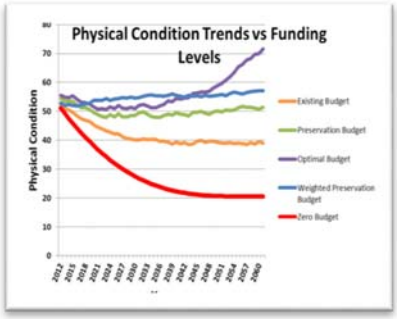
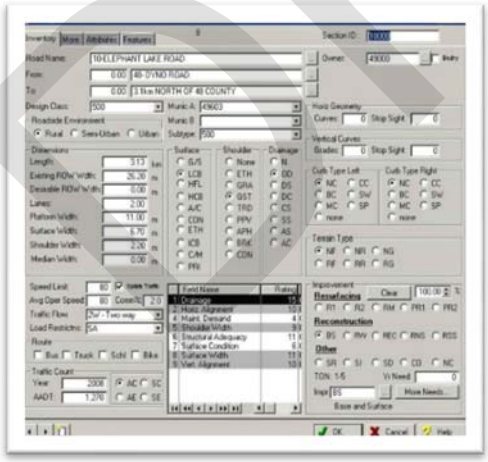
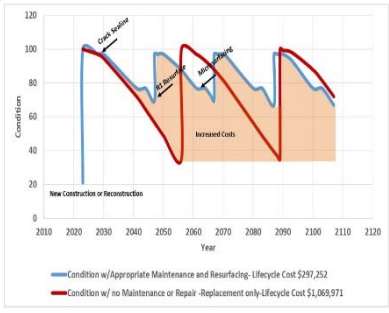
The TOWNSHIP of NORTH DUMFRIES

Township of North Dumfries
2016 State of the Infrastructure - Roads







Roads Management Services Inc.

7 Candle Crescent, Kitchener Ontario, N2P 2K7

www.4roads.ca

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7 Candle Crescent,
Kitchener, Ontario, N2P 2K7

January 9, 2017

Township of North Dumfries,
2958 Greenfield Road, P.O. Box 1060
Ayr, Ontario, N0B 1E0

Attention: **Mr. Mark Smuck, Director of Public Works,**

Subject: **2016 State of the Infrastructure - Roads**

Dear Mr. Smuck,

4 Roads Management Services Inc. (4 Roads) is pleased to provide this report on the 2016 State of the Infrastructure -Roads.

The 2016 project which was originally entitled 'Comprehensive Road Needs Study' was retitled 'State of the Infrastructure – Roads, to better reflect the content of the report in a current context that aligns with the provincial requirements for an Asset Management Plan (AMP). Primary tasks in the project included;

- road asset section numbering and creation of a road system database
- collection of relevant condition data, dimensional data and other factors
- traffic counting in over 60 locations which was sufficient to develop additional estimated traffic counts for the remainder of the system
- development of costing and analysis including estimated improvement and replacement costs. Calculations for Time of Need, Improvement and Replacement Costs, and Performance modeling were developed utilizing WorkTech Asset Manager Foundation Software.

We trust that the information provided in this report will be beneficial to the Township of North Dumfries in the continuing evolution of their Asset Management Plans.

Please do not hesitate to call or email if you require any further information or discussion on any aspect of the report. Thank you for the opportunity to prepare this report. If 4 Roads Management Services Inc. may be of any further service, please do not hesitate to contact the undersigned.

Yours truly,

David Anderson, CET
President,
4 Roads Management Services Inc.
Dave.anderson@4roads.ca
519 505 5065

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Executive Summary

In the fall of 2012, the Province of Ontario, introduced a requirement for an Asset Management Plan (AMP) as a prerequisite for municipalities seeking funding assistance for capital projects, from the province; effectively creating a conditional grant. To qualify for future infrastructure grants, an AMP had to be developed and approved by a municipal council by December 2013. On April 26, 2013 the province announced that it had created a $100 million Infrastructure Fund for small, rural and northern municipalities.

Subsequently, the province has introduced further initiatives for infrastructure funding: Ontario Community Infrastructure Fund (OCIF) and the Small Communities Fund (SCF). An Asset Management Plan approved by Council is required as part of the submission for OCIF Applications. Asset Management Plans will be reviewed for comprehensiveness.

The Township of North Dumfries (TND) currently develops an AMP for the various asset groups, roads being one of them. A key component of the AMP is a *'State of the Infrastructure'* (SotI) review of the asset or asset group. The 2016 State of the Infrastructure - Roads report provides the SotI review of the Township of North Dumfries road system. Further, the report also provides recommendations for budgets and road asset management; essentially an asset management plan for the roads asset group.

The scope of this report includes:

- Development of a database for the road system
- Review and condition rating on the road assets within the TND road system
- Traffic counting in approximately 60 locations and estimated counting for the remainder of the system
- Development/review of recommendations for improvement and associated costing on deficient assets
- Development of current replacement costs for each road asset using Ministry of Transportation Inventory Manual for Municipal Roads improvement Types
- Development of recommendations for annual budgets based on current costs for amortization/capital depreciation and major program areas based on updated unit costs provided by the TND
- Development of an analysis on the effect of current and recommended budgets on overall system performance
- Development of a geodatabase for the road system that includes relevant road related data
- Provision of Level of Service recommendations
- Provision of Asset Management Strategy recommendations

The 2016 State of the Infrastructure - Roads Report summarizes the data collected during road system survey conducted during the late summer / early fall of 2016. The survey identifies the condition of each road asset by its time of need and recommended maintenance, rehabilitation or reconstruction treatment.

Further, the report provides an overview of the physical and financial needs of the road system in its entirety, as well as by each road section. Both information sources are used to develop programming

and budgets. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the specific project.

This report should not be confused with a road safety audit. A road safety audit is the formal safety performance examination of an existing or future road or intersection, which qualitatively estimates and reports on potential road safety issues, and identifies opportunities for improvements for all road users Typically, and more predominantly in a lower tier, rural municipality on lower volume road sections, the road system has some deficiencies with the existing horizontal and vertical alignment. Road sections with potentially substandard horizontal and vertical alignments are listed in Appendix E. These sections should be reviewed to ensure that regulatory and advisory signage is in compliance with the Ontario Traffic Manual.

The project developed a database that was utilized for the analysis and development of a geodatabase which was provided to the TND as a deliverable.

Traffic counts were taken in approximately 60 locations which then allowed for the development of models which could provide defensible estimates for the remainder of the road system. TND obtained traffic count data for the Regional Road system within the TND boundaries which further aided this aspect of the work. . Accurate and current traffic counts are critical in managing a road system and their importance cannot be over emphasized. Accurate traffic and truck counts are critical to decision making.

Traffic counts establish road maintenance classifications for Minimum Maintenance Standards (MMS) purposes, as per Ontario Regulation 239/02 (*Minimum Maintenance Standards for Municipal Roads*), as well as determining appropriate geometry, structure, and cross-section when the road is rehabilitated or reconstructed. Township of North Dumfries should continue their traffic counting program including truck counts. Traffic counts should be updated on a regular cycle, as a risk management exercise.

Road sections were developed as necessary during the field review process. Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, traffic count or a combination of these factors. For example, new sections should be created as surface type, surface condition, cross-section, or speed limit changes.

Data collection and road ratings were completed in general accordance with the Ministry of Transportation Ontario (MTO) *Inventory Manual for Municipal Roads* from 1991 (*Inventory Manual or IM*).

Road conditions are evaluated during a field inspection. The ratings are either as a standalone value or incorporated into calculations performed by the software, that then classify the road section as a 'NOW', '1 to 5', or '6 to 10' year need for maintenance, rehabilitation or reconstruction in six critical areas. The Time of Need is a prediction of the time until the road requires reconstruction*, not the time frame until action is required.* Generally, the closer the timeline to reconstruction, the greater the deterioration of the road is. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible to further defer the need to reconstruct.

Recommendations are made based on the defects observed and other information available in the database at the time of preparation of the report. Once a road asset reaches the project level, the municipality may have selected another alternative based on additional information, asset management strategy, development considerations or available funding.

'NOW' needs represent road sections that require reconstruction or major rehabilitation. 'NOW' needs are the backlog of work required on the road system; however, 'NOW' needs may not necessarily be the priority, depending on funding levels. Construction improvements identified within this time period are representative of roads that have little or no service life left and are in poor condition. Resurfacing treatments are never 'NOW' need, with the following exceptions;

- RW (Resurface and Widen)
- PR1 or PR2 (Pulverize and resurface 1 or 2 lifts of asphalt)
- When the surface type is inadequate for the traffic volume (gravel road over 400AADT)
- When the surface is gravel and the roadside environment is Urban or Semi-Urban

'1 to 5' identifies road sections where reconstruction is anticipated within the next five years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), deferring the need to reconstruct. These roads would be described as being in fair condition

'6 to 10' identifies road sections where reconstruction improvements are anticipated within six to ten years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct. These roads would be described as being in good condition.

'ADEQ' identifies road sections that do not have reconstruction or resurfacing needs, although minor maintenance such as crack sealing or spot drainage may be required. These roads would be described as being good to excellent condition and require only maintenance.

This report summarizes the needs identified through a number of tabular appendices.

When the *Inventory Manual* was originally developed, the Province provided funding for municipal road systems; the road systems were measured by their system adequacy. The system adequacy is the percentage of the road system that is not a "NOW" need.

The *Inventory Manual* provides direction that roads with a traffic volume of less than 50 vehicles per day *are deemed to be adequate,* even if they have structural, geometric, or drainage deficiencies that would otherwise be identified as being in a Time of Need and were to be corrected within the maintenance budget. This approach is directly parallel to Regulation 239/02, *Minimum Maintenance Standards for Municipal Roads*, which states that roads with less than 50 vehicles per day, and a speed limit of less than 80 km/hr., are classified as Class 6 with no standard for repair. This factor has a very minor effect on the system adequacy calculation for the Township of North Dumfries as there is only 0.274 km of roads sections with an actual or estimated traffic count of less than 5o vehicles per day.

During the field review, and in reviewing the data and the needs for the road network, there were several unique aspects of the network that came to light:

- The overall condition of the road system would be characterized as being at the boundary of fair to good using the weighted average Physical Condition of 58.45. (4 Roads would typically recommend that the weighted average Physical Condition be at 70 or higher.) This would indicate the average road section has just over 5 years of anticipated remaining service life. The overall condition may be influenced by the following factors;

  - The overall condition may have been influenced by Infrastructure Funds and Grants that may have not been identified in the annual or average annual funding level.
  - Development roads are raising the average rating.

- The weighted average rating is of concern as it is relatively low and has been influenced by the newer subdivision roads. This would tend to indicate that the road system without the new development roads being included, is in poorer condition than the measures would indicate. This is discussed further in section 4 of the report.
- Roads with a surface width less than the minimum tolerable standard were identified on 0.876km of road sections. Typically these road sections are low volume, however, the correction would be a reconstruction of the section to produce the required width. As a risk management exercise and an interim solution, the Township should consider advisory signage. Roads with substandard width may be a direct result of a substandard road allowance; less than 20m.
- Shoulder berms were noted on many sections of all surface types on rural and semi urban road sections. The berms are an impediment to the free drainage of the road surface and will accelerate the deterioration of the road section over time.
- Approximately 78% of the road system requires drainage improvements.
- Gravel roads do not appear to have appropriate crossfall.
- 25.7% (40.148 km) of the TND road system requires resurfacing (Hot mix asphalt or surface treatment). If not addressed, the resurfacing needs will become major rehabilitation or reconstruction needs at significantly greater cost.
- 8.6% (13.396km) of the road system has a structural adequacy score of 15 or 16, indicating that those roads would be an additional resurfacing need in the next 1 to 3 year period. (All surface types are included.)

Based on the current review of the road system, the current system adequacy measure is **73.7**% meaning that, 26.3% of the road system is deficient in the 'NOW' time period and is in poor condition. The current system adequacy is at an acceptable level. However, the system adequacy measure by itself is misleading as the average condition is lower than recommended. As noted in the foregoing, there are a number of factors potentially influencing the system adequacy.

Based on the current unit costs being experienced, the total estimated cost of recommended improvements is **$41,263,134.** The improvement costs include **$20,839,909** for those roads identified as NOW needs and **$20,423,225** is for road work required in the '1 to 10' year time period or for maintenance. Included in those amounts is **$118,721** for work on road sections that are otherwise adequate and require only maintenance.

Based on the composition of the road system, budget recommendations have been developed for annual capital and maintenance programs as follows:

- **$108,013,100** to replace the road system. Annualized, this would be **$2,160,300**, based upon a 50-year life cycle. (This would be similar to the PSAB 3150 amortization value using current replacement costs)
- **$1,096,900** annually on average for hot mix resurfacing, based upon an 18(17.6)-year cycle.(This would approximate an average of 7.95km per year)

- **$1,500** annually on average, for single surface treatment of existing surface-treated roads, based on a six-year cycle, not including additional padding or geometric correction.
- **$111,700** annually for crack sealing.

For modeling purposes, 4 Roads has created a funding level described as the 'Preservation Budget'. The Preservation Budget is the total of the recommended funding levels for hot mix resurfacing, single surface treatment, and crack sealing: **$1,408,000**. The premise being that if the preservation and resurfacing programs are adequately funded then the system should be sustained. Adequately funded preservation and resurfacing programs will reduce overall costs and defer the need to reconstruct.

Performance modeling is discussed in Section 9 of this report. To clarify, the required funding level to sustain or improve the road system is *not* the total of all of the above recommendations. Sustainable funding has to be between the Preservation Budget and the Capital Depreciation. The preservation budget and performance model thereof are computer derived. Intangible values and decisions and the effects of other external forces cannot be incorporated into the model. As such the preservation model is the minimum required to maintain the system- in theory. From a more pragmatic perspective and to deal with the real life realities of maintaining a road system, it should be greater.

Municipal pavement and asset management strategies are critical to managing the performance of the road system, more so, if funding is limited. Funding constraints should push the strategy toward those programs that extend the life cycle of the road by providing the correct treatment at the optimum time. Resurfacing, rehabilitation, and preservation projects should be a higher priority than reconstruction projects. The objective is to "keep the good roads good".

As the municipality advances the development of their Asset Management Plan (AMP), a paradigm shift will be required in the way that we approach management of assets. Traditionally, municipalities have spent a fixed amount on capital and maintenance each year. As evidenced by Table ES.11, programs are not at a consistent funding level on an annual basis. The annual budget overall is met, however, the distribution of costs between traditional capital and maintenance activities varies. That variance is being driven by the demands of the road system based on condition and project selection is based on condition and best Return on Investment. This concept has to be applied to all assets.

Re-stated, instead of the traditional capital and maintenance line items, consider the gross budget as the annual reinvestment level, with program funding levels fluctuating within the gross amounts, but driven by asset condition.

The prime goal of any pavement management strategy should be to maintain overall system adequacy or condition. The funding level for asset related programming should be set at a sufficient level so as to ensure that overall system adequacy does not decrease over time.

In addition to the budgetary recommendations, the following recommendations are provided for the management of the road inventory.

1. The information and budget recommendations included in this report should be used to further develop and evolve the corporate Asset Management Plan.
2. The budget should be increased from the current funding level of 640,000 to the Preservation funding level of $1,408,000 over a 5 year period.
3. Budgets should be adjusted annually to account for growth and inflation.

4. The cycle for review of the condition of road system should be no greater than a four year cycle.
5. Unit costs, budget recommendations, update history, and performance models should be updated annually.
6. The System Adequacy should be maintained at 60% or higher.
7. The weighted average Physical Condition should be at 70 or higher.
8. The Good to Very Good roads should be at 60% or higher
9. Programming should be reviewed to ensure that resurfacing and preservation programs are optimized.
10. Traffic counts should be updated and repeated on a regular basis on a 3 to 5 year cycle. The counting should include the percentage of truck traffic and the year.
11. Roads sections where potentially substandard horizontal and vertical alignment have been identified, should be reviewed to ensure signage is in compliance with the Ontario Traffic Manual.
12. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
13. Storm Water Master Plans should be developed for urbanized areas.
14. The results and recommendations for programming of this report should be integrated with the other assets groups to ensure available funding is optimized.

Summary Information

(Tabular information adjusted for boundary road length unless otherwise noted)

Table ES 1: Road System by Local Municipality and Roadside Environment

Surface Material	Roadside Environment R		S		U		TOTAL		% OF TOTAL	
	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
Gravel, Stone, Other Loosetop	18.838	37.675	0.359	0.718	0	0	**19.197**	**38.393**	12.30%	12.30%
High Class Bit.-asphalt	92.932	185.863	29.319	58.638	14.069	28.138	**136.32**	**272.639**	87.32%	87.32%
Low Class Bit.-surface treated	0.601	1.202	0	0	0	0	**0.601**	**1.202**	0.38%	0.38%
TOTAL	**112.37**	**224.74**	**29.678**	**59.356**	**14.069**	**28.138**	**156.117**	**312.234**		
% OF TOTAL	71.98%	71.98%	19.01%	19.01%	9.01%	9.01%				

Table ES 2: Roadside Environment and Functional Class

Functional Class / Subtype	Lanes	Roadside Environment R		S		U		TOTAL		% OF TOTAL	
		Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
200	2	17.953	35.905	0	0	0	0	**17.953**	**35.905**	11.50%	11.50%
300	2	15.372	30.744	0	0	0	0	**15.372**	**30.744**	9.85%	9.85%
400	2	43.5	87	0	0	0	0	**43.5**	**87**	27.86%	27.86%
500	2	23.414	46.828	0	0	0	0	**23.414**	**46.828**	15.00%	15.00%
600	2	2.586	5.172	0	0	0	0	**2.586**	**5.172**	1.66%	1.66%
700	2	8.807	17.614	0	0	0	0	**8.807**	**17.614**	5.64%	5.64%
800	2	0.37	0.739	0	0	0	0	**0.37**	**0.739**	0.24%	0.24%
C/R	2	0.369	0.738	5.024	10.048	4.838	9.676	**10.231**	**20.462**	6.55%	6.55%
CCI	2	0	0	0.214	0.428	0.096	0.192	**0.31**	**0.62**	0.20%	0.20%
L/R	2	0	0	17.504	35.008	9.135	18.27	**26.639**	**53.278**	17.06%	17.06%
LCI	2	0	0	6.936	13.872	0	0	**6.936**	**13.872**	4.44%	4.44%
TOTAL		**112.37**	**224.74**	**29.678**	**59.356**	**14.069**	**28.138**	**156.117**	**312.234**		
% OF TOTAL		71.98%	71.98%	19.01%	19.01%	9.01%	9.01%				

Table ES 3: MMS Class Distribution

Lanes		Regulation 239/02 Classification								TOTAL		% OF TOTAL	
		3		*4*		*5*		*6*					
	Roadside	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
2	Rural	18.837	37.673	71.596	143.191	21.938	43.876	0.000	0.000	**112.370**	**224.740**	71.98%	71.98%
2	Semi Urban	0.690	1.380	11.165	22.330	17.639	35.278	0.184	0.368	**29.678**	**59.356**	19.01%	19.01%
2	Urban	0.000	0.000	6.625	13.250	7.354	14.708	0.090	0.180	**14.069**	**28.138**	9.01%	9.01%
TOTAL		**19.527**	**39.053**	**89.386**	**178.771**	**46.931**	**93.862**	**0.274**	**0.548**	**156.117**	**312.234**		
% OF TOTAL		12.51%	12.51%	57.26%	57.26%	30.06%	30.06%	0.18%	0.18%				

Table ES 4: Average Traffic Count by MMS Class

Roadside	Regulation 239/02 Classification				AVERAGE
	3	4	5	6	
Rural	2,614	795	299	0	927
Semi Urban	5,250	1,222	210	23	1,676
Urban	0	1,161	300	20	370
AVERAGE	**2,621**	**1,060**	**269**	**14**	**991**

Table ES 5: Traffic Count Vs Count Year

Year	Counted	Estimated	TOTAL	% OF TOTAL
2014	0	2.011	**2.011**	1.29%
2015	0.33	3.69	**4.02**	2.57%
2016	77.717	72.369	**150.086**	96.14%
TOTAL	**78.047**	**78.07**	**156.117**	
% OF TOTAL	49.99%	50.01%		

Table ES 6: Overall Time of Need by Length and MMS Class

Time of Need	Regulation 239/02 Classification								TOTAL		% OF TOTAL	
	3		*4*		*5*		*6*					
	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
1 to 5	3.917	7.834	16.886	33.772	13.121	26.242	0	0	**33.924**	**67.848**	21.73%	21.73%
6 to 10	7.466	14.932	42.228	84.455	18.104	36.208	0	0	**67.798**	**135.595**	43.43%	43.43%
ADEQ	0.307	0.614	8.565	17.129	4.117	8.234	0.274	0.548	**13.263**	**26.525**	8.50%	8.50%
NOW	7.837	15.673	21.708	43.415	11.589	23.178	0	0	**41.133**	**82.266**	26.35%	26.35%
TOTAL	**19.527**	**39.053**	**89.386**	**178.771**	**46.931**	**93.862**	**0.274**	**0.548**	**156.117**	**312.234**		
% OF TOTAL	12.51%	12.51%	57.26%	57.26%	30.06%	30.06%	0.18%	0.18%				
System Adequacy	59.9%	59.9%	75.7%	75.7%	75.3%	75.3%	100.0%	100.0%	73.7%	73.7%		
Good to Very Good	39.8%	39.8%	56.8%	56.8%	47.3%	47.3%	100.0%	100.0%	51.9%	51.9%		

Table ES 7: Replacement Costs by Functional Class

Functional Class / Subtype	Roadside Environment						TOTAL		% OF TOTAL		Cost /km ($)
	Rural		Semi Urban		Urban						
	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	
200	10,328,238	24.55	0	0	0	0	**10,328,238**	**24.55**	9.56%	14.78%	420,702
300	7,327,176	16.53	0	0	0	0	**7,327,176**	**16.53**	6.78%	9.95%	443,265
400	26,413,101	43.5	0	0	0	0	**26,413,101**	**43.5**	24.45%	26.19%	607,198
500	17,140,583	25.11	0	0	0	0	**17,140,583**	**25.11**	15.87%	15.12%	682,620
600	2,159,997	2.59	0	0	0	0	**2,159,997**	**2.59**	2.00%	1.56%	833,976
700	7,768,107	8.81	0	0	0	0	**7,768,107**	**8.81**	7.19%	5.30%	881,737
800	610,669	0.74	0	0	0	0	**610,669**	**0.74**	0.57%	0.44%	825,228
C/R	472,555	0.37	2,967,190	5.17	7,374,045	4.84	**10,813,790**	**10.38**	10.01%	6.25%	1,041,791
CCI	0	0	187,995	0.21	179,058	0.1	**367,053**	**0.31**	0.34%	0.19%	1,184,042
L/R	0	0	7,800,467	17.5	13,525,820	9.14	**21,326,287**	**26.64**	19.74%	16.04%	800,536
LCI	0	0	3,758,131	6.94	0	0	**3,758,131**	**6.94**	3.48%	4.18%	541,517
TOTAL	**72,220,426**	**122.2**	**14,713,783**	**29.83**	**21,078,923**	**14.07**	**108,013,132**	**166.1**			
% OF TOTAL	66.86%	73.57%	13.62%	17.96%	19.52%	8.47%					

Table ES 8: Needs by Time of Need, Improvement Length and Cost

Improvement Class		Improvement ID / Desc	Time of Need								TOTAL		% OF TOTAL		Cost /km ($)
			1 to 5		6 to 10		ADEQ		NOW						
			Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	
Const	BS	Base and Surface	501,079	1.8	2,815,300	10.176	0	0	654,830	2.346	**3,971,208**	**14.322**	9.62%	9.17%	277,280
Const	NONE	No Improvement Required	0	0	0	0	0	4.45	0	0	**0**	**4.45**		2.85%	-
Const	REC	Reconstruction - Rural	3,648,770	5.876	1,628,409	3.562	0	0	5,171,067	9.813	**10,448,246**	**19.251**	25.32%	12.33%	542,738
Const	REChd	Reconstruction - Rural- Heavy Duty	1,456,793	1.607	321,538	0.35	0	0	7,067,967	6.432	**8,846,298**	**8.389**	21.44%	5.37%	1,054,512
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0	0	0	0	302,908	0.424	**302,908**	**0.424**	0.73%	0.27%	714,406
Const	RSS	Reconstruction with Storm Sewers	1,018,947	0.653	715,393	0.47	66,119	0.047	3,420,025	2.383	**5,220,484**	**3.553**	12.65%	2.28%	1,469,317
Maint	CRK	Crack Sealing	0	0	0	0	32,808	8.202	0	0	**32,808**	**8.202**	0.08%	5.25%	4,000
Maint	GRRplus	Maintenance Gravel and Minor Ditching	0	0	141,413	4.191	0	0	0	0	**141,413**	**4.191**	0.34%	2.68%	33,742
Maint	MICRO	Microsurfacing	0	0	0	0	7,522	0.307	0	0	**7,522**	**0.307**	0.02%	0.20%	24,502
Maint	RSpLimit	Reduce Speed limit	0	0	0	0	0	0	0	0.33	**0**	**0.33**		0.21%	-
Maint	SD	Spot Drainage	0	0	44,093	9.186	902	0.188	0	0	**44,995**	**9.374**	0.11%	6.00%	4,800
Maint	SDcrk	Spot Drainage and Crack Sealing	0	0	209,194	23.772	0	0	0	0	**209,194**	**23.772**	0.51%	15.23%	8,800
Rehab	PR2	Pulverize and Resurface 2 - 100mm	287,725	1.502	0	0	11,371	0.069	886,631	4.825	**1,185,727**	**6.396**	2.87%	4.10%	185,386
Rehab	PR2sd	Pulverize and Resurface 2 -100mm and SD	2,867,606	14.249	34,810	0.182	0	0	1,689,864	8.368	**4,592,280**	**22.799**	11.13%	14.60%	201,425
Rehab	PR3	Pulverize and Resurface 3 - 150mm	712,995	2.248	0	0	0	0	119,156	0.385	**832,151**	**2.633**	2.02%	1.69%	316,047
Rehab	PR3sd	Pulv and Resurf - 3 , 150mm and SD	825,049	3.255	488,286	1.885	0	0	1,380,540	5.389	**2,693,875**	**10.529**	6.53%	6.74%	255,853
Rehab	R1	Basic Resurfacing 1 - 50mm	406,222	2.301	2,000,834	14.024	0	0	0	0	**2,407,055**	**16.325**	5.83%	10.46%	147,446
Rehab	R2	Basic Resurfacing 2 - 100mm	180,049	0.433	0	0	0	0	146,920	0.438	**326,969**	**0.871**	0.79%	0.56%	375,395
TOTAL			**11,905,235**	**33.924**	**8,399,269**	**67.798**	**118,721**	**13.263**	**20,839,909**	**41.133**	**41,263,134**	**156.117**			
% OF TOTAL			28.85%	21.73%	20.36%	43.43%	0.29%	8.50%	50.50%	26.35%					

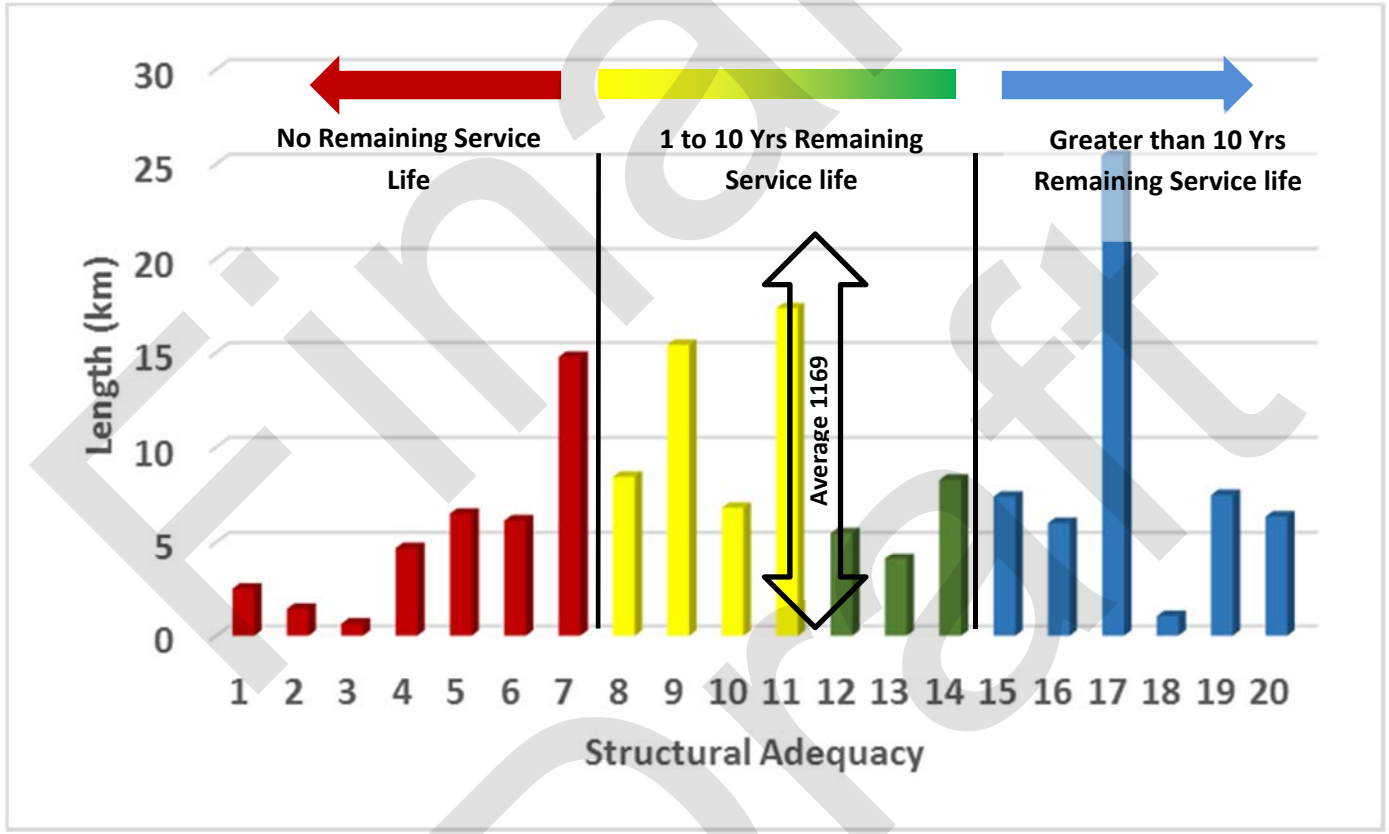
Table ES 9: Needs by Improvement Type and Roadside Environment

Improvement Class		Improvement ID / Description	Roadside Environment						TOTAL		% OF TOTAL		Cost /km ($)
			Rural		Semi Urban		Urban						
			Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	
Const	BS	Base and Surface	10.874	2,969,459	3.339	949,039	0.109	52,710	**14.322**	**3,971,208**	9.17%	9.62%	277,280
Const	NONE	No Improvement Required	1.943	0	0.576	0	1.931	0	**4.45**	**0**	2.85%		-
Const	REC	Reconstruction - Rural	15.74	8,392,578	3.511	2,055,667	0	0	**19.251**	**10,448,246**	12.33%	25.32%	542,738
Const	REChd	Reconstruction - Rural- Heavy Duty	7.462	8,028,078	0.927	818,220	0	0	**8.389**	**8,846,298**	5.37%	21.44%	1,054,512
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0.208	116,743	0.216	186,165	**0.424**	**302,908**	0.27%	0.73%	714,406
Const	RSS	Reconstruction with Storm Sewers	0	0	3.351	4,926,649	0.202	293,835	**3.553**	**5,220,484**	2.28%	12.65%	1,469,317
Maint	CRK	Crack Sealing	1.62	6,480	0.974	3,896	5.608	22,432	**8.202**	**32,808**	5.25%	0.08%	4,000
Maint	GRRplus	Maintenance Gravel and Minor Ditching	4.191	141,413	0	0	0	0	**4.191**	**141,413**	2.68%	0.34%	33,742
Maint	MICRO	Microsurfacing	0.307	7,522	0	0	0	0	**0.307**	**7,522**	0.20%	0.02%	24,502
Maint	RSpLimit	Reduce Speed limit	0.33	0	0	0	0	0	**0.33**	**0**	0.21%		-
Maint	SD	Spot Drainage	8.137	39,058	0.887	4,258	0.35	1,680	**9.374**	**44,995**	6.00%	0.11%	4,800
Maint	SDcrk	Spot Drainage and Crack Sealing	21.32	187,616	2.197	19,334	0.255	2,244	**23.772**	**209,194**	15.23%	0.51%	8,800
Rehab	PR2	Pulverize and Resurface 2 - 100mm	3.153	565,943	3.243	619,785	0	0	**6.396**	**1,185,727**	4.10%	2.87%	185,386
Rehab	PR2sd	Pulverize and Resurface 2 -100mm and SD	20.161	4,089,545	2.638	502,735	0	0	**22.799**	**4,592,280**	14.60%	11.13%	201,425
Rehab	PR3	Pulverize and Resurface 3 - 150mm	0	0	2.633	832,151	0	0	**2.633**	**832,151**	1.69%	2.02%	316,047
Rehab	PR3sd	Pulv and Resurf - 3 , 150mm and SD	9.029	2,293,136	1.5	400,740	0	0	**10.529**	**2,693,875**	6.74%	6.53%	255,853
Rehab	R1	Basic Resurfacing 1 - 50mm	8.104	1,041,919	3.694	562,819	4.527	802,317	**16.325**	**2,407,055**	10.46%	5.83%	147,446
Rehab	R2	Basic Resurfacing 2 - 100mm	0	0	0	0	0.871	326,969	**0.871**	**326,969**	0.56%	0.79%	375,395
TOTAL			**112.37**	**27,762,747**	**29.678**	**11,812,035**	**14.069**	**1,688,353**	**156.117**	**41,263,134**			
% OF TOTAL			71.98%	67.28%	19.01%	28.63%	9.01%	4.09%					

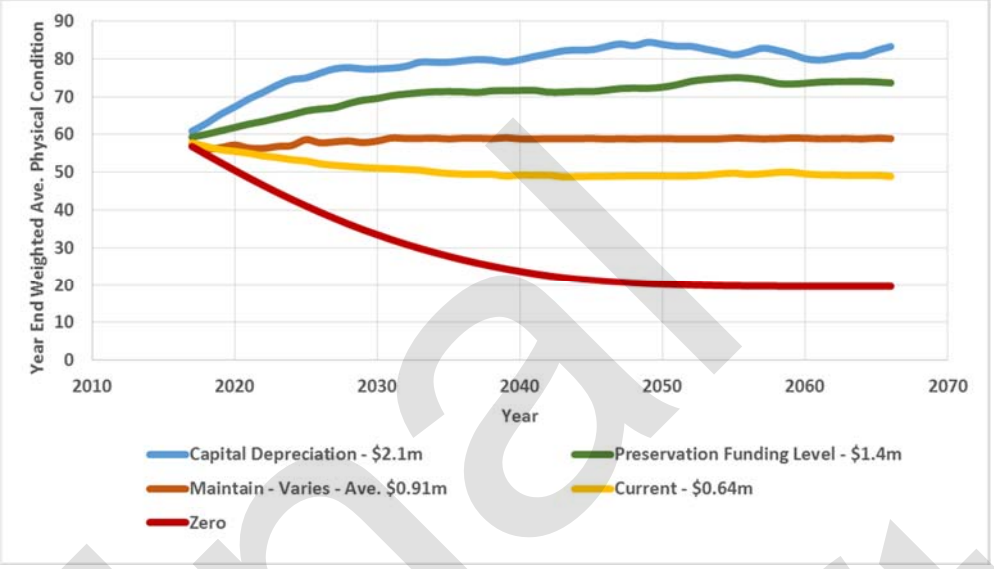
Table ES 10: Good to Very Good Roads by Structural Adequacy

Structural Adequacy	Rural	Roadside Semi-Urban	Urban	Description	TOTAL	% OF TOTAL
1	1.362	1.128	0	Poor	2.49	1.59%
2	0.715	0.536	0.167	Poor	1.418	0.91%
3	0	0.637	0	Poor	0.637	0.41%
4	4.217	0.466	0	Poor	4.683	3.00%
5	3.647	2.377	0.473	Poor	6.497	4.16%
6	4.804	1.228	0.105	Poor	6.137	3.93%
7	11.936	2.71	0.111	Poor	14.757	9.45%
8	7.489	0.954	0	Fair	8.443	5.41%
9	10.896	4.162	0.332	Fair	15.39	9.86%
10	4.351	2.249	0.21	Fair	6.81	4.36%
11	12.057	3.059	2.205	Fair	17.321	11.09%
12	2.999	2.347	0.119	Good	5.465	3.50%
13	2.14	1.158	0.788	Good	4.086	2.62%
14	5.2	1.67	1.415	Good	8.285	5.31%
15	6.591	0.315	0.486	Good to Excellent	7.392	4.73%
16	4.138	0.816	1.05	Good to Excellent	6.004	3.85%
17	19.264	2.721	3.444	Good to Excellent	25.429	16.29%
18	0.363	0	0.679	Good to Excellent	1.042	0.67%
19	6.377	0.311	0.795	Good to Excellent	7.483	4.79%
20	3.826	0.834	1.69	Good to Excellent	6.35	4.07%
TOTAL	112.37	29.678	14.069		156.117	
% OF TOTAL	71.98%	19.01%	9.01%			
% Good to Very Good	45.3%	34.3%	74.4%		45.8%	

Graph ES1: Estimated Remaining Service Life: Structural Adequacy Rating vs. Length



Graph ES.2: Predicted System Performance at Varying Funding Levels



***Notes: Data points are year-end performance estimate**
Predicted performance assumes program developed through the model will be followed- particularly critical at minimal funding levels

Graph ES.3: Road System Value vs Funding Level

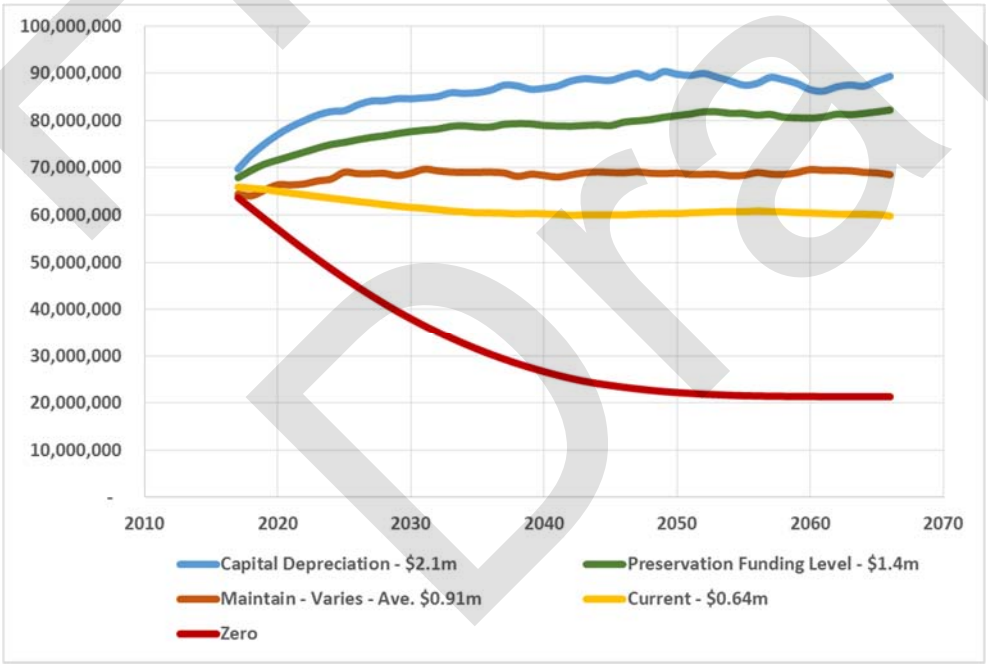


Table ES 13: 10Year Program -Performance Model Output (20161222– Proposed Funding Level, Adjusted for Inflation

Improvement	Year										
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Grand Total
BS								60,547		13,367	**73,914**
CRK	27,544	14,610	5,581	28,831	17,459	9,203	20,761	29,662	27,555	22,915	**204,121**
GRR2				11,162				22,510	10,729		**44,401**
MICRO					5,551		12,029	7,256	17,742	2,190	**44,768**
PR2		121,731	104,541	251,210	273,127	57,359	200,182	13,061	106,066		**1,127,277**
PR2sd			624,832	740,897	420,772	1,062,574	1,042,297	293,559	567,667		**4,752,598**
PR3sd				101,018	280,130	177,961		887,451		617,979	**2,064,539**
R1	455,301	255,580	117,243		346,862	207,059	107,166	257,755	26,063	546,880	**2,319,909**
R2	146,920		117,923				145,145		522,361	443,964	**1,376,313**
REC									314,982		**314,982**
RSS		368,773									**368,773**
SD	2,827	29,214	8,234			3,989		2,293			**46,557**
SDcrk	6,688	23,454		25,352		19,404	40,642	25,232	38,697	17,112	**196,581**
Grand Total	**639,280**	**813,362**	**978,354**	**1,158,470**	**1,343,901**	**1,537,549**	**1,568,222**	**1,599,326**	**1,631,862**	**1,664,407**	**12,934,733**

***Detailed listing of Individual projects is shown in Appendix F**

Table ES 12: Improvement Type Abbreviation Summary

Inventory Manual Improvements	
Code	**Description**
R1	Basic Resurfacing
R2	Basic Resurfacing – Double Lift
RM	Major Resurfacing – removes existing asphalt and replace with existing plus and additional lift.
PR1	Pulverizing and Resurfacing
PR2	Pulverizing and Resurfacing – Double Lift
BS	Tolerable standard for lower volume roads: – Rural and Semi-Urban Cross sections only. Improves drainage and adds structure (granular base) and a surface but not to a reconstruct standard. Typically specified where width is to an acceptable standard.
RW	Resurface and Widen- adds additional lanes and resurfaces the entire road
REC	Reconstruction
RNS	Reconstruction Nominal Storm Sewers (Urban: no new sewer, adjust manholes, catch basins, add
RSS	Reconstruction including Installation of Storm Sewers (New storm sewers, and manholes in addition
NC	Proposed Road Construction
SRR	Storm Sewer Installation and Road Reinstatement
Additional Treatments	
BSgravel	Tolerable standard for lower volume roads – Rural and Semi-Urban Cross sections only. Improves drainage and adds structure (granular base) to a gravel surface but not to a reconstruct standard. Typically specified where width is to an acceptable standard.
RECgravel	Reconstruction to a Gravel road surface. Typically specified where the width is less than standard and used to calculate replacement costs of the gravel roads.
RECIcb	Reconstruction to a surface treated surface and used to calculate replacement costs of existing surface treated road assets.
RECeth	Reconstruction to an earth surface. Used only in replacement cost development
DST	Double Surface Treatment. Typically specified where it appears that the gravel road surface is adequate and may be a converted to a hard top surface.
DSTconv	Double Surface Treatment Conversion. Used where a gravel road appears to be reasonably structurally sound and has adequate ditches. Add 75mm of Granular A and Double Surface Treat
DSTrehab	Pulverize and existing surface treated road and add 75mm of gravel and resurface treat. Typically specified where the road appears to be structurally sound but the surface treatment is deteriorated beyond the point where it should not be resurfaced,
SST	Single Surface Treatment
SST+	Single Surface Treatment and minor ditching
SST++	Single Surface Treatment , 10% base repairs and minor ditching
GRR /GRR2	Gravel road resurfacing 1 lift or 2 lifts; 75mm or 150mm; Plus includes ditching for 10% of the length
Micro	Microsurfacing
CRK	Crack sealing

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1 Introduction and Background

In the fall of 2012, the Province of Ontario, introduced a requirement for an Asset Management Plan (AMP) as a prerequisite for municipalities seeking funding assistance for capital projects, from the province; effectively creating a conditional grant. To qualify for future infrastructure grants, municipalities were required to develop an AMP that was approved by council by December 2013. On April 26, 2013 the province announced that it had created a $100 million Infrastructure Fund for small, rural and northern municipalities.

Subsequently, the province has introduced further initiatives for infrastructure funding: the Ontario Community Infrastructure Fund (OCIF) and the Small Communities Fund (SCF). An Asset Management Plan approved by Council is required as part of the submission for OCIF Applications. Asset Management Plans will be reviewed for comprehensiveness.

Conditional Grants are not new to Ontario. Until the mid-1990's, Road Needs Studies (RNS) were completed by municipalities and submitted to the Ministry of Transportation (MTO) on an annual basis in order to receive provincial funding for their road programs.

The Township of North Dumfries (TND) currently develops an AMP for the various asset groups, roads being one of them. A key component of the AMP is a 'State of the Infrastructure' (SotI) review of the asset or asset group. The 2016 State of the Infrastructure -Roads provides the SotI review of the Township of North Dumfries road system. Further, the report also provides recommendations for budgets and road asset management; essentially an asset management plan for the roads asset group.

The scope of this report includes:

- Development of a database for the road system
- Review and condition rating on the road assets within the TND road system
- Traffic counting in approximately 60 locations and estimated counting for the remainder of the system
- Development/review of recommendations for improvement and associated costing on deficient assets
- Development of current replacement costs for each road asset using Ministry of Transportation Inventory Manual for Municipal Roads improvement Types
- Development of recommendations for annual budgets based on current costs for amortization/capital depreciation and major program areas based on updated unit costs provided by the TND
- Development of an analysis on the effect of current and recommended budgets on overall system performance
- Development of a geodatabase for the road system that includes relevant road related data
- Provision of Level of Service recommendations
- Provision of Asset Management Strategy recommendations

The 2016 report summarizes the condition data survey conducted during the late summer/ early fall of 2016. The database identifies the condition of each road asset by its time of need and recommended maintenance, rehabilitation or reconstruction treatment.

Recommendations are made based on the defects observed and other information available in the database at the time of preparation of the report. Once a road asset reaches the project level, the municipality may have selected another alternative based on additional information, asset management strategy, development considerations or available funding.

Road sections that will not be addressed in the immediate plan should be reviewed for advisory signage, as a risk management exercise.

4 Roads believes that the content of this report satisfies the State of the infrastructure requirements and provides a solid foundation to further develop and evolve the Expected Levels of Services, Asset Management and Financing requirements. 4 Roads Management Services Inc. has prepared this report in a format that it believes will readily lend itself to integration with the corporate AMP.

The Inventory Manual methodology is discussed further in Section 2 of this report and Appendix A.

2 Asset Condition Rating Methodology

2.1 Asset Condition Rating Methodology

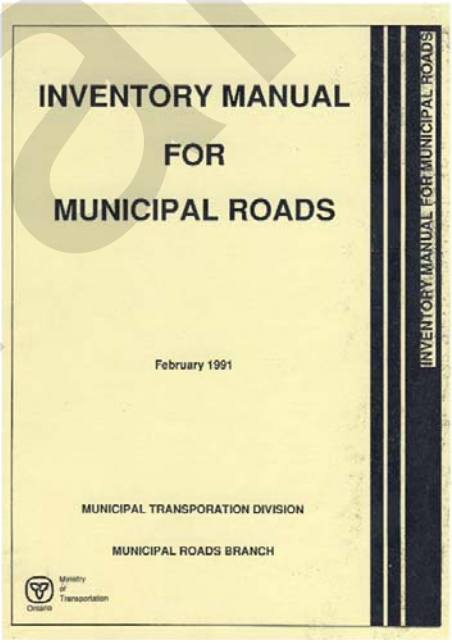
The provincial requirements for AMP's include asset condition assessment in accordance with standard engineering practices. The road section reviews follow the methodology of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

2.1.1 Inventory Manual History

From the 1960's until the mid 1990's, the Ministry of Transportation (MTO) required municipalities to regularly update the condition ratings of their road systems in a number of key areas. The process was originally created by the MTO, as a means to distribute conditional funding, on an equitable basis, between municipalities. The report was referred to as a 'Road Needs Study' (RNS) and was required in order to receive a conditional grant to subsidize the municipal road programs. After the introduction in the 1960's by the MTO, the methodology evolved into the current format by the late 1970's. The most current version of the Inventory Manual is dated 1991, and is the methodology used for this report. The practice was discontinued by a number of municipalities, when conditional funding for roads was eliminated in the mid 1990's.

2.1.2 Inventory Manual Overview

The Inventory Manual Methodology is a sound, consistent, asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound asset management practice that should be repeated on a cyclical basis. The road section review identifies the condition of each road asset by its time of need and recommended rehabilitation strategy.



The TND report summarizes the road system survey conducted during the late summer / early fall of 2016. The report provides an overview of the overall condition of the road system by road section, including such factors as structural adequacy, drainage, and surface condition. The study also provides an indication of apparent deficiencies in horizontal and vertical alignment elements, as per the Ministry of Transportation's manual, "Geometric Design Standards for Ontario Highways".

Further, the report provides an overview of the physical and financial needs of the road system, which may be used for programming and budgeting. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the project.

Asset Management by its very nature is holistic. Managing a road network based solely on pavement condition would be critically deficient in scope in terms of the information required to make an informed decision as to the improvements required on a road section.

The *Inventory Manual* offers a holistic review of each road section, developing a Time of Need (TON) or an Adequate rating in six areas that are critical to municipal decision making:

- Geometrics
- Surface Type
- Surface Width
- Capacity
- Structural Adequacy
- Drainage

4 Roads refers to the above six areas as critical. The Inventory Manual describes the standards in 4 of the areas as 'Minimum Tolerable Standards. To render an appropriate improvement recommendation, consideration should be given to each of the areas. Given the 'Minimum Tolerable' designation in the manual, 4 Roads has referred to the areas as 'critical'.

Evaluations of each road section were completed generally in accordance with the MTO's *Inventory Manual for Municipal Roads* (1991). Data collected was entered directly into WorkTech's Asset Foundation software. Condition ratings, Time of Need, Priority Ratings, and associated costs were then calculated by the software, in accordance with the *Inventory Manual*. Unit costs for construction were developed based on 4 Roads experience through comparative analysis with similar municipalities.

Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, or a combination of these factors. As an example, section changes should occur as surface type, surface condition, cross-section, or speed limit changes.

The Condition Ratings, developed through the scoring in the *Inventory Manual*, classify roads as 'NOW', '1 to 5', or '6 to 10' year needs for reconstruction. The Time of Need is a prediction of the time until the road requires reconstruction, *not the time frame until action is required*. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible, to further defer the need to reconstruct.

Field data is obtained through a visual examination of the road system and includes: structural adequacy, level of service, maintenance demand, horizontal and vertical alignment, surface and shoulder width, surface condition, and drainage. The Condition Rating is calculated based upon a combination of other calculations and data.

To best utilize the database information and modern asset management concepts, it has to be understood that the Time of Need (TON) ratings are the estimated time before the road would require reconstruction. NOW needs are still roads that require reconstruction; however, it is not intended that '1 to 5' and '6 to 10' year needs are to be acted on in that timeframe. The '1 to 5' and '6 to 10' year needs are current candidates for resurfacing treatments that will elevate their structural status to 'ADEQ', and offer the greatest return on investment for a road authority (notwithstanding a drainage or capacity need, etc.). The Time of Need ratings from the Structural Adequacy perspective are described more fully in Appendix A.

2.2 Types of Improvements

This report identifies ratings that are resultant from identification of deficiencies on each road section that equate to a TON in one or more of the six critical areas: Geometry, Surface Type, Surface Width, Capacity, Structural Adequacy, or Drainage. Based on the ratings and the deficiencies noted an improvement type recommendation is also provided.

The key factor in providing an improvement type recommendation is the visual survey. During the visual survey, a determination is made as to whether the appearance and performance of a road relates to an underlying structural problem, or simply to aged surface materials. A road's structural or drainage problem would tend to result in a reconstruction/ replacement treatment recommendation, whereas aged surface materials would result in a resurfacing/rehabilitation treatment recommendation. A determination of the root cause of the problem or the condition is critical; reconstructing a road that should have had some type of resurfacing treatment would be an ineffective use of available resources. For the purposes of this report, the standard improvement types and associated costing formulae identified in the Inventory Manual have been used. The table below provides a list of road improvements.

Table 2.1: Road Improvement Types

Inventory Manual Improvements	
Code	**Description**
R1	Basic Resurfacing
R2	Basic Resurfacing – Double Lift
RM	Major Resurfacing – removes existing asphalt and replace with existing plus and additional lift.
PR1	Pulverizing and Resurfacing
PR2	Pulverizing and Resurfacing – Double Lift
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RW	Resurface and Widen- adds additional lanes and resurfaces the entire road
REC	Reconstruction
RNS	Reconstruction Nominal Storm Sewers (Urban: no new sewer, adjust manholes, catch basins, add sub-
RSS	Reconstruction including Installation of Storm Sewers (New storm sewers, and manholes in addition to the
NC	Proposed Road Construction
SRR	Storm Sewer Installation and Road Reinstatement
Additional Treatments	
BSgravel	Tolerable standard for lower volume roads – Rural and Semi-Urban Cross sections only. Improves drainage and adds structure (granular base) to a gravel surface but not to a reconstruct standard. Typically specified where width is to an acceptable standard.
RECgravel	Reconstruction to a Gravel road surface. Typically specified where the width is less than standard and used to calculate replacement costs of the gravel roads.

Additional Treatments, Cont'd	
RECIcb	Reconstruction to a surface treated surface and used to calculate replacement costs of existing surface treated road assets.
RECeth	Reconstruction to an earth surface. Used only in replacement cost development
DST	Double Surface Treatment. Typically specified where it appears that the gravel road surface is adequate and may be a converted to a hard top surface.
DSTconv	Double Surface Treatment Conversion. Used where a gravel road appears to be reasonably structurally sound and has adequate ditches. Add 75mm of Granular A and Double Surface Treat
DSTrehab	Pulverize and existing surface treated road and add 75mm of gravel and resurface treat. Typically specified where the road appears to be structurally sound but the surface treatment is deteriorated beyond the point where it should not be resurfaced,
SST	Single Surface Treatment
SST+	Single Surface Treatment and minor ditching
SST++	Single Surface Treatment , 10% base repairs and minor ditching
GRR /GRR2	Gravel road resurfacing 1 lift or 2 lifts; 75mm or 150mm; Plus includes ditching for 10% of the length
Micro	Microsurfacing
CRK	Crack sealing

Table 2.2: Average Improvement Costs per Kilometre by Improvement Type

Improvement Class		Improvement ID / Description	Roadside Environment: Rural		Semi Urban		Urban		TOTAL		% OF TOTAL		Cost /km ($)
			Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	
Const	BS	Base and Surface	10.874	2,969,459	3.339	949,039	0.109	52,710	**14.322**	**3,971,208**	9.17%	9.62%	277,280
Const	NONE	No Improvement Required	1.943	0	0.576	0	1.931	0	**4.45**	**0**	2.85%		-
Const	REC	Reconstruction - Rural	15.74	8,392,578	3.511	2,055,667	0	0	**19.251**	**10,448,246**	12.33%	25.32%	542,738
Const	REChd	Reconstruction - Rural- Heavy Duty	7.462	8,028,078	0.927	818,220	0	0	**8.389**	**8,846,298**	5.37%	21.44%	1,054,512
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0.208	116,743	0.216	186,165	**0.424**	**302,908**	0.27%	0.73%	714,406
Const	RSS	Reconstruction with Storm Sewers	0	0	3.351	4,926,649	0.202	293,835	**3.553**	**5,220,484**	2.28%	12.65%	1,469,317
Maint	CRK	Crack Sealing	1.62	6,480	0.974	3,896	5.608	22,432	**8.202**	**32,808**	5.25%	0.08%	4,000
Maint	GRRplus	Maintenance Gravel and Minor Ditching	4.191	141,413	0	0	0	0	**4.191**	**141,413**	2.68%	0.34%	33,742
Maint	MICRO	Microsurfacing	0.307	7,522	0	0	0	0	**0.307**	**7,522**	0.20%	0.02%	24,502
Maint	RSpLimit	Reduce Speed limit	0.33	0	0	0	0	0	**0.33**	**0**	0.21%		-
Maint	SD	Spot Drainage	8.137	39,058	0.887	4,258	0.35	1,680	**9.374**	**44,995**	6.00%	0.11%	4,800
Maint	SDcrk	Spot Drainage and Crack Sealing	21.32	187,616	2.197	19,334	0.255	2,244	**23.772**	**209,194**	15.23%	0.51%	8,800
Rehab	PR2	Pulverize and Resurface 2 - 100mm	3.153	565,943	3.243	619,785	0	0	**6.396**	**1,185,727**	4.10%	2.87%	185,386
Rehab	PR2sd	Pulverize and Resurface 2 -100mm and SD	20.161	4,089,545	2.638	502,735	0	0	**22.799**	**4,592,280**	14.60%	11.13%	201,425
Rehab	PR3	Pulverize and Resurface 3 - 150mm	0	0	2.633	832,151	0	0	**2.633**	**832,151**	1.69%	2.02%	316,047
Rehab	PR3sd	Pulv and Resurf - 3 , 150mm and SD	9.029	2,293,136	1.5	400,740	0	0	**10.529**	**2,693,875**	6.74%	6.53%	255,853
Rehab	R1	Basic Resurfacing 1 - 50mm	8.104	1,041,919	3.694	562,819	4.527	802,317	**16.325**	**2,407,055**	10.46%	5.83%	147,446
Rehab	R2	Basic Resurfacing 2 - 100mm	0	0	0	0	0.871	326,969	**0.871**	**326,969**	0.56%	0.79%	375,395
TOTAL			**112.37**	**27,762,747**	**29.678**	**11,812,035**	**14.069**	**1,688,353**	**156.117**	**41,263,134**			
% OF TOTAL			71.98%	67.28%	19.01%	28.63%	9.01%	4.09%					

Appendix A includes fuller descriptions of each of the above noted improvements.

Appendix B of this report includes a discussion of Pavement Structure and defects.

3 State of the Infrastructure

3.1 Scope / Asset Type(s)

This report addresses road assets only. The content will provide review and analysis of the road system from a number of perspectives including condition rating, functional classification, roadside environment, replacement cost and regulation 239/02 classification.

3.2 Section Numbering

The existing number system as reflected in the PSAB database did not appear to have a consistent naming convention. A simple numbering convention was developed where sections on east/west roads increased from west to east. Gaps were left between the asset numbers in case future re-sectioning was required. On road sections that ran north/south, a similar concept was applied where the numbers are sequential, but with gaps.

Road sections within road systems may be classified in a number of ways to illustrate the roadside environment, surface type, functional classification, and so forth. The classifications provide assistance in developing further information, with respect to the road system, such as replacement costs and performance modeling and expectations.

3.3 Surface Types and Roadside Environment

Roadside environment and surface type criteria of a road section are useful in characterization of the road section, and in determining costs for replacement, reconstruction and rehabilitation treatments.

The *Inventory Manual* classifies the roadside environment as Rural, Semi-Urban or Urban. The classification is determined by length, servicing, and adjacent land use.

- ***Rural Roads*** – within areas of sparse development, or where development is less than 50% of the frontage, including developed areas extending less than 300 m on one side or 200 m on both sides, with no curbs and gutters.
- ***Semi-Urban Roads*** – within areas where development exceeds 50% of the frontage for a minimum of 300 m on one side, or 200 m on both sides, with no curbs and gutters, with or without storm/combination sewers, or for subdivisions where the lot frontages are 30 m or greater.
- ***Urban Roads*** – within areas where there are curbs and gutters on both sides, served with storm or combination sewers, or curb and gutter on one side, served with storm or combination sewers, or reversed paved shoulders with, or served by, storm or combination sewers, or for subdivisions with frontages less than 30 m.

Table 3.1: Surface Type and Roadside Environment Distribution

Surface Material	Roadside Environment						TOTAL		% OF TOTAL	
	R		S		U					
	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
Gravel, Stone, Other Loosetop	18.838	37.675	0.359	0.718	0	0	**19.197**	**38.393**	12.30%	12.30%
High Class Bit.-asphalt	92.932	185.863	29.319	58.638	14.069	28.138	**136.32**	**272.639**	87.32%	87.32%
Low Class Bit.-surface treated	0.601	1.202	0	0	0	0	**0.601**	**1.202**	0.38%	0.38%
TOTAL	**112.37**	**224.74**	**29.678**	**59.356**	**14.069**	**28.138**	**156.117**	**312.234**		
% OF TOTAL	71.98%	71.98%	19.01%	19.01%	9.01%	9.01%				

3.4 Minimum Maintenance Standard (MMS) Classification

In November 2002, Regulation 239/02, *Minimum Maintenance Standards for Municipal Highways (MMS)* came into effect. Essentially, if a municipality met the standard and documented it, they would not be negligent per Section 44(3)c of the Municipal Act noted above. Regulation 239/02 provided for a review five years after its original implementation. A process to revise Regulation 239/02, chaired by the Ontario Good Roads Association (OGRA), culminated in a revised regulation, Regulation 23/10, coming into effect in February 2010.

In the late fall of 2011, a court decision (Giuliani) was rendered that effectively created case law that negated the protection that the MMS afforded, and in particular, Tables 4 and 5 of the regulation (Tables 4 and 5 address Snow Accumulation and Icy Roads). Essentially, the decision created a new standard that went beyond the MMS. The effect on a municipality is that a higher standard of weather monitoring and documentation and response to monitoring is required.

OGRA re-called the MMS committee to further amend the regulation, to address the outcome of the Giuliani decision. As a result of the committee meetings and discussions with the province, Regulation 47/13 came into effect, amending Regulations 239/02 and 23/10, on January 25 2013. The current regulation is now in the mandatory review cycle.

The Minimum Maintenance Standards do not have to be adopted by a municipal council per se. The regulation is provincial, applies to all municipalities, and is available for municipalities to use as a defense if they have met the standard and documented it. The more important issue would be to ensure that the TND has the appropriate Standard Operating Procedures (SOP's) in place, and that they are followed and documented, rather than trying to reword or parallel the language of the regulation into a document that is municipality-specific.

Table 3.2: Regulation 239/02 Minimum Maintenance Standard Road Classification

Annual Average Daily Traffic (number of motor vehicles per day)	Posted or Statutory Speed Limit (kilometres per hour)						
	100	90	80	70	60	50	40
15, 000 or more	1	1	1	2	2	2	2
12, 000 - 14, 999	1	1	1	2	2	3	3
10, 000 - 11, 999	1	1	2	2	3	3	3
8, 000 - 9, 999	1	1	2	3	3	3	3
6, 000 - 7, 999	1	2	2	3	3	3	3
5, 000 - 5, 999	1	2	2	3	3	3	3
4, 000 - 4, 999	1	2	3	3	3	3	4
3, 000 - 3, 999	1	2	3	3	3	4	4
2, 000 - 2,999	1	2	3	3	4	4	4
1, 000 - 1,999	1	3	3	3	4	4	5
500 - 999	1	3	4	4	4	4	5
200 - 499	1	3	4	4	5	5	5
50 - 199	1	3	4	5	5	5	5
0 - 49	1	3	6	6	6	6	6

Traffic counts are important for a number of decision making purposes, with respect to the road system. Accurate, defensible traffic counts, in conjunction with the posted speed limits, are used in determining the MMS class of the respective road sections.

Roads are divided into six service classes by posted speed and traffic count, with Class 1 being the highest service level and Class 6 being the lowest. There are no service standards for Class 6 roads which have less than 50 vehicles per day. Table 3.2 shows Regulation 239/02's traffic/speed/ classification matrix.

As per the Regulation, different road classifications require different response times. For example, the response time that is required to remove snow accumulation is 12 hours for a Class 3 road, and 16 hours for a Class 4.

Response time is the time from when the municipality becomes aware that a condition exists, until the time that the condition is corrected or brought within the limits specified in the regulation. This may have a significant impact with respect to the equipment and staffing that may be required to meet the standard, particularly in the case of winter control. The implications are that this increased service level

may require the municipality to increase the inspection frequency, staff, and machinery to deliver the service beyond the service delivery hours that may currently exist.

The distribution of the Regulation 239/02 classes across the road system is detailed in Table 3.3.

Table 3.3: Minimum Maintenance Standards Class Distribution

Roadside	Regulation 239/02 Classification				TOTAL	% OF TOTAL
	3	4	5	6		
Rural	18.837	71.596	21.938		**112.37**	71.98%
Semi Urban	0.69	11.165	17.639	0.184	**29.678**	19.01%
Urban		6.625	7.354	0.09	**14.069**	9.01%
TOTAL	**19.527**	**89.386**	**46.931**	**0.274**	**156.117**	
% OF TOTAL	12.51%	57.26%	30.06%	0.18%		

WorkTech Asset Manager Foundation automatically classifies road sections by Regulation 239/02 once traffic data and speed limits have been entered.

3.5 Functional / Existing / Design Classifications

Roads are further classified within the database by classes such as Local, Collector, or Arterial and Residential or Industrial. Items 33 and 105 in the *Inventory Manual* provide further direction on determination of the Existing or Design Classes of road. Generally, the classifications are predicated on the existing use, roadside environment, and anticipated growth over either the ten- or twenty-year planning horizon.

Table 3.4: Functional Road Class Distribution

Functional Class / Subtype		Roadside Environment						TOTAL		% OF TOTAL	
		R		S		U					
	Lanes	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
200	2	17.953	35.905	0	0	0	0	**17.953**	**35.905**	11.50%	11.50%
300	2	15.372	30.744	0	0	0	0	**15.372**	**30.744**	9.85%	9.85%
400	2	43.5	87	0	0	0	0	**43.5**	**87**	27.86%	27.86%
500	2	23.414	46.828	0	0	0	0	**23.414**	**46.828**	15.00%	15.00%
600	2	2.586	5.172	0	0	0	0	**2.586**	**5.172**	1.66%	1.66%
700	2	8.807	17.614	0	0	0	0	**8.807**	**17.614**	5.64%	5.64%
800	2	0.37	0.739	0	0	0	0	**0.37**	**0.739**	0.24%	0.24%
C/R	2	0.369	0.738	5.024	10.048	4.838	9.676	**10.231**	**20.462**	6.55%	6.55%
CCI	2	0	0	0.214	0.428	0.096	0.192	**0.31**	**0.62**	0.20%	0.20%
L/R	2	0	0	17.504	35.008	9.135	18.27	**26.639**	**53.278**	17.06%	17.06%
LCI	2	0	0	6.936	13.872	0	0	**6.936**	**13.872**	4.44%	4.44%
TOTAL		**112.37**	**224.74**	**29.678**	**59.356**	**14.069**	**28.138**	**156.117**	**312.234**		
% OF TOTAL		71.98%	71.98%	19.01%	19.01%	9.01%	9.01%				

The road sections are classified by the rater at the time of the field review. Table 3.4 identifies the Functional Road Class Distribution.

3.6 Horizontal and Vertical Alignment

The changes in direction and elevation of the road are referred to as the horizontal and vertical alignment. The changes in direction should be designed and constructed such that the posted speed limit of the road section may be safely maintained throughout the section. If maintaining the posted speed in safety cannot be achieved, then the horizontal or vertical curve would be identified as substandard.

Lower volume roads that have not been reconstructed, tend to closely follow (or avoid) the existing contours of the land. In southern Ontario, which is relatively flat, there was a greater tendency to follow the alignments of the original Township surveys. However, where these roads were adjacent to larger streams and rivers, there was still a tendency to follow the topography. The result was/is a road alignment that tends to change vertical and horizontal direction frequently; at times without much notice.

When a new road is designed, one of the considerations is the Safe Stopping Distance (SSD). The calculation of the distance to stop safely from any given speed is based upon several factors, such as posted speed limit, reaction times, and friction. When road sections are evaluated for a road needs study, the number of vertical and horizontal curves that appear to be deficient are identified. The identification is based on whether there is sufficient SSD for the posted speed limit. The following table is an excerpt from the Geometric Design Standards for Ontario Highways, and indicates the SSD's required for various design speeds.

Figure 3.1: Safe Stopping Distance (Table C2-1 from MTO Geometric Design Standards for Ontario Highways)

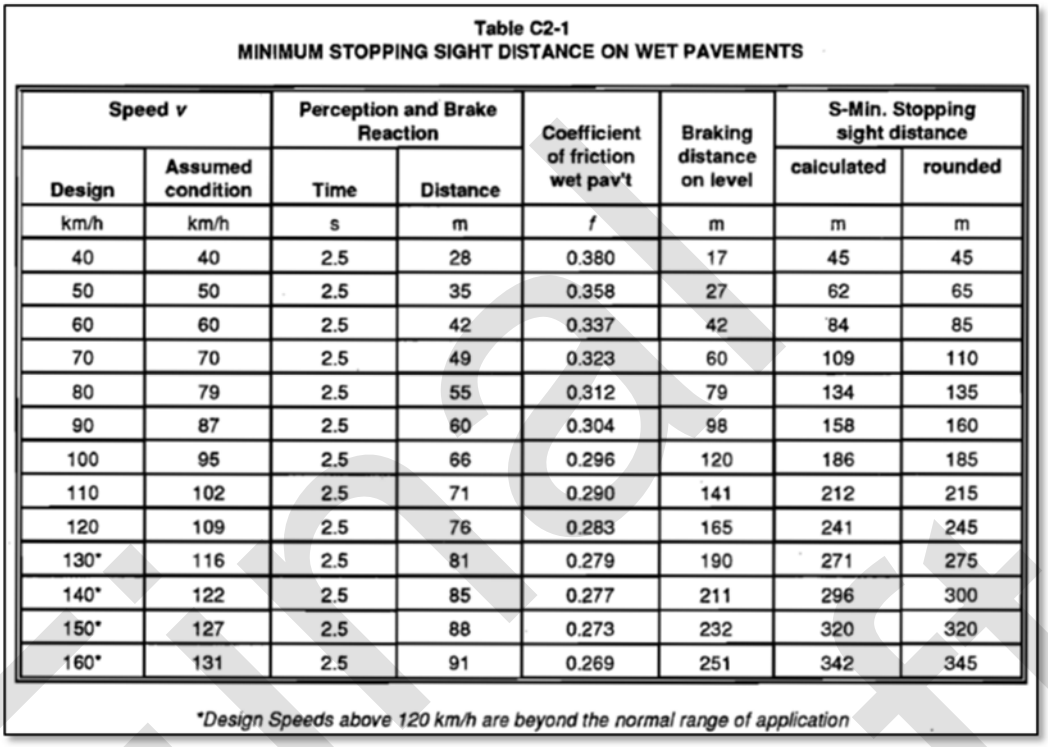


Table C2-1
MINIMUM STOPPING SIGHT DISTANCE ON WET PAVEMENTS

Speed *v*		Perception and Brake Reaction		Coefficient of friction wet pav't	Braking distance on level	S-Min. Stopping sight distance	
Design	Assumed condition	Time	Distance			calculated	rounded
km/h	km/h	s	m	*f*	m	m	m
40	40	2.5	28	0.380	17	45	45
50	50	2.5	35	0.358	27	62	65
60	60	2.5	42	0.337	42	84	85
70	70	2.5	49	0.323	60	109	110
80	79	2.5	55	0.312	79	134	135
90	87	2.5	60	0.304	98	158	160
100	95	2.5	66	0.296	120	186	185
110	102	2.5	71	0.290	141	212	215
120	109	2.5	76	0.283	165	241	245
130*	116	2.5	81	0.279	190	271	275
140*	122	2.5	85	0.277	211	296	300
150*	127	2.5	88	0.273	232	320	320
160*	131	2.5	91	0.269	251	342	345

**Design Speeds above 120 km/h are beyond the normal range of application*

On rural roads, one of the effects of substandard alignments is a decrease in the Average Operating Speed through the road section. An Average Operating Speed that is significantly lower than the posted speed will result in a Geometric Need for the road section. Table 3.5 from the *Inventory Manual* identifies the limits that will trigger a geometric need for typical posted speed limits.

Table 3.5: Posted Speed vs. Minimum Tolerable Operating Speed

Item	Speed					
Legal Speed Limit	40	50	60	70	80	90
Minimum Tolerable Operating Speed	35	45	50	60	65	75

The following pictures were not taken in TND, but provide examples of potentially substandard alignments.

Figure 3.2: Potentially Substandard Vertical and Horizontal Alignment

Table 3.6 provides a listing of TND road sections with a 'NOW' need for geometry.

Table 3.6: NOW Needs For Geometry

Asset ID	Street Name	From Desc	To Desc	Length (km)
1082	Brant Waterloo Rd	1700m East of Sprague's Road (Regional Road 75)	900m West of West River Road North	0.922
1410	Alps Rd	Northumberland St (Reg. Rd 58)	330m East of Regional Road 58	0.33
1555	Langdon Dr	City of Cambridge Boundary	400m North of Whistlebare Road	0.601
1810	Reidsville Rd	Wrigley Rd (Reg. Rd 49)	Brant Waterloo Rd	1.709
			Total Length	**3.562**

Appendix F includes a listing of all of the rural road sections with potentially sub-standard vertical or horizontal alignments that should be reviewed for signage, speed reduction, or correction. Signage should be in conformity with the Ontario Traffic Manual. The alignments have been referred to as 'potentially substandard' as the study undertaken is only a visual assessment of existing conditions. Further engineering review would be required to determine if the curves are substandard and if any additional signage or correction is required.

3.7 Substandard Width

The Inventory Manual also includes an analysis of width. Different classes of roads have different minimum tolerable standards for road width depending on traffic volume. The minimum tolerable standards generally conform to the Ontario Geometric Design Guidelines and the Transportation Association of Canada Guidelines.

Table 3.7 provides a listing of road sections with a 'NOW' Need for width.

Table 3.7: NOW Need Width

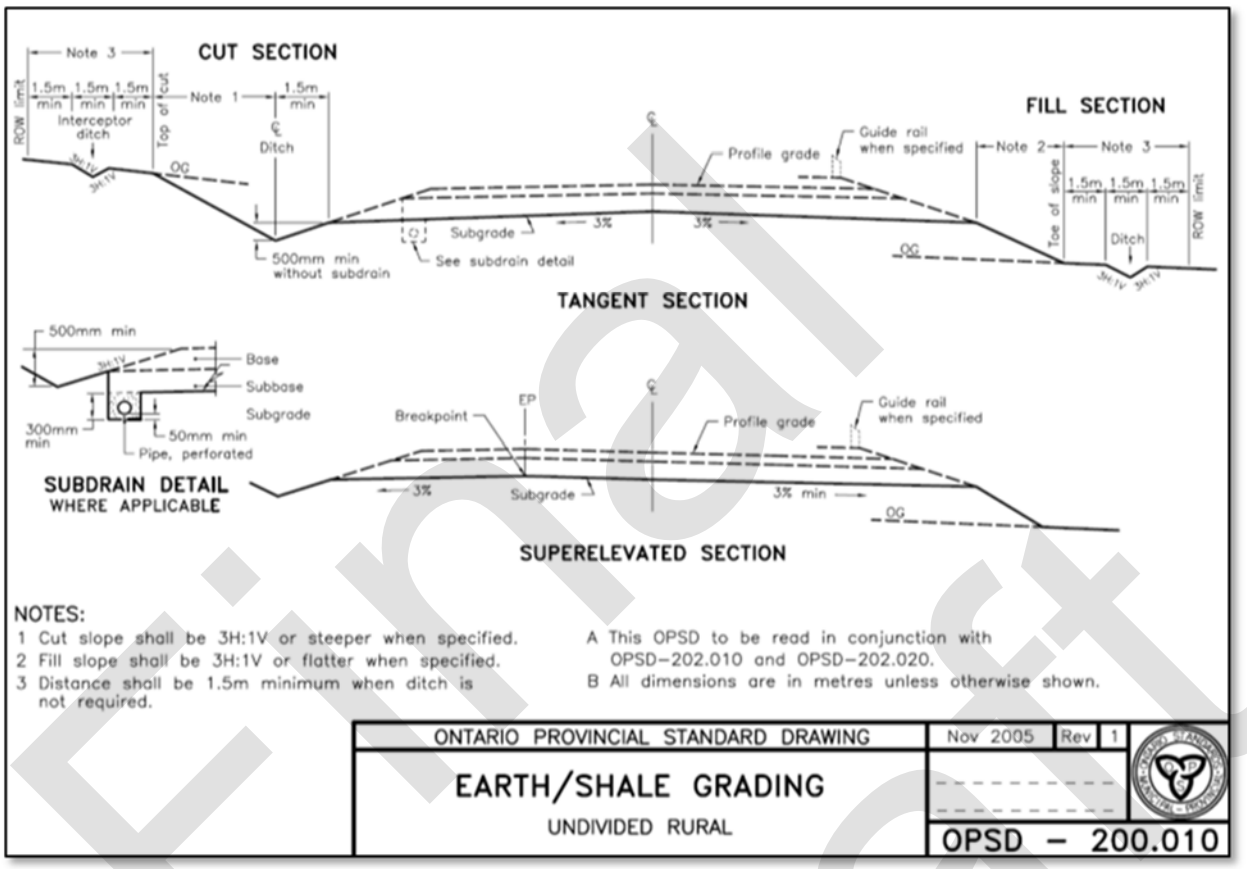
Asset ID	Street Name	From Desc	To Desc	Length (km)
1250	Nith Rd	1434m N of Brant Waterloo Rd	North End	0.069
1555	Langdon Dr	City of Cambridge Boundary	400m North of Whistlebare Road	0.601
3620	Hall St	Willison St	Colquhoun St	0.105
3680	Bute St	Northumberland St (Reg. Rd 58)	Bute Street Bend	0.101
			Total Length	**0.876**

3.8 Drainage

Adequate drainage is critical to the performance of a road to maximize its life expectancy. Roads are designed, constructed, and maintained in order to minimize the amount of water that may enter, or flow over, the road structure.

In the case of water flowing over the road, assessment must be made of the circumstances on a site-specific basis. Factors that should be considered include the traffic volumes of the road section, economic impacts to the loss of the use of the road, upgrade costs, and risks.

Figure 3.3: OPSS 200.10



Water in a road base can cause different reactions at different times of the year. In non-freezing conditions, the granular road base can become saturated. Too much water displaces the granular material; it removes the material's ability to support the loads for which it was designed. Too much water in the granular material actually acts like a lubricant, and facilitates the displacement of the material under load. In freezing conditions, water in the road structure can cause frost heave, potholes, and pavement break-up as the water freezes and expands. Generally, a saturated granular road base results in structural failure of the road.

Figure 3.3 provides an example of a rural road, illustrating what the relationship between the gravel road base and the drainage should be. The relationship is the same in an urban system, although not as obvious. Rural road drainage is typically achieved through roadside ditches. Rural road ditches should be a minimum of 500 mm below the granular road base, to ensure that the road base remains free from moisture and maintains its ability to carry loads.

Urban roads typically have a storm sewer pipe network that carries the minor storm event. The roadway itself is often part of the overland flow route for the major event. The drainage of the granular road base is accomplished through sub-drains installed below the curb and gutter, lower than the lowest elevation

of the granular base. This satisfies the same purpose as the ditch in a rural cross-section, by providing an outlet to ensure that the granular base remains dry.

Evaluations of the drainage scores were in part predicated upon the structural score. For example where a road section had virtually no ditch, or very minimal ditching but the road structure did not show any signs of failure typically observed when there is inadequate drainage, then generally a rating was between 12 and 14 and an 'SD- (Spot drainage) improvement noted. Where it was obvious that the inadequate ditch was exacerbating the distress on the road or there was occasional flooding, the score would be further reduced and the improvement type would be some type of major rehabilitation or reconstruction dependent upon the traffic volumes. Table 3.8 provides an overview of the drainage needs of the road system by Time of Need.

Table 3.8: Drainage by Roadside and Time of Need (Km)

	Time of Need					
Roadside	1 to 5	6 to 10	ADEQ	NOW	TOTAL	% OF TOTAL
Rural	0.901	100.576	10.433	0.461	112.37	71.98%
Semi Urban	1.487	18.063	10.128	0	29.678	19.01%
Urban	0.202	0.714	13.153	0	14.069	9.01%
TOTAL	2.59	119.353	33.714	0.461	156.117	
% OF TOTAL	1.66%	76.45%	21.60%	0.30%		

Table 3.9: Drainage by Roadside Environment and Drainage Type (km)

Roadside	AS - Adjacent Road, Storm Sewer	DS - Ditch and Storm Sewer	N - None	OD - Open Ditch	SS - Storm Sewer	TOTAL	% OF TOTAL
Rural	0	0	4.011	108.359	0	**112.37**	71.98%
Semi Urban	0.208	3.451	4.371	21.648	0	**29.678**	19.01%
Urban	0	0.323	0.202	0.225	13.319	**14.069**	9.01%
TOTAL	**0.208**	**3.774**	**8.584**	**130.232**	**13.319**	**156.117**	
% OF TOTAL	0.13%	2.42%	5.50%	83.42%	8.53%		

Maintenance of the drainage system(s) is critical to the long-term performance of a road system. Low volume rural roads tend to have a winter maintenance program that includes the application of sand to improve traction. Over time, that sand builds up on the edge of the pavement, to a point where it effectively blocks runoff from getting to the ditch. The runoff is trapped at the edge of pavement, where it saturates that area of the road bed, contributing to the early failure of the edge of the pavement. This element of the road cross-section is not scored as part of the overall evaluation.

Presence or absence of roadside berms is not evaluated during a road review. This is a maintenance issue, however, if roadside berms are not removed, the effect on the overall pavement is similar to not having a ditch. Water cannot drain from the road and it enters into the granular base potentially saturating it. The saturated base cannot support load.

Figure 3.4: Poor Shoulder Drainage

3.8.1 Drainage Outlet and Master Planning

Correcting drainage issues is not quite as simple as digging a ditch or installing a storm sewer. In Ontario, Common Law for drainage is such that water cannot simply be collected and directed. It has to be directed to a legal, adequate outlet. There are two primary methodologies to achieve the legal outlet; a Class Environmental Assessment Process or a petition for a Municipal Drain under the Drainage Act. The 'adequate' component is an engineering function.

As the TND reconstructs/rehabilitates sections of the road network in the urban and semi urban areas, a Master Drainage Plan should be developed as part of a Class Environmental Assessment process prior to the reconstruction process occurring, in order that both minor and major storm events are dealt with appropriately. A Master Drainage Plan is not part of this report.

3.9 Boundary Roads

Boundary roads, are roads that a municipality would have in common with the abutting municipality. In order to manage the joint responsibilities, a Boundary Road Agreement that identifies the responsibilities of both agencies is created. The agreements are usually in writing; however, some are informal.

The Boundary Road Agreement should identify costs sharing and responsibility arrangements for maintenance or capital works on the road section. From a risk management perspective, the agreement reduces the risk for one of the parties in the event of a claim, depending upon the content of the agreement.

Boundary road reporting can be dealt with in one of two ways: the length can be split to provide a more accurate depiction of the road system that is actually maintained by the agency, or they may not be adjusted. When MTO was providing subsidy, the roads were adjusted for reporting and accounting purposes. For the purposes of this report adjustment has been made to the road system sizes to account for the 50% sharing of the length of the boundary roads.

When a boundary is reconstructed on a day labour basis by the adjacent municipalities, the project should be treated no differently than if the work were being tendered. The exposure to risk for the TND is no different. The assignment of the various aspects of the work should be clear and the timing for completion of the tasks clearly identified and adhered to.

The listing of the boundary roads is in Appendix F.

Table 3.10: Boundary Road Summary

Adjacent Agency	Asset ID	Street Name	Rural	Semi Urban	Urban	TOTAL
Brant County	1000	Brant Waterloo Rd	1.18			**1.18**
Brant County	1010	Brant Waterloo Rd	1.03			**1.03**
Brant County	1020	Brant Waterloo Rd	0.48			**0.48**
Brant County	1030	Brant Waterloo Rd	1.52			**1.52**
Brant County	1040	Brant Waterloo Rd	1.81			**1.81**
Brant County	1050	Brant Waterloo Rd	1.3			**1.3**
Brant County	1070	Brant Waterloo Rd		0.3		**0.3**
Brant County	1080	Brant Waterloo Rd	1.4			**1.4**
Brant County	1082	Brant Waterloo Rd	0.92			**0.92**
Brant County	1084	Brant Waterloo Rd	0.9			**0.9**
Brant County	2060	Lockie Rd	2.85			**2.85**
Brant County	2070	Lockie Rd	1.52			**1.52**
Brant County	2080	Lockie Rd	1.51			**1.51**
Township of Puslinch	2280	Gore Rd	0.74			**0.74**
Township of Puslinch	2290	Gore Rd	2.44			**2.44**
Township of Puslinch	2300	Gore Rd	0.97			**0.97**
TOTAL			**20.56**	**0.3**	**0**	**20.86**

4 Road System Condition

The provincial requirements for AMP's include asset condition assessment in accordance with standard engineering practices. The road section reviews follow the methodology of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

4.1 Road System Condition by Time of Need

The Inventory Manual methodology results in overall rating of road sections by Time of Need (TON); NOW, 1 to 5, 6 to 10, or Adeq (Adequate).Table 4.1 below provides a breakdown of the road system by time of Need and MMS Class.

Table 4.1: Roads System by Time of Need and MMS Class

Time of Need	Regulation 239/02 Classification								TOTAL	
	3		*4*		*5*		*6*			
	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km	Length (km)	Lane-km
1 to 5	3.917	7.834	16.886	33.772	13.121	26.242	0	0	**33.924**	**67.848**
6 to 10	7.466	14.932	42.228	84.455	18.104	36.208	0	0	**67.798**	**135.595**
ADEQ	0.307	0.614	8.565	17.129	4.117	8.234	0.274	0.548	**13.263**	**26.525**
NOW	7.837	15.673	21.708	43.415	11.589	23.178	0	0	**41.133**	**82.266**
TOTAL	**19.527**	**39.053**	**89.386**	**178.771**	**46.931**	**93.862**	**0.274**	**0.548**	**156.117**	**312.234**
% OF TOTAL	12.51%	12.51%	57.26%	57.26%	30.06%	30.06%	0.18%	0.18%		
System Adequacy	59.9%	59.9%	75.7%	75.7%	75.3%	75.3%	100.0%	100.0%	73.7%	73.7%
Good to Very Good	39.8%	39.8%	56.8%	56.8%	47.3%	47.3%	100.0%	100.0%	51.9%	51.9%

4.2 Road System Adequacy

The system adequacy is a measure of the ratio of the 'NOW' needs to the total system, and includes needs from the six critical areas described earlier in the report. The overall TON is the most severe or earliest identified need. For example a road section may appear to be in good condition, but is identified as a NOW need for capacity, indicating that it requires additional lanes.

$$\text{System Adequacy} = \frac{\text{Total System (km)} - \text{NOW Deficiencies (km)}}{\text{Total System (km)}} \times 100$$

The TND currently has a road system adequacy measure of 73.7**%**. The road system currently measures 26.3 centreline-kilometres (adjusted for boundary roads), with 41.133 kilometres rated as deficient in the 'NOW' time period.

The *Inventory Manual* provides direction that roads with a traffic volume of less than 50 vehicles per day *are deemed to be adequate,* even if they have structural, geometric, or drainage deficiencies that would otherwise be identified as being in a Time of Need. Low volume road deficiencies were to be corrected within the maintenance budget. This approach is directly parallel to Regulation 239/02, *Minimum Maintenance Standards for Municipal Roads*, which states that roads with less than 50 vehicles per day, and a speed limit of less than 80 km/hr., are classified as Class 6 with no standard for repair. This factor has a very small effect on the system adequacy calculation for the Township of North Dumfries. There is 0.274 km that have an actual or estimated traffic count of less than 50 vehicles per day.

The traditional target adequacy for upper-tier road systems (Regions and Counties) was 75%, while a lower-tier's target adequacy was 60. Based on these former MTO targets, which were in effect when the municipal grant system was in place, the target adequacy for the TND should be 60%, as a minimum. The minimum target adequacies were established by MTO, to reflect the nature and purpose of the road system.

The overall condition of the road system is at the boundary between fair and good using the weighted average Physical Condition of 58.45. This would indicate the average road section has approximately just over 5 years of remaining service life. The overall condition may be influenced by the following factors;

- The overall condition may have been influenced by Infrastructure Funds and Grants that may have not been identified in the annual or average annual funding level.
- New development roads are raising the average score.

The weighted average rating is of concern as it is relatively low and has been influenced by the newer subdivision roads. This would tend to indicate that the road system without the new development roads being included, is in poorer condition. Table 4.2 and Table 4.3 illustrates this point.

Table 4.2: Time of Need vs Roadside Environment

Roadside	Time of Need					% OF TOTAL	% NOW
	1 to 5	6 to 10	ADEQ	NOW	TOTAL		
Rural	21.68	63.4	4.35	32.77	**122.2**	73.57%	26.8%
Semi Urban	10.15	8.12	1.85	9.71	**29.83**	17.96%	32.5%
Urban	2.75	2.93	7.54	0.86	**14.07**	8.47%	6.1%
TOTAL	**34.57**	**74.45**	**13.75**	**43.33**	**166.1**		
% OF TOTAL	20.82%	44.82%	8.28%	26.09%			

Table 4.3: Physical Condition vs Roadside Environment

Physical Condition	Rural	Wt. Ave. Ph. Condition	Semi Urban	Wt. Ave. Ph. Condition	Urban	Wt. Ave. Ph. Condition	TOTAL
5	1.823	0.075	1.128	0.189	0.000	0.000	3.215
10	0.715	0.059	0.685	0.230	0.167	0.119	1.855
15	0.000	0.000	0.637	0.320	0.000	0.000	0.957
20	4.217	0.690	0.466	0.312	0.000	0.000	5.686
25	3.647	0.746	2.377	1.992	0.473	0.841	9.235
30	6.021	1.478	1.228	1.235	0.105	0.224	10.067
35	12.305	3.524	2.710	3.180	0.111	0.276	21.830
40	8.189	2.681	0.954	1.279	0.000	0.000	13.103
45	11.546	4.252	4.162	6.279	0.332	1.062	26.571
50	5.254	2.150	2.249	3.770	0.210	0.746	13.633
55	16.348	7.358	3.059	5.641	2.205	8.620	34.611
60	2.999	1.473	2.347	4.721	0.119	0.507	11.659
65	2.140	1.138	1.158	2.524	0.788	3.641	7.748
70	5.200	2.979	1.670	3.919	1.415	7.040	15.183
75	7.345	4.508	0.315	0.792	0.486	2.591	13.446
80	4.138	2.709	0.816	2.189	1.050	5.971	10.902
85	19.264	13.400	2.721	7.754	3.444	20.807	46.583
90	0.363	0.267	0.000	0.000	0.679	4.344	1.309
95	6.377	4.958	0.311	0.991	0.795	5.368	13.431
100	4.308	3.525	0.834	2.796	1.690	12.012	13.154
TOTAL	**122.199**	**57.969**	**29.827**	**50.114**	**14.069**	**74.169**	**274.178**
% OF TOTAL	44.57%		10.88%		5.13%		

4.3 Road System Needs

The estimates provided in this report are in accordance with the formulae included in the Inventory Manual. Other treatments have been developed by 4 Roads where an alternative seemed more appropriate. For example, from the traffic data it appears that a significant number of North Dumfries roads have a higher percentage of Commercial traffic. Improvement recommendations were developed to provide appropriate costing and improvement recommendations to deal with that circumstance. All treatments utilize the unit costs as identified in Table 4.2. These costs include adjustment factors as per the Inventory Manual, such as Basic Construction, Terrain, Contingency Roadside Environment, and Engineering.

Based on the unit costs identified in Table 4.4, the improvements costs have been calculated generally in accordance with TND Improvement Types. Table 4.5 identifies the improvement costs by Time of Need and Improvement Type.

Table 4.4: 2016 Unit Costs

Item	Unit	2016 Costs $
Excavation	m^3	12.00
Hot Mix Asphalt	t	75.00
Single Surface Treatment	m^2	2.75
Granular A	t	16.30
Granular B	t	12.50
Conc- Curb and Gutter-place	linear m	50.00
Conc- Curb and Gutter-removal	linear m	10.00
Subdrains	linear m	23.00
Storm Sewer-525mm	linear m	300.00
Manholes	ea	3500.00
• - manhole removed	ea	750.00
• - manholes-Adjust	ea	600.00
Catch Basins	ea	2000.00
Catch-Basins- removed	ea	420.00
Catch Basin Leads	Linear m	200.00
Catchbasins - adjust	ea	400.00
Asphalt Planing	m^2	5.00
Asphalt Pulverizing	m^2	1.70
Crack Sealing	m	2.00
Microsurfacing	m^2	3.5

Table 4.5: Improvement Costs by Improvement Type and Time of Need

Improvement Class		Improvement ID / Desc	Time of Need								TOTAL		% OF TOTAL		Cost /km ($)
			1 to 5		6 to 10		ADEQ		NOW						
			Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	
Const	BS	Base and Surface	501,079	1.8	2,815,300	10.176	0	0	654,830	2.346	**3,971,208**	**14.322**	9.62%	9.17%	277,280
Const	NONE	No Improvement Required	0	0	0	0	0	4.45	0	0	**0**	**4.45**		2.85%	-
Const	REC	Reconstruction - Rural	3,648,770	5.876	1,628,409	3.562	0	0	5,171,067	9.813	**10,448,246**	**19.251**	25.32%	12.33%	542,738
Const	REChd	Reconstruction - Rural- Heavy Duty	1,456,793	1.607	321,538	0.35	0	0	7,067,967	6.432	**8,846,298**	**8.389**	21.44%	5.37%	1,054,512
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0	0	0	0	302,908	0.424	**302,908**	**0.424**	0.73%	0.27%	714,406
Const	RSS	Reconstruction with Storm Sewers	1,018,947	0.653	715,393	0.47	66,119	0.047	3,420,025	2.383	**5,220,484**	**3.553**	12.65%	2.28%	1,469,317
Maint	CRK	Crack Sealing	0	0	0	0	32,808	8.202	0	0	**32,808**	**8.202**	0.08%	5.25%	4,000
Maint	GRRplus	Maintenance Gravel and Minor Ditching	0	0	141,413	4.191	0	0	0	0	**141,413**	**4.191**	0.34%	2.68%	33,742
Maint	MICRO	Microsurfacing	0	0	0	0	7,522	0.307	0	0	**7,522**	**0.307**	0.02%	0.20%	24,502
Maint	RSpLimit	Reduce Speed limit	0	0	0	0	0	0	0	0.33	**0**	**0.33**		0.21%	-
Maint	SD	Spot Drainage	0	0	44,093	9.186	902	0.188	0	0	**44,995**	**9.374**	0.11%	6.00%	4,800
Maint	SDcrk	Spot Drainage and Crack Sealing	0	0	209,194	23.772	0	0	0	0	**209,194**	**23.772**	0.51%	15.23%	8,800
Rehab	PR2	Pulverize and Resurface 2 - 100mm	287,725	1.502	0	0	11,371	0.069	886,631	4.825	**1,185,727**	**6.396**	2.87%	4.10%	185,386
Rehab	PR2sd	Pulverize and Resurface 2 -100mm and SD	2,867,606	14.249	34,810	0.182	0	0	1,689,864	8.368	**4,592,280**	**22.799**	11.13%	14.60%	201,425
Rehab	PR3	Pulverize and Resurface 3 - 150mm	712,995	2.248	0	0	0	0	119,156	0.385	**832,151**	**2.633**	2.02%	1.69%	316,047
Rehab	PR3sd	Pulv and Resurf - 3 , 150mm and SD	825,049	3.255	488,286	1.885	0	0	1,380,540	5.389	**2,693,875**	**10.529**	6.53%	6.74%	255,853
Rehab	R1	Basic Resurfacing 1 - 50mm	406,222	2.301	2,000,834	14.024	0	0	0	0	**2,407,055**	**16.325**	5.83%	10.46%	147,446
Rehab	R2	Basic Resurfacing 2 - 100mm	180,049	0.433	0	0	0	0	146,920	0.438	**326,969**	**0.871**	0.79%	0.56%	375,395
TOTAL			**11,905,235**	**33.924**	**8,399,269**	**67.798**	**118,721**	**13.263**	**20,839,909**	**41.133**	**41,263,134**	**156.117**			
% OF TOTAL			28.85%	21.73%	20.36%	43.43%	0.29%	8.50%	50.50%	26.35%					

Table 4.6: Needs by Improvement Type and Roadside Environment

Improvement Class		Improvement ID / Description	Roadside Environment						TOTAL		% OF TOTAL		Cost /km ($)
			Rural		Semi Urban		Urban						
			Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	Length (km)	Imp. Cost ($)	
Const	BS	Base and Surface	10.874	2,969,459	3.339	949,039	0.109	52,710	**14.322**	**3,971,208**	9.17%	9.62%	277,280
Const	NONE	No Improvement Required	1.943	0	0.576	0	1.931	0	**4.45**	**0**	2.85%		-
Const	REC	Reconstruction - Rural	15.74	8,392,578	3.511	2,055,667	0	0	**19.251**	**10,448,246**	12.33%	25.32%	542,738
Const	REChd	Reconstruction - Rural- Heavy Duty	7.462	8,028,078	0.927	818,220	0	0	**8.389**	**8,846,298**	5.37%	21.44%	1,054,512
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0.208	116,743	0.216	186,165	**0.424**	**302,908**	0.27%	0.73%	714,406
Const	RSS	Reconstruction with Storm Sewers	0	0	3.351	4,926,649	0.202	293,835	**3.553**	**5,220,484**	2.28%	12.65%	1,469,317
Maint	CRK	Crack Sealing	1.62	6,480	0.974	3,896	5.608	22,432	**8.202**	**32,808**	5.25%	0.08%	4,000
Maint	GRRplus	Maintenance Gravel and Minor Ditching	4.191	141,413	0	0	0	0	**4.191**	**141,413**	2.68%	0.34%	33,742
Maint	MICRO	Microsurfacing	0.307	7,522	0	0	0	0	**0.307**	**7,522**	0.20%	0.02%	24,502
Maint	RSpLimit	Reduce Speed limit	0.33	0	0	0	0	0	**0.33**	**0**	0.21%		-
Maint	SD	Spot Drainage	8.137	39,058	0.887	4,258	0.35	1,680	**9.374**	**44,995**	6.00%	0.11%	4,800
Maint	SDcrk	Spot Drainage and Crack Sealing	21.32	187,616	2.197	19,334	0.255	2,244	**23.772**	**209,194**	15.23%	0.51%	8,800
Rehab	PR2	Pulverize and Resurface 2 - 100mm	3.153	565,943	3.243	619,785	0	0	**6.396**	**1,185,727**	4.10%	2.87%	185,386
Rehab	PR2sd	Pulverize and Resurface 2 -100mm and SD	20.161	4,089,545	2.638	502,735	0	0	**22.799**	**4,592,280**	14.60%	11.13%	201,425
Rehab	PR3	Pulverize and Resurface 3 - 150mm	0	0	2.633	832,151	0	0	**2.633**	**832,151**	1.69%	2.02%	316,047
Rehab	PR3sd	Pulv and Resurf - 3 , 150mm and SD	9.029	2,293,136	1.5	400,740	0	0	**10.529**	**2,693,875**	6.74%	6.53%	255,853
Rehab	R1	Basic Resurfacing 1 - 50mm	8.104	1,041,919	3.694	562,819	4.527	802,317	**16.325**	**2,407,055**	10.46%	5.83%	147,446
Rehab	R2	Basic Resurfacing 2 - 100mm	0	0	0	0	0.871	326,969	**0.871**	**326,969**	0.56%	0.79%	375,395
TOTAL			**112.37**	**27,762,747**	**29.678**	**11,812,035**	**14.069**	**1,688,353**	**156.117**	**41,263,134**			
% OF TOTAL			71.98%	67.28%	19.01%	28.63%	9.01%	4.09%					

4.3.1 Physical Condition

The Physical Condition is an alternate method of describing the condition of a road section or the average condition of the road system. The value is the structural adequacy converted to be expressed as a value out of 100, instead of 20. This methodology lends itself to modeling and comparators that may be more easily understood. There isn't a 1:1 relationship between the weighted average physical condition and the system adequacy. As noted in the discussion on System Adequacy, that rating is strongly influenced by the newer roads and the roads deemed adequate due to actual or estimated traffic counts of less than 50 AADT. This rating is based purely on the condition of the road surface regardless of traffic count.

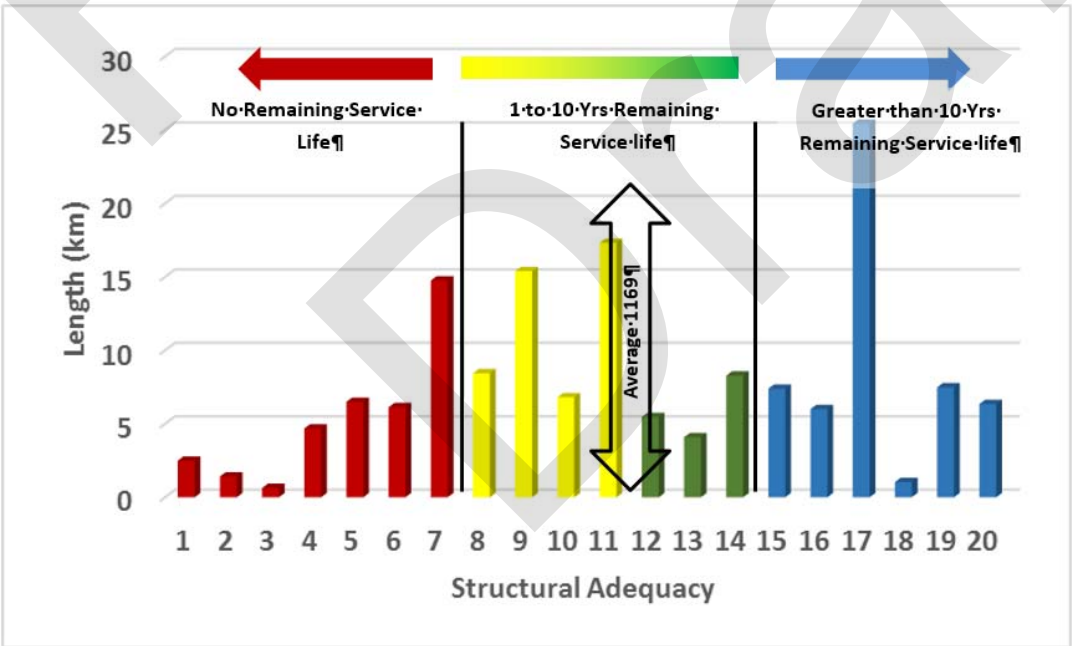
The Weighted Average Physical Condition of the road system is currently 58.45.

This would indicate that the average road section has approximately just over 5 years' service life remaining until reconstruction or major rehabilitation is required.

4.3.2 Remaining Service Life

As indicated previously, the Time of Need (TON) is really a prediction model in terms of an estimate based on current condition to the time for reconstruction. The TON then also provides an estimate of the remaining life in the road system/section. The following figure summarizes the Physical Condition ratings (Structural Adequacy times 5) of the road system and illustrates the estimated remaining service life of the road system.

Figure 4.1: Remaining Service Life; Physical Condition vs Length



4.4 Record of Assumptions –Time of Need (TON), Improvement and Replacement Costs

The methodology of this report is such that the Inventory Manual itself forms the basis of a large number of assumptions in terms of;

- Dimensional requirements for the development of improvement and replacement costs
- Structural requirements based on road classification
- Time of needs based on the ratings and subsequent calculations
- Assumptions for deterioration are included in Appendix D

5 Replacement Cost Valuation

Program funding recommendations are a function of the dimensional information, surface type, roadside environment, and functional class of the individual assets. Recommended funding for the road system should include sufficient capital expenditures that would allow the replacement of infrastructure as the end of design life is approached, in addition to sufficient funding for maintenance, to ensure that full life expectancy may be realized.

Budgetary recommendations in this report do not include items related to development and growth. The TND should consider those items as additional to the recommendations in this report. Generally, that type of improvement or expansion to the system would be funded from a different source, such as Development Charges.

The budget recommendations bear a direct relationship to the value of the road system. 4 Roads estimates the cost to replace the road system, to its current standard, at **$108,013,100.** This estimate is based on the TND's unit costs and improvement types.

All estimates are based upon the unit costs identified in Table 4.4. All formulae for improvement and replacement costs are as per the TND improvement Types. Average Replacement costs are identified in Table 5.1.

Table 5.1: Average Replacement Costs by Functional Class

Functional Class / Subtype	Roadside Environment						TOTAL		% OF TOTAL		
	Rural		Semi Urban		Urban						
	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Repl. Cost ($)	Length (km)	Cost /km ($)
200	10,328,238	24.55	0	0	0	0	**10,328,238**	**24.55**	9.56%	14.78%	420,702
300	7,327,176	16.53	0	0	0	0	**7,327,176**	**16.53**	6.78%	9.95%	443,265
400	26,413,101	43.5	0	0	0	0	**26,413,101**	**43.5**	24.45%	26.19%	607,198
500	17,140,583	25.11	0	0	0	0	**17,140,583**	**25.11**	15.87%	15.12%	682,620
600	2,159,997	2.59	0	0	0	0	**2,159,997**	**2.59**	2.00%	1.56%	833,976
700	7,768,107	8.81	0	0	0	0	**7,768,107**	**8.81**	7.19%	5.30%	881,737
800	610,669	0.74	0	0	0	0	**610,669**	**0.74**	0.57%	0.44%	825,228
C/R	472,555	0.37	2,967,190	5.17	7,374,045	4.84	**10,813,790**	**10.38**	10.01%	6.25%	1,041,791
CCI	0	0	187,995	0.21	179,058	0.1	**367,053**	**0.31**	0.34%	0.19%	1,184,042
L/R	0	0	7,800,467	17.5	13,525,820	9.14	**21,326,287**	**26.64**	19.74%	16.04%	800,536
LCI	0	0	3,758,131	6.94	0	0	**3,758,131**	**6.94**	3.48%	4.18%	541,517
TOTAL	**72,220,426**	**122.2**	**14,713,783**	**29.83**	**21,078,923**	**14.07**	**108,013,132**	**166.1**			
% OF TOTAL	66.86%	73.57%	13.62%	17.96%	19.52%	8.47%					

6 Asset Condition Assessment and Plan Updates.

6.1 Plan Update and Maintenance and Condition Assessment Cycle

4 Roads would recommend that the entire road system be reviewed on a maximum four year cycle. This could be undertaken on a quarterly or bi-annual basis, or at 4 year intervals.

The Unit costs, budget recommendations, update history and models should be updated annually.

7 Level of Service (LOS)

Level of Service has a different meaning for different interests. For instance, the cost per unit may not have an impact to a ratepayer whose chief concern may be service delivery. Similarly, cost or expenditure per unit may not illustrate the condition of the asset to the end user. Further, municipalities are required to report on various Municipal Performance Measures (MPMP). This is Schedule 80 Statistical Info Section 11, Transportation Services, Line 1720 in the FIR report.

4 Roads believes that multiple service measures may be required to adequately relate the condition of an asset to the various user groups; condition, operating costs, and end user. The following sections identify various measurements of service of the road system.

7.1 Current Level of Service Measurement

7.1.1 System Adequacy

As described earlier in the report, the system adequacy is the ratio of the "NOW' need roads to the total system. This is a holistic measure as, using the Inventory Manual Methodology, needs are identified in six critical areas, not just the distress on the road surface.

The current system adequacy is **73.7**%.

The System Adequacy should be maintained at 60% or higher.

7.1.2 Physical Condition

Physical condition is the Structural Adequacy rating multiplied by five to produce a rating of between 5 and 100. This is a measure of the amount of distress on the road however the scale is not linear.

The current weighted average Physical Condition of the road system is **58.45**. This would indicate that the average road section is has just over 5 years of service life remaining until reconstruction or major rehabilitation is required. Section 8.3 of this report provides further discussion on pavement management and optimal programming based on condition.

The weighted average Physical Condition should be at 70 or higher.

7.1.3 MPMP Good to Very Good

The province requires annual reporting on the percentage of roads that are rated as good to very good. It has been assumed that the 6-10 year and adequate roads are good to very good and this has been expressed as a percentage of the system.

Good to very good roads represent **45.8% to 51.9%** of the road system. (Dependant on inclusion of all Time of Needs or Structural Adequacy only.).)

The Good to Very Good roads should be at 60% or higher.

8 Asset Management Strategy

8.1 Asset Management Overview

Asset management has almost as many definitions as there are agencies that manage assets. The American Association of State Highway and Transportation Officials (AASHTO) defines asset management as

> "... a strategic approach to managing transportation infrastructure. It focuses on business processes for resource allocation and utilization with the objective of better decision-making based upon quality information and well-defined objectives."

The document entitled *Managing Public Infrastructure Assets, 2001*, prepared by AMSA, AMWA, WEF, and AWWA, defines asset management as;

> 'managing infrastructure assets to minimize the total cost of owning and operating them, while continuously delivering the service levels customers desire, at an acceptable level of risk.'

The Province of Ontario's document *'Building Together- Guide for Municipal Asset Management Plans'* indicates

> 'The asset management strategy is the set of actions that, taken together, has the lowest total cost- not the set of actions that each has the lowest cost individually'

Regardless of the source of the definition, the key themes that are repeated are;

- Managing
- Strategic
- Effective
- Efficient
- $$$$$!!
- Service
- Optimizing asset life cycle
- Risk Management

As an absolute minimum, the objective of any asset management plan, or strategy, should be to ensure that the overall condition of an asset group does not diminish over time. The asset management strategy of an agency is heavily predicated, and inextricably linked to the available funding.

Most agencies are not fully funded, and a large number are not even funded sufficiently as to maintain the current condition of their system. Given those circumstances, the strategy should be twofold

- Develop the financial plan in order that there is sufficient funding to maintain the condition of the road system
- Focus should be on a pavement management strategy that utilizes available funding on preservation and resurfacing programs as a priority. Reconstruction and replacement candidates will remain reconstruction and replacement candidates and cost increases will be incremental

with inflation. Preservation and resurfacing opportunities that are missed will escalate in cost by several hundred percent depending on site specifics.

8.2 Priority Rating vs. Condition Rating

Information in a database may be sorted and analyzed in numerous ways. Understanding what information a data field represents, is key to the analysis. The Inventory Manual has many rated and calculated data fields and thus provides for many ways to sort data. Some commonly used representations, or sorting of information, from the database include:

- Priority Rating
- Priority Guide Number
- Structural Adequacy (Condition)

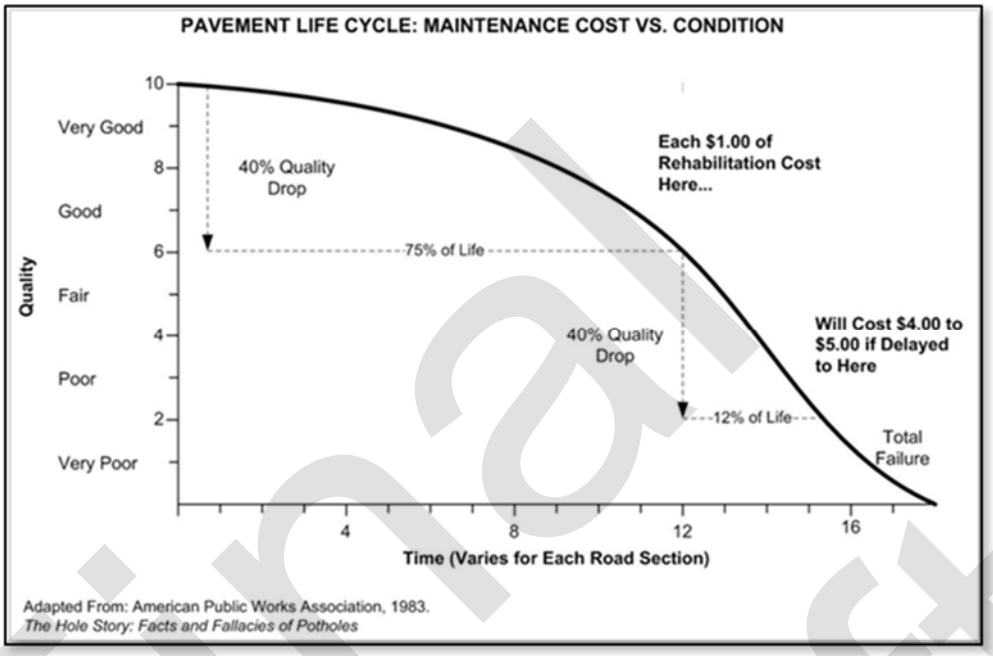
Priority Rating is a calculated field in the Inventory Manual, and is a function of the traffic count and the overall condition rating of the road section. This approach adds weight to the traffic count of the section. A higher traffic volume road in poorer condition produces a higher priority number. Although the word 'priority' is included in the field name, a road section that has a higher calculated 'Priority Rating' is not necessarily a higher priority in the broader sense of asset management. Figure 8.3 provides and illustration of the effect of using the priority number as a performance modeling parameter on a marginally funded road system.

Similarly, a road agency may choose to sort the road sections based on condition and cost per vehicle. The Priority Guide Number data field would assist in providing that analysis, as sorting on that parameter would prioritize road sections that have higher traffic and thus a lower cost per vehicle.

Developing a road capital program around the Priority Rating or Priority Guide Number fields will result in programming that would lead to a less efficient expenditure of funds and reduced system performance per budget dollar, as road sections with high traffic and in poor condition would be selected first, as opposed to selecting the best rehabilitation candidates at the appropriate time in their life cycles. The exception to this statement would be cases where rehabilitation funding is at a high enough level to ensure that the preservation program requirements can be met.

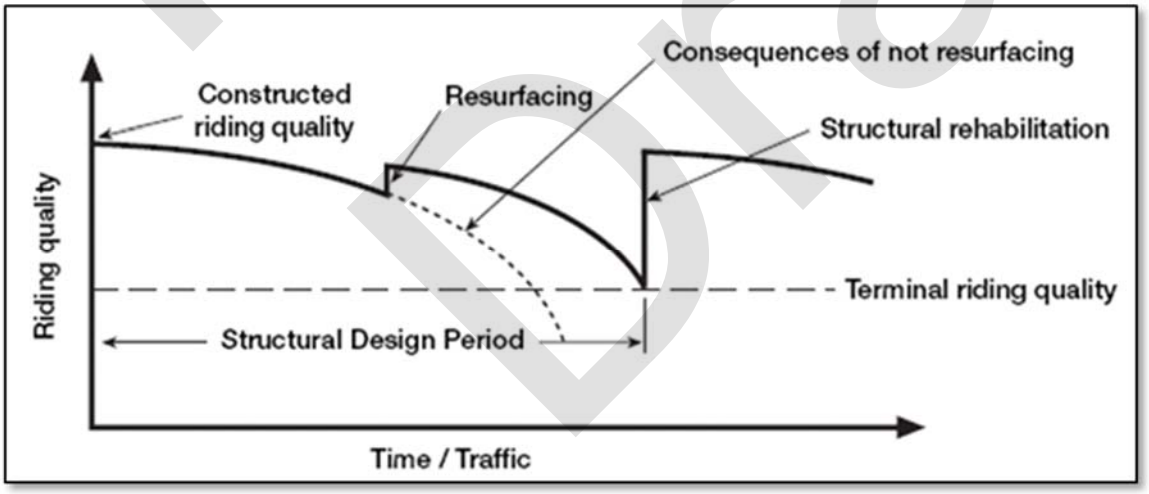
From a more current asset management perspective, project selection should be predicated by condition. (Structural Adequacy or PCI). Figure 8.1clearly illustrates the financial advantages of managing the road system by performing the right treatment at the right time of the asset life cycle. If appropriate strategies are not undertaken at the correct time, there is a less effective usage of the available funding.

Figure 8.1 Treatment Cost vs. Deterioration



Ideally, if a road is constructed and maintained with timely appropriate maintenance and resurfacing, the road system will reach a point where the majority of the activities will be preservation and resurfacing. Figure 8.2 clearly illustrates the effect the life span of a pavement by applying the correct treatment at the correct time in the life cycle.

Figure 8.2: Pavement Management- The Right Treatment at the Right Time

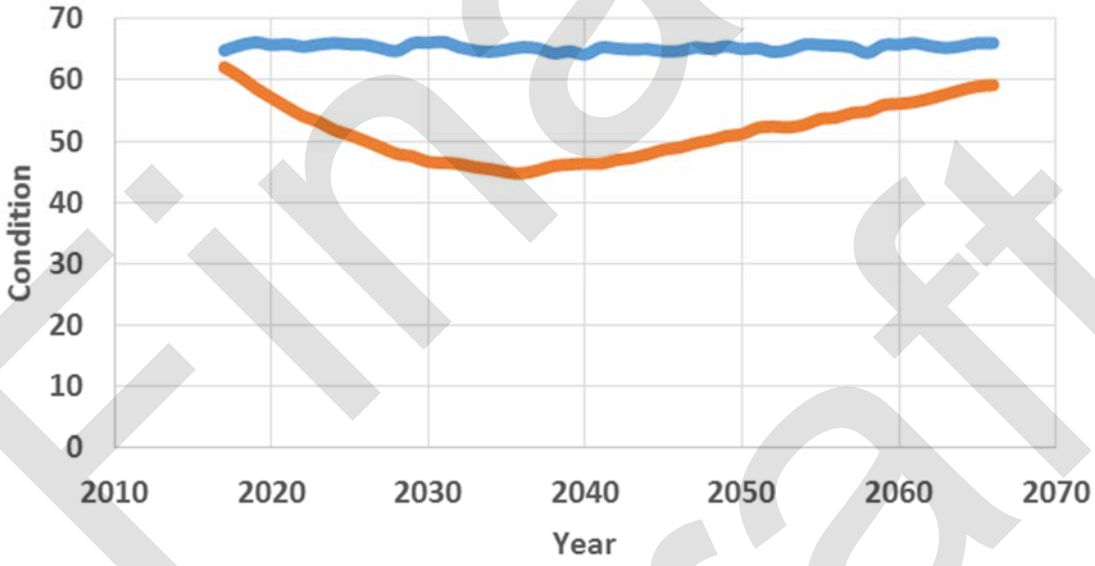


Source: Wirtgen Cold Recycling Manual

If an agency's budget is fully funded, the programming will include reconstruction, resurfacing, and preservation programs. Prioritization within the different programs will vary as demands are different. However, within the resurfacing and preservation programs, the pavement condition should drive the decision making.

Figure 8.3 illustrates the difference in system performance over time where best Return on Investment drives the project selection rather than worst first. When available funding is limited, treatment / project selection is critical. Prioritizing worst first projects will result in a considerably poorer performance of the road system over time.

Figure 8.3: System Performance –Worst First (Priority #) vs Best ROI



Note: Not from the North Dumfries Road system

The blue line is system performance based on a best return on investment project selection and the orange line is the system performance based on the priority number. (The priority number is a function of condition and traffic – a poor condition road with high traffic would generate a higher priority number.) The differences in performance are more dramatic when annual budgets are minimal.

Where funding is limited, resurfacing and preservation programs should be prioritized over the construction program. The effect of this approach will be that 'NOW' need roads will remain 'NOW' needs. However, by virtue of their 'NOW' need condition, 'NOW' need roads will require increased maintenance and likely generate increased complaints from the driving public. To deal with this eventuality, a municipality should create a *'maintenance paving budget',* over and above the resurfacing budget. The purpose of this budget is to defer the reconstruction needs, and reduce maintenance efforts and complaints until the road can be reconstructed.

8.3 Optimal Programming and Network Condition

Section 7.1.2 of this report provides information on the current weighted average physical condition of the road system. Figure 8.4 from the Transportation Association of Canada's Pavement Asset Design and Management Guide provides a visual representation of various measures of road network and individual section performance.

Figure 8.4: Service Levels and Triggers for Pavement Improvements

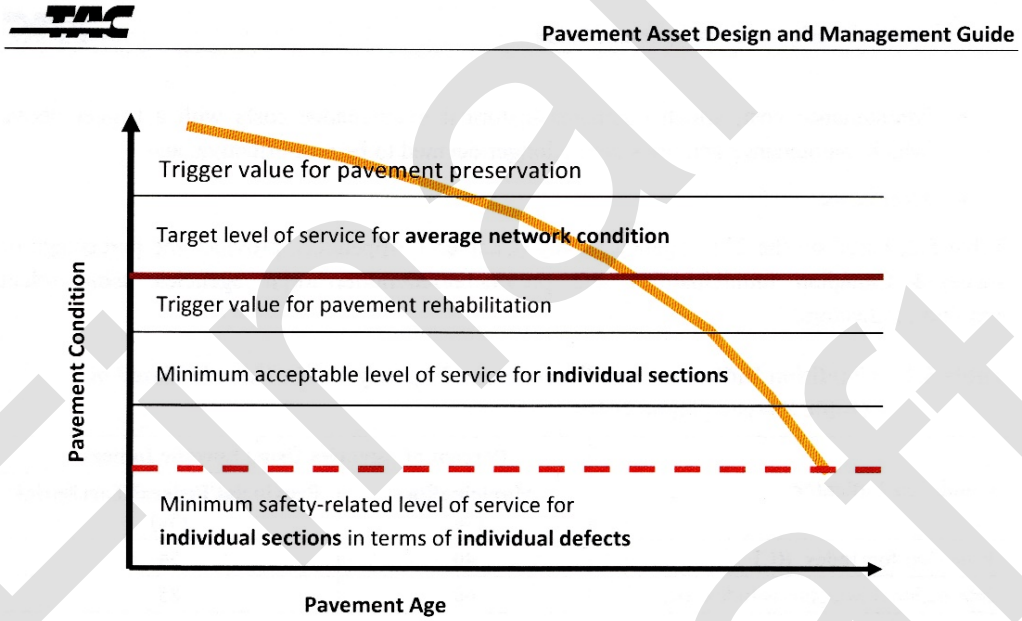


Figure 5.3 – Types of Service Levels and Trigger Levels for Pavements [Adapted from FCM 2003]

4 Roads has recommended that the weighted average Physical Condition of the Network be a minimum of 70. Figure 8.4 supports that recommendation based on the following analysis. Using the Inventory Manual methodology, the trigger for pavement rehabilitation is a Structural Adequacy of 14, which is a Physical Condition of 70. From the graph, the average network condition should be higher than the trigger value for network rehabilitation; supporting 4 Roads recommendation that the weighted average Physical Condition be greater than 70.

8.4 Cross Asset Integration and Project Prioritization

Prioritizing projects from a purely asset management perspective is a relatively straightforward exercise, regardless of funding level. Complications arise when the specific needs, commitments of the agency, and priorities of other utilities factor into the decision making process.

The road system is, in reality, a utility corridor. Multiple utilities in both urban and rural roadside environments will present conflicting demands and priorities in advancing projects. The Road Needs

Study provides ratings that deal strictly with the condition of various factors as they relate to the road section. Those factors have to be considered in conjunction with needs and priorities that may exist for other utilities or pending development. In fact, the condition of other infrastructure within the road allowance may be the key element in the prioritization. For example, a road rated as a reconstruction project may have a relatively low priority rating, but a trunk storm sewer servicing a greater area may require immediate installation. The priority of the road is then dictated by the other utility, and should be integrated into the capital plan, to best serve all interests.

Less tangible priorities may also be project prioritization tools for some agencies. For example, an agency may want to advance projects that also include bus routes or bike lanes.

As a municipal road program is developed, opportunities to complete work on smaller sections adjacent to the main project, at a lesser cost than if completed as a stand-alone project, should be considered to realize economies of scale, and complete improvements that may otherwise be passed over.

8.5 Gravel Roads Management Strategy

TND has a gravel road system of approximately 19.197 centre line kilometres. The budget recommendation is $197,900 annually, for the materials only (Placed on the site).

Proper maintenance of a gravel road surface is deceptively expensive. Costs include gravel, dust control, and grading. Frequently, budget analysis proves that the per-kilometre cost of gravel road maintenance is greater than the per-kilometre cost for hard top maintenance. For this reason, conversion of gravel surface roads to hard top roads generally proves to make economic sense and improves user satisfaction.

Road agencies in both Canada and the United States, have conducted studies that have generally indicated that, dependent upon local unit costs, gravel road conversion to hardtop, can be a cost-effective strategy. One source indicates that this may be effective management for roads with traffic volumes as low as 100 AADT.

Appendix C of this report includes additional information on gravel road conversions including a flow chart to illustrate the decision matrix for conversion. Benefits to converting a gravel road include:

- Customer satisfaction
- Reduced maintenance costs for routine maintenance
- Reduced maintenance costs for winter maintenance

Based on the criteria identified in Appendix C, **Table 8.1** identifies gravel road conversion candidates that meet the criteria for conversion.

Table 8.1: Potential Gravel Road Conversion Candidates

Asset ID	Street Name	From Desc	To Desc	Length (km)	AADT
1890	Beke Rd	Spragues Rd (Reg. Rd 75)	Shouldice Side Rd	2.045	190
1995	Maple Manor Rd	Bend at City of Hamilton Boundary	90m South of Concession 7 West	0.363	290
2050	Lockie Rd	Brantford Hwy (Hwy 24)	239m E of Hwy 24 (W Boundary of Lockie)	0.239	190
2080	Lockie Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	1.509	100
			Total	**4.156**	

Subject to further structural and geotechnical review

9 Program Funding Recommendations

9.1 Overview

Program funding recommendations are a function of the dimensional information, surface type, roadside environment, functional class of the individual assets and current unit costing. Recommended funding for the road system should include sufficient capital expenditures that would allow the replacement of infrastructure as the end of design life is approached, in addition to sufficient funding for maintenance, to ensure that that full life expectancy may be realized.

Budgetary recommendations in this report do not include items related to development and growth; those should be considered as additional. Generally, that type of improvement or expansion to the system would be funded from a different source, such as Development Charges.

The budget recommendations bear a direct relationship to the value of the road system. 4 Roads estimates the cost to replace the road system, to its current standard, at **$108,013,100**. The budget recommendations provided in this report are based on the constitution of the road system. This represents an opportunity to develop a financial plan in concert with the asset management plan, for a phased implementation.

9.2 Capital Depreciation

The estimated replacement/depreciation value of the TND road system to the current standard is **$108,013,100**. This equates to an annual capital depreciation of **$2,160,300** over 50 years**.** The annual capital depreciation is strictly a function of the replacement cost and the design life, and would best be described as an *'Accountaneering'* number. This estimate does not include bridges, culverts, cross culverts less than 3 m, sidewalks, or street lighting. The typical design life for a road structure is 50 years before reconstruction/replacement. If the life span is 50 years, then 2% of the replacement cost should be the annual contribution to the capital reserve, to ensure that it can be reconstructed in that time frame.

The estimated replacement/depreciation is based upon the replacement value of the road system over a 50-year life cycle. However, the 50-year life cycle can only be a reality if maintenance and preservation treatments such as crack sealing and hot mix asphalt overlays are delivered at the appropriate time. Inadequate maintenance and preservation will result in premature failure and increased life cycle costs.

Analogies to houses and cars sometimes make road maintenance easier to understand. If a house does not have the roof renewed within the correct time frame, there will be damage to the structure, below the roof, and if this is not dealt with, it will result in a rapid deterioration of the house. Similarly, roads require crack sealing and resurfacing at the appropriate time, during the life cycle, in order to maximize the life expectancy of the asset. Preservation and maintenance extend the useful life of the pavement, reducing life cycle costs.

9.3 Hot Mix Resurfacing

Roads require major maintenance throughout the life cycle, in order to optimize and maximize the asset life span. Roads require resurfacing at the appropriate interval, for the respective class of road. Different agencies categorize the expense differently, usually dependent upon the dollar value; however, resurfacing is essentially a maintenance activity.

Resurfacing schedules are dependent upon traffic loading and the percentage of commercial traffic. Higher traffic volumes and percentages of commercial traffic shorten the interval between resurfacings. Optimal resurfacing intervals will vary from ten to twenty years (or more), depending upon the road function, classification, and quality of design and construction.

The Hot Mix Asphalt Resurfacing recommendation in this report is based upon the distribution of the TND's hot mix asphalt inventory. As such, the optimal budget calculation will focus on the 18-year interval (17.6), for hot mix roads.

Given the aforementioned, and the information with respect to surface type contained in Table 3.1 , the funding for the annual average resurfacing program should be **$1,096,900** per year on average, in order to maintain the system at its current adequacy level. This estimate is for the major resurfacing work only, and does not include any estimated costs for other pavement preservation activities or programs. Table 9.1 identifies the distribution of hot asphalt roads by asset class and the basis for the recommendation for the annual program budget recommendation.

Table 9.1: Hot Mix Asphalt Roads by Asset Class and Life Cycle

Asset Class	L.C. Yrs	Average Annual Cost	Asset Qty.	Unit Cost	Weighted Average
A/C-R	19				
A/C-S	19				
A/C-U	19				
HCB1-R	10				
HCB1-S	10				
HCB1-U	10				
HCB2-R	12				
HCB2-S	12				
HCB2-U	12				
HCB3-R	15	330060.69	37.63	8771.21	4.038709
HCB3-S	15	84507.2	8.29	10193.87	0.88974
HCB3-U	15	42319.05	3.81	11107.36	0.408915
HCB4-R	19	394568.03	58.48	6747.06	7.9502
HCB4-S	19	149208.98	21.25	7021.6	2.888881
HCB4-U	19	96278.62	10.3	9347.44	1.400258
TOTALS			**139.76**		**17.57**

9.4 Surface Treatment Resurfacing

Most agencies report that the average life of surface treated road is seven years. The TND advises that six years is more appropriate for their jurisdiction. Similar to the concept applied to the development of the hot mix resurfacing recommendations, the surface-treated road network should be completely resurfaced every seven years, or approximately 14% of the surface treated inventory in each calendar year.

At a unit cost of $2.75 per square metre, the annual average program size should be **$1,500**, on average, exclusive of hot mix asphalt padding and other preparatory work.

9.5 Gravel Road Resurfacing

When MTO was providing maintenance subsidy, the standard practice for gravel road maintenance was to place approximately 75 mm of gravel on each gravel road section, every three years.

Since the conditional grant system was discontinued, a large number of municipalities have reduced the amount of gravel that has been placed on gravel roads, to the point where the gravel roads in the system are a major maintenance problem, particularly in the latter part of the winter and early spring. If the granular base is not replenished, the road structure will disappear through normal usage, and the remaining gravel typically becomes contaminated by other materials, such as the native soil and winter sand.

AT has 19.197 km of gravel surfaced roads, as per Table 3.1 of this report. Using TND's benchmark costing, the annual gravel resurfacing program size should be **$197,900** per year, based on adding 75 mm of gravel every three years. (This is 75mm across the entire platform.) This estimate does not include costs for re-grading, dust control, or gravel road conversion.

9.6 Crack Sealing

Crack sealing is a preservation activity that extends the life of a hot mix asphalt surface. A program estimate is provided based on crack sealing one metre per two lane metre of pavement every 5 years at the unit cost provided by TND. Based on that premise, the recommended average annual budget for crack sealing is **$111,700**.

9.7 Preservation Budget Concept

Typically, municipalities, and more particularly public works departments, prepare annual budgets that have a specific line items for capital, operational and maintenance expenditures. The definitions for capital and operational costs can vary between municipalities and it also varies between agencies.

From a pure asset management perspective, project selection and annual programming should be driven by asset condition, rather than a fixed line item amount. Section 8 of this report, provided a review of this asset management philosophy.

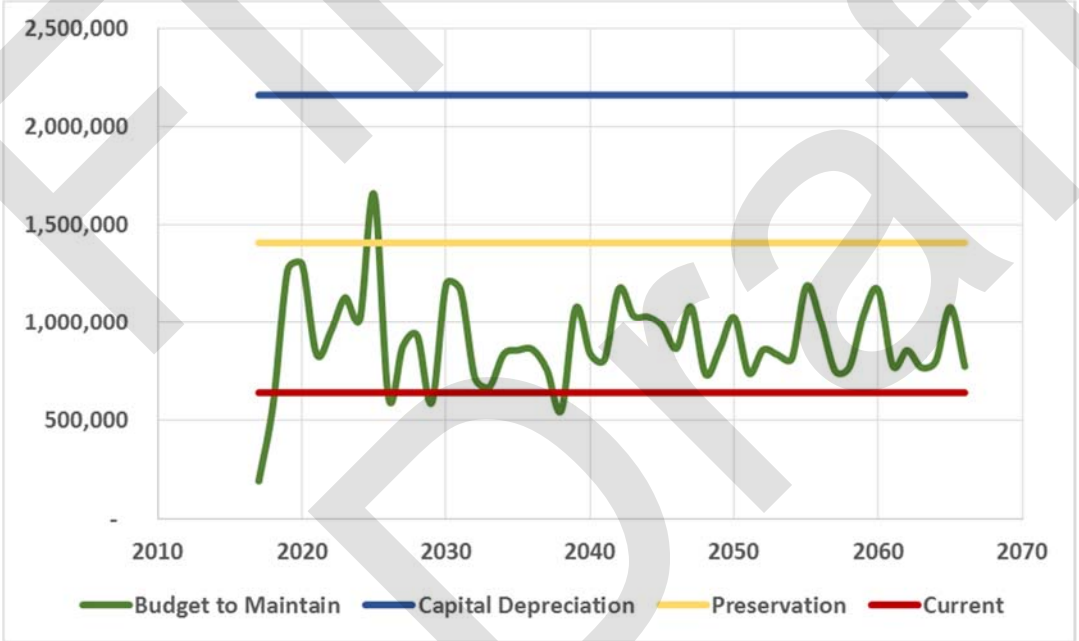
Rather than have a fixed line item for certain activities, 4 Road recommends that a 'funding window' be determined and that the annual re-investment amount should be in the 'window'. Annual expenditures will meet the overall bottom line, however, when projects and programs are driven by condition, the annual line items will vary.

Using the recommendations developed in this report, 4 Roads has created a funding level described as the 'Preservation Budget'. The Preservation Budget is the total of the recommended funding levels for hot mix resurfacing, single surface treatment, and crack sealing: **$1,408,000**. The premise being that if the preservation and resurfacing programs are adequately funded then the system should be sustained. Adequately funded preservation and resurfacing programs will reduce overall costs and defer the need to reconstruct.

Based on a 50 year design life, 4 Roads has calculated that the annualized capital depreciation is **$2,160,300**.

The 'funding window' is the range between the preservation budget and the annualized capital depreciation. Re-stated, instead of the traditional capital and maintenance line items, consider the gross budget as the annual reinvestment level, with program funding levels fluctuating within the gross amounts, but driven by asset condition.

Figure 9.1: The Funding Window



To clarify, the required funding level to sustain or improve the road system is *not* the total of all of the budget recommendations. Sustainable funding has to be between the Preservation Budget and the Capital Depreciation.

Municipal pavement and asset management strategies are critical to managing the performance of the road system, more so, if funding is limited. Funding constraints should push the strategy toward those programs that extend the life cycle of the road by providing the correct treatment at the optimum time. Resurfacing, rehabilitation, and preservation projects should be a higher priority than reconstruction projects. The objective is to "keep the good roads good".

The preservation budget and performance model thereof are computer derived. Intangible values and decisions and the effects of other external forces cannot be incorporated into the model. As such the preservation model is the minimum required to maintain the system- in theory. From a more pragmatic perspective and to deal with the real life realities of maintaining a road system, it should be greater.

As the municipality advances the development of their Asset Management Plan (AMP), a paradigm shift will be required in the way that we approach management of assets. Traditionally, municipalities have spent a fixed amount on capital and maintenance each year. As evidenced by Table 9.4, programs are not at a consistent funding level on an annual basis. The annual budget overall is met, however, the distribution of costs between traditional capital and maintenance activities varies. That variance is being driven by the demands of the road system based on condition and project selection is based on condition and best Return on Investment. This concept can and should be applied to all assets.

9.8 Annual Budget Adjustments

9.8.1 Inflation

The typical approach to annual budget adjustments is to adjust with some reference or consideration to the Consumer Price Index (CPI). Public Works Departments have not fared well with this approach, as a large portion of the Public Works Budget is expended on commodities and services that typically vary/increase at a rate significantly higher than the CPI. Public Works Departments' annual increases based solely on CPI, will generally result in a continual downward spiral in overall condition of the road system and service levels. Decreasing service levels increase risk. Ontario is becoming much more litigious; therefore, the reduction in service levels increases the risk for a municipality, and the cost of service provision versus the cost of litigation should be considered.

In recent years, increases and decreases in fuel, asphalt, and salt have been disproportionate to the CPI. As such, consideration should be given to annual adjustments in road funding, which are more reflective of the actual experience. Some municipalities provide for such disproportionate changes in their budget process, in order that the specific impacts of a commodity price increase and service delivery are considered.

9.8.2 Plant Adjustment

Most municipalities experience development-related growth. Growth comes at a cost, both in the longer-term, with additional resurfacing and replacement requirements, and in the shorter-term, with Operational budgets. Operational budgets should be adjusted on a pro-rata basis to account for the additional length of road that has to be maintained.

Capital budgets and forecasts should also be adjusted annually, to reflect the changes in the system, and integrated into the longer-term financial plan.

9.9 Performance Modeling- Budget Effect on System Performance

9.9.1 Asset Management Plan (AMP) and Strategy Analysis

The asset management plan is a function of the strategy and available financing. The development process for all elements is iterative, concurrent and holistic on a number of levels. It is complex.

The provincial guidelines for the preparation of an AMP indicate that the following must be considered;

- Options must be compared on Lifecycle cost- the total cost of constructing, maintaining, renewing and operating an infrastructure asset throughout its service life. Future costs must be discounted and inflation must be incorporated.
- Assessment of all other relevant direct and indirect costs and benefits associated with each option.
    - Direct benefits and Costs
        - Efficiencies and network effects
        - Investment scheduling to appropriately time expansion in asset lifecycles
        - Safety
        - Environmental
        - Vulnerability to climate change
    - Indirect Benefits and Costs
        - Municipal wellbeing and costs
        - Amenity values
        - Value of culturally or historically significant sites
        - Municipal image
- Assessment of Risks associated with all potential options. Each option must be evaluated based on its potential risk, using an approach that allows for comparative analysis. Risks associated with each option can be scored based on quantitative measures when reasonable estimates can be made of the probability of the risk event happening and the cost associated with the risk event. Qualitative measures can be used when reasonable estimates of probability and cost associated with the risk event cannot be made.

Significant effort (and expense) will be required to meet all of these requirements.

9.9.2 Performance Model Overview

A properly developed performance model will satisfy the majority of the requirements identified in the foregoing. Key elements of a Performance Model will include;

- Deterioration Curves identifying anticipated deterioration of an appropriately constructed asset over the life cycle of the asset
- 'Trigger' points throughout the deterioration curve identifying appropriate treatments at condition ranges
- Current costing for all treatments identified

To capture the essence of the provincial requirements, development and use of a Performance Model is recommended. Through modeling and the resultant outputs the following may be addressed;

- Review of options and lifecycle effects based on a Return on Investment Analysis
- Efficiencies and network effects
- Budget requirements to achieve LOS goals

It is respectfully suggested that a 10 year AMP can be developed through a Performance model, however, 4 Roads is of the opinion a number of other requirements that the province has identified should not be addressed until they reach the project stage. Further, a number of those requirements would be addressed through a Class Environmental Assessment process.

Through performance modeling appropriate budget levels, programming and associated costs can be determined, delivering key elements of any plan that can be refined or revisited as circumstances change. Once a model is developed, then the effect of any alternatives may also be measured.

9.9.3 Performance Model Scenario Options

Performance models may be developed to favour certain asset attributes or financial outcomes. For example, a model may be developed to weight the traffic as a priority in project selection. This would produce a work program when higher traffic volume roads would be prioritized over lower volume roads. Where funding is limited, this generally produces a worse outcome than if it were not weighted.

All of the models for this project were developed using a Return on Investment (ROI) scenario. The outcome of this scenario is that the model will select treatments by best ROI on a project level, which will in turn produce the best ROI at the scenario level. The effect of the ROI scenario is that it `*keeps the good roads good*` by selecting the correct treatment at the correct asset condition. Typically the preservation and minor rehabilitation treatments offer the best ROI.

ROI is calculated at two levels; by the overall scenario and by individual project. Calculations for both are shown in the following figure.

Figure 9.2: Return on Investment Calculation

$$\text{ROI} = \frac{\text{(Asset Value if Work is Funded - Do Nothing Asset Value)}}{\text{Cost of Required Work}}$$

9.10 System Performance at Various Budget Levels

This report includes budget recommendations for various aspects of the programming that are typical to road departments. System performance can be predicted based on the level of funding.

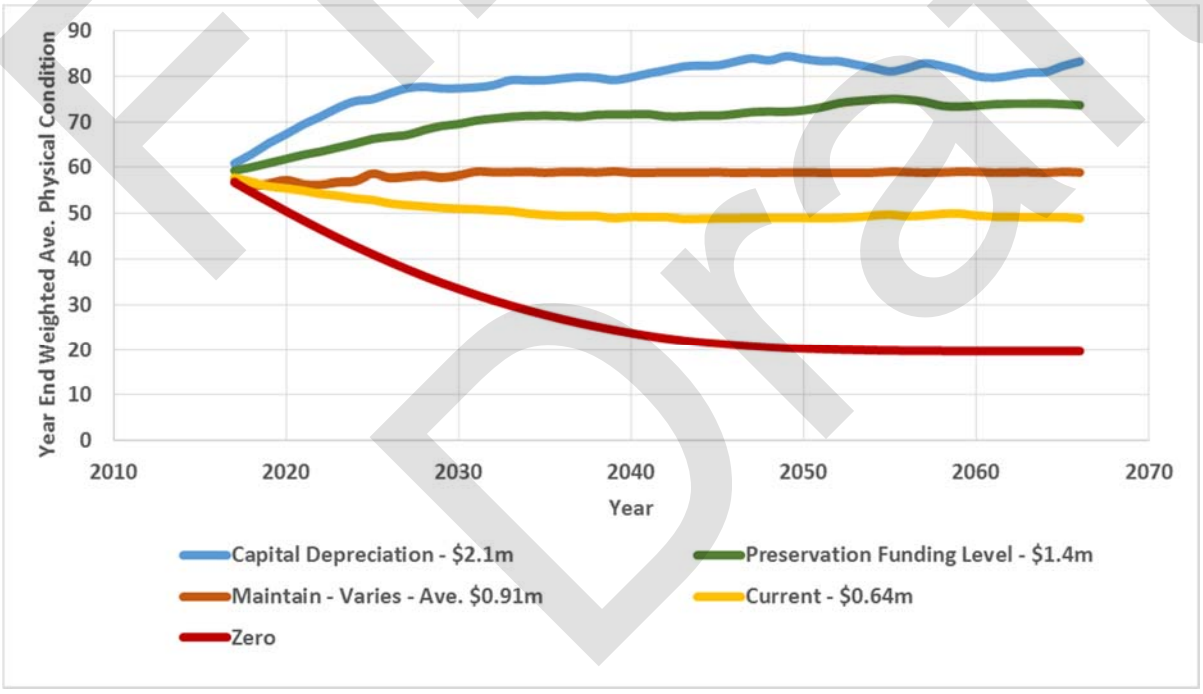
4 Roads has prepared four different 50-year performance models for the road system. The models have been prepared with the following parameters:

- Zero budget – demonstrates the effect of no work being performed on the road system and how quickly it will deteriorate
- Existing budget – this includes amounts in the current budget for capital, hot mix resurfacing, single surface treatment, gravel road resurfacing and crack sealing, paralleling the basis of the preservation funding level. $0.64m
- Maintain budget- varies each year dependent upon demand by condition to maintain the current condition –average is $0.91m
- Preservation budget – This includes the total dollar value of the budget recommendations for Hot Mix Asphalt resurfacing, surface treatment, crack sealing, and gravel road resurfacing. $1.41m
- Capital Depreciation over 50 years- full replacement cost of the road system annualized. 2.1m

The Weighted Average Physical Condition of the road system is currently 58.45. The performance model calculations all begin with the current Physical Condition and, for purposes of the graphing, the year-end Physical Condition is displayed based on the effects that the improvements have had on the overall condition of the road system.

In reviewing the results of the performance models, it should be understood that, with the methodology being used, the trigger for a resurfacing activity is a Physical Condition of 70 (Structural Adequacy of 14).

Figure 9.3: Predicted Performance Modeling at Various Budget Levels



Notes: Data points are year-end performance estimate

Predicted performance assumes program developed through the model will be followed- particularly critical at minimal funding levels

Performance Models are all in current dollars – not adjusted for inflation

At appropriate funding levels the system condition improves over time. However, the improvement in terms of the Physical Condition will only increase to approximately the high 70's to the low 80's, depending on the system.

It should be noted that the Capital Depreciation model will typically only expend the full dollar value of that budget in the earlier years of the program. With adequate funding, once a road has been reconstructed and if it is maintained and resurfaced at the correct condition, it should perform well for several decades. In the information shown in this report, the funding level for this model is $2.1m annually for a 50 Year total of $108,013,100. However, analysis of the results reveals that over the 50 year modeling period, expenditures totaled $92,600,711 or an average of $1.85m annually.

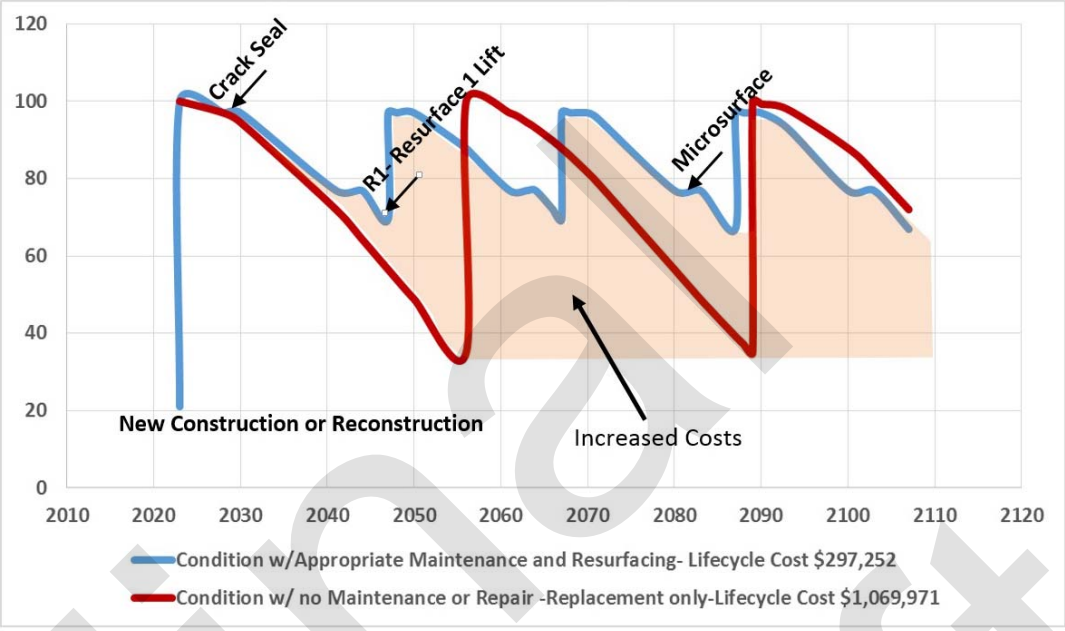
The deterioration curves that have been used consider an average/typical performance for the various road classes. When used in the model at a reasonable funding level the overall average system condition will remain at a similar level as the model will treat the pavements as perpetual. This concept is illustrated in Table 9.2 using TND Section 1082, Brant Waterloo Road, 1700m East of Sprague Road (Regional Road 75)-to-900m West of West River Road North.

For the purposes of a short to mid-term plan considering the pavement as performing as a perpetual pavement does not pose a problem. The aggregate road base will deteriorate over time however, the time frame where that may be contributory to the road decline would be beyond 50 years. Condition data is collected regularly and monitoring and analysis would alert the municipality to changes that are occurring.

Table 9.2: Sample Section Life Cycle

Road Asset 1082, Brant Waterloo Road, 1700m East of Sprague Road (Regional Road 75)-to-900m West of West River Road North							
Year	Imp. Type	Imp. Cost	Start Condition	End Condition	Yrs Hold	Start Value	End Value
2019	REC	190707	5	100		19,071	381,415
2024	CRK	1844	97	97	2	369,973	369,973
2036	MICRO	9681	79.27	79.27	3	302,348	302,348
2043	R1	51384	69.47	97		264,969	369,973
2044	CRK	3688	97	97	2	369,973	369,973
2056	MICRO	19362	79.27	79.27	3	302,348	302,348
2063	R1	102767	69.47	97		264,969	369,973
2064	CRK	3688	97	97	2	369,973	369,973

Figure 9.4: Graphical Representation of a Typical Life Cycle and Strategy Cost Differential (Asphalt)

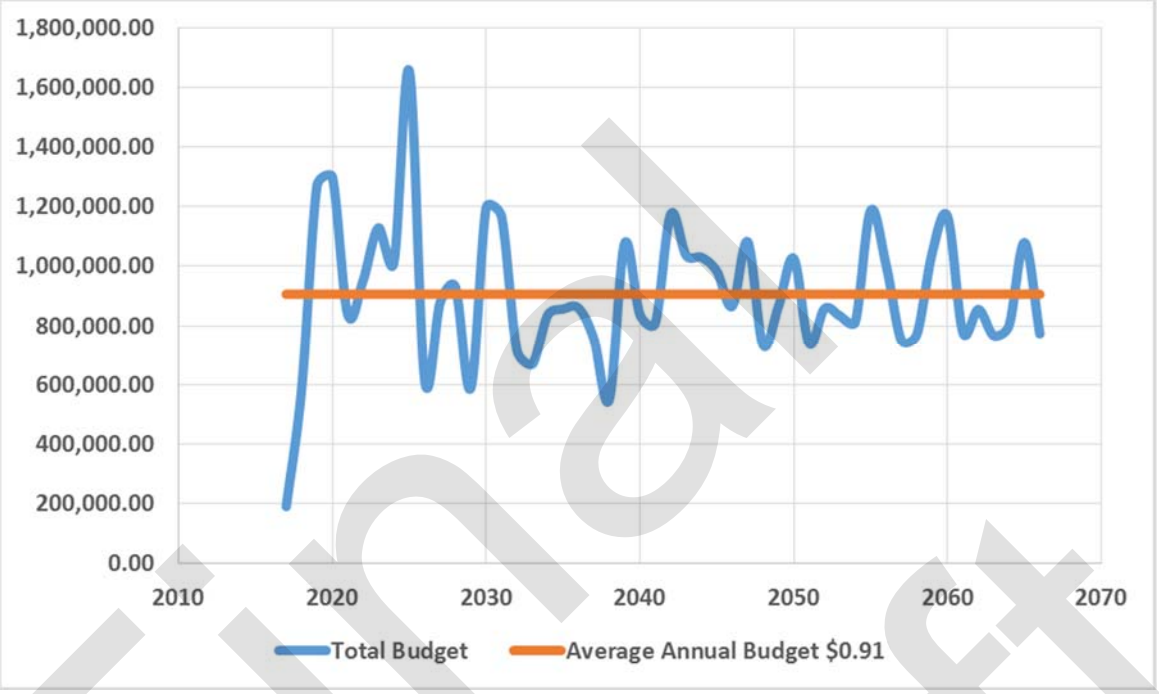


Note: The orange shaded area illustrates increased lifecycle costs between the two strategies

Figure 9.5 illustrates the typical effect on budget requirements by holding the condition of the system at a specified level. If the orange line represented the average annual expense, the budget years above that line would require debt financing or funding from reserves. Conversely, in those years where the funding requirement is less than the annual average then the unspent funds would accumulate in a reserve.

Deterioration curves developed by 4 Roads have been utilized for development of funding and prediction models, and based on our experience with a large cross-section of municipalities and resultant feedback, we believe that those deterioration profiles are representative if all of the assumptions are met in terms of construction standards and traffic. Typically, where funding is at an appropriate level the models indicate that the overall condition of the road system will continue to increase over time to a point where the average physical condition will be in the high 70's to mid 80's range depending on the constitution of the system. A physical condition beyond that level may be indicating an over-expenditure/inefficiency in the programming. An average physical condition above 70 would indicate that the average road only requires maintenance.

Figure 9.5: Annual Expenditures Budget to Maintain Current Condition



9.11 System Performance at the Proposed Budget Level

4 Roads has provided a recommendation that the current budget of $640,000 be increased annually over a five year period to the Preservation budget funding level of $1,408,000, (expressed in 2016 dollars).

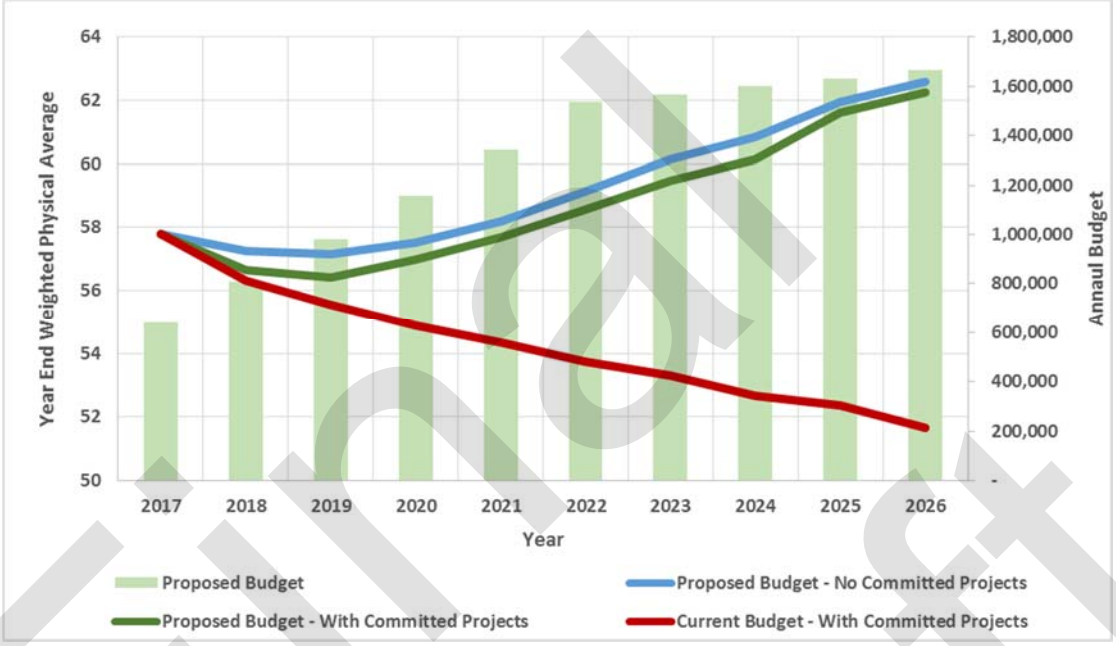
Based on discussions with Township staff, a performance model has been created that increases project costs by 2% annually and also increases the proposed budget incrementally or five years to reach the inflation adjusted Preservation Budget funding level, with the same 2% inflation factor.

Performance modeling is a very useful tool as the program is developed objectively based on the deterioration curve assumptions, agency specific unit costs and model selection criteria. However, it would be a near impossible task to create a model with absolutely all possible decision matrices and data included in a database.

As an example, TND anticipates a townhouse development on Bute Street to advance to the construction stage in 2017. Bute St. is currently in poor condition, having structural and drainage deficiencies and one segment is too narrow. The recommended improvement is to 'Reconstruct with Storm Sewers (RSS)', for all three Bute Street segments. Given the timing of the development, the timing of the reconstruction should occur reasonably quickly afterward. In order that the Bute St. reconstruction occur at the appropriate time, committed projects were created within the model to have the work occur in 2018.

4 Roads has also created a model at the existing funding level, adjusted for inflation, to illustrate the effect on the system of the development demands.

Figure 9.6: 10 Year Program Performance



Note: Annual budgets adjusted for inflation
Annual budgets increased annual over 5 years to reach Preservation Funding Level
Committed projects included as indicated

9.12 Record of Assumptions -Performance Modeling

9.12.1 Pavement Classification for Modeling

In order to develop budget recommendations, 4 Roads adds an additional classification of roads differentiated by surface type, roadside environment and traffic volume. It is anticipated that each road classification will deteriorate at a different rate. Differentiation by roadside environment within a classification permits calculation of the different replacement costs to reflect the servicing and feature differences.

Table 9.3: Road Asset Classes

Asset Class	Subtype	Material	RDSE Envt	AADT Low	AADT High
A/C-	All	A/C	R	1	100,000
CM	All	C/M	R	1	3,000
CON	All	CON	R	1	100,000
GST1	All	G/S	R	1	10,000
HCB1	ART	HCB	R	20,000	100,000
HCB2	ART	HCB	R	10,000	19,999
HCB3	All	HCB	R	1,000	9,999
HCB4	All	HCB	R	1	999
ICB	All	ICB	S	1	3,000
LCB1	All	LCB	R	1	2,000

Figure 9.7: Treatment Selection vs. Condition (Asphalt Surfaces)

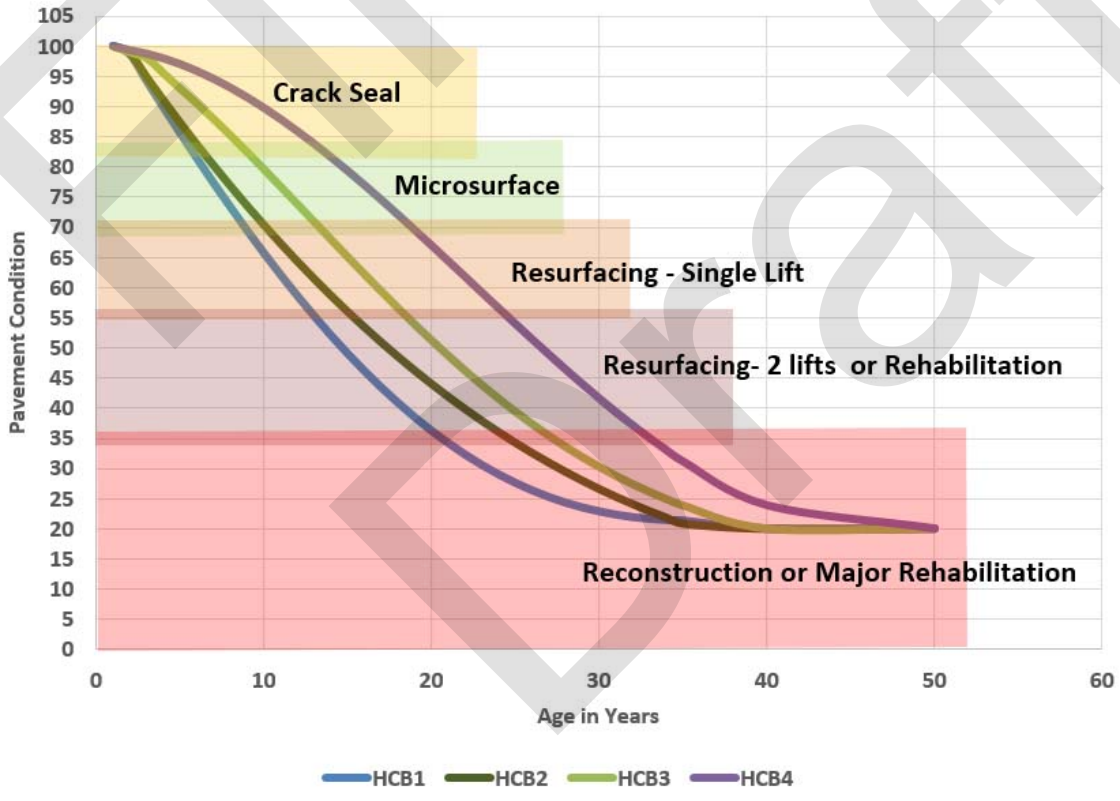


Figure 9.7 illustrates treatment selection by time and asset classes for hot mix roads and provides a graphic of the matrix that has been embedded in WorkTech for roads with a hot mix asphalt surface.

Typical treatments and/or improvements have been superimposed over the deterioration curves, to illustrate the general timelines for implementing the treatments. Other road asset classes have been treated similarly. An important concept to remember is that as a road deteriorates the cost of rehabilitation increases. The deterioration curves, improvement types, current unit costs and current condition ratings are essentially the assumptions used to develop budget and programming recommendations in this report. Appendix C provides detail on the deterioration curves for all road asset classes.

9.13 10 Year Program- Proposed Funding Level

Appendix E includes the results of a 10 Year program based on the ROI Performance model at the proposed funding level as identified in the following chart which extracted from the 10 year performance model.

The resultant project selection from the model may vary from the current program and forecast as the model will select projects based on best ROI initially and then expend remaining funds on other projects. The model can be a starting point for program development but has to be metered with decisions than cannot be easily introduced into a model.

Table 9.4: Performance Model Summary - Ten Year Program – Proposed Funding Level, Adjusted for Inflation

Improvement	Year										
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Grand Total
BS								60,547		13,367	**73,914**
CRK	27,544	14,610	5,581	28,831	17,459	9,203	20,761	29,662	27,555	22,915	**204,121**
GRR2				11,162				22,510	10,729		**44,401**
MICRO					5,551		12,029	7,256	17,742	2,190	**44,768**
PR2		121,731	104,541	251,210	273,127	57,359	200,182	13,061	106,066		**1,127,277**
PR2sd			624,832	740,897	420,772	1,062,574	1,042,297	293,559	567,667		**4,752,598**
PR3sd				101,018	280,130	177,961		887,451		617,979	**2,064,539**
R1	455,301	255,580	117,243		346,862	207,059	107,166	257,755	26,063	546,880	**2,319,909**
R2	146,920		117,923				145,145		522,361	443,964	**1,376,313**
REC									314,982		**314,982**
RSS		368,773									**368,773**
SD	2,827	29,214	8,234			3,989		2,293			**46,557**
SDcrk	6,688	23,454		25,352		19,404	40,642	25,232	38,697	17,112	**196,581**
Grand Total	**639,280**	**813,362**	**978,354**	**1,158,470**	**1,343,901**	**1,537,549**	**1,568,222**	**1,599,326**	**1,631,862**	**1,664,407**	**12,934,733**

10 State of the Infrastructure –Roads Recommendations

In addition to the budgetary recommendations, the following recommendations are provided for the management of the road inventory.

1. The information and budget recommendations included in this report should be used to further develop and evolve the corporate Asset Management Plan.
2. The budget should be increased from the current funding level of $640,000 to the Preservation funding level of $1,408,000 over a 5 year period.
3. Budgets should be adjusted annually to account for growth and inflation.
4. The cycle for review of the condition of road system should be no greater than a four year cycle.
5. Unit costs, budget recommendations, update history, and performance models should be updated annually.
6. The System Adequacy should be maintained at 60% or higher.
7. The weighted average Physical Condition should be at 70 or higher.
8. The Good to Very Good roads should be at 60% or higher
9. Programming should be reviewed to ensure that resurfacing and preservation programs are optimized.
10. Traffic counts should be updated and repeated on a regular basis on a 3 to 5 year cycle. The counting should include the percentage of truck traffic and the year.
11. Roads sections where potentially substandard horizontal and vertical alignment have been identified, should be reviewed to ensure signage is in compliance with the Ontario Traffic Manual.
12. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
13. Storm Water Master Plans should be developed for urbanized areas.
14. The results and recommendations for programming of this report should be integrated with the other assets groups to ensure available funding is optimized.

Appendix A: Inventory Manual Methodology Overview

Asset Condition Rating Methodology

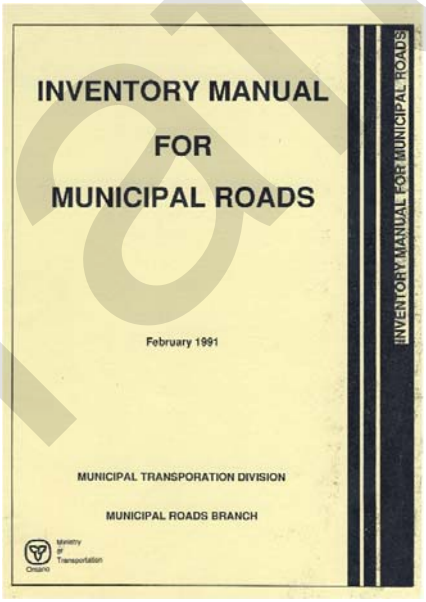
The provincial requirements for AMP's include asset condition assessment in accordance with standard engineering practices. The road asset reviews generally conform to the methodology of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

Inventory Manual History

From the 1960's until the mid-1990's, the Ministry of Transportation (MTO) required municipalities to regularly update the condition ratings of their road systems in a number of key areas. The process was originally created by the MTO as a means to distribute conditional funding, on an equitable basis, between municipalities. The reports were referred to as a 'Road Need Study' (RNS) and were required in order to receive a conditional grant to subsidize municipal road programs. After the introduction in the 1960's by the MTO, the methodology evolved into the current format by the late 1970's. The most current version of the Inventory Manual is dated 1991, and is the methodology used for this report and supported by WorkTech Asset Manager Foundation Software. The practice was discontinued by a number of municipalities when conditional funding for roads was eliminated in the mid 1990's.

Inventory Manual Overview

The Inventory Manual Methodology is a sound, consistent, asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound road asset inventorying and management system. Road system reviews should be repeated on a cyclical basis. The road section review identifies the condition of each road asset by its time of need and recommended rehabilitation strategy.



To put terminology in a current context, the past Road Needs Study is now *'The State of the Infrastructure Report (SotI)'.* The SotI analyzes and summarizes the road system survey data collected (or provided) and provides an overview of the overall condition of the road system by road section, including such factors as structural adequacy, drainage, and surface condition. The study also provides an indication of apparent deficiencies in horizontal, and vertical alignment elements, as per the Ministry of Transportation's manual, "Geometric Design Standards for Ontario Highways".

The report provides an overview of the physical and financial needs of the road system, which may be used for programming and budgeting. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the project.

Asset Management by its' very nature is holistic. Managing a road network based solely on pavement condition would be critically deficient in scope in terms of the information required to make an informed decision as to the improvements required on a road section.

The *Inventory Manual* offers a holistic review of each road section, developing a Time of Need (TON) or an Adequate rating in six areas that are critical to municipal decision making:

- Geometrics
- Surface Type
- Surface Width
- Capacity
- Structural Adequacy
- Drainage

Evaluations of each road section were completed generally in accordance with the MTO's *Inventory Manual for Municipal Roads* (1991). Data collected was entered directly into WorkTech's Asset Manager Foundation software. Condition ratings, Time of Need, Priority Ratings, and associated costs were then calculated by the software, in accordance with the *Inventory Manual*. Unit costs for construction are typically provided by municipal staff.

Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, or a combination of these factors. As an example, section changes should occur as surface type, surface condition, cross-section, or speed limit changes.

The Condition Ratings, developed through the scoring in the *Inventory Manual*, classify roads as 'NOW', '1 to 5', or '6 to 10' year needs for reconstruction. **The Time of Need is a prediction of the time until the road requires reconstruction, *not the time frame until action is required***. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible, to further defer the need to reconstruct.

Field data is obtained through a visual examination of the road system and includes: structural adequacy, level of service, maintenance demand, horizontal and vertical alignment, surface and shoulder width, surface condition, and drainage. The Condition Rating is calculated based upon a combination of other calculations and data.

To best utilize the database information and modern asset management concepts, it has to be understood that the Time of Need (TON) ratings are the estimated time before the road would require reconstruction. NOW needs are still roads that require reconstruction; however, it is not intended that '1 to 5' and '6 to 10' year needs are to be acted on in that timeframe for resurfacing recommendations. The '1 to 5' and '6 to 10' year needs are current candidates for resurfacing treatments that will elevate their structural status to 'ADEQ', and offer the greatest return on investment for a road authority(notwithstanding a drainage or capacity need, etc.).

‘NOW’ Needs

‘NOW’ needs represent the backlog of work required on the road system. A ‘NOW’ need is not necessarily the highest priority from asset management or return on investment perspectives. Construction improvements identified within this time period are representative of roads that have little or no service life left and are in poor condition. F Theoretically a resurfacing strategy is never a ‘NOW’ need, with the exceptions of a PR1 or PR2 treatment recommendation (Pulverize and resurface one or two lifts of asphalt) and where the surface type is inadequate for the traffic volume.

If a road with an improvement recommendation of “resurface” deteriorates too far, it becomes a ‘NOW’ construction need. A ‘NOW’ need rating may be triggered by substandard ratings in any of the Structural Adequacy, Surface Type, Surface Width, Capacity, Drainage, or Geometrics data fields.

These roads would be described as being on ‘Poor’ condition

‘1 to 5’ Year Needs

‘1 to 5’ Identifies road sections where reconstruction is anticipated within the next five years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct. These roads would be described as being in ‘Fair’ condition.

'6 to 10' Year Needs

'6 to 10' Identifies road sections where reconstruction improvements are anticipated within six to ten years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct. These roads would be described as being in 'Good' condition.

'ADEQ'

An ***'ADEQ'*** rating encompasses a wide range of conditions that include the following:

- Roads with a traffic volume of less than 50 vehicles per day will be deemed adequate, and deficiencies on those roads are to be corrected with the maintenance budgets
- Gravel Roads with a structural adequacy rating that is not a 'NOW' need (more than 25% distress) is adequate; there is no further differentiation by time period
- Roads that do not require improvement other than maintenance

These roads would be described as being in good to excellent condition

INVENTORY MANUAL TREATMENTS

Table A.1: Road Improvement Types

Code	Description
R1	Basic Resurfacing
R2	Basic Resurfacing – Double Lift
RM	Major Resurfacing
PR1	Pulverizing and Resurfacing
PR2	Pulverizing and Resurfacing – Double Lift
BS	Tolerable standard for lower volume roads – Rural and Semi-Urban Cross sections only
RW	Resurface and Widen
REC	Reconstruction
RNS	Reconstruction Nominal Storm Sewers (Urban: no new sewer, adjust manholes, catch basins, add sub-drain, remove and replace curb and gutter, granular, and hot mix)
RSS	Reconstruction including Installation of Storm Sewers (New storm sewers and manholes in addition to the above)
NC	Proposed Road Construction
SRR	Storm Sewer Installation and Road Reinstatement
Micro*	Microsurfacing (Preservation Activity)
SST*	Application of a Single Surface Treatment
SSTplus*	Single Surface Treatment, Geometric Padding/Correction, Ditch improvements
DST*	Double Surface Treatment

*Additional Improvement Types developed by 4 Roads not included in the Inventory Manual

Types of Improvements

For each Type of Improvement **(Item 104)**, there are a number of specific road improvements that are included in the total cost relative to the Roadside Environment **(Item 32)** and the Design Class **(Item 105)**. The computer will check a number of Items on the appraisal sheet in order to select the appropriate factors and cross section standards and then calculate the Bench Mark Cost. For example, a Resurfacing and Widening improvement coded under Item 104 is a significantly different road cross section and cost when applied to a rural road vs. an urban arterial. The computer will make all of the necessary checks to arrive at the recommended improvement cost.

Described in the following pages are the road improvements and associated construction activities costed for each Type of Improvement listed under Item 104. Please note, that the Codes **(CO)** – Carry Over, **(SR)** – Spot Road, **(SI)** – Spot Intersection and **(SD)** – Spot Drainage are direct cost inputs and **are not** included in the Bench Mark Cost system.

(R1) - BASIC RESURFACING

(Single Lift of Hot Mix – 50 mm)

Rural and Semi-Urban Roads (Cross Section A)

(a) Hot mix padding for 20% of area to be resurfaced
(b) Single life of hot mix (50 mm)
(c) Granular material to raise shoulders to new surface grade

Urban Roads – Granular Base (Cross Section B-1)
– Concrete Base (Cross Section C-1)

(a) Minor base repairs for 10% of area to be resurfaced
(b) Hot mix padding for 20% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Planning 1.0m of existing pavement along both curbs
(e) Adjust manholes and catch basins to new surface grade
(f) Single lift of hot mix (50 mm)

(R2) - BASIC RESURFACING

(Double Lift of Hot Mix – 100 mm)

Rural and Semi-Urban Roads (Cross Section A)

(a) Hot mix padding for 20% of area to be resurfaced
(b) Double lift of hot mix (100 mm)
(c) Granular materials to raise shoulder to new surface grade

Urban Roads – Granular Base (Cross Section B-1)
– Concrete Base (Cross Section C-1)

(a) Minor base repairs for 10% of area to be resurfaced
(b) Hot mix padding for 20% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Planning 1.0 m of existing pavement along both curbs
(e) Adjust manholes and catch basins to new surface grade
(f) Double lift of hot mix (100 mm)

(RM) - MAJOR RESURFACING

(Double Lift of Hot Mix – 100 mm)

Urban Roads (Arterials and Collectors) – Granular Base (Cross Section B-1)
– Concrete Base (Cross Section C-1)

(a) Base repairs for 50% of area to be resurfaced
(b) Planning for 50% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Adjust manholes and catch basins to new surface grade
(e) Double lift of hot mix (100 mm)

(PR1) - PULVERIZING AND RESURFACING

(Single lift of Hot Mix – 50 mm)

Rural Roads (Cross Section A)

(a) Pulverize existing hard top surface
(b) Single lift of hot mix (50 mm)
(c) Granular material to raise shoulders to new surface grade

(**PR2) - PULVERIZING AND RESURFACING (Double Lift of Hot Mix – 100 mm**)

Rural Roads (Cross Section A)

(a) Pulverize existing hard top surface
(b) Double lift of hot mix (100 mm)
(c) Granular material to raise shoulders to new surface grade

(BS) - BASE AND SURFACE

Rural Roads – Tolerable Standard (50 to 100 AADT) (Cross Section D)

(a) Granular material for base
(b) Granular material for loose top surface
(c) Minimal shoulder widening
(d) Minor Ditching

Rural Roads – Design Standard (200 to 399 AADT) (Cross Section D)

(a) Placing granular material
(b) Minimal shoulder widening
(c) Double surface treatment
(d) Minor ditching

Rural Roads – Design Standard (400 plus AADT) (Cross Section D)
and
Semi-Urban Roads – Design Standard (Cross Section D)

(a) Placing granular material
(b) Minimal shoulder widening
(c) Hot mix (50/100 mm, see table F-1)
(d) Minor ditching

(RW) - RESURFACE AND WIDEN

Rural Roads – Tolerable Standard (50 to 199 AADT) (Cross Section E)

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Granular material for loose top surface

Rural Roads – Design Standard (200 to 399 AADT) (Cross Section E)

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Double surface treatment

Rural Road – Design Standard (400 plus AADT) (Cross Section E)

and

Semi-Urban Roads – Design Standard (Cross Section E)

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Base Course of hot mix for widening
(e) Hot mix Padding for 20% of existing surface area
(f) Single life of hot mix (50 mm)

Urban Roads – Design Standard – Granular Base (Cross Section F)

(a) Excavating for widening
(b) Curb and Gutter removal
(c) Catch Basin removal
(d) Base repair 10% of existing surface area
(e) Granular material for widening
(f) Place catch basins and leads
(g) New curb and gutter
(h) New sub-drains
(i) Base course of hot mix for widening
(j) Hot mix padding for 20% of existing surface area
(k) Adjust manholes to new surface grade
(l) Single lift of hot mix (50 mm) curb to curb

Urban Roads – Design Standard – Concrete Base (Cross section G)

(a) Excavating for widening
(b) Curb and gutter removal
(c) Catch basin removal
(d) Base repair for 10% of existing surface area
(e) Place new catch basins and leads
(f) Granular material for widening
(g) Concrete base for widening
(h) New curb and gutter
(i) New subdrains
(j) Base course of hot mix for widening
(k) Hot mix padding for 20% of existing surface area
(l) Adjust manholes to new surface grade
(m) Single lift of hot mix (50 mm) curb to curb

(REC) - RECONSTRUCTION (RURAL and SEMI-URBAN)

Rural Roads – Design Standard (200 to 399 AADT) (Cross Section H)

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular material
(e) Double surface treatment

Rural Roads – Design Standard (400 plus AADT) Cross Section H)

and

Semi-Urban Roads – Design Standard (Cross Section H)

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular material
(e) Hot mix (50/100 mm, see Table F-1)

Rural and Semi-Urban Roads – Design Standard (Concrete Surface)

(Cross Section P)

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular Material
(e) Concrete base and surface

(RNS) - RECONSTRUCTION NOMINAL STORM SEWERS (URBAN)

Urban Roads – Design Standard – Granular Base (Cross Section I)

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) New curb and gutter
(e) New sub-drains
(f) Adjust manholes and catch basins
(g) Hot mix (50/100 mm, see Table F-1)

Urban Roads – Design Standard – Concrete Base (Cross Section J)

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) Concrete base
(e) New curb and gutter
(f) New sub-drains
(g) Adjust manholes and catch basins
(h) Hot mix (50/100 mm, see Table H-5)

Urban Roads – Design Standard – Concrete Surface (Cross Section O)

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) Concrete base and surface
(e) New curb and gutter
(f) New sub-drains
(g) Adjust manholes and catch basins

(RSS) - RECONSTRUCTION INCLUDING INSTALLATION OF STORM SEWERS

Urban Roads – Design Standard – Granular Base (Cross Section K)

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
(j) Hot mix (100/150 mm, see Table F-1

Urban Roads – Design Standard – Concrete Base (Cross Section L)

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
(j) Concrete base
(k) Hot mix (50/100 mm, see Table F-1)

Urban Roads – Design Standard – Concrete Surface (Cross Section Q)

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
(j) Concrete base and surface

(NC) - PROPOSED ROAD CONSTRUCTION

Rural Roads – Design Standard (200 – 399 AADT) (Cross Section H)

(a) Grading
(b) Ditching and cross culverts
(c) Granular base
(d) Double surface treatment

Rural Roads – Design Standard (400 plus AADT) (Cross Section H)

(a) Grading
(b) Ditching and cross culverts
(c) Granular base
(d) Hot mix (50.100 mm, see Table F-1)

Semi-Urban Roads

New Construction does not apply to semi-urban roads as there is no existing frontage development.

Urban Roads – Design Standard – Granular Base (Cross Section K)

(a) Grading
(b) Storm Sewers
(c) Manholes and catch basins including leads
(d) Curb and gutter
(e) Sub-drains
(f) Granular base
(g) Hot mix (100 mm/150 mm, see Table F-1)

Urban Roads – Design Standard – Concrete Base (Cross Section L)

(a) Grading
(b) Storm Sewers
(c) Manholes and catch basins including leads
(d) Curb and gutter
(e) Sub-drains
(f) Granular base
(g) Concrete base
(h) Hot mix (50 mm/100 mm , see Table F-1)

(SRR) - STORM SEWER INSTALLATION AND ROAD REINSTATEMENT (URBAN AND SEMI-URBAN)

Urban and Semi-Urban Roads – Granular Base (Cross Section M)

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewer including bedding
(d) Granular materials in trench
(e) Hot mix to restore surface grade (100/150 mm, see Table F-1)

Urban and Semi-Urban Roads – Concrete Base (Cross Section N)

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewers including bedding
(d) Granular material in trench
(e) Concrete base for trenched area
(f) Hot mix to restore surface grade (50/100 mm, See Table F-1)

Urban and Semi-Urban Roads – Concrete Surface (Cross Section R)

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewers including bedding
(d) Granular material in trench
(e) Concrete base and surface for trenched area

(MICRO) SINGLE LIFT OF MICROSURFACING

Urban, Semi-Urban and Rural Roads with a HCB (High Class Bituminous) surface type

(a) Unit cost per square metre of Microsurfacing

(SST) SINGLE LIFT OF SURFACE TREATMENT

Urban, Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type

(a) Unit cost per square metre of Single Surface Treatment

(SSTplus) SINGLE LIFT OF SURFACE TREATMENT, GEOMETRIC CORRECTION DITCHING IMPROVEMENTS

Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type

(a) Unit cost per square metre of Single Surface Treatment
(b) 20% Surface area padding to 50mm to correct geometric deficiencies
(c) Earth Excavation allowance to provide for minor ditch improvements and berm removal

(DST) DOUBLE LIFT OF SURFACE TREATMENT

Urban, Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type

(a) Unit cost per square metre of Double Surface Treatment

Appendix B: Pavement Structure and Defects

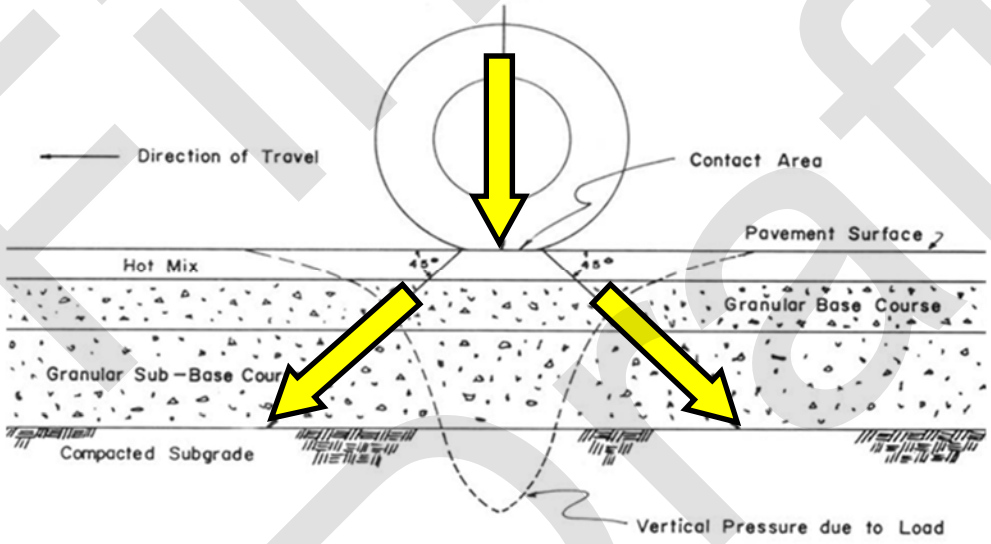
Pavement Structure

To assist in understanding the content and methodology of the report, the following discussion provides an overview of how flexible and rigid pavement structures are designed and function. The majority of municipal roads would be described as having a flexible pavement structure. Hot mix asphalt, surface treatment, and gravel road surfaces are typical flexible pavement road structures. Other pavement structure types include rigid and composite, and are more typically found on 400 series highways, or on arterial roads of larger urban centres.

Flexible Pavement Road Structure

Load is applied to the pavement structure, and ultimately to the native sub-grade, via wheel loads of vehicles. The pavement structure between the native sub-grade and the load application point has to be designed such that the load that is transmitted to the sub-grade is not greater than the sub-grade's ability to support the load. The figure below shows a typical flexible pavement structure and how applied load dissipates.

Load Distribution through Pavement Structure



From MTO

Depth Below Surface	Stress (psi)	Stress (Kpa)
At Surface	90	620.50
8" (200 mm) Below	11	75.84
11" (275 mm) Below	7	48.26
16" (400 mm) Below	4	27.58

Surface materials experience the highest loading at the point of contact with the vehicle's tire. Radial truck tires, running from 110 psi to 120 psi, can have an impact 20 times higher at the surface, than at the compacted sub-grade. The loading actually occurs in three dimensions, in a conical fashion, dissipating both vertically and horizontally as it passes through the pavement structure. Loading

decreases exponentially as it passes through the road structure. Therefore, materials of lesser strength or lesser quality can be used deeper in the road structure.

As a rule of thumb, the closer the road building materials are placed to the surface of the road, the higher the quality required. Similarly, the poorer the sub-grade or native material, the deeper/stronger the road structure has to be to carry the same loads.

Traffic counts, and the percentage of trucks, are critical to structural design of the pavement. Depending upon the source, the effect of a single truck on the pavement structure can be equivalent to 2,000 to 8,000 passenger cars. The effect of farm machinery would be very similar to that of heavy trucks. However, the Highway Traffic does permit certain types of farm machinery and equipment to use the roads even during half load season, so this is an additional consideration when designing rural roads.

Pavement evaluation involves a review of each road section and an assessment of the type and extent of the distress(es) observed. Treatment recommendations are predicated by whether the cause of the major distress(es) is structural or non-structural.

Flexible pavements will have age-related distresses and wearing such as thermal cracking and oxidation. These distresses are non-structural; however, once a crack develops and water enters the pavement structure, deterioration will accelerate. Poor construction practices, quality control, or materials may produce other non-structural surface defects, such as segregation and raveling, which will also result in a reduced life expectancy of the surface asphalt.

Fatigue cracking indicates structural failure and can manifest itself in many forms, such as wheel path, alligator, and edge cracking. It can be localized or throughout a road section. When roads that have exhibited fatigue cracking are rehabilitated, there should be particular attention paid to the rehabilitation treatment, to ensure that the upgraded facility has sufficient structure.

Wheelpath Fatigue Cracking

Flexible Pavement Road Structure Design

There are a number of flexible pavement structural design methodologies and associated software. The simplest way to describe structural design may be the Granular Base Equivalency (GBE) Methodology. This GBE methodology is still used in Ontario, by a number of agencies, and is frequently used as a cross-check where more sophisticated analysis has been undertaken.

The measurement is unit-less and relates to the structural value of one millimetre of Granular 'A' material. The relationship of the typical road building materials is expressed in either of the two following ways:

- **1 mm of HMA = 2 mm of Granular A = 3 mm of Granular B**

Or

- **HMA = 2, Granular A = 1, Granular B = 0.67**

To gain some perspective on what this means in terms of typical construction activities, the following table indicates a typical subdivision road construction as expressed in GBE.

Granular Base Equivalency

Material	Example 1 Depth	Granular Base Equivalency	Example 2 Depth	Granular Base Equivalency
Hot Mix Asphalt (HMA)	100	200	150	300
Granular A	150	150	300	300
Granular B	300	200	0	0
TOTAL	**550**	**550**	**450**	**600**

When reconstruction and rehabilitation projects are undertaken, and use of alternate materials and/or road structure is contemplated, the GBE concept is important to bear in mind, as different treatments such as Expanded Asphalt and Cold in Place recycling also have a structural value. For design purposes, it may be prudent to use a conservative equivalency of 1.5 for these products (although, some sources indicate GBE's of up to 1.8).

As an example, if a 200 mm pavement is replaced with 150 mm of Expanded Asphalt or Cold in Place Recycling, with a 50 mm overlay of Hot Mix asphalt, a pavement structure with a GBE of 400 is replaced by a pavement structure with a GBE of 325; a significant difference. Premature failure will be the result of an under-designed pavement structure, wasting resources and available funding.

The purpose of this example is to illustrate the different structural values that products have. Expanded Asphalt and Cold in Place recycling are both excellent products to rehabilitate pavement structures when used appropriately.

The MTO's *Pavement Design and Rehabilitation Manual* is an excellent resource for use in pavement structure design and rehabilitation, and is available from the online MTO Catalog.

Thin Lift Pavements

Hot mix asphalt mixes are designed in Ontario either by the Marshall Method or the Superpave Method. Through time, this has resulted in a number of commonly used mixes that are typically sorted by size. One of the parameters used to describe that sizing is the Nominal Maximum Aggregate Size (NMAS).

In the Marshall Mix Method, typical mix designations are HL1, HL2, HL3, HL4, and HL8. In the Superpave mix design methodology, mixes are designated by the NMAS.

The following table identifies the NMAS for the more commonly used mixes, and indicates recommended minimum lift thicknesses for them.

Recommended Minimum Lift Thicknesses

Mix Type	NMAS (mm)	Lift Thickness Range (mm)
SP 9.5	9.5	30 to 40
SP 12.5	12.5	40 to 50
SP 19	19.0	60 to 80
HL3	13.2	40 to 55
HL4	16.0	50 to 65
HL8	19.0	60 to 80

Thin Lift Pavement

Thin lift with inappropriate aggregate size

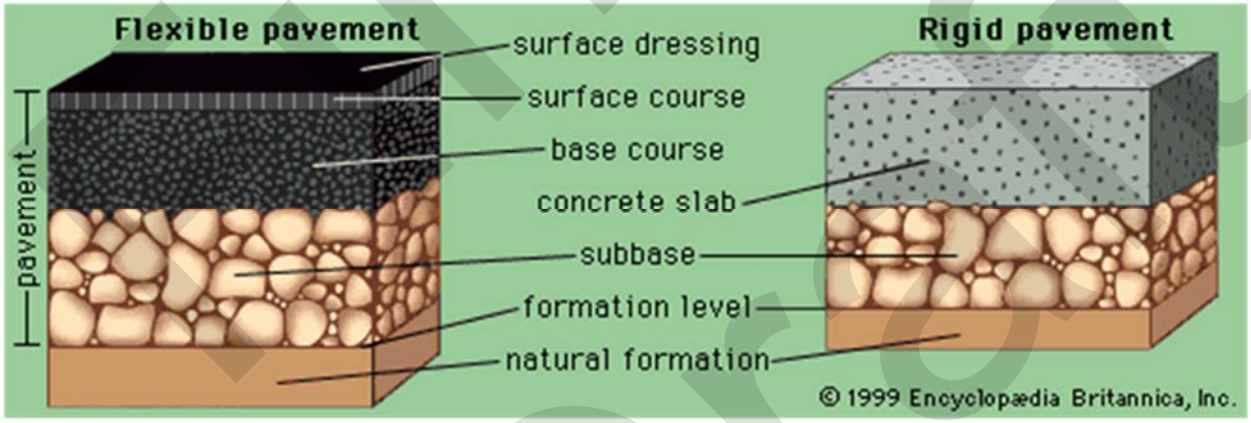
Rigid Pavement Structure

Rigid Pavements are constructed of concrete, or concrete with an asphalt wearing surface. The fundamental difference between a flexible pavement and a rigid pavement is the method in which the load is transferred. Whereas the flexible pavement distributes load through the pavement structure in a conical fashion, with a higher point load directly beneath the loading point, the rigid pavement structure distributes that load in a beam-like fashion, more evenly across the pavement structure. Rigid pavements may have an exposed concrete wearing surface, or they may be covered with an asphaltic concrete wearing surface.

The resulting rigid pavement structure is usually thinner overall, when compared to a flexible pavement, designed to accommodate the same traffic loading. This does not necessarily translate into a reduced cost of construction. Any comparison of costs between flexible and rigid pavements should be on a life cycle basis, for the most accurate assessment.

Older concrete pavements were prone to failure at joints, as load transfer caused a slight movement in the concrete slab, and with the intrusion of water, a structural failure. Newer concrete pavements are designed with improved load transfer technology.

Figure 1 Flexible vs. Rigid Pavement Structure(s)



Flexible Pavement Distresses and Treatment Selection

Treatment recommendation is dependent upon the condition of the road section at the time of the review.

Treatment Selection – Critical Area Analysis

When using the Inventory Manual methodology all of the 'holistic' needs are considered in the recommendation. For example, a road may appear to require only a resurfacing, however, when the other critical areas are reviewed, there may be a capacity problem which would then result in a recommendation to resurface and widen (RW) that would address both the pavement condition and the need for additional lanes. Another example would be where the pavement is exhibiting some type of

distress but there is also poor drainage. The recommendation would then be to reconstruct (REC if rural, RSS if urban).

Treatment Selection for Non-Structural Rehabilitation

Resurfacing recommendations are predicated upon the type and extent of distress noted. For example, all pavements will develop thermal/transverse cracking as they age. As the age of the pavement increases, the frequency of the cracking increases. If the spacing of the cracks is still greater than 10m, then the R1 – resurface with one lift of asphalt – treatment will typically be sufficient to restore the road as the treatment provides for overlay and base asphalt repair. However, if the frequency of transverse cracking , which may have become transverse alligator cracking if left unattended too long, then the recommendation will be more extensive, such as a PR2- Pulverize and resurface with 2 lifts of asphalt. The following illustrates transverse cracking.

Transverse /Thermal cracking

Treatment Selection for Structural Rehabilitation

Road sections exhibiting structural failure such as fatigue cracking require a more extensive rehabilitation to restore the performance of the road section. In simple terms, placing a single lift of asphalt over structurally failed asphalt will guarantee the same failure in a very short time period. Unless the single lift overlay is placed knowingly as a holding strategy, it should be avoided on structurally deficient pavements. For pavements that have failed structurally or have too much transverse cracking, the recommendation is typically PR2 as a minimum provided the drainage is adequate or requires only minor improvement.

Reflective Cracking

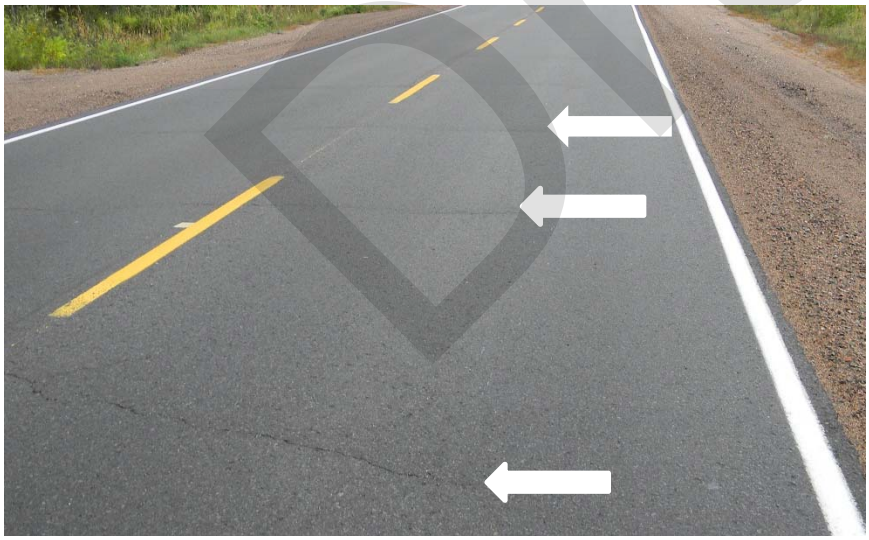
Paving over an active crack(s) will result in a crack(s) in the same location within 2 to 3 years. As a rule of thumb, the crack will migrate through at approximately 25mm per year. Therefore it would be

anticipated that if a 50mm overlay is placed, then the cracking would reappear in approximately 2 years. This is not an efficient usage of available funding.

Structurally Failed Pavement

The above figure illustrates a pavement that has failed both structurally and has very frequent severe transverse cracks. Placement of a 50mm overlay over this type of pavement condition will result in rapid failure and is not recommended. The figure below illustrates a newer pavement that already has very frequent transverse cracks appearing, likely the result of paving over a failed pavement. Under normal circumstances, the first transverse cracks generally appear in approximately 4 to 6 years and the cracks are 40m to 50m or more apart.

Reflective Transverse Cracking on Newer Pavement



Appendix C: Gravel Road Conversion Criteria

Gravel Road Conversion

Gravel Road Maintenance Overview

Gravel roads tend to be the 'forgotten' asset. Gravel roads form an integral component of the road asset group for the municipality and should be managed as any other asset.

One of the difficulties in determining the deterioration of a gravel road is that the wearing surface and the granular layers are one and the same, so the extent of deterioration may not be as obvious until the deterioration is significant. Appropriate gravel road maintenance can be deceptively expensive. Frequently, budget analysis proves that the per-kilometre cost of adequate gravel road maintenance is greater than the per-kilometre cost for hard top maintenance. This is further exacerbated as traffic volume on a gravel road increases.

Like other road assets, gravel roads have lifecycle maintenance and rehabilitation costs that should be addressed as part of any asset management plan. Life cycle costs include regular addition of gravel, dust control, grading and labour. Grading will typically include equipment costs for a motor grader. A Net Present Value (NPV) assessment comparing life cycle of a gravel surface vs. hard top surface would be a key element in determining the merit of converting a gravel road to hard top.

NPV Analysis Components

Process

Given the above noted, a Net Present Value (NPV) assessment of the gravel road, in comparison with a surface treated road section or other hard top surface, should be undertaken as it may be more cost-effective to convert/upgrade the gravel road to a hard surface; typically surface treatment.

Road agencies in both Canada and the United States have conducted studies that have generally indicated that, dependent upon local unit costs, gravel road conversion to hardtop can be a cost-effective strategy. One source indicates that this may be effective management for roads with traffic volumes as low as 100 AADT.

It is preferable to address the cost comparisons over a period of time where the life cycles may conclude concurrently. For instance, if the gravel maintenance is on a three year basis and the surface treatment is seven, then the cycles coincide at 21 years. Total life cycle cost over that time period should be considered.

Gravel

This report provides an annual cost for maintenance costs for 75mm of additional gravel to be added every three years and does not included regular grading or dust control. This was a typical standard that was used in the past by many municipalities. Due to the natural life cycle wear and tear, maintenance, and winter control activities, gravel roads require additional gravel on a regular basis to ensure continuing performance.

Equipment

As part of a holistic review of service delivery, consideration should be given to the equipment hourly rates and replacement. Accurate hourly rates are required to provide a true assessment. Equipment rates should include capital depreciation and operating costs.

One of the factors driving the overall cost is the equipment that is required to properly maintain a gravel road system - particularly graders. Part of the gravel road conversion analysis should include:

- Has the hourly rate for the equipment been calculated properly to include capital depreciation and maintenance costs?
  A new grader will typically cost over $300,000. At a 20-year life span, there is a minimum of $15,000 in capital depreciation alone on the grader. What is the current rate for the grader? If there is not full cost recovery on the grader hourly rate, then the cost for gravel road maintenance is not accurate either.
- Is the grader used for any other purpose/activities?
- What is the length of the gravel road system? A commonly used length of gravel roads used to justify a grader is 75 kilometres of gravel.
- How many hours per year is the grader operated?
- Are there other pieces of equipment that could be used or rented to maintain the gravel roads?

Surface Treatment or other hard top

Whatever other surface type is being compared with the gravel road surface should include the same factors as for gravel so there is a 1:1 comparison.

Additional Factors and Considerations

If the argument for conversion may be made from a financial perspective, then there are additional factors that should be considered from physical and risk perspectives. Other factors for consideration include:

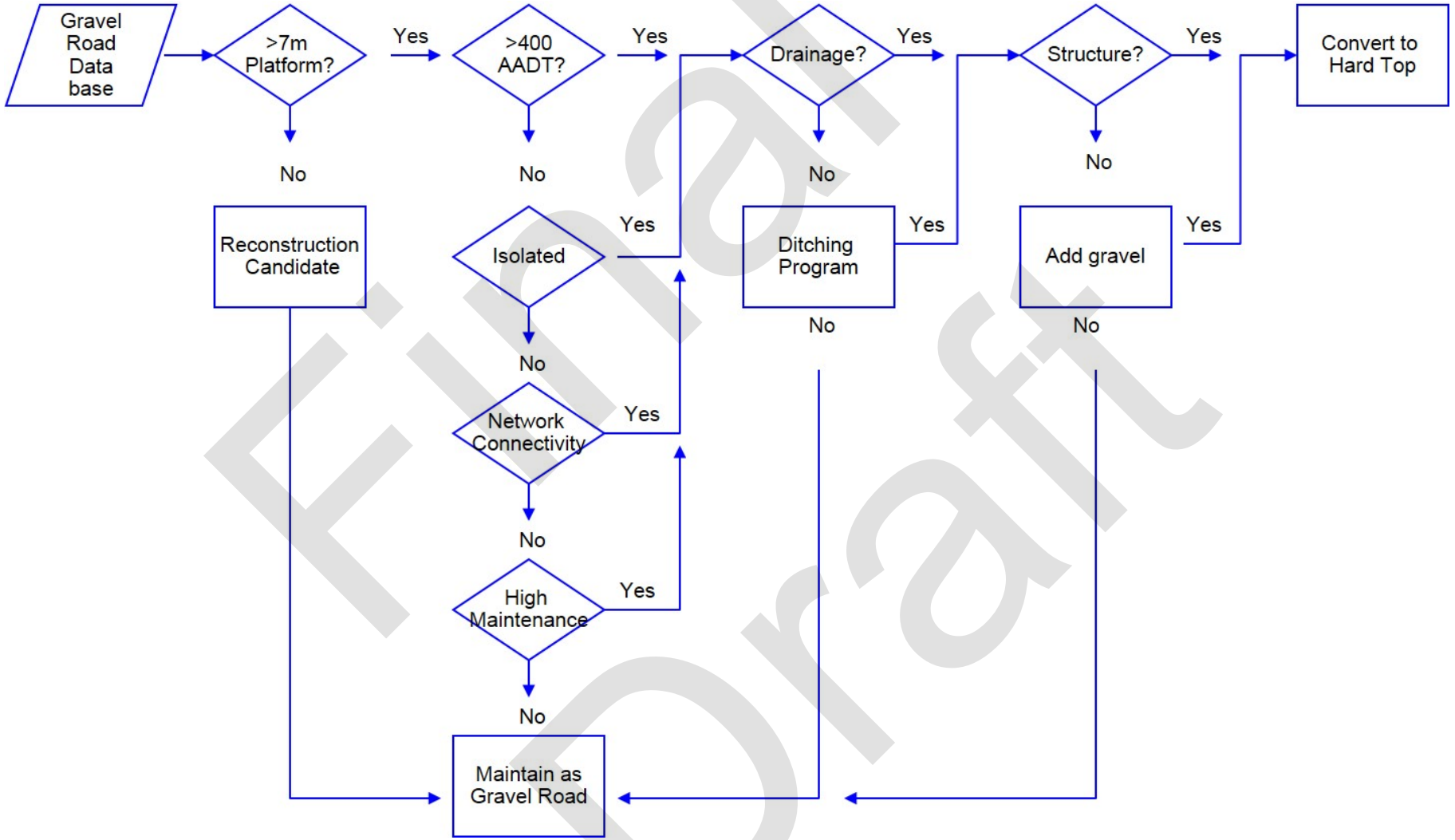
- Platform width
- Drainage
- Structural Adequacy
- Traffic Volume and Type

The figure below provides a graphical illustration of the different factors and decision flow that may be considered in developing a case to convert a gravel road to hard top.

Benefits to converting a gravel road include:

- Customer satisfaction
- Reduced maintenance costs for routine maintenance
- Reduced maintenance costs for winter maintenance, dependent upon local practices
- Reduced complaints

Gravel Road Conversion Matrix



Conversion candidates should have a width that meets or exceeds the minimum standard width for the traffic volume of the road section plus minimum 0.5 metre shoulder, be sound structurally, and have good drainage. Structural soundness may be obtained through geotechnical examination or documented past performance.

Appendix D: Deterioration Curve Detail

WorkTech Asset Classes and Deterioration Curves for Roads

Asset Classes

In order to utilize the Best Practice and Performance Modeling modules of WorkTech Asset Manager Foundation (WT), assets must be defined by an asset class. Table 1 identifies the road asset classes that have been developed for use in WT by 4 Roads Management Services Inc.

Table 1: Road Asset Classes

Asset Class	Subtype	Material	RDSE Envt	AADT Low	AADT High
A/C-R	All	A/C	R	1	100,000
A/C-S	All	A/C	S	1	100,000
A/C-U	All	A/C	U	1	100,000
CM1-R	All	C/M	R	1	3,000
CM1-S	All	C/M	S	1	3,000
CM1-U	All	C/M	U	1	3,000
CON-R	All	CON	R	1	100,000
CON-S	All	CON	S	1	100,000
CON-U	All	CON	U	1	100,000
GST1-R	All	G/S	R	1	10,000
GST1-S	All	G/S	S	1	10,000
HCB1-R	ART	HCB	R	20,000	100,000
HCB1-S	ART	HCB	S	20,000	100,000
HCB1-U	ART	HCB	U	20,000	100,000
HCB2-R	ART	HCB	R	10,000	19,999
HCB2-S	ART	HCB	S	10,000	19,999
HCB2-U	ART	HCB	U	10,000	19,999
HCB3-R	All	HCB	R	1,000	9,999
HCB3-S	All	HCB	S	1,000	9,999
HCB3-U	All	HCB	U	1,000	9,999
HCB4-R	All	HCB	R	1	999
HCB4-S	All	HCB	S	1	999
HCB4-U	All	HCB	U	1	999
ICB-S	All	ICB	S	1	3,000
ICB-U	All	ICB	U	1	3,000
ICB1-R	All	ICB	R	1	3,000
LCB1-R	All	LCB	R	1	2,000
LCB1-S	All	LCB	S	1	2,000
LCB1-U	All	LCB	U	1	2,000

WorkTech Asset Classes and Deterioration Curves for Roads

Conventional wisdom has been to define road assets by their functional classes such as Arterial, Collector or Local, and then further differentiate by usage, such as residential or commercial. From a performance modeling perspective, using the functional classification will only work to a point, as the traffic on a functional class will vary between agencies.

4 Roads believes that the performance/deterioration of a road section is more predictable based on surface type and traffic volume rather than by functional class. Based on that philosophy, Table 1 was created identifying Road Asset Classification by Surface Type, Traffic Volume and Roadside Environment. Roadside Environment has been added to permit the calculation of different replacement costs between rural and urban cross-sections.

Deterioration Curves

From **ASTM 6344**, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys;

> *2.1.4 pavement condition index (PCI)—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.*
>
> *4.1 The PCI is a numerical indicator that rates the surface condition of the pavement. The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI provides feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.*

In WorkTech, Physical Condition is the Structural Adequacy multiplied by 5 to produce a score from 5 to 100; very much a parallel to the PCI and it's inherent usage as identified above.

When using the Inventory Manual (IM) methodology, Structural Adequacy is a measurement of the percentage of the surface of the road that is exhibiting distress. The rater will consider the type of distress as well as the other critical areas (surface width, capacity, geometry, drainage and surface width) in order to provide a recommendation for an improvement. In the IM, any, or multiple of the critical areas, may produce a Time of Need (TON). The overall TON of the road section is the worst of all of the TON's. For example, if five of the TON's are ADEQ, and one is NOW, the section is a NOW need.

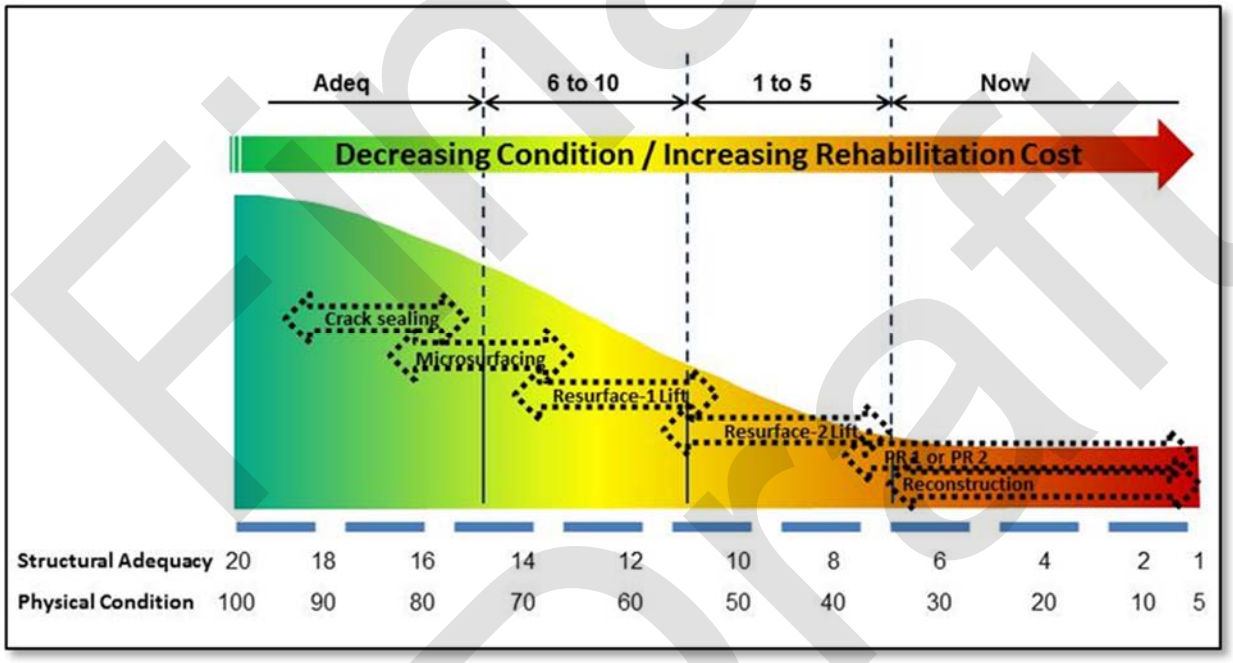
All deterioration curves relate to the 'Physical Condition' data field in WorkTech. The Physical Condition deterioration curve is specific to the Inventory Manual and therefore the trigger points and definition of the curve will be different than other methodologies. It should be noted that different evaluation methodologies will produce varying deterioration curves and trigger points. Familiarity with the rating system being utilized is essential.

It would be possible, but very difficult, to develop performance models around all of the critical areas. So for the purposes of the performance modeling, Structural Adequacy (distress) has been selected to be the driver in the decisions with respect to the model.

In the early years of the model, if a project is selected that has an identified improvement type, that improvement will be used for the project in the year that it is selected. In the later years, presumably after all current deficiencies have been corrected the model will revert to the assigned asset class for deterioration and project selection based on estimated condition.

The deterioration curves are the same for each asset class regardless of roadside environment. For urban sections, the improvement is RSS- Reconstruction with Storm Sewers, rather than REC- Reconstruction Rural.

Figure 1: Physical Condition versus Improvement Selection



Where the MTO PCI / Inventory Manual Condition Rating format is being used, the PCI data is entered to produce a PCI score from different formulas that represent the defects and weightings by surface type. The PCI score is then used to approximate a Structural Adequacy score (and a Physical Condition). Table 2 identifies the approximations to convert PCI to Structural Adequacy and a Time of Need.

Table 2: PCI to Structural Adequacy Approximations

Time of Need	ASTM 6344	Structural Adequacy	Physical Condition	MTO PCI	Surface Condition	Description	Approximation PCI to SA
NOW	1-39	1 to 7	1 to 35	1 to 55	Now Needs – Reconstruction or Major Rehabilitation	Poor to Very Poor to Failed	IF PCI <=55 then, PCI / 8 = SA
1 to 5	40-55	8 to 11	36 to 55	56 to 75	1 to 5 year Needs – R2 /more extensive rehabilitation	Poor /Fair / Passable	IF PCI >55<=75 then, PCI / 7 =SA
6 to 10	55-70	12 to 14	56 to 70	76 to 85	6 to 10 year Needs – R1 Resurfacing	Fair / Good	IF PCI >75<=85 then, PCI / 6 =SA
ADEQ	71-100	15 to 20	75 to 100	86 to 100	Adequate – Maintenance and Preservation	Satisfactory/ Good/ Excellent	If PCI >85 then, PCI /5.4 =SA

Once a Structural Adequacy Score has been determined, the TON is also calculated. What this achieves is the detail of PCI data collection and the strength of the holistic evaluation of the Inventory Manual.

Improvement Types- Effect on the Asset

Appendix A of this report includes a summary of the improvement types that are included in the inventory Manual. In WorkTech there is no restriction on what may be developed as an improvement type for a road agency. However, regardless of the improvement types that are used the effect that the improvement has on the asset has to be understood in order to use performance modeling.

The following table identifies a number of improvement types and further identifies the effect that they have on a road asset. A similar approach may be taken with other assets.

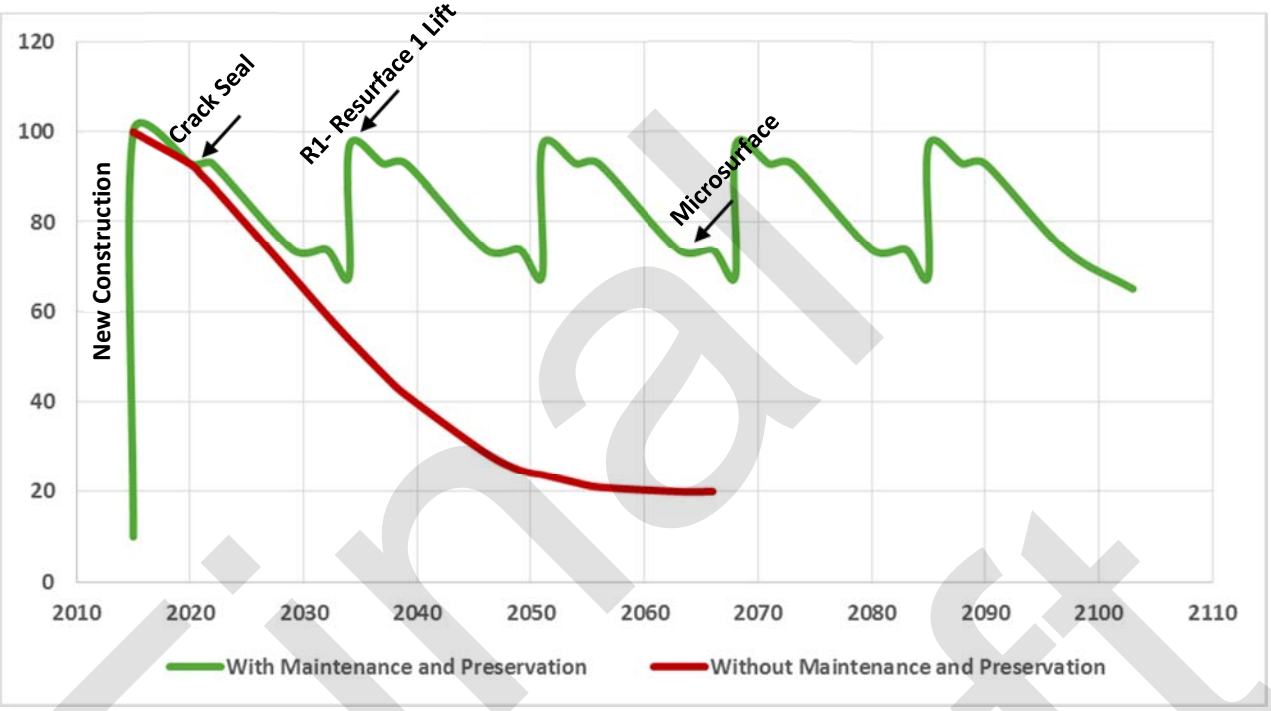
The effect that a treatment has on an asset is critical to the analysis. Inaccurate determination of the effect of a treatment on an asset will produce an inaccurate – and indefensible- result. The following chart is a comparison of the deterioration of a road section without any treatment applied versus a road section that has appropriate treatment at the optimal condition, producing a more cost effective life cycle.

Table 3: Treatment Effect on the Asset

Code	Description	Effect on the Asset
R1	Basic Resurfacing – Single Lift	Increase Physical Condition to 97
R2	Basic Resurfacing – Double Lift	Increase Physical Condition to 100
RM	Major Resurfacing	Increase Physical Condition to 100
PR1	Pulverizing and Resurfacing – Single Lift	Increase Physical Condition to 95
PR2	Pulverizing and Resurfacing – Double Lift	Increase Physical Condition to 100
BS	Base and Surface Tolerable – Tolerable standard for lower volume roads – Rural and Semi-Urban Cross sections only	Increase Physical Condition to 95
RW	Resurface and Widen	Increase Physical Condition to 97
REC	Reconstruction	Increase Physical Condition to 100
RNS	Reconstruction Nominal Storm Sewers (Urban: no new sewer, adjust manholes, catch basins, add sub-drain, remove and replace curb and gutter, granular, and hot mix)	Increase Physical Condition to 100
RSS	Reconstruction including Installation of Storm Sewers (New storm sewers and manholes in addition to the above)	Increase Physical Condition to 100
NC	Proposed Road Construction	Increase Physical Condition to 100
SRR	Storm Sewer Installation and Road Reinstatement	No effect
CRK	Crack Sealing	Hold Physical Condition for 2 Years
MICRO	Microsurfacing	Hold Physical Condition for 3 years
GRR	Gravel Road Resurfacing – add 75mm	Hold Physical Condition for 3 years
GRR2	Gravel Road Resurfacing - Add 150mm	Increase Physical Condition by 20

Figure 2, shown following, illustrates several different aspects of performance model output including the effect of a treatment on an asset and the effect of multiple treatments undertaken at the optimal asset condition to produce a cost effective management strategy.

Figure 2: Performance Model – Effect of Treatment on Asset



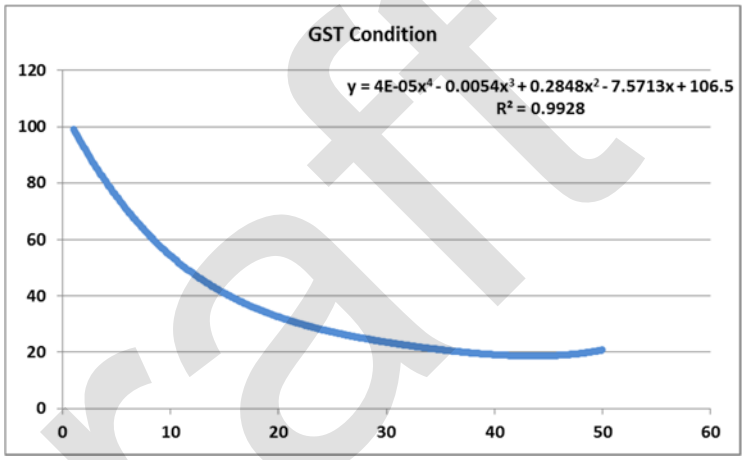
Deterioration Curves by Surface Type and Traffic Volume

The following pages includes tables and graphs indicating the anticipated performance of an appropriately constructed road asset and the condition triggers for treatments. The deterioration curves by asset class used in concert with the table indicating the treatment effect on the asset, and the agency's unit costs, will produce a performance model that demonstrates the effect on the system at various budget levels and produce a program based on input parameters.

WorkTech Asset Classes and Deterioration Curves for Roads

Gravel Roads- All Roadsides, all AADT

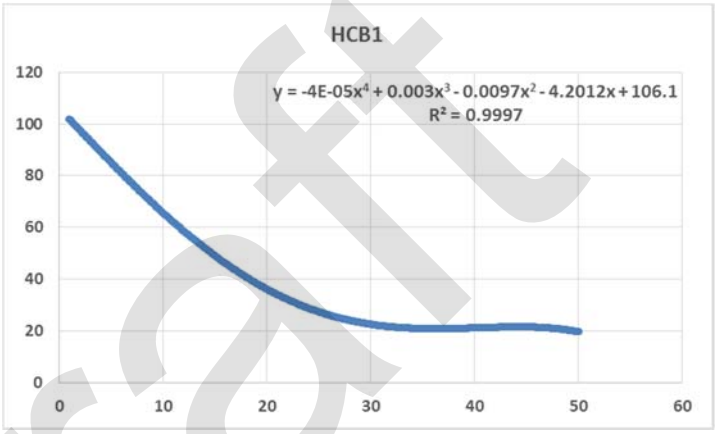
Year	Condition	Imp Typet	Description
1	100	NONE	No Improvement Required
2	92.45	NONE	No Improvement Required
3	86.21	GRR	75mm of Granular A
4	80.43	GRR	75mm of Granular A
5	75.11	GRR	75mm of Granular A
6	70.21	GRR	75mm of Granular A
7	65.7	GRR2	150mm of additional Gravel
8	61.55	GRR2	150mm of additional Gravel
9	57.75	GRR2	150mm of additional Gravel
10	54.27	GRR2	150mm of additional Gravel
11	51.07	GRR2	150mm of additional Gravel
12	48.15	GRR2	150mm of additional Gravel
13	45.48	GRR2	150mm of additional Gravel
14	43.04	GRR2	150mm of additional Gravel
15	40.81	GRR2	150mm of additional Gravel
16	38.77	GRR2	150mm of additional Gravel
17	36.9	GRR2	150mm of additional Gravel
18	35.2	GRR2	150mm of additional Gravel
19	33.63	REC	Reconstruction - Rural
20	32.19	REC	Reconstruction - Rural
21	30.86	REC	Reconstruction - Rural
22	29.64	REC	Reconstruction - Rural
23	28.51	REC	Reconstruction - Rural
24	27.45	REC	Reconstruction - Rural
25	26.47	REC	Reconstruction - Rural
30	22.28	REC	Reconstruction - Rural
35	18.88	REC	Reconstruction - Rural
40	20	REC	Reconstruction - Rural
45	20	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



WorkTech Asset Classes and Deterioration Curves for Roads

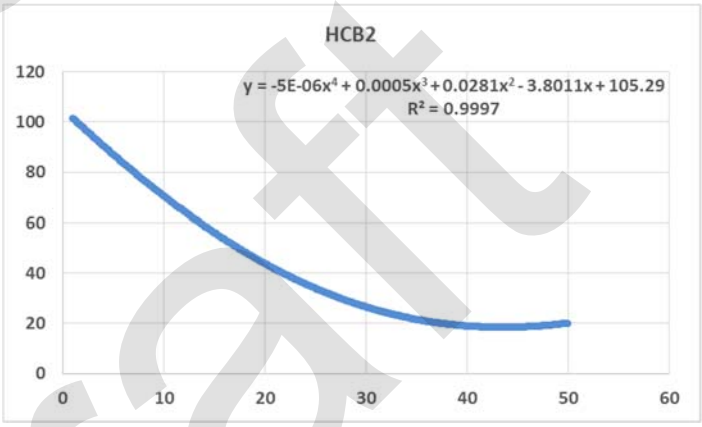
HCB1 All Roadsides- AADT > 20,000, assumes 10% Commercial

>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	98.61	NONE	No Improvement Required
3	94.19	NONE	No Improvement Required
4	89.83	CRK	Crack Sealing
5	85.55	CRK	Crack Sealing
6	81.36	CRK	Crack Sealing
7	77.26	MICRO	Microsurfacing -Pavement Preservation
8	73.28	MICRO	Microsurfacing -Pavement Preservation
9	69.4	R1	Basic Resurfacing 1 - 50mm
10	65.65	R1	Basic Resurfacing 1 - 50mm
11	62.02	R1	Basic Resurfacing 1 - 50mm
12	58.54	R1	Basic Resurfacing 1 - 50mm
13	55.19	R2	Basic Resurfacing 2 - 100mm
14	52	R2	Basic Resurfacing 2 - 100mm
15	48.96	R2	Basic Resurfacing 2 - 100mm
16	46.08	R2	Basic Resurfacing 2 - 100mm
17	43.36	R2	Basic Resurfacing 2 - 100mm
18	40.81	R2	Basic Resurfacing 2 - 100mm
19	38.41	R2	Basic Resurfacing 2 - 100mm
20	36.19	REC	Reconstruction - Rural
22	32.24	REC	Reconstruction - Rural
23	30.51	REC	Reconstruction - Rural
24	28.95	REC	Reconstruction - Rural
25	27.55	REC	Reconstruction - Rural
26	26.3	REC	Reconstruction - Rural
27	25.21	REC	Reconstruction - Rural
28	24.27	REC	Reconstruction - Rural
29	23.47	REC	Reconstruction - Rural
30	22.82	REC	Reconstruction - Rural
35	21.31	REC	Reconstruction - Rural
40	20	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



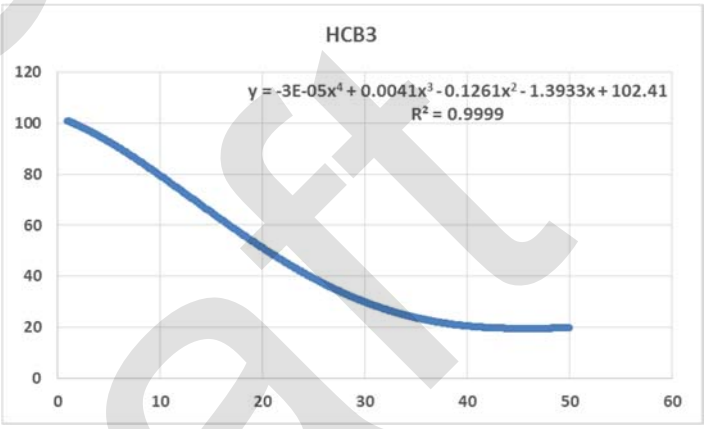
HCB 2 All Roadsides- AADT >10,000 <20,000, Assumes 10% Commercial

>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	98.79	NONE	No Improvement Required
3	94.85	NONE	No Improvement Required
4	91.01	CRK	Crack Sealing
5	87.29	CRK	Crack Sealing
6	83.68	CRK	Crack Sealing
7	80.18	CRK2	Crack Sealing
8	76.79	MICRO	Microsurfacing -Pavement Preservation
9	73.51	MICRO	Microsurfacing -Pavement Preservation
10	70.33	R1	Basic Resurfacing 1 - 50mm
11	67.26	R1	Basic Resurfacing 1 - 50mm
12	64.28	R1	Basic Resurfacing 1 - 50mm
13	61.41	R1	Basic Resurfacing 1 - 50mm
14	58.63	R1	Basic Resurfacing 1 - 50mm
15	55.95	R2	Basic Resurfacing 2 - 100mm
16	53.38	R2	Basic Resurfacing 2 - 100mm
17	50.89	R2	Basic Resurfacing 2 - 100mm
18	48.5	R2	Basic Resurfacing 2 - 100mm
19	46.2	R2	Basic Resurfacing 2 - 100mm
20	43.99	R2	Basic Resurfacing 2 - 100mm
21	41.87	R2	Basic Resurfacing 2 - 100mm
22	39.84	R2	Basic Resurfacing 2 - 100mm
23	37.89	R2	Basic Resurfacing 2 - 100mm
24	36.03	R2	Basic Resurfacing 2 - 100mm
25	34.26	REC	Reconstruction - Rural
26	32.56	REC	Reconstruction - Rural
27	30.95	REC	Reconstruction - Rural
28	29.42	REC	Reconstruction - Rural
29	27.97	REC	Reconstruction - Rural
30	26.59	REC	Reconstruction - Rural
35	20.86	REC	Reconstruction - Rural
40	20	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



HCB 3 All Roadsides – AADT 1,000 < 10,000, Assumes 10% Commercial

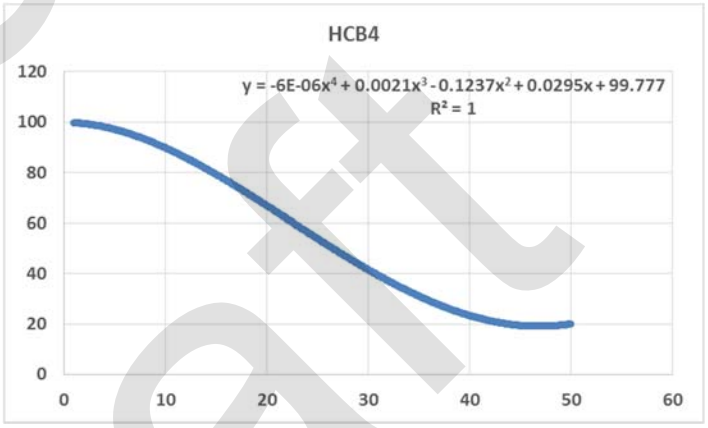
>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	99.44	NONE	No Improvement Required
3	97.46	NONE	No Improvement Required
4	95.29	NONE	No Improvement Required
5	92.95	CRK	Crack Sealing
6	90.48	CRK	Crack Sealing
7	87.88	CRK2	Crack Sealing
8	85.18	CRK2	Crack Sealing
9	82.4	CRK2	Crack Sealing
10	79.56	MICRO	Microsurfacing -Pavement Preservation
11	76.67	MICRO	Microsurfacing -Pavement Preservation
12	73.76	MICRO	Microsurfacing -Pavement Preservation
13	70.83	R1	Basic Resurfacing 1 - 50mm
14	67.91	R1	Basic Resurfacing 1 - 50mm
15	65.01	R1	Basic Resurfacing 1 - 50mm
16	62.14	R1	Basic Resurfacing 1 - 50mm
17	59.31	R1	Basic Resurfacing 1 - 50mm
18	56.54	R1	Basic Resurfacing 1 - 50mm
19	53.83	R2	Basic Resurfacing 2 - 100mm
20	51.19	R2	Basic Resurfacing 2 - 100mm
21	48.63	R2	Basic Resurfacing 2 - 100mm
22	46.17	R2	Basic Resurfacing 2 - 100mm
23	43.8	R2	Basic Resurfacing 2 - 100mm
24	41.53	R2	Basic Resurfacing 2 - 100mm
25	39.37	R2	Basic Resurfacing 2 - 100mm
26	37.31	R2	Basic Resurfacing 2 - 100mm
27	35.37	R2	Basic Resurfacing 2 - 100mm
28	33.54	REC	Reconstruction - Rural
29	31.82	REC	Reconstruction - Rural
30	30.22	REC	Reconstruction - Rural
35	23.83	REC	Reconstruction - Rural
40	20	REC	Reconstruction - Rural
45	20	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



WorkTech Asset Classes and Deterioration Curves for Roads

HCB 4 All Roadsides- AADT <1,000, Assumes 5% Commercial

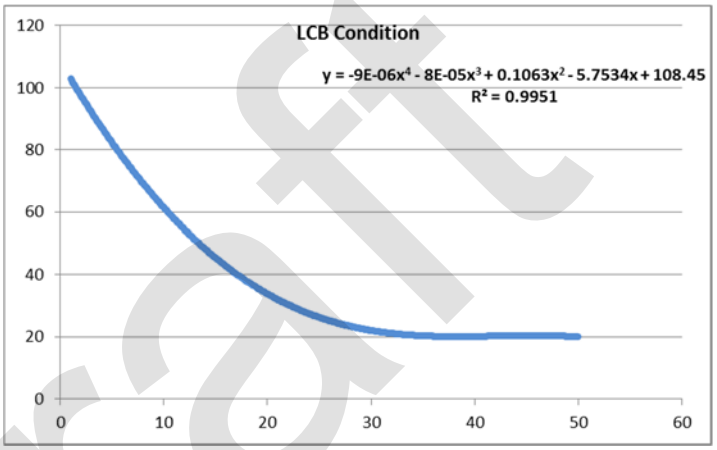
Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	99.3	NONE	No Improvement Required
3	98.73	NONE	No Improvement Required
4	97.96	NONE	No Improvement Required
5	97	CRK	Crack Sealing
6	95.86	CRK	Crack Sealing
7	94.55	CRK	Crack Sealing
8	93.09	CRK	Crack Sealing
9	91.48	CRK	Crack Sealing
10	89.73	CRK	Crack Sealing
11	87.85	CRK	Crack Sealing
12	85.85	CRK	Crack Sealing
13	83.76	CRK	Crack Sealing
14	81.56	CRK	Crack Sealing
15	79.27	MICRO	Microsurfacing – Pavement Preservation
16	76.91	MICRO	Microsurfacing – Pavement Preservation
17	74.48	MICRO	Microsurfacing – Pavement Preservation
18	72	MICRO	Microsurfacing – Pavement Preservation
19	69.47	R1	Basic Resurfacing 1 - 50mm
20	66.91	R1	Basic Resurfacing 1 - 50mm
21	64.32	R1	Basic Resurfacing 1 - 50mm
22	61.71	R1	Basic Resurfacing 1 - 50mm
23	59.1	R1	Basic Resurfacing 1 - 50mm
24	56.5	R1	Basic Resurfacing 1 - 50mm
25	53.91	R2	Basic Resurfacing 2 - 100mm
26	51.35	R2	Basic Resurfacing 2 - 100mm
27	48.82	R2	Basic Resurfacing 2 - 100mm
28	46.33	R2	Basic Resurfacing 2 - 100mm
29	43.91	R2	Basic Resurfacing 2 - 100mm
30	41.55	R2	Basic Resurfacing 2 - 100mm
35	31.1	REC	Reconstruction - Rural
40	23.85	REC	Reconstruction - Rural
45	21.06	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



WorkTech Asset Classes and Deterioration Curves for Roads

LCB All roadsides – All AADT's

Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	98.61	NONE	No Improvement Required
3	94.19	NONE	No Improvement Required
4	89.84	NONE	No Improvement Required
5	85.56	NONE	No Improvement Required
6	81.36	NONE	No Improvement Required
7	77.26	SST	Single Surface Treatment
8	73.28	SST	Single Surface Treatment
9	69.4	SST	Single Surface Treatment
10	65.65	SST	Single Surface Treatment
11	62.02	SST	Single Surface Treatment
12	58.54	SST	Single Surface Treatment
13	55.19	SST	Single Surface Treatment
14	52	SSTplus	SST plus Padding / geometric correction
15	48.96	SSTplus	SST plus Padding / geometric correction
16	46.08	SSTplus	SST plus Padding / geometric correction
17	43.36	SSTplus	SST plus Padding / geometric correction
18	40.81	SSTplus	SST plus Padding / geometric correction
19	38.41	SSTplus	SST plus Padding / geometric correction
20	36.19	REC	Reconstruction - Rural
21	34.13	REC	Reconstruction - Rural
22	32.24	REC	Reconstruction - Rural
23	30.51	REC	Reconstruction - Rural
24	28.95	REC	Reconstruction - Rural
25	27.55	REC	Reconstruction - Rural
30	22.82	REC	Reconstruction - Rural
35	21.31	REC	Reconstruction - Rural
40	21.92	REC	Reconstruction - Rural
45	20	REC	Reconstruction - Rural
50	20	REC	Reconstruction - Rural



Appendix E: Potential Substandard Alignment

Geometric Needs

Current Insp - Rural w/Curve Needs Only

ID	Street Name	From Description	To Description	Length	Rsde. Env.	AADT	Limit	Op. Speed	TON	H.Curve	H. SSD	V. Curve	V.SSD
1010	Brant Waterloo Rd	Nith Rd	Swan St (Reg. Rd 58)	1.031	R	150	80	0	ADEQ	0	0	0	1
1020	Brant Waterloo Rd	Swan St (Reg. Rd 58)	484m E of Reg. Rd 58 (Ayr Boundary)	0.484	R	170	80	80	ADEQ	0	0	0	1
1030	Brant Waterloo Rd	484m E of Reg. Rd 58 (Ayr Boundary)	Reidsville Rd	1.517	R	170	80	65	ADEQ	0	0	0	4
1040	Brant Waterloo Rd	Reidsville Rd	1806m East of Reidsville Road	1.806	R	190	80	65	ADEQ	0	0	1	3
1050	Brant Waterloo Rd	1806m East of Reidsville Road	Spragues Road (Regnal Road 75)	1.300	R	190	60	50	ADEQ	4	0	0	1
1080	Brant Waterloo Rd	300m East of Spragues Road (Regional Road 75)	1700m East of Spragues Road (Regional Road 75)	1.400	R	250	60	0	ADEQ	0	0	0	3
1240	Nith Rd	Brant Waterloo Rd	1434m N of Brant Waterloo Rd	1.434	R	150	80	80	ADEQ	0	0	0	2
1295	Greenfield Rd	Melair Dr	560m East of Melair Drive	0.560	R	1,700	60	60	ADEQ	0	0	0	1
1300	Greenfield Rd	560m East of Melair Drive	CP Railway Crossing	1.325	R	1,700	80	80	ADEQ	2	0	0	2
1320	Greenfield Rd	Reidsville Rd	Dumfries Rd (Reg. Rd 47)	3.052	R	1,300	80	70	ADEQ	2	0	0	4
1330	Greenfield Rd	Dumfries Rd (Reg. Rd 47)	Taylor Crt	0.613	R	660	80	80	ADEQ	0	0	0	1
1350	Greenfield Rd	Taylor Crt	900m West of Shouldice Sideroad	1.587	R	600	80	75	ADEQ	0	0	0	3
1360	Greenfield Rd	900m West of Shouldice Sideroad	Shouldice Side Rd	0.900	R	660	60	60	ADEQ	0	0	0	1
1370	Greenfield Rd	Shouldice Side Rd	Spragues Rd (Reg. Rd 75)	0.562	R	660	60	60	ADEQ	0	0	0	1
1380	Greenfield Rd	Spragues Rd (Reg. Rd 75)	East End	0.815	R	60	80	65	ADEQ	0	1	0	2
1400	Alps Rd W	Trussler Rd	Northumberland St (Reg. Rd 58)	1.476	R	220	80	75	ADEQ	2	0	0	0
1410	Alps Rd	Northumberland St (Reg. Rd 58)	330m East of Regional Road 58	0.330	R	1,300	80	60	NOW	2	0	0	0
1420	Alps Rd	330m East of Regional Road 58	650m West of Reidsville Road, South Leg	2.024	R	900	80	80	ADEQ	0	0	0	3
1430	Alps Rd	650m West of Reidsville Road, South Leg	Reidsville Rd	0.650	R	900	50	50	ADEQ	0	0	0	1
1450	Alps Rd	Railway Crossing	Dumfries Road (Reg. Rd. 47)	2.321	R	520	80	80	ADEQ	0	0	0	3
1455	Alps Rd	Dumfries Road (Reg. Rd. 47)	640m East of Dumfries Road (Reg. Rd. 47)	0.640	R	660	80	65	ADEQ	0	0	0	2
1460	Alps Rd	640m East of Dumfries Road (Reg. Rd. 47)	150m West of Shouldice Road, South Leg	2.140	R	660	80	65	ADEQ	0	0	0	5
1470	Alps Rd	Shouldice Side Road, North Leg	Spragues Rd (Reg. Rd 75)	2.184	R	1,200	60	60	ADEQ	0	0	0	3
1500	Cameron Rd	New Dundee Rd (Reg. Rd 12/City of Kitchener Boundary)	Roseville Rd (Reg. Rd 46)	1.909	R	2,000	80	80	ADEQ	0	0	0	4
1510	Kings Rd	City of Kitchener Boundary	Roseville Rd (Reg. Rd 46)	2.094	R	1,700	80	70	ADEQ	3	0	0	0
1520	Whistle Bare Rd	Roseville Rd (Reg. Rd 46)	Dickie Settlement Rd (Reg. Rd 71)	2.989	R	270	80	75	ADEQ	0	3	0	0
1530	Whistle Bare Rd	Dickie Settlement Road (Reg Road 71)	980m East of Dickie Settlement Road(Regioal Road 71)	0.980	R	140	60	60	ADEQ	0	0	0	2
1540	Whistle Bare Rd	Langdon Dr	Roseville Rd (Reg. Rd 46)	1.820	R	200	60	55	ADEQ	1	0	0	3
1550	Langdon Dr	Whistle Bare Rd	400m North of Whistlebare Road	0.400	R	120	80	65	ADEQ	0	2	0	0
1555	Langdon Dr	City of Cambridge Boundary	400m North of Whistlebare Road	0.601	R	120	80	60	NOW	2	0	0	0
1610	Industrial Rd	Roseville Rd (Reg. Rd 46)	300m North of Waydom Drive	0.957	R	3,800	60	60	ADEQ	0	0	0	3
1785	Reidsville Rd	Alps Rd	64m North of Railway Crossing	1.178	R	450	50	45	ADEQ	4	0	0	2
1800	Reidsville Rd	Greenfield Rd	Wrigley Rd (Reg. Rd 49)	1.631	R	640	60	60	ADEQ	0	0	0	3
1810	Reidsville Rd	Wrigley Rd (Reg. Rd 49)	Brant Waterloo Rd	1.709	R	110	80	60	NOW	4	0	0	3

Geometric Needs

Current Insp - Rural w/Curve Needs Only

ID	Street Name	From Description	To Description	Length	Rsde. Env.	AADT	Limit	Op. Speed	TON	H.Curve	H. SSD	V. Curve	V.SSD
1850	Shouldice Side Rd	Alps Rd	Greenfield Rd	1.649	R	540	60	60	ADEQ	2	0	0	3
1870	Shouldice Side Rd	Sprague Rd (Reg. Rd 75)	Beke Rd	1.390	R	540	80	70	ADEQ	0	0	0	3
1880	Shouldice Side Rd	Beke Rd	Brant Waterloo Rd	1.702	R	150	80	70	ADEQ	4	0	0	3
1890	Beke Rd	Sprague Rd (Reg. Rd 75)	Shouldice Side Rd	2.045	R	190	60	60	ADEQ	0	0	0	2
1900	Beke Rd	Shouldice Side Rd	275m West of Gravel Pit Entrance	1.100	R	500	60	60	ADEQ	0	0	0	2
1902	Beke Rd	275m West of Gravel Pit Entrance	West River Rd	2.100	R	500	40	40	ADEQ	2	0	0	1
1910	Waynco Rd	Brantford Hwy (Hwy 24)	350m E of Hwy 24	0.350	R	600	80	65	ADEQ	1	0	0	1
1920	Waynco Rd	350m E of Hwy 24	600m West of Cheese Factory Road	1.332	R	600	80	80	ADEQ	0	0	0	1
1925	Waynco Rd	600m West of Cheese Factory Road	Cheese Factory Rd	0.600	R	600	80	80	ADEQ	0	0	0	2
1960	Maple Manor Rd	Silver Maple Cres (E Leg)	414m E of Silver Maple Cres (E Leg)	0.414	R	1,000	50	50	ADEQ	0	0	0	1
1970	Maple Manor Rd	414m E of Silver Maple Cres (E Leg)	Cheese Factory Rd	0.643	R	1,000	80	70	ADEQ	0	0	0	2
1980	Maple Manor Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	1.533	R	640	80	80	ADEQ	0	0	0	2
1990	Maple Manor Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	1.511	R	290	80	75	ADEQ	1	0	0	1
1995	Maple Manor Rd	Bend at City of Hamilton Boundary	90m South of Concession 7 West	0.363	R	290	80	70	ADEQ	1	0	0	0
2050	Lockie Rd	Brantford Hwy (Hwy 24)	239m E of Hwy 24 (W Boundary of Lockie)	0.239	R	190	60	50	ADEQ	1	0	0	0
2060	Lockie Rd	239m E of Hwy 24 (W Boundary of Lockie)	Cheese Factory Rd	2.848	R	190	60	60	ADEQ	0	0	0	8
2070	Lockie Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	1.520	R	190	60	60	ADEQ	0	0	0	2
2080	Lockie Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	1.509	R	100	80	80	ADEQ	1	0	0	3
2100	Cheese Factory Rd	City of Cambridge Boundary	Waynco Rd	1.065	R	3,200	60	0	ADEQ	0	0	0	4
2110	Cheese Factory Rd	Waynco Rd	Maple Manor Rd	1.646	R	3,200	60	60	ADEQ	0	1	0	5
2120	Cheese Factory Rd	Maple Manor Rd	Lockie Rd	1.633	R	1,900	60	55	ADEQ	0	0	0	6
2140	Morrison Rd	Branchton Rd (Reg. Rd 43)	100m West of Bend	1.391	R	260	50	50	ADEQ	0	0	0	1
2150	Morrison Rd	100m West of Bend	Highway 8	0.774	R	260	50	45	ADEQ	1	0	0	0
2160	Morrison Rd	Dundas St S (Hwy 8)	Shellard Rd	0.690	R	1,400	50	45	ADEQ	1	0	0	0
2210	Morrison Rd	Sheffield Rd	Seaton Rd	1.373	R	710	60	60	ADEQ	0	0	0	3
2260	Seaton Rd	Sheffield Rd	Morrison Rd	1.886	R	270	50	0	ADEQ	1	0	0	2
2270	Seaton Rd	Morrison Rd	City of Hamilton Boundary	1.100	R	270	50	50	ADEQ	1	0	0	0
2280	Gore Rd	City of Cambridge Boundary	Shellard Rd	0.739	R	5,700	60	60	ADEQ	1	0	0	0
2290	Gore Rd	Shellard Rd	Village Rd	2.435	R	1,900	60	60	ADEQ	0	0	0	5
2310	Gore Rd	Sideroad 10 S	City of Hamilton Boundary	1.097	R	1,000	60	60	ADEQ	0	0	0	1
2320	Shellard Rd	Gore Rd	Clyde Rd (Reg. Rd 27)	1.094	R	3,800	60	60	ADEQ	0	0	0	3
2410	Clyde Rd	Clydebank Dr	City of Hamilton Boundary	1.890	R	690	50	50	ADEQ	0	0	0	3
2445	Sheffield Rd	Old Beverly Road (Reg. Rd. 97)	450m South of Old Beverly Road (Reg Rd. 97)	0.450	R	930	60	60	ADEQ	0	0	0	1
2450	Sheffield Rd	450m South of Old Beverly Road (Reg Rd. 97)	Seaton Rd	0.694	R	930	60	60	ADEQ	0	0	0	1
2470	Sheffield Rd	Morrison Rd	City of Hamilton Boundary	1.010	R	930	60	60	ADEQ	0	0	0	2

Geometric Needs

Current Insp - Rural w/Curve Needs Only

ID	Street Name	From Description	To Description	Length	Rsde. Env.	AADT	Limit	Op. Speed	TON	H.Curve	H. SSD	V. Curve	V.SSD
				90.234									

Appendix F: 10 Year Program Based on Proposed Budget

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2017	3320	Hilltop Dr	(to) Hunt St-to-Howard Marshall St	CRK	$ 1,020	85	85	2	$ 353,742	$ 353,742	0.255
2017	2940	Piper St	(to) Church St-to-96m W of Reg. Rd 58 (Nith River Bridge)	CRK	$ 512	85	85	2	$ 177,565	$ 177,565	0.128
2017	2920	Piper St	(to) Rose St-to-Walter St	CRK	$ 792	85	85	2	$ 249,999	$ 249,999	0.198
2017	3230	Hunt St	(to) Hilltop Dr-to-Robert Simone Way	CRK	$ 392	85	85	2	$ 123,737	$ 123,737	0.098
2017	3330	Hilltop Dr	(to) Howard Marshall St (N Leg)-to-Howard Marshall St (S Leg)	CRK	$ 1,032	85	85	2	$ 325,757	$ 325,757	0.258
2017	2910	Piper St	(to) 116m West of Rose Street-to-Rose St	CRK	$ 464	95	95	2	$ 179,849	$ 179,849	0.116
2017	2930	Piper St	(to) Walter St-to-Church St	CRK	$ 988	95	95	2	$ 382,955	$ 382,955	0.247
2017	3355	Hilltop Dr	(to) Swan Sreet (Reg. Rd. 58)-to-125m East of Watson Crescent, West Leg	CRK	$ 772	90	90	2	$ 258,021	$ 258,021	0.193
2017	3450	Main St	(to) Scott St (Reg. Rd 49)-to-Hope St	SD	$ 326	95	95	1	$ 95,960	$ 95,960	0.068
2017	3770	Inglis Crt	(to) Inglis St-to-South End	CRK	$ 392	85	85	2	$ 151,971	$ 151,971	0.098
2017	3460	Main St	(to) Hope St-to-Hall St	SDcrk	$ 2,244	85	85	2	$ 353,742	$ 353,742	0.255
2017	3150	Mitchell St	(to) Malone St-to-Hunt St	CRK	$ 1,708	85	85	2	$ 539,141	$ 539,141	0.427
2017	3750	Inglis St	(to) Willison St-to-Inglis Crt	CRK	$ 1,296	85	85	2	$ 400,604	$ 400,604	0.324
2017	3990	Nith River Crt	(to) Nith River Way-to-North End	CRK	$ 952	85	85	2	$ 294,271	$ 294,271	0.238
2017	3300	Jones Crt	(to) Hunt St-to-South End	CRK	$ 908	85	85	2	$ 280,670	$ 280,670	0.227
2017	3358	Watson Cres	(to) Hilltop Dr-to-220m East of Watson Cescent, West Leg,/ Hilltop	CRK	$ 880	85	85	2	$ 272,015	$ 272,015	0.22
2017	3400	Burnside Dr	(to) Swan St (Reg. Rd 58)-to-West End	CRK	$ 1,488	85	85	2	$ 459,953	$ 459,953	0.372
2017	3760	Inglis St	(to) Inglis Crt-to-East End	CRK	$ 256	85	85	2	$ 79,132	$ 79,132	0.064
2017	1210	Maple Dr	(to) Sylvan Split-to-Maple Dr	SD	$ 1,354	85	85	1	$ 383,083	$ 383,083	0.282
2017	2050	Lockie Rd	(to) Brantford Hwy (Hwy 24)-to-239m E of Hwy 24 (W Boundary of Lockie)	SD	$ 1,147	75	75	1	$ 73,962	$ 73,962	0.239
2017	3350	Hilltop Dr	(to) 125m East of Watson Crescent, West Leg-to-Watson Crescent, East Leg	R2	$ 56,017	10	100		$ 24,807	$ 248,068	0.167
2017	2908	Piper St	(to) 500m East of Gladstone Road-to-116m West of Rose Street	CRK	$ 1,504	85	85	2	$ 178,312	$ 178,312	0.376
2017	3470	Main St	(to) Hall St-to-Newell St	R1	$ 19,646	55	97		$ 90,686	$ 159,937	0.111
2017	3480	Main St	(to) Newell St-to-Cooper St	R1	$ 37,693	55	97		$ 174,019	$ 306,907	0.213
2017	3910	Nith River Way	(to) Simone Pl-to-Melissa Crt	R1	$ 18,217	55	97		$ 84,150	$ 148,410	0.103
2017	3920	Nith River Way	(to) Melissa Crt-to-Nith River Crt	R1	$ 38,098	55	97		$ 175,654	$ 309,789	0.215
2017	3580	Newell St	(to) James St-to-Main St	R1	$ 16,841	55	97		$ 76,804	$ 135,455	0.096
2017	3980	Melissa Crt	(to) Nith River Way-to-North End	R1	$ 28,499	55	97		$ 128,807	$ 227,169	0.161
2017	3510	Cooper St	(to) Main St-to-Upton Crt	R1	$ 38,951	55	97		$ 176,010	$ 310,417	0.22
2017	3530	Upton Crt	(to) Cooper St-to-East End	R1	$ 44,092	55	97		$ 199,211	$ 351,336	0.249

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2017	3940	Douglas Dr	(to) Nith River Way-to-Broom St	R1	$ 86,584	55	97		$ 391,222	$ 689,974	0.489
2017	3950	Robson St	(to) Nith River Way-to-Broom St	R1	$ 61,626	55	97		$ 278,416	$ 491,024	0.348
2017	2950	Stanley St	(to) 96m W of Reg. Rd 58 (Nith River Bridge)-to-Northumberland St (Reg. Rd 58)	R1	$ 17,972	65	97		$ 116,388	$ 173,686	0.096
2017	3930	Nith River Way	(to) Nith River Crt-to-Northumberland St (Reg. Rd 58)	R1	$ 20,401	60	97		$ 106,060	$ 171,464	0.119
2017	3360	Watson Cres	(to) Hilltop Dr-to-220m East of Watson Cescent, West Leg,/ Hilltop	R2	$ 90,903	25	100		$ 98,551	$ 394,204	0.271
2017	1465	Alps Rd	(to) 150m West of Shouldice Road, South Leg-to-Shouldice Road, North Leg	CRK	$ 988	95	95	2	$ 142,833	$ 142,833	0.247
2017	3415	Stanley Drive	(to) Stanley Street (Reg. Rd. 49)-to-113m East of Stanley Street, (Reg. Rd. 49)	R1	$ 17,389	70	97		$ 126,416	$ 175,176	0.113
2017	3210	Hunt St	(to) Mitchell St-to-Jones Crt	CRK	$ 480	80	80	2	$ 139,644	$ 139,644	0.12
2017	3860	Broom St	(to) Robson St-to-Nith River Way	CRK	$ 488	80	80	2	$ 141,972	$ 141,972	0.122
2017	3870	Nith River Way	(to) Broom St-to-Broom St	CRK	$ 1,684	80	80	2	$ 489,918	$ 489,918	0.421
2017	3160	Mitchell St	(to) Hunt St-to-Field St (E Leg)	R1	$ 9,292	70	97		$ 52,949	$ 73,372	0.052
2017	3200	Field St	(to) Mitchell St-to-Mitchell St	CRK	$ 748	75	75	2	$ 224,144	$ 224,144	0.187
2017	3850	Broom St	(to) Nith River Way-to-Robson St	CRK	$ 416	75	75	2	$ 115,865	$ 115,865	0.104
2017	3880	Nith River Way	(to) Broom St-to-Robson St	CRK	$ 780	75	75	2	$ 212,739	$ 212,739	0.195
2017	3310	Hilltop Dr	(to) Scott St (Reg. Rd 49)-to-100m North of North School Entrance	CRK	$ 1,112	80	80	2	$ 362,963	$ 362,963	0.278
2017	2905	Piper St	(to) Gladstone Rd-to-500m East of Gladstone Road	SDcrk	$ 4,444	85	85	2	$ 257,247	$ 257,247	0.505
2017	2210	Morrison Rd	(to) Sheffield Rd-to- Seaton Rd	CRK	$ 5,492	85	85	2	$ 656,126	$ 656,126	1.373
					$ 639,280						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2018	3250	Robert Simone Way	(to) Hunt St-to-Robert Simone Way	CRK	$ 534	89.73	89.73	2	$ 174,406	$ 174,406	0.131
2018	3390	Challenger Drive	(to) Hilltop Dr-to-East End	CRK	$ 571	89.73	89.73	2	$ 186,388	$ 186,388	0.14
2018	3410	James Edgar Crt	(to) Burnside Dr-to-South End	CRK	$ 510	89.73	89.73	2	$ 166,417	$ 166,417	0.125
2018	3490	Main St	(to) Cooper St-to-North End	CRK	$ 367	89.73	89.73	2	$ 119,820	$ 119,820	0.09
2018	3260	Robert Simone Way	(to) Robert Simone Way (S Leg)-to-Challenger Drive	CRK	$ 502	94.55	94.55	2	$ 172,551	$ 172,551	0.123
2018	1410	Alps Rd	(to) Northumberland St (Reg. Rd 58)-to-330m East of Regional Road 58	CRK	$ 1,346	92.95	92.95	2	$ 235,636	$ 235,636	0.33
2018	3415	Stanley Drive	(to) Stanley Street (Reg. Rd. 49)-to-113m East of Stanley Street, (Reg. Rd. 49)	CRK	$ 461	97	97	2	$ 178,680	$ 178,680	0.113
2018	3910	Nith River Way	(to) Simone Pl-to-Melissa Crt	CRK	$ 420	97	97	2	$ 151,378	$ 151,378	0.103
2018	3480	Main St	(to) Newell St-to-Cooper St	CRK	$ 869	97	97	2	$ 313,045	$ 313,045	0.213
2018	1150	West River Rd	(to) Footbridge Rd-to-369m N of Footbridge Rd	SDcrk	$ 3,312	79.56	79.56	2	$ 383,484	$ 383,484	0.369
2018	3160	Mitchell St	(to) Hunt St-to-Field St (E Leg)	CRK	$ 212	97	97	2	$ 74,839	$ 74,839	0.052
2018	3530	Upton Crt	(to) Cooper St-to-East End	CRK	$ 1,016	97	97	2	$ 358,363	$ 358,363	0.249
2018	3940	Douglas Dr	(to) Nith River Way-to-Broom St	CRK	$ 1,995	97	97	2	$ 703,773	$ 703,773	0.489
2018	3950	Robson St	(to) Nith River Way-to-Broom St	CRK	$ 1,420	97	97	2	$ 500,844	$ 500,844	0.348
2018	3510	Cooper St	(to) Main St-to-Upton Crt	CRK	$ 898	97	97	2	$ 316,626	$ 316,626	0.22
2018	3580	Newell St	(to) James St-to-Main St	CRK	$ 392	97	97	2	$ 138,164	$ 138,164	0.096
2018	3980	Melissa Crt	(to) Nith River Way-to-North End	CRK	$ 657	97	97	2	$ 231,713	$ 231,713	0.161
2018	2110	Cheese Factory Rd	(to) Waynco Rd-to-Maple Manor Rd	SD	$ 8,059	99.44	99.44	1	$ 1,484,707	$ 1,484,707	1.646
2018	3170	Mitchell St	(to) Field St (E Leg)-to-Field St (W Leg)	R1	$ 67,583	64.32	97		$ 379,559	$ 572,407	0.362
2018	3180	Mitchell St	(to) Field St (W End)-to-Swan St (Reg. Rd 58)	R1	$ 60,232	64.32	97		$ 321,599	$ 484,999	0.33
2018	3315	Hilltop Dr	(to) 100m North of North School Entrance-to-Hunt St	R1	$ 69,534	67.92	97		$ 406,490	$ 580,529	0.395
2018	1280	Greenfield Rd	(to) 220m West of Northumberland Street (Reg. Rd.58)-to-Northumberland St (Reg. Rd 58)	PR2	$ 40,722	28.74	100		$ 43,384	$ 150,953	0.221
2018	1790	Reidsville Rd	(to) 64m North of Railway Crossing-to-Greenfield Rd	PR2	$ 81,009	20	100		$ 52,637	$ 263,187	0.479
2018	2250	Studiman Rd	(to) Morrison Rd-to-City of Hamilton Boundary	SD	$ 4,964	83.76	83.76	1	$ 487,049	$ 487,049	1.014
2018	2340	Shellard Rd	(to) Old Beverly Rd (Reg. Rd 97)-to-Morrison Rd	SDcrk	$ 18,051	92.95	92.95	2	$ 1,695,552	$ 1,695,552	2.011
2018	2700	Jenkings Crt	(to) Branchton Rd (Reg. Rd 43)-to-West End	CRK	$ 2,440	83.76	83.76	2	$ 231,631	$ 231,631	0.598
2018	3220	Hunt St	(to) Jones Crt-to-Hilltop Dr	R1	$ 27,554	69.47	97		$ 155,642	$ 217,321	0.151
2018	3890	Nith River Way	(to) Robson St-to-Seyler St	R1	$ 30,677	69.47	97		$ 173,164	$ 241,787	0.168
2018	1520	Whistle Bare Rd	(to) Roseville Rd (Reg. Rd 46)-to-Dickie Settlement Rd (Reg. Rd 71)	SD	$ 14,634	83.76	83.76	1	$ 1,167,097	$ 1,167,097	2.989
2018	2530	Brown Ave	(to) Oakwood Dr-to-Roseville Rd (Reg. Rd 46)	SD	$ 1,557	83.76	83.76	1	$ 118,909	$ 118,909	0.318
2018	1860	Shouldice Side Rd	(to) Greenfield Rd-to-Spragues Rd (Reg. Rd 75)	SDcrk	$ 2,091	79.27	79.27	2	$ 105,030	$ 105,030	0.233
2018	3680	Bute St	(to) Northumberland St (Reg. Rd 58)-to-Bute Street Bend	RSS	$ 144,927	48.82	100		$ 20,433	$ 41,854	0.101

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2018	3685	Bute St	(to) McCrae Street-to-Bute Street Bend	RSS	$ 149,231	15	100		$ 6,652	$ 44,347	0.104
2018	3690	Bute St	(to) McRae St-to-North End	RSS	$ 74,615	5	100		$ 1,161	$ 23,214	0.052
					$ 813,362						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2019	3450	Main St	(to) Scott St (Reg. Rd 49)-to-Hope St	CRK	$ 283	92.95	92.95	2	$ 97,682	$ 97,682	0.068
2019	1210	Maple Dr	(to) Sylvan Split-to-Maple Dr	CRK	$ 1,174	83.76	83.76	2	$ 392,745	$ 392,745	0.282
2019	3170	Mitchell St	(to) Field St (E Leg)-to-Field St (W Leg)	CRK	$ 1,477	97	97	2	$ 583,856	$ 583,856	0.362
2019	3180	Mitchell St	(to) Field St (W End)-to-Swan St (Reg. Rd 58)	CRK	$ 1,346	97	97	2	$ 494,699	$ 494,699	0.33
2019	3220	Hunt St	(to) Jones Crt-to-Hilltop Dr	CRK	$ 616	97	97	2	$ 221,667	$ 221,667	0.151
2019	3890	Nith River Way	(to) Robson St-to-Seyler St	CRK	$ 685	97	97	2	$ 246,622	$ 246,622	0.168
2019	3960	Seyler St	(to) Nith River Way-to-North End	R1	$ 49,548	66.91	97		$ 269,355	$ 390,486	0.266
2019	3900	Nith River Way	(to) Seyler St-to-Simone Pl	R1	$ 50,796	66.91	97		$ 273,405	$ 396,358	0.27
2019	1500	Cameron Rd	(to) New Dundee Rd (Reg. Rd 12/City of Kitchener Boundary)-to-Roseville Rd (Reg. Rd 46)	PR2sd	$ 408,640	37.31	100		$ 620,650	$ 1,663,496	1.909
2019	2445	Sheffield Rd	(to) Old Beverly Road (Reg. Rd. 97)-to-450m South of Old Beverly Road (Reg Rd. 97)	PR2	$ 104,541	23.85	100		$ 85,262	$ 357,493	0.45
2019	3970	Simone Pl	(to) Nith River Way-to-North End	R2	$ 117,923	41.55	100		$ 208,767	$ 502,447	0.332
2019	2470	Sheffield Rd	(to) Morrison Rd-to-City of Hamilton Boundary	PR2sd	$ 216,192	20	100		$ 139,638	$ 698,192	1.01
2019	1850	Shouldice Side Rd	(to) Alps Rd-to-Greenfield Rd	SD	$ 8,234	93.09	93.09	1	$ 1,020,484	$ 1,020,484	1.649
2019	1435	Alps Rd	(to) Reidsville Road , South Leg-to-Reidsville Road, North Leg	R1	$ 16,899	56.5	97		$ 46,158	$ 79,244	0.129
					$ 978,354						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2020	2950	Stanley St	(to) 96m W of Reg. Rd 58 (Nith River Bridge)-to-Northumberland St (Reg. Rd 58)	CRK	$ 392	92.95	92.95	2	$ 176,622	$ 176,622	0.096
2020	3460	Main St	(to) Hope St-to-Hall St	CRK	$ 1,082	82.4	82.4	2	$ 363,911	$ 363,911	0.255
2020	3920	Nith River Way	(to) Melissa Crt-to-Nith River Crt	CRK	$ 877	92.95	92.95	2	$ 315,024	$ 315,024	0.215
2020	3470	Main St	(to) Hall St-to-Newell St	CRK	$ 453	92.95	92.95	2	$ 162,640	$ 162,640	0.111
2020	3930	Nith River Way	(to) Nith River Crt-to-Northumberland St (Reg. Rd 58)	CRK	$ 486	92.95	92.95	2	$ 174,362	$ 174,362	0.119
2020	3140	Mitchell St	(to) Swan St (Reg. Rd 58)-to-Malone St	CRK	$ 412	92.95	92.95	2	$ 142,127	$ 142,127	0.097
2020	3370	Howard Marshall St	(to) South End-to-Hilltop Dr	CRK	$ 611	94.55	94.55	2	$ 214,624	$ 214,624	0.144
2020	3960	Seyler St	(to) Nith River Way-to-North End	CRK	$ 1,085	97	97	2	$ 398,296	$ 398,296	0.266
2020	3900	Nith River Way	(to) Seyler St-to-Simone Pl	CRK	$ 1,102	97	97	2	$ 404,285	$ 404,285	0.27
2020	2905	Piper St	(to) Gladstone Rd-to-500m East of Gladstone Road	CRK	$ 2,144	82.4	82.4	2	$ 264,643	$ 264,643	0.505
2020	2250	Studiman Rd	(to) Morrison Rd-to-City of Hamilton Boundary	CRK	$ 4,304	81.56	81.56	2	$ 493,416	$ 493,416	1.014
2020	1520	Whistle Bare Rd	(to) Roseville Rd (Reg. Rd 46)-to-Dickie Settlement Rd (Reg. Rd 71)	CRK	$ 12,688	81.56	81.56	2	$ 1,182,355	$ 1,182,355	2.989
2020	1930	Maple Manor Rd	(to) Brantford Hwy (Hwy 24)-to-Misty Maple Trail	PR2sd	$ 209,195	23.06	100		$ 155,768	$ 675,490	0.958
2020	2530	Brown Ave	(to) Oakwood Dr-to-Roseville Rd (Reg. Rd 46)	CRK	$ 1,349	81.56	81.56	2	$ 120,463	$ 120,463	0.318
2020	2200	Morrison Rd	(to) 1012m W of Sheffield Rd (E Boundary of Hall)-to-Sheffield Rd	PR2	$ 186,782	23.29	100		$ 140,759	$ 604,376	1.013
2020	2450	Sheffield Rd	(to) 450m South of Old Beverly Road (Reg Rd. 97)-to-Seaton Rd	PR2sd	$ 158,907	20	100		$ 98,637	$ 493,186	0.694
2020	1290	Greenfield Rd	(to) Northumberland St (Reg. Rd 58)-to-Melair Dr	PR3sd	$ 101,018	30.22	100		$ 105,808	$ 350,125	0.371
2020	1350	Greenfield Rd	(to) Taylor Crt-to-900m West of Shouldice Sideroad	PR2sd	$ 320,799	26.29	100		$ 275,980	$ 1,049,753	1.587
2020	1940	Maple Manor Rd	(to) Misty Maple Trail-to-Silver Maple Cres	PR2sd	$ 51,996	26.08	100		$ 43,766	$ 167,815	0.238
2020	2020	Red Maple Crt	(to) Silver Maple Cres-to-North End	PR2	$ 64,428	5	100		$ 8,102	$ 162,043	0.311
2020	2050	Lockie Rd	(to) Brantford Hwy (Hwy 24)-to-239m E of Hwy 24 (W Boundary of Lockie)	GRR2	$ 11,162	65.7	85.7		$ 68,756	$ 89,687	0.239
2020	3830	Broom St	(to) Northumberland St (Reg. Rd 58)-to-113m West of Douglas Drive	SDcrk	$ 2,773	73.76	73.76	2	$ 132,631	$ 132,631	0.297
2020	1420	Alps Rd	(to) 330m East of Regional Road 58-to-650m West of Reidsville Road, South Leg	SDcrk	$ 18,901	79.27	79.27	2	$ 1,149,056	$ 1,149,056	2.024
2020	1435	Alps Rd	(to) Reidsville Road , South Leg-to-Reidsville Road, North Leg	CRK	$ 526	97	97	2	$ 80,829	$ 80,829	0.129
2020	2770	Hughson St	(to) 125 m West of King Street-to-Hughson Lane	CRK	$ 1,320	94.55	94.55	2	$ 140,250	$ 140,250	0.311
2020	4000	Guthrie St	(to) Northumberland St (Reg. Rd 58)-to-Melair Dr	SDcrk	$ 2,623	74.49	74.49	2	$ 116,532	$ 116,532	0.281
2020	2870	Albert St	(to) Queen St-to-Branchton Rd (Reg. Rd 43)	SDcrk	$ 1,055	74.49	74.49	2	$ 41,200	$ 41,200	0.113
					$ 1,158,470						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2021	3315	Hilltop Dr	(to) 100m North of North School Entrance-to-Hunt St	CRK	$ 1,612	92.95	92.95	2	$ 590,340	$ 590,340	0.395
2021	2340	Shellard Rd	(to) Old Beverly Rd (Reg. Rd 97)-to-Morrison Rd	CRK	$ 8,707	90.48	90.48	2	$ 1,751,519	$ 1,751,519	2.011
2021	1850	Shouldice Side Rd	(to) Alps Rd-to-Greenfield Rd	CRK	$ 7,140	91.48	91.48	2	$ 1,043,349	$ 1,043,349	1.649
2021	2120	Cheese Factory Rd	(to) Maple Manor Rd-to-Lockie Rd	R1	$ 232,492	59.31	97		$ 878,072	$ 1,436,065	1.633
2021	1610	Industrial Rd	(to) Roseville Rd (Reg. Rd 46)-to-300m North of Waydom Drive	PR3sd	$ 280,130	28.74	100		$ 272,755	$ 949,044	0.957
2021	1430	Alps Rd	(to) 650m West of Reidsville Road, South Leg-to-Reidsville Rd	PR2sd	$ 137,963	32.98	100		$ 156,598	$ 474,827	0.65
2021	1440	Alps Rd	(to) Reidsville Rd-to-Railway Crossing	PR2	$ 127,895	29.36	100		$ 122,428	$ 416,990	0.691
2021	1370	Greenfield Rd	(to) Shouldice Side Rd-to-Spragues Rd (Reg. Rd 75)	PR2sd	$ 125,123	22.73	100		$ 86,188	$ 379,181	0.562
2021	3840	Broom St	(to) 113m West of Douglas Drive-to-Nith River Way	R1	$ 22,012	70.84	97		$ 124,154	$ 170,002	0.109
2021	2600	Paul Ave	(to) West Side of Paul Ave. Cul De Sac-to-Roseville Rd (Reg. Rd 46)	PR2	$ 73,973	5	100		$ 8,921	$ 178,411	0.38
2021	1820	Edworthy Side Rd	(to) Cedar Creek Rd (Reg. Rd 97)-to-Alpine Crt	PR2sd	$ 157,686	37.31	100		$ 199,011	$ 533,398	0.703
2021	1160	West River Rd	(to) 369m N of Footbridge Rd-to-781m South of City of Cambridge Boundary	R1	$ 92,358	59.31	97		$ 285,506	$ 466,938	0.68
2021	2010	Sugar Maple Crt	(to) Silver Maple Cres-to-East End	PR2	$ 51,353	10	100		$ 12,008	$ 120,080	0.249
2021	2720	Mary St	(to) Queen St-to-King St	PR2	$ 19,906	29.36	100		$ 14,614	$ 49,776	0.11
2021	2920	Piper St	(to) Rose St-to-Walter St	MICRO	$ 5,551	79.56	79.56	3	$ 253,289	$ 253,289	0.198
					$ 1,343,901						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2022	3350	Hilltop Dr	(to) 125m East of Watson Crescent, West Leg-to-Watson Crescent, East Leg	CRK	$ 737	92.95	92.95	2	$ 254,578	$ 254,578	0.167
2022	2110	Cheese Factory Rd	(to) Waynco Rd-to-Maple Manor Rd	CRK	$ 7,270	92.95	92.95	2	$ 1,502,206	$ 1,502,206	1.646
2022	3360	Watson Cres	(to) Hilltop Dr-to-220m East of Watson Cescent, West Leg,/ Hilltop	CRK	$ 1,196	97	97	2	$ 422,176	$ 422,176	0.271
2022	3200	Field St	(to) Mitchell St-to-Mitchell St	R1	$ 37,819	69.47	97		$ 229,226	$ 320,066	0.187
2022	3880	Nith River Way	(to) Broom St-to-Robson St	R1	$ 38,560	69.47	97		$ 217,562	$ 303,779	0.195
2022	3850	Broom St	(to) Nith River Way-to-Robson St	R1	$ 21,387	69.47	97		$ 118,492	$ 165,448	0.104
2022	1830	Edworthy Side Rd	(to) Alpine Crt-to-Alps Rd	PR2sd	$ 218,055	35.37	100		$ 260,870	$ 737,545	0.953
2022	2460	Sheffield Rd	(to) Seaton Rd-to-Morrison Rd	PR2sd	$ 203,542	27.75	100		$ 168,373	$ 606,751	0.917
2022	1970	Maple Manor Rd	(to) 414m E of Silver Maple Cres (E Leg)-to-Cheese Factory Rd	PR2sd	$ 146,010	35.37	100		$ 166,840	$ 471,699	0.643
2022	1470	Alps Rd	(to) Shouldice Side Road, North Leg-to-Spragues Rd (Reg. Rd 75)	PR2sd	$ 494,967	35.37	100		$ 557,784	$ 1,576,996	2.184
2022	1480	Roseville Rd	(to) Trussler Rd-to-664m E of Trussler Rd (W Boundary of Plumtree)	PR3sd	$ 177,961	21.52	100		$ 102,355	$ 475,628	0.664
2022	2170	Morrison Rd	(to) Shellard Rd-to-Studiman Rd	R1	$ 109,293	56.54	97		$ 292,008	$ 500,969	0.793
2022	2180	Morrison Rd	(to) Studiman Rd-to-299m E of Studimen Rd (W Boundary of Hall)	PR2	$ 57,359	39.27	100		$ 72,884	$ 185,596	0.299
2022	1925	Waynco Rd	(to) 600m West of Cheese Factory Road-to-Cheese Factory Rd	SD	$ 3,180	95.86	95.86	1	$ 425,644	$ 425,644	0.6
2022	1800	Reidsville Rd	(to) Greenfield Rd-to-Wrigley Rd (Reg. Rd 49)	SDcrk	$ 15,848	74.48	74.48	2	$ 849,994	$ 849,994	1.631
2022	3740	Inglis St	(to) Colquhoun St-to-Willison St	SDcrk	$ 1,273	74.49	74.49	2	$ 58,300	$ 58,300	0.131
2022	3790	Gibson St	(to) MacDonald St-to-East End	SD	$ 279	95.86	95.86	1	$ 29,175	$ 29,175	0.053
2022	3700	McRae St	(to) Bute St-to-Northumberland St (Reg. Rd 58)	SD	$ 530	95.86	95.86	1	$ 52,139	$ 52,139	0.1
2022	3060	William St	(to) Water St-to-Church St	SDcrk	$ 1,214	69.47	69.47	2	$ 42,715	$ 42,715	0.125
2022	2860	Albert St	(to) King St-to-Queen St	SDcrk	$ 1,069	74.49	74.49	2	$ 39,950	$ 39,950	0.11
					$ 1,537,549						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2023	3340	Hilltop Dr	(to) Howard Marshall St (S Leg)-to-Watson Cres (E Leg)	CRK	$ 621	92.95	92.95	2	$ 214,578	$ 214,578	0.138
2023	2300	Gore Rd	(to) Village Rd-to-Sideroad 10 S	CRK	$ 2,174	92.95	92.95	2	$ 681,709	$ 681,709	0.965
2023	3200	Field St	(to) Mitchell St-to-Mitchell St	CRK	$ 763	97	97	2	$ 326,467	$ 326,467	0.187
2023	3850	Broom St	(to) Nith River Way-to-Robson St	CRK	$ 424	97	97	2	$ 168,757	$ 168,757	0.104
2023	3880	Nith River Way	(to) Broom St-to-Robson St	CRK	$ 796	97	97	2	$ 309,855	$ 309,855	0.195
2023	1280	Greenfield Rd	(to) 220m West of Northumberland Street (Reg. Rd.58)-to-Northumberland St (Reg. Rd 58)	CRK	$ 902	92.95	92.95	2	$ 154,914	$ 154,914	0.221
2023	3240	Robert Simone Way	(to) Hunt St-to-Robert Simone Way	CRK	$ 2,590	97	97	2	$ 913,677	$ 913,677	0.575
2023	3270	Patterson Dr	(to) Challenger Drive-to-Vincent Dr	CRK	$ 964	97	97	2	$ 340,046	$ 340,046	0.214
2023	3380	Howard Marshall St	(to) Hilltop Dr-to-Hilltop Dr	CRK	$ 1,234	97	97	2	$ 435,387	$ 435,387	0.274
2023	3280	Vincent Dr	(to) Patterson Dr-to-Howard Marshall St	CRK	$ 1,100	97	97	2	$ 387,716	$ 387,716	0.244
2023	3290	Vincent Dr	(to) Howard Marshall St-to-West End	CRK	$ 1,104	97	97	2	$ 389,306	$ 389,306	0.245
2023	2310	Gore Rd	(to) Sideroad 10 S-to-City of Hamilton Boundary	CRK	$ 4,942	92.95	92.95	2	$ 762,975	$ 762,975	1.097
2023	1775	Darrell Dr	(to) 202m South of Boida Ave.-to-South End Culdesac	CRK	$ 919	92.95	92.95	2	$ 130,373	$ 130,373	0.204
2023	3780	Gibson St	(to) Northumberland St (Reg. Rd 58)-to-MacDonald St	CRK	$ 274	92.95	92.95	2	$ 34,839	$ 34,839	0.061
2023	1150	West River Rd	(to) Footbridge Rd-to-369m N of Footbridge Rd	R1	$ 51,888	70.83	97		$ 376,939	$ 516,208	0.369
2023	3310	Hilltop Dr	(to) Scott St (Reg. Rd 49)-to-100m North of North School Entrance	R1	$ 55,278	70.84	97		$ 361,953	$ 495,616	0.278
2023	1360	Greenfield Rd	(to) 900m West of Shouldice Sideroad-to-Shouldice Side Rd	PR2sd	$ 231,378	23.29	100		$ 147,137	$ 631,762	0.9
2023	1190	Footbridge Rd	(to) West River Rd-to-Brantford Hwy (Hwy 24)	R2	$ 70,024	46.17	100		$ 120,195	$ 260,330	0.306
2023	1960	Maple Manor Rd	(to) Silver Maple Cres (E Leg)-to-414m E of Silver Maple Cres (E Leg)	PR2sd	$ 95,852	37.31	100		$ 115,579	$ 309,780	0.414
2023	2240	McLean Rd	(to) Dundas St S (Hwy 8)-to-City of Hamilton Boundary	PR2sd	$ 81,382	26.29	100		$ 58,371	$ 222,026	0.376
2023	3500	Reed Pl	(to) Main St-to-East End	R2	$ 75,121	37.07	100		$ 87,058	$ 234,847	0.101
2023	2390	Village Rd	(to) Clyde Rd-to-Old Beverly Rd (Reg. Rd 97)	PR2sd	$ 455,912	32.98	100		$ 434,624	$ 1,317,840	2.014
2023	2000	Silver Maple Cres	(to) Maple Manor Rd-to-Maple Manor Rd	PR2	$ 154,596	21.61	100		$ 83,896	$ 388,230	0.696
2023	2090	Bethany Crt	(to) Lockie Rd-to-North End	PR2	$ 45,586	20	100		$ 22,180	$ 110,900	0.225
2023	1950	Maple Manor Rd	(to) Silver Maple Cres (W Leg)-to-Silver Maple Cres	PR2sd	$ 35,796	37.31	100		$ 39,786	$ 106,635	0.158
2023	1330	Greenfield Rd	(to) Dumfries Rd (Reg. Rd 47)-to-Taylor Crt	PR2sd	$ 141,977	41.55	100		$ 178,790	$ 430,300	0.613
2023	3460	Main St	(to) Hope St-to-Hall St	MICRO	$ 7,438	79.56	79.56	3	$ 372,875	$ 372,875	0.255
2023	1785	Reidsville Rd	(to) Alps Rd-to-64m North of Railway Crossing	SDcrk	$ 11,673	72	72	2	$ 595,372	$ 595,372	1.178
2023	1980	Maple Manor Rd	(to) Cheese Factory Rd-to-Branchton Rd (Reg. Rd 43)	SDcrk	$ 15,192	72	72	2	$ 774,793	$ 774,793	1.533
2023	1870	Shouldice Side Rd	(to) Spragues Rd (Reg. Rd 75)-to-Beke Rd	SDcrk	$ 13,777	72	72	2	$ 696,638	$ 696,638	1.39
2023	1790	Reidsville Rd	(to) 64m North of Railway Crossing-to-Greenfield Rd	CRK	$ 1,954	97	97	2	$ 281,862	$ 281,862	0.479
2023	2940	Piper St	(to) Church St-to-96m W of Reg. Rd 58 (Nith River Bridge)	MICRO	$ 4,591	73.76	73.76	3	$ 173,524	$ 173,524	0.128

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
					$ 1,568,222						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2024	3840	Broom St	(to) 113m West of Douglas Drive-to-Nith River Way	CRK	$ 445	92.95	92.95	2	$ 172,875	$ 172,875	0.109
2024	1500	Cameron Rd	(to) New Dundee Rd (Reg. Rd 12/City of Kitchener Boundary)-to-Roseville Rd (Reg. Rd 46)	CRK	$ 7,789	92.95	92.95	2	$ 1,707,151	$ 1,707,151	1.909
2024	2120	Cheese Factory Rd	(to) Maple Manor Rd-to-Lockie Rd	CRK	$ 6,663	92.95	92.95	2	$ 1,460,334	$ 1,460,334	1.633
2024	1160	West River Rd	(to) 369m N of Footbridge Rd-to-781m South of City of Cambridge Boundary	CRK	$ 2,774	92.95	92.95	2	$ 474,829	$ 474,829	0.68
2024	3970	Simone Pl	(to) Nith River Way-to-North End	CRK	$ 1,526	97	97	2	$ 538,099	$ 538,099	0.332
2024	3320	Hilltop Dr	(to) Hunt St-to-Howard Marshall St	R1	$ 49,129	70.84	97		$ 338,647	$ 463,704	0.255
2024	3330	Hilltop Dr	(to) Howard Marshall St (N Leg)-to-Howard Marshall St (S Leg)	R1	$ 51,365	70.84	97		$ 311,856	$ 427,019	0.258
2024	1925	Waynco Rd	(to) 600m West of Cheese Factory Road-to-Cheese Factory Rd	CRK	$ 2,757	94.55	94.55	2	$ 436,789	$ 436,789	0.6
2024	2445	Sheffield Rd	(to) Old Beverly Road (Reg. Rd. 97)-to-450m South of Old Beverly Road (Reg Rd. 97)	CRK	$ 1,836	97	97	2	$ 382,860	$ 382,860	0.45
2024	3210	Hunt St	(to) Mitchell St-to-Jones Crt	R1	$ 24,666	69.47	97		$ 139,293	$ 194,494	0.12
2024	3870	Nith River Way	(to) Broom St-to-Broom St	R1	$ 86,528	69.47	97		$ 488,689	$ 682,349	0.421
2024	3230	Hunt St	(to) Hilltop Dr-to-Robert Simone Way	R1	$ 19,945	70.84	97		$ 118,457	$ 162,201	0.098
2024	3860	Broom St	(to) Robson St-to-Nith River Way	R1	$ 26,122	69.47	97		$ 141,616	$ 197,736	0.122
2024	2470	Sheffield Rd	(to) Morrison Rd-to-City of Hamilton Boundary	CRK	$ 4,121	97	97	2	$ 747,734	$ 747,734	1.01
2024	1320	Greenfield Rd	(to) Reidsville Rd-to-Dumfries Rd (Reg. Rd 47)	PR3sd	$ 887,451	24.9	100		$ 580,013	$ 2,329,370	3.052
2024	1750	Reidsville Rd	(to) Boida Ave-to-Alps Rd	PR2sd	$ 293,559	39.27	100		$ 365,524	$ 930,796	1.3
2024	3790	Gibson St	(to) MacDonald St-to-East End	CRK	$ 244	94.55	94.55	2	$ 29,939	$ 29,939	0.053
2024	2800	Victoria St	(to) Hughson St-to-King St	BS	$ 60,547	34.97	95		$ 63,690	$ 173,022	0.109
2024	1995	Maple Manor Rd	(to) Bend at City of Hamilton Boundary-to-90m South of Concession 7 West	GRR2	$ 22,510	65.7	85.7		$ 113,038	$ 147,448	0.363
2024	1450	Alps Rd	(to) Railway Crossing-to-Dumfries Road (Reg. Rd. 47)	SDcrk	$ 23,463	69.47	69.47	2	$ 1,154,472	$ 1,154,472	2.321
2024	3700	McRae St	(to) Bute St-to-Northumberland St (Reg. Rd 58)	CRK	$ 459	94.55	94.55	2	$ 53,504	$ 53,504	0.1
2024	2730	Mary St	(to) King St-to-West End	PR2	$ 13,061	31.1	100		$ 10,305	$ 33,134	0.069
2024	1210	Maple Dr	(to) Sylvan Split-to-Maple Dr	MICRO	$ 7,256	76.91	76.91	3	$ 398,160	$ 398,160	0.282
2024	3690	Bute St	(to) McRae St-to-North End	CRK	$ 212	95.86	95.86	2	$ 25,061	$ 25,061	0.052
2024	3685	Bute St	(to) McCrae Street-to-Bute Street Bend	CRK	$ 424	95.86	95.86	2	$ 47,874	$ 47,874	0.104
2024	3030	Water St	(to) William St-to-East End	SD	$ 375	93.09	93.09	1	$ 32,555	$ 32,555	0.068
2024	3680	Bute St	(to) Northumberland St (Reg. Rd 58)-to-Bute Street Bend	CRK	$ 412	95.86	95.86	2	$ 45,183	$ 45,183	0.101
2024	2790	Jane St	(to) Victoria St-to-North End	SD	$ 662	93.09	93.09	1	$ 56,161	$ 56,161	0.12
2024	2765	Hughson St	(to) King St-to-125 m West of King Street	SD	$ 689	93.09	93.09	1	$ 56,927	$ 56,927	0.125
2024	3050	William St	(to) 103m S of Water St-to-Water St	SD	$ 567	93.09	93.09	1	$ 45,610	$ 45,610	0.103

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2024	2780	Hughson St	(to) Hughson Lane-to-Victoria St	SDcrk	$ 1,769	69.47	69.47	2	$ 62,765	$ 62,765	0.175
					$ 1,599,326						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2025	1290	Greenfield Rd	(to) Northumberland St (Reg. Rd 58)-to-Melair Dr	CRK	$ 1,514	92.95	92.95	2	$ 359,314	$ 359,314	0.371
2025	3210	Hunt St	(to) Mitchell St-to-Jones Crt	CRK	$ 490	97	97	2	$ 198,383	$ 198,383	0.12
2025	3860	Broom St	(to) Robson St-to-Nith River Way	CRK	$ 498	97	97	2	$ 201,691	$ 201,691	0.122
2025	3870	Nith River Way	(to) Broom St-to-Broom St	CRK	$ 1,718	97	97	2	$ 695,996	$ 695,996	0.421
2025	1930	Maple Manor Rd	(to) Brantford Hwy (Hwy 24)-to-Misty Maple Trail	CRK	$ 3,909	92.95	92.95	2	$ 693,217	$ 693,217	0.958
2025	1940	Maple Manor Rd	(to) Misty Maple Trail-to-Silver Maple Cres	CRK	$ 971	92.95	92.95	2	$ 172,219	$ 172,219	0.238
2025	2170	Morrison Rd	(to) Shellard Rd-to-Studiman Rd	CRK	$ 3,235	92.95	92.95	2	$ 509,435	$ 509,435	0.793
2025	2050	Lockie Rd	(to) Brantford Hwy (Hwy 24)-to-239m E of Hwy 24 (W Boundary of Lockie)	GRR2	$ 10,729	65.7	85.7		$ 75,913	$ 99,022	0.239
2025	2450	Sheffield Rd	(to) 450m South of Old Beverly Road (Reg Rd. 97)-to-Seaton Rd	CRK	$ 2,832	97	97	2	$ 528,181	$ 528,181	0.694
2025	1350	Greenfield Rd	(to) Taylor Crt-to-900m West of Shouldice Sideroad	CRK	$ 6,475	97	97	2	$ 1,124,242	$ 1,124,242	1.587
2025	1900	Beke Rd	(to) Shouldice Side Rd-to-275m West of Gravel Pit Entrance	R2	$ 228,265	46.33	100		$ 372,191	$ 803,348	1.1
2025	2160	Morrison Rd	(to) Dundas St S (Hwy 8)-to-Shellard Rd	R2	$ 146,576	43.8	100		$ 215,543	$ 492,106	0.69
2025	1530	Whistle Bare Rd	(to) Dickie Settlement Road (Reg Road 71)-to-980m East of Dickie Settlement Road(Regioal Road 71)	PR2sd	$ 219,477	29.36	100		$ 173,766	$ 591,847	0.98
2025	1082	Brant Waterloo Rd	(to) 1700m East of Sprague Road (Regional Road 75)-to-900m West of West River Road North	REC	$ 223,444	5	100		$ 22,344	$ 446,888	0.922
2025	2890	Gladstone Rd	(to) Trussler Rd-to-Piper St	R2	$ 147,520	41.55	100		$ 190,508	$ 458,502	0.679
2025	2605	Paul Ave	(to) Fischer Hallman Road (Regioal Road 58)-to-West Side of Paul Ave. Cul De Sac	PR2sd	$ 73,469	23.85	100		$ 42,665	$ 178,888	0.352
2025	2200	Morrison Rd	(to) 1012m W of Sheffield Rd (E Boundary of Hall)-to-Sheffield Rd	CRK	$ 4,133	97	97	2	$ 647,262	$ 647,262	1.013
2025	2150	Morrison Rd	(to) 100m West of Bend-to-Highway 8	PR2sd	$ 168,168	23.85	100		$ 95,440	$ 400,169	0.774
2025	2910	Piper St	(to) 116m West of Rose Street-to-Rose St	MICRO	$ 3,520	79.56	79.56	3	$ 176,474	$ 176,474	0.116
2025	2930	Piper St	(to) Walter St-to-Church St	MICRO	$ 7,495	79.56	79.56	3	$ 375,769	$ 375,769	0.247
2025	1070	Brant Waterloo Rd	(to) Spragues Rd (Reg. Rd 75)-to-300m East of Spragues Road (Regional Road 75)	REC	$ 91,538	10	100		$ 18,308	$ 183,076	0.298
2025	1390	Taylor Crt	(to) Greenfield Rd-to-East End	PR2	$ 80,035	29.36	100		$ 55,374	$ 188,602	0.352
2025	2620	Marshall Ave	(to) Paul Ave-to-Roseville Rd (Reg. Rd 46)	PR2sd	$ 81,440	29.36	100		$ 55,174	$ 187,921	0.36
2025	2900	Piper St	(to) Trussler Rd-to-Gladstone Rd	SDcrk	$ 9,105	66.91	66.91	2	$ 392,438	$ 392,438	0.883
2025	1460	Alps Rd	(to) 640m East of Dumfries Road (Reg. Rd. 47)-to-150m West of Shouldice Road, South Leg	SDcrk	$ 22,066	81.56	81.56	2	$ 1,296,025	$ 1,296,025	2.14
2025	2230	Morrison Rd	(to) Seaton Rd-to-City of Hamilton Boundary	SDcrk	$ 6,599	66.91	66.91	2	$ 282,079	$ 282,079	0.64
2025	2710	Mary St	(to) Branchton Rd (Reg. Rd 43)-to-Queen St	PR2sd	$ 25,113	26.29	100		$ 14,422	$ 54,858	0.112

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2025	2800	Victoria St	(to) Hughson St-to-King St	CRK	$ 511	95	95	2	$ 176,483	$ 176,483	0.109
2025	2850	King St	(to) Albert St-to-Mary St	R1	$ 26,063	51.35	97		$ 45,273	$ 85,520	0.18
2025	2020	Red Maple Crt	(to) Silver Maple Cres-to-North End	CRK	$ 1,269	97	97	2	$ 173,542	$ 173,542	0.311
2025	2500	Hillside Ave	(to) Roseville Rd (Reg. Rd 46)-to-Oakwood Dr	PR2	$ 26,031	37.07	100		$ 23,896	$ 64,461	0.128
2025	3355	Hilltop Dr	(to) Swan Sreet (Reg. Rd. 58)-to-125m East of Watson Crescent, West Leg	MICRO	$ 6,727	73.76	73.76	3	$ 247,762	$ 247,762	0.193
2025	3020	Water St	(to) John St-to-William St	SDcrk	$ 927	66.91	66.91	2	$ 29,496	$ 29,496	0.09
					$ 1,631,862						

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2026	3310	Hilltop Dr	(to) Scott St (Reg. Rd 49)-to-100m North of North School Entrance	CRK	$ 1,134	92.95	92.95	2	$ 503,992	$ 503,992	0.278
2026	1150	West River Rd	(to) Footbridge Rd-to-369m N of Footbridge Rd	CRK	$ 1,506	92.95	92.95	2	$ 524,932	$ 524,932	0.369
2026	1610	Industrial Rd	(to) Roseville Rd (Reg. Rd 46)-to-300m North of Waydom Drive	CRK	$ 3,905	92.95	92.95	2	$ 973,950	$ 973,950	0.957
2026	1820	Edworthy Side Rd	(to) Cedar Creek Rd (Reg. Rd 97)-to-Alpine Crt	CRK	$ 2,868	92.95	92.95	2	$ 547,396	$ 547,396	0.703
2026	3990	Nith River Crt	(to) Nith River Way-to-North End	R1	$ 47,686	69.47	97		$ 287,427	$ 401,330	0.238
2026	3150	Mitchell St	(to) Malone St-to-Hunt St	R1	$ 91,337	69.47	97		$ 526,601	$ 735,286	0.427
2026	3760	Inglis St	(to) Inglis Crt-to-East End	R1	$ 13,512	69.47	97		$ 77,291	$ 107,921	0.064
2026	3750	Inglis St	(to) Willison St-to-Inglis Crt	R1	$ 68,526	69.47	97		$ 391,287	$ 546,349	0.324
2026	3400	Burnside Dr	(to) Swan St (Reg. Rd 58)-to-West End	R1	$ 79,538	69.47	97		$ 449,255	$ 627,289	0.372
2026	3300	Jones Crt	(to) Hunt St-to-South End	R1	$ 48,567	69.47	97		$ 274,142	$ 382,781	0.227
2026	3358	Watson Cres	(to) Hilltop Dr-to-220m East of Watson Cescent, West Leg,/ Hilltop	R1	$ 47,835	69.47	97		$ 265,689	$ 370,978	0.22
2026	1430	Alps Rd	(to) 650m West of Reidsville Road, South Leg-to-Reidsville Rd	CRK	$ 2,652	97	97	2	$ 508,520	$ 508,520	0.65
2026	1370	Greenfield Rd	(to) Shouldice Side Rd-to-Spragues Rd (Reg. Rd 75)	CRK	$ 2,293	97	97	2	$ 406,087	$ 406,087	0.562
2026	3030	Water St	(to) William St-to-East End	CRK	$ 325	91.48	91.48	2	$ 33,285	$ 33,285	0.068
2026	2790	Jane St	(to) Victoria St-to-North End	CRK	$ 573	91.48	91.48	2	$ 57,420	$ 57,420	0.12
2026	1510	Kings Rd	(to) City of Kitchener Boundary-to-Roseville Rd (Reg. Rd 46)	R2	$ 443,964	46.17	100		$ 681,558	$ 1,476,193	2.094
2026	1440	Alps Rd	(to) Reidsville Rd-to-Railway Crossing	CRK	$ 2,819	97	97	2	$ 446,579	$ 446,579	0.691
2026	2765	Hughson St	(to) King St-to-125 m West of King Street	CRK	$ 598	91.48	91.48	2	$ 58,202	$ 58,202	0.125
2026	3050	William St	(to) 103m S of Water St-to-Water St	CRK	$ 493	91.48	91.48	2	$ 46,632	$ 46,632	0.103
2026	3770	Inglis Crt	(to) Inglis St-to-South End	R1	$ 35,805	69.47	97		$ 148,436	$ 207,259	0.098
2026	1902	Beke Rd	(to) 275m West of Gravel Pit Entrance-to-West River Rd	PR3sd	$ 617,979	31.1	100		$ 478,363	$ 1,538,146	2.1
2026	2760	Queen St	(to) Victoria St-to-King St	R1	$ 32,791	48.82	97		$ 53,415	$ 106,131	0.213
2026	1690	Earl Thompson Pl	(to) Earl Thompson Rd-to-South End	R1	$ 31,258	48.82	97		$ 50,286	$ 99,914	0.151
2026	2630	Meadow Rose Lane	(to) Roseville Rd (Reg. Rd 46)-to-South End	R1	$ 50,025	48.82	97		$ 79,718	$ 158,390	0.304
2026	3450	Main St	(to) Scott St (Reg. Rd 49)-to-Hope St	MICRO	$ 2,190	79.56	79.56	3	$ 96,042	$ 96,042	0.068
2026	1250	Nith Rd	(to) 1434m N of Brant Waterloo Rd-to-North End	BS	$ 13,367	27.45	95		$ 8,353	$ 28,908	0.069
2026	1400	Alps Rd W	(to) Trussler Rd-to-Northumberland St (Reg. Rd 58)	SDcrk	$ 15,523	64.32	64.32	2	$ 584,811	$ 584,811	1.476
2026	2010	Sugar Maple Crt	(to) Silver Maple Cres-to-East End	CRK	$ 1,016	97	97	2	$ 128,600	$ 128,600	0.249
2026	2600	Paul Ave	(to) West Side of Paul Ave. Cul De Sac-to-Roseville Rd (Reg. Rd 46)	CRK	$ 1,550	97	97	2	$ 191,071	$ 191,071	0.38
2026	2720	Mary St	(to) Queen St-to-King St	CRK	$ 449	97	97	2	$ 53,308	$ 53,308	0.11

Township of North Dumfries

10 Year Work Plan From Performance Model (20161222)

Year	Asset ID	Street Name	Description	Imp. Type	Imp. Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value	Length (km)
2026	2850	King St	(to) Albert St-to-Mary St	CRK	$ 734	97	97	2	$ 87,230	$ 87,230	0.18
2026	3010	Water St	(to) Colonial Dr-to-John St	SDcrk	$ 1,589	64.32	64.32	2	$ 51,712	$ 51,712	0.151
					$ 1,664,407						

Appendix G: Critical Deficiencies by Asset ID

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
1000	Brant Waterloo Rd	Trussler Rd	Nith Rd	1.182	130	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1010	Brant Waterloo Rd	Nith Rd	Swan St (Reg. Rd 58)	1.031	150	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1020	Brant Waterloo Rd	Swan St (Reg. Rd 58)	484m E of Reg. Rd 58 (Ayr Boundary)	0.484	170	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1030	Brant Waterloo Rd	484m E of Reg. Rd 58 (Ayr Boundary)	Reidsville Rd	1.517	170	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1040	Brant Waterloo Rd	Reidsville Rd	1806m East of Reidsville Road	1.806	190	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1050	Brant Waterloo Rd	1806m East of Reidsville Road	Sprague Road (Regnal Road 75)	1.300	190	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1070	Brant Waterloo Rd	Sprague Rd (Reg. Rd 75)	300m East of Sprague Road (Regional Road 75)	0.298	250	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1080	Brant Waterloo Rd	300m East of Sprague Road (Regional Road 75)	1700m East of Sprague Road (Regional Road 75)	1.400	250	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	REC	6-10
1082	Brant Waterloo Rd	1700m East of Sprague Road (Regional Road 75)	900m West of West River Road North	0.922	250	ADEQ	NOW	NOW	NOW	ADEQ	ADEQ	REC	NOW
1084	Brant Waterloo Rd	900m West of West River Road North	West River Road North	0.901	250	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1100	West River Rd	Brant Waterloo Rd	1311m E of Brant Waterloo Rd (W Boundary of Innanen)	1.311	470	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1110	West River Rd	1311m E of Brant Waterloo Rd (W Boundary of Innanen)	738m S of Edgewood Cres	0.966	470	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1120	West River Rd	738m S of Edgewood Cres	Edgewood Cres	0.738	470	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1130	West River Rd	Edgewood Cres	Beke Rd	0.477	470	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1140	West River Rd	Beke Rd	Footbridge Rd	0.953	950	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1150	West River Rd	Footbridge Rd	369m N of Footbridge Rd	0.369	1,800	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1160	West River Rd	369m N of Footbridge Rd	781m South of City of Cambridge Boundary	0.680	1,800	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1180	West River Rd	781m South of City of Cambridge Boundary	City of Cambridge Boundary, 57m South of Gaskin Street	0.781	1,800	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REC	1-5
1190	Footbridge Rd	West River Rd	Brantford Hwy (Hwy 24)	0.306	2,500	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1200	Sylvan Dr	West River Rd	Sylvan Split	0.077	480	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
1202	Sylvan Dr	Sylvan Split	Maple Dr	0.301	220	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
1210	Maple Dr	Sylvan Split	Maple Dr	0.282	260	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
1215	Maple Dr	Sylvan Dr	Sylvan Dr	0.094	60	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
1220	Sylvan Dr	Maple Dr (W Leg)	Maple Dr	0.527	250	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
1230	Edgewood Cres	West River Rd	East End	0.162	60	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1240	Nith Rd	Brant Waterloo Rd	1434m N of Brant Waterloo Rd	1.434	150	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1250	Nith Rd	1434m N of Brant Waterloo Rd	North End	0.069	150	ADEQ	6-10	ADEQ	ADEQ	NOW	ADEQ	BS	NOW
1260	Greenfield Rd	Trussler Rd	550m East of Trussler Road (Oxford Road 36)	0.550	1,400	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1270	Greenfield Rd	550m East of Trussler Road (Oxford Road 36)	220m West of Northumberland Street (Reg. Rd.58)	0.635	1,200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1280	Greenfield Rd	220m West of Northumberland Street (Reg. Rd.58)	Northumberland St (Reg. Rd 58)	0.221	1,900	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
1290	Greenfield Rd	Northumberland St (Reg. Rd 58)	Melair Dr	0.371	2,800	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR3sd	NOW
1295	Greenfield Rd	Melair Dr	560m East of Melair Drive	0.560	1,700	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	PR3sd	6-10
1300	Greenfield Rd	560m East of Melair Drive	CP Railway Crossing	1.325	1,700	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	PR3sd	6-10

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
1310	Greenfield Rd	CP Railway Crossing	Reidsville Rd	0.307	1,300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	MICRO	ADEQ
1320	Greenfield Rd	Reidsville Rd	Dumfries Rd (Reg. Rd 47)	3.052	1,300	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR3sd	NOW
1330	Greenfield Rd	Dumfries Rd (Reg. Rd 47)	Taylor Crt	0.613	660	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1350	Greenfield Rd	Taylor Crt	900m West of Shouldice Sideroad	1.587	600	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
1360	Greenfield Rd	900m West of Shouldice Sideroad	Shouldice Side Rd	0.900	660	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
1370	Greenfield Rd	Shouldice Side Rd	Spragues Rd (Reg. Rd 75)	0.562	660	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
1380	Greenfield Rd	Spragues Rd (Reg. Rd 75)	East End	0.815	60	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1390	Taylor Crt	Greenfield Rd	East End	0.352	90	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
1400	Alps Rd W	Trussler Rd	Northumberland St (Reg. Rd 58)	1.476	220	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1410	Alps Rd	Northumberland St (Reg. Rd 58)	330m East of Regional Road 58	0.330	1,300	ADEQ	ADEQ	NOW	ADEQ	ADEQ	ADEQ	RSpLim	NOW
1420	Alps Rd	330m East of Regional Road 58	650m West of Reidsville Road, South Leg	2.024	900	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1430	Alps Rd	650m West of Reidsville Road, South Leg	Reidsville Rd	0.650	900	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1435	Alps Rd	Reidsville Road , South Leg	Reidsville Road, North Leg	0.129	900	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1440	Alps Rd	Reidsville Rd	Railway Crossing	0.691	520	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
1450	Alps Rd	Railway Crossing	Dumfries Road (Reg. Rd. 47)	2.321	520	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1455	Alps Rd	Dumfries Road (Reg. Rd. 47)	640m East of Dumfries Road (Reg. Rd. 47)	0.640	660	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1460	Alps Rd	640m East of Dumfries Road (Reg. Rd. 47)	150m West of Shouldice Road, South Leg	2.140	660	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1465	Alps Rd	150m West of Shouldice Road, South Leg	Shouldice Road, North Leg	0.247	1,200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
1470	Alps Rd	Shouldice Side Road, North Leg	Spragues Rd (Reg. Rd 75)	2.184	1,200	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1480	Roseville Rd	Trussler Rd	664m E of Trussler Rd (W Boundary of Plumtree)	0.664	1,200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR3sd	NOW
1490	Roseville Rd	664m E of Trussler Rd (W Boundary of Plumtree)	Northumberland St (Reg. Rd 58)	0.526	1,200	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR3sd	1-5
1500	Cameron Rd	New Dundee Rd (Reg. Rd 12/City of Kitchener Boundary)	Roseville Rd (Reg. Rd 46)	1.909	2,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1510	Kings Rd	City of Kitchener Boundary	Roseville Rd (Reg. Rd 46)	2.094	1,700	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1520	Whistle Bare Rd	Roseville Rd (Reg. Rd 46)	Dickie Settlement Rd (Reg. Rd 71)	2.989	270	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
1530	Whistle Bare Rd	Dickie Settlement Road (Reg Road 71)	980m East of Dickie Settlement Road(Regioal Road 71)	0.980	140	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1535	Whistle Bare Rd	980m East of Dickie Settlement Road(Regional Road 71)	Langdon Dr	0.459	140	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	REC	6-10
1540	Whistle Bare Rd	Langdon Dr	Roseville Rd (Reg. Rd 46)	1.820	200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
1550	Langdon Dr	Whistle Bare Rd	400m North of Whistlebare Road	0.400	120	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
1555	Langdon Dr	City of Cambridge Boundary	400m North of Whistlebare Road	0.601	120	ADEQ	6-10	NOW	1-5	NOW	ADEQ	REC	NOW
1600	Rife Rd	Dumfries Rd (Reg. Rd 47)	West End	0.629	1,900	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR3sd	1-5
1610	Industrial Rd	Roseville Rd (Reg. Rd 46)	300m North of Waydom Drive	0.957	3,800	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR3sd	NOW
1615	Industrial Rd	Waydom Dr	300m North of Waydom Drive	0.300	3,800	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1620	Industrial Rd	Waydom Dr	Cedar Creek Rd (Reg. Rd 97)	0.390	6,700	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1630	Wanless Crt	Industrial Rd	North End	0.421	1,200	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10

Critical Deficiencies

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ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
1640	Waydom Dr	Industrial Rd	Arnold Dr	0.621	3,800	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1650	Waydom Dr	Arnold Dr	East End	0.587	1,900	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1660	Arnold Dr	Waydom Dr	North End	0.130	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	NOW	REC	NOW
1670	Cochran Dr	Cedar Creek Rd (Reg. Rd 97)	North End	0.385	1,000	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR3	NOW
1680	Earl Thompson Rd	Cedar Creek Rd (Reg. Rd 97)	Earl Thompson Pl	0.634	1,100	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1690	Earl Thompson Pl	Earl Thompson Rd	South End	0.151	200	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1700	Darrell Dr	Earl Thompson Rd	West End	0.096	200	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
1710	Boida Ave	Earl Thompson Rd	Harmony Rd	0.239	3,200	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1720	Boida Ave	Harmony Rd	Darrell Dr	0.252	3,200	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1730	Boida Ave	Darrell Dr	Reidsville Rd	0.137	780	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1750	Reidsville Rd	Boida Ave	Alps Rd	1.300	780	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1760	Harmony Rd	Boida Ave	South End	0.285	1,100	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1770	Darrell Dr	Boida Ave	202m South of Boida Ave.	0.202	1,100	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR3	1-5
1775	Darrell Dr	202m South of Boida Ave.	South End Culdesac	0.204	1,100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
1785	Reidsville Rd	Alps Rd	64m North of Railway Crossing	1.178	450	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1790	Reidsville Rd	64m North of Railway Crossing	Greenfield Rd	0.479	450	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
1800	Reidsville Rd	Greenfield Rd	Wrigley Rd (Reg. Rd 49)	1.631	640	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1810	Reidsville Rd	Wrigley Rd (Reg. Rd 49)	Brant Waterloo Rd	1.709	110	ADEQ	6-10	NOW	1-5	ADEQ	ADEQ	REC	NOW
1820	Edworthy Side Rd	Cedar Creek Rd (Reg. Rd 97)	Alpine Crt	0.703	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1830	Edworthy Side Rd	Alpine Crt	Alps Rd	0.953	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1840	Alpine Crt	Edworthy Side Rd	East End	0.292	90	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1850	Shouldice Side Rd	Alps Rd	Greenfield Rd	1.649	540	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
1860	Shouldice Side Rd	Greenfield Rd	Sprague Rd (Reg. Rd 75)	0.233	540	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1870	Shouldice Side Rd	Sprague Rd (Reg. Rd 75)	Beke Rd	1.390	540	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1880	Shouldice Side Rd	Beke Rd	Brant Waterloo Rd	1.702	150	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	REC	6-10
1890	Beke Rd	Sprague Rd (Reg. Rd 75)	Shouldice Side Rd	2.045	190	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	GRRplu	6-10
1900	Beke Rd	Shouldice Side Rd	275m West of Gravel Pit Entrance	1.100	500	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1902	Beke Rd	275m West of Gravel Pit Entrance	West River Rd	2.100	500	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR3sd	1-5
1910	Waynco Rd	Brantford Hwy (Hwy 24)	350m E of Hwy 24	0.350	600	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	REChd	6-10
1920	Waynco Rd	350m E of Hwy 24	600m West of Cheese Factory Road	1.332	600	ADEQ	6-10	ADEQ	ADEQ	ADEQ	NOW	REChd	NOW
1925	Waynco Rd	600m West of Cheese Factory Road	Cheese Factory Rd	0.600	600	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
1930	Maple Manor Rd	Brantford Hwy (Hwy 24)	Misty Maple Trail	0.958	1,000	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
1940	Maple Manor Rd	Misty Maple Trail	Silver Maple Cres	0.238	1,000	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
1950	Maple Manor Rd	Silver Maple Cres (W Leg)	Silver Maple Cres	0.158	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1960	Maple Manor Rd	Silver Maple Cres (E Leg)	414m E of Silver Maple Cres (E Leg)	0.414	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1970	Maple Manor Rd	414m E of Silver Maple Cres (E Leg)	Cheese Factory Rd	0.643	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
1980	Maple Manor Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	1.533	640	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
1990	Maple Manor Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	1.511	290	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10

Critical Deficiencies

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ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
1995	Maple Manor Rd	Bend at City of Hamilton Boundary	90m South of Concession 7 West	0.363	290	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
2000	Silver Maple Cres	Maple Manor Rd	Maple Manor Rd	0.696	170	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2010	Sugar Maple Crt	Silver Maple Cres	East End	0.249	70	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2020	Red Maple Crt	Silver Maple Cres	North End	0.311	60	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2030	Misty Maple Trail	Maple Manor Rd	Autumn Maple Cres	0.202	120	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2040	Autumn Maple Cres	Misty Maple Trail	North End Cul De Sac	0.252	90	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2050	Lockie Rd	Brantford Hwy (Hwy 24)	239m E of Hwy 24 (W Boundary of Lockie)	0.239	190	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2060	Lockie Rd	239m E of Hwy 24 (W Boundary of Lockie)	Cheese Factory Rd	2.848	190	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
2070	Lockie Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	1.520	190	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
2080	Lockie Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	1.509	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	GRRplu	6-10
2090	Bethany Crt	Lockie Rd	North End	0.225	50	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2100	Cheese Factory Rd	City of Cambridge Boundary	Waynco Rd	1.065	3,200	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REChd	1-5
2110	Cheese Factory Rd	Waynco Rd	Maple Manor Rd	1.646	3,200	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2120	Cheese Factory Rd	Maple Manor Rd	Lockie Rd	1.633	1,900	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2130	Morrison Rd	Branchton Rd (Reg. Rd 43)	West End	0.901	80	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
2140	Morrison Rd	Branchton Rd (Reg. Rd 43)	100m West of Bend	1.391	260	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	GRRplu	6-10
2150	Morrison Rd	100m West of Bend	Highway 8	0.774	260	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2160	Morrison Rd	Dundas St S (Hwy 8)	Shellard Rd	0.690	1,400	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2170	Morrison Rd	Shellard Rd	Studiman Rd	0.793	1,400	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2180	Morrison Rd	Studiman Rd	299m E of Studimen Rd (W Boundary of Hall)	0.299	710	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
2190	Morrison Rd	299m E of Studimen Rd (W Boundary of Hall)	1012m W of Sheffield Rd (W Boundary of Hall)	0.348	710	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	REC	6-10
2200	Morrison Rd	1012m W of Sheffield Rd (E Boundary of Hall)	Sheffield Rd	1.013	710	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2210	Morrison Rd	Sheffield Rd	Seaton Rd	1.373	710	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2230	Morrison Rd	Seaton Rd	City of Hamilton Boundary	0.640	710	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2240	McLean Rd	Dundas St S (Hwy 8)	City of Hamilton Boundary	0.376	660	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2250	Studiman Rd	Morrison Rd	City of Hamilton Boundary	1.014	660	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2260	Seaton Rd	Sheffield Rd	Morrison Rd	1.886	270	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2270	Seaton Rd	Morrison Rd	City of Hamilton Boundary	1.100	270	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2280	Gore Rd	City of Cambridge Boundary	Shellard Rd	0.739	5,700	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REChd	NOW
2290	Gore Rd	Shellard Rd	Village Rd	2.435	1,900	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REChd	NOW
2300	Gore Rd	Village Rd	Sideroad 10 S	0.965	1,000	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
2310	Gore Rd	Sideroad 10 S	City of Hamilton Boundary	1.097	1,000	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
2320	Shellard Rd	Gore Rd	Clyde Rd (Reg. Rd 27)	1.094	3,800	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REChd	NOW
2330	Shellard Rd	Clyde Rd (Reg. Rd 27)	Old Beverly Rd (Reg. Rd 97)	2.034	3,600	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REChd	NOW
2340	Shellard Rd	Old Beverly Rd (Reg. Rd 97)	Morrison Rd	2.011	3,000	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2360	Village Rd	Gore Rd	353m N of Clyde Rd (N Boundary of Clyde)	0.715	1,000	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
2370	Village Rd	353m N of Clyde Rd (N Boundary of Clyde)	Clyde Rd (Reg. Rd 27)	0.353	1,100	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	REC	6-10

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
2390	Village Rd	Clyde Rd	Old Beverly Rd (Reg. Rd 97)	2.014	830	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2400	Clyde Rd	Village Rd	385m E of Village Rd (E Boundary of Clyde)	0.385	690	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REChd	NOW
2410	Clyde Rd	Clydebank Dr	City of Hamilton Boundary	1.890	690	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
2420	Clydebank Dr	Village Rd	Clyde Rd	0.551	170	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2430	Langford Dr	Clyde Rd (Reg. Rd 27)	Village Rd	0.473	140	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
2440	Angus Crt	Langford Dr	South End	0.173	50	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
2445	Sheffield Rd	Old Beverly Road (Reg. Rd. 97)	450m South of Old Beverly Road (Reg Rd. 97)	0.450	930	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2450	Sheffield Rd	450m South of Old Beverly Road (Reg Rd. 97)	Seaton Rd	0.694	930	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2460	Sheffield Rd	Seaton Rd	Morrison Rd	0.917	930	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2470	Sheffield Rd	Morrison Rd	City of Hamilton Boundary	1.010	930	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2500	Hillside Ave	Roseville Rd (Reg. Rd 46)	Oakwood Dr	0.128	250	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
2510	Oakwood Dr	Hillside Ave	Brown Ave	0.599	266	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2520	Oakwood Dr	Hillside Ave	Oakwood Dr (South Leg)	0.266	130	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2530	Brown Ave	Oakwood Dr	Roseville Rd (Reg. Rd 46)	0.318	350	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2600	Paul Ave	West Side of Paul Ave. Cul De Sac	Roseville Rd (Reg. Rd 46)	0.380	200	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2605	Paul Ave	Fischer Hallman Road (Regioal Road 58)	West Side of Paul Ave. Cul De Sac	0.352	450	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2sd	NOW
2610	Roseview Cres	Paul Ave	Paul Ave	0.391	180	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2620	Marshall Ave	Paul Ave	Roseville Rd (Reg. Rd 46)	0.360	200	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2630	Meadow Rose Lane	Roseville Rd (Reg. Rd 46)	South End	0.304	170	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2700	Jenkings Crt	Branchton Rd (Reg. Rd 43)	West End	0.598	180	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2710	Mary St	Branchton Rd (Reg. Rd 43)	Queen St	0.112	130	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2sd	1-5
2720	Mary St	Queen St	King St	0.110	80	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2730	Mary St	King St	West End	0.069	10	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	ADEQ
2740	Queen St	Mary St	Albert St	0.182	70	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	PR2sd	6-10
2750	Queen St	Albert St	Victoria St	0.184	95	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2760	Queen St	Victoria St	King St	0.213	120	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2765	Hughson St	King St	125 m West of King Street	0.125	120	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2770	Hughson St	125 m West of King Street	Hughson Lane	0.311	130	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
2780	Hughson St	Hughson Lane	Victoria St	0.175	140	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2790	Jane St	Victoria St	North End	0.120	60	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
2800	Victoria St	Hughson St	King St	0.109	220	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
2810	Victoria St	King St	Queen St	0.110	390	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
2820	Victoria St	Queen St	Branchton Rd (Reg. Rd 43)	0.116	590	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	BS	6-10
2830	King St	Hughson St	Victoria St	0.156	120	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	BS	6-10
2840	King St	Victoria St	Albert St	0.186	70	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
2850	King St	Albert St	Mary St	0.180	60	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2860	Albert St	King St	Queen St	0.110	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2870	Albert St	Queen St	Branchton Rd (Reg. Rd 43)	0.113	210	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2880	Welsh Dr	Trussler Rd	E End	0.500	130	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
2890	Gladstone Rd	Trussler Rd	Piper St	0.679	770	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2900	Piper St	Trussler Rd	Gladstone Rd	0.883	530	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2905	Piper St	Gladstone Rd	500m East of Gladstone Road	0.505	1,300	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
2908	Piper St	500m East of Gladstone Road	116m West of Rose Street	0.376	1,300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2910	Piper St	116m West of Rose Street	Rose St	0.116	1,300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2920	Piper St	Rose St	Walter St	0.198	1,400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2930	Piper St	Walter St	Church St	0.247	1,400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2940	Piper St	Church St	96m W of Reg. Rd 58 (Nith River Bridge)	0.128	2,000	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
2950	Stanley St	96m W of Reg. Rd 58 (Nith River Bridge)	Northumberland St (Reg. Rd 58)	0.096	2,000	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2960	Tannery St	Stanley St	North End	0.044	50	ADEQ	6-10	ADEQ	NOW	ADEQ	NOW	RSS	NOW
3000	Rose St	Piper St	Water St	0.346	210	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3005	Water St	Rose St	Colonial Dr	0.173	210	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3010	Water St	Colonial Dr	John St	0.151	230	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3020	Water St	John St	William St	0.090	230	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3030	Water St	William St	East End	0.068	30	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
3040	Colonial Dr	Water Street, West Intersection with Colonial Drive	William St	0.426	270	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3050	William St	103m S of Water St	Water St	0.103	270	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
3060	William St	Water St	Church St	0.125	350	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3070	Church St	Piper St	William St	0.087	460	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3080	Church St	William St	John St	0.087	100	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3090	Church St	John St	Walter St	0.081	160	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3100	Walter St	Church St	Piper St	0.185	160	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3110	John St	Water St	Church St	0.125	90	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
3120	Fowler St	Swan St (Reg. Rd 58)	St Andrew St	0.099	70	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	BS	1-5
3130	St Andrew St	Stanley St (Reg. Rd 49)	South End	0.197	70	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
3140	Mitchell St	Swan St (Reg. Rd 58)	Malone St	0.097	1,000	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3150	Mitchell St	Malone St	Hunt St	0.427	880	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3160	Mitchell St	Hunt St	Field St (E Leg)	0.052	300	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3170	Mitchell St	Field St (E Leg)	Field St (W Leg)	0.362	300	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3180	Mitchell St	Field St (W End)	Swan St (Reg. Rd 58)	0.330	630	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3190	Malone St	Mitchell St	South End	0.047	30	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RSS	ADEQ
3200	Field St	Mitchell St	Mitchell St	0.187	140	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3210	Hunt St	Mitchell St	Jones Crt	0.120	510	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3220	Hunt St	Jones Crt	Hilltop Dr	0.151	600	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3230	Hunt St	Hilltop Dr	Robert Simone Way	0.098	1,000	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3240	Robert Simone Way	Hunt St	Robert Simone Way	0.575	800	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3250	Robert Simone Way	Hunt St	Robert Simone Way	0.131	620	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3260	Robert Simone Way	Robert Simone Way (S Leg)	Challenger Drive	0.123	110	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3270	Patterson Dr	Challenger Drive	Vincent Dr	0.214	320	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3280	Vincent Dr	Patterson Dr	Howard Marshall St	0.244	490	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
3290	Vincent Dr	Howard Marshall St	West End	0.245	390	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3300	Jones Crt	Hunt St	South End	0.227	150	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3310	Hilltop Dr	Scott St (Reg. Rd 49)	100m North of North School Entrance	0.278	1,400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3315	Hilltop Dr	100m North of North School Entrance	Hunt St	0.395	1,400	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3320	Hilltop Dr	Hunt St	Howard Marshall St	0.255	1,060	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3330	Hilltop Dr	Howard Marshall St (N Leg)	Howard Marshall St (S Leg)	0.258	1,540	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3340	Hilltop Dr	Howard Marshall St (S Leg)	Watson Cres (E Leg)	0.138	1,600	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3350	Hilltop Dr	125m East of Watson Crescent, West Leg	Watson Crescent, East Leg	0.167	1,700	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	R2	NOW
3355	Hilltop Dr	Swan Sreet (Reg. Rd. 58)	125m East of Watson Crescent, West Leg	0.193	2,300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3358	Watson Cres	Hilltop Dr	220m East of Watson Cescent, West Leg,/ Hilltop	0.220	450	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3360	Watson Cres	Hilltop Dr	220m East of Watson Cescent, West Leg,/ Hilltop	0.271	450	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	R2	NOW
3370	Howard Marshall St	South End	Hilltop Dr	0.144	870	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3380	Howard Marshall St	Hilltop Dr	Hilltop Dr	0.274	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3390	Challenger Drive	Hilltop Dr	East End	0.140	380	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3400	Burnside Dr	Swan St (Reg. Rd 58)	West End	0.372	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3410	James Edgar Crt	Burnside Dr	South End	0.125	90	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3415	Stanley Drive	Stanley Street (Reg. Rd. 49)	113m East of Stanley Street, (Reg. Rd. 49)	0.113	490	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3420	Stanley St	113m East of Stanley Street, (Reg. Rd. 49)	Scott St (Reg. Rd 49)	0.366	490	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	RSS	6-10
3430	Grey St	Main St (Reg. Rd 49)	Scott St (Reg. Rd 49)	0.194	70	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3440	Hope St	Main St	Scott St (Reg. Rd 49)	0.185	60	ADEQ	6-10	ADEQ	ADEQ	ADEQ	NOW	RSS	NOW
3450	Main St	Scott St (Reg. Rd 49)	Hope St	0.068	1,400	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
3460	Main St	Hope St	Hall St	0.255	1,300	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3470	Main St	Hall St	Newell St	0.111	1,280	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3480	Main St	Newell St	Cooper St	0.213	880	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3490	Main St	Cooper St	North End	0.090	20	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3500	Reed Pl	Main St	East End	0.101	110	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R2	1-5
3510	Cooper St	Main St	Upton Crt	0.220	620	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3520	Cooper St	Upton Crt	Willison St	0.097	620	ADEQ	1-5	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
3530	Upton Crt	Cooper St	East End	0.249	280	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3540	Willison St	Inglis St	Cooper St	0.048	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	RSS	6-10
3550	Willison St	Cooper St	Newell St	0.171	240	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3560	Willison St	Newell St	Hall St	0.118	360	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3570	Newell St	Willison St	James St	0.148	150	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3580	Newell St	James St	Main St	0.096	240	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3590	James St	Newell St	Hall St	0.114	80	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3600	Hall St	Main St	James St	0.056	710	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	RSS	6-10
3610	Hall St	James St	Willison St	0.146	710	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
3620	Hall St	Willison St	Colquhoun St	0.105	750	ADEQ	6-10	ADEQ	1-5	NOW	ADEQ	RSS	NOW
3630	Hall St	Colquhoun St	Thompson St	0.111	1,200	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
3640	Hall St	Thompson St	Northumberland St (Reg. Rd 58)	0.105	1,400	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
3650	Colquhoun St	Inglis St	Hall St	0.278	400	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3660	Thompson St	Inglis St	Hall St	0.211	210	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3670	Elliot St	Inglis St	Thompson St	0.202	70	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3680	Bute St	Northumberland St (Reg. Rd 58)	Bute Street Bend	0.101	290	ADEQ	6-10	ADEQ	1-5	NOW	ADEQ	RSS	NOW
3685	Bute St	McCrae Street	Bute Street Bend	0.104	140	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3690	Bute St	McRae St	North End	0.052	50	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3700	McRae St	Bute St	Northumberland St (Reg. Rd 58)	0.100	290	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
3710	Inglis St	Northumberland St (Reg. Rd 58)	Thompson St	0.104	1,000	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
3720	Inglis St	Thompson St	Elliot St	0.110	910	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
3730	Inglis St	Elliot St	Colquhoun St	0.145	880	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
3740	Inglis St	Colquhoun St	Willison St	0.131	840	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3750	Inglis St	Willison St	Inglis Crt	0.324	730	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3760	Inglis St	Inglis Crt	East End	0.064	130	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3770	Inglis Crt	Inglis St	South End	0.098	150	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3780	Gibson St	Northumberland St (Reg. Rd 58)	MacDonald St	0.061	1,200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
3790	Gibson St	MacDonald St	East End	0.053	80	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
3800	MacDonald St	Gibson St	Manley St	0.123	550	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
3810	Manley St	Northumberland St (Reg. Rd 58)	MacDonald St	0.070	560	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
3820	Manley St	MacDonald St	East End	0.138	230	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
3830	Broom St	Northumberland St (Reg. Rd 58)	113m West of Douglas Drive	0.297	1,600	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
3840	Broom St	113m West of Douglas Drive	Nith River Way	0.109	1,300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3850	Broom St	Nith River Way	Robson St	0.104	650	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3860	Broom St	Robson St	Nith River Way	0.122	380	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3870	Nith River Way	Broom St	Broom St	0.421	600	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3880	Nith River Way	Broom St	Robson St	0.195	360	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
3890	Nith River Way	Robson St	Seyler St	0.168	270	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3900	Nith River Way	Seyler St	Simone Pl	0.270	490	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3910	Nith River Way	Simone Pl	Melissa Crt	0.103	900	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3920	Nith River Way	Melissa Crt	Nith River Crt	0.215	1,200	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3930	Nith River Way	Nith River Crt	Northumberland St (Reg. Rd 58)	0.119	1,400	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3940	Douglas Dr	Nith River Way	Broom St	0.489	390	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3950	Robson St	Nith River Way	Broom St	0.348	240	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3960	Seyler St	Nith River Way	North End	0.266	180	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3970	Simone Pl	Nith River Way	North End	0.332	290	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R2	1-5
3980	Melissa Crt	Nith River Way	North End	0.161	120	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
3990	Nith River Crt	Nith River Way	North End	0.238	150	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
4000	Guthrie St	Northumberland St (Reg. Rd 58)	Melair Dr	0.281	570	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SDcrk	6-10
4010	Melair Dr	Greenfield Rd	Guthrie St	0.542	920	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	REChd	1-5
4020	Melair Dr	Guthrie St	East End	0.345	440	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR3sd	NOW

Critical Deficiencies

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
				166.095									

Appendix H: Needs Sorted By Time of Need and Improvement Category

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
R2										
34.00	3350	Hilltop Dr	125m East of Watson Crescent, West Leg	Watson Crescent, East Leg	1,700	0.167	NOW	Rehab	R2	56,017.44
22.00	3360	Watson Cres	Hilltop Dr	220m East of Watson Cescent, West Leg,/ Hilltop	450	0.271	NOW	Rehab	R2	90,902.57
16.00	3970	Simone Pl	Nith River Way	North End	290	0.332	1-5	Rehab	R2	113,343.93
11.00	3500	Reed Pl	Main St	East End	110	0.101	1-5	Rehab	R2	66,705.28
						0.871				326,969.22
R1										
42.00	2120	Cheese Factory Rd	Maple Manor Rd	Lockie Rd	1,900	1.633	6-10	Rehab	R1	214,786.11
31.00	1160	West River Rd	369m N of Footbridge Rd	781m South of City of Cambridge Boundary	1,800	0.680	6-10	Rehab	R1	85,324.38
31.00	1510	Kings Rd	City of Kitchener Boundary	Roseville Rd (Reg. Rd 46)	1,700	2.094	6-10	Rehab	R1	261,414.67
29.00	2160	Morrison Rd	Dundas St S (Hwy 8)	Shellard Rd	1,400	0.690	6-10	Rehab	R1	90,762.08
27.00	2170	Morrison Rd	Shellard Rd	Studiman Rd	1,400	0.793	6-10	Rehab	R1	98,989.67
27.00	1900	Beke Rd	Shouldice Side Rd	275m West of Gravel Pit Entrance	500	1.100	6-10	Rehab	R1	144,693.06
27.00	1620	Industrial Rd	Waydom Dr	Cedar Creek Rd (Reg. Rd 97)	6,700	0.390	6-10	Rehab	R1	62,140.88
27.00	1435	Alps Rd	Reidsville Road , South Leg	Reidsville Road, North Leg	900	0.129	6-10	Rehab	R1	16,243.13
20.00	3470	Main St	Hall St	Newell St	1,280	0.111	1-5	Rehab	R1	19,646.26
20.00	3920	Nith River Way	Melissa Crt	Nith River Crt	1,200	0.215	1-5	Rehab	R1	38,097.67
19.00	3930	Nith River Way	Nith River Crt	Northumberland St (Reg. Rd 58)	1,400	0.119	6-10	Rehab	R1	20,400.55
19.00	2890	Gladstone Rd	Trussler Rd	Piper St	770	0.679	6-10	Rehab	R1	90,456.18
19.00	1190	Footbridge Rd	West River Rd	Brantford Hwy (Hwy 24)	2,500	0.306	6-10	Rehab	R1	39,250.14
18.00	1760	Harmony Rd	Boida Ave	South End	1,100	0.285	6-10	Rehab	R1	48,031.25
18.00	3480	Main St	Newell St	Cooper St	880	0.213	1-5	Rehab	R1	37,692.71
18.00	3910	Nith River Way	Simone Pl	Melissa Crt	900	0.103	1-5	Rehab	R1	18,217.13
17.00	2950	Stanley St	96m W of Reg. Rd 58 (Nith River Bridge)	Northumberland St (Reg. Rd 58)	2,000	0.096	6-10	Rehab	R1	17,972.08
17.00	1650	Waydom Dr	Arnold Dr	East End	1,900	0.587	6-10	Rehab	R1	97,551.00
17.00	1630	Wanless Crt	Industrial Rd	North End	1,200	0.421	6-10	Rehab	R1	67,704.89
17.00	3510	Cooper St	Main St	Upton Crt	620	0.220	1-5	Rehab	R1	38,951.15
16.00	2750	Queen St	Albert St	Victoria St	95	0.184	6-10	Rehab	R1	22,714.95
16.00	2760	Queen St	Victoria St	King St	120	0.213	6-10	Rehab	R1	27,438.29
16.00	1730	Boida Ave	Darrell Dr	Reidsville Rd	780	0.137	6-10	Rehab	R1	22,781.17
16.00	3315	Hilltop Dr	100m North of North School Entrance	Hunt St	1,400	0.395	6-10	Rehab	R1	68,170.65
15.00	3940	Douglas Dr	Nith River Way	Broom St	390	0.489	1-5	Rehab	R1	86,584.11
14.00	3180	Mitchell St	Field St (W End)	Swan St (Reg. Rd 58)	630	0.330	6-10	Rehab	R1	59,050.50
13.00	3220	Hunt St	Jones Crt	Hilltop Dr	600	0.151	6-10	Rehab	R1	27,013.71
13.00	3415	Stanley Drive	Stanley Street (Reg. Rd. 49)	113m East of Stanley Street, (Reg. Rd. 49)	490	0.113	6-10	Rehab	R1	17,389.48
13.00	3950	Robson St	Nith River Way	Broom St	240	0.348	1-5	Rehab	R1	61,626.33
13.00	3530	Upton Crt	Cooper St	East End	280	0.249	1-5	Rehab	R1	44,091.96
13.00	3580	Newell St	James St	Main St	240	0.096	1-5	Rehab	R1	16,840.81

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
13.00	1700	Darrell Dr	Earl Thompson Rd	West End	200	0.096	1-5	Rehab	R1	15,974.77
12.00	1840	Alpine Crt	Edworthy Side Rd	East End	90	0.292	6-10	Rehab	R1	41,253.48
12.00	2630	Meadow Rose Lane	Roseville Rd (Reg. Rd 46)	South End	170	0.304	6-10	Rehab	R1	41,858.85
12.00	3900	Nith River Way	Seyler St	Simone Pl	490	0.270	6-10	Rehab	R1	48,824.43
12.00	3170	Mitchell St	Field St (E Leg)	Field St (W Leg)	300	0.362	6-10	Rehab	R1	66,258.43
12.00	3980	Melissa Crt	Nith River Way	North End	120	0.161	1-5	Rehab	R1	28,498.80
11.00	3890	Nith River Way	Robson St	Seyler St	270	0.168	6-10	Rehab	R1	30,074.80
11.00	2850	King St	Albert St	Mary St	60	0.180	6-10	Rehab	R1	22,244.48
10.00	3160	Mitchell St	Hunt St	Field St (E Leg)	300	0.052	6-10	Rehab	R1	9,292.21
10.00	3960	Seyler St	Nith River Way	North End	180	0.266	6-10	Rehab	R1	47,623.71
10.00	1690	Earl Thompson Pl	Earl Thompson Rd	South End	200	0.151	6-10	Rehab	R1	26,154.92
9.00	2040	Autumn Maple Cres	Misty Maple Trail	North End Cul De Sac	90	0.252	6-10	Rehab	R1	35,989.68
8.00	2030	Misty Maple Trail	Maple Manor Rd	Autumn Maple Cres	120	0.202	6-10	Rehab	R1	30,979.91
						16.325				2,407,055.42
PR3sd										
61.00	1610	Industrial Rd	Roseville Rd (Reg. Rd 46)	300m North of Waydom Drive	3,800	0.957	NOW	Rehab	PR3sd	258,797.12
47.00	1480	Roseville Rd	Trussler Rd	664m E of Trussler Rd (W Boundary of Plumtree)	1,200	0.664	NOW	Rehab	PR3sd	161,185.18
47.00	1320	Greenfield Rd	Reidsville Rd	Dumfries Rd (Reg. Rd 47)	1,300	3.052	NOW	Rehab	PR3sd	772,579.22
42.00	1290	Greenfield Rd	Northumberland St (Reg. Rd 58)	Melair Dr	2,800	0.371	NOW	Rehab	PR3sd	95,191.13
41.00	1300	Greenfield Rd	560m East of Melair Drive	CP Railway Crossing	1,700	1.325	6-10	Rehab	PR3sd	344,592.98
35.00	1490	Roseville Rd	664m E of Trussler Rd (W Boundary of Plumtree)	Northumberland St (Reg. Rd 58)	1,200	0.526	1-5	Rehab	PR3sd	141,076.29
33.00	1295	Greenfield Rd	Melair Dr	560m East of Melair Drive	1,700	0.560	6-10	Rehab	PR3sd	143,693.44
28.00	4020	Melair Dr	Guthrie St	East End	440	0.345	NOW	Rehab	PR3sd	92,787.77
28.00	1902	Beke Rd	275m West of Gravel Pit Entrance	West River Rd	500	2.100	1-5	Rehab	PR3sd	517,096.65
26.00	1600	Rife Rd	Dumfries Rd (Reg. Rd 47)	West End	1,900	0.629	1-5	Rehab	PR3sd	166,875.63
						10.529				2,693,875.41
PR3										
36.00	1670	Cochran Dr	Cedar Creek Rd (Reg. Rd 97)	North End	1,000	0.385	NOW	Rehab	PR3	119,155.73
29.00	1615	Industrial Rd	Waydom Dr	300m North of Waydom Drive	3,800	0.300	1-5	Rehab	PR3	96,038.40
26.00	1640	Waydom Dr	Industrial Rd	Arnold Dr	3,800	0.621	1-5	Rehab	PR3	196,576.54
25.00	1710	Boida Ave	Earl Thompson Rd	Harmony Rd	3,200	0.239	1-5	Rehab	PR3	75,663.33
24.00	1720	Boida Ave	Harmony Rd	Darrell Dr	3,200	0.252	1-5	Rehab	PR3	79,760.68
19.00	1680	Earl Thompson Rd	Cedar Creek Rd (Reg. Rd 97)	Earl Thompson Pl	1,100	0.634	1-5	Rehab	PR3	200,673.90
19.00	1770	Darrell Dr	Boida Ave	202m South of Boida Ave.	1,100	0.202	1-5	Rehab	PR3	64,282.40
						2.633				832,150.98
PR2sd										
45.00	1470	Alps Rd	Shouldice Side Road, North Leg	Sprague Rd (Reg. Rd 75)	1,200	2.184	1-5	Rehab	PR2sd	448,308.28
44.00	1970	Maple Manor Rd	414m E of Silver Maple Cres (E Leg)	Cheese Factory Rd	1,000	0.643	1-5	Rehab	PR2sd	132,244.61
42.00	2470	Sheffield Rd	Morrison Rd	City of Hamilton Boundary	930	1.010	NOW	Rehab	PR2sd	207,796.69

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
41.00	1500	Cameron Rd	New Dundee Rd (Reg. Rd 12/City of Kitchener Boundary)	Roseville Rd (Reg. Rd 46)	2,000	1.909	1-5	Rehab	PR2sd	392,771.59
38.00	1930	Maple Manor Rd	Brantford Hwy (Hwy 24)	Misty Maple Trail	1,000	0.958	NOW	Rehab	PR2sd	197,128.76
37.00	1940	Maple Manor Rd	Misty Maple Trail	Silver Maple Cres	1,000	0.238	NOW	Rehab	PR2sd	48,996.47
37.00	2450	Sheffield Rd	450m South of Old Beverly Road (Reg Rd. 97)	Seaton Rd	930	0.694	NOW	Rehab	PR2sd	149,740.98
37.00	1370	Greenfield Rd	Shouldice Side Rd	Spragues Rd (Reg. Rd 75)	660	0.562	NOW	Rehab	PR2sd	115,594.97
37.00	1350	Greenfield Rd	Taylor Crt	900m West of Shouldice Sideroad	600	1.587	NOW	Rehab	PR2sd	302,295.73
37.00	1430	Alps Rd	650m West of Reidsville Road, South Leg	Reidsville Rd	900	0.650	1-5	Rehab	PR2sd	127,457.42
37.00	1960	Maple Manor Rd	Silver Maple Cres (E Leg)	414m E of Silver Maple Cres (E Leg)	1,000	0.414	1-5	Rehab	PR2sd	85,115.04
33.00	1360	Greenfield Rd	900m West of Shouldice Sideroad	Shouldice Side Rd	660	0.900	NOW	Rehab	PR2sd	205,456.91
30.00	2460	Sheffield Rd	Seaton Rd	Morrison Rd	930	0.917	NOW	Rehab	PR2sd	184,353.90
29.00	2240	McLean Rd	Dundas St S (Hwy 8)	City of Hamilton Boundary	660	0.376	NOW	Rehab	PR2sd	72,264.85
29.00	2390	Village Rd	Clyde Rd	Old Beverly Rd (Reg. Rd 97)	830	2.014	1-5	Rehab	PR2sd	404,836.97
29.00	1950	Maple Manor Rd	Silver Maple Cres (W Leg)	Silver Maple Cres	1,000	0.158	1-5	Rehab	PR2sd	31,786.46
28.00	1330	Greenfield Rd	Dumfries Rd (Reg. Rd 47)	Taylor Crt	660	0.613	1-5	Rehab	PR2sd	126,072.43
27.00	2605	Paul Ave	Fischer Hallman Road (Regioal Road 58)	West Side of Paul Ave. Cul De Sac	450	0.352	NOW	Rehab	PR2sd	62,704.68
27.00	2150	Morrison Rd	100m West of Bend	Highway 8	260	0.774	NOW	Rehab	PR2sd	143,529.82
27.00	1830	Edworthy Side Rd	Alpine Crt	Alps Rd	1,000	0.953	1-5	Rehab	PR2sd	197,498.08
26.00	1820	Edworthy Side Rd	Cedar Creek Rd (Reg. Rd 97)	Alpine Crt	1,000	0.703	1-5	Rehab	PR2sd	145,676.51
22.00	1750	Reidsville Rd	Boida Ave	Alps Rd	780	1.300	1-5	Rehab	PR2sd	255,560.79
22.00	2620	Marshall Ave	Paul Ave	Roseville Rd (Reg. Rd 46)	200	0.360	1-5	Rehab	PR2sd	69,508.23
20.00	2520	Oakwood Dr	Hillside Ave	Oakwood Dr (South Leg)	130	0.266	1-5	Rehab	PR2sd	51,195.46
19.00	2610	Roseview Cres	Paul Ave	Paul Ave	180	0.391	1-5	Rehab	PR2sd	75,398.26
19.00	2510	Oakwood Dr	Hillside Ave	Brown Ave	266	0.599	1-5	Rehab	PR2sd	115,419.83
19.00	2710	Mary St	Branchton Rd (Reg. Rd 43)	Queen St	130	0.112	1-5	Rehab	PR2sd	21,433.55
19.00	1530	Whistle Bare Rd	Dickie Settlement Road (Reg Road 71)	980m East of Dickie Settlement Road (Regioal Road 71)	140	0.980	1-5	Rehab	PR2sd	187,322.59
13.00	2740	Queen St	Mary St	Albert St	70	0.182	6-10	Rehab	PR2sd	34,809.66
						22.799				4,592,279.52
PR2										
40.00	2445	Sheffield Rd	Old Beverly Road (Reg. Rd. 97)	450m South of Old Beverly Road (Reg Rd. 97)	930	0.450	NOW	Rehab	PR2	100,481.08
39.00	1280	Greenfield Rd	220m West of Northumberland Street (Reg. Rd.58)	Northumberland St (Reg. Rd 58)	1,900	0.221	NOW	Rehab	PR2	39,924.08
31.00	2200	Morrison Rd	1012m W of Sheffield Rd (E Boundary of Hall)	Sheffield Rd	710	1.013	NOW	Rehab	PR2	176,009.27
27.00	1440	Alps Rd	Reidsville Rd	Railway Crossing	520	0.691	NOW	Rehab	PR2	118,155.47
26.00	1790	Reidsville Rd	64m North of Railway Crossing	Greenfield Rd	450	0.479	NOW	Rehab	PR2	79,421.28
26.00	2600	Paul Ave	West Side of Paul Ave. Cul De Sac	Roseville Rd (Reg. Rd 46)	200	0.380	NOW	Rehab	PR2	68,340.25
24.00	2180	Morrison Rd	Studiman Rd	299m E of Studimen Rd (W Boundary of Hall)	710	0.299	1-5	Rehab	PR2	51,951.40
19.00	2090	Bethany Crt	Lockie Rd	North End	50	0.225	NOW	Rehab	PR2	40,478.76

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
19.00	2000	Silver Maple Cres	Maple Manor Rd	Maple Manor Rd	170	0.696	NOW	Rehab	PR2	137,276.69
19.00	2010	Sugar Maple Crt	Silver Maple Cres	East End	70	0.249	NOW	Rehab	PR2	47,442.24
19.00	2020	Red Maple Crt	Silver Maple Cres	North End	60	0.311	NOW	Rehab	PR2	60,712.25
19.00	2500	Hillside Ave	Roseville Rd (Reg. Rd 46)	Oakwood Dr	250	0.128	1-5	Rehab	PR2	22,217.66
18.00	2720	Mary St	Queen St	King St	80	0.110	NOW	Rehab	PR2	18,390.08
18.00	1200	Sylvan Dr	West River Rd	Sylvan Split	480	0.077	1-5	Rehab	PR2	23,355.46
14.00	1390	Taylor Crt	Greenfield Rd	East End	90	0.352	1-5	Rehab	PR2	68,309.26
13.00	2730	Mary St	King St	West End	10	0.069	ADEQ	Rehab	PR2	11,370.94
13.00	2430	Langford Dr	Clyde Rd (Reg. Rd 27)	Village Rd	140	0.473	1-5	Rehab	PR2	90,602.40
13.00	2440	Angus Crt	Langford Dr	South End	50	0.173	1-5	Rehab	PR2	31,288.80
						6.396				1,185,727.37
SDcrk										
43.00	1150	West River Rd	Footbridge Rd	369m N of Footbridge Rd	1,800	0.369	6-10	Maint	SDcrk	3,247.20
31.00	1785	Reidsville Rd	Alps Rd	64m North of Railway Crossing	450	1.178	6-10	Maint	SDcrk	10,366.40
26.00	3830	Broom St	Northumberland St (Reg. Rd 58)	113m West of Douglas Drive	1,600	0.297	6-10	Maint	SDcrk	2,613.60
22.00	3740	Inglis St	Colquhoun St	Willison St	840	0.131	6-10	Maint	SDcrk	1,152.80
22.00	1800	Reidsville Rd	Greenfield Rd	Wrigley Rd (Reg. Rd 49)	640	1.631	6-10	Maint	SDcrk	14,352.80
21.00	1420	Alps Rd	330m East of Regional Road 58	650m West of Reidsville Road, South Leg	900	2.024	6-10	Maint	SDcrk	17,811.20
21.00	2260	Seaton Rd	Sheffield Rd	Morrison Rd	270	1.886	6-10	Maint	SDcrk	16,596.80
20.00	2270	Seaton Rd	Morrison Rd	City of Hamilton Boundary	270	1.100	6-10	Maint	SDcrk	9,680.00
20.00	1870	Shouldice Side Rd	Sprague Rd (Reg. Rd 75)	Beke Rd	540	1.390	6-10	Maint	SDcrk	12,232.00
20.00	4000	Guthrie St	Northumberland St (Reg. Rd 58)	Melair Dr	570	0.281	6-10	Maint	SDcrk	2,472.80
20.00	2905	Piper St	Gladstone Rd	500m East of Gladstone Road	1,300	0.505	6-10	Maint	SDcrk	4,444.00
19.00	3060	William St	Water St	Church St	350	0.125	6-10	Maint	SDcrk	1,100.00
19.00	1980	Maple Manor Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	640	1.533	6-10	Maint	SDcrk	13,490.40
19.00	2340	Shellard Rd	Old Beverly Rd (Reg. Rd 97)	Morrison Rd	3,000	2.011	6-10	Maint	SDcrk	17,696.80
19.00	1460	Alps Rd	640m East of Dumfries Road (Reg. Rd. 47)	150m West of Shouldice Road, South Leg	660	2.140	6-10	Maint	SDcrk	18,832.00
18.00	1450	Alps Rd	Railway Crossing	Dumfries Road (Reg. Rd. 47)	520	2.321	6-10	Maint	SDcrk	20,424.80
17.00	2230	Morrison Rd	Seaton Rd	City of Hamilton Boundary	710	0.640	6-10	Maint	SDcrk	5,632.00
17.00	3020	Water St	John St	William St	230	0.090	6-10	Maint	SDcrk	792.00
17.00	2900	Piper St	Trussler Rd	Gladstone Rd	530	0.883	6-10	Maint	SDcrk	7,770.40
16.00	2870	Albert St	Queen St	Branchton Rd (Reg. Rd 43)	210	0.113	6-10	Maint	SDcrk	994.40
16.00	1400	Alps Rd W	Trussler Rd	Northumberland St (Reg. Rd 58)	220	1.476	6-10	Maint	SDcrk	12,988.80
15.00	3010	Water St	Colonial Dr	John St	230	0.151	6-10	Maint	SDcrk	1,328.80
15.00	3005	Water St	Rose St	Colonial Dr	210	0.173	6-10	Maint	SDcrk	1,522.40
13.00	2860	Albert St	King St	Queen St	100	0.110	6-10	Maint	SDcrk	968.00
13.00	3460	Main St	Hope St	Hall St	1,300	0.255	6-10	Maint	SDcrk	2,244.00
13.00	1860	Shouldice Side Rd	Greenfield Rd	Sprague Rd (Reg. Rd 75)	540	0.233	6-10	Maint	SDcrk	2,050.40
11.00	2780	Hughson St	Hughson Lane	Victoria St	140	0.175	6-10	Maint	SDcrk	1,540.00

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
7.00	2420	Clydebank Dr	Village Rd	Clyde Rd	170	0.551	6-10	Maint	SDcrk	4,848.80
						23.772				209,193.60
SD										
34.00	2110	Cheese Factory Rd	Waynco Rd	Maple Manor Rd	3,200	1.646	6-10	Maint	SD	7,900.80
24.00	2050	Lockie Rd	Brantford Hwy (Hwy 24)	239m E of Hwy 24 (W Boundary of Lockie)	190	0.239	6-10	Maint	SD	1,147.20
18.00	2250	Studiman Rd	Morrison Rd	City of Hamilton Boundary	660	1.014	6-10	Maint	SD	4,867.20
18.00	2530	Brown Ave	Oakwood Dr	Roseville Rd (Reg. Rd 46)	350	0.318	6-10	Maint	SD	1,526.40
18.00	1925	Waynco Rd	600m West of Cheese Factory Road	Cheese Factory Rd	600	0.600	6-10	Maint	SD	2,880.00
16.00	1850	Shouldice Side Rd	Alps Rd	Greenfield Rd	540	1.649	6-10	Maint	SD	7,915.20
15.00	1520	Whistle Bare Rd	Roseville Rd (Reg. Rd 46)	Dickie Settlement Rd (Reg. Rd 71)	270	2.989	6-10	Maint	SD	14,347.20
12.00	3700	McRae St	Bute St	Northumberland St (Reg. Rd 58)	290	0.100	6-10	Maint	SD	480.00
12.00	3050	William St	103m S of Water St	Water St	270	0.103	6-10	Maint	SD	494.40
10.00	2765	Hughson St	King St	125 m West of King Street	120	0.125	6-10	Maint	SD	600.00
9.00	3030	Water St	William St	East End	30	0.068	ADEQ	Maint	SD	326.40
9.00	3790	Gibson St	MacDonald St	East End	80	0.053	6-10	Maint	SD	254.40
8.00	1210	Maple Dr	Sylvan Split	Maple Dr	260	0.282	6-10	Maint	SD	1,353.60
6.00	3450	Main St	Scott St (Reg. Rd 49)	Hope St	1,400	0.068	6-10	Maint	SD	326.40
5.00	2790	Jane St	Victoria St	North End	60	0.120	ADEQ	Maint	SD	576.00
						9.374				44,995.20
RSpLimit										
15.00	1410	Alps Rd	Northumberland St (Reg. Rd 58)	330m East of Regional Road 58	1,300	0.330	NOW	Maint	RSpLimit	0.00
						0.330				0.00
MICRO										
19.00	1310	Greenfield Rd	CP Railway Crossing	Reidsville Rd	1,300	0.307	ADEQ	Maint	MICRO	7,521.50
						0.307				7,521.50
GRRplus										
18.00	2080	Lockie Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	100	1.509	6-10	Maint	GRRplus	42,662.45
16.00	1890	Beke Rd	Spragues Rd (Reg. Rd 75)	Shouldice Side Rd	190	2.045	6-10	Maint	GRRplus	59,016.25
16.00	2140	Morrison Rd	Branchton Rd (Reg. Rd 43)	100m West of Bend	260	1.391	6-10	Maint	GRRplus	39,734.47
						4.945				141,413.17
CRK										
20.00	2210	Morrison Rd	Sheffield Rd	Seaton Rd	710	1.373	ADEQ	Maint	CRK	5,492.00
20.00	2908	Piper St	500m East of Gladstone Road	116m West of Rose Street	1,300	0.376	ADEQ	Maint	CRK	1,504.00
15.00	1465	Alps Rd	150m West of Shouldice Road, South Leg	Shouldice Road, North Leg	1,200	0.247	ADEQ	Maint	CRK	988.00
13.00	3840	Broom St	113m West of Douglas Drive	Nith River Way	1,300	0.109	ADEQ	Maint	CRK	436.00
12.00	3850	Broom St	Nith River Way	Robson St	650	0.104	ADEQ	Maint	CRK	416.00
12.00	3310	Hilltop Dr	Scott St (Reg. Rd 49)	100m North of North School Entrance	1,400	0.278	ADEQ	Maint	CRK	1,112.00

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
12.00	3355	Hilltop Dr	Swan Sreet (Reg. Rd. 58)	125m East of Watson Crescent, West Leg	2,300	0.193	ADEQ	Maint	CRK	772.00
11.00	3320	Hilltop Dr	Hunt St	Howard Marshall St	1,060	0.255	ADEQ	Maint	CRK	1,020.00
11.00	3330	Hilltop Dr	Howard Marshall St (N Leg)	Howard Marshall St (S Leg)	1,540	0.258	ADEQ	Maint	CRK	1,032.00
11.00	3870	Nith River Way	Broom St	Broom St	600	0.421	ADEQ	Maint	CRK	1,684.00
10.00	3880	Nith River Way	Broom St	Robson St	360	0.195	ADEQ	Maint	CRK	780.00
10.00	3210	Hunt St	Mitchell St	Jones Crt	510	0.120	ADEQ	Maint	CRK	480.00
10.00	2940	Piper St	Church St	96m W of Reg. Rd 58 (Nith River Bridge)	2,000	0.128	ADEQ	Maint	CRK	512.00
9.00	3150	Mitchell St	Malone St	Hunt St	880	0.427	ADEQ	Maint	CRK	1,708.00
9.00	2920	Piper St	Rose St	Walter St	1,400	0.198	ADEQ	Maint	CRK	792.00
9.00	3230	Hunt St	Hilltop Dr	Robert Simone Way	1,000	0.098	ADEQ	Maint	CRK	392.00
9.00	3358	Watson Cres	Hilltop Dr	220m East of Watson Cescent, West Leg,/ Hilltop	450	0.220	ADEQ	Maint	CRK	880.00
9.00	3860	Broom St	Robson St	Nith River Way	380	0.122	ADEQ	Maint	CRK	488.00
9.00	3750	Inglis St	Willison St	Inglis Crt	730	0.324	ADEQ	Maint	CRK	1,296.00
8.00	3200	Field St	Mitchell St	Mitchell St	140	0.187	ADEQ	Maint	CRK	748.00
7.00	3400	Burnside Dr	Swan St (Reg. Rd 58)	West End	300	0.372	ADEQ	Maint	CRK	1,488.00
7.00	2930	Piper St	Walter St	Church St	1,400	0.247	ADEQ	Maint	CRK	988.00
7.00	3990	Nith River Crt	Nith River Way	North End	150	0.238	ADEQ	Maint	CRK	952.00
7.00	2700	Jenkings Crt	Branchton Rd (Reg. Rd 43)	West End	180	0.598	ADEQ	Maint	CRK	2,392.00
6.00	3760	Inglis St	Inglis Crt	East End	130	0.064	ADEQ	Maint	CRK	256.00
6.00	3770	Inglis Crt	Inglis St	South End	150	0.098	ADEQ	Maint	CRK	392.00
6.00	3390	Challenger Drive	Hilltop Dr	East End	380	0.140	ADEQ	Maint	CRK	560.00
5.00	3300	Jones Crt	Hunt St	South End	150	0.227	ADEQ	Maint	CRK	908.00
5.00	3250	Robert Simone Way	Hunt St	Robert Simone Way	620	0.131	ADEQ	Maint	CRK	524.00
4.00	3490	Main St	Cooper St	North End	20	0.090	ADEQ	Maint	CRK	360.00
4.00	3410	James Edgar Crt	Burnside Dr	South End	90	0.125	ADEQ	Maint	CRK	500.00
4.00	2910	Piper St	116m West of Rose Street	Rose St	1,300	0.116	ADEQ	Maint	CRK	464.00
3.00	3260	Robert Simone Way	Robert Simone Way (S Leg)	Challenger Drive	110	0.123	ADEQ	Maint	CRK	492.00
						8.202				32,808.00
RSS										
44.00	3620	Hall St	Willison St	Colquhoun St	750	0.105	NOW	Const	RSS	150,840.55
38.00	3650	Colquhoun St	Inglis St	Hall St	400	0.278	NOW	Const	RSS	391,084.15
38.00	3610	Hall St	James St	Willison St	710	0.146	NOW	Const	RSS	209,740.19
36.00	3680	Bute St	Northumberland St (Reg. Rd 58)	Bute Street Bend	290	0.101	NOW	Const	RSS	142,084.53
34.00	3800	MacDonald St	Gibson St	Manley St	550	0.123	NOW	Const	RSS	173,033.63
34.00	3710	Inglis St	Northumberland St (Reg. Rd 58)	Thompson St	1,000	0.104	1-5	Const	RSS	188,172.10
34.00	3720	Inglis St	Thompson St	Elliot St	910	0.110	1-5	Const	RSS	180,599.66
33.00	3560	Willison St	Newell St	Hall St	360	0.118	NOW	Const	RSS	165,999.75
32.00	3660	Thompson St	Inglis St	Hall St	210	0.211	NOW	Const	RSS	296,830.06
32.00	3685	Bute St	McCrae Street	Bute Street Bend	140	0.104	NOW	Const	RSS	146,304.87

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
31.00	3550	Willison St	Cooper St	Newell St	240	0.171	NOW	Const	RSS	240,558.96
31.00	3520	Cooper St	Upton Crt	Willison St	620	0.097	1-5	Const	RSS	136,457.42
30.00	3730	Inglis St	Elliot St	Colquhoun St	880	0.145	1-5	Const	RSS	208,303.62
29.00	2960	Tannery St	Stanley St	North End	50	0.044	NOW	Const	RSS	68,214.36
28.00	3690	Bute St	McRae St	North End	50	0.052	NOW	Const	RSS	73,152.43
27.00	3590	James St	Newell St	Hall St	80	0.114	NOW	Const	RSS	176,737.19
26.00	3570	Newell St	Willison St	James St	150	0.148	NOW	Const	RSS	208,203.07
25.00	3600	Hall St	Main St	James St	710	0.056	6-10	Const	RSS	80,448.29
25.00	3420	Stanley St	113m East of Stanley Street, (Reg. Rd. 49)	Scott St (Reg. Rd 49)	490	0.366	6-10	Const	RSS	567,419.40
24.00	3430	Grey St	Main St (Reg. Rd 49)	Scott St (Reg. Rd 49)	70	0.194	NOW	Const	RSS	300,763.29
23.00	3070	Church St	Piper St	William St	460	0.087	NOW	Const	RSS	122,389.64
19.00	3190	Malone St	Mitchell St	South End	30	0.047	ADEQ	Const	RSS	66,118.54
19.00	3130	St Andrew St	Stanley St (Reg. Rd 49)	South End	70	0.197	1-5	Const	RSS	305,414.27
18.00	3670	Elliot St	Inglis St	Thompson St	70	0.202	NOW	Const	RSS	293,834.67
15.00	3440	Hope St	Main St	Scott St (Reg. Rd 49)	60	0.185	NOW	Const	RSS	260,253.84
14.00	3540	Willison St	Inglis St	Cooper St	100	0.048	6-10	Const	RSS	67,525.32
						3.553				5,220,483.80
RNS										
37.00	3810	Manley St	Northumberland St (Reg. Rd 58)	MacDonald St	560	0.070	NOW	Const	RNS	41,294.18
32.00	3820	Manley St	MacDonald St	East End	230	0.138	NOW	Const	RNS	75,449.29
27.00	3640	Hall St	Thompson St	Northumberland St (Reg. Rd 58)	1,400	0.105	NOW	Const	RNS	90,496.88
23.00	3630	Hall St	Colquhoun St	Thompson St	1,200	0.111	NOW	Const	RNS	95,668.12
						0.424				302,908.47
REChd										
67.00	2100	Cheese Factory Rd	City of Cambridge Boundary	Waynco Rd	3,200	1.065	1-5	Const	REChd	978,394.70
61.00	2320	Shellard Rd	Gore Rd	Clyde Rd (Reg. Rd 27)	3,800	1.094	NOW	Const	REChd	906,503.44
57.00	2280	Gore Rd	City of Cambridge Boundary	Shellard Rd	5,700	0.739	NOW	Const	REChd	612,345.56
53.00	2290	Gore Rd	Shellard Rd	Village Rd	1,900	2.435	NOW	Const	REChd	2,236,986.94
52.00	2330	Shellard Rd	Clyde Rd (Reg. Rd 27)	Old Beverly Rd (Reg. Rd 97)	3,600	2.034	NOW	Const	REChd	1,868,596.07
38.00	1910	Waynco Rd	Brantford Hwy (Hwy 24)	350m E of Hwy 24	600	0.350	6-10	Const	REChd	321,538.16
36.00	1920	Waynco Rd	350m E of Hwy 24	600m West of Cheese Factory Road	600	1.332	NOW	Const	REChd	1,103,713.53
32.00	4010	Melair Dr	Greenfield Rd	Guthrie St	920	0.542	1-5	Const	REChd	478,398.34
30.00	2400	Clyde Rd	Village Rd	385m E of Village Rd (E Boundary of Clyde)	690	0.385	NOW	Const	REChd	339,821.71
						9.976				8,846,298.45
REC										
43.00	2360	Village Rd	Gore Rd	353m N of Clyde Rd (N Boundary of Clyde)	1,000	0.715	NOW	Const	REC	475,071.41
42.00	1082	Brant Waterloo Rd	1700m East of Spragues Road (Regional Road 75)	900m West of West River Road North	250	0.922	NOW	Const	REC	381,414.85

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
41.00	1455	Alps Rd	Dumfries Road (Reg. Rd. 47)	640m East of Dumfries Road (Reg. Rd. 47)	660	0.640	NOW	Const	REC	392,244.51
40.00	1270	Greenfield Rd	550m East of Trussler Road (Oxford Road 36)	220m West of Northumberland Street (Reg. Rd.58)	1,200	0.635	NOW	Const	REC	387,495.04
37.00	2410	Clyde Rd	Clydebank Dr	City of Hamilton Boundary	690	1.890	NOW	Const	REC	1,187,933.92
37.00	1180	West River Rd	781m South of City of Cambridge Boundary	City of Cambridge Boundary, 57m South of Gaskin Street	1,800	0.781	1-5	Const	REC	462,136.78
36.00	1555	Langdon Dr	City of Cambridge Boundary	400m North of Whistlebare Road	120	0.601	NOW	Const	REC	219,302.67
34.00	1140	West River Rd	Beke Rd	Footbridge Rd	950	0.953	1-5	Const	REC	563,913.40
32.00	1070	Brant Waterloo Rd	Sprague Rd (Reg. Rd 75)	300m East of Sprague Road (Regional Road 75)	250	0.298	NOW	Const	REC	156,253.96
32.00	1100	West River Rd	Brant Waterloo Rd	1311m E of Brant Waterloo Rd (W Boundary of Innanen)	470	1.311	1-5	Const	REC	724,714.99
30.00	1540	Whistle Bare Rd	Langdon Dr	Roseville Rd (Reg. Rd 46)	200	1.820	NOW	Const	REC	664,111.24
29.00	1110	West River Rd	1311m E of Brant Waterloo Rd (W Boundary of Innanen)	738m S of Edgewood Cres	470	0.966	1-5	Const	REC	534,000.52
29.00	1120	West River Rd	738m S of Edgewood Cres	Edgewood Cres	470	0.738	1-5	Const	REC	407,963.13
28.00	1084	Brant Waterloo Rd	900m West of West River Road North	West River Road North	250	0.901	NOW	Const	REC	397,581.26
28.00	1080	Brant Waterloo Rd	300m East of Sprague Road (Regional Road 75)	1700m East of Sprague Road (Regional Road 75)	250	1.400	6-10	Const	REC	510,854.80
27.00	1230	Edgewood Cres	West River Rd	East End	60	0.162	NOW	Const	REC	65,815.25
27.00	1050	Brant Waterloo Rd	1806m East of Reidsville Road	Sprague Road (Regnal Road 75)	190	1.300	1-5	Const	REC	658,718.32
26.00	2370	Village Rd	353m N of Clyde Rd (N Boundary of Clyde)	Clyde Rd (Reg. Rd 27)	1,100	0.353	6-10	Const	REC	170,263.59
26.00	2190	Morrison Rd	299m E of Studimen Rd (W Boundary of Hall)	1012m W of Sheffield Rd (W Boundary of Hall)	710	0.348	6-10	Const	REC	189,775.00
25.00	1810	Reidsville Rd	Wrigley Rd (Reg. Rd 49)	Brant Waterloo Rd	110	1.709	NOW	Const	REC	783,828.56
24.00	1130	West River Rd	Edgewood Cres	Beke Rd	470	0.477	1-5	Const	REC	297,322.85
23.00	1880	Shouldice Side Rd	Beke Rd	Brant Waterloo Rd	150	1.702	6-10	Const	REC	596,617.75
11.00	1660	Arnold Dr	Waydom Dr	North End	100	0.130	NOW	Const	REC	60,014.46
11.00	1535	Whistle Bare Rd	980m East of Dickie Settlement Road (Regional Road 71)	Langdon Dr	140	0.459	6-10	Const	REC	160,897.51
						21.211				10,448,245.77
NONE										
15.00	1995	Maple Manor Rd	Bend at City of Hamilton Boundary	90m South of Concession 7 West	290	0.363	ADEQ	Const	NONE	0.00
14.00	3780	Gibson St	Northumberland St (Reg. Rd 58)	MacDonald St	1,200	0.061	ADEQ	Const	NONE	0.00
14.00	2310	Gore Rd	Sideroad 10 S	City of Hamilton Boundary	1,000	1.097	ADEQ	Const	NONE	0.00
11.00	2300	Gore Rd	Village Rd	Sideroad 10 S	1,000	0.965	ADEQ	Const	NONE	0.00
5.00	2770	Hughson St	125 m West of King Street	Hughson Lane	130	0.311	ADEQ	Const	NONE	0.00
4.00	3140	Mitchell St	Swan St (Reg. Rd 58)	Malone St	1,000	0.097	ADEQ	Const	NONE	0.00
4.00	3370	Howard Marshall St	South End	Hilltop Dr	870	0.144	ADEQ	Const	NONE	0.00
3.00	3240	Robert Simone Way	Hunt St	Robert Simone Way	800	0.575	ADEQ	Const	NONE	0.00
3.00	3340	Hilltop Dr	Howard Marshall St (S Leg)	Watson Cres (E Leg)	1,600	0.138	ADEQ	Const	NONE	0.00
3.00	1775	Darrell Dr	202m South of Boida Ave.	South End Culdesac	1,100	0.204	ADEQ	Const	NONE	0.00
2.00	3270	Patterson Dr	Challenger Drive	Vincent Dr	320	0.214	ADEQ	Const	NONE	0.00

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
2.00	3280	Vincent Dr	Patterson Dr	Howard Marshall St	490	0.244	ADEQ	Const	NONE	0.00
2.00	3290	Vincent Dr	Howard Marshall St	West End	390	0.245	ADEQ	Const	NONE	0.00
0.00	3380	Howard Marshall St	Hilltop Dr	Hilltop Dr	100	0.274	ADEQ	Const	NONE	0.00
						4.932				0.00
BS										
34.00	1250	Nith Rd	1434m N of Brant Waterloo Rd	North End	150	0.069	NOW	Const	BS	11,185.21
30.00	1380	Greenfield Rd	Spragues Rd (Reg. Rd 75)	East End	60	0.815	6-10	Const	BS	142,048.66
29.00	3040	Colonial Dr	Water Street, West Intersection with Colonial Drive	William St	270	0.426	NOW	Const	BS	118,634.13
28.00	1220	Sylvan Dr	Maple Dr (W Leg)	Maple Dr	250	0.527	NOW	Const	BS	157,096.29
27.00	3000	Rose St	Piper St	Water St	210	0.346	NOW	Const	BS	94,507.52
27.00	2060	Lockie Rd	239m E of Hwy 24 (W Boundary of Lockie)	Cheese Factory Rd	190	2.848	6-10	Const	BS	496,385.99
26.00	1040	Brant Waterloo Rd	Reidsville Rd	1806m East of Reidsville Road	190	1.806	6-10	Const	BS	314,772.86
25.00	3100	Walter St	Church St	Piper St	160	0.185	NOW	Const	BS	51,025.50
25.00	1240	Nith Rd	Brant Waterloo Rd	1434m N of Brant Waterloo Rd	150	1.434	6-10	Const	BS	249,935.93
24.00	3080	Church St	William St	John St	100	0.087	NOW	Const	BS	23,298.81
24.00	3090	Church St	John St	Walter St	160	0.081	NOW	Const	BS	21,691.99
24.00	1550	Langdon Dr	Whistle Bare Rd	400m North of Whistlebare Road	120	0.400	6-10	Const	BS	69,717.13
24.00	1260	Greenfield Rd	Trussler Rd	550m East of Trussler Road (Oxford Road 36)	1,400	0.550	6-10	Const	BS	170,742.97
24.00	1030	Brant Waterloo Rd	484m E of Reg. Rd 58 (Ayr Boundary)	Reidsville Rd	170	1.517	6-10	Const	BS	264,402.22
24.00	2810	Victoria St	King St	Queen St	390	0.110	1-5	Const	BS	30,339.48
23.00	1020	Brant Waterloo Rd	Swan St (Reg. Rd 58)	484m E of Reg. Rd 58 (Ayr Boundary)	170	0.484	6-10	Const	BS	84,357.73
23.00	2070	Lockie Rd	Cheese Factory Rd	Branchton Rd (Reg. Rd 43)	190	1.520	6-10	Const	BS	264,925.10
23.00	1990	Maple Manor Rd	Branchton Rd (Reg. Rd 43)	City of Hamilton Boundary	290	1.511	6-10	Const	BS	308,192.03
23.00	2130	Morrison Rd	Branchton Rd (Reg. Rd 43)	West End	80	0.901	1-5	Const	BS	221,489.85
21.00	2880	Welsh Dr	Trussler Rd	E End	130	0.500	NOW	Const	BS	141,912.32
21.00	3110	John St	Water St	Church St	90	0.125	NOW	Const	BS	35,478.08
21.00	2820	Victoria St	Queen St	Branchton Rd (Reg. Rd 43)	590	0.116	6-10	Const	BS	35,905.38
21.00	1202	Sylvan Dr	Sylvan Split	Maple Dr	220	0.301	1-5	Const	BS	91,447.50
20.00	1010	Brant Waterloo Rd	Nith Rd	Swan St (Reg. Rd 58)	150	1.031	6-10	Const	BS	179,695.92
18.00	1000	Brant Waterloo Rd	Trussler Rd	Nith Rd	130	1.182	6-10	Const	BS	191,607.54
18.00	1215	Maple Dr	Sylvan Dr	Sylvan Dr	60	0.094	1-5	Const	BS	27,181.54
16.00	2840	King St	Victoria St	Albert St	70	0.186	1-5	Const	BS	49,811.24
16.00	2800	Victoria St	Hughson St	King St	220	0.109	1-5	Const	BS	52,710.37
16.00	3120	Fowler St	Swan St (Reg. Rd 58)	St Andrew St	70	0.099	1-5	Const	BS	28,098.63
15.00	2830	King St	Hughson St	Victoria St	120	0.156	6-10	Const	BS	42,610.32
						19.516				3,971,208.24
						166.095				41,263,134.12
						166.095				41,263,134.12

Appendix I: Mapping- Roads Inventory Sections


REGIONAL MUNICIPALITY OF WATERLOO
CITY OF KITCHENER
COUNTY OF WELLINGTON
TOWNSHIP OF PUSLINCH
REGIONAL MUNICIPALITY OF WATERLOO
CITY OF CAMBRIDGE
CITY OF HAMILTON
COUNTY OF BRANT
COUNTY OF OXFORD
TOWNSHIP OF BLANDFORD-BLENHEIM
Plumtree
Roseville
Brown
Reidsville
Taylor
Ayr
Parker
Riverview
Innanen
Lockie
Ranchlands
Branchton
Morrison
Clyde
Roseville Rd.
Cameron Rd.
Kings Rd.
Whistle Bare Rd.
Langdon Dr.
Cruickston Park Lane
Gore Rd.
Angus Crt.
Langford Dr.
Village Rd.
Clydebank Dr.
Clyde Rd.
Rife Rd.
Industrial Rd.
Vanless Crt.
Arnold Dr.
Waydon Dr.
Cochran Dr.
Boida Ave.
Earl Thompson Rd.
Earl Thompson Pl.
Harmony Rd.
Darrell Dr.
Reidsville Rd.
Edworthy Sideroad
Alpine Crt.
Sheffield Rd.
Alps Rd.W
Alps Rd.
Shouldice Sideroad
Seaton Rd.
Morrison Rd.
Greenfield Rd.
Melair Dr.
Taylor Crt.
Waynco Rd.
McLean Rd.
Studiman Rd.
Footbridge Rd.
Sylvan Dr.
Maple Dr.
West River Rd.
Silver Maple Cres.
Autumn Maple Cres.
Red Maple Crt.
Sugar Maple Crt.
Welsh Dr.
Gladstone Rd.
Piper St.
Nith Rd.
Beke Rd.
Maple Manor Rd.
Misty Maple Trail
Edgewood Cres.
Cheese Factory Rd.
Bannister Lake
Wrigley's Lake
Deans Lake
Grand River
Brant Waterloo Rd.
Bethany Crt.
Lockie Rd.

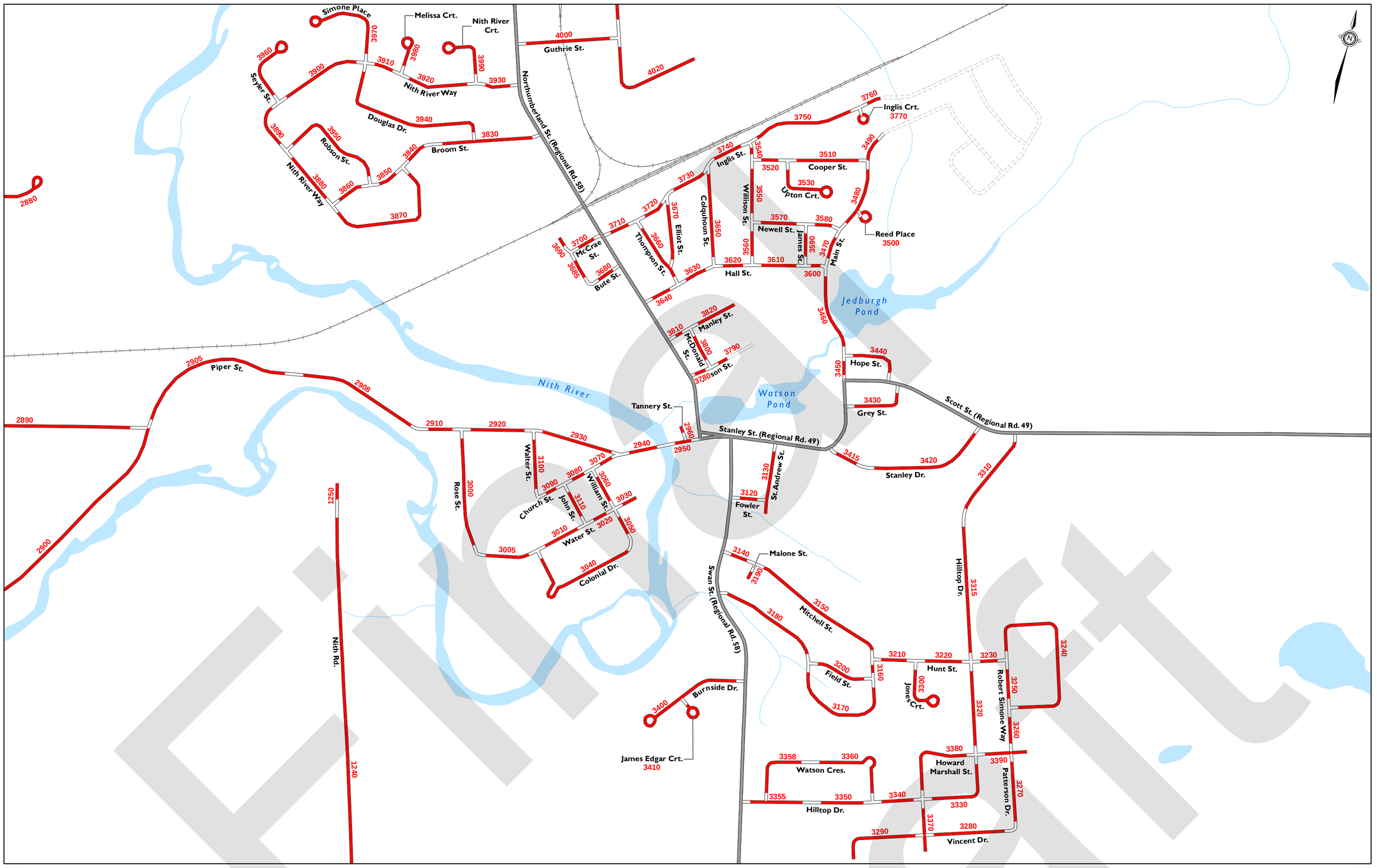
CIMA+
Roads Management Services Inc.

CLIENT:
The TOWNSHIP of NORTH DUMFRIES

LEGEND:
- ROAD INVENTORY SECTION
- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

SCALE:
500 250 0 500 1,000 1,500 2,000
meters
1:30,000

PROJECT NAME: 2016 ROAD NEEDS STUDY	PROJECT No: C14-0153		CLIENT FILE No: --
	DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 1A
SHEET TITLE: ROAD SECTION INVENTORY	APPROVER: D. CAMPBELL	APPROVER: ---	
	DATE: 11/30/2016		SHEET No: 1 of 1



CIMA Roads Management Services Inc.

CLIENT: The TOWNSHIP of NORTH DUMFRIES

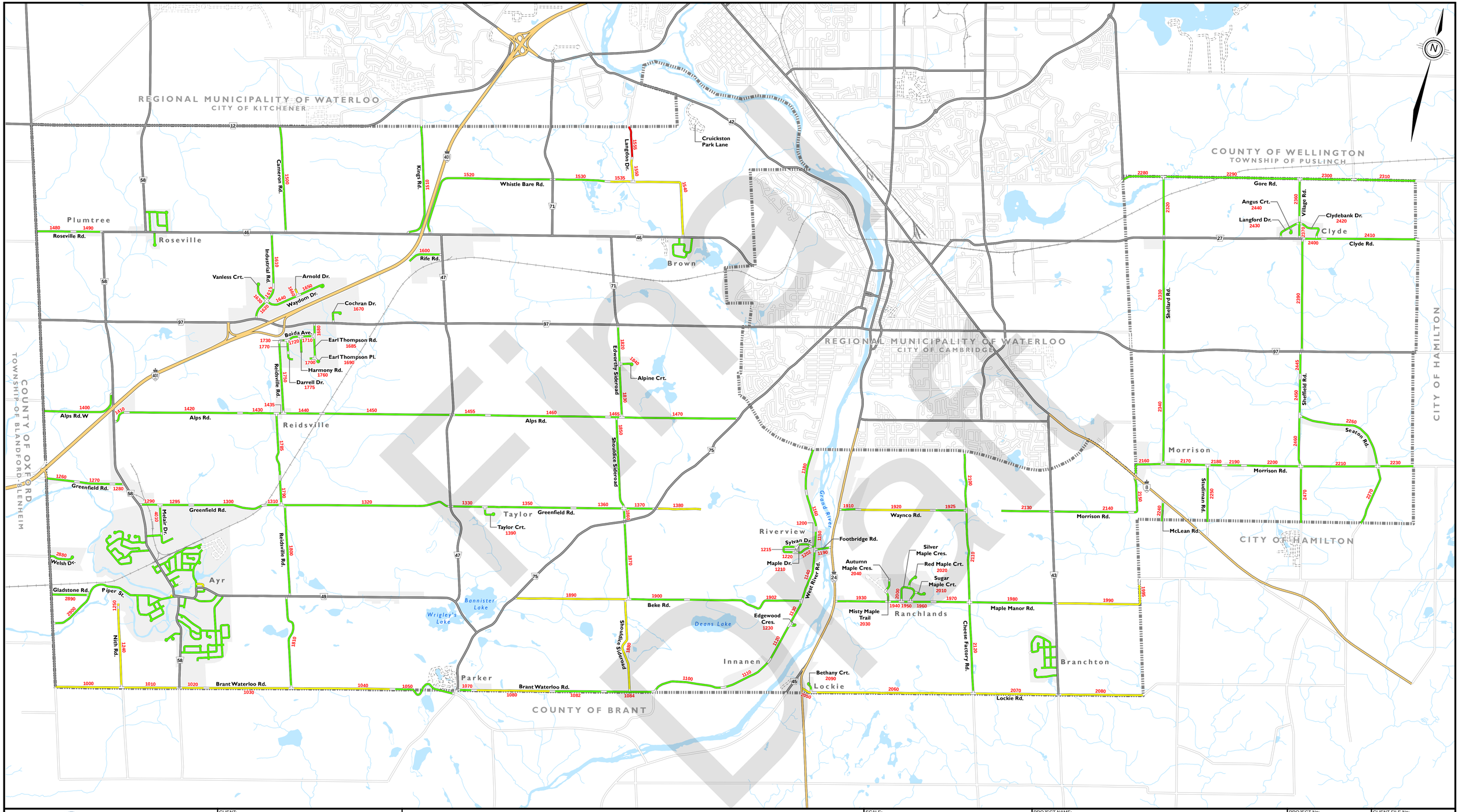
LEGEND:
- ROAD INVENTORY SECTION
- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

PROJECT NAME: **2016 ROAD NEEDS STUDY**

SHEET TITLE: **ROAD SECTION INVENTORY**

PROJECT No: C14-0153		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	SCALE: AS NOTED	DRAWING No: 1B
APPROVER: D. CAMPBELL		
DATE: 11/30/2016		SHEET No: 1 of 1

Appendix J: Mapping- Roads by Surface Type



CIMA Roads Management Services Inc.

CLIENT: The Township of North Dumfries

LEGEND:

ROAD SURFACE TYPE
- GRAVEL
- HIGH CLASS BITUMINOUS (ASPHALT)
- LOW CLASS BITUMINOUS (SURFACE TREATMENT)

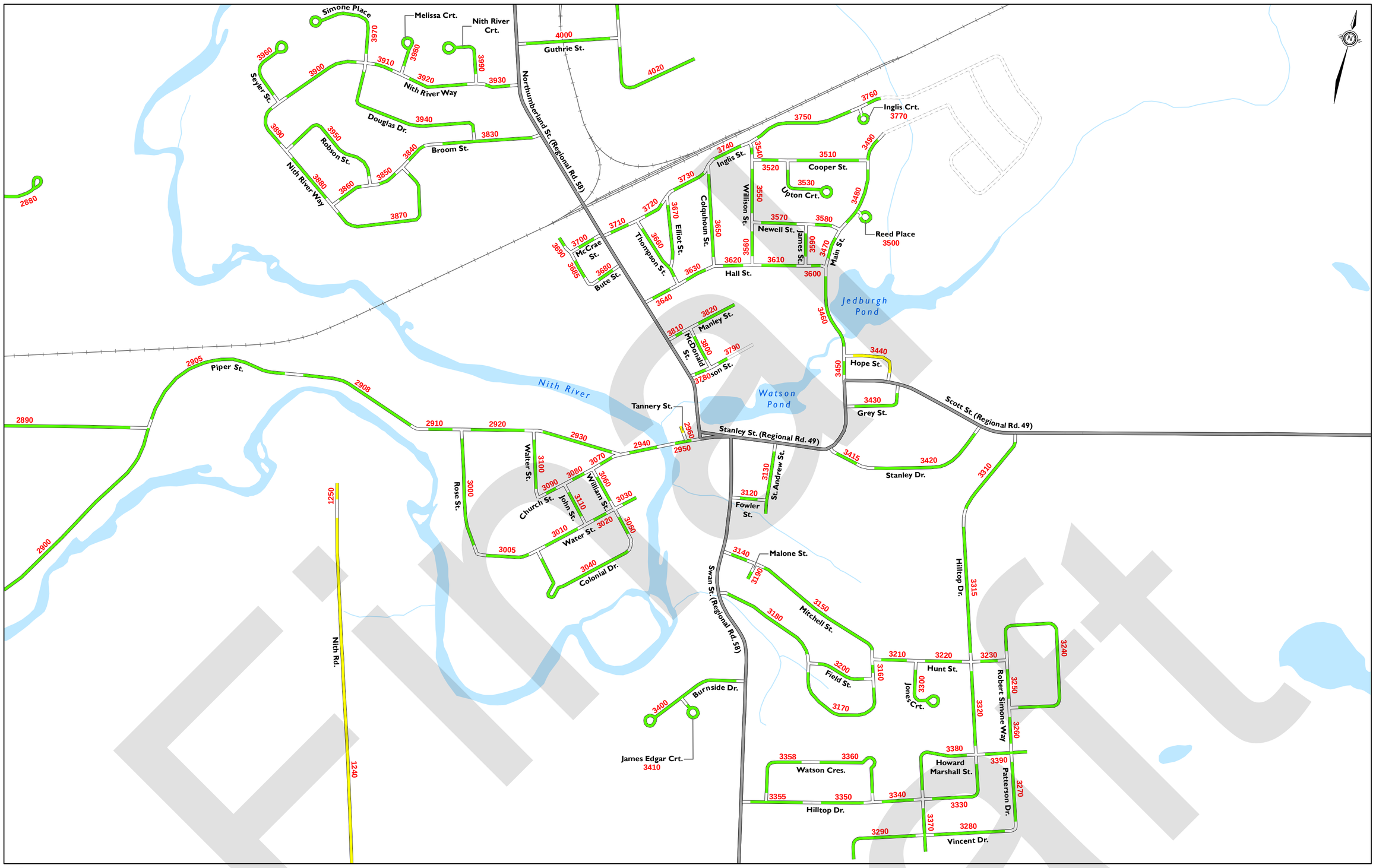
OTHER FEATURES
- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

SCALE:
500 250 0 500 1,000 1,500 2,000
meters
1:30,000

PROJECT NAME: **2016 ROAD NEEDS STUDY**

SHEET TITLE: **ROAD SURFACE TYPE**

PROJECT No: C14-0153		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 2A
APPROVER: D. CAMPBELL	APPROVER: ---	
DATE: 11/30/2016		SHEET No: 1 of 1



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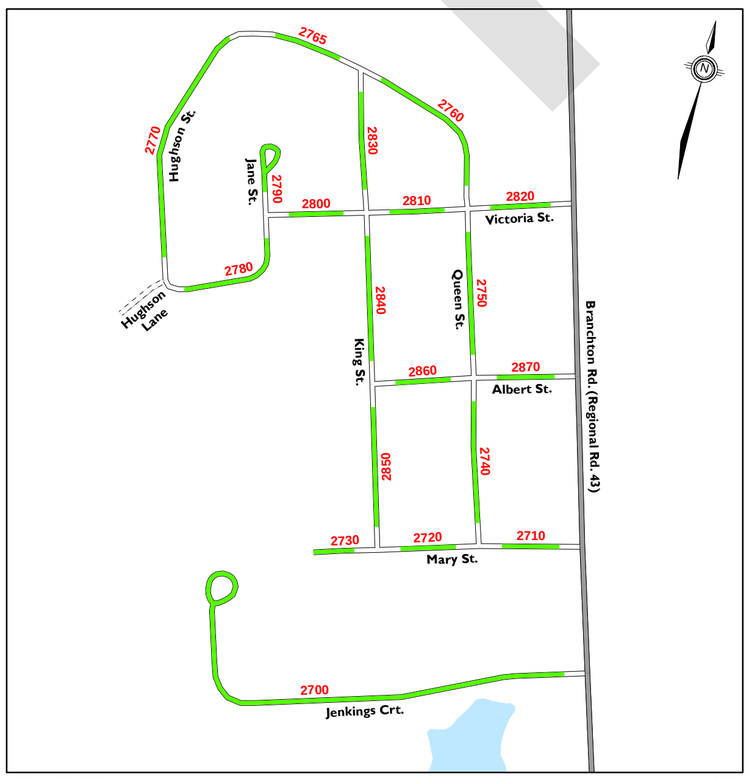

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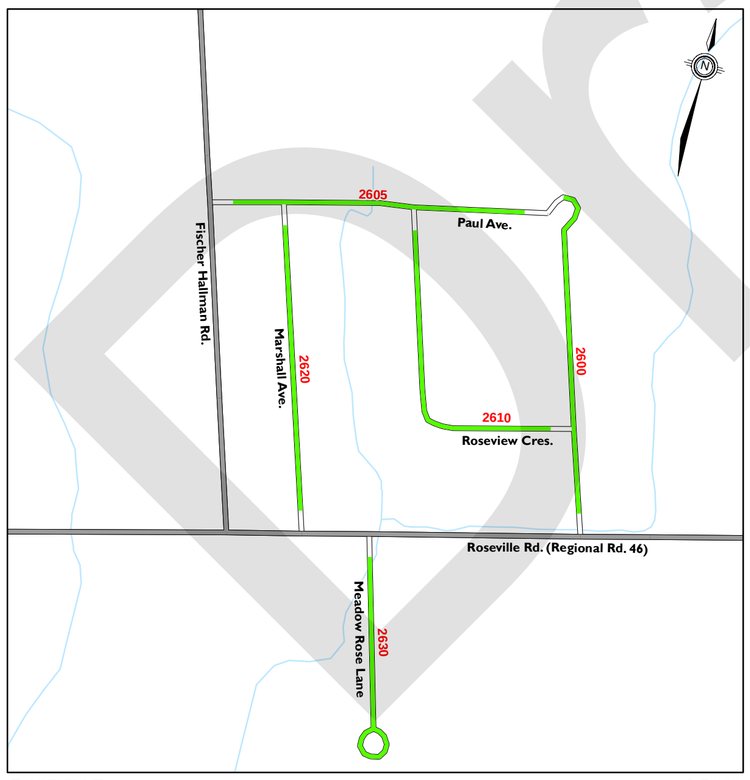
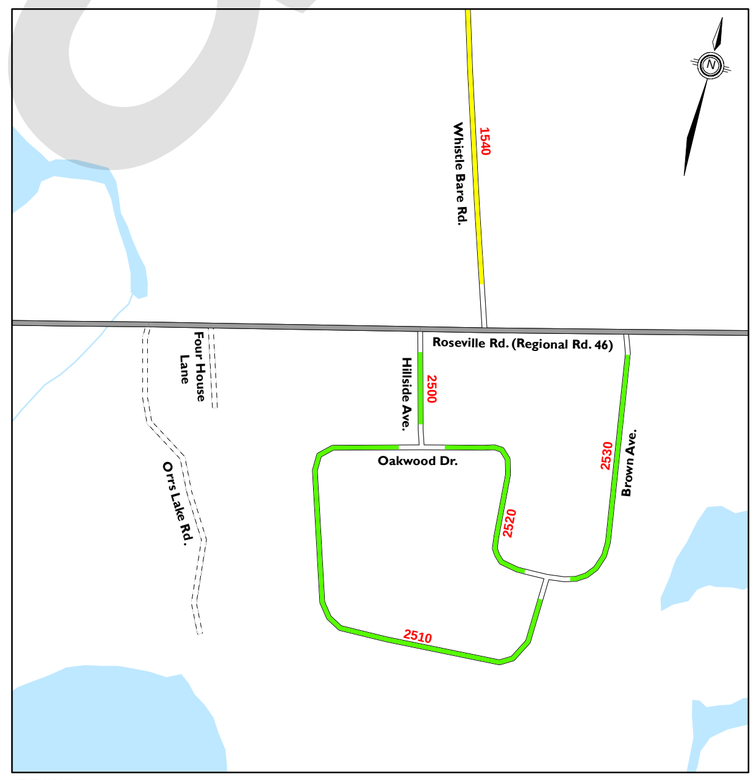


ROSEVILLE 1:5,000



BROWN 1:5,000

CIMA Roads Management Services Inc.

CLIENT: The TOWNSHIP of NORTH DUMFRIES

LEGEND:

ROAD SURFACE TYPE
- GRAVEL
- HIGH CLASS BITUMINOUS (ASPHALT)
- LOW CLASS BITUMINOUS (SURFACE TREATMENT)

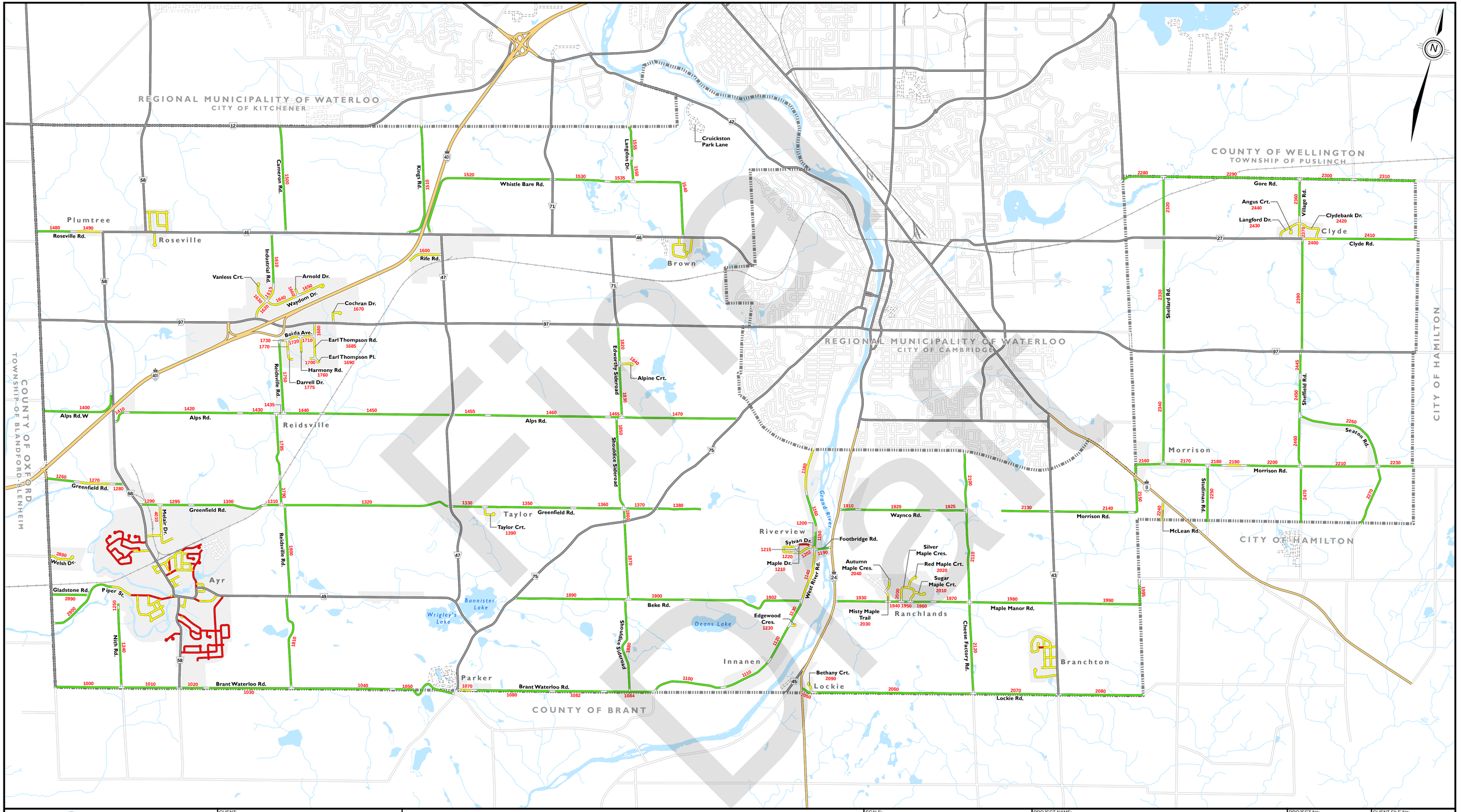
OTHER FEATURES
- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

PROJECT NAME: 2016 ROAD NEEDS STUDY

SHEET TITLE: ROAD SURFACE TYPE

PROJECT No: C14-0153		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	SCALE: AS NOTED	DRAWING No: 2B
APPROVER: D. CAMPBELL		
DATE: 11/30/2016		SHEET No: 1 of 1

Appendix K: Mapping - Roadside Environment



CIMA Roads Management Services Inc.

CLIENT: The Township of North Dumfries

LEGEND:

ROADSIDE ENVIRONMENT: RURAL; SEMI-URBAN; URBAN

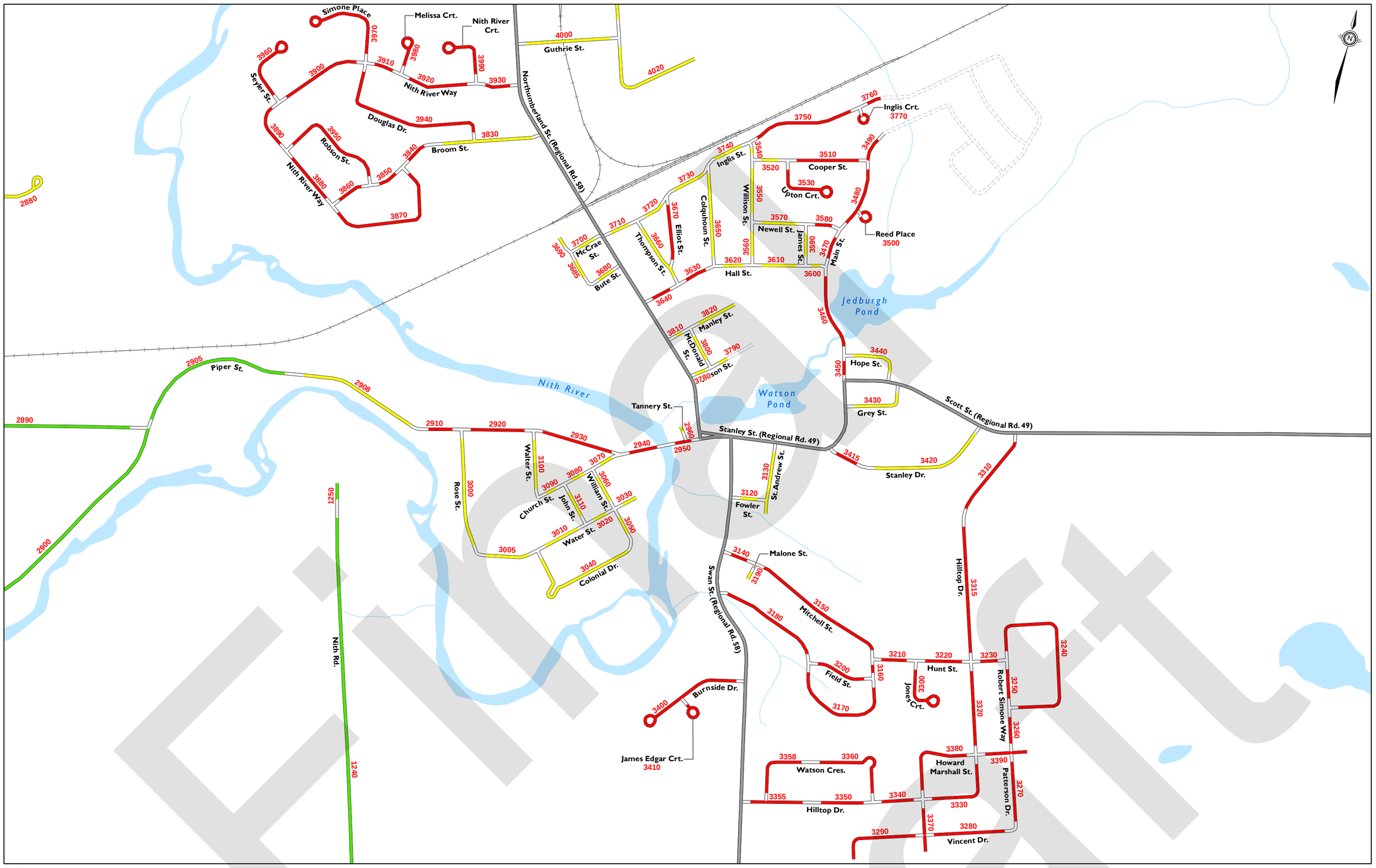
OTHER FEATURES: PROVINCIAL HIGHWAY; REGIONAL ROAD; LOCAL ROAD; PRIVATE ROAD; FUTURE OR PLANNED ROAD; RAILWAY; MUNICIPAL BOUNDARY

SCALE: 500 250 0 500 1,000 1,500 2,000 meters
1:30,000

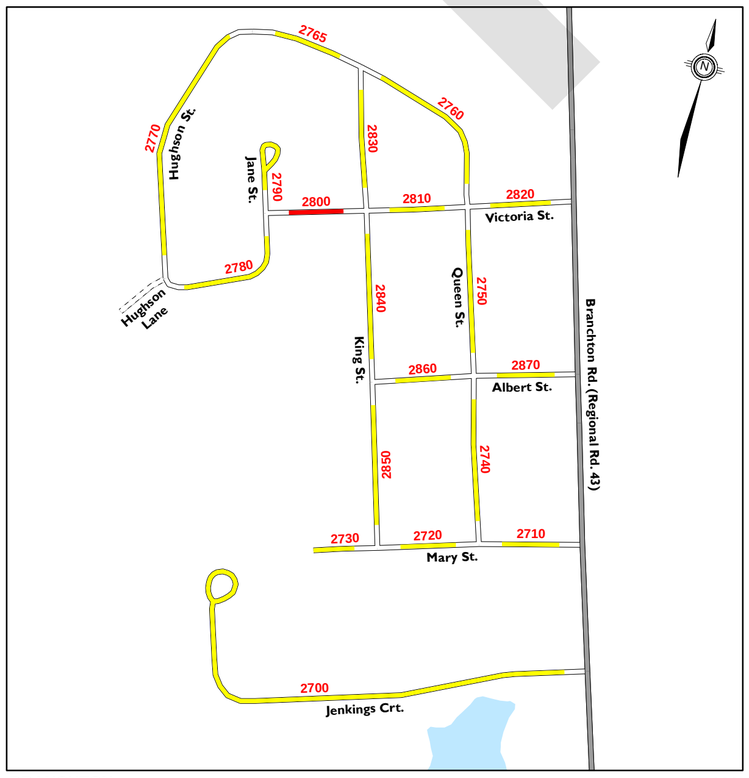
PROJECT NAME: **2016 ROAD NEEDS STUDY**

SHEET TITLE: **ROADSIDE ENVIRONMENT**

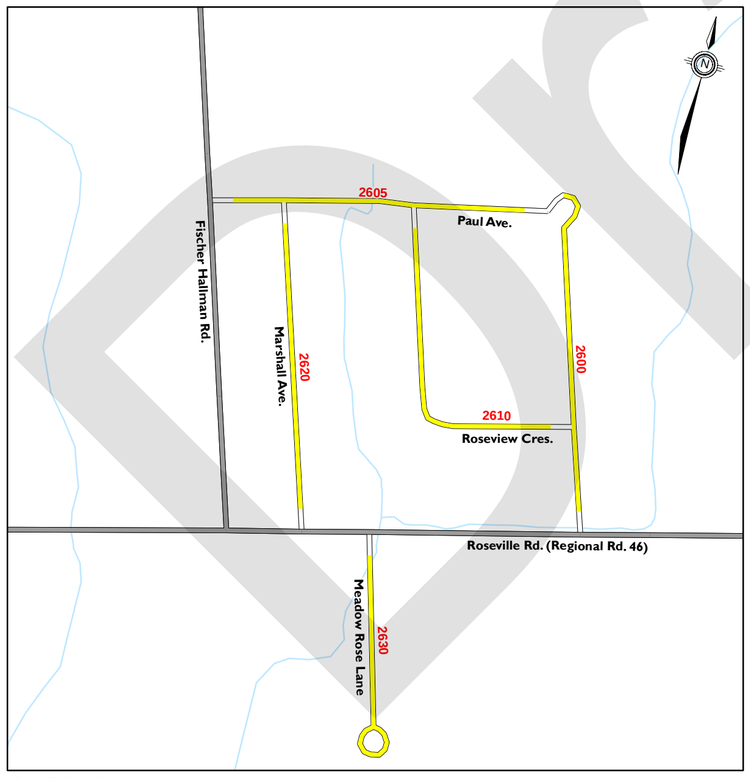
PROJECT No: C14-0153		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 3A
APPROVER: D. CAMPBELL	APPROVER: ---	
DATE: 11/30/2016		SHEET No: 1 of 1



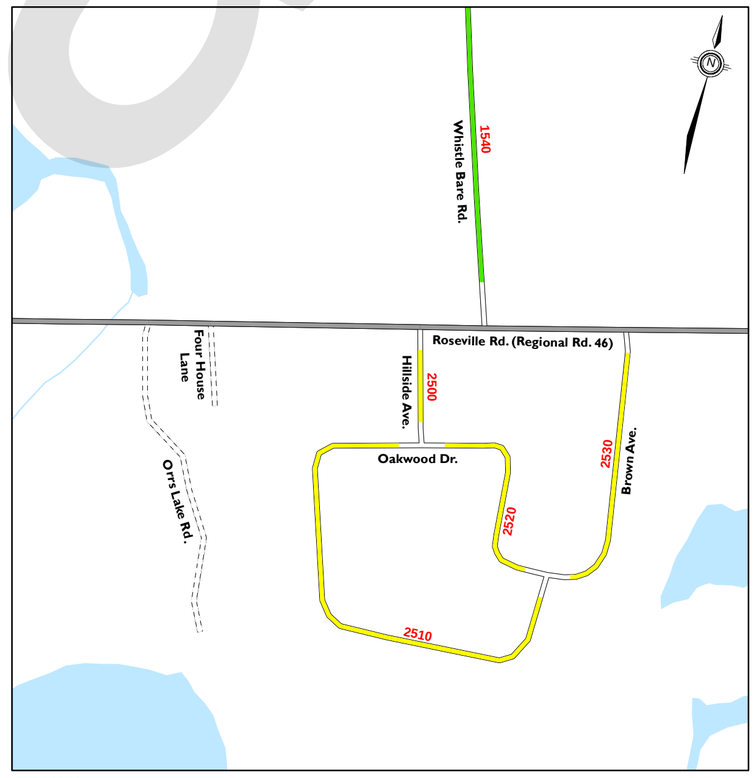
AYR 1:7,500



BRANCHTON 1:5,000



ROSEVILLE 1:5,000



BROWN 1:5,000

CIMA Roads Management Services Inc.

CLIENT: The TOWNSHIP of NORTH DUMFRIES

LEGEND:

ROADSIDE ENVIRONMENT
- RURAL
- SEMI-URBAN
- URBAN

OTHER FEATURES
- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

PROJECT NAME: 2016 ROAD NEEDS STUDY

SHEET TITLE: ROADSIDE ENVIRONMENT

PROJECT No: C14-0153

CLIENT FILE No: --

DRAFTER: S. ELLIOTT

SCALE: AS NOTED

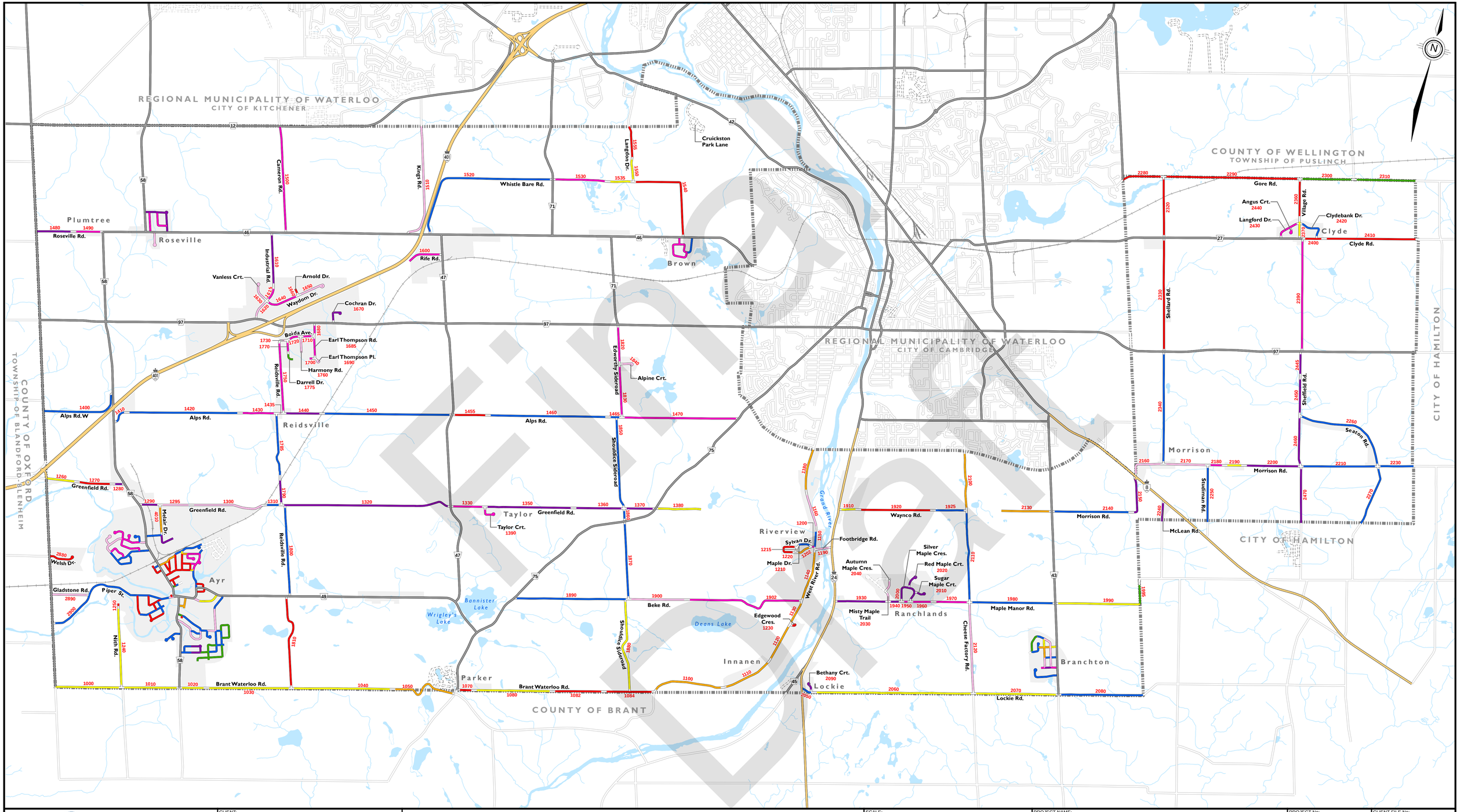
APPROVER: D. CAMPBELL

DRAWING No: 3B

DATE: 11/30/2016

SHEET No: 1 of 1

Appendix L: Mapping- Roads by Improvement Time of Need and Type



CIMA Roads Management Services Inc.

CLIENT: The Township of North Dumfries

LEGEND:

ROAD IMPROVEMENT NEEDS

- ADEQUATE
- NOW CONSTRUCTION NEED
- 1 TO 5 YEAR CONSTRUCTION NEED
- 6 TO 10 YEAR CONSTRUCTION NEED
- NOW RESURFACING NEED
- 1 TO 5 YEAR RESURFACING NEED
- 6 TO 10 YEAR RESURFACING NEED
- MAINTENANCE

OTHER FEATURES

- PROVINCIAL HIGHWAY
- REGIONAL ROAD
- LOCAL ROAD
- PRIVATE ROAD
- FUTURE OR PLANNED ROAD
- RAILWAY
- MUNICIPAL BOUNDARY

SCALE:

500 250 0 500 1,000 1,500 2,000

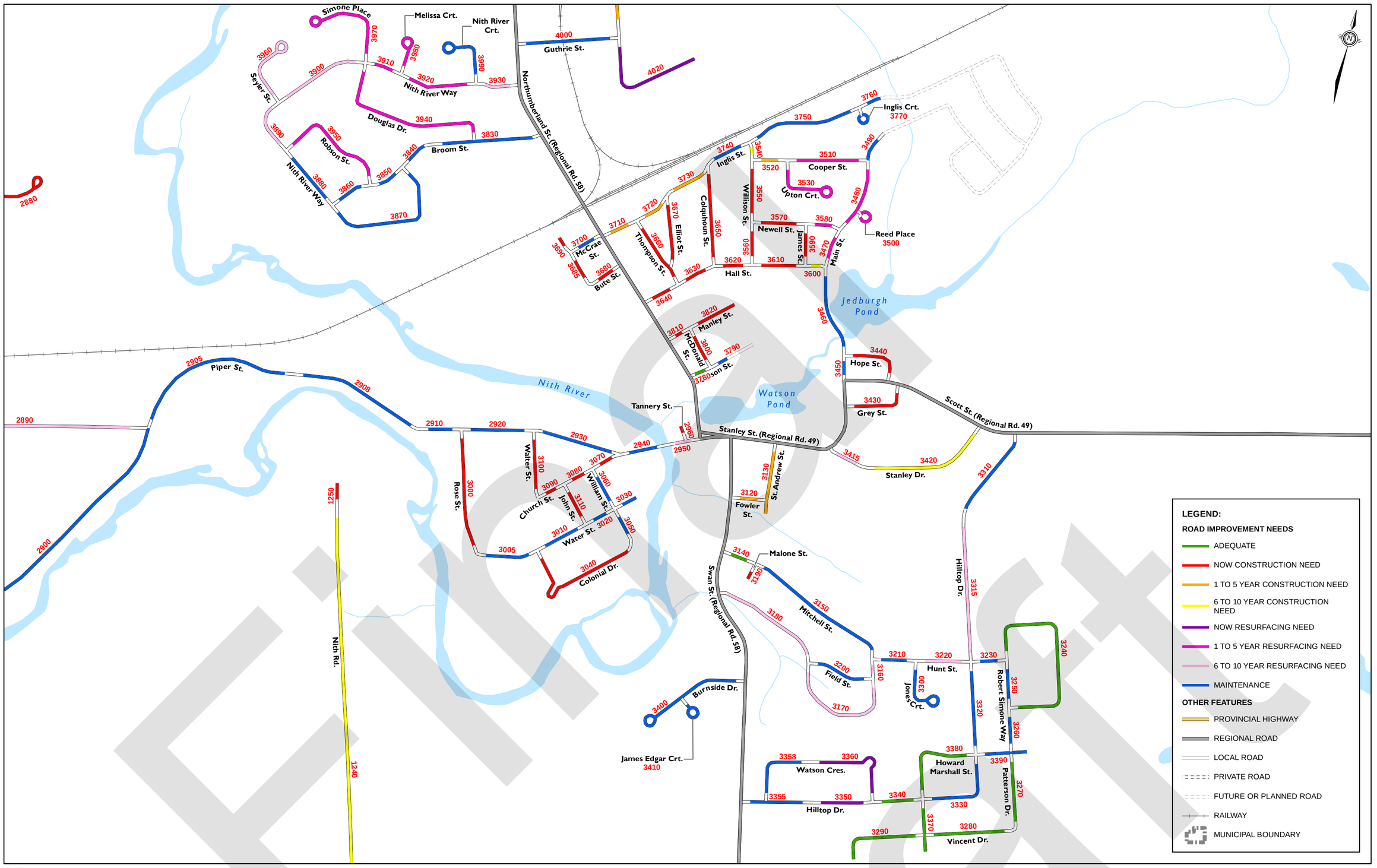
meters

1:30,000

PROJECT NAME: **2016 ROAD NEEDS STUDY**

SHEET TITLE: **IMPROVEMENT NEEDS**

PROJECT No: C14-0153		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 4A
APPROVER: D. CAMPBELL	APPROVER: ---	
DATE: 11/30/2016		SHEET No: 1 of 1



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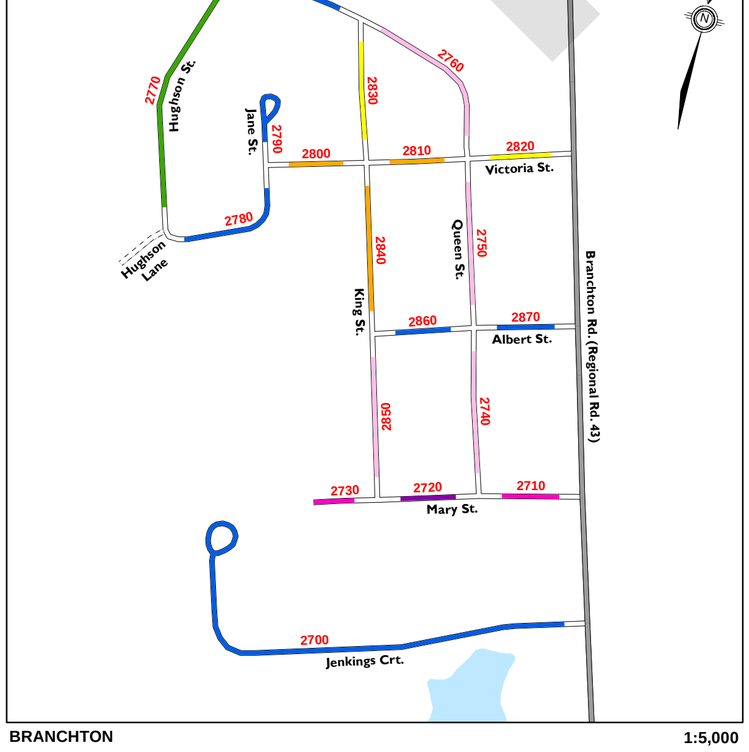
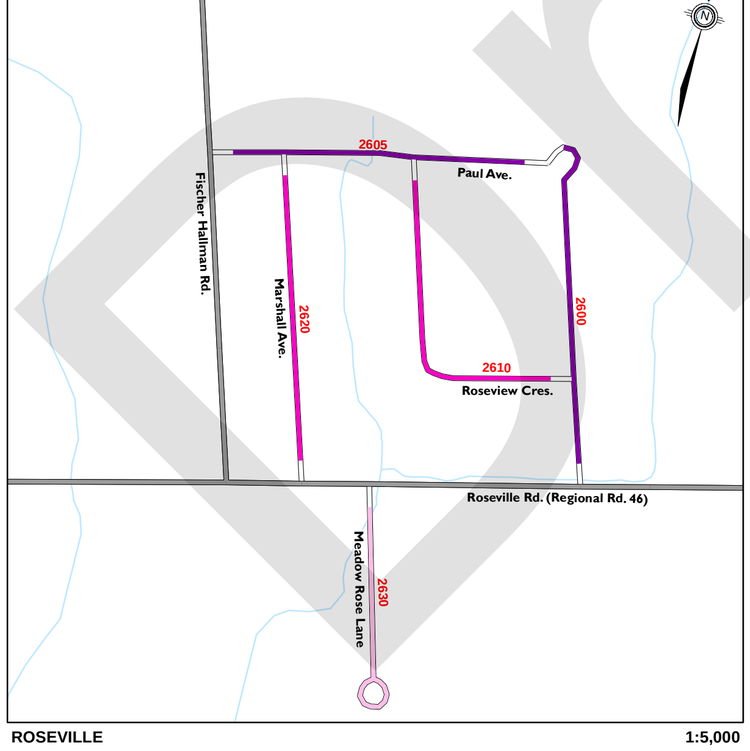
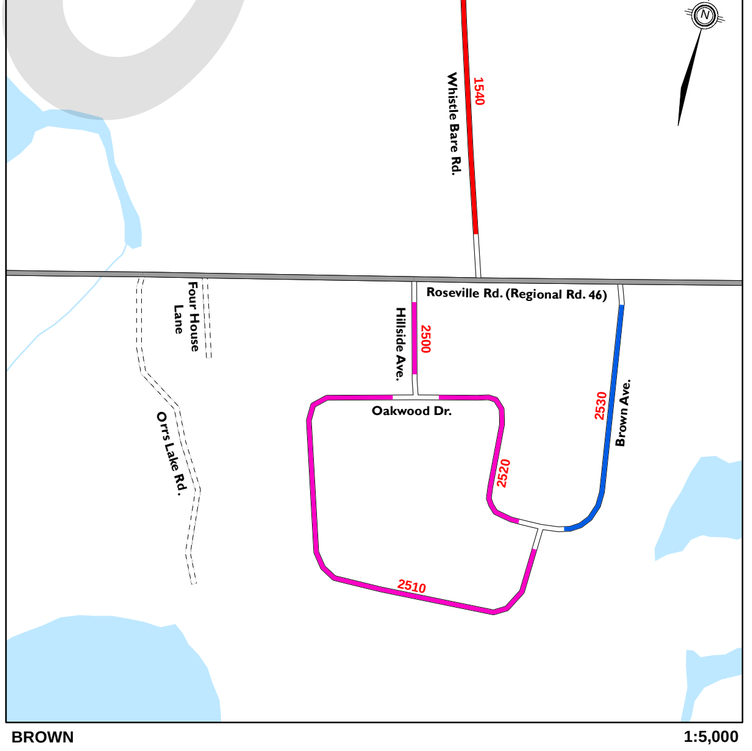


BRANCHTON 1:5,000



ROSEVILLE 1:5,000



BROWN 1:5,000

CIMA Roads Management Services Inc.

CLIENT: The TOWNSHIP of NORTH DUMFRIES

PROJECT NAME: 2016 ROAD NEEDS STUDY	PROJECT No: C14-0153		CLIENT FILE No: --
	DRAFTER: S. ELLIOTT	SCALE: AS NOTED	DRAWING No: 4B
SHEET TITLE: ROADSIDE ENVIRONMENT	APPROVER: D. CAMPBELL		
	DATE: 11/30/2016		SHEET No: 1 of 1