TOWNSHIP OF SOUTH GLENGARRY

MEETING OF COUNCIL
PUBLIC MEETING
2016 State of the Infrastructure – Roads Report

Date: September 6, 2016
Time: 5:00 pm - 6:45 pm
Council Chambers, Municipal Office

AGENDA

1. CALL TO ORDER

2. APPROVAL OF AGENDA

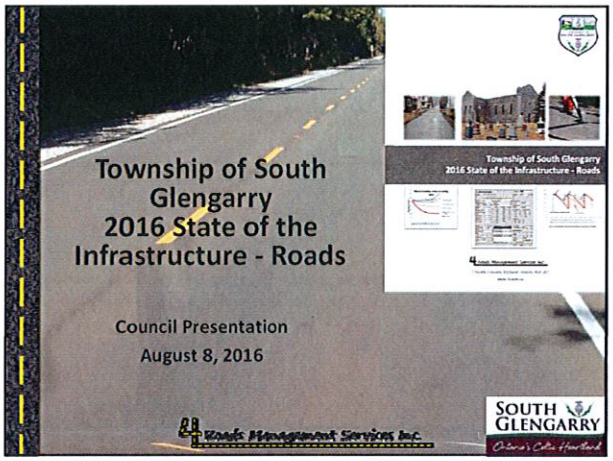
3. DECLARATION OF PECUNIARY INTEREST

4. PRESENTATION

   - David Anderson, CET – President 4 Roads Management Services Inc.

5. DISCUSSION ON THE SUBJECT

6. ADJOURNMENT



Presentation Overview

- Introductions
- Township of South Glengarry 2015 State of the Infrastructure – Roads (SotI)
  - Provincial Requirements
  - What is it?
  - Where and How does it fit in to the overall plan?
- South Glengarry Road System Condition
- Pavement / Asset Management
- Findings and Recommendations

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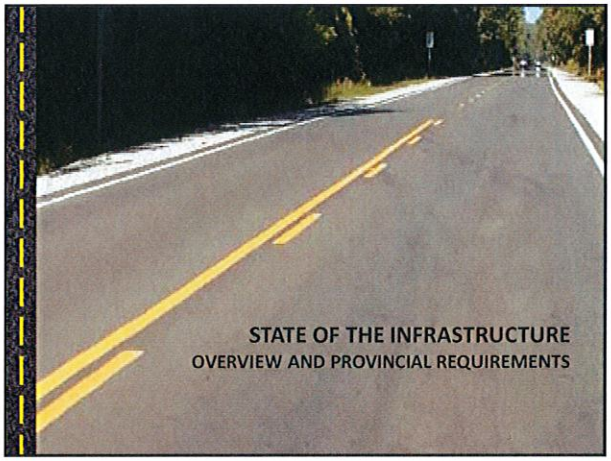

South Glengarry Study and Provincial Context

- South Glengarry 2016 State of the Infrastructure – Roads Municipal Road Condition Assessment and Capital Improvement Plans
- Asset Management Plans (Provincial Requirement) require a State of the Infrastructure (SotI)of each asset and asset group
- This report provides a SotI for Roads and provides an Asset Management Plan for the Road Assets
  - Has to be integrated with other assets

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What is a State of the Infrastructure Report?

Report and analysis on many aspects of an asset type or group:

1. What do you have and where is it?
   - (Inventory)
2. What is it worth?
   - (Costs/Replacement Rates)
3. What is its condition and expected remaining service life?
   - (Condition and Capability Analysis)
4. What is the level of service expectation, and what needs to be done?
   - (Capital and Operating Plans)
5. When do you need to do it?
   - (Capital and Operating Plans)
6. How much will it cost and what is the acceptable level of risk(s)?
   - (Short- and Long-term Financial Plan)
7. How do you ensure long-term sustainability?

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PART 3 THE ELEMENTS OF A DETAILED ASSET MANAGEMENT PLAN

Where and how does it fit into the overall Plan?

BUILDING TOGETHER: Guide for Municipal Asset Management Plans

An asset management plan is a strategic document that states how a group of assets is to be managed over a period of time. The plan describes the characteristics and condition of infrastructure assets, the levels of service expected from them, planned actions to ensure the assets are providing the expected level of service, and financing strategies to implement the planned actions. A detailed asset management plan has the following sections:

- Executive summary
- Introduction
- State of local infrastructure
- Expected levels of service
- Asset management strategy
- Financing strategy

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PART 2 ASSET MANAGEMENT PLANNING

Where and How does it fit into the Overall Plan?

BUILDING TOGETHER: Guide for Municipal Asset Management Plans

An Accountaneering Exercise

1 ASSET MANAGEMENT IN ONTARIO

What is asset management?

Asset management planning is the process of making the best possible decisions regarding the building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. The objective is to maximize benefits, manage risk, and provide satisfactory levels of service to the public in a sustainable manner. Asset management requires a thorough understanding of the characteristics and condition of infrastructure assets, as well as the service levels expected from them. It also involves setting strategic priorities to optimize decision-making about when and how to proceed with investments. Finally, it requires the development of a financial plan, which is the most critical step in putting the plan into action.

MIII Requirements for State of the Infrastructure

- State of the Infrastructure (SotI)
  - Asset types
    - Materials, subtypes
  - Financial Accounting Valuation
    - Historic
    - Replacement costs
  - Asset Age Distribution
    - May be some difficulties with some assets
      - Age of the composite asset vs the apparent age
    - May estimate by material or current condition
    - Asset condition using standard engineering practices

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MIII Requirements for State of the Infrastructure

- SotI
  - Existing Inventory from PSAB?
  - Replacement Cost?
    - Can be calculated in WorkTech
  - Condition Assessments
    - Can be completed in WorkTech
      - PCI
      - Inventory Manual
    - Currency? Last completed?
    - Review
    - Levels
      - High- Approach Phase 1 of process at a high level?
        - » Some detail- still mostly desktop
      - Detailed- field work required
      - Full (suggest that this may be project level)
    - Review cycle should be part of policy

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MIII Requirements for State of the Infrastructure

- SotI
  - Existing Inventory from GIS Inventory
  - Replacement Cost
    - Calculated in WorkTech based on South Glengarry Unit Costs
  - Condition Assessments
    - Roads Completed in WorkTech - Inventory Manual / RIMS methodology
    - Current- Last completed in 2016
      - Detailed- field work required
      - Dimensional information confirmed
      - Full (suggest that this may be project level)
  - Review cycle should be part of policy

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MIII Requirements for State of the Infrastructure

- Record of assumptions
  - Should be repeatable, consistent and defensible
    - Inventory Manual and WorkTech
  - Many assumptions per the Inventory Manual
  - Deterioration Assumptions in Appendix E
- QA / Verification
  - Field work is the verification
- Supported by a database
  - WorkTech Asset Manager Foundation
- Regularly Updated
  - Condition Assessment Policy
  - Will vary by asset group

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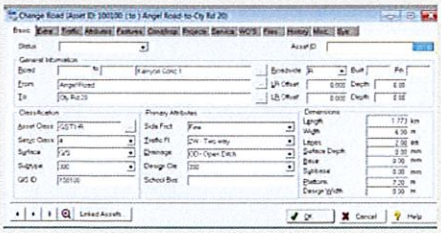
Worktech Asset Manager Foundation



- Worktech Asset Manager Foundation
- Can be used for any and all assets
- Used on this project for Budget Development, Performance Modeling, Analysis

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MIII Requirements -Level of Service

- Desired / Target
- Existing
- How measured?
  - Operational?
  - Overall Condition
  - May have to have multiple measures for some assets

MIII Requirements -Level of Service

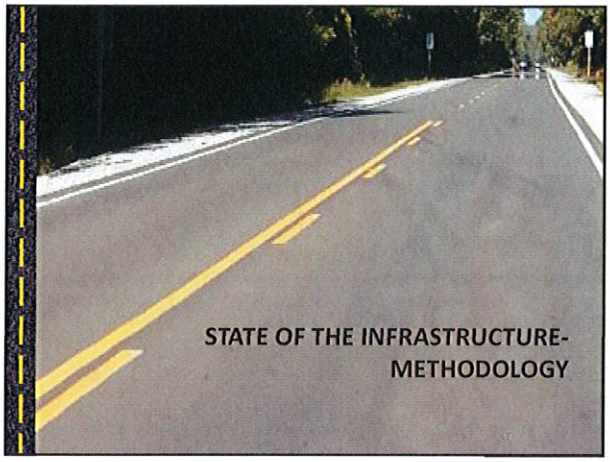
- Desired / Target
- Existing
- How measured?
  - Operational?
    - Number of breaks in watermains system wide or per segment
    - 24 / 7 100% reliable service
    - Meet MMS
    - Regulatory
  - Overall Condition?
    - System Adequacy
    - Average condition; PCI, Physical Condition
  - May have to have multiple measures for some assets
    - For example for roads- Meet MMS and overall average condition measure

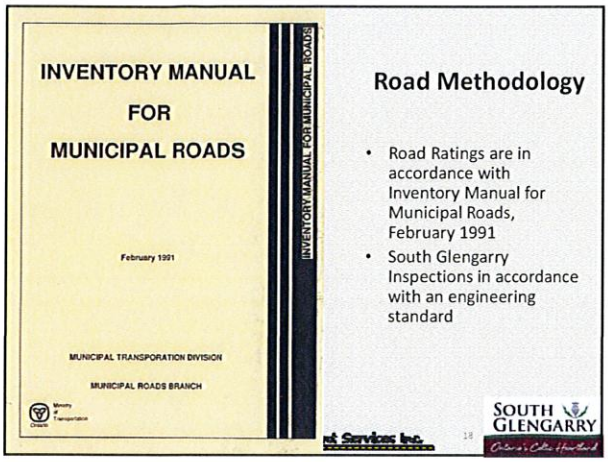
MIII Requirements- Asset Management Strategy

- Overall Asset Management Strategy should cross integrate assets
- Has to be in lock step with the financial plan
- Planned actions to include
  - Non-infrastructure solutions
  - Maintenance Activities
  - Renewal and rehab
  - Replacement
  - Disposal
  - Expansion

MIII Requirements- Asset Management Strategy

- From MIII handbook
- *"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"*
- Also consider the best overall affect to asset group or groups
- Plan has to include Operating and Capital costs and activities


STATE OF THE INFRASTRUCTURE-
METHODOLOGY


INVENTORY MANUAL
FOR
MUNICIPAL ROADS
February 1991
MUNICIPAL TRANSPORATION DIVISION
MUNICIPAL ROADS BRANCH
INVENTORY MANUAL FOR MUNICIPAL ROADS
Road Methodology
• Road Ratings are in accordance with Inventory Manual for Municipal Roads, February 1991
• South Glengarry Inspections in accordance with an engineering standard
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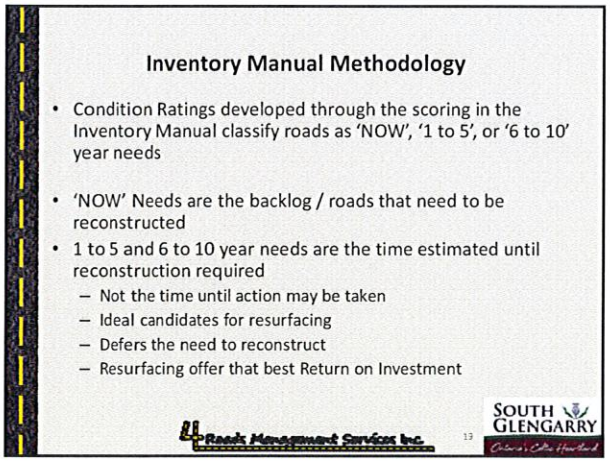
Inventory Manual Methodology
• Condition Ratings developed through the scoring in the Inventory Manual classify roads as 'NOW', '1 to 5', or '6 to 10' year needs
• 'NOW' Needs are the backlog / roads that need to be reconstructed
• 1 to 5 and 6 to 10 year needs are the time estimated until reconstruction required
– Not the time until action may be taken
– Ideal candidates for resurfacing
– Defers the need to reconstruct
– Resurfacing offer that best Return on Investment
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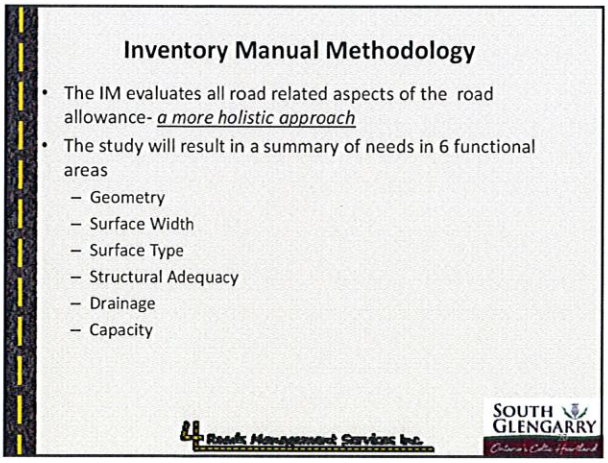
Inventory Manual Methodology
• The IM evaluates all road related aspects of the road allowance- a more holistic approach
• The study will result in a summary of needs in 6 functional areas
– Geometry
– Surface Width
– Surface Type
– Structural Adequacy
– Drainage
– Capacity
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Report Methodology

- Traffic counts are an important factor in any decision making relative to the road system
  - Maintenance
  - Design
    - Cross-section
    - Geometry
    - Structure
  - Establishing road maintenance classifications for Minimum Maintenance Standards purposes as per Regulation 239/02 (now Regulation 23/10)
- % of trucks is critical to the design
- Urban and Rural counts required

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Report Methodology

- NOW' – Roads where total rehabilitation required *(a resurfacing treatment is generally never a 'NOW' need- some exceptions.)*
- Generally represents the backlog of work required on the road system
- Treatments are generally the most expensive and offer the lowest Return on Investment

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Report Methodology

'1 to 5' – and '6 to 10' Identify road sections where reconstruction is anticipated within the next 1 to 10 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 the other deficiencies if any), deferring the need to reconstruct.

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Report Methodology

'6 to 10' - Identifies road sections where reconstruction improvements are anticipated within 6 to 10 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 the other deficiencies if any), deferring the need to reconstruct.

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Report Methodology

Adequate Road - May be a wide range of conditions

•Roads with an AADT of less than 50 are not dealt with in this methodology, similar to Class 6 roads in Minimum Maintenance Standards

Report Methodology Standard Improvements

- R1- Basic Resurfacing
- R2 – Basic Resurfacing –double lift
- RM- Major Resurfacing
- PR1- Pulverizing and Resurfacing
- PR2 - Pulverize and Resurfacing –Double lift
- BS - Tolerable standard for lower volume rural and semi-urban roads
- RW - Resurface and widen
- REC - Reconstruction
- RNS - Reconstruction Nominal Storm Sewers (Urban)
- RSS - Reconstruction including installation of Storm Sewers
- NC - Proposed road Construction
- SRR - Storm Sewer Installation and Road re-instatement
- CRK Crack Sealing
- SD Spot Drainage

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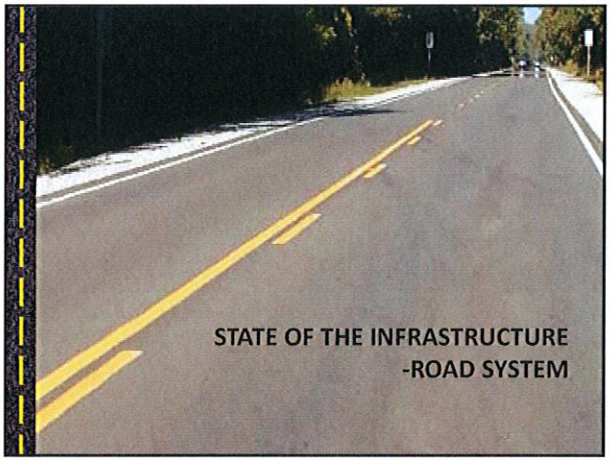

Minimum Maintenance Standards

CLASSIFICATION OF HIGHWAYS - Classes 1 to 6

Average Annual Daily Traffic (number of motor vehicles)	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

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Minimum Maintenance Standards

- Regulation 239/02 effective November 2002
  - Revised February 18, 2010 – Regulation 23/10
  - Revised January 2013 – regulation 47/13
  - Currently under review
- Classifies roads by traffic and posted speed
- Response times dictated by classification
- Roads with an AADT of less than 50 are Class 6 and do not have a standard
- Accurate traffic counts a good risk management exercise

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South Glengarry Roads By Minimum Maintenance Standard (MMS) Class (Regulation 239/02)

		MMS Class											
		3		4		5		6		TOTAL		% OF TOTAL	
Lanes	Roadside	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km
1	S	0	0	0	0	0.23	0.23	0	0	0.23	0.23	0.06%	0.03%
2	R	8.092	16.184	273.421	546.842	13.578	27.156	29.493	58.986	324.584	649.168	84.63%	84.65%
2	S	0	0	2.922	5.844	44.162	88.324	10.712	21.424	57.796	115.592	15.07%	15.07%
2	U	0	0	0	0	0.931	1.862	0	0	0.931	1.862	0.24%	0.24%
TOTAL		8.092	16.184	276.343	552.686	58.901	117.572	40.205	80.41	383.541	766.852		
% OF TOTAL		2.11%	2.11%	72.05%	72.07%	15.36%	15.33%	10.48%	10.49%				

MMS provides standards for service delivery and response times

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System Inventory –Surface Type and Roadside

	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
Gravel, Stone, Other Lowstop	169.366	338.732	3.515	7.030	0.000	0.000	172.881	345.762	45.07%	45.09%
High Class Bit.-asphalt	98.662	197.324	54.121	108.012	0.931	1.862	153.714	307.198	40.08%	40.06%
Low Class Bit.-surface treated	56.536	113.112	0.390	0.780	0.000	0.000	56.946	113.892	14.85%	14.85%
Total	324.584	649.168	58.026	115.822	0.931	1.862	383.541	766.852		
% of Total	84.63%	84.65%	15.13%	15.10%	0.24%	0.24%				

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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	29.493	58.986					29.493	58.986	7.69%	7.69%
200	2	127.683	255.366					127.683	255.366	33.29%	33.30%
300	2	115.973	231.946					115.973	231.946	30.24%	30.25%
400	2	43.343	86.686					43.343	86.686	11.30%	11.30%
500	2	5.281	10.562					5.281	10.562	1.38%	1.38%
600	2	1.249	2.498					1.249	2.498	0.33%	0.33%
800	2	1.562	3.124					1.562	3.124	0.41%	0.41%
C/R	2			2.066	4.132			2.066	4.132	0.54%	0.54%
L/R	1			0.23	0.23			0.23	0.23	0.06%	0.03%
L/R	2			54.581	109.162	0.931	1.862	55.512	111.024	14.47%	14.48%
LCI	2			1.149	2.298			1.149	2.298	0.30%	0.30%
Total		324.584	649.168	58.026	115.822	0.931	1.862	383.541	766.852		
% of Total		84.63%	84.65%	15.13%	15.10%	0.24%	0.24%				

- Classes 100 to 800 are rural roads subdivided by traffic volumes

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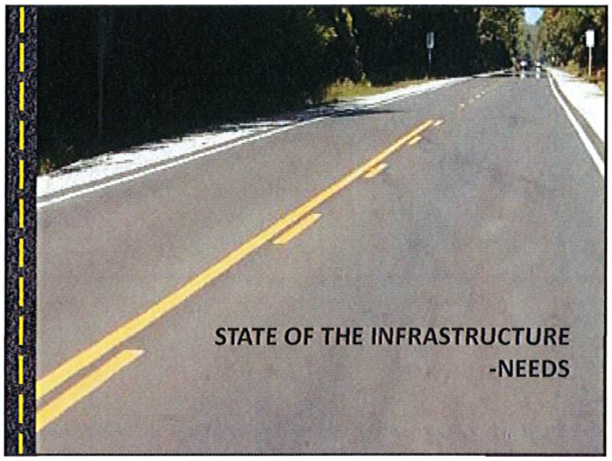

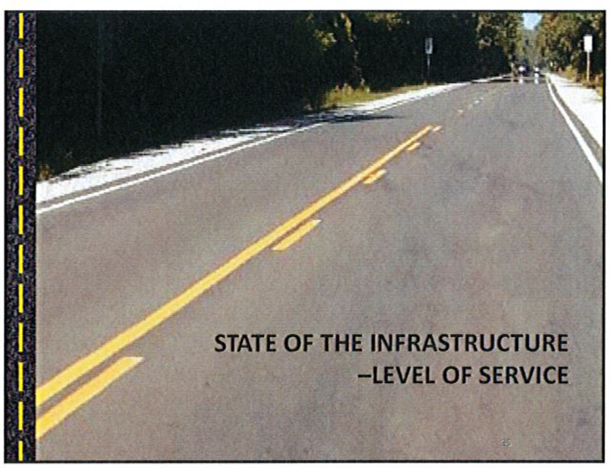

LOS - Road System Adequacy

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

Current System Adequacy is 74.4 %

South Glengarry Minimum target range should be 60% based on former provincial targets

- *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 a significant effect on the budget recommendations.)
- *As noted above, 10.48% of the system is deemed adequate due to having a counted or estimated traffic count of less than 50 vehicles per day. From a user perspective then, the road system may appear to be in a lesser condition.

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LOS Measures

System Adequacy

- The current system adequacy is **74.4**%.
- The System Adequacy should be maintained at 60% or higher.

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 . (This includes road sections with less than 50 AADT)
- The weighted average Physical Condition should be at 61 or higher.

MPMP Good to Very Good

- Good to very good roads represent 61.2 to 65.7% 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.

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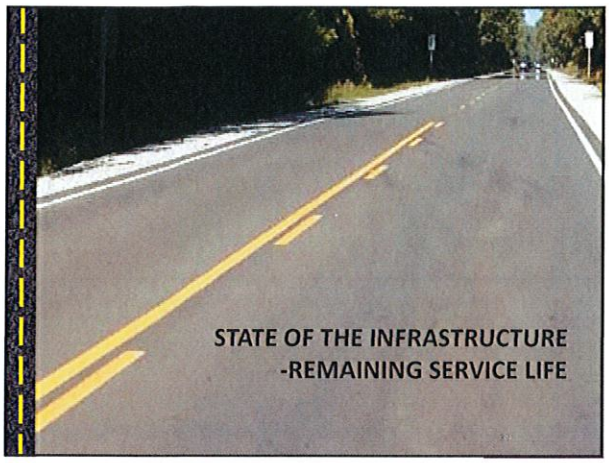
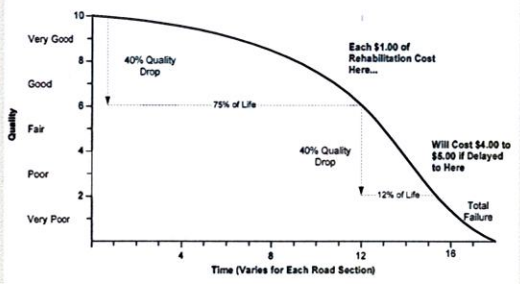


Pavement Management Strategy

PAVEMENT LIFE CYCLE: MAINTENANCE COST VS. CONDITION



Adapted From American Public Works Association, 1983.
The Hole Story: Facts and Fallacies of Potholes

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Remaining Service Life - Roads

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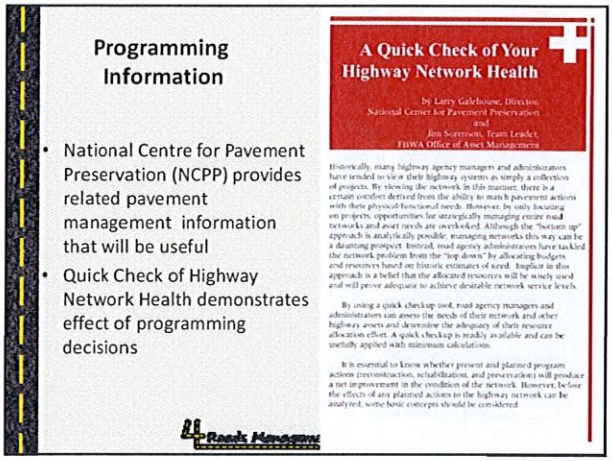
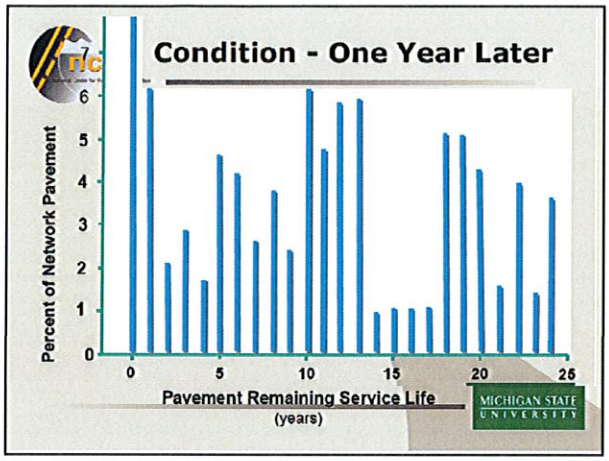
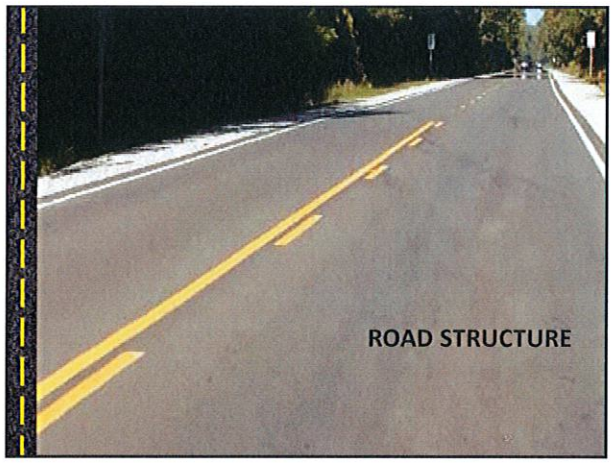
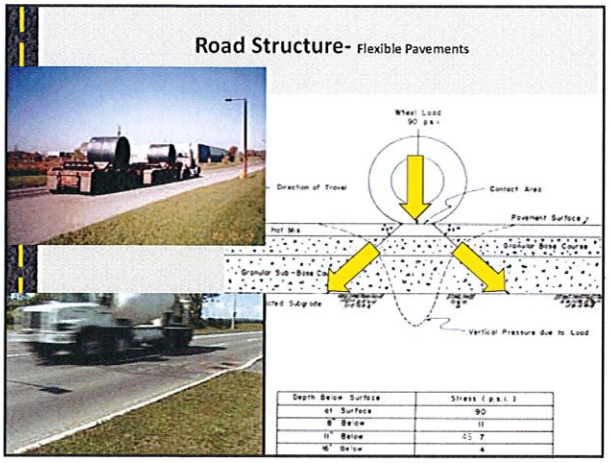

Programming Information
• National Centre for Pavement Preservation (NCPP) provides related pavement management information that will be useful
• Quick Check of Highway Network Health demonstrates effect of programming decisions
A Quick Check of Your Highway Network Health
by Larry Galehouse, Director, National Center for Pavement Preservation
and
Jim Sorenson, Team Leader, FHWA Office of Asset Management
Historically, many highway agency managers and administrators have tended to view their highway systems as simply a collection of projects. By viewing the network in this manner, there is a certain comfort derived from the ability to match pavement actions with their physical/functional needs. However, by only focusing on projects, opportunities for strategically managing entire road networks and asset needs are overlooked. Although the "bottom up" approach is analytically possible, managing networks this way can be a daunting prospect. Instead, road agency administrators have tackled the network problem from the "top down" by allocating budgets and resources based on historic estimates of need. Implicit in this approach is a belief that the allocated resources will be wisely used and will prove adequate to achieve desirable network service levels.
By using a quick checkup tool, road agency managers and administrators can assess the needs of their network and other highway assets and determine the adequacy of their resource allocation effort. A quick checkup is readily available and can be usefully applied with minimum calculations.
It is essential to know whether present and planned program actions (reconstruction, rehabilitation, and preservation) will produce a net improvement in the condition of the network. However, before the effects of any planned actions to the highway network can be analyzed, some basic concepts should be considered.

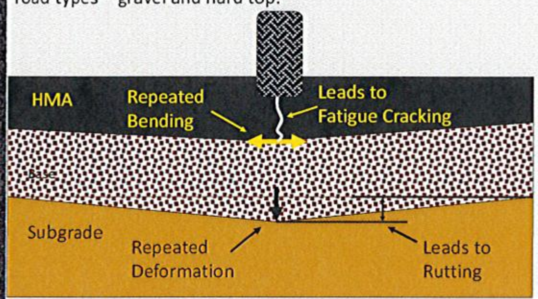

Condition - One Year Later
Percent of Network Pavement
0
1
2
3
4
5
6
0
5
10
15
20
25
Pavement Remaining Service Life
(years)
MICHIGAN STATE UNIVERSITY


ROAD STRUCTURE


Road Structure- Flexible Pavements
Wheel Load
90 p.s.i.
Direction of Travel
Contact Area
Pavement Surface
Hot Mix
Granular Base Course
Granular Sub-Base Course
Prepared Subgrade
Vertical Pressure due to Load
Depth Below Surface
Stress (p.s.i.)
at Surface
90
9" Below
11
11" Below
45.7
18" Below
4

Pavement Performance Goals

Appropriate pavement structure design applies to all flexible road types – gravel and hard top.



Source: Asphalt Paving Alliance Power Point Presentation on Perpetual Pavements

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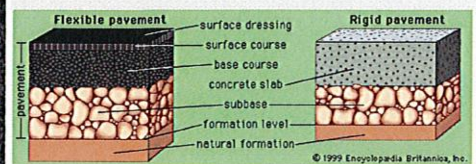
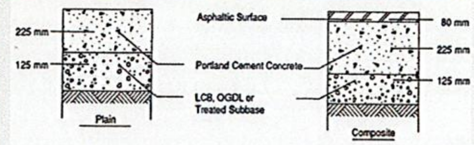
Flexible vs Rigid Pavements





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•Native soils and traffic, especially trucks, will dictate the road structure

Pavement Design and Rehabilitation Manual — Chapter 3 Pavement Design—Page 23

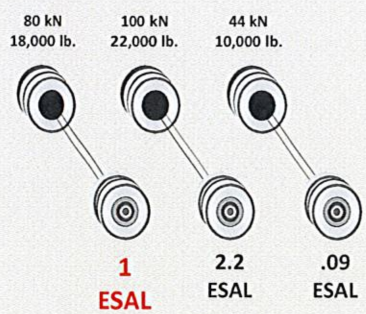
Table 3.4 Structural Design Guidelines for Flexible Pavements — Secondary Highways

AADT	Pavement Structure Elements	Gravels and Sands Suitable as Gran Borrow	Sands and Silts 5-75µm <40%	Sands and Silts 5-75µm 40-55%	Sands and Silts 5-75µm >55%	Lacustrine Clays	Varved & Leda Clays
2000-3000 AADT	HM	90	90	90	90	90	90
	B	150	150	150	150	150	150
	SB**	—	300	450	600	450	800
	GBE	330	530	630	730	630	865
1500-2000 AADT	HM	50	50	50	50	50	50
	B	150	150	150	150	150	150
	SB**	—	230	300	450	300	450 (300-600)
	GBE	250	415	450	550	450	550 (450-650)
1000-1500 AADT	CL	50	50	50	50	50	50
	B	150	150	150	150	150	150
	SB**	—	250	300	450	300	450 (300-600)
	GBE	240	405	440	540	450	540 (450-640)
500-1000 AADT	ST*	—	—	—	—	—	—
	B	150	150	150	150	150	150
	SB*	—	150	250	300	250	350 (250-450)
	GBE	150	250	315	350	315	385 (315-450)
200-500 AADT	ST*	—	—	—	—	—	—
	B	150	150	150	150	150	150
	SB**	—	150	250	300	250	300
	GBE	180	280	315	350	315	350
Less than 200 AADT	Gravel	—	—	—	—	—	—
	B	100	100	100	100	100	100
	SB**	—	150	250	300	250	300
	GBE	100	200	265	300	265	300

Notes: All AADT Volumes refer to Present Traffic.
HM — Hot Mix Asphalt & Thickness
B — Base Thickness
SB — Subbase Thickness
GBE — Granular Base Equivalency Thickness (1 mm HM = 2 mm B = 3 mm SB = 1.11)
CL — Cold Mixed, Cold Laid or Road Mixed Mulch
ST — Double Surface Treatment or Single Surface Treatment with Prime
* — Apply surface treatments 0.25 m wider than lane width.
** — Proposed subbase thicknesses may be decreased or increased respectively, for harder or softer subgrade conditions in each category, except for varved and leda clay subgrade where exceptionally large ranges are shown.

Roads

ESAL Comparison *(Equivalent Single Axle Load)*



(Equivalent Single Axle Load)

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ESAL Comparison

67 kN
15,000 lb
0.48 ESAL

+

27 kN
6,000 lb
0.01 ESAL

= **0.49 ESALs**

151 kN
34,000 lb
1.10

+

151 kN
34,000 lb
1.10

+

54 kN
12,000 lb
0.19

= **2.39 ESALs**

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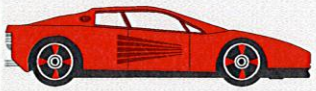
Ontario's Celtic Heartland



= **0.0002 ESAL**

1,000 lb
.00001 ESAL

2,000 lb
.00019 ESAL

Truck @ 2.39 ESAL
——————————— = 11,950
Auto @ 0.0002 ESAL

Cars do not count

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EASL's in Rural Areas

- The Township of South Glengarry is largely rural with some urban and semi urban
- Prevalence of large farm machinery
- Axles equivalent or possibly heavier than 1 EASL
- HTA exempts farm equipment from load restrictions during half load season
  - Milk trucks for example
  - Liquid Manure
- Consideration when designing reconstructions and rehabilitations

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Road Structure- Drainage

- Drainage is one of the most important elements of road building
- Saturated road structures cannot support load
- Ditches critical on rural roads
  - Sub-drains alone not sufficient
  - Major and minor events
  - Legal adequate outlet required
- Sub-drains critical on urban roads in addition to sewer system
- Infilling of ditches should be strongly discouraged
  - It's municipal property
  - Interferes with the granular base drainage
  - Could cause a bigger problem in a major event

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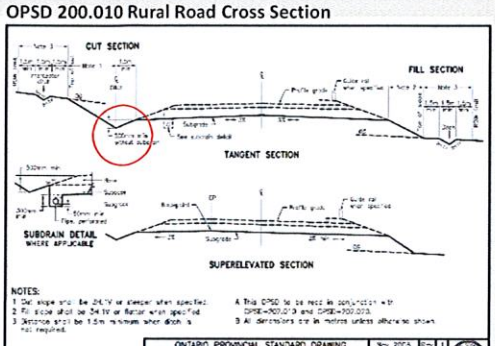
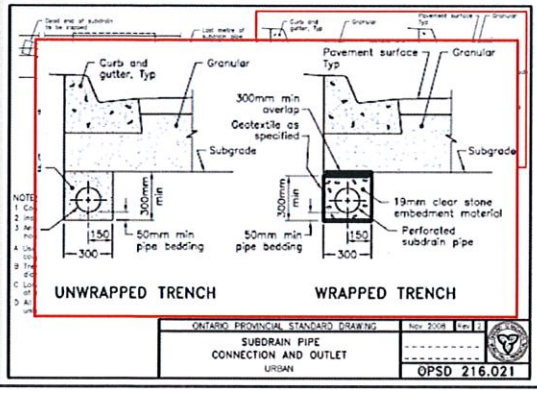
OPSD 200.010 Rural Road Cross Section

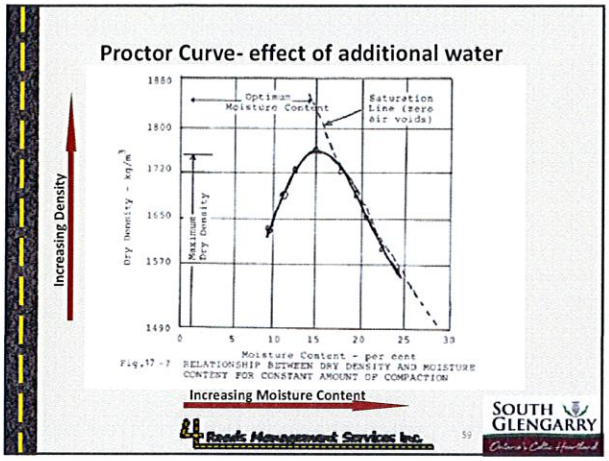


Drainage

OPSD 216.021 –Subdrain Pipe (Urban)Sections)




Drainage / Berm Removal


Proctor Curve- effect of additional water
Increasing Density
Optimum Moisture Content
Saturation Line (zero air voids)
Maximum Dry Density
Dry Density - kg/m³
1880
1800
1720
1650
1570
1490
0
5
10
15
20
25
30
Moisture Content - per cent
Fig.17-7 RELATIONSHIP BETWEEN DRY DENSITY AND MOISTURE CONTENT FOR CONSTANT AMOUNT OF COMPACTION
Increasing Moisture Content
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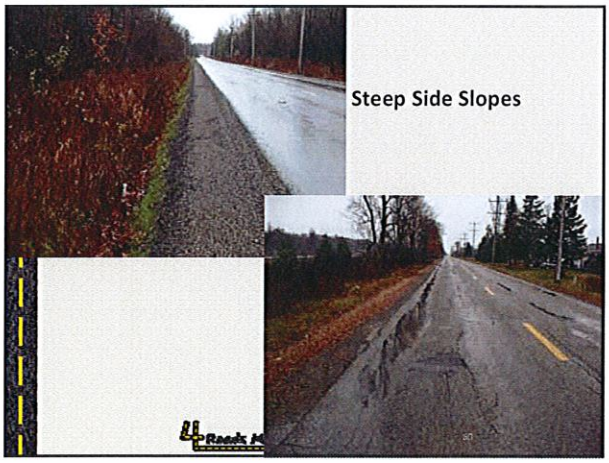
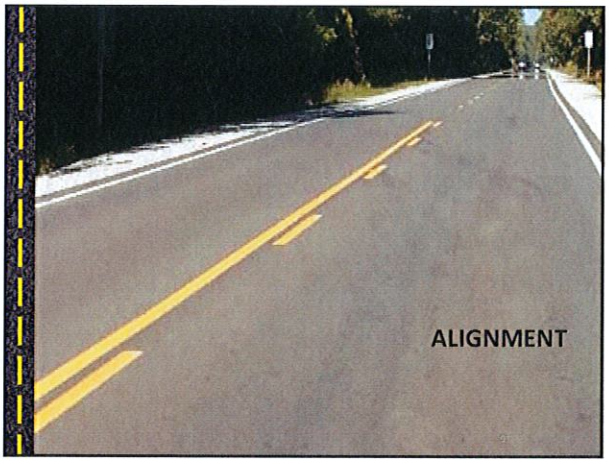
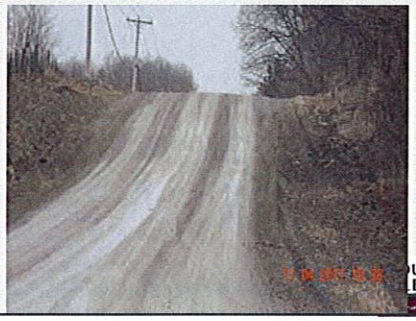

Steep Side Slopes


ALIGNMENT

Horizontal and Vertical Alignments

Substandard horizontal and vertical alignments should be reviewed for additional signage



Safe Stopping Sight Distance

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
Source: Geometric Design Standards for Ontario Highways

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Geometric Needs

Asset ID	Street Name	From Desc	To Desc	Length
110900	MacGillivray Rd	120m South of Kirk Street, Martintown	Cty Rd 27	5.935
210300	Heron Rd	Cty Rd 27	1.2Km North of Peanut Line	3.291
403900	Leitch Rd	Cty Rd 27	Dead End	1.412
505201	Butternut Lane	West End	251m West of 3rd Line Road	0.538
505500	1st Line Rd	Concession Road 8	Concession Road 8	0.635
604200	24th Avenue (Heron Bay)	S Service Rd	Dead End	1.016

- South Glengarry has 12.827km of road sections road sections with a "NOW" Geometric Need
  - The average operating speed is below the minimum tolerable standard
  - Consider reducing speed limit
- There are also additional substandard horizontal and vertical curves which should be reviewed for signage and/or line painting

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Regulatory and Advisory Signage

- Rural roads without posted limits are assumed to be 80 km/hr
- Built up area roads without posted limits are assumed to be 50 km/hr

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Pavement Maintenance

- Pavement life varies dependant on,
  - Adequacy of initial design
  - Adequate maintenance programming,
  - Adequate drainage,
  - Traffic volumes
  - Traffic type

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Pavement/Road Surface Maintenance

- Maintenance programs should include the following components;
  - Spot improvements to the asphalt surface
  - Spot improvements to the road drainage system
  - Crack sealing
  - Resurfacing/overlays at the appropriate time.
  - Gravel resurfacing, re-grading, and dust control at the appropriate time
  - Pavement preservation strategies, if appropriate.

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Pavement Maintenance

- Gravel roads require significant maintenance
  - Additional gravel
  - Grading
  - Dust control
- Gravel roads are not "cheap" roads
- Often deteriorate as the base and the riding surface are the same material and deterioration not recognized

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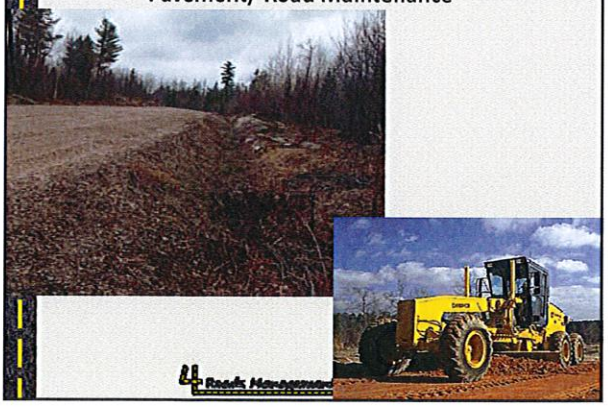
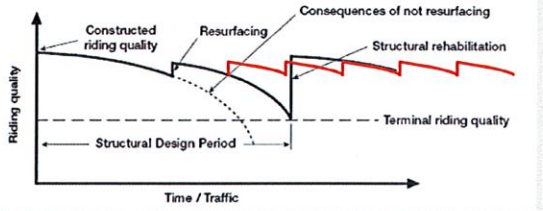
Pavement/ Road Maintenance



Roads Management

Pavement Maintenance



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Inventory Manual Cost Calculation Parameters

TABLE F-1 ROAD DESIGN STANDARDS

RURAL ROAD STANDARDS

		50-199 AADT 200	200-399 AADT 300	400-999 AADT 400	1000-1999 AADT 500	2000-2999 AADT 600	3000-3999 AADT 700	4000+ AADT 800	4 lanes & Exp 4LN,EXP
	Surface Width (m)	6.0	6.0	6.5	6.5	7.0	7.0	7.5	15.0
SHw	Shoulder Width (m)	1.5	1.5	1.5	2.5	2.5	3.0	3.0	3.0
SOP	Hot Mix (mm)		*16	50	50	100	100	100	100
SA	Granular A (mm)	150	150	150	150	150	150	150	150
SB	Southern Ontario Granular B (mm)								
	BS	150	150	150	150	150	150	150	150
	RW, REC,NC	300	300	450	450	450	450	450	450
SB	Northern Ontario Granular B (mm)								
	BS	250	250	250	250	250	250	250	250
	RW, REC,NC	400	400	550	550	550	550	550	550
	Concrete Surface								
SC	Concrete (mm)	150	150	150	225	225	225	225	225
SB	Granular B (mm)	150	150	150	150	150	150	150	150

* Double Surface Treatment (DST) assumed to equal 16 mm of Hot Mix

Note: Class 100 rural roads are eligible for maintenance subsidy only.

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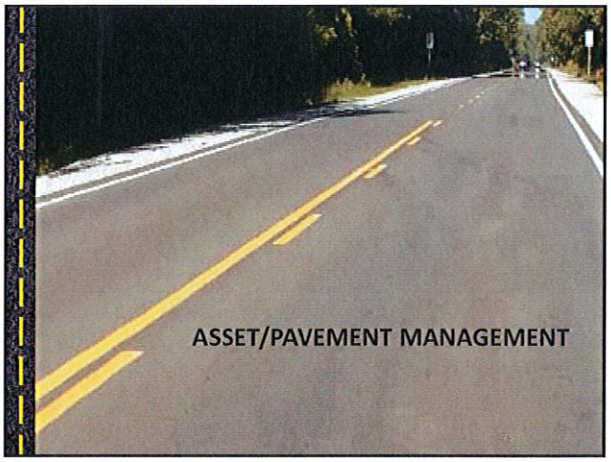

Asset Management

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, 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."*

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Asset Management

- Asset Management is a state of mind and a perpetual process
- Has to be integrated into our work processes
  - Daily,
  - Weekly
  - Monthly
  - Annually

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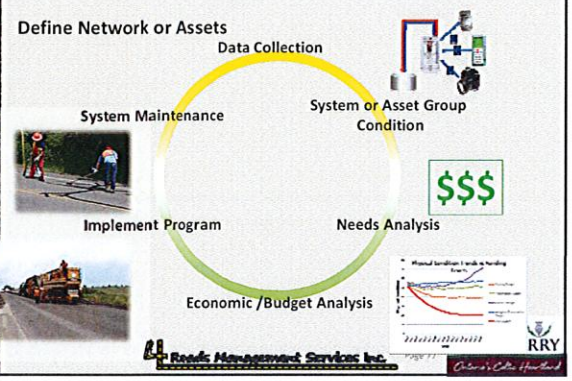
Typical Asset Management Plan Cycle



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PSAB vs Asset Management

- PSAB is not Asset Management
- PSAB is a standard method for reporting on capital depreciation and improvements to assets or asset groups

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PSAB vs Asset Management

- Tandem Dump Truck Purchase
- Initial Cost = $250,000
- Assume 1000 hrs / yr of use and 10 year life cycle
- Capital Depreciation / hr = $25
- At end of Life Cycle $250,000 in reserve to replace vehicle
- At the end of life cycle at 2% inflation replacement vehicle costs $304,748
  - Approximately $55,000 shortfall
  - Apply this to all assets!!!!!!!

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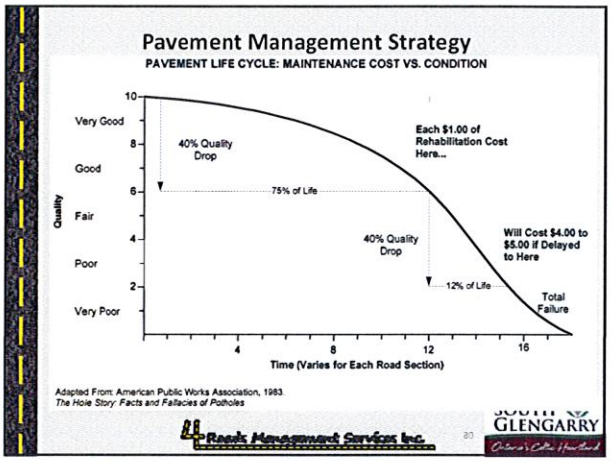
Pavement Management Strategy
PAVEMENT LIFE CYCLE: MAINTENANCE COST VS. CONDITION
Very Good
Good
Fair
Poor
Very Poor
Quality
10
8
6
4
2
40% Quality Drop
75% of Life
Each $1.00 of Rehabilitation Cost Here...
40% Quality Drop
12% of Life
Will Cost $4.00 to $5.00 if Delayed to Here
Total Failure
4
8
12
16
Time (Varies for Each Road Section)
Adapted From: American Public Works Association, 1983.
The Hole Story: Facts and Fallacies of Potholes
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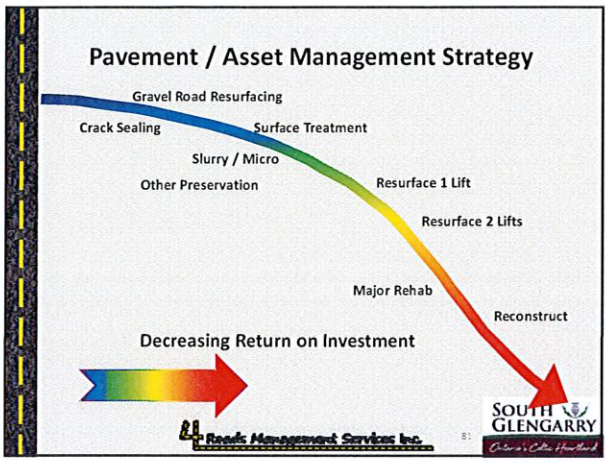
Pavement / Asset Management Strategy
Gravel Road Resurfacing
Crack Sealing
Surface Treatment
Slurry / Micro
Other Preservation
Resurface 1 Lift
Resurface 2 Lifts
Major Rehab
Reconstruct
Decreasing Return on Investment
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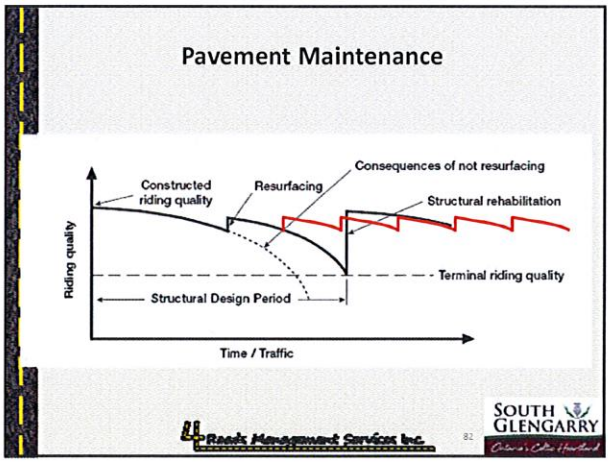
Pavement Maintenance
Constructed riding quality
Resurfacing
Consequences of not resurfacing
Structural rehabilitation
Riding quality
Terminal riding quality
Structural Design Period
Time / Traffic
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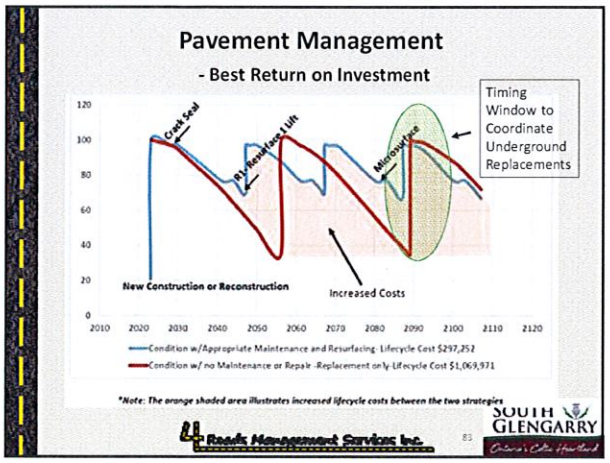
Pavement Management
- Best Return on Investment
Timing Window to Coordinate Underground Replacements
Crack Seal
Microsurface
New Construction or Reconstruction
Increased Costs
120
100
80
60
40
20
0
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
2110
2120
Condition w/Appropriate Maintenance and Resurfacing: Lifecycle Cost $297,352
Condition w/ no Maintenance or Repair -Replacement only-Lifecycle Cost $1,069,971
*Note: The orange shaded area illustrates increased lifecycle costs between the two strategies
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10 Year Program Model

	Year										
Imp. Types	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Grand Total
BSgravel	259,371	199,365	373,268	420,093	247,664				126,817		1,627,378
CRK	14,608	37,729		27,936	42,175	5,767	48,273	4,311	59,923	22,944	263,666
DST			168,948	91,224							260,172
DSTconv				146,031	361,770	461,158	882,010	98,047	559,662	109,845	2,618,523
DSTrehab	428,681										428,681
G4R				4,870							4,870
GR2		77,386	277,820		77,986	33,738		570,954	67,126	204,508	1,310,158
MICRO			2,925	4,515	12,552	7,771					27,763
PR2	345,782	1,237,371	631,088		638,521	346,678			234,493	548,261	4,032,192
R1			194,152	958,284	106,367	799,134	161,994	727,866	412,745	685,048	4,045,590
REGgravel	6,952										6,952
SST	84,765	191,092	5,197		165,762		561,913	252,772	143,064	82,704	1,397,299
SST++	514,084										514,084
Grand Total	1,654,241	1,654,141	1,653,398	1,652,953	1,652,797	1,654,244	1,654,190	1,651,990	1,653,850	1,653,310	16,537,318

Do the right activity at the right time/condition

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Strategy and Prioritization

- Program priority is resurfacing programs
  - Hot mix, Surface Treatment, Gravel Road Resurfacing
  - Other pavement preservation
    - Crack Sealing
    - Microsurfacing
- Generally projects by priority, *by program*
- Assess less tangible criteria
- Assess other infrastructure needs (i.e. water and sanitary sewer)
- Assess adjacent project opportunities

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Pavement Management Overview

- Roads Infrastructure generally the largest asset
- PMS another tool
- Provides analysis of programs and funding levels
- Benefits many potential users groups within a municipality

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Asset Management User Levels

	Political	Programming	Budgeting and Financial	Engineering / Asset Manager
System Composition	✓			✓
Detailed Physical Inventory				✓
Overall System Condition	✓	✓		✓
Condition Ratings		✓		✓
Rehabilitation Options / Costs	✓	✓	✓	✓
Budget Limitation Implications	✓	✓	✓	✓
Strategy	✓	✓		✓
Project Coordination		✓		✓
Priorities	✓	✓		✓
Deterioration Prediction	✓	✓	✓	✓
Managing Cash Flow			✓	✓
Fiscal Policy Development	✓	✓	✓	✓

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Surface Treatment Strategy

- Generally 7 year cycle
  - If average is shorter review other factors such as traffic vs surface type
- Subject to annual review
- Review traffic growth
- NPV assessment of SST vs. Hot mix if traffic warrants

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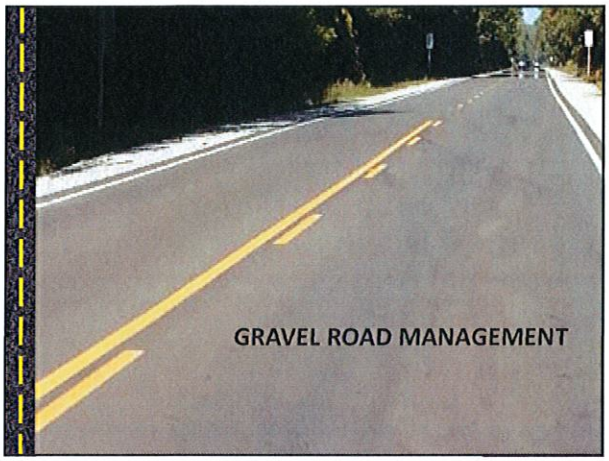

Gravel Roads Strategy

- Properly maintained gravel roads are not cheap!
  - Grading
  - Additional aggregate
  - Dust control
- NPV review of the cost of gravel vs. SST

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Material Specifications

- Use Ontario Provincial Standards and Specifications for
  - Municipal work
  - Subdivision and development
- Implement a Quality Assurance Program
- Use a minimum 75mm lift of gravel for maintenance

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Gravel Roads Strategy

- Ultimately good to upgrade all gravel to *SST-provided structure is adequate*
- Start conversion program with roads that
  - Are structurally sound
  - Adequate drainage
  - High maintenance costs and complaints
  - Isolation from other gravel sections
  - Promote hard top continuity.
  - Proximity to other work (i.e. supplement gravel with millings)
- Since scoring will be similar, project priority predicted on other factors

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Gravel Roads Strategy

- Benefits to converting a gravel road include
  - customer satisfaction/ complaints reduction
  - reduced maintenance costs for routine maintenance
  - reduced maintenance costs for winter maintenance

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Gravel Roads Strategy

- Consider additional funding to improve non-structurally adequate roads for future SST
- Gravel roads strategy *not to be confused with a reconstruction program*
- Road geometry, vertical and horizontal alignment problems will still exist.

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Gravel Roads Decision Flow Chart

- Gravel roads typically have a low traffic volume; Class 200 or Class 300 roads; <400 AADT
- The minimum tolerable standard shoulder width for Class 200 and 300 roads is 0.5m.
- The recommended surface width for Class 200 and 300 roads is 6m
- 6m surface width and 0.5m shoulder would require a minimum 7m platform
- For Class 200 and 300 roads in southern Ontario, the minimum granular base should be 150mm Granular A over 300mm Granular B

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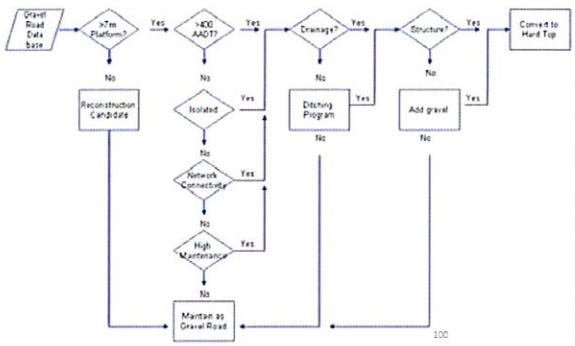
Gravel Road Conversion Decision Matrix



100

South Glengarry Observations

- The overall condition of the road system is good. Influencing factors include:
  - 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 a significant effect on the budget recommendations.)
  - As noted above, 10.48% of the system is deemed adequate due to having a counted or estimated traffic count of less than 50 vehicles per day. From a user perspective then, the road system may appear to be in a lesser condition.

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South Glengarry Observations

- Roads with a surface width less than the minimum tolerable standard were identified on 38.053km of road sections. . Typically these road sections are low volume, however, the correction would be a reconstruction of the section to produce the required width. As an interim solution, signage would reduce the municipality's exposure. These sections are listed in Appendix H.
- Roads with substandard width may be a direct result of a substandard road allowance (i.e. less than 20m.) Township of South Glengarry should try to address those areas of substandard road allowance width when improvements are required and/or when adjacent lands are being redeveloped.

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South Glengarry Observations

- Traffic Counts raise a number of issues:
  - Approximately 69% of the traffic counts are estimated. Counts appear be inconsistent with field observations in some instances.
  - Percentage of trucks or commercial vehicles were not included in the data provided.
  - There are a number of sections that appear to have been assigned a nominal AADT (i.e. 125) that may not be an accurate reflection of the traffic.

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South Glengarry Observations

- Based on conditions observed there appears to be a number of gravel road sections that may be suitable for conversion to a hard top surface. Any construction work would be subject to a geotechnical investigation and more detailed investigation.
- 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.
- End of Load segregation was observed in a number of locations. The Township may wish to consider a Material Transfer Vehicle for inclusion in the hot mix asphalt tender,
- There were a number of low volume sections that may be viable for closure. The key criteria is not land locking another property.

Roads Management Services Inc. 108 SOUTH GLENGARRY Ontario's Celtic Heartland

South Glengarry Observations

- Generally, the majority of the road system is low volume roads. There appears that there may have been a preference for hot mix asphalt surfaces. Some consideration should be given to other hard top surface types such as surface treatments where the percentage of trucks is not an issue.
- Ditch infilling was observed in new subdivisions. Inadequate drainage greatly affects the performance of the road from a structural perspective and also may cause property damage through flooding.

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South Glengarry Observations

- Approximately 31.5% (120.691km) of the ToSG road system requires resurfacing or rehabilitation (Hot mix asphalt or surface treatment). If not addressed, the resurfacing needs will become major rehabilitation or reconstruction needs at significantly greater cost.
- Approximately 17.04% (67.4km) 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.)

Road Budget Recommendations

- **$155,278,475** to replace the road system.
  - Annualized, this would be **$3,105,600** for the roads capital/depreciation, based upon a 50-year life cycle.
- **Preservation Budget is $2,355,200** and includes the following:
  - **$926,700** for average annual hot mix resurfacing, based upon an 19(18.78)-year cycle.(This would approximate an average of 3.3km per year)
  - **$156,500** 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.
  - **$1,162,600** 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.).
  - **$109,400** annually for crack sealing.

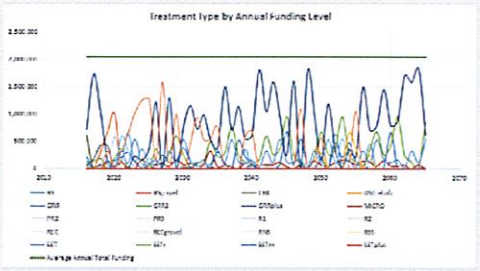
Road Budget Recommendations

- Budget Recommendations are ***not*** cumulative
- Preservation Budget is **$2,355,200**
  - Includes recommendations for resurfacing, surface treatment, gravel resurfacing and crack sealing
- Annual Expenditures – 'Re-investment'- should be between the Preservation and Capital depreciation levels.

Programming

- The Preservation Budget and Asset Management Concept
- Paradigm shift required
  - Instead of annual funding at fixed levels of capital and operating look at the gross total as a level of re-investment.
- Gross Funding Level stays fixed
  - Programs 'flex' within the funding limit

Treatment Selection and Annual Funding Levels



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Roads Strategy

- 'Worst First' only works if funding is adequate across all programs
  - Is not the case.
- Hot Mix resurfacing program (or any activity that preserves the asset value) should be the priority program over reconstruction
  - The preferred treatment on some road sections will be driven by other utilities in some cases (i.e. water, sewers)
- Roads that do not get resurfaced at the right time deteriorate rapidly to construction needs

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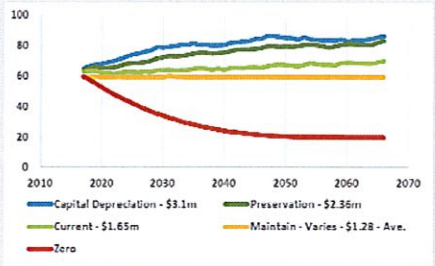
System Performance vs Funding Level – Predicted System Condition



Current budget will only sustain the system is project and treatment selection are appropriate.

Roads Management Services Inc. 116 SOUTH GLENGARRY

Recommendations

In addition to the budgetary recommendations, 4 Roads makes the following recommendations for the management of the Township of South Glengarry's 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. Annualized funding should be increased to $2,355,200 and adjusted annually for inflation.
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.

Roads Management Services Inc. SOUTH GLENGARRY

Recommendations

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.

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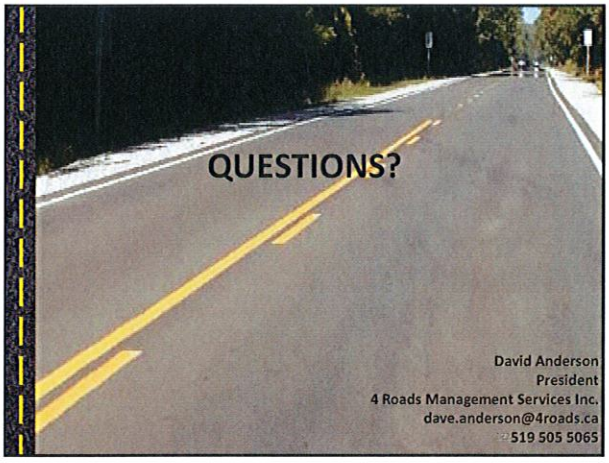
Recommendations

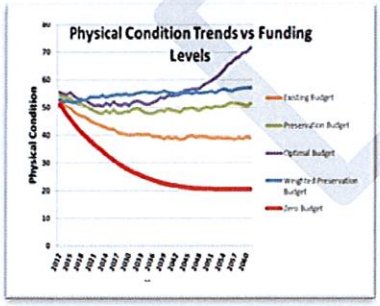
11. Further analysis should be undertaken on the Gravel Road system with respect to the potential for conversion to a hardtop surface. A decision matrix is included in Appendix C of this report.
12. Roads sections where potentially substandard horizontal and vertical alignment have been identified, should be reviewed to ensure signage is in compliance with the Ontario Traffic Manual.
13. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
14. A Master Drainage Plan should be developed for each of the development areas.
15. The results and recommendations for programming of this report should be integrated with the other assets groups to ensure available funding is optimized.

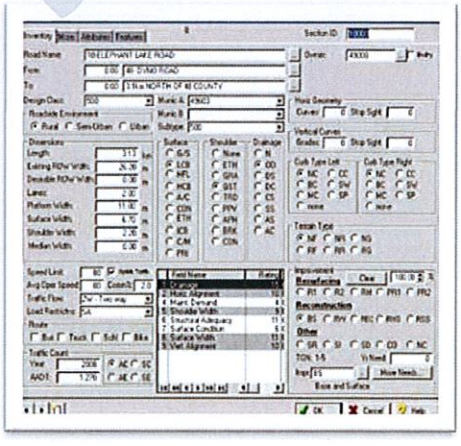
4 Roads Management Services Inc. 119 SOUTH GLENGARRY

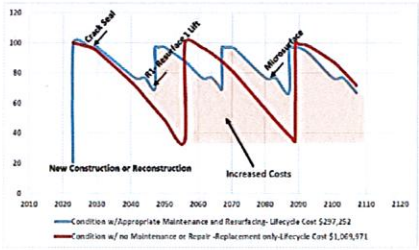


TOWNSHIP OF SOUTH GLENGARRY

Township of South Glengarry
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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7 Candle Crescent,
Kitchener Ontario, N2P 2K7

May 14, 2016

Township of South Glengarry
6 Oak Street
PO Box 220
Lancaster, Ontario K0C 1N0

Attention: **Mr. Ewen MacDonald, CRSS, RRFM, General Manager of Infrastructure Services**

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

Dear Mr. MacDonald,

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 the Township of South Glengarry 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

SOUTH GLENGARRY

Ontario's Celtic Heartland

Township of South Glengarry

2016 State of the Infrastructure -Roads

4 Roads Management Services Inc.

7 Candle Crescent, Kitchener Ontario, N2P 2K7

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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.

Township of South Glengarry (ToSG) currently develops an AMP for the various asset groups, roads being one of them. A key component of the AMP is a *'State of the Infrastructure'* (SotI) review of the asset or asset group. The 2016 State of the Infrastructure - Roads provides the SotI review of the Township of South Glengarry 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 ToSG 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 the ToSG
- 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 F. These section should be reviewed to ensure that regulatory and advisory signage is in compliance with the Ontario Traffic Manual.

ToSG provided a geodatabase through the County 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. Township of South Glengarry 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. This resulted in the creation of an additional 55 sections.

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. This factor does have an effect on the system adequacy calculation for Township of South Glengarry. The road system currently includes 40.205km of road sections that had an actual or estimated traffic count of less than 50 vehicles per day. This represents approximately 10.48% of the road system.

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 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 fair. 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 a significant effect on the budget recommendations.)
    - As noted above, 10.48% of the system is deemed adequate due to having a counted or estimated traffic count of less than 50 vehicles per day. From a user perspective then, the road system may appear to be in a lesser condition.

- Roads with a surface width less than the minimum tolerable standard were identified on 38.053km of road sections. . Typically these road sections are low volume, however, the correction would be a reconstruction of the section to produce the required width. As an interim solution, signage would reduce the municipality's exposure. These sections are listed in Appendix H.
- Roads with substandard width may be a direct result of a substandard road allowance (i.e. less than 20m.) Township of South Glengarry 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:
    - Approximately 69% of the traffic counts are estimated. Counts appear be inconsistent with field observations in some instances.
    - Percentage of trucks or commercial vehicles were not included in the data provided.
    - There are a number of sections that appear to have been assigned a nominal AADT (i.e. 125) that may not be an accurate reflection of the traffic.
- Based on conditions observed there appears to be a number of gravel road sections that may be suitable for conversion to a hard top surface. Any construction work would be subject to a geotechnical investigation and more detailed investigation.
- 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.
- End of Load segregation was observed in a number of locations. The Township may wish to consider a Material Transfer Vehicle for inclusion in the hot mix asphalt tender,
- There were a number of low volume sections that may be viable for closure. The key criteria is not landlocking another property.
- Generally, the majority of the road system is low volume roads. There appears that there may have been a preference for hot mix asphalt surfaces. Some consideration should be given to other hard top surface types such as surface treatments where the percentage of trucks is not an issue.
- Ditch infilling was observed in new subdivisions. Inadequate drainage greatly affects the performance of the road from a structural perspective and also may cause property damage through flooding.
- Approximately 31.5% (120.691km) of the ToSG road system requires resurfacing or rehabilitation (Hot mix asphalt or surface treatment). If not addressed, the resurfacing needs will become major rehabilitation or reconstruction needs at significantly greater cost.
- Approximately 17.04% (67.4km) of the road system has a structural adequacy score of 15 or 16, indicating that those roads would be an additional resurfacing need in the next 1 to 3 year period. (All surface types are included.)

Based on the current review of the road system, the current system adequacy measure is 74.4% meaning that, 25.6% 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 based on the former Provincial standards when conditionalized grants were provided. As noted in the foregoing, there are a number of factors potentially influencing the system adequacy.

Based on the current unit costs being experienced, the total estimated cost of recommended improvements is **$62,235,672.** The improvement costs include **$30,156,331** for those roads identified as NOW needs and **$32,079,341** is for road work required in the '1 to 10' year time period or for maintenance. Included in those amounts is **$11,197,123** 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:

- **$155,278,475** to replace the road system. Annualized, this would be **$3,105,600,** 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.)
- **$926,700**annually hot mix resurfacing, based upon an 19.(18.78)-year cycle.(This would approximate an average of 3.3km per year)
- **$156,500** 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.
- **$1,162,641** 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.).
- **$109,400** 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: **$2,355,200**. 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 and project selection is based on condition and best Return on Investment. This concept has to be applied to all assets.

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

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

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

1. The information and budget recommendations included in this report should be used to further develop and evolve the corporate Asset Management Plan.
2. Annualized funding should be increased to $2,355,200 and adjusted annually for inflation.
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. Further analysis should be undertaken on the Gravel Road system with respect to the potential for conversion to a hardtop surface. A decision matrix is included in Appendix C of this report.
12. 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.

13. Roads sections with substandard width should be signed with advisory signage, to reduce municipal exposure.
14. A Master Drainage Plan should be developed for each of the development areas.
15. 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
Gravel, Stone, Other Loosetop	169.366	338.732	3.515	7.030	0.000	0.000	**172.881**	**345.762**	45.07%	45.09%
High Class Bit.-asphalt	98.662	197.324	54.121	108.012	0.931	1.862	**153.714**	**307.198**	40.08%	40.06%
Low Class Bit.-surface treated	56.556	113.112	0.390	0.780	0.000	0.000	**56.946**	**113.892**	14.85%	14.85%
Total	**324.584**	**649.168**	**58.026**	**115.822**	**0.931**	**1.862**	**383.541**	**766.852**		
% of Total	84.63%	84.65%	15.13%	15.10%	0.24%	0.24%				

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	29.493	58.986					**29.493**	**58.986**	7.69%	7.69%
200	2	127.683	255.366					**127.683**	**255.366**	33.29%	33.30%
300	2	115.973	231.946					**115.973**	**231.946**	30.24%	30.25%
400	2	43.343	86.686					**43.343**	**86.686**	11.30%	11.30%
500	2	5.281	10.562					**5.281**	**10.562**	1.38%	1.38%
600	2	1.249	2.498					**1.249**	**2.498**	0.33%	0.33%
800	2	1.562	3.124					**1.562**	**3.124**	0.41%	0.41%
C/R	2			2.066	4.132			**2.066**	**4.132**	0.54%	0.54%
L/R	1			0.23	0.23			**0.23**	**0.23**	0.06%	0.03%
L/R	2			54.581	109.162	0.931	1.862	**55.512**	**111.024**	14.47%	14.48%
LCI	2			1.149	2.298			**1.149**	**2.298**	0.30%	0.30%
Total		**324.584**	**649.168**	**58.026**	**115.822**	**0.931**	**1.862**	**383.541**	**766.852**		
% of Total		84.63%	84.65%	15.13%	15.10%	0.24%	0.24%				

Table ES 3: MMS Class by Lanes and Roadside Environment

		MMS Class											
		3		4		5		6		TOTAL		% OF TOTAL	
Lanes	Roadside	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km	Cl-km	Ln-km
1	S	0	0	0	0	0.23	0.23	0	0	**0.23**	**0.23**	0.06%	0.03%
2	R	8.092	16.184	273.421	546.842	13.578	27.156	29.493	58.986	**324.584**	**649.168**	84.63%	84.65%
2	S	0	0	2.922	5.844	44.162	88.324	10.712	21.424	**57.796**	**115.592**	15.07%	15.07%
2	U	0	0	0	0	0.931	1.862	0	0	**0.931**	**1.862**	0.24%	0.24%
TOTAL		**8.092**	**16.184**	**276.343**	**552.686**	**58.901**	**117.572**	**40.205**	**80.41**	**383.541**	**766.852**		
% OF TOTAL		2.11%	2.11%	72.05%	72.07%	15.36%	15.33%	10.48%	10.49%				

Table ES 4: Overall Time of Need by Length and MMS Class

	3		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	Cl-km	Lane-km
1 to 5	0.852	1.704	22.101	44.202	10.425	20.85	0	0	**33.378**	**66.756**	8.70%	8.71%
6 to 10	0	0	86.399	172.798	15.171	30.112	0	0	**101.57**	**202.91**	26.48%	26.46%
Adequate	7.24	14.48	90.391	180.782	12.401	24.802	40.205	80.41	**150.237**	**300.474**	39.17%	39.18%
NOW	0	0	77.452	154.904	20.904	41.808	0	0	**98.356**	**196.712**	25.64%	25.65%
Total	**8.092**	**16.184**	**276.343**	**552.686**	**58.901**	**117.572**	**40.205**	**80.41**	**383.541**	**766.852**		
% of Total	2.11%	2.11%	72.05%	72.07%	15.36%	15.33%	10.48%	10.49%				
System Adequacy %	100.0%	100.0%	72.0%	72.0%	64.5%	64.4%	100.0%	100.0%	74.4%	74.3%		
Overall Good to Very Good	89.5%	89.5%	64.0%	64.0%	46.8%	46.7%	100.0%	100.0%	65.7%	65.6%		

Table ES 5: Average Replacement Costs by Functional Class

Class	R Replacement Cost	R Length (km)	S Replacement Cost	S Length (km)	U Replacement Cost	U Length (km)	TOTAL Replacement Cost	TOTAL Length (km)	% OF TOTAL Replacement Cost	% OF TOTAL Length (km)	Cost / Km
100	$9,095,603	29.493		0.000		0.000	**$ 9,095,603**	**29.493**	5.86%	7.69%	$ 308,399
200	$43,034,869	127.683		0.000		0.000	**$ 43,034,869**	**127.683**	27.71%	33.29%	$ 337,045
300	$45,919,458	115.973		0.000		0.000	**$ 45,919,458**	**115.973**	29.57%	30.24%	$ 395,950
400	$24,209,969	43.343		0.000		0.000	**$ 24,209,969**	**43.343**	15.59%	11.30%	$ 558,567
500	$3,383,138	5.281		0.000		0.000	**$ 3,383,138**	**5.281**	2.18%	1.38%	$ 640,625
600	$1,006,172	1.249		0.000		0.000	**$ 1,006,172**	**1.249**	0.65%	0.33%	$ 805,582
800	$1,443,254	1.562		0.000		0.000	**$ 1,443,254**	**1.562**	0.93%	0.41%	$ 923,978
C/R		0.000	$ 1,193,690	2.066		0.000	**$ 1,193,690**	**2.066**	0.77%	0.54%	$ 577,778
L/R		0.000	$ 23,583,155	54.811	$ 1,825,269	0.931	**$ 25,408,424**	**55.742**	16.36%	14.53%	$ 455,822
LCI		0.000	$ 583,898	1.149		0.000	**$ 583,898**	**1.149**	0.38%	0.30%	$ 508,179
TOTAL	**$ 128,092,463**	**$ 324.584**	**$ 25,360,743**	**58.026**	**$ 1,825,269**	**0.931**	**$ 155,278,475**	**383.541**			$ 404,855
% OF TOTAL	82.49%	84.63%	16.33%	15.13%	1.18%	0.24%					

Table ES 6: Traffic Count by Year and Method

Count Year	Counted	Estimated	TOTAL	% OF TOTAL
1997	3.951	0	**3.951**	1.03%
1998	24.614	4.88	**29.494**	7.69%
1999	67.45	0.552	**68.002**	17.73%
2001	3.558	0	**3.558**	0.93%
2002	0	11.934	**11.934**	3.11%
2009	0	5.803	**5.803**	1.51%
2011	3.084	181.516	**184.6**	48.13%
2012	0	2.143	**2.143**	0.56%
2014	10.591	18.518	**29.109**	7.59%
2015	4.24	0	**4.24**	1.11%
2016	0	40.707	**40.707**	10.61%
TOTAL	**117.488**	**266.053**	**383.541**	
% OF TOTAL	30.63%	69.37%		

Table ES 7: Average Traffic Count by MMS Class

	MMS Class					
Roadside	3	4	5	6	AVERAGE	% OF TOTAL
R	2,621	261	209	25	**779**	75.48%
S	0	700	163	24	**222**	21.49%
U	0	0	125	0	**31**	3.03%
AVERAGE	**874**	**320**	**166**	**17**	**344**	
% OF TOTAL	63.48%	23.28%	12.04%	1.20%		

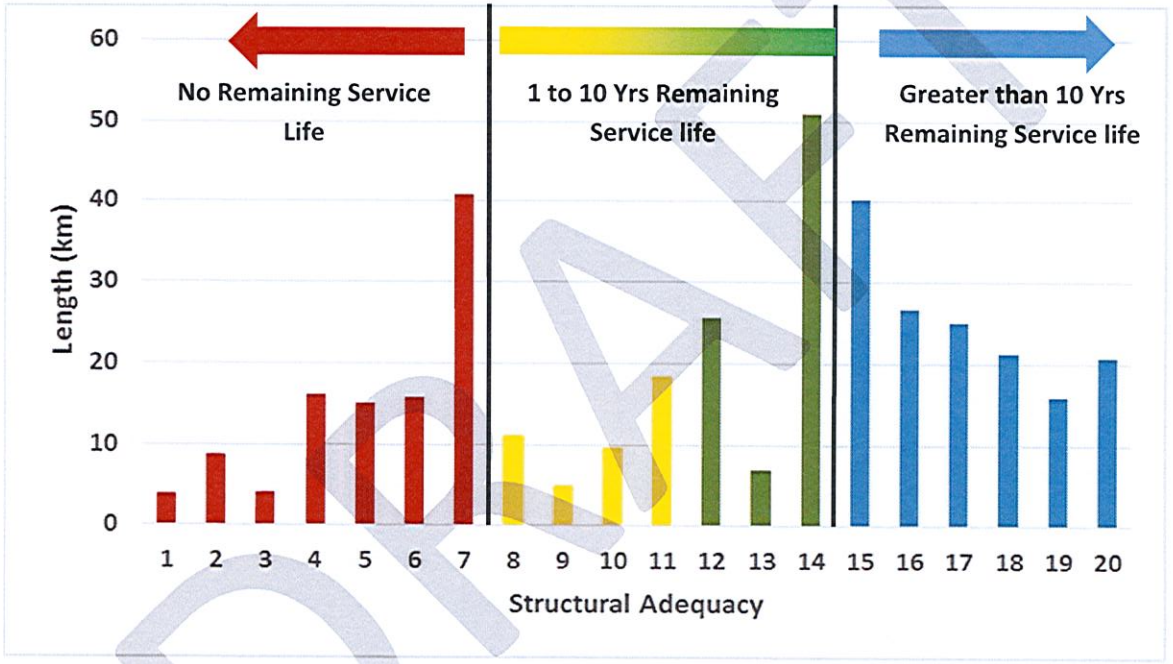
Table ES 8: Good to Very Good Roads by Structural Adequacy

Structural Adequacy	Time of Need	MMS Class 3	4	5	6	Length (km)	% of System Length
1	NOW	0	1.202	1.006	1.644	**3.852**	1.00%
2	NOW	0	4.813	3.545	0.325	**8.683**	6.68%
3	NOW	0	0	3.782	0.272	**4.054**	3.37%
4	NOW	0	11.262	0.612	4.189	**16.063**	13.35%
5	NOW	0	8.722	1.358	4.953	**15.033**	12.49%
6	NOW	0	10.694	3.399	1.594	**15.687**	13.04%
7	NOW	0	33.935	4.743	2.103	**40.781**	33.89%
8	1 to 5	0	6.272	1.865	3.038	**11.175**	9.29%
9	1 to 5	0	2.093	2.909	0	**5.002**	4.16%
10	1 to 5	0	6.29	3.134	0.155	**9.579**	1.47%
11	1 to 5	0.852	7.809	6.182	3.525	**18.368**	2.82%
12	6 to 10	0	20.91	0.847	3.788	**25.545**	3.92%
13	6 to 10	0	3.508	1.981	1.461	**6.95**	1.07%
14	6 to 10	0	48.184	3.15	1.128	**52.462**	8.05%
15	ADEQ	0	32.356	0.352	7.61	**40.318**	6.19%
16	ADEQ	5.281	17.078	4.04	0.323	**26.722**	4.10%
17	ADEQ	0.71	14.751	8.926	0.629	**25.016**	3.84%
18	ADEQ	0	19.529	0.91	0.941	**21.38**	3.28%
19	ADEQ	1.249	12.713	1.573	0.484	**16.019**	2.46%
20	ADEQ	0	14.222	4.587	2.043	**20.852**	3.15%
Grand Total		**8.092**	**276.343**	**58.901**	**40.205**	**383.541**	
Good to Very Good%		89.5%	66.3%	44.8%	45.8%	61.3%	

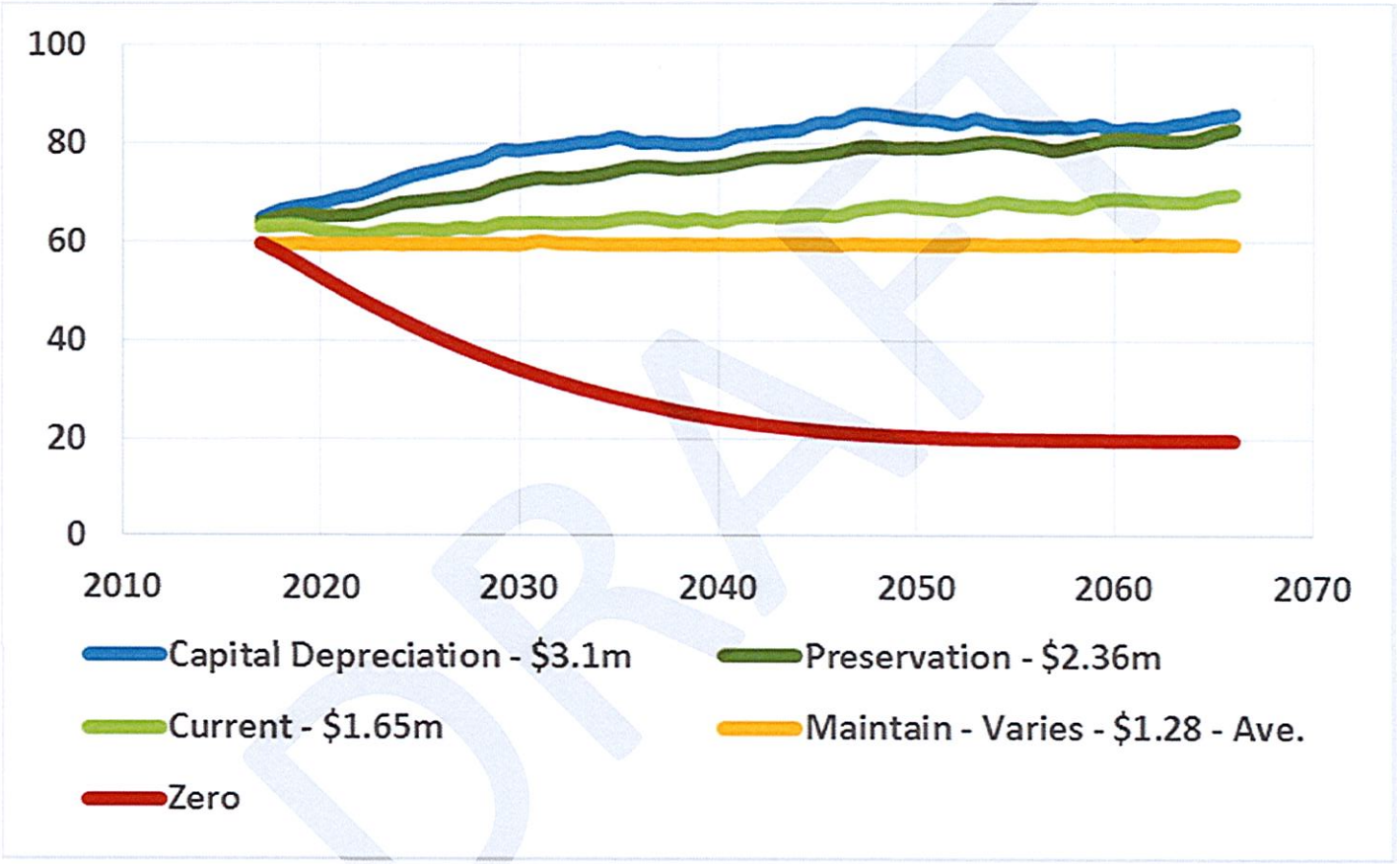
Table ES 9: Road System Needs Summary

Improvement Class	Improvement ID	Improvement Description	Time of Need: 1 to 5 Imp. Cost	1 to 5 Cl km	6 to 10 Imp. Cost	6 to 10 Cl km	ADEQ Imp. Cost	ADEQ Cl km	NOW Imp. Cost	NOW Cl km	TOTAL Imp. Cost	TOTAL Cl km	% OF TOTAL Imp. Cost	% OF TOTAL Cl km
Const	BS	Base and Surface	378,377	1.434	3,172,143	17.828	472,092	1.915	8,350,515	39.242	12,373,127	60.419	19.88%	15.75%
Const	BSgravel	Base and Surface to Gravel	0	0	0	0	1,285,276	12.364	1,439,304	12.4	2,724,580	24.764	4.38%	6.46%
Const	DSTconv	DST and Gravel Road Conversion	0	0	1,081,163	12.994	1,748,550	20.695	0	0	2,829,713	33.689	4.55%	8.78%
Const	DSTrehab	Double Surface Treatment Rehabilitation	361,330	5.788	0	0	0	0	67,351	1.091	428,682	6.879	0.69%	1.79%
Const	GRR2	Gravel Resurfacing 150mm	0	0	77,986	2.019	0	0	0	0	77,986	2.019	0.13%	0.53%
Const	GRR	Gravel Road Resurfacing Single Lift 75mm	0	0	0	0	15,291	0.844	0	0	15,291	0.844	0.02%	0.22%
Const	None	No Improvement Required	0	0	0	0	0	60.474	0	0.255	0	60.729		15.83%
Const	REC	Reconstruction - Rural	151,660	0.348	0	0	589,288	1.729	2,891,467	6.846	3,632,415	8.923	5.84%	2.33%
Const	RECgravel	Reconstruction Gravel Road	0	0	0	0	3,072,747	10.022	3,794,668	12.396	6,867,415	22.418	11.03%	5.85%
Const	RNS	Reconstruction Nominal Storm Sewer	0	0	0	0	0	0	111,150	0.105	111,150	0.105	0.18%	0.03%
Const	RSS	Reconstruction with Storm Sewers	1,710,242	0.902	5,651,642	3.005	2,885,797	1.522	9,755,208	5.145	20,002,889	10.574	32.14%	2.76%
Maint	CRK	Crack Sealing	0	0	0	0	39,466	11.086	0	0	39,466	11.086	0.06%	2.89%
Maint	GRRplus	Maintenance Gravel and Minor Ditching	0	0	137,324	5.96	63,289	2.723	0	0	200,613	8.683	0.32%	2.26%
Maint	Micro	Microsurfacing	0	0	0	0	108,037	4.561	0	0	108,037	4.561	0.17%	1.19%
Maint	RSpLimit	Reduce Speed limit	0	0	0	0	0	0.655	0	1.412	0	2.067		0.54%
Maint	SD	Spot Drainage	0	2.788	0	6.624	0	7.438	0	0	0	16.85		4.39%
Maint	SR	Spot Repairs	0	0	0	5.359	0	0.695	0	0	0	6.054		1.58%
Rehab	DST	Double Surface Treatment	0	0	83,604	2.574	172,637	5.138	3,931	0.117	260,172	7.829	0.42%	2.04%
Rehab	PR2	Pulverize and Resurface 2 - 100mm	4,094,128	20.974	0	0	220,568	1.081	3,742,736	19.347	8,057,433	41.402	12.95%	10.79%
Rehab	R1	Basic Resurfacing 1 - 50mm	0	0	3,231,490	28.102	267,288	2.31	0	0	3,498,778	30.412	5.62%	7.93%
Rehab	R2	Basic Resurfacing 2 - 100mm	237,046	1.144	0	0	172,030	0.853	0	0	409,076	1.997	0.66%	0.52%
Rehab	SST++	SST, 10% Base Repairs, Minor Ditching	0	0	514,083	17.105	0	0	0	0	514,083	17.105	0.83%	4.46%
Rehab	SST	Single Surface Treatment	0	0	0	0	84,765	4.132	0	0	84,765	4.132	0.14%	1.08%
TOTAL			6,932,783	33.378	13,949,434	101.57	11,197,123	150.237	30,156,331	98.356	62,235,672	383.541		
% OF TOTAL			11.14%	8.70%	22.41%	26.48%	17.99%	39.17%	48.46%	25.64%				

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



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



Notes: Data points are year-end performance estimate

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

	Year										
Imp. Types	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Grand Total
BSgravel	259,371	199,965	373,268	420,093	247,664				126,817		**1,627,178**
CRK	14,608	37,729		27,936	42,175	5,767	48,273	4,311	59,923	22,944	**263,666**
DST			168,948	91,224							**260,172**
DSTconv				146,031	361,770	461,158	882,010	98,047	559,662	109,845	**2,618,523**
DSTrehab	428,681										**428,681**
GRR				4,870							**4,870**
GRR2		77,986	277,820		77,986	33,738		570,994	67,126	204,508	**1,310,158**
MICRO			2,925	4,515	12,552	7,771					**27,763**
PR2	345,782	1,237,371	631,088		638,521	346,676			284,493	548,261	**4,032,192**
R1			194,152	958,284	106,367	799,134	161,994	727,866	412,745	685,048	**4,045,590**
RECgravel	6,952										**6,952**
SST	84,765	101,092	5,197		165,762		561,913	252,772	143,084	82,704	**1,397,289**
SST++	514,084										**514,084**
Grand Total	**1,654,243**	**1,654,143**	**1,653,398**	**1,652,953**	**1,652,797**	**1,654,244**	**1,654,190**	**1,653,990**	**1,653,850**	**1,653,310**	**16,537,118**

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

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