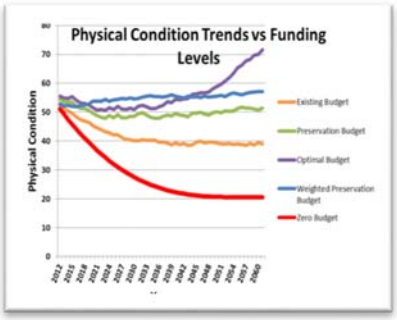
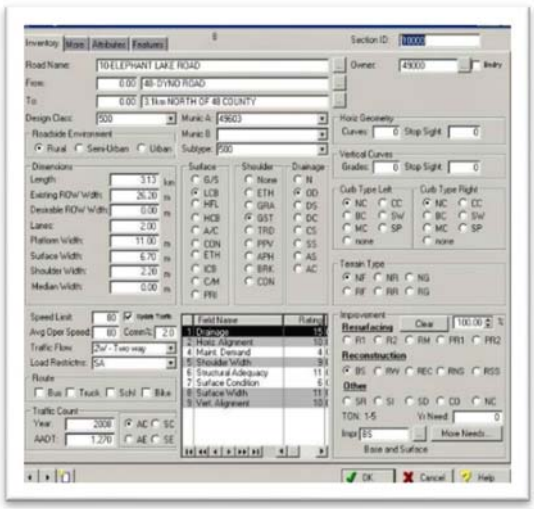
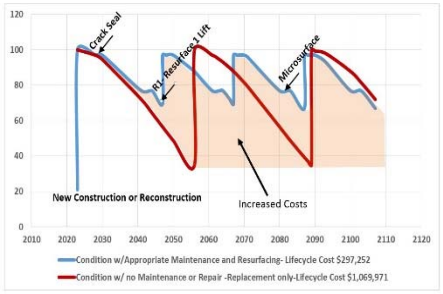
Augusta TOWNSHIP
A Community of Opportunity

Township of Augusta
2016 State of the Infrastructure - Roads







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

4 Roads Management Services Inc.

7 Candle Crescent, Kitchener Ontario, N2P 2K7

www.4roads.ca

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June 30, 2016

Augusta Township
3560 County Road 26, R.R. #2,
Prescott, ON, K0E 1T0

Attention: **Mr. Michel P. Riberdy, CET, Public Works Manager,**

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

Dear Mr. Riberdy,

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

The 2016 project updated the condition and dimensional data on the road sections, added new sections and developed costing and analysis on the entire road system database and reports on same.

All road sections have been reviewed and have 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 Augusta Township in the 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

Augusta Township

2016 State of the Infrastructure -Roads

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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.

Augusta Township (AT) 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 Augusta Township 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:

- Review and condition rating on the road assets within the AT road system
- Development of current replacement costs for each road asset
- Development/review of recommendations for improvement and associated costing on deficient assets
- 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 AT
- Development of an analysis on the effect of current and recommended budgets on overall system performance
- 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 spring 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.

AT provided a geodatabase through the United Counties of Leeds and Grenville and additional information in Excel format, from which relevant data was extracted to create a database in WorkTech Asset Manager Foundation. Traffic count data was included in the data transfer.

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. Augusta Township should continue their traffic counting program and include truck counts and the date of the count. Traffic counts should be updated on a regular cycle, as a risk management exercise.

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. As 4 Roads reviewed the road sections, some changes were made to the network data, to ensure the road sections were consistent.

Data collection and road ratings were completed generally in 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.

'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.

'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.

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. (However, roads with less than 50 vehicles per day, do have a standard for basic geometry.) This factor does have an effect on the system adequacy calculation for Augusta Township. The road system currently includes 8.14km of road sections that had an actual or estimated traffic count of less than 50 vehicles per day. This represents approximately 3.99% of the road system.

For the purposes of this report, road sections with a traffic count of less than 50 vehicles per day have been provided with recommended treatment and associated improvement costs in order to provide a more accurate assessment of the total needs and condition of the road network. (The calculations will rate them as adequate due to the traffic count.)

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 is good. However, this is influenced to a large extent 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 that has occurred over the past 20 years is influencing the overall condition as these roads have not required anything other than basic

maintenance. (The development roads also have an effect on the budget recommendations.)

- As noted above, 3.99% (8.14 km) of the system is deemed adequate due to having a counted or estimated traffic count of less than 50 vehicles per day.
- 2016 data collection was undertaken just after initial spring maintenance had occurred on most roads.

- Roads with a surface width less than the minimum tolerable standard were identified on 10.220km of road sections. (Not adjusted for Boundary Roads). Typically these road sections are low volume, however, the correction would be a reconstruction of the section to produce the required width. As an interim solution, signage would reduce the municipality's exposure. These sections are listed in Appendix G.
- Roads with substandard width may be a direct result of a substandard road allowance; less than 20m. Augusta Township should try to address those areas of substandard road allowance width when improvements are required and/or when adjacent lands are being redeveloped.
- Traffic Counts raise a number of issues:
  - Traffic Counts are estimated on 71.53% of the system. This may cause an issue from a defensibility perspective.
  - Counts appear to be inconsistent with field observations in some instances.
  - Percentage of trucks or commercial vehicles were not included in the data provided. This is significant as heavier vehicles cause a disproportionate amount of damage to the road.
- The status of Boundary roads is unclear and should be resolved. There does not appear to be any written documentation with respect to Boundary Road Agreements, however, there is anecdotal information that services exchanges occur.
- Shoulder berms were noted on many sections of all surface types. The berms are an impediment to the free drainage of the road surface and will accelerate the deterioration of the road section over time.
- There appears to be a number of low volume road sections that may meet criteria for closure.
- The Township road system is predominantly hot mix asphalt and gravel surface types with a shorter length on Surface treated roads. Roads with a single lift of hot mix asphalt typically do not perform that well. When reconstructing or rehabilitating a road, some consideration should be given to other surface types during the design process. The surface type will be a function of traffic volume, and more particularly, the percentage of trucks.
- Approximately 26.2% (54.35 km) of the AT 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.

- Approximately 10.5% (21.42km) 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.)

System Adequacy is the ratio of the road sections that are not NOW needs (Roads in poor condition) to the length of the entire system. Based on the current review of the road system, the current system adequacy measure is 73.2% meaning that, 26.8% 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, albeit at the minimum level. As noted in the foregoing, there are a number of factors potentially influencing the system adequacy. However, the Weighted Average Physical Condition is 59.73 indicating that the average road is estimated to be 5 to 7 years from being in poor condition.

Based on the current unit costs being experienced, the total estimated cost of recommended improvements is **$25,791,892.** The improvement costs include **$14,264,082** for those roads identified as NOW needs and **$11,527,810** is for road work required in the '1 to 10' year time period or for maintenance. Included in those amounts is **$1,027,875** for work on road sections with a traffic count of less than 50 vehicles per day or require only maintenance.

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

- **$104,870,300** to replace the road system. Annualized, this would be **$2,097,400**, based upon a 50-year life cycle. (This would be similar to the PSAB 3150 amortization value using current replacement costs) The annualized value and 50 year life cycle assumes that there will be regular maintenance and resurfacing in addition to the depreciation costs. (Section 8 of the report provides additional discussion on this subject.)
- **$770,800** annually hot mix resurfacing, based upon an 20-year cycle.(This would approximate an average of 5.4km per year)
- **$29,600** annually, for single surface treatment of existing surface-treated roads, based on a seven-year cycle, not including additional padding or geometric correction. This is approximately 16.7km per year.
- **$770,800** annually, for resurfacing gravel roads on a three-year cycle based on adding 75mm every three years (this does not include any additional gravel road conversion costs; nor ditching, re-grading, dust control, etc.).
- **$57,900** 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, gravel road resurfacing and crack sealing: **$1,512,300**. 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.10, 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 while 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. Funding should be increased by $100,000 annually over the next 5 year period until it reaches $1.51m (2016 dollars).
3. The cycle for review of the condition of road system should be no greater than a four year cycle.
4. Unit costs, budget recommendations, update history, and performance models should be updated annually.
5. Current Units costs should be re-reviewed to ensure an accurate reflection of current costing experience.
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. Data collected on the road asset should be referenced to the road asset.
12. The status of Boundary roads should be clarified. Where a boundary road exists, a written Boundary Road Agreement should be in place. The agreement should be approved by Council.
13. Further analysis should be undertaken on the Gravel Road system, with respect to the potential for conversion to a hardtop surface.
14. Further analysis should be undertaken on the very low volume road sections for closure.
15. 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.
16. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
17. 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: Roadside Environment and Surface Type

	Roadside Environment									
	Rural		Semi-Urban		Urban		Total		% of Total	
Surface Type	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km
Earth	2.34	4.68	0	0	0	0	**2.34**	**4.68**	1.15%	1.15%
Gravel, Stone, Other Loosetop	83.51	167.02	0.22	0.44	0	0	**83.73**	**167.46**	41.08%	41.08%
High Class Bit.-asphalt	73.87	147.74	33.86	67.72	1.09	2.18	**108.82**	**217.64**	53.39%	53.39%
Low Class Bit.-surface treated	8.92	17.84	0	0	0	0	**8.92**	**17.84**	4.38%	4.38%
Total	**168.64**	**337.28**	**34.08**	**68.16**	**1.09**	**2.18**	**203.81**	**407.62**		
% of Total	82.74%	82.74%	16.72%	16.72%	0.53%	0.53%				

Table ES 2: Roadside Environment and Functional Class

		Roadside Environment									
		Rural		Semi-Urban		Urban		Total		% of Total	
Road Classification	Lanes	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km
100	2	7.82	15.64					**7.82**	**15.64**	3.84%	3.84%
200	2	95.09	190.18					**95.09**	**190.18**	46.66%	46.66%
300	2	35.5	71					**35.5**	**71**	17.42%	17.42%
400	2	30.23	60.46					**30.23**	**60.46**	14.83%	14.83%
C/R	2			3.35	6.7			**3.35**	**6.7**	1.64%	1.64%
L/R	2			30.73	61.46	1.09	2.18	**31.82**	**63.64**	15.61%	15.61%
Total		**168.64**	**337.28**	**34.08**	**68.16**	**1.09**	**2.18**	**203.81**	**407.62**		
% of Total		82.74%	82.74%	16.72%	16.72 %	0.53%	0.53%				

Table ES 3: Traffic Count Vs Count Year

Year	Actual Count (km)	Estimated Count (km)	TOTAL	% of Total
1999	2.22	0	**2.22**	1.09%
2000	0	1.16	**1.16**	0.57%
2001	6.53	2.4	**8.93**	4.38%
2003	21.76	0	**21.76**	10.68%
2007	4.15	122.55	**126.7**	62.17%
2013	13.82	0	**13.82**	6.78%
2016	9.55	19.67	**29.22**	14.34%
TOTAL	**58.03**	**145.78**	**203.81**	
% OF TOTAL	28.47%	71.53%		

Table ES 4: MMS Class by Lanes and Roadside Environment

MMS Class		4		5		6		TOTAL		% OF TOTAL	
Lanes	Roadside	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km
2	R	155.200	310.400	5.620	11.240	7.820	15.640	**168.640**	**337.280**	82.74%	82.74%
2	S	11.690	23.380	22.070	44.140	0.320	0.640	**34.080**	**68.160**	16.72%	16.72%
2	U	0.000	0.000	1.090	2.180	0.000	0.000	**1.090**	**2.180**	0.53%	0.53%
TOTAL		**166.890**	**333.780**	**28.780**	**57.560**	**8.140**	**16.280**	**203.810**	**407.620**		
% OF TOTAL		81.89%	81.89%	14.12%	14.12%	3.99%	3.99%				

Table ES 5: Overall Time of Need by Length and MMS Class

	MMS Class									
	4		5		6		TOTAL		% OF TOTAL	
Time of Need	**Cl km**	**Lane km**	**Cl km**	**Lane km**	**Cl km**	**Lane km**	**Cl km**	**Lane km**	**Cl km**	**Lane km**
1 to 5	8.675	17.350	3.240	6.480	0.000	0.000	**11.915**	**23.830**	5.85%	5.85%
6 to 10	69.555	139.110	5.260	10.520	0.000	0.000	**74.815**	**149.630**	37.40%	37.40%
ADEQ	41.610	83.220	12.010	24.020	8.140	16.280	**61.760**	**123.520**	29.91%	29.91%
NOW	47.050	94.100	8.270	16.540	0.000	0.000	**55.320**	**110.640**	26.83%	26.83%
TOTAL	**166.890**	**333.780**	**28.780**	**57.560**	**8.140**	**16.280**	**203.810**	**407.620**		
% OF TOTAL	82.51%	82.51%	14.14%	14.14%	3.35%	3.35%				
System Adequacy	71.8%	71.8%	71.3%	71.3%	100.0%	100.0%	**72.9%**	**72.9%**		
Good to Very Good	66.6%	66.6%	60.0%	60.0%	100.0%	100.0%	**67.0%**	**67.0%**		

Table ES 6: Average Replacement Costs by Functional Class

	Roadside Environment										
	R		S		U		TOTAL		% OF TOTAL		
Asset Subtype	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Cost per Km ($)
100	2,434,251	7.9	0	0	0	0	**2,434,251**	**7.9**	2.32%	3.82%	308,133
200	42,084,527	98.14	0	0	0	0	**42,084,527**	**98.14**	40.13%	47.42%	428,821
300	18,454,604	35.5	0	0	0	0	**18,454,604**	**35.5**	17.60%	17.15%	519,848
400	21,275,066	30.23	0	0	0	0	**21,275,066**	**30.23**	20.29%	14.61%	703,773
C/R	0	0	2,185,025	3.35	0	0	**2,185,025**	**3.35**	2.08%	1.62%	652,246
L/R	0	0	16,402,170	30.73	2,034,684	1.09	**18,436,854**	**31.82**	17.58%	15.38%	579,411
TOTAL	**84,248,448**	**171.77**	**18,587,195**	**34.08**	**2,034,684**	**1.09**	**104,870,327**	**206.94**			
% OF TOTAL	80.34%	83.00%	17.72%	16.47%	1.94%	0.53%					

Table ES 7: Average Traffic Count by MMS Class

	MMS Class				
Roadside Environment	4	5	6	AVERAGE	% OF TOTAL
R	219	258	18	**165**	39.49%
S	371	157	40	**189**	45.24%
U	0	192	0	**64**	15.27%
AVERAGE	**197**	**202**	**19**	**140**	
% OF TOTAL	46.99%	48.35%	4.65%		

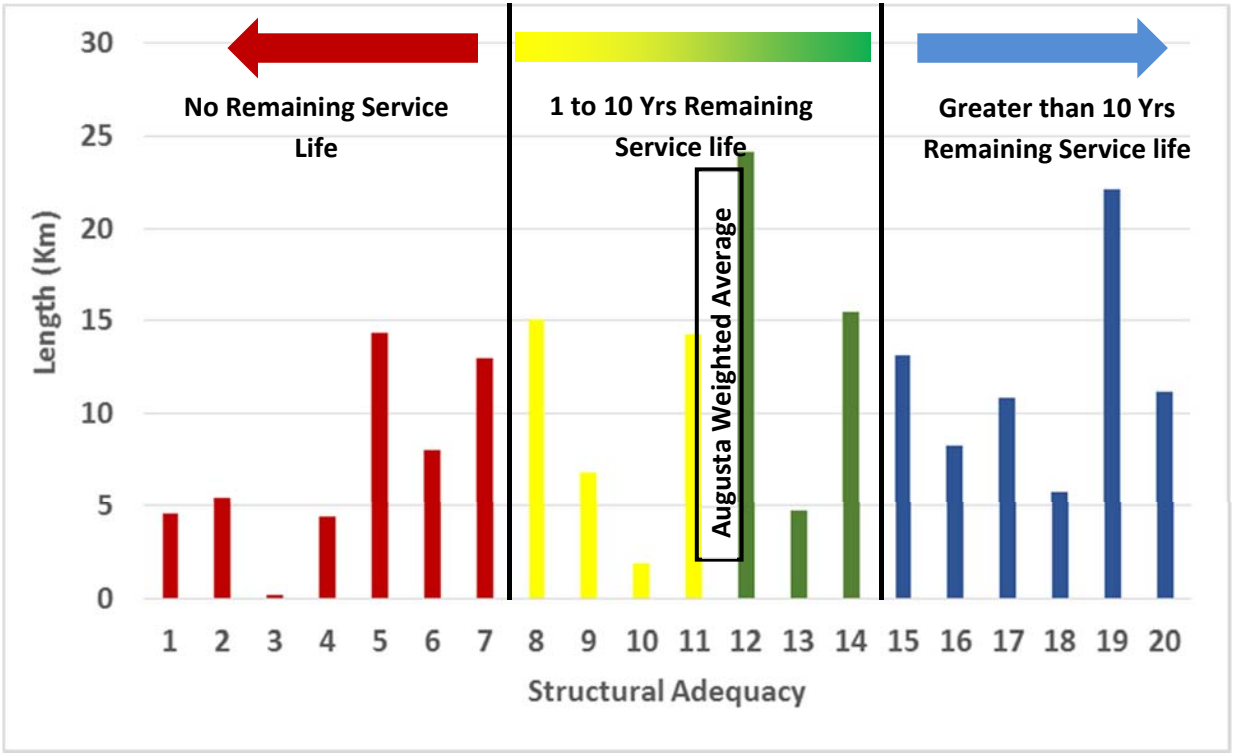
Table ES 8: Good to Very Good Roads by Structural Adequacy

Structural Adequacy	MMS Class 4	5	6	TOTAL	% OF TOTAL
1	2.77	1.58	0.21	**4.56**	2.24%
2	1.79	1.35	2.34	**5.48**	7.43%
3	0	0.17	0	**0.17**	0.24%
4	3.22	0.73	0.43	**4.38**	6.09%
5	12.06	2.18	0.12	**14.36**	19.96%
6	6.61	1	0.43	**8.04**	11.18%
7	11.77	1.15	0.08	**13**	18.07%
8	13.78	0.38	0.95	**15.11**	21.01%
9	5.87	0	0.96	**6.83**	9.50%
10	0.51	1.35	0	**1.86**	0.54%
11	12.39	1.51	0.33	**14.23**	4.15%
12	23.17	0.82	0.15	**24.14**	7.05%
13	3.96	0.79	0	**4.75**	1.39%
14	14.19	1.3	0	**15.49**	4.52%
15	10.86	0.15	2.14	**13.15**	3.84%
16	6.99	1.28	0	**8.27**	2.41%
17	6.55	4.33	0	**10.88**	3.18%
18	4.94	0.86	0	**5.8**	1.69%
19	16.53	5.61	0	**22.14**	6.46%
20	8.93	2.24	0	**11.17**	3.12%
TOTAL	**170.89**	**33.78**	**14.14**	**203.81**	
% OF TOTAL	82.51%	14.14%	3.35%		
Good To Very Good	**56.2%**	**51.5%**	**16.2%**	**56.8%**	

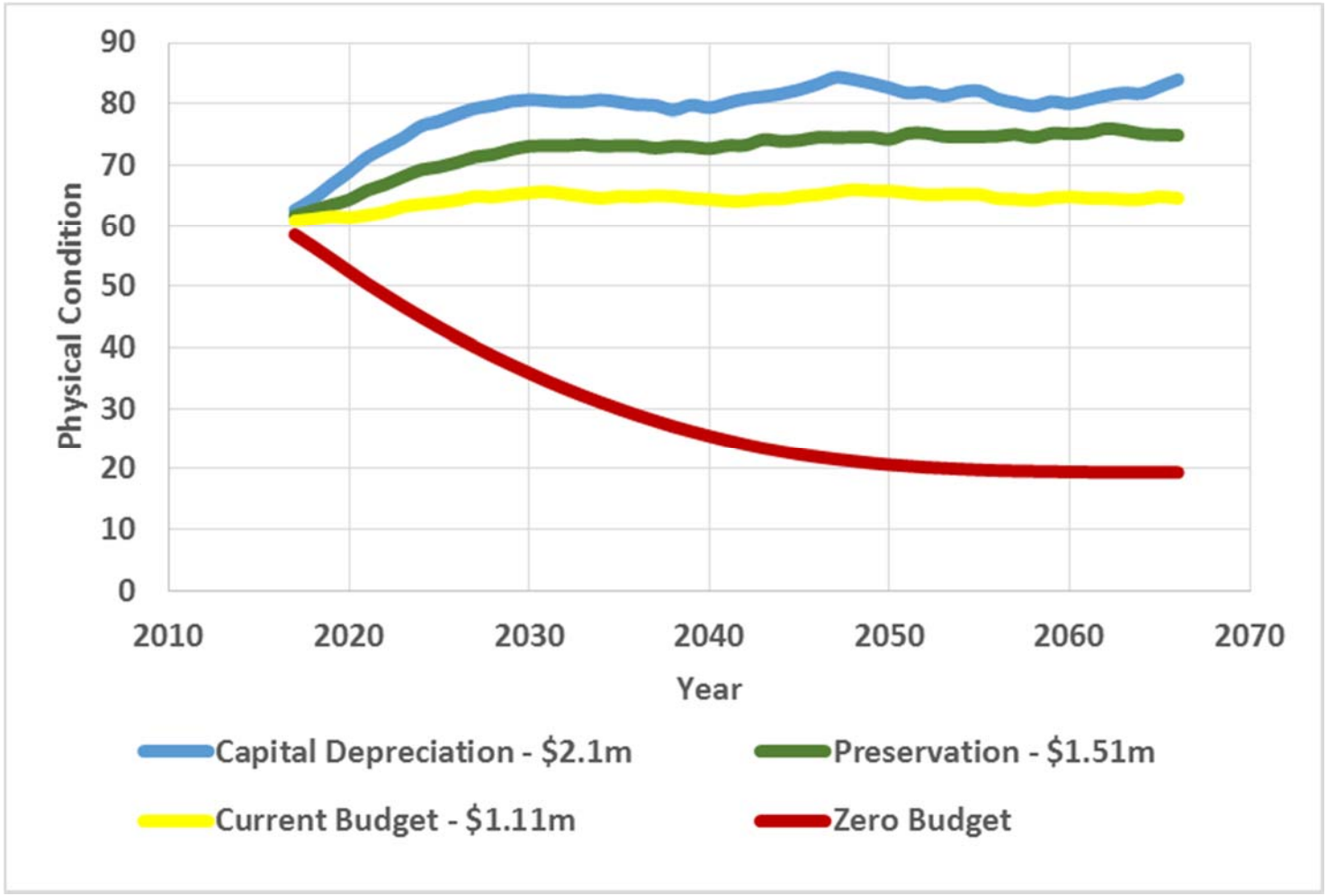
Table ES 9: Road System Needs Summary

Imp. Class	Improvement ID/Description		Time of Need: 1 to 5		6 to 10		ADEQ		NOW		TOTAL		% OF TOTAL	
			Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km
Const	BS	Base and Surface	0	0	694,102	3.19	50,615	0.15	2,113,785	6.55	**2,858,502**	**9.89**	11.08%	4.85%
Const	BSgravel	Base and Surface to Gravel	359,516	1.185	4,996,703	34.145	204,632	1.59	1,810,451	12.9	**7,371,302**	**49.82**	28.58%	24.44%
Const	GRR	Gravel Road Resurfacing Single Lift 75mm	0	0	0	0	39,031	1.39	0	0	**39,031**	**1.39**	0.15%	0.68%
Const	None	No Improvement Required	0	0	0	0	0	34.95	0	0	**0**	**34.95**		17.15%
Const	REC	Reconstruction - Rural	0	0	0	0	0	0	813,784	1.81	**813,784**	**1.81**	3.16%	0.89%
Const	RECgravel	Reconstruction Gravel Road	0	0	0	0	772,628	1.92	1,726,328	4.15	**2,498,956**	**6.07**	9.69%	2.98%
Const	RNS	Reconstruction Nominal Storm Sewer	38,479	0.07	216,452	0.38	0	0	446,355	0.41	**701,287**	**0.86**	2.72%	0.42%
Const	RSS	Reconstruction with Storm Sewers	480,467	0.31	0	0	0	0	1,447,939	0.74	**1,928,406**	**1.05**	7.48%	0.52%
Maint	CRK	Crack Sealing	0	0	0	0	42,267	15.89	0	0	**42,267**	**15.89**	0.16%	7.80%
Maint	GRRplus	Maintenance Gravel and Minor Ditching	0	0	89,448	2.5	0	0	0	0	**89,448**	**2.5**	0.35%	1.23%
Maint	RSpLimit	Reduce Speed limit	0	0	0	0	0	0	0	0.2	**0**	**0.2**		0.10%
Maint	SD	Spot Drainage	0	0	0	17.74	0	5.87	0	1.42	**0**	**25.03**		12.28%
Rehab	PR2	Pulverize and Resurface 2 - 100mm	1,106,297	5.17	0	0	0	0	5,905,441	27.14	**7,011,738**	**32.31**	27.19%	15.85%
Rehab	R1	Basic Resurfacing 1 - 50mm	406,943	3.32	1,517,523	12.81	0	0	0	0	**1,924,466**	**16.13**	7.46%	7.91%
Rehab	R2	Basic Resurfacing 2 - 100mm	399,137	1.86	0	0	0	0	0	0	**399,137**	**1.86**	1.55%	0.91%
Rehab	SST++	SST, 10% Base Repairs, Minor Ditching	0	0	59,711	1.85	0	0	0	0	**59,711**	**1.85**	0.23%	0.91%
Rehab	SST	Single Surface Treatment	0	0	53,856	2.2	0	0	0	0	**53,856**	**2.2**	0.21%	1.08%
TOTAL			**2,790,840**	**11.915**	**7,627,797**	**74.815**	**1,109,174**	**61.76**	**14,264,082**	**55.32**	**25,791,892**	**203.81**		
% OF TOTAL			10.82%	5.85%	29.57%	36.71%	4.30%	30.30%	55.30%	27.14%				

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 estimated year-end performance

Table ES 10: 10 Year Program -Performance Model Output – Current Funding Level

Imp. ID	Year										Grand Total
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
BSgravel		138,868			100,900	508,693	794,316	359,516	386,564	911,440	**3,200,297**
CRK	26,971	39,768		35,698	19,844	24,312	36,257	12,608	10,826	4,815	**211,099**
GRR				31,815	6,696						**38,511**
GRR2			158,508		42,509		30,326	122,054	35,424	42,509	**431,330**
MICRO				4,950	7,484			1,386			**13,820**
PR2	970,379	919,576	868,590	434,218	205,258	268,036	48,958	375,848	551,803		**4,642,666**
R1			82,180	598,875	569,677	309,430	88,174	236,238	80,182	149,229	**2,113,985**
R2					108,025						**108,025**
SST	53,856				50,803		112,446		43,772		**260,877**
SST++	59,711										**59,711**
Grand Total	**1,110,917**	**1,098,212**	**1,109,278**	**1,105,556**	**1,111,196**	**1,110,471**	**1,110,477**	**1,107,650**	**1,108,571**	**1,107,993**	**11,080,321**

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

Table ES 11: 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 is 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.

Augusta Township (AT) 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 Augusta Township 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:

- Review and condition rating on the road assets within the Augusta Township road system.
- Development of current replacement costs for each road asset.
- Development/review of recommendations for improvement and associated costing on deficient assets.
- 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 AT.
- Development of an analysis on the effect of current and recommended budgets on overall system performance.
- Provision of Level of Service recommendations.
- Provision of Asset Management Strategy recommendations.

The 2016 report summarizes the condition data survey conducted during the spring 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

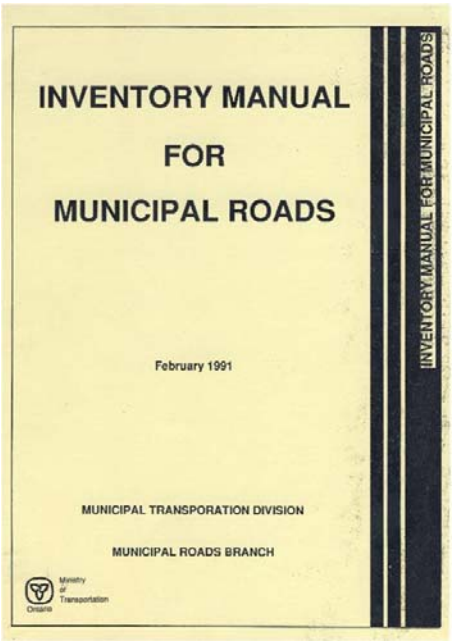
The provincial requirements for AMP's include asset condition assessment in accordance with standard engineering practices. The road section reviews follow the methodology of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

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 AT report summarizes the road system survey conducted during the spring2016. 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 provided by AT staff and 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 following 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
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 sub-drain, remove
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
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	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

Imp. Type	Imp. Description	Roadside Environment R		S		U		TOTAL		% OF TOTAL		
		Imp. Cost	Length	Imp. Cost	Length	Imp. Cost	Length	Imp. Cost	Length	Imp. Cost	Length	Cost per Km ($)
BS	Base and Surface	2,277,016	8.23	581,486	1.66	0	0	**2,858,502**	**9.89**	11.08%	4.78%	$ 289,030
BSgravel	Base and Surface to Gravel	7,371,302	51.26	0	0	0	0	**7,371,302**	**51.26**	28.58%	24.77%	$ 143,802
CRK	Crack Sealing	25,722	9.67	16,545	6.22	0	0	**42,267**	**15.89**	0.16%	7.68%	$ 2,660
GRR	Gravel Road Resurfacing Single Lift 75mm	39,031	1.39	0	0	0	0	**39,031**	**1.39**	0.15%	0.67%	$ 28,080
GRRplus	Maintenance Gravel and Minor Ditching	89,448	2.5	0	0	0	0	**89,448**	**2.5**	0.35%	1.21%	$ 35,779
None	No Improvement Required	0	30.95	0	3.85	0	0.15	**0**	**34.95**		16.89%	
PR2	Pulverize and Resurface 2 - 100mm	4,765,688	22.46	2,246,050	9.85	0	0	**7,011,738**	**32.31**	27.19%	15.61%	$ 217,014
R1	Basic Resurfacing 1 - 50mm	1,169,653	10.04	754,814	6.09	0	0	**1,924,466**	**16.13**	7.46%	7.79%	$ 119,310
R2	Basic Resurfacing 2 - 100mm	399,137	1.86	0	0	0	0	**399,137**	**1.86**	1.55%	0.90%	$ 214,590
REC	Reconstruction - Rural	529,201	1.36	284,583	0.45	0	0	**813,784**	**1.81**	3.16%	0.87%	$ 449,604
RECgravel	Reconstruction Gravel Road	2,401,548	5.93	97,408	0.22	0	0	**2,498,956**	**6.15**	9.69%	2.97%	$ 406,334
RNS	Reconstruction Nominal Storm Sewer	0	0	254,931	0.45	446,355	0.41	**701,287**	**0.86**	2.72%	0.42%	$ 815,450
RSS	Reconstruction with Storm Sewers	0	0	883,440	0.52	1,044,966	0.53	**1,928,406**	**1.05**	7.48%	0.51%	$ 1,836,577
RSpLimit	Reduce Speed limit	0	0.2	0	0	0	0	**0**	**0.2**		0.10%	
SD	Spot Drainage	0	21.87	0	4.77	0	0	**0**	**26.64**		12.87%	
SST++	SST, 10% Base Repairs, Minor Ditching	59,711	1.85	0	0	0	0	**59,711**	**1.85**	0.23%	0.89%	$ 32,276
SST	Single Surface Treatment	53,856	2.2	0	0	0	0	**53,856**	**2.2**	0.21%	1.06%	$ 24,480
TOTAL		**19,181,313**	**171.77**	**5,119,257**	**34.08**	**1,491,321**	**1.09**	**25,791,892**	**206.94**			
% OF TOTAL		74.37%	83.00%	19.85%	16.47%	5.78%	0.53%					

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 Road System Inventory and Classification

Road sections within road systems may be classified in a number of ways, to illustrate their 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 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

	Roadside Environment									
	Rural		Semi-Urban		Urban		Total		% of Total	
Surface Type	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km	Cl-km	Lane-km
Earth	2.34	4.68	0	0	0	0	**2.34**	**4.68**	1.15%	1.15%
Gravel, Stone, Other Loosetop	83.51	167.02	0.22	0.44	0	0	**83.73**	**167.46**	41.08%	41.08%
High Class Bit.-asphalt	73.87	147.74	33.86	67.72	1.09	2.18	**108.82**	**217.64**	53.39%	53.39%
Low Class Bit.-surface treated	8.92	17.84	0	0	0	0	**8.92**	**17.84**	4.38%	4.38%
Total	**168.64**	**337.28**	**34.08**	**68.16**	**1.09**	**2.18**	**203.81**	**407.62**		
% of Total	82.74%	82.74%	16.72%	16.72%	0.53%	0.53%				

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 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 AT 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.

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. However, there are geometric standards for low volume

roads that have to be met and are relatively consistent across Canada. Table 3.2 shows Regulation 239/02's traffic/speed/ classification matrix.

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

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 MMS Classes across the road system is detailed in Table 3.3.

Table 3.3: Minimum Maintenance Standards Class Distribution

Lanes	Roadside	MMS Class 4	5	6	TOTAL	% OF TOTAL
2	R	155.2	5.62	7.82	**168.64**	82.74%
2	S	11.69	22.07	0.32	**34.08**	16.72%
2	U	0	1.09	0	**1.09**	0.53%
TOTAL		**166.89**	**28.78**	**8.14**	**203.81**	
% OF TOTAL		81.89%	14.12%	3.99%		

WorkTech Asset Manager Foundation automatically classifies road sections by the MMS once traffic data and speed limits have been entered. Traffic data provided for this project is limited. This is a potential liability for the municipality.

Table 3.4 identifies the year traffic counts were captured or entered into the database and whether the counts were actual counts or were estimated. The table indicates that 71.53% of the traffic information is estimated. This poses a potential risk for the municipality from a defensibility perspective. The traffic counts do affect the MMS class. Delivery of a service level that is lesser than required, is an exposure to risk for the municipality.

Table 3.4: Traffic Counts by Year

Year	Actual Count (km)	Estimated Count (km)	TOTAL	% of Total
1999	2.22	0	**2.22**	1.09%
2000	0	1.16	**1.16**	0.57%
2001	6.53	2.4	**8.93**	4.38%
2003	21.76	0	**21.76**	10.68%
2007	4.15	122.55	**126.7**	62.17%
2013	13.82	0	**13.82**	6.78%
2016	9.55	19.67	**29.22**	14.34%
TOTAL	**58.03**	**145.78**	**203.81**	
% OF TOTAL	28.47%	71.53%		

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.

The road sections are classified by the rater at the time of the field review. Table 3.5 identifies the Functional Road Class Distribution.

Table 3.5: Functional Road Class Distribution

Road Classification	Lanes	Roadside Environment: Rural Cl-km	Rural Lane-km	Semi-Urban Cl-km	Semi-Urban Lane-km	Urban Cl-km	Urban Lane-km	Total Cl-km	Total Lane-km	% of Total Cl-km	% of Total Lane-km
100	2	7.82	15.64					**7.82**	**15.64**	3.84%	3.84%
200	2	95.09	190.18					**95.09**	**190.18**	46.66%	46.66%
300	2	35.5	71					**35.5**	**71**	17.42%	17.42%
400	2	30.23	60.46					**30.23**	**60.46**	14.83%	14.83%
C/R	2			3.35	6.7			**3.35**	**6.7**	1.64%	1.64%
L/R	2			30.73	61.46	1.09	2.18	**31.82**	**63.64**	15.61%	15.61%
Total		**168.64**	**337.28**	**34.08**	**68.16**	**1.09**	**2.18**	**203.81**	**407.62**		
% of Total		82.74%	82.74%	16.72%	16.72%	0.53%	0.53%				

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. The following table from the *Inventory Manual* identifies the limits that will trigger a geometric need for typical posted speed limits.

Table 3.6: 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

Table 3.7 identifies speed reduction candidates in Augusta Township.

Table 3.7: 'NOW' Geometry Needs –Speed Limit Reduction Candidates

Asset ID	Street Name	From Desc	To Desc	Length	AADT	Speed Limit	Avg Oper Speed
290	Knapp Dr	Bisseltown Rd	Algonquin Rd	1.36	50	80	60
310	Bains Rd	Augusta/Elizabethtown Townline	Knapp Dr	0.85	50	80	50
320	Carpenter Rd	Augusta/Elizabethtown Townline	Algonquin Rd	0.81	50	80	50
520	Maple Ave	County Rd 18	East End	0.43	50	80	50
530	Barton Rd	County Rd 18	East End	0.7	60	80	50
550	McCully Rd	4th Concession Rd	200m N of 4th Concession	0.2	100	80	60
580	Hillbrook Rd	Maple Ave	4th Concession Rd	1.85	223	80	50
1030	Brooks Rd	County Rd 18	County Rd 18	1.42	50	80	60
1130	Johnston Rd	Charleville Rd	Skakum Rd	1.87	50	80	60
1180	Buker Rd	Charleville Rd	County Rd 21	0.81	30	80	60
1190	Mcleansville Rd Loop	County Rd 21	County Rd 21	0.7	50	80	50
			Total	**11.00**			

Appendix D 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.

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

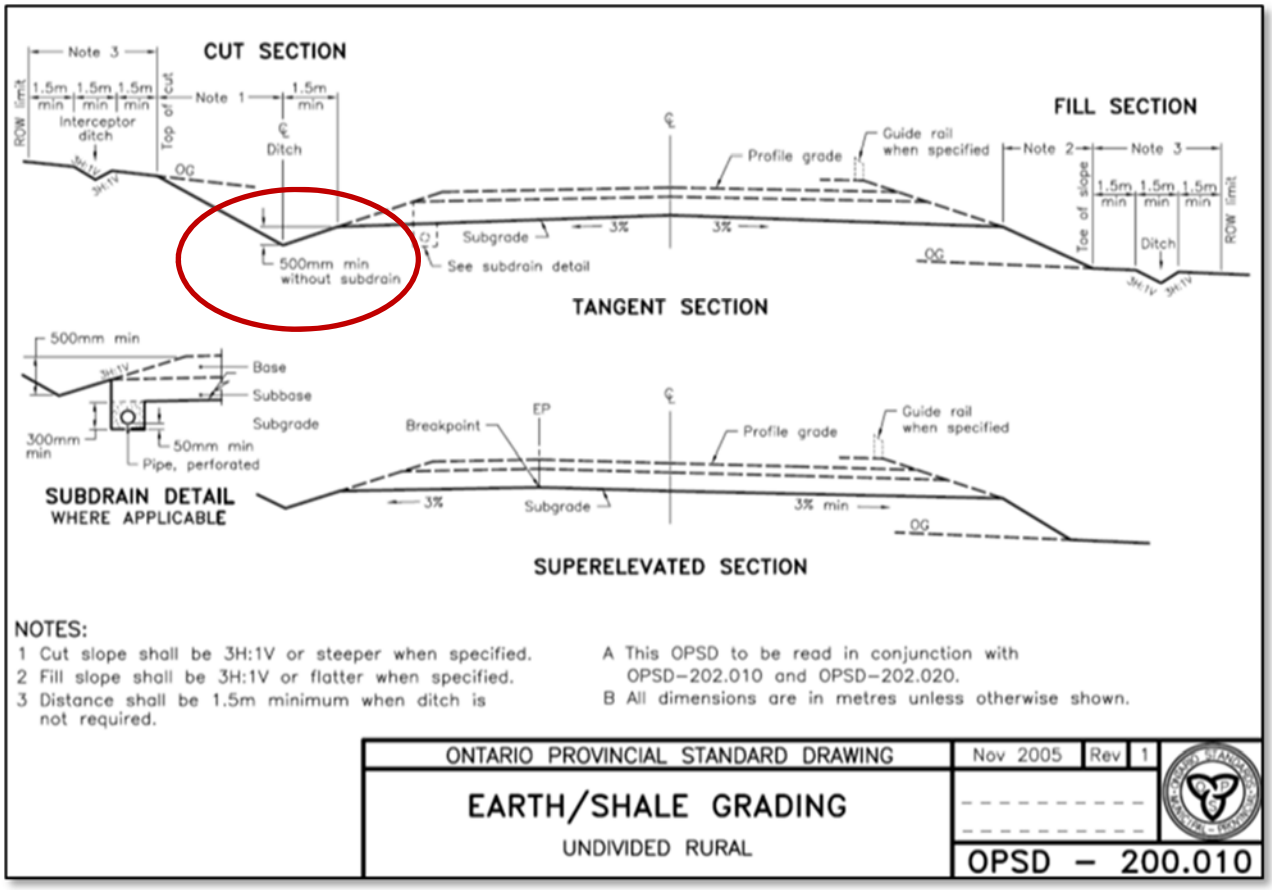
Figure 3.2: Potentially Substandard Vertical and Horizontal Alignment

3.7 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 Time of Need (Km)

	Time of Need					
Roadside	1 to 5	6 to 10	ADEQ	NOW	TOTAL	% OF TOTAL
R	6.795	89.555	69.95	2.34	**168.64**	82.74%
S	0.27	8.31	25.5	0	**34.08**	16.72%
U	0	0	1.09	0	**1.09**	0.53%
TOTAL	**7.065**	**97.865**	**96.54**	**2.34**	**203.81**	
% OF TOTAL	3.47%	48.02%	47.37%	1.15%		

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

3.7.1 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 AT 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.

3.8 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 AT 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 status of Boundary roads for Augusta Township is unclear and should be resolved. There does not appear to be any written documentation with respect to Boundary Road Agreements, however, there is anecdotal information that service exchanges occur.

Table 3.9 identifies the Augusta Township boundary roads.

Table 3.9: Boundary Roads

Asset ID	Road Name	From	To	Length	Adjacent Municipality
325	Carpenter Rd	Carpenter Rd	6th Concession Rd	0.51	Township of Elizabethtown-Kitley
820	Wiltsie Rd	Seeker Rd	Bend at N End at Townline/ Wiltsie Intersection	2.37	Township of Elizabethtown-Kitley
885	Kinch Rd	Augusta/Elizabethtown-Kitley Townline	County Rd 15	0.16	Township of North Grenville
1020	Harvey Rd	Kyle Rd	County Rd 18	2.23	Township of North Grenville
1040	Boomhouwer Rd	County Rd 18	Limerick Rd	0.43	Township of North Grenville
1085	Forsythe Rd	Shanty Trail	Augusta / North Grenville Town Limit	3.22	Township of Edwardsburgh/Cardinal
			Total	**8.92**	

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

	MMS Class							
	4		5		6		TOTAL	
Time of Need	Cl km	Lane km	Cl km	Lane km	Cl km	Lane km	Cl km	Lane km
1 to 5	8.675	17.350	3.240	6.480	0.000	0.000	**11.915**	**23.830**
6 to 10	69.555	139.110	5.260	10.520	0.000	0.000	**74.815**	**149.630**
ADEQ	41.610	83.220	12.010	24.020	8.140	16.280	**61.760**	**123.520**
NOW	47.050	94.100	8.270	16.540	0.000	0.000	**55.320**	**110.640**
TOTAL	**166.890**	**333.780**	**28.780**	**57.560**	**8.140**	**16.280**	**203.810**	**407.620**
% OF TOTAL	82.51%	82.51%	14.14%	14.14%	3.35%	3.35%		
System Adequacy	71.8%	71.8%	71.3%	71.3%	100.0%	100.0%	**72.9%**	**72.9%**
Good to Very Good	66.6%	66.6%	60.0%	60.0%	100.0%	100.0%	**67.0%**	**67.0%**

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.

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

AT currently has a road system adequacy measure of 72.9**%**. The road system currently measures 203.81 centreline-kilometres (adjusted for boundary roads), with 55.32 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 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 an effect on the calculation for Augusta Township. The road system currently includes 8.14km of road sections that had an actual or estimated traffic count of less than 50 vehicles per day. This represents approximately 3.35% of the road system. From a road users' perspective then, the system condition may appear lower.

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 AT 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 fair. However, this is influenced to some extent by the following factors:

- The overall condition may have been influenced by Infrastructure Funds and Grants that have not been identified in the annual funding level.
- The gravel road system was *not* reviewed during the spring breakup Field observations and staff input on performance history were considered in the development of the scoring.
- As noted above, 3.99% of the system is deemed adequate due to having a counted or estimated traffic count of less than 50 vehicles per day.

The estimates provided in this report are generally in accordance with the formulae in the *Inventory Manual,* and 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.

Table 4.2: Unit Costs

Item	Unit	2016 Costs $
Excavation	m^3	12.00
Hot Mix Asphalt	t	100.00
Single Surface Treatment	m^2	3.00
Granular A	t	20.00
Granular B	t	18.00
Conc- Curb and Gutter-place	linear m	45.00
Conc- Curb and Gutter-removal	linear m	8.00
Subdrains	linear m	15.00
Storm Sewer-525mm	linear m	325.00
Manholes	ea	3,600.00
• - manhole removed	ea	550.00
• - manholes-Adjust	ea	750.00
Catch Basins	ea	2000.00
Catch-Basins- removed	ea	550.00
Catch Basin Leads	Linear m	200.00
Catchbasins - adjust	ea	750.00
Asphalt Planing	m^2	5.00
Asphalt Pulverizing	m^2	2.13
Crack Sealing	m	2.00
Microsurfacing	m^2	4.00

4.3 Road System Needs

Based on the unit costs identified in Table 4.2, the improvements costs have been calculated generally in accordance with the Inventory Manual. Table 4.3 identifies the improvement costs by Time of Need and Improvement Type.

However, for the purposes of this report, road sections with a traffic count of less than 50 vehicles per day have been provided with recommended treatment and associated improvement cost in

order to provide a more accurate assessment of the total needs and conditions. (The calculations will rate them as adequate due to the traffic count) The road system currently includes 8.14 km of road sections that had an actual or estimated traffic count of less than 50 vehicles per day. This represents approximately 3.99% of the road system. The total value of the needs identified in this report includes **$1,027,875** on those roads sections with an actual or estimated count of less than 50 vehicles per day.

Table 4.3: Improvement Costs by Improvement Type and Time of Need

Imp. Class	Improvement ID/Description		Time of Need: 1 to 5		6 to 10		ADEQ		NOW		TOTAL		% OF TOTAL	
			Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km	Imp. Cost	Cl Km
Const	BS	Base and Surface	0	0	694,102	3.19	50,615	0.15	2,113,785	6.55	**2,858,502**	**9.89**	11.08%	4.85%
Const	BSgravel	Base and Surface to Gravel	359,516	1.185	4,996,703	34.145	204,632	1.59	1,810,451	12.9	**7,371,302**	**49.82**	28.58%	24.44%
Const	GRR	Gravel Road Resurfacing Single Lift 75mm	0	0	0	0	39,031	1.39	0	0	**39,031**	**1.39**	0.15%	0.68%
Const	None	No Improvement Required	0	0	0	0	0	34.95	0	0	**0**	**34.95**		17.15%
Const	REC	Reconstruction - Rural	0	0	0	0	0	0	813,784	1.81	**813,784**	**1.81**	3.16%	0.89%
Const	RECgravel	Reconstruction Gravel Road	0	0	0	0	772,628	1.92	1,726,328	4.15	**2,498,956**	**6.07**	9.69%	2.98%
Const	RNS	Reconstruction Nominal Storm Sewer	38,479	0.07	216,452	0.38	0	0	446,355	0.41	**701,287**	**0.86**	2.72%	0.42%
Const	RSS	Reconstruction with Storm Sewers	480,467	0.31	0	0	0	0	1,447,939	0.74	**1,928,406**	**1.05**	7.48%	0.52%
Maint	CRK	Crack Sealing	0	0	0	0	42,267	15.89	0	0	**42,267**	**15.89**	0.16%	7.80%
Maint	GRRplus	Maintenance Gravel and Minor Ditching	0	0	89,448	2.5	0	0	0	0	**89,448**	**2.5**	0.35%	1.23%
Maint	RSpLimit	Reduce Speed limit	0	0	0	0	0	0	0	0.2	**0**	**0.2**		0.10%
Maint	SD	Spot Drainage	0	0	0	17.74	0	5.87	0	1.42	**0**	**25.03**		12.28%
Rehab	PR2	Pulverize and Resurface 2 - 100mm	1,106,297	5.17	0	0	0	0	5,905,441	27.14	**7,011,738**	**32.31**	27.19%	15.85%
Rehab	R1	Basic Resurfacing 1 - 50mm	406,943	3.32	1,517,523	12.81	0	0	0	0	**1,924,466**	**16.13**	7.46%	7.91%
Rehab	R2	Basic Resurfacing 2 - 100mm	399,137	1.86	0	0	0	0	0	0	**399,137**	**1.86**	1.55%	0.91%
Rehab	SST++	SST, 10% Base Repairs, Minor Ditching	0	0	59,711	1.85	0	0	0	0	**59,711**	**1.85**	0.23%	0.91%
Rehab	SST	Single Surface Treatment	0	0	53,856	2.2	0	0	0	0	**53,856**	**2.2**	0.21%	1.08%
TOTAL			**2,790,840**	**11.915**	**7,627,797**	**74.815**	**1,109,174**	**61.76**	**14,264,082**	**55.32**	**25,791,892**	**203.81**		
% OF TOTAL			10.82%	5.85%	29.57%	36.71%	4.30%	30.30%	55.30%	27.14%				

4.3.1 Physical Condition

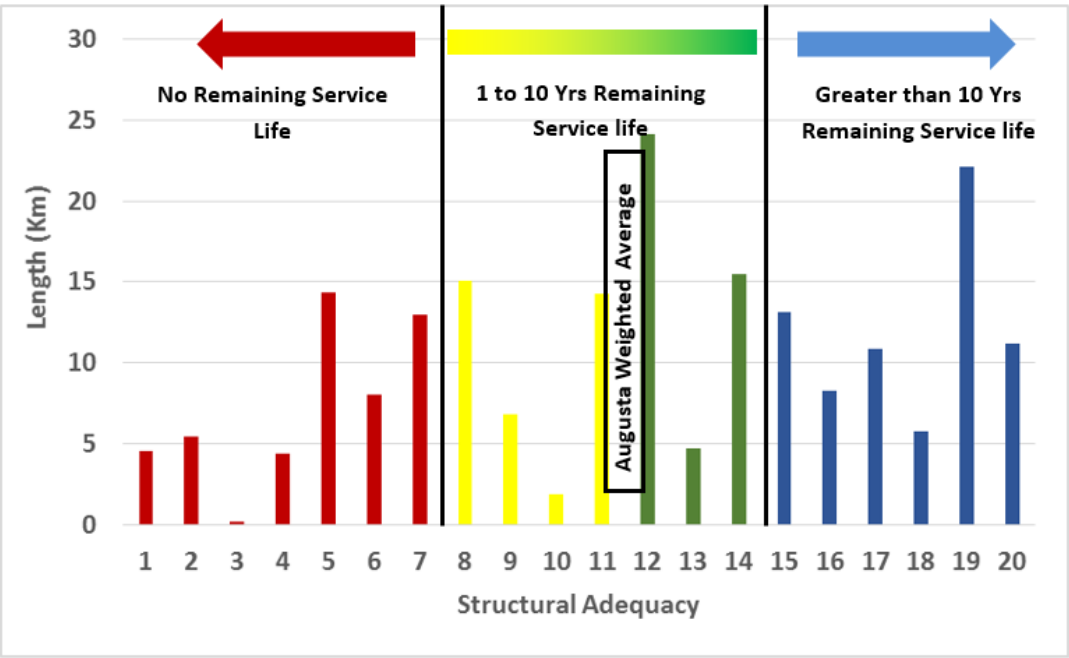
The Physical Condition is an alternate method of describing the condition of a road section or the average condition of the road system. The value is the structural adequacy converted to be expressed as a value out of 100, instead of 20. This methodology lends itself to modeling and comparators that 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 59.6.

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 Structural Adequacy ratings of the road system and illustrates the estimated remaining service life of the road system. The weighted average structural adequacy is 11.9, placing the average road section on the boundary between 1 to 5 and 6 to 10 year needs.

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 E

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 that full life expectancy may be realized.

Budgetary recommendations in this report do not include items related to development and growth. AT 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 **$104,870,300**. This estimate is based on the AT's unit costs.

All estimates are based upon the unit costs identified in Table 4.2. All formulae for improvement and replacement costs are as per the Inventory Manual Appendix F. Average Replacement costs are identified in Table 5.1.

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Table 5.1: Average Replacement Costs by Functional Class

	Roadside Environment										
	R		S		U		TOTAL		% OF TOTAL		
Asset Subtype	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Replacement Cost	Length	Cost per Km ($)
100	2,434,251	7.9	0	0	0	0	**2,434,251**	**7.9**	2.32%	3.82%	308,133
200	42,084,527	98.14	0	0	0	0	**42,084,527**	**98.14**	40.13%	47.42%	428,821
300	18,454,604	35.5	0	0	0	0	**18,454,604**	**35.5**	17.60%	17.15%	519,848
400	21,275,066	30.23	0	0	0	0	**21,275,066**	**30.23**	20.29%	14.61%	703,773
C/R	0	0	2,185,025	3.35	0	0	**2,185,025**	**3.35**	2.08%	1.62%	652,246
L/R	0	0	16,402,170	30.73	2,034,684	1.09	**18,436,854**	**31.82**	17.58%	15.38%	579,411
TOTAL	**84,248,448**	**171.77**	**18,587,195**	**34.08**	**2,034,684**	**1.09**	**104,870,327**	**206.94**			
% OF TOTAL	80.34%	83.00%	17.72%	16.47%	1.94%	0.53%					

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 **72.9**%.

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 **59.6**. (This includes road sections with less than 50 AADT)

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 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 **56.8 to 67%** of the road system. (Dependant on how Class 6 Roads are dealt with.)

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 keep being 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)

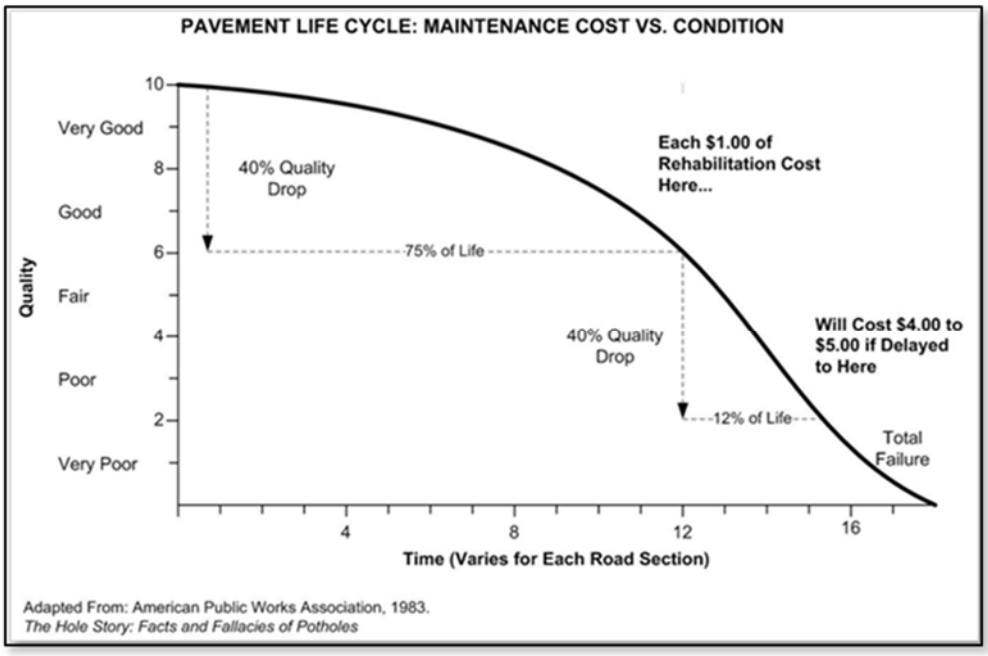
Priority Rating is a calculated field in the Inventory Manual, and is a function of the traffic count and the overall condition rating of the road section. This approach adds weight to the traffic count of the section. Although the word 'priority' is included in the field name, a road section that has a higher calculated 'Priority Rating' is not necessarily a higher priority in the broader sense of asset management.

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.

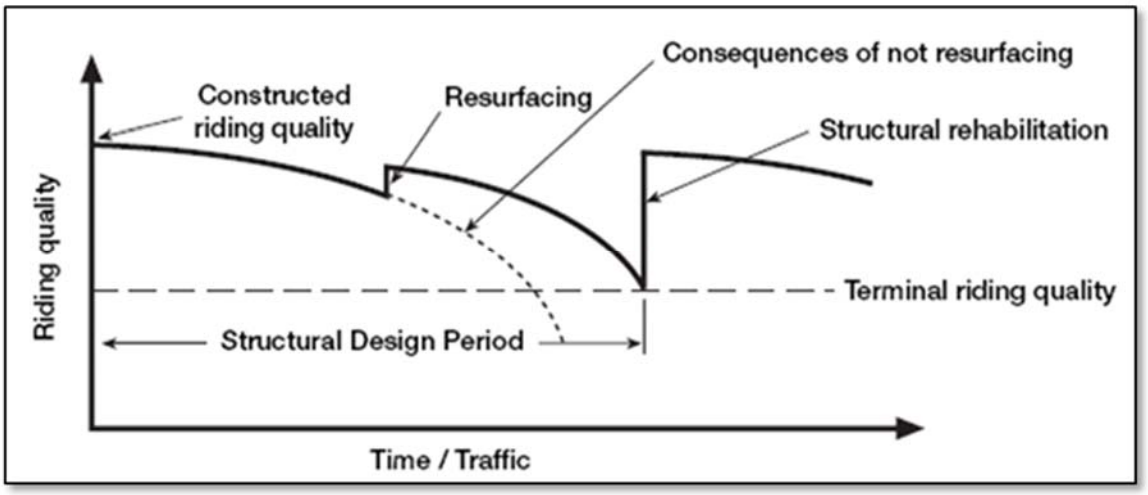
From a more current asset management perspective, project selection should be predicated by condition. (Structural Adequacy or PCI). Figure 8.1 clearly illustrates the financial advantages of managing the road system by performing the right treatment at the right time of the asset life cycle. If appropriate 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 correction time in the life cycle.

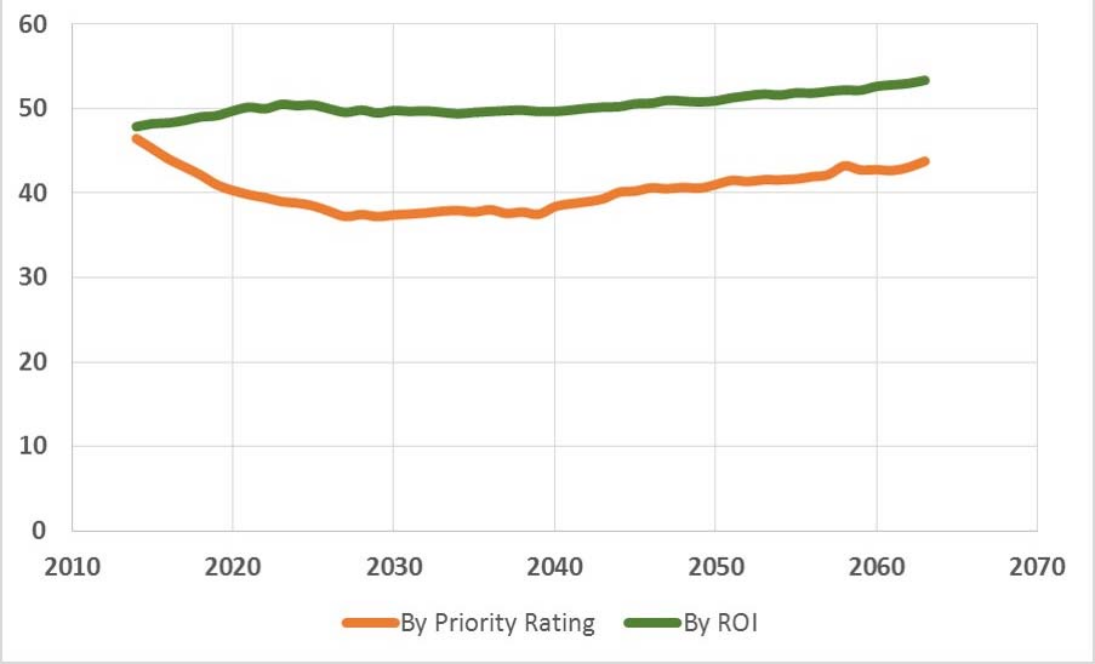
Figure 8.2: Pavement Management- The Right Treatment at the Right Time



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: System Performance –Worst First vs Best ROI



Note: Not the Augusta Township Road system

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 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.

8.4 Gravel Roads Management Strategy

AT has a gravel road system of approximately 83.73 centre line kilometres. The budget recommendation is $770,800 annually, for the materials only.

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	RDSD	Service Class
690	Ashby Rd	West End	Lord Mills Rd	0.82	40	R	6
900	Hart Rd	Branch Rd	400m N of Branch Rd	0.4	50	R	4
990	Diamond Rd	Hall Rd	County Rd 18	1.32	25	R	6
1000	Hall Rd	Kyle Rd	County Road 18	5.1	50	R	4
1010	Kyle Rd	Branch Rd	Harvey Rd	2.33	50	R	4
1020	Harvey Rd	Kyle Rd	County Rd 18	2.23	50	R	4
1030	Brooks Rd	County Rd 18	County Rd 18	1.42	50	R	4
1085	Forsythe Rd	Shanty Trail	Augusta / North Grenville Town Limit	3.22	50	R	4
			Total	**16.84**			

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 **$104,870,300**. 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 AT road system to the current standard is **$104,870,300**. This equates to an annual capital depreciation of **$2,097,400** 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 AT's hot mix asphalt inventory. As such, the optimal budget calculation will focus on the 20-year interval, 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 resurfacing program should be **$654,000** 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	20	0	0	0	0
A/C-S	20	0	0	0	0
A/C-U	20	0	0	0	0
HCB1-R	10	0	0	0	0
HCB1-S	10	0	0	0	0
HCB1-U	10	0	0	0	0
HCB2-R	12	0	0	0	0
HCB2-S	12	0	0	0	0
HCB2-U	12	0	0	0	0
HCB3-R	15	0	0	0	0
HCB3-S	15	0	0	0	0
HCB3-U	15	0	0	0	0
HCB4-R	20	429579.4	73.87	5815.34	13.57655
HCB4-S	20	209091.6	33.86	6175.18	6.223121
HCB4-U	20	15365	1.09	14096.33	0.200331
TOTALS			**108.82**		**20.000**

9.4 Surface Treatment Resurfacing

Most agencies report that the average life of surface treated road is seven years. 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 $3.00 per square metre, the annual program size should be **$29,600**, 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 83.73 km of gravel surfaced roads, as per Table 3.1 of this report. Using AT's benchmark costing, the annual gravel resurfacing program size should be **$770,800** 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 AT. Based on that premise, the recommended budget for crack sealing is **$57,900**.

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, gravel road resurfacing and crack sealing: **$1,512,300**. 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 **$2,097,400**.

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

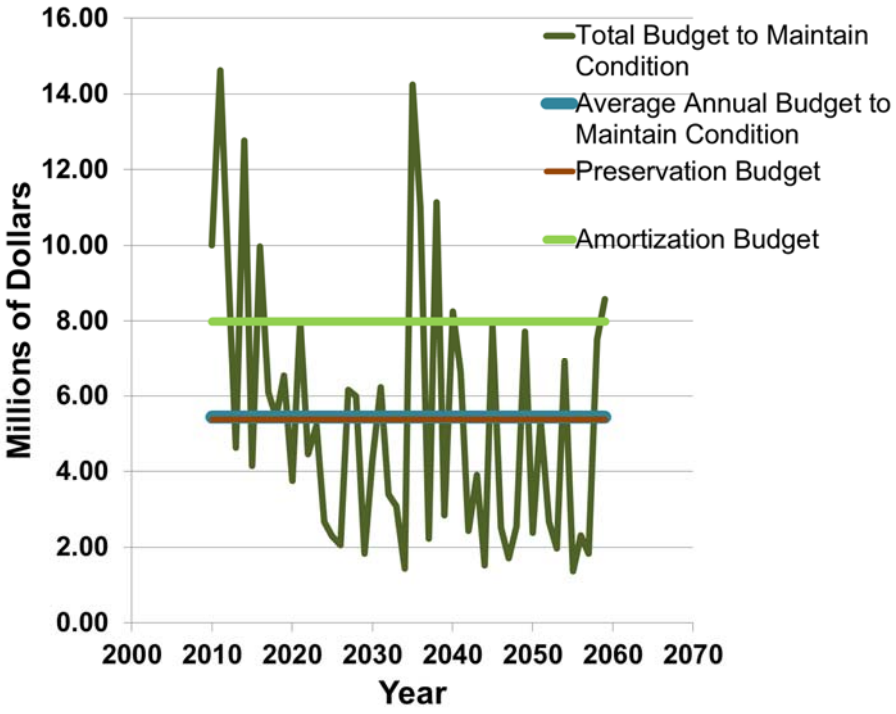


Figure 9.1 is from another study, however, it illustrates the concept of the funding window.

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.

9.10 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. $1.11m
- Maintain budget- varies each year dependent upon demand by condition –average is $0.96m
- 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. $1.51m
- 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 59.7. 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.

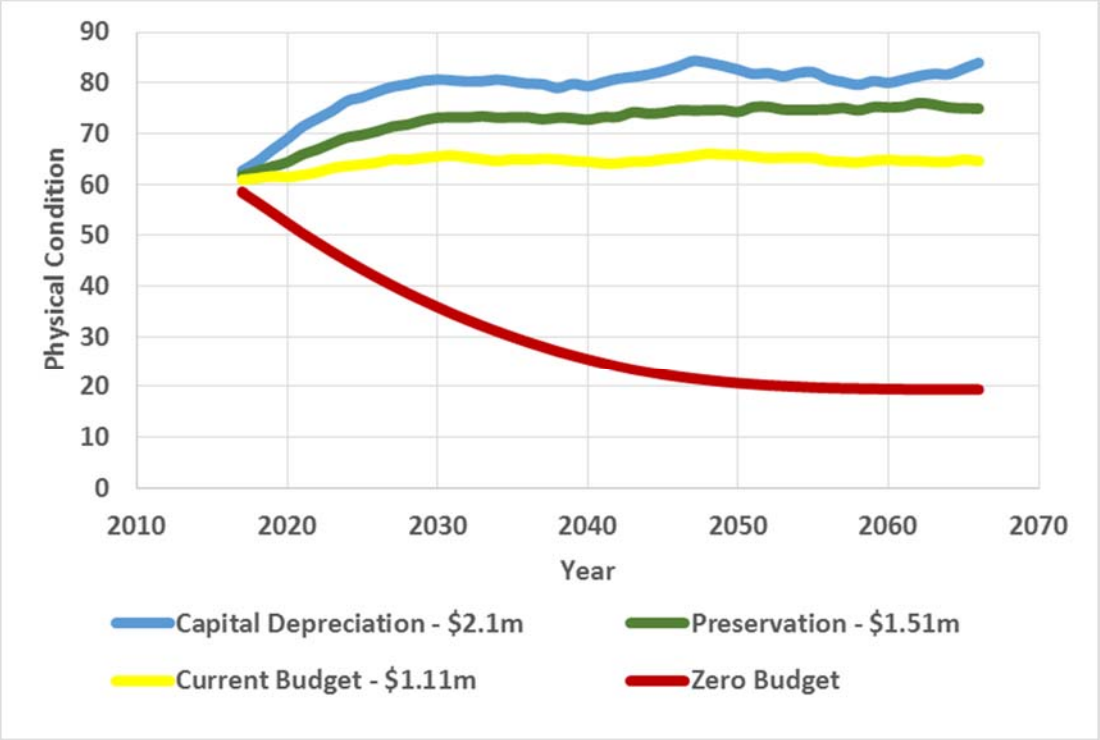
In reviewing the results of the performance models, it should be understood that, with the methodology being used, the trigger for a resurfacing activity is a Physical condition of 70 (Structural Adequacy of 14).

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 $2,097,400 annually for a 50 Year total of $104,870,400. However, analysis of the results reveals that over the 50 year modeling period, expenditures totaled only $97,724,100 or an average of $1,954,500 annually.

4 Roads believes that the existing funding level of $1.1m annually is significantly less than the funding level required to sustain the road system. 4 Roads has recommended that the annual budget be increased to the Preservation funding level - $1.51m.

Figure 9.2: Predicted Performance Modeling at Various Budget Levels



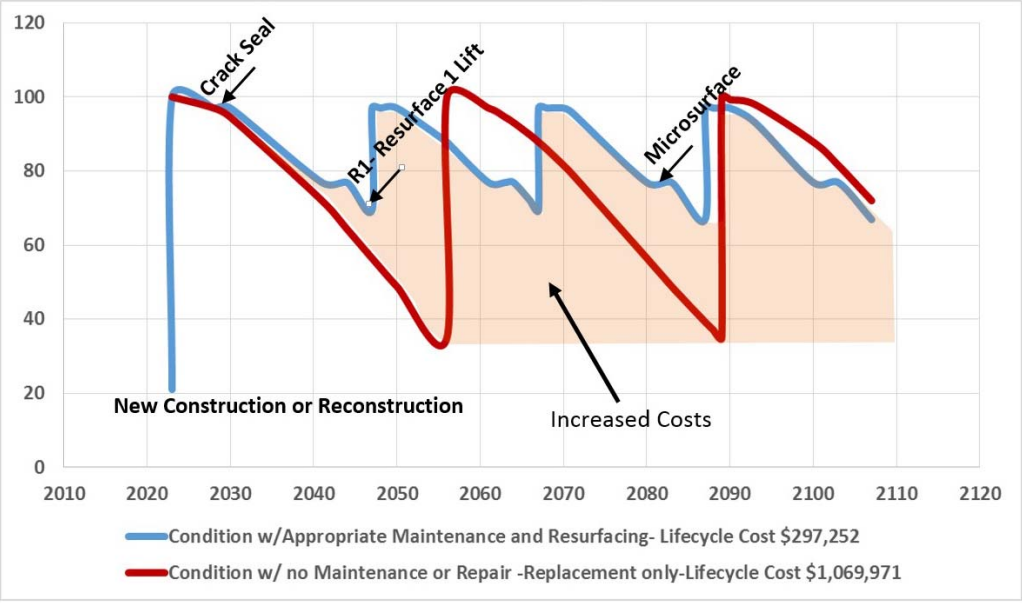
The deterioration curves that have been used consider an average/typical performance for the various road classes. The deterioration of a road section is greatly dependent on quality design, materials, construction and maintenance. When used in the model at a reasonable funding level the overall average 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 Road Asset 280, Bisseltown Road, from Knapp Drive to County Road 15.

Table 9.2: Sample Section Life Cycle

Sample Section, Asset ID 280 Bisseltown Road, Knapp Drive to County Road 15							
Year	Imp. ID	Cost	Start Cond	End Cond	Yrs Hold	Start Value	End Value
2017	PR2	$ 542,734	30	100		$ 552,968	$ 1,843,227
2022	CRK	$ 6,544	97	97	2	$ 1,787,930	$ 1,787,930
2034	MICRO	$ 68,191	79.27	79.27	3	$ 1,461,126	$ 1,461,126
2041	R1	$ 296,695	69.47	97		$ 1,280,490	$ 1,787,930
2042	CRK	$ 6,544	97	97	2	$ 1,787,930	$ 1,787,930
2054	MICRO	$ 68,191	79.27	79.27	3	$ 1,461,126	$ 1,461,126
2061	R1	$ 296,695	69.47	97		$ 1,280,490	$ 1,787,930
2062	CRK	$ 6,544	97	97	2	$ 1,787,930	$ 1,787,930

Figure 9.3 illustrates the cost differential between applying the right treatment at the right time/condition versus the costs the letting the asset to deteriorate to a poor condition and repairing through major rehabilitation or construction.

Figure 9.3: Graphical Representation of a Typical Life Cycle and Strategy Cost Differential (Asphalt)

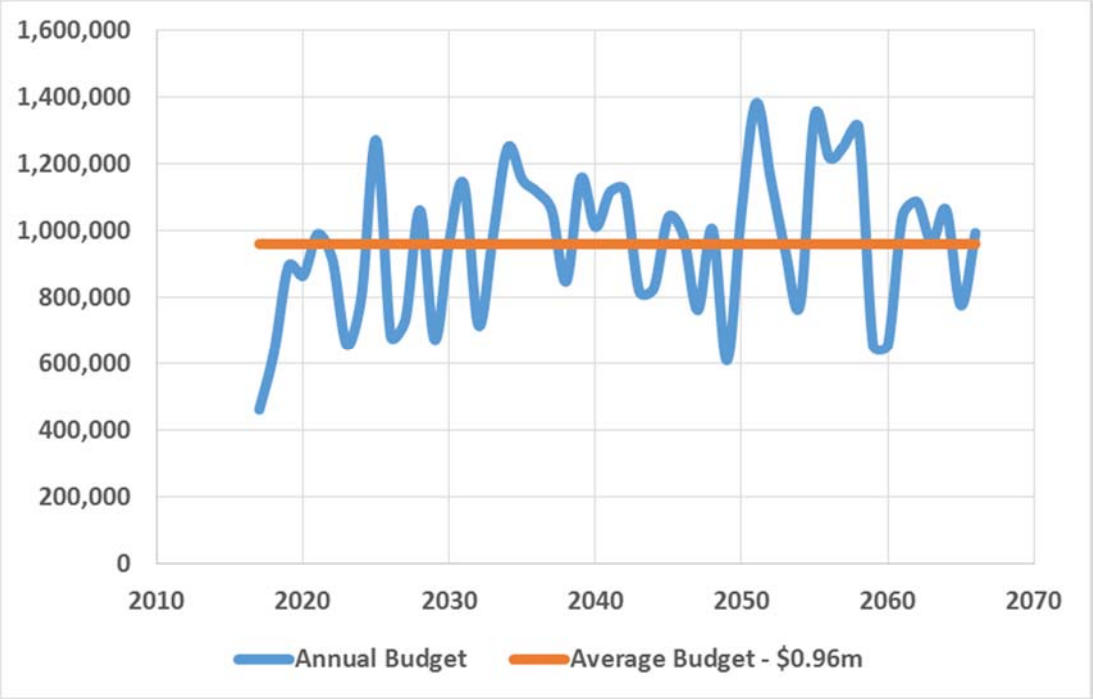


Note: The orange shaded area illustrates increased lifecycle costs between the two strategies

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.

Figure 9.4 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.

Figure 9.4: Annual Expenditures Budget to Maintain Current Condition



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.

9.11 Record of Assumptions -Performance Modeling

9.11.1 Pavement Classification for Modeling

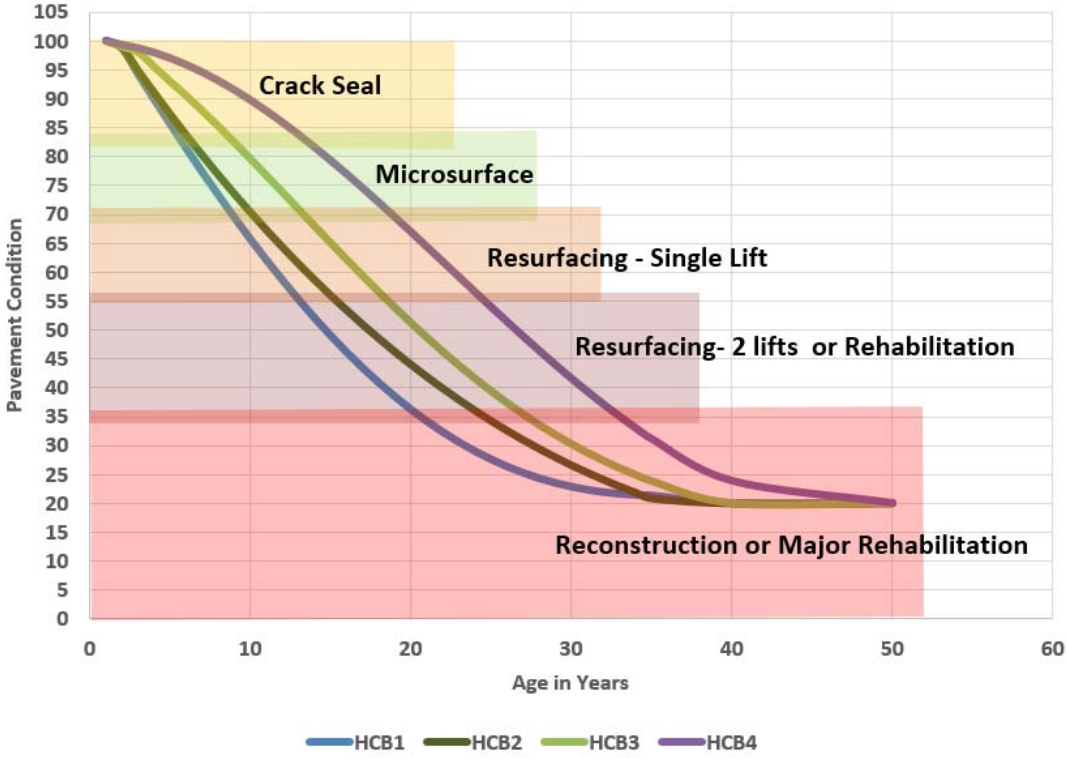
In order to develop budget recommendations, 4 Roads adds an additional classification of roads differentiated by surface type, roadside environment and traffic volume. It is anticipated that each road classification will deteriorate at a different rate. Differentiation by roadside environment within 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	20,000
HCB3	All	HCB	R	1,000	10,000
HCB4	All	HCB	R	1	1,000
ICB	All	ICB	S	1	3,000
LCB1	All	LCB	R	1	2,000

Figure 9.5 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 D provides detail on the deterioration curves for all road asset classes.

Figure 9.5: Treatment Selection vs. Condition (Asphalt Surfaces)



9.12 10 Year Program

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

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 – Current Funding Level

Imp. ID	Year										Grand Total
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
BSgravel		138,868			100,900	508,693	794,316	359,516	386,564	911,440	**3,200,297**
CRK	26,971	39,768		35,698	19,844	24,312	36,257	12,608	10,826	4,815	**211,099**
GRR				31,815	6,696						**38,511**
GRR2			158,508		42,509		30,326	122,054	35,424	42,509	**431,330**
MICRO				4,950	7,484			1,386			**13,820**
PR2	970,379	919,576	868,590	434,218	205,258	268,036	48,958	375,848	551,803		**4,642,666**
R1			82,180	598,875	569,677	309,430	88,174	236,238	80,182	149,229	**2,113,985**
R2					108,025						**108,025**
SST	53,856				50,803		112,446		43,772		**260,877**
SST++	59,711										**59,711**
Grand Total	**1,110,917**	**1,098,212**	**1,109,278**	**1,105,556**	**1,111,196**	**1,110,471**	**1,110,477**	**1,107,650**	**1,108,571**	**1,107,993**	**11,080,321**

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. Funding should be increased by $100,000 annually over the next 5 year period until it reaches $1.51m (2016 dollars).
3. The cycle for review of the condition of road system should be no greater than a four year cycle.
4. Unit costs, budget recommendations, update history, and performance models should be updated annually.
5. Current Units costs should be re-reviewed to ensure an accurate reflection of current costing experience.
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. Data collected on the road asset should be referenced to the road asset.

12. The status of Boundary roads should be clarified. Where a boundary road exists, a written Boundary Road Agreement should be in place. The agreement should be approved by Council.
13. Further analysis should be undertaken on the Gravel Road system, with respect to the potential for conversion to a hardtop surface.
14. Further analysis should be undertaken on the very low volume road sections for closure.
15. 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.
16. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
17. 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

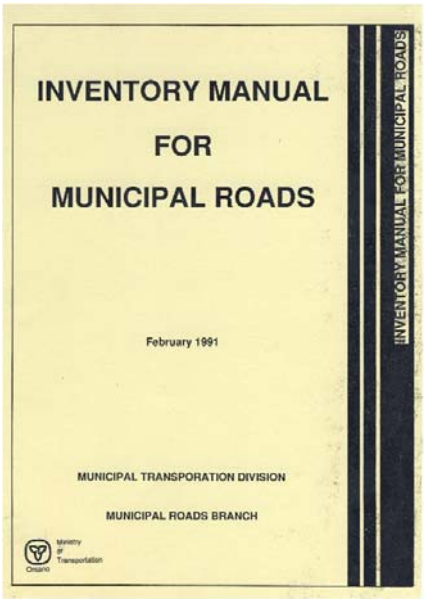
The provincial requirements for AMP's include asset condition assessment in accordance with standard engineering practices. The road asset reviews generally conform to the methodology of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

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. 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.

‘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.

‘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.

‘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

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

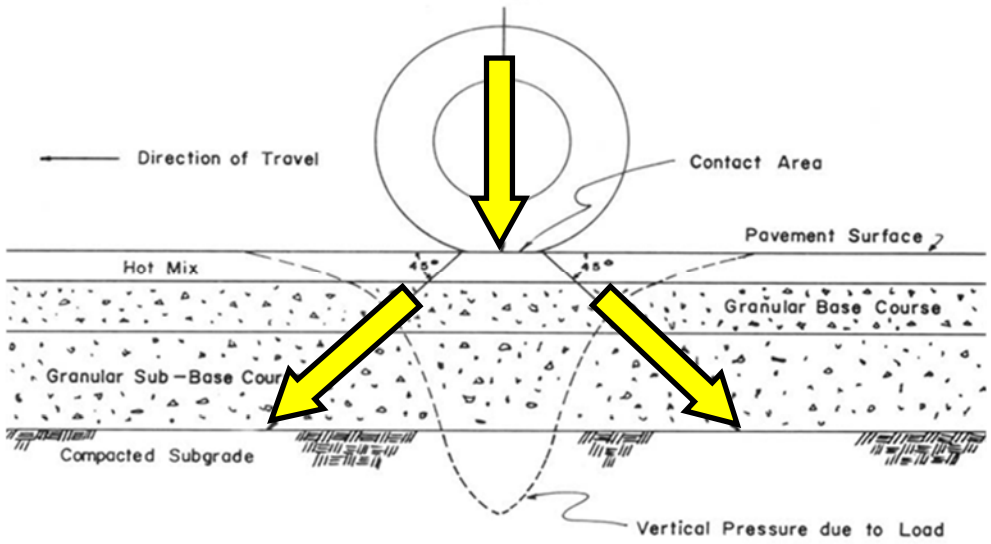
Pavement Structure

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

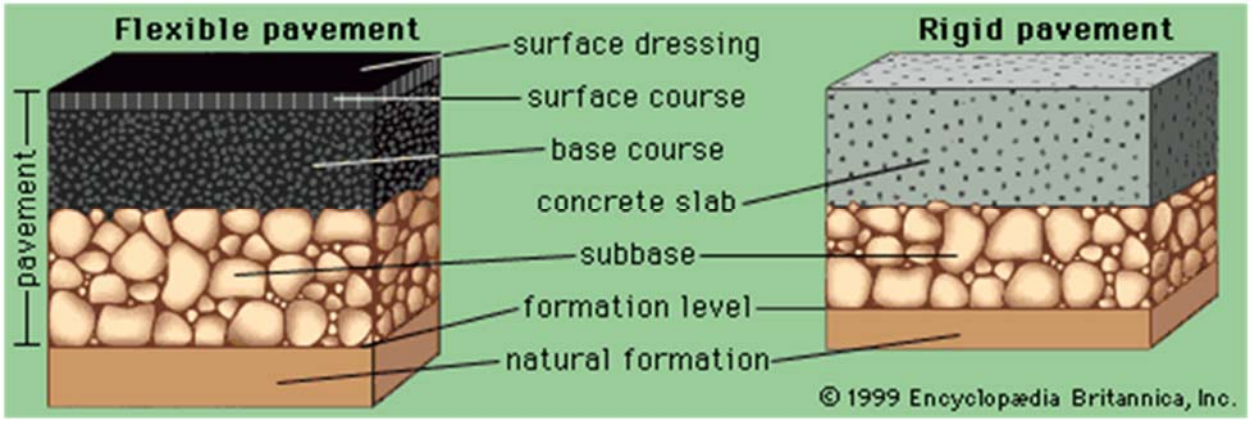
Rigid Pavement Structure

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 disperses 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 he 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

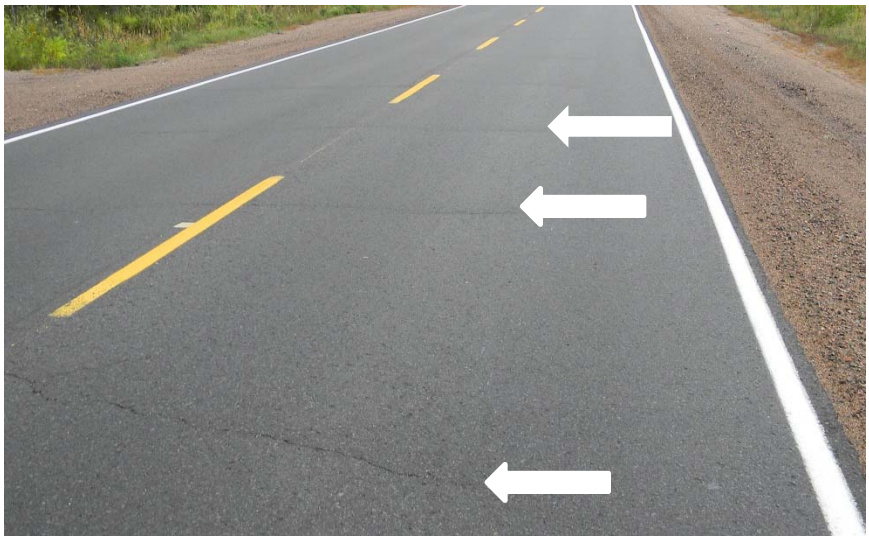
Paving over an active crack(s) will result in a crack(s) in the same location with 2 to 3 years. As a rule of thumb, the crack will migrate through at approximately 25mm per year. Therefore it would be

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 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

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:

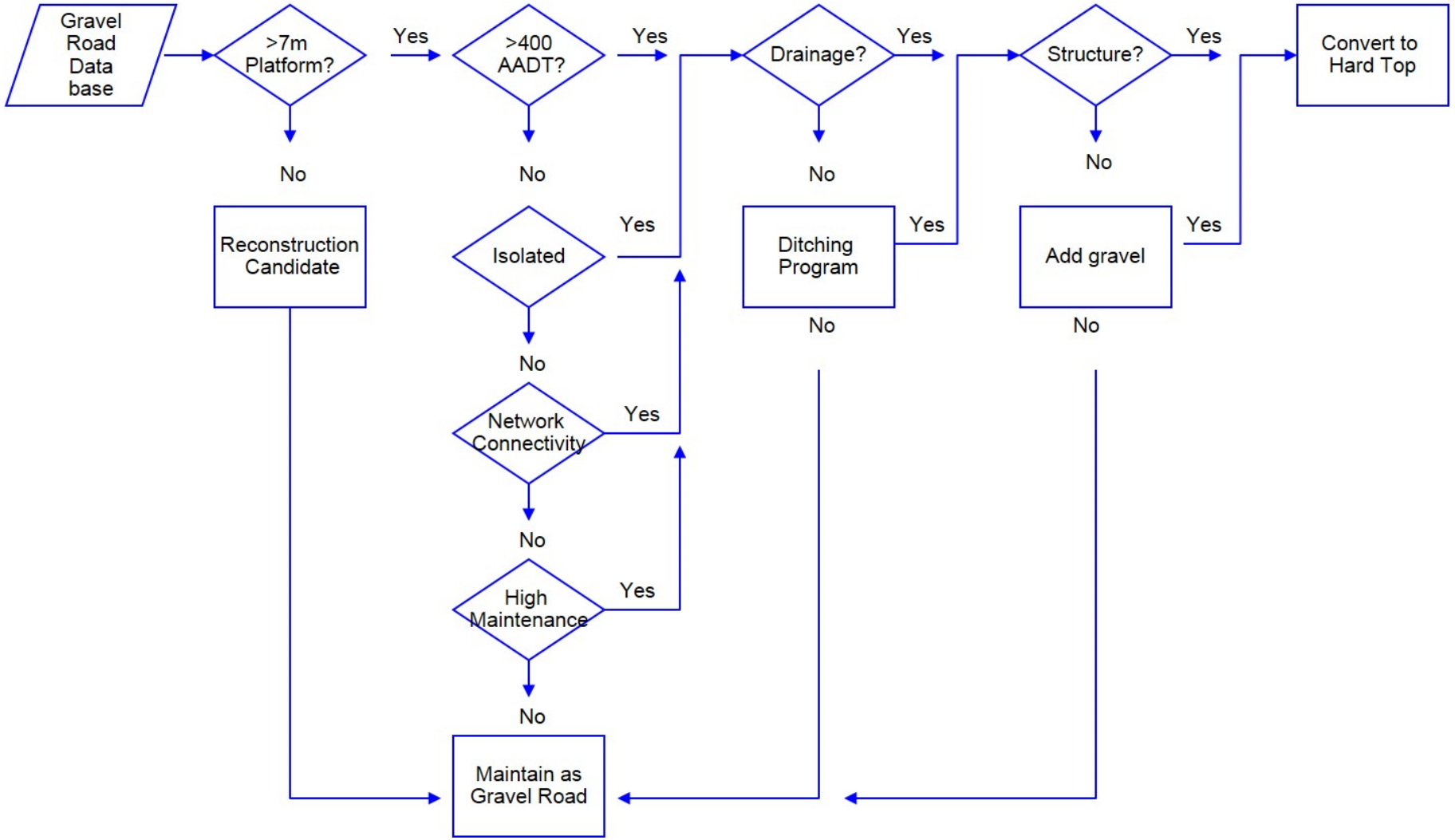
- Platform width
- Drainage
- Structural Adequacy
- Traffic Volume and Type

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

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.

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.

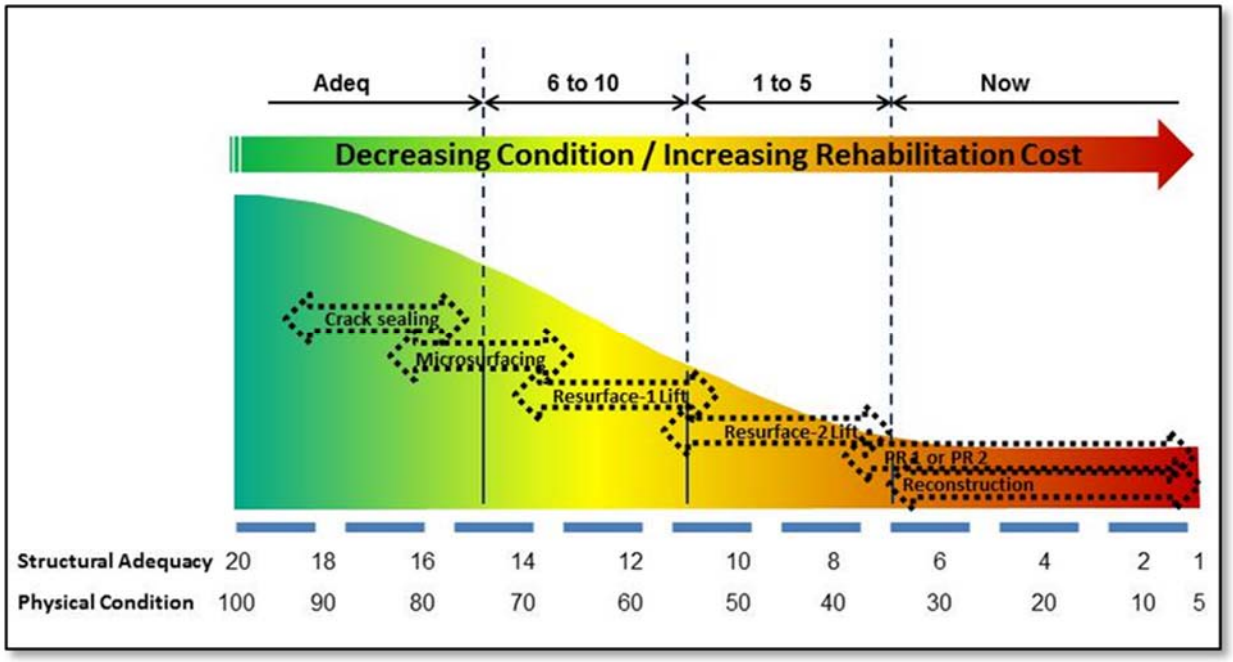
In the early years of the model, if a project is selected that has an identified improvement type, that improvement will be used for the project in the year that it is selected. In the later years, presumably after all current deficiencies have been corrected the model will revert to the assigned asset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

All deterioration curves relate to the 'Physical Condition' data field in WorkTech. Physical Condition is the Structural Adequacy multiplied by 5 to produce a score from 5 to 100. 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.

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.

WorkTech Asset Classes and Deterioration Curves for Roads

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	Fair / Passable	IF PCI >55<=75 then, PCI / 7 =SA
6 to 10	55-70	12 to 14	56to 70	76 to 85	6 to 10 year Needs – R1 Resurfacing	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.

WorkTech Asset Classes and Deterioration Curves for Roads

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.

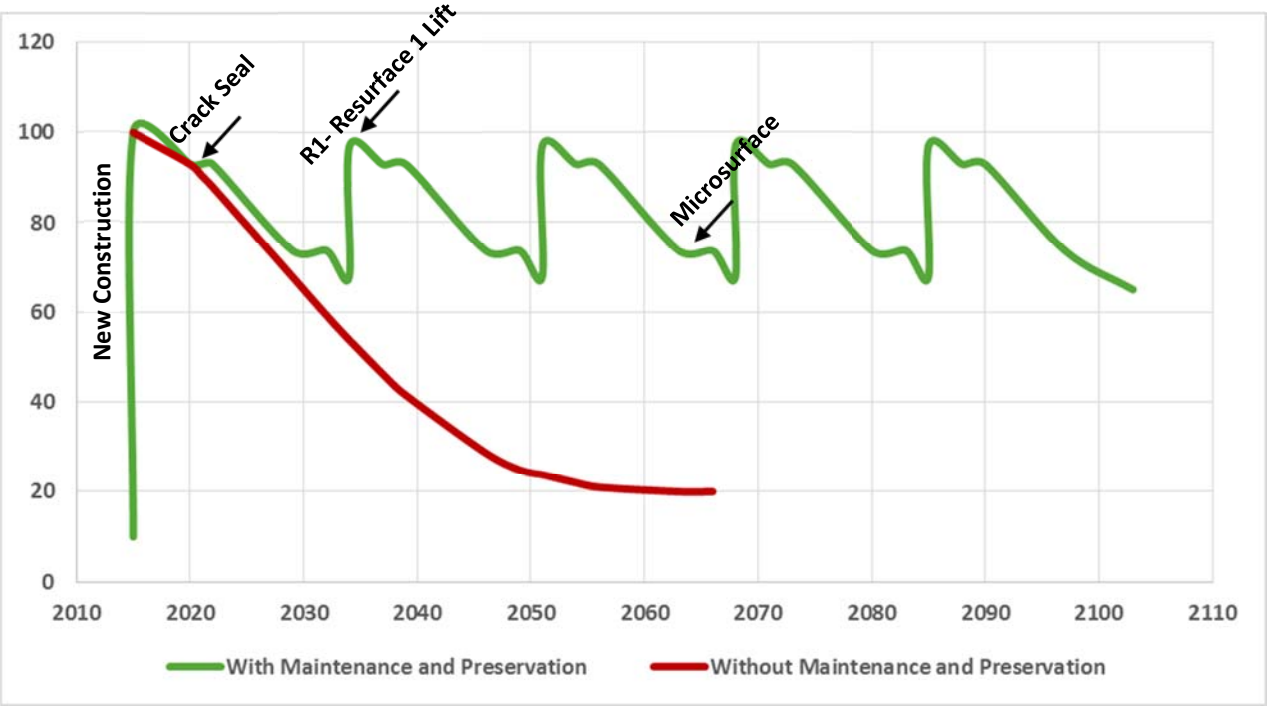
The following table identifies a number of improvement types and further identifies the effect that they have on a road asset. A similar approach may be taken with other assets.

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

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.

Figure 2, shown below, 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



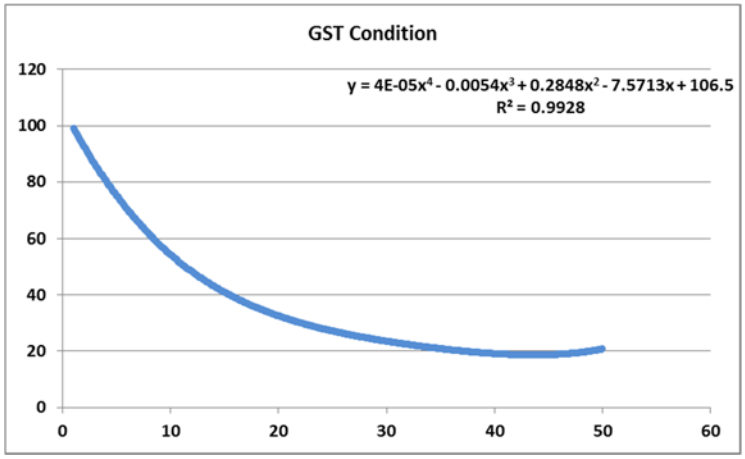
Deterioration Curves by Surface Type and Traffic Volume

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

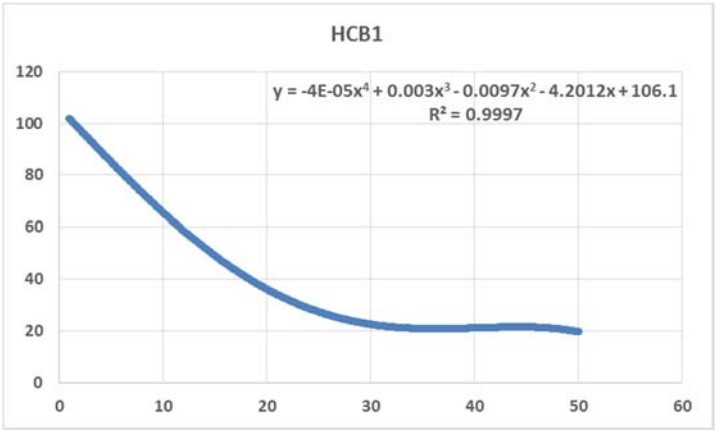
Year	Condition	Imp Typet	Description
1	100	NONE	No Improvement Required
2	92.45	NONE	No Improvement Required
3	86.21	GRR	75mm of Granular A
4	80.43	GRR	75mm of Granular A
5	75.11	GRR	75mm of Granular A
6	70.21	GRR	75mm of Granular A
7	65.7	GRR2	150mm of additional Gravel
8	61.55	GRR2	150mm of additional 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

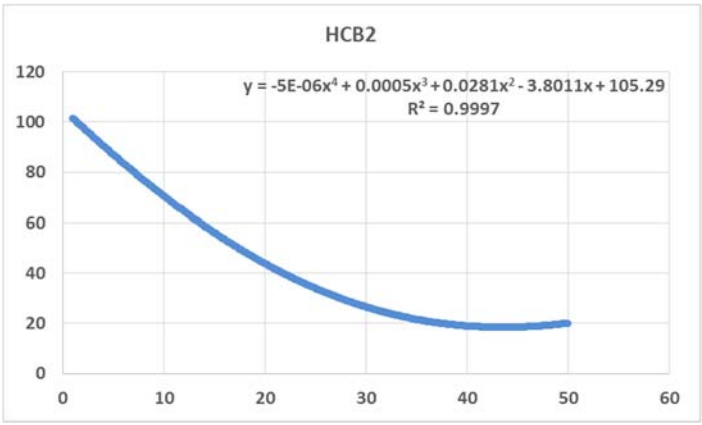
>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	98.61	NONE	No Improvement Required
3	94.19	NONE	No Improvement Required
4	89.83	CRK	Crack Sealing
5	85.55	CRK	Crack Sealing
6	81.36	CRK	Crack Sealing
7	77.26	MICRO	Microsurfacing -Pavement Preservation
8	73.28	MICRO	Microsurfacing -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



WorkTech Asset Classes and Deterioration Curves for Roads

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

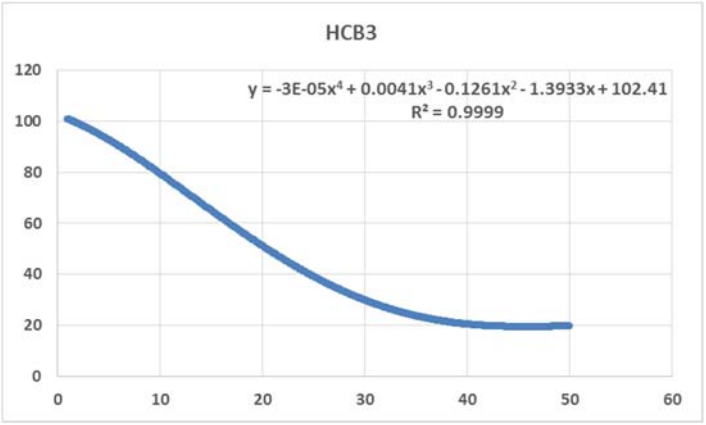
>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	98.79	NONE	No Improvement Required
3	94.85	NONE	No Improvement Required
4	91.01	CRK	Crack Sealing
5	87.29	CRK	Crack Sealing
6	83.68	CRK	Crack Sealing
7	80.18	CRK2	Crack Sealing
8	76.79	MICRO	Microsurfacing -Pavement Preservation
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



WorkTech Asset Classes and Deterioration Curves for Roads

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

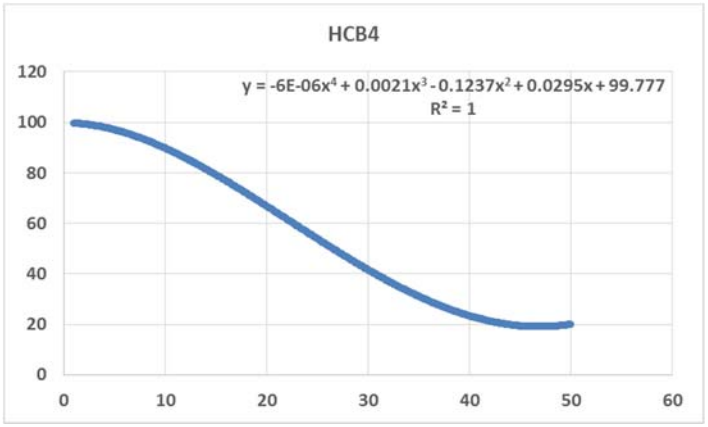
>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	99.44	NONE	No Improvement Required
3	97.46	NONE	No Improvement Required
4	95.29	NONE	No Improvement Required
5	92.95	CRK	Crack Sealing
6	90.48	CRK	Crack Sealing
7	87.88	CRK2	Crack Sealing
8	85.18	CRK2	Crack Sealing
9	82.4	CRK2	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

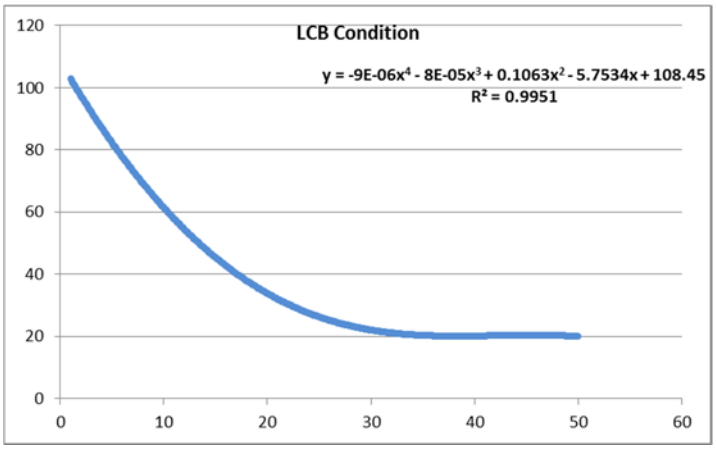
>Year	Condition	Imp. Type	Description
1	100	NONE	No Improvement Required
2	99.44	NONE	No Improvement Required
3	97.46	NONE	No Improvement Required
4	95.29	NONE	No Improvement Required
5	92.95	CRK	Crack Sealing
6	90.48	CRK	Crack Sealing
7	87.88	CRK2	Crack Sealing
8	85.18	CRK2	Crack Sealing
9	82.4	CRK2	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
40	20	REC	Reconstruction - Rural
45	20	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 by Street Name

Current Insp - Rural w/Curve Needs Only

ID	Street Name	From Description	To Description	Length	RDSD	AADT	Limit	Op. Speed	TON	H.Curve	H. SSD	V. Curve	V.SSD
0170	2nd Concession Rd	North Campbell Rd	County Rd 31	1.170	R	450	80	70	ADEQ	3	0	0	0
0180	2nd Concession Rd	County Rd 31 - Blue Church Rd	900m E of Rocky Rd	3.530	R	400	80	80	ADEQ	2	0	0	0
0570	4th Concession Rd	McCully Rd	Hillbrook Rd	1.960	R	200	80	70	ADEQ	2	0	0	0
0540	4th Concession Rd	McCully Rd	500m W of County Rd 18	0.490	R	200	80	70	ADEQ	2	0	0	2
0640	4th Concession Rd	Blue Church Rd	Charleville Rd	0.910	R	200	80	80	ADEQ	0	0	0	1
0330	6th Concession Rd	Carpenter Rd	Algonquin Rd	0.800	R	50	80	70	ADEQ	1	1	0	2
1090	6th Concession Rd	County Rd 18	East End	1.560	R	50	80	70	ADEQ	2	0	0	0
1220	6th Concession Rd	Charleville Rd	1350m West of County Road 18	2.450	R	300	80	75	ADEQ	0	0	1	0
1225	6th Concession Rd	1350m West of County Road 18	County Road 18	1.350	R	300	60	60	ADEQ	0	0	0	1
0350	Algonquin Rd	Knapp Dr	700m East of Knapp Road	0.700	R	150	80	80	ADEQ	1	1	0	1
0390	Algonquin Rd	60m E of Cheyenne Trail	Dejong Rd	1.910	R	207	80	80	ADEQ	1	0	0	0
0410	Algonquin Rd	200m E of Dejong Rd	Glenmore Rd	3.270	R	207	80	70	ADEQ	2	0	0	0
0450	Algonquin Rd	Glenmore Rd	890m E of Glenmore Road	0.890	R	121	80	65	ADEQ	2	1	0	0
0455	Algonquin Rd	890m E of Glenmore Road	1150m W of Charleville Road	0.230	R	121	80	65	ADEQ	1	0	0	0
0300	Algonquin Rd	Knapp Dr	6th Concession Rd	2.340	R	73	80	65	ADEQ	2	2	0	2
0310	Bains Rd	Augusta/Elizabethtown Townline	Knapp Dr	0.850	R	50	80	50	NOW	2	1	0	0
0240	Bethel Rd	Augusta/Elizabethtown Townline	County Rd 26	0.810	R	600	80	65	ADEQ	2	0	0	0
0280	Bisseltown Rd	Knapp Dr	County Rd 15	2.460	R	463	80	80	ADEQ	2	0	0	1
0660	Blue Chruch Rd	County Rd 26	700m N of County Rd 26	0.700	R	100	80	80	ADEQ	0	0	0	2
0650	Blue Church Rd	4th Concession Rd	700m N of County Rd 26	1.330	R	100	80	80	ADEQ	0	0	0	1
1040	Boomhouwer Rd	County Rd 18	Limerick Rd	0.430	R	20	80	65	ADEQ	1	1	0	0
0980	Branch Rd	520m E of Kyle Road	County Rd 18	2.130	R	358	80	65	ADEQ	2	0	0	0
0930	Branch Rd	1100m East of Klitbo Road	Hart Rd	2.550	R	671	80	75	ADEQ	4	0	0	0
1030	Brooks Rd	County Rd 18	County Rd 18	1.420	R	50	80	60	NOW	3	0	0	0
1180	Buker Rd	Charleville Rd	County Rd 21	0.810	R	30	80	60	NOW	1	1	0	0
0320	Carpenter Rd	Augusta/Elizabethtown Townline	Algonquin Rd	0.810	R	50	80	50	NOW	3	0	0	0
0325	Carpenter Rd	Carpenter Rd	6th Concession Rd	0.510	R	50	80	70	ADEQ	1	0	0	1
1170	Charleville Rd	6th Concession Rd	County Rd 21	2.890	R	410	80	75	ADEQ	3	0	0	0
0840	Colville Rd	County Rd 15	County Rd 21	2.490	R	186	80	65	ADEQ	1	0	0	2
1050	Cooper Rd	Ferguson Rd	Augusta/North Grenville Townline	1.760	R	50	80	80	ADEQ	1	1	0	0
1060	Cooper Rd	County Rd 18	Ferguson Rd	2.970	R	50	80	70	ADEQ	2	0	0	2
0760	DeJong Rd	Lord Mills Rd	Algonquin Rd	2.220	R	150	80	65	ADEQ	2	0	0	1
1080	Forsythe Rd	County Road 21	Shanty Trail	5.630	R	50	80	80	ADEQ	2	0	0	2
1085	Forsythe Rd	Shanty Trail	Augusta / North Grenville Town Limit	3.220	R	50	80	80	ADEQ	1	1	0	0
5010	Glen Small Rd	County Rd 26	Augusta/Edwardsburgh/Cardinal Townline	1.350	R	200	80	65	ADEQ	1	0	0	0
0430	Glenmore Rd	Algonquin Rd	Algonquin Rd	0.540	R	50	80	80	ADEQ	0	1	0	0
0440	Glenmore Rd	Algonquin Rd	South End	0.210	R	20	80	80	ADEQ	0	0	0	1
0900	Hart Rd	Branch Rd	400m N of Branch Rd	0.400	R	50	80	65	ADEQ	1	0	0	0
0910	Hart Rd	400m N of Branch Rd	Land O'Nod Rd	2.340	R	5	80	65	ADEQ	1	1	0	0
1020	Harvey Rd	Kyle Rd	County Rd 18	2.230	R	50	80	80	ADEQ	2	0	0	0

Geometric Needs by Street Name

Current Insp - Rural w/Curve Needs Only

ID	Street Name	From Description	To Description	Length	RDSD	AADT	Limit	Op. Speed	TON	H.Curve	H. SSD	V. Curve	V.SSD
0580	Hillbrook Rd	Maple Ave	4th Concession Rd	1.850	R	223	80	50	NOW	5	0	0	1
0585	Hillbrook Rd	County Road 26	Maple Ave	0.430	R	223	80	80	ADEQ	0	0	0	1
0880	Jellyby Rd	Rock Springs Road / Jellyby Road Intersection	County Rd 15	1.530	R	100	80	80	ADEQ	1	0	0	0
0882	Jellyby Rd	Elizabethtown-Kitley Townline	Rock Springs Road / Jellyby Road Intersection	0.260	R	100	80	65	ADEQ	1	0	0	0
1130	Johnston Rd	Charleville Rd	Skakum Rd	1.870	R	50	80	60	NOW	3	1	0	0
0885	Kinch Rd	Augusta/Elizabethtown-Kitley Townline	County Rd 15	0.160	R	10	80	80	ADEQ	2	2	0	0
0860	Klitbo Rd	County Rd 21	Branch Rd	1.810	R	50	80	70	ADEQ	2	0	0	2
0290	Knapp Dr	Bisseltown Rd	Algonquin Rd	1.360	R	50	80	60	NOW	3	0	0	0
0945	Kyle Rd	County Road 21	300m N of County Road 21	0.300	R	90	80	65	ADEQ	1	0	0	0
0950	Kyle Rd	300m N of County Road 21	Branch Rd	2.060	R	50	80	65	ADEQ	2	0	0	0
1005	Kyle Rd	Hall Rd	Branch Rd	2.230	R	50	80	70	ADEQ	2	1	0	0
1010	Kyle Rd	Branch Rd	Harvey Rd	2.330	R	50	80	70	ADEQ	3	0	0	0
0890	Land O'Nod Rd	County Rd 15	Augusta/Merrickville/Wolford Townline	4.380	R	50	80	70	ADEQ	2	0	0	0
0700	Lord Mills Rd	DeJong Rd	Ashby Rd	2.350	R	150	80	70	ADEQ	3	0	0	0
1210	McCrea Rd	6th Concession Rd	County Rd 18	2.490	R	100	80	70	ADEQ	1	0	0	0
0550	McCully Rd	4th Concession Rd	200m N of 4th Concession	0.200	R	100	80	60	NOW	1	0	0	0
0110	McIntosh Rd	Merwin Lane, South Leg	County Rd 18	1.590	R	958	80	80	ADEQ	2	0	0	0
0140	McIntosh Rd	320m E of North Campbell Road	Merwin Lane, North Leg	1.670	R	958	80	80	ADEQ	1	0	0	1
1200	Mcleansville Rd	6th Concession Rd	Mcleansville Rd Loop	2.180	R	50	80	65	ADEQ	0	0	0	1
1190	Mcleansville Rd Loop	County Rd 21	County Rd 21	0.700	R	50	80	50	NOW	1	0	0	0
0620	North Campbell Rd	McIntosh Rd	County Rd 26	1.930	R	106	80	75	ADEQ	3	0	0	1
0490	Patterson Rd	County Rd 18	Township Limit	0.790	R	50	80	65	ADEQ	1	0	0	0
0940	S Branch Rd	Klitbo Rd	Kyle Rd	4.570	R	50	80	70	ADEQ	0	0	1	0
0080	South Campbell Road	County Rd 2	North End	1.480	R	100	80	65	ADEQ	1	0	0	1
1110	Weir Rd	County Rd 18	Augusta/Edwardsburgh Townline	1.770	R	835	80	70	ADEQ	2	0	0	0
0820	Wiltsie Rd	Seeker Rd	Bend at N End at Townline/ Wiltsie Intersection	2.370	R	50	80	65	ADEQ	2	1	0	0
0830	Wiltsie Rd	Wiltsie Rd S	County Rd 15	1.780	R	50	80	70	ADEQ	1	0	0	1
				113.060									

Appendix F: 10 Year Program Based on Proposed Budget

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type	Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2017	470	Skakum Rd	(to) Charleville Rd-to-2200m E of Charleville Road	SST	$ 53,856	70	95		2.2
2017	600	4th Concession Rd	(to) Hillbrook Rd-to-Charleville Rd	SST++	$ 59,711	65	95		1.85
2017	200	2nd Concession Rd	(to) 1400m W of Rocky Rd-to-Rocky Rd	CRK	$ 3,724	85	85	2	1.4
2017	230	2nd Concession Rd	(to) Augusta/Elizabethtown Townline-to-1500m E of Townline	CRK	$ 3,990	85	85	2	1.5
2017	20	Irace Dr	(to) County Rd 2-to-Irace Dr	PR2	$ 281,058	5	100		1.16
2017	30	Riverdale Cr	(to) Irace Dr-to-West End Cul de Sac	PR2	$ 60,573	5	100		0.25
2017	7170	Lorena Lane	(to) County Rd 15-to-Jones Crt	PR2	$ 40,239	5	100		0.17
2017	960	Branch Rd	(to) Hart Rd-to-800m E of Hart Rd	CRK	$ 2,128	85	85	2	0.8
2017	3020	Broad St	(to) Charleville Rd-to-East End	CRK	$ 585	85	85	2	0.22
2017	210	2nd Concession Rd	(to) County Rd 15-to-1400m W of Rocky Rd	CRK	$ 1,942	85	85	2	0.73
2017	930	Branch Rd	(to) 1100m East of Klitbo Road-to-Hart Rd	PR2	$ 534,211	25	100		2.55
2017	2020	Avenue Rd	(to) Alta Vista Dr-to-Sunnymeade Ave	CRK	$ 505	85	85	2	0.19
2017	2030	Alta Vista Dr	(to) County Rd 2-to-Sunset Dr	CRK	$ 1,623	85	85	2	0.61
2017	2060	Bradley Cres	(to) County Rd 2-to-North End	CRK	$ 505	85	85	2	0.19
2017	7070	Sarah St	(to) Jane St-to-George St	CRK	$ 1,702	85	85	2	0.64
2017	7080	Sarah St	(to) Church St-to-County Rd 15	CRK	$ 532	85	85	2	0.2
2017	7065	East McLean Blvd	(to) Thompson St-to-East End	PR2	$ 54,298	10	100		0.25
2017	920	Branch Rd	(to) Klitbo Rd-to-1100m E of Klitbo Rd	CRK	$ 2,926	80	80	2	1.1
2017	1140	Charleville Rd	(to) 4th Concession Rd-to-Skakum Rd	CRK	$ 5,506	80	80	2	2.07
2017	2050	Sunset Dr	(to) Avenue Rd-to-Merwin Line	CRK	$ 1,303	80	80	2	0.49
					$ 1,110,917				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2018	3010	Charleville Rd	(to) County Rd 26-to-1000m N of County Rd 26	CRK	$	2,660	89.73	89.73	2	1
2018	1150	Charleville Rd	(to) Skakum Rd-to-300m N of Algonquin Rd	CRK	$	1,383	79.27	79.27	2	0.52
2018	1230	6th Concession Rd	(to) Dejong Rd-to-850m W of Tanny Lane	CRK	$	3,352	83.76	83.76	2	1.26
2018	2040	Connell Pl	(to) Alta Vista Dr-to-West End	CRK	$	133	83.76	83.76	2	0.05
2018	110	McIntosh Rd	(to) Merwin Lane, South Leg-to-County Rd 18	CRK	$	4,229	94.55	94.55	2	1.59
2018	130	McIntosh Rd	(to) Merwin Lane, North Leg-to-Merwin Lane, South Leg	CRK	$	1,091	94.55	94.55	2	0.41
2018	610	Charlville Rd	(to) 1000m N of County Road 26-to-4th Concession Rd	CRK	$	2,687	89.73	89.73	2	1.01
2018	220	2nd Concession Rd	(to) 1500m E of Townline-to-300m West of County Road 15	CRK	$	3,884	94.55	94.55	2	1.46
2018	7310	Meadowview Drive	(to) West End Cul De Sac-to-2nd Concession Rd	CRK	$	1,037	89.73	89.73	2	0.39
2018	150	McIntosh Rd	(to) North Campbell Rd-to-320m E of North Campbell Road	CRK	$	851	94.55	94.55	2	0.32
2018	3040	Robert St	(to) Stewart Dr-to-County Rd 26	CRK	$	1,250	89.73	89.73	2	0.47
2018	7020	West Mclean Blvd	(to) Wood St-to-Jane St	CRK	$	745	94.55	94.55	2	0.28
2018	4010	Montana Way	(to) County Rd 15-to-Cheyanne Tr	CRK	$	931	94.55	94.55	2	0.35
2018	970	Branch Rd	(to) 800m E of Hart Road-to-520m E of Kyle Road	CRK	$	4,761	94.55	94.55	2	1.79
2018	7010	Wood St	(to) County Rd 2-to-Bernard Cres	CRK	$	426	94.55	94.55	2	0.16
2018	App001	Apple Blossom Drive	(to) County Road 2-to-Old Orchard Drive	CRK	$	1,729	94.55	94.55	2	0.65
2018	OLD001	Old Orchard Drive	(to) West End-to-West Mclean Blvd	CRK	$	718	94.55	94.55	2	0.27
2018	Wes001	West Mclean Blvd	(to) 120m North of Jane Street-to-Old Orchard Drive	CRK	$	266	94.55	94.55	2	0.1
2018	590	Maple Ave	(to) Hillbrook Rd-to-County Rd 18	CRK	$	5,746	94.55	94.55	2	2.16
2018	7040	West Mclean Blvd	(to) Jane St-to-North End	CRK	$	319	94.55	94.55	2	0.12
2018	7300	Kemp St	(to) Second Concession Rd-to-Meadowview Dr	CRK	$	293	94.55	94.55	2	0.11
2018	3030	Stewart Dr	(to) Broad St-to-Charleville Rd	CRK	$	1,277	94.55	94.55	2	0.48
2018	280	Bisseltown Rd	(to) Knapp Dr-to-County Rd 15	PR2	$	542,734	29.36	100		2.46
2018	670	4th Concession Rd	(to) 800m E of Ashby Rd-to-Blue Church Road	PR2	$	211,225	5	100		0.99
2018	945	Kyle Rd	(to) County Road 21-to-300m N of County Road 21	PR2	$	65,167	5	100		0.3
2018	7090	George St	(to) County Rd 2-to-Sarah St	PR2	$	45,634	20	100		0.23

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type	Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2018	1070	Ferguson Rd	(to) Cooper Rd-to-Forsyth Rd	BSgravel	$ 100,771	33.63	95		0.82
2018	400	Algonquin Rd	(to) Dejong Rd-to-200m E of Dejong Rd	PR2	$ 46,222	20	100		0.22
2018	1240	Tanney Road	(to) Algonquin Rd-to-6th Concession Rd	BSgravel	$ 38,097	38.77	95		0.31
2018	7130	Richmond St	(to) Church St-to-Amherst St	PR2	$ 8,594	24.98	100		0.04
					$ 1,098,212				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2019	1085	Forsythe Rd	(to) Shanty Trail-to-Augusta / North Grenville Town Limit	GRR2	$	86,940	65.7	85.7		3.22
2019	880	Jellyby Rd	(to) Rock Springs Road / Jellyby Road Intersection-to-County Rd 15	PR2	$	319,219	10	100		1.53
2019	1110	Weir Rd	(to) County Rd 18-to-Augusta/Edwardsburgh Townline	PR2	$	380,575	32.98	100		1.77
2019	270	Bisseltown Rd	(to) Spicer Rd-to-Knapp Dr	PR2	$	168,796	27.75	100		0.74
2019	1030	Brooks Rd	(to) County Rd 18-to-County Rd 18	GRR2	$	71,568	65.7	85.7		1.42
2019	5030	Baker St	(to) Corbett St-to-4th Concession Rd	R1	$	82,180	51.35	97		0.68
					$	**1,109,278**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2020	1235	6th Concession Rd	(to) 850m W of Tanny Lane-to-Tanney Road	CRK	$	2,261	83.76	83.76	2	0.85
2020	180	2nd Concession Rd	(to) County Rd 31 - Blue Church Rd-to-900m E of Rocky Rd	CRK	$	9,390	94.55	94.55	2	3.53
2020	140	McIntosh Rd	(to) 320m E of North Campbell Road-to-Merwin Lane, North Leg	CRK	$	4,442	94.55	94.55	2	1.67
2020	1170	Charleville Rd	(to) 6th Concession Rd-to-County Rd 21	CRK	$	7,687	94.55	94.55	2	2.89
2020	7270	Pine St	(to) Meikle Drive-to-Cedar St	CRK	$	559	94.55	94.55	2	0.21
2020	4030	Cheyenne Tr	(to) Algonquin Rd-to-North End, 50m N of Montana Way	CRK	$	612	94.55	94.55	2	0.23
2020	1245	6th Concession Rd	(to) Tanney Road-to-Charleville Rd	CRK	$	5,772	94.55	94.55	2	2.17
2020	7250	Meikle Dr	(to) John St-to-Oak St	CRK	$	665	94.55	94.55	2	0.25
2020	7280	Oak St	(to) County Rd 15 (Church St)-to-Cedar St	CRK	$	931	94.55	94.55	2	0.35
2020	7210	Cedar St	(to) John St-to-Oak St	CRK	$	692	94.55	94.55	2	0.26
2020	7220	Cedar St	(to) Oak St-to-N End Cul De Sac	CRK	$	878	94.55	94.55	2	0.33
2020	1085	Forsythe Rd	(to) Shanty Trail-to-Augusta / North Grenville Town Limit	GRR	$	21,735	85.7	85.7	3	3.22
2020	5030	Baker St	(to) Corbett St-to-4th Concession Rd	CRK	$	1,809	97	97	2	0.68
2020	90	Merwin Ln	(to) County Rd 2-to-South Limit 401 ROW	PR2	$	434,218	39.27	100		2.02
2020	7200	Cedar St	(to) County Rd 15-to-John St	R1	$	99,063	48.82	97		0.83
2020	390	Algonquin Rd	(to) 60m E of Cheyenne Trail-to-Dejong Rd	R1	$	217,651	53.91	97		1.91
2020	630	Merwin Ln	(to) McIntosh Rd-to-County Rd 26	R1	$	225,700	48.82	97		1.81
2020	7240	Meikle Dr	(to) Cedar St-to-John St	R1	$	56,461	53.91	97		0.44
2020	380	Algonquin Rd	(to) County Rd 15-to-150m E of County Rd 15	MICRO	$	4,950	74.48	74.48	3	0.15
2020	900	Hart Rd	(to) Branch Rd-to-400m N of Branch Rd	GRR	$	10,080	70.21	70.21	3	0.4
					$	**1,105,556**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2021	640	4th Concession Rd	(to) Blue Church Rd-to-Charleville Rd	SST	$	20,639	77.27	95		0.91
2021	650	Blue Church Rd	(to) 4th Concession Rd-to-700m N of County Rd 26	SST	$	30,164	77.27	95		1.33
2021	170	2nd Concession Rd	(to) North Campbell Rd-to-County Rd 31	CRK	$	3,112	97	97	2	1.17
2021	240	Bethel Rd	(to) Augusta/Elizabethtown Townline-to-County Rd 26	CRK	$	2,155	97	97	2	0.81
2021	7240	Meikle Dr	(to) Cedar St-to-John St	CRK	$	1,170	97	97	2	0.44
2021	390	Algonquin Rd	(to) 60m E of Cheyenne Trail-to-Dejong Rd	CRK	$	5,081	97	97	2	1.91
2021	550	McCully Rd	(to) 4th Concession Rd-to-200m N of 4th Concession	CRK	$	532	97	97	2	0.2
2021	160	North Campbell Rd	(to) McIntosh Rd-to-2nd Concession Rd	CRK	$	771	97	97	2	0.29
2021	630	Merwin Ln	(to) McIntosh Rd-to-County Rd 26	CRK	$	4,815	97	97	2	1.81
2021	7200	Cedar St	(to) County Rd 15-to-John St	CRK	$	2,208	97	97	2	0.83
2021	1160	Charleville Rd	(to) 300m N of Algonquin Rd-to-6th Concession Rd	R1	$	216,276	51.35	97		1.84
2021	980	Branch Rd	(to) 520m E of Kyle Road-to-County Rd 18	R1	$	253,891	51.35	97		2.13
2021	1180	Buker Rd	(to) Charleville Rd-to-County Rd 21	BSgravel	$	100,900	36.9	95		0.81
2021	7180	Jones Court	(to) S End Cul De Sac-to-N End Cul De Sac	PR2	$	205,258	10	100		0.82
2021	7260	John St	(to) County Rd 15-to-Cedar St	R1	$	46,606	56.5	97		0.37
2021	7290	Willow St	(to) Oak St-to-Cedar St	R1	$	52,904	56.5	97		0.42
2021	690	Ashby Rd	(to) West End-to-Lord Mills Rd	GRR2	$	42,509	65.7	85.7		0.82
2021	100	Merwin Ln	(to) North Limit 401 ROW-to-McIntosh Rd	R2	$	108,025	41.55	100		0.51
2021	1240	Tanney Road	(to) Algonquin Rd-to-6th Concession Rd	GRR	$	6,696	86.21	86.21	3	0.31
2021	385	Algonquin Rd	(to) 150m East of County Road 15-to-60m E of Cheyenne Trail	MICRO	$	7,484	76.92	76.92	3	0.27
					$	**1,111,196**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2022	930	Branch Rd	(to) 1100m East of Klitbo Road-to-Hart Rd	CRK	$	6,783	97	97	2	2.55
2022	20	Irace Dr	(to) County Rd 2-to-Irace Dr	CRK	$	3,086	97	97	2	1.16
2022	30	Riverdale Cr	(to) Irace Dr-to-West End Cul de Sac	CRK	$	665	97	97	2	0.25
2022	7170	Lorena Lane	(to) County Rd 15-to-Jones Crt	CRK	$	452	97	97	2	0.17
2022	7065	East McLean Blvd	(to) Thompson St-to-East End	CRK	$	665	97	97	2	0.25
2022	7260	John St	(to) County Rd 15-to-Cedar St	CRK	$	984	97	97	2	0.37
2022	7290	Willow St	(to) Oak St-to-Cedar St	CRK	$	1,117	97	97	2	0.42
2022	1160	Charleville Rd	(to) 300m N of Algonquin Rd-to-6th Concession Rd	CRK	$	4,894	97	97	2	1.84
2022	980	Branch Rd	(to) 520m E of Kyle Road-to-County Rd 18	CRK	$	5,666	97	97	2	2.13
2022	480	Skakum Rd	(to) 2200m E of Charleville Road-to-County Rd 18	R1	$	248,013	53.91	97		2.11
2022	760	DeJong Rd	(to) Lord Mills Rd-to-Algonquin Rd	BSgravel	$	317,995	28.51	95		2.22
2022	5010	Glen Small Rd	(to) County Rd 26-to-Augusta/Edwardsburgh/Cardinal Townline	PR2	$	268,036	22.17	100		1.35
2022	1120	Stephenson Rd	(to) Skakum Rd-to-North End	BSgravel	$	65,636	32.19	95		0.47
2022	330	6th Concession Rd	(to) Carpenter Rd-to-Algonquin Rd	BSgravel	$	125,062	32.19	95		0.8
2022	360	Algonquin Rd	(to) 700m W of County Road 15-to-350m W of County Rd 15	R1	$	39,691	59.1	97		0.35
2022	4020	Appaloosa Path	(to) Montana Way-to-North End Cul-de-sac	R1	$	21,726	59.1	97		0.16
					$	**1,110,471**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2023	660	Blue Chruch Rd	(to) County Rd 26-to-700m N of County Rd 26	SST	$	16,632	77.27	95		0.7
2023	600	4th Concession Rd	(to) Hillbrook Rd-to-Charleville Rd	SST	$	41,958	77.27	95		1.85
2023	470	Skakum Rd	(to) Charleville Rd-to-2200m E of Charleville Road	SST	$	53,856	77.27	95		2.2
2023	280	Bisseltown Rd	(to) Knapp Dr-to-County Rd 15	CRK	$	6,544	97	97	2	2.46
2023	250	Bisseltown Rd	(to) Bethel Rd-to-Spicer Rd	CRK	$	6,464	97	97	2	2.43
2023	190	2nd Concession Rd	(to) Rocky Rd-to-900m E of Rocky Rd	CRK	$	2,394	97	97	2	0.9
2023	7060	East McLean Blvd	(to) Jane St-to-Thompson Rd	CRK	$	825	97	97	2	0.31
2023	7050	Jane St	(to) West Mclean Blvd-to-Sarah St	CRK	$	372	97	97	2	0.14
2023	585	Hillbrook Rd	(to) County Road 26-to-Maple Ave	CRK	$	1,144	97	97	2	0.43
2023	7100	Thompson St	(to) Sarah St-to-East McLean St	CRK	$	399	97	97	2	0.15
2023	7110	Bernard Cres	(to) Wood St-to-Sarah St	CRK	$	1,197	97	97	2	0.45
2023	7090	George St	(to) County Rd 2-to-Sarah St	CRK	$	612	97	97	2	0.23
2023	4020	Appaloosa Path	(to) Montana Way-to-North End Cul-de-sac	CRK	$	426	97	97	2	0.16
2023	400	Algonquin Rd	(to) Dejong Rd-to-200m E of Dejong Rd	CRK	$	585	97	97	2	0.22
2023	670	4th Concession Rd	(to) 800m E of Ashby Rd-to-Blue Church Road	CRK	$	2,633	97	97	2	0.99
2023	360	Algonquin Rd	(to) 700m W of County Road 15-to-350m W of County Rd 15	CRK	$	931	97	97	2	0.35
2023	480	Skakum Rd	(to) 2200m E of Charleville Road-to-County Rd 18	CRK	$	5,613	97	97	2	2.11
2023	570	4th Concession Rd	(to) McCully Rd-to-Hillbrook Rd	CRK	$	5,214	97	97	2	1.96
2023	945	Kyle Rd	(to) County Road 21-to-300m N of County Road 21	CRK	$	798	97	97	2	0.3
2023	7130	Richmond St	(to) Church St-to-Amherst St	CRK	$	106	97	97	2	0.04
2023	1080	Forsythe Rd	(to) County Road 21-to-Shanty Trail	BSgravel	$	794,316	27.45	95		5.63
2023	740	Lord Mills Rd	(to) 700m N of County Rd 26-to-1400m N of County Rd 26	R1	$	88,174	56.5	97		0.7
2023	455	Algonquin Rd	(to) 890m E of Glenmore Road-to-1150m W of Charleville Road	PR2	$	48,958	26.29	100		0.23
2023	430	Glenmore Rd	(to) Algonquin Rd-to-Algonquin Rd	GRR2	$	30,326	45.48	65.48		0.54
					$	**1,110,477**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2024	1110	Weir Rd	(to) County Rd 18-to-Augusta/Edwardsburgh Townline	CRK	$	4,708	97	97	2	1.77
2024	270	Bisseltown Rd	(to) Spicer Rd-to-Knapp Dr	CRK	$	1,968	97	97	2	0.74
2024	740	Lord Mills Rd	(to) 700m N of County Rd 26-to-1400m N of County Rd 26	CRK	$	1,862	97	97	2	0.7
2024	880	Jellyby Rd	(to) Rock Springs Road / Jellyby Road Intersection-to-County Rd 15	CRK	$	4,070	97	97	2	1.53
2024	790	Dixon Rd	(to) County Rd 15-to-1700m E of County Rd 15	R1	$	194,132	53.91	97		1.7
2024	1030	Brooks Rd	(to) County Rd 18-to-County Rd 18	GRR2	$	71,568	65.7	85.7		1.42
2024	820	Wiltsie Rd	(to) Seeker Rd-to-Bend at N End at Townline/ Wiltsie Intersection	BSgravel	$	359,516	29.64	95		2.37
2024	770	DeJong Rd	(to) Algonquin Rd-to-6th Concession Rd	PR2	$	375,848	20	100		1.78
2024	900	Hart Rd	(to) Branch Rd-to-400m N of Branch Rd	GRR2	$	20,160	65.7	85.7		0.4
2024	370	Algonquin Rd	(to) 350m W of County Rd 15-to-County Rd 15	R1	$	42,106	53.91	97		0.35
2024	430	Glenmore Rd	(to) Algonquin Rd-to-Algonquin Rd	GRR2	$	30,326	65.48	85.48		0.54
2024	2040	Connell Pl	(to) Alta Vista Dr-to-West End	MICRO	$	1,386	74.49	74.49	3	0.05
					$	**1,107,650**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2025	620	North Campbell Rd	(to) McIntosh Rd-to-County Rd 26	SST	$	43,772	77.27	95		1.93
2025	90	Merwin Ln	(to) County Rd 2-to-South Limit 401 ROW	CRK	$	5,373	97	97	2	2.02
2025	1070	Ferguson Rd	(to) Cooper Rd-to-Forsyth Rd	GRR2	$	35,424	65.7	85.7		0.82
2025	790	Dixon Rd	(to) County Rd 15-to-1700m E of County Rd 15	CRK	$	4,522	97	97	2	1.7
2025	370	Algonquin Rd	(to) 350m W of County Rd 15-to-County Rd 15	CRK	$	931	97	97	2	0.35
2025	2010	Sunnymeade Ave	(to) Merwin Ln-to-Avenue Rd	R1	$	39,894	51.35	97		0.33
2025	310	Bains Rd	(to) Augusta/Elizabethtown Townline-to-Knapp Dr	BSgravel	$	118,703	28.51	95		0.85
2025	1130	Johnston Rd	(to) Charleville Rd-to-Skakum Rd	BSgravel	$	267,861	28.51	95		1.87
2025	1220	6th Concession Rd	(to) Charleville Rd-to-1350m West of County Road 18	PR2	$	509,204	22.17	100		2.45
2025	7190	Alexander Rd	(to) Jones Court-to-County Rd 15	PR2	$	42,599	15	100		0.17
2025	380	Algonquin Rd	(to) County Rd 15-to-150m E of County Rd 15	R1	$	40,288	69.47	97		0.15
					$	**1,108,571**				

Augusta Township

10 Year Work Plan from Performance Model - Current Funding Level

Year	Asset ID	Street Name	Description	Improvement Type		Cost	Start Cond	End Cond	Yrs Hold	Length (km)
2026	380	Algonquin Rd	(to) County Rd 15-to-150m E of County Rd 15	CRK	$	399	97	97	2	0.15
2026	100	Merwin Ln	(to) North Limit 401 ROW-to-McIntosh Rd	CRK	$	1,357	97	97	2	0.51
2026	7180	Jones Court	(to) S End Cul De Sac-to-N End Cul De Sac	CRK	$	2,181	97	97	2	0.82
2026	2010	Sunnymeade Ave	(to) Merwin Ln-to-Avenue Rd	CRK	$	878	97	97	2	0.33
2026	920	Branch Rd	(to) Klitbo Rd-to-1100m E of Klitbo Rd	R1	$	126,260	64.32	97		1.1
2026	340	6th Concession Rd	(to) Algonquin Rd-to-County Rd 15	BSgravel	$	187,560	27.45	95		1.29
2026	1090	6th Concession Rd	(to) County Rd 18-to-East End	BSgravel	$	204,783	35.2	95		1.56
2026	300	Algonquin Rd	(to) Knapp Dr-to-6th Concession Rd	BSgravel	$	346,948	27.45	95		2.34
2026	320	Carpenter Rd	(to) Augusta/Elizabethtown Townline-to-Algonquin Rd	BSgravel	$	121,261	27.45	95		0.81
2026	690	Ashby Rd	(to) West End-to-Lord Mills Rd	GRR2	$	42,509	65.7	85.7		0.82
2026	420	Glenmore Rd	(to) 6th Concession Rd-to-Algonquin Rd	BSgravel	$	50,888	35.2	95		0.35
2026	2020	Avenue Rd	(to) Alta Vista Dr-to-Sunnymeade Ave	R1	$	22,969	69.47	97		0.19
					$	**1,107,993**				

Appendix G: Roads with Sub-Standard Width

Substandard Width

NOW Needs with Substandard Width

Asset ID	Street Name	From Description	To Description	Length	RDSD	Width	TON
0440	Glenmore Rd	Algonquin Rd	South End	0.210	R	4.80	NOW
0490	Patterson Rd	County Rd 18	Township Limit	0.790	R	4.20	NOW
0520	Maple Ave	County Rd 18	East End	0.430	R	4.00	NOW
0530	Barton Rd	County Rd 18	East End	0.700	R	5.30	NOW
0710	Sear Farm Road	Lord Mills Rd (at bend)	North End	0.120	R	4.60	NOW
0850	Finucan Rd	County Rd 21	North End	0.170	S	4.80	NOW
0885	Kinch Rd	Augusta/Elizabethtown-Kitley Townline	County Rd 15	0.160	R	4.50	NOW
0910	Hart Rd	400m N of Branch Rd	Land O'Nod Rd	2.340	R	2.50	NOW
1040	Boomhouwer Rd	County Rd 18	Limerick Rd	0.430	R	4.50	NOW
1070	Ferguson Rd	Cooper Rd	Forsyth Rd	0.820	R	5.00	NOW
1190	Mcleansville Rd Loop	County Rd 21	County Rd 21	0.700	R	5.20	NOW
1200	Mcleansville Rd	6th Concession Rd	Mcleansville Rd Loop	2.180	R	5.20	NOW
6050	Amelia St	West End	Mill St	0.150	S	4.90	NOW
7150	Amherst St	Richmond St	East End	0.050	S	3.50	NOW
7160	Philips St	Church St	East End	0.060	S	2.90	NOW
Gar001	Garretton Road	County Road 18	North End	0.150	R	4.00	NOW
UnNamed1	UnNamed1	South End	6th Concession Rd	0.330	R	4.60	NOW
UnNamed2	UnNamed2	County Road 15	East End	0.430	R	4.00	NOW
Grand Total Count: 18				10.220			

Appendix H: Critical Deficiencies by Asset ID

Critical Deficiencies by Street Name

Current Inspection Batch

ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
0170	2nd Concession Rd	North Campbell Rd	County Rd 31	1.170	450	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0180	2nd Concession Rd	County Rd 31 - Blue Church Rd	900m E of Rocky Rd	3.530	400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0190	2nd Concession Rd	Rocky Rd	900m E of Rocky Rd	0.900	400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0200	2nd Concession Rd	1400m W of Rocky Rd	Rocky Rd	1.400	400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0210	2nd Concession Rd	County Rd 15	1400m W of Rocky Rd	0.730	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0220	2nd Concession Rd	1500m E of Townline	300m West of County Road 15	1.460	400	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0230	2nd Concession Rd	Augusta/Elizabethtown Townline	1500m E of Townline	1.500	400	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0570	4th Concession Rd	McCully Rd	Hillbrook Rd	1.960	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0540	4th Concession Rd	McCully Rd	500m W of County Rd 18	0.490	200	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
0600	4th Concession Rd	Hillbrook Rd	Charleville Rd	1.850	211	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	SST++	6-10
0640	4th Concession Rd	Blue Church Rd	Charleville Rd	0.910	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0670	4th Concession Rd	800m E of Ashby Rd	Blue Church Road	0.990	150	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
5050	4th Concession Rd	500m W of County Rd 18	County Rd 18	0.500	200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
1220	6th Concession Rd	Charleville Rd	1350m West of County Road 18	2.450	300	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
1225	6th Concession Rd	1350m West of County Road 18	County Road 18	1.350	300	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	R2	1-5
1230	6th Concession Rd	Dejong Rd	850m W of Tanny Lane	1.260	374	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
1235	6th Concession Rd	850m W of Tanny Lane	Tanney Road	0.850	374	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
1245	6th Concession Rd	Tanney Road	Charleville Rd	2.170	374	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
1090	6th Concession Rd	County Rd 18	East End	1.560	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0780	6th Concession Rd	County Rd 15	DeJong Rd	3.110	199	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0330	6th Concession Rd	Carpenter Rd	Algonquin Rd	0.800	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0340	6th Concession Rd	Algonquin Rd	County Rd 15	1.290	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
7190	Alexander Rd	Jones Court	County Rd 15	0.170	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0350	Algonquin Rd	Knapp Dr	700m East of Knapp Road	0.700	150	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
0355	Algonquin Rd	700m East of Knapp Road	700m W of County Road 15	0.710	150	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0360	Algonquin Rd	700m W of County Road 15	350m W of County Rd 15	0.350	150	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0370	Algonquin Rd	350m W of County Rd 15	County Rd 15	0.350	150	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0380	Algonquin Rd	County Rd 15	150m E of County Rd 15	0.150	267	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0385	Algonquin Rd	150m East of County Road 15	60m E of Cheyenne Trail	0.270	225	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0390	Algonquin Rd	60m E of Cheyenne Trail	Dejong Rd	1.910	207	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0400	Algonquin Rd	Dejong Rd	200m E of Dejong Rd	0.220	207	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0410	Algonquin Rd	200m E of Dejong Rd	Glenmore Rd	3.270	207	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0300	Algonquin Rd	Knapp Dr	6th Concession Rd	2.340	73	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0450	Algonquin Rd	Glenmore Rd	890m E of Glenmore Road	0.890	121	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0455	Algonquin Rd	890m E of Glenmore Road	1150m W of Charleville Road	0.230	121	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0460	Algonquin Rd	1150m W of Charleville Road	Charleville Rd	1.150	121	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
2030	Alta Vista Dr	County Rd 2	Sunset Dr	0.610	170	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
6050	Amelia St	West End	Mill St	0.150	40	ADEQ	6-10	ADEQ	1-5	NOW	ADEQ	BS	ADEQ
7150	Amherst St	Richmond St	East End	0.050	50	ADEQ	6-10	ADEQ	ADEQ	NOW	NOW	RECgra	NOW
4020	Appaloosa Path	Montana Way	North End Cul-de-sac	0.160	50	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
App001	Apple Blossom Drive	County Road 2	Old Orchard Drive	0.650	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0690	Ashby Rd	West End	Lord Mills Rd	0.820	40	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ

Critical Deficiencies by Street Name

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ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
2020	Avenue Rd	Alta Vista Dr	Sunnymeade Ave	0.190	220	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0310	Bains Rd	Augusta/Elizabethtown Townline	Knapp Dr	0.850	50	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	BSgrave	NOW
5030	Baker St	Corbett St	4th Concession Rd	0.680	100	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
0530	Barton Rd	County Rd 18	East End	0.700	60	ADEQ	1-5	NOW	ADEQ	NOW	ADEQ	BSgrave	NOW
7110	Bernard Cres	Wood St	Sarah St	0.450	250	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0240	Bethel Rd	Augusta/Elizabethtown Townline	County Rd 26	0.810	600	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0250	Bisseltown Rd	Bethel Rd	Spicer Rd	2.430	463	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0270	Bisseltown Rd	Spicer Rd	Knapp Dr	0.740	463	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0280	Bisseltown Rd	Knapp Dr	County Rd 15	2.460	463	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0660	Blue Chruch Rd	County Rd 26	700m N of County Rd 26	0.700	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0650	Blue Church Rd	4th Concession Rd	700m N of County Rd 26	1.330	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
1040	Boomhouwer Rd	County Rd 18	Limerick Rd	0.430	20	ADEQ	ADEQ	ADEQ	NOW	NOW	ADEQ	RECgra	ADEQ
2060	Bradley Cres	County Rd 2	North End	0.190	50	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
6010	Branch Rd	County Rd 15	390m E of County Road 15	0.390	671	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	REC	NOW
0870	Branch Rd	390m E of County Road 15	Klitbo Rd	0.960	671	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
0920	Branch Rd	Klitbo Rd	1100m E of Klitbo Rd	1.100	671	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0930	Branch Rd	1100m East of Klitbo Road	Hart Rd	2.550	671	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0960	Branch Rd	Hart Rd	800m E of Hart Rd	0.800	358	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0970	Branch Rd	800m E of Hart Road	520m E of Kyle Road	1.790	358	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0980	Branch Rd	520m E of Kyle Road	County Rd 18	2.130	358	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
3020	Broad St	Charleville Rd	East End	0.220	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
1030	Brooks Rd	County Rd 18	County Rd 18	1.420	50	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	SD	NOW
0810	Brown Rd	Wiltsie Rd	County Rd 15	1.920	118	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
1180	Buker Rd	Charleville Rd	County Rd 21	0.810	30	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	BSgrave	ADEQ
0010	Burnside Dr	County Rd 2	South End Cul de Sac	0.280	250	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
0320	Carpenter Rd	Augusta/Elizabethtown Townline	Algonquin Rd	0.810	50	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	BSgrave	NOW
0325	Carpenter Rd	Carpenter Rd	6th Concession Rd	0.510	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0510	Cedar Grove Rd	County Rd 18	Augusta/Edwardsburgh/Cardinal Townline	0.790	200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
7200	Cedar St	County Rd 15	John St	0.830	240	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
7210	Cedar St	John St	Oak St	0.260	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
7220	Cedar St	Oak St	N End Cul De Sac	0.330	150	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
3010	Charleville Rd	County Rd 26	1000m N of County Rd 26	1.000	500	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
1140	Charleville Rd	4th Concession Rd	Skakum Rd	2.070	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
1150	Charleville Rd	Skakum Rd	300m N of Algonquin Rd	0.520	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
1160	Charleville Rd	300m N of Algonquin Rd	6th Concession Rd	1.840	300	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1170	Charleville Rd	6th Concession Rd	County Rd 21	2.890	410	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0610	Charlville Rd	1000m N of County Road 26	4th Concession Rd	1.010	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
4030	Cheyenne Tr	Algonquin Rd	North End, 50m N of Montana Way	0.230	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
7120	Church St	County Rd 2	County Rd 15	0.530	200	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW
0840	Colville Rd	County Rd 15	County Rd 21	2.490	186	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BS	6-10
2040	Connell Pl	Alta Vista Dr	West End	0.050	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10

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ID	Street Name	From Description	To Description	Length	AADT	Cap.	Drain	Geo	SA	Width	Type	Imp	Overall TON
1050	Cooper Rd	Ferguson Rd	Augusta/North Grenville Townline	1.760	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
1060	Cooper Rd	County Rd 18	Ferguson Rd	2.970	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
5020	Corbett St	County Rd 18	Barker Dr	0.390	50	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0760	DeJong Rd	Lord Mills Rd	Algonquin Rd	2.220	150	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BSgrave	NOW
0770	DeJong Rd	Algonquin Rd	6th Concession Rd	1.780	175	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0990	Diamond Rd	Hall Rd	County Rd 18	1.320	25	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
0790	Dixon Rd	County Rd 15	1700m E of County Rd 15	1.700	302	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0800	Dixon Rd	1700m E of County Rd 15	East End	1.260	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
7060	East McLean Blvd	Jane St	Thompson Rd	0.310	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
7065	East McLean Blvd	Thompson St	East End	0.250	150	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
1070	Ferguson Rd	Cooper Rd	Forsyth Rd	0.820	50	ADEQ	1-5	ADEQ	NOW	NOW	ADEQ	BSgrave	NOW
0850	Finucan Rd	County Rd 21	North End	0.170	40	ADEQ	6-10	ADEQ	ADEQ	NOW	NOW	RECgra	ADEQ
1080	Forsythe Rd	County Road 21	Shanty Trail	5.630	50	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BSgrave	NOW
1085	Forsythe Rd	Shanty Trail	Augusta / North Grenville Town Limit	3.220	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
Gar001	Garretton Road	County Road 18	North End	0.150	10	ADEQ	6-10	ADEQ	ADEQ	NOW	ADEQ	RECgra	ADEQ
7090	George St	County Rd 2	Sarah St	0.230	90	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
5010	Glen Small Rd	County Rd 26	Augusta/Edwardsburgh/Cardinal Townline	1.350	200	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0420	Glenmore Rd	6th Concession Rd	Algonquin Rd	0.350	207	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0430	Glenmore Rd	Algonquin Rd	Algonquin Rd	0.540	50	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0440	Glenmore Rd	Algonquin Rd	South End	0.210	20	ADEQ	6-10	ADEQ	NOW	NOW	ADEQ	RECgra	ADEQ
1000	Hall Rd	Kyle Rd	County Road 18	5.100	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0900	Hart Rd	Branch Rd	400m N of Branch Rd	0.400	50	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0910	Hart Rd	400m N of Branch Rd	Land O'Nod Rd	2.340	5	ADEQ	NOW	ADEQ	NOW	NOW	ADEQ	None	ADEQ
1020	Harvey Rd	Kyle Rd	County Rd 18	2.230	50	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0580	Hillbrook Rd	Maple Ave	4th Concession Rd	1.850	223	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	BS	NOW
0585	Hillbrook Rd	County Road 26	Maple Ave	0.430	223	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0020	Irace Dr	County Rd 2	Irace Dr	1.160	160	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
7050	Jane St	West Mclean Blvd	Sarah St	0.140	70	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0880	Jellyby Rd	Rock Springs Road / Jellyby Road Intersection	County Rd 15	1.530	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0882	Jellyby Rd	Elizabethtown-Kitley Townline	Rock Springs Road / Jellyby Road Intersection	0.260	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
7260	John St	County Rd 15	Cedar St	0.370	200	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
1130	Johnston Rd	Charleville Rd	Skakum Rd	1.870	50	ADEQ	6-10	NOW	ADEQ	ADEQ	ADEQ	BSgrave	NOW
7180	Jones Court	S End Cul De Sac	N End Cul De Sac	0.820	200	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
5040	Kelso St	Baker Dr	Corbett St	0.440	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
7300	Kemp St	Second Concession Rd	Meadowview Dr	0.110	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0885	Kinch Rd	Augusta/Elizabethtown-Kitley Townline	County Rd 15	0.160	10	ADEQ	6-10	ADEQ	NOW	NOW	ADEQ	RECgra	ADEQ
0860	Klitbo Rd	County Rd 21	Branch Rd	1.810	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0290	Knapp Dr	Bisseltown Rd	Algonquin Rd	1.360	50	ADEQ	1-5	NOW	NOW	ADEQ	ADEQ	REC	NOW
1005	Kyle Rd	Hall Rd	Branch Rd	2.230	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
1010	Kyle Rd	Branch Rd	Harvey Rd	2.330	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10

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0945	Kyle Rd	County Road 21	300m N of County Road 21	0.300	90	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0950	Kyle Rd	300m N of County Road 21	Branch Rd	2.060	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	GRRplu	6-10
0890	Land O'Nod Rd	County Rd 15	Augusta/Merrickville/Wolford Townline	4.380	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
LEM001	Lemon Lane	County Road 2	East End	0.130	50	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	RNS	NOW
0730	Lord Mills Rd	County Rd 26	700m N of County Rd 26	0.700	320	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0740	Lord Mills Rd	700m N of County Rd 26	1400m N of County Rd 26	0.700	300	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0750	Lord Mills Rd	1400m N of County Rd 26	DeJong Rd	1.680	300	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0700	Lord Mills Rd	DeJong Rd	Ashby Rd	2.350	150	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
0680	Lord Mills Rd	Ashby Rd	800m E of Ashby Rd	0.800	150	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
7170	Lorena Lane	County Rd 15	Jones Crt	0.170	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
6030	Main St	West End	County Rd 15	0.380	150	ADEQ	6-10	ADEQ	6-10	ADEQ	ADEQ	RNS	6-10
6020	Main St E	County Rd 15	East End	0.070	50	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RNS	1-5
7230	Maitland Dr	Cedar St	Cedar St	0.370	110	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0590	Maple Ave	Hillbrook Rd	County Rd 18	2.160	189	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0520	Maple Ave	County Rd 18	East End	0.430	50	ADEQ	6-10	NOW	ADEQ	NOW	ADEQ	RECgra	NOW
1210	McCrea Rd	6th Concession Rd	County Rd 18	2.490	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
1100	McCully Rd	Skakum Rd	County Rd 18	0.730	100	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
0550	McCully Rd	4th Concession Rd	200m N of 4th Concession	0.200	100	ADEQ	ADEQ	NOW	ADEQ	ADEQ	ADEQ	RSpLim	NOW
0560	McCully Rd	200m N of 4th Concession	Skakum Rd	1.390	50	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	GRR	ADEQ
0110	McIntosh Rd	Merwin Lane, South Leg	County Rd 18	1.590	958	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
0130	McIntosh Rd	Merwin Lane, North Leg	Merwin Lane, South Leg	0.410	958	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
0140	McIntosh Rd	320m E of North Campbell Road	Merwin Lane, North Leg	1.670	958	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	NONE	ADEQ
0150	McIntosh Rd	North Campbell Rd	320m E of North Campbell Road	0.320	958	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
1200	Mcleansville Rd	6th Concession Rd	Mcleansville Rd Loop	2.180	50	ADEQ	1-5	ADEQ	NOW	NOW	ADEQ	RECgra	NOW
1190	Mcleansville Rd Loop	County Rd 21	County Rd 21	0.700	50	ADEQ	6-10	NOW	ADEQ	NOW	ADEQ	RECgra	NOW
7310	Meadowview Drive	West End Cul De Sac	2nd Concession Rd	0.390	220	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
7240	Meikle Dr	Cedar St	John St	0.440	200	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
7250	Meikle Dr	John St	Oak St	0.250	120	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0090	Merwin Ln	County Rd 2	South Limit 401 ROW	2.020	600	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	PR2	1-5
0100	Merwin Ln	North Limit 401 ROW	McIntosh Rd	0.510	630	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	R2	1-5
0630	Merwin Ln	McIntosh Rd	County Rd 26	1.810	300	ADEQ	ADEQ	ADEQ	1-5	ADEQ	ADEQ	R1	1-5
6040	Mill St	County Rd 15	North End	0.310	100	ADEQ	6-10	ADEQ	1-5	ADEQ	ADEQ	RSS	1-5
4010	Montana Way	County Rd 15	Cheyanne Tr	0.350	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0620	North Campbell Rd	McIntosh Rd	County Rd 26	1.930	106	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
0160	North Campbell Rd	McIntosh Rd	2nd Concession Rd	0.290	337	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	SD	ADEQ
7280	Oak St	County Rd 15 (Church St)	Cedar St	0.350	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
OLD001	Old Orchard Drive	West End	West Mclean Blvd	0.270	125	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0490	Patterson Rd	County Rd 18	Township Limit	0.790	50	ADEQ	6-10	ADEQ	NOW	NOW	ADEQ	RECgra	NOW
7160	Philips St	Church St	East End	0.060	50	ADEQ	1-5	ADEQ	6-10	NOW	ADEQ	REC	NOW
7270	Pine St	Meikle Drive	Cedar St	0.210	60	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
7130	Richmond St	Church St	Amherst St	0.040	80	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
7140	Richmond St	Amherst St	County Rd 2	0.210	80	ADEQ	1-5	ADEQ	NOW	ADEQ	ADEQ	RSS	NOW

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0030	Riverdale Cr	Irace Dr	West End Cul de Sac	0.250	50	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
3040	Robert St	Stewart Dr	County Rd 26	0.470	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
0720	Rocky Rd	1100m S of County Rd 26	County Rd 26	1.100	150	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0725	Rocky Rd	2nd Concession Rd	1100m S of County Rd 26	1.060	150	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
0940	S Branch Rd	Klitbo Rd	Kyle Rd	4.570	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	6-10
0070	Saint Lawrence Ct	County Rd 2	East and West Cul de Sacs	0.280	100	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
7070	Sarah St	Jane St	George St	0.640	300	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
7080	Sarah St	Church St	County Rd 15	0.200	380	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
0710	Sear Farm Road	Lord Mills Rd (at bend)	North End	0.120	10	ADEQ	1-5	ADEQ	NOW	NOW	ADEQ	RECgra	ADEQ
0470	Skakum Rd	Charleville Rd	2200m E of Charleville Road	2.200	100	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	SST	6-10
0480	Skakum Rd	2200m E of Charleville Road	County Rd 18	2.110	100	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0080	South Campbell Road	County Rd 2	North End	1.480	100	ADEQ	6-10	ADEQ	NOW	ADEQ	ADEQ	BS	NOW
0260	Spicer Rd	Augusta/Elizabethtown Townline	Bisseltown Rd	0.440	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	GRRplu	6-10
1120	Stephenson Rd	Skakum Rd	North End	0.470	20	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	ADEQ
3030	Stewart Dr	Broad St	Charleville Rd	0.480	100	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
2010	Sunnymeade Ave	Merwin Ln	Avenue Rd	0.330	220	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
2050	Sunset Dr	Avenue Rd	Merwin Line	0.490	250	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
1240	Tanney Road	Algonquin Rd	6th Concession Rd	0.310	20	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	ADEQ
7100	Thompson St	Sarah St	East McLean St	0.150	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	None	ADEQ
UnNamed1	UnNamed1	South End	6th Concession Rd	0.330	10	ADEQ	6-10	ADEQ	ADEQ	NOW	ADEQ	RECgra	ADEQ
UnNamed2	UnNamed2	County Road 15	East End	0.430	20	ADEQ	1-5	ADEQ	NOW	NOW	ADEQ	RECgra	ADEQ
1110	Weir Rd	County Rd 18	Augusta/Edwardsburgh Townline	1.770	835	ADEQ	ADEQ	ADEQ	NOW	ADEQ	ADEQ	PR2	NOW
7020	West Mclean Blvd	Wood St	Jane St	0.280	190	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
7040	West Mclean Blvd	Jane St	North End	0.120	70	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
Wes001	West Mclean Blvd	120m North of Jane Street	Old Orchard Drive	0.100	100	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
7290	Willow St	Oak St	Cedar St	0.420	200	ADEQ	ADEQ	ADEQ	6-10	ADEQ	ADEQ	R1	6-10
0820	Wiltsie Rd	Seeker Rd	Bend at N End at Townline/ Wiltsie Intersection	2.370	50	ADEQ	1-5	ADEQ	ADEQ	ADEQ	ADEQ	BSgrave	1-5
0830	Wiltsie Rd	Wiltsie Rd S	County Rd 15	1.780	50	ADEQ	6-10	ADEQ	ADEQ	ADEQ	ADEQ	SD	6-10
7010	Wood St	County Rd 2	Bernard Cres	0.160	200	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	ADEQ	CRK	ADEQ
				206.940									

Appendix I: 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
SST++										
14.00	0600	4th Concession Rd	Hillbrook Rd	Charleville Rd	211	1.850	6-10	Rehab	SST++	59,711.06
						1.850				59,711.06
SST										
15.00	0470	Skakum Rd	Charleville Rd	2200m E of Charleville Road	100	2.200	6-10	Rehab	SST	53,856.00
						2.200				53,856.00
R2										
29.00	0100	Merwin Ln	North Limit 401 ROW	McIntosh Rd	630	0.510	1-5	Rehab	R2	108,024.50
21.00	1225	6th Concession Rd	1350m West of County Road 18	County Road 18	300	1.350	1-5	Rehab	R2	291,112.79
						1.860				399,137.29
R1										
18.00	0390	Algonquin Rd	60m E of Cheyenne Trail	Dejong Rd	207	1.910	6-10	Rehab	R1	217,651.19
16.00	0980	Branch Rd	520m E of Kyle Road	County Rd 18	358	2.130	6-10	Rehab	R1	253,890.68
15.00	0790	Dixon Rd	County Rd 15	1700m E of County Rd 15	302	1.700	6-10	Rehab	R1	194,131.50
15.00	7200	Cedar St	County Rd 15	John St	240	0.830	1-5	Rehab	R1	99,062.66
14.00	7240	Meikle Dr	Cedar St	John St	200	0.440	6-10	Rehab	R1	56,460.62
14.00	0360	Algonquin Rd	700m W of County Road 15	350m W of County Rd 15	150	0.350	6-10	Rehab	R1	39,690.53
13.00	0370	Algonquin Rd	350m W of County Rd 15	County Rd 15	150	0.350	6-10	Rehab	R1	42,106.47
13.00	2010	Sunnymeade Ave	Merwin Ln	Avenue Rd	220	0.330	6-10	Rehab	R1	39,893.63
13.00	7260	John St	County Rd 15	Cedar St	200	0.370	6-10	Rehab	R1	46,606.13
13.00	5030	Baker St	Corbett St	4th Concession Rd	100	0.680	1-5	Rehab	R1	82,180.18
12.00	7290	Willow St	Oak St	Cedar St	200	0.420	6-10	Rehab	R1	52,904.25
12.00	0740	Lord Mills Rd	700m N of County Rd 26	1400m N of County Rd 26	300	0.700	6-10	Rehab	R1	88,173.75
12.00	0630	Merwin Ln	McIntosh Rd	County Rd 26	300	1.810	1-5	Rehab	R1	225,700.12
11.00	1160	Charleville Rd	300m N of Algonquin Rd	6th Concession Rd	300	1.840	6-10	Rehab	R1	216,276.36
8.00	0480	Skakum Rd	2200m E of Charleville Road	County Rd 18	100	2.110	6-10	Rehab	R1	248,012.57
8.00	4020	Appaloosa Path	Montana Way	North End Cul-de-sac	50	0.160	6-10	Rehab	R1	21,725.76
						16.130				1,924,466.40
PR2										
41.00	0930	Branch Rd	1100m East of Klitbo Road	Hart Rd	671	2.550	NOW	Rehab	PR2	534,210.59
33.00	1110	Weir Rd	County Rd 18	Augusta/Edwardsburgh Townline	835	1.770	NOW	Rehab	PR2	380,575.40
30.00	0270	Bisseltown Rd	Spicer Rd	Knapp Dr	463	0.740	NOW	Rehab	PR2	168,795.61
29.00	7090	George St	County Rd 2	Sarah St	90	0.230	NOW	Rehab	PR2	45,634.30
29.00	0090	Merwin Ln	County Rd 2	South Limit 401 ROW	600	2.020	1-5	Rehab	PR2	434,218.03
27.00	0280	Bisseltown Rd	Knapp Dr	County Rd 15	463	2.460	NOW	Rehab	PR2	542,733.61
27.00	1220	6th Concession Rd	Charleville Rd	1350m West of County Road 18	300	2.450	NOW	Rehab	PR2	509,203.96
27.00	0945	Kyle Rd	County Road 21	300m N of County Road 21	90	0.300	NOW	Rehab	PR2	65,166.71
26.00	0400	Algonquin Rd	Dejong Rd	200m E of Dejong Rd	207	0.220	NOW	Rehab	PR2	46,221.84
25.00	7180	Jones Court	S End Cul De Sac	N End Cul De Sac	200	0.820	NOW	Rehab	PR2	205,258.07

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
24.00	5010	Glen Small Rd	County Rd 26	Augusta/Edwardsburgh/Cardinal Townline	200	1.350	NOW	Rehab	PR2	268,036.02
24.00	7170	Lorena Lane	County Rd 15	Jones Crt	100	0.170	NOW	Rehab	PR2	40,238.96
24.00	0455	Algonquin Rd	890m E of Glenmore Road	1150m W of Charleville Road	121	0.230	NOW	Rehab	PR2	48,957.63
23.00	0670	4th Concession Rd	800m E of Ashby Rd	Blue Church Road	150	0.990	NOW	Rehab	PR2	211,224.77
23.00	0020	Irace Dr	County Rd 2	Irace Dr	160	1.160	NOW	Rehab	PR2	281,058.37
22.00	0880	Jellyby Rd	Rock Springs Road / Jellyby Road Intersection	County Rd 15	100	1.530	NOW	Rehab	PR2	319,219.05
22.00	7065	East McLean Blvd	Thompson St	East End	150	0.250	NOW	Rehab	PR2	54,298.35
21.00	0750	Lord Mills Rd	1400m N of County Rd 26	DeJong Rd	300	1.680	NOW	Rehab	PR2	382,672.62
21.00	0510	Cedar Grove Rd	County Rd 18	Augusta/Edwardsburgh/Cardinal Townline	200	0.790	NOW	Rehab	PR2	167,244.86
20.00	0730	Lord Mills Rd	County Rd 26	700m N of County Rd 26	320	0.700	NOW	Rehab	PR2	150,510.05
20.00	7190	Alexander Rd	Jones Court	County Rd 15	100	0.170	NOW	Rehab	PR2	42,598.51
20.00	7230	Maitland Dr	Cedar St	Cedar St	110	0.370	NOW	Rehab	PR2	84,299.85
19.00	0720	Rocky Rd	1100m S of County Rd 26	County Rd 26	150	1.100	NOW	Rehab	PR2	237,676.25
19.00	0725	Rocky Rd	2nd Concession Rd	1100m S of County Rd 26	150	1.060	NOW	Rehab	PR2	234,620.10
19.00	0770	DeJong Rd	Algonquin Rd	6th Concession Rd	175	1.780	NOW	Rehab	PR2	375,847.62
19.00	0030	Riverdale Cr	Irace Dr	West End Cul de Sac	50	0.250	NOW	Rehab	PR2	60,572.93
18.00	0460	Algonquin Rd	1150m W of Charleville Road	Charleville Rd	121	1.150	NOW	Rehab	PR2	253,562.79
18.00	5040	Kelso St	Baker Dr	Corbett St	100	0.440	NOW	Rehab	PR2	98,818.98
17.00	5020	Corbett St	County Rd 18	Barker Dr	50	0.390	NOW	Rehab	PR2	87,589.55
17.00	0700	Lord Mills Rd	DeJong Rd	Ashby Rd	150	2.350	1-5	Rehab	PR2	501,392.12
16.00	7130	Richmond St	Church St	Amherst St	80	0.040	NOW	Rehab	PR2	8,593.68
13.00	0680	Lord Mills Rd	Ashby Rd	800m E of Ashby Rd	150	0.800	1-5	Rehab	PR2	170,686.68
						32.310				7,011,737.86
SD										
21.00	0240	Bethel Rd	Augusta/Elizabethtown Townline	County Rd 26	600	0.810	6-10	Maint	SD	0.00
20.00	0150	McIntosh Rd	North Campbell Rd	320m E of North Campbell Road	958	0.320	6-10	Maint	SD	0.00
17.00	1030	Brooks Rd	County Rd 18	County Rd 18	50	1.420	NOW	Maint	SD	0.00
17.00	0830	Wiltsie Rd	Wiltsie Rd S	County Rd 15	50	1.780	6-10	Maint	SD	0.00
14.00	1000	Hall Rd	Kyle Rd	County Road 18	50	5.100	6-10	Maint	SD	0.00
14.00	1085	Forsythe Rd	Shanty Trail	Augusta / North Grenville Town Limit	50	3.220	6-10	Maint	SD	0.00
14.00	0170	2nd Concession Rd	North Campbell Rd	County Rd 31	450	1.170	6-10	Maint	SD	0.00
13.00	0110	McIntosh Rd	Merwin Lane, South Leg	County Rd 18	958	1.590	ADEQ	Maint	SD	0.00
13.00	0990	Diamond Rd	Hall Rd	County Rd 18	25	1.320	ADEQ	Maint	SD	0.00
13.00	1010	Kyle Rd	Branch Rd	Harvey Rd	50	2.330	6-10	Maint	SD	0.00
12.00	2040	Connell Pl	Alta Vista Dr	West End	50	0.050	6-10	Maint	SD	0.00
11.00	3010	Charleville Rd	County Rd 26	1000m N of County Rd 26	500	1.000	ADEQ	Maint	SD	0.00
11.00	3040	Robert St	Stewart Dr	County Rd 26	100	0.470	6-10	Maint	SD	0.00
10.00	3030	Stewart Dr	Broad St	Charleville Rd	100	0.480	6-10	Maint	SD	0.00
10.00	0220	2nd Concession Rd	1500m E of Townline	300m West of County Road 15	400	1.460	6-10	Maint	SD	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
8.00	0130	McIntosh Rd	Merwin Lane, North Leg	Merwin Lane, South Leg	958	0.410	ADEQ	Maint	SD	0.00
8.00	1230	6th Concession Rd	Dejong Rd	850m W of Tanny Lane	374	1.260	ADEQ	Maint	SD	0.00
7.00	0590	Maple Ave	Hillbrook Rd	County Rd 18	189	2.160	6-10	Maint	SD	0.00
1.00	0160	North Campbell Rd	McIntosh Rd	2nd Concession Rd	337	0.290	ADEQ	Maint	SD	0.00
						26.640				0.00
RSpLimit										
11.00	0550	McCully Rd	4th Concession Rd	200m N of 4th Concession	100	0.200	NOW	Maint	RSpLimit	0.00
						0.200				0.00
GRRplus										
14.00	0950	Kyle Rd	300m N of County Road 21	Branch Rd	50	2.060	6-10	Maint	GRRplus	73,418.40
11.00	0260	Spicer Rd	Augusta/Elizabethtown Townline	Bisseltown Rd	50	0.440	6-10	Maint	GRRplus	16,030.08
						2.500				89,448.48
CRK										
19.00	0920	Branch Rd	Klitbo Rd	1100m E of Klitbo Rd	671	1.100	ADEQ	Maint	CRK	2,926.00
14.00	0230	2nd Concession Rd	Augusta/Elizabethtown Townline	1500m E of Townline	400	1.500	ADEQ	Maint	CRK	3,990.00
12.00	2050	Sunset Dr	Avenue Rd	Merwin Line	250	0.490	ADEQ	Maint	CRK	1,303.40
12.00	7310	Meadowview Drive	West End Cul De Sac	2nd Concession Rd	220	0.390	ADEQ	Maint	CRK	1,037.40
11.00	2020	Avenue Rd	Alta Vista Dr	Sunnymeade Ave	220	0.190	ADEQ	Maint	CRK	505.40
10.00	1140	Charleville Rd	4th Concession Rd	Skakum Rd	300	2.070	ADEQ	Maint	CRK	5,506.20
10.00	1150	Charleville Rd	Skakum Rd	300m N of Algonquin Rd	300	0.520	ADEQ	Maint	CRK	1,383.20
10.00	0200	2nd Concession Rd	1400m W of Rocky Rd	Rocky Rd	400	1.400	ADEQ	Maint	CRK	3,724.00
10.00	0610	Charlville Rd	1000m N of County Road 26	4th Concession Rd	300	1.010	ADEQ	Maint	CRK	2,686.60
10.00	7080	Sarah St	Church St	County Rd 15	380	0.200	ADEQ	Maint	CRK	532.00
8.00	7070	Sarah St	Jane St	George St	300	0.640	ADEQ	Maint	CRK	1,702.40
8.00	7300	Kemp St	Second Concession Rd	Meadowview Dr	100	0.110	ADEQ	Maint	CRK	292.60
8.00	0210	2nd Concession Rd	County Rd 15	1400m W of Rocky Rd	300	0.730	ADEQ	Maint	CRK	1,941.80
8.00	2030	Alta Vista Dr	County Rd 2	Sunset Dr	170	0.610	ADEQ	Maint	CRK	1,622.60
8.00	2060	Bradley Cres	County Rd 2	North End	50	0.190	ADEQ	Maint	CRK	505.40
8.00	3020	Broad St	Charleville Rd	East End	100	0.220	ADEQ	Maint	CRK	585.20
8.00	0960	Branch Rd	Hart Rd	800m E of Hart Rd	358	0.800	ADEQ	Maint	CRK	2,128.00
7.00	7020	West Mclean Blvd	Wood St	Jane St	190	0.280	ADEQ	Maint	CRK	744.80
6.00	7040	West Mclean Blvd	Jane St	North End	70	0.120	ADEQ	Maint	CRK	319.20
5.00	4010	Montana Way	County Rd 15	Cheyanne Tr	200	0.350	ADEQ	Maint	CRK	931.00
5.00	7010	Wood St	County Rd 2	Bernard Cres	200	0.160	ADEQ	Maint	CRK	425.60
4.00	Wes001	West Mclean Blvd	120m North of Jane Street	Old Orchard Drive	100	0.100	ADEQ	Maint	CRK	266.00
4.00	0970	Branch Rd	800m E of Hart Road	520m E of Kyle Road	358	1.790	ADEQ	Maint	CRK	4,761.40
3.00	App001	Apple Blossom Drive	County Road 2	Old Orchard Drive	300	0.650	ADEQ	Maint	CRK	1,729.00
2.00	OLD001	Old Orchard Drive	West End	West Mclean Blvd	125	0.270	ADEQ	Maint	CRK	718.20
						15.890				42,267.40

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
RSS										
22.00	7140	Richmond St	Amherst St	County Rd 2	80	0.210	NOW	Const	RSS	402,972.57
20.00	7120	Church St	County Rd 2	County Rd 15	200	0.530	NOW	Const	RSS	1,044,966.29
17.00	6040	Mill St	County Rd 15	North End	100	0.310	1-5	Const	RSS	480,467.30
						1.050				1,928,406.16
RNS										
19.00	0010	Burnside Dr	County Rd 2	South End Cul de Sac	250	0.280	NOW	Const	RNS	293,676.18
14.00	LEM001	Lemon Lane	County Road 2	East End	50	0.130	NOW	Const	RNS	152,678.96
13.00	6030	Main St	West End	County Rd 15	150	0.380	6-10	Const	RNS	216,451.91
11.00	6020	Main St E	County Rd 15	East End	50	0.070	1-5	Const	RNS	38,479.46
						0.860				701,286.51
RECgravel										
33.00	0440	Glenmore Rd	Algonquin Rd	South End	20	0.210	ADEQ	Const	RECgravel	87,287.76
31.00	0490	Patterson Rd	County Rd 18	Township Limit	50	0.790	NOW	Const	RECgravel	328,368.24
30.00	1040	Boomhouwer Rd	County Rd 18	Limerick Rd	20	0.430	ADEQ	Const	RECgravel	178,732.08
29.00	1200	Mcleansville Rd	6th Concession Rd	Mcleansville Rd Loop	50	2.180	NOW	Const	RECgravel	906,130.08
29.00	0885	Kinch Rd	Augusta/Elizabethtown-Kitley Townline	County Rd 15	10	0.160	ADEQ	Const	RECgravel	66,504.96
29.00	UnNamed2	UnNamed2	County Road 15	East End	20	0.430	ADEQ	Const	RECgravel	148,824.72
27.00	1190	Mcleansville Rd Loop	County Rd 21	County Rd 21	50	0.700	NOW	Const	RECgravel	290,959.20
27.00	0710	Sear Farm Road	Lord Mills Rd (at bend)	North End	10	0.120	ADEQ	Const	RECgravel	49,878.72
26.00	0850	Finucan Rd	County Rd 21	North End	40	0.170	ADEQ	Const	RECgravel	75,269.88
24.00	0520	Maple Ave	County Rd 18	East End	50	0.430	NOW	Const	RECgravel	178,732.08
22.00	7150	Amherst St	Richmond St	East End	50	0.050	NOW	Const	RECgravel	22,138.20
21.00	UnNamed1	UnNamed1	South End	6th Concession Rd	10	0.330	ADEQ	Const	RECgravel	114,214.32
21.00	Gar001	Garretton Road	County Road 18	North End	10	0.150	ADEQ	Const	RECgravel	51,915.60
						6.150				2,498,955.84
REC										
39.00	6010	Branch Rd	County Rd 15	390m E of County Road 15	671	0.390	NOW	Const	REC	254,376.08
23.00	7160	Philips St	Church St	East End	50	0.060	NOW	Const	REC	30,206.74
22.00	0290	Knapp Dr	Bisseltown Rd	Algonquin Rd	50	1.360	NOW	Const	REC	529,201.30
						1.810				813,784.12
None										
36.00	0910	Hart Rd	400m N of Branch Rd	Land O'Nod Rd	5	2.340	ADEQ	Const	None	0.00
18.00	0900	Hart Rd	Branch Rd	400m N of Branch Rd	50	0.400	ADEQ	Const	None	0.00
17.00	0430	Glenmore Rd	Algonquin Rd	Algonquin Rd	50	0.540	ADEQ	Const	None	0.00
						3.280				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
NONE										
16.00	0140	McIntosh Rd	320m E of North Campbell Road	Merwin Lane, North Leg	958	1.670	ADEQ	Const	NONE	0.00
						1.670				0.00
None										
14.00	0640	4th Concession Rd	Blue Church Rd	Charleville Rd	200	0.910	ADEQ	Const	None	0.00
13.00	0660	Blue Chruch Rd	County Rd 26	700m N of County Rd 26	100	0.700	ADEQ	Const	None	0.00
12.00	0650	Blue Church Rd	4th Concession Rd	700m N of County Rd 26	100	1.330	ADEQ	Const	None	0.00
12.00	0690	Ashby Rd	West End	Lord Mills Rd	40	0.820	ADEQ	Const	None	0.00
12.00	0385	Algonquin Rd	150m East of County Road 15	60m E of Cheyenne Trail	225	0.270	ADEQ	Const	None	0.00
12.00	0250	Bisseltown Rd	Bethel Rd	Spicer Rd	463	2.430	ADEQ	Const	None	0.00
12.00	1020	Harvey Rd	Kyle Rd	County Rd 18	50	2.230	ADEQ	Const	None	0.00
11.00	1170	Charleville Rd	6th Concession Rd	County Rd 21	410	2.890	ADEQ	Const	None	0.00
11.00	0780	6th Concession Rd	County Rd 15	DeJong Rd	199	3.110	ADEQ	Const	None	0.00
11.00	0355	Algonquin Rd	700m East of Knapp Road	700m W of County Road 15	150	0.710	ADEQ	Const	None	0.00
10.00	0585	Hillbrook Rd	County Road 26	Maple Ave	223	0.430	ADEQ	Const	None	0.00
10.00	0620	North Campbell Rd	McIntosh Rd	County Rd 26	106	1.930	ADEQ	Const	None	0.00
10.00	0570	4th Concession Rd	McCully Rd	Hillbrook Rd	200	1.960	ADEQ	Const	None	0.00
9.00	0380	Algonquin Rd	County Rd 15	150m E of County Rd 15	267	0.150	ADEQ	Const	None	0.00
8.00	0190	2nd Concession Rd	Rocky Rd	900m E of Rocky Rd	400	0.900	ADEQ	Const	None	0.00
8.00	1235	6th Concession Rd	850m W of Tanny Lane	Tanney Road	374	0.850	ADEQ	Const	None	0.00
6.00	7060	East McLean Blvd	Jane St	Thompson Rd	200	0.310	ADEQ	Const	None	0.00
5.00	7100	Thompson St	Sarah St	East McLean St	200	0.150	ADEQ	Const	None	0.00
5.00	7280	Oak St	County Rd 15 (Church St)	Cedar St	200	0.350	ADEQ	Const	None	0.00
5.00	7220	Cedar St	Oak St	N End Cul De Sac	150	0.330	ADEQ	Const	None	0.00
5.00	0180	2nd Concession Rd	County Rd 31 - Blue Church Rd	900m E of Rocky Rd	400	3.530	ADEQ	Const	None	0.00
4.00	1245	6th Concession Rd	Tanney Road	Charleville Rd	374	2.170	ADEQ	Const	None	0.00
4.00	7270	Pine St	Meikle Drive	Cedar St	60	0.210	ADEQ	Const	None	0.00
4.00	7110	Bernard Cres	Wood St	Sarah St	250	0.450	ADEQ	Const	None	0.00
4.00	7210	Cedar St	John St	Oak St	100	0.260	ADEQ	Const	None	0.00
4.00	7050	Jane St	West Mclean Blvd	Sarah St	70	0.140	ADEQ	Const	None	0.00
3.00	4030	Cheyenne Tr	Algonquin Rd	North End, 50m N of Montana Way	100	0.230	ADEQ	Const	None	0.00
3.00	7250	Meikle Dr	John St	Oak St	120	0.250	ADEQ	Const	None	0.00
						30.000				0.00
GRR										
11.00	0560	McCully Rd	200m N of 4th Concession	Skakum Rd	50	1.390	ADEQ	Const	GRR	39,031.20
						1.390				39,031.20
BSgravel										
29.00	1070	Ferguson Rd	Cooper Rd	Forsyth Rd	50	0.820	NOW	Const	BSgravel	100,771.44
28.00	1180	Buker Rd	Charleville Rd	County Rd 21	30	0.810	ADEQ	Const	BSgravel	100,899.92
26.00	0330	6th Concession Rd	Carpenter Rd	Algonquin Rd	50	0.800	6-10	Const	BSgravel	125,062.08

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
25.00	0760	DeJong Rd	Lord Mills Rd	Algonquin Rd	150	2.220	NOW	Const	BSgravel	317,995.02
25.00	1240	Tanney Road	Algonquin Rd	6th Concession Rd	20	0.310	ADEQ	Const	BSgravel	38,096.52
24.00	0310	Bains Rd	Augusta/Elizabethtown Townline	Knapp Dr	50	0.850	NOW	Const	BSgravel	118,702.50
24.00	0325	Carpenter Rd	Carpenter Rd	6th Concession Rd	50	0.510	6-10	Const	BSgravel	79,727.08
24.00	1090	6th Concession Rd	County Rd 18	East End	50	1.560	6-10	Const	BSgravel	204,782.76
23.00	0530	Barton Rd	County Rd 18	East End	60	0.700	NOW	Const	BSgravel	89,543.58
23.00	0450	Algonquin Rd	Glenmore Rd	890m E of Glenmore Road	121	0.890	6-10	Const	BSgravel	130,680.48
22.00	0300	Algonquin Rd	Knapp Dr	6th Concession Rd	73	2.340	6-10	Const	BSgravel	346,948.06
22.00	0820	Wiltsie Rd	Seeker Rd	Bend at N End at Townline/ Wiltsie Intersection	50	2.370	1-5	Const	BSgravel	359,515.73
21.00	1130	Johnston Rd	Charleville Rd	Skakum Rd	50	1.870	NOW	Const	BSgravel	267,860.67
20.00	1080	Forsythe Rd	County Road 21	Shanty Trail	50	5.630	NOW	Const	BSgravel	794,316.43
20.00	0320	Carpenter Rd	Augusta/Elizabethtown Townline	Algonquin Rd	50	0.810	NOW	Const	BSgravel	121,260.89
19.00	0410	Algonquin Rd	200m E of Dejong Rd	Glenmore Rd	207	3.270	6-10	Const	BSgravel	475,443.61
19.00	0420	Glenmore Rd	6th Concession Rd	Algonquin Rd	207	0.350	6-10	Const	BSgravel	50,888.46
19.00	1050	Cooper Rd	Ferguson Rd	Augusta/North Grenville Townline	50	1.760	6-10	Const	BSgravel	245,784.00
18.00	1060	Cooper Rd	County Rd 18	Ferguson Rd	50	2.970	6-10	Const	BSgravel	425,425.77
18.00	1005	Kyle Rd	Hall Rd	Branch Rd	50	2.230	6-10	Const	BSgravel	314,622.67
17.00	1120	Stephenson Rd	Skakum Rd	North End	20	0.470	ADEQ	Const	BSgravel	65,635.50
17.00	0860	Klitbo Rd	County Rd 21	Branch Rd	50	1.810	6-10	Const	BSgravel	265,765.92
16.00	0890	Land O'Nod Rd	County Rd 15	Augusta/Merrickville/Wolford Townline	50	4.380	6-10	Const	BSgravel	643,124.16
16.00	1210	McCrea Rd	6th Concession Rd	County Rd 18	100	2.490	6-10	Const	BSgravel	362,035.04
16.00	0340	6th Concession Rd	Algonquin Rd	County Rd 15	50	1.290	6-10	Const	BSgravel	187,560.32
15.00	0810	Brown Rd	Wiltsie Rd	County Rd 15	118	1.920	6-10	Const	BSgravel	281,917.44
13.00	0800	Dixon Rd	1700m E of County Rd 15	East End	50	1.260	6-10	Const	BSgravel	185,913.25
12.00	0940	S Branch Rd	Klitbo Rd	Kyle Rd	50	4.570	6-10	Const	BSgravel	671,022.24
						51.260				7,371,301.54
BS										
39.00	0870	Branch Rd	390m E of County Road 15	Klitbo Rd	671	0.960	NOW	Const	BS	319,270.22
38.00	0540	4th Concession Rd	McCully Rd	500m W of County Rd 18	200	0.490	NOW	Const	BS	158,102.42
34.00	0080	South Campbell Road	County Rd 2	North End	100	1.480	NOW	Const	BS	502,920.13
29.00	0580	Hillbrook Rd	Maple Ave	4th Concession Rd	223	1.850	NOW	Const	BS	518,729.64
26.00	0882	Jellyby Rd	Elizabethtown-Kitley Townline	Rock Springs Road / Jellyby Road Intersection	100	0.260	NOW	Const	BS	83,891.08
26.00	0350	Algonquin Rd	Knapp Dr	700m East of Knapp Road	150	0.700	6-10	Const	BS	143,867.43
23.00	5050	4th Concession Rd	500m W of County Rd 18	County Rd 18	200	0.500	NOW	Const	BS	172,246.00
22.00	0070	Saint Lawrence Ct	County Rd 2	East and West Cul de Sacs	100	0.280	NOW	Const	BS	112,297.75
22.00	1100	McCully Rd	Skakum Rd	County Rd 18	100	0.730	NOW	Const	BS	246,327.26
22.00	6050	Amelia St	West End	Mill St	40	0.150	ADEQ	Const	BS	50,615.19
20.00	0840	Colville Rd	County Rd 15	County Rd 21	186	2.490	6-10	Const	BS	550,234.97

Total Needs Summary by Improvement Type

Current Inspection Batch

Priority #	Asset ID	Street Name	From	To	AADT	Length	TON	Imp. Class	Imp	Imp. Cost
						9.890				2,858,502.09
						206.940				25,791,891.95
						206.940				25,791,891.95

Appendix J: Mapping- Roads Inventory Sections

LEGEND

ROAD SECTION
PROVINCIAL HIGHWAY
COUNTY ROAD
ADJACENT MUNICIPAL ROAD
PRIVATE ROAD
RAILWAY
WATERCOURSE
WATERBODY
MUNICIPAL BOUNDARY

VILLAGE OF MERRICKVILLE-WOLFORD
MUNICIPALITY OF NORTH GRENVILLE
TOWNSHIP OF ELIZABETHTOWN-KITLEY
TOWNSHIP OF EDWARDSBURGH/CARDINAL
TOWN OF PRESCOTT

KINCH RD 885
LAND O'NOD RD 890
HART RD 910
HARVEY RD 1020
BOOMHOUWER RD 1040
COUNTY RD 18 1030
BROOKS RD
COOPER RD 1050
FORSYTHE RD 1085
COOPER RD 1060
FERGUSON RD 1070
GARRETON RD GAR001
Garretton
South Branch
BRANCH RD 980
DIAMOND RD 990
KYLE RD 1005
HALL RD 1000
JELLYBY RD 880
882
COUNTY RD 15
BRANCH RD 930
SOUTH BRANCH RD 940
COUNTY RD 6
6010
870
920
North Augusta
KLITBO RD 860
FINUCAN RD 850
Throoptown
945
COVILLE RD 830 840
COUNTY RD 18
FORSYTHE RD
BUKER RD 1180
COUNTY RD 21
Roebuck
WILTSIE RD 820
BROWN RD 810
DIXON RD 790 800
CHARLEVILLE RD 1170
MCLEANSVILLE RD 1200
MCLEANSVILLE RD 1190
Centre Augusta
TANNY LANE 1240
1245
1220
1225
1090
SIXTH CONCESSION RD
UNNAMED UNNAMED1
MCCREA RD 1210
780
1230
1235
420
GLENMORE RD
Glenmore
430
WEIR RD 1110
STEPHENSON RD 1120
1160
SAYEAU RD 440
450
455
460
ALGONQUIN RD
Charleville
1150
1000
1100
SKAKUM RD
470
480
490
PATTERSON RD
330
340
325
320
CARPENTER RD
ALGONQUIN RD
770
DEJONG RD
410
400
Algonquin
390
310
BAINS RD
300
350
355
360
370
ALGONQUIN RD
JOHNSTON RD 1130
MCCULLY RD 560
Domville
570
550
540
FOURTH CONCESSION RD
5010
GLEN SMAIL RD
280
KNAPP DR
280
BISSELTOWN RD
COUNTY RD 15
760
DEJONG RD
SEARS FARM RD 710
700
LORD MILLS RD
690
ASHBY RD
680
670
640
600
FOURTH CONCESSION RD
Leed Mills
750
740
LORDS MILLS RD
650
BLUE CHURCH RD
610
3010
CHARLEVILLE RD
580
HILLBROOK RD
590
MAPLE AVE
530
BARTON RD
SPICER RD
260
270
250
730
660
620
630
NORTH CAMPBELL RD
MERWINLANE
510
CEDAR GROVE RD
240
BETHEL RD
COUNTY RD 26
Maynard
South Augusta
Stones Corners
720
ROCKY RD
725
Old Kemp
190
180
SECOND CONCESSION RD
170
160
MCINTOSH RD
150
140
130
110
100
401
230
SECOND CONCESSION RD 220
210
200
BLUE CHURCH RD
80
SOUTH CAMPBELL RD
Riverview Heights
90
MERWIN LANE
BROCKCHEM RD
Maitland
Blue Church
IRACE DR 20
RIVERDALE CR 30
BURNSIDE DR 10
COUNTY RD 2
LEMON POINT LANE LEM001
ST LAWRENCE CT 70
St. Lawrence River

DOMVILLE 1:7,500
5020 CORBETT ST
BAKER DR 5040
KELSO ST
5030
COUNTY RD 18
5050 FOURTH CONCESSION

MAYNARD 1:7,500
3010 CHARLEVILLE RD
3030 STEWART DR
ROBERT RD 3040
3020 BROAD ST
COUNTY RD 26

RIVERVIEW HEIGHTS 1:7,500
CHARLES PL
CONNELL PL 2040
ALTA VISTA DR
BRADLEY CRES 2060
2030
2050 SUNSET DR
2010 SUNNYMEADE AVE
AVENUE RD 2020
MERWIN LN 90
COUNTY RD 2

NORTH AUGUSTA 1:7,500
6020
MAIN ST
6030
MILL ST
6040
6050 AMELIA ST
COUNTY RD 15

SOUTH MAITLAND 1:7,500
OLD ORCHARD DR
OLD001
WES001
APP001
APPLE BLOSSOM DR
7040 WEST MCLEAN BV
7060
7065 EAST MCLEAN BV
THOMPSON RD 7100
7050 JANE ST
7070
7080 SARAH ST
7120 CHURCH ST
7160 PHILLIPS ST
7150
7130
7140 RICHMOND ST
7090 GEORGE ST
7020
7110
BERNARD CRES
7010 WOOD ST
COUNTY RD 2

ALGONQUIN 1:7,500
COUNRT RD 15
4020 APPALOOSA PA
4010
MONTANA WY
4030 CHEYENNE TL
380
385
390
ALGONQUIN RD

NORTH MAITLAND 1:7,500
7310 MEADOWVIEW DR
KEMP ST 7300
210
SECOND CONCESSION RD
7290 WILLOW DR
7220
7280 OAK ST
7250
7270 PINE ST
7260 JOHN ST
7210
MEIKLE DR
7240
7190 ALEXANDER RD
7180 JONES CT
7230 MAITLAND DR
CEDAR ST
7200
7170 LORENA LN

Roads Management Services Inc.

CLIENT: Augusta TOWNSHIP A Community of Opportunity

SCALE:
750 375 0 750 1,500 2,250 3,000
meters
1:40,000

PROJECT NAME: 2016 ROAD NEEDS STUDY

SHEET TITLE: ROAD INVENTORY

PROJECT No: C14-0135		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 1A
APPROVER: D. CAMPBELL	APPROVER: ---	
DATE: 6/1/2016		SHEET No: 1 of 1

Appendix K: Mapping- Roads by Surface Type

LEGEND

ROAD SURFACE TYPE

- HIGH CLASS BITUMINOUS (ASPHALT)
- LOW CLASS BITUMINOUS (SURFACE TREATMENT)
- GRAVEL/EARTH

OTHER FEATURES

- PROVINCIAL HIGHWAY
- COUNTY ROAD
- ADJACENT MUNICIPAL ROAD
- PRIVATE ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

VILLAGE OF MERRICKVILLE-WOLFORD

MUNICIPALITY OF NORTH GRENVILLE

TOWNSHIP OF ELIZABETHTOWN-KITLEY

TOWNSHIP OF EDWARDSBURGH/CARDINAL

TOWN OF PRESCOTT

KINCH RD 885

LAND O'NOD RD 890

HART RD 910

HARVEY RD 1020

BOOMHOUWER RD 1040

COUNTY RD 18 1030

BROOKS RD

COOPER RD 1050

FORSYTHE RD 1085

COOPER RD 1060

FERGUSON RD 1070

GARRETON RD GAR001

Garretton

South Branch

BRANCH RD 980

JELLYBY RD 880

882

COUNTY RD 15

BRANCH RD 930

KYLE RD 1005

DIAMOND RD 990

HALL RD 1000

SOUTH BRANCH RD 940

COUNTY RD 6

North Augusta

KLITBO RD 860

FINUCAN RD 850

Throoptown

COVILLE RD 840

COUNTY RD 21

Roebuck

BUKER RD 1180

MCLEANSVILLE RD 1190

WILTSIE RD 820

DIXON RD 800

BROWN RD 810

CHARLEVILLE RD 1170

MCLEANSVILLE RD 1200

Centre Augusta

TANNY LANE 1240

SIXTH CONCESSION RD 1220

1225

1090

UNNAMED UNNAMED1

MCCREA RD 1210

WEIR RD 1110

SIXTH CONCESSION RD 1230

1235

780

340

330

Glenmore

GLENMORE RD 420

430

STEPHENSON RD 1120

CARPENTER RD 320

325

ALGONQUIN RD 300

DEJONG RD 770

ALGONQUIN RD 410

SAYEAU RD 440

ALGONQUIN RD 450

455

460

1150

Charleville

SKAKUM RD 470

480

490

PATTERSON RD

1100

BAINS RD 310

Algonquin

ALGONQUIN RD 390

350

355

360

370

400

JOHNSTON RD 1130

MCCULLY RD 560

Domville

FOURTH CONCESSION RD 570

550

540

5010

GLEN SMAIL RD

KNAPP DR 290

BISSELTOWN RD 280

SPICER RD

260

270

250

COUNTY RD 15

DEJONG RD 760

LORD MILLS RD 700

SEARS FARM RD 710

ASHBY RD 690

LORD MILLS RD 680

670

640

600

FOURTH CONCESSION RD

Leed Mills

LORDS MILLS RD 750

740

730

BLUE CHURCH RD 650

660

CHARLEVILLE RD 610

3010

Maynard

HILLBROOK RD 580

585

590

MAPLE AVE

COUNTY RD 18

BARTON RD 530

520

COUNTY RD 26

BETHEL RD 240

South Augusta

Stones Corners

ROCKY RD 720

NORTH CAMPBELL RD 620

MERWINLANE 630

CEDAR GROVE RD 510

MCINTOSH RD 150

140

130

110

100

401

ROCKY RD 725

Old Kemp

SECOND CONCESSION RD 180

170

160

190

200

210

230 SECOND CONCESSION RD 220

401

BROCKCHEM RD

BLUE CHURCH RD

SOUTH CAMPBELL RD 80

Riverview Heights

MERWIN LANE 90

Blue Church

ST LAWRENCE CT 70

IRAGE DR 20

Maitland

RIVERDALE CR 30

BURNSIDE DR 10

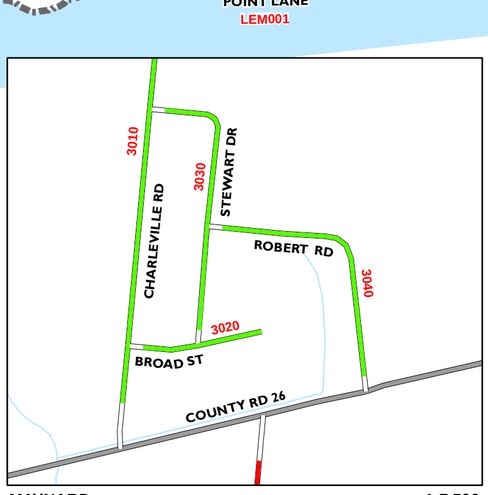
COUNTY RD 2

LEMON POINT LANE LEM001

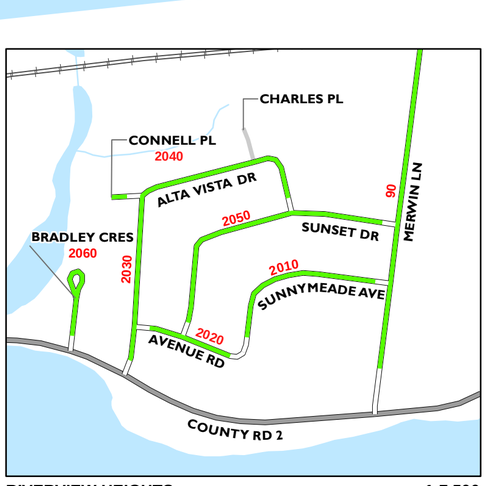
St. Lawrence River

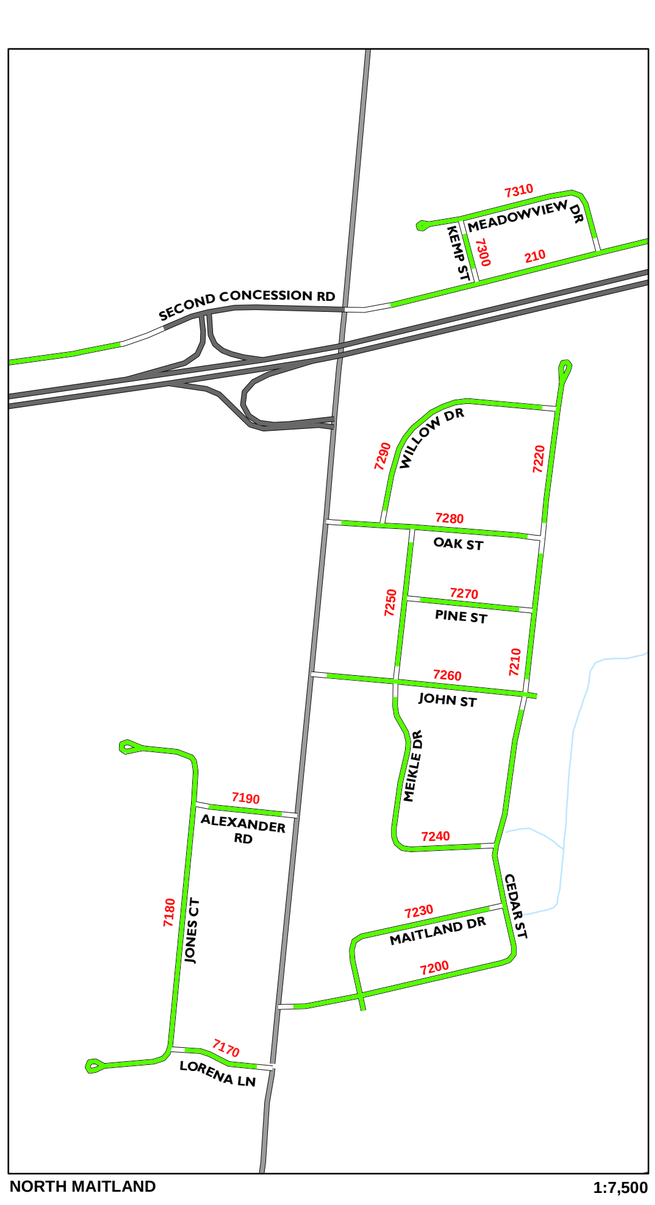
DOMVILLE 1:7,500

MAYNARD 1:7,500



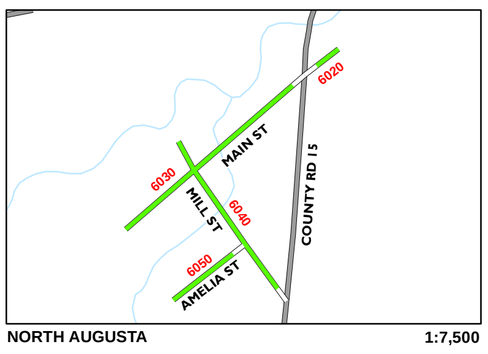
RIVERVIEW HEIGHTS 1:7,500





NORTH MAITLAND 1:7,500

NORTH AUGUSTA 1:7,500



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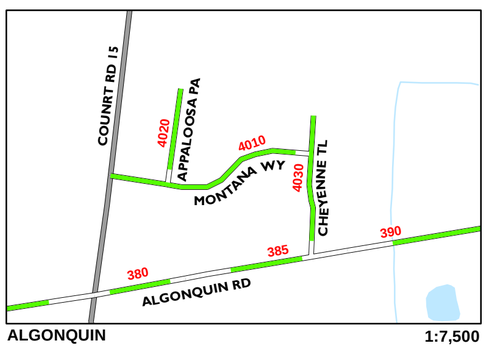
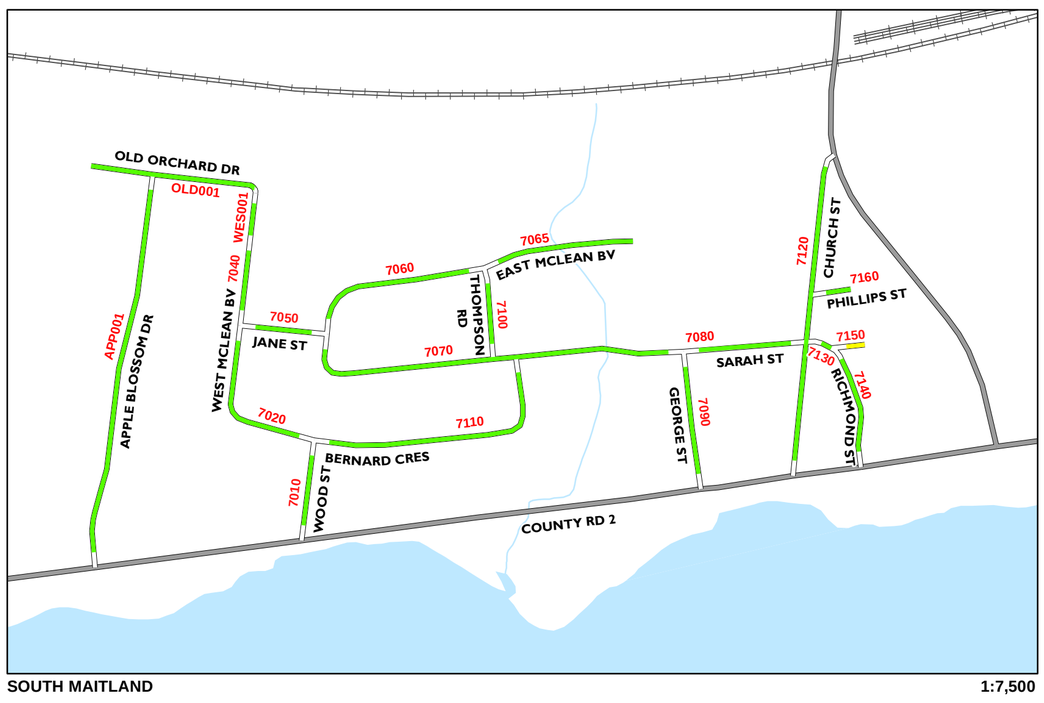


SOUTH MAITLAND 1:7,500



CIMA Roads Management Services Inc.	CLIENT: Augusta Township, A Community of Opportunity	SCALE: 750 375 0 750 1,500 2,250 3,000 meters 1:40,000	PROJECT NAME: 2016 ROAD NEEDS STUDY	PROJECT No: C14-0135	CLIENT FILE No: --
				DRAFTER: S. ELLIOTT / DESIGNER: ---	DRAWING No: 2A
			SHEET TITLE: ROAD SURFACE TYPE	APPROVER: D. CAMPBELL / APPROVER: ---	
				DATE: 6/1/2016	SHEET No: 1 of 1

Appendix L: Mapping - Roadside Environment

LEGEND

ROADSIDE ENVIRONMENT

- RURAL
- SEMI-URBAN
- URBAN

OTHER FEATURES

- PROVINCIAL HIGHWAY
- COUNTY ROAD
- ADJACENT MUNICIPAL ROAD
- PRIVATE ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

VILLAGE OF MERRICKVILLE-WOLFORD

MUNICIPALITY OF NORTH GRENVILLE

TOWNSHIP OF ELIZABETHTOWN-KITLEY

TOWNSHIP OF EDWARDSBURGH/CARDINAL

TOWN OF PRESCOTT

KINCH RD 885

LAND O'NOD RD 890

HART RD 910

JELLYBY RD 880

882

COUNTY RD 15

COUNTY RD 6

6010

North Augusta

KLITBO RD 860

FINUCAN RD 850

South Branch

BRANCH RD 900 930 960 970 980

HARVEY RD 1020

1010

COUNTY RD 18 1030

BROOKS RD

BOOMHOUWER RD 1040

COOPER RD 1050

FORSYTHE RD 1085

1060

COOPER RD 1070

FERGUSON RD

GARRETON RD GAR001

Garretton

DIAMOND RD 990

KYLE RD 1005

HALL RD 1000

SOUTH BRANCH RD 940

950

Throoptown

945

COVILLE RD 830 840

COUNTY RD 21

BUKER RD 1180

Roebuck

MCLEANSVILLE RD 1190

CHARLEVILLE RD 1170

MCLEANSVILLE RD 1200

WILTSIE RD 820

BROWN RD 810

DIXON RD 790 800

TANNY LANE 1240

1245

SIXTH CONCESSION RD 1220 1225 1090

UNNAMED UNNAMED1

MCCREA RD 1210

1230 1235

SIXTH CONCESSION RD 780

340 330

325 320

CARPENTER RD

ALGONQUIN RD 300

BAINS RD 310

Centre Augusta

420

GLENMORE RD 430

Glenmore

410

DEJONG RD 770

SAYEAU RD 440

450 455 460

ALGONQUIN RD

1160

1150

Charleville

1080

1110

WEIR RD

STEPHENSON RD 1120

1100

SKAKUM RD 470 480 490

PATTERSON RD

1130

JOHNSTON RD

MCCULLY RD 560

Domville

570 550 540

FOURTH CONCESSION RD

5010

GLEN SMAIL RD

Algonquin

390

400

ALGONQUIN RD 350 355 360 370

KNAPP DR 290

BISSELTOWN RD 280

SPICER RD 260 270

250

760

DEJONG RD

LORD MILLS RD 700

SEARS FARM RD 710

ASHBY RD 690

LORD MILLS RD 670 680

640

1140

FOURTH CONCESSION RD 600

HILLBROOK RD 580

590

MAPLE AVE

585

520

BARTON RD 530

COUNTY RD 18

Leed Mills

750

LORDS MILLS RD 740

BLUE CHURCH RD 650

3010

CHARLEVILLE RD 610

660

730

COUNTY RD 26

620

NORTH CAMPBELL RD

630

MERWINLANE

510

CEDAR GROVE RD

BETHEL RD 240

South Augusta

Stones Corners

720

ROCKY RD

140 150

MCINTOSH RD

130 110

160 170

100

725

Old Kemp

180

SECOND CONCESSION RD

190

210 200

230 SECOND CONCESSION RD 220

401

BROCKCHEM RD

80

SOUTH CAMPBELL RD

90

MERWIN LANE

Riverview Heights

Blue Church

ST LAWRENCE CT 70

IRAGE DR 20

Maitland

RIVERDALE CR 30

BURNSIDE DR 10

COUNTY RD 2

LEMON POINT LANE LEM001

St. Lawrence River

DOMVILLE 1:7,500

5020 CORBETT ST

BAKER DR 5040

KELSO ST

5030

COUNTY RD 18

5050 FOURTH CONCESSION

MAYNARD 1:7,500

3010 CHARLEVILLE RD

3030 STEWART DR

ROBERT RD 3040

3020 BROAD ST

COUNTY RD 26

RIVERVIEW HEIGHTS 1:7,500

CHARLES PL

CONNELL PL 2040

ALTA VISTA DR

90 MERWIN LN

BRADLEY CRES 2060

2030

2050 SUNSET DR

2010 SUNNYMEADE AVE

AVENUE RD 2020

COUNTY RD 2

NORTH AUGUSTA 1:7,500

6020

MAIN ST

6030

MILL ST

6040

6050 AMELIA ST

COUNTY RD 15

ALGONQUIN 1:7,500

COUNRT RD 15

4020 APPALOOSA PA

4010 MONTANA WY

4030 CHEYENNE TL

380 385 390

ALGONQUIN RD

SOUTH MAITLAND 1:7,500

OLD ORCHARD DR

OLD001

WES001

7040

7065

7060

EAST MCLEAN BV

THOMPSON RD 7100

7050

JANE ST

7070

7080

7120

CHURCH ST

7160 PHILLIPS ST

7150

SARAH ST

7130

RICHMOND ST 7140

APP001

APPLE BLOSSOM DR

WEST MCLEAN BV

7020

7110

BERNARD CRES

7010

WOOD ST

GEORGE ST 7090

COUNTY RD 2

NORTH MAITLAND 1:7,500

7310

MEADOWVIEW DR

KEMP ST 7300

210

SECOND CONCESSION RD

7290

WILLOW DR

7220

7280

OAK ST

7250

7270

PINE ST

7210

7260

JOHN ST

MEIKLE DR

7240

7190

ALEXANDER RD

7180

JONES CT

7230

MAITLAND DR

7200

CEDAR ST

7170

LORENA LN

CIMA+ Roads Management Services Inc.

CLIENT: Augusta TOWNSHIP A Community of Opportunity

SCALE:

750 375 0 750 1,500 2,250 3,000

meters

1:40,000

PROJECT NAME: 2016 ROAD NEEDS STUDY

SHEET TITLE: ROADSIDE ENVIRONMENT

PROJECT No: C14-0135		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: ---	DRAWING No: 3A
APPROVER: D. CAMPBELL	APPROVER: ---	
DATE: 6/1/2016		SHEET No: 1 of 1

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

LEGEND

ROAD IMPOVEMENT NEEDS

- ADEQUATE
- ADEQUATE (LOW TRAFFIC) WITH RECOMMENDED IMPROVMENT
- 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
- NOW MAINTENANCE NEED
- 6 TO 10 YEAR MAINTENANCE NEED

OTHER FEATURES

- PROVINCIAL HIGHWAY
- COUNTY ROAD
- ADJACENT MUNICIPAL ROAD
- PRIVATE ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- MUNICIPAL BOUNDARY

VILLAGE OF MERRICKVILLE-WOLFORD

MUNICIPALITY OF NORTH GRENVILLE

TOWNSHIP OF ELIZABETHTOWN-KITLEY

TOWNSHIP OF EDWARDSBURGH/CARDINAL

TOWN OF PRESCOTT

KINCH RD 885

LAND O'NOD RD 890

HART RD 910

HARVEY RD 1020

BOOMHOUWER RD 1040

BROOKS RD 1030

COUNTY RD 18 1010

COOPER RD 1050

FORSYTHE RD 1085

COOPER RD 1060

FERGUSON RD 1070

GARRETON RD GAR001

Garretton

South Branch

BRANCH RD 980

DIAMOND RD 990

KYLE RD 1005

HALL RD 1000

JELLYBY RD 880

882

COUNTY RD 15

BRANCH RD 930

SOUTH BRANCH RD 940

COUNTY RD 6

870

6010

North Augusta

KLITBO RD 860

FINUCAN RD 850

945

Throoptown

COVILLE RD 840

830

WILTSIE RD 820

DIXON RD 800

790

BROWN RD 810

COUNTY RD 21

BUKER RD 1180

MCLEANSVILLE RD 1190

CHARLEVILLE RD 1170

MCLEANSVILLE RD 1200

Roebuck

Centre Augusta

TANNY LANE 1240

1245

SIXTH CONCESSION RD 1230

1235

780

340

330

UNNAMED UNNAMED1

SIXTH CONCESSION RD 1220

1225

1090

MCCREA RD 1210

GLENMORE RD 420

430

Glenmore

DEJONG RD 770

ALGONQUIN RD 410

SAYEAU RD 440

450

455

460

ALGONQUIN RD

1160

1150

CARPENTER RD 320

325

ALGONQUIN RD 300

310

BAINS RD

Algonquin

390

400

DEJONG RD 760

STEPHENSON RD 1120

1100

1080

WEIR RD 1110

Charleville

470

480

490

SKAKUM RD

PATTERSON RD

JOHNSTON RD 1130

MCCULLY RD 560

Domville

570

550

540

FOURTH CONCESSION RD

GLEN SMAIL RD 5010

350

355

360

370

ALGONQUIN RD

KNAPP DR 290

280

BISSELTOWN RD

SPICER RD

260

270

250

240

BETHEL RD

South Augusta

Stones Corners

LORD MILLS RD 700

SEARS FARM RD 710

690

ASHBY RD

680

670

LORD MILLS RD

640

600

FOURTH CONCESSION RD

Leed Mills

LORDS MILLS RD 750

740

730

720

ROCKY RD

725

BLUE CHURCH RD 650

660

CHARLEVILLE RD 610

3010

Maynard

HILLBROOK RD 580

585

590

MAPLE AVE

520

BARTON RD 530

COUNTY RD 18

510

CEDAR GROVE RD

COUNTY RD 26

MERWINLANE 630

NORTH CAMPBELL RD 620

MCINTOSH RD 150

140

130

110

100

160

170

401

180

SECOND CONCESSION RD

Old Kemp

190

210

200

230

220

401

SECOND CONCESSION RD

BROCKCHEM RD

BLUE CHURCH RD

SOUTH CAMPBELL RD 80

Riverview Heights

90

MERWIN LANE

Blue Church

ST LAWRENCE CT 70

IRAGE DR 20

Maitland

RIVERDALE CR 30

BURNSIDE DR 10

COUNTY RD 2

LEMON POINT LANE LEM001

St. Lawrence River

DOMVILLE 1:7,500

5020 CORBETT ST; 5040 KELSO ST; BAKER DR; 5030; COUNTY RD 18; 5050 FOURTH CONCESSION

MAYNARD 1:7,500

3010 CHARLEVILLE RD; 3030 STEWART DR; ROBERT RD; 3040; 3020 BROAD ST; COUNTY RD 26

RIVERVIEW HEIGHTS 1:7,500

CHARLES PL; CONNELL PL 2040; ALTA VISTA DR; BRADLEY CRES 2060; 2030; 2050 SUNSET DR; 2010 SUNNYMEADE AVE; 2020 AVENUE RD; 90 MERWIN LN; COUNTY RD 2

NORTH AUGUSTA 1:7,500

6020; MAIN ST; 6030; MILL ST; 6040; 6050 AMELIA ST; COUNTY RD 15

ALGONQUIN 1:7,500

COUNRT RD 15; 4020 APPALOOSA PA; 4010 MONTANA WY; 4030 CHEYENNE TL; 380; 385 ALGONQUIN RD; 390

SOUTH MAITLAND 1:7,500

OLD ORCHARD DR; OLD001; WES001; 7040 WEST MCLEAN BV; APP001 APPLE BLOSSOM DR; 7060; 7065 EAST MCLEAN BV; THOMPSON RD 7100; 7050 JANE ST; 7070; 7080 SARAH ST; 7120 CHURCH ST; 7160 PHILLIPS ST; 7150; 7130; 7140 RICHMOND ST; GEORGE ST 7090; 7020; 7110; BERNARD CRES; 7010 WOOD ST; COUNTY RD 2

NORTH MAITLAND 1:7,500

7310 MEADOWVIEW DR; KEMP ST 7300; 210; SECOND CONCESSION RD; 7290 WILLOW DR; 7220; 7280 OAK ST; 7250; 7270 PINE ST; 7260; 7210; JOHN ST; MEIKLE DR; 7190 ALEXANDER RD; 7180 JONES CT; 7240; 7230 MAITLAND DR; CEDAR ST; 7200; 7170 LORENA LN

CIMA Roads Management Services Inc.	CLIENT: Augusta TOWNSHIP A Community of Opportunity	SCALE: 750 375 0 750 1,500 2,250 3,000 meters 1:40,000	PROJECT NAME: 2016 ROAD NEEDS STUDY SHEET TITLE: IMPROVEMENT NEEDS	PROJECT No: C14-0135 DRAFTER: S. ELLIOTT / DESIGNER: --- APPROVER: D. CAMPBELL / APPROVER: --- DATE: 6/1/2016 CLIENT FILE No: -- DRAWING No: 4A SHEET No: 1 of 1