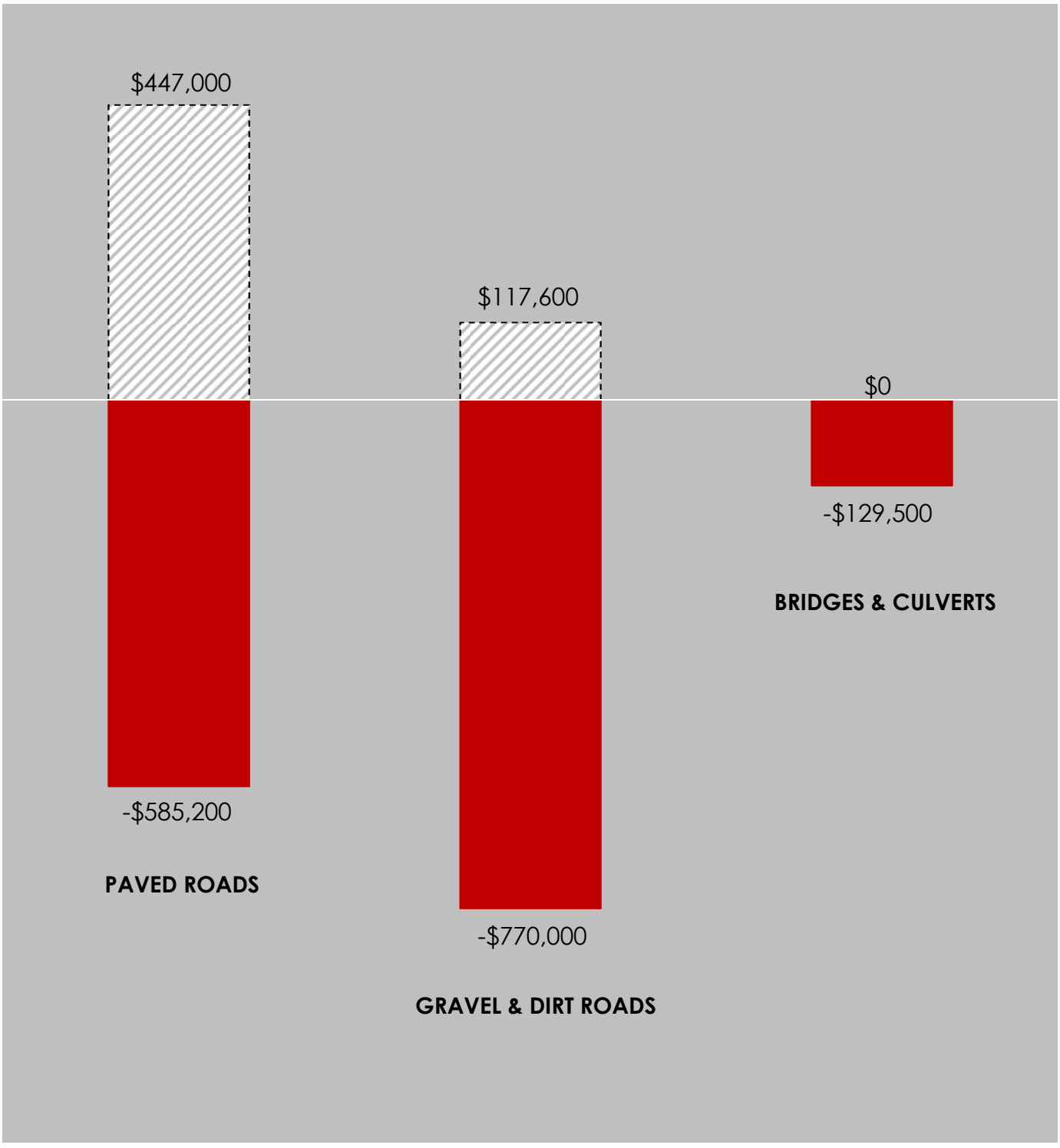
THE ASSET MANAGEMENT PLAN FOR THE TOWNSHIP OF DOURO-DUMMER

2013

THE TOWNSHIP OF DOURO-DUMMER
894 SOUTH STREET
WARSAW, ONTARIO, K0L 3A0

SUBMITTED DECEMBER 2013
BY PUBLIC SECTOR DIGEST
148 FULLARTON STREET, SUITE 1410
LONDON, ONTARIO, N6A 5P3

AVERAGE ANNUAL FUNDING REQUIRED **vs.** AVERAGE ANNUAL FUNDING AVAILABLE



Total Annual Deficit: $1,484,700

Annual Funding Available
Annual Funding Deficit

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December 2013

The Township of Douro-Dummer
894 South Street
Warsaw, Ontario,K0L 3A0

We are pleased to submit the 2013 Asset Management Plan (AMP) for The Township of Douro-Dummer. This AMP complies with the requirements as outlined within the provincial *Building Together Guide for Municipal Asset Management Plans.* It will serve as a strategic, tactical, and financial document, ensuring the management of the municipal infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service. Given the broad and profound impact of asset management on the community, and the financial & administrative complexity involved in this ongoing process, we recommend that senior decision-makers from across the organization are actively involved in its implementation.

The performance of a community's infrastructure provides the foundation for its economic development, competitiveness, prosperity, reputation, and the overall quality of life for its residents. As such, we are appreciative of your decision to entrust us with the strategic direction of its infrastructure and asset management planning, and are confident that this AMP will serve as a valuable tool.

Sincerely,
The Public Sector Digest Inc.

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1.0 Executive Summary

The performance of a community's infrastructure provides the foundation for its economic development, competitiveness, prosperity, reputation, and the overall quality of life for its residents. Reliable and well-maintained infrastructure assets are essential for the delivery of critical core services for the citizens of a township.

A technically precise and financially rigorous asset management plan, diligently implemented, will mean that sufficient investments are made to ensure delivery of sustainable infrastructure services to current and future residents. The plan will also indicate the respective financial obligations required to maintain this delivery at established levels of service.

This Asset Management Plan (AMP) for The Township of Douro-Dummer meets all requirements as outlined within the provincial *Building Together Guide for Municipal Asset Management Plans*. It will serve as a strategic, tactical, and financial document, ensuring the management of the municipal roads and bridges infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service. Given the expansive financial and social impact of asset management on both a township, and its citizens, it is critical that senior decision-makers, including department heads as well as the chief executives, are strategically involved.

Measured in 2012 dollars, the replacement value of the assets analyzed in the roads and bridges network totaled **approximately $62.4 million** for Douro-Dummer.

In assessing the township's state of the roads and bridges infrastructure, we examined, and graded, both the current condition (Condition vs. Performance) of its road network and bridges and culverts as well as the township's financial capacity to fund the assets' average annual requirement for sustainability (Funding vs. Need). We then generated the township's infrastructure report card. Douro-Dummer received a 'C' on the Condition vs. Performance dimension for its paved roads, a 'D+' for its gravel and dirt roads, and a 'C' for its bridges and culverts, indicating that these networks are generally in fair condition. However, significant replacements are required over the next five years. On the Funding vs. Need dimension, the township received an 'F' in all asset categories.

The average annual investment requirement for paved roads, gravel roads, and bridges & culverts is approximately $2,049,300. Annual revenue currently allocated to these assets for capital purposes is $564,600 leaving an annual deficit of $1,484,700. To put it another way, these infrastructure categories are currently funded at 28% of their long-term requirements. In 2013, Douro-Dummer has annual tax revenues of $3,564,300. Without consideration of any other sources of revenue, full funding would require a combined tax increase of 41.6% over time. We recommend a 10 year option which involves full funding being achieved over 10 years by:

a) increasing tax revenues by 4.16% each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
b) continuing to allocate $178,000 (of a total of $214,000) of the gas tax revenue to the paved roads category.
c) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in. Those future increases could be achieved through tax increases or by allocating a larger portion of the gas tax revenue.

The revenue options outlined in this plan allow Douro-Dummer to fully fund its long-term infrastructure requirements without further use of debt. However, as explained in section 7.3.2, the recommended condition rating analysis may require otherwise. The township's roads construction reserves, totaling approximately $542,600, are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Douro-Dummer's judicious use of debt in the past, allows the scenarios to assume that, if required, available reserves and debt capacity can be used for high priority and emergency infrastructure investments in the short to medium-term.

2.0 Introduction

This Asset Management Plan meets all provincial requirements as outlined within the Ontario Building Together Guide for Municipal Asset Management Plans. As such, the following key sections and content are included:

1. Executive Summary and Introduction
2. State of the Current Infrastructure
3. Desired Levels of Service
4. Asset Management Strategy
5. Financial Strategy

The following asset classes are addressed:

1. **Road Network:** Urban and rural, paved and gravel
2. **Bridges & Culverts**.

Municipalities are encouraged to cover all asset classes in future iterations of the AMP.

This asset management plan will serve as a strategic, tactical, and financial document ensuring the management of the municipal roads and bridges infrastructure follows sound asset management practices and principles, while optimizing available resources and establishing desired levels of service.

At a strategic level, within the State of the Current Infrastructure section, it will identify current and future challenges that should be addressed in order to maintain sustainable infrastructure services on a long-term, life cycle basis.

It will outline a Desired Level of Service (LOS) Framework for each asset category to assist the development and tracking of LOS through performance measures across strategic, financial, tactical, operational, and maintenance activities within the organization.

At a tactical level, within the Asset Management Strategy section, it will develop an implementation process to be applied to the needs-identification and prioritization of renewal, rehabilitation, and maintenance activities, resulting in a 10 year plan that will include growth projections.

At a financial level, within the Financial Strategy section, a strategy will be developed that fully integrates with other sections of this asset management plan, to ensure delivery and optimization of the 10 year infrastructure budget.

Asset information has been provided through Diamond Software that Douro-Dummer is currently utilizing. Through the development of this plan, all data, analysis, life cycle projections, and budget models will be provided through the Public Sector Digest's CityWide suite of software products.

It is therefore recommended that the plan be revisited and updated on an annual basis, particularly as more detailed information becomes available.

2.1 Importance of Infrastructure

Municipalities throughout Ontario, large and small, own a diverse portfolio of infrastructure assets that in turn provide a varied number of services to their citizens. The infrastructure, in essence, is a conduit for the various public services the township provides, e.g., the roads supply a transportation network service; the water infrastructure supplies a clean drinking water service. A community's prosperity, economic development, competitiveness, image, and overall quality of life are inherently and explicitly tied to the performance of its infrastructure.

2.2 Asset Management Plan (AMP) - Relationship to Strategic Plan

The major benefit of strategic planning is the promotion of strategic thought and action. A strategic plan spells out where an organization wants to go, how it's going to get there, and helps decide how and where to allocate resources, ensuring alignment to the strategic priorities and objectives. It will help identify priorities and guide how municipal tax dollars and revenues are spent into the future.

The strategic plan usually includes a vision and mission statement, and key organizational priorities with alignment to objectives and action plans. Given the growing economic and political significance of infrastructure, the asset management plan will become a central component of most municipal strategic plans, influencing corporate priorities, objectives, and actions.

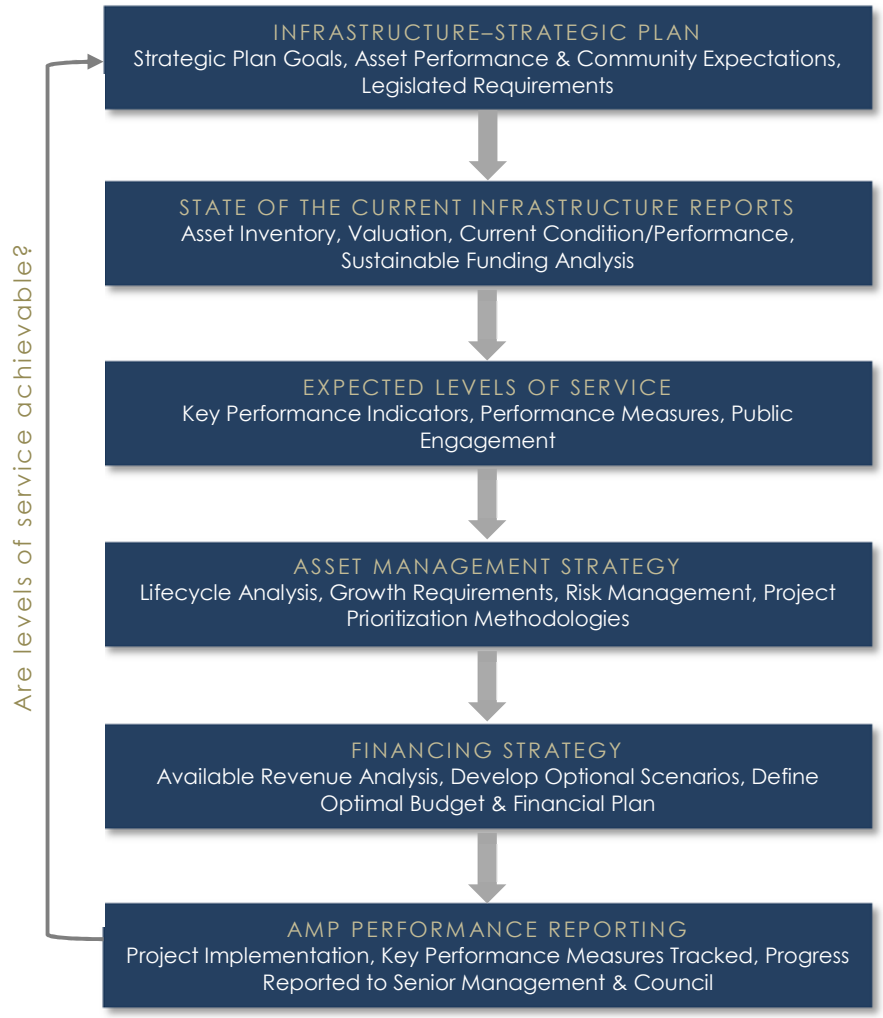
2.3 AMP - Relationship to other Plans

An asset management plan is a key component of the township's planning process linking with multiple other corporate plans and documents. For example:

- **The Official Plan** – The AMP should utilize and influence the land use policy directions for long-term growth and development as provided through the Official Plan.
- **Long Term Financial Plan** – The AMP should both utilize and conversely influence the financial forecasts within the long-term financial plan.
- **Capital Budget** – The decision framework and infrastructure needs identified in the AMP form the basis on which future capital budgets are prepared.
- **Infrastructure Master Plans** – The AMP will utilize goals and projections from infrastructure master plans and in turn will influence future master plan recommendations.
- **By-Laws, standards, and policies** – The AMP will influence and utilize policies and by-laws related to infrastructure management practices and standards.
- **Regulations** – The AMP must recognize and abide by industry and senior government regulations.
- **Business Plans** – The service levels, policies, processes, and budgets defined in the AMP are incorporated into business plans as activity budgets, management strategies, and performance measures.
- **Vision** – The AMP has recognized the Township's vision, "Dedicated to building our future, while respecting our past."
- **Mission** – The AMP has acknowledged the Township's mission statement, "The Township of Douro-Dummer is committed to providing a high level of effective and efficient service throughout our municipality. We promise open responsible leadership, enhancing the quality of life, and building for the future while respecting our heritage."

2.4 Purpose and Methodology

The following diagram depicts the approach and methodology, including the key components and links between those components that embody this asset management plan:



It can be seen from the above that a township's infrastructure planning starts at the corporate level with ties to the strategic plan, alignment to the community's expectations, and compliance with industry and government regulations.

Then, through the State of the Infrastructure analysis, overall asset inventory, valuation, condition and performance are reported. Also, a life cycle analysis of needs for each infrastructure class is conducted. This analysis yields the sustainable funding level, compared against actual current funding levels, and determines whether there is a funding surplus or deficit for each infrastructure program. The overall measure of condition and available funding is finally scored for each asset class and presented as a star rating (similar to the hotel star rating) and a letter grade (A-F) within the Infrastructure Report card.

From the lifecycle analysis above, the township gains an understanding of the level of service provided today for each infrastructure class and the projected level of service for the future. The next section of the AMP provides a framework for a township to develop a Desired Level of Service (or target service level) and develop performance measures to track the year-to-year progress towards this established target level of service.

The Asset Management Strategy then provides a detailed analysis for each infrastructure class. Included in this analysis are best practices and methodologies from within the industry which can guide the overall management of the infrastructure in order to achieve the desired level of service. This section also provides an overview of condition assessment techniques for each asset class; life cycle interventions required, including those interventions that yield the best return on investment; and prioritization techniques, including risk quantification, to determine which priority projects should move forward into the budget first.

The Financing Strategy then fully integrates with the asset management strategy and asset management plan, and provides a financial analysis that optimizes the 10 year infrastructure budget. All revenue sources available are reviewed, such as the tax levy, debt allocations, rates, reserves, grants, gas tax, development charges, etc., and necessary budget allocations are analysed to inform and deliver the infrastructure programs.

Finally, in subsequent updates to this AMP, actual project implementation will be reviewed and measured through the established performance metrics to quantify whether the desired level of service is achieved or achievable for each infrastructure class. If shortfalls in performance are observed, these will be discussed and alternate financial models or service level target adjustments will be presented.

3.0 State of the Infrastructure (SOTI)

3.1 Objective and Scope

Objective: To identify the state of the township's roads and bridges infrastructure today and the projected state in the future if current funding levels and management practices remain status quo.

The analysis and subsequent communication tools will outline future asset requirements, will start the development of tactical implementation plans, and ultimately assist the organization to provide cost effective sustainable services to the current and future community.

The approach was based on the following key industry state of the infrastructure documents:

- Canadian Infrastructure Report Card
- City of Hamilton's State of the Infrastructure reports
- Other Ontario Municipal State of the Infrastructure reports

The above reports are themselves based on established principles found within key, industry best practices documents such as:

- The National Guide for Sustainable Municipal Infrastructure (Canada)
- The International Infrastructure Management Manual (Australia / New Zealand)
- American Society of Civil Engineering Manuals (U.S.A.)

Scope: Within this State of the Infrastructure report, a high level review will be undertaken for the following asset classes:

1. **Road Network:** Urban and rural, paved and gravel
2. **Bridges & Culverts**.

3.2 Approach

The asset classes above were reviewed at a very high level due to the nature of data and information available. Subsequent detailed reviews of this analysis are recommended on an annual basis, as more detailed conditions assessment information becomes available for each infrastructure program.

3.2.1 Base Data

In order to understand the full inventory of the roads and bridges infrastructure assets within Douro-Dummer, all tangible capital asset data, as collected to meet the PSAB 3150 accounting standard, was loaded into the CityWide Tangible Asset™ software module using an excel report created in Diamond Software. This data base provides a detailed and summarized inventory of assets as used throughout the analysis within this report and the entire Asset Management Plan.

3.2.2 Asset Deterioration Review

The township has supplied condition data for all road surface types (HCB, LCB, gravel, and dirt) and all bridges and culverts. The condition data recalculates a new performance age for each individual asset and, as such, a far more accurate prediction of future replacement can be established and applied to the future investment requirements within this AMP report.

For those assets without condition data the deterioration review will rely on the 'straight line' amortization schedule approach provided from the accounting data. Although this approach is based on age data and useful life projections, and is not as accurate as the use of detailed condition data, it does provide a relatively reliable benchmark of future requirements.

3.2.3 Identify Sustainable Investment Requirements

A gap analysis was performed to identify sustainable investment requirements for each asset category. Information on current spending levels and budgets was acquired from the organization, future investment requirements were calculated, and the gap between the two was identified.

The above analysis is performed by using investment and financial planning models, and life cycle costing analysis, embedded within the CityWide software suite of applications.

3.2.4 Asset Rating Criteria

Each asset category will be rated on two key dimensions:

- **Condition vs. Performance**: Based on the condition of the asset today and how well it performs its function.
- **Funding vs. Need**: Based on the actual investment requirements to ensure replacement of the asset at the right time, versus current spending levels for each asset group.

3.2.5 Infrastructure Report Card

The dimensions above will be based on a simple 1–5 star rating system, which will be converted into a letter grading system ranging from A-F. An average of the two ratings will be used to calculate the combined rating for each asset class. The outputs for all municipal assets will be consolidated within the CityWide software to produce one overall Infrastructure Report Card showing the current state of the assets.

Grading Scale: Condition vs. Performance

What is the condition of the asset today and how well does it perform its function?

Star Rating	Letter Grade	Color Indicator	Description
★★★★★	A		**Excellent**: No noticeable defects
★★★★	B		**Good**: Minor deterioration
★★★	C		**Fair**: Deterioration evident, function is affected
★★	D		**Poor**: Serious deterioration. Function is inadequate
★	F		**Critical**: No longer functional. General or complete failure

Grading Scale: Funding vs. Need

Based on the actual investment requirements to ensure replacement of the asset at the right time, versus current spending levels for each asset group.

Star Rating	Letter Grade	Description
★★★★★	A	**Excellent**: 91 to 100% of need
★★★★	B	**Good**: 76 to 90% of need
★★★	C	**Fair**: 61 to 75% of need
★★	D	**Poor**: 46 to 60% of need
★	F	**Critical**: under 45% of need

3.2.6 General Methodology and Reporting Approach

The report will be based on the seven key questions of asset management as outlined within the National Guide for Sustainable Municipal Infrastructure:

- What do you own and where is it? (inventory)
- What is it worth? (valuation / replacement cost)
- What is its condition / remaining service life? (function & performance)
- What needs to be done? (maintain, rehabilitate, replace)
- When do you need to do it? (useful life analysis)
- How much will it cost? (investment requirements)
- How do you ensure sustainability? (long-term financial plan)

The above questions will be answered for each individual asset category in the following report sections.

3.3 Road Network

F

INFRASTRUCTURE REPORT CARD GRADE

3.3 Road Network

3.3.1 What do we own?

As shown in the summary table below, the entire network comprises approximately 265 centreline km of road, of which 143 km are gravel or dirt roads, and 122 km are paved.

Road Network Inventory

Asset Type	Asset Component	Quantity/Units
Road Network	Dirt Surface	6,500m
	Road Base - Dirt	6,500m
	Gravel Surface	136,600m
	Road Base - Gravel	136,600m
	HCB Surface	5,600m
	Road Base - HCB	5,600m
	LCB Surface	116,500m
	Road Base - LCB	116,500m

The road network data was uploaded from an excel report created by Diamond software, and then extracted from the Tangible Capital Asset module of the CityWide software suite.

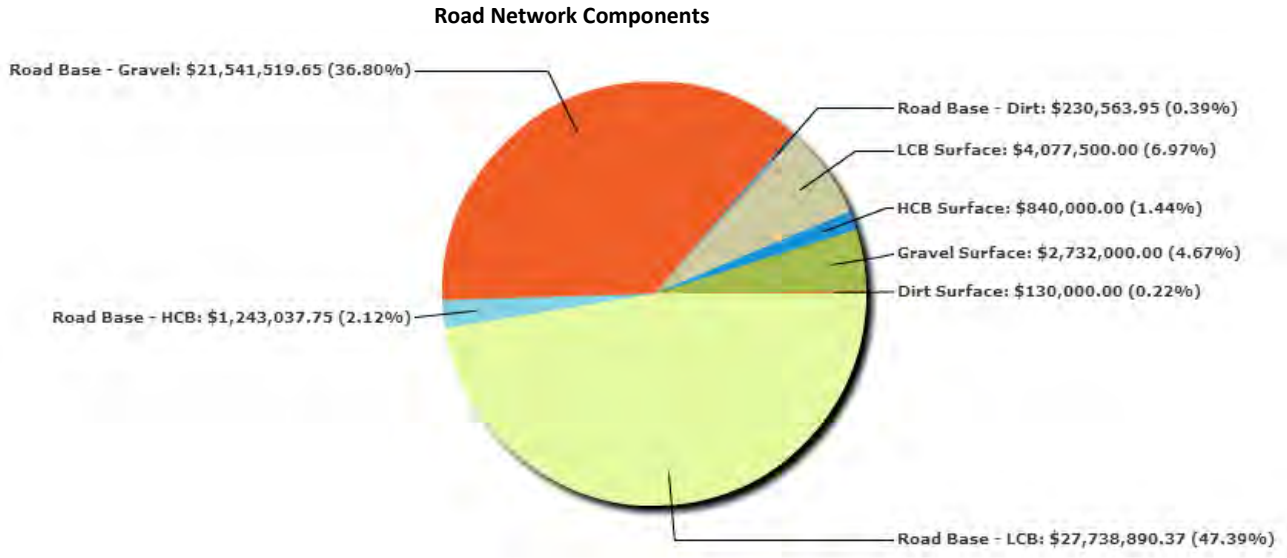
3.3.2 What is it worth?

The estimated replacement value of the road network, in 2012 dollars, is approximately $58.5 million. The cost per household for the road network is $16,355 based on 3,579 households.

Road Network Replacement Value

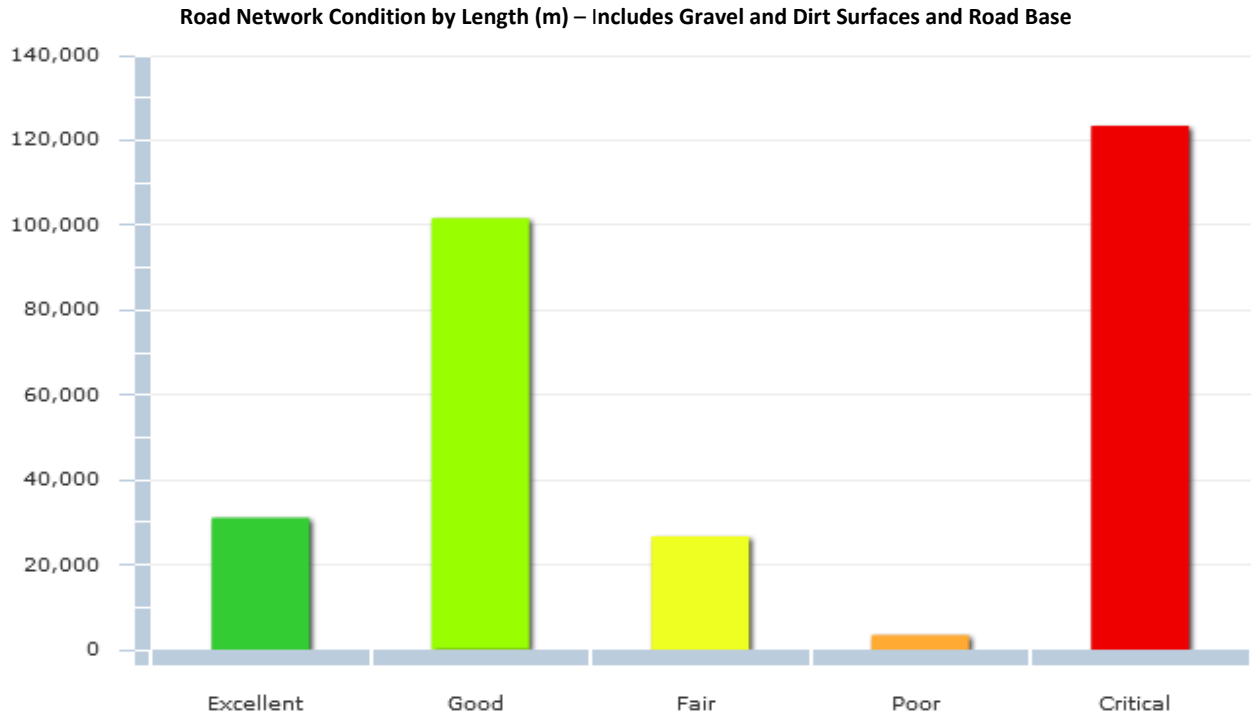
Asset Type	Asset Component	Quantity/Units	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Road Network	Dirt Surface	6,500m	$20/m (Convert to Gravel)	$130,000
	Road Base - Dirt	6,500m	CPI Index	$231,000
	Gravel Surface	136,600m	$20/m (Resurfacing)	$2,732,000
	Road Base - Gravel	136,600m	CPI Index	$21,542,000
	HCB Surface	5,600m	$150/m	$840,000
	Road Base - HCB	5,600m	CPI Index	$1,243,000
	LCB Surface	116,500m	$35/m	$4,078,000
	Road Base - LCB	116,500m	CPI Index	$27,739,000
				$58,534,000

The pie chart below provides a breakdown of each of the network components to the overall system value.



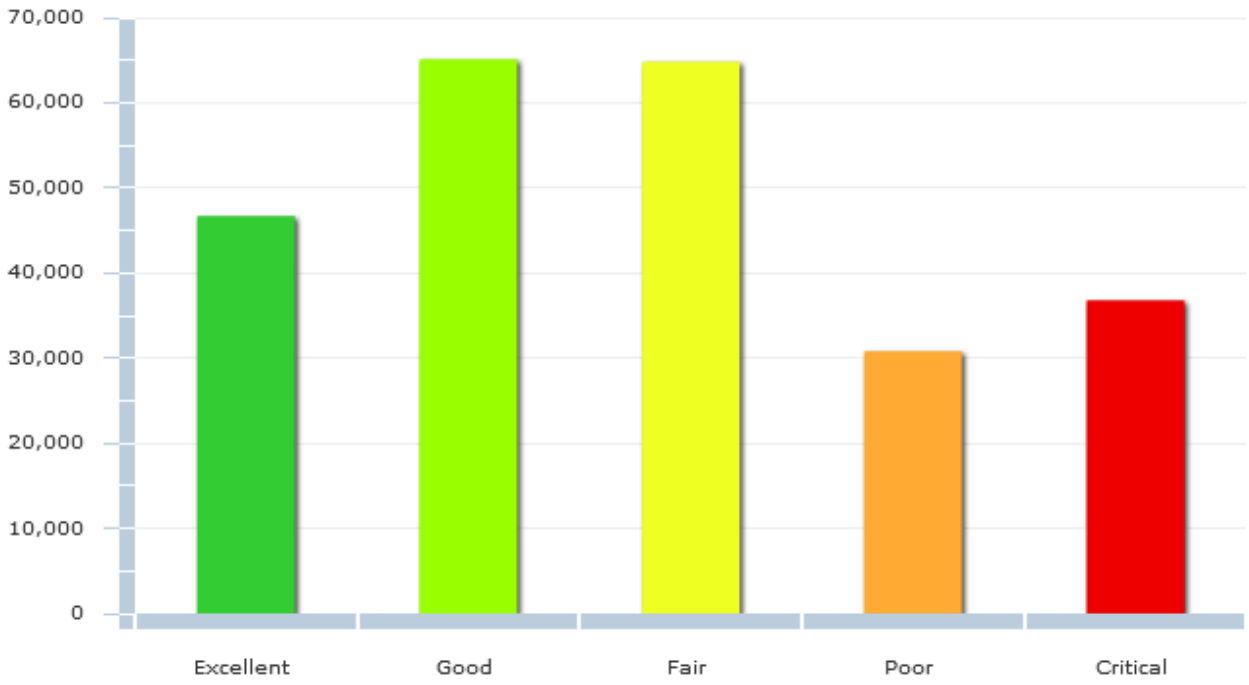
3.3.3 What condition is it in?

56% of the township's gravel and dirt road network is in fair to excellent condition with the remaining 44% being in poor to critical. As such, the township received a Condition vs. Performance rating of 'D+' based on a weighted star rating of 2.7 stars.



72% of the township's HCB & LCB road surfaces and road base are in fair to excellent condition, with the remaining 28% in poor to critical condition. As such, the township received a Condition vs. Performance rating of 'C' based on a weighted star rating of 3.2 stars.

Road Network Condition by Length (m) – Includes HCB and LCB Surfaces and Road Base



3.3.4 What do we need to do to it?

There are generally four distinct phases in an asset's life cycle that require specific types of attention and lifecycle activity. These are presented at a high level for the road network below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs

Phase	Lifecycle Activity	Asset Life Stage
Minor maintenance	Activities such as inspections, monitoring, sweeping, winter control, etc.	1st Qtr
Major maintenance	Activities such as repairing pot holes, grinding out roadway rutting, and patching sections of road.	2nd Qtr
Rehabilitation	Rehabilitation activities such as asphalt overlays, mill and paves, etc.	3rd Qtr
Replacement	Full road reconstruction	4th Qtr

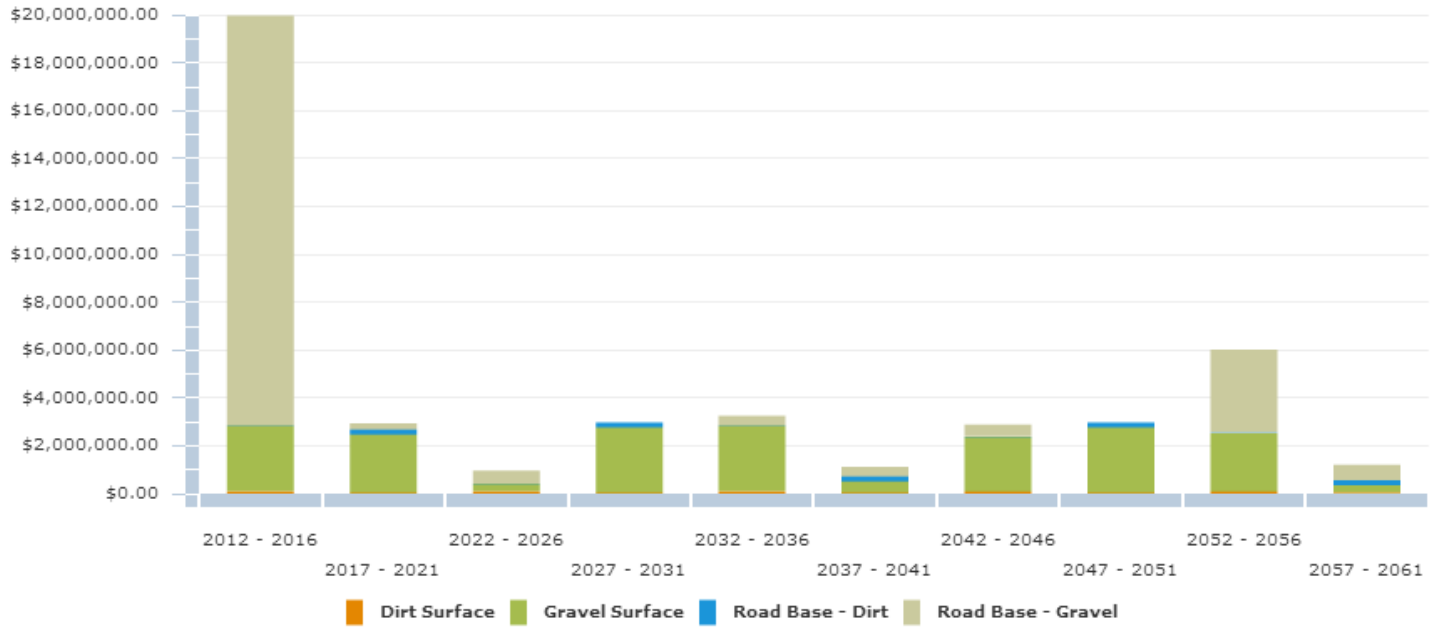
3.3.5 When do we need to do it?

For the purpose of this report, 'useful life' data for each asset class was obtained from the accounting data within the CityWide software database. This proposed useful life is used to determine replacement needs of individual assets. These needs are calculated and quantified in the system as part of the overall financial requirements.

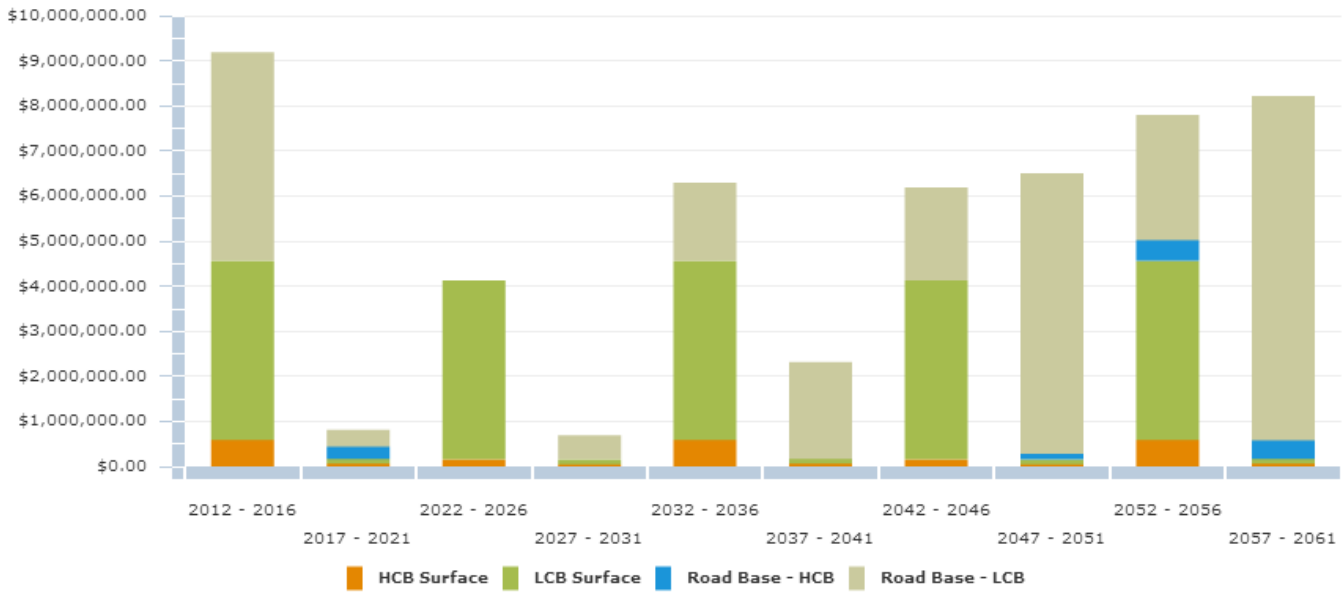
Asset Useful Life in Years

Asset Type	Asset Component	Useful Life
Road Network	Dirt Surface	10
	Road Base - Dirt	10
	Gravel Surface	10
	Road Base - Gravel	50
	HCB Surface	20
	Road Base - HCB	50
	LCB Surface	10
	Road Base - LCB	50

Road Network Resurfacing Profile (Gravel Surface, Converting Dirt to Gravel and Road Base)



Road Network Replacement Profile (HCB & LCB Surface and Road Base)



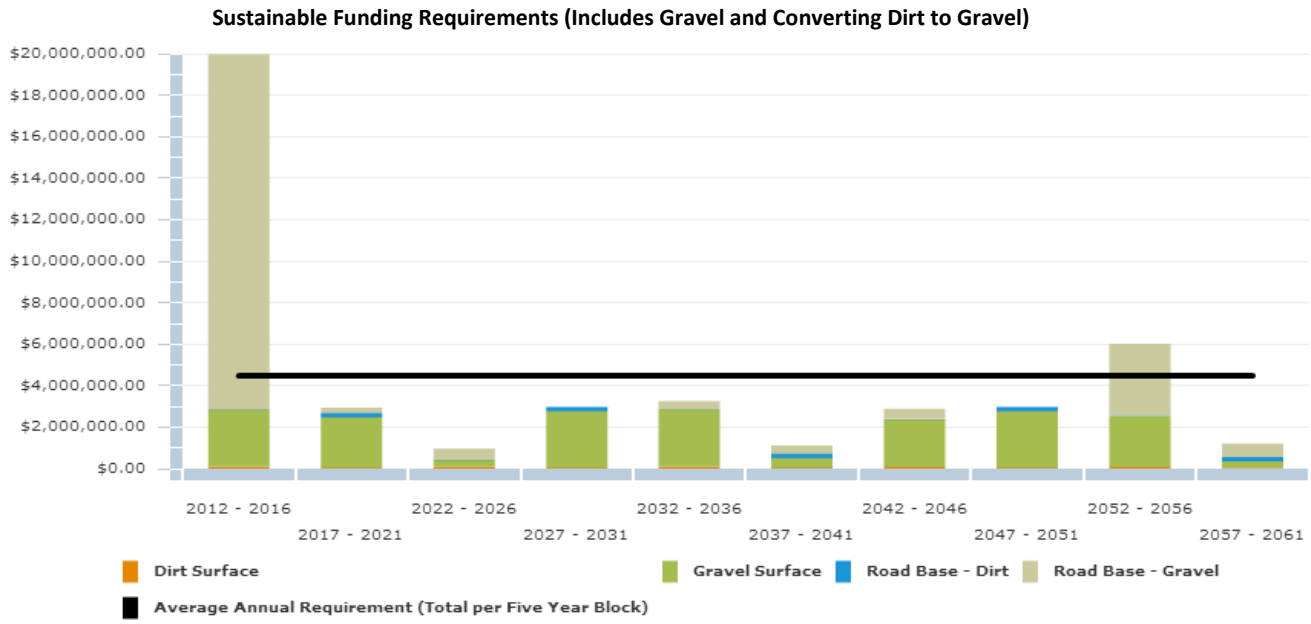
3.3.6 How much money do we need?

The analysis completed to determine capital revenue requirements was based on the following constraints and assumptions:

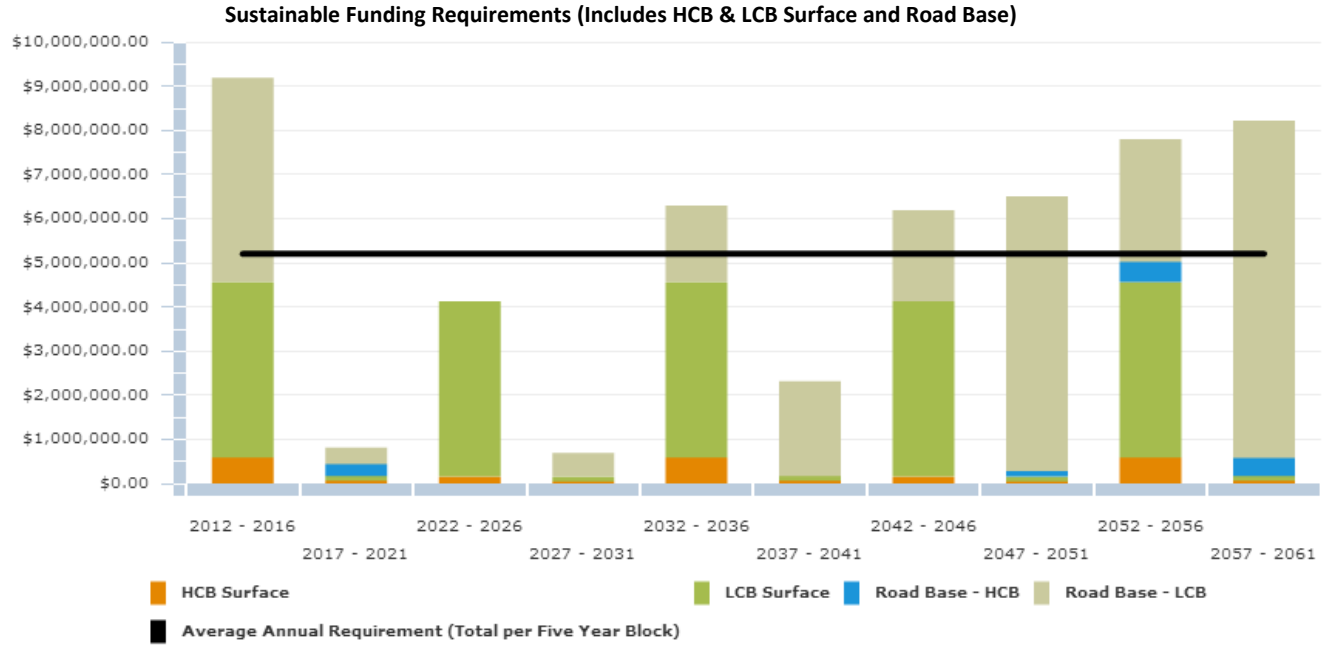
1. Replacement costs are based upon the unit costs identified within the "What is it worth" section.
2. The timing for individual road replacement was defined by the replacement year as described in the "When do you need to do it?" section.
3. The above replacement profile includes resurfacing of gravel roads every 7 years at an average replacement cost of $20,000/km, based on an average of 4" of gravel.
4. All values are presented in 2012 dollars.
5. The analysis was run for a 50 year period to ensure all assets went through at least one iteration of replacement, therefore providing a sustainable projection.

3.3.7 How do we reach sustainability?

Based upon the above parameters, the average annual revenue required to sustain Douro-Dummer's gravel and dirt road network is approximately **$887,600.** Based on Douro-Dummer's current annual funding of **$117,600**, the category has a **deficit of $770,000**. As such, the township received a Funding vs. Need rating of 'F'. The following graph illustrates the expenditure requirements against the sustainable funding threshold line.



Based upon the parameters, the average annual revenue required to sustain Douro-Dummer's HCB and LCB road network is **$1,032,200**. Based on Douro-Dummer's current annual funding of **$447,000**, the category has a **deficit of $585,200**. As such, the township received a Funding vs. Need rating of 'F'. The following graph illustrates the expenditure requirements in five year increments against the sustainable funding threshold line.



In conclusion, based on field condition data, the road network is generally in fair to good condition. There are, however, significant replacement requirements to be addressed within the next 5 years totaling approximately $29 million. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement and assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.3.8 Recommendations

The township received an overall rating of 'F' for its road network, calculated from the Condition vs. Performance and the Funding vs. Need ratings. Accordingly, we recommend the following:

1. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement.

2. A tailored life cycle activity framework should also be developed by the Township as outlined further within the "Asset Management Strategy" section of this AMP.

3. Once the above studies are complete or underway, the data should be updated and a new "current state of the infrastructure" analysis should be generated.

4. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and be added to future AMP reporting.

5. The Infrastructure Report Card should be updated on an annual basis.

3.4 Gravel Roads – Maintenance Requirements

3.4.1 Introduction

Paved roads are usually designed and constructed with careful consideration given to the correct shape of the cross section. Once paving is complete the roadway will keep its general shape for the duration of its useful life. Gravel roads are quite different. Many have poor base construction, will be prone to wheel track rutting in wet weather, and traffic will continually displace gravel from the surface to the shoulder area, even the ditch, during wet and dry weather. Maintaining the shape of the road surface and shoulder is essential to ensure proper performance and to provide a sufficient level of service for the public.

Therefore, the management of gravel roads includes good perpetual maintenance and some minor rehabilitation which depend on a few basic principles: proper techniques and cycles for grading; the use and upkeep of good surface gravel; and, dust abatement and stabilization.

3.4.2 Maintaining a Good Cross Section

In order to maintain a gravel road properly, a good cross section is required consisting of a crowned driving surface, a shoulder with correct slope, and a ditch. The crown of the road is essential for good drainage. A road with no crown, or insufficient crown, will cause water to collect on the surface during a rainfall, will soften the crust, and ultimately lead to rutting which will become severe if the subgrade also softens. Even if the subgrade remains firm, traffic will cause depressions in the road where water collects and the road will develop potholes. It is a generally accepted industry standard that 1.25cm per 12cm (one foot), approximately 4%, on the cross slope is ideal for road crown.

The road shoulder serves some key functions. It supports the edge of the travelled portion of the roadway, provides a safe area for drivers to regain control of vehicles if they are forced to leave the road, and finally, carries water further away from the road surface. The shoulder should ideally meet the edge of the roadway at the same elevation and then slope away gradually towards the ditch.

The ditch is the most important and common drainage structure for gravel roads. Every effort should be made to maintain a minimal ditch. The ditch should be kept free of obstructions such as eroded soil, vegetation or debris.

3.4.3 Grading Operations

Routine grading is the activity that ensures gravel roadways maintain a good cross section or proper profile. The three key components to good grading are: operating speed, blade angle, and blade pitch.

Excessive operating speed can cause many problems such as inconsistent profile, and blade movement or bouncing that can cut depressions and leave ridges in the road surface. It is generally accepted that grader speed should not exceed 8km per hour. The angle of the blade is also critical for good maintenance and industry standards suggest the optimal angle is between 30 and 45 degrees. Finally, the correct pitch or tilt of the blade is very important. If the blade is pitched back too far, the material will tend to build up in front of the blade and will not fall forward, which mixes the materials, and will move along and discharge at the end of the blade.

3.4.4 Good Surface Gravel

Once the correct shape is established on a roadway and drainage matters are taken care of, attention must be given to the placement of good gravel. Good surface gravel requires a percentage of stone which gives strength to support loads, particularly in wet weather. It also requires a percentage of sand size particles to fill the voids between the stones which provide stability. And finally, a percentage of plastic fines are needed to bind the material together which allows a gravel road to form a crust and shed water. Typical municipal maintenance routines will include activities to ensure a good gravel surface through both spot repairs (often annually) and also re-graveling of roadways (approximately every five years).

3.4.5 Dust Abatement and stabilization

A typical maintenance activity for gravel roads also includes dust abatement and stabilization. All gravel roads will give off dust at some point, although the amount of dust can vary greatly from region to region. The most common treatment to reduce dust is the application of Calcium Chloride, in flake or liquid form, or Magnesium Chloride, generally just in liquid form. Of course, there are other products on the market as well. Calcium and Magnesium Chloride can be very effective if used properly. They are hygroscopic products which draw moisture from the air and keep the road surface constantly damp. In addition to alleviating dust issues, the continual dampness also serves to maintain the loss of fine materials within the gravel surface, which in turn helps maintain road binding and stabilization. A good dust abatement program can actually help waterproof and bind the road, in doing so can reduce gravel loss, and therefore, reduce the frequency of grading.

3.4.6 The Cost of Maintaining Gravel Roads

We conducted an industry review to determine the standard cost for maintaining gravel roads. However, it became apparent that no industry standard exists for either the cost of maintenance or for the frequency at which the maintenance activities should be completed. Presented below, as a guideline only, are two studies on the maintenance costs for gravel roads:

3.4.7 Minnesota Study (2005)

The first study is from the Minnesota Department of Transportation (MnDOT) Local Road Research Board (LRRB), where the researchers looked at historical and estimated cost data from multiple counties in Minnesota.

The study team found that the typical maintenance schedule consisted of routine grading and re-graveling with two inches of new gravel every five years. They found that a typical road needed to be graded 21 times a year or three times a month from April – October, and the upper bound for re-graveling was five years for any road over 100 ADT; lower volume roads could possibly go longer. The calculated costs including materials, labour, and hauling totaled $1,400 per year or $67 per visit for the grading activity and $13,800 for the re-gravel activity every five years. The re-gravel included an estimate gravel cost of $7.00 per cubic yard and a 2.5" thick lift of gravel (to be compacted down to 2"). Therefore, they developed an average estimated annual maintenance cost for gravel roads at $4,160 per mile. This converts to $2,600 per km of roadway and if adjusted for inflation into 2012 dollars, using the Non-Residential Building Construction Price Index (NRBCPI), it would be $3,500.

Reference: Jahren, Charles T. et. al. "Economics of Upgrading an Aggregate Road," Minnesota Department of Transportation, St. Paul, Mn, January 2005.

3.4.8 South Dakota study (2004)

This second study was conducted by South Dakota's Department of Transportation (SDDOT). The default maintenance program for gravel roads from SDDOT's report includes grading 50 times per year, re-graveling once every six years, and spot graveling once per year. The unit cost for grading was very similar to Minnesota at $65 per mile, re-gravel at $7,036 per mile and spot graveling or pothole repair at $2,420 per mile, totaling to an average annual maintenance cost of $6,843 per mile. Due to the frequency of the grading activity and the addition of the spot gravel maintenance, the SDDOT number is higher than Minnesota reported even though the re-gravel activity is reported at about half of the price in Minnesota.

This converts to $4,277 per km of roadway and if adjusted for inflation into 2012 dollars, using the NRBCPI, it would be $5,758.

Reference: Zimmerman, K.A. and A.S. Wolters. "Local Road Surfacing Criteria," South Dakota Department of Transportation, Pierre, SD, June 2004.

3.4.9 Ontario Municipal Benchmarking Initiative (OMBI)

One of the many metrics tracked through the Ontario Municipal Benchmarking Initiative is the "Operating costs for Unpaved (Loose top) Roads per lane Km." As referenced from the OMBI data dictionary, this includes maintenance activities such as dust suppression, loose top grading, loose top gravelling, spot base repair and wash out repair.

Of the six Ontario municipalities that included 2012 costs for this category, there is a wide variation in the reporting. The highest cost per lane km was $14,900 while the lowest cost was $397. The average cost was $6,300 per lane km. Assuming two lanes per gravel road to match the studies above, the Ontario OMBI average becomes $12,600 per km of roadway.

Summary of Costs

Source	2012 Maintenance Cost per km (adjusted for inflation using NRBCPI)
Minnesota Study	$3,500
South Dakota Study	$5,758
OMBI Average (six municipalities)	$12,600

3.4.10 Conclusion

As discussed above, there are currently no industry standards in regards to the cost of gravel road maintenance and the frequency at which the maintenance activities should be completed. Also, there is no established benchmark cost for the maintenance of a km of gravel road and the numbers presented above will vary significantly due to the level of service or maintenance that's provided (i.e., frequency of grading cycles and re-gravel cycles).

Douro-Dummer currently spends $117,600 (based on 2014 numbers) annually on gravel road capital. With a gravel road network of approximately 143 km, the maintenance cost per km of roadway is $822. This appears to be significantly less than the typical budget limits as shown above. Of course, there are many variables in this analysis, therefore it is recommended that a detailed study be undertaken to establish different cost options associated with different levels of service and that this be included with future updates to this AMP.

3.5 Bridge & Culvert Infrastructure

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INFRASTRUCTURE REPORT CARD GRADE

3.5 Bridge & Culvert Infrastructure

3.5.1 What do we own?

As shown in the summary table below the Township owns 4 bridges and 8 large culverts. 2 of the bridges are shared with the Township of Otonabee-South Monaghan.

Bridge and Culvert Inventory

Asset Type	Asset Component	Quantity
Bridges	Structure	4
Culverts	Structure	8

The bridge & culvert data was uploaded from the municipal bridge and culvert bridge appraisal and then extracted from the Tangible Capital Asset module of the CityWide software suite.

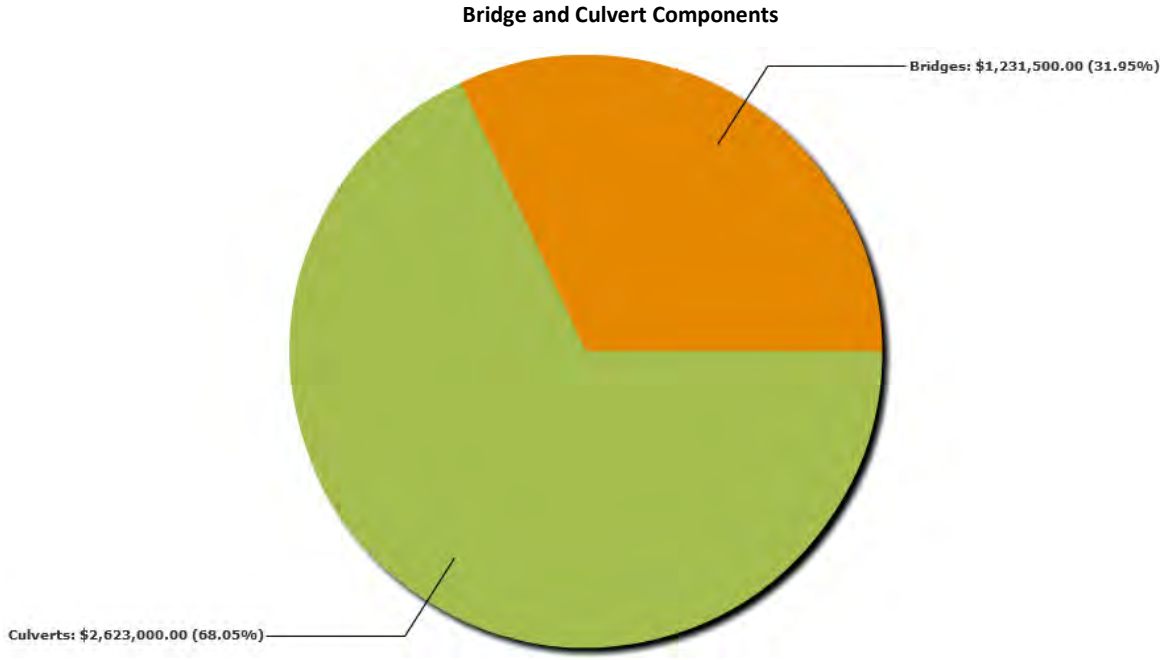
3.5.2 What is it worth?

The estimated replacement value of the bridge and culvert infrastructure, in 2012 dollars, is approximately $3.85 million. The cost per household for the bridge and & culvert infrastructure is $1,077 based on 3,579 households.

Bridge and Culvert Replacement Value

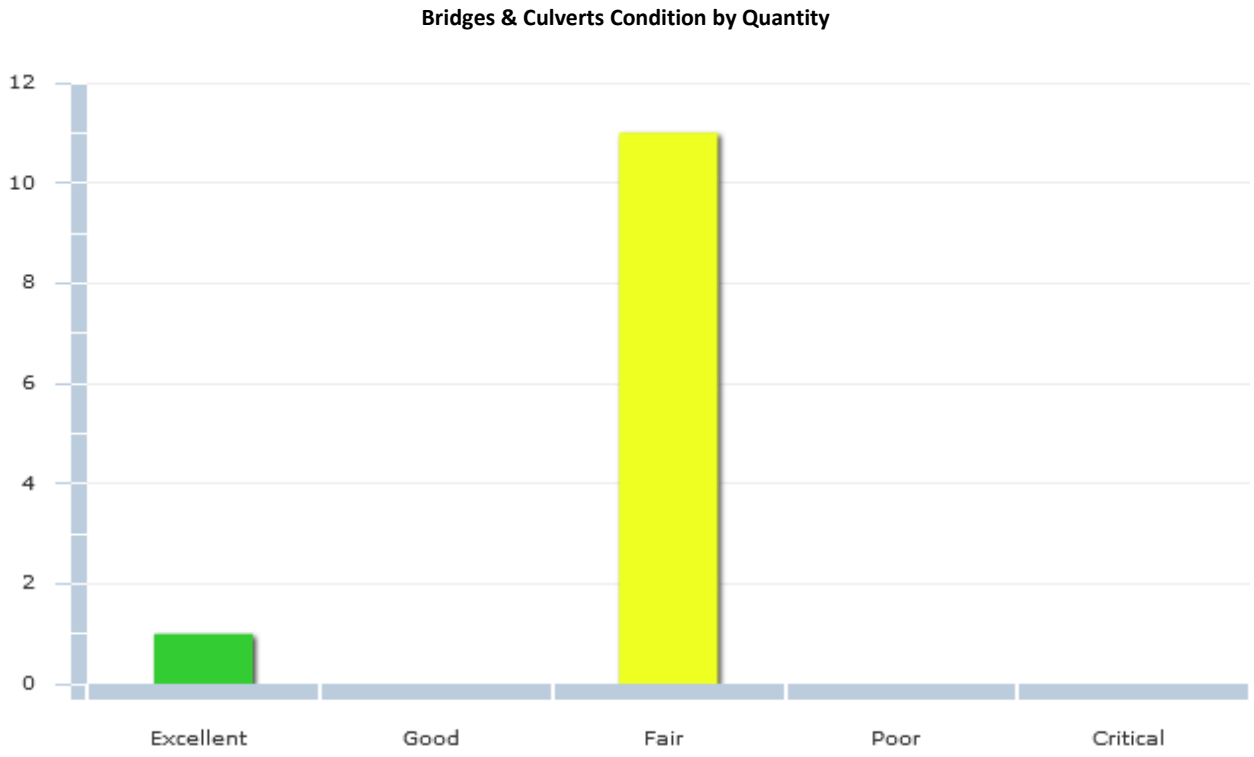
Asset Type	Asset Component	Count	2012 Unit Replacement Cost	2012 Overall Replacement Cost
Bridges	Structure	4	User-Defined	$1,231,500
Culverts	Structure	8	User-Defined	$2,623,000
				$3,854,500

The pie chart below provides a breakdown of each of the bridge and culverts components to the overall structures value.



3.5.3 What condition is it in?

92% or 11 of the bridge and culvert structures, based on condition data, are in Fair condition with the remaining 1 culvert being in excellent condition. As such, the township received a Condition vs Performance rating of 'C' based on a weighted star rating of 3.2 stars.



3.5.4 What do we need to do to it?

There are generally four distinct phases in an asset's life cycle. These are presented at a high level for the bridge and culvert structures below. Further detail is provided in the "Asset Management Strategy" section of this AMP.

Addressing Asset Needs

Phase	Lifecycle Activity	Asset Life Stage
Minor Maintenance	activities such as inspections, monitoring, sweeping, winter control, etc.	1st Qtr
Major Maintenance	activities such as repairs to cracked or spalled concrete, damaged expansion joints, bent or damaged railings, etc.	2nd Qtr
Rehabilitation	rehabilitation events such as structural reinforcement of structural elements, deck replacements, etc.	3rd Qtr
Replacement	full structure reconstruction	4th Qtr

3.5.5 When do we need to do it?

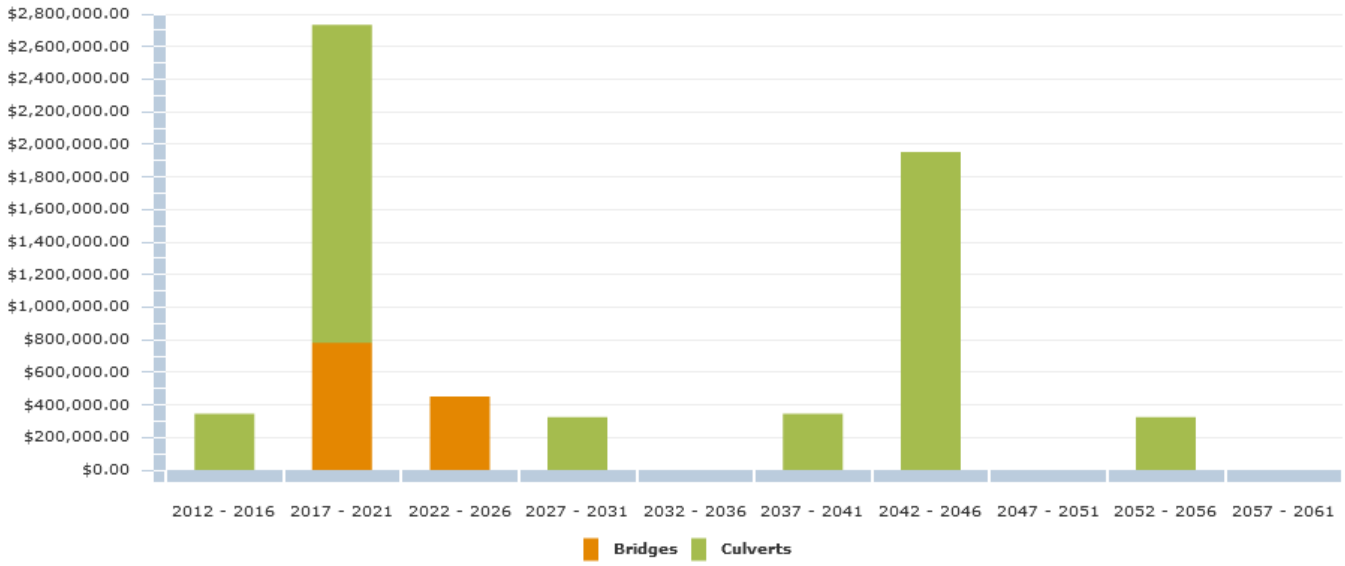
For the purpose of this report, 'useful life' data for each asset class was obtained from the accounting data. This proposed useful life and condition are used to determine replacement needs of individual assets, which are calculated in the system as part of the overall financial requirements.

Asset Useful Life in Years

Asset Type	Asset Component	Useful Life
Bridges	Structure	50
Culverts	Structure	25

As field condition information becomes available in time, the data should be analyzed in order to have an increasingly more accurate picture of current asset age and, therefore, future replacement requirements. The following table shows the current projection of structure replacements based on the age of the asset only.

Structures Replacement Profile



3.5.6 How much money do we need?

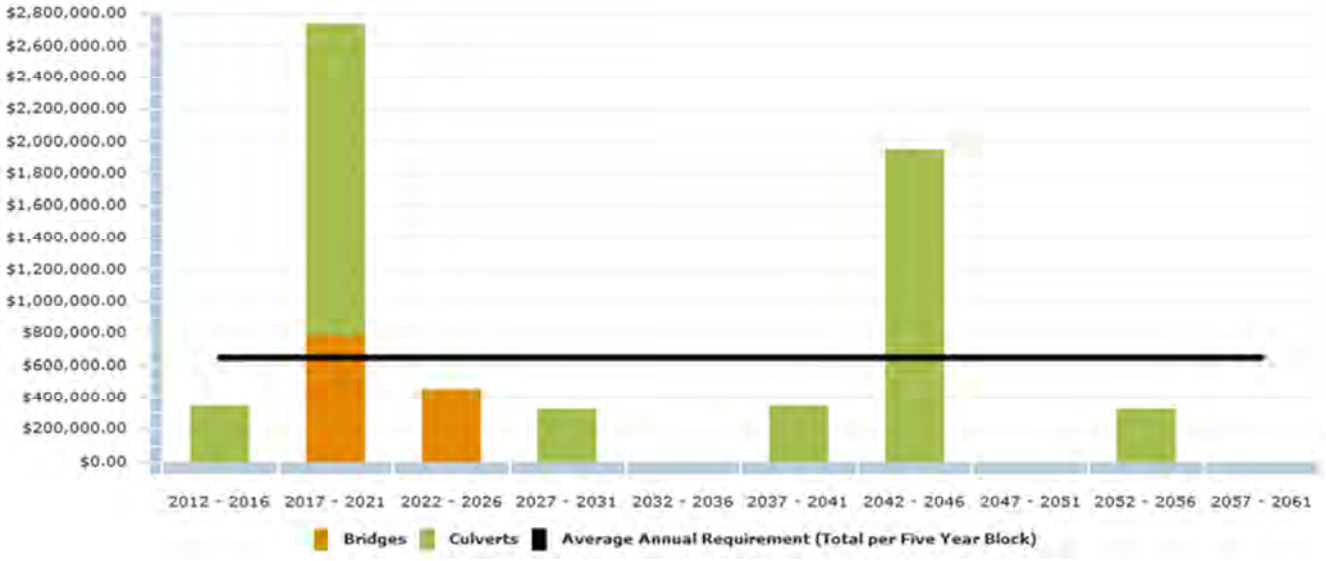
The analysis completed to determine capital revenue requirements was based on the following constraints and assumptions:

1. Replacement costs are based upon the "What is it worth" section above.
2. The timing for individual structure replacement was defined by the replacement year as described in the "When do you need to do it?" section above.
3. All values are presented in current (2012) dollars.
4. The analysis was run for a 50 year period to ensure all assets cycled through at least one iteration of replacement, therefore providing a sustainable projection.

3.5.7 How do we reach sustainability?

Based upon the above assumptions, the average annual revenue required to sustain Douro Dummer's bridge and culvert structures is approximately **$129,500**. Based on Douro Dummer's current annual funding of **$0**, there is an annual **deficit of $129,500**. The township received a Funding vs Need rating of 'F' based on a weighted star rating of 2.9 stars. The following table presents five year blocks of expenditure requirements against the sustainable funding threshold line.

Sustainable Revenue Requirement



In conclusion, based on field condition data, 92% of bridges and large structures are in fair condition. This has generated a backlog of needs to be addressed within the next 5 years totaling approximately $346,000. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement and assist with optimizing the long and short term budgets. Further detail is outlined within the "asset management strategy" section of this AMP.

3.5.8 Recommendations

The township received an overall rating of 'F' for its bridge and culvert infrastructure, calculated from the Condition vs Performance and the Funding vs Need ratings. Accordingly, we recommend the following:

1. The condition assessment data, along with risk management strategies, should be reviewed together to aid in prioritizing overall needs for rehabilitation and replacement.

2. An appropriate % of asset replacement value should be used for operations and maintenance activities on an annual basis. This should be determined through a detailed analysis of O & M activities and added to future AMP reporting.

3. The Infrastructure Report Card should be updated on an annual basis.

4.0 Infrastructure Report Card

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Infrastructure Report Card

The Township of Douro-Dummer

1. Each asset category was rated on two key, equally weighted (50/50) dimensions: **Condition vs. Performance**, and **Funding vs. Need**.
2. See the "***What condition is it in***?" section details on the grade of each asset category on the Condition vs. Performance dimension.
3. See the "***How do we reach sustainability***?" section for details on the grade of each asset category on the Funding vs. Need dimension.
4. The 'Overall Rating' below is the average of the two ratings.

Asset Category	Condition vs. Performance	Funding vs. Need	Overall Grade	Comments
Road Network (HCB & LCB)	C	F	D	72% of the township's HCB & LCB road surfaces and road base are in fair to excellent condition, with the remaining 28% in poor to critical condition. The average annual revenue required to sustain Douro-Dummer's HCB & LCB road surfaces and base is approximately **$1,032,200.** Based on Douro-Dummer's current annual funding of **$447,000**, the category is has a **deficit of $585,200**.
Road Network (Dirt & Gravel)	D+	F	F	56% of the township's gravel and dirt road network is in fair to excellent condition, with the remaining 44% being in poor to critical. The average annual revenue required to sustain Douro-Dummer's gravel and dirt road network is **$887,600**. Based on Douro-Dummer's current annual funding of **$117,600**, the category is has a **deficit of $770,000**.
Bridges & Culverts	C	F	F	92% or 11 of the bridge and culvert structures, based on condition data, are in fair condition with the remaining 1 culvert being in excellent condition. The average annual revenue required to sustain Douro Dummer's bridge and culvert structures is approximately **$129,500**. Based on Douro Dummer's current annual funding of **$0**, there is an annual **deficit of $129,500**.

5.0 Desired Levels of Service

Desired levels of service are high level indicators, comprising many factors, as listed below, that establish defined quality thresholds at which municipal services should be supplied to the community. They support the organization's strategic goals and are based on customer expectations, statutory requirements, standards, and the financial capacity of a township to deliver those levels of service.

Levels of Service are used:

- to inform customers of the proposed type and level of service to be offered;
- to identify the costs and benefits of the services offered;
- to assess suitability, affordability and equity of the services offered;
- as a measure of the effectiveness of the asset management plan
- as a focus for the AM strategies developed to deliver the required level of service

In order for a township to establish a desired level of service, it will be important to review the key factors involved in the delivery of that service, and the interactions between those factors. In addition, it will be important to establish some key performance metrics and track them over an annual cycle to gain a better understanding of the current level of service supplied.

Within this first Asset Management Plan, key factors affecting level of service will be outlined below and some key performance indicators for each asset type will be outlined for further review. This will provide a framework and starting point from which the township can determine future desired levels of service for each infrastructure class.

5.1 Key factors that influence a level of service:

- Strategic and Corporate Goals
- Legislative Requirements
- Expected Asset Performance
- Community Expectations
- Availability of Finances

5.1.1 Strategic and Corporate Goals

Infrastructure levels of service can be influenced by strategic and corporate goals. Strategic plans spell out where an organization wants to go, how it's going to get there, and helps decide how and where to allocate resources, ensuring alignment to the strategic priorities and objectives . It will help identify priorities and guide how municipal tax dollars and revenues are spent into the future. The level of importance that a community's vision is dependent upon infrastructure, will ultimately affect the levels of service provided or those levels that it ultimately aspires to deliver.

5.1.2 Legislative Requirements

Infrastructure levels of service are directly influenced by many legislative and regulatory requirements. For instance, the Minimum Maintenance Standards for municipal highways, building codes, and the Accessibility for Ontarians with Disabilities Act are all legislative requirements that prevent levels of service from declining below a certain standard.

5.1.3 Expected Asset Performance

A level of service will be affected by current asset condition, and performance and limitations in regards to safety, capacity, and the ability to meet regulatory and environmental requirements. In addition, the design life of the asset, the maintenance items required, the rehabilitation or replacement schedule of the asset, and the total costs, are all critical factors that will affect the level of service that can be provided.

5.1.4 Community Expectations

Levels of services are directly related to the expectations that the general public has from the infrastructure. For example, the public will have a qualitative opinion on what an acceptable road looks like, and a quantitative one on how long it should take to travel between two locations. Infrastructure costs

are projected to increase dramatically in the future, therefore it is essential that the public is not only consulted, but also be educated, and ultimately make choices with respect to the service levels that they wish to pay for.

5.1.5 Availability of Finances

Availability of finances will ultimately control all aspects of a desired level of service. Ideally, these funds must be sufficient to achieve corporate goals, meet legislative requirements, address an asset's life cycle needs, and meet community expectations. Levels of service will be dictated by availability of funds or elected officials' ability to increase funds, or the community's willingness to pay.

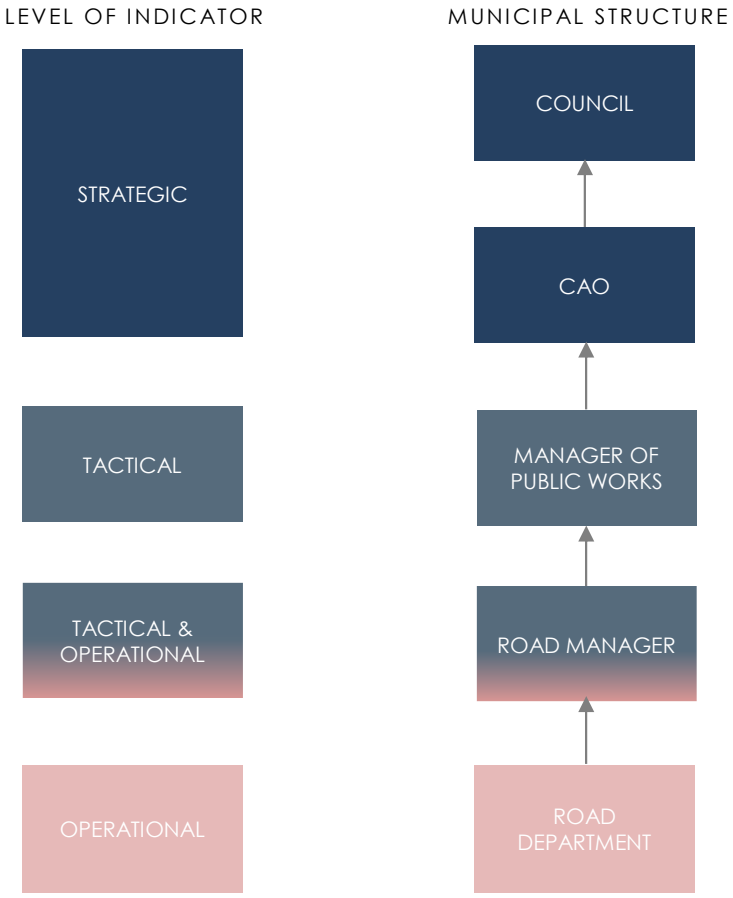
5.2 Key Performance Indicators

Performance measures or key performance indicators (KPIs) that track levels of service should be specific, measurable, achievable, relevant, and timebound (SMART).

In establishing measures, a good rule of thumb to remember is that maintenance activities ensure the performance of an asset and prevent premature aging, whereas rehab activities extend the life of an asset. Replacement activities, by definition, renew the life of an asset. In addition, these activities are constrained by resource availability (in particular, finances) and strategic plan objectives. Therefore, performance measures should not just be established for operating and maintenance activities, but also for the strategic, financial, and tactical levels of the asset management program. This will assist all levels of program delivery to review their performance as part of the overall level of service provided.

This is a very similar approach to the "balanced score card" methodology, in which financial and non-financial measures are established and reviewed to determine whether current performance meets expectations. The "balanced score card", by design, links day to day operations activities to tactical and strategic priorities in order to achieve an overall goal, or in this case, a desired level of service.

The structure of accountability and level of indicator with this type of process is represented in the following table, modified from the InfraGuide's best practice document, "Developing Indicators and Benchmarks" published in April 2003.



As a note, a caution should be raised over developing too many performance indicators that may result in data overload and lack of clarity. It is better to develop a select few that focus in on the targets of the asset management plan.

Outlined below for each infrastructure class is a suggested service description, suggested service scope, and suggested performance indicators. These should be reviewed and updated in each iteration of the AMP.

5.3 Transportation Services

5.3.1 Service Description

The township's transportation network comprises approximately 265 centreline km of road, of which 143 km are gravel or dirt roads, and 122 km are paved roads. The transport network also includes 12 bridge and culvert structures.

Together, the above infrastructure enables the township to deliver transportation and pedestrian facility services and give people a range of options for moving about in a safe and efficient manner.

5.3.2 Scope of Services

- **Movement** – providing for the movement of people and goods.
- **Access** – providing access to residential, commercial, and industrial properties and other community amenities.
- **Recreation** –providing for recreational use, such as walking, cycling, or special events such as parades.

5.3.3 Performance Indicators (reported annually)

Performance Indicators (reported annually)	
Strategic Indicators	■ percentage of total reinvestment compared to asset replacement value ■ completion of strategic plan objectives (related to transportation)
Financial Indicators	■ annual revenues compared to annual expenditures ■ annual replacement value depreciation compared to annual expenditures ■ total cost of borrowing compared to total cost of service ■ revenue required to maintain annual network growth
Tactical Indicators	■ percentage of road network rehabilitated / reconstructed ■ value of bridge / large culvert structures rehabilitated or reconstructed ■ overall road condition index as a percentage of desired condition index ■ overall bridge condition index as a percentage of desired condition index ■ annual adjustment in condition indexes ■ annual percentage of network growth ■ percent of paved road lane km where the condition is rated poor or critical ■ number of bridge / large culvert structures where the condition is rated poor or critical ■ percentage of road network replacement value spent on operations and maintenance ■ percentage of bridge / large culvert structures replacement value spent on operations and maintenance
Operational Indicators	■ percentage of road network inspected within last 5 years ■ percentage of bridge / large culvert structures inspected within last two years ■ operating costs for paved roads per lane km ■ operating costs for gravel roads per lane km ■ operating costs for bridge / large culvert structures per square metre ■ number of customer requests received annually ■ percentage of customer requests responded to within 24 hours

The above list acts as a guide for indicators the township will track annually in the future. The items chosen will be the internal discretion of Douro-Dummer.

6.0 Asset Management Strategy

6.1 Objective

To outline and establish a set of planned actions, based on best practice, that will enable the assets to provide a desired and sustainable level of service, while managing risk, at the lowest life cycle cost.

The Asset Management Strategy will develop an implementation process that can be applied to the needs identification and prioritization of renewal, rehabilitation, and maintenance activities. This will assist in the production of a 10 year plan, including growth projections, to ensure the best overall health and performance of the township's roads and bridges infrastructure.

This section includes an overview of condition assessment techniques for each asset class; the life cycle interventions required, including interventions with the best ROI; and prioritization techniques, including risk, to determine which priority projects should move forward into the budget first.

6.2 Non-Infrastructure Solutions and Requirements

The township should explore, as requested through the provincial requirements, which non-infrastructure solutions should be incorporated into the budgets for the road and bridges & culverts programs. Non-Infrastructure solutions are such items as studies, policies, condition assessments, consultation exercises, etc., that could potentially extend the life of assets or lower total asset program costs in the future.

Typical solutions for a township include linking the asset management plan to the strategic plan, growth and demand management studies, infrastructure master plans, better integrated infrastructure and land use planning, public consultation on levels of service, and condition assessment programs. As part of future asset management plans, a review of these requirements should take place, and a portion of the capital budget should be dedicated for these items in each programs budget.

It is recommended, under this category of solutions, that the township implement holistic condition assessment programs for their road networks. This will lead to higher understanding of infrastructure needs, enhanced budget prioritization methodologies, and a clearer path of what is required to achieve sustainable infrastructure programs.

6.3 Condition Assessment Programs

The foundation of good asset management practice is based on having comprehensive and reliable information on the current condition of the infrastructure. Municipalities need to have a clear understanding regarding performance and condition of their assets, as all management decisions regarding future expenditures and field activities should be based on this knowledge. An incomplete understanding about an asset may lead to its premature failure or premature replacement.

Some benefits of holistic condition assessment programs within the overall asset management process are listed below:

- Understanding of overall network condition leads to better management practices
- Allows for the establishment of rehabilitation programs
- Prevents future failures and provides liability protection
- Potential reduction in operation / maintenance costs
- Accurate current asset valuation
- Allows for the establishment of risk assessment programs
- Establishes proactive repair schedules and preventive maintenance programs
- Avoids unnecessary expenditures
- Extends asset service life therefore improving level of service
- Improves financial transparency and accountability
- Enables accurate asset reporting which, in turn, enables better decision making

Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a very detailed or very cursory approach.

When establishing the condition assessment of an entire asset class, the cursory approach (metrics such as good, fair, poor, critical) is used. This will be a less expensive approach when applied to thousands of assets, yet will still provide up to date information, and will allow for detailed assessment or follow up inspections on those assets captured as poor or critical condition later.

The following section outlines condition assessment programs available for road and bridge networks that would be useful for the township.

6.3.1 Pavement Network Inspections

Typical industry pavement inspections are performed by consulting firms using specialized assessment vehicles equipped with various electronic sensors and data capture equipment. The vehicles will drive the entire road network and typically collect two different types of inspection data – surface distress data and roughness data.

Surface distress data involves the collection of multiple industry standard surface distresses, which are captured either electronically, using sensing detection equipment mounted on the van, or visually, by the van's inspection crew. Examples of surface distresses are:

- **For asphalt surfaces**
  alligator cracking; distortion; excessive crown; flushing; longitudinal cracking; map cracking; patching; edge cracking; potholes; ravelling; rippling; transverse cracking; wheel track rutting

- **For concrete surfaces**
  coarse aggregate loss; corner 'C' and 'D' cracking; distortion; joint faulting; joint sealant loss; joint spalling; linear cracking; patching; polishing; potholes; ravelling; scaling; transverse cracking

Roughness data capture involves the measurement of the roughness of the road, measured by lasers that are mounted on the inspection van's bumper, calibrated to an international roughness index.

Most firms will deliver this data to the client in a database format complete with engineering algorithms and weighting factors to produce an overall condition index for each segment of roadway.

The above process is an excellent way to capture road condition as the inspection trucks will provide detailed surface and roughness data for each road segment, and often include video or street imagery. A very rough industry estimate of cost would be about $100 per centreline km of road, which means it would cost the township approximately $12,200 for the 122 centreline km of paved road network.

Another option for a cursory level of condition assessment is for municipal road crews to perform simple windshield surveys as part of their regular patrol. Many municipalities have created data collection inspection forms to assist this process and to standardize what presence of defects would constitute a good, fair, poor, or critical score. Lacking any other data for the complete road network, this can still be seen as a good method and will assist greatly with the overall management of the road network

It is recommended that the township establish a pavement condition assessment program and that a portion of capital funding is dedicated to this.

6.3.2 Bridges & Culverts (greater than 3m) Inspections

Ontario municipalities are mandated by the Ministry of Transportation to inspect all structures that have a span of 3 metres or more, according to the OSIM (Ontario Structure Inspection Manual). At present, in the township, there is 1 structure that meets this criterion.

Structure inspections must be performed by, or under the guidance of, a structural engineer, must be performed on a biennial basis (once every two years), and include such information as structure type, number of spans, span lengths, other key attribute data, detailed photo images, and structure element by element inspection, rating and recommendations for repair, rehabilitation, and replacement.

The best approach to develop a 10 year needs list for the township's structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, and rehabilitation and replacement requirements report as part of the overall assignment. In addition to refining the overall needs requirements, the structural engineer should identify those structures that will require more detailed investigations and non-destructive testing techniques. Examples of these investigations are:

- Detailed deck condition survey
- Non-destructive delamination survey of asphalt covered decks
- Substructure condition survey
- Detailed coating condition survey
- Underwater investigation
- Fatigue investigation
- Structure evaluation

Through the OSIM recommendations and additional detailed investigations, a 10 year needs list will be developed for the township's bridges.

The 10 year needs list developed could then be further prioritized using risk management techniques to better allocate resources.

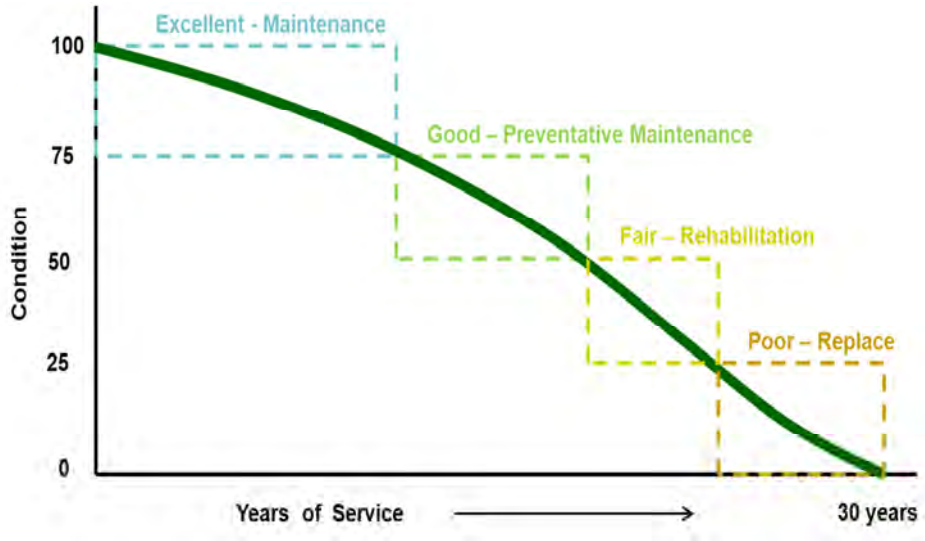
6.4 AM Strategy – Life Cycle Analysis Framework

An industry review was conducted to determine which life cycle activities can be applied at the appropriate time in an asset's life, to provide the greatest additional life at the lowest cost. In the asset management industry, this is simply put as doing the right thing to the right asset at the right time. If these techniques are applied across entire asset networks or portfolios (e.g., the entire road network), the township could gain the best overall asset condition while expending the lowest total cost for those programs.

6.4.1 Paved Roads

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for paved roads. With future updates of this Asset Management Strategy, the township may wish to run the same analysis with a detailed review of township activities used for roads and the associated local costs for those work activities.

The following diagram depicts a general deterioration profile of a road with a 30 year life.



As shown above, during the road's life cycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; preventative maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied to also coincide approximately with the condition state of the asset as shown below:

Asset Condition and Related Work Activity: Paved Roads

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	■ maintenance only
Good Condition (Preventative maintenance phase)	75 - 51	■ crack sealing ■ emulsions
Fair Condition (Rehabilitation phase)	50 -26	■ resurface - mill & pave ■ resurface - asphalt overlay ■ single & double surface treatment (for rural roads)
Poor Condition (Reconstruction phase)	25 - 1	■ reconstruct - pulverize and pave ■ reconstruct - full surface and base reconstruction
Critical Condition (Reconstruction phase)	0	■ critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

With future updates of this Asset Management Strategy the township may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the township's work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These adjustments will be an important component of future Asset Management Plans, as the Province requires each township to present various management options within the financing plan.

The table below outlines the costs for various road activities, the added life obtained for each, the condition range at which they should be applied, and the cost of 1 year added life for each (cost of activity / added life) in order to present an apples to apples comparison.

Road Lifecycle Activity Options

Treatment	Average Unit Cost (per sq. m)	Added Life (Years)	Condition Range	Cost Of Activity/Added Life
Urban Reconstruction	$205	30	25 - 0	$6.83
Urban Resurfacing	$84	15	50 - 26	$5.60
Rural Reconstruction	$135	30	25 - 0	$4.50
Rural Resurfacing	$40	15	50 - 26	$2.67
Double Surface Treatment	$25	10	50 - 26	$2.50
Routing & Crack Sealing (P.M)	$2	3	75 - 51	$0.67

As can be seen in the table above, preventative maintenance activities such as routing and crack sealing have the lowest associated cost (per sq. m) in order to obtain one year of added life. Of course, preventative maintenance activities can only be applied to a road at a relatively early point in the life cycle. It is recommended that the township engage in an active preventative maintenance program for all paved roads and that a portion of the maintenance budget is allocated to this.

Also, rehabilitation activities, such as urban and rural resurfacing or double surface treatments (tar and chip) for rural roads have a lower cost to obtain each year of added life than full reconstruction activities. It is recommended, if not in place already, that the township engages in an active rehabilitation program for urban and rural paved roads and that a portion of the capital budget is dedicated to this.

Of course, in order to implement the above programs it will be important to also establish a general condition score for each road segment, established through standard condition assessment protocols as previously described.

It is important to note that a "worst first" budget approach, whereby no life cycle activities other than reconstruction at the end of a roads life are applied, will result in the most costly method of managing a road network overall.

6.4.2 Gravel Roads

The life cycle activities required for these roads are quite different from paved roads. Gravel roads require a cycle of perpetual maintenance, including general re-grading, reshaping of the crown and cross section, gravel spot and section replacement, dust abatement and ditch clearing and cleaning.

Gravel roads can require frequent maintenance, especially after wet periods and when accommodating increased traffic. Wheel motion shoves material to the outside (as well as in-between travelled lanes), leading to rutting, reduced water-runoff, and eventual road destruction if unchecked. This deterioration process is prevented if interrupted early enough, simple re-grading is sufficient, with material being pushed back into the proper profile.

As a high proportion of gravel roads can have a significant impact on the maintenance budget, it is recommended that with further updates of this asset management plan the township study the traffic volumes and maintenance requirements in more detail for its gravel road network.

The township has Policy No. T-27 in place to determine the criteria for surface treatment.

6.4.3 Bridges & Culverts (greater than 3m span)

The best approach to develop a 10 year needs list for the township's bridge structure portfolio would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required. This approach is described in more detail within the "Bridges & Culverts (greater than 3m) Inspections" section above.

6.5 Growth and Demand

Typically a township will have specific plans associated with population growth. It is essential that the asset management strategy should address not only the existing infrastructure, as above, but must include the impact of projected growth on defined project schedules and funding requirements. Projects would include the funding of the construction of new infrastructure, and/or the expansion of existing infrastructure to meet new demands.

6.6 Project Prioritization

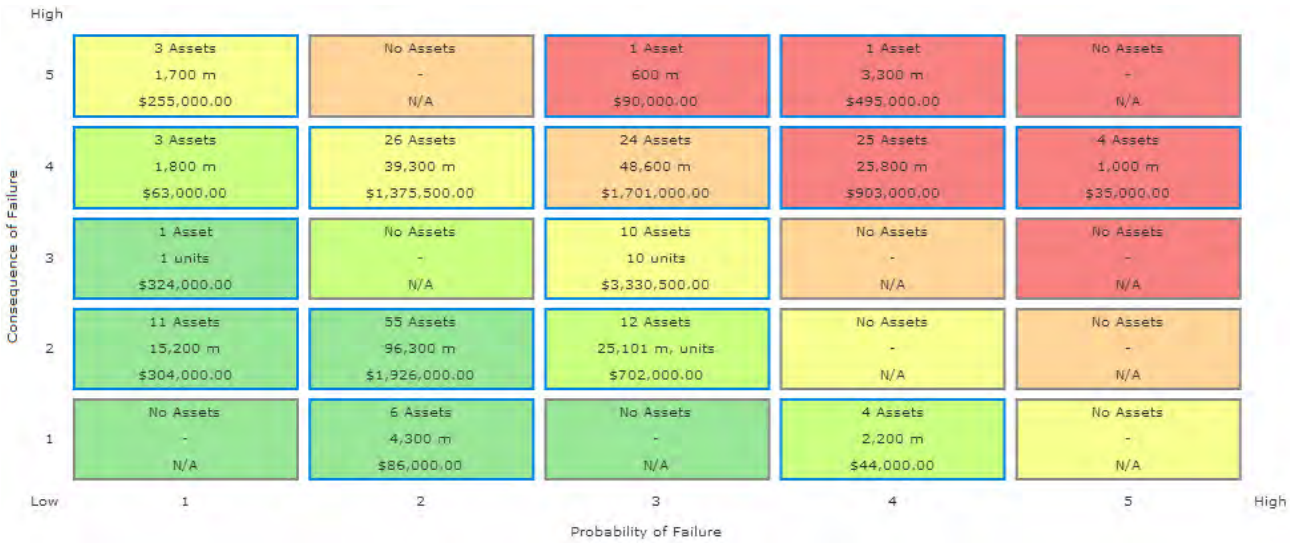
The above techniques and processes when established for the road and bridge networks will supply a significant listing of potential projects. Typically the infrastructure needs will exceed available resources and therefore project prioritization parameters must be developed to ensure the right projects come forward into the short and long range budgets. An important method of project prioritization is to rank each project, or each piece of infrastructure, on the basis of how much risk it represents to the organization.

6.6.1 Risk Matrix and Scoring Methodology

Risk within the infrastructure industry is often defined as the probability (likelihood) of failure multiplied by the consequence of that failure.

RISK = LIKELIHOOD OF FAILURE **x** CONSEQUENCE OF FAILURE

The likelihood of failure relates to the current condition state of each asset, whether they are in excellent, good, fair, poor or critical condition, as this is a good indicator regarding their future risk of failure. The consequence of failure relates to the magnitude, or overall effect, that an asset's failure will cause. For instance, a small culvert on a low traffic road may cause a few customers to have no access for a period of time, whereby a large bridge on a major urban road could have disastrous effects and would be a front page news item. The following table represents the scoring matrix for risk:



All of the township's assets analyzed within this asset management plan have been given both a likelihood of failure score and a consequence of failure score within the CityWide software.

The following risk scores have been developed at a high level for each asset class within the CityWide software. It is recommended that the township undertake a detailed study to develop a more tailored suite of risk scores, particularly in regards to the consequence of failure.

The current scores that will determine budget prioritization currently within the system are as follows:

All assets:
The Likelihood of Failure score is based on the condition of the assets:

Likelihood of Failure: **All Assets**	
Asset condition	Likelihood of failure
Excellent condition	score of 1
Good condition	score of 2
Fair condition	score of 3
Poor condition	score of 4
Critical condition	score of 5

Bridges (based on valuation):
The consequence of failure score for this initial AMP is based upon the replacement value of the structure. The higher the value, probably the larger the structure and therefore probably the higher the consequential risk of failure:

Consequence of Failure: **Bridges & Culverts**	
Replacement Value	Consequence of failure
Up to $100k	Score of 1
$101 to $250k	Score of 2
$251 to $500k	Score of 3
$501 to $850k	Score of 4
$851k and over	Score of 5

Roads (based on classification):
The consequence of failure score for this initial AMP is based upon the road classification as this will reflect traffic volumes and number of people affected.

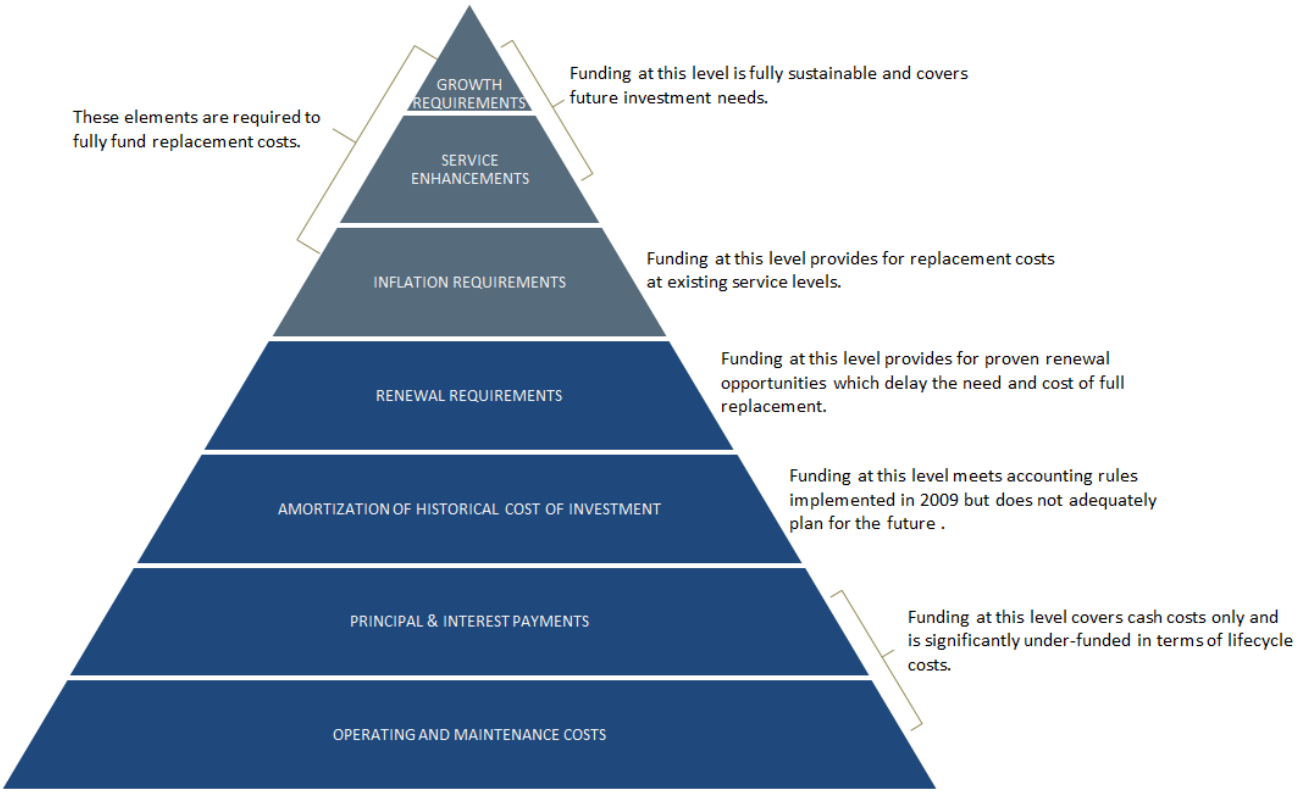
Consequence of Failure: **Roads**	
Road Classification	Consequence of failure
Dirt	score of 1
Gravel	score of 2
Road Base	score of 3
LCB	score of 4
HCB	score of 5

7.0 Financial Strategy

7.1 General overview of financial plan requirements

In order for an AMP to be effectively put into action, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow Douro-Dummer to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service and projected growth requirements.

The following pyramid depicts the various cost elements and resulting funding levels that should be incorporated into AMP's that are based on best practices.



This report develops such a financial plan by presenting several scenarios for consideration and culminating with final recommendations. As outlined below, the scenarios presented model different combinations of the following components:

a) the financial requirements (as documented in the SOTI section of this report) for:
- existing assets
- existing service levels
- requirements of contemplated changes in service levels (none identified for this plan)
- requirements of anticipated growth (none identified for this plan)

b) use of traditional sources of municipal funds:
- tax levies
- user fees
- reserves
- debt (no additional debt required for this AMP)
- development charges (not applicable)

c) use of non-traditional sources of municipal funds:
- reallocated budgets (not required for this AMP)
- partnerships (not applicable)
- procurement methods (no changes recommended)

d) use of senior government funds:
- gas tax
- grants (not included in this plan due to Provincial requirements for firm commitments)

If the financial plan component of an AMP results in a funding shortfall, the Province requires the inclusion of a specific plan as to how the impact of the shortfall will be managed. In determining the legitimacy of a funding shortfall, the Province may evaluate a township's approach to the following:

a) in order to reduce financial requirements, consideration has been given to revising service levels downward
b) all asset management and financial strategies have been considered. For example:
- if a zero debt policy is in place, is it warranted? If not, the use of debt should be considered.
- do user fees reflect the cost of the applicable service? If not, increased user fees should be considered.

This AMP includes recommendations that avoid long-term funding deficits.

7.2 Financial information relating to Douro-Dummer's AMP

We have developed scenarios that would enable Douro-Dummer to achieve full funding within 5 to 10 years for the following assets:

a) **Tax funded assets**: Road Network and Bridges and Culverts.

For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

7.3 Tax funded assets

7.3.1 Current funding position

Tables 1 and 2 outline, by asset category, Douro-Dummer's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by taxes.

Table 1. Summary of Roads and Bridges Infrastructure Requirements & Current Funding Available

Asset Category	Average Annual Investment Required	3 Year Average Annual Funding Available				Annual Deficit/Surplus
		Taxes	Gas Tax	Taxes to Reserves	Total Funding Available	
HCB & LCB Road Network	1,032,200	222,000	178,000	47,000	447,000	585,200
Gravel & Dirt Road Network	887,600	117,600			117,600	770,000
Bridges & Culverts	129,500	0	0	0	0	129.500
TOTAL	**2,049,300**	**339,600**	**178,000**	**47,000**	**564,600**	**1,484,700**

Notes:
a) Annual gas tax revenue is $214,000. $178,000 of that amount is allocated to roads with the balance used for non AMP purposes.
b) For the past 3 years the Township has made an average annual contribution to the Road Construction Reserve of $47,000 from taxes.

7.3.2 Recommendations for full funding

The average annual investment requirement for paved roads, gravel roads, and bridges & culverts is $2,049,300. Annual revenue currently allocated to these assets for capital purposes is $564,600 leaving an annual deficit of $1,484,700. To put it another way, these infrastructure categories are currently funded at 28% of their long-term requirements.

In 2013, Douro-Dummer has annual tax revenues of $3,564,300. As illustrated in table 2, without consideration of any other sources of revenue, full funding would require the following tax increases over time:

Table 2. Tax Increases Required for Full Funding

Asset Category	Tax Increase Required for Full Funding
HCB & LCB Road Network	16.4%
Gravel & Dirt Road Network	21.6%
Bridges & Culverts	3.6%
Total	**41.6%**

Through table 3, we have expanded the above scenario to present multiple options:

Table 3. Revenue Options for Full Funding

	Tax Revenues	
	5 YEARS	10 YEARS
Annual tax increases required	8.32%	4.16%

Considering the above information, we recommend the 10 year option in table 3. This involves full funding being achieved over 10 years by:

d) increasing tax revenues by 4.16% each year for the next 10 years solely for the purpose of phasing in full funding to the asset categories covered in this section of the AMP.
e) continuing to allocate $178,000 (of a total of $214,000) of the gas tax revenue to the paved roads category.
f) increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in. Those future increases could be achieved through tax increases or by allocating a larger portion of the gas tax revenue.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this funding cannot be incorporated into the AMP unless there are firm commitments in place.

Although Douro-Dummer has achieved full funding on an annual basis and this provides financial sustainability over the period modeled (to 2050), the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2013, age based data shows a backlog investment demand of $23,031,400 for the road network. Prioritizing future projects will require the age based data to be replaced by condition based data. Although our recommendations include no further use of debt, the results of the condition based analysis may require otherwise.

7.4 Rate funded assets

Douro-Dummer is not responsible for any Sanitary Sewer Network or Water Network infrastructure.

7.5 Use of debt

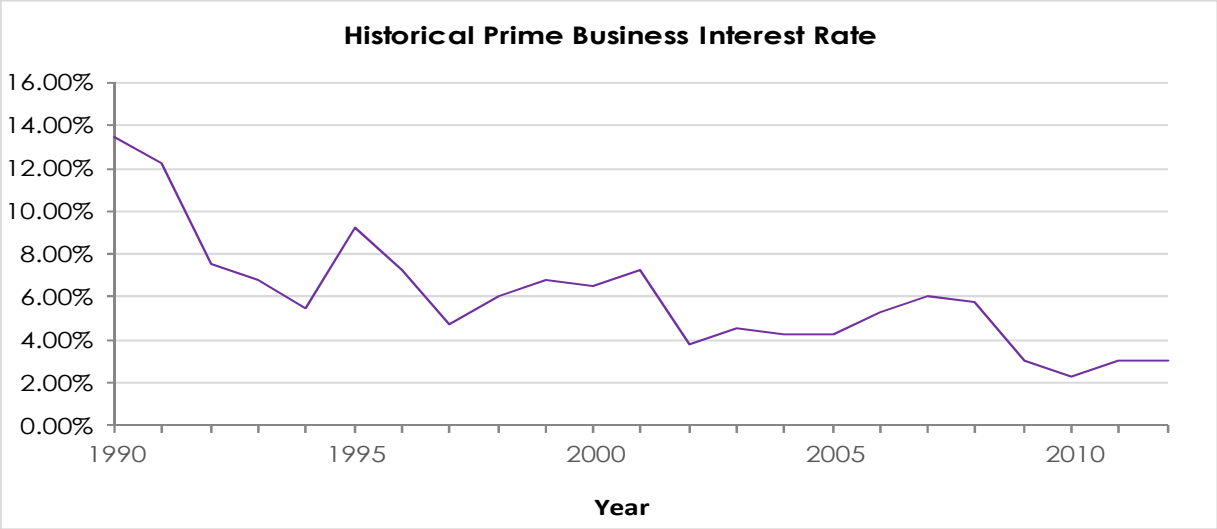
For reference purposes, table 4 outlines the premium paid on a project if financed by debt. For example, a $1M project financed at 3.0%[1] over 15 years would result in a 26% premium or $260,000 of increased costs due to interest payments. For simplicity, the table does not take into account the time value of money or the effect of inflation on delayed projects.

Table 4. Total Interest Paid as a % of Project Costs

Interest Rate	Number of Years Financed					
	5	10	15	20	25	30
7.0%	22%	42%	65%	89%	115%	142%
6.5%	20%	39%	60%	82%	105%	130%
6.0%	19%	36%	54%	74%	96%	118%
5.5%	17%	33%	49%	67%	86%	106%
5.0%	15%	30%	45%	60%	77%	95%
4.5%	14%	26%	40%	54%	69%	84%
4.0%	12%	23%	35%	47%	60%	73%
3.5%	11%	20%	30%	41%	52%	63%
3.0%	9%	17%	26%	34%	44%	53%
2.5%	8%	14%	21%	28%	36%	43%
2.0%	6%	11%	17%	22%	28%	34%
1.5%	5%	8%	12%	16%	21%	25%
1.0%	3%	6%	8%	11%	14%	16%
0.5%	2%	3%	4%	5%	7%	8%
0.0%	0%	0%	0%	0%	0%	0%

It should be noted that current interest rates are near all-time lows. Sustainable funding models that include debt need to incorporate the risk of rising interest rates. The following graph shows where historical lending rates have been:

[1] Current municipal Infrastructure Ontario rates for 15 year money is 3.2%.



As illustrated in table 4, a change in 15 year rates from 3% to 6% would change the premium from 26% to 54%. Such a change would have a significant impact on a financial plan.

Tables 5 and 6 outline how Douro-Dummer has historically not used debt for investing in the asset categories as listed. There is currently $0 of debt outstanding for the assets covered by this AMP. In terms of overall debt capacity, Douro-Dummer currently has $0 of total outstanding debt and $0 of total annual principal and interest payment commitments. These principal and interest payments are well within its provincially prescribed annual maximum of $1,070,000.

Table 5. Overview of Use of Debt						
Asset Category	Current Debt Outstanding	Use Of Debt in the Last Five Years				
		2009	2010	2011	2012	2013
HCB & LCB Road Network	0	0	0	0	0	0
Gravel & Dirt Road Network	0	0	0	0	0	0
Bridges & Culverts	0	0	0	0	0	0
Non AMP Debt	0	0	0	0	0	0
Overall Total	**0**	**0**	**0**	**0**	**0**	**0**

Table 6. Overview of Debt Costs					
Asset Category	Principal & Interest Payments in the Next Five Years				
	2013	2014	2015	2016	2017
HCB & LCB Road Network	0	0	0	0	0
Gravel & Dirt Road Network	0	0	0	0	0
Bridges & Culverts	0	0	0	0	0
Non Amp Debt	0	0	0	0	0
Overall Total	**0**	**0**	**0**	**0**	**0**

The revenue options outlined in this plan allow Douro-Dummer to fully fund its long-term infrastructure requirements without further use of debt. However, as explained in section 7.3.2, the recommended condition rating analysis may require otherwise.

7.6 Use of reserves

7.6.1 Available reserves

Reserves play a critical role in long-term financial planning. The benefits of having reserves available for infrastructure planning include:

- the ability to stabilize tax rates when dealing with variable and sometimes uncontrollable factors
- financing one-time or short-term investments
- accumulating the funding for significant future infrastructure investments
- managing the use of debt
- normalizing infrastructure funding requirements

By infrastructure category, table 7 outlines the details of the reserves currently available to Douro-Dummer.

Table 7. Summary of Reserves Available	
Asset Category	Balance at December 31, 2012
Roads	542,600
Bridges & Culverts	0
TOTAL	**542,600**

There is considerable debate in the municipal sector as to the appropriate level of reserves that a township should have on hand. There is no clear guideline that has gained wide acceptance. Factors that municipalities should take into account when determining their capital reserve requirements include:

- breadth of services provided
- age and condition of infrastructure
- use and level of debt
- economic conditions and outlook
- internal reserve and debt policies.

The reserves in table 7 are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Douro-Dummer's judicious use of debt in the past, allows the scenarios to assume that, if required, available reserves and debt capacity can be used for high priority and emergency infrastructure investments in the short to medium-term.

7.6.2 Recommendation

As Douro-Dummer updates it's AMP and expands it to include other asset categories, we recommend that future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances.

8.0 Appendix A: Report Card Calculations

Key Calculations

1. "Weighted, unadjusted star rating":

(% of assets in given condition) x (potential star rating)

2. "Adjusted star rating"

(weighted, unadjsted star rating) x (% of total replacement value)

3. "Overall Rating"

$$\frac{\textit{(Condition vs. Performance star rating)} + \textit{(Funding vs. Need star rating)}}{2}$$

Grade Cuttoffs

1. Conditions vs Performance

Letter Grade	Star Rating
F	0
D	2
D+	2.5
C	2.9
C+	3.5
B	3.9
B+	4.5
A	4.9
A	5

2. Funding vs Need

Funding %	Star rating	Grade
0.0%	0	F
25.0%	1	F
46.0%	1.9	D
61.0%	2.9	C
76.0%	3.9	B
91.0%	4.9	A
100.0%	5	A

Paved Roads Douro-Dummer

1. Condition vs. Performance

Total category replacement value	$34,316,000	Segment replacement value	$34,316,000	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Paved Roads (HCB & LCB Surfaces and Road Bases)	Excellent	A	5	46,700	19%	0.96	3.2
	Good	B	4	65,100	27%	1.07	
	Fair	C	3	64,700	27%	0.80	
	Poor	D	2	30,800	13%	0.25	
	Critical	F	1	36,800	15%	0.15	
			Totals	**244,100**	**100%**	**3.22**	

Category star rating	Category letter grade
3.2	C

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit		
$1,032,200	$447,000	43.3%	$585,200		

Category star rating	Category letter grade
1.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
3.2	1.0	2.1	D

Gravel & Dirt Roads Douro-Dummer

1. Condition vs. Performance

Total category replacement value	$2,732,000	Segment replacement value	$2,732,000	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantity (m) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Gravel & Dirt Roads (Surface and Bases)	Excellent	A	5	31,100	11%	0.5	2.7
	Good	B	4	101,600	35%	1.4	
	Fair	C	3	26,700	9%	0.3	
	Poor	D	2	3,400	1%	0.0	
	Critical	F	1	123,400	43%	0.4	
			Totals	**286,200**	**100%**	**2.7**	

Category star rating	Category letter grade
2.7	**D+**

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit
$887,600	$117,600	13.2%	$770,000

Category star rating	Category letter grade
0.0	**F**

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
2.7	0.0	**1.3**	**F**

Bridges & Culverts Douro-Dummer

1. Condition vs. Performance

Total category replacement value	$3,854,500	Segment replacement value	$3,854,500	Segment value as a % of total category replacement value	100.0%

Segment	Condition	Letter grade	Star rating	Quantity (units) in given condition	% of Assets in given condition	Weighted, unadjusted star rating	Segment adjusted star rating
Bridges & Culverts	Excellent	A	5	1	8%	0.42	3.2
	Good	B	4	0	0%	0.00	
	Fair	C	3	11	92%	2.75	
	Poor	D	2	0	0%	0.00	
	Critical	F	1	0	0%	0.00	
			Totals	**12**	**100%**	**3.17**	

Category star rating	Category letter grade
3.2	C

2. Funding vs. Need

Average annual investment required	2013 funding available	Funding percentage	Deficit		
$129,500	$0	0.0%	$129,500		

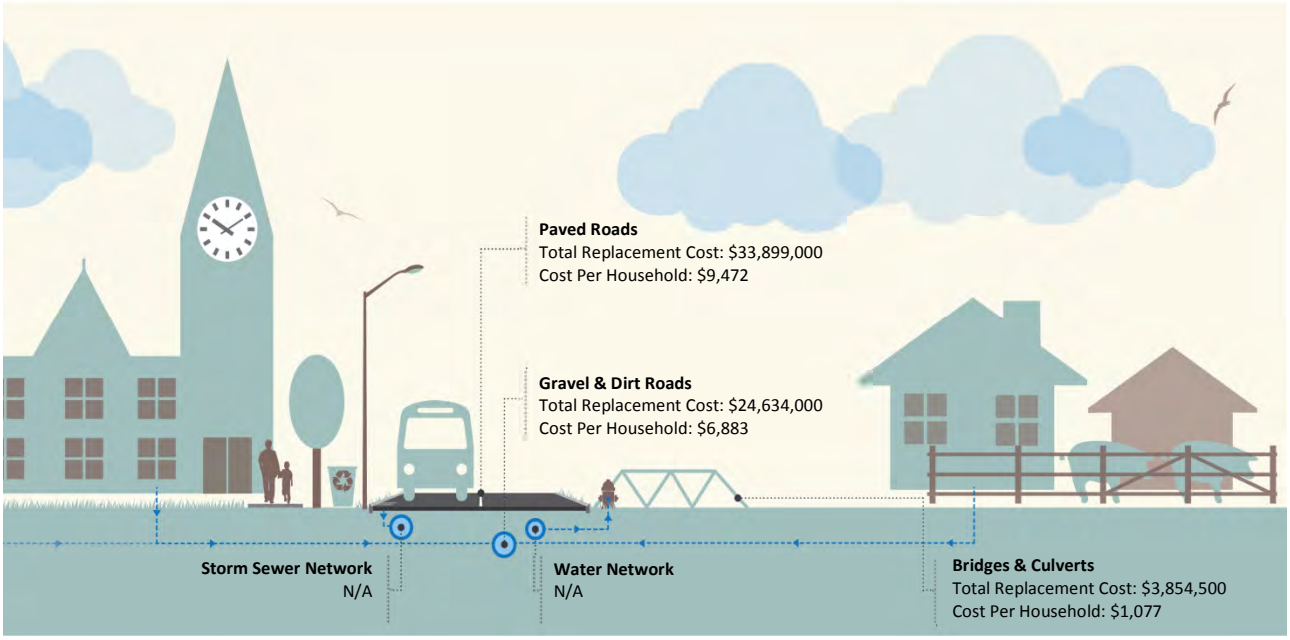
Category star rating	Category letter grade
0.0	F

3. Overall Rating

Condition vs Performance star rating	Funding vs. Need star rating	Average star rating	Overall letter grade
3.2	0.0	1.6	F

Infrastructure Replacement Cost Per Household

Total: $17,432 per household



Daily Investment Required Per Household for Infrastructure Sustainability