation Forecast 1

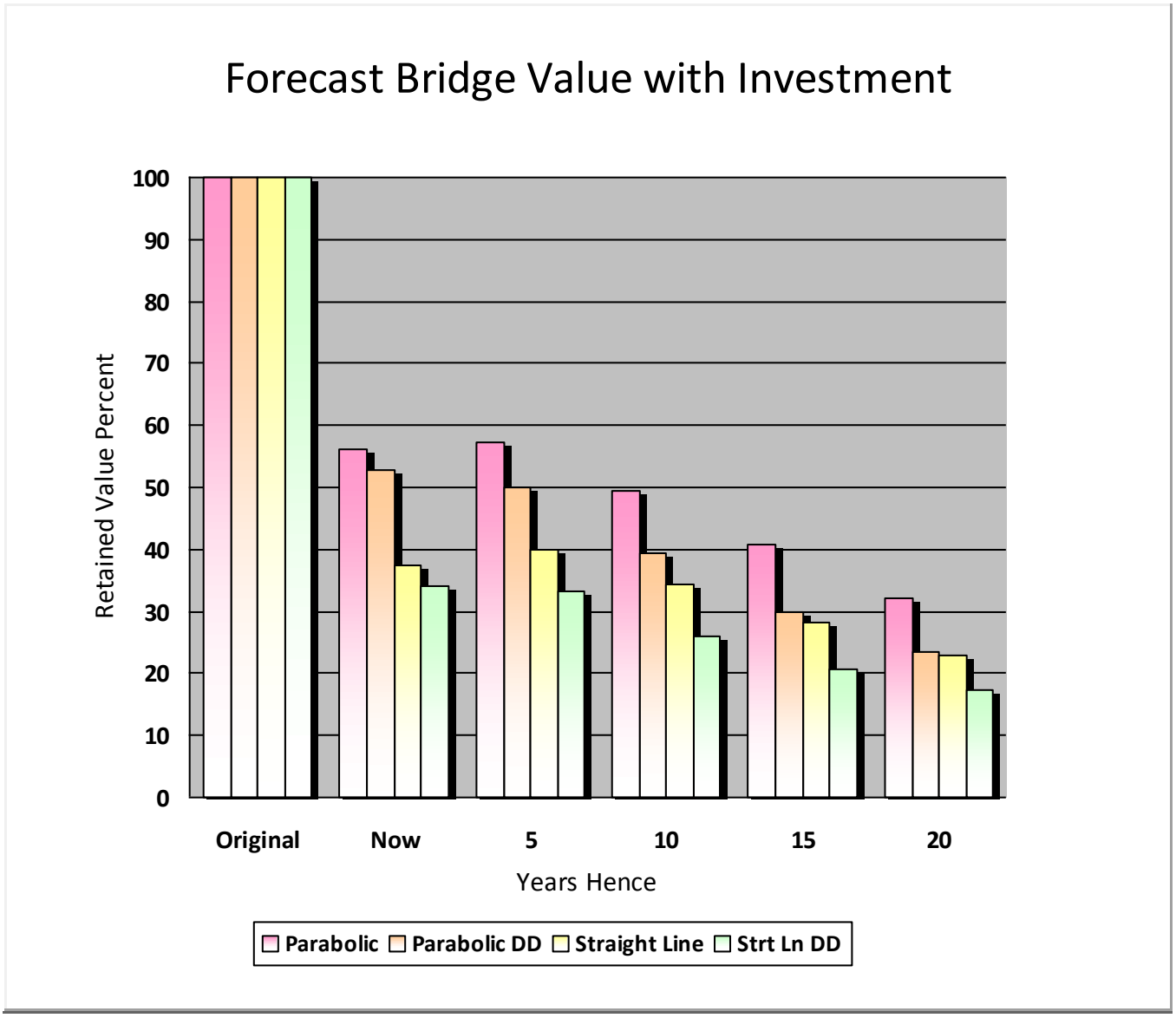


Legend

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

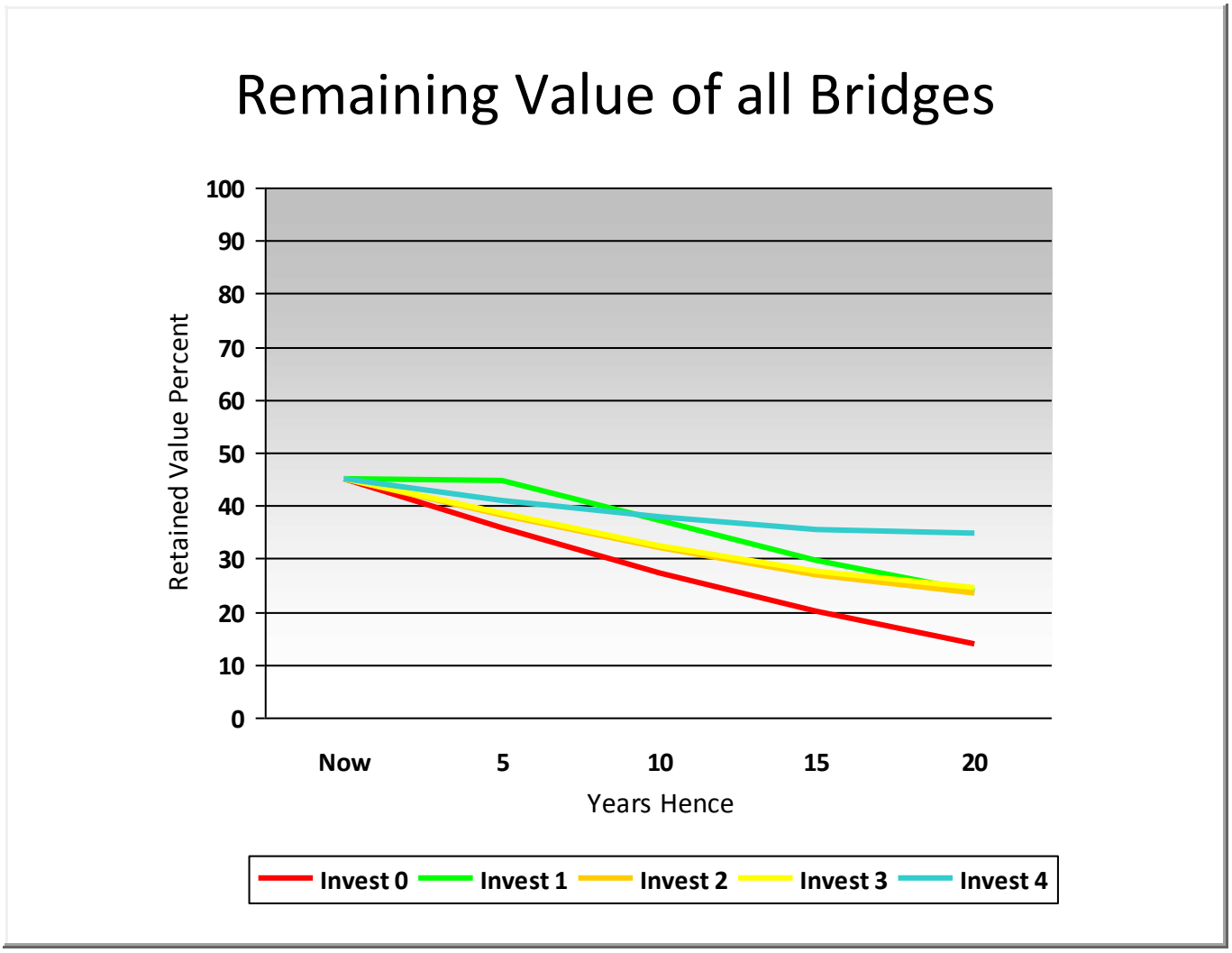
With Recommended Capital Investment



Legend

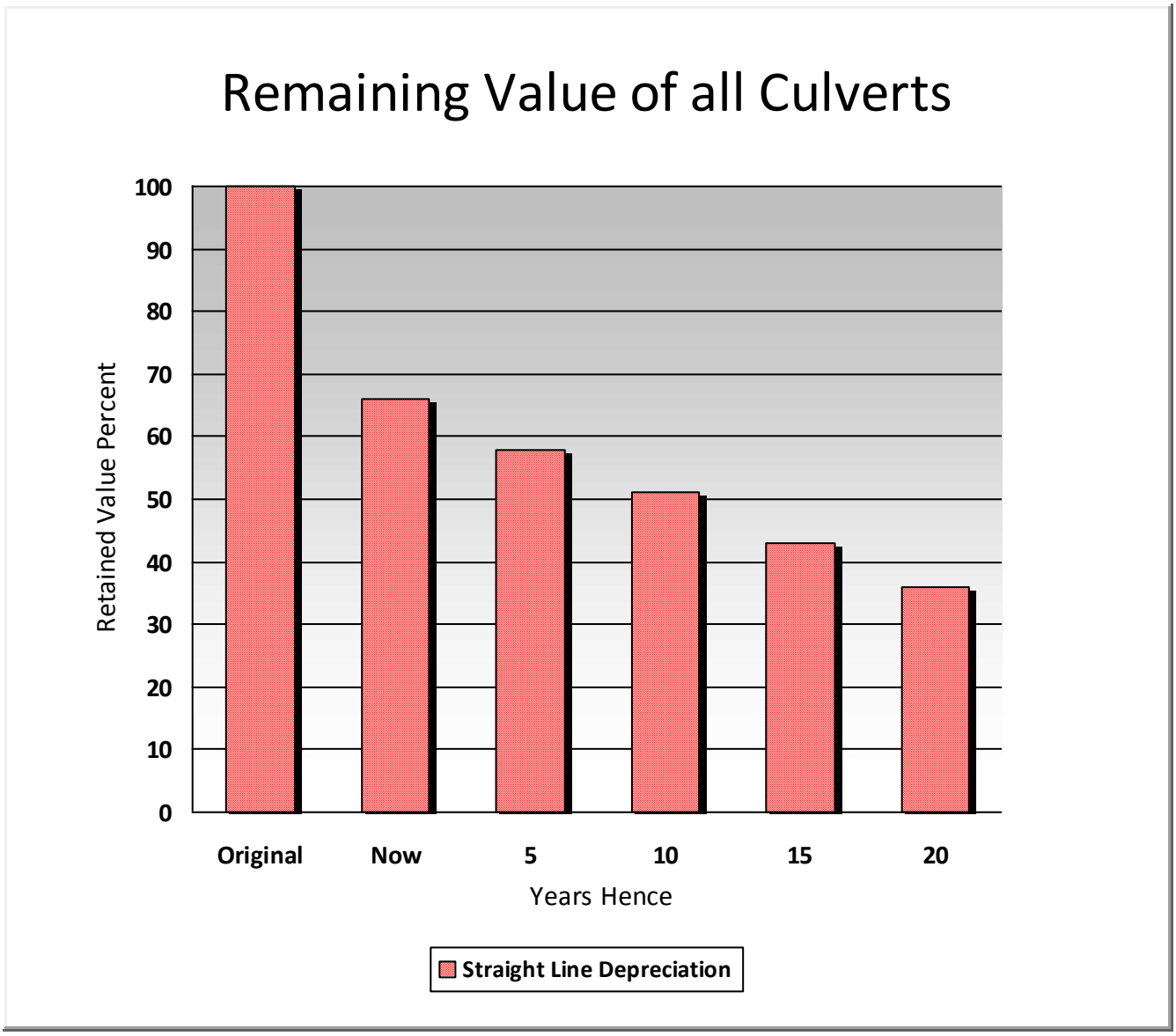
Parabolic: Parabolic Depreciation not including effects of Defects & Damage
Parabolic DD: Parabolic Depreciation including effects of Defects & Damage
Straight Line: Straight-Line Depreciation not including effects of Defects & Damage
Strt Ln DD: Straight-Line Depreciation including effects of Defects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

Average Bridge Depreciation with Investment



Key	Investment Description	Annual Amount
Invest 0	No Investment	$0
Invest 1	Recommended Capital (Average)	$94,000
Invest 2	Rounded Up Recommended Capital	$90,000
Invest 3	Improved Uniform Capital	$100,000
Invest 4	Greatly Improved Uniform Capital	$200,000

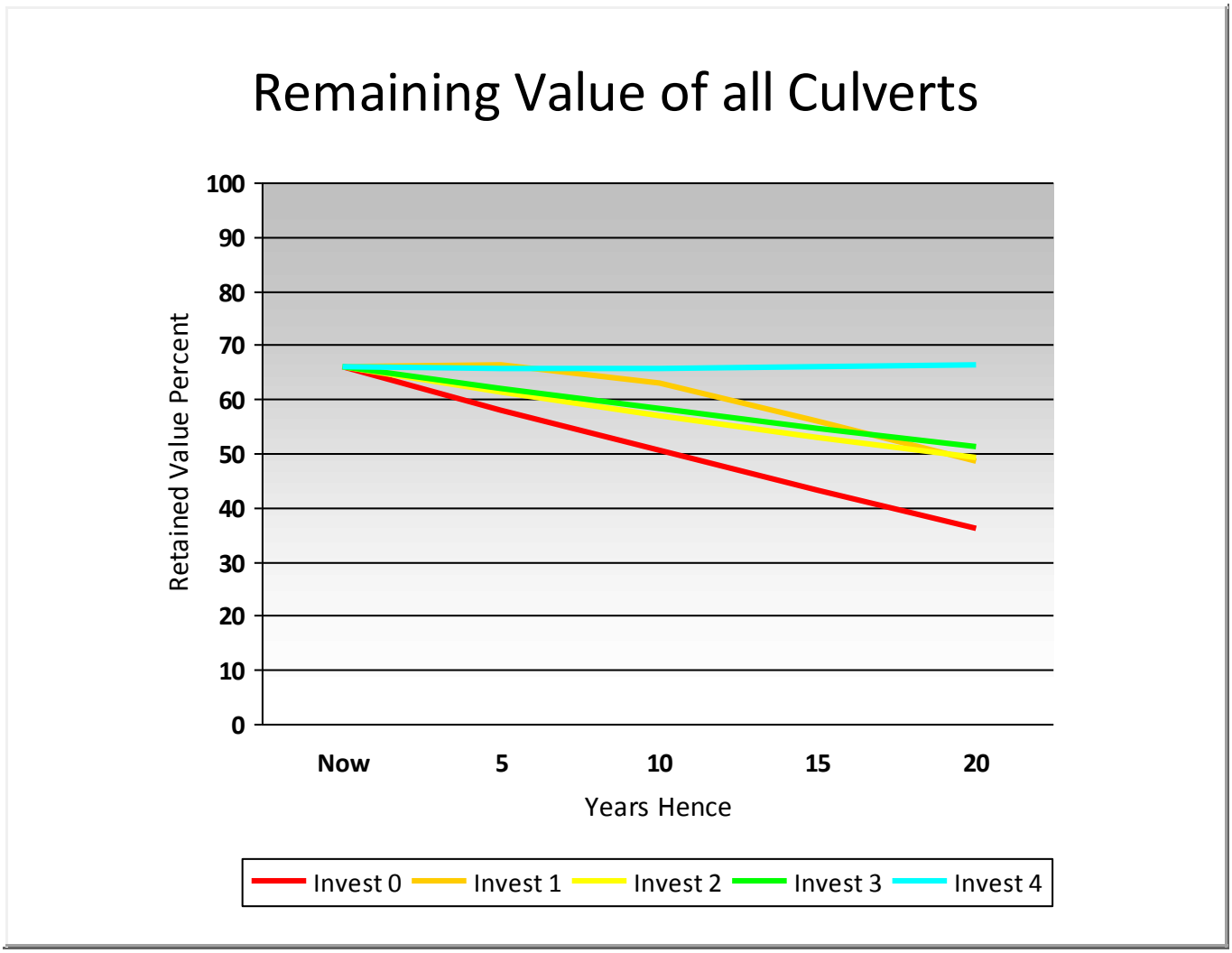
Culvert Depreciation Forecast



Original & Depreciated Values

Original	Now	5	10	15	20
$9,255,000	$6,104,564	$5,385,614	$4,689,741	$4,018,896	$3,361,428

Average Culvert Depreciation with Investment



Key	Investment Description	Annual Amount
Invest 0	No Investment	$0
Invest 1	Recommended Capital (Average)	$58,000
Invest 2	Rounded Up Recommended Capital	$60,000
Invest 3	Improved Uniform Capital	$70,000
Invest 4	Greatly Improved Uniform Capital	$140,000

Recommended Investigations

Bridge ID	Name	Deck Condition Survey	Enhanced Inspection	Underwater Investigation	Ice Inspection	Boat Inspection	Structure Evaluation	Load Posting	Planning Study
013	Rd 10 Bridge Ruscom River						✓		
016	Rd 10 Bridge Belle River						✓		
018	Rd 11 Bridge Ruscom River	✓					✓	✓	✓
026	Rd 3 W Bridge Nelson Drain								✓
030	Rd 5 W Bridge W Townline Drain	✓							
031	Centre Ave Bridge						✓	✓	
038	N Townline Drain W Culvert				✓				
047	Boose Drain Culvert Rd 6 East				✓				
052	Jasperson Lane Bridge	✓							
502	Mill Creek Culvert Division Rd								✓

Performance Deficiencies Report

Bridge ID	Name	Component	Deficiency
001	Ruscom River Bridge	Conc Curb	Inadequate Height
003	Hughs Drain Bridge	Steel Post & Guide Rail	Weakened
007	East Bridge Orton Drain	Spread Footing	Undermining
008	Lane Drain	Water Channel	Aggradation
009	Division Rd Drain	Water Channel	Obstructed
011	Billings Drain	Water Channel	Aggradation
012	Cameron Sideroad Bridge	Embankment	Erosion
		Water Channel	Poor Alignment
013	Rd 10 Bridge Ruscom River	Delineator	Obscured
		RC Parapet	Inadequate Height
016	Rd 10 Bridge Belle River	Twin Pipe Hand Rail	Miss-shapen
		Scupper & Pipe	Inadequate Length
018	Rd 11 Bridge Ruscom River	RC Parapet	Inadequate Height
025	Rd 3 W Bridge Centre Branch 47 Drain	Embankment	Erosion
031	Centre Ave Bridge	Water Channel	Lacking Freeboard
		RC T-Beam	Under Strength
032	Cedar Island Bridge	Steel Post & Panel	Weakened
036	S Talbot Rd Bridge Tully Drain	Water Channel	Poor Alignment
037	Rd 9 W Culvert	Water Channel	Poor Alignment
039	N Talbot Rd Bridge Burstyn Drain	Water Channel	Poor Alignment
041	Newman Kay Drain Culvert	Water Channel	Poor Alignment
046	Old No. 5 Drain S Talbot Rd	CIP RF Box Culvert	Insufficient Barrel Length
048	Lakeside Park Bridge 1	Steel Tube Rail & Post	Weakened
		Approach Slab	Settlement
052	Jasperson Lane Bridge	Embankment	Erosion
		Steel Post & Guide Rail	Weakened
053	Sandy Brook Way Culvert	Timber Post & Guide Rail	Inadequate Height
502	Mill Creek Culvert Division Rd	Water Channel	Poor Alignment
		Timber Post & Guide Rail	Weakened
		Sidewalk	Undermined/Voids

Bridge ID	Name	Component	Deficiency
503	Mill Creek Scratch Wigle Drain Culvert	CS Plate Pipe Arch	Load Carrying Capacity
504	W 7th Conc Rd Drain Culvert	Water Channel	Aggradation

Bridge Condition Index Report

Bridge ID	Name	BCI
001	Ruscom River Bridge	**73.5**
002	Ferry Drain Bridge	**74.5**
003	Hughs Drain Bridge	**85.4**
004	Lovelace Outlet Drain Bridge	**75.0**
005	Orton Drain Culvert	**71.7**
006	Orton Sideroad Drain	**74.3**
007	East Bridge Orton Drain	**73.0**
008	Lane Drain	**84.9**
009	Division Rd Drain	**73.7**
010	West Wigle Creek Bridge	**82.9**
011	Billings Drain	**89.8**
012	Cameron Sideroad Bridge	**74.5**
013	Rd 10 Bridge Ruscom River	**74.1**
014	Rd 10 Bridge Patterson Drain	**58.3**
015	Rd 10 Culvert Orton Drain	**73.0**
016	Rd 10 Bridge Belle River	**74.2**
017	Rd 10 Bridge Jackson Drain	**75.0**
018	Rd 11 Bridge Ruscom River	**71.6**
019	Rd 11 Bridge Paterson Drain	**70.7**
020	Rd 11 Bridge Belle River	**73.9**
021	Rd 8 E Culvert Orton Drain	**82.7**
022	Rd 8 E Bridge Upcott Drain	**74.4**
023	Inman Sideroad Bridge Upcott Drain	**72.0**
024	Rd 3 W Bridge E Branch 47 Drain	**71.0**
025	Rd 3 W Bridge Centre Branch 47 Drain	**71.5**
026	Rd 3 W Bridge Nelson Drain	**73.0**
027	Rd 3 W Bridge W Townline Drain	**74.5**
028	Rd 2 W Bridge Wigle Creek	**75.0**
029	Rd 8 W Bridge Mulcaster Drain	**76.8**
030	Rd 5 W Bridge W Townline Drain	**73.2**
031	Centre Ave Bridge	**72.7**
032	Cedar Island Bridge	**74.3**
033	Kratz Rd Bridge	**73.5**
034	Rd 5 W Bridge Centre Branch 47th Drain	**70.2**
035	Rd 6 W Bridge Central Branch 47th Drain	**70.5**
036	S Talbot Rd Bridge Tully Drain	**73.9**
037	Rd 9 W Culvert	**74.6**

Bridge ID	Name	BCI
038	N Townline Drain W Culvert	**82.0**
039	N Talbot Rd Bridge Burstyn Drain	**74.8**
040	N Talbot Rd Bridge Tomengo Drain	**71.2**
041	Newman Kay Drain Culvert	**71.3**
042	Maddox Drain Culvert	**70.2**
043	N Talbot Rd Bridge Upcott Drain	**74.4**
044	S Talbot Rd Culvert	**75.0**
045	Old No. 5 Drain S Talbot Rd.	**73.8**
046	Old No. 5 Drain S Talbot Rd	**64.4**
047	Boose Drain Culvert Rd 6 East	**72.4**
048	Lakeside Park Bridge 1	**75.5**
049	Lakeside Park bridge 2	**72.3**
050	Mill Creek Bridge	**73.5**
051	Frank Remark Trail Ped Bridge	**70.7**
052	Jasperson Lane Bridge	**72.1**
053	Sandy Brook Way Culvert	**91.2**
054	Sandybrook Way Steel Culvert	**96.3**
055	Rd 3 East Culvert	**95.8**
056	Queen St. Culvert	**78.6**
500	Irwin Drain Culvert Rd 11	**69.4**
501	Mill Creek Culvert	**92.5**
502	Mill Creek Culvert Division Rd	**67.4**
503	Mill Creek Scratch Wigle Drain Culvert	**56.6**
504	W 7th Conc Rd Drain Culvert	**75.4**

Total Number of Structures: 61

BCI < 50:	**0**	**BCI Between 50 and 60:**	**2**	**BCI Between 60 and 70:**	**3**	**BCI Above 70:**	**56**
Percent:	**0**		**3.3%**		**4.9%**		**91.8%**