

What Do I Have and Where is it Located? Quantifying Ontario's Municipal Lane Kilometres

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ABSTRACT

An essential requirement of a good asset management plan is data. There are many benefits to having good data: trust, reduced liability, improved asset knowledge, improved budgeting, and improved customer service. Without this, it is impossible to make strategic asset management decisions.

In 1995, the Ministry of Transportation of Ontario ended the *Conditional Grant Program* that provided partial funding for municipalities to support maintenance, rehabilitation, and reconstruction of their roadways. This decision also impacted the collection of road inventory, condition and performance data. At this time, it was estimated that Ontario municipalities owned and maintained approximately 275,000 lane kilometres of road. Since this time, there have been numerous changes within the province that would affect the lane kilometre value: downloading of provincial highways to local municipalities; municipal amalgamations; and system growth/development.

In an attempt to recapture some of this missing road infrastructure data, the Municipal Performance Measure Program (MPMP) was created in 2000. Under this program, Ontario municipalities are required to report efficiency and effectiveness performance measures for the services they are responsible for delivering as part of their Financial Information Return (FIR). Although mandated, there has never been 100% compliance by Ontario's 444 municipalities.

Fast forward to 2012, 343 Ontario municipalities (77%) submitted lane kilometre data through MPMP. Recognizing the importance of this value in an asset management context, the Ministry of Municipal Affairs and Housing (MMAH) initiated the *Roads and Bridges Data Improvement Project*. The goal of the project was to fill in the missing gaps and to create a complete data set for the number of Ontario lane kilometres that are under municipal jurisdiction and confirm the accuracy of the information being provided. Through rigorous follow-up with individual municipalities, MMAH was able to obtain 100% participation and determine that Ontario municipalities are responsible for 301,886 lane kilometres of road.

The paper focuses on five key areas of the *Roads and Bridge Improvement Project*: context and goals; the data improvement process; projects results; data verification; and observations/lessons learned. The results of this effort is an accurate starting point to begin collecting important road infrastructure data that can be used to make strategic asset management decisions at both the provincial and municipal levels of government and allow for accurate benchmarking comparisons to take place.

INTRODUCTION

The performance of a municipality's infrastructure provides the foundation for its economic prosperity and quality of life. Asset management provides an opportunity for municipalities to strategically and systematically build, operate and maintain their infrastructure while providing value to their ratepayers. The key elements/principals of asset management can be addressed through answering seven fundamental questions:

1. What do I have and where is it located?
2. What is the asset worth?
3. What is the assets condition and remaining service life?
4. What needs to be done to the asset?
5. When do I need to do it?
6. How much will it cost?
7. How do I ensure accountability (long term sustainability)?

Public Sector accounting Board (PSAB) 3150 introduced in the 2000's required municipality to identify and collect some basic data on the infrastructure that they are responsible for. The development of an asset management plan builds upon this information but requires additional attribute data.

BACKGROUND

Prior to 1995, the Province of Ontario, through the Ministry of Transportation (MTO) provided both technical and financial assistance to municipalities and First Nation Communities for the construction and maintenance of their road infrastructure (roads and bridges). Each year the municipality in conjunction with the MTO would evaluate their road infrastructure and the results were stored in either the MTO's Municipal Road Inventory Management System (MRIMS) or Municipal Bridge Appraisal Data Entry System (MBADES). When the Conditional Grant Program ended so too did the road and bridge inventory program. At that time there was 273,982 lane kilometres of road that was maintained by Ontario municipalities (1). The value, 273,982 represents the last accurate information the Province of Ontario had on the number of municipal lane kilometres for almost 20 years. Following the discontinuation of the Conditional Grant Program, municipalities were no longer required to report road inventory information and many stopped keeping track of this information due to financial and resource burdens. Since 1995, there have been numerous changes within the province that would affect the lane kilometre value: MTO downloading of approximately 5,000 centerline kilometres of provincial highways to local municipalities; municipal amalgamations; and system growth/development.

MUNICIPAL PERFORMANCE MEASUREMENT PROGRAM (MPMP)

The MPMP was introduced in 2000 as a way to promote municipal transparency, accountability, and recapture service level data through the reporting of yearly performance measures. Each year Ontario municipalities are responsible for submitting service level, efficiency, and effectiveness measures in thirteen service areas as part of the Financial Information Return (FIR).

The 2011 edition of the MPMP, seven efficiency and effectiveness measures for the Roadway Service Area are collected. These included (2):

- Operating/Total costs for paved (hard top) roads per lane kilometre;

- Operating/Total costs for unpaved (loose top) roads per lane kilometre;
- Operating/Total costs for bridges and culverts per square metre of surface area;
- Operating/Total costs for winter control maintenance of roadways, excluding sidewalks and parking lots, per lane kilometre maintained in winter;
- Percentage of paved lane kilometres where the condition is rated as good to very good;
- Percentage of bridges and culverts where the condition is rated as good to very good; and
- Percentage of winter events where the response met or exceeded locally determined municipal service levels for road maintenance.

SCOPE AND OBJECTIVES

In the fall of 2012, Ministry of Municipal Affairs and Housing (MMAH) requested a comprehensive set of data on the number of lane kilometres of roads maintained by Ontario's 444 municipalities. At that time, the Ministry of Finance was considering options for what to include in the calculation of the Northern and Rural Municipal Fiscal Circumstances Index, which is used in calculating Ontario Municipal Partnership Fund transfers to some municipalities.

A preliminary scan of the raw 2011 MPMP data showed that 77% of Ontario municipalities (343 of 444) had submitted roads related data which included information on the number of lane kilometres. Additionally, 165 municipalities were identified as having gaps in their 2011 MPMP roads and bridges or had submitted data that appeared to be incorrect.

MMAH had four goals in mind for improving the overall accuracy and completeness of MPMP roads and bridge data submitted by municipalities:

- To create a complete data source for the number of lane kilometres of roads owned and maintained by Ontario municipalities.
- To confirm the accuracy of MPMP roads data submitted by municipalities.
- To demonstrate to municipalities that MPMP data submission as an important Ministry priority, in addition to being a legal requirement for all municipalities.
- To gain insights into the barriers to reporting timely and accurate MPMP data.

ROADS AND BRIDGE DATA IMPROVEMENT PROJECT: METHODOLOGY

A data improvement process was developed by MMAH for roads and bridges data in MPMP Schedules 91, 92, 94. The two major elements of the data improvement process were improving the completeness of the data and verifying the accuracy of the data received. The process for improving the data involved emailing FIR contacts for all municipalities that had not submitted MPMP roads data or appeared to have errors in their data submissions. Subsequently, MMAH would follow-up with calls and further emails until improved data had been received or a satisfactory explanation given for the apparent discrepancies.

MMAHC's efforts to contact 266 municipalities that had gaps or apparent discrepancies/errors in their MPMP roads and bridges data resulted in a significant increase in the percentage of municipalities reporting municipal lane kilometres data, from 77% to 100% (343 municipalities to 444 municipalities). Having a complete dataset revealed that Ontario municipalities are responsible for 301,886 lane kilometres of road.

To verify the accuracy of the MPMP data, it was compared to data from other sources, which included the Ontario Good Roads Association's (OGRA) Municipal DataWorks (MDW) initiative, Ontario Roads Coalition (ORC) municipal roads survey, a statistical model developed by OGRA, and Land Information Ontario's Ontario Roads Network (ORN) data.

Analysis of the Ontario Roads Network (ORN) data from Land Information Ontario indicates that the ORN lane kilometre count is significantly greater, 315,730 lane kilometres total, than the values reported by the municipalities. Possible explanations for this variance include:

- ORN data may include cottage roads, private laneways, alley ways and roads in and around industrial complexes.
- ORN data may include single lane roads that border farmers' fields.
- ORN data may include single laneways behind houses.
- ORN data may count some wide laneways as two lane roads.
- ORN data counts unassumed roads within municipal boundaries
- ORN data includes unopened roads (lot concession roads that have never been opened to traffic)
- ORN data includes unopened road allowances extending to the water's edge that have never been opened to traffic)
- MPMP data may not include all single lane portions of some municipal roads.

OGRA developed a series of five multiple linear regression models to predict individual municipality's lane kilometre information based the MPMP regions. A breakdown of the regions by and the corresponding number of municipalities by tier is provided in Figure 1.

Models were developed using municipal data supplied through the FIR and MPMP as independent variables. Eight combinations of population, area, number of dwellings, and municipal tier were used to create to select the final equation used to predict the number of municipal lane kilometres based on the highest adjusted coefficient of determination (R^2_{adj}) value. The original model was developed based on data for Central Region and the same structure was used for the remaining regions. The equation coefficients for the five models are presented in Table 1.

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Where:

P_{ij} = Population of the municipality;

A_{ij} = Land area of the municipality in km^2 based on 2011 Canada Census data;

D_{ij} = Total number of private dwellings based on 2011 Canada Census data; and

S_{ij} = Municipal status (LT=1, ST=2, and UT=3).



Region	# Municipalities	LT*	ST*	UT*
Central (C)	78	66	4	8
Eastern(E)	114	90	13	11
North Eastern (NE)	110	0	110	0
North Western (NW)	34	0	34	0
Western (W)	108	85	12	11
Total	444	241	173	30

* LT, Lower Tier ST, Single Tier UT, Upper Tier

Figure 1. Ontario MPMP Regions and Municipal Breakdown

Table 1. Equation Coefficients

Region	β_1	β_2	β_3	β_4	β_5	β_6	Intercept
Central	-1.69E-09	-0.0097	-0.0002	0.9083	0.0470	-1101.60	1288.16
Eastern	-7.09E-09	0.00597	-8E-05	0.6572	0.0301	-527.86	619.71
North Eastern	3.60E-08	-0.0376	-6E-05	0.3365	0.1135	0	51.92
North Western	-1.55E-07	0.0385	-9E-05	0.3640	-0.0131	0	31.09
Western	-2.29E-08	0.0174	-0.0003	1.5680	-0.0063	-454.6	445.90

Four of the five the developed models showed a high degree of accuracy in predicting the municipal lane kilometres as demonstrated by the R^2_{adj} values (Central = 0.909, Eastern = 0.884, North Eastern = 0.901, North Western = 0.781, and Western = 0.546). Figure 2 shows a comparison of predicted versus actual municipal lane kilometres for Central Region broken down tier level. Table 2 presents a summary of the total lane kilometre comparison of five MPMP regions.

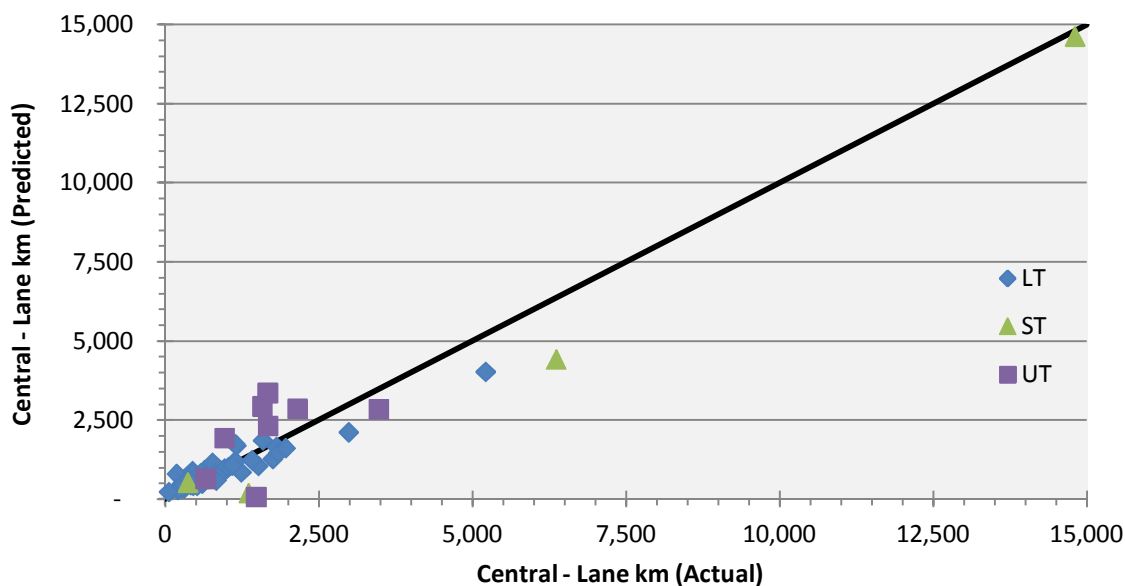


Figure 2. Central Region Lane Kilometres

Table 2. Comparison of Municipal Lane Kilometre Values

Region	Actual	Model
Central	91,576	90,608
Eastern	80,244	82,044
North Eastern	26,060	27,037
North Western	9,312	8,657
Western	94,694	92,704
Total	301,886	301,050

ROADS AND BRIDGE DATA IMPROVEMENT PROJECT: OBSERVATIONS

Based on the follow-up with the 266 municipalities that were either missing data or identified as requiring clarification, four key themes regarding MPMP reporting were identified.

Mandatory requirement to complete all MPMP schedules not understood by some municipalities
Staff from many small municipalities, many located in the North, said that they did not realize the Ministry expected them to fill in Schedule 94. Others stated that they understood that filling in MPMP schedules was a MMAH requirement but did not feel that it was important, given that there are no negative consequences for those who do not complete the MPMP schedules. The Ontario Roads Coalition, during their peer review of the data, commented that many municipalities have the perception that there is no reward or benefit for reporting MPMP data.

Many municipalities rely on their auditors to fill in MPMP schedules

Municipal staff from several municipalities indicated that the accounting firm that audits their financial statements fills in their FIR and MPMP schedules. More than a few municipalities that had incomplete MPMP data said that they thought their auditor had filled in their MPMP schedules and submitted them to the Ministry.

Lack of systems in municipalities for service managers to communicate data to treasurers

Data on expenses and revenue received from other municipalities is automatically carried forward from FIR schedule 40 to Schedule 91, Performance Measures: Efficiency. This data is used to automatically calculate the numerators of the efficiency measures: Operating Costs for service, and Total Costs for service. All that is required to complete MPMP efficiency measures is for municipal staff to enter data in the denominator. Efficiency measure denominators consist of readily available information such as the number of paved lane kilometres. Similarly, data for effectiveness measures consists of data that is routinely collected by municipal departments. MMAH observed that several municipalities were having challenges with providing this information. It seems many municipalities do not have a system in place for service managers to send the data required for MPMP to treasurers.

Some small municipalities lack the staff resources to provide MPMP data

Given the automatic carry forwards from previous FIR schedules 02, 12 and 40, completing MPMP schedules is a straightforward task. It requires filling in denominators in Schedule 91, numerators and denominators in Schedule 92, and answering questions on Schedules 94. However some municipalities indicated that they did not have basic information about their municipality that was required to complete MPMP schedules. Some municipalities do not have up to date maps of their municipal roads. One municipality did not know how many lane kilometres of roads they had and staff said that they would call back after they drove the roads and checked their truck's odometer.

CONCLUSIONS AND RECOMMENDATIONS

The Roads and Bridge Data Improvement Project not only achieved all four of the identified objectives, but in the process was able to quantify Ontario's municipal lane kilometres. 301,886 lane kilometers represents the first time since 1995 that an accurate value is known with the Province of Ontario.

Improving the MPMP roads and bridges service level data is a good starting point. The roads and bridges data improvement project provides an excellent framework for improving the quality of the roadway service area efficiency and effectiveness measures. Additionally, the framework could be applied to the remaining twelve MPMP service areas. Moving forward the municipal lane kilometer data used to answer the question, what do I have and where is it located? can serve as the starting point to address the remaining six questions of asset management.

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