Township of Havelock-Belmont-Methuen

Road Needs Study Update - 2015

D.M. Wills Project Number 15-4550

D.M. Wills Associates Limited
PARTNERS IN ENGINEERING

Peterborough
North Bay

Final Report

August 2016

Executive Summary

The Township of Havelock-Belmont-Methuen (the Township) retained the services of D.M. Wills Associates (Wills) to undertake a review of the Township's existing road network, assess its physical condition as well as confirm various road attributes, and to inventory and review signage throughout the Township. Data collected as a result of the field review was used to develop a prioritized listing of the road network needs, the results of which are documented in this report.

The Township's complete road infrastructure system spans a total of approximately 159 km within a mixed urban and rural setting. The road network includes surfaces ranging from gravel to hot mix paved (asphalt). The Township has approximately 84 km of gravel roads, 65 km of surface treated roads (low class bituminous (LCB)), and 10 km of hot mix asphalt paved roads (high class bituminous (HCB)).

An overall road system adequacy has been calculated, consistent with the MTO Inventory Manual for Municipal Road, February 1991, based on a number of road characteristics including:

- Capacity
- Surface Condition
- Shoulder and Road Widths
- Structural Adequacy
- Drainage
- Maintenance Demand

The overall system adequacy for the 2015 Road Needs Assessment is 97%, per the inventory manual practice.

Capital Improvements

Prioritization and recommendations for planned capital improvements have been developed based on the condition rating and traffic demands on each road. Those roads identified as having a "NOW", "1-5" and "6-10" year Need (with the exception of drainage improvements) have been included in the capital improvement plan.

A total length of approximately 32 km of road were identified as having Surface Type or Structural Needs in the "NOW," 1-5, and 6-10 year periods. The estimated cost to improve these roads is approximately $ 4.9 M. Note that a significant portion of the Township's HCB network has reached the end of its service life and accounts for $ 2.2 M of the $ 4.9 M projected Road Needs.

An additional length of approximately 28 km of road was identified as having inadequate surface widths only. Generally, provided no operational or safety concerns are identified, roads with surface width deficiencies are typically addressed / considered at the next full reconstruction cycle.

Resurfacing

Based on typical degradation rates for gravel roads, surface treatment, and hot mix, a resurfacing program / budget is recommended as follows:

Hot Mix Paved Roads:

- 10.2 km of paved roads (HCB).
- Degradation rate 0.25/year (rating drops from "10" to "5" over a 20 year period)
- Annual Resurfacing 0.5 km / year.
- Annual Budget $115,000 (0.5 km /year x $115,000 / ln **RMP1** x 2 lanes).

Surface Treated Roads:

- 65.0 km of surface treated roads (LCB).
- Degradation rate 0.625/year (rating drops from "10" to "5" over a 7 year period)
- Annual Resurfacing 9.3 km / year.
- Annual Budget $ 353,400 (9.3km / year x $38,000 / km **ST2**).

Gravel roads require regular maintenance. Maintenance includes regular grading and reapplication of new gravel. 75mm of new gravel is recommended every 3-5 years.

Gravel Roads:

- 83.5 km of earth / gravel roads.
- 75mm gravel every 3 years.
- Annual Gravelling of 27.8 km.
- Granular A ($11,000 / km).
- Annual Budget $ 305,800 (0.1 km /year x $ 11,000 / km **G**)**

** Cost based on supply and application of gravel by external forces.

The total resurfacing program, (hot mix, surface treatment and gravel) is estimated at $ 774,200 per year.

Further, it is recommended that regular maintenance in the form of roadside ditch cleanout and clearing be undertaken in order to extend the useful service life of the existing roads.

Road System Inventory

Township of Havelock-Belmont-Methuen Road System in Kilometres as of August, 2016		
A.	**Surface Type**	
		Totals*
	Earth	0
	Gravel (Loose Top Gravel)	84
	Surface Treatment (LCB)	65
	Hot Mix Asphalt (HCB)	10
	Total A	**159**
B.	**Roadside Environment**	
(i)	**Rural**	
	Earth	0
	Gravel (Loose Top Gravel)	83
	Surface Treatment (LCB)	61
	Hot Mix Asphalt (HCB)	2
	Total Rural	**146 km**
(ii)	**Semi-Urban**	
	Gravel (Loose Top Gravel)	1
	Surface Treatment (LCB)	4
	Hot Mix Asphalt (HCB)	6
	Total Semi-Urban	**11 km**
(iii)	**Urban**	
	Gravel (Loose Top Gravel)	0
	Surface Treatment (LCB)	0
	Hot Mix Asphalt (HCB)	2
	Total Urban	**2 km**
*Estimated to the nearest kilometre.		

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1.0 Purpose, Background and Study Method

1.1 Purpose

The purpose of the Road Needs Study is to update the current road inventory and road condition assessments within the Township of Havelock-Belmont-Methuen (the Township). Using this information, a prioritized listing of the road network needs is developed. The information derived from the study and documented in this report will provide assistance to the Township for developing and executing a planned road maintenance and improvement program budget.

The Township retained the services of D.M. Wills Associates (Wills) to undertake a review of the existing road network and assess its physical condition as well as confirm various road attributes. Data collected as a result of the field review is used to develop a prioritized listing of the road network needs, the results of which are documented in this report.

1.2 Background

The Township of Havelock-Belmont-Methuen is located in Eastern Ontario, and as the name suggests, is the result of an amalgamation of the former Townships of Belmont and Methuen with the Village of Havelock. The Township is largely rural, with most of the semi-urban and urban development concentrated in the Village of Havelock.

In 2007 the Township commissioned a Road Needs Study Update to inventory and document their existing road assets according to the Ministry of Transportation (MTO) Inventory Manual. This current study (2015) utilizes and builds from the road asset information collected as part of the 2007 study.

1.3 Study Objectives

Based on the Request for Proposal and in discussion with Township staff the following study objectives were identified:

- Provide a current inventory and replacement value of the Township's roads.
- Assess road conditions and needs to develop a priority listing for construction and improvements.

The Road Needs Study will be used to assist the Township in managing their road asset in accordance with OGRA and Provincial guidelines / practices. The study has been conducted in accordance with such guidelines.

1.4 Study Methodology

The procedure utilized to complete the study was in accordance with the Ministry of Transportation's Inventory Manual for Municipal Roads (February 1991). A visual assessment of each road segment was undertaken in Fall 2015.

During the field study the following road characteristics were reviewed and documented to assess the current adequacy of the road, per the MTO Inventory Manual:

- Platform Width (overall width of road)
- Surface Width (width of pavement surface)
- Surface Condition
- Structural Adequacy
- Shoulder Width
- Surface Type (gravel, low class bituminous, high class bituminous, or concrete)
- Drainage Type (open ditches vs. storm sewers etc.)
- Roadside Environment
- Alignment

Critical Deficiencies

Critical deficiencies represent road characteristics that result in increased maintenance costs and which lead to an inadequate level of service. Road sections may be assessed as critically deficient if any one of the following characteristics fall below the minimum tolerable standards defined in the MTO Inventory Manual:

- Surface type - Insufficient surface type for traffic volumes.
- Surface width - Insufficient width of the road surface excluding the shoulders.
- Capacity - Inability of the road to accommodate traffic volumes at peak periods.
- Structural Adequacy - Inability of the road base to support vehicular traffic.

Surface Type

The following parameters were used to assess the adequacy of the road surface type. Roads with traffic volumes (AADT) in excess of the values recommended below for various surface types were noted as critically deficient triggering a "Now" need.

Table 1.4 - Surface Type by Annual Average Daily Traffic (AADT)

AADT	Surface Type Recommended

0 – 200	Gravel
201 – 400	Low Class Bituminous
>400	High Class Bituminous

Surface Width

Surface widths that fall below minimum tolerable standards, as detailed in the MTO Inventory Manual were noted as critically deficient triggering a "Now" need.

Capacity

An in-depth traffic capacity analysis was not completed as part of the scope of this Road Needs Study. Decisions with respect to expansion of roads should be made within the context of a Transportation Master Plan or Official Plan for the Township.

However, from a general perspective a two lane road can typically provide adequate service up to an AADT of approximately 12,000 vehicles. The functionality of a road from a capacity standpoint is of course dependent upon other factors in combination with volume. Adjacent land uses, number of access points i.e. entrances and side roads etc. also have a significant impact on how the road functions.

A rural road with limited entrances and side roads will have a much greater capacity to flow traffic versus an urban street with many entrances and side road intersections. The AADT of 12,000 can be used as a 'rule of thumb' to trigger further analysis on the road capacity and operation. For the purposes of this study, a detailed capacity analysis was not undertaken as part of the scope of work.

Structural Adequacy

In cases where road base or structure is showing significant distress over more than 20% of the length of the road section, a "Now" need is assessed.

Drainage

A road section is assessed as a "Now" need for drainage generally when a road becomes impassible due to water one (1) or more times a year. This information is not readily accessible from inspection. Characteristics such as ditching, water ponding on or around the road, and erosion were used to assess road drainage. Township Staff informed Wills that no section of road becomes impassable due to water on a regular basis.

Condition Rating

The Condition Rating (CR) is a comprehensive road rating that incorporates a roads physical condition (surface, structural, maintenance and drainage ratings), cross-section, alignment (rural roads only), and level of service (semi urban and urban roads only) on a hundred point scale.

2.0 The Road System

2.1 Inventory and Classification

All roads in the municipal road system were inventoried according to the methods outlined in the Inventory Manual for Municipal Roads.

The inventory procedure requires that each road in the system be studied as a separate unit. Initially, the road system was divided into sections so that each conformed, as close as possible, to the following requirements:

- Uniform traffic volume
- Uniform terrain
- Uniform physical conditions
- Uniform adjacent land use

Depending on location with respect to the built up areas, roads were classified in a manner generally descriptive of the type of construction as follows:

- Urban — Roads with curb and gutter and storm sewer drainage.
- Semi-Urban — Roads in built up areas (development exceeds 50% of the frontage) without curb and gutter or curb and gutter on one (1) side only.
- Rural — Roads with development over less than 50% of the frontage.

Table 2.1 on the next page**,** summarizes the total road length in kilometres by surface type and road environment as of November 2015.

2.2 Traffic Data

Annual Average Daily Traffic (AADT) is an important measure of annual vehicular use of any particular road section. Design standards, road classification and priority for improvements all depend to a large extent on this information.

Traffic counts were not conducted for this study. Some traffic counts for roads intersecting with Highway 7 were available from the MTO. Otherwise, AADT was typically inferred from traffic information provided by the MTO or County of Peterborough and local land use.

The previous Road Needs Study estimated traffic ranges which generally match the values estimated for this report. However, the new specific estimates imply a higher road class as per the Minimum Maintenance Standards for 25 km of road.

Traffic levels within the Township are under 1000 AADT, with the exception of Ottawa Street (AADT of 6675) which is a connecting link for Highway 7. Furthermore, 149 km have AADT's at or below 400 and 115 km have AADT's at or below 100.

Table 2.1 - Road System Inventory

Township of Havelock-Belmont-Methuen Road System in Kilometres as of August, 2016		
A.	**Surface Type**	
		Totals*
	Earth	0
	Gravel (Loose Top Gravel)	84
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*Estimated to the nearest kilometre.		

3.0 Construction Needs

The primary purpose of the study is to develop a list of all roads within the Township ranked according to priority with respect to road construction needs.

The method of evaluating construction needs in terms of type, cost and timing of improvements is identified in the Inventory Manual for Municipal Roads.

It is important to note that budgetary restrictions will often influence the level of upgrades to the road system and therefore it is imperative to maximize the improvements based on availability of funds and needs priority.

3.1 Critical Deficiencies

The inventory of the road system revealed that certain road sections are now deficient or will become deficient during the study period.

As noted previously, critical deficiencies include road characteristics which result in increased maintenance costs and which inevitably lead to an inadequate level of service. A road section is critically deficient if any one of the following characteristics fall below the minimum tolerable standards defined in the Inventory Manual.

- Surface Type — Incorrect surface type to suit traffic volumes on the roadway. See **Table 1.4**.
- Surface Width — Insufficient width of the road surface excluding the shoulders.
- Capacity — Inability of the road to accommodate traffic volumes at peak periods.
- Structural Adequacy — Inability of the road base to support vehicular traffic (minimum tolerable for resurfacing = 12/20, critically deficient = 7/20 and lower).

Of the 159 km of roads inventoried, a total of 38 km were found to be critically deficient in one or more areas. Of the 38 km, approximately 27 km represents roads with AADT of less than 50 vehicles. Regardless of condition, roads with AADT of 50 or less are typically assigned as "Adequate", as per the Ministry protocol, for the purpose of the system adequacy calculation.

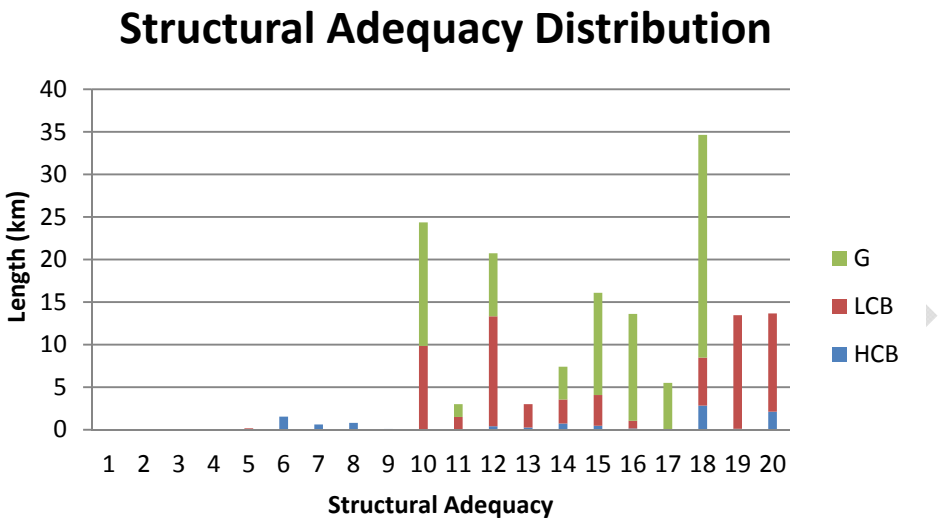
The overall system adequacy for the Town's road network, which is based upon the total road kilometres less the identified critically deficient ("NOW" needs) roads, is as follows:

$$\textbf{\textit{2015 System Adequacy}} = \frac{159 - (32 - 27)}{159} \times 100\% = 97\%$$

3.2 Network Condition

The average surface condition rating of all roads is 7/10 while the average structural adequacy rating is 15/20.

Although the average rating for the network is fair, a significant number of roads have structural adequacies below or at 12/20.



Much of the Township's HCB network, largely within the Village of Havelock, is reaching the end of its service life. HCB roads, although consisting of only 6% of the total network, account for $ 2.2 M of the estimated $ 4.9 M projected Road Needs in the next ten years. This cost estimate is for the road alone, and does not consider investment in associated drainage infrastructure. Improvements to the Township's HCB network should be coordinated with the improvement of underground services to ensure the full service lives are realized.

The Township's LCB network is, on average, fair. However, a large portion is in excellent condition (25 km have a structural rating above 17/20), a large portion is past or just at the point of requiring reconstruction (24 km have a structural rating below or at 12/20), and a small portion is in fair to good condition (16 km have a structural rating from 13/20 to 17/20).

The Township's Gravel network appeared to be in fair condition. Gravel road ratings are, however, highly variable as grading activities conceal defects in the surface. Discussion with Township staff revealed that there is a negligible amount of spring break-up, frost boils or other base issues.

3.3 Priority Ratings of Roads

A mathematical empirical formula was used to calculate the priority rating for each road section. The priority rating is a weighted calculation which takes into account the existing traffic volume and overall condition rating of the road.

This priority analysis is an impartial procedure to place the deficiencies in order of relative need. **A higher Priority Rating Number indicates a relatively greater need for improvement.**

The formula takes into account the current traffic volume (AADT), whether it is from actual road counts or estimated road counts and the condition rating (CR) of the road at the time of this road needs study. The formula is as follows:

$$\textbf{Priority Rating} = 0.2 \times (100 - CR) \times (AADT + 40)^{0.25}$$

In utilizing the above equation Wills identified a priority listing for review with Township staff. It is important to emphasize that the priority rating calculation considers only condition ratings and traffic volumes.

When developing the recommended capital expenditure plan consideration may be given to the remaining useful service life of a road / roadbed with a view to coordinating major reconstruction efforts at/near the end of the road's life. Furthermore, while a priority rating will give a general idea of which roads should be improved before others, it does not prescribe an exact order for road improvements nor does it help in determining the timing of preservation and rehabilitation work. For example, it may be wise to defer the full reconstruction of a high priority road (let the bad roads fail) in favour of resurfacing work on a medium priority road (keep the good roads good).

4.0 Roads Best Management Practices

The key to managing a pavement / road network is the timing of maintenance and rehabilitation activities. This idea evolves from the fact that a pavement's structural integrity does not fall constantly with time. A pavement generally provides a constant, acceptable condition for the first part of its service life and then begins to deteriorate very rapidly. In many cases, maintenance and rehabilitation measures are not taken until structural failure or noticeable changes in ride quality become apparent. This is the "fix it once it is already broken" approach.

The unfortunate consequence of this decision is that maintenance and rehabilitation becomes exponentially more expensive over the life of the pavement and is often overlooked until the pavement condition reaches a severe state of distress. There is opportunity for substantial cost savings when intervention is made *before* the pavement becomes severely compromised; i.e. "fix it before it breaks".

Figure 1 illustrates the underlying principle in support of a preservation management approach to pavement infrastructure. The principle also has application to each of the classes of roads maintained by the Township. Significant cost savings will result from proactive intervention rather than simply waiting as long as possible before performing maintenance.

Examples of approaches to roads management with their associated cost implications over the lifecycle of a road are set out below and are provided as an illustration of the benefit of a "preservation management approach".

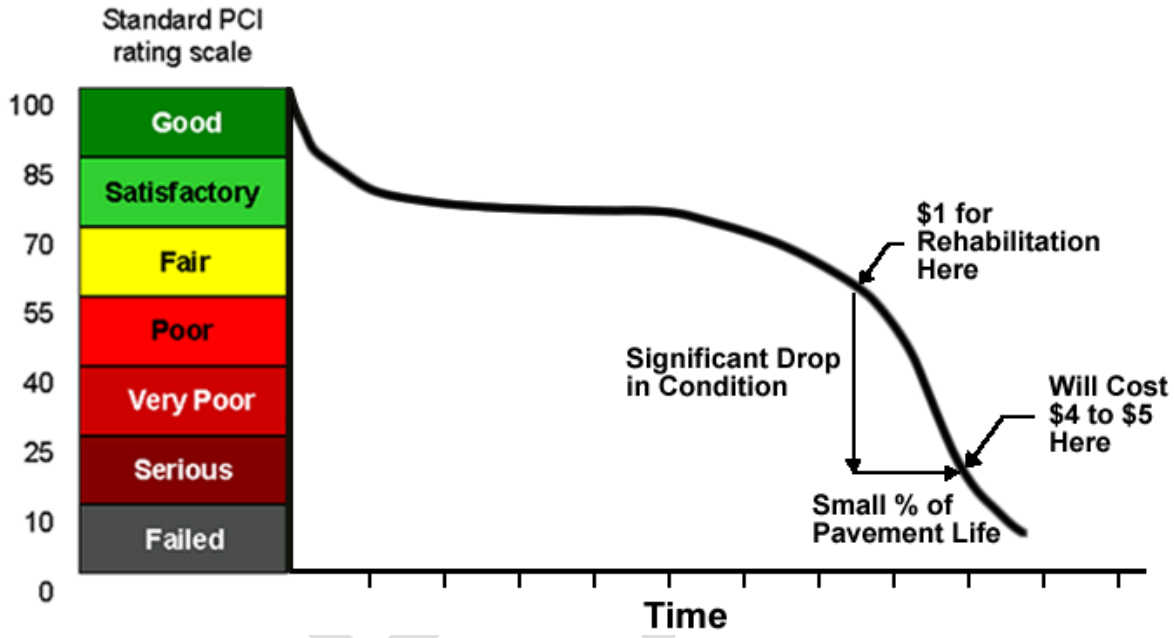


Figure 1 - Typical Service Life of an Asphalt Pavement

4.1 Example Life Cycle Cost Analysis

The following life cycle costs analysis compares three (3) different municipalities Municipality 1, Municipality 2 and Municipality 3, each with three (3) distinct approaches to pavement management. For this analysis we will assume each of the three (3) municipalities have 7000 m^2 of pavement i.e. 1 km of asphalt paved road that is 7 m wide. In each scenario, the road is assumed to have been constructed in 2013 and will operate under normal traffic loading.

The Life Cycle Cost Analysis (LCCA) assumes no user costs. The LCCA uses a discount rate of 2.5% / year.

The LCCA shows the three (3) different municipalities and tracks their pavement management decisions and related condition over the specified time period. Municipality 1 represents decisions made based on strategic preventive maintenance and rehabilitation (M&R), Municipality 2 represents decisions based on no preventive M&R and Municipality 3 represents decisions based on resurfacing only.

The figure below illustrates a time-pavement condition plot for each municipality.

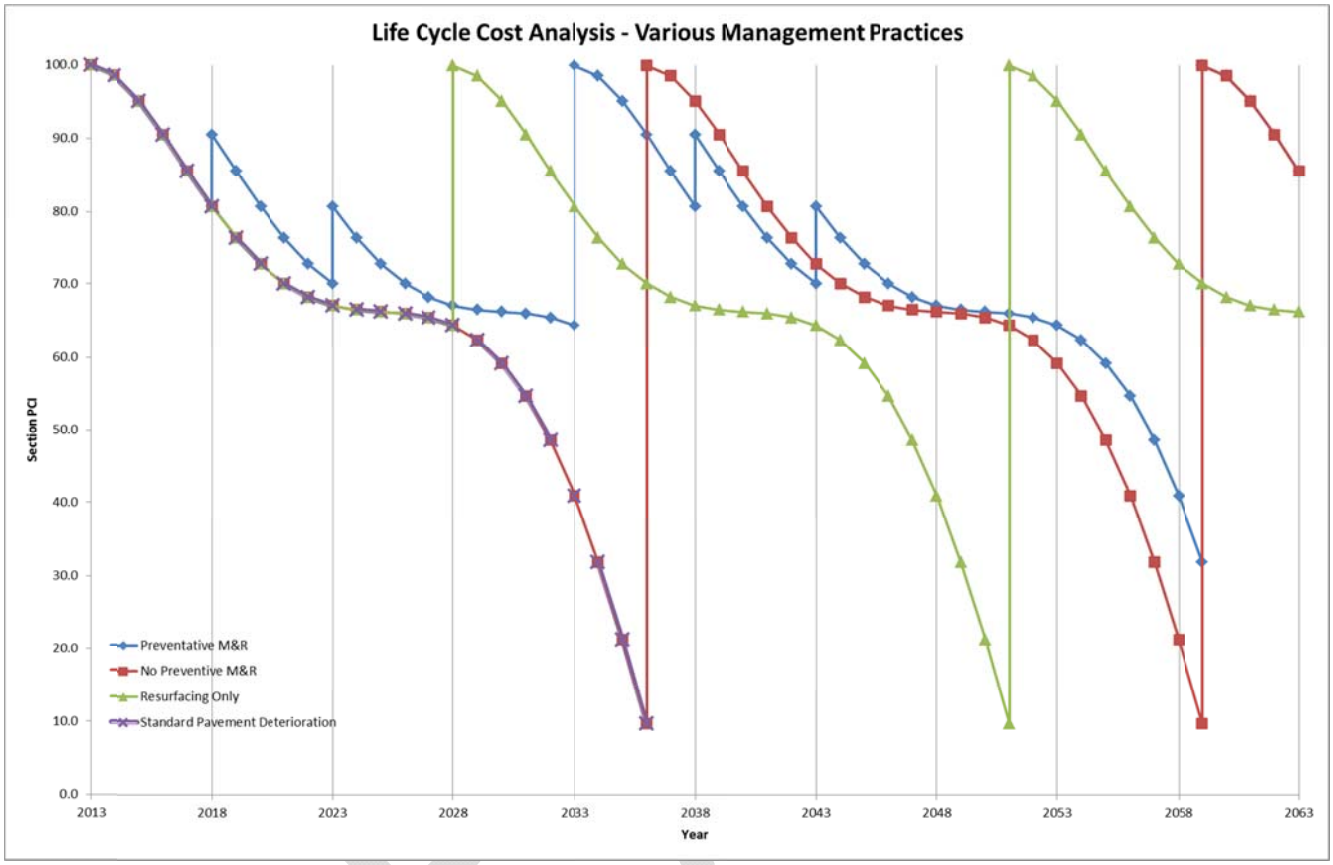


Figure 2 - Time-Condition Plot for 3 Municipalities

The costs associated with the corresponding maintenance and rehabilitation decisions are outlined in the following tables:

Preventive M&R									
Year	**Age**	**Treatment**	**Δ PCI**	**PCI_q**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Present Worth**
		-- Annual Ditching/Clearing --							
2018	**5**	**Localized Preventive - Rout and Seal**	81-90	Satisfactory-Good	1000	m	$1.50	$1,500.00	**$1,325.78**
2023	**10**	**Global Preventive - Slurry Seal**	70-81	Satisfactory-Good	7000	m^2	$6.50	$45,500.00	**$35,544.53**
2033	**20**	**Surface Course**	64-100	Poor-Good					
		Mill and Dispose of Surface Course			7000	m^2	$12.00	$84,000.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$204,487.50	**$124,792.78**
2038	**25**	**Localized Preventive - Rout and Seal**	81-88	Satisfactory-Good	4500	m	$1.50	$6,750.00	**$3,640.89**
2043	**30**	**Global Preventive - Slurry Seal**	68-78	Satisfactory-Good	7000	m^2	$6.50	$45,500.00	**$21,691.79**
2048	**35**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	5%	m^2	$30.00	$10,500.00	**$4,424.40**
2053	**40**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	10%	m^2	$30.00	$21,000.00	**$7,821.04**
2058	**45**	**Full Reconstruction**	32-100	Serious-Good					
		Remove Asphalt Full Depth			7000	m^2	$15.00	$105,000.00	
		Add and Compact Corrective Aggregate/Correct Crossfall (25mm avg.)			420	t	$35.00	$14,700.00	
		40mm Base Course			686	t	$125.00	$85,750.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$325,937.50	**$107,290.28**
2063	**5**	**Localized Preventive - Rout and Seal**	81-90	Satisfactory-Good	1000	m	$1.50	$1,500.00	**$436.41**
		Final PCI in 2063:	**90**	**Good**				**Net:**	**$306,967.90**
								Residual Value:	**$85,346.08**
								Total Cost:	**$221,621.82**

The policy of Municipality 1 is to strategically intervene with preventative maintenance measures over the course of the pavement's service life. Two (2) significant maintenance measures are performed on the pavement at various times and ultimately extend the service life of the pavement, prorating the total cost of the pavement over a longer period of time. Eventually, a full reconstruction is required and this cycle repeats. The total life cycle costs are substantially less when compared to Municipality 2 and 3, at a total of $221,622 over 50 years.

No Preventive M&R									
Year	**Age**	**Treatment**	**Δ PCI**	**PCI_q**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Present Worth**
2023	**10**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	5%	m^2	$30.00	$10,500.00	**$8,202.58**
2028	**15**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	10%	m^2	$30.00	$21,000.00	**$14,499.78**
2030	**17**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	20%	m^2	$30.00	$42,000.00	**$27,602.19**
2036	**23**	**Full Reconstruction**	10-100	Poor-Good					
		Remove Asphalt Full Depth			7000	m^2	$15.00	$105,000.00	
		Add and Compact Corrective Aggregate/Correct Crossfall (25mm avg.)			420	t	$35.00	$14,700.00	
		40mm Base Course			686	t	$125.00	$85,750.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$325,937.50	**$184,707.88**
2043	**7**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	5%	m^2	$30.00	$10,500.00	**$5,005.80**
2048	**12**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	10%	m^2	$30.00	$21,000.00	**$8,848.79**
2053	**17**	**Safety/Stopgap Maintenance - AC Patching/Leveling**	N/A	N/A	20%	m^2	$30.00	$42,000.00	**$15,642.09**
2059	**23**	**Full Reconstruction**	10-100	Poor-Good					
		Remove Asphalt Full Depth			7000	m^2	$15.00	$105,000.00	
		Add and Compact Corrective Aggregate/Correct Crossfall (25mm avg.)			420	t	$35.00	$14,700.00	
		40mm Base Course			686	t	$125.00	$85,750.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$325,937.50	**$104,673.45**
		Final PCI in 2063:	**86**	**Good**				**Net:**	**$369,182.56**
								Residiual Value:	**$81,552.92**
								Total Cost:	**$287,629.64**

The policy of Municipality 2 is to simply construct the pavement and wait until serious deficiencies begin to appear before acting. This approach unfortunately remains common still today. Over the last period of the pavement's life, maintenance is required to ensure safety and operation until the pavement becomes completely destroyed. Once the pavement has failed, a complete reconstruction is carried out restoring the pavement to new condition. This cycle repeats again until a second reconstruction is required. The total costs are substantial and total $287,630 over 50 years.

Resurfacing Only									
Year	**Age**	**Treatment**	**Δ PCI**	**PCI_q**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Present Worth**
2028	**15**	**Surface Course**	64-100	Poor-Good					
		Mill and Dispose of Surface Course			7000	m^2	$12.00	$84,000.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$204,487.50	**$141,191.58**
2051	**23**	**Full Reconstruction**	10-100	Serious-Good					
		Remove Asphalt Full Depth			7000	m^2	$15.00	$105,000.00	
		Add and Compact Corrective Aggregate/Correct Crossfall (25mm avg.)			420	t	$35.00	$14,700.00	
		40mm Base Course			686	t	$125.00	$85,750.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$325,937.50	**$127,534.43**
2067	**15**	**Surface Course**	64-100	Poor-Good					
		Mill and Dispose of Surface Course			7000	m^2	$12.00	$84,000.00	
		50mm Surface Course			892.5	t	$135.00	$120,487.50	
								$204,487.50	**$53,898.67**
		Final PCI in 2063:	**66**	**Good**				**Net:**	**$322,624.67**
								Residiual Value:	**$62,587.12**
								Total Cost:	**$260,037.55**

The policy of Municipality 3 is periodic resurfacing. The pavement is constructed and time passes until early signs of serious distress are observed. This occurs after the time when preventive maintenance is neither appropriate nor possible, but before the pavement becomes completely destroyed. Resurfacing is performed and restores the pavement to almost new condition. The pavement then deteriorates for the remainder of its life, requiring significant maintenance in the last years before it becomes completely destroyed. A full reconstruction is then carried out and the cycle continues. The total costs are in between that of Municipality 1 and 2 at $260,038 over 50 years.

It may be easy to see upfront cost savings by understanding that as long as any costs associated with maintaining the pavement are deferred as long as possible, money will be saved. The reality is that extending a pavements service life pro-rates the total cost of the pavement over a longer period of time and ultimately becomes more economical in the long run. If preventive maintenance measures are strategically planned and carried out then the service life of the pavement can be maximized and substantial reconstruction costs can be deferred for longer periods of time. In a time when economy and efficiency are becoming more and more important, this type of proactive management is essential in the management of infrastructure.

4.2 Preservation Management Approach

4.2.1 Gravel Roads

The Township currently maintains 84 km of gravel road. The proposed preservation management approach for this class of road is outlined in the following Tables**.**

Preservation Management Approach- Gravel Surface

Action	Frequency
Regrade surfaces to maintain smooth/safe driving surface and proper crossfall.	As needed. Generally 2-3 times per year for higher volume gravel, or more frequently as necessary; 1-2 for lower volume.
Add calcium to tighten surface, retain aggregate and reduce dust.	Each spring on all roads of higher volume and as needed during summer months.
Ditching and brushing of right-of-ways to improve roadbed drainage and safety.	Complete road network every 10 years.

Capital Activities – Gravel Roads

Action	Frequency
Add layer (75mm) of granular material to road surface.	Every 3 years for gravel roads
Base and sub-base improvements.	As needed or as dictated by traffic volumes.
Reconstruct/convert to hard top.	As dictated by traffic volumes.

4.2.2 Surface Treated Roads

Surface treated roads have a hard wearing surface that must be preserved in order to be effective. The Township currently maintains 65 km of surface treated roads, the predominant road surface in the Township. Unlike gravel roads, a significant investment has been made in the surface and consequently these roads must be managed properly to obtain the longest possible service life from the surface.

Preservation Management Approach – Surface Treated Roads

Activity	Age (Years)	Ride Condition Rating	Estimated Service Life Extension (years)
Slurry Seal	3	8	4
Slurry Seal	6	7	3
Double Surface Treatment	10	6	5
Pulverize and DST	14	<4	8

In addition to the above noted preservation approach, the following best management practices may be employed to preserve the surface, extend the service life and reduce life cycle costs of surface treated roads:

1. Surface treatment shall be applied to the entire road platform, from "grass to grass", including any shoulders. This will eliminate grading on surface treated roads, which has a tendency to damage the edge of the surface treatment and cause premature failure of the surface.
2. Suitable new technologies will be utilized where they can be demonstrated to reduce life cycle costs, such as fibre-reinforced surface treatment. This technology can be used to mitigate reflective cracking when a single or double surface treatment is applied over an aging surface. It can eliminate the need for pulverizing the underlying surface in certain situations and can reduce overall costs.
3. Assess drainage and culvert needs prior to any significant renewal or rehabilitation strategy and complete any improvements concurrently. This will eliminate the need to cut / excavate a relatively new surface to replace a culvert.
4. Ditching and clearing (brushing) of the right-of-ways to improve roadbed drainage and safety.

4.2.3 Asphalt Roads

Asphalt surfaces are the smoothest and most durable hard top surface used by the Township, however they are also the most expensive. The Township currently maintains 10 km of asphalt surface roads. Asphalt provides a constant, acceptable condition for the initial portion of its service life but then begins to deteriorate rapidly as it ages. Surface defects such as cracking and raveling are the first signs of the deterioration. If left untreated, the pavement will rapidly deteriorate to the point where reconstruction is the only option. A preservation management strategy can mitigate this by applying renewal treatments earlier in the pavements life before the conditions begin to deteriorate too far. The table below summarizes preservation management activities to be considered for asphalt roads:

Table 4.1.2 D - Asphalt Roads

Activity	Age (Years)	Ride Condition Rating	Estimated Service Life Extension (years)
Crack seal	2-6	9	2
Slurry seal/ Microsurface*	4-8	8	4-6
Overlay	12-15	6-7	10
Pulverize and Pave	20-25	<5	20
Reconstruct	30	<4	30

*Slurry seal can be used on lower volume paved roads (less than 1000 vehicles per day). For roads with volumes in excess of 1000 vpd, microsurfacing should be considered.

Given the short length of the Township's HCB network, it may be impractical to program preservation activities such as crack and surface sealing individually. It is recommended that the Township coordinates such efforts as an add-on with the County of Peterborough's road program whenever feasible.

In addition to the above noted preservation approach, the following best management practices may be employed to extend the service life and reduce life cycle costs of asphalt roads:

1. Review the condition of other infrastructure, particularly underground infrastructure prior to implementing any major renewal or rehabilitation of the pavement. Any repairs or capital upgrades to other infrastructure should be coordinated. This should reduce utility cuts in newer asphalt.
2. Repair potholes in the surface in a timely fashion to prevent saturation and weakening of road base.
3. Undertake regular shouldering program of rural paved roads to promote proper drainage. Poorly maintained shoulders allow surface water to pond and saturate the road base, which weakens the base and leads to cracking at the edge of pavements.
4. Undertake a ditching program to ensure there is adequate drainage for road base on rural roads. This will reduce the likelihood of structural distresses caused by softening of the road base due to poor drainage.
5. Specify the appropriate type of performance graded asphalt cement for the location.
6. Undertake a clearing program to reduce shading of the roadbed and remove roots / vegetation from the road base.

4.3 Application of Preservation Management Approach

The preservation management activities detailed in each of the tables above are not necessarily intended or required to be completed on each and every road. Road deterioration rates and the type of deterioration will dictate when action should be taken and what kind of treatment is most appropriate. The intention of the above is to outline the series of techniques to be considered in an effort to realize and extend the useful service life of the road asset for the lowest overall lifecycle cost while maintaining the highest overall condition. As detailed in the life cycle costs analysis presented above, the preservation management approach to roads is proven to yield the lowest overall life-cycle costs.

Each of the preservation management activities for gravel, surface treatment and asphalt roads identified above, including route and seal, slurry seal, resurfacing etc. shall be considered as part of the regular Road Needs Study every (five) 5 years. Recommendations on the specific treatments required shall be documented and prioritized in the Road Needs Study.

5.0 Road Needs Study Summary Table

The Road Needs Study Summary Table provides a complete priority listing of the Township's road system in descending order of priority rating, (highest priority to lowest) and is provided electronically.

5.1 Types of Improvements

Preliminary recommendations have been developed for each of the road segments included within the priorities list. The recommendations and associated estimated costs are included in the Road Needs Summary Table.

5.1.1 Asphalt

High Class Bituminous roads (HCB) or hot mix asphalt roads have rehabilitation alternatives ranging from a simple overlay to complete reconstruction. The following is a listing of standard road rehabilitation techniques that were considered for hot mix asphalt roads.

RO1	**Resurfacing, Single-Lift Overlay**
RO2	**Resurfacing, Double-Lift Overlay**
RMP1	**Resurfacing, Mill and Pave 1-Lift**
RMP2	**Resurfacing, Mill and Pave 2-Lifts**
PP1	**Pulverize and Pave 1-Lift**
PP2	**Pulverize and Pave 2-Lifts**
Recon 1R	**Excavate and Reconstruct Road and Pave 1-Lift – Rural**
Recon 1S	**Excavate and Reconstruct Road and Pave 1-Lift – Semi-Urban**
Recon 2S	**Excavate and Reconstruct Road and Pave 2-Lifts – Semi-Urban**
Recon 2U	**Excavate and Reconstruct Urban Road and Pave 2-Lifts - Urban**

5.1.2 Surface Treatment

Surface treated roads are generally able to be rehabilitated with either a single or double LCB overlay treatment. They may also be upgraded to HCB pavement or downgraded to gravel. In some cases, previous resurfacing of LCB roads has occurred or the LCB surface or road structure has deteriorated to a state where a simple overlay surface treatment is not feasible. In these cases consideration can be given to removal of the existing surface treatment and placement of a new application. In some cases, where it is necessary to improve the overall roadbed structure, the addition of Granular A to build up the road and the reapplication of a surface treatment is recommended. The following is a listing of standard road rehabilitation techniques that were considered for LCB (surface treated) roads.

ST1	**Single Surface Treatment**
ST2	**Double Surface Treatment**
ST2R	**Double Surface Treatment with Removal of Existing**
ST2A	**Double Surface Treatment over new Granular A**

5.1.3 Gravel

Gravel roads can likewise be upgraded with the reapplication of Gravel (**G**) or surface treatments (**ST1**).

"Order of Magnitude" construction costs were developed for each of the above options on a per kilometer basis, as detailed in **Appendix A**. An estimated cost for isolated frost heave repairs was also considered and included in Appendix A. The estimated costs for rehabilitation of each of the 5-Year Plan roads are included in the Road Needs Summary Table.

The above alternative rehabilitation strategies are considered preliminary in nature and are intended to assist in providing an order of magnitude cost estimate for construction program budgeting. Further field investigations and engineering design is required to confirm and develop the rehabilitation strategies for each road.

5.2 Benchmark Construction Costs

A Unit Price Form based on average prices for the local area was prepared. The unit prices were used to prepare an array of benchmark construction costs. The Unit Price Form for the 2015 Road Assessment Study is included in **Appendix A** together with benchmark construction costs for various types and standards of road improvements.

For the Township of Havelock-Belmont-Methuen, the following design standards (**Table 3**) were utilized for development of the benchmark cost estimate for reconstruction. It should be noted that these are suggested standards and therefore should not necessarily be used as standards for detail design of roadway improvements.

Table 5.2 - Design Standards for Construction Cost Estimates

Functional classification	Surface Width (m)	Shoulder Width (m)	Granular A Depth (mm)	Granular B Depth (mm)	Hot Mix Depth (mm)*
Rural R200 (50 to 199 vpd)	6.0	1.5	150	450	-
Rural R300 (200 to 399 vpd)	6.0	1.5	150	450	16*
Rural R400 (400 to 999 vpd)	6.5	1.5	150	450	50
Semi - Urban Local Residential	6	1.5	150	450	50
Semi - Urban Local Industrial	6.5	1.5	150	450	50
Urban Local Residential	8.5	-	150	450	100
Urban Local Industrial	9.0	-	150	450	100

*Prime and Double Surface Treatment is based on 16 mm of Hot Mix.

6.0 Improvement Plan

6.1 Road Needs

An excerpt from the Road Needs Study Summary Table is included on the next page noting the recommended Capital Construction Plan in terms of priorities throughout the Township. All costs are based on 2015 dollars and should be adjusted for inflation based on program year, for budgeting purposes. The capital improvements are listed based on need (NOW, 1-5 years, 6-10 years, surface upgrades and widening) and in descending priority based on traffic volumes and CR, as described previously.

Township of Havelock-Belmont-Methuen Road Needs

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
Structural NOW Needs									
05H	Mclean Ave	Cty Rd 46	Union St	405	250	*Recon 2U - Full Reconstruction + 2 Lifts*	*$278,936*	3	6
06H	Donald St	Cty Rd 46	Union St	375	100	*Recon 2U - Full Reconstruction + 2 Lifts*	*$258,274*	3	6
09H	Union St	Ontario St	Mclean Ave	300	250	*Recon 2U - Full Reconstruction + 2 Lifts*	*$206,619*	3	7
19H	William St	Mathison St E	North Turn Around	220	72	*Recon 2U - Full Reconstruction + 2 Lifts*	*$151,521*	5	7
18H	William St	Ottawa St (Hwy7)	Mathison St E	210	150	*Recon 2U - Full Reconstruction + 2 Lifts*	*$144,633*	5	6
08H(b)	Ann St 08	Alexander St	Donald St	100	6	*Recon 2U - Full Reconstruction + 2 Lifts*	*$68,873*	3	7
42B(B)	Church Rd	Cty Rd 44	Train Tracks	170	45	*ST2A - Double Surface Treatment with Granular A*	*$12,471*	2	5
Structural 1-5 Year Needs									
56B(c)	Preston Rd	Cty Rd 48 S	West Of Cty Rd 48	6,100	250	*ST2A - Double Surface Treatment with Granular A*	*$447,496*	5	10
57B	Preston Rd Extension To Fr 23	Preston Rd 2	Dead End	150	148	*ST2PAW - Widening by 1 m, Double Surface Treatment, with Pulverization of Existing and Granular A*	*$20,124*	4	10
36B	11th Concession Rd	Hwy 7	North School Rd	1,500	390	*ST2A - Double Surface Treatment with Granular A*	*$110,040*	5	11

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
Structural 1-5 Year Needs									
11H	Quebec St	Ottawa St (Hwy7)	Ontario St	50	900	*Recon 2U - Full Reconstruction + 2 Lifts*	*$34,436*	6	10
12H	Quebec St	George St	Mathison St	100	500	*Recon 2U - Full Reconstruction + 2 Lifts*	*$68,873*	5	9
35B (a)	11th Concession Rd	Old Norwood Rd	Hwy 7	200	188	*ST2A - Double Surface Treatment with Granular A*	*$14,672*	4	10
23H	Mathison St	Victoria St	Union St	450	100	*Recon 2U - Full Reconstruction + 2 Lifts*	*$309,928*	4	8
20H	Mary St	George St N	Dead End	360	24	*Recon 2U - Full Reconstruction + 2 Lifts*	*$247,943*	5	8
Structural 6-10 Year Needs									
20B	7th Concession Rd	Seymour Twp Bound.	Hwy 7	3,160	625	*Recon 1R - Full Reconstruction + 1 Lift*	*$1,047,323*	6	12
52B	Van Sickle Rd	Cty Rd 48 N	Fr 59 (N Of Cordova Lake)	7,000	250	*ST2A - Double Surface Treatment with Granular A*	*$513,520*	6	12
13B	3rd Concession Rd	Hwy 7 N	Cty Rd 48	2,830	130	*ST2 - Double Surface Treatment*	*$106,974*	6	14
37B(b)	North School Rd	Dummer Twp Boundary	Baker Rd	1,400	100	*ST2A - Double Surface Treatment with Granular A*	*$102,704*	6	12
70M	Unimin Road	Cty Rd 46	Mine	1,300	250	*ST2 - Double Surface Treatment*	*$49,140*	6	13
34B(a)	Old Norwood Rd	Concession 10	Concession 11	1,440	150	*ST2 - Double Surface Treatment*	*$54,432*	6	13
48B (A)	Burnt Dam Rd	Sugar Bush Rd	Preston Rd	460	120	*ST2A - Double Surface Treatment with Granular A*	*$33,746*	6	12
39B(a)	Baker Rd	Cty Rd 46 W	1.5 Km	1,460	150	*Preventative Maintenance*	*$0*	9	12

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
Structural 6-10 Year Needs									
22H	Mary St	Ottawa St (Hwy7)	S Ward Bound.	170	484	*RMP1 - Mill & Pave, 1 Lift*	*$39,178*	6	13
17H(B)	Mathison St E	William Street	Park St	131	150	*Recon 2U - Full Reconstruction + 2 Lifts*	*$90,224*	6	12
04B	Blairton Rd	Cole Rd N .8 Km	911 Add 374	900	250	*ST2A - Double Surface Treatment with Granular A*	*$66,024*	6	12
14H	Victoria St	George St	King St	200	250	*Recon 2U - Full Reconstruction + 2 Lifts*	*$137,746*	6	12
28B	8th Concession Rd	Hav S. Ward Bound.	Old Norwood Rd	330	250	*RMP1 - Mill & Pave, 1 Lift*	*$76,052*	7	14
03H	Pomeroy Dr	Cty Rd 30	Dead End	80	20	*Recon 2U - Full Reconstruction + 2 Lifts*	*$55,098*	6	12
13H	Quebec St	Mathison St	King St	100	30	*RMP1 - Mill & Pave, 1 Lift*	*$23,046*	6	13
15H	Orange St	Ottawa St	George St	100	12	*RMP1 - Mill & Pave, 1 Lift*	*$23,046*	6	14
54B1	Streets A,B&C Cordova	Cty Rd 48 S	Dead End	300	20	*RMP1 - Mill & Pave, 1 Lift*	*$69,138*	7	14
Surface Type Needs									
*20B**	*7th Concession Rd*	*Seymour Twp Bound.*	*Hwy 7*	*3,160*	*625*	*Recon 1R - Full Reconstruction + 1 Lift*	*$1,047,323*	*6*	*12*
65M**	West Kosh Rd	Cty Rd 6 N	Dead End-Kosh Lake	4,500	348	*ST2 - Double Surface Treatment*	*$170,100*	8	20
10B***	2nd Concession Rd	Cty Rd 48 S	Hwy 7	3,000	576	*Preventative Maintenance*	*$0*	10	20

**Also a Structural 6-10 Years Need*
**Traffic is an estimate only, Field verify AADT prior to performing any surface treatment to ensure need
***Traffic level supplied by MTO from a week long count. Confirm AADT prior to any paving to ensure need

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
Surface Width Needs Only									
72M	Penninsula Rd	North Shore Rd	Fr 80d	3,500	100	*GW - Gravel Road Widening*	*$82,425*	8	20
24B	7th Concession Rd	County Rd 48	1.2 Km N Of Cty Rd 48	1,220	60	*GW - Gravel Road Widening*	*$28,731*	8	18
08B	Blairton Rd	Hwy 7 S	Dead End	100	8	*GW - Gravel Road Widening*	*$2,355*	8	18
29H	Mill Ln	Ottawa St	George St	100	18	*Preventative Maintenance*	*$0*	8	16
44B	Hubble Rd	Cty Rd 44 N Junction	S Junction	4,550	10	*GW - Gravel Road Widening*	*$107,153*	8	15
51B	Bowen Rd	Cty Rd 48 S & E	Crowe River	4,400	32	*GW - Gravel Road Widening*	*$103,620*	8	18
53B	Vansickle Rd	Fr 59 (N End Of Cordova Lake N)	Dead End	3,400	40	*GW - Gravel Road Widening*	*$80,070*	5	14
54B2	Street B To Ball Park	Cty Rd 48 S	Dead End	200	20	*Preventative Maintenance*	*$0*	8	18
55B	1st Concession Rd	Cty Rd 48 N	Dead End	940	28	*GW - Gravel Road Widening*	*$22,137*	9	18
59M	Devils 4 Mile Rd	Cty Rd 46	Vansickle Rd	7,400	10	*GW - Gravel Road Widening*	*$174,270*	5	12
60M	Vansickle Trail	Cty Rd 46	Dead End	570	16	*GW - Gravel Road Widening*	*$13,424*	9	18
73M	Clare Newnhams Rd	Cty Rd 46	Dead End	1,500	16	*GW - Gravel Road Widening*	*$35,325*	7	11
75M	Tangamong Rd	Sandy Lake Rd	Dead End At Lake	3,400	10	*GW - Gravel Road Widening*	*$80,070*	5	10

6.2 Resurfacing

Based on typical degradation rates for gravel roads, surface treatment, and hot mix, a resurfacing program / budget is recommended as follows:

Hot Mix Paved Roads:

- 10.2 km of paved roads (HCB).
- Degradation rate 0.25/year (rating drops from "10" to "5" over a 20 year period)
- Annual Resurfacing 0.5 km / year.
- Annual Budget $115,000 (0.5 km /year x $115,000 / ln **RMP1** x 2 lanes).

Surface Treated Roads:

- 65.0 km of surface treated roads (LCB).
- Degradation rate 0.625/year (rating drops from "10" to "5" over a 7 year period)
- Annual Resurfacing 9.3 km / year.
- Annual Budget $ 353,400 (9.3km / year x $38,000 / km **ST2**).

Gravel roads require regular maintenance. Maintenance includes regular grading and reapplication of new gravel. 75mm of new gravel is recommended every 3-5 years.

Gravel Roads:

- 83.5 km of earth / gravel roads.
- 75mm gravel every 3 years.
- Annual Gravelling of 27.8 km.
- Granular A ($11,000 / km).
- Annual Budget $ 305,800 (0.1 km /year x $11,000 / km **G**)**

** Cost based on supply and application of gravel by external forces.

The total resurfacing program, (hot mix, surface treatment and gravel) is estimated at $774,200 per year.

An excerpt from the Road Needs Study Summary Table is included on the next page noting the recommended resurfacing in terms of priorities throughout the Township. All costs are based on 2015 dollars and should be adjusted for inflation based on program year, for budgeting purposes. They are listed in descending priority based on traffic volumes and CR, as described previously.

Township of Havelock-Belmont-Methuen Resurfacing Priorities

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
67M(a)	Stoney Point Rd	1.1km From West Kosh	Dead End (At Marina)	900	150	*G - Gravel (75mm)*	*$10,206*	8	20
37B(c)	North School Rd	Baker Rd	2.4km East Of Baker Rd	2,400	250	*ST2 - Double Surface Treatment*	*$90,720*	7	15
71M	North Shore Rd	Cty Rd 46	Dead End At Kosh Lake	2,100	150	*G - Gravel (75mm)*	*$23,814*	8	20
21H	Industrial Dr	Mary St	Rotary Park	450	400	*RMP1 - Mill & Pave, 1 Lift*	*$103,707*	5	18
67M(b)	Stoney Point Rd	West Kosh Rd	1.1km From West Kosh	1,100	200	*G - Gravel (75mm)*	*$12,474*	8	20
11B	2nd Concession Rd	Hwy 7	Dewey Rd	3,100	180	*G - Gravel (75mm)*	*$35,154*	7	16
26B	Weller Rd	Cty Rd 48	Hwy 7	600	75	*G - Gravel (75mm)*	*$6,804*	8	18
23B	6th Concession Rd	Hwy 7 North	County Rd 48	1,700	483	*RMP1 - Mill & Pave, 1 Lift*	*$391,784*	7	20
16B	Sawmill Bay	Cty Rd 48 N	Dead End At Fr 30	700	100	*ST2 - Double Surface Treatment*	*$26,460*	7	15
02B	Boundary Rd	Hwy 7	North Dead End	800	126	*G - Gravel (75mm)*	*$9,072*	8	18
14B	Mile Of Memories	Cty Rd 48	Belmont Lake	1,900	242	*Preventative Maintenance*		10	20
17B	4th Concession Rd	Hwy 7	Concession Allowance	2,300	113	*G - Gravel (75mm)*	*$26,082*	8	18
10H	Elm St	Ottawa St (Hwy7)	Ontario St	55	400	*RMP1 - Mill & Pave, 1 Lift*	*$12,675*	5	16
27B	Weller Rd	Hwy 7 S	Concession Rd 8	515	71	*G - Gravel (75mm)*	*$5,840*	8	18
34B(b)	Old Norwood Rd	Hwy 30	Concession 10	1,290	150	*Preventative Maintenance*		9	19
29B	8th Concession Rd	Old Nrwd Rd	0.8 Km S Of Old Nrwd Rd	1,800	150	*Preventative Maintenance*		9	19

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
45B	Anderson Rd	Cty Rd 46 S	Dead End	2,850	72	*Preventative Maintenance*		9	18
26H	Ottawa St	West Connecting Link Limits	Start Of C&G	220	8000	*RMP1 - Mill & Pave, 1 Lift*	*$50,701*	7	15
27H	Ottawa St	Start Of C&G	260m East (Pavement Joint)	260	8000	*RMP1 - Mill & Pave, 1 Lift*	*$59,920*	7	15
33B	Old Norwood Rd	Just East Of 8th Concession	Municipal Well Entrance	260	150	*Preventative Maintenance*		10	20
64M	Shady Lane Rd	Jack Lake Rd	End (At Millers)	1,300	225	*Preventative Maintenance*		9	19
56B(b)	Preston Rd	West Of CTY Rd 48	East Of 6th Line	350	250	*Preventative Maintenance*		9	18
03B	Blairton Rd	Hwy 7 N	Cole Rd	1,100	394	*Preventative Maintenance*		9	18
56B (a)	Preston Rd	East Of 6th Line	6th Line	435	250	*Preventative Maintenance*		10	20
50B	6th Concession Rd	Burnt Dam Rd/Preston Rd S	Cty Rd 48	4,930	395	*Preventative Maintenance*		9	19
28H	Ottawa St	260m East (Pavement Joint)	East Connecting Link Limits	1,520	8000	*Preventative Maintenance*		8	18
07H	Alexander St	Cty Rd 46	Union St	350	58	*Preventative Maintenance*		9	18
19B	Trent River Rd	Cty Rd 50	7th Concession Rd	2,520	250	*Preventative Maintenance*		9	19
31B(a)	Browns Line	8th Concession Rd	Cty Road 30	1,510	150	*Preventative Maintenance*		8	19
02H	Norwood Rd	Municipal Well Entrance	Cty Rd 30	1,335	150	*Preventative Maintenance*		9	18
16H	Park St	George	Mathison	100	100	*Preventative Maintenance*		10	20
30B	8th Concession Rd	0.8 Km S Of Old Norwood Rd	Brown's Line	2,250	150	*Preventative Maintenance*		10	20

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
39B(b)	Baker Rd	1.5 Km East Of Cty Rd 46	North School Rd	1,140	150	*Preventative Maintenance*		10	20
46B	Round Lake Rd	Cty Rd 46	3km East Of Cty Rd 46	3,800	395	*Preventative Maintenance*		10	20
06B	Blairton Tent & Trailer Park Rd	Blairton Rd	Dead End	300	167	*Preventative Maintenance*		10	20
25H(b)	Oak St	Ottawa St (Hwy7)	George St	110	375	*Preventative Maintenance*		9	19
01B	Boundary Rd	Hwy 7	S Dead End	1,000	40	*G - Gravel (75mm)*	*$11,340*	8	18
01H	Norwood Rd	End Of C&G	CTY Rd 30	110	150	*Preventative Maintenance*		10	20
04H	Princess St	Cty Rd 30	Dead End	110	20	*Preventative Maintenance*		8	18
05B	Blairton Rd	.8 Km N Of Cole Rd	Dead End	1,300	40	*G - Gravel (75mm)*	*$14,742*	6	16
07B	Queen St (Blairton)	Blairton Rd W	Dead End	100	16	*G - Gravel (75mm)*	*$1,134*	7	15
08H(a)	Ann St 08	Ontario St	Alexander St	100	12	*Preventative Maintenance*		10	18
09B	Cole Rd	Blairton Rd W	2nd Concession	1,500	30	*G - Gravel (75mm)*	*$17,010*	7	16
12B	Dewey Rd (Boundary Rd)	2nd Concession	Dead End	770	28	*G - Gravel (75mm)*	*$8,732*	7	16
15B	5th Concession Rd	Cty Rd 48 St	Dead End	330	4	*G - Gravel (75mm)*	*$3,742*	7	15
17H(A)	Mathison St E	William Street	E Dead End	109	40	*Preventative Maintenance*		10	20
17H(C)	Mathison St E	W Dead End (Arena)	Park St	110	28	*Preventative Maintenance*		8	18
18B	4th Concession Rd	2.3km South Of Hwy 7	Seymour Twp. Boundary	1,000	45	*G - Gravel (75mm)*	*$11,340*	7	17
22B	6th Concession Rd	Hwy 7	Dead End	1,640	48	*G - Gravel (75mm)*	*$18,598*	8	18
24H	King St	Union	Dead End At Arena Park	550	250	*Preventative Maintenance*		10	20

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
25H(a)	Oak St	George St	King St	210	450	*Preventative Maintenance*		10	20
32B	10th Concession Rd	County Rd 42	Old Norwood Rd	3,100	45	*G - Gravel (75mm)*	*$35,154*	7	18
35B (b)	11th Concession Rd	County Rd 42	Old Norwood Rd	3,200	40	*G - Gravel (75mm)*	*$36,288*	9	18
37B(a)	North School Rd	2.4 Km E Baker Rd	Cty Rd 46 (C9 L13)	890	36	*Preventative Maintenance*		8	16
38B	Menzies Rd	Cty Rd 46 E	Dead End	310	12	*G - Gravel (75mm)*	*$3,515*	8	18
40B	10th Concession Rd	North School Rd	Church Rd	2,400	28	*G - Gravel (75mm)*	*$27,216*	8	18
41B	10th Concession Rd	Church Rd	Dead End	1,900	28	*G - Gravel (75mm)*	*$21,546*	8	18
42B(A)	Church Rd	Cty Rd 46	East Of Country Rd 44	1,530	45	*G - Gravel (75mm)*	*$17,350*	7	15
42B(C)	Church Rd	10th Concession Rd	Train Tracks	1,180	45	*G - Gravel (75mm)*	*$13,381*	6	18
47B	N Belmont 7th Line	Round Lake Road	Dead End	200	46	*G - Gravel (75mm)*	*$2,268*	7	15
48B (B)	Burnt Dam Rd	Sugar Bush Rd	Dead End	1,500	32	*G - Gravel (75mm)*	*$17,010*	7	15
49B	Sugar Bush Lane	Burnt Dam Rd N	Dead End	440	48	*G - Gravel (75mm)*	*$4,990*	6	14
58B	Keating Rd Lots 17&18 Con 9	Cty Rd 46 S Junction	N Junction	700	8	*G - Gravel (75mm)*	*$7,938*	7	15
59B	Fire Rd 25	Preston Rd S	Dead End	300	48	*G - Gravel (75mm)*	*$3,402*	7	16
61M	Post Road	Cty Rd 46 Nw	Dead End At Oak Lake	500	32	*Preventative Maintenance*		8	15
62M	East Posts Rd	Posts Rd E	Cty Rd 46	260	4	*Preventative Maintenance*		10	20
66M	Holdcroft Rd	West Kosh Rd	Dead End-Kosh Lake	500	20	*G - Gravel (75mm)*	*$5,670*	8	20
69M	Blue Mountain Rd	West Kosh Rd	Dead End	600	28	*G - Gravel (75mm)*	*$6,804*	8	20

Sect. No.	Road Name	From	To	Length (m)	AADT	Preliminary Improvement Type Recommendation	Cost	Surface Rating (10)	Structural Adequacy (20)
74M	Sandy Lake Rd	Cty Rd 46 Ntos	Cty Rd 46 Twin Lakes	11,100	20	*G - Gravel (75mm)*	*$125,874*	8	20

6.3 Road Maintenance

Preventative road and roadside maintenance is critical to prolonging the useful service life of a road and maximizing the capital investment. A continuous road and roadside maintenance program is recommended to reduce the road degradation rates. This can either be accomplished through dedicated internal Township forces or sub-contracting to private contractors. Ditch cleanout and clearing of vegetation from the right-of-way should be carried out on a regular basis. Consideration may be given to a dedicated capital program of ditch cleanout and clearing, to ensure resources are dedicated to these important activities.

7.0 Replacement Cost

In conjunction with the road assessment study, a replacement cost for the road asset was calculated based strictly on roadbed materials i.e. sub-base, base and surface. Road design standards noted in Table 3 were used to estimate the existing depth of road bed materials for the purpose of the replacement cost calculation.

The total replacement cost for the Township's road infrastructure is approximately $ 18.2 M.

Note this cost represents the theoretical road bed materials costs only and does not include items such as removal of the existing road bed, installation of signs, pavement markings, lighting, drainage infrastructure, property etc.

8.0 Summary

D.M. Wills Associates (Wills) undertook a review of the Township of Havelock-Belmont-Methuen's existing road network to assess its physical condition and confirm various road attributes. Data collected as a result of the field review was used to develop a prioritized listing of the road network needs based primarily on pavement condition rating (CR) and traffic volumes.

An overall road system adequacy has been calculated, consistent with the MTO Inventory Manual for Municipal Road, February 1991, based on a number of road characteristics including:

- Capacity
- Geometrics
- Surface Condition
- Shoulder and Road Widths
- Structural Adequacy
- Drainage

- Maintenance Demand

The overall system adequacy for the 2015 Road Needs Assessment is 97%.

Capital Improvements

Prioritization and recommendations for planned capital improvements have been developed based on the condition and traffic demands on each road. Any roads identified as having a "NOW", "1-5" and "6-10" year Need (with the exception of drainage improvements) have been included in the capital improvement plan.

A total length of approximately 32 km of road were identified as having Surface Type or Structural Needs in the "NOW," 1-5, and 6-10 year periods. The estimated cost to improve these roads is approximately $ 4.9 M. Note that a significant portion of the Township's HCB network has reached the end of its service life and accounts for $ 2.2 M of the $ 4.9 M projected Road Needs.

An additional length of approximately 28 km of road was identified as having inadequate surface widths only. Generally, provided no operational or safety concerns are identified, roads with surface width deficiencies are typically addressed / considered at the next full reconstruction cycle.

Implementation / continuation of a road and roadside preventative maintenance program is strongly recommended. This will help to decrease or slow the typical degradation rates of the roads and to maintain system adequacy. A concerted effort and funding for regular roads maintenance can reduce the annual resurfacing / reconstruction requirements by prolonging the useful service life of the roads.

We trust the above and attached information will be of benefit to the Township and appreciate the opportunity to assist the Township in developing its road improvement plan.

Respectfully submitted,

Michael Lang, P. Eng.
Manager, Transportation Engineering

Statement of Limitations

This report has been prepared by D.M. Wills Associates on behalf of the Township of Havelock-Belmont-Methuen. The conclusions and recommendations in this report are based on available background documentation and discussions with applicable Township staff at the time of preparation.

The report is intended to document the 2015 Roads Needs Study findings and assist the Township in developing budgetary plans for investment into their road network.

Any use which a third party makes of this report, other than as a Road Needs Study is the responsibility of such third parties. D.M. Wills Associates Limited accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or action taken based on using this report for purposes other than as a summary of the 2015 Road Needs Study findings.

Appendix A

Road Improvement Costs

ROAD IMPROVEMENT COSTS
Township of Havelock-Belmont-Methuen

Unit Costs	Units	Unit Cost
Granular A	t	$9.00
Granular B	t	$11.00
Hot Mix	t	$135.00
Earth Excavation	m3	$10.00
Asphalt Removal	m2	$4.00
Asphalt Removal - Partial Depth	m2	$2.00
Removal of Concrete Curb & Gutter	m	$12.00
Concrete Curb & Gutter	m	$55.00
In-Place Full Depth Reclamation	m2	$4.00
Granular A Conversion	2.4	t/m3
Granular B Conversion	2	t/m3
Hot Mix Conversion	2.45	t/m3

Gravel (75mm)

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*		*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Granular A	7.0	75	2.4	t		1260	$9.00	$ 11
							G	**$ 11**

Frost Heave Treatment

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*		*Quantity*	*Unit Cost*	*Cost/50m Digout (x 1000)*
Earth Excavation	8.0	800		m3		320	$10.00	$ 3
Granular A	7.0	150	2.4	t		126	$9.00	$ 1
Granular B	8.0	650	2	t		520	$11.00	$ 6
							FT	**10**

Surface Treatment - Rural/Semi Urban - Single [ST1]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*		*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Single (Overlay)	7.0			m2		7000	$2.70	$ 19
							ST1	**19**

Surface Treatment - Rural/Semi Urban - Double [ST2]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*		*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Double (Overlay)	7.0			m2		14000	$2.00	$ 28
							ST2	**28**

Surface Treatment - Rural/Semi Urban - Double with Removal of Existing [ST2R]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Double	7.0			m2		7000	$4.00	$ 28
Removal Asphalt Pavement	7.0	16		m2		7000	$4.00	$ 28
							ST2R	**56**

Surface Treatment - Rural/Semi Urban - Double with Granular Base [ST2A]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Double	7.0			m2		7000	$4.00	$ 28
Granular A	7.0	300	2.4	t		5040	$9.00	$ 45
							ST2A	**73**

Surface Treatment - Rural/Semi Urban - Double with Pulverization and Granular Base [ST2PA]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Double	7.0			m2		7000	$4.00	$ 28
Granular A	7.0	300	2.4	t		5040	$9.00	$ 45
Pulverizing	7.0			m2		7000.0	$4.00	$ 28
Minor Items @ 25%								$ 7
							ST2PA	**108**

Surface Treatment - Rural/Semi Urban - Widening and Double with Pulverization and Granular Base [ST2PAW]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*
Surface Treatment - Double	7.0			m2		7000	$4.00	$ 28
Granular A	7.0	300	2.4	t		5040	$9.00	$ 45
Pulverizing	7.0			m2		7000.0	$4.00	$ 28
Earth Excavation	2	450		m3		900	$10.00	$ 9
Granular B	1	300	2	t		600	$11.00	$ 7
Minor Items @ 25%								$ 11
							ST2PAW	**128**

Resurfacing - Rural/Semi Urban Single Lift Overlay [RO1]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction **	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	3	50	2.45	t	74	441	$135.00	$ 60	
Granular A	1.5	50	2.4	t		180	$9.00	$ 2	
Minor Items @ 15%								$ 9	
							RO1	**70**	**(per Lane Kilometre)**

Resurfacing - Rural/Semi Urban - Double Lift Overlay [RO2]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction **	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	3	90	2.45	t	66	728	$135.00	$ 98	
Granular A	1.5	90	2.4	t		324	$9.00	$ 3	
Minor Items @ 15%								$ 15	
							RO2	**116**	**(per Lane Kilometre)**

Resurfacing - Urban - Single Lift Mill and Pave [RMP1]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	4.25	50	2.45	t		521	$135.00	$ 70	
Remove Curb and Gutter				m		200	$12.00	$ 2.40	
Curb and Gutter - 20%				m		200	$55.00	$ 11.00	
Milling	4.25			m2		4250	$2.00	$ 8.50	
Minor Items @ 25%								$ 23	
							RMP1	**115**	**(per Lane Kilometre)**

Resurfacing - Urban - Double Lift Mill and Pave [RMP2]

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	4.25	90	2.45	t		937	$135.00	$ 127	
Remove Curb and Gutter				m		200	$12.00	$ 2.40	
Curb and Gutter - 20%				m		200	$55.00	$ 11.00	
Milling	4.25			m2		4250	$3.00	$ 12.75	
Minor Items @ 25%								$ 38	
							RMP2	**191**	**(per Lane Kilometre)**

Pulverize and Pave One Lift [PP1] Rural/Semi-Urban

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	3	50	2.45	t		367.5	$135.00	$ 50	
Granular A	1.5	50	2.4	t		180	$9.00	$ 2	
Pulverize	3			m2		3000	$4.00	$ 12.00	
Minor Items @ 25%								$ 16	
							PP1	**79**	**(per Lane Kilometre)**

Pulverize and Pave Two Lifts [PP2] Rural/Semi-Urban

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Hot Mix	3	90	2.45	t		661.5	$135.00	$ 89	
Granular A	1.5	90	2.4	t		324	$9.00	$ 3	
Pulverize	3			m2		3000	$4.00	$ 12	
Minor Items @ 25%								$ 26	
							PP2	**130**	**(per Lane Kilometre)**

Semi-Urban: Resurfacing and Widening
Residential (Single Lift Widening)

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction **	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Earth Excavation	2	500		m3		1000	$10.00	$ 10	
Granular A	5	150	2.4	t		1800	$9.00	$ 16	
Granular B	5	300	2	t		3000	$11.00	$ 33	
Hot Mix	8	50	2.45	t	196	1176	$135.00	$ 159	
Milling	4			m2		4000	$2.00	$ 8	
Minor Items @ 25%								$ 56	
							RW1	**282**	**(widening one side)**

Commercial and Industrial (Double Lift Widening)

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Earth Excavation	2	600		m3		1200	$10.00	$ 12	
Granular A	5	150	2.4	t		1800	$9.00	$ 16	
Granular B	5	450	2	t		4500	$11.00	$ 50	
Hot Mix	8	90	2.45	t	353	2117	$135.00	$ 286	
Milling	4			m2		4000	$2.00	$ 8	
Minor Items @ 25%								$ 93	
							RW2	**464**	**(widening one side)**

Gravel Road Widening

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Earth Excavation	2	450		m3		900	$10.00	$ 9	
Granular A	1	150	2.4	t		360	$9.00	$ 3	
Granular B	1	300	2	t		600	$11.00	$ 7	
Minor Items @ 25%								$ 5	
							GW	**24**	**(widening one side)**

Rural: Full Excavation and Reconstruction - Gravel (6 m surface width)

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Earth Excavation	5	450		m3		2250	$10.00	$ 23	
Granular A	3	150	2.4	t		1080	$9.00	$ 10	
Granular B	5	300	2	t		3000	$11.00	$ 33	
Minor Items @ 25%								$ 16	
							Recon G	**82**	**(per Lane Kilometre)**

Rural: Full Excavation and Reconstruction - 1 Lift

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Asphalt Removal - Full Depth	3			m2		3000	$4.00	$ 12	
Earth Excavation	5	500		m3		2500	$10.00	$ 25	
Granular A	4	150	2.4	t		1440	$9.00	$ 13	
Granular B	5	300	2	t		3000	$11.00	$ 33	
Hot Mix	3	50	2.45	t		368	$135.00	$ 50	
Minor Items @ 25%								$ 33	
							Recon 1R	**166**	**(per Lane Kilometre)**

Semi-Urban: Full Excavation and Reconstruction - 1 Lift

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Asphalt Removal - Full Depth	3			m2		3000	$4.00	$ 12	
Earth Excavation	5	500		m3		2500	$10.00	$ 25	
Granular A	4	150	2.4	t		1440	$9.00	$ 13	
Granular B	5	300	2	t		3000	$11.00	$ 33	
Hot Mix	3	50	2.45	t		368	$135.00	$ 50	
Minor Items @ 25%								$ 33	
							Recon 1S	**166**	**(per Lane Kilometre)**

Semi-Urban: Full Excavation and Reconstruction - 2 Lift

Item	Width - m	Depth - mm	Conversion Factor	Unit	Crossfall Correction	Quantity	Unit Cost	Cost/km (x 1000)	
Asphalt Removal - Full Depth	3			m2		3000	$4.00	$ 12	
Earth Excavation	5	500		m3		2500	$10.00	$ 25	
Granular A	4	150	2.4	t		1440	$9.00	$ 13	
Granular B	5	300	2	t		3000	$11.00	$ 33	
Hot Mix	3	90	2.45	t		662	$135.00	$ 89	
Minor Items @ 25%								$ 43	
							Recon 2S	**215**	**(per Lane Kilometre)**

Urban: Full Excavation and Reconstruction - 2 Lift

Item	*Width - m*	*Depth - mm*	*Conversion Factor*	*Unit*	*Crossfall Correction*	*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Asphalt Removal - Full Depth	4.25			m2		4250	$4.00	$ 17	
Earth Excavation	5.5	500		m3		2750	$10.00	$ 28	
Granular A	4.5	150	2.4	t		1620	$9.00	$ 15	
Granular B	5.5	300	2	t		3300	$11.00	$ 36	
Hot Mix	4.25	90	2.45	t		937	$135.00	$ 127	
Remove Curb and Gutter				m		1000	$12.00	$ 12.00	
Curb and Gutter				m		1000	$55.00	$ 55.00	
Minor Items @ 25%								$ 55	
							Recon 2U	**344**	**(per Lane Kilometre)**

Rout and Seal

Item				*Unit*		*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Rout and Seal				m		1000	$4.00	$ 4	
							RS	**4**	**(per Lane Kilometre)**

Slurry Seal

Item	*Width - m*			*Unit*		*Quantity*	*Unit Cost*	*Cost/km (x 1000)*	
Rout and Seal	7			m2		7000	$1.80	$ 13	
							RS	**13**	