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ROAD SAFETY PROGRAM SELF ASSESSMENT

FINAL REPORT

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1.0 FOREWORD

The Technical Liaison Committee (TLC) was originally formed in early 2006 to address communications, technical projects, and support initiatives. Additionally, the TLC acts as a liaison between Canadian District members, the CITE Executive and ITE International with the TLC Chair sitting as District representative on the International Coordinating Council (ICC).

Comprised of a small group of CITE members who have a keen interest in transportation engineering, planning and policy development, the TLC's mandate is to ensure that Canadian District members have the opportunity to participate in technical projects and policy development through:

- ITE Council participation
- Dissemination of technical projects / initiatives through ITE and other organizations
- Management of various Canadian District technical projects and related policy development that has a direct impact on the future of transportation engineering both in Canada and internationally

Since the TLC is a coordinating body tasked with ensuring that volunteers have the tools and support required it does not directly involve itself with the working elements of active projects. However, the TLC does set project priorities, and maintains communication to prevent projects from lagging or becoming stale.

Mission and Mandate

- Provide quality technical products and services to Canadian transportation community
- Raise technical competency of Canadian transportation community
- International technical information dissemination to our membership
- Increase Canadian members access to, and awareness of, ITE products and services
- Oversee Canadian technical activities and projects
- Engage Canadian membership in international technical activities
- Promote Canadian technical products and services
- Monitor Canadian satisfaction with CITE technical products and services
- Serve multiple disciplines of transportation community
- Identify Canadian technical needs and issues
- Minimize bureaucracy / focus on products and services
- Co-ordinate Canadian membership participation on international Council Executive
- Recommend Canadian representation at Transportation Certification Board Inc.
- Manage and promote Canadian members for awards including sections, individuals and projects

2.0 ACKNOWLEDGMENTS

This project was made possible as a result of the generous contributions of a number of individuals and their organizations. The contributions of the following are recognized:

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- City of Fredericton
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Province of Nova Scotia

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- Nova Scotia Department of Transportation

Province of Québec

- City of Blainville
- City of Bromont
- City of Mascouche
- City of Montréal
- City of Rosemère

Province of Ontario

- City of Brampton
- City of Brantford
- City of Burlington
- City of Hamilton
- City of Kingston
- City of London
- City of Mississauga
- City of Sarnia
- City of Toronto
- City of Waterloo
- Municipality of Leamington
- Region of Durham
- Region of Halton
- Region of Niagara
- Region of Waterloo
- Town of Milton
- Town of Richmond Hill
- Town of Whitby
- York Region
- Ontario Ministry of Transportation

Province of Manitoba

- City of Brandon
- Rural Municipality of Cartier

- Rural Municipality of St. François Xavier

Province of Saskatchewan

- City of Regina

Province of Alberta

- City of Calgary
- City of Edmonton
- City of Lethbridge
- City of Red Deer
- Town of Cochrane
- Alberta Transportation

Province of British Columbia

- City of Kamloops
- City of Kelowna
- City of Langley
- City of Prince George
- City of Surrey

In addition, the committee would like to acknowledge Kerra Mruss (MMM Group) and Sandy Remple (CITE Communications Coordinator) for reviewing and editing this report.

3.0 PROJECT BACKGROUND AND SCOPE

Although collision frequency and severity trends show that Canadian road safety has improved during the last decade [1], road safety still remains one of the top priorities for most Canadian road agencies. Over the past two decades many researchers and practitioners have contributed to the science of road safety in the form of research papers, guidelines, and manuals. Road safety knowledge was collected in the Highway Safety Manual (HSM) [2] published in 2010 by the American Association of State Highway Officials (AASHTO), and the Canadian Road Safety Handbook (CRaSH) series published by the Transportation Association of Canada (TAC). These documents are valuable resources for practitioners to develop and conduct road safety programs based on sound methodologies according to the latest state of the practice developments.

One of the challenges that road agencies often face is identifying suitable road safety programs for their jurisdictions given their size and characteristics. The main purpose of this project was to provide road agencies with the means to better understand the components of common road safety programs, and to measure their current data collection practices and safety programs against other similar Canadian jurisdictions. Road agencies can use this document to assess their current programs and strategies against peer agencies. It should be noted that this document does not identify what are the best practices in road safety management, it merely presents a "snapshot" of road safety practices in various Canadian jurisdictions.

Section 4 of this document provides a description of various road safety program components including:

- Road Safety Vision / Action Plan
- Integrated Road Safety Plan
- Network Screening
- Road Safety Audits
- In-Service Road Safety Reviews
- Safety Impact Studies
- Before and After Studies / Evaluations
- Collision Modification Factors
- Safety Surrogate Measures
- Education and Enforcement Programs

Section 5 summarizes the efforts to obtain information from jurisdictions of different sizes about their current road safety programs and relevant data collection practices.

Section 6 then provides the survey results which can be used by road agencies to compare themselves with similar sized jurisdictions. The document concludes with some closing remarks.

4.0 DESCRIPTION OF SAFETY PROGRAM COMPONENTS

A safety program is a set of policies and practices developed to improve safety. A safety program can target one or various fields of intervention in safety such as education and public awareness, vehicle safety, road infrastructure, laws and enforcement, post-crash care, etc. A safety program is generally based on a road safety vision and an action plan that dictates the commitment of each stakeholders and agencies to achieve the vision. Successful safety programs have the following components:

- Attainable targets within a timeframe
- Commitment from different levels of governance
- Integration and linking with other areas of transport and stakeholders
- Efficiency evaluation and follow-up process
- Resources allocation

This section briefly describes a road safety vision and an action plan, and then presents some components of common safety programs.

4.1 Road Safety Vision

A road safety vision describes the future desirable state, which provides direction for the road safety work and improvements required to achieve it. This vision is shared by all stakeholders and is attained through large efforts over a long period of time. Formed as the basis for road safety plans and programs, the vision can be prepared at national, regional and local levels to direct road safety actions.

As an example of a road safety vision, the goal of Canada's Road Safety Strategy 2015 is to make our roads the safest in the world, and the Canadian Council of Motor Transport Administrators (CCMTA) outlines the key guiding principles of this Strategy including: year-over-year downward trends in fatalities and serious injuries, safer systems concepts, a five-year timeframe, a continuation of collision reporting by province / territory, and a framework of best practices.

As good practice in road safety visions, the "Sustainable Safety in the Netherlands" and the "Vision Zero in Sweden" have proven to reduce the number of fatalities.

4.2 Road Safety Plan

The road safety plan is based on a road safety vision which describes goals and principles for the organization of road safety work and specifies the actions within a timeframe. The road safety plan is more specific and defines responsibilities, provides funding for the implementation of effective safety measures, and demonstrates the agency's commitment to ensure that all stakeholders work cooperatively to reduce fatalities and injuries.

The road safety plan sets safety targets and provides a precise quantitative description of what is to be attained, and within what timeframe. Evaluation process is part of the plan to measure its effectiveness.

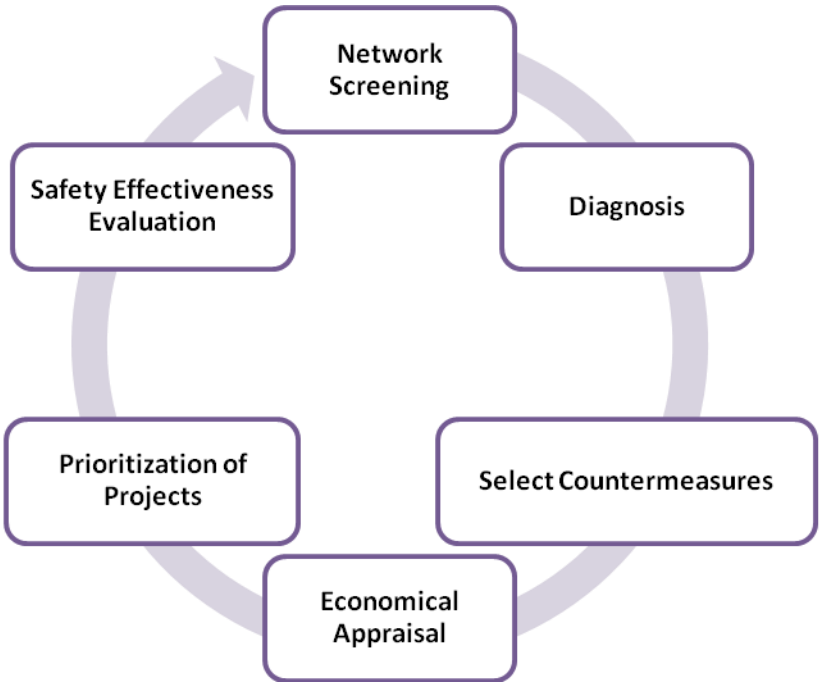
4.3 Network Screening

During the past two decades road authorities started to recognize the challenges associated with a highly reactive approach to road safety [1]. As a result most municipalities have adopted a more

proactive approach regarding their road safety programs. The Highway Safety Manual (HSM) [2] presents a systematic approach for a road safety management process (as shown in **Figure 1**:).

This process starts with network screening to identify road locations that have poor safety performance and need safety investigations. In the screening process network entities (e.g. road sections, ramps, intersections, ramp terminals, at-grade railway crossings, etc.) within a jurisdiction are ranked based on their safety performance in two separate lists. The locations which exhibit poorer safety performance are often ranked at the top of the list.

Figure 1: Road Safety Management Process [2]



The measure used to quantify the safety performance of each location depends on the methodology used for the screening. The HSM provides a number of methodologies for network screening, among those, the following are most frequently used by jurisdictions:

- Collision Frequency
- Collision Rate
- Critical Collision Rate
- Empirical Bayes (EB) Method
- Dominant Collision Type (proportional analysis)

In the **collision frequency method**, similar network entities (e.g. intersections or road sections) are ranked based on their collision frequency over a specified time period (usually between three to five years). The main strength of this method is its simplicity requiring only collision data and limited infrastructure characteristic data. However, this method suffers significant challenges[1] as it does not consider the effect of traffic exposure (volume). As a result this method is not recommended.

[1] Refer to Highway Safety Manual [2], Page 4-10.

The **collision rate method** is an improved version of the collision frequency method in which the effect of traffic exposure or traffic volume is considered. In this method average collision frequency of a network entity is normalized by the average traffic exposure over a specified time, with the result referred to as average collision rate. The entities are then ranked based on their average collision rate. This method still suffers from a number of limitations[2], one of which is that there is no measure to assist the analyst in identifying whether collisions at a location are more than what is predicted for such a location. In other words, there is no measure to identify whether the location is performing well or poorly.

This limitation is overcome in the critical collision rate method in which similar locations, in terms of geometry, traffic operations, and adjacent land-use, are categorized into different groups (e.g. four-leg signalized intersections or two lane rural roads) often called reference groups. For each reference group the average collision rate for a specified time period is calculated. This average collision rate is referred to as the critical collision rate for each group and is used as a threshold to assess whether each entity performs well or poorly. For example, the collision rate of a four-leg signalized intersection is compared with its reference group in the study area. If the collision rate of the intersection is larger than the collision rate of the reference group it is concluded that the intersection is performing poorly with respect to its peers and has to be further investigated.

The **Empirical Bayes (EB) method** is based on a concrete statistical foundation and does not have the drawbacks of previous methods. In this method, the observed collision frequency for a given site is linearly combined with predicted collision frequency data obtained from a reference group to estimate the expected collision frequency at each location. The predicted collision frequencies are obtained from Safety Performance Functions (SPFs) developed for each reference group. If the expected collision frequency at a location is larger than the predicted collision frequency of the reference population it shows that the subject entity has potential for safety improvement. In the EB method the locations are ranked based on their Potential for Safety Improvement (PSI).

In the dominant collision type, or proportional analysis[3], locations are ranked based on the probability that the true proportion of a particular collision type or severity is greater than the threshold proportions. A threshold proportion is calculated for each reference group based on the proportion of the target collision type or severity in the reference population.

4.4 Road Safety Audits

Road Safety Audit (RSA) is defined in The Canadian Road Safety Audit Guide [4] as:

> *"A road safety audit is a formal and independent safety performance review of a road transportation project by an experienced team of safety specialists, addressing the safety for all road users."*

An RSA is conducted during the plan and design stages of new roads, or improvements to existing roads, in order to reduce the risk of preventable collisions in the future. An RSA is performed by a multidisciplinary team of experts who are independent from the design team. The outcome of an RSA is an input to the planning or design process, and well-documented experience indicates that RSAs are effective and cost beneficial proactive measures to improve safety [**Error! Reference source not found.**].

[2] Refer to Highway Safety Manual [2], Page 4-10.

[3] Highway Safety Manual refers to this method as probability of specific collision type exceeding threshold proportions.

4.5 In-Service Safety Reviews

As defined by TAC in The Canadian Guide to In-Service Road Safety Reviews, the objective of the In-Service Road Safety Review is an:

> *"... in-depth engineering study of an existing road using road safety principles with the purpose of identifying cost-effective countermeasures that would improve road safety and operations for all road users."*

Aimed at reducing the frequency and severity of collisions as well as evaluating the cause of exhibited collision characteristics, the in-service road safety review consists of analyzing the geometric, traffic, collision and conflict characteristics of a given location and identifying cost-effective solutions to improve safety and operational performance.

Operational reviews and safety audits have become a fundamental aspect of engineering activities with respect to new road construction and the improvement of existing road networks. The safety review objective is to reduce the likelihood and severity of potential collisions, and can be a preventative and proactive approach to road safety including:

- Identify existing safety problems as locations of high risk
- Diagnose likely collision causes
- Develop cost-effective options to mitigate collisions or prevent potential collisions from occurring

In-service road safety reviews take into account all road network users including pedestrians, cyclists, motorcyclists, trucks, buses and automobiles.

4.6 Safety Impact Study

When development is being considered at a particular location, many jurisdictions request that a Traffic Impact Study (TIS) be conducted to provide answers regarding the proposed development's capacity impact on the neighbouring road network. However, there is a need to consider safety early, and often throughout, the roadway life cycle with safety planning being a proactive approach that incorporates road safety at the planning stage with the purpose to prevent occurrence of unsafe situations, such as traffic collisions, in the first place.

Typically, the TIS identifies required road network improvements to ensure operation at an acceptable level of service upon completion of the proposed development, while a Safety Impact Study (SIS) complements traffic impact analysis by identifying and examining opportunities to mitigate the undesirable safety impacts while considering both the site itself and the adjacent public road network. It is a proactive approach and a way to address road safety in the early stages of planning that also considers the potential safety impact of a new development in the future.

4.7 Before and After Study / Evaluation

To assess road safety effectiveness, monitoring implemented improvements in a road safety management program is imperative, and at times this involves conducting a before and after collision analysis to evaluate the safety effectiveness of implemented countermeasures.

The identification of road safety improvements and selection of appropriate countermeasures for the problem location, along with an associated cost estimate for each countermeasure, is essential. Often more than one countermeasure with the potential to remedy the problem is identified.

Before and after study / evaluation is very important to assess the effectiveness of improvements, which is critical to ensure that proposed changes address any current safety issues as identified by the safety review, and to incorporate appropriate countermeasures for those issues.

4.8 Collision Modification Factors

Collision Modification Factors (CMFs) quantify the expected change in collision frequency as a result of operational or geometric modifications to a road section or intersection compared to a base condition. For example, a CMF of 0.93 (7% reduction in all collisions) is expected by widening a 0.91 m (3 ft) shoulder (the base condition) to a 1.82 m (6 ft) shoulder.

The CMF term is relatively new and was introduced with the HSM, however, the premise and research behind the CMF have existed in the road safety industry for many years. Essentially, a before and after study was completed for a particular improvement and the expected collision reduction was placed into decimal form. Many of the studies used to develop the CMFs in the HSM, and those housed in the CMF Clearinghouse (www.cmfclearinghouse.com), are based on research that the transportation industry has referenced for years, in some cases dating back to the 1960s.

Today these collision reduction estimate resources are now assembled in one location that make for easier and more frequent access. Additionally, the research has been screened or met expert panel approval to provide the end user with some indication of the technical rigour and reliability of the results.

4.9 Safety Surrogate Measures

Since collision frequency and severity are direct measures of safety performance, road safety analysis has traditionally been undertaken using collision data. While collision data provides this direct measure there are reasons and instances that Safety Surrogate Measures (SSMs) or metrics are used both in research and practice:

- **Data Availability and Quality Issues** – Due to small sample sizes or incomplete / erroneous entries collision data is not always sufficient for analysis, especially for specific road users such as pedestrians and bicyclists
- **Contributory Causes** – Collision records in some jurisdictions provide little insight into opportunities for pre-collision avoidance by those involved along with other contributory causes
- **Reactive Methods** – The use of collision records for safety analysis is a reactive approach, and in some cases limits the ability to examine the safety effects of newly implemented safety countermeasures or pilot programs

The most prevalent SSM considered by transportation practitioners is traffic conflicts and their frequency. This surrogate measure is based on an observable non-collision event that is physically related in a predictable way to a collision. There have been a number of practical methods proposed to convert these non-collision events into a corresponding collision frequency and / or severity. Other SSMs include operational measures such as red light running or travel speeds.

4.10 Education and Enforcement Programs

A comprehensive road safety program includes a range of engineering, education and enforcement initiatives, and there is a wide range of programs that could be implemented by a jurisdiction or agency to address specific target areas. These programs are broad based, but can be directed towards specific

population groups and are intended to bring awareness to and/or initiate changes in road safety behaviors.

The following is a list of non-engineering related initiatives that were targeted in the surveys; however, respondents were permitted to identify others:

- Sober driving campaigns
- Safe routes to schools
- Distracted driving
- Pedestrian, bicycle, motorcycle and heavy vehicle awareness
- Animal awareness (moose, deer, etc.)
- Share the road
- Work zone safety
- Red light cameras
- Speed enforcement programs
- Road / speed watch
- Aerial enforcement

5.0 JURISDICTION SURVEY

5.1 Survey Content and Distribution

As described in the previous section, a comprehensive list of various road safety programs, their definitions, and their data requirements were compiled by the project team. In the next step a questionnaire in English and French was developed in an online format. The questionnaire was reviewed by the project team to ensure simplicity, accuracy, and completeness. The English questionnaire and the French questionnaire are shown in Appendix A and Appendix B respectively. The questionnaire included questions in the following categories:

- Jurisdiction Characteristics
  - Population, area, percentage rural, percentage of freeways
- Staff
  - Number of full time staff dedicated to road safety
  - Equivalent full time staff involved in road safety programs
- Data Collection and Data Management Practices
  - Collision Data
  - Traffic Volume Data
  - Infrastructure Characteristics Data
- Road Safety Engineering Programs
  - Safety Guidance or Policy Documents on Road Safety
  - Network Screening
  - Road Safety Audit
  - In-Service Road Safety Review
  - Road Safety Impact Study
  - Before and After Studies
  - Development of Collision Modification Factors
  - Surrogate Measures of Road Safety
- Road Safety Educational Programs
- Road Safety Enforcement Programs

The survey was designed such that respondents could click on certain keywords (e.g. network screening) to see the definition or more information about the keyword.

In April 2011 the questionnaire was distributed to a compiled contact list of staff from various jurisdictions in the following Canadian provinces:

- British Columbia
- Alberta
- Saskatchewan
- Manitoba
- Ontario
- Québec
- New Brunswick
- Nova Scotia

5.2 Jurisdiction Reponses and Characteristics

The project team received 52 complete responses which were distributed among all provinces contacted. The project team thoroughly reviewed the content of the survey responses involving a logical quality control. For example, if inconsistencies were found relating to the population, area and number of staff, the information was either verified with the road agency or removed from the data. In the event of more than one response from a road agency, the responses were then cross-referenced to identify discrepancies, and if any existed, the road agency was then consulted to choose the most accurate response. After completion of the quality control of the survey responses and the above mentioned follow up with the agencies, responses from 49 road agencies were found credible and subsequently used in this review.

The populations of the jurisdictions participated in the survey ranged from 1,090 to 2.7 million people. **Table 1** shows the number of respondents in different population bins, and as can be seen in this table, the respondents were relatively evenly distributed across the population bins.

Table 1: Number of Responses for Various Population Bins

Jurisdiction Population	Number of Responses
< 50,000	12
50,000 to < 100,000	10
100,000 to < 250,000	8
250,000 to < 500,000	7
500,000+ (including 4 provincial transportation ministries)	12

6.0 PROGRAM ASSESSMENT

6.1 Road Safety Vision / Action Plan

Respondents were questioned if their jurisdiction developed a road safety vision or an action plan to reduce the number of fatalities and injuries in their territory. From the results presented in **Table 2**, only 31% of the municipal jurisdictions have a guidance document outlining their vision and principles. At the provincial level, two out of four jurisdictions have developed their road safety vision / action plan.

Table 2: Number of Municipal Jurisdictions Having a High Level Guidance Document

Jurisdiction Population	Number of Responses	Number of Municipal Jurisdictions Having a High Level Guidance Document
< 50,000	12	1
50,000 to < 100,000	10	3
100,000 to < 250,000	8	3
250,000 to < 500,000	7	2
500,000+	8	5

6.2 Integrated Road Safety Plan

Respondents were asked if a road safety plan is available to practitioners in their jurisdiction to outline their actions. Based on the responses from **Table 3**, only 18% of the jurisdictions at the municipal level have access to such a guidance document. At the provincial level, none of the four respondents have any practitioner-level guidance document.

Table 3: Number of Municipal Jurisdictions Having a Practitioner-Level Guidance Document

Jurisdiction Population	Number of Responses	Number of Municipal Jurisdictions Having a Practitioner-Level Guidance Document
< 50,000	12	0
50,000 to < 100,000	10	1
100,000 to < 250,000	8	2
250,000 to < 500,000	7	1
500,000+	8	4

6.3 Network Screening

Table 4 shows the survey question options related to network screening, as well as the number and percentage of respondents associated with each option. As can be seen in this table, an equal number of respondents (17.8%) are using collision frequency or the Empirical Bayes for conducting their network screening, 20.0% use critical collision rate to conduct network screening, and 22.2% do not screen their network to identify higher collision risk locations. A significant number (11.1%) of municipalities prefer to record their collisions on GIS maps, and two municipalities chose the last option (other, please specify) indicating they use other approaches such as a risk analysis method.

Table 4: Network Screening Methods Applied

Survey Question Options	Number of Respondents	Percentage of Respondents
Do not screen our network for higher collision risk locations	10	22.2%
Collision Frequency method is conducted for network screening	8	17.8%
Collision Rate or Critical Collision Rate is conducted for network screening	9	20.0%
The Empirical Bayes method (using Safety Performance Functions) is used	8	17.8%
Dominant collision type review is conducted	1	2.2%
We map collisions on GIS maps	5	11.1%
Other, please specify	2	4.4%
No Response	2	4.4%

Table 5 summarizes participating municipalities' responses in terms of population. As shown, the Empirical Bayes method is most popular for municipalities with a population greater than 500,000. As expected, smaller municipalities either do not conduct any network screening or use a simplified frequency method. However, it is surprising that in the population category of 250,000 to 500,000 three municipalities do not have any network screening program in place. Among the larger municipalities, more than 500,000 population, only 37.5% use the Empirical Bayes method for network screening. This suggests that perhaps the larger municipalities should use more concrete approaches in road safety programs. This is particularly important for the larger municipalities to allocate their limited resources efficiently to locations which have the largest potential for safety improvement and likelihood of success.

Table 5: Network Screening Methods Used by Jurisdictions of Different Sizes

Survey Question Options	Population									
	<50,000		50,000-100,000		100,000-250,000		250,000-500,000		>500,000	
	No.	%	No.	%	No.	%	No.	%	No.	%
No network screening	5	41.7%	0	0.0%	1	12.5%	3	42.9%	1	12.5%
Collision Frequency method	5	41.7%	2	20.0%	0	0.0%	0	0.0%	1	12.5%
Collision Rate or Critical Collision Rate	0	0.0%	2	20.0%	4	50.0%	2	28.6%	1	12.5%
The Empirical Bayes method	0	0.0%	2	20.0%	2	25.0%	1	14.3%	3	37.5%
Dominant collision type review	0	0.0%	0	0.0%	1	12.5%	0	0.0%	0	0.0%
GI-Based mapping	1	8.3%	3	30.0%	0	0.0%	0	0.0%	1	12.5%
Other, please specify	0	0.0%	0	0.0%	0	0.0%	1	14.3%	1	12.5%
No Response	1	8.3%	1	10.0%	0	0.0%	0	0.0%	0	0.0%

6.4 Road Safety Audits

Table 6 shows the survey question options for conducting Road Safety Audits (RSA), along with the number and percentage of respondents associated with each option. As can be seen in this table, 37.8% conduct RSA at the design stage and 31.1% conduct RSA during value engineering studies. Both of these stages are very effective for conducting road safety audits.

Table 6: Road Safety Audit Studies

Survey Question Options	Number of Respondents	Percentage of Respondents
Audits of proposed designs.	17	37.8%
Vulnerable user specific safety audits.	7	15.6%
Audits during value engineering studies.	14	31.1%
No Response	7	15.6%

Table 7 summarizes the responses of the participating municipalities in terms of population for the municipalities conducting RSA. Results showed the majority of jurisdictions conduct RSAs either during design stage or during value engineering studies.

Table 7: Road Safety Audit Studies Used by Jurisdictions of Different Sizes

Survey Question Options	Population									
	<50,000		50,000-100,000		100,000-250,000		250,000-500,000		>500,000	
	No.	%	No.	%	No.	%	No.	%	No.	%
Audits of proposed designs	4	30.8%	2	18.2%	3	33.3%	3	33.3%	5	35.7%
Vulnerable user specific safety audits	2	15.4%	0	0.0%	0	0.0%	2	22.2%	3	21.4%
Audits during value engineering studies	2	15.4%	2	18.2%	2	22.2%	3	33.3%	5	35.7%
No Response	5	38.5%	7	63.6%	4	44.4%	1	11.1%	1	7.1%

6.5 In-Service Road Safety Reviews

The purpose of an in-service road safety review is to focus solely on safety effects of the many attributes of design, operations and maintenance, and the interaction with the many road users. These reviews are conducted in a post-construction environment where the roadway has been in use allowing for operational data on which to base the review.

Jurisdictions were asked if they undertake in-service safety reviews, and **Table 8** summarizes the municipal / city jurisdictions that responded to our survey and typically undertake in-service safety reviews.

Table 8: Jurisdictions Undertaking In-Service Safety Reviews

Does your jurisdiction undertake in-service safety reviews?	Jurisdiction Population					
	< 50,000	50,000 to 100,000	100,000 to 250,000	250,000 to 500,000	500,000+	Provincial
Yes	3	4	4	5	7	3
No	9	6	4	2	*	1

Note: No answer provided*

Forty five municipal / city jurisdiction, including regional jurisdictions, across Canada responded to our survey. Based on the responses, it should be noted that the number of municipalities undertaking in-service safety reviews is higher corresponding with size / larger population. Additionally, the number of jurisdictions undertaking an in-service safety review (23 or 52%) is similar to those that are not (21 or 48%).

As shown in **Table 8**, four provinces responded to our survey and the majority of them (75%) are undertaking in-service safety reviews. It is very likely that provinces in general conduct more in-service safety reviews than municipalities as part of their safety programs.

Jurisdictions were asked to average how many intersection in-service safety reviews they complete annually. The survey results and analysis of average annual intersection in-service safety reviews by city size and provinces are presented in **Table 9.**

As indicated earlier, jurisdictions with larger population are undertaking more intersection in-service safety reviews annually. Based on the 45 municipal / city jurisdiction responses, an average of twelve intersection in-service safety reviews are undertaken annually.

Table 9: Average Annual Intersection In-Service Safety Reviews by Jurisdiction Size

Average annual intersection in-service safety reviews	**Jurisdiction Population**					
	< 50,000	**50,000 to 100,000**	**100,000 to 250,000**	**250,000 to 500,000**	**500,000+**	**Provincial**
Average	8	9	4	15	23	24

Only four ministries of transportation responded to our survey, and while one provincial representative indicated they do not undertake in-service safety reviews, based on the other three responses an average of 24 intersection in-service safety reviews are undertaken annually, which is double when compared to the municipal jurisdictions (twelve intersections annually).

When asked how many centerline kilometers each jurisdiction completed in-service safety reviews for annually, the results indicated that on average only 9 km per jurisdiction is completed. The summary of survey results are shown in **Table 10**.

Table 10: Average Annual In-Service Safety Reviews (centreline kilometres) by Jurisdiction Size

Average annual intersection in-service safety reviews (centreline km)	Jurisdiction Population					
	< 50,000	50,000 to 100,000	100,000 to 250,000	250,000 to 500,000	500,000+	Provincial
Average	15	0*	6	9	17	543

Note: No answer provided*

The survey results show that larger jurisdictions undertake more kilometers of in-service safety reviews annually (above average). Based on three provincial responses, an average of 543 kilometers of in-service safety reviews are completed annually.

6.6 Safety Impact Study

Survey results indicate around 40% of jurisdictions require a Safety Impact Study (SIS) for proposed new developments that provide the road authority with the required information to assess these developments from a safety perspective. Considering that a SIS for new developments is a relatively new approach, 40% represents a relatively high number.

As shown in **Table 11**, where road authorities have carried out safety reviews to help safety issues, the findings indicate that smaller municipalities lead in undertaking new development safety impact studies.

Table 11: Safety Impact Study Requirements for Proposed / New Developments

Safety Impact study requirements for proposed / new developments	Jurisdiction Population					
	< 50,000	50,000 to 100,000	100,000 to 250,000	250,000 to 500,000	500,000+	Provincial
Yes	6	2	2	2	5	1
No	5	7	6	4	3	3

Table 11 shows that from the four Canadian provinces who participated in the survey, only one province requires a safety impact study for proposed new developments.

Based on the survey results, a very small number of municipal jurisdictions (4) always require review of collisions and road user safety data for a TIS. These results are presented in **Table 12.**

Table 12: TIS Review of Collisions and Road User Safety Requirements

TIS explicit review of collisions and road user safety requirements	Jurisdiction Population					
	< 50,000	50,000 to 100,000	100,000 to 250,000	250,000 to 500,000	500,000+	Provincial
Always	0	1	0	1	2	0
Sometimes	12	7	6	4	4	0
Never	0	1	1	2	1	2

The results also indicate that smaller jurisdictions more often look for collision analysis and road user safety requirements in their traffic impact studies. When comparing the four provincial responses and requirements, two do not require explicit review of collisions and road user safety for TIS completion.

6.7 Before and After Study / Evaluation

Table 13 summarizes responses by jurisdictions which perform before and after studies to evaluate the safety effect of improvements.

Results indicate that only four municipal jurisdictions often require before and after studies in order to evaluate the safety effects of improvements. The majority (32) of municipalities only "sometimes" complete before and after safety studies, while eight municipalities never undertake before and after safety studies.

Table 13: Before and After Studies of Safety Effectiveness of Improvements Evaluation

Before and After Studies	Jurisdiction Population					
	< 50,000	50,000 to 100,000	100,000 to 250,000	250,000 to 500,000	500,000+	Provincial
Often	0	2	0	1	1	0
Sometimes	7	5	8	5	7	3
Never	5	2	0	1	0	1

On the provincial level, it is apparent that in order to evaluate the safety effect of improvements the majority of provinces "sometimes" undertake before and after studies (**Table 13).** The survey results show that, in general, many Canadian jurisdictions are not undertaking before and after safety studies.

This is a significant concern because assessing the effectiveness of improvements through a before and after study is critical to ensure that proposed changes address any current safety issues as identified by the safety review, and incorporate appropriate countermeasures.

6.8 Collision Modification Factors

Respondents were asked if their jurisdictions employed Collision Modification Factors (CMFs) in project planning and development to assess the safety implications associated with their decision making. Surprisingly, very few jurisdictions apply CMFs in their projects. For jurisdictions whose population is below 100,000, less than 20% (4 of 22) of jurisdictions indicate they actively use CMFs, and in jurisdictions over 100,000 only one in 15 responded positive to the same question.

This low utilization may be a result of one or more of the following:

- The jurisdiction uses CMFs in their operational / safety reviews of existing facilities, but do not apply them during project planning and development
- The respondent may have misinterpreted the nature of the survey question and limited their response to only the former applications
- The relatively new term and aggregated resources associated with CMF development may have not been widely applied at the time of the survey
- Transportation practitioners' belief that CMF application is associated with remedial actions and not appropriate / valid for all aspects of road facility planning, design, operations and maintenance

Given the relative importance of CMF application to decision making these results suggest a wider practitioner education is required.

Respondents were also asked if their jurisdictions formulated in-house CMFs for internal use. One jurisdiction less than 500,000 population indicated they had developed in-house CMFs, while three of the eight respondents with jurisdictions greater than 500,000 population indicated they have developed internal CMFs.

6.9 Safety Surrogate Measures

Jurisdictions were asked if Safety Surrogate Measures (SSMs) for road safety evaluation have been used. No specifics regarding the nature of the SSMs were requested. Included in **Table 14** is a summary of responses by size of jurisdictions using SSMs for safety evaluation.

Table 14: Safety Surrogate Measures by Jurisdiction Size

Jurisdiction Population	Number of Responses	Number Using SSMs for Safety Evaluation
< 50,000	12	2
50,000 to < 100,000	10	1
100,000 to < 250,000	8	1
250,000 to < 500,000	7	1

500,000+	8	3

While SSM application is not wide-spread there appears to be a general trend of more frequent use in larger jurisdictions.

6.10 Staff and Training

Information was collected in regard to the number of staff members dedicated solely to road safety programs. **Table 15** indicates the average involved in municipal and provincial jurisdictions.

Table 15: Staff Dedicated to Road Safety Programs

Staff Dedicated to Road Safety Programs	**Jurisdiction Population**					
	< 50,000	**50,000 to 100,000**	**100,000 to 250,000**	**250,000 to 500,000**	**500,000+**	**Provincial**
Average Number Dedicated	1	1	2	0	5	12
Average Number of FTEs Involved	1	2	3	4	7	21
Total number of Responses	11	10	8	7	8	4

The above responses show there is no trend between the number of staff members dedicated solely to road safety programs and the size of the jurisdiction. However, as the population of the jurisdiction grows more resources are allocated to road safety programs. The proportion of jurisdictions having at least one dedicated staff is presented in **Table 16**. Given the results, there is still no trend to have more dedicated staff in jurisdictions with a larger population. However, as the jurisdiction is growing, more time is invested in road safety programs by staff.

Table 16: Proportion of Jurisdictions with Staff Dedicated to Road Safety Programs

Proportion of Jurisdictions with Staff in Road Safety	**Jurisdiction Population**					
	< 50,000	**50,000 to 100,000**	**100,000 to 250,000**	**250,000 to 500,000**	**500,000+**	**Provincial**
At Least 1 Dedicated Staff	36 %	30 %	62 %	14 %	75 %	75 %
At Least 1 FTE Involved	64 %	70 %	100 %	86 %	100 %	100 %
Total number of Responses	11	10	8	7	8	4

Respondents were asked to specify the formal training provided to their staff in various fields of transportation. **Table 17** summarizes the number of jurisdictions that provide training in different fields. From the 49 responses, the field of work area traffic control (80%) is most popular followed by road safety / collision courses and roadway design (73%). Human-factors training is least popular with only 24% of the jurisdictions attending.

Among respondents industry conferences are attended by 63% of jurisdictions and webinars by 53%. The other types of training or courses recognized by some municipalities include those conducted by the Ontario Traffic Council (OTC), International Municipal Signal Association (IMSA), Alberta Road Builders Association, Ontario Good Roads Association (OGRA), and post-secondary education courses.

Table 17: Number of Jurisdictions Providing Formal Training in Road Safety in Different Fields

Training Description	**Number of Jurisdictions Providing Formal Training in Road Safety**	
	Municipal Level	**Provincial Level**
Transportation Fields		
Road Safety / Collision	32	4
Roadway Design (roundabouts, roadside, highway, etc.)	32	4
Work Area Traffic Control	36	3
Site Design	17	3
Designing for Vulnerable Users	11	3
Human Factors	10	2
Training Mediums		
Industry Conferences	27	4
ITE or FHWA Safety Webinars	23	3
Other	6	0

6.11 Data Collection and Analysis

One of the key factors to successful road safety programs is accurate and up-to-date data. Collision data is always required to identify collision patterns and target collisions in order to identify appropriate countermeasures. Depending on the safety program in consideration, traffic volume (often in the form of Average Annual Daily Traffic (AADT)) and road network characteristic data are required. As a result participating municipalities were asked about their practices in data collection, data processing, and data archiving.

6.11.1 Collision Data

Table 18 shows the survey question options along with number and percentage of respondents associated with each option. Note that only 4.4% of participants maintain their collision records in hard copy format. One municipality does not maintain their collision records, and a consultant maintains collision records in another municipality. Assuming that insurance companies maintain their data in digital databases, it appears that the majority of municipalities maintain their collision data in a digital format.

Table 18: Collision Data Practices, Number of Respondents, and Percentage of Respondents

Survey Question Options	Number of Respondents	Percentage of Respondents
Collision records are kept in an in-house developed database or software package.	17	37.8%
Collision records are kept in a commercial off-the-shelf software package.	6	13.3%
Police maintain all collision records.	9	20.0%
Collision records are kept by insurance companies.	7	15.6%
Collisions are maintained by your upper tier jurisdiction.	3	6.7%
Collision records obtained and filed in hard copy format.	2	4.4%
No Response	1	2.2%

Table 19 summarizes the responses of the participating municipalities in terms of population. Note that for smaller municipalities (population less than 50,000) collision data are maintained by the police, while larger municipalities (population more than 500,000) store their collision records using in-house digital databases.

Table 19: Collision Data Collection Practices by Jurisdiction Population

Survey Question Options	Population									
	<50,000		50,000-100,000		100,000-250,000		250,000-500,000		>500,000	
	No	%	No	%	No	%	No	%	No	%
Collision records are kept in an in-house developed database or software package.	1	8.3%	4	40.0%	3	37.5%	2	28.6%	7	77.8%
Collision records are kept in a commercial off-the-shelf software package.	0	0.0%	2	20.0%	1	12.5%	3	42.9%	0	0.0%
Police maintain all collision records.	7	58.3%	1	10.0%	0	0.0%	0	0.0%	1	11.1%
Collision records are kept by insurance companies.	1	8.3%	2	20.0%	3	37.5%	1	14.3%	0	0.0%
Collisions are maintained by your upper tier jurisdiction.	1	8.3%	1	10.0%	0	0.0%	1	14.3%	0	0.0%
Collision records obtained and filed in hard copy format.	1	8.3%	0	0.0%	1	12.5%	0	0.0%	0	0.0%
Other, please specify	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	11.1%
No Response	1	8.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

All four provincial jurisdiction participants keep their collision records using either an in-house database or software package.

6.11.2 Volume Data

Table 20 shows the survey question options along with the number and percentage of respondents associated with each option. Note that 13.3% of participants collect TMC and ATR data only for major intersections and major road sections. Six municipalities chose the last option (other, please specify). These municipalities indicated that they are using different approaches such as data collection by outside firm, screen line counts, demand based count program, and data collection program implemented under traffic signal upgrade project. It appears that most municipalities have at least some kind of volume data collection program.

Table 20: Traffic Volume Data Practices, Number of Respondents, and Percentage of Respondents

Survey Question Options	Number of Respondents	Percentage of Respondents
Your jurisdiction has a program in place for collecting TMCs for intersections as well as ATR data for road sections.	27	60.0%
AADT for highways and major roads are collected by your upper tier jurisdiction.	5	11.1%
TMC and ATR data are collected only for major intersections and major road sections respectively.	6	13.3%
Other, please specify	6	13.3%
No Response	1	2.2%

Table 21 summarizes responses in terms of municipality populations. A significant number of smaller municipalities (population less than 50,000) collect the volume data for major intersections and major road sections only, while in some cases the volume data are collected by their upper tier jurisdiction. In all cases there is a program in place for collecting volumes, however, in some cases the data are collected only for major intersections and major road sections.

Table 21: Traffic Volume Data Collection Practices by Jurisdiction Population

Survey Question Options	Population									
	<50,000		50,000-100,000		100,000-250,000		250,000-500,000		>500,000	
	No	%	No	%	No	%	No	%	No	%
Program in place for collecting TMCs for intersections as well as ATR data for road sections.	3	25.0%	7	70.0%	5	62.5%	5	71.4%	7	87.5%
AADT for highways and major roads are collected by your upper tier jurisdiction.	2	16.7%	1	10.0%	2	25.0%	0	0.0%	0	0.0%
TMC and ATR data are collected only for major intersections and major road sections respectively.	4	33.3%	2	20.0%	0	0.0%	0	0.0%	0	0.0%
Other, please specify	2	16.7%	0	0.0%	1	12.5%	2	28.6%	1	12.5%
No Response	1	8.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

6.11.3 Road Network Characteristic Data

Table 22 shows the survey question options along with the number and percentage of respondents associated with each option. Note that 22.2% of participants do not maintain their road network characteristics data in a database. Further, 11.1% of the respondents maintain only the intersection data and 2.2% maintain only the midblock data. Not indicated is whether their road network characteristics records are in hard copy format. Two municipalities chose the last option (other, please specify). These municipalities use different approaches such as maintaining data only for important corridors.

Table 22: Road Network Characteristics Data Housing, Number of Respondents, and Percentage of Respondents

Survey Question Options	Number of Respondents	Percentage of Respondents
Characteristic data for intersections and mid-blocks are maintained in a database.	23	51.1%
Characteristic data for intersections and mid-blocks are not maintained in a database.	10	22.2%
Only intersection characteristic data are maintained in a database.	5	11.1%
Only mid-block characteristic data are maintained in a database.	1	2.2%
Other, please specify	2	4.4%
No Response	4	8.9%

Table 23 summarizes the responses in terms of municipality population. Most of the larger municipalities (population greater than 50,000) maintain their road network characteristics data in a database, while other municipalities either maintain a database for partial data (either intersections or midblock) or do not maintain a database at all.

Table 23: Road Network Characteristics Data Housing by Jurisdiction Population

Survey Question Options	Population									
	<50,000		50,000-100,000		100,000-250,000		250,000-500,000		>500,000	
	No.	%	No.	%	No.	%	No.	%	No.	%
Characteristic data for intersections and mid-blocks are maintained in a database.	1	8.3%	5	50.0%	5	62.5%	5	71.4%	7	87.5%
Characteristic data for intersections and mid-blocks are not maintained in a database.	5	41.7%	2	20.0%	1	12.5%	1	14.3%	1	12.5%
Only intersection characteristic data are maintained in a database.	2	16.7%	1	10.0%	1	12.5%	1	14.3%	0	0.0%
Only mid-block characteristic data are maintained in a database.	0	0.0%	0	0.0%	1	12.5%	0	0.0%	0	0.0%
Other, please specify	1	8.3%	1	10.0%	0	0.0%	0	0.0%	0	0.0%
No Response	3	25.0%	1	0.1	0	0	0	0	0	0

6.12 Education and Enforcement Programs

The survey respondents were asked to identify road user safety education programs currently employed to target specific contributory factors or target groups. Included in **Table 24** is a summary of the responses.

Table 24: Education Program Survey Responses

Education Campaign	Jurisdiction Population					Total
	< 50,000	50,000 to < 100,000	100,000 to < 250,000	250,000 to < 500,000	500,000+	
Sober Driving Campaigns	6	3	3	2	4	18
Safe Routes to Schools	5	8	7	6	6	32
Distracted Driving	2	1	1	2	3	9
Pedestrian Awareness	1	6	4	5	6	22
Motorcycle Awareness	1	1	0	0	2	4
Heavy Vehicle Awareness	1	0	1	0	0	2
Cyclist Awareness	5	5	6	4	6	26
Animal Awareness	2	1	2	0	1	6
Share the Road	6	5	4	4	7	26
Work Zone Safety	5	4	6	4	3	22

Based on the above responses, it is apparent that the majority of campaigns and initiatives relate to vulnerable / active transportation road users including school aged children, pedestrians and bicyclists. The level of deployment of these initiatives does not appear to be a function of jurisdiction size. With the increasing demand for, and promotion of, walking / biking to school and active transportation modes, it is good to see that parallel safety programs are being implemented.

Sober driving campaigns were also prevalent throughout the range of jurisdiction population size.

The survey respondents were asked to identify road user safety enforcement programs currently employed to target specific contributory factors. Included in **Table 25** is a summary of the responses, and speed-related enforcement programs are the dominant initiatives throughout all jurisdiction sizes.

Table 25: Enforcement Program Survey Responses

Enforcement Campaign	Jurisdiction Population					Total
	< 50,000	50,000 to < 100,000	100,000 to < 250,000	250,000 to < 500,000	500,000+	
Red Light Cameras	2	4	4	2	5	17
Speed Enforcement Programs	7	7	6	6	5	31
Road / Speed Watch	7	4	5	7	6	29
Aerial Enforcement	1	0	0	1	2	4
Other	0	0	0	0	1	1

7.0 CLOSING REMARKS

The Highway Safety Manual and TAC CRaSH Handbook Series are valuable resources documenting the latest science of road safety developments, and provide road agencies with the required tools to develop a road safety program in their jurisdictions. One of the challenges faced by road agencies is determining what road safety components are appropriate based on jurisdiction size and limited resources. This project provides potential assistance to this end by identifying the various components of road safety programs, along with jurisdictional peer comparisons. For this report similar populations are assumed peer jurisdictions.

The current road safety and data collection practices of Canadian jurisdictions were collected through a survey in which 49 jurisdictions from eight Canadian provinces participated. Four provincial road authorities (Ministries of Transportation) also participated in this survey.

A number of key findings of the survey conducted in this project include:

- Most jurisdictions with more than 500,000 population have a guiding document in the form of a road safety vision / action plan or an integrated road safety plan
- More than 73% of all responding jurisdictions have a program to conduct network screening. However, less than 20% use scientifically valid approaches such as the Empirical Bayes method for their network screening
- Almost 38% of jurisdictions have programs in place to conduct road safety audit of proposed new designs
- Only 53% of all participating jurisdictions conduct in-service road safety reviews
- Most jurisdictions do not require road safety as part of their traffic impact studies for proposed / new developments
- Most jurisdictions sometimes conduct before and after studies to evaluate the effectiveness of implemented countermeasures

It is highly recommended that road agencies should have proactive road safety programs in order to improve safety in their jurisdiction. Jurisdictions may use this report to compare themselves with similar agencies to gauge if they are performing to a similar level.

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