City of Richmond Hill

Traffic Safety and Operations Strategy: Phase 1

Final Report

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B001474

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City of Richmond Hill

Final Report

Traffic Safety and Operations Strategy Phase 1

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EXECUTIVE SUMMARY

CIMA+ was retained by the City of Richmond Hill (the City) to develop a Traffic Safety and Operations Strategy. Phase 1 of this project includes two major interconnected components: review the current state of services, processes, practices and performance of the Traffic Safety and Operations Group and develop, prepare and deliver updated new resources and tools, which are in harmony with current industry practice. The above components serve the main objective of the study, which is to provide a framework for a program in the City that will maximize the safety, efficiency, and capacity of the existing municipal road system.

The essence of the TSOS is to set the stage for later efforts by the City's Traffic Safety and Operations Group through a planning level review of the City's policies and procedures. Clear and objective policies and guidelines are also critical building blocks of an efficient and consistent transportation system for any road agency. Policies and guidelines can be adopted from national and provincial guidelines, but the unique needs of the City may not be directly addressed in these documents.

Methodology

The high-level steps for the TSOS are represented in the following flowchart shown in **Figure E-1**.

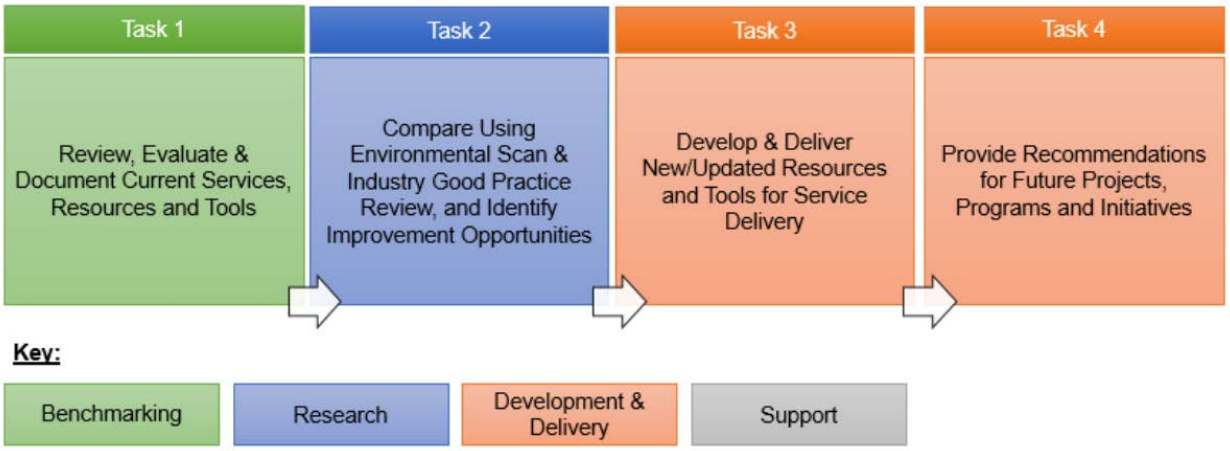

Figure E-1 – Overview of Project Process

The first task served as a **benchmarking** task. CIMA+, in collaboration with the City, developed a complete picture of the existing services, resources and tools currently in

use by the Traffic Safety and Operations Group to deliver on their mandate to improve safety and operations in the City.

The second task served as a **research** task. It involved an Environmental Scan and Industry Good Practice review to determine what other municipalities are doing and what is considered good practice in the industry related to safety and operations as a means of determining potential gaps in service delivery in the City of Richmond Hill. The review involved contacting and engaging with professionals in the traffic safety and operations community in municipalities in the immediate vicinity of the City of Richmond Hill, in addition to municipalities within the Greater Toronto Area that are leaders in traffic safety and operations.

The third task involved the identification of **enhancements** to the City's existing services, resources and tools based on the outcome of the second task. The third task focussed on development and delivery, with the development of various policies and procedures.

For the fourth task, CIMA+ developed an **action plan** for the second phase of the TSOS that will include the establishment of priority projects, programs and initiatives (such as pilot projects) and a plan to maintain the resources and tools developed as part of this study.

Scope

The City of Richmond Hill identified the following broad categories for the policies, procedures and practices to be developed. These policies, procedures and practices were developed by CIMA+ in collaboration with City staff.

- Inquiry Review Process
- Speed Management, Speed Limit Policy, Traffic Calming Policy, Before-After Studies and Traffic Calming Toolbox
- Pedestrian Crossovers
- Community Safety Zones
- Automated Speed Enforcement
- Crossing Guard Procedure and Policy
- Traffic Data Collection
- Road Safety Public Awareness and Education Programs
- Road Safety Programs
- Resources and Reference Materials

- Annual Performance Report Templates

Recommendations

A set of policies, projects, programs and initiatives were identified as a result of the work undertaken in the development of the Traffic Safety and Operations Strategy, representing 48 separate recommendations. These recommendations are summarized below in **Table E-1**, grouped by category. Additional stakeholders that would be impacted by the recommendations is also indicated.

Table E-1 – Summary of Recommendations

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
Inquiry Review Process	Traffic Inquiry Prioritization Tool	● Prioritize public inquiries in accordance with priority matrix (in consideration of inquiry type and whether a specific event occurred)	● Allows City staff to prioritize inquiries in a consistent manner, manage workload and workflow internally	-
	Traffic Inquiry Geolocating Tool	● Develop dynamic and interactive inquiry maps using software programs with geolocating features such as ArcGIS and Microsoft Power BI (linked to City's Excel spreadsheet)	● Allows inquiries to be visually displayed spatially	-
	Public Inquiry Web App	● Develop a web-based app to collect public inquiries that is linked to a database	● Allows inquiries to be received in a more consistent manner ● Can be linked to City's existing Excel tracking sheet	Access Richmond Hill
Traffic Data Management	Refinements to Data Collection Periods and Seasons	● Implement refinements to data collection periods and locations	● Align City's methodologies for data collection with best practice	-
	Traffic Count Program Needs Assessment	● Implement further refinements to data collection periods and seasons ● Determine optimal locations for the count program ● Develop conversion factors for time of day, day of week and month	● Improve City's understanding of traffic flow patterns and growth rates ● Ensure adequate spatial and temporal coverage to provide high-quality input for other projects and programs	-
	Expand Pedestrian and Cyclist Count Program	● Explore and adapt different technologies for collecting pedestrian and cyclist counts	● Improve City's understanding of pedestrian and cyclist activity on the local	-

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
			road network ● Application for PXO and crossing guard warrants	
	Development of Growth Factors	● Develop growth factors using the common growth factor method	● Improve City's understanding of traffic flow patterns and growth rates	-
Speed Management	Speed Limit Policy	● Establish base speed limits throughout City, including area speed limits (40 km/h or 50 km/h)	● Consistent approach to posting speeds	Public Works Operations York Regional Police
	Traffic Calming Toolbox	● Adopt traffic calming toolbox for the selection of treatments for locations identified as suitable for traffic calming	● Selection of treatments based on operating speeds, collision performance and cross section of roadway	Infrastructure Delivery Public Works Operations Asset Management York Regional Police Fire and EMS
	Before-After Studies	● Before-after study determining effects of traffic calming implementation based on performance indicators	● Insight into effectiveness of traffic calming measures implemented	-
	Network-wide Speed Limit Review	● Evaluate need for adjustments to base speed limits on collector roads and 'grid' local roads ●Identify streets suitable for Area Speed Limits	● Refinements to base speed limits based on industry practice	Public Works Operations York Regional Police
	Speed Data Collection for Traffic Calming Network Screening	● Collect speed data on all collector roads and 'grid' local roads, as needed to supplement data collected through the City's regular count program	● Required data for network review of base speed limits	-
	Traffic Calming Network Screening	● Establish a formal process for identifying candidate locations for traffic calming based on speed, collision performance and other factors	● Approach to selecting candidate locations for traffic calming that is objective and defendable	Infrastructure Delivery Public Works Operations Asset Management York Regional Police Fire and EMS
	Long-term Speed Limit Monitoring	● Monitor locations within new subdivisions or existing roads with a significant change in land use or function	● Continued surveillance of locations that may require speed limit adjustments	Public Works Operations York Regional Police

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
Automated Speed Enforcement	Prepare for Implementation of Automated Speed Enforcement	● Assess and Define Operational Parameters and Cost Estimates for the ASE Program ● Develop Candidate Site Selection Criteria and Prioritization Methodology (refer to Community Safety Zone Network Screening) ● Enter Agreements with City of Toronto, MTO and ASE Equipment Vendor ● Configure Road Network to Accommodate ASE	● Ensures that City is fully prepared for the implementation of ASE technology	Community Standards Public Works Operations York Regional Police
	Automated Speed Enforcement	● Implement ASE at Community Safety Zones and School Zones	● Enforcement of appropriate operating speeds	Community Standards Public Works Operations York Regional Police
Pedestrian Crossovers	PXO Implementation	● Continue with existing implementation of PXOs	● Continuity until medium term project can be implemented	Infrastructure Delivery Public Works Operations Asset Management
	Review and Prioritization of PXO Candidate Locations	● City wide review to identify candidate locations collect necessary data to apply warrant ● Ranking of candidate locations based on connectivity, demand and safety	● Systematic review across entire City ● Data will be used to prioritize locations ● Objective means of prioritizing locations	Infrastructure Delivery Public Works Operations Asset Management
Road Safety Programs	Network screening	● Collect and assemble necessary data ● Develop Safety Performance Functions (SPFs) ● Conduct Network Screening using Empirical Bayes Method ● Identify sites with higher Potential for Safety Improvements (PSI)	• Develop ranked list of priority locations within City based on potential for safety improvement	-
	Systemic road safety evaluation	● Collect and assemble necessary data ● Identify risk factors and assign to sites ● Identify and rank sites with one or more risk factors ● Identify systemic safety treatments	● Develop ranked list of priority locations within City based on risk factors • Identify treatments best suited to address risk factors	-
	Conflict Analysis	● Based on a jurisdictional / industry scan, establish criteria for recommending video conflict	● Standardized criteria for assessing the need for conflict analysis as a	-

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
		analysis at specific sites, in the context of in-service road safety reviews and/or complex traffic inquiries. Include considerations for timing and duration of analyses	supplementary tool for conducting in-service road safety reviews and/or reviewing complex traffic inquiries	
	In-service Road Safety Reviews	● Develop and implement a program to conduct in-service road safety reviews at top ranked locations in the City (5 locations per year assumed)	● Identify deficiencies and associated treatments based on in depth office review and field investigation	-
	STOP Sign Visibility Enhancements	● Adopt policy relating to the use of STOP AHEAD signs, additional left hand side signs, oversize STOP signs and tiger-trial signs ● Compile and maintain STOP sign compliance database to determine 85th percentile compliance rate	● Enhanced and consistent approach to the implementation of STOP sign visibility improvements	Public Works Operations Engineering Subdivisions
	Crosswalk Markings	● Adopt policy relating to the use of crosswalk markings	● Enhanced and consistent approach to the implementation of crosswalk markings	Public Works Operations Engineering Subdivisions
	All-way STOP Sign Warrant	● Adopt policy relating to nearly warranted all-way STOP signs	● Flexible criteria relating to the use of All-way STOP sign controls compared to OTM warrants	Public Works Operations Engineering Subdivisions
	Conversion from All-way STOP Minor Road STOP Control	● Adopt policy relating to conversion of all-way STOP sign warrant to minor STOP control	● Standardized procedure for converting all-way STOP sign warrant to minor STOP control	Public Works Operations
	Intersection Sight Distance at Local Road Intersections	● Adopt policy relating to intersection sight distance requirements at local road intersections	● Flexible criteria and standardized procedure for evaluating the need for sightline improvements at local road intersections	Public Works Operations Risk Management
	PXOs at Roundabouts	● Adopt policy relating to the use of PXOs at City roundabouts	● Standardized procedure for use of PXOs at City roundabouts	Public Works Operations Engineering Subdivisions Asset Management
	School Zones	● Adopt policy relating to the use of School Zone signing near schools	● Standardized procedure for use of School Zones	Public Works Operations York Regional Police York Region

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
				District School Board York Catholic District School Board
	Directional Dividing Lines	● Adopt policy relating to the use of directional dividing line delineation	● Standardized procedure for use of directional dividing line delineation	Public Works Operations Engineering Subdivisions
	On Street Parking Regulations Retrofitting	● Adopt policy relating to implementing parking regulations across the City, restricting on-street parking based on cross section width, transit, and land use in accordance with City Standards and Specification Manual	● Standardized procedure for implementing on-street parking regulations	Public Works Operations Community Standards
	Oversize Parking Regulation Signs	● Adopt policy relating to allowing the use of oversize NO STOPPING and NO PARKING signs	● Standardized procedure for use of oversize NO STOPPING and NO PARKING signs	Public Works Operations Community Standards
	City Standards and Specifications Updates	● Integrate the following items into the City Standards and Specifications so that staff, designers and developers are aware of new policies that affect design, including: - STOP sign visibility considerations - Crosswalk and directional dividing line marking criteria - Widening of curb ramps - All-way STOP warrant criteria - PXO requirements at roundabouts - Parking regulation requirements - Traffic calming measures	● Expedite design process by reducing the amount of reviews to correct elements not in accordance with new policies	Infrastructure Delivery Engineering Subdivisions
School Crossing Guards	School Crossing Guard Warrant	● Use pre-selection criteria for identifying candidate crossing guard locations ● Use modified Exposure Index for warrant (in addition to Gap Study) ● Implement additional sign, pavement marking and pedestrian improvements as per revised policy at crossing guard locations	● Use of warrant and implementation guidance that is customized to City needs and based on current engineering practice	Public Works Operations York Region District School Board York Catholic District School Board
	School Crossing Guard Annual Review	● Conduct annual reviews to identify new candidate locations	● Continued and consistent application of policy	Public Works Operations York Region

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
		or to confirm continued need for crossing guards		District School Board York Catholic District School Board
	Refine School Crossing Guard Exposure Index	● Develop local exposure index based on Richmond Hill data (or in combination with other municipalities in York)	● Use of local Exposure Index that accounts for local traffic patterns	-
Community Safety Zones	Community Safety Zone Warrant	● Revised warrant for establishing Community Safety Zones	● Immediate use of revised warrant that is customized to City needs	Public Works Operations York Regional Police
	Community Safety Zone Network Screening	● Conduct network screening to identify candidate locations for Community Safety Zones	● Ranked list of candidate locations best suited for Community Safety Zones	Public Works Operations York Regional Police
	Community Safety Zone Implementation	● Implement CSZs at top ranked locations	● Implementation of CSZs based on network screening ranking	Public Works Operations York Regional Police
Public Awareness and Education	Continue to Support Active School Travel Program	● Continue to support program and distribute walkability and bike-ability checklists	● Collaboration with School Boards and local schools	York Region District School Board York Catholic District School Board
	SLOW DOWN lawn sign program	● Establish criteria for launching SLOW DOWN lawn sign program	● Consistent use of SLOW DOWN lawn signs	Communications Community Standards
	Road Watch Program	● Continue to support York Regional Police Road Watch program and local Road Watch committee and raise awareness of road safety public awareness and education road programs	● Continued support of existing program	-
	Calendar of Road Safety Events	● Develop an integrated Region/City calendar as part of York Region Traveller Safety Strategy	● In collaboration with Region and other local municipalities ● Increased awareness of regional and provincial safety events	Communications
	Expansion of Road Watch Committee Mandate	● Broaden Road Watch Committee mandate to consider City's Transportation Master Plan, specifically active transportation and micromobility	● Broaden scope for committee	-

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
Administration	Resource and Reference Materials Library	● Assemble a digital library and obtain / purchase copies of provincial (MTO), national (TAC) and international (FHWA, AASHTO) manuals on traffic safety and operations	● Ensures that staff are using resources and reference materials that represent best practice	-
	Traffic Safety and Operations Project & Program Delivery Report	● Use enhanced annual performance template to report on accomplishments of Traffic Safety and Operations staff	● Uniform and consistent approach to reporting on Traffic Safety and Operations accomplishments	-
	Annual Traveler Safety Report	● Contribute collision data to Region's for their use in Annual Traveler Safety Report	● Consistent approach to reporting on City's collision performance and comparator to other municipalities	-
	Transportation Data and Assets GIS Database	● Develop Open Data platform that would include traffic data and assets such as signals, PXOs, crosswalks, school crossings, traffic calming treatments. This would be integrated with York Data Warehouse as much as possible.	● Open data platform acts as a resource for external stakeholders.	-

Table E-2 summarizes the recommendations identified for the future policies, projects, programs and initiatives, grouped by category. It should be noted that these costs are assumed to be in addition to services currently provided by the group. Design and construction staff will require their own budgets.

Table E-2 – Summary of Recommendations by Broad Category

Category	Number of Recommendations	Short Term	Medium Term	Long Term
Inquiry Review Process	3	-	$40,000	-
Traffic Data Management	4	-	$65,000	$20,000 (every 5 years) for development of growth factors
Speed Management	7	-	$70,000 $20,000 – Annually (4)	$20,000 – Annually (4)
Automated Speed Enforcement	2	-	$520,000 (1) $120,000 (2)	$520,000 (1)
Pedestrian Crossovers	2	-	$45,000	$45,000 (every 5 years) for review and prioritization of PXOs
Road Safety Program	15	-	$100,000 $50,000 - Annually (3)	$50,000 - Annually (3) $45,000 (every 5 years) for network screening $40,000 (every 5 years) for systemic road safety evaluation
School Crossing Guards	3	-	-	-
Community Safety Zones	3		-	-
Public Awareness and Education	5	$25,000 (5)	-	-
Administration	4	$2,500	$20,000	-

Notes:

1. Annual cost of program
2. First year would include an additional $30,000 per camera for initial setup
3. $50,000 would be budgeted annually for in-service road safety reviews
4. $20,000 would be budgeted annually for before-after studies relating to traffic calming projects

Cost for pilot ‘Slow Down Lawn Sign Program’. Additional medium to long-term costs may apply depending on the success of the program

Table E-3 and **Figure E-2** illustrates the timeline for the next ten years (green for short term, blue for medium term and orange for long term) showing the annual budget and the associated additional resources (full time staff equivalent staff – FTE) required to undertake the work identified in the Richmond Hill Traffic Safety and Operations Strategy. City staff have indicated that they will require 1 or 2 FTE positions by the end of the program..

Table E-3 – Year and Budget[1]

Year	Budget
2024	$67,500
2025	$350,000
2026	$90,000
2027	$70,000
2028	$70,000
2029	$70,000
2030	$220,000
2031	$90,000
2032	$70,000
2033	$70,000

[1] Excludes budget for Automated Speed Enforcement (ASE). If the City proceeds with the implementation of ASE, the assumed costs for 4 cameras are $640,000 for the first year and $520,000 per year for subsequent years. These values assume no cost offsets from speeding ticket revenues. City staff are currently working on defining Operational Parameters and Cost Estimates for a potential ASE Program. The above costs do not include costs associated with implementation of traffic calming treatments.

Figure E-2 – Timeline, Budget and associated resources[2]

[2] **Note:** Excludes budget for Automated Speed Enforcement (ASE). If the City proceeds with the implementation of ASE, the assumed costs for 4 cameras are $640,000 for the first year and $520,000 per year for subsequent years. These values assume no cost offsets from speeding ticket revenues. City staff are currently working on defining Operational Parameters and Cost Estimates for a potential ASE Program. An additional 0.50 FTE staff is also expected to be required annually.
The above costs do not include costs associated with implementation of traffic calming treatments.

1 INTRODUCTION

CIMA+ was retained by the City of Richmond Hill (the City) to develop a Traffic Safety and Operations Strategy. Phase 1 of this project includes two major interconnected components: review the current state of services, processes, practices and performance of the Traffic Safety and Operations Group and develop, prepare and deliver updated new resources and tools, which are in harmony with current industry practice. The above components serve the main objective of the study, which is to provide a framework for a program in the City that will maximize the safety, efficiency, and capacity of the existing municipal road system.

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1.1 Methodology

The high-level steps for the TSOS are represented in the following flowchart shown in **Figure 1-1**.

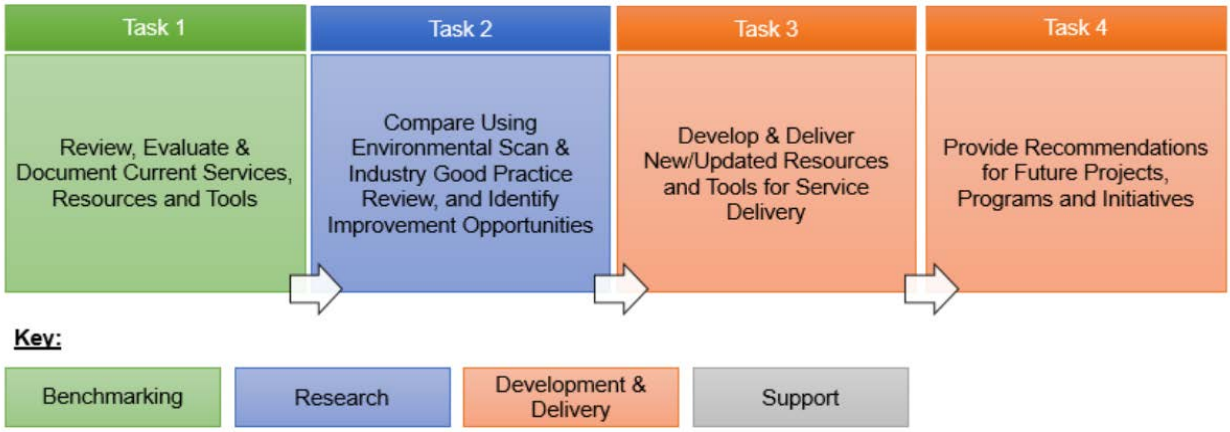


Figure 1-1 – Overview of Project Process

The first task served as a **benchmarking** task. CIMA+, in collaboration with the City, developed a complete picture of the existing services, resources and tools currently in use by the Traffic Safety and Operations Group to deliver on their mandate to improve safety and operations in the City.

The second task served as a **research** task. It involved an Environmental Scan and Industry Good Practice review to determine what other municipalities are doing and what is considered good practice in the industry related to safety and operations as a means of determining potential gaps in service delivery in the City of Richmond Hill. The review involved contacting and engaging with professionals in the traffic safety and operations community in municipalities in the immediate vicinity of the City of Richmond Hill, in addition to municipalities within the Greater Toronto Area that are leaders in traffic safety and operations.

The third task involved the identification of **enhancements** to the City's existing services, resources and tools based on the outcome of the second task. The third task focussed on development and delivery, with the development of various policies and procedures. Some of the resources and tools were to be led by CIMA+, with the remaining being developed by City staff while CIMA+ staff playing a support role.

For the fourth task, CIMA+ developed an **action plan** for the second phase of the TSOS that will include the establishment of priority projects, programs and initiatives (such as pilot projects) and a plan to maintain the resources and tools developed as part of this study.

1.2 Scope

The City of Richmond Hill identified the following broad categories for the policies, procedures and practices to be developed. These policies, procedures and practices were developed by CIMA+ in collaboration with City of Richmond Hill staff.

- Inquiry Review Process
- Speed Management, Speed Limit Policy, Traffic Calming Policy, Before-After Studies and Traffic Calming Toolbox
- Pedestrian Crossovers
- Community Safety Zones
- Automated Speed Enforcement
- Crossing Guard Procedure and Policy
- Traffic Data Collection
- Road Safety Public Awareness and Education Program
- Road Safety Program
- Resources and Reference Materials
- Annual Performance Report Templates

1.3 Organization of Report

Section 2.0 of this report presents information on the existing state of the City's policies, procedures and programs. **Section 3.0** of this report presents the findings of a jurisdiction scan indicating how other municipalities have developed their own policies, procedures and programs relating to items listed in Section 1.2. **Section 4.0** presents enhancements to the City's policies, procedures and programs developed by CIMA+ in collaboration with City staff. **Section 5.0** outlines the recommendations made based on the identified enhancements.

Following the body of this report, a set of appendices are provided listing additional supplementary materials, including policies developed for the City.

2 REVIEW OF CURRENT SERVICES, RESOURCES AND TOOLS

CIMA+ conducted a review of current services, resources and tools conducted by the TSOS group within the City. **Table 2-1** summarizes the existing state of the City's current programs, services, policies and procedures.

Table 2-1 – Existing State of City's Current Programs, Services, Policies and Procedures

Programs	Developed and Endorsed by Council	Developed Not Endorsed	Developed as Working Draft	Conducted Ad Hoc	Not Currently Practiced
Inquiry Review Process				X	
Speed Management					
Speed Management Policy				X	
Speed Limit Policy				X	
Traffic Calming Policy	X				
Automated Speed Enforcement Future-Ready Audit					X
Traffic Calming Design					
Traffic Calming Design Toolbox				X	
Traffic Circles	X				
Pilot Projects				X	
Warrants					
All-Way Stop Sign Control	X				
PXO Policy				X	
Crossing Guard Policy	X				
Community Safety Zones Policy	X				
Data Management					
Traffic Data Collection Program			X		

Programs	Developed and Endorsed by Council	Developed Not Endorsed	Developed as Working Draft	Conducted Ad Hoc	Not Currently Practiced
Annual Performance Report Templates				X	
Road Safety Programs				X	
Road Safety Public Awareness and Education program				X	
Resources and Reference Materials				X	

The following section presents an overview of the existing state of the current services, resources and tools in the City of Richmond Hill as it relates to the above areas.

2.1 Inquiry Review Process

The City's existing inquiry processing procedure consists of four key components, which are:

- Inquiry Tracking System
  - EnerGOV – a tracking software that is operated by administrative staff
  - Tracking sheet – a Microsoft Excel spreadsheet managed by administrative staff and the TSO Group[3]
- Workload and Workflow Management: the TSO Group uses Microsoft Planner as an internal workload and workflow management tool
- Inquiry Responding: a standard operating procedures (SOP) document that provides detailed guidance on responses of each type of inquiry and
- Record Keeping: location-specific documenting using Microsoft Word, where all historical inquiries at the same location are documented in the same file.

An overview of the existing inquiry processing procedure is illustrated in **Figure 2-1**.

[3] City staff are required to track inquiries using EnerGOV, however it has limitations in terms of workflow. Therefore, to make the day-to-day work more agile, staff use these alternative tools.

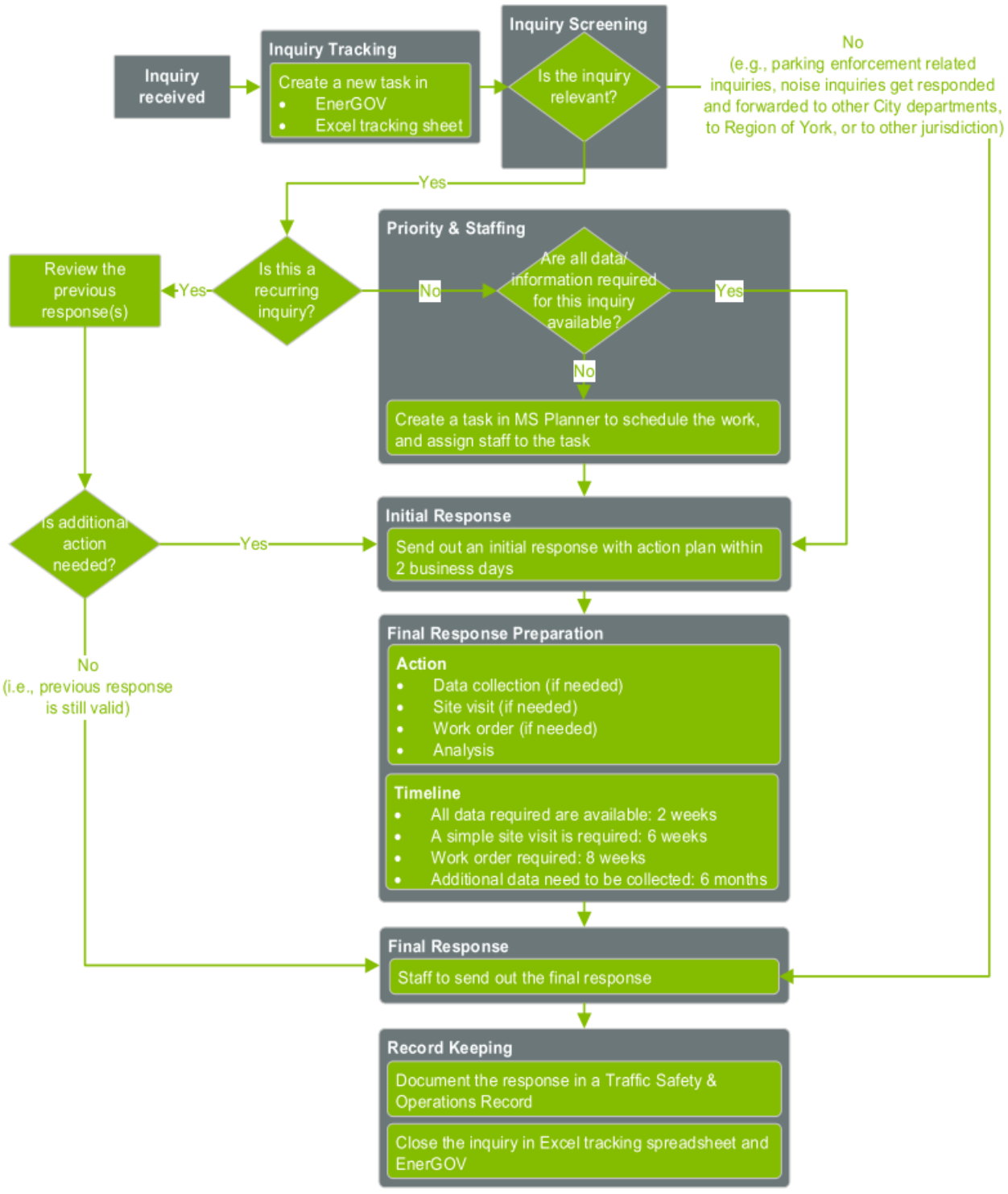


Figure 2-1 – Overview of Existing Inquiry Processing Procedure

2.1.1 Inquiry Tracking System

Each inquiry is tracked in both EnerGOV and an Excel tracking sheet – EnerGOV is managed by administrative staff, and the Excel tracking sheet is managed by both administrative staff and the TSO Group.

When an inquiry is received, EnerGOV records the following key information of the inquiry:

- Date entered (i.e., inquiry receival date)
- Complete date
- Request status (i.e., status of the inquiry)
- Complainant information
- Type of Complaint (i.e., inquiry type)
- Comments (i.e., detailed description of the inquiry)
- Location associated with the inquiry and
- Related complaints (if applicable)

The Excel tracking sheet records the same information noted above, as well as the TSO Group member assigned to the inquiry and whether additional data collection, a site visit, or work order preparation is required.

2.1.2 Workload and Workflow Management

To manage workload and workflow, a task is created in Microsoft Planner for each inquiry with the information outlined in **Table 2-2**.

Table 2-2 – Microsoft Planner

Item	Description
Location	• The location of the inquiry
Task Assignment **The person who leads the investigation**	• Supervisor • Senior Traffic Analyst • Traffic Analyst
Bucket **The nature of the inquiry**	• Public Inquiry: inquiries from the public through calls, email, etc. • Internal Inquiry:[4] inquiries from other City departments (e.g., inquiries related to parking regulations from By-law staff inquiries related to traffic signage from Public Works Operations staff)

[4] Internal inquiries were not reviewed as part of this study, but they follow the same process as public inquiries.

Item	Description
Inquiry Type **Common inquiries that the TSO Group often receives**	• AWSC Warrant • CSZ • Cycling • Parking • Pedestrian Safety • School Safety • Sight Distance • Signals • Signs/Pavement Markings • Speed • Stop Sign Compliance • General Questions • Other
Progress: **The current status of the inquiry**	• Not Started: The task is created but TSO Group has not worked on it yet • In progress: TSO Group is currently working on the inquiry • On-hold: TSO Group is waiting on additional information/data to complete the analysis for the inquiry • Completed: final response is sent out, the inquiry is closed in EnerGOV and the Excel tracking sheet, and all correspondences are documented
Priority	• High • General
Notes	• A brief description of the inquiry • Inquirer's contact information • Internal record-keeping file path
Checklist	• The list of tasks under this inquiry
Comments	• Internal communication records between Traffic Operations and Safety team members

2.1.3 Inquiry Review and Response

The TSOS Group currently has a self-developed SOP document that provides reference information and step-by-step instruction on how to review a number of inquiry types that the TSOS Group frequently receives:

- All-way Stop Requests
- Children at Play Signs
- Cycling Facilities
- Noise Complaints
- Parking Concerns
- Pedestrian Crossing Concerns
- Speeding Concerns
- Stop Sign Compliance Concerns
- School-Related Issues
- Miscellaneous

Although not a formal policy, the SOP document helps TSOS Group members to provide consistent responses to inquiries in an efficient manner

2.1.4 Record Keeping

A Microsoft Word document is created for each location (intersection or road segment) to document the historical inquiries at the location. For each inquiry, the document records the following:

- Details about the inquiry (e.g., inquiry type, date received, trucking number, status, etc.)
- Office review, including analysis results
- Field investigation and findings
- Conclusions and recommendations and
- Responses provided

2.2 Speed Management, Speed Limit Policy, Traffic Calming Policy, Before-After Studies, and Traffic Calming Toolbox

The following outlines the existing programs used by the City of Richmond Hill related to Speed Management, Speed Limits, Traffic Calming and Pilot Projects.

2.2.1 Speed Management Program

Speed management is currently conducted in a reactive manner (ad-hoc basis), as it is conducted only as per specific needs and not previously planned. Elements of speed management are present in other existing policies such as the Traffic Calming Process, Community Safety Zone and Traffic Circle policy.

2.2.2 Speed Limit Policy

The setting of speed limits is currently conducted on an ad-hoc basis, using the Transportation Association of Canada's (TAC) *2009 Canadian Guidelines for Establishing Posted Speed Limits* as a guideline.

2.2.3 Traffic Calming Policy

In the City, to initiate a study for considering traffic calming, one of two criteria must be satisfied:

- A petition signed by 75% of registered property owners on the street where traffic calming is being considered or
- Direction from Council to proceed with traffic calming

Upon satisfaction of either criterion, an optional notice of commencement is placed in the newspaper at the start of the project to notify residents and a notice will be mailed to all residents on the street.

Once alternatives to the undertaking have been developed and evaluated, two public consultation sessions are held to provide input from the public. Comments received will then be addressed if issues raised are not addressed to the objector’s satisfaction, they can submit a letter to the City Council.

A final report is then sent to the Council with recommendations based on the comments received.

2.2.4 Pilot Projects

The City does not currently have any pilot projects or carry out any formal before-and-after studies evaluating the impacts of traffic calming.

2.2.5 Traffic Calming Toolbox

The City implements traffic calming treatments on an ad hoc basis with no policies established except for traffic circles as noted below. As part of this project, a traffic calming toolbox was developed.

Traffic Circles

The City currently have guidelines on traffic circles. The guidelines provide a review of existing roundabout-controlled intersections in Richmond Hill and provide a recommendation on the preferred design for conversion of existing traffic circles to roundabouts and a preferred design for new construction of a single lane roundabout.

The guidelines are to be consulted for the implementation of new traffic circles, in addition to existing standards (i.e. the *CITE Canadian Guide to Neighbourhood Traffic Calming*).

2.3 Pedestrian Crossovers

The City of Richmond Hill is currently using the Ontario Traffic Manual (OTM) Book 15 to determine if PXOs are warranted along with determining the appropriate type of PXO. The City currently has a spreadsheet outlining PXO candidate locations and supporting data to determine their warrant status as per OTM's Book 15, as outlined below.

2.3.1 Pedestrian Crossover Assessment

If a traffic signal (i.e. IPS, MPS, or full traffic signal) is not warranted at a site, the need for a PXO can be assessed based on the following three factors[5]:

1. **Traffic volume:** Research has found that there is a statistically significant relationship between pedestrian collision rate and traffic volume. Specifically, at locations with marked crosswalks, collision rates increase significantly as a function of traffic volume, for ADTs greater than approximately 9000 vehicles per day. This suggests the need to enhance the marked crosswalks at these locations with additional treatments to improve pedestrian safety. In addition, there is also a relationship between traffic volume and crossing opportunities, which affects pedestrian delay. Therefore, by including traffic volume as a variable within the preliminary assessment process, delay considerations are also integrated.
2. **Crossing distance:** Research has also found that crossing distance has an impact on the likelihood of a pedestrian collision, particularly on roads with higher traffic volumes (i.e., the wider the crossing distance, the more difficult it is for pedestrians to safely cross the street).
3. **Pedestrian system connectivity:** The provision of pedestrian system connectivity is important for proper pedestrian accommodation. Facilitating connectivity between crosswalks and sidewalks, and/or trail networks involves understanding and monitoring pedestrian desire lines, which evolve as a function of land use, the location of pedestrian generators and attractors, and proximity/connectivity to existing crossing facilities. Providing proper connectivity between origins and destinations allow pedestrians simple and convenient access to facilities with the shortest possible deviation. Additionally, it reduces the possibility of pedestrians crossing at unsuitable locations.

[5] Adapted from: Ontario Traffic Manual Book 15: Pedestrian Crossing Treatments (June 2016)

Figure 2-2 graphically outlines the process for evaluating the need for a PXO. Based on the above factors, the steps to check the requirement for a PXO are as follows, in which two out of three factors need to be met:

- Verify minimum pedestrian and vehicular volume at location, either the total 8-hour volume or 4-hour volume, specifically:
  - ≥100 pedestrians and ≥750 vehicles in an 8-hour period or
  - ≥65 pedestrians and ≥395 vehicles in a 4-hour period
- Verify if the distance of the site to the closest traffic control device is more than 200 m and
- Verify if there is a requirement for a controlled crossing based on system connectivity or pedestrian desire lines.[6]

[6] The 200 m minimum distance required from the site to the nearest traffic control device is consistent with Justification 6 of OTM Book 12 and the Transportation Association of Canada's (TAC) *Pedestrian Crossing Control Guide*.

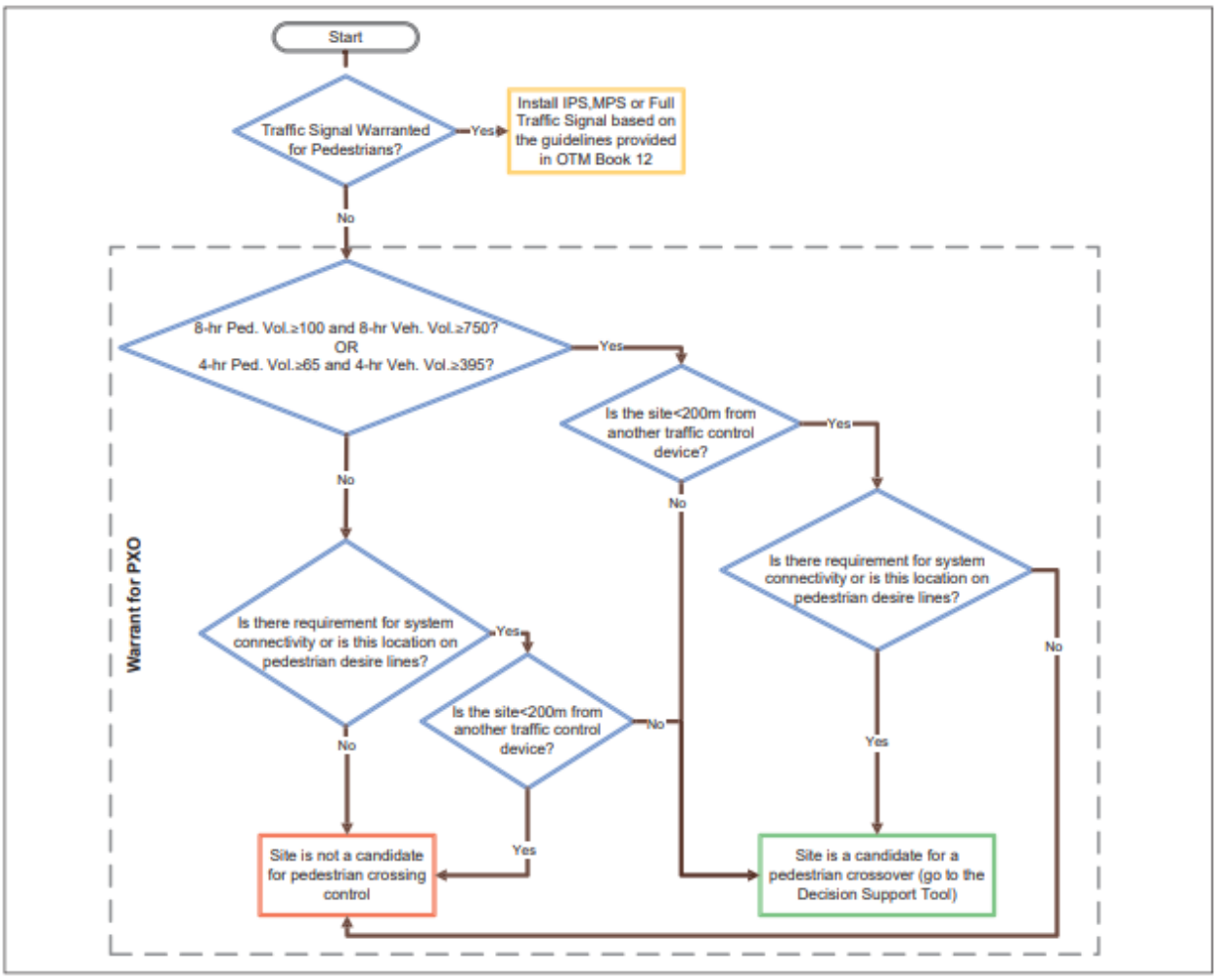


Figure 2-2 – Decision Support Tool - Preliminary Assessment

2.3.2 Types of Pedestrian Crossovers

As per OTM Book 15, there are different levels and types of PXOs. The four different types and levels are outlined in **Table 2-3** as stated in OTM Book 15 and used by the City of Richmond Hill. **Figure 2-3** on the following page outlines the selection matrix used for PXO treatment systems as per OTM Book 15.

Table 2-3 – Different PXO Treatments[7]

PXO Types	Description
Level 1 Type A PXO	Is distinctly defined by the use of regulatory and warning signs, flashing amber beacons, and pavement markings prescribed and illustrated by Ontario Regulation 402/15. This treatment system uses internally illuminated overhead warning signs.
Level 2 Type B PXO	Is distinctly defined by the prescribed use of regulatory and warning signs, rapid rectangular flashing beacons (RRFB) and pavement markings prescribed and illustrated by Ontario Regulation 402/15. The system uses both the side mounted and overhead regulatory signs.
Level 2 Type C PXO	Is distinctly defined by the prescribed use of regulatory and warning signs, RRFB and pavement markings prescribed and illustrated by Ontario Regulation 402/15. The system uses only side mounted regulatory signs.
Level 2 Type D PXO	Is distinctly defined by the prescribed use of regulatory and warning signs, and pavement markings prescribed and illustrated by Ontario Regulation 402/15. The system uses only side mounted regulatory signs and does not require flashing beacons.

[7] Ontario Traffic Manual Book 15: Pedestrian Crossing Treatments, 2016 – Table 5

Two-way Vehicular Volume			Posted Speed Limit (km/h	Total Number of Lanes for the Roadway Cross Section[1]			
Time Period	Lower Bound	Upper Bound		1 or 2 Lanes	3 lanes	4 lanes w/raised refuge	4 lanes w/o raised refuge
8 Hour	750	2,250	≤50	Level 2 Type D	Level 2 Type C[3]	Level 2 Type D[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	750	2,250	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	2,250	4,500	≤50	Level 2 Type D	Level 2 Type B	Level 2 Type D[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	2,250	4,500	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	4,500	6,000	≤50	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	4,500	6,000	60	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	6,000	7,500	≤50	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 1 Type A
4 Hour	3,155	3,950					
8 Hour	6,000	7,500	60	Level 2 Type B	Level 2 Type B		
4 Hour	3,155	3,950					
8 Hour	7,500	17,500	≤50	Level 2 Type B	Level 2 Type B		
4 Hour	3,950	9,215					
8 Hour	7,500	17,500	60	Level 2 Type B			
4 Hour	3,950	9,215					

Type A Type B Type C Type D

Approaches to roundabouts should be considered a separate roadways.

[1]The total number of lanes is representative of crossing distance. The width of these lanes is assumed to be between 3.0 m and 3.75 m according to MTO Geometric Design Standards for Ontario Highways (Chapter D.2). A cross sectional feature (e.g. bike lane or on-street parking) may extend the average crossing distance beyond this range of lane widths.

[2]Use of two sets of side mounted signs for each direction (one on the right side and one on the median)

[3] Use Level 2 Type B PXO up to 3 lanes total, cross section one-way.

The hatched cells in this table show that a PXO is not recommended for sites with these traffic and geometric conditions. Generally a traffic signal is warranted for such conditions.

Figure 2-3 – Pedestrian Crossover Selection Matrix[8]

[8] Ontario Traffic Manual Book 15 – Pedestrian Crossover Selection Matrix, Table 7

2.4 Community Safety Zones

In 1998, Section 214.1(1) of the *Highway Traffic Act* was enacted, which delegated authority to the Council of a municipality to designate, by by-law, a part of a highway under its jurisdiction as a CSZ if, in the Council's opinion, public safety is of special concern on that part of the highway. In addition, CSZ is one of the two location criteria[9] where automated speed enforcement (ASE) is allowed to be implemented.

The City has implemented 11 CSZs in areas with anticipated high volumes of vulnerable pedestrians (school-aged children and/or senior citizens). The City wishes to review and refine the current policy in use. The following tasks will be included in the refinement of the CSZ policy:

- Review the existing criteria for selecting CSZ and City's experience with them and
- Based on good engineering practice and applicable guidelines (Task 2), develop a policy for assessing the need for and implementing further CSZs on local and collector roadways in the City

The following sub-sections outline the existing policy used by the City of Richmond Hill related to CSZ. The policy includes three components:

- Warrant
- Final Approval and Designation of a CSZ and
- Implementation Guidelines

2.4.1 Warrant

The existing policy includes a two-step warrant system to determine if a candidate location is suitable for CSZ implementation:

- Warrant 1 – Designated Area of Special Concern: Warrant 1 outlines the specific locations where CSZ will be considered and
- Warrant 2 – Safety Warrant: when Warrant 1 is satisfied, Warrant 2 reviews the candidate location's historical collision records, traffic volumes, and road characteristics

Details on these warrants are discussed in the subsections below.

Warrant 1 – Designated Area of Special Concerns

Warrant 1 specifies that CSZ can only be implemented on the City's right-of-way at the following locations:

- Schools (elementary or secondary)

[9] The Highway Traffic Act only authorizes the use of ASE in school zones and community safety zones

- Community centres
- Senior's centres and residences and
- High pedestrian traffic locations (i.e., locations with an average of 75 pedestrians/hour or more for any given 8-hour period of the day)

The length of a CSZ can range from 500 metres to 2.5 kilometres.

Warrant 2 – Safety Warrant

Warrant 2 includes a risk scoring matrix, as shown in **Table 2-4**Error! Reference source not found.. The risk matrix considers eight risk factors, and each risk factor is assigned a score ranging from 1 to 3. The total score can range from 8 to 24, and a minimum total score of 15 is required to satisfy this warrant. It is also specified that roadways with a posted speed limit greater than 60 km/h will not be considered for CSZ.

Table 2-4 – Existing Risk Scoring Matrix

Risk Factor	Risk Factor Scoring			Score
	High (Score 3)	Moderate (Score 2)	Low (Score 1)	
Average daily traffic	> 10,000	5,000 to 10,000	<5,000	
Number of lanes	>4	3 to 4	2	
Length of Sidewalk (% of road)	< 25%	25% to 75%	>75%	
Truck volume (% of traffic)	>5%	3% to 5%	<3%	
Pedestrians crossing in any 8-hours	>75	40 to 75	<40	
Intersection and entrances per km	>10	4 to 10	<4	
85th percentile speed (km/h) over speed limit	>20	15 to 20	<15	
Collisions per year for 3 years	>3	2 to 3	<2	
			Total Score	/ 24

2.4.2 Final Approval and Designation of a CSZ

After determining if a candidate location is suitable for CSZ implementation using the two-step warrant system, the designation of a CSZ needs to be supported and endorsed by the York Region Police for enforcement.

2.4.3 Implementation Guidelines for CSZ

The guidelines in the existing policy provide further details on CSZ implementation:

- CSZs should only be implemented near community-based facilities (e.g., schools, day-care centres, community centres, children's parks, retirement facilities) or roadway sections with high collision rates
- CSZs should be in effect 24/7 to assist the police with enforcement
- New implementation of CSZ requires direct input from Council, Police, School Boards, local ratepayers associations or community policing committees, and the City staff experience and reports which are supported by appropriate field studies
- CSZ must be appropriately signed and accompanied by public education, other traffic safety measures and police enforcement
- The designation of CSZ must be endorsed by York Region Police and
- Each CSZ must at least have three types of signs in each travel direction, including a CSZ sign with a "begins" tab at the start of the CSZ, one CSZ sign for every 300 metres, and a CSZ sign with an "ends" tab.

2.5 Automated Speed Enforcement

The City does not currently have an automated speed enforcement program.

2.6 Crossing Guard Procedure and Policy

The following outlines the existing policy used by the City of Richmond Hill relating to crossing guards:

Program Overview

The Crossing Guard Warrant is used to assess potential locations and determine if a crossing guard may be required. This is done based on a conducted:

- Site Inspection Warrant
- Gap Analysis Survey

Site inspections and gap studies must be conducted at all significant locations (including signalized locations) within four weeks of a new school opening. To be considered a suitable location for study, at least five students must use the location as a crossing.

The City currently has 46 locations designated to be supervised by a crossing guard however, currently, not all are supervised due to staffing shortages, particularly after the start of the COVID-19 pandemic.

Requirement Overview

The site inspection warrant is a worksheet filled out during a site inspection, used to determine the hazards at a proposed school crossing. The worksheet notes the

environmental conditions, traffic control, sight obstructions, and proximity to the school. Additional comments and a review of collision history are conducted.

The gap analysis is conducted on-site and records safe gaps per hour, the number of vehicles making turns through the crosswalk, pedestrian volumes, and vehicle/pedestrian conflicts. Safe gaps are defined based on crosswalk width and crossing group size.

A crossing guard is warranted if either of the two following criteria is satisfied:

1. Criterion 1
    a. Less than four safe gaps in traffic in 50% of the five-minute timed intervals on the road with a speed limit of not more than 60 km/hr and
    b. The number of students crossing is greater than or equal to five.
2. Criterion 2
    a. The designated crossing point is close to meeting Criteria 1a and
    b. The number of students crossing is greater than or equal to five and
    c. Student/vehicle conflict is observed, or the potential for conflict is high due to issues with sightlines or a lack of logical crossing point. Additionally, the Site Inspection Authority must consider all other options to mitigate these issues before satisfying this criterion.

Implementation

Upon satisfaction of the crossing guard warrant, a crossing guard will be hired to service the location.

2.7 Traffic Data Collection

To understand and monitor safety and operations throughout the City, there is a need to collect traffic data in a systematic and logical fashion, that is well-spread spatially and is conducted on a regular basis. This will allow the City to monitor trends over time and proactively identify and respond to potential issues. The City collects traffic volume, classification and speed information on local roadways and has selected locations for the current year. While there is evidence of a methodology/process for selecting count locations based on the provided traffic count program rotation provided, there is no recorded methodology on how the rotation year or frequency are selected.

2.8 Road Safety Public Awareness and Education Program

The following subsections outline the City's existing practices and policies relating to public awareness and education programs related to traffic safety. The City implements road safety education and public awareness programs on an ad hoc basis. Outreach is currently focused on safe school routes, safety campaigns (back-to-school safety, safe cycling, and Halloween

safety awareness), and proper ways to use transportation facilities. Campaigns are generally led by York Regional Police and/or York Region District School Board or the York Catholic District School Board, with the City playing a supportive promotional role.

Road Safety Education and Public Awareness Programs on City Website

The City currently has web pages dedicated to the following topics:

- 8 Back to School Road Safety Tips for Richmond Hill Students and Drivers – tips for students and drivers relating to providing a raised level of awareness when walking or driving
- Walking and Cycling – trail etiquette for walking and cycling on the City's trail system
- Traffic Circles – how to drive safely through a traffic circle
- Active School Travel – active school traffic safety tips[10]

Active School Travel

The City receives many complaints about congestion around schools during pick-up and drop-off periods. City staff's ability to address these issues is very limited most situations involve a compromise between motor vehicle movement and the need for parking/stopping to pick-up or drop-off students, which is infeasible due to limited street right of way. City staff have noted that school congestion problems can be most effectively addressed by transportation demand management (TDM) strategies (i.e., encouraging walking/cycling/public transportation and other strategies such as park-and-ride) and/or operational/physical changes to schools' internal drop-off/pick-up areas. Efforts to address these issues are typically led by the school boards, with City staff contributing to the identification of issues and potential mitigating measures. The City sees potential for Smart Commute Markham, Richmond Hill, a workplace travel program in York Region, to be more involved in active school travel programming.

SLOW DOWN lawn signs

The City's Sign By-law 52-09 does not permit "SLOW DOWN" lawn signs on boulevards and private properties. A motion was submitted in advance of the May 2022 City Council meeting (and later withdrawn) to permit these types of signs.

Road Watch Program and Committee

The City wishes to involve members of the Road Watch Committee to deliver and support in part road safety and public awareness education programs. The City's Road Watch committee's purpose is *'to work as a community based volunteer program to make the City of*

[10] This webpage is currently in draft but will be on the site shortly.

Richmond Hill (the City) a safer place to live and work, in respect of public highways and other similar roadways'. According to the mandate of the Road Watch Committee's mandate, it is to undertake various information initiatives to promote road safety.

2.9 Road Safety Programs

The City currently implements road safety programs on an ad hoc basis, such as conducting in-service road safety reviews. The City currently does not have a network screening or systemic road safety program in place, nor does it conduct conflict analysis.

3 ENVIRONMENTAL SCAN AND INDUSTRY REVIEW

A survey was sent to jurisdictions in Ontario to understand their current level of application of various safety policies that CIMA+ developed as part of this project. Policy application was sorted into three overall categories, with sub-categories to assess the formality of the usage:

- Jurisdiction Specific Policy – The jurisdiction has developed their own unique guidelines that covers the listed policy.
    - Developed as Working Draft – Policy developed as working draft internal staff use only.
    - Developed, not Endorsed by Council – Established policy that is not yet endorsed by Council.
    - Developed and Endorsed by Council – Established policy that is endorsed by Council.
- Usage of Industry Standard – The jurisdiction uses an existing industry standard.
    - Conducted Ad-Hoc – No written policy staff use other guidelines.
    - Not Endorsed by Council – Usage not yet endorsed by council.
    - Endorsed by Council – Usage endorsed by council.
- Not Practiced / Not Applicable – Not currently practiced within the jurisdiction.

Additionally, if a jurisdiction had developed unique safety policies not included in the survey list, they were invited to provide the policy as part of their response.

The summary of survey responses includes any relevant notes regarding the usage of policies, as well as a short description of policies unique to the jurisdiction if required. A matrix that combines all received responses is provided in **Appendix A**. As a comparator, the City of Richmond Hill's current practice is also shown (with a red R). The following municipalities provided responses to the survey:

- City of Vaughan
- City of Markham
- Town of Newmarket
- Town of Oakville
- City of Burlington
- City of Ottawa
- Town of Milton
- York Region
- City of Cambridge
- Region of Waterloo
- City of Mississauga
- City of London

Some of the municipalities provided copies of their policies and procedures. In addition, as part of the jurisdictional scan, CIMA+ obtained additional content from other municipalities in Ontario. Finally, CIMA+ identified reports, manuals and guidelines available through MTO, TAC, AASHTO and FHWA that provided additional guidance.

The following section outlines the key findings of the environmental scan and industry review grouped by focus area.

3.1 Inquiry Review Process

Through the jurisdictional scan, among the 14 municipalities that were contacted, it was identified that:

- The Town of Newmarket, the Town of Oakville, and the City of London have developed SOPs which are endorsed by their Councils
- The City of Mississauga, and the City of Ottawa have developed their SOPs which have not yet been endorsed by their Councils
- The Region of Waterloo has a SOP working draft
- The City of Vaughan has adopted an industry standard (mainly focuses on responding timeline), which is endorsed by Council and
- The City of Markham has adopted an industry standard (detail information not available), but it has not yet been endorsed by Council.

3.1.1 “Cityworks” Software Program

In comparison to the City’s current of inquiry processing system where inquiry tracking, workload management, and record keeping take place on different software platforms (i.e., Excel, Teams, and Word), it was noted that the Region of York is currently using an ArcGIS based software that integrates inquiry tracking, workload management, and record keeping in one software program.

In addition, the software program also has the following key features that can help with data-driven decision making, and improve efficiency:

- The software can integrate the City’s existing datasets (i.e., current inquiry tracking sheet, collision database, traffic volume databases, etc.) and extract data from them to form customizable dashboards. These dashboards can provide data summaries such as inquiry status, currently workload, ongoing workorder, etc.
- Interactive maps can show real-time inquiry locations along with detail information of the inquiries
- The software platform can be accessed not only on computers, but also on portable devices such as smartphones and tablets, so that field staff can have access to the database in the field, and can also update the inquire status as tasks being completed.

Figure 3-1 shows examples of the Cityworks user interface on a computer, a tablet, and a smartphone.

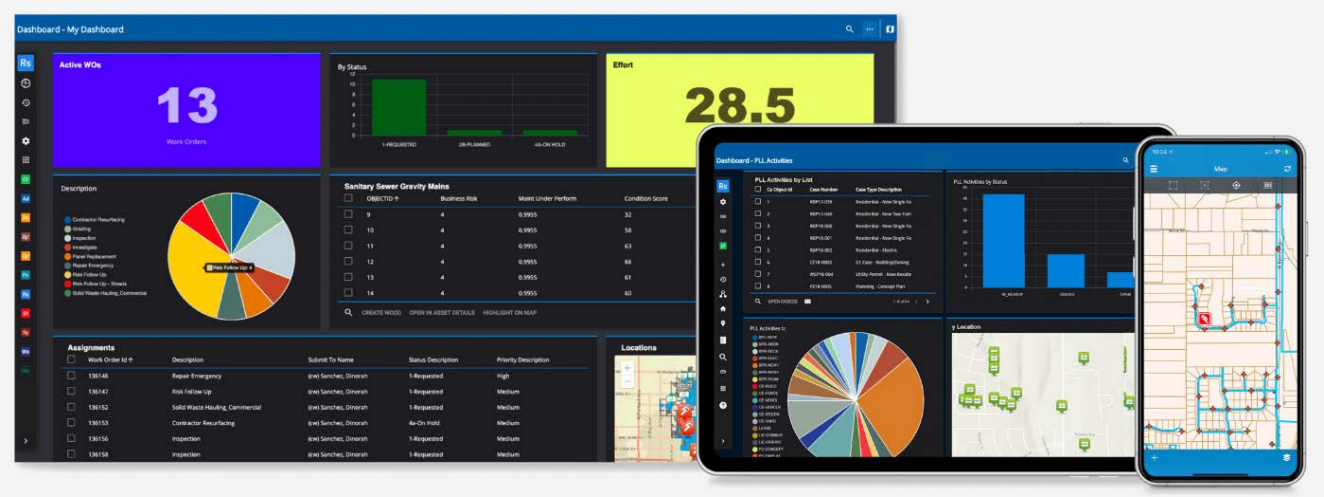


Figure 3-1 – Cityworks User Interface Samples

3.2 Speed Management, Speed Limit Policy, Traffic Calming Policy and Pilot Projects

On the basis of the jurisdictional scan conducted for Task 2, which included a survey of municipalities in southern Ontario, specifically those with a similar population size to that of the City, CIMA+ identified current practices relating to speed management, speed limits, traffic calming and pilot studies. The following section outlines key findings of this survey.

Relating to this policy, the following jurisdictions provided a response to the survey issued during the jurisdictional scan conducted in Task 2:

- City of Vaughan
- City of Markham
- Town of Newmarket
- Town of Oakville
- City of Burlington
- Town of Milton
- City of Mississauga
- City of Ottawa
- York Region
- City of Cambridge
- Region of Waterloo
- City of London

Many of the jurisdictions reviewed have fully developed policies on speed management, speed limits, traffic calming and pilot studies with a number of those being fully endorsed by their Council with a small subgroup that have adopted an industry standard (Transportation Association of Canada's 2009 Canadian Guidelines for Establishing Posted Speed Limits and the 2018 Canadian Guide to Traffic Calming). With regard to neighbouring jurisdictions:

- The Town of Newmarket has an overall speed management policy that has been developed and endorsed by Council while the City of Markham has an overall speed management policy that has been developed but not endorsed by Council
- The City of Vaughan has a speed limit policy that has been developed and endorsed by Council
- The Town of Newmarket has a traffic calming policy that has been developed and endorsed by Council and
- The City of Vaughan has a traffic calming policy that follows outdated Ontario Traffic Manual Guidance and, like Richmond Hill are in the process of updating their policies, processes and procedures.

3.2.1 Basic Principles of Speed

The following presents definitions of key concepts that reflect current understanding as it relates to speed.[11]

- **Design Speed** – the speed used to determine the various geometric design features of the roadway. From a safety perspective, key elements are stopping sight distance, intersection sight distance and visibility to traffic control devices (mainly stop signs and traffic signals). The design speed is typically set higher than the speed limit to account for variability in operating speeds
- **Operating Speed** - the speeds at which vehicles are observed (measured) operating during free flow conditions. Free flow conditions mean that vehicles are unimpeded by other vehicles or by traffic control devices such as traffic signals
- **85th Percentile Speed** - the speed at or below which 85 percent of vehicles travel
- **Posted Speed Limit** - the maximum lawful speed for a particular location as displayed on a regulatory sign
- **Speed Limit** - the maximum lawful vehicle speed for a specific location
- **Statutory Speed Limit** - the numerical speed limits established by the province that apply to various classes or categories of roads in the absence of posted speed limits. Within a local municipality (such as Richmond Hill), the statutory speed limit is 50 km/h. May also be referred to as Default Speed Limit.

[11] Adapted from https://www.ite.org/technical-resources/topics/speed-management-for-safety/setting-speed-limits/

- **Speed Zone** - A speed zone is a section of roadway with a single speed limit throughout its length, which should be applied to a homogeneous roadway section
- **Advisory Speed** - a recommended speed where the need to reduce speed below the speed limit is advised due to a specific road condition (e.g., curves, traffic calming measures, etc.).

The relationship between operating speed, speed limit and safety is complex. The following should be considered when setting speed limits.[12]

- As travel speeds increase, the pressure on the environment from higher noise levels and greater exhaust emissions also rises
- Collision severity increases with higher travel speeds
- Mobility increases with higher travel speeds and most drivers tend to operate at the highest speed that they are comfortable with under the prevailing roadway and environmental conditions
- The potential for collisions is lowest when speed differentials between vehicles in the traffic stream are smallest (i.e., more uniform travel speeds reduces the risk of collisions)
- Setting the posted speed limit at the 85th percentile speed will generally result in a low dispersion in travel speeds in the traffic stream however this needs to be considered in the context of the presence of pedestrians and cyclists
- The strongest influence on a driver's selection of travel speed is the physical appearance of the road which is directly influenced by the design speed selected for that particular road section
- Speed control aimed at encouraging drivers to travel at an appropriate speed for prevailing conditions encompasses enforcement, education, and engineering techniques
- While police enforcement has been the traditional approach to controlling speeds, significant increases in enforcement levels are required to influence driver behavior (i.e., Police impact on speeds is relative to the degree of enforcement)
- Based on extensive research, it has been concluded that simply raising or lowering the posted speed limit, without physical interventions to change drivers' perception of the road, has little overall effect on the operating speed of a road, and does not lead to any statistically significant changes in total or severe collisions
- A posted speed limit that is set too low will make a significant number of "reasonable" drivers operate illegally, place unnecessary burdens on law

[12] Adapted from Town of Milton, *Speed Limit Policy*

enforcement personnel, lead to a lack of credibility and compliance in the posted speed limit, and result in increased tolerance by enforcement agencies and
- Given the functional hierarchy of a road network (arterial, collector and local roads), speed limits should be set in accordance with the function of each road which it is designed to serve.

3.2.2 Speed Related Public Requests/Complaints

Many road authorities in Ontario have established a formalized process relating to their response to complaints about operating speed and/or speed limits. The following outlines the general approach taken:

Individual Requests

- Requests by individuals for changes to the speed limit are dealt with on a yearly basis in a formalized annual review
- The results and recommendations of the annual review are communicated to the requestor prior to being presented to Council

Signed Petitions

- Council may direct staff to conduct a review of an individual road section as a result of a signed petition by residents (owners) exceeding a certain threshold of the households
- Staff will meet with the resident group to receive input and share findings for the subject road section
- Staff will share their recommendation to Council along with resident group comments

3.2.3 Identifying and Setting Appropriate Speed Limits

Many jurisdictions in Ontario have a general policy of setting base speed limits for their entire road network and then reviewing specific roads as the need arises as discussed in Section 3.2. Base speed limits are set based on road classification (local, collector and arterial) and land use (urban versus rural). The City of Richmond Hill essentially has only local and collector roads with almost all arterial roads being under York Region's jurisdiction.

The following paragraphs provide general guidance, typically used in Ontario municipalities, to identify appropriate speed limits, outlining how base posted speeds are identified, as well as when to modify posted speed limits.

Base Posted Speeds

- Under the Ontario Highway Traffic Act (HTA):

- The posted speed is 50 km/h on a highway (road) within a local municipality or within a built-up area (referred to as the statutory speed limit)
- The posted speed is 80 km/h on a highway (road) not within a built-up area or within a local municipality that has the status of a township (referred to as the statutory speed limit)
- The general interpretation of the above is all municipalities considered to be towns or cities in the Province or townships with a built-up area have a statutory speed limit of 50 km/h
- The implication of the above is that, in the City of Richmond Hill, all roads should be considered to have a speed limit of 50 km/h unless otherwise signed
- Relating to the above, some towns and cities have posted signs on all entry roads into their jurisdiction stating that the speed is 50 km/h on all roads unless otherwise posted and
- Posted speed limits may be set between 30 km/h and 100 km/h in increments of 10 km/h.

When to Modify a Base Speed Limit:

In some circumstances, the base speed limit has to be modified. The speed limit should ideally be set at a value that is consistent with the physical characteristics of the road, and therefore is more likely to result in the 85th percentile speed being equal to the speed limit (i.e., the speed limit is credible to drivers). Most municipalities in Ontario use the 2009 Transportation Association of Canada's *Guidelines for Establishing Posted Speed Limits* as a basis for evaluating individual speed limits. In some circumstances, the base speed limit may be lowered due to:

- Physical characteristics of the road
- Constraints by adjacent land uses and associated activities
- Requirements for heightened driver awareness in sensitive areas such as school zones or a demonstrated conflict between vulnerable road users (bicyclists and/or pedestrians) and motorists
- The posted speed is higher than the inferred design speed.

In highly unusual circumstances, the posted speed limit may be set above the recommended level if justified through a review of the 85th percentile speed, the collision record, and the inferred design speed and no presence of vulnerable road users. The difference in posted speed limits between adjacent road sections should not exceed 20 km/h, unless there is a drastic change in the physical characteristics of the road such as a sharp curve. The latter should be accompanied by appropriate warning signs (i.e. advisory speed signs with tabs).

Annual Review of Posted Speed Limits

The City of Richmond Hill currently maintains a spreadsheet with collected speed data from different locations. The spreadsheet shows the mean speed, 85th percentile speed and excess speeds (i.e., the difference between the 85th percentile speed and the speed limit) for each corresponding location. Similarly, other jurisdictions collect speed data on an annual basis and indicate road segments with excess speeds. **Figure 3-2** below shows annual comparisons of speed data collected by the City of Richmond Hill for the 85th percentile speed as compared to the posted speed of the road.

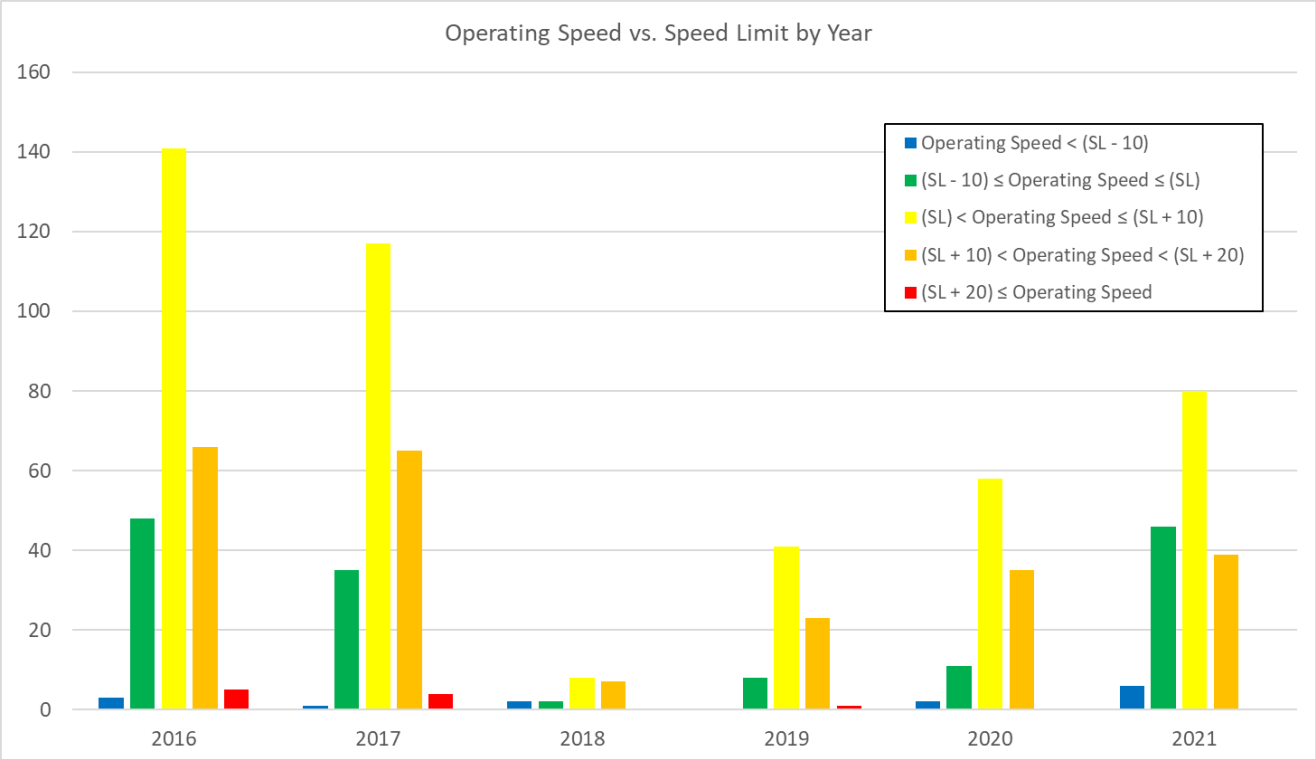


Figure 3-2 – Comparison of 85th Percentile Speeds to Posted Speeds (2016 – 2021)

3.2.4 Principles of Traffic Calming

Traffic calming and/or automated speed enforcement can help reduce vehicle speeds and increase road safety for all road users, including pedestrians and cyclists. The following principles are commonly applied by jurisdictions in Ontario when selecting and implementing traffic calming measures. Application of these general principles ensure that appropriate traffic calming measures are selected, that they are compatible with the community's needs, and that any potential negative impacts are minimized. While each situation is unique, the principles of traffic calming are relevant to each situation.

Application of these principles will maximize effectiveness of the traffic calming plans and help build community acceptance and support of final traffic calming plans.[13]

- **Establish whether the problem is real or only perceived -** It is very important to identify the real problem, so the appropriate traffic calming measures are selected. Traffic issues or road safety issues are always emotional subjects for many people it is important to keep the problems in perspective to maximize the effectiveness of the limited available resources by allocating them towards solving demonstrated problems and not perceived-only problems (i.e., adopting a data-driven approach).
- **Quantify the Problem -** To select the appropriate measures, it is important to quantify the extent of the problem. This normally requires gathering data, including traffic counts, speeds, collision data and pedestrian usage while also taking into consideration the adjacent land uses of the subject road, including the presence of schools, parks and other pedestrian generators.
- **Maintain and Minimize Impacts on Delivery of Fire and Emergency Services, Police and Transit -** Consideration of these services when identifying appropriate traffic calming measures for implementation will minimize delays/impacts to these services. This will also aid in building support for traffic calming in general. When selecting traffic calming measures, staff should strive to balance the needs of these services with slowing traffic on residential streets, while ensuring that traffic calming objectives are still adhered as much as possible. Additionally, the road authorities should work with Fire and Emergency Services, Police and Transit to ensure that the negative impacts resulting from the implementation of traffic calming measures are minimized, again, ensuring that traffic calming objectives are still adhered as much as possible.
- **Maintain and Minimize Impacts on Delivery of Public Services -** Consideration of snow plowing, street sweeping, drainage, waste collection and school bus services when identifying appropriate traffic calming measures for implementation will minimize delays/impacts to these services.
- **Use Cost Effective Measures -** The cost of traffic calming measures can vary greatly depending on the materials used, labour involved and the cost of the process to implement certain alternatives. For cost control reasons, only appropriate traffic calming measures will be implemented, and a phased approach should be implemented when determined to be appropriate. Traffic calming measures can, generally, be upgraded after initial installation therefore, over design of the initial implementation must be avoided to allow distribution of funds throughout the municipality rather than concentrating limited funds on one or two neighbourhoods only.

[13] Adapted from Town of Ajax, *Traffic Calming Policy Update*, 2020

- **Minimize Impacts on Adjacent Residential Streets -** Prior to considering traffic calming, any potential negative impacts on adjacent streets should be considered. Impacts may include traffic diverted to another street, or changes in turning movements with increase delays with other intersections. These effects will be considered in advance of approval, so traffic calming solutions do not create or exacerbate existing problems.
- **Target Automobiles While Accommodating Not Non-Motorized Modes -** The purpose of traffic calming is to reduce the negative effects of motor vehicles while improving conditions for other road users. Traffic calming measures should be designed to permit cyclists and pedestrians to travel unaffected (and/or to have an improved travel experience), while slowing down motor vehicles.

3.2.5 Initial Screening

In context of the above, the general approach taken by municipalities in Ontario is to evaluate the need for traffic calming through a two-tiered system. The first 'tier' involves an initial screening of the location to determine if it would be suitable for traffic calming. The second 'tier' involves evaluating the short-listed requests based on a point-based system that is then used to establish a minimum threshold and a means of ranking different candidate locations (**Section 3.6**).

The initial process is usually initiated by a request for traffic calming via phone, email, and/or mail by the public, councillor, or city staff. The request for traffic calming entails the specific concerned location, and a description of the traffic concern.

The following is a list of preliminary screening criteria used by different municipalities to justify if traffic calming is suitable, based on a the jurisdictional scan. Out of 12 traffic calming policies reviewed:

- 12 (100%) use road classification as a screening criterion
- 11 (92%) use block length
- 10 (83%) use daily traffic volume
- 9 (75%) use speed limit
- 8 (67%) use grade
- 6 (50%) use previous evaluation
- 4 (33%) use collision history and
- 3 (25%) use previous implementation.

Based on the jurisdictional scan, the following represents general guidance noted in the initial screening:

- **Road Classification** – The road must be local or collector road to be considered for traffic calming
- **Block Length** – The distance between traffic control devices (i.e., stop signs or traffic signals) must exceed a threshold to be eligible for traffic calming (i.e.110 metres)
- **Daily Traffic Volume** – The road must carry more traffic than a given threshold. For example, for a local road, the road must carry more than 750 vehicles per day and at least 1,500 for a collector road
- **Speed Limit** – Speed limits generally must not be greater than 50 km/h
- **Grade** – The grade of the road must be less than 8% for traffic calming to be permitted
- **Previous Evaluation** – No evaluations in the last 24 months
- **Collision History** – The number of collisions on the roadway must be less than a specified threshold, otherwise a full safety review is advised
- **Previous Implementation** – No traffic calming has been installed on the street in the last 5 years. Also, the location has not been ineligible for traffic calming within the last 5 years without considerable changes in conditions.

If any of the criteria is not met during the preliminary screening process, the location is not considered suitable for traffic calming.

3.2.6 Evaluation of Short-Listed Requests (Points and Ranking)

Following the initial screening process is the evaluation of the application which includes traffic calming warrant criteria and a scoring system. The determination of whether traffic calming will be required is based on the total number of points (score). The concerned road/location will not qualify for traffic calming if it scores below the minimum point threshold. The following list outlines criteria typically included in scoring locations on the need for traffic calming, and an example points system (note the scoring varies for location to location):

- **Traffic Speeds** – 1 point for every 1 km/h the 85th percentile speed is above the speed limit
- **Traffic Volumes** – For local roads: 1 point for each 50 vehicles above the specified threshold, and for collector roads: 1 point for each 100 vehicles above the specified threshold
- **Collision History** – 5 points at any location with collisions in the last 3 years or specified period, regardless of the contributing factors
- **Pedestrian Generators or Facilities** – 5 points per designated pedestrian crossing, park, or school in the area of interest

- **Sidewalks** – 10 points if there are no sidewalks, 5 points if there is a sidewalk on only 1 side of the street in the concerning area, and 0 points for sidewalk on both sides
- **Bicycle Facilities or Routes** – 10 points where in the study area there is a presence of bicycle lanes, designated routes or trails, or multi-use trails

An example of Ajax's point-based system is provided in **Figure** 3-3**.** Ajax's policy specifies that, for the road segment to qualify for traffic calming, it must score a minimum of points according to the corresponding road classification:

- 35 points for a Local Road
- 40 points for a Collector Road
- 45 points for a Type 'C' Arterial Road

Criteria	Minimum Threshold	Points	Maximum Points
Operating Speed	85th percentile speed is higher than 10km/h above the posted speed limit	1 point for each km/h above posted speed PLUS 1 point for each 1% of vehicles over 15 km/h above posted speed	25
Traffic Volume	900 vehicles/day for Local roads 2,000 vehicles/day for Collector roads 5,000 vehicles/day for Type 'C' Arterial roads	1 point for each 50 vehicles above local threshold 1 point for each 100 vehicles above collector threshold 1 point for each 200 vehicles above arterial threshold	20
Collision History	Less than 6 (local) or 12 (collector / arterial) within the last 3 years	5 points for each qualifying collisions in excess of 3 *Qualifying collisions include collisions with vulnerable road users (pedestrians, cyclists) and collisions for which 'exceeding speed limit' or 'speed too fast for condition' is reported in the MVAR.	20
Pedestrian Generator		5 points for each school or park within the study area *Other Pedestrian Generators may be defined by Ajax and the study area includes the frontage of the road segment or within 300m	15
Pedestrian Facilities		10 points if there are no sidewalks in the study area 5 points if only on one side	10
Bicycle Facilities or Routes		5 points if bicycle lanes, sharrows, or routes are present on the road segment	5

Figure 3-3 – Points System – Town of Ajax Traffic Calming

3.2.7 Public Input on Traffic Calming Programs

Aside from the initial public inquiry, municipalities involve the public to varying degrees in the process of determining the need for traffic calming and the selection and placement of traffic calming measures. In general, municipalities require buy-in from the public on whether to proceed with traffic calming by means of a petition or a public consultation process (with the number of respondents exceeding a set threshold). Typically, the municipality will select traffic calming measures for implementation based on an internal evaluation and then provide an opportunity for members of the public to comment.

3.2.8 Pilot Projects

It is important to report to Council and the community on the success of implemented traffic calming measures. It also provides an opportunity for the community to provide feedback, identify any concerns which do not produce the desired results or receives adverse community reaction. Comparable traffic volumes, speed and collision data should be collected before and after implementation.

Pilot projects can be used to perform before and after studies to test different traffic calming treatments. An example of a pilot project used to test flexible bollards, a traffic calming treatment, is the Ravenscroft Road Pilot Study in the Town of Ajax. The purpose of the plot study was to test the flexible bollards which were placed along the centerline of the road and close to the side curbs to create a narrowing effect, illustrated in **Figure 3-4**. The traffic calming solution was seen as a quick, flexible, and low-cost solution when compared to its alternatives and therefore could be used in multiple locations.

Figure 3-4 – Ravenscroft Pilot Project Implementation

The bollards were installed in September 2019 initially, and then in the summer of 2020 with changes/updates to the design and new locations as well following feedback from the 2019 test. After both traffic calming installations in 2019 and 2020, before and after traffic data was collected to evaluate the treatments and their effectiveness. Additionally, positive and negative feedback was received from the public and councillors, with the overall conclusion that traffic bollards were a suitable option to be considered for traffic calming in the area. Refinements were identified from the pilot study relating to the bollard spacing, loss of on-street parking and impacts to driveways and proximity to fire hydrants.

3.2.9 Toolbox for Traffic Calming Treatments

A formal jurisdictional review of municipal use of approved traffic calming treatments was not undertaken. Many municipalities use the 2018 Transportation Association of Canada publication, *Canadian Guide to Traffic Calming* which includes a wide variety of traffic calming treatments.

3.3 Pedestrian Crossovers

On the basis of the jurisdictional scan conducted for Task 2 which included a survey of municipalities in Southern Ontario, specifically those with similar populations to the City, CIMA+ identified current practice as it relates to the use of Pedestrian Crossover Policies (PXOs). Relating to this policy, the following jurisdictions provided a response to the survey issued during the jurisdictional scan conducted in Task 2:

- City of Vaughan
- City of Markham
- Town of Newmarket
- Town of Oakville
- City of Burlington
- Town of Milton
- City of Mississauga
- City of Ottawa
- York Region
- City of Cambridge
- Region of Waterloo
- City of London

The following section outlines key findings. Several jurisdictions have developed policies endorsed by their council relating to PXOs, with the vast majority of jurisdictions having adopted an industry standard for their PXO policies.

3.3.1 Guiding Principles

OTM Book 15 references the TAC Pedestrian Crossing Control Guide (Transportation Association of Canada, 2012) which states the following guiding principles to guide the provision of crossing treatments[14]:

- **Safety:** This is the key objective in providing pedestrian crossing control and other supporting facilities and devices. It is fundamental that the road system protect pedestrians and other vulnerable road users by achieving a high level of compliance from drivers, bicyclists, and pedestrians and by minimizing pedestrian exposure to traffic.
- **Delay:** Delay experienced by pedestrians attempting to cross the road should be carefully managed. As pedestrian delay increases, the likelihood of pedestrians making risky or non-compliant crossings also increases. This reduces the efficiency and safety of the crossing for both pedestrians and motorists.
- **Equity:** The demographics of the pedestrian population as well as the mix of road users at different time periods should be considered and crossing treatment systems should be designed accordingly. As the population changes, a “design pedestrian” should be considered to ensure the accessibility of all road users and not only those with good visual, mental, and physical capabilities.
- **Expectancy:** The presence of a pedestrian crossing system should not violate driver expectancy, thereby increasing the likelihood of drivers responding to situations correctly and quickly. The crossing location and any waiting or crossing pedestrian should be clearly visible. If driver expectancy is not met, driver workload and visual limitations may result in drivers not noticing a pedestrian until it is too late.
- **Connectivity:** Effective crossing opportunities should be provided to ensure system connectivity for pedestrians, while considering driver workload and expectation, proximity to other crossings, and the safety of pedestrians. Facilitating connectivity between crosswalks and sidewalks, and/or trail networks involves understanding and monitoring pedestrian desire lines, which evolve as a function of land use, the location of pedestrian generators and attractors, and proximity to existing crossing facilities. When alternatives to pedestrian desire lines are required due to other factors, these facilities should be simple, convenient, and clearly marked, and should effectively channel pedestrians so that they modify their natural choice with the shortest possible deviation.
- **Pragmatism:** The professional should consider the practical issues or consequences associated with the provision of pedestrian crossing control. The pragmatic selection of pedestrian crossing control devices involves consideration of costs, effectiveness of the device in local conditions, ease of installation and maintenance of the device (particularly in winter, when maintenance due to snow and ice can be challenging). The professional must realize that when a device is

[14] Content taken from Ontario Traffic Manual Book 15, Pedestrian Crossing Treatments, Section 4.3

provided it should be functional year-round, unless it is intended to be used only temporarily.

3.3.2 Preliminary Pedestrian Crossing Treatment Assessment

Many jurisdictions, including the City of Richmond Hill, follow the same preliminary PXO treatment assessment as per OTM Book 15, using the decision support tool for preliminary assessment noted in Section 2.1 as well as the PXO selection matrix as per OTM Book 15.

3.3.3 Pedestrian Crossover Treatments

OTM Book 15 includes four different types of PXOs (Level 1 Type A PXO, Level 2 Type B PXO, Level 2 Type C PXO, and Level 2 Type D PXO). The general components and physical characteristics of each PXO are illustrated in **Figure 3-5**, and **Figure 3-6** shows examples of actual PXO installations in Ontario.

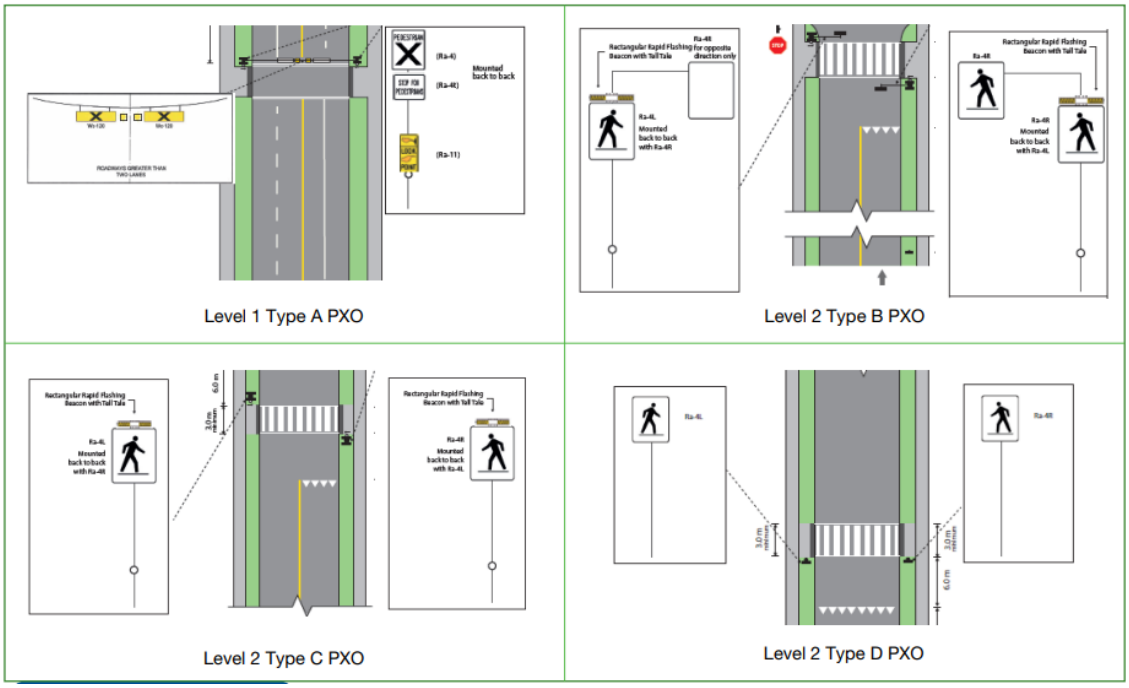


Figure 3-5 – Pedestrian Crossover Treatments

Figure 3-6 – Example PXO Crossings in Town of Oakville

OTM Book 15 includes required and desirable elements for the implementation of each type of PXO. Some of these elements include regulatory signage and pavement markings, as well as parking & stopping restrictions upstream and downstream of the PXO.

The following are some components that must be included at a minimum in the design of PXOs, as stated in OTM Book 15 and outlined by many other jurisdictions:

- **Pavement Markings** – This may include standard crosswalk markings, stop line, advanced stop bar, and yield to pedestrian line. Crosswalks must be marked for all types of controlled pedestrian crossing treatments.
- **Curb Ramps** – Curb ramps provide access for people using wheelchairs or scooters at crossings where there is an elevation change between the sidewalk and the street level crossing.
- **Signage** – Mandatory warning and regulatory signage for PXOs is specified by Ontario Regulation 402/15.

- **Illumination** – Adequate lighting must be provided to enhance the safety of pedestrians.
- **Sight Distance** – Adequate sight distance for both motorists and pedestrians must be provided.

3.3.4 Prioritization Methods

OTM Book 15 presents warranting criteria for determining the need for a PXO at a given location but does not present any methodology for prioritizing PXO installations amongst a group of candidate sites. The Town of Oakville's Pedestrian Safety program presents a process for prioritizing candidate locations.[15] According to their Pedestrian Safety program, Town staff use a set of criteria to prioritize where PXOs should be installed. This process is done prior to reviewing the OTM warrant and is used to help select initial locations. The Town's prioritization method starts by identifying candidate crossing locations based on past collisions involving pedestrians, existing school crossing locations, and resident requests at specific locations.[16]

Following the identification process, the Town of Oakville's Pedestrian Safety Program report outlines their prioritization criteria. The following three key categories were identified as critical to the prioritization evaluation:

- **Connectivity:** Effective crossing opportunities should be provided to ensure system connectivity for pedestrians. Facilitating connectivity between crosswalks and sidewalks, and/or trail networks involves understanding pedestrian desire lines, which evolve as a function of land use, the location of pedestrian generators and attractors, and proximity to existing crossing facilities.
- **Demand:** Pedestrian volumes are included in the preliminary assessment for the need to provide pedestrian crossing control. The minimum volumes trigger the need to provide crossing control, however higher pedestrian volumes and expected use of a crossing can increase the priority of the crossing location.
- **Safety:** It is fundamental that the road system protect pedestrians and other vulnerable road users by achieving a high level of compliance from drivers, bicyclists, and pedestrians and by minimizing pedestrian exposure to traffic.

The criteria outlined above is then quantified as shown in **Figure 3-7** with corresponding weighting factors.

[15] Town of Oakville, Pedestrian Safety Program – Final Report (September 2017). The City of Vaughan and the City of Markham do not have a similar methodology for ranking candidate PXO locations.
[16] Following this, several locations were removed that were duplicates or already had controlled intersections or were on Regional roadways within 100m of an existing controlled crossing location. However, locations that were within 100 m to 200 m were kept for the initial analysis process.

Criterion	Maximum Score
Connectivity	
Proximity to senior facilities and medical centres	15
Proximity to elementary and middle school	10
Proximity to high school or post secondary institution	5
Transit route or proximity to a transit stop	5
Proximity to major pedestrian facility	5
Multi-use trail or major trail facility crossing	5
Proximity to nearest controlled crossing location (all-way stop, traffic signal, or other PXO)	5
Total Crossing Control Connectivity	**50**
Demand	
Community request	5
Land use	5
Total Crossing Control Demand	**10**
Safety	
Pedestrian Collision History	5
Road class	5
Posted speed limit	5
Total Crossing Control Safety	**15**
Total Connectivity, Demand, and Safety	**75**

Figure 3-7 – Prioritization Criteria Used in the Town of Oakville

Similar to the Town of Oakville, the City of London has also created a set of criteria and strategy for PXOs selection in their Pedestrian Crossover Program.[17]

The selection criteria and strategy consists of the following:

- Implement PXOs at low-risk locations to allow road users to become familiar with the treatments
- Select majority of initial PXO Type D locations from the current list of school crossing guard locations with no existing traffic control
- Focus, initially, on Type D installations and a few Type C installations
- Conduct a communication strategy to raise awareness and educate Londoners and
- Follow Book 15 process consisting of:
    - Screen potential crossing locations based on pedestrian volumes, desire lines and connectivity, traffic volumes, road context and risk assessment
    - Select PXO type based on vehicular volumes, posted speed limit and number of lanes and
    - Determine the required conditions for the installation of the PXO.

[17] Adapted from: https://pub-london.escribemeetings.com/filestream.ashx?DocumentId=24288

The City also conducted a communication strategy to raise awareness and educate local residents.

3.4 Community Safety Zones

A jurisdictional scan was conducted focusing on municipalities within Ontario that have experience with CSZ, which includes:

- City of Ottawa
- City of Burlington
- City of London
- City of Toronto
- Region of Durham
- Region of Waterloo
- Region of Niagara
- City of Brampton
- City of Vaughan

Based on the jurisdictional scan, CIMA+ identified current practices relating to CSZ implementation. Summary of key findings from the jurisdictional scan are listed below:

- Locations are primarily selected based on land use specifically, land uses that would indicate the presence of vulnerable road users (pedestrians and cyclists) such as schools, parks, and community centres
- CSZs are primarily selected by the road authority with police playing a secondary role (independently conducting their own speed enforcement)
- CSZs without ASE tend to be ineffective and do not result in a marked change in driver behaviour as their effectiveness relies on police actively enforcing speeds. It should be noted that a road segment needs to be designated as CSZ before ASE implementation (i.e., The Highway Traffic Act only authorizes the use of ASE in CSZs and school zones) and
- CSZs tend to be much more effective with presence of ASE.

It is worth noting that some municipalities are starting to conduct CSZ network screening to proactively identify the locations that are suitable candidates for CSZ implementation and prioritize based on the CSZ ranking. CIMA recently developed a methodology for identifying candidate locations for CSZ. First, locations in the Region of Halton were shortlisted based on land use. Second, network screening of the shortlisted locations was conducted where the following roadway characteristics were identified as risk factors for priority ranking:

- AADT equal to or greater than 20,000

- Number of lanes equal to or greater than 5
- Presence of bus stops
- Daily volume of heavy trucks equal to or greater than 250 and
- 85th percentile speed compliance equal to or greater than 5 km/h.

Detailed information on the CSZ network screening is provided in **Section 4.4.4**.

3.5 Automated Speed Enforcement

As illustrated in the flow chart in **Figure 3-8**, there are four main components to the ASE system, specifically:

- **ASE units** (fixed or mobile) that capture images of speeding vehicles including their license information
- **Ministry of Transportation Ontario (MTO)** that provides lookup vehicle ownership information to identify the owner of the vehicle to submit the ticket
- **Joint Processing Centre (JPC)**, where provincial offences officers review the images to identify the vehicle license plate numbers and confirm a speeding infraction has occurred
- **Administrative Monetary Penalty (AMP) System**, in which a municipal designated employee can adjudicate the offence rather than a Justice of the Peace (using the court system), with an AMP being issued by the individual municipality, rather than a ticket using the Provincial Offence Act (POA) authority

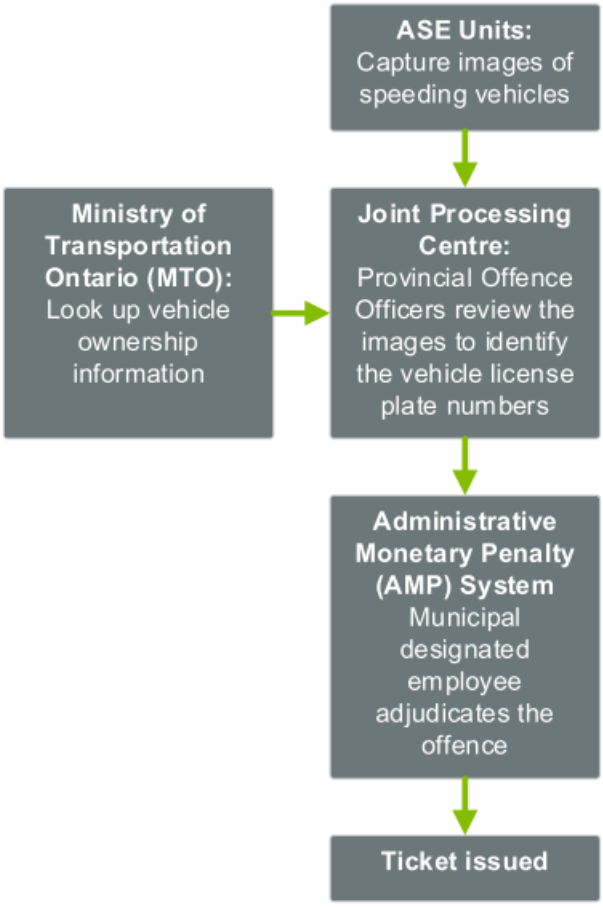


Figure 3-8 – ASE Operations

3.5.1 ASE Deployment

The subsections below discuss the technical details of ASE deployment. The information summarized in this section are based on ASE deployment experience from the following 9 municipalities:

- City of Ottawa
- City of Burlington
- City of London
- City of Toronto
- Region of Durham
- Region of Waterloo
- Region of Niagara
- City of Brampton (Region of Peel)
- City of Vaughan (Region of York)

3.5.2 Site Location Selection

ASE locations may only be implemented within road segments that are designated Community Safety Zones or School Zones. In summary, the site location selection is primarily driven by:

- Historical collision data and speed data
- Public complaints and Council requests
- Review of roadway characteristics (e.g., absence of speed transitioning locations)
- Anticipated volumes of vulnerable road users (e.g., pedestrians, especially students and/or senior residents, and cyclists) and
- Anticipated number of charges (due to the limited capacity at the JPC and court).

In addition to the criteria listed above, some municipalities have additional considerations when selecting an ASE site location, such as the number of anticipated charges and ensuring an even distribution of the ASE sites within different Council wards.

3.5.3 Camera Unit Location Selection

Adequate boulevard space is required to house the equipment. Clear sightlines are required to allow the camera to record vehicle license plates – permanent ASE units would not be recommended on boulevards with a significant amount of tree canopies as they are mounted higher up on a utility pole, and the camera sightline can be obstructed by tree canopies temporary ASE units would not be recommended on boulevards with on-street parking as the camera is housed in a cabinet at a lower height, and the camera sightline can be obstructed by parked vehicles. Roadway alignment (grades and curvature) will impact camera sightlines and typically will have lower operating speeds to begin with. Finally, locations should have no planned construction for the foreseeable future as this will impact operating speeds and may also result in damage to camera equipment. In addition, it was noted by City of Ottawa staff that access to the power supply should also be considered when deploying a permanent ASE unit.

3.5.4 Temporary vs. Permanent Cameras

There are two types of ASE deployments, temporary deployments and permanent deployments, as shown in **Figure 3-9**. Temporary cameras have the advantage of being more flexible in their deployment, as well as a lower installation cost.

Figure 3-9 – Temporary (Left) and Permanent (Right) ASE Deployment[18]

3.5.5 ASE Rotation

For temporary deployments, the ASE units are usually rotated regularly. The rotation frequency varies between municipalities for example, the Region of Durham rotates their ASE units every two (2) months, the City of Brampton rotate their ASE units every three (3) months, and the City of Toronto's rotation frequencies range from three (3) months to six (6) months. Rotation of the cameras can be labour intensive and is an important consideration. Some municipalities do not issue tickets in the first couple of works of operation to accommodate adjustments to the camera operation, in particular at mobile locations.

3.5.6 Reporting

To assess the effectiveness of the ASE, speed data should be collected at the ASE deployment locations before the deployment, during the period when ASE is activated, and after the deployment (i.e., after the ASE units are rotated to other locations). In addition, a successful ASE program is expected to have a halo effect where speed reduction is not only observed at the ASE deployment locations, but also observed city-

[18] Images credit: Region of Durham

wide due to driver's increased awareness on speed enforcement. This halo effect may not be observed for quite some time after the program is implemented. To capture this halo effect of the ASE, additional speed data should be collected across the City outside of ASE deployment locations.

In addition, all partnering municipalities are required to share data collected at the ASE deployment locations with the MTO to assist in determining the effectiveness of ASE. The data required includes speed data, collision data and violation data. These data are to be reported to the MTO every six (6) months.

3.5.7 Advantages vs. Disadvantages

Based on the current partnering municipalities' experience with their ASE programs, most municipalities recognize the following advantages of ASE:

- Public support (aside from vandalism)
- Effectiveness (i.e., marked reduction on speed)
- Reduced police workload so police resources can be engaged elsewhere
- No requirements for changes to the roadway, and often more cost-effective than roadway improvement/redesign that would encourage lower operating speeds
- Temporary ASE units can be rotated to cover multiple locations – therefore they are flexible and cost-efficient
- The program may be self-funded (to some degree) although there is no guarantee that the revenue from tickets will offset the cost of the program, particularly in the initial stages
- The revenue can be used to support other road safety programs and
- Promotes equity by reducing interaction between police and motorists.

The following disadvantages or challenges were also noted:

- Upfront cost
- Additional staff resources needed
- One-time intervention (i.e., once the ASE unit is rotated to another location, operating speeds could increase to the pre-implementation level) and
- Technical/feasibility issues with installation.

3.6 Crossing Guard Procedure and Policy

Relating to this policy, the following jurisdictions provided a response to the survey issued during the jurisdictional scan conducted in Task 2:

- City of Vaughan
- City of Markham
- Town of Newmarket

- Town of Oakville
- City of Burlington
- Town of Milton
- City of Mississauga
- City of Ottawa
- York Region
- City of Cambridge
- Region of Waterloo
- City of London

Based on the jurisdictional scan, five municipalities indicated that they had a formal policy on the use of crossing guards that their Council endorsed. Three other municipalities use the 2017 *Ontario Traffic Council's School Crossing Guard Guide* (either endorsed or not endorsed by their Council)[19]. A recent report by the City of Vaughan indicated that 60 percent of surveyed municipalities had adopted the 2017 OTC guidelines[20]. All of the jurisdictions reviewed have adopted the 2017 OTC guidelines with minor variations.

3.6.1 Pre-Selection Criteria and Minimum Thresholds

Most municipalities indicate that crossing guards are only to be provided on roads with a posted speed of 60 km/h or less. Other pre-selection criteria include:

- The associated school has an age range between Junior Kindergarten and Grade 5 or Grade 6[21,22]
- The requested location is within the walking boundary or within 1.5 km of the school[23]
- Average speeds are less than 60 km/h and traffic volumes are less than 12,000 (Milton) or 15,000 (Ottawa) vehicles per day [24]
- No more than one lane of travel in each direction (if uncontrolled)[3]
- A distance greater than 200 metres from another traffic control device (if mid-block)[3]

[19] Ontario Traffic Council, *School Crossing Guard Guide*, 2017
[20] https://pub-vaughan.escribemeetings.com/filestream.ashx?DocumentId=53204
[21] City of Toronto Crossing Guard program - https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/safety-initiatives/school-crossing-guard-program/
[22] City of Ottawa, Report to Transportation Committee, Adult School Crossing Guard Program Update, May 1, 2019 - http://ottwatch.ca/meetings/file/580609
[23] City of Toronto Crossing Guard program - https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/safety-initiatives/school-crossing-guard-program/
[24] Town of Oakville, School Crossing Guard Warrant - https://www.oakville.ca/assets/general%20-%20town%20hall/MS-CDV-002-002%20Appendix%20A%20-%20School%20Crossing%20Guard%20Warrant.pdf

- Adequate sightlines[3]

Ontario Traffic Council's *School Crossing Guard Guide* sets minimum thresholds for implementing crossing guards, being 40 assisted and unassisted elementary school children crossing at a location (over the school peak periods). These same criteria have been adopted by municipalities such as the City of Vaughan and Town of Milton[1]. However, other municipalities have set a lower threshold, being 10 in Ottawa[3] and 12 in Scugog[25]. The Town of Oakville has separate values depending on the type of traffic control, specifically 5 students for a side-street or mid-block location, 10 students for an all-way Stop and 15 students for a traffic or pedestrian signal[26]. The lower values reflects a more cautious approach to selecting locations for crossing guards.

3.6.2 Site Inspections

The Ontario Traffic Council recommends that a site inspection be undertaken at any location being considered for a crossing guard. The purpose of the site inspection is to review site operation and geometric conditions, demographics of the nearby school, whether the proposed location would be a safe location for a crossing guard (i.e. absence of potential sight obstructions) and what types of treatments may be undertaken to make the location safer (removal of on-street parking/removal of sight obstructions). A copy of a sample site inspection report is presented in **Appendix E**.

3.6.3 Warranting Criteria

The OTC *School Crossing Guard Guide* presents two methods to determine warranting conditions for a crossing guard. They are:

- Exposure Index method: a warrant methodology suitable for controlled (signalized) crossing facilities that have conflicting movements between vehicular and student volumes and
- Gap Study method: warrant methodology suitable for uncontrolled (unsignalized) crossing facilities – this methodology may also be used to evaluate some controlled crossing facilities.

[25] Township of Scugog, Crossing Guard Warrant Study – Simcoe Street and Reach Street, 2020 - https://pub-scugog.escribemeetings.com/filestream.ashx?DocumentId=596
[26] Identification of School Crossing Guard Locations Procedure - https://www.oakville.ca/townhall/ms-cdv-002-002.html

Each of these are described below.

Exposure Index method

The exposure index method is used as a screening tool for the need for a crossing guard and is based on peak hour conflicting vehicle and student volumes at existing school crossing guard locations. Each municipality is encouraged to collect this information at their existing school crossing guard locations to develop their own exposure index for each type of intersection (individually for signalized intersections, all-way Stop-controlled intersections, minor street stop-controlled intersections, intersection pedestrian signals and pedestrian crossovers at an intersection). The approach generally involves:

- Counting the conflicting vehicular volume during the arrival, midday and dismissal time across all locations in the jurisdiction that have crossing guards
- Counting the number of students crossing with the assistance of a crossing guard
- Multiply the student crossing volume by the conflicting vehicle volume for each location for each school period
- Select the school period with the highest cross product for each location
- Determine the 85th percentile of the cross products
- Plot the 85th percentile for a number of values and
- Any location with a cross product above the curve is a potential candidate for a crossing guard.

Several lower-tier municipalities with populations similar to Richmond Hill have developed their own Exposure Indexes (consisting of the cross product between vehicular and pedestrian volumes) as follows:

Oakville

- Side street stop controlled – 4,000
- All-way Stop controlled – 6,700
- Signal controlled – 5,500[27]

Milton

- All-way Stop controlled – 8,102[28]

The Town of Oakville's values are shown in **Figure 3-10** below.

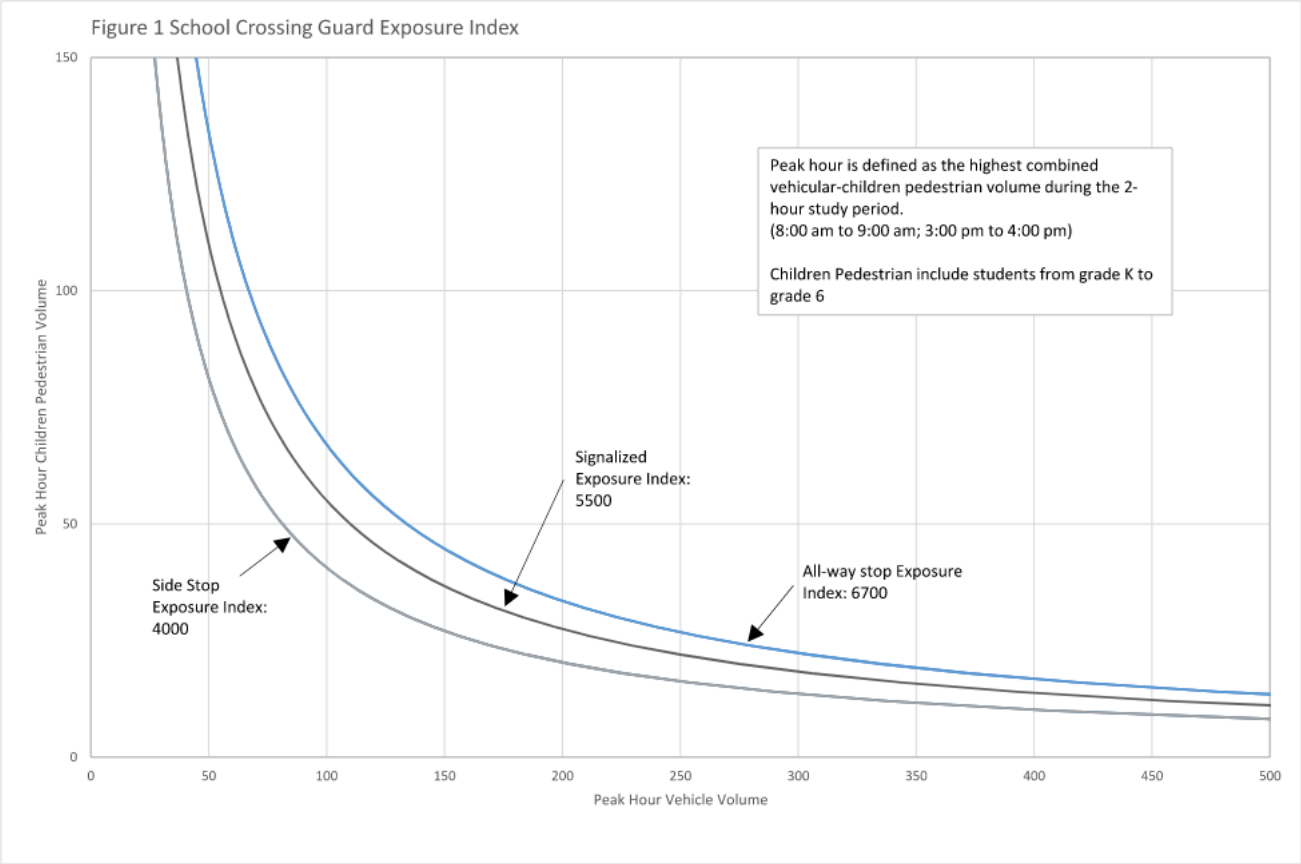


Figure 3-10 – Town of Oakville Exposure Index Curves

[27] Town of Oakville, School Crossing Guard Warrant - https://www.oakville.ca/assets/general%20-%20town%20hall/MS-CDV-002-002%20Appendix%20A%20-%20School%20Crossing%20Guard%20Warrant.pdf

[28] Town of Milton, Placement of School Crossing Guards Policy, 2020 - https://www.oakville.ca/assets/general%20-%20town%20hall/MS-CDV-002-002%20Appendix%20A%20-%20School%20Crossing%20Guard%20Warrant.pdf. Milton has not developed exposure indices for side street stop controlled or signalized intersections, only forall-way stop controlled intersections.

Gap Study method

The gap study method is an objective means of evaluating whether there are sufficient safe gaps in traffic along a road section for students to cross. The safe gap time is calculated based on the site-specific characteristics for each location and is typically used at an uncontrolled crossing (intersection with minor stop control for crossing the major leg or a mid-block location). The approach generally involves:

Safe Gap Time (G) = Perception & Reaction Time (P) + Crossing Time + Group Factor Time

which is the equivalent to:

$$G = P + (W / S) + T (N - 1)$$

- Calculating the Safe Gap Time based on the equation shown to the right, based on average perception and reaction time (P), width of the roadway (W), average walking speed of students (S), a group factor (T) and the predominant group size (N)
- Record the number of gaps (in seconds) on the free flow approach of the minor street stop controlled/ mid-block location in five-minute intervals
- Record the number of students crossing during the gap survey in the five-minute intervals
- Count the number of gaps recorded in each five-minute interval that is equal to or higher than the Safe Gap Time
- Count the number of five-minute intervals where there are less than four surveyed gaps that are equal to or higher than the Safe Gap Time
- Count the total number of five-minute intervals surveyed
- Determine the proportion of five-minute intervals where there are less than four Safe Gap Times and
- If more than 50% of the five-minute intervals surveyed had less than four Safe Gaps, then a school crossing guard is warranted for the location

An example of a gap study form is also found in **Appendix E**.

3.6.4 Other Factors to Be Considered

The Ontario Traffic Council's *School Crossing Guard Guide* does not explicitly indicate conducting a conflict analysis. Other factors that should be considered in the evaluation of the location are:

- Observations of aggressive driving or poor driver behaviour (not yielding right of way to pedestrians or not coming to a complete stop)
- Student timidity and/or observed lack of knowledge of proper crossing behaviour
- Historical collision record at the location and
- Inadequate visibility.

3.6.5 Sign Placement

According to both the Ontario Traffic Council's *School Crossing Guide* and Ontario Traffic Manual Book 15 on Pedestrian Crossing Facilities, School Crossing (Wc-2, Wc-102) and School Crossing Ahead (Wc-2A and Wc-102A) signs are to be installed at mid-block locations in rural and urban areas. The intent of the sign is to highlight the presence of a crossing location that is supervised by a crossing guard. It is assumed that the same set of signs should be installed at a Stop controlled intersection where the Stop control is on the minor approach, and the crossing is on the major (free flow) approach, as shown in **Figure 3-11.**

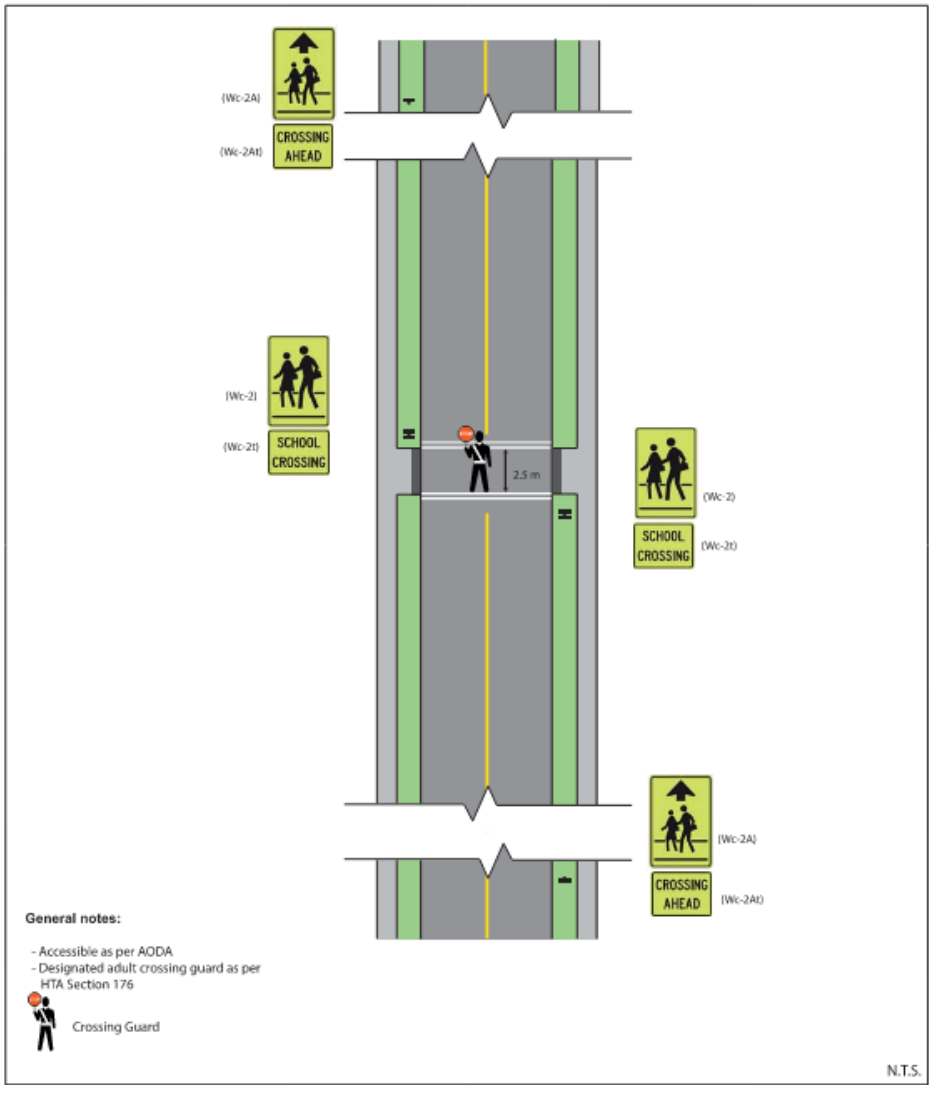


Figure 3-11 – Mid-Block School Crossing with Designated Crossing Guard

However, no specific mention is made of the use of School Crossing and School Crossing Ahead signs on approaches to intersections where there is a Stop control in place or at a signalized intersection. Some municipalities have installed signs in these instances, either on both sides or on the left side only. However, the use of these types of signs at these locations is redundant and contributes to sign clutter, which may lead to an increased likelihood of driver error and overlooking the need to yield or stop. Examples of sign clutter are shown in **Figure 3-12** below.

Figure 3-12 – Examples of Sign Clutter

3.6.6 Crossing Guards at Signalized Intersections

Where a school is located adjacent to a signalized intersection, the following treatments may be considered in conjunction with a crossing guard:[29]

- Implementing Leading Pedestrian Intervals
- Prohibiting right turns on red
- Extending the pedestrian walk time (i.e., using a lower pedestrian walking speed to program the signal)
- Ensuring that pedestrian countdown and information signs (i.e. when to walk and not walk) are installed at the intersection

3.6.7 New Schools, Public Inquiries and Annual Review

The City of Vaughan has a practice of implementing a crossing guard at all new schools for one whole school calendar year, collecting data at the location to determine if the

[29] Town of Milton, Placement of School Crossing Guards Policy, 2020 - https://www.oakville.ca/assets/general%20-%20town%20hall/MS-CDV-002-002%20Appendix%20A%20-%20School%20Crossing%20Guard%20Warrant.pdf

crossing guard is warranted and then, based on the outcome of the data collection, deciding to continue with a crossing guard or remove them[30].

Some municipalities have set up an online form on their website where members of the public may request that a location be evaluated as a candidate for a crossing guard[31].

The City of Vaughan reviews 25 candidate locations (based on community requests) annually and meets with the York Public and Catholic School Boards in February of each year to discuss school crossing guard matters.

3.7 Traffic Data Collection

A jurisdiction scan relating to traffic data collection revealed the following:

- The Cities of Oakville, Cambridge, and Ottawa have a program on traffic counts (turning movement counts, ATR counts, and vehicle classification), a pedestrian and cyclist count program, and a speed data collection program and
- The Town of Milton, Cities of Markham, Mississauga and Newmarket, Region of York and Waterloo do not have formal policy on the above data collection

3.8 Road Safety Public Awareness and Education Program

Based on the jurisdictional scan, three municipalities have developed an active school travel policy (as a working draft and not endorsed by their respective Councils). Three municipalities have formal safety campaigns policies, with two others having developed working drafts. Five municipalities have formal developed policies on SLOW DOWN lawn signs endorsed by their respective Councils. Only one municipality has a formal policy on the ROAD WATCH Committee.

The following sections outlines active school travel programs initiatives, the use of SLOW DOWN lawn signs, Road Watch committees, and calendars of road safety events.

3.8.1 Active School Travel Programs

Only a few municipalities have developed any programs on active school travel (or ‘safe routes to school’ programs). These programs are primarily led by different councils (i.e. Ontario Active School Travel Council) and different school boards (Public or Catholic). The following presents an overview of provincial, regional and nearby local programs.

[30] City of Vaughan Committee of the Whole (Working Session) Report, School Crossing Guard Policy, November 2020 - https://pub-vaughan.escribemeetings.com/filestream.ashx?DocumentId=53204
[31] https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/safety-initiatives/school-crossing-guard-program/

Ontario Active School Travel (OAST)

The Ontario Active School Travel (OAST) Council is an advisory committee composed of select active school travel leaders (private and public sector) that seeks to create a culture of active school travel and make active transportation and independent mobility normative for school-aged youth. OAST Council provides support to local schools through online resources such as:

- School Travel Planning Toolkit
- iwalk-iwheel Club
- Seasonal walk and wheel events[32]

York Region's Active School Travel Program

York Region has recently launched an Active School Travel pilot program that promotes any type of 'human-powered' travel to and from schools. This program is in collaboration with York Catholic District School Board (YCDSB), York Region District School Board (YRDSB), York Region Public Health and York Regional Police. The Active School Travel program is designed to:

- Enhance road safety and help manage vehicle congestion around school zones
- Educate and raise awareness among the community about the benefits of active and sustainable travel
- Improve air quality in school zones by reducing pollution and greenhouse gases made by vehicles
- Improve students' physical and mental health, social development and academic performance
- Build lifelong habits of active and independent mobility
- Raise awareness of road safety being a shared value and responsibility and
- Encourage students to reap the benefits of Active School Travel while having fun[33].

Active school travel pilots are underway in the Cities of Markham and Newmarket and will be implemented in the City of Vaughan in the fall of 2022. Initiatives include:

[32] https://ontarioactiveschooltravel.ca/get-help/
[33] https://www2.yrdsb.ca/schools-programs/student-transportation/active-school-travel

- School Streets – these are temporary road closures of streets in front of schools during peak school drop-off and pick-up times. They create car-free zones that facilitate a safer environment for active school travel by restricting traffic during these peak times

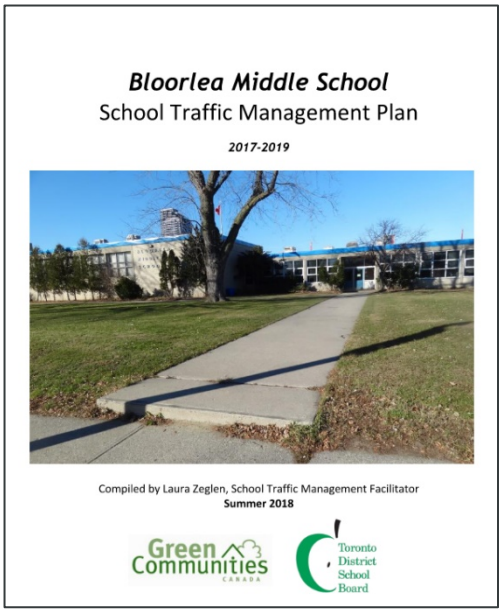
- Weekly walking programs
- Participation in dates like IWALK, Winter Walk Day and Bike to School Week
- Communications to schools, families and students about benefits and opportunities to participate in active school travel
- Bicycle education
- Customized wayfinding signage
- Interactive sidewalk stencils to create a more enjoyable walk to school
- Classroom competitions
- Group walks to help build family connections
- Traffic enhancements: zebra crossing, restricted on-street pick-up and drop-off activity, painted curb lines to reinforce restricted zones, school zone road stencils and
- Kiss & Ride loop closures once a week[34].

Toronto – Active and Safe Routes to School Pilot

The City of Toronto's Active and Safe Routes to School pilot project began in 2018. It encouraged children to use active transportation such as walking, biking or scootering to and from school, as well as improving safety in areas around schools. This project is one of many initiatives under the City's Vision Zero Road Safety Plan and has received grants from Green Communities Canada and Ontario Active School Travel to continue implementing and promoting this project[35].

[34] https://www2.yrdsb.ca/schools-programs/student-transportation/active-school-travel
[35] https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/safety-initiatives/active-and-safe-routes-to-school-pilot/#:~:text=The%20main%20objectives%20of%20the,walking%2Fbiking%20routes%20to%20school.

As part of the program, the Toronto District School Board Sustainability Office launched the School Traffic Management Program to provide schools with traffic management assistance. This program is being delivered in collaboration with Green Communities Canada, the City of Toronto's Transportation Services and Toronto Public Health. A School Traffic Management Facilitator supports local schools by:



- Investigating and responding to traffic-related concerns on school sites and facilitating workable solutions in collaboration with Board administration, school staff and parent councils
- Designing, scheduling and conducting field studies
- Assessing traffic flow and behaviour at school sites and preparing a School Traffic Management Plan (refer to the example on the right)
- Identifying infrastructure improvements needed and maintaining an Action Plan to monitor progress
- Liaising with City Transportation staff to address traffic-related concerns around school sites
- Developing a 'Routes to School map' for schools for families and
- Supporting schools to develop and implement initiatives to encourage active modes of school travel

3.8.2 SLOW DOWN Lawn Signs

Several municipalities permit residents to display SLOW DOWN lawn signs on their property (i.e., Mississauga, Toronto and Guelph)[36,37,38]. As a general principle, the SLOW DOWN lawn signs are not to create any obstruction or hazard for road users. Guidelines include that the sign is:

- Only to be placed directly on or in front of the resident's property
- Not to obstruct sight lines for pedestrians, cyclists or drivers
- Not to be installed on a building, structure, post, pole, tree or bush
- To be set back a minimum of 0.6 m from the curb or the edge of the road

[36] https://www.mississauga.ca/services-and-programs/transportation-and-streets/road-safety/please-slow-down-lawn-signs/#:~:text=Contact%20311%20(905%2D615%2D,the%20City%20and%20are%20free.
[37] https://www.toronto.ca/services-payments/streets-parking-transportation/road-safety/vision-zero/educational-campaigns/fall-safety-campaign/
[38] https://guelph.ca/living/getting-around/drive/slow-down-lawn-signs/

- Not to be installed within 15 metres of any traffic control devices (i.e. signal or stop sign)
- Not to obstruct any road, ditch, median, traffic island, sidewalk, bicycle path or multi-use trail
- To be placed at least 3 metres from a fire hydrant and
- To be inserted into the ground using the wire frame only[39]

The following represents existing practice regarding the program:

- Signs are provided for free by participating municipalities, typically through local Councillors. One sign is generally provided per household, with the exception of corner lots where two signs (one on each side of the property) may be provided.
- City staff may request that the sign be removed or relocated for any reason.
- Signs are not to be modified in any way (i.e. adding reflective tape). They must be maintained and replaced if they are damaged or cannot stay secured into the ground.
- The signs are not enforceable but are meant to encourage motorists to watch their speed while travelling through the displayed neighbourhoods.
- Some municipalities only permit them to be displayed between April 1 and November 30 of each year, presumably so that the signs are not damaged as a result of snow clearing operations.

Slow Down lawn sign examples are shown below. It is recommended that the City adopt a sign with minimal text and graphics to ensure that motorists clearly understand the message, without drawing attention away from other traffic signs (regulatory, warning, etc.). The City of Toronto example is preferred from a human factors perspective as the colour scheme and font style is substantially different from those used in signs in the Ontario Traffic Manual this ensures that there is no potential for the sign to be confused with a regulatory or warning sign.

[39] https://www.mississauga.ca/services-and-programs/transportation-and-streets/road-safety/please-slow-down-lawn-signs/#:~:text=Contact%20311%20(905%2D615%2D,the%20City%20and%20are%20free.

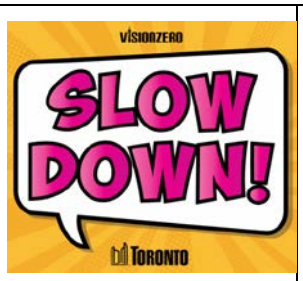
			
Region of Peel	**City of Toronto**	**City of Guelph**	**CAA**

Figure 3-13 – Examples of Slow Down signs

It should be noted that other types of signs are used elsewhere with different messaging (i.e. Keep Kids Safe) and Look Up! Look Around! Some of these signs are meant to encourage school-aged children to be more aware of their surroundings. To avoid a proliferation of signs with different types of messaging, it is recommended that the City only permit a single sign(i.e., advising motorists to 'slow down').

3.8.3 Road Watch Programs / Committees

The Road Watch program started in the Town of Caledon in 1993, and currently operates in several municipalities across Ontario[40]. General components of a Road Watch program are:

- Encouraging local residents and visitors to report drivers' aggressive or unsafe driving
- Use of an online Road Watch Report form
- Police sending letters to drivers identified in the program (first time), direct contact by phone or in person (second time) and possible enforcement action (subsequent times)
- Partnerships between municipal staff, police, a local safety committee (Road Watch) and MTO

ROAD WATCH©
YRP.CA

York Regional Police Road Watch program

The York Regional Police's Road Watch program is a community-driven program created to allow individuals to report aggressive driving in their community. York Regional Police endeavours to reduce motor vehicle collisions, enhance road safety for all road users, and work in collaboration with York residents to achieve that goal. Municipalities within York Region collaborate with York Regional Police to ensure that

[40] https://www.caledonenterprise.com/community-story/9562959-did-you-know-road-watch-is-no-longer-active-in-caledon/

hot spots and locations identified by residents are monitored and enforced. The online reporting form is found here.

Road Safety Committees

Several municipalities have Committees of Council that involve residents with a mandate to promote road safety. Many of these go by different names (e.g., Road Safety Committee as opposed to Road Watch Committee). The following features are noted in these committees, indicating a similar mandate to the City's Road Watch Committee[41,42,43]:

- They are established by their Council
- Their mandate is to reduce collisions and fatalities through:
    - Awareness of unsafe driving practices and promoting general road safety
    - Education through social media, websites and school activities (i.e. contests)
    - Enforcement with Road Watch programs
- Membership includes citizen appointments, police, Neighbourhood Watch representatives, Mayor's designates, municipal traffic representatives, and MTO representatives
- General tasks include:
    - Attending Committee meetings
    - Committing to participating for a term (typically one year)
    - Working with the public to increase awareness and stimulate participation
    - Volunteering to promote road safety at various events
    - Visiting schools to provide education about the program
    - Helping run fundraising events
    - Working with police and municipal staff

3.9 Road Safety Programs

This section provides an overview of four types of road safety projects currently commonly used in Ontario:

- Network screening
- In-service road safety reviews
- Systemic safety analysis
- Conflict analysis

[41] Town of Whitby, Road Watch Committee Terms of Reference, 2017 - https://whitby.civicweb.net/document/96190/
[42] City of Thorold, Road Safety Advisory Committee Mandate, 2021 - https://www.thorold.ca/en/city-hall/resources/Road-Safety-Committee.Feb-2021.pdf
[43] City of Mississauga, Terms of Reference for Road Safety Committee, undated - https://www.mississauga.ca/wp-content/uploads/2019/05/14145639/Road-Safety-Committee-Terms-of-Reference.pdf

These four types of safety projects are part of the Road Safety Management (RSM) process. The Road Safety Management (RSM) process is comprised of six steps, shown as shown in **Figure 3-14**, to help agencies identify locations in need of safety improvements (Step 1), identify underlying deficiencies at priority locations (Step 2), develop an optimal list of safety improvement projects in response to underlying safety issues (Steps 3 to 5), and evaluate their effectiveness in reducing collision frequency and severity (Step 6).

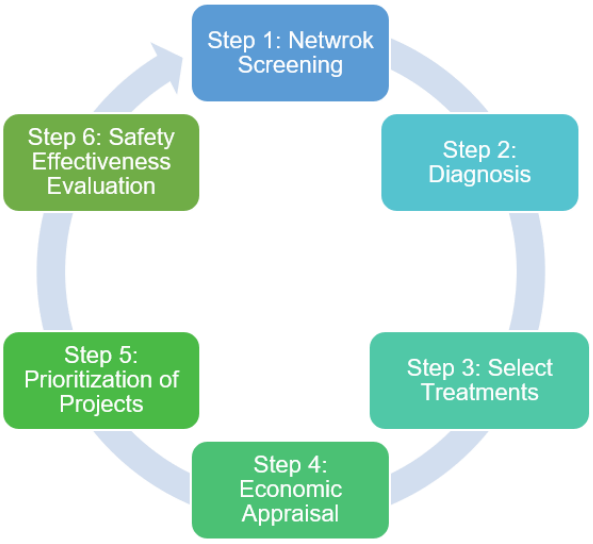


Figure 3-14 – Road Safety Management Process

3.9.1 Network Screening

Network screening aims at identifying locations that could benefit from the implementation of treatments to reduce the frequency and severity of collisions. The major steps involved in network screening are identifying facility types, selecting the screening method, and selecting performance measures. In terms of facility type, it is common to conduct a separate network screening for different facility types, such as intersections, road segments, ramps, and roundabouts.

The HSM provides the details of different network screening methods. Examples include:

- **Basic Screening** using average collision frequency, collision rate, Equivalent Property Damage Only (EPDO) collision frequency, EPDO collision rate, and relative severity index

- **Advanced Screening** using predicted collision frequency estimated by safety performance functions (SPFs), expected collision frequency following Empirical Bayes (EB) approach, and excess collision frequency following the EB approach.

The basic screening approaches are easy to understand and implement but can be misleading due to several challenges and limitations, including the Regression-to-the-Mean (RTM) bias[44].

As the science of road safety advanced, researchers developed more advanced approaches for prioritizing sites for safety improvements.[45] The main idea was to identify sites that experienced more collisions than expected from an average site with similar characteristics. As such, the Empirical Bayes (EB) approach was introduced, which is best suited for the predictive collision-based safety management approach. The EB approach also accounts for the RTM phenomenon and provides more reliable collision estimates compared to the basic screening approaches.

According to this approach, at a specific site with a given AADT value, the predicted number of collisions can first be calculated using an appropriate safety performance function (SPF). SPF is a tool to measure the safety performance of different facilities across the network. SPFs are mathematical equations that correlate the average collisions of different sites with their corresponding traffic volume, traffic control, and geometric characteristics.

Once the SPFs are developed and/or calibrated, the predicted and observed number of collisions can be combined by calculating a weighted average value which is called the ***expected number of collisions***. Notably, the assigned weights to the predicted collisions are a function of the SPF quality (i.e., the better the quality of the developed SPF, the more weight on the predicted number of collisions as opposed to the observed number of collisions).

The difference between the expected and predicted number of collisions will be calculated as the ***Potential for Safety Improvements (PSI)*** which can be utilized to rank the study locations as shown in **Figure 3-15**. And the PSI ranking is used to prioritize the sites for further detailed investigation. In other words, the network screening process using the EB methodology ranks different sites according to where the safety of road users could potentially see the greatest increase from safety improvements.

[44] Regression to the mean (RTM) is the phenomenon where the number of collisions at a location fluctuates from year to year, but ultimately returns to a long-term average.
[45] Hauer, E. (1997). Observational before/after studies in road safety. estimating the effect of highway and traffic engineering measures on road safety.

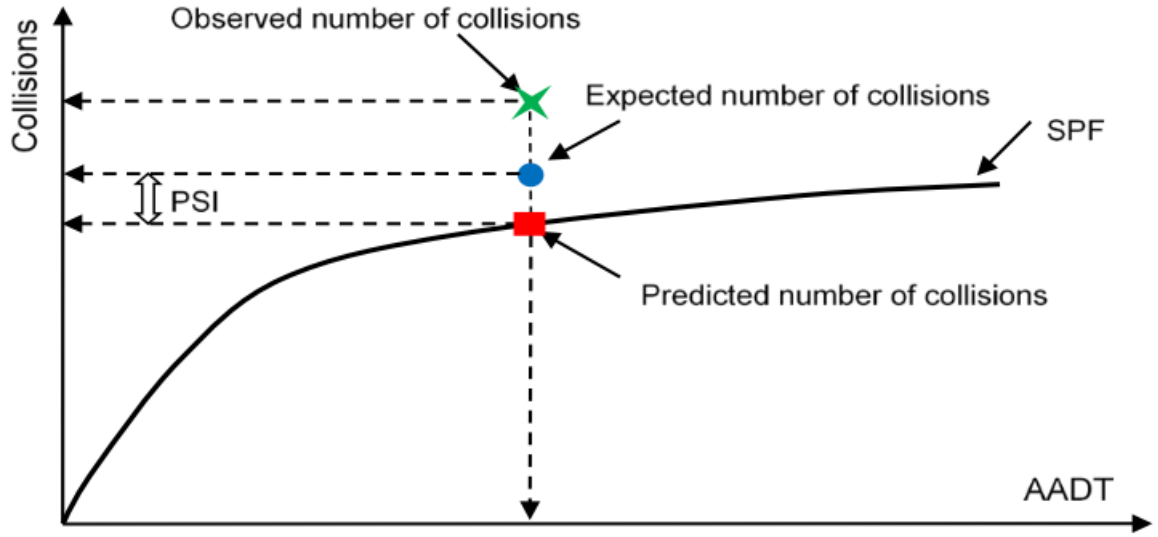


Figure 3-15 – Empirical Bayes (EB) method

3.9.2 In-Service Road Safety Reviews

The diagnosis step (also known as in-service road safety review and engineering road safety review) is the investigation of prioritized sites identified through network screening. In the predictive collision-based safety management approach, the activities included in the diagnosis step provide an understanding of collision patterns and physical characteristics of the site before potential treatments are selected.

The diagnosis typically involves an office review and site visit. During the office review, the available road safety data, including historical collisions, traffic operations (e.g., operating speeds and outcomes of capacity analysis), and other relevant information such as residents' complaints and requests from elected officials, will be reviewed in detail. A minimum of five years of safety data is recommended to be compiled and reviewed to improve the reliability of the diagnosis step. This review will assist in identifying collision patterns and underlying environmental conditions (e.g., lighting conditions, weather, surface conditions) contributing to collisions. Various visualization techniques can be used to efficiently document and present the findings of the office review. These visualization tools include simple techniques such as tables, bar charts, pie charts, trend charts, and more complicated techniques such as multidimensional charts, GIS heat maps, infographics, and collision diagrams.

After the office review, experienced road safety investigators will attend the site to complete a formal field investigation. As part of this process, the safety, and operational characteristics of the site, such as roadway and roadside features, traffic conditions, road users' behaviour, roadway consistency, and surrounding land use, will be reviewed and documented.

3.9.3 Systemic Safety Analysis

A systemic approach addresses sites with similar risk factors, regardless of collision history. The approach falls along a spectrum of other approaches to safety that are proactive in treating sites based on risk or prior collision history.

The predictive safety management approach accounts for the inherent randomness of the collision data and effectively enables the prioritization of sites based on their potential for safety improvements. However, the predictive process is reactive in nature, as it relies on the occurrence of collisions to identify sites requiring safety intervention. While this approach is valuable in identifying high-priority sites, it could ignore or downplay the importance of sites that experience a lower collision frequency but present risk factors that increase the potential for collisions. The FHWA has recently introduced the systemic safety management approach to address some of the limitations of the predictive collision-based safety management approach as shown in **Figure 3-16**.[46] The purpose of the systemic approach is to proactively address locations that exhibit high-collision potential due to location attributes such as roadway geometry and cross-sectional design, roadside and area features, traffic control, and more.

The systemic method is a network-wide evaluation approach which identifies and prioritizes collision-prone locations based on their safety risk factors. This approach will primarily deploy low-cost treatments at multiple locations to address their underlying risk factors.

[46] Preston, H., Storm, R., Dowds, J. B., Wemple, B., Hill, C., & Systematics, C. (2013). Systemic safety project selection tool (No. FHWA-SA-13-019). United States. Federal Highway Administration. Office of Safety.

Figure 3-16 – FHWA framework for systemic safety project selection tool

Potential benefits of the systemic approach include:

- Proactive approach, as collision-prone locations are identified based on risk factors rather than collision history
- No requirement for high-quality, historical, site-level collision data
- Adaptable based on available data
- Provides an opportunity to better distribute safety funds across the agency's jurisdiction
- More reliable in identifying collision-prone locations, as it targets risk factors rather than collisions, which are prone to high randomness
- Capable of addressing collision types that are frequent but dispersed across the network

3.9.4 Conflicts and Avoidance Maneuvers

The application of traffic conflict techniques in assessing the level of safety of road facilities, including intersections and road segments, has been continuously gaining attention among safety researchers and practitioners. Several studies have demonstrated the feasibility of collecting conflict data and other avoidance maneuvers,

such as swerving or hard braking, using field observers[47] [48], simulation models[49], and video cameras[50] [51] to assess the safety of a particular road facility. These safety measures fall into the *surrogate safety measures* category, which can be utilized to supplement collision data analysis.[52] An example of a conflict resulting in a near miss is shown in **Figure 3-17**.

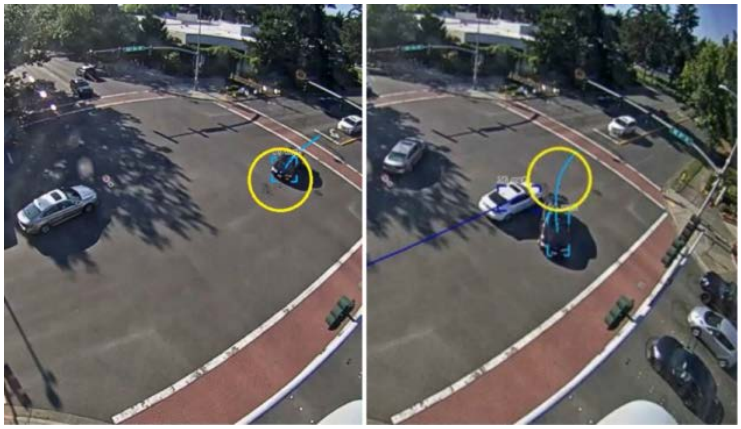


Figure 3-17 – Near miss instance at an intersection

With the advancement of high-definition video and automatic analytics, the use of traffic conflicts in conjunction with in-service road safety reviews and before-after studies has seen a surge in recent years.

Regardless of the method by which traffic conflicts are recorded, this approach offers traffic safety analysts a unique opportunity to observe unsafe interactions (potential collisions) and to pinpoint the failure mechanism that leads to such dangerous behaviour. In addition, because these methods use events that occur at a much greater frequency than collisions, it is possible to assess the safety of a given location without waiting for many collisions to occur.[53] As such, the conflict-based analysis is viewed as

[47] Sayed, T., & Zein, S. (1999). Traffic conflict standards for intersections. Transportation Planning and Technology, 22(4), 309-323.
[48] Crowe, E. C. (1990). Traffic conflict values for three-leg, unsignalized intersections. Transportation Research Record, (1287).
[49] Mehmood, A., Saccomanno, F., & Hellinga, B. (2001). Simulation of road crashes by use of systems dynamics. Transportation research record, 1746(1), 37-46.
[50] Autey, J., Sayed, T., & Zaki, M. H. (2012). Safety evaluation of right-turn smart channels using automated traffic conflict analysis. Accident Analysis & Prevention, 45, 120-130.
[51] Ismail, K., Sayed, T., & Saunier, N. (2010). Automated analysis of pedestrian–vehicle conflicts: Context for before-and-after studies. Transportation research record, 2198(1), 52-64.
[52] Carter, D., Gelinne, D., Kirley, B., Sundstrom, C., Srinivasan, R., & Palcher-Silliman, J. (2017). Road Safety Fundamentals: Concepts, Strategies, and Practices that Reduce Fatalities and Injuries on the Road (No. FHWA-SA-18-003). United States. Federal Highway Administration. Office of Safety.
[53] Ariza, A. (2011). Validation of Road Safety Surrogate Measures as a Predictor of Crash Frequency Rates on a Large-Scale Microsimulation Network. Toronto, ON: University of Toronto.

a proactive safety management approach compared to the reactive safety analysis using historical collision data.

Video conflict analysis can also record instances of road user manoeuvres that may not have resulted in a conflict but have associated risks, such as red-light running or pedestrians not complying with traffic signals. Moreover, additional information can be collected for select conflict types if specified at the onset of the video conflict assignment. For example, the exact time for the red-light running within the signal cycle can be recorded. This information can help the analyst to differentiate between intentional and unintentional violations. These additional parameters can be tailored to the specific concerns of particular locations or routinely across several locations.

Despite the recent advancements in conflict analysis, by their surrogate nature, there is potential for inaccuracy in determining which types of conflicts are good indicators of collisions. Therefore, further studies would be needed to quantify the direct correlation between collisions and conflicts. Nevertheless, conflict analysis can be a useful tool in the safety analysis toolbox, and can help municipalities to better understand the safety issues of a particular road entity, or assist in the safety evaluation of proposed countermeasure(s), as part of the before-after analysis.

4 NEW RESOURCES AND TOOLS FOR SERVICE DELIVERY

On the basis of the jurisdiction scan, the following new resources and tools for service delivery were identified. This section provides an overview of proposed enhancements to City's existing resources, services and tools.

4.1 Inquiry Review Process

Based on the review of the existing inquiry processing procedure and the findings from the jurisdictional scan, the following enhancements are proposed:

- Prioritization Tool
- Geolocating Tool and
- Public Inquiry Web App.

The enhancements noted above are further discussed in the subsections below.

4.1.1 Prioritization Tool

The City receives hundreds of traffic related inquiries every year, and current available resources may not allow addressing all inquiries in an expedient manner. Additionally, in the existing inquiry processing procedure, the priority of each inquiry is assigned by the TSO Group members based on their professional judgment and on the nature of the inquiry, without an established standard procedure for prioritization. It is recommended that a tool be developed to prioritize the inquiries using a data-driven approach while still taking the nature of the inquiry into consideration. The purpose of the tool is to help the TSO Group members to prioritize the inquiries in a consistent manner, and to use the priority level to manage workload and workflow internally. Although there is currently no available information on the use of such prioritization procedure from other municipalities, the City could benefit from establishing a consistent procedure for inquiry prioritization.

The first step of the prioritization process is to determine the preliminary priority of each inquiry using the prioritization matrix as shown in **Table 4-1**.

Table 4-1 – Recommended Inquiry Type Priority

Prioritization Matrix		Specific Event Reported?	
		Yes	No
Inquiry Type	• Pedestrian Safety • Cycling Safety • School Safety • Speeding • Sight Distance	**Urgent**	**Moderate**
	• General Questions • AWSC Warrant • Stop Sign Compliance • Parking • Traffic Signal • Sign/Pavement Marking • CSZ • Other	**High**	**Normal**

As shown in **Table 4-1**, there are four priority levels (i.e., urgent, high, moderate, and normal) which can be determined for each inquiry using the 2x2 prioritization matrix. In the matrix, the vertical axis includes inquiry types, and each inquiry would be assigned with a priority level depending on whether a specific event is reported by the inquirer. A specific event is one that may trigger immediate corrective action includes, although is not limited to the following:

- A recent collision, or a near-miss
- A change in road or traffic conditions that is causing unsafe road user behaviour and/or
- A defective traffic control device.

Inquiries that do not mention a specific event are those that do not trigger, or that are not feasible for, immediate corrective action. For example, traffic calming requests require a process to be followed and, if traffic calming measures are recommended, additional work in the form of budgeting, design and construction are necessary all-way stop requests require Council approval and by-law amendments.

The second step of the prioritization process involves a preliminary review of the inquiry. This process assesses the inquiry comprehensively based on a list of relevant data and information for the inquiry location, such as speed data, traffic volume data, historical collision data, network screening results, systemic risk-based results, anecdotal observations, previous history, construction plans/history, etc. This preliminary review of

the inquiry will help the TSO Group members make data-driven decisions on the priority of the inquiries, such that the preliminary priority level assigned in the first step can be adjusted accordingly when appropriate.

As a long-term enhancement, it is recommended that the City develop a dashboard that can improve the efficiency of the preliminary review process. This dashboard would connect to the City's various data sources, where the above-noted data and information can be easily filtered out by location. Such a dashboard can be developed in software programs such as Microsoft Power BI or ArcGIS based software such as Cityworks.

Additionally, the City may wish to consider developing an algorithm to automate the above-noted prioritization process. This algorithm can be embedded with a methodology that applies a weighting factor to each relevant data, which will calculate an overall priority score for each inquiry. The TSO Group members can then use these scores to prioritize their work.

4.1.2 Geolocating Tool

To visually present the inquiries across the City, it is recommended to develop dynamic and interactive inquiry maps using software programs with geolocating features such as ArcGIS and Microsoft Power BI. The dynamic inquiry maps would be linked to the Excel tracking sheet to reflect changes in real-time (e.g., status changes to existing inquiry, new inquiry, etc.).

The inquiry maps would be able to visually present the data from the Excel tracking sheet and would be highly customizable as it would be able to:

- Show the number of inquiries at each location in the form of a bubble, where the size of the bubble reflects the number of inquiries
- Show/hide certain types of inquiries (e.g., by date, by status, by inquiry type, etc.) and
- Show the distribution of inquiries.

This tool would also provide the opportunity to identify locations where multiple inquiries are received for these locations, the City might wish to initiate a study to examine and address the issues collectively instead of individually (i.e., a neighbourhood study).

As a value-add, software programs such as Microsoft Power BI can also be used for record keeping as it can also be customized to display detailed information of the inquiry as long as the information is stored in a consistent format in a database (e.g., the Excel tracking sheet).

4.1.3 Public Inquiry Web App

Instead of, or in addition to receiving inquiries through traditional methods (e.g., emails, phone calls), municipalities might wish to develop a web app to collect public inquiries. The web app would include the following key elements:

- Contact information field
- A map interface for the user to identify the inquiry location
- Drop down list for the user to select inquiry type
- Description field for the user to provide details about the inquiry and
- Attachment field for the user to provide additional files (e.g., images) to support the inquiry.

The web app would then summarize the information from each inquiry into a database (i.e., similar to the TSO Group's existing Excel tracking sheet), and the database would feed into the maps in the geolocating tool as mentioned in **Section 4.1.2**.

4.1.4 Proposed Inquiry Processing Procedure

Based on the existing inquiry processing procedure and the proposed enhancements, **Figure 4-1** shows the proposed inquiry processing procedure, where the proposed enhancements are highlighted in red.

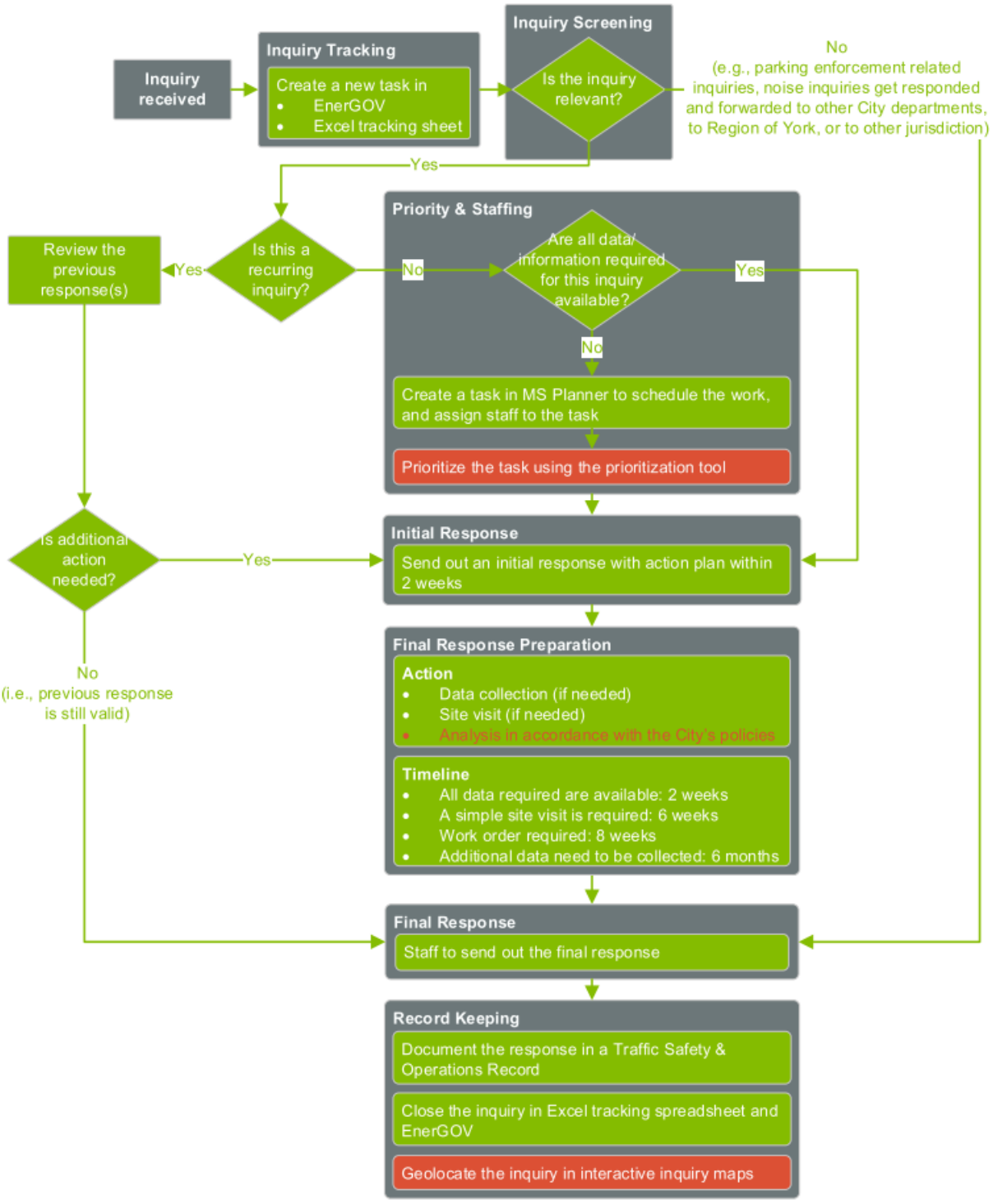


Figure 4-1 – Overview of Proposed Inquiry Processing Procedure

4.2 Speed Management, Speed Limit Policy, Traffic Calming Policy and Pilot Projects

4.2.1 Setting Base Speed Limits

It is proposed that the City apply the following criteria outlined in **Table 4-2** as 'base' speed limits throughout the City.

Table 4-2 – City of Richmond Hill Recommended Base Speed Limits

Base Speed Limit	Characteristics
40 km/h	• Roads classified as local in residential areas • Use of 'area-wide' speed limit signs on entry roads into subdivisions
50 km/h	• Roads classified as local in commercial and/or industrial areas • Roads classified as local in residential areas where it is impractical to travel at higher speeds[54] • All roads classified as collector

Roads with a 40 km/h speed limit would be all local roads within a residential area that would be posted by means of 'area' speed limit signs[55]. Signs would be posted on all entry roads into the residential area as shown in **Figure 4-2** (with the 'begins' and 'ends' tab as applicable).

[54] Examples include crescents or cul-de-sacs made up of short sections of road that only have an outlet onto a collector road. To efficiently allocate City resources, 40 km/h and the corresponding signs would only be installed on these roads if speed studies indicate the need

[55] Currently, the default speed limit is 50 km/h, unless posted otherwise. Section 128 (2.1) of the Ontario Highway Traffic Act now allows municipalities to pass a by-law to set a speed limit less than 50 km/h for all roads within a designated area

Figure 4-2 – Area Speed Limit Signs

Roads with a 50 km/h speed limit would be essentially all remaining roads, being local roads in a non-residential area (i.e. in commercial or industrial land use) or collector roads. The above classification will ensure overall consistency in how speed zones are being applied in the City of Richmond Hill. However, these base speed limits would be subject to further refinement as discussed in the following section.

4.2.2 Network Review of Speed Limits

As a further refinement to the above, it is recommended that the City of Richmond Hill conduct a review of selected roads in their network to verify that the base speed limit is appropriate and identify areas where operating speeds differ from the speed limit. **Table 4-3** summarizes the recommended approach.

It is recommended that the network review of posted speeds include all collector roads and all local roads that are ‘grid’ roads, being roads that have essentially a straight alignment and a direct connection at either end to a collector road. For all roads included in this grouping, the 2009 TAC *Guidelines for Establishing Posted Speeds* should be applied in addition to the collection of speed data (refer to Traffic Data Collection Memo).

Table 4-3 – Network Review of Speed Limits

Base Speed Limit	TAC Recommended Speed Limit	Operating (85th percentile) Speed	Action
40 km/h	40 km/h	≤50km/h	• Maintain speed limit at 40 km/h
	40 km/h	>50km/h	• Maintain speed limit at 40 km/h • Investigate need for physical restrictions to roadway to reinforce posted speed (traffic calming) • Investigate need for Automated Speed Enforcement
	50 km/h	≤50km/h	• Maintain speed limit at 40 km/h
	50 km/h	>50km/h	• Review collision history and increased presence of vulnerable road users and posted speed on surrounding roads • If no reported collisions and/or increased presence of vulnerable road users, increase posted speed to 50 km/h • If reported collisions and/or increased presence of vulnerable road users, maintain speed limit at 40 km/h and investigate need for traffic calming measures and/or Automated Speed Enforcement
50 km/h	40 km/h	≤50km/h	• Reduce speed limit to 40 km/h
	40 km/h	>50km/h	• Reduce posted speed to 40 km/h • Investigate need for further physical restrictions to roadway to reinforce posted speed (traffic calming) • Investigate need for Automated Speed Enforcement
	50 km/h	≤60km/h	• Maintain speed limit at 50 km/h

Base Speed Limit	TAC Recommended Speed Limit	Operating (85th percentile) Speed	Action
	50 km/h	>60km/h	• Maintain speed limit at 50 km/h • Investigate need for further physical restrictions to roadway to reinforce posted speed (traffic calming) • Investigate need for Automated Speed Enforcement

The following is noted:

- In all instances, where the existing speed limit and the TAC recommended speed limit are in agreement, the base posted speed is to be maintained
- Where the base speed limit and the TAC recommended speed limit are in agreement but the operating speeds are greater than 10 km/h above posted, the City should investigate the need for further physical restrictions to the roadway to reinforce the speed limit, in addition to investigating the need for Automated Speed Enforcement (if the location qualifies) and
- Where the existing speed limit is 40 km/h but the TAC recommended speed limit is 50 km/h and the operating speeds are greater than 50 km/h, the City should conduct a study to evaluate whether the posted speed can be increased to 50 km/h by reviewing the collision history and the presence of vulnerable road users.

City staff noted that there are a small number of rural roads on which it may be appropriate to permit a higher speed limit. It is recommended that these roads be addressed on an individual basis by means of the 2009 TAC *Guidelines for Establishing Posted Speeds.*

Following the network review of speed limits, the City need only carry out the same exercise in the following situations:

- Within new subdivisions and
- Existing roads with a significant change in land use or function (i.e. opening of a elementary school, senior's centre, cycling facilities or a trail crossing or changes in parking regulations)

The above exercise will streamline the approach taken by City staff, establish posted speeds that are realistic and defensible, in consideration of the road network and the presence of vulnerable road users.

The City should however continue their practice of collecting speed data on their road network on an annual basis, as noted in the Traffic Data Collection Memo.

4.2.3 Network Screening for Candidate Locations for Traffic Calming

Other jurisdictions in Ontario take a reactive approach to selecting locations for traffic calming stemming from public inquiries/complaints. The City has indicated that they wish to shift to a proactive approach to addressing the potential need for traffic calming by evaluating their entire road network (network screening) to identify and rank candidate locations in a manner that is objective, evidence based and defensible.

As noted in other jurisdictions, the City should consider screening out locations where traffic calming would not be feasible and/or would have limited effectiveness, as follows:

- Roads passing through exclusively rural, commercial and/or industrial areas
- Roads where the grade exceeds 8%
- The distance between two traffic control devices is less than 100 metres
- Distance to geometric features that would force a speed reduction such as 90-degree bends in the roadway and
- The road carries less than 750 vehicles per day (for local roads) or less than 2,000 vehicles per day (for collector roads).[56]

For the remaining roads, it is proposed that the City of Richmond Hill use a systemic approach in identifying which road sections would be the best candidate locations for traffic calming through the collection and review of the data presented in **Table 4-4**. This assessment would be undertaken every 5 years.

The general approach would be to collect the data identified in **Table 4-4** and identify risk factors that contribute to the risk of a collision in residential neighbourhoods through an examination of the relationship between variables relating to speed, volume, road classification, land use, vulnerable road users and collisions (this can be done either by following the FHWA systemic approach to road safety or by developing specific Safety Performance Functions for collisions involving speeding while including the above potential risk factors into the model). Factors demonstrated to have an elevated risk of a collision (i.e., 85th percentile speed) will be identified. Based on this exercise, a risk index would be developed for those factors identified as having an elevated risk of a collision. Using the risk index, locations would be ranked from highest to lowest in terms of locations having the greatest potential for an improvement in safety due to traffic

[56] Approximately 30% of local roads with recent data in the City's database carry less than 750 vehicles per day, and approximately 25% of collector roads with recent data in the City's database carry less than 2,000 vehicles per day. On roads that do not meet the volume threshold but where there is a reported (and verified) issue with speed, City staff should request York Regional Police to conduct periodic enforcement.

calming. A yearly schedule for the implementation of traffic calming treatments can then be developed, dependent on the City's annual budget for traffic calming treatments.

Table 4-4 – Suggested Variables for Systemic Review

Category	Data
Speed	• Speed limit • Base speed limit or Recommended speed (2009 TAC guidelines) • Operating (85th percentile) speed
Volume	• Vehicle volumes (ATR) • Truck percentages
Road classification	• Local • Collector
Land Use	• Presence of schools, playgrounds, hospitals, seniors' centres, or community centres
Vulnerable Road Users Facilities	• Sidewalks (none, one side, both sides) • Cycling facilities (none, shared, bicycle lane, off road) • Crossings (pedestrian crossings, trail crossings)
Collisions	• PDO collisions • Injury or fatal collisions • Collisions involving vulnerable road users (pedestrians and cyclists)

In the short term, prior to the systemic review being carried out, the City of Richmond Hill could rank the screened locations (eliminating those based on road classification, land use, traffic control, grade) based on excess speed above the speed limit and implement traffic calming as noted in later sections.

4.2.4 Tiered Approach to Implementing Traffic Calming

An additional enhancement the City of Richmond Hill has proposed is having a tiered approach to implementing traffic calming in which treatments would range from low-cost to high-cost measures based on their ranking as outlined in Section 4.3 (potential for safety improvement). Lower-cost measures would include treatments such as modifications to pavement markings and/or signs. Higher-cost measures would include treatments that involve physical changes to the roadway (vertical and/or horizontal deflection). The tiered approach would:

- Customize the City's response to each situation, with lower ranked locations receiving a lower cost measure and higher ranked locations receiving a higher cost measure – as such, the ranking is expected to represent the magnitude of the speed issue and the corresponding expected benefit of the recommended traffic calming measure and
- Allow the City to implement lower cost traffic calming measures more broadly in the context of budget constraints

Further information on specific treatments to be considered for traffic calming are provided in the Traffic Calming Toolbox presented in **Appendix B**.

4.2.5 Public Input

Public input into the City's traffic calming program will continue to be a key component in the context of the above proposed network screening approach to selecting and ranking candidate sites for traffic calming. As the City receives inquiries about the need for traffic calming on a specific roadway, the City will be able to share the ranking of the candidate site and if and when their particular road is scheduled for traffic calming (either a lower cost or a higher cost treatment based on the tiered approach).

As part of the City's yearly program for implementing traffic calming on selected roads, members of the public in the affected area (property owners only on the affected road) would have an opportunity to review and comment on the proposed treatments through a formal process in which:

- A page on the City's website would be set up to announce the plan to implement the traffic calming (including staff contact information and a form for leaving comments)
- A mail out would be sent out indicating the intention to implement traffic calming on the affected road
- A public meeting would be held to:
    - Explain the rationale for implementing traffic calming on the affected road (findings of systemic review)
    - Explain the type of treatments recommended for implementation and their anticipated benefit, as well as alternatives that were considered, if applicable
    - Show the planned location of the treatment
    - Obtain public feedback on the proposed treatments and
    - Determine what, if any, modifications would be required to the proposed treatments because of the public feedback.
- Members of the public (property owners only on the affected road) would be invited to provide input on the preferred design

- If high cost traffic calming measures are to proceed, City staff will include the location in the capital budget request for design and construction in the following years.

4.2.6 Before-After Studies

The City expressed a desire to have a formalized process for conducting pilot studies. The collection of data before and after the implementation of traffic calming treatments will be key to understanding the effectiveness of the treatment and gauging continued public support for the treatments. Components of a successful before-after study will be:

- Collection of a 7-day ATR count (speed, volume, classification) on the affected road and any parallel adjacent road prior to its implementation
- Collection of a 7-day ATR count (speed, volume, classification) on the affected road and any parallel adjacent road one week after its implementation and in the following year (to evaluate long term impacts)
- Evaluation of collision performance (for the before period and in the following year)
- Collecting public feedback on the City's website dedicated to this specific project
- Collecting feedback from York Regional Police, emergency services, school bus operators, transit, City maintenance and garbage collection (if physical changes to the roadway have been implemented) and
- Development of a spreadsheet tool that tracks before-after data for individual traffic calming treatment to gain an understanding in the future as to the anticipated impacts of different treatments (for new projects)

In very limited situations, the City may decide to remove the traffic calming treatments based on negative feedback from either the residents and/or affected stakeholders (York Regional Police, emergency services, school bus operators, transit, City maintenance and garbage collection).

4.2.7 Traffic Calming Toolbox

In collaboration with City staff, a set of treatments were identified for implementation in the City, as follows:

- Centrelines
- Raised median islands
- Edge lines
- Urban shoulders
- Bump outs/Curb extensions
- Bike lanes (conventional and buffered)
- On-street parking

- Gateway features
- Flexible bollards (vertical centreline treatment)
- Speed cushions
- Raised crosswalk
- Traffic circle/mini roundabout
- On-road 'Sign' pavement markings and
- Speed display devices.

An Excel tool was developed to streamline the process of selecting suitable traffic calming measures for a given road segment. A description of the use of the Excel tool is provided in **Appendix B,** providing guidance to City staff on how to operate the tool, and briefly introducing the methodology embedded in the tool.

4.2.8 Proposed Policies

The proposed policies in flowchart form are provided in **Appendix B**.

4.3 Pedestrian Crossovers

The following enhancements have been identified based on findings from the literature review and jurisdictional scan, in addition to conversations with City of Richmond Hill staff and are recommended to be adopted for use.

4.3.1 Recommended Project to Review Candidate Locations

The City of Richmond Hill currently has PXO locations throughout the City and has identified additional locations for implementation in 2023, following assessments as per OTM Book 15. As a future project, it is recommended that the City of Richmond Hill conduct a City-wide review of candidate locations for future PXOs. Candidate locations for this review will consist of those where there are currently no controls (i.e. midblock locations or minor-road stop controlled intersections), including:

- Locations where a pedestrian collision has occurred
- School crossing locations
- Trail networks where trails cross roads
- Locations where schools or new trails are being/were recently built and
- Locations identified based on public input.

For the above noted locations, the City should determine their potential eligibility for a PXO based on a review of either the 8-hour or 4-hour pedestrian crossing and traffic volumes and considering desire lines and the distance from the nearest controlled crossing, per OTM Book 15 criteria.

This City-wide review should be repeated every 5 years to capture potential changes in traffic patterns.

Additionally, for new roads, PXOs should be considered where the OTM Book 15 distance and connectivity requirement are met. Engineering judgment should be applied at the design stage to determine if a PXO should be implemented with the new road construction, or if any design elements (e.g., appropriate sight distance, sufficient space for AODA elements, etc.) should be included in the design in anticipation that volume requirements may be met in the future.

4.3.2 Development of a Prioritization Method

After reviewing the above, it is recommended that the City of Richmond Hill adopt a prioritization tool to assist with ranking the identified locations suitable for a PXO installation. Selected locations should be prioritized based on the following key components, each with a corresponding weight/score:

- Connectivity (similar to that developed by the Town of Oakville)
- Demand (similar to that developed by the Town of Oakville) and
- Safety – Including collision history with pedestrians and vehicles, road class, 85th percentile speed, and vehicle pedestrian cross product.

Table 4-5 is the proposed priority criteria table with weights that can be adapted by the City of Richmond Hill, similar to the one used by the Town of Oakville. Each criterion is divided into separate categories to assign corresponding weights based on impact/priority with the higher score representing the greater the impact of the specific category. The distances shown in **Table 4-5** are based on likely walking thresholds as described in OTM Book 15, which states that “most people are willing to walk 5 to 10 minutes at a comfortable pace to reach a destination, with walking trips averaging a distance of 0.4 km.” However, the following modifications to the Town of Oakville’s method are proposed.

- **85th percentile speeds** - The Town of Oakville used the posted speed limit as a method of prioritizing safety however, it is suggested that the City of Richmond Hill use the 85th percentile speed because it is a better indicator of the prevailing speed and considers the potential consequences to pedestrians in the event of a collision (refer to **Figure 4-3** below). Speed is the key factor that affects the severity of a collision involving vulnerable road users, where even a 5 km/h increase in speed could significantly increase the chance of a fatality or injury. As shown in **Table 4-5**, if the 85th percentile speed is greater than 50 km/h, the location receives a score of ‘5’, as opposed to if the 85th percentile speed is between 40 – 50 km/h where the location receives a score of ‘3’ and if below 40 km/h, it receives a score of ‘1’.

- **Cross product** - Additionally, it is recommended that the City of Richmond Hill consider the vehicle-pedestrian cross product under demand. As seen in **Table 4-5**, the values calculated were based on the City of Richmond Hill's current PXO candidates and warrants by location with corresponding 8-hour pedestrian and vehicle data. The cross product of each 8-hour vehicle and 8-hour pedestrian data values was calculated and the weights were developed in accordance. As the City collects more data on potential PXO candidates, the weighting can be adjusted to more accurately capture the range of values.
- **Community requests** - The City wishes to adopt a data-driven approach, following evolving industry trends, and since a City-wide project is being recommended, the role of community requests, which is mainly to trigger a review, is not necessary for the purposes of prioritization.
- **Land use** - This criterion overlaps with the proximity criteria, therefore it is not necessary.

Table 4-5 – Priority Criteria / Justification and Weighting

Criteria /Justification	Category	Score
Connectivity		
Proximity to nursing homes and medical centres (*Senior citizens have an increased risk of serious death and/or death in a collision)*	Adjacent to facility (<100m)	15
	101-200m from facility	12
	201-300m from facility	9
	301-400m from facility	6
	>400m from facility or N/A	0
Proximity to elementary schools (K-8) (*Children have more difficulty judging speed, spatial relations and distance compared to adults)*	Adjacent to school (<100m)	15
	101-200m from facility	12
	201-300m from facility	9
	301-400m from facility	6
	>400m from facility or N/A	0
Proximity to high schools (*High schools are major pedestrian attractors but are scored lower as students in high school have a better understanding relating to safely judging gaps in traffic)*	Adjacent to school (<100m)	10
	101-200m from facility	8
	201-300m from facility	6
	301-400m from facility	4
	>400m from facility or N/A	0
Proximity to transit (route or stop) (*Transit stops are natural pedestrian attractors and encourage mid-block crossing behaviour)*	On transit route	5
	Not on transit route but <100m from bus stop	4
	Not on transit route and 101-200m from bus stop	3
	Not on transit route and 201-301m from bus stop	2
	Not on transit route and 301-400m from bus stop	1
	Not on transit route and >400m from bus stop	0
Proximity to major pedestrian facilities (i.e. libraries, community centres, retirement	Adjacent to any major pedestrian facility (<100m)	5

homes, sport facilities, parks, pools, playgrounds) *(These types of facilities attract/generate pedestrian trips)*	101-200m from any major pedestrian facility	4
	201-300m from any major pedestrian facility	3
	301-400m from any major pedestrian facility	2
	>400m from any major pedestrian facility or N/A	0
Multi-use trail or major trail facility crossing *(Users of these facilities are often unwilling to detour to the nearest controlled crossing)*	Yes	5
	No	0
Proximity to nearest controlled crossing location *(Sites greater than 200m from a controlled crossing are potential candidates provided they meet the pedestrian and vehicle thresholds)*	>300m	5
	251-300m	3
	201-250m	2
	<200m	0
Demand		
Vehicle-pedestrian cross product (based on 8-hour volumes) *(Higher cross product associated with decreased crossing opportunities)*	>300,000	40
	200,000 - 299,999	35
	100,000 - 199,999	30
	60,000 – 99,999	25
	40,000 – 59,999	20
	30,000 - 39,999	15
	20,000 - 29,999	10
	10,000 – 19,999	5
	0 – 9,999	0
Safety		
Pedestrian Collision History *(Past history of pedestrian collision suggests unsafe conditions at location)*	≥1 collision	5
Road Class *(Higher road classification suggest fewer crossing opportunities)*	Collector	3
	Local	1
85th percentile speed (*Higher operating speeds associated with decreased safety/crossing opportunities)*	>50 km/h	5
	40 km/h – 50 km/h	3
	<40 km/h	1

Figure 4-3 – Speed vs. Severity[57]

Each location would be ranked based on the priority criteria and weighting as seen in **Table 4-5**. The total score for criteria/justification would be added up, giving a total score for Connectivity, Demand, and Safety for each location. The location(s) with a higher score would then be given a higher prioritization than location(s) with a lower score. **Appendix C** provides a detailed example using the prioritization table.

4.3.3 Enhanced Policy

A copy of the enhanced policy is provided in **Appendix C**.

4.4 Community Safety Zones

The proposed changes to the existing CSZ policy are discussed in the following subsections. **These proposed changes are intended to be used in the short-term only, until the long-term recommendation to conduct network screening can be implemented (refer to Section 4.4.4)**. The City of Richmond Hill is also considering adopting a blanket policy in addition to the warrant based noted below that would involve the implementation of CSZs on roadways fronting elementary and secondary schools, similar to the approach taken in York Region and the City of Toronto.

[57] Image Credit: Institute of Transportation Engineers (ITE)

4.4.1 Designated Area of Special Concern

Based on the jurisdictional scan, most municipalities considered implementing CSZ near schools, hospitals, retirement residences, playgrounds, and parks. In addition, some municipalities have additional considerations when implementing CSZ, such as neighbourhoods with cut-through traffic and roadways with bike facilities (e.g., bike lanes, multi-use paths). It is recommended that the City consider expanding the existing list of candidate locations to include the following:

- Hospitals
- Playgrounds and parks
- Residential neighbourhoods with cut-through traffic and
- Roadways with bike facilities (e.g., bike lanes, multi-use paths).

Additionally, since the pedestrian volume is already considered as a risk factor in Warrant 2, removing "high pedestrian traffic locations" from the candidate location criteria (Warrant 1) is recommended.

4.4.2 Risk Factors and Thresholds

Based on the jurisdictional scan and review of industry standards (e.g., *TAC Geometric Design Guide for Canadian Roads*), changes to the risk factors and adjustments to the thresholds are proposed.

Average Daily Traffic

In the existing scoring system, the lower and upper boundaries of the average daily traffic (ADT) are 5,000 vehicles per day and 10,000 vehicles per day.

TAC Geometric Design Guide for Canadian Roads provides a good reference on typical ADTs on urban roadways, as shown in **Table 4-6**.

Table 4-6 – Typical ADT on Local and Collector Roads – TAC Geometric Design Guide for Canadian Roads

Road Class	Residential	Industrial/Commercial
Local	500 to 1,000	1,000 to 3,000
Collector	1,000 to 8,000	1,000 to 12,000

In addition, based on the review of the City's ADT dataset[58], it was found that, on the City's roads where volume information is available, the 50th percentile (i.e., median)

[58] Only the data from 2018 and 2019 were included in the review – data before 2018 might be outdated, and date after 2020 might be skewed due to the COVID-19 pandemic.

ADT is approximately 3,000 vehicles per day, and the 85th percentile ADT is approximately 5,800 vehicles per day.

The City is recommended to revise the ADT range based on its ADT data, as shown in **Table 4-7**. These ranges can be further adjusted as new data become available.

Table 4-7 – Proposed Risk Scoring Matrix – Traffic Volume

Risk Factor	Risk Factor Scoring		
	High (score 3)	Moderate (score 2)	Low (score 1)
Average daily traffic	> 6,000	3,000 to 6,000	< 3,000

Pedestrian Volumes

In the existing policy, both Warrant 1 and Warrant 2 include pedestrian volumes. However, it is ambiguous how the pedestrian volumes should be collected – in Warrant 1, the criteria for pedestrian volume is "an average of 75 pedestrians/hour or more, for any 8 hours of the day", while in Warrant 2, the criterion is "pedestrian crossing in any 8-hours", and an 8-hour pedestrian volume of 75 or more is considered as "High". Based on the review of Ontario Traffic Manual (OTM) Book 12 and Book 15, it is our opinion that the **total** 8-hour pedestrian volume of 75 is a more reasonable threshold for "high" pedestrian crossing volume (since the hourly pedestrian volume of 75 is very likely high enough to warrant for a PXO or a midblock pedestrian signal).

The revised scoring matrix for pedestrian volumes is shown in **Table 4-8**.

Table 4-8 – Proposed Risk Scoring Matrix – Pedestrian Volume

Risk Factor	Risk Factor Scoring		
	High (score 3)	Moderate (score 2)	Low (score 1)
Pedestrians (crossing in any 8-hours	> 75	40 to 75	< 40

85th Percentile Speed

In the existing scoring system, the lower and upper boundaries of the 85th percentile speed (ADT) are 15 km/h over the speed limit and 20 km/h over the speed limit.

As shown in **Figure 4-4**, speed is the key factor that affects the severity of a collision involving vulnerable road users, where even a 5 km/h increase in speed could significantly increase the chance of fatal/injury. Therefore, the use of more conservative ranges for speeds is recommended.

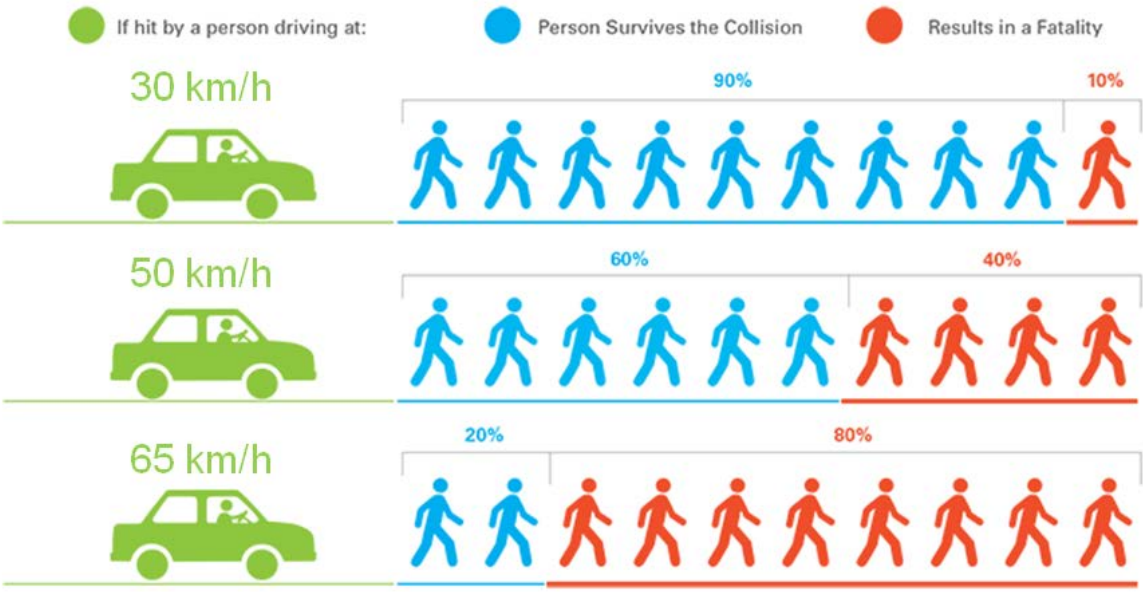


Figure 4-4 – Speed vs. Severity[59]

In addition, as most of the CSZ would have a posted limit of 40 km/h, it is recommended that the 85th percentile speed to be used directly as a risk factor, as shown in **Table 4-9,** instead of using the difference between the 85th percentile and the speed limit.

Table 4-9 – Proposed Risk Scoring Matrix – the 85th Percentile Speed

Risk Factor	Risk Factor Scoring		
	High (score 3)	Moderate (score 2)	Low (score 1)
85th percentile speed (km/h)	> 50	40 to 50	< 40

Presence of Bus Stops (Additional)

The presence of bus stops, especially in midblock segments, could create pedestrian crossing desire lines that encourage pedestrians to cross without right-of-way. And the presence of bus stop has been used as a risk factor in Region of Halton's CSZ network screening. Therefore, it is recommended that the presence of bus stops in the midblock segment be considered as an additional risk factor. The specific scoring thresholds for this risk factor are presented in **Table 4-10**Error! Reference source not found..

[59] Image Credit: Institute of Transportation Engineers (ITE)

Table 4-10 – Proposed Risk Scoring Matrix – Presence of Bus Stop

Risk Factor	Risk Factor Scoring		
	High (score 3)	Moderate (score 2)	Low (score 1)
Number of bus stops (in both directions) per km	> 4	2 to 4	< 2

Length of Sidewalk (To Be Removed)

Higher sidewalk coverage does encourage more pedestrian activity however, the amount of pedestrian exposure is already accounted for by pedestrian volumes risk factor. Therefore, removing the length of the sidewalk from the risk scoring matrix is recommended.

Number of Lanes (To Be Removed)

Most roadways under the City's jurisdiction are two-lane roads (i.e., one lane per direction), so the number of lanes is mostly likely irrelevant for the City when considering CSZ implementation. It is recommended that this risk factor be removed from this matrix.

Minimum Score

As shown in **Table 4-11**, due to the change in the number of risk factors from 8 to 7 (i.e., one addition, two removals), the minimum total points required to satisfy Warrant 2 is adjusted from 15 to 13.

Table 4-11 – Proposed Minimum Total Point Required

Warrant 2	Number of Risk Factors	Point Range	Min. Warrant Score
Existing	8	8 to 24	15 (62.5% of max. score)
Proposed	7	7 to 21	13 (61.9% of max. score)

4.4.3 Implementation Guidelines for CSZ

Some of the content listed in the Implementation Guidelines overlap with contents in other sections of the policy:

- Item (i) – CSZs should only be implemented for community based facilities such as schools, day-care centres, community centres, children's parks, retirement facilities or roadway sections with high collision rates and
- Item (vi) – The endorsement of the police department must be received by Council prior to designating any section of Municipal road or Regional road as a CSZ.

It is recommended that these guidelines be removed from this section of the policy.

4.4.4 CSZ Network Screening – Long-term

Network screening can not only identify the locations that are suitable for CSZ implementation but also prioritize the locations that would benefit the most from the CSZ implementation.

The network screening involves six main steps, which are summarized below:

- **Step 1: Create a Shortlist of Road Segments Adjacent to Sensitive Land Uses** - The candidate locations for the implementation of CSZs are those road segments in proximity to sensitive land uses such as schools, community housing, long-term care, parks, and outdoor playgrounds. Generally, these land uses generate trips involving vulnerable road users who are required to be protected against vehicular traffic subject to the presence of certain risk factors
- **Step 2: Identify and Evaluate Risk Factors** - This step further refines the shortlisted road segments by documenting the most common characteristics of locations with high collision frequencies (also known as risk factors):
  - Identifying risk factors requires detailed information from infrastructure datasets to determine initial characteristics that should be considered for the analysis depending on several factors, including their potential contribution to collision types of interest and the ability to gather them efficiently for all study facilities
  - The risk factor assessment then can be completed by reviewing the relationship between potential road characteristics and fatal and non-fatal injury collisions – different weights are assigned to risk factors based on their contribution to fatal and non-fatal collisions
- **Step 3: Calculate Risk Index for the Shortlisted Road Segments** – The ranking of high-risk road segments consists of identifying all selected risk factors present at each shortlisted road segment and assigning a higher priority to those road segments that present a higher number of risk factors
- **Step 4: Create Ranking Based on the Calculated Risk Indices**
- **Step 5: Create Ranking Based on the Expected Fatal and Non-Fatal Injury Collisions** and
- **Step 6: Create the Final Ranking** – the final ranking is a combination of the risked-based and collision-based rankings.

A copy of the final policy is provided in **Appendix D**.

4.5 Automated Speed Enforcement

The City is planning on implementing automated speed enforcement on roads in the City ranked high according to the Community Safety Zone network screening. Key implementation steps identified are:

- Assess and Define Operational Parameters and Cost Estimates for the ASE Program
- Develop Candidate Site Selection Criteria and Prioritization Methodology (refer to Community Safety Zone Network Screening)
- Enter Agreements with Processing Centre, MTO and ASE Equipment Vendor and
- Configure Road Network to Accommodate ASE.

4.6 Crossing Guard Procedure and Policy

The following enhancements to current City practices/policies have been identified based on input provided by CIMA+ in addition to conversations with City of Richmond Hill staff and are suggested to be adopted for use.

4.6.1 Pre-Selection Criteria and Minimum Thresholds

In view of the above, the City of Richmond Hill should adopt pre-selection criteria for crossing guard locations, only considering crossing guards at locations where:

- The associated school is intended for students between Junior Kindergarten and Grade 8 (i.e., up to elementary school)
- The requested location is within the walking boundary or within 1.5 km of the school
- Daily traffic volumes are less than 8,000
- There is no more than one lane of travel in each direction (on the free flow approach)
- The location is greater than 200 metres from another traffic control device (if free flow)
- There are no less than 20 assisted and unassisted elementary school children crossing at the candidate location over the school peak periods[60] and
- There are adequate sightlines (stopping sight distance according to the 2017 TAC *Geometric Design Guide for Canadian Roads*).

[60] Given the current difficulty to recruit crossing guards experienced by many Ontario municipalities, the minimum number of students has been increased from the City's current 5 to 50% of the OTC Crossing Guard Guide minimum of 40. This threshold may be refined with future updates to the City's Traffic Safety and Operations Strategy.

4.6.2 Adoption of the Ontario Traffic Council's School Crossing Guard Warrant

It is recommended that the City of Richmond Hill move towards adopting the Ontario Traffic Council's methodology for screening candidate locations for consideration in its crossing guard program, using either the Exposure Index method or the Gap Study method, depending on whether the candidate location is controlled or uncontrolled.

The Exposure Index requires a significant amount of data to be collected to develop the 85th percentile curve. As the City of Richmond Hill does not have its own values developed, the adoption of the Town of Oakville's values is recommended until the City can develop its own. The Town of Oakville is expected to have similar values to the City of Richmond Hill, given that it is a lower-tier municipality with almost the same population[61].

In the long term, the City should develop Exposure Index specific to locations within the City, by control type, for evaluating locations (signalized, all-way Stop control, IPS, PXO, roundabout or stop controlled on minor approach) using the Exposure Index method. Locations falling above the Exposure Index curve should be considered candidate locations for a crossing guard. If there are insufficient locations (i.e. less than twenty) within the City to accurately plot the Exposure Index, the City may wish to collaborate with neighbouring jurisdictions (i.e., combining data).

For uncontrolled crossing facilities, the City should use the Safe Gap Time approach to evaluate the need for a crossing guard.

4.6.3 Sign Placement

It is recommended that the City of Richmond Hill only install School Crossing and Crossing Ahead signs at mid-block locations or at Stop-controlled intersections on the major road (free-flow) approach. The City should review its existing locations to ensure conformance to this practice.

OTC School Crossing Guard Guide contains sample training manuals suitable for crossing guards. The City should provide enhanced training for crossing guards at locations where there are other types of traffic control and School Crossing / School Crossing Ahead signs are no longer provided. Additionally, at these locations, the City should install high visibility ('ladder') crosswalk markings on all approaches, oversize STOP signs, and secondary (left-side) STOP signs.

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[61] The City of Vaughan recently developed their own Exposure Index values; however it has a larger population than the City of Richmond Hill.

4.6.4 Consideration of Supplementary and Alternative Treatments

Before considering a crossing guard at a location, a site assessment should be undertaken to ensure:

a) That any existing deficiencies (geometry, signage, pavement markings, etc.) are corrected
b) Whether alternative treatments, such as permanent traffic controls, visibility improvements, etc. can mitigate the concerns that originated the request for a crossing guard and
c) The suitability of the location for a crossing guard, reviewing roadway elements such as sightlines and the condition of the pedestrian crossing facilities and related traffic control devices. The City should consider developing a checklist for evaluating the suitability of crossing guard locations, adapting their own version of the form found in **Appendix E**.

Where a school is located adjacent to a signalized intersection, the following treatments should be considered in conjunction with a crossing guard:

- Implementing Leading Pedestrian Intervals
- Prohibiting right turns on red
- Extending the pedestrian walk time and
- Ensuring that pedestrian countdown and information signs are installed at the intersection.

Where a crossing guard is being considered at a signalized intersection that is operated by the Region of York, staff should request that the Region of York consider the implementation of these measures.

4.6.5 New Schools, Public Inquiries and Annual Review

At all new schools, in the absence of any data, it is recommended that the City of Richmond Hill adopt a policy of implementing a crossing guard for one whole school calendar year, collecting data at the location to determine if the crossing guard is warranted, and then based on the outcome of the data collection making a decision to continue with a crossing guard or remove them. A new school is defined as a Public or Catholic school that is established at, or relocated to, a site where students (Junior Kindergarten through Grade 8) did not previously walk to and from.

It should be made clear to parents and the involved school boards that the decision to implement the school crossing guard is temporary and conditional upon reaching the City's minimal threshold together with the warranting conditions.

It is recommended that the City of Richmond Hill outline their pre-selection criteria and minimum thresholds on the City's website to ensure that members of the public are aware of the criteria used for considering a location for a crossing guard. A summary of the Exposure Index and Safe Gap Time methodology may also be posted on the website.

It is recommended that City conduct an annual review of all locations identified as part of public inquiries made in the previous year relating to the need for a crossing guard. In addition, the City should select a subset of existing crossing locations (10 recommended) to determine whether the location continues to be warranted. Emphasis should be put on locations previously identified as being close to not meeting the exposure index (i.e. either not having sufficient pedestrians or vehicular traffic).

For any locations outlined as part of the annual review that are deemed to be not suitable for a crossing guard due to lower student numbers, the City should coordinate with the public or Catholic school board regarding the removal of the crossing guard.

A copy of the City's enhanced policy for crossing guards is provided in **Appendix E**.

4.7 Traffic Data Collection

Traffic data can be collected in support of various initiatives throughout the City, including but not limited to, Traffic Impact Study (TIS), traffic volume and/or speed studies, intersection and roadway segment capacity analysis, parking studies, etc. Typically, traffic data are being collected for 4-hour, 8-hour, or 24-hour periods, and during weekdays, from Tuesday to Thursday, representing "normal" traffic conditions. The 4-hour traffic counts can be utilized to capture the peak hours, during AM and PM peak periods. The 8-hour traffic counts represent approximately 50% to 60% of the average daily traffic and provide a better understanding of traffic patterns, in the absence of 24-hour counts.

To capture the daily fluctuations in traffic conditions, it would be preferred to extend the data collection effort for more than one day. Other considerations include the following:

- Data must include hours with highest volumes during the day
- Data can be summarized per hour or preferably 15-min intervals and
- Data should be classified per vehicle type (e.g., cars, medium trucks, heavy trucks, buses), and following the Federal Highway Administration (FHWA)'s vehicle classifications.[62]

[62] Traffic Monitoring Guide. (2013). Federal Highway Administration (FHWA), UC Department of Transportation, Washington D.C.

Seasonal variations can have a major impact on the magnitude of traffic counts. Therefore, it would be preferred to collect the traffic counts during the season/period that represents peak traffic conditions. The list of count locations should be reviewed, and efforts can be divided in a sense to meet the following criteria:

- Counts near schools to be conducted during the Fall season
- Counts near outdoor recreational facilities, such as parks and playgrounds, should be conducted during the Summer season. Depending on the facility, the traffic counts might be more suitable to be collected during weekends, comparing to weekdays
- Counts near places of worship should be collected during specific days that may result in higher traffic counts (i.e., Sunday counts near churches) and
- Counts near GO Stations should be prioritized during Fall or Spring season to reflect commuter traffic.

The City should review the list of locations to assess the peak traffic season and schedule the traffic counts within those periods, if possible.

4.7.1 Multi-Year Traffic Count Program

To address the future transportation planning needs in the City, it is important to create a better understanding of the traffic flow patterns and growth rates, which is one of the essential components for many of the planning and design functions of the City. The availability and frequency of traffic data from Automatic Traffic Recorders (ATRs) and Turning Movement Counts (TMCs) play an essential role in accurate estimation of growth rates.

The City has provided the location of 388 counting stations in both Excel and kmz formats. Out of these 388 locations, 53 locations, including 30 intersections and 23 roadway segments, are being counted every year. Other locations are part of a 3-year count program, and each location is scheduled for counting once every three years.

For traffic growth estimations, the availability of annual traffic counts at each counted location would be an ideal scenario to capture the historical trends of traffic, and ultimately project the future growth. Given the availability of limited resources, the multi-year count program adopted by the City is following industry best practice[63] and is similar with programs implemented by other municipalities in Ontario.

Based on the 3-year count program, it is recommended to:

- Conduct a needs assessment to define the type of studies that would require traffic counts, and if needed, update the existing list of intersections and roadway segments, scheduled for traffic counts. As indicated in our proposal, a detailed

[63] Traffic Data Computational Method: Pocket Guide. (2018). Federal Highway Administration (FHWA), US Department of Transportation, Publication No. FHWA-PL-18-027

analysis would be needed to determine the optimum locations for the data collection program.

- While most intersections and roadway segments can be scheduled as part of the multi-year count program, certain locations would benefit from annual counting strategy to capture the variations in traffic volumes. For example, newly developed areas or areas planned for future development would experience a substantial increase in traffic volumes during early stages of development, comparing to developed areas. The lack of annual data in this scenario might result in overestimation of future growth rates for a long-term horizon. As such, the City should identify those locations that would require annual traffic counts. Other examples include locations near GO transit facilities, and locations with high fluctuations in historical traffic volumes and/or growth rates. Depending on the availability of resources and the number of count stations, the City can choose a certain number of locations where counts should be performed on an annual basis. Based on number of locations identified for annual counts, the City could investigate installing Permanent Count Stations (PCS) at those locations.
- For other candidate locations, the City can distribute the list of intersections and road segments spatially within each ward and temporally within the 3-year period to ensure a relatively even distribution of traffic counts within the City, as part of the count program. Considerations should be given to the preferred season for counting the selected locations, as discussed in Section 2. If needed, our team will be able to assist the City in selecting the count locations for each year and within each ward.

4.7.2 Growth Rate Estimation Techniques

Different approaches have been used to forecast future traffic growth. A preliminary review of the published literature revealed that traffic growth forecasting methodologies can be differentiated based on their data use and their forecasting techniques.[64, 65]:

- **Growth factor methods** are the most common approaches used to forecast traffic growth rates. These methods are fairly simple, easy to implement, and use count data that are routinely collected across the road network (e.g., ATR counts). However, the count-based methods rely heavily on the assumption that historical growth patterns will remain the same in the future, regardless of changes in demographic, land use, and other factors. Moreover, count-based methods are notoriously biased because of the limited sample size and low frequency of the counts. These limitations are repeatedly reported to result in unreliable traffic growth forecasts from the statistical point of view.

[64] Williams, T. A., Chigoy, B., Borowiec, J. D., & Glover, B. (2016). Methodologies used to estimate and forecast vehicle miles traveled (VMT), Texas A&M Transportation Institute, Texas
[65] Liu, F., Kaiser, R. G., Zekkos, M., & Allison, C. (2006). Growth forecasting of vehicle miles of travel at county and statewide levels. *Transportation research record*, *1957*(1), 56-65.

- **Econometric models** (regression models) on the other hand, can describe the relationship between traffic growth rate and its driving forces by capturing the correlation between the dependant variable (i.e., growth in traffic volume) and explanatory variables (e.g., demographic and socioeconomic factors). Examples include forecasting traffic growth rates in the state highway systems in New York[66] and Indiana[67], on county roads in Indiana[68], and in the state highway system in West Virginia[69]. A variety of independent variables have been tested in these studies, including major demographic, economic, land use, highway supply, and accessibility variables. It was found that different variables were significant for different road classifications. The most common variables that were found to be significant include population, households, employment, and roadway kilometers.

Considering the above discussion, the preferred approach would be to utilize the regression technique, which is proven to be more reliable compared to other available methods in the literature, to forecast the traffic growth rates. To initiate the modeling exercise, it is essential to acquire the required modelling data (such as ATRs, PCSs, socioeconomic data, demographic, land use, roadway network, etc.). Next, variety of regression model forms, including ordinary least squares (OLS), cross-sectional time series OLS, two-stage least squares, and geographically weighted regression (GWR) techniques can be tested. Separate models can be created for different roadway classifications. Currently, our team is undertaking a similar approach for development and implementation of traffic growth rate forecasting for the Region of Peel.

Given the scope of the above-noted regression modeling techniques, the City may wish to adopt the more common growth factor method, discussed earlier, that examines historical traffic growth trends through regression models applied to traffic volume data available from count stations. However, based on the limitations of this approach, the analyst's professional judgement would be needed to adjust the growth rates based on socioeconomic conditions.

4.7.3 Pedestrian and Cyclist Counts

Pedestrian and cyclist counts can be reported in conjunction with vehicular counts, as part of manual data collection process in the field. In addition to the manual process,

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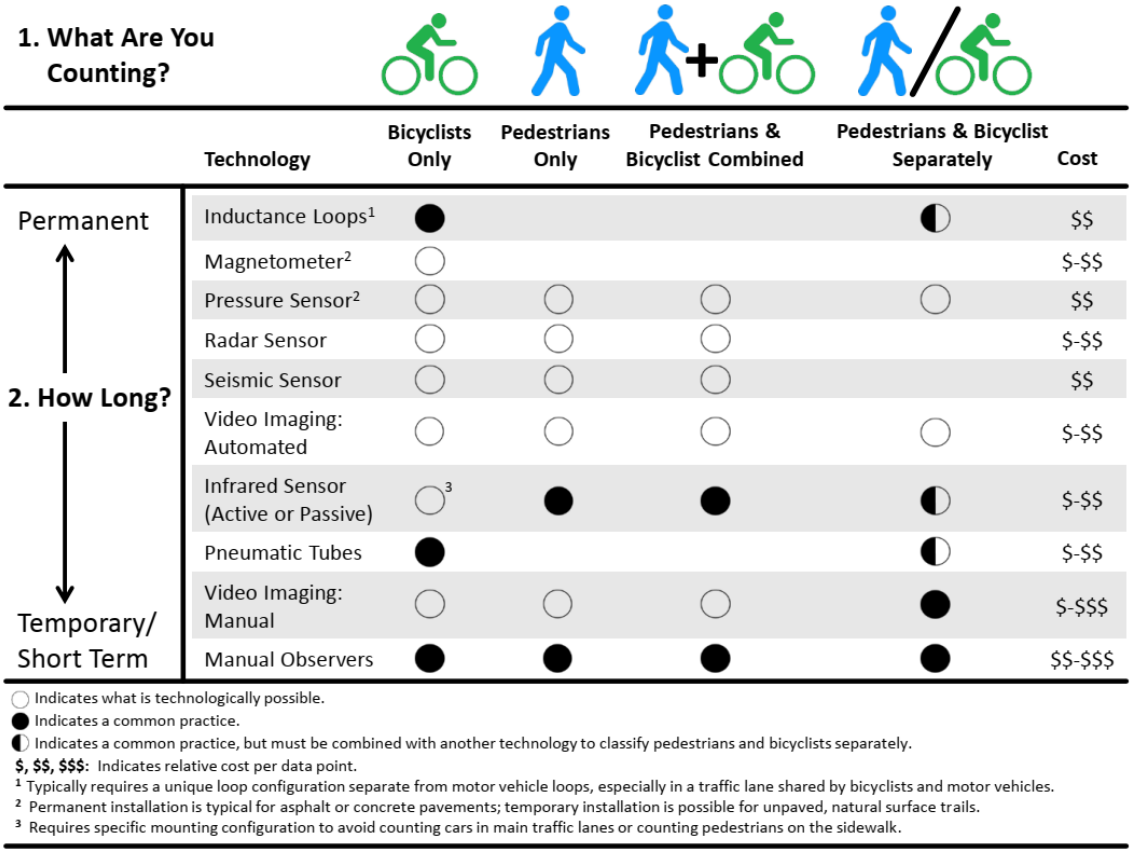
[66] Neveu, A. J. Quick-Response Procedures to Forecast Rural Traffic. In Transportation Research Record 944, TRB, National Research Council, Washington, D.C., 1983, pp. 47–53

[67] Saha, S. K., and J. D. Fricker. Traffic Volume Forecasting Methods for Rural State Highways. In Transportation Research Record 1203, TRB, National Research Council, Washington, D.C., 1988, pp. 10–26

[68] Mohamad, D., K. C. Sinha, T. Kuczek, and C. F. Scholer. Annual Average Daily Traffic Prediction Model for County Roads. In Transportation Research Record 1617, Washington, D.C., 1998, pp. 69–77.

[69] Iskander, W., M. Jaraiedi, and T. Thomas. Traffic Volume Projections in West Virginia and the I-81 Corridor. Final Report. West Virginia Department of Transportation, 1996.

there are a number of additional technologies, such as infrared beams and video cameras, that can be used to collect non-motorized volume data. **Figure 4-5** presents a simplified flowchart to assist road agencies in selecting various technologies for pedestrian and/or cyclist counts.[70]



	Technology	Bicyclists Only	Pedestrians Only	Pedestrians & Bicyclist Combined	Pedestrians & Bicyclist Separately	Cost
Permanent	Inductance Loops[1]	●			◐	$$
	Magnetometer[2]	○				$-$$
	Pressure Sensor[2]	○	○	○	○	$$
	Radar Sensor	○	○	○		$-$$
	Seismic Sensor	○	○	○		$$
	Video Imaging: Automated	○	○	○	○	$-$$
	Infrared Sensor (Active or Passive)	○[3]	●	●	◐	$-$$
	Pneumatic Tubes	●			◐	$-$$
Temporary/ Short Term	Video Imaging: Manual	○	○	○	●	$-$$$
	Manual Observers	●	●	●	●	$$-$$$

○ Indicates what is technologically possible.
● Indicates a common practice.
◐ Indicates a common practice, but must be combined with another technology to classify pedestrians and bicyclists separately.
$, $$, $$$: Indicates relative cost per data point.
[1] Typically requires a unique loop configuration separate from motor vehicle loops, especially in a traffic lane shared by bicyclists and motor vehicles.
[2] Permanent installation is typical for asphalt or concrete pavements; temporary installation is possible for unpaved, natural surface trails.
[3] Requires specific mounting configuration to avoid counting cars in main traffic lanes or counting pedestrians on the sidewalk.

Figure 4-5 – Flowchart for Selecting Nonmotorized Count Equipment

The commercial marketplace for nonmotorized traffic monitoring is still maturing. While several companies are still working to adapt their motorized traffic monitoring technology to accurately count bicyclists and pedestrians, others are selling nonmotorized traffic monitoring equipment for more than a decade, using video image processing techniques to count bicyclists and pedestrians.

Mobile devices with GPS and/or Bluetooth capabilities also provide a means to monitor small samples of bicyclist and pedestrian traffic. Several municipalities in North America are evaluating or using these technologies to gather route choice, origin-destination, and travel time data. However, these technologies alone cannot directly count the total volumes of bicyclists and pedestrians.

[70] Traffic Monitoring Guide. (2016). Federal Highway Administration (FHWA), US Department of Transportation

Fitness tracking apps may also provide additional information to jurisdictions regarding where bicyclist and pedestrian activity is occurring. Some care is needed when using these data due to the self-selection bias present from users having to opt-in to the tracking and only using for specific types of activities (e.g., fitness cycling rather than commuting).[71]

One of the biggest challenges in collecting accurate volume data is implementing a quality assurance process to ensure that counts are accurately recorded. Traffic volume for most roads is also based on sampling, which leads to estimates of volume on much of the road. As technology continues to develop and become more prevalent on the roads and in the vehicles, the accuracy will improve considerably. Additionally, pedestrian and bicyclist counts are more susceptible to higher variability due to their lower volumes thus, longer count durations are required for accurate data applications.

4.7.4 Archiving Traffic Data

Agencies responsible for traffic count program should systematically archived the collected traffic counts, and ensure the necessary details are preserved in a readily accessible format. An extended body of the literature on motorized and nonmotorized traffic count programs have focused on detailed steps for creating a centralized data archive and common formatting system.[72, 73, 74, 75] Overall, the following steps should be taken to create such an archive and associated functionalities:

- Review count data types, standard data formats, and existing online archives
- List primary functional requirements of the archive
- Define basic architecture for the archive and
- Detail the archive data structure.

In terms of archiving, the traffic data from ATRs, TMCs, or other resources can be stored in different ways. Typically, a central archival database of year / location / count stations can be created to save the collected counts. The database can be accessed by operators generating “reports” (for instance, daily volumes for weekdays in March, for a given set of ATR). These reports consist of database queries, which return the desired

[71] Carter, D., Gelinne, D., Kirley, B., Sundstrom, C., Srinivasan, R., & Palcher-Silliman, J. (2017). Road Safety Fundamentals: Concepts, Strategies, and Practices that Reduce Fatalities and Injuries on the Road (No. FHWA-SA-18-003). United States. Federal Highway Administration. Office of Safety
[72] Nordback, K., Tufte, K. A., Harvey, M., McNeil, N., Stolz, E., & Liu, J. (2015). Creating a national nonmotorized traffic count archive: process and progress. Transportation research record, 2527(1), 90-98.
[73] Erhardt, G., Schmitt, D., Hoque, J., Chaudhary, A., Rapolu, S., Kim, K., & Weller, S. (2020). Traffic forecasting accuracy assessment research. National Cooperative Highway Research Program NCHRP Report 934. Transportation Research Board, 10, 25637.
[74] Waller, S. T., Kockelman, K. M., Sun, D., Boyles, S., Lin, D. Y., Ng, M., & Wang, X. (2008). Archiving, sharing, and quantifying reliability of traffic data (No. FHWA/TX-09/0-5686-1).
[75] Bauer, J., Margiotta, R. A., & Pack, M. L. (2016). Applying Archived Operations Data in Transportation Planning–A Primer (No. FHWA-HOP-16-082). United States. Federal Highway Administration.

data. Missing or suspect data can optionally be replaced by interpolated or estimated data at this stage as well.

The archiving system should be designed with maximum future flexibility in mind, including the ability to handle data from multiple detector technologies with ease. To facilitate this, all incoming data can be preprocessed into a common form, indicating the following information:

- Location ID
- Location Description
- Coordinates
- Count Date
- Source of Data (e.g., ATR, TMC, PCS)
- Type of Count (e.g., vehicular, pedestrian, cyclists) and
- Duration of Count (e.g., 4-hr, 8-hr, 24-hr).

To design a flexible and efficient way of archiving traffic data, PostgreSQL, as an open-source relational database can be utilized. Alternatively, the traffic data could be geo-coded using GIS application, which can streamline the process of accessing traffic counts for different studies. As new data becomes available, the database and GIS file can be updated. The GIS file can also be shared with public as part of a potential Open Data initiative, similar to the platform implemented by Durham Region[76].

4.7.5 Application of Big-Data in Traffic Counting Program

In the past few years, emerging wireless communication technologies and the widespread use of mobile devices and in-vehicle navigation systems provide the opportunity to automatically obtain travel time and speed information over a wide spatial area at significantly lower cost than using dedicated sensors. Currently, several vendors are able to utilize the probe data from mobile phones and GPS devices to provide the travel time and speed data with high level of accuracy and sample size. Despite these recent advancements, currently, none of the vendors in the market can truly replicate the traffic counts, generated from traditional count stations, such as loop detectors, ATRs, and PCSs. StreetLight Data, a Big Data analytics company based in San Francisco would provide an estimation of traffic counts, such as TMCs. For the year 2020, the traffic volume estimation approach was tested and validated using over 2,500 permanent counters, in four provinces of British Columbia, Alberta, Manitoba, and Nova Scotia. While the actual and estimated AADT values were found to be highly correlated, the Mean Absolute Percentage Error (MAPE) was reported to be as high as 25% for locations with lower volume (i.e., AADT of less than 500).[77] In addition, the report

[76] Traffic Volume Counts, Traffic Engineering and Operations, Durham Region, https://maps.durham.ca/TrafficCounts, Accessed 28 March 28, 2022
[77] StreetLight AADT 2020 Methodology and Validation White Paper. (August 2021). Streetlight Insight (link),

acknowledges the lack of local traffic counts from Ontario and Quebec in the validation process, which could be perceived to have different errors, compared to the ones reported for other provinces. In fact, a direct comparison between the collected traffic volume data from selected intersections in the City and the estimated counts from StreetLight revealed a substantial difference between the two values, and in some cases, as high as 400% to 800%.

In addition to the above, StreetLight collaborated with the Federal Highway Administration (FHWA) and 18 State Department of Transportations (DOTs) and academics to evaluate how Big Data can greatly reduce AADT costs to State DOTs and improve coverage of up-to-date counts.[78] AADT estimations were evaluated across a wide range of roadway classifications and locations throughout all 48 States. For roads between 500 and 2000 AADT, the results of the probe data estimation technique were not conclusive. As such, the report indicates that individual states may wish to look at their local results for decisions in implementation.

Overall, there is still substantial work involved to generate an accurate traffic volume estimation. Additional contextual information, such as census demographics, environmental, and roadway characteristics, are needed, as well as a machine learning model in order to obtain the best estimate. Given the existing shortcoming of the traffic volume estimation techniques, it is recommended to collect the traffic data using the traditional count stations within the City.

4.8 Road Safety Public Awareness and Education Program

The following enhancements to current City practices/policies have been identified based on information obtained through the literature review and jurisdictional scan in addition to conversations with City of Richmond Hill staff and are suggestions that can be adopted for use.

4.8.1 Active School Travel Program

The York Region Active School Travel Program is led by York Region Catholic District School Board, and York Region District School Board, and includes York Region Public Health, York Regional Police, and the City as major stakeholders. The York Region Program and the Toronto Program provide examples of how these agencies can promote road safety within the framework of promoting safe and active transportation to schools.

[78] Non-Traditional Methods to Obtain Annual Average Daily Traffic. (2021). Federal Highway Administration, Publication No. FHWA-PL-21-030

Richmond Hill staff should encourage stakeholders within the Public and Catholic School Boards to initiate the Active School Travel Program within local schools and work alongside School Board staff to identify approaches to improve school safety. The City has recently begun to promote active transportation at specific schools through mobile signs that link to the City's Active School Travel web page. This effort will continue into 2023 and complement other efforts the City makes to improve school travel awareness and conditions, including social media sharing and targeted enhancement of trail winter maintenance. A copy of these mobile signs is provided in **Appendix F**.

One specific way that City of Richmond Hill staff can encourage School Board staff to proactively identify safety issues is by encouraging them to conduct their own audits by providing them with materials (e.g., NHTSA walkability and bike-ability checklists)[79]. These checklists are very straightforward and are written with a layperson in mind. In addition, City staff may wish to provide a sample School Traffic Management Plan such as the one completed by the Toronto District School Board.

4.8.2 SLOW DOWN Lawn Signs

The City of Richmond Hill may consider permitting interested residents to display SLOW DOWN lawn signs on their property, if they do not create any obstruction or hazard for road users. SLOW DOWN lawn sign programs have been adopted in other Ontario municipalities and residents of Richmond Hill have often requested them. It should be emphasized that the signs are for public education purposes only and there is no evidence that they reduce speeds.

Establishing clear guidelines will provide controls over the use of these types of signs, allowing for a consistent message and placement, as well as ensuring consistent enforcement of City by-laws. It is recommended that the SLOW DOWN lawn signs:

- Only be placed directly on or in front of the resident's property
- Not obstruct sight lines for pedestrians, cyclists, micromobility users, or drivers
- Not be installed on a building, structure, post, pole, tree or bush
- Be set-back a minimum of 0.6 m from the curb or the edge of the road
- Be installed within 15 metres of any traffic control devices (i.e. signal or stop sign)
- Not obstruct any road, ditch, median, traffic island, sidewalk, bicycle path or multi-use trail
- Be placed 3 metres or more from a fire hydrant and

[79] Walkability Checklist - https://www.nhtsa.gov/sites/nhtsa.gov/files/walkingchecklist.pdf and Bikeability Checklist - https://www.nhtsa.gov/sites/nhtsa.gov/files/bikabilitychecklist1.pdf

- Be inserted into the ground using wire frame only.

Furthermore, City staff may request that the sign be removed or relocated for any reason based on engineering judgment.

One sign is to be provided per household with the exception of corner lots where two signs (one on each side of the property) may be provided. To eliminate the risk of sign clutter, the minimum spacing between adjacent SLOW DOWN signs should be 50 metres.

Signs are not to be modified in any way (i.e. adding reflective tape). They must be maintained and replaced if damaged or cannot stay secured into the ground.

Finally, it is recommended that the City adopt a sign format similar to the City of Toronto sign (shown here) and only permit one particular type of sign (i.e. SLOW DOWN). It is preferred as the colour and style of font is quite different from the style (in terms of font and colour scheme) used in signs in the Ontario Traffic Manual, therefore there is no ambiguity that the sign could be confused with a regulatory or warning sign. Other types of signs (i.e. signs with alternative messages) should be removed.

4.8.3 Road Watch programs and committees

In the short term, it is recommended that the City continue to support the York Regional Police Road Watch program by promoting the program on the City's website and through the work of the City's Road Watch Committee. City staff should continue to play an active role in supporting the work of this committee, providing Committee members with updates on City programs and policies (such as work being conducted as part of the Traffic Safety and Operations Strategy) and encouraging Committee support and involvement in other road safety public awareness and education programs, such as the Active School Travel Programs, SLOW DOWN lawn signs and development of a calendar of road safety events as discussed in Section 4.4.

In the long term, consideration might be given to expanding the scope of City's Committee of Council to also more explicitly consider elements of the City's transportation master plan, namely active transportation and micromobility. Many municipalities have active transportation committees, and this would be an opportunity to achieve both the Road Safety mandate and further goals within the transportation master plan as they relate to active transportation (which is frequently about safety for vulnerable road users).

Also in the long term, it is recommended that the Road Watch Committee undergo a name change, while preserving the Road Watch function, to reflect a possible broader

scope. This could help to further goals of the City as they relate to sustainable transportation.

4.8.4 Calendar of road safety events

A final recommendation for City staff is to adapt the MTO's annual Road Safety Calendar for City use. This could involve:

- Adapting the MTO Road Safety Calendar on the City's website
- Liaising with provincial and national groups and initiatives listed in the calendar that promote road safety to gain a better understanding of current initiatives at the provincial and national level and
- Promoting different safety initiatives throughout the year (i.e. Canada Safe Driving Week) on the City's website and encouraging the City's Road Watch Committee to do the same through community events (scaled to the local level).

A copy of the enhanced policy for Road Safety Public Awareness and Education is provided in **Appendix F**.

4.9 Road Safety Programs

This section identifies enhancements recommended for the City of Richmond Hill relating to network screening, in-service road safety reviews, systemic safety analysis and conflict analysis.

4.9.1 Network Screening

It is recommended that the City of Richmond Hill implement network screening within the City on their City on their arterial, collector roads and select local roads[80] by developing Safety Performance Functions following the Empirical Bayes Method[81]. Based on the network screening, the City can then identify sites with a higher potential for safety improvement (PSI). In the context of the York Traveller Safety program, there is an opportunity to share information and collaborate with other lower-tier municipalities within the Region using the York Region's Traffic Data Warehouse. This project should be repeated every five years.

[80] Roads that are formally classified as locals but, in practice, are very similar to collectors and/or are used as cut-through routes to avoid Regional Roads. Some examples in Richmond Hill include Sunset Beach Road, Regatta Avenue, Ashfield Drive, Don Head Village Boulevard, Castle Rock Drive, Harding Boulevard (east of Yonge) / Lennox Avenue/Ruggles Avenue, and Arnold Street/Hopkins Crescent/Elmwood Avenue.

[81] The City has some streets that are classified as locals, but in practice they are very similar to collectors and/or are used as cut-through routes to avoid Regional Roads.

4.9.2 In-Service Road Safety Reviews

It is recommended that the City of Richmond Hill develop a program to conduct in-service road safety reviews at top ranked locations in the City on an annual basis (5 to 10 locations per year recommended). This will allow the City to identify deficiencies and associated treatments based on an in-depth office review and field investigation.

4.9.3 Systemic Safety Analysis

It is recommended that the City of Richmond Hill implement a systemic road safety evaluation within the City, collecting and assembling necessary data for the same roads for which network screening is conducted, identifying risk factors and assigning to sites, identifying and ranking sites with one or more risk factors and then identifying systemic safety treatments. In the context of the York Traveller Safety program, there is an opportunity to share information and collaborate with other lower-tier municipalities within the Region using the York Region's Traffic Data Warehouse. This project should be repeated every five years.

4.9.4 Conflict Analysis

It is recommended that the City of Richmond Hill establish criteria for recommending video conflict analysis at specific sites, in the context of in-service road safety reviews and/or complex traffic inquiries. The criteria should include considerations for timing and the duration of the analyses. It should be noted that this type of review tends to be more costly and, as such, the use of this technique should be reserved for select sites that meet certain criteria. The above will provide the City with standardized criteria for assessing the need for conflict analysis as a supplementary tool for conducting in-service road safety reviews and /or reviewing complex traffic inquiries.

4.9.5 Traffic and Parking Enhancements

CIMA+, together with City of Richmond Hill staff also identified a set of enhancement practices relating to traffic and parking relating to the following:

- STOP Sign Visibility Enhancements
- Crosswalk Markings
- ‘Nearly Warranted’ All-Way-Stop-Control Intersections
- Conversion from All-Way-Stop-Control to Minor-Road-Stop-Control
- Intersection Sight Distance
- PXOs at Roundabouts
- School Zones
- Directional Dividing Line Markings

- Parking Restrictions Retrofitting and
- Oversize Parking and Stopping.

Appendix G contains detailed information on each of the above, including:

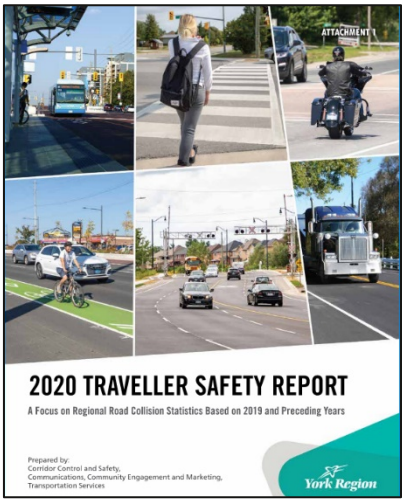
- Background
- Target issue
- Engineering/best practice
- Policy/implementation criteria and
- Implementation considerations.

4.10 Annual Performance Report Templates

The City requested that CIMA+ prepare recommendations for an annual performance report template that would be used (using a data-driven and evidence-based approach) to measure the City's performance in addressing safety and operations. CIMA+ worked with City staff to prepare and deliver annual performance report templates for the City's road network. Synergies with the Region's annual report and the TES reporting function were considered. Aside from reporting on safety-related statistics (i.e., collision and speed data), measures related to program delivery were reviewed. In addition, the use of software programs such as Power BI (to display and present statistical information) were explored.

4.10.1 Synergies with Region's annual collision report / TES reporting function

The Region's Annual Traveller Safety Report examines collisions on Regional roads in the municipalities of Aurora, King, Markham, Newmarket, Richmond Hill, Vaughan, East Gwillimbury, and Georgina based on parameters such as the time of day, the impact type, the location, and the severity of collisions. The primary objectives of the Region's Annual Traveller Safety Report are to:



- Identify overall collision trends on the Regional road network
- Benchmark road safety (as compared to other jurisdictions and in previous years)
- Aid Regional staff in making decisions about how to implement safety programs and
- Provide a means of reporting on the state of road safety and work on safety programs to key stakeholders and the public.

It is proposed that the City of Richmond Hill (the City) create a companion Annual Traveller Safety Report to present information on collisions that occur within their

jurisdiction. Similar to the Region's report, the primary objective of this report would be to identify collision patterns and trends in traveller behaviour.

Alternatively, as a result of the Region’s Traveler Safety Strategy project, the City may explore the opportunity to simply provide the collision data to the Region, who would compile the report for Regional and Local roads across all local municipalities or give the Region authorization to use City data through the traffic data warehouse they are developing.

The City of Richmond Hill uses the TES software platform for managing their collision data. The TES software can be used for statistical analysis. The TES software has statistical techniques for locating a site-specific collision patterns. The statistical procedures comprise a variety of methodologies for network screening to identify a site's potential for safety enhancements and the collision types that are overrepresented at that site. The analyses help to identify the collision patterns that need to be addressed at study intersections and study corridors. To better understand the collision risk, cross-tabulation can be used to look more closely at the collision attributes that are high or statistically overrepresented.

The City should explore the opportunity to report safety performance and program delivery statistics jointly with York Region and with other local municipalities, using a consistent format across the Region. This is expected to be developed as part of the York Region Traveler Safety Plan project that was initiated in October 2022 and will be completed throughout 2023, as well as the soon-to-be launched the York Region’s Traffic Data Warehouse.

The following information can be considered by the City for inclusion in its safety performance/program delivery reports.

4.10.2 Safety Related Statistics

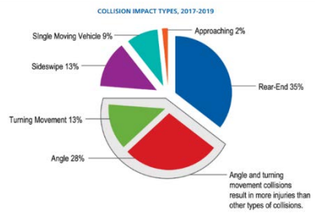
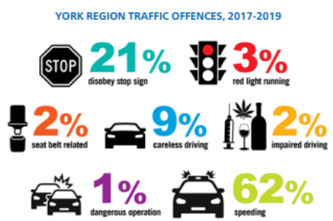
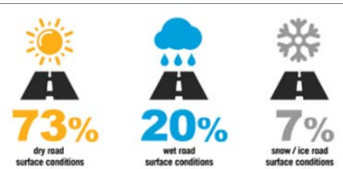
The following section outlines safety-related statistics that may be included in the City's companion Annual Traveller Safety Report if the City chooses to develop one, otherwise it is recommended that the City request this information continue to be included in the Region’s Annual Traveller Safety Report.

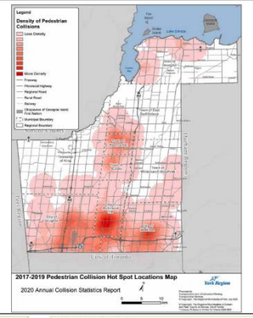
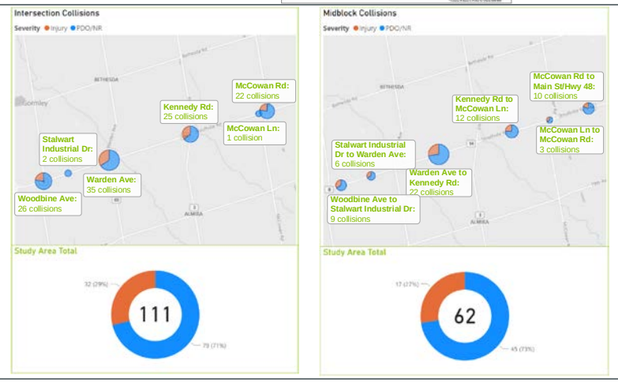
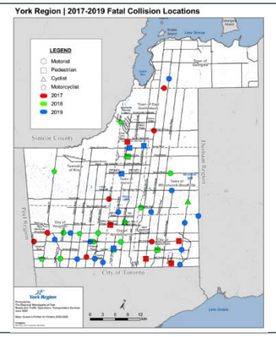
Collisions

The Region's Annual Traveller Safety report is very comprehensive as it contains a wealth of information on a wide variety of collision trends displayed in charts, graphs and maps. It is recommended that the City follow a similar format as the Regional report, although the City should focus on a subset that conveys key metrics.

Table 4-12 lists those key items recommended to be included in the annual performance template relating to collisions. The recommended collision performance metrics focus on the assessment of annual collision history on all intersections and road segments across the City to create a better understanding of the underlying collision patterns (e.g., severity distribution), road user trends (e.g., involvement of vulnerable road users), environmental factors (e.g., road conditions), temporal factors (e.g., time of day) and spatial correlation (e.g., proximity to schools).

Table 4-12 – Annual Performance Measures

Category	Data	Example Display Type	Value to City
Overall Collision Data	Severity Distribution	• Pie chart displaying annual collision classification (i.e. property damage only, injury and fatal) • Bar chart displaying collision classification over time	Shows the overall distribution of collisions by severity and annual trends
	Comparison of Provincial, Regional, and City collision frequency/rate	• Line graph displaying provincial, regional, and City collisions annualized per population	Allows for benchmarking of City collisions to regional and provincial rates
	Collisions by Road User Modes	• Pie chart displaying the annual proportion of pedestrian, cyclist, motorcycle, transit, truck, and vehicle collisions • Bar graph displaying the yearly frequency of pedestrian, cyclist, motorist, transit, truck and vehicle collisions • 'Odometer' style graphics showing road users province-wide, Regionally, and within the City expressed as a rate per 10,000 population (see graphic on the right) 	Shows collisions by road user modes and annual trends Comparison to provincial and regional statistics
	Collision Impact Type	• Pie chart showing the distribution of collisions by impact type 	Shows the initial impact type leading to collisions
	Collisions by Traffic Offenses	• Graphic showing the overall distribution of collisions by traffic offences 	Shows offences associated with collisions
Vulnerable Road Users	Pedestrians, Cyclists, Motorcyclists	• Bar chart displaying yearly occurrence of vulnerable road user collisions	Shows collisions involving vulnerable road users
Environmental Factors	Light, Weather, Road Surface Conditions	• Graphic showing the lighting, weather and road surface conditions 	Displays the environmental factors present at the moment of collisions
Temporal Factors	Yearly, Seasonal, Monthly, Weekly, Time of Day Distribution	• Yearly collisions (bar chart) • Seasonal (winter, spring, summer, fall) • Weekday (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday)	Shows temporal trends (yearly, seasonal, weekdays, time of day)

		• Time of day (Hour of occurrence)	
Spatial Correlation	Location of Pedestrian, Cyclist Collisions	• Spatial distribution of pedestrian and cyclist collisions using GIS 	Used to identify 'hotspot' where pedestrian and cyclist collisions have occurred Used to help prioritize future locations of PXOs and/or crossing guards
	Intersection and Midblock Collisions	• Spatial distribution of intersection and midblock collisions using GIS 	Used to visualize spatial distribution of collisions
	Top Collision Locations	• Map displaying annual top ten collision locations or top ten collision locations over an extended period of time	Used to identify collision 'hotspots'
	Fatal Collision Locations	• Map displaying location of fatal collisions by specific type 	Used to identify collision 'hotspots' where fatal collisions have occurred

Comparison with Other Jurisdictions

The City of Richmond Hill's annual collision data can be compared to collision data from York Region and other Ontario municipalities. For this comparison, publicly available collision data from other jurisdictions, such as total collisions, injury collisions, pedestrian collisions, and cyclist collisions, can be used. In **Table 4-13**, for instance, statistics on population and collisions for York Region, Markham, and six other municipalities with various populations are summarized for the 2014 to 2018 study period.

Table 4-13 – Sample Comparison with Other Jurisdictions

Municipality	Population (Census 2016)	Total Collisions	Injury Collisions	Pedestrian Collisions	Cyclist Collisions
Markham	328,966	4,397	1,080	192	111
Burlington	183,315	6,576	907	118	132
Oakville	193,830	5,890	679	110	135
London	383,822	39,023	5,508	826	554
Hamilton	536,915	41,582	8,727	1,284	885
Brampton	593,638	19,552	2,880	679	314
Ottawa	934,240	71,055	13,427	1,676	1,360
York Region	1,109,909	39,778	10,526	815	509

Speed

The City of Richmond Hill maintains a spreadsheet with speed data gathered from various locations. For each corresponding location, the spreadsheet displays the mean speed, 85th percentile speed, and excess speeds (i.e., the difference between the 85th percentile speed and the speed limit). Excess speeds, defined as the difference between the 85th percentile speed and the posted speed limit, are used to rank locations. This information can be highlighted in the Annual Traveller Safety Report for the City. **Figure 4-6** below shows an annual comparison of speed data collected by the City of Richmond Hill for the 85th percentile speed as compared to the posted speed of the road.

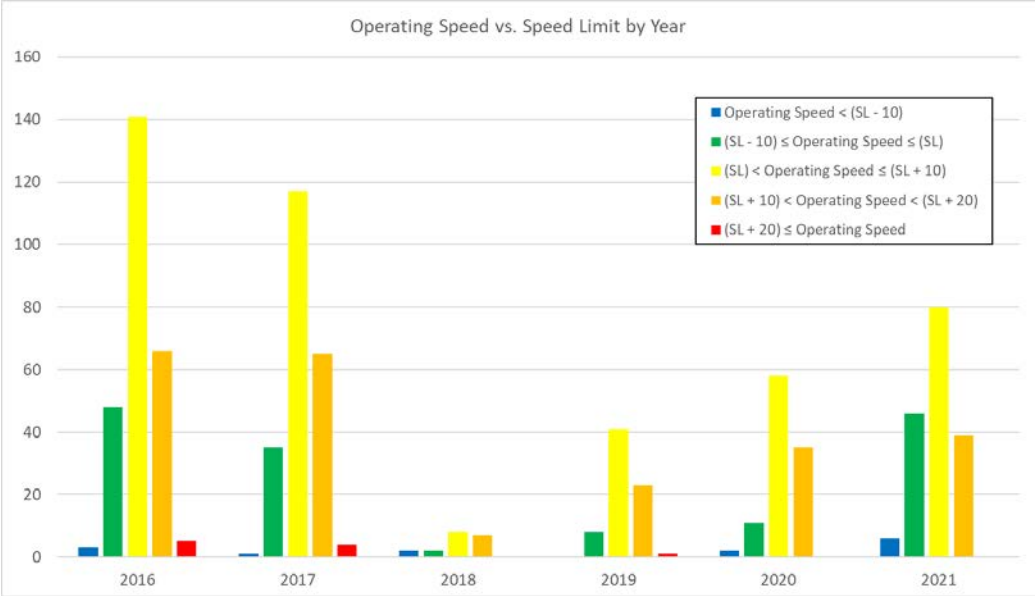


Figure 4-6 – Comparison of 85th Percentile Speeds to Posted Speeds (2016 – 2021)

4.10.3 Program delivery statistics

The City has a number of programs currently underway or proposed to be implemented as a result of the TSOS project. **Table 4-14** presents metrics that can be reported on in the Annual Traveller Safety Report to showcase the work completed in the Traffic Operations and Safety Group or can be more informally tracked internally by staff. Further details on these programs are provided in the corresponding technical memos for each procedure/program.

Table 4-14 – Suggested Program Delivery Statistics

Metric	Data
Speed management and traffic calming program	
Posted speed limits	• Number of road sections where changes to posted speed were implemented (i.e. 50 km/h to 40 km/h) in a given year
Network screening of traffic calming candidate locations	• Ranked list of candidate locations for traffic calming (with related metrics such as speed data, volume, road classification, land use, vulnerable road user facilities and collision data) in a given year
Before-after pilot studies	• Before and after operating speeds at study locations • Before and after collision data at study locations
Traffic calming locations	• List of locations where traffic calming has been implemented with details on treatments implemented in a given year

Metric	Data
Pedestrian crossovers	
Network screening of PXO candidate locations	• Annual ranked list of candidate locations for future PXOs
PXO installations	• List of locations where PXOs were installed in a given year
School crossing guards	
Crossing guard locations	• School crossing guard locations installed in a given year at new schools • School crossing guard locations installed in a given year at existing schools • School crossing guard locations removed in a given year at existing schools
Community safety zones	
CSZ locations	• New CSZ locations implemented in a given year
Traffic data collection	
Counts	• Number of locations where TMC data was collected in a given year • Number of locations where ATR data was collected in a given year • Number of locations where pedestrian and cyclist count data was collected in a given year
Road safety public awareness	
Lawn Signs distributed	• Number of lawn signs distributed
School safety audits	• Yearly update on staff involvement in school safety audits
Road safety programs	
Traffic and parking enhancements	• Stop sign visibility enhancement installations in a given year • Parallel crosswalk installations in a given year • Ladder crosswalk installations in a given year • All-way Stop control installations/removals in a given year • School zone installations in a given year • Centreline installations in a given year

Metric	Data
Systemic road safety	• Annual ranked list of locations with recommended treatments[82]
Network screening	• Annual ranked list of locations with PSI score[82]
In-service road safety reviews	• Details on completed in-service road safety review in a given year • Implementation details
Video conflict studies	• Details on video conflict studies and outcomes

4.10.4 Software programs for displaying and presenting information

The City may consider creating dynamic and interactive inquiry maps with geolocating features, such as ArcGIS and Microsoft Power BI, to visually present collisions in the Annual Traveller Safety Report. The dynamic collision maps would be linked to the Excel tracking sheet in real-time to incorporate new collisions. TES may have the capability to develop these once the City's data is housed in the Region's warehouse.

The collision maps would be able to visually present the data from the Excel tracking sheet and would be highly customizable to:

- Show the number of collisions at intersections and midblocks in the form of a bubble, where the size of the bubble reflects the number of collisions
- Show/hide certain types of collisions (e.g., by date, severity, location type, weather etc.) and
- Show the distribution of collisions along the City's road network.

This tool would also allow for identifying areas where numerous collisions occur for these areas, the City might want to start a study to look at and address the problems collectively rather than individually (i.e., a neighbourhood study).

Figure 4-7 shows a screen capture from the York Regional Police Road Safety Map, which displays collisions in the Region using ArcGIS. This map can be recreated to show collisions in the City of Richmond Hill.

[82] Since this type of review is typically repeated only every 5 years, locations that have been treated in a given year would be removed from the following years' lists.

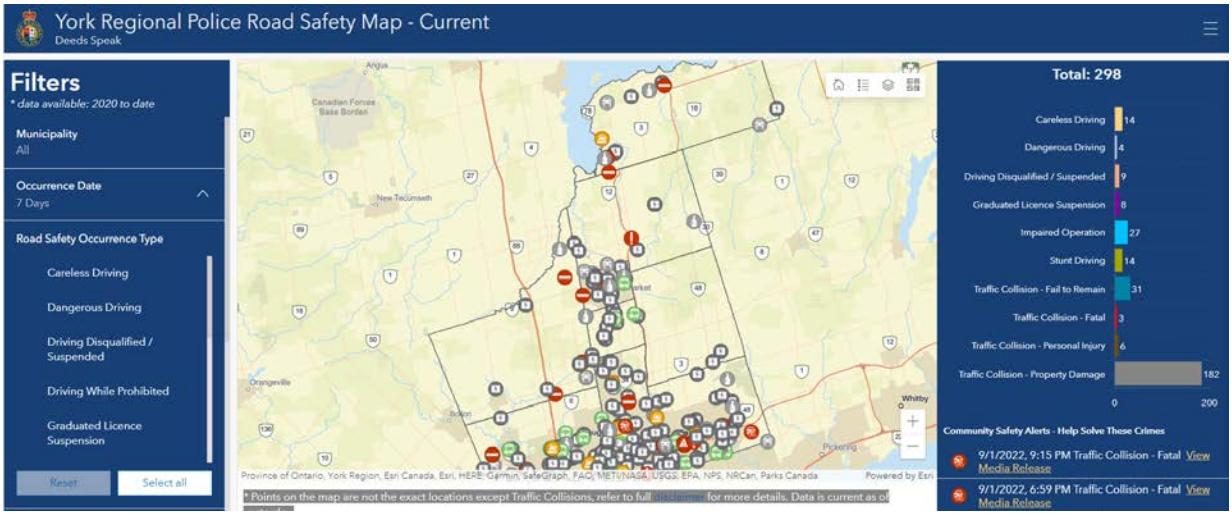


Figure 4-7– York Region Road Safety Map (Created using ArcGIS)

As a value-add, software programs such as Microsoft Power BI can also be used for record-keeping as it can also be customized to display detailed information on the collision as long as the information is stored in a consistent format in a database (e.g., the Excel tracking sheet). For example, this software can be used to display the location of and status of public inquiries in a visual manner. Dynamic and interactive inquiry maps using software programs with geolocating features such as ArcGIS and Microsoft Power BI. The dynamic inquiry maps would be linked to the Excel tracking sheet to reflect changes in real-time (e.g., status changes to existing inquiries, new inquiries, etc.).

4.11 Resources and Reference Materials

Finally, City staff together with CIMA+ staff identified a list of resources and reference materials that TSOS staff should have on hand when undertaken their day to day work as it relates to traffic safety and operations. A copy of this list is provided in **Appendix H**.

5 RECOMMENDATIONS FOR FUTURE PROJECTS, PROGRAMS AND INITIATIVES

A set of policies, projects, programs and initiatives were identified as a result of the work undertaken in the development of the Traffic Safety and Operations Strategy, representing 48 separate recommendations. These recommendations are summarized below in **Table 5-1**, grouped by category. Additional stakeholders that would be impacted by the recommendations is also indicated.

Table 5-1 – Summary of Recommendations

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
Inquiry Review Process	Traffic Inquiry Prioritization Tool	● Prioritize public inquiries in accordance with priority matrix (in consideration of inquiry type and whether a specific event occurred)	● Allows City staff to prioritize inquiries in a consistent manner, manage workload and workflow internally	-
	Traffic Inquiry Geolocating Tool	● Develop dynamic and interactive inquiry maps using software programs with geolocating features such as ArcGIS and Microsoft Power BI (linked to City's Excel spreadsheet)	● Allows inquiries to be visually displayed spatially	-
	Public Inquiry Web App	● Develop a web-based app to collect public inquiries that is linked to a database	● Allows inquiries to be received in a more consistent manner ● Can be linked to City's existing Excel tracking sheet	Access Richmond Hill
Traffic Data Management	Refinements to Data Collection Periods and Seasons	● Implement refinements to data collection periods and locations	● Align City's methodologies for data collection with best practice	-
	Traffic Count Program Needs Assessment	● Implement further refinements to data collection periods and seasons ● Determine optimal locations for the count program ● Develop conversion factors for time of day, day of week and month	● Improve City's understanding of traffic flow patterns and growth rates ● Ensure adequate spatial and temporal coverage to provide high-quality input for other projects and programs	-
	Expand Pedestrian and Cyclist Count Program	● Explore and adapt different technologies for collecting pedestrian and cyclist counts	● Improve City's understanding of pedestrian and cyclist activity on the local road network ● Application for PXO	-

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
			and crossing guard warrants	
	Development of Growth Factors	● Develop growth factors using the common growth factor method	● Improve City's understanding of traffic flow patterns and growth rates	-
Speed Management	Speed Limit Policy	● Establish base speed limits throughout City, including area speed limits (40 km/h or 50 km/h)	● Consistent approach to posting speeds	Public Works Operations York Regional Police
	Traffic Calming Toolbox	● Adopt traffic calming toolbox for the selection of treatments for locations identified as suitable for traffic calming	● Selection of treatments based on operating speeds, collision performance and cross section of roadway	Infrastructure Delivery Public Works Operations Asset Management York Regional Police Fire and EMS
	Before-After Studies	● Before-after study determining effects of traffic calming implementation based on performance indicators	● Insight into effectiveness of traffic calming measures implemented	-
	Network-wide Speed Limit Review	● Evaluate need for adjustments to base speed limits on collector roads and 'grid' local roads ●Identify streets suitable for Area Speed Limits	● Refinements to base speed limits based on industry practice	Public Works Operations York Regional Police
	Speed Data Collection for Traffic Calming Network Screening	● Collect speed data on all collector roads and 'grid' local roads, as needed to supplement data collected through the City's regular count program	● Required data for network review of base speed limits	-
	Traffic Calming Network Screening	● Establish a formal process for identifying candidate locations for traffic calming based on speed, collision performance and other factors	● Approach to selecting candidate locations for traffic calming that is objective and defendable	Infrastructure Delivery Public Works Operations Asset Management York Regional Police Fire and EMS
	Long-term Speed Limit Monitoring	● Monitor locations within new subdivisions or existing roads with a significant change in land use or function	● Continued surveillance of locations that may require speed limit adjustments	Public Works Operations York Regional Police
Automated Speed Enforcement	Prepare for Implementation of Automated Speed Enforcement	● Assess and Define Operational Parameters and Cost Estimates for the ASE Program ● Develop Candidate Site Selection Criteria and Prioritization Methodology (refer to Community Safety Zone Network Screening)	● Ensures that City is fully prepared for the implementation of ASE technology	Community Standards Public Works Operations York Regional Police

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
		● Enter Agreements with City of Toronto, MTO and ASE Equipment Vendor ● Configure Road Network to Accommodate ASE		
	Automated Speed Enforcement	● Implement ASE at Community Safety Zones and School Zones	● Enforcement of appropriate operating speeds	Community Standards Public Works Operations York Regional Police
Pedestrian Crossovers	PXO Implementation	● Continue with existing implementation of PXOs	● Continuity until medium term project can be implemented	Infrastructure Delivery Public Works Operations Asset Management
	Review and Prioritization of PXO Candidate Locations	● City wide review to identify candidate locations collect necessary data to apply warrant ● Ranking of candidate locations based on connectivity, demand and safety	● Systematic review across entire City ● Data will be used to prioritize locations ● Objective means of prioritizing locations	Infrastructure Delivery Public Works Operations Asset Management
Road Safety Programs	Network screening	● Collect and assemble necessary data ● Develop Safety Performance Functions (SPFs) ● Conduct Network Screening using Empirical Bayes Method ● Identify sites with higher Potential for Safety Improvements (PSI)	● Develop ranked list of priority locations within City based on potential for safety improvement	-
	Systemic road safety evaluation	● Collect and assemble necessary data ● Identify risk factors and assign to sites ● Identify and rank sites with one or more risk factors ● Identify systemic safety treatments	● Develop ranked list of priority locations within City based on risk factors ● Identify treatments best suited to address risk factors	-
	Conflict Analysis	● Based on a jurisdictional / industry scan, establish criteria for recommending video conflict analysis at specific sites, in the context of in-service road safety reviews and/or complex traffic inquiries. Include considerations for timing and duration of analyses	● Standardized criteria for assessing the need for conflict analysis as a supplementary tool for conducting in-service road safety reviews and/or reviewing complex traffic inquiries	-
	In-service Road Safety Reviews	● Develop and implement a program to conduct in-service road safety reviews at top ranked locations in the City (5 locations per year assumed)	● Identify deficiencies and associated treatments based on in depth office review and field investigation	-

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
	STOP Sign Visibility Enhancements	● Adopt policy relating to the use of STOP AHEAD signs, additional left hand side signs, oversize STOP signs and tiger-trial signs ● Compile and maintain STOP sign compliance database to determine 85th percentile compliance rate	● Enhanced and consistent approach to the implementation of STOP sign visibility improvements	Public Works Operations Engineering Subdivisions
	Crosswalk Markings	● Adopt policy relating to the use of crosswalk markings	● Enhanced and consistent approach to the implementation of crosswalk markings	Public Works Operations Engineering Subdivisions
	All-way STOP Sign Warrant	● Adopt policy relating to nearly warranted all-way STOP signs	● Flexible criteria relating to the use of All-way STOP sign controls compared to OTM warrants	Public Works Operations Engineering Subdivisions
	Conversion from All-way STOP Minor Road STOP Control	● Adopt policy relating to conversion of all-way STOP sign warrant to minor STOP control	● Standardized procedure for converting all-way STOP sign warrant to minor STOP control	Public Works Operations
	Intersection Sight Distance at Local Road Intersections	● Adopt policy relating to intersection sight distance requirements at local road intersections	● Flexible criteria and standardized procedure for evaluating the need for sightline improvements at local road intersections	Public Works Operations Risk Management
	PXOs at Roundabouts	● Adopt policy relating to the use of PXOs at City roundabouts	● Standardized procedure for use of PXOs at City roundabouts	Public Works Operations Engineering Subdivisions Asset Management
	School Zones	● Adopt policy relating to the use of School Zone signing near schools	● Standardized procedure for use of School Zones	Public Works Operations York Regional Police York Region District School Board York Catholic District School Board
	Directional Dividing Lines	● Adopt policy relating to the use of directional dividing line delineation	● Standardized procedure for use of directional dividing line delineation	Public Works Operations Engineering Subdivisions
	On Street Parking Regulations Retrofitting	● Adopt policy relating to implementing parking regulations across the City, restricting on-street parking based on cross section width, transit, and land use in accordance with City	● Standardized procedure for implementing on-street parking regulations	Public Works Operations Community Standards

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
		Standards and Specification Manual		
	Oversize Parking Regulation Signs	● Adopt policy relating to allowing the use of oversize NO STOPPING and NO PARKING signs	● Standardized procedure for use of oversize NO STOPPING and NO PARKING signs	Public Works Operations Community Standards
	City Standards and Specifications Updates	● Integrate the following items into the City Standards and Specifications so that staff, designers and developers are aware of new policies that affect design, including: - STOP sign visibility considerations - Crosswalk and directional dividing line marking criteria - Widening of curb ramps - All-way STOP warrant criteria - PXO requirements at roundabouts - Parking regulation requirements - Traffic calming measures	● Expedite design process by reducing the amount of reviews to correct elements not in accordance with new policies	Infrastructure Delivery Engineering Subdivisions
School Crossing Guards	School Crossing Guard Warrant	● Use pre-selection criteria for identifying candidate crossing guard locations ● Use modified Exposure Index for warrant (in addition to Gap Study) ● Implement additional sign, pavement marking and pedestrian improvements as per revised policy at crossing guard locations	● Use of warrant and implementation guidance that is customized to City needs and based on current engineering practice	Public Works Operations York Region District School Board York Catholic District School Board
	School Crossing Guard Annual Review	● Conduct annual reviews to identify new candidate locations or to confirm continued need for crossing guards	● Continued and consistent application of policy	Public Works Operations York Region District School Board York Catholic District School Board
	Refine School Crossing Guard Exposure Index	● Develop local exposure index based on Richmond Hill data (or in combination with other municipalities in York)	● Use of local Exposure Index that accounts for local traffic patterns	-
Community Safety Zones	Community Safety Zone Warrant	● Revised warrant for establishing Community Safety Zones	● Immediate use of revised warrant that is customized to City needs	Public Works Operations York Regional Police
	Community Safety Zone Network Screening	● Conduct network screening to identify candidate locations for Community Safety Zones	● Ranked list of candidate locations best suited for Community Safety Zones	Public Works Operations York Regional Police

Category	Recommendation	Description	Benefit to City	Stakeholders Impacted
	Community Safety Zone Implementation	● Implement CSZs at top ranked locations	● Implementation of CSZs based on network screening ranking	Public Works Operations York Regional Police
Public Awareness and Education	Continue to Support Active School Travel Program	● Continue to support program and distribute walkability and bike-ability checklists	● Collaboration with School Boards and local schools	York Region District School Board York Catholic District School Board
	SLOW DOWN lawn sign program	● Establish criteria for launching SLOW DOWN lawn sign program	● Consistent use of SLOW DOWN lawn signs	Communications Community Standards
	Road Watch Program	● Continue to support York Regional Police Road Watch program and local Road Watch committee and raise awareness of road safety public awareness and education road programs	● Continued support of existing program	-
	Calendar of Road Safety Events	● Develop an integrated Region/City calendar as part of York Region Traveller Safety Strategy	● In collaboration with Region and other local municipalities ● Increased awareness of regional and provincial safety events	Communications
	Expansion of Road Watch Committee Mandate	● Broaden Road Watch Committee mandate to consider City's Transportation Master Plan, specifically active transportation and micromobility	● Broaden scope for committee	-
Administration	Resource and Reference Materials Library	● Assemble a digital library and obtain / purchase copies of provincial (MTO), national (TAC) and international (FHWA, AASHTO) manuals on traffic safety and operations	● Ensures that staff are using resources and reference materials that represent best practice	-
	Traffic Safety and Operations Project & Program Delivery Report	● Use enhanced annual performance template to report on accomplishments of Traffic Safety and Operations staff	● Uniform and consistent approach to reporting on Traffic Safety and Operations accomplishments	-
	Annual Traveler Safety Report	● Contribute collision data to Region's for their use in Annual Traveler Safety Report	● Consistent approach to reporting on City's collision performance and comparator to other municipalities	-
	Transportation Data and Assets GIS Database	● Develop Open Data platform that would include traffic data and assets such as signals, PXOs, crosswalks, school crossings, traffic calming treatments. This would be integrated with York Data Warehouse as much as possible.	● Open data platform acts as a resource for external stakeholders.	-

Table 5-2 summarizes the recommendations identified for the future policies, projects, programs and initiatives, grouped by category. It should be noted that these costs are assumed to be in addition to services currently provided by the group. Design and construction staff will require their own budgets.

Table 5-2 – Summary of Recommendations by Broad Category

Category	Number of Recommendations	Short Term	Medium Term	Long Term
Inquiry Review Process	3	-	$40,000	-
Traffic Data Management	4	-	$65,000	$20,000 (every 5 years) for development of growth factors
Speed Management	7	-	$70,000 $20,000 – Annually (4)	$20,000 – Annually (4)
Automated Speed Enforcement	2	-	$520,000 (1) $120,000 (2)	$520,000 (1)
Pedestrian Crossovers	2	-	$45,000	$45,000 (every 5 years) for review and prioritization of PXOs
Road Safety Program	15	-	$100,000 $50,000 - Annually (3)	$50,000 - Annually (3) $45,000 (every 5 years) for network screening $40,000 (every 5 years) for systemic road safety evaluation
School Crossing Guards	3	-	-	-
Community Safety Zones	3		-	-
Public Awareness and Education	5	$25,000 (5)	-	-
Administration	4	$2,500	$20,000	-

Notes:

1. Annual cost of program
2. First year would include an additional $30,000 per camera for initial setup
3. $50,000 would be budgeted annually for in-service road safety reviews
4. $20,000 would be budgeted annually for before-after studies relating to traffic calming projects

Cost for pilot ‘Slow Down Lawn Sign Program’. Additional medium to long-term costs may apply depending on the success of the program

Table 5-3 and **Figure 5-1** illustrates the timeline for the next ten years (green for short term, blue for medium term and orange for long term) showing the annual budget and the associated additional resources (full time staff equivalent staff – FTE) required to

undertake the work identified in the Richmond Hill Traffic Safety and Operations Strategy. City staff have indicated that they will require 1 or 2 FTE positions by the end of the program.

Table 5-3 – Year and Budget[83]

Year	Budget
2024	$67,500
2025	$350,000
2026	$90,000
2027	$70,000
2028	$70,000
2029	$70,000
2030	$220,000
2031	$90,000
2032	$70,000
2033	$70,000

[83] Excludes budget for Automated Speed Enforcement (ASE). If the City proceeds with the implementation of ASE, the assumed costs for 4 cameras are $640,000 for the first year and $520,000 per year for subsequent years. These values assume no cost offsets from speeding ticket revenues. City staff are currently working on defining Operational Parameters and Cost Estimates for a potential ASE Program.

Figure 5-1 – Timeline, Budget and Associated Resources[84]

[84] **Note:** Excludes budget for Automated Speed Enforcement (ASE). If the City proceeds with the implementation of ASE, the assumed costs for 4 cameras are $640,000 for the first year and $520,000 per year for subsequent years. These values assume no cost offsets from speeding ticket revenues. City staff are currently working on defining Operational Parameters and Cost Estimates for a potential ASE Program. An additional 0.50 FTE staff is also expected to be required annually.
The above costs do not include costs associated with implementation of traffic calming treatments.

A

Appendix A – Jurisdictional Scan Matrix

Programs	Jurisdiction Specific Policy			Usage of Industry Standard			Not Practiced/Not Applicable	Notes
	Developed And Endorsed By Council	Developed Not Endorsed	Developed As Working Draft	Endorsed By Council	Not Endorsed	Conducted Ad Hoc		
Inquiry Review Process								
Policy for Responding to Public/Council Inquiries Relating to Safety/Operations	N O L	Mi Ot	W	V	Ma	Y R	B C	
Speed Management								
Overall Speed Management Policy	N C W L	Ma				O Y W R	V B Ot	
Speed Limit Policy	V Mi Y W L Ot			B Y	R	Ma O C W	N	
Traffic Calming Policy (Process for Determining Candidate Locations for Traffic Calming)	N O B Mi C L Ot R			V M	Ma	Y		
Automated Speed Enforcement	O C W L		Ot	Y M		W	V Ma N B Mi R	
Traffic Calming Treatments								
Traffic Calming Design Toolbox (Suite of Approved Traffic Calming Treatments for Use in Municipality)	O Mi Y L Ot		N	V M	Ma	C	B R	
Pilot Projects (Before-After Studies)	N L	Mi	O	Y		Ma C M Ot	V B R	
Warrants								
All-Way Stop Sign Control	N O B Mi C L Ot R			V Y M	Ma	W		Richmond Hill - Industry Standard has been updated twice since endorsing
Traffic Signals	Mi Y W L Ot			V Y	Ma O R	N B C		
Roundabouts	W L R	Ot		V	O Mi	Ma Y C	N B	Richmond Hill - In process of developing a standard through City standards update project
Crossing Guards	N O Mi L Ot R			V B C	Ma		Y W	Industry standard has been updated since endorsing
Sidewalks / Multi-Use Pathways	V Ma N B C L Ot R	B		O	Mi		Y W	B Developed & Endorsed Sidewalks, B Developed not Endorsed Multi-Use Pathways
Cycling Facilities	V Mi C W L Ot	Ma		O B		N W R	Y	Richmond Hill - Endorsed by Council (Transportation Master Plan) but done ad hoc
PXO Policy	O Y W L			Y	Ma Mi Ot R	V B C W M	N	
Data Management								
Traffic Count Program (Turning Movement Counts, ATR Counts, Vehicle Classification)			O C Ot R		Mi	Ma N Y W M	B	
Pedestrian and Cyclist Count Program			O C Ot		Mi	Ma N O Y W M	B R	
Speed Data Collection Program			O C Ot R		Mi	Ma N Y W M	V B	
Road Safety Programs								
In-Service Road Safety Reviews	C				Mi Ot	Ma N O Y W R	V B	
Road Safety Audits (New/Modified Roads)		Ma Ot			Mi	N O Y W R	V B C	
Fatal and Serious Injury Investigations			Ot		V Mi	Ma N O Y W	B C R	
Toolbox of Typical Countermeasures (Suite of Approved Treatments for Use in Municipality)	N		Ma		Mi Ot	O Y W	V B R	
Collision Network Screening	Ma C		O		Mi Ot	B Y W	V N R	
Systematic Approach to Road User Safety (Proactive Program Considering Risk Factors)	Ma				Mi Ot	O Y W	V N B C R	
Multi-Modal Level of Service Evaluations	Ot				Mi	O Y W	V Ma N B C R	
Road Safety Public Awareness and Education programs								
Safe Routes to School		V	N O	B	Ma Mi	C	Y W Ot R	Richmond Hill - City supports York Region school boards
Safety Campaigns	V N O		Ma Ot		Mi	Y W R	B C	
SLOW DOWN Lawn Signs	V N O B M	Mi	Ot			Y	Ma C W R	Richmond Hill - No input from TOSS group
ROAD WATCH Committee	N				Mi	R	V Ma O B Y C W Ot	
Resources and Reference Materials								
Library of Guides and Manuals	V	O	Ot		O Mi	R	N Y W	
Other (City of Vaughan/City of Richmond Hill only)								
Parking or Stopping Prohibition Request				V		R		Included in the Traffic Engineering Procedures Manual
Pavement Marking Requests				V		R		Included in the Traffic Engineering Procedures Manual
Pavement Marking Applications Tender				V		R		Included in the Traffic Engineering Procedures Manual
Speed Compliance Program					V			Included in the Traffic Engineering Procedures Manual
Pedestrian Signals	R			V				Included in the Traffic Engineering Procedures Manual
Paid permit On-Street Parking in Residential Areas	R							CW(WS)0124_18_1_Adopted January 2018
Community Safety Zone	R							Adopted January 2000_will be updated through new policy study commencing in late 2022
Traffic Safety in School Zones						R		https://www.vaughan.ca/services/residential/transportation/Pages/School-Zone-Safety.aspx
Other - York Region								
Community Safety Zones	Y							The original warrant criteria was developed in 2003 (still valid for non-school zones), with Regional Council changing the policy to designate all school zones as Community Safety Zones without the need for an assessment in 2012

B

Appendix B – Speed Management, Speed Limit Policy, Traffic Calming Policy, Pilot Projects and Traffic Calming Toolbox

Figure B-1 illustrates the process for setting base speed limits and conducting a network review of posted speeds in a flow chart, with four major components:

- Set base speed limit
- Collect speed data
- Network review of speed limits and
- Continuous monitoring.

Figure B-2 illustrates the process for conducting a traffic calming program, with four major components:

- Traffic calming location selection/systemic network screening
- Developing a tiered approach to implementing traffic calming
- Public input and
- Before-after studies and pilot studies.

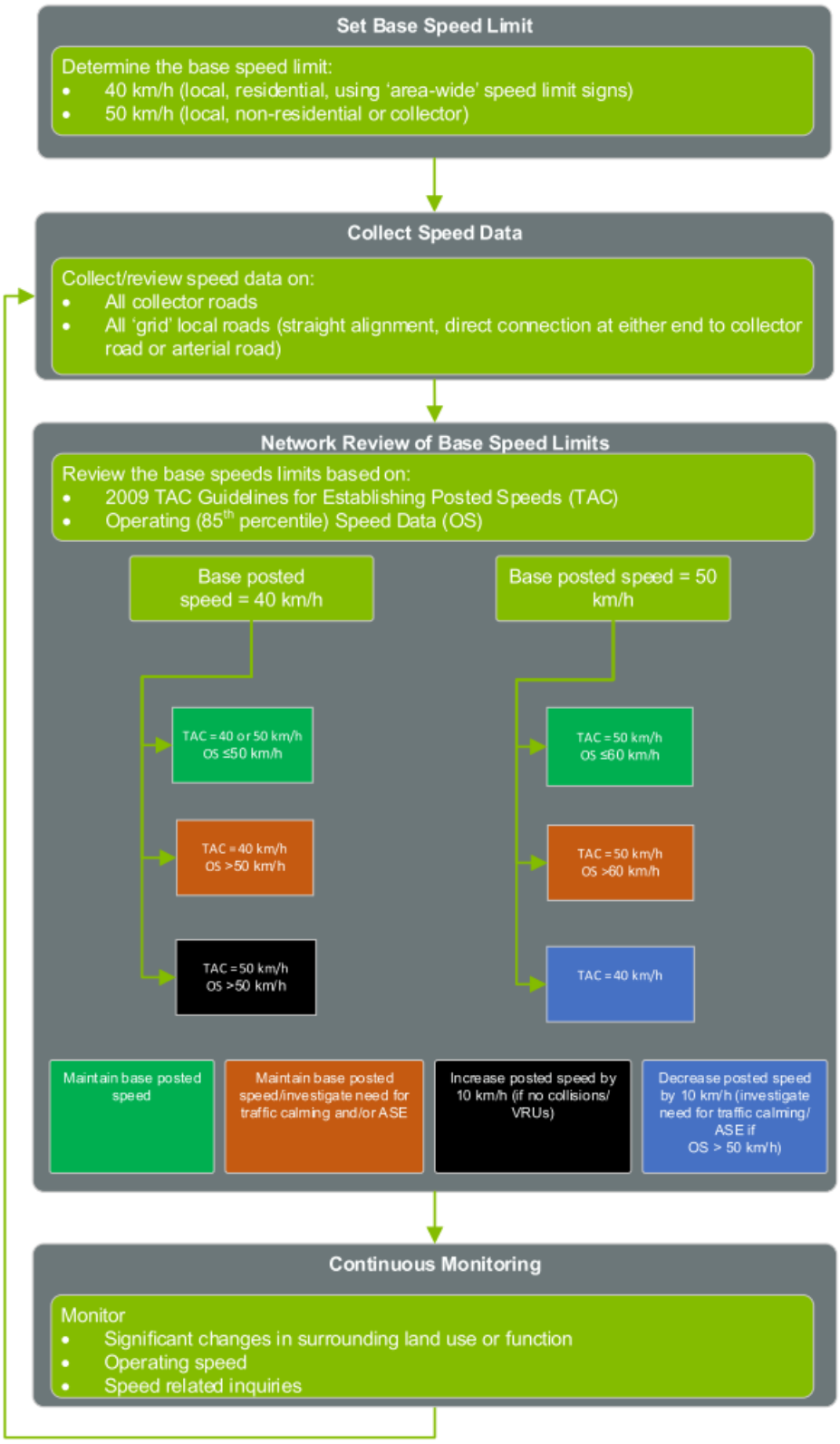


Figure B-1: Speed Management / Selection of Posted Speed Limits

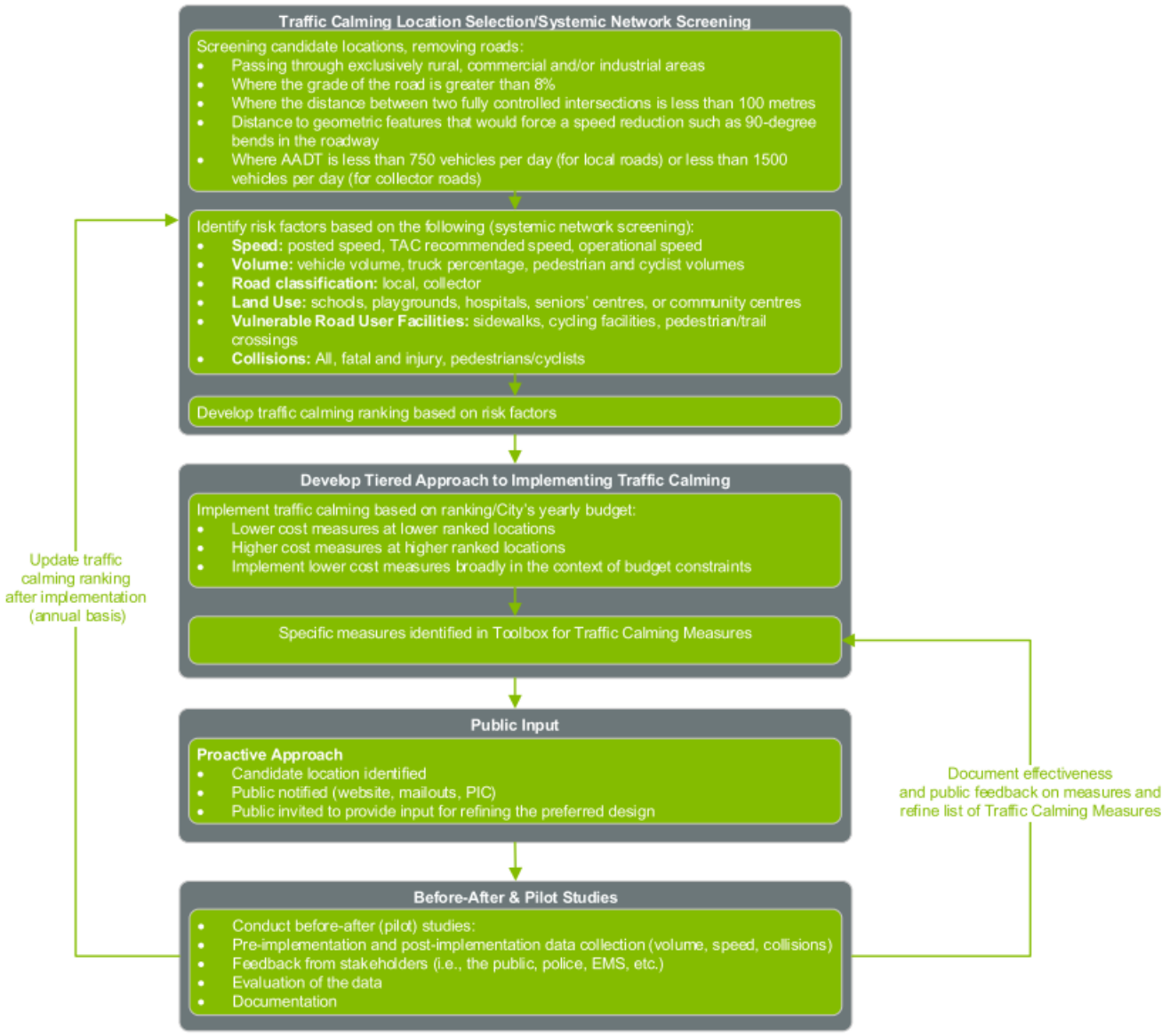


Figure B-2: Traffic Calming Program

Traffic Calming Toolbox – Additional Reference Information

The selection of lane narrowing measures combination is mainly based on the number of lanes, pavement width, and presence of transit operations.

The pavement width ranges for each lane narrowing measures combination are calculated based on the minimum and maximum width of each cross-section element as listed in **Table B-2,** along with a reference as applicable. **Table B-3** provides a summary of the estimated unit costs (i.e., cost per km) of the lane narrowing measures. **Table B-4** shows pavement width requirements for different combinations of traffic calming measures.

Table B-2: Pavement Width Information for Lane Narrowing Measures

Cross-section	Elements	Required Pavement Width		
		Min.	Max.	Reference
Travel Lane	Through lane	3.0m	3.3m	The City's Standard and Specifications Manual
	Curb lane (without transit)	3.0m	3.5m	
	Curb lane (with transit)	3.3m	3.5m	
Centre Measure	Centreline	-	-	-
	Raised Median	1.5m	4.0m	Min: TAC Traffic Calming Guide Max: based on the available right-of-way, but typically less than 4.0m
Curb Measure	Edge lines	-	-	-
	Urban shoulder	1.2m	2.0m	Min: OTM Book 18 Max: OTM Book 18
	Bike lane (conventional)	1.5m	1.8m	
	Bike lane (buffered)	1.8m	2.8m	
	Bump outs/Curb Extensions	2.0m	2.5m	Min: TAC Traffic Calming Guide Max: City Standard (for parking lane)
	Parking lane	2.0m	2.5m	The City's Standard and Specifications Manual
	Parking lane (buffered)	2.6m	3.5m	Min: OTM Book 18 Max: OTM Book 18

Table B-3: Cost Information for Lane Narrowing Measures Combination

Lane	Narrowing Measure	Cost per KM	Cost Reference
Centre	Centreline	$6,000	Based on the information provided by local contractors
	Raised Median Islands	$54,000	Assume spacing of 250m (i.e., 4 islands every 1 km, and $13,500 per island) Average cost from *Costs for Pedestrian and Bicyclist Infrastructure Improvements*[85]
Curb	Edge lines	$6,000	Based on information provided by local contractors
	Urban shoulder	$6,000	
	Bike lane (conventional)	$7,000	
	Bike lane (buffered)	$20,000	
	Bump outs/Curb Extensions	$52,000	Assume spacing of 250m (i.e., 4 pairs every 1 km, and $13,000 per pair) Average cost from *Costs for Pedestrian and Bicyclist Infrastructure Improvements*
	Parking lane	$2,000	Based on information provided by local contractors
	Parking lane (buffered)	$15,000	

[85] Document source: https://www.pedbikeinfo.org/cms/downloads/Countermeasure%20Costs_Report_Nov2013.pdf

Table B-4: Pavement Width Lookup Table

Lane Narrowing Measure	Cost per km	Speed Reduction Effectiveness	Pavement Width Range							
			2-lane without transit		2-lane with transit		4-lane without transit		4-lane with transit	
			Min	Max	Min	Max	Min	Max	Min	Max
Centreline	$6,000	Low: 0-5 km/h	6.0	7.0	6.6	7.0	12.0	13.6	12.6	13.6
Centreline + Edge lines	$18,000	Low: 0-5 km/h	6.0	7.0	6.6	7.0	12.0	13.6	12.6	13.6
Raised Median Islands	$54,000	Moderate: 5-10 km/h	7.5	11.0	8.1	11.0	13.5	17.6	14.1	17.6
Raised Median Islands + Edge lines	$66,000	Moderate: 5-10 km/h	7.5	11.0	8.1	11.0	13.5	17.6	14.1	17.6
Centreline + Bump outs/Curb Extensions	$58,000	Moderate: 5-10 km/h	8.0	9.5	8.6	9.5	14.0	16.1	14.6	16.1
Centreline + Parking lane (one side)	$8,000	Moderate: 5-10 km/h	8.0	9.5	8.6	9.5	14.0	16.1	14.6	16.1
Centreline + Urban shoulders	$18,000	Low: 0-5 km/h	8.4	11.0	9.0	11.0	14.4	17.6	15.0	17.6
Centreline + Bike lanes (conventional)	$20,000	Low: 0-5 km/h	9.0	10.6	9.6	10.6	15.0	17.2	15.6	17.2
Raised Median Islands + Bump outs/Curb Extensions	$106,000	High: 10+ km/h	9.5	13.5	10.1	13.5	15.5	20.1	16.1	20.1
Raised Median Islands + Parking lane (one side)	$56,000	High: 10+ km/h	9.5	13.5	10.1	13.5	15.5	20.1	16.1	20.1
Centreline + Bike lanes (buffered)	$45,700	Moderate: 5-10 km/h	9.6	12.6	10.2	12.6	15.6	19.2	16.2	19.2
Raised Median Islands + Urban shoulders	$66,000	Moderate: 5-10 km/h	9.9	15.0	10.5	15.0	15.9	21.6	16.5	21.6
Centreline + Parking lane (both sides)	$10,000	Moderate: 5-10 km/h	10.0	12.0	10.6	12.0	16.0	18.6	16.6	18.6
Raised Median Islands + Bike lanes (conventional)	$68,000	High: 10+ km/h	10.5	14.6	11.1	14.6	16.5	21.2	17.1	21.2
Raised Median Islands + Bike lanes (buffered)	$93,700	High: 10+ km/h	11.1	16.6	11.7	16.6	17.1	23.2	17.7	23.2
Raised Median Islands + Parking lane (both sides)	$58,000	High: 10+ km/h	11.5	16.0	12.1	16.0	17.5	22.6	18.1	22.6
Centreline + Bike lanes (buffered, both sides) + Parking lane (buffered, one side)	$60,550	Moderate: 5-10 km/h	12.2	16.1	12.8	16.1	18.2	22.7	18.8	22.7
Raised Median Islands + Bike lanes (buffered, both sides) + Parking lane (buffered, one side)	$108,550	High: 10+ km/h	13.7	20.1	14.3	20.1	19.7	26.7	20.3	26.7
Centreline + Bike lanes (buffered, both sides) + Parking lanes (buffered, both sides)	$75,400	Moderate: 5-10 km/h	14.8	19.6	15.4	19.6	20.8	26.2	21.4	26.2
Raised Median Islands + Bike lanes (buffered, both sides) + Parking lanes (buffered, both sides)	$123,400	High: 10+ km/h	16.3	23.6	16.9	23.6	22.3	30.2	22.9	30.2

Table B-5: Vertical/Horizontal Deflection & Signage Measures Selection Criteria

Additional Measures	Road Classification		Number of Lanes		Minimum Pavement Width	Speed Limit (km/h)			Major EMS/Snow Removal Route?	Transit Route?	Speed Reduction Effectiveness
	Local	Collector	2	4		40	50	60			
Gateway Features	X		X	X		X	X	X	X	X	Moderate
Flexible Bollards (Vertical Centreline Treatment)	X	X	X[86]			X	X	X	X[87]	X	Low
Speed Cushions	X	X	X	X	6.3m[88]	X	X	[89]	X[90]	X	High
Raised Crosswalk	X	X	X	X		X	X	[91]	[92]	X	High
Traffic Circle/Mini Roundabout	X	X	X		6.0m[93]	X	X	[94]	[95]	[96]	High

[86] Flex sticks: TAC Traffic Calming Guide notes that this measure can be used on 4-lane roads, but they are most effective on two-lane roads
[87] Flex sticks: TAC Traffic Calming Guide notes that permanent installation may cause difficulty of snow removal; City of Kingston Traffic Calming Guide notes that consideration is required for larger vehicles along narrow roads or where on-street parking is provided.
[88] Speed Cushion: based on design details in TAC Traffic Calming Guide
[89] Speed Cushion: TAC Traffic Calming Guide suggests that this measure should be installed on roadway with speed limit less than or equal to 50km/h
[90] Speed Cushion: TAC Traffic Calming Guide suggests that this measure may slightly affect emergency vehicle response times but not as much as speed humps or speed tables
[91] Raised Crosswalk: NCHRP 893 Systemic Pedestrian Safety Analysis and TAC Traffic Calming Guide both suggest that this measure should be installed on roadway with speed limit less than or equal to 50km/h (approximately 30 mph)
[92] Raised Crosswalk: TAC Traffic Calming Guide suggests avoiding use of this measure on designated emergency access routes
[93] Traffic Circle/Mini Roundabout: based on design details in TAC Traffic Calming Guide
[94] Traffic Circle/Mini Roundabout: TAC Traffic Calming Guide suggests that this measure should be installed on roadway with speed limits less than or equal to 50km/h
[95] Traffic Circle/Mini Roundabout: TAC Traffic Calming Guide suggests avoiding use of this measure on designated emergency access routes and transit routes
[96] See Footnote 13

Additional Measures	Road Classification	Number of Lanes	Minimum Pavement Width	Speed Limit (km/h)	Major EMS/Snow Removal Route?	Transit Route?	Speed Reduction Effectiveness
On-Road 'Sign' Pavement Markings	X	X	X	X		X	X	X	X	X	Low
Speed Display Devices	X	X	X	X		X	X	X	X	X	Moderate

Implementation Spacing

The effectiveness of traffic calming measures gradually reduces as drivers pass the measure, in order to sustain the reduced speed over a stretch of a roadway, the City staff might consider repeating some measures (e.g., bump outs/curb extensions, raised median islands, and speed cushions) depending on the length of the implementation segment and the magnitude of the speeding issue.

A study, *Effective Speed Management Measures: Methodology and Application in City of Edmonton*[97], has found that the spacing required for traffic calming measures is essentially determined by the two main factors: the desired speed reduction (i.e., the difference between the 85th percentile speed and the posted speed limit) and the effectiveness of the traffic calming measure. As examples from the study, **Table B-6** below summarizes the resulting spacings at two locations with different magnitudes of speeding issues.

Table B-6: Example of Minimum Spacing

Posted Speed Limit	85th Percentile Speed	Desired Speed Reduction	Resulting Minimum Spacing		
			Bump outs / Curb extensions	Raised Median Islands	Speed Tables
50 km/h	73 km/h	23 km/h	70m	70m	95m
	63 km/h	13 km/h	140m	140m	180m

As shown in **Table B-6**, greater speed reduction can be achieved by the shorter spacing between the measures. It should be noted that these spacings are not meant to be used as guidelines for implementations in the City, it is suggested that the City staff follow the methodology outlined in this study to determine the spacing required.

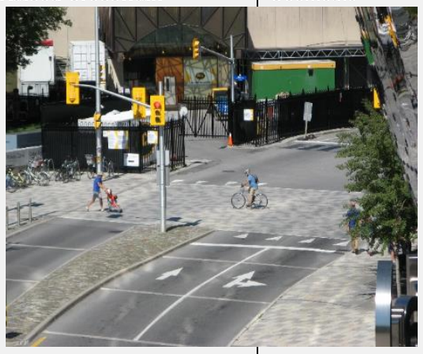
97 https://saiv.espaceweb.usherbrooke.ca/References/176_2014_EffectiveSpeedManagementMeasures_17p.pdf

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
Lane Narrowing 	Pavement Marking	Lane narrowing is the process of reducing lane widths using pavement markings (for example, centreline, urban shoulders, bicycle lanes). The intention is for drivers to perceive the roadway to be less comfortable at higher speeds due to the narrowing of the lanes and ultimately reduce operating speeds.	> **Vehicle Speeds:** Reduction in 85th percentile speed up to 10 km/h > **Conflicts:** If lanes are physically narrowed and space is not allocated to other modes, the reduced crossing distance at pedestrian crossings may reduce pedestrian-vehicle conflicts > **Other:** - Can be implemented rapidly if using pavement markings and no physical change is required - Space can be allocated for urban amenities and activities such as bicycle lanes - No effect on emergency vehicles, resident access, snow plowing, street sweeping, and police enforcement	> **Active Transportation and Transit:** Cyclists can feel squeezed closer to vehicles if no bicycle lanes are provided > **Maintenance:** - Pavement markings requires regular maintenance - Pavement markings may be less effective in winter months due to snow/ice cover > **Other:** Reduced separation between oncoming vehicles	> **Road Classification:** Local and collector streets > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban cross-section; typically applied on two- and four-lane roadways	> Physical lane narrowing tends to provide better results than simple pavement markings, which have minimal effect > Low cost when implemented using pavement markings only, however, studies show this is less effective than narrowing roadways using physical measures as speeds did not appear to be affected > Ensure consistency in application to avoid driver confusion > **Required Pavement Width:** - Urban shoulder (one side): 1.2m to 2.0m - Conventional bike lane (one side): 1.5m to 1.8m - Buffered bike lane (one side): 1.8m to 2.8m Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.	Cost per 1 km: - Centreline: $6,000 - Urban shoulder (one side): $6,000 - Conventional bike lane (one side): $7,000 - Buffered bike lane (one side): $20,000 Note: For pavement marking installation on a short road segment (i.e., less than 500m), instead of estimating the cost based on the unit price, a minimum cost of $3,000 is expected.	Based on the quotes the City of Richmond Hill received
On-street Parking 	Pavement Marking	On-street parking is the reduction of the roadway width available for vehicle movement by allowing motor vehicles to park adjacent and parallel to the curb. Angled parking is not appropriate as a traffic calming measure, due to the increased potential for conflicts. The effect of using on-street parking to narrow the effective roadway space is to reduce vehicle speeds and to reduce possible short-cutting or through traffic.	> **Conflicts:** Parked vehicles provide a buffer between traffic and pedestrians on sidewalks > **Environment:** Traffic noise may be reduced due to a reduction in traffic volumes or speeds > **Other:** No effect on resident access and police enforcement	> **Active Transportation and Transit:** - On-street parking may reduce mutual visibility for pedestrians crossing the roadway - Requires a minimum width to allow for safe passing of cyclists around opened car doors > **Maintenance:** Parked vehicles may obstruct street sweeping and snow removal operations, unless parking restrictions are applied for these operations > **Other:** - Parked vehicles may obstruct driveways, or reduce visibility for motorists entering the roadway from driveways - Could increase rear-end or sideswipe collisions	> **Road Classification:** Local and collector streets; urban commercial streets > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban cross-section – curb and gutter > May be used in combination with speed humps, curb extensions, etc. > Due to varying jurisdictional guidelines and regulations, on-street parking should not be implemented if it results in substandard roadway widths which conflict with lane width, transit or emergency services requirements > **Locations to Avoid:** Driveways, areas with limited sight distance, bus zones, designated school zones, unfenced playgrounds, and poorly illuminated streets	> Narrower roadway widths may not be appropriate in municipalities with significant snowfall, or for streets with relatively high two-way traffic volumes (use with caution on roads > 10,000 veh/day) > Required Pavement Width: 2.0m to 2.5m Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.	Cost per 1 km (one side): $2,000	Based on the quotes the City of Richmond Hill received

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
Bump outs/Curb Extension 	Geometric	A curb extension (also known as neckdown, choker, curb bulb, or bulb-out) is a horizontal intrusion of the curb into the roadway resulting in a narrow section of roadway. The curb is extended on one or both sides of the roadway to reduce its width to as a little as 6.0 m for two-lane, two-way traffic. In urban environments, it is possible to implement curb extensions by removing existing parking spaces. The purpose of a curb extension is to reduce vehicle speeds, reduce crossing distance for pedestrians, increase visibility of pedestrians, and prevent parking close to an intersection.	> **Vehicle Speeds:** Reduction between 2 and 8 km/h > **Conflicts:** - Reduced pedestrian crossing distance at intersections may reduce pedestrian-vehicle conflicts - Better mutual visibility between pedestrians and motorists if crosswalks are installed between curb extensions > **Environment:** Landscaped curb extensions, can improve the appearance of a street > **Other:** - No effect on resident access, snow plowing, street sweeping, and police enforcement - Can provide additional storage for snow, however, height of windrow should not negatively impact pedestrian visibility	> **Active Transportation and Transit:** - Not compatible with bicycle lanes - Can be hazardous for drivers and cyclists if not designed and maintained properly - Cyclists can feel squeezed closer to vehicles as motorists attempt to overtake them at the narrowing points > **Parking:** Potential loss of on-street parking > **Maintenance:** Increased snow removal cost and snow plow damage to grass, trees and curb extensions > **Other:** - Long trucks, buses and other large vehicles may need to cross into oncoming travel lanes in order to negotiate turns at intersections with curb extensions - Between snow removals in winter environments, the roadway's effective width can be significantly reduced	> **Road Classification:** Local and collector streets; urban arterial streets > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban cross-section – curb and gutter	> The effectiveness of a curb extension can be increased when used in combination with other traffic calming measures (speed humps, raised crosswalks, raised intersections, textured crosswalks, curb radius reductions, raised median islands) > Used often with on-street parking to create bays and increase pedestrian visibility at crossings - Keeps road narrow when parked vehicles are not present - On urban arterial streets, applicability may not be recommended if the arterial street has a parking lane that can be needed to carry occasional traffic volume increases (e.g., Emergency Detour Route (EDR), evacuation route, ceremonial route, flexibility of flow management during road repair, etc.) > Drainage system adjustments may be required where curb extensions are needed > Should be marked with signs or other objects to be visible to motorists and plow operators > Sight lines should be respected if there is landscaping > Required Pavement Width: 2.0m to 2.5m Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.	$13,000 per pair	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
Gateway Features 	Geometric	Gateways are the combination of traffic calming devices, that help to provide an entry or "gateway" which identifies transitional zones such as between commercial/rural areas and urban/rural residential zones, villages, or hamlets.	> **Vehicle Speeds:** - Reduction in 85th percentile speed up to 10 km/h (up to 15 km/h if followed by other devices in an urban area) - May increase compliance with speed limit > **Environment:** - May improve aesthetics if incorporating colour/texture pavement and landscaping. > **Other:** - Creates easily identifiable transitional zone for motorists	> **Maintenance:** - Requires considerable ongoing maintenance if incorporating pavement markings, textured pavements, landscaping or other traffic calming devices > **Other:** - Gateways may infringe on clear zone - Not as effective for frequent commuters	> **Road Classification:** All roadways > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban and rural cross-section > Entrances to residential communities; speed transition zones; approaching intersections / built-up areas	> Gateways would best be placed in the speed transition zones where a gradual reduction of speed is desired > Most effective on infrequent users of the corridor > Gateway entrance treatments may include features which present a fixed roadside object hazard, therefore should meet clear-zone, structural, and protection requirements > Gateway needs to be large enough to attract the attention of drivers > For local roads that are not wide enough to accommodate physical gateway features, gateway features in form of pavement marking can be considered > Gateway features is recommended for new subdivisions. It should be carefully considered for existing roads with narrow pavement width Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.	$13,500 (assumed based on median island)	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***
Raised Medians/Landscaped Island 	Geometric	A raised median island is an elevated median constructed on the centerline of a two-way roadway to reduce the overall width of the adjacent travel lanes. The purpose of a raised median island is to reduce vehicle speeds and to reduce pedestrian–vehicle conflicts.	> **Vehicle Speeds:** Reduction between 3 and 8 km/h > **Conflicts:** Can function as a pedestrian refuge resulting in reduced pedestrian-vehicle conflicts > **Environment:** Aesthetic benefit if well-maintained planting is incorporated > **Other:** No effect on snow plowing (islands are visible due to signing), street sweeping, or police enforcement	> **Local Access:** May restrict access to driveways from one direction only > **Active Transportation and Transit:** Cyclists may feel squeezed where insufficient room has been left between a central median and the adjacent curb (aggravated on roads with high proportions of heavy vehicles) > **Parking:** May require additional right-of-way and/or removal of on-street parking > **Other:** Speeds may increase if mid-block left turn movements are not possible	> **Road Classification:** Local and collector streets, urban arterials > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban cross-section – curb and gutter; rural cross-section; most effective on roads with two traffic lanes (one each direction)	> Effectiveness can be increased if used in combination with curb extensions before and/or after raised median islands > If required, bicycle lanes can be included to prevent motorists from intruding into the path of cyclists > In retrofit situations, there are risks of overhead tree canopy and utility poles coming into contact with larger vehicles due to the median shifting vehicles closer to the curb > Median landscaping should not negatively impact or reduce pedestrian visibility > Required Pavement	$13,500 each	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
						Width: 1.5m to 4.0m Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.		
Flexible Bollards 	Signage	The use of vertical treatments such as flexible post-mounted delineators or raised pavement markers to create a centre median. This could be used to give drivers a perception of lane narrowing and create a sense of constriction. Flexible post-mounted delineators are similar in appearance to bollards. They are commonly used in work zones, high-occupancy vehicle (HOV) lanes, and on-ramp exits to direct vehicles or prevent particular movements.	>**Vehicle Speeds:** Reduction in 85th percentile speed up to 5 km/h >**Conflicts:** Separation of traffic has the potential to reduce collisions >**Other:** Collapsible design is able to withstand impact with a vehicle	> **Maintenance:** - May require regular maintenance with collection of debris around posts and repeated impacts from vehicles - Permanent installation may cause difficulty of snow removal > **Other:** - In rural areas, wider vehicles or farm equipment may have difficulty passing if post-mounted delineators excessively narrow the roadway - May cause confusion as measure can be perceived as temporary or as an indication of a construction zone	> **Road Classification:** Local and collector streets > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban or rural cross-section; two-lane roadways in order to achieve lane narrowing > **Locations to Avoid:** Where it may block driveways or cross streets > Separation of conflicting movements when barriers are too costly or impractical	> Typically are between 45 and 90 cm tall, spaced 30m to 50m apart > May also be installed at the start and end of a speed reduction zone (e.g., a School Zone) along with other traffic calming measures (e.g., speed cushions, raised islands, bump outs/curb extensions) to increase the visibility of traffic calming measures and create "gateway-like" features > May also be installed within a speed reduction zone between other traffic calming measures Where transit routes operate, remaining lane width should be a minimum of 3.1 m, preferably 3.3 m.	$125 per bollard	Cost for Flexible Bollards from ***Oxford County Trails Master Plan*** (factored up from $100 to 2022 cost of $125)
Speed Cushions 	Geometric	A raised area on a road, similar to a speed hump, but does not cover the entire width of the road. The width is designed to allow a large vehicle, such as a bus, to “straddle” the cushion, while light vehicles will have at least one side of the vehicle deflected upward. Speed cushions are intended to produce sufficient discomfort to limit passenger vehicle travel speeds yet allow the driver to maintain vehicle control, while allowing larger vehicles such as buses and emergency vehicles to pass without difficulty.	>**Vehicle Speeds:** Reduction in 85th percentile speed up to 8 km/h >**Traffic Volumes:** Reduction of approximately 30% >**Environment:** Traffic noise may be reduced due to lower speeds (benefits may be offset by increased noise due to braking and accelerating) >**Other:** - No effect on bicycles riding at moderate speeds - No effect on resident access, street sweeping (small amount of debris may remain at edges of speed cushion), and police enforcement	> **Emergency Response:** May slightly affect emergency vehicle response times but not as much as speed humps or speed tables > **Active Transportation and Transit:** May slightly affect transit routes; a series of vertical deflection measures may increase travel time > **Maintenance:** Negative effects on snow plowing/removal; plow operators must use caution to avoid damaging speed cushion surface > **Other:** - More difficult to construct compared to speed humps requiring more precise hand work - Increased traffic noise levels due to braking and accelerating - Increased gas consumption and emission levels if there are significant	> **Road Classification:** Local and collector streets > **Traffic Conditions:** Posted speed limit ≤ 50 km/h; all traffic volumes > **Roadway:** Urban cross-section – curb and gutter > **Locations to Avoid:** - Small turning radius curves and other areas with limited sight distance, intersections, and driveways - Traffic signals – locate at least 75 m distance from traffic signals so that the speed cushion is not within the decision or braking zones - Grades over 8%	> Allows greater access for transit and emergency services compared to other traffic calming devices Could be considered as an alternative to speed humps on emergency routes > Speed humps are more effective in reducing speeds > Snow removal personnel may require special training in removing snow from speed cushion areas > A series of speed cushions is more effective than a single installation; spacing can range from 60 m to 250 m depending on the desired 85th percentile speed > Installation of WA-50 Speed Hump sign is considered mandatory > Speed cushions are not	$6,000 each location (assumed based on cost for speed bump)	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
				variations in speed, especially if there are multiple devices within close proximity on the same street - Pavement markings and signing could detract from the appearance of a street - Traffic may be diverted to parallel streets without traffic calming measures		to be implemented together with raised median island		
Raised Crosswalk 	Geometric	A raised crosswalk is a marked pedestrian crosswalk at an intersection or mid-block location constructed at a higher elevation than the adjacent roadway. The purpose of a raised crosswalk is to reduce vehicle speeds, improve pedestrian visibility, and reduce pedestrian–vehicle conflicts.	> **Vehicle Speeds:** Reduction in 85th percentile speed from 5 km/h to 13 km/h > **Traffic volumes:** Reduction of up to 26%, and increase of up to 7% on neighbouring streets > **Conflicts:** - 53% of drivers yielding to pedestrians compared to 13% before - Pedestrian crossing area better defined; vehicles are forced to slow through pedestrian conflict zone > **Environment:** Traffic noise may be reduced due to lower speeds (benefits may be offset by increased noise due to braking and accelerating) > **Other:** - No effect on bicycles riding at moderate speeds - No effect on resident access, street sweeping (small amount of debris may remain at edges of raised crosswalk), and police enforcement - Pedestrians using assistive devices are able to cross more easily and with increased comfort due to no accumulation of rain or snow at the bottom of the curb	> **Emergency Response:** Impacts and delays to emergency vehicles; Fire vehicles – 3.8 seconds' delay per raised crosswalk > **Active Transportation and Transit:** - May result in a false sense of pedestrian security - Visually-impaired pedestrians may have difficulty differentiating between the curb and the travelled portion of the street (can be mitigated with appropriate design elements for accessibility requirements such as tactile walking surface indicators) - Some cyclists may experience loss of control at speeds over 40 km/h - May slightly affect transit routes; a series of vertical deflection measures may increase travel time > **Maintenance:** - Snow clearing time may be increased - Raised crosswalks interfere with pavement overlays > **Other:** - Catch basins may be required to provide drainage depending on location of raised crosswalk and site specific conditions - If catch basins become blocked, ponding may occur on uphill edge of crosswalk - Increased traffic noise levels due to braking and accelerating - Increased gas consumption and emission levels if there are significant variations in speed, especially if there are multiple devices within close proximity on the	> **Road Classification:** - Local and collector streets; commercial collector streets > **Traffic Conditions:** Posted speed limit ≤ 50 km/h; all traffic volumes > **Roadway:** Urban cross-section – curb and gutter > School zones > **Locations to Avoid:** - Designated emergency access routes - Small turning radius curves and other areas with limited sight distance, intersections, and driveways - Transit routes where articulated buses are used due to potential decoupling - Bus stops – locate at least 25 m in advance to minimize potential stability problems - Traffic signals – locate at least 75 m distance from traffic signals so that the crosswalk is not within the decision or braking zones - Grades over 8%	> Not recommended unless there is an existing marked crosswalk > Not recommended in limited right-of-way > There must be a sidewalk on at least one side of the road and landing areas on each end of the raised crosswalk > May cause discomfort for transit users > Consistent configuration throughout a community is desirable to facilitate safe use by those with mental impairment > Snow removal personnel may require special training in raised crosswalk areas > Raised crosswalks with gentle approach and exit gradients, flush leading edges and smooth surfaces pose a less significant hazard to cyclists	$8,000.00 each	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
				same street - Pavement markings and signing could detract from the appearance of a street - Traffic may be diverted to parallel streets without traffic calming measures				
Traffic Circle/Mini Roundabout  	Geometric	A traffic circle/traffic button/mini-roundabout is an island located at the centre of an intersection, which requires vehicles to travel through the intersection in a counter-clockwise direction around the island.Mini-roundabouts are designed in accordance with full-size roundabout design principles presenting splitter islands and deflection of vehicles on all approaches, except that they have a smaller diameter and traversable islands. A traffic circle is typically smaller than a mini-roundabout and does not have splitter islands on the approaches. A traffic button is similar to a traffic circle, however, the former is typically made of coloured asphalt while the latter is landscaped. The turning radius for left-turning trucks, buses, or emergency vehicles may require a diameter which would be larger than the intersection space commonly available. Consequently vehicles may turn in left in front of the traffic circle or mount the centre raised island rather than travelling around it.Yield traffic control is recommended.	>**Vehicle Speeds:** Reduction in 85th percentile speed up to 14 km/h>**Traffic volumes:** Reduction of up to 20%>**Conflicts:** Collision rate reductions of approximately 30% compared to signalized intersections>**Environment:** - Traffic noise reduction of 3 dBA due to lower speeds (benefits may be offset by increased noise due to braking and accelerating) - Environmental benefit through reduced delay, fuel consumption, and vehicle emissions - When landscaped, can improve the appearance of a street>**Other:** No effect on resident access, street sweeping, and police enforcement	> **Emergency Response:** Delay between 1.3 and 10.7 seconds for emergency vehicle response times> **Active Transportation and Transit:** - May force vehicles into crosswalk area increasing potential for pedestrian-vehicle conflicts> **Parking:** May require removal of some on-street parking in vicinity of traffic circle> **Maintenance:** “Minor” effects on winter maintenance by increasing snow plowing time> **Other:** - Restricted access for trucks and longer school buses - Traffic may be diverted to parallel streets without traffic calming measures	> Road Classification: Local and collector street intersections> Traffic Conditions: - Posted speed limit ≤ 50 km/h - < 1500 vehicles per day; Use with caution for low-volume collectors with 1500 to 5000 vehicles per day> Roadway: Urban cross-section – curb and gutter; rural cross-section; maximum two traffic lanes (one each direction)> Locations to Avoid: - Designated emergency access routes and transit routes - Intersections with high pedestrian volumes - Intersections where collector street traffic volumes are significantly higher than the intersecting street	> Preferred with textured crosswalks and most effective when used in series> Sight lines should be respected if there is landscaping> Mini roundabouts are often more suitable for collector roads, and traffic circles are more suitable for local roads	Average $85,500.00 each	***Costs for Pedestrian and Bicyclist Infrastructure Improvements***
On-Road 'Sign' Pavement Markings 	Pavement Marking	On-road ‘sign’ pavement markings provide information that would typically be shown to drivers through signage but are painted on the roadway to provide a larger image, and one that is directly in the driver’s line of sight. Some examples could be speed limit, ‘SLOW’, 'Stop ahead, etc.	> **Vehicle Speeds:** Reduction between 6 and 14 km/h > **Environment:** No increase in noise > **Other:** - Can be implemented rapidly - No impact to emergency vehicles, snow plowing, street sweeping, and police enforcement - No adverse effect on vehicle operations	> **Maintenance:** - Pavement markings will require regular maintenance - May be less effective in winter months due to snow/ice cover	> **Road Classificatio**n: Local, collector and arterial streets > **Traffic Conditions:** All traffic volumes > **Roadway:** Urban and rural cross-section > Advance of hazards/curves > Entrance treatment to urban and rural communities	> Refer to provincial legislation and guidelines, if available, to ensure standards for traffic control devices are met > If there is no provincial guidance for placement, speed limit on-road ‘sign’ pavement markings should be placed in the same location as speed limit signs to reinforce regulatory environment > May be used as part of gateways to alert drivers	$200 to $500 each	Pavement Marking Symbols from ***Costs for Pedestrian and Bicyclist Infrastructure Improvements***

Countermeasure	Type	Description & Purpose	Advantages	Disadvantages	Applicability	Implementation Considerations	Cost	Cost Reference
						that they are entering a rural community		
Speed Display Devices 	Signage	A speed display device is an interactive sign that displays vehicle speeds as oncoming motorists approach. Vehicle speed is captured using radar and can trigger the display board to show when vehicles approach at predetermined unsafe speeds. Can be used upstream of manned speed enforcement.	> **Vehicle Speeds:** Reduction in 85th percentile speed between 3 and 14 km/h > **Conflicts:** Reduction in speed related collisions > **Other:** - Portable units can be relocated and deployed immediately at different locations - Less expensive than police enforcement when considering long-term use	> **Enforcement:** - Drivers may become immune to devices if there is no further perception of enforcement - Motorists may speed up to see how fast they can go - May be less effective or less accurate on multi-lane roads, or heavily trafficked roads > **Maintenance:** Requires regular maintenance and a source of power	> **Road Classification:** All roadways > **Traffic conditions:** All traffic volumes > **Roadway:** Urban and rural cross-section > Generally used at the beginning of regulatory school zones, upstream of high speed signalized intersections, and upstream of deficient horizontal curves	> Speed display devices can be used as curve advisory systems > Speed displays can be used on a weather-related basis > If used in conjunction with manned enforcement downstream on some occasions, can be very effective and may decrease complaints about manned enforcement as well	$5,000.00 each if mounted on existing pole $7,500 each if additional pole is required	Based on the quotes the City of Richmond Hill received

C

Appendix C – Pedestrian Crossovers

The City follows the OTM Book 15 warrant and selected methodology for determining the need for a PXO and the appropriate type. The City of Richmond Hill uses PXOs as a way for pedestrians to safely cross roads without the use of stop signs or traffic signals.

1. Warrant for Determining Need for PXO and Type

Figure C-1 graphically outlines the process for evaluating the need for a PXO in accordance with OTM Book 15. The steps to check the requirement for a PXO are as follows, in which two out of three factors need to be met:

- Verify minimum pedestrian and vehicular volume at location, either the total 8-hour volume or 4-hour volume, specifically:
    - ≥100 pedestrians and ≥750 vehicles in an 8-hour period or
    - ≥65 pedestrians and ≥395 vehicles in a 4-hour period
- Verify if the distance of the site to the closest traffic control device is more than 200 m; and
- Verify if there is a requirement for a controlled crossing based on system connectivity or pedestrian desire lines.

Figure C-2 shows the selection matrix for determining the type of PXO to be used. Further information on each PXO type can be found in OTM Book 15.

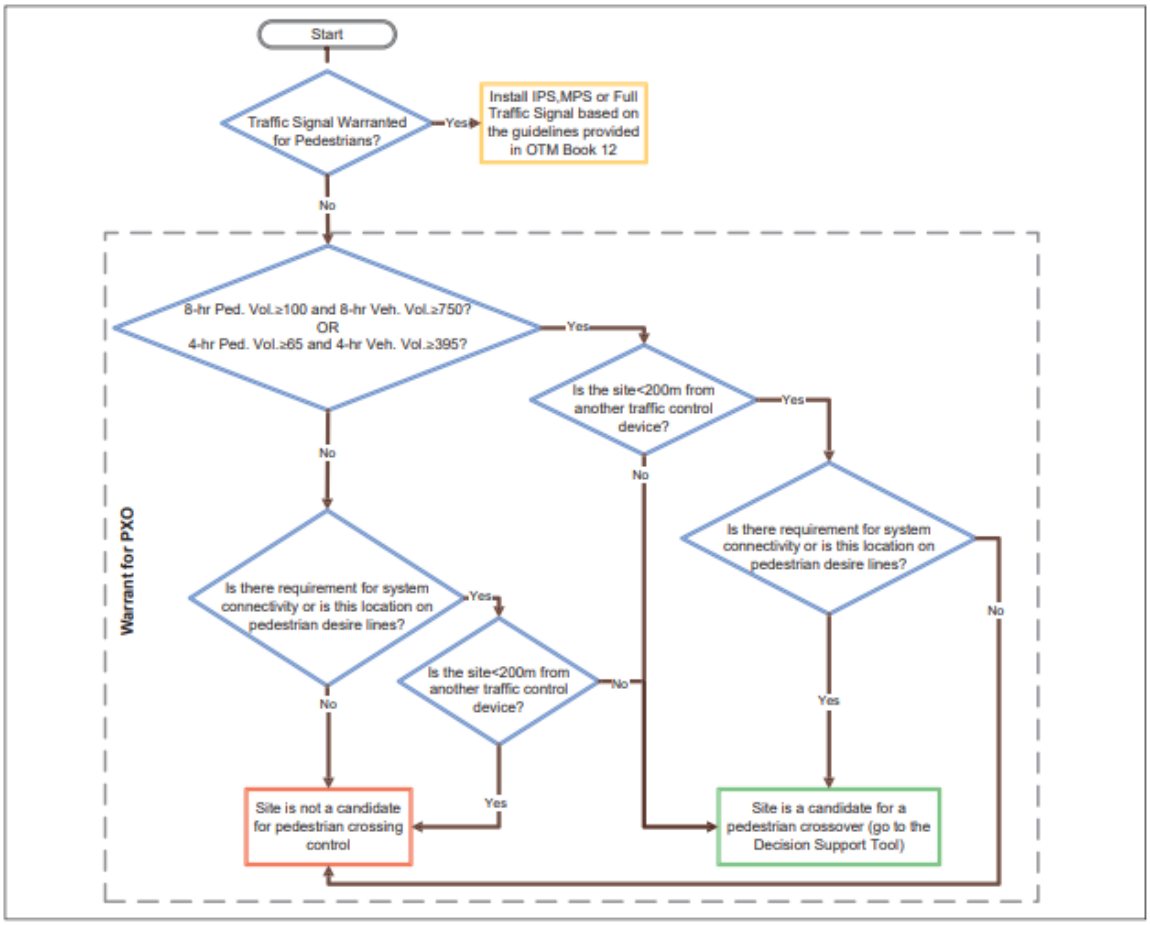


Figure C-1 - Decision Support Tool - Preliminary Assessment

Two-way Vehicular Volume			Posted Speed Limit (km/h	Total Number of Lanes for the Roadway Cross Section[1]			
Time Period	Lower Bound	Upper Bound		1 or 2 Lanes	3 lanes	4 lanes w/raised refuge	4 lanes w/o raised refuge
8 Hour	750	2,250	≤50	Level 2 Type D	Level 2 Type C[3]	Level 2 Type D[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	750	2,250	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	2,250	4,500	≤50	Level 2 Type D	Level 2 Type B	Level 2 Type D[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	2,250	4,500	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	4,500	6,000	≤50	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	4,500	6,000	60	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	6,000	7,500	≤50	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 1 Type A
4 Hour	3,155	3,950					
8 Hour	6,000	7,500	60	Level 2 Type B	Level 2 Type B		
4 Hour	3,155	3,950					
8 Hour	7,500	17,500	≤50	Level 2 Type B	Level 2 Type B		
4 Hour	3,950	9,215					
8 Hour	7,500	17,500	60	Level 2 Type B			
4 Hour	3,950	9,215					

Type A Type B Type C Type D

Approaches to roundabouts should be considered a separate roadways.

[1]The total number of lanes is representative of crossing distance. The width of these lanes is assumed to be between 3.0 m and 3.75 m according to MTO Geometric Design Standards for Ontario Highways (Chapter D.2). A cross sectional feature (e.g. bike lane or on-street parking) may extend the average crossing distance beyond this range of lane widths.

[2]Use of two sets of side mounted signs for each direction (one on the right side and one on the median)

[3] Use Level 2 Type B PXO up to 3 lanes total, cross section one-way.

The hatched cells in this table show that a PXO is not recommended for sites with these traffic and geometric conditions. Generally a traffic signal is warranted for such conditions.

Figure C-2 - Pedestrian Crossover Selection Matrix

2. Review of Candidate Locations

The City will conduct a City-wide review of candidate locations, every 5 years, for future candidate PXOs at the following locations where there are currently no controls (i.e. midblock locations or minor-road stop controlled intersections). These locations include:

- Locations where a pedestrian collision has occurred

- Crossing guard locations[98]
- Locations where schools or new trails are being built
- Trail networks where trails cross roads
- Locations identified based on public input

Upon identifying the candidate locations, the necessary data collection will be undertaken and warrant analyses, following OTM Book 15 methodology, will be undertaken.

3. Prioritization of Candidate Locations

The City will use a prioritization tool to assist with ranking identified locations suitable for a PXO installation as per **Table C-1**. Selected (warranted) locations should be prioritized based on the following key components, each with a corresponding weight/score:

- **Connectivity** (proximity to nursing homes, medical centres, elementary schools, high schools, transit routes, major pedestrian facilities, multi-use trail or major trail facility crossings and proximity to nearest controlled crossing location);
- **Demand** (vehicle-pedestrian cross product); and
- **Safety** (pedestrian collision history, road class, 85th percentile speed)

Table C-1: Priority Criteria / Justification and Weighting

Criteria /Justification	Category	Score
Connectivity		
Proximity to nursing homes and medical centres (*Senior citizens have an increased risk of serious death and/or death in a collision)*	Adjacent to facility (<100m)	15
	101-200m from facility	12
	201-300m from facility	9
	301-400m from facility	6
	>400m from facility or N/A	0
Proximity to elementary schools (K-8) (*Children have more difficulty judging speed, spatial relations and distance compared to adults)*	Adjacent to school (<100m)	15
	101-200m from facility	12
	201-300m from facility	9
	301-400m from facility	6
	>400m from facility or N/A	0
Proximity to high schools (*High schools are major pedestrian attractors but are scored lower as students in high school have a better understanding relating to safely judging gaps in traffic)*	Adjacent to school (<100m)	10
	101-200m from facility	8
	201-300m from facility	6
	301-400m from facility	4
	>400m from facility or N/A	0

[98] At locations that warrant a PXO and that would be eligible to, or that are upgraded from, school crossing guards, Level 2 Type C PXOs should be considered at a minimum.

Proximity to transit (route or stop) (*Transit stops are natural pedestrian attractors and encourage mid-block crossing behaviour)*	On transit route	5
	Not on transit route but <100m from bus stop	4
	Not on transit route and 101-200m from bus stop	3
	Not on transit route and 201-301m from bus stop	2
	Not on transit route and 301-400m from bus stop	1
	Not on transit route and >400m from bus stop	0
Proximity to major pedestrian facilities (i.e. libraries, community centres, retirement homes, sport facilities, parks, pools, playgrounds) *(These types of facilities attract/generate pedestrian trips)*	Adjacent to any major pedestrian facility (<100m)	5
	101-200m from any major pedestrian facility	4
	201-300m from any major pedestrian facility	3
	301-400m from any major pedestrian facility	2
	>400m from any major pedestrian facility or N/A	0
Multi-use trail or major trail facility crossing *(Users of these facilities are often unwilling to detour to the nearest controlled crossing)*	Yes	5
	No	0
Proximity to nearest controlled crossing location *(Sites greater than 200m from a controlled crossing are potential candidates provided they meet the pedestrian and vehicle thresholds)*	>300m	5
	251-300m	3
	201-250m	2
	<200m	0
Demand		
Vehicle pedestrian cross product (based on 8 hour counts) *(Higher cross product associated with decreased crossing opportunities)*	>300,000	40
	200,000 - 299,999	35
	100,000 - 199,999	30
	60,000 – 99,999	25
	40,000 – 59,999	20
	30,000 - 39,999	15
	20,000 - 29,999	10
	10,000 – 19,999	5
	0 – 9,999	0
Safety		
Pedestrian Collision History *(Past history of pedestrian collisions suggests unsafe conditions at location)*	≥1 collision	5
Road Class *(Higher road classification suggest fewer crossing opportunities)*	Collector	3
	Local	1
85th percentile speed (*Higher operating speeds associated with decreased safety/crossing opportunities)*	>50 km/h	5
	40 km/h – 50 km/h	3
	<40 km/h	1

Each location would be ranked based on the priority criteria and weighting. The total score for criteria/justification would be added up, giving a total score for Connectivity, Demand, and Safety for each location. The location(s) with a higher score would then be given a higher prioritization than location(s) with a lower score. As the City collects more data on potential PXO candidates, the weighting for the cross product will be adjusted to more accurately capture the range of values.

4. New Locations / Periodic Review

The City-wide review and prioritization should be repeated every 5 years to capture potential changes in traffic patterns and on the road network. Additionally, for new roads, PXOs should be considered where the OTM Book 15 distance and connectivity requirements are met. At the design stage, City staff will apply engineering judgment to determine if a PXO should be implemented with the new road construction, or if any design elements (e.g., appropriate sight distance, sufficient space for AODA elements, etc.) should be included in the design in anticipation that volume requirements may be met in the future.

5. Implementation

Based on the prioritization scoring, the City will implement PXOs at the highest ranked locations on a yearly basis, subject to budget availability.

The following elements should be incorporated into the design of a PXO, as well ass any other elements outlined in OTM Book 15:

- **Pavement Markings** – This may include standard crosswalk markings, stop line, advanced stop bar, and yield to pedestrian line. Crosswalks must be marked for all types of controlled pedestrian crossing treatments.
- **Curb Ramps** – Curb ramps provide access for people using wheelchairs or scooters at crossings where there is an elevation change between the sidewalk and the street level crossing.
- **Signage** – Mandatory warning and regulatory signage for PXOs is specified by Ontario Regulation 402/15.
- **Illumination** – Adequate lighting must be provided to enhance the safety of pedestrians.
- **Sight Distance** – Adequate sight distance for both motorists and pedestrians must be provided.

Table C-2 provides an example of the priority criteria and corresponding weighting used to evaluate the unsignalized 4-legged intersection of Grovewood Street & Newbridge Avenue in Richmond Hill, Ontario, based on data collected in November 2021.

Table C-2 - Priority Criteria Example for Grovewood Street & Newbridge Avenue

Criteria /Justification	Explanation of Score	Score
Connectivity		
Proximity to nursing homes and medical centres	>400 m from nearest facility	0
Proximity to elementary schools (K-8)	>400 m from nearest facility	0
Proximity to high schools	>400 m from nearest facility	0
Proximity to transit (route or stop)	Bus stops at the intersection	5
Proximity to major pedestrian facilities	Park 140 m south of intersection	4
Multi-use trail or major trail facility crossing	No	0
Proximity to nearest controlled crossing location	175 m from nearest controlled crossing location	0
Total Crossing Control Connectivity		**9**
Demand		
Vehicle pedestrian cross product (8 hours)	173 pedestrians * 1,313 vehicles = 227,149	35
Total Crossing Control Demand		**35**
Safety		
Pedestrian Collision History	Zero pedestrian collisions	0
Road Class	Collector	3
85th percentile speed*	85th percentile speed - 48 km/h	3
Total Crossing Control Safety		**6**
Total Connectivity, Demand, and Safety		**50**

*As per the speed data provided from November 9th, 2022 – November 11th, 2022, the 85th percentile speed along Newbridge Avenue from Grad Oak Drive to Grovewood Street was 48km/h.

D

Appendix D – Community Safety Zones

The refined CSZ policy is presented below. This refined CSZ policy is intended for staff to use in the short-term, until the establishment of a CSZ network screening program.

1. Community Safety Zone Warrant

Community Safety Zones (CSZs) are to be installed along "parts of a roadway" where public safety is of special concern to a community. The CSZ warrant is comprised of two major components. The first component, Warrant 1 - Designated Area of Special Concern, outlines the specific areas where CSZ will be only considered. Warrant 1 must be satisfied before continuing onto Warrant 2. Warrant 2 - Safety, considers collision and risk components related to the traffic and road characteristics of the area under consideration.

a. Warrant 1 – Designated Area of Special Concern

Community Safety Zones (CSZ) must only be installed/implemented on the City of Richmond Hill public right-of-way where special concerns related to public safety are obvious to the road user. Therefore, Community Safety Zones must only be implemented at the following locations:

- Schools (elementary or secondary);
- Community centres;
- Senior's centres and residences;
- Hospitals;
- Playgrounds and parks;
- Neighbourhoods with cut-through traffic; and
- Roadways with bike facilities (e.g., bike lanes, multi-use paths).

The proposed CSZ must have a minimum length of 0.5 kilometres to a maximum of 2.5 kilometres depending on the area of special concern.

b. Warrant 2 – Safety Warrant

The safety warrant comprises a list of seven (7) risk factors considered to be key in assessing whether a candidate site shall be designated as a CSZ. Each risk factor has its respective threshold range of values. Each of the seven (7) risk factors are assigned a score ranging from 1 to 3 depending on the threshold value. ***A minimum total of 13 points must be accumulated in order to satisfy the required safety warrant.***

Table 1, entitled "Warrant 2 - Safety Warrant", details the threshold values for each risk factor and the associated scoring.

Table 1: Warrant 2 – Safety Warrant

Risk Factor	Risk Factor Scoring			Score
	High (score 3)	Moderate (score 2)	Low (score 1)	
Average daily traffic	> 6,000	3,000 to 6,000	< 3,000	
Truck volume (% of traffic)	>5%	3% to 5%	<3%	
Pedestrians (equivalent adults[99]) crossing in any 8-hours	>75	40 to 75	<40	
Intersection and entrances per km	>10	4 to 10	<4	
85th percentile speed (km/h)	>50	40 to 50	<40	
Collisions per year for 3 years	>3	2 to 3	<2	
Number of bus stop per km	>4	2 to 4	>4	
			Total Score	**/21**

2. Final Approval and Designation of a CSZ

After determining if a candidate location is suitable for CSZ implementation using the two warrants, the designation of a CSZ needs to be supported and endorsed by the York Region Police for enforcement.

3. Implementation Guidelines for CSZ

All designated Community Safety Zones (CSZs) within the City of Richmond Hill shall meet the following requirements:

i. Each by-law establishing a CSZ must specify that the designation is in effect for 24 hours a day and 7 days a week to assist the police with enforcement;
ii. Identification and recommendations for adopting new CSZs within the Town require direct input from Municipal Council, Police, School Boards, local ratepayers associations or community policing committees, the Town's

[99] **Equivalent adult volume** = unassisted pedestrian volume + 2 x Assisted pedestrian volume, where:
Unassisted – Adults and adolescents at or above the age of 12 are considered “unassisted” pedestrians;
Assisted – Children under the age of 12, senior citizens, disabled pedestrians and other pedestrians requiring special consideration or assistance are considered “assisted” pedestrians. In cases where an adult is accompanying a pedestrian included in the “assisted” category, both individuals should be counted as “assisted” pedestrians to reflect their higher vulnerability.
It should be recognized that the exact age of the pedestrian is not critical, but the observers will need to use their judgment to place each pedestrian into one of the two categories

engineering staff experience and reports which are supported by appropriate field studies;

iii. CSZs must always be used in conjunction with other traffic safety mitigating measures and police enforcement;

iv. The effectiveness of CSZs will require the proper signing of the designated CSZ, public education and active police enforcement;

For zones equal to 500 metres in length, three (3) CSZ signs are required per travel direction: a CSZ sign including a "begins" tab, a CSZ sign with an "ends" tab, plus an additional CSZ sign placed within/between the zone's start and endpoints. The spacing of additional CSZ signs for larger zones with a speed limit of 60 km/h or less shall be 300 metres or less

E

Appendix E – Crossing Guard Policy

The following outlines the enhanced policy used by the City of Richmond Hill relating to crossing guards:

1. Program Overview

The City of Richmond Hill makes use of crossing guards to assist students in crossing roadways. Pre-selection criteria are as follows:

- The associated school is intended for students between Junior Kindergarten and Grade 8 (i.e., up to elementary school);
- The requested location is within the walking boundary or within 1.5 km of the school;
- Daily traffic volumes are less than 8,000;
- There is no more than one lane of travel in each direction;
- The location is greater than 200 metres from another traffic control device (if free flow); and
- There are adequate sightlines (stopping sight distance according to the 2017 TAC *Geometric Design Guide for Canadian Roads*).

School crossing guards will only be considered at crossing locations with a minimum of 20 assisted and unassisted elementary school children crossing at a location over the school peak periods

a. Crossing Guard Warrants

The City uses the Ontario Traffic Council School Crossing Guard warrant produced in 2017, using either the Exposure Index method (controlled crossings) or the Gap Study method (uncontrolled crossings). Using the Exposure Index method, for a location to be considered for a crossing guard, the cross product of the peak hour vehicular volume and the peak hour pedestrian volume must exceed the following values (and as shown in **Figure 3**):

- 5,500 at signalized intersections
- 6,700 at all-way stop controlled intersections
- 4,000 at side street stop-controlled intersections

These thresholds may be revised periodically, in accordance with guidance in the Ontario Traffic Council School Crossing Guard Guide, as new data is collected across the City.

When considering a school crossing guard at a signal controlled crossing, in addition to exceeding the applicable exposure index threshold, at least two of the following criteria must be observed:

- The road where the intersection is located leads to a main arterial or collector and there is a substantial volume of trucks and other large vehicles using the intersection, potentially affecting visibility for both pedestrians and drivers;
- Poor driver behaviour, such as not yielding the right of way to pedestrians, not coming to a complete stop prior to turning on a red signal, drivers inching forward thus intimidating pedestrians on, or about to cross, the roadway;
- The students appear timid in crossing the roadway or do not seem to be properly trained on how to cross the road safely (e.g., forgetting to push the pedestrian pushbutton if one is present, or entering the roadway after the Flashing Don't Walk indication appears).

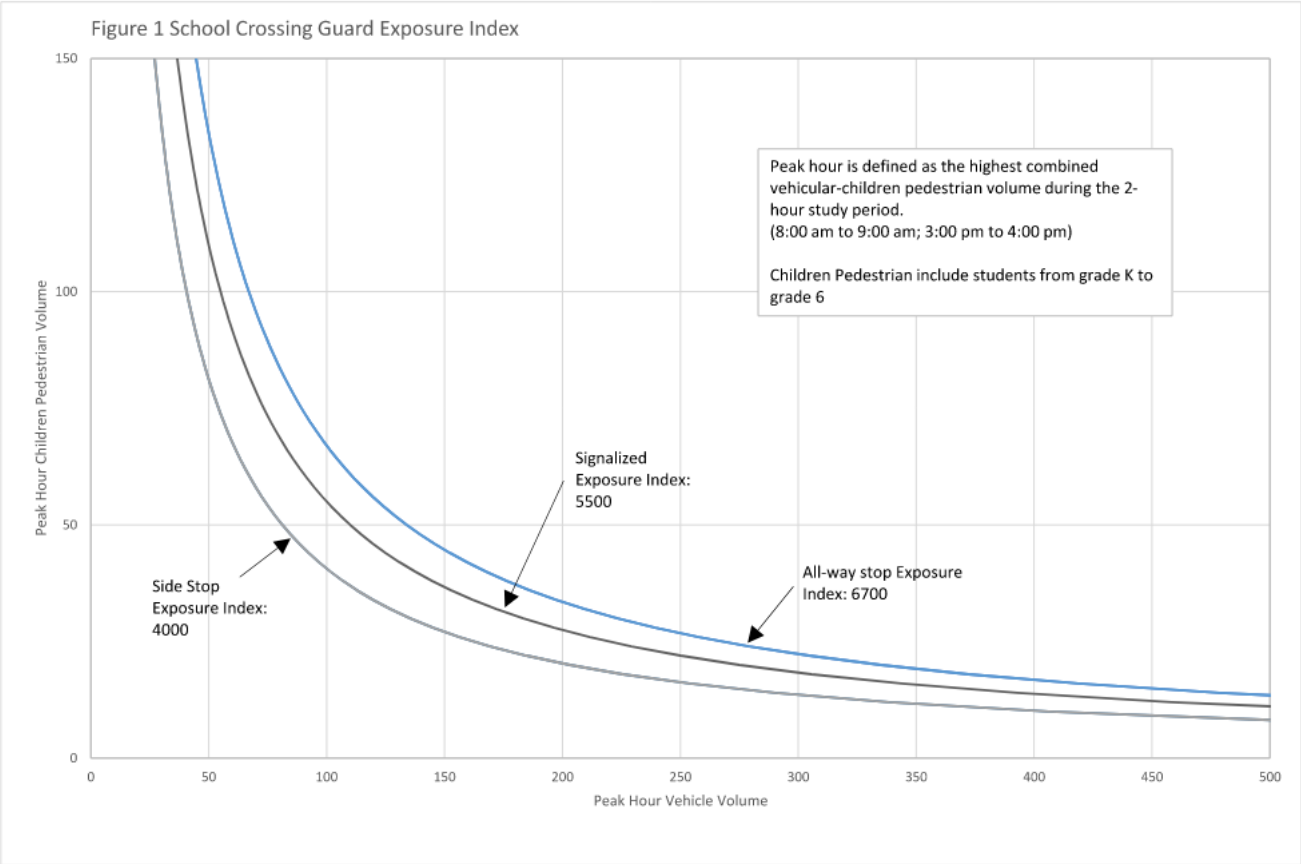


Figure 3 – Recommended City Exposure Index Curves

For uncontrolled crossings, the Safe Gap Time methodology is to be used based on average perception and reaction time (P), width of the roadway (W), average walking speed of students (S), a group factor (T) and the predominant group size (N).

Safe Gap Time (G) = Perception & Reaction Time (P) + Crossing Time + Group Factor Time

which is the equivalent to:

$$G = P + (W / S) + T (N - 1)$$

Further information on the methodology for calculating the Safe Gap Time is presented in Section 8.4 of the Ontario Traffic Council's School Crossing Guard Guide[100]. Where more than 50% of the five minute intervals surveyed have less than four Safe Gaps, then a school crossing guard is warranted for the location.

b. Implementation

School Crossing (Wc-2, Wc-102) and School Crossing Ahead (Wc-2A and Wc-102A) signs are to be installed at mid-block locations or uncontrolled intersection approaches, in accordance with Ontario Traffic Manual guidance.

At stop-controlled intersection approaches where a school crossing guard is assigned, School Crossing (Wc-2, Wc-102) and School Crossing Ahead (Wc-2A and Wc-102A) signs are not to be provided. At the intersection, high visibility ('ladder') crosswalk markings on all approaches, oversize STOP signs and secondary (left-side) STOP signs are to be installed.

c. Other Measures to Improve School Crossing Safety

Before considering a crossing guard at a location, a site assessment shall be undertaken to ensure:

- That any existing deficiencies (geometry, signage, pavement markings, etc.) are corrected;
- Whether alternative treatments, such as permanent traffic controls, visibility improvements, etc. can mitigate the concerns that originated the request for a crossing guard; and
- The suitability of the location for a crossing guard, reviewing roadway elements such as sightlines and the condition of the pedestrian crossing facilities and related traffic control devices.

At signalized crossings, the following enhancements may be considered before the potential implementation of School Crossing Guard, as well as in conjunction with a crossing guard:

- Implementing Leading Pedestrian Intervals;
- Prohibiting right turns on red;
- Extending the pedestrian walk time; and/or
- Ensuring that pedestrian countdown and information signs are installed at the intersection

[100] Ontario Traffic Council, School Crossing Guard Guide, May 2017

Where a crossing guard is recommended at a signalized intersection that is operated by the Region of York, staff should request that the Region of York consider the implementation of these measures.

Enhanced training should be provided to crossing guards assigned to locations where there are other types of traffic control (signals, STOP signs, PXOs, roundabouts) and School Crossing (Wc-2, Wc-102) and School Crossing Ahead (Wc-2A and Wc-102A) signs are no longer provided.

As part of their training, all crossing guards shall be made aware of how to report aggressive driving and/or non-compliance with the crossing guard directions using York Regional Police's Road Watch program.

d. New Schools and Annual Reviews

At all new schools, crossing guards will be implemented for a full school year at locations meeting the City's pre-screening criteria. The decision to continue having a school crossing guard will be based on the location:

- Meeting the minimum threshold - 20 assisted and unassisted elementary school children over the school peak periods; and
- Meeting the minimum threshold for the Exposure Index (for controlled crossings) or the Safe Gap Time warrants (for uncontrolled crossings).

The City conducts annual reviews of their crossing guard locations to confirm the need for the continued use of crossing guards. Crossing guards will be discontinued at locations not meeting the minimum threshold or not meeting the Exposure Index or Safe Gap Time warrants.

Sample Site Inspection Form

SCHOOL CROSSING - SITE INSPECTION REPORT

OBSERVER	Observed By: _____ Day / Date of Inspection: _____ Time: _____ Weather Conditions: ☐ Dry ☐ Sunny ☐ Rain ☐ Snow ☐ Other
SITE	**Location:** _____ Name of School(s): _____ Type of Crossing: ☐ 4 Way Intersection ☐ 3 Way Intersection ☐ Midblock Type of Control: ☐ No Control ☐ Traffic Signal ☐ IPS ☐ All Way Stop ☐ Stop Sign ☐ Yield Sign
OBSERVATIONS	School Signs: ☐ Non ☐ School Zone signs ☐ School Crossing signs ☐ Advance School Crossing signs Posted Speed: ☐ 40 km/hr ☐ 50 km/hr ☐ 60 km/hr ☐ Other: _____ Pedestrian Sight Distance: _____ (m) ☐ Poor ☐ Fair ☐ Good Sight Obstructions On: ☐ NE corner due to _____ ☐ SE corner due to _____ ☐ NW corner due to _____ ☐ SW corner due to _____ Road Classification ☐ Local ☐ Collector ☐ Arterial ☐ 2-lane ☐ 4-lane Road Grade: ☐ Flat ☐ Incline ☐ Decline Road Geometrics: ☐ Straight ☐ Curved Road Width(m): Curb to Curb: _____ Curb to Median: _____ Crosswalk Length (m) - used in the calculation of the safe gap time: _____ Road Conditions: ☐ Dry ☐ Wet ☐ Ice ☐ Snow Covered Sidewalks: ☐ None ☐ North ☐ South ☐ East ☐ West Proximity to School: ☐ In front of ☐ Within _____ m Route Survey: ☐ Shopping Area ☐ Construction ☐ Driveway ☐ Parked Vehicle(s) ☐ Transit Bus Stop ☐ Other_____

Other Site Observations:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Sketch ↑ N

Sample Gap Analysis Form

Appendix E

GAP SURVEY FORM (MORNING)

Location:			
School:			
Date:			
TIME	Gaps over 4 seconds (seconds)	# of students	Comments
7:30 - 7:35			
7:35 - 7:40			
7:40 – 7:45			
7:45 - 7:50			
7:50 - 7:55			
7:55 - 8:00			
8:00 - 8:05			
8:05 - 8:10			
8:10 - 8:15			
8:15 - 8:20			
8:20 - 8:25			
8:25 - 8:30			
8:30 - 8:35			
8:35 - 8:40			
8:40 - 8:45			
8:45 - 8:50			
8:50 - 8:55			
8:55 - 9:00			
9:00 - 9:05			

Appendix E

GAP SURVEY FORM (MIDDAY)

Location:	
School:	
Date:	

TIME	Gaps over 4 seconds (seconds)	# of students	Comments
11:10 - 11:15			
11:15 - 11:20			
11:20 - 11:25			
11:25 - 11:30			
11:30 - 11:35			
11:35 - 11:40			
11:40 - 11:45			
11:45 - 11:50			
11:50 - 11:55			
11:55 - 12:00			
12:00 - 12:05			
12:05 - 12:10			
12:10 - 12:15			
12:15 - 12:20			
12:20 - 12:25			
12:25 - 12:30			
12:30 - 12:35			
12:35 - 12:40			
12:40 - 12:45			
12:45 - 12:50			
12:50 - 12:55			
12:55 - 1:00			
1:00 - 1:05			

GAP SURVEY FORM (AFTERNOON)

Location:	
School:	
Date:	

TIME	Gaps over 4 seconds (seconds)	# of students	Comments
2:30 - 2:35			
2:35 - 2:40			
2:40 - 2:45			
2:45 - 2:50			
2:50 - 2:55			
2:55 - 3:00			
3:00 - 3:05			
3:05 - 3:10			
3:10 - 3:15			
3:15 - 3:20			
3:20 - 3:25			
3:25 - 3:30			
3:30 - 3:35			
3:35 - 3:40			
3:40 - 3:45			
3:45 - 3:50			
3:50 - 3:55			
3:55 - 4:00			

F

Appendix F – Road Safety Public Awareness Signs

Curbex

Mini B® PROOF

(Main Panel - 58"h x 96"w) (Topper - 12"h x 58"w)

112 STAVE CRESCENT, RICHMOND HILL

(BYLAW RESTRICTION: 3 COLOURS MAX, GRAYSCALE IMAGES, 5'X8' SIGN OK, NO TOPPER)

CIMA+

Richmond Hill


GET ACTIVE
Walk or bike to school today!
RichmondHill.ca/ActiveSchoolTravel


GET ACTIVE
on your way to school today!
RichmondHill.ca/ActiveSchoolTravel

G

Appendix G – Traffic and Parking Enhancements

1. STOP Sign Visibility Enhancements

a. Background

City staff have identified the need for STOP sign visibility enhancements at some intersections where the existing STOP sign is not properly visible and/or conspicuous. As a proactive measure, staff have recently doubled-up STOP signs (i.e., installing a second sign on the left-hand side of approaching drivers) at intersections downstream of horizontal curves to the right, where the right-side sign may not be as visible/conspicuous.

Other STOP sign visibility enhancements that have been implemented in Ontario municipalities are oversize STOP signs and “Tiger-tail” signs (Wa-33B, Wa-33E).

Image Source: Google Maps

b. Target Issue

- Intersections with reduced visibility and/or conspicuity to STOP signs
- Intersections with low stopping compliance or angle collisions

c. Engineering / Best Practice

Use of STOP Sign – OTM Book 5

Standard size signs (60x60 cm) are generally used at locations with posted speed limit of 60 km/h or less.

The oversize sign (75x75 cm) should be used where posted speeds are greater than 70 km/h or traffic conditions warrant greater visibility or emphasis for lower-speed roadways, e.g., roadway geometry, complex visual environments where many signs and other devices compete for driver attention, or high traffic volume locations where drivers need to concentrate more on the driving task.

The oversize 90x90 cm signs should be used where the 75x75 cm signs have been found not to provide sufficient emphasis. The sign should only be used after other methods of gaining compliance (e.g., left-hand side STOP signs) have been tried without success.

Use of STOP AHEAD Sign – OTM Book 6

The STOP AHEAD sign must be used upstream of a STOP sign that is not visible from the location where drivers are required to first see it (stopping sight distance per TAC *Geometric Design Guide for Canadian Roads*), to bring their vehicles safely to a smooth and complete stop at the location where they are required to stop.

OTM Book 5 provides guidance for visibility of regulatory signs. For speeds up to 50 km/h, the STOP sign must be continuously visible for 60 m. A higher viewing distance, preferably stopping sight distance should be considered for speeds higher than 50 km/h. Based on TAC *Geometric Design Guide for Canadian Roads*, this distance is 130 m for a posted speed of 60 km/h, 160 m for a posted speed of 70 km/h, and 185 m for a posted speed of 80 km/h.

The STOP AHEAD sign should also be used if there is evidence that drivers are not noticing or heeding the STOP sign, e.g., collision or conflict experience directly attributed to lack of observance of the stop regulation.

The installation of a STOP AHEAD sign in advance of the STOP sign should meet the advance placement requirements of the most recent version of OTM Book 6. The STOP AHEAD sign should comply with the visibility requirements of the OTM Book 6.

In some cases, factors such as roadway configuration or the presence of a feature (e.g., presence of a driveway) may constrain the location of a STOP AHEAD sign to a non-standard distance, or the sign might not be visible as per the above-noted visibility requirements (i.e., presence of any obstructions, such as trees). Also, the presence of an intersection between a STOP AHEAD sign and the STOP sign may result in misinterpretation of the sign. For these situations, the DISTANCE tab sign containing text such as “100 m” should be used in combination with the STOP AHEAD sign.

Use of Additional Left-hand Side STOP Sign – OTM Book 5

An additional left-hand side STOP sign may be installed:

- For two-way roadways, if collision records show an unusually high proportion (or over-representation) of failure to stop collisions at the STOP sign on an intersection approach, a supplementary STOP sign on the left-hand side of the roadway or in the median may be installed. However, practitioners are reminded that overuse of traffic control devices tends to lessen their effectiveness; or
- On approaches where the roadway environment makes the regular STOP signs less conspicuous (e.g., horizontal/vertical roadway alignment, presence of trees or other objects obstructing sightlines) and an existing STOP AHEAD sign has not been proved to be effective.

Use of Tiger-tail signs

Although there are no formal standards/guidelines on the use of tiger-tail signs, they are widely used in many municipalities in Ontario, such as the City of Burlington, City of Mississauga, City of Brantford, City of Cambridge, Town of Milton, and Region of Waterloo. They are generally more frequently used at All-way Stop Controlled (AWSC) intersections when compared to Minor Road Stop Controlled (MRSC) intersections. In the Town of Milton, City of Cambridge, City of Brantford and Region of Waterloo, all AWSC intersections are equipped with tiger-tail signs.

Tiger-tail signs are mainly retro-reflective strips provided on the posts. They are beneficial under low-light conditions to enhance STOP sign conspicuity under headlights. They can be more effective where there is evidence of low compliance under dark conditions, as well as on rural arterials to improve STOP sign conspicuity in low-light conditions, where the STOP signs may be provided at the end of a long stretch of roadway.

d. Policy / Implementation Criteria

STOP AHEAD Signs

The STOP AHEAD sign must be used upstream of a right-hand side STOP sign that is not visible from the STOP sign visibility distance listed below per OTM Book 5 and TAC *Geometric Design Guide for Canadian Roads*.

Speed Limit (km/h)	Stop Sign Visibility Distance (m)
≤50	85[101]
60	130
70	160
80	185

The installation of a STOP AHEAD sign in advance of the STOP sign should meet the advance placement requirements of the most recent version of OTM Book 6. The STOP AHEAD sign should comply with the visibility requirement of the OTM Book 6.

STOP AHEAD signs should also be used if there is evidence that drivers are not noticing or heeding the STOP sign, e.g., collision or conflict experience directly attributed to lack of observance of the stop regulation.

DISTANCE tab signs might be required under certain situations (refer to Implementation Considerations)

Additional Left-hand Side STOP Signs

An additional left-hand side sign should only be used at locations which qualify for STOP AHEAD signs and meet any of the following criteria:

- If collision records show an unusually high proportion (or over-representation) of collisions for which 'disobeyed traffic control' apparent driver action is reported at the subject intersection approach; or
- On intersection approaches with a peak hour traffic volume greater than 100 vehicles, where the roadway environment makes the regular STOP sign less conspicuous (e.g., horizontal or vertical roadway alignment, presence of trees or other objects obstructing sightlines) and there is evidence that drivers are not noticing or heeding the STOP sign (e.g., the location is marked as a "low STOP sign compliance" location – refer to the Implementation Considerations below); and
- Locations where there is a crossing guard.

[101] For speed limits 50 km/h or lower, the desirable stop sign visibility distance is 85 m; however, if this is not achievable, a minimum of 60 m is acceptable.

Note: For low-volume approaches (i.e., traffic volumes do not meet the traffic volume criteria above) with conspicuity issues, instead of using an additional left-hand side STOP sign, a DISTANCE tab sign can be added to the STOP AHEAD sign.

Oversize STOP Signs

Regular STOP signs should be replaced with oversize STOP signs if any of the following criteria is met:

- On roadways with posted speeds of 70 km/h or greater; or
- At lower speed locations, where the standard size left-hand side STOP signs have been tried without success;
- At locations where there is a crossing guard; or
- In areas with visual clutter (e.g., commercial signage/lighting in the downtown area), and high workload situations (e.g., with multiple approaches with a separate left turn lane at an all-way stop control intersection), use oversized STOP signs on approaches that are affected.

Note: For approaches with both left- and right-hand side STOP signs, the size of both STOP signs should be consistent.

Tiger-tail Signs

Tiger-tail signs (Wa-33B or Wa-33E) should be used on all approaches at all AWSC intersections.

e. Implementation Considerations

STOP AHEAD Signs

The installation of a STOP AHEAD sign in advance of the STOP sign should meet the advance placement requirements of the most recent version of OTM Book 6.

The STOP AHEAD sign should comply with the visibility requirement of the OTM Book 6, however, it is recognized that this may not always be achievable due to the presence of obstructions (e.g., trees, fences, landscaping) that cannot be reasonably removed.

For the following situations, a DISTANCE tab sign containing text such as “100 m” should be used in combination with the STOP AHEAD sign:

- If the roadway configuration or the presence of a feature (e.g., presence of a driveway) constrains the location of a STOP AHEAD sign to a non-standard distance; or
- If the STOP AHEAD sign is not visible as per the visibility requirements from OTM Book 6 (i.e., presence of any obstructions, such as trees); or

- If the presence of an intersection between a STOP AHEAD sign and the associated STOP sign may result in misinterpretation of the sign.

Data Collection

A threshold for “low STOP sign compliance” (e.g., the 85th percentile compliance rate) can be determined by reviewing compliance rate data at locations with a history of complaints of low compliance. The compliance rates should be collected separately by major road approaches and side street approaches.

Expectancy/Consistency

Left-hand side STOP signs should not be used as a corridor treatment or a neighbourhood treatment as it might affect drivers’ expectancy at other locations with regular STOP sign configurations.

2. Crosswalk Markings

a. Background

City staff receive numerous requests to install crosswalks at intersections, as well as to make them more visible at certain locations. High-visibility crosswalk markings (i.e., ladder crossing markings), in particular, can provide enhanced visibility of the crosswalk and thereby increases drivers' awareness of potential conflicts with pedestrians.

Image Source: Google Maps

b. Target Issue

- Pedestrian safety at intersections/crossings

c. Engineering / Best Practice

OTM Book 15 / OTM Book 11

Standard crosswalk markings must be provided at all controlled pedestrian crossings, which include locations that are controlled by STOP or YIELD signs, and traffic signals (including intersection pedestrian signals – IPS and mid-block pedestrian signals – MPS).

Ladder crossing markings provide enhanced visibility of the crosswalk and thereby increase drivers' awareness of potential conflicts with pedestrians. However, care

should be taken to avoid excessive use of ladder crosswalks in order to retain their effectiveness in gaining the particular attention of motorists to the potential presence of pedestrians.

Ladder crossing markings are required for all Level 2 Pedestrian Crossovers (PXO) – i.e., Types B, C and D, and double parallel markings are required for Level 1 Type A PXOs.

School crossings have specific crosswalk markings for rural and urban environments. The rural crosswalk markings consist of blocks (ladder markings) and the urban crosswalk markings are double parallel markings.

Town of Oakville

The Town of Oakville has upgraded several school crossings to PXOs with ladder crosswalk markings. These PXOs can not only be used as supervised school crossings during the school hours, but also provide a controlled environment for pedestrians outside of school hours.

d. Policy / Implementation Criteria

General

Crosswalks are not to be installed where it is not feasible to provide proper curb ramps and/or sidewalk connections. In these situations, crosswalks should be considered as part of future capital projects.

Standard Crosswalks (parallel line markings)

Standard crosswalks are the minimum requirement for all controlled pedestrian crossings.

Double Parallel Crosswalk (school crosswalk markings)

Double parallel crosswalks should be installed at all designated supervised school crossing locations in urban areas (refer to OTM Book 11 and 15) where the crossing guard is the only available traffic control.

High-visibility Crosswalks (i.e., ladder markings)

Ladder crosswalk markings should be used on all controlled approaches at signalized, all-way stop-controlled, and minor-road stop-controlled intersections that meet one of the following criteria:

- **Vehicular volumes:** AADT is equal to or greater than the 85th percentile AADT on City's roads (i.e., approximately 6,000 vehicles per day);[102]
- **Pedestrian volumes:** 8-hour pedestrian volumes, for all intersection approaches combined, greater than or equal to 75 pedestrians, or 4-hour pedestrian volumes greater than or equal to 50 pedestrians;
- **PXOs:** PXO locations that are warranted for a Level 2 PXO (i.e., Types B, C or D).

Ladder crosswalk markings should also be used at all designated school crossings that are not uncontrolled (e.g., traffic signals or stop-controlled approaches with a designated school crossing guard during school hours) and that do not meet the above-noted criteria for high-visibility crosswalks.

Note: All approaches of an intersection should have consistent crosswalk markings. Even if only one approach is warranted for high-visibility crosswalks, all other approaches should have the same style of crosswalk marking.

e. Implementation Considerations

General

To mitigate potential tripping hazards, curb ramps should be widened so that the full width of the depressed curb matches the width of the crosswalk at all new high-visibility crosswalks, PXOs and school crossings.

At new or existing parallel crosswalks and existing high-visibility crosswalks, PXOs and school crossings, curb ramps should be widened at the next opportunity when capital projects, resurfacing or curb and sidewalk repairs are completed.

Standard Crosswalks

For intersections within the City that are currently not equipped with standard crosswalks, installation of standard crosswalk markings shall follow these criteria:

- **Road classification:** prioritize installations along collector roads over local roads;
- **Traffic volumes:** prioritize installations at intersections with higher major road volumes; and
- **Expectancy/Consistency:** crosswalks should be installed as a corridor treatment (i.e., at all intersections along a major road), and/or as an area treatment (i.e., at intersections across a subdivision)

[102] This threshold may be updated every 5 years, as a part of the City's Traffic Safety and Operations Strategy Update.

3. ‘Nearly Warranted’ All-Way-Stop-Control

a. Background

Some minor-road-stop-controlled (MRSC) intersections in the City are close to meeting the traffic volume requirements for all-way-stop-controlled (AWSC) intersections. While AWSC intersections do provide additional safety features at the cost of traffic delay to the major road approaches, at lower-volume intersections, the safety benefit – particularly for pedestrians – would likely outweigh the impact on traffic operations. As vehicles from all approaches are required to stop and yield to any pedestrian before proceeding through the intersection, the main safety features of AWSC intersections when compared to MRSC intersections are:

- AWSC intersections provide a controlled crossing to allow pedestrians to cross the major road safely; and
- In the event of a collision, it is more likely to occur at a low speed, which is less likely to result in injuries.

Image Source: Google Maps

b. Target Issue

- Traffic Control and Pedestrian Safety

c. Engineering / Best Practice

OTM Book 5

AWSC Traffic Volume Warrant for Local Road Intersections:

- The total vehicle volume on all intersection approaches exceeds 200 vehicles per hour for each of the highest 4 hours of the day;
- The combined vehicle and pedestrian volume on the minor road exceeds 75 units per hour (all vehicles plus pedestrians wishing to enter the intersection) for each of the same 4 hours as the total volume; and
- The volume split does not exceed 70/30 (that is the minor road must not be less than 30% of the total volume entering the intersection) as measured over the entire eight-hour count period. For three-legged intersections, a volume split of 75/25 is permissible.

OTM Book 1

The traffic practitioner's fundamental responsibility is to exercise engineering judgment and experience on technical matters in the best interests of the public and workers. Guidelines are provided in the OTM to assist in making those judgments, but they should not be used as a substitute for judgment.

Human Factors

Drivers are more familiar with STOP signs at minor residential intersections (particularly considering Level 2 Type D PXOs do not have flashing beacons), therefore a STOP sign tends to be better suited to match drivers' expectations when compared to a PXO.

d. Policy / Implementation Criteria

At local road intersections within residential neighbourhoods where All-Way Stop Control (AWSC) is not warranted based on OTM Book 5 criteria, staff may still consider its implementation in the following situations:

- The total vehicle volume on all intersection approaches exceeds 150 vehicles per hour for each of the highest 4 hours of the day; and
- The combined vehicle and pedestrian volume on the minor road exceeds 60 units per hour for each of the same 4 hours as the total volume; and
- A PXO Level 2 Type D is warranted based on OTM Book 15 criteria, but All-way Stop Control is considered to better match drivers' expectations.

OR

- The total vehicle volume on all intersection approaches exceeds 350 vehicles for the highest hour of the day; and
- Intersection capacity analysis for the AM or PM Peak Hours, under existing conditions, indicates a volume-to-capacity ratio exceeding 0.95, Level of Service (LOS) E or worse, or 95th percentile queue in excess of 50 metres for any of the minor road approaches;
    - Alternatively, field observations indicate an average delay in excess of 35 seconds (i.e., LOS E or worse) or 95th percentile queues in excess of 7 vehicles; and
- Intersection capacity analysis for the AM or PM Peak Hours, under AWSC, indicates that major road approaches are not expected to experience volume-to-capacity ratios greater than 0.85, LOS E or worse, or queues that would interfere with adjacent intersections.

OR

- Anticipated traffic growth in the area is expected to meet OTM Book 5 warranting criteria within the next 3 years.

At intersections along collector roads, where AWSC is not warranted based on OTM Book 5 criteria but other operational or safety concerns are identified that may require consideration for AWSC, staff may determine the need to undertake a detailed Intersection Control Study (ICS) to evaluate advantages and disadvantages of different control types. An ICS study should investigate operational and safety performance of the intersection under different traffic control devices, as well as human factors considerations and impacts on pedestrian, cyclists and other vulnerable road users, as applicable for the site context.

For more complex locations, or for those that rank high in network screening or systemic risk assessment, staff may choose to undertake more formal safety studies. Such locations can be considered for AWSC as a mitigation measure recommended as a result of a formal In-service Road Safety Review, Conflict Analysis, Road Safety Audit, or a study conducted for determining systemic risk factors.

e. Implementation Considerations

When installing new STOP signs on the minor road approaches, the NEW (sunburst) warning signs need to be installed for a duration of 60 days.

The City's Municipal Code must be amended through by-law for implementing any STOP control.

4. Conversion from All-Way-Stop-Control to Minor-Road-Stop-Control

a. Background

Some existing all-way-stop-controlled (AWSC) intersections within the City may not experience sufficient volumes to warrant AWSC. Some of these may have been implemented at the time of road or subdivision construction, while some may have been installed following older versions of the OTM Book 5 warranting criteria.

Since the use of unwarranted STOP signs could lead to reduced credibility and/or compliance by drivers, City staff may re-evaluate the need for AWSC and determine if minor-road-stop-control (MRSC) is a more appropriate control type for these intersections.

Image Source: Google Maps

b. Target Issue

- Traffic Control and STOP Sign Compliance

c. Engineering / Best Practice

Refer to Section 3c.

d. Policy / Implementation Criteria

The conversion of AWSC to MRSC is expected to occur rarely in the City of Richmond Hill. However, if deemed necessary, City staff may consider such conversion if all of the following criteria are met:

- Recent volume data indicates that the location is not close to being warranted for AWSC (see details in Section 4.3);
- The highest hourly pedestrian volume is less than 20 pedestrians crossing the major road;[103]
- Intersection sight distances for drivers entering the intersection from the minor road approaches are available, in accordance with TAC Geometric Design Guidelines for Canadian Roads (refer to Intersection Sight Distance policy); and
- There is evidence of low compliance with the AWSC on the major road.[104]

e. Implementation Considerations

When existing AWSC is to be removed and a through roadway is created, information regarding the change in right-of-way control must be publicized using signage (i.e., CROSS TRAFFIC DOES NOT STOP), and through local print and electronic media (refer to OTM Book 5 for further details).

Once the conversion is completed, a site visit should be conducted to identify any unexpected unsafe road user behaviours.

[103] Note: this hourly pedestrian volume matches the minimum threshold in the City's crossing guard policy
[104] Low compliance should be defined by determining a threshold based on the 85th percentile compliance value using historical data collected at other City AWSC intersections (refer to Section 1.5).

5. Intersection Sight Distance at Local Road Intersections

a. Background

The City has many local road intersections where trees or fences restrict the available sight distance below the minimum intersection sight distance (ISD) requirements per TAC *Geometric Design Guide for Canadian Roads.*

However, sometimes it may be unreasonable to remove a mature tree or a fence that has been in place for decades at low-risk locations (e.g., low volumes, low operating speeds, no historical collision patterns). ”Legal non-conforming” situations are very common, in which the available sight distance does not meet current requirements from design standards, but did meet the requirements in the past, when different design standards were in effect. In these cases, ISDs that do not meet current requirements may be acceptable if there is evidence that the restricted sight distance does not represent a safety risk to road users.

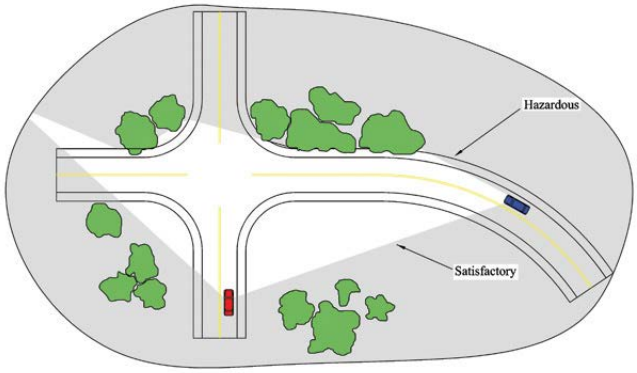


Image Source: Federal Highway Administration

b. Target Issue

- Limited sightlines at minor-road stop-controlled intersections

c. Engineering / Best Practice

TAC *Geometric Design Guide for Canadian Roads*

Intersection Sight Distance

Roadway intersections are characterized by potential road user (e.g., vehicles, cyclists, and pedestrians) conflicts. The avoidance of collisions and the efficiency of operation depends to a large extent on the judgement, capabilities, and responses of individual road users. Intersections, therefore, must be provided with sufficient sight distance for

road users to perceive potential conflicts and carry out the actions needed to negotiate the intersection safely.

Sight distance requirements must be considered both for approaching the intersection and departing from the stopped position at the intersection. The minimum sight distance criterion for vehicles approaching an intersection is stopping sight distance (SSD) based on design speed.

Intersection sight distance (ISD) is defined as the sight distance available from a point where vehicles are required to stop on the intersecting road, while drivers are looking left and right along the major roadway, before entering the intersection. The ISD is adequate when it allows the design vehicles to safely make all the maneuvers that are permitted by the layout (e.g., left turns, right turns, through moves), without significantly affecting vehicles travelling on the major road.

The TAC *Geometric Design Guide for Canadian Roads* (GDGCR) requirements for ISD are based on sight triangles. Specified areas along intersection approach legs and across their included corners, known as sight triangles, should be clear of obstructions that might block a driver's view of potentially conflicting vehicles. The dimensions of the legs of the sight triangles depend on the design speeds of intersecting roadways and the type of traffic control used at the intersection. Two types of clear sight triangles are used at intersections: approach sight triangles, and departure sight triangles:

- The approach sight triangles consist of a triangular area free of obstructions that might block an approaching driver's view of potentially conflicting vehicles. The approach sight triangles are only applicable for intersection approaches not controlled by stop signs or traffic signals and are not discussed further as this policy is for stop-controlled intersections. In this case, the need for approaching vehicles to stop is determined by the traffic control device.
- The departure sight triangles provide sight distance sufficient for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As per TAC Geometric Design Guide, the requirement of departure sight triangles is mainly for two situations:[105]
    - Left turns from the minor road – The departure sight triangles for traffic approaching from either left or right should be provided for left turns from the minor road onto the major road for all stop-controlled approaches.

[105] The departure sight triangles for left and right turns onto the major road will also provide more than adequate sight distance for minor-road vehicles to cross the major road.

- Right Turns from the minor road – A departure sight triangle for traffic approaching from the left should be provided for right turns from the minor road onto the major road.

The required length of the leg of the sight triangles for the above-noted situations is based on the design speed and are provided in Table 9.9.4 (for left turns from minor road) and in Table 9.9.6 (for right turns) in the GDGCR.

Design Exceptions

In many cases dealing with roadway design, meeting the guidelines may not be practical or desirable. The roadway design must respect controls and constraints to a greater or lesser degree depending on their nature and significance. Often, design engineers are faced with the dilemma of being unable to choose design dimensions or criteria that will satisfy all controls and constraints; a compromise is then required. Some design criteria are inviolate, such as vertical clearance at structures. Others are less rigid, and some are chosen based primarily on considerations of safety, service, capacity, or economy. There is a continuous relationship between service, cost, and safety, and changes in the value of design dimensions. Deviations from the guidelines or less generous design dimensions may not necessarily lead to roadways that are not safe. Likewise, more generous design dimensions do not necessarily lead to safer roadways. Design is a process in which sound engineering judgement and experience considering service, cost, and safety play significant roles.

A Design Exception is a case where one or more design elements for one or more modes of transportation falls outside normal boundaries of the design domain for that design element. It is an extraordinary situation and one where the design needs to be tailored to its context through sound professional judgment.

Design exceptions should be supported by appropriate engineering judgment, and detailed documentation which includes a summary of mitigating strategies. The GDGCR has provided a six-step process for evaluating the design exceptions, which includes an evaluation of risks as a result of the design deviation, and the development of mitigation measures.

Design Exception for Intersection Sight Distance

The GDGCR states that requiring a design exception evaluation for every design element is impractical, and identifies 12 key criteria having substantial importance to the operational and safety performance of any highway so that special attention should be paid to them in design decisions. These key criteria include Design Speed, Horizontal Alignment, Superelevation, Vertical Alignment, Grade, Stopping Sight Distance, Vertical

Clearance, Cross Slope, Lane Width, Shoulder Width, Bridge Width, and Lateral Offset to Obstruction. Intersection Sight Distance is not included among the referred key design criteria.

At low-speed (i.e., post speed limit of 50 km/h or less), low-volume (i.e., within low-density residential neighbourhoods), minor-road stop-controlled local road intersections, there might be situations where adequate ISD cannot be provided. In such cases, as long as the SSD can be maintained on the major road, when a driver on the minor road enters the intersection, the driver on the major road would have sufficient time to safely react and come to a complete stop before reaching the intersection. Therefore, if there is no clear evidence that the inadequate ISD is resulting in safety issues (i.e., road user collisions or conflicts), then City staff may decide not to remove the object(s) causing the obstruction, and install INTERSECTION warning signs as a mitigating measure.

d. Policy / Implementation Criteria

At local road intersections within residential neighbourhoods where the Intersection Sight Distance (ISD), per TAC *Geometric Design Guide for Canadian Roads*, is not available due to the presence of trees, fences, landscaping or other objects, staff may decide not to remove the object(s) causing the obstruction if all of the following conditions are met:

- No collisions have been reported, in the past ten (10) years, involving a driver on the subject minor road approach disobeying traffic control or failing to yield the right of way; and
- The 95th percentile speed on the subject major road approach does not exceed 50 km/h; and
- The available ISD is equal to or greater than the SSD based on the major road approach design speed; and
- Field observations indicate that most drivers experience no difficulty or hesitation entering the intersection from the subject approach, and most drivers on the major road are not required to brake or swerve to avoid a collision.

If these conditions are met, INTERSECTION warning signs (Wa-11A or Wa-13a) with HIDDEN INTERSECTION tab signs (Wa-18t) are to be installed on the affected major street approaches. Sign placement should be in accordance with the current version of OTM Book 6.

At other intersections (i.e., collector roads or not within residential neighbourhoods), HIDDEN INTERSECTION signage is to be installed if the available ISD, measured

following procedures in the TAC *Geometric Design Guide for Canadian Roads*, is less than the Minimum Sight Distance values specified in OTM Book 6 for these signs.

e. Implementation Considerations

A formal memo outlining the justification/decision for not removing the sight obstruction should be prepared and approved by senior management.

NO STOPPING zones should be established within the sight triangles and they need to be strictly enforced so that the sightline will not be obstructed by parked vehicles.

6. PXOs at Roundabouts

a. Background

Roundabouts have been proven to reduce the frequency and severity of collisions when compared to stop-controlled and signalized intersections. The three main roundabout design features that contribute to safety benefits are fewer conflict points, slower speed, and smaller entry angle.

In terms of pedestrian safety, pedestrians only need to cross one direction of traffic at a time when crossing a roundabout, which reduces the likelihood of pedestrian collisions. PXOs at roundabouts can further improve pedestrian safety by ensuring traffic stops for pedestrians before entering the roundabout.

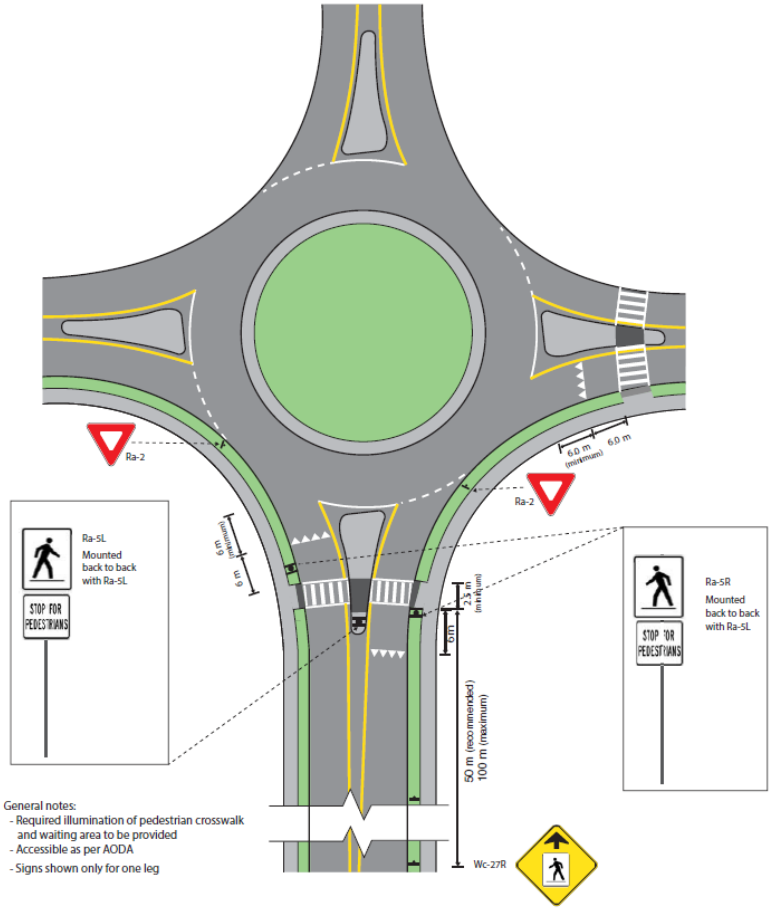


Image Source: OTM Book 15

b. Target Issue

- Pedestrian Safety at Roundabouts

c. Engineering / Best Practice

The need for PXOs and the selection of the type of PXOs at roundabouts can be determined using the Decision Support Tool and PXO Selection Matrix from OTM Book 15.

Most roundabouts within the City are located in residential areas, where pedestrian movement is expected, and drivers in North America are still not fully familiar with roundabout operations. PXOs can reduce the risk to pedestrians at roundabouts, since they clearly indicate who has the right of way.

d. Policy / Implementation Criteria

All roundabouts in urban areas where pedestrian activity is expected should be equipped with PXOs. The specific PXO type should be determined per OTM Book 15 guidance.

e. Implementation Considerations

In cases where different PXO types are warranted for different approaches of a roundabout, the higher tier PXO type should be used consistently on all warranted approaches.

7. School Zones

a. Background

School zones are sections of road adjacent to schools where temporary speed limit reductions can be in effect during certain times of regular school days. School Zones and Community Safety Zones are the two types of designated zones where automated speed enforcement can be deployed.

Image Source: Google Maps

b. Target Issue

- Speeds on roads adjacent to elementary and high schools

c. Engineering / Best Practice

Per the Highway Traffic Act amended Regulation 615, the new School Zone Maximum Speed sign (without flashers), as shown below, should be used to allow the use of automated speed enforcement in School Zones. A School Zone should cover a minimum of 150m in advance and after the frontage of the school.

Per OTM Book 5, the municipal school zone maximum speed with times, days, months signs (the SCHOOL ZONE sign) must be installed at the beginning of the school zone in each direction of travel on the road. The start of the school zone is typically chosen to ensure that drivers have sufficient time to reduce their speeds and begin to monitor the presence of students before reaching the areas of key activity such as the school entrance or driveways. On roads with posted speed limit of 50 km/h or 60 km/h, the SCHOOL ZONE signs should be installed 50m in advance of the areas of key activity, and the signs must be visible for a minimum distance of 60m. A regulatory speed limit sign must be placed at the end of a School Zone.

d. Policy / Implementation Criteria

School Zones will be implemented on all City roads, with a speed limit of 50 km/h or higher, fronting school entrances and where a Community Safety Zone is not warranted.

On City roads fronting school entrances with a speed limit of 40 km/h, and where a Community Safety Zone is not warranted, School Zones will not be considered. If a speed limit reduction to 30 km/h is to be considered, it must be in the context of the City's Speed Limit and Traffic Calming Policy, accompanied by physical traffic calming measures.

e. Implementation Considerations

School Zones should be priority locations for automated speed enforcement deployment.

8. Directional Dividing Line Markings

a. Background

Directional dividing lines are used to designate the portion of a two-lane two-way roadway available for traffic travelling in each direction.

Image Source: Google Maps

b. Target Issue

- Directional dividing line delineation

c. Engineering / Best Practice

OTM Book 11

Directional dividing lines are generally required throughout the length of all two-lane, two-way roadways. However, continuous directional dividing lines may not be necessary and/or practicable on low-volume local roadways in an urban area (i.e., two-way peak hour volume less than 500 vehicles).

Where a continuous directional dividing line is determined to be impracticable or unnecessary, short segments of directional dividing lines are required at specific roadway features. These include:

- Vertical/horizontal curves;
- Intersections, crosswalks, pedestrian crossovers; and
- Railway crossings, bridges, subways, obstructions within the roadway.

d. Policy / Implementation Criteria

At intersections, directional dividing lines should be provided for all controlled approaches, with or without stop bars, as follows:

- The directional dividing lines at intersection approaches should be at least 15m long (approximately 2 passenger car lengths), as measured from the stop bar or from the point where a vehicle must stop or yield[106] the right-of-way to any traffic before entering the intersection; and
- On approaches where a STOP sign or YIELD sign is not visible from the required stopping sight distance, the directional dividing line should be extended to match the required stopping sight distance, in conjunction with other STOP/YIELD sign visibility enhancements
- On road segments, directional dividing lines should be provided if any of the following is met:
- The two-way peak hour volume is greater than 500 vehicles per hour; or
- Along the approaches to the crest of a hill where the available sight distance is less than 150 m; or
- From 30 m in advance through 30 m beyond any curve having a radius of less than 180 m (10 degrees of curvature or greater), or where the sight distance is less than 150 m;

Directional dividing lines should only be terminated based on engineering judgement (e.g., at intersections with STOP signs or traffic signals where a directional dividing line is no longer warranted based on traffic volumes).

Directional dividing lines should be discontinued through roadway intersections.

e. Implementation Considerations

For roads within the City that meet the criteria for directional dividing lines, but are currently not equipped with them, directional dividing line installation should be prioritized following these criteria:

- **Road classification**: prioritize installations on collector roads over local roads;
- **Traffic volumes**: prioritize roadways with higher traffic volumes; and
- **Expectancy/Consistency**: directional dividing lines should be installed as a corridor treatment (i.e., at all intersections along a major road), and/or installed as an area treatment (i.e., at all intersections across a subdivision)

[106] Any existing Yield-controlled intersections are to be converted to stop-controlled, with the exception of roundabouts

9. Parking Restrictions Retrofitting

a. Background

The City's Standards and Specifications Manual prescribes on-street parking on only one side of the road on Local and on Minor Collector roads, and no on-street parking on either side of the road for Major Collector, Industrial and Arterial Roads. Additionally, minimum roadway widths must be maintained at all times to ensure unobstructed two-way traffic and access to emergency vehicles.

Historically, NO PARKING signs have not been installed on such roads at the time of their construction. As a result, residents reach out to City staff requesting the implementation of parking prohibitions to ensure unobstructed two-way traffic and access to emergency vehicles.

Image Source: Google Maps

b. Target Issue

- On-street parking obstructing two-way traffic and emergency vehicle access

c. Engineering / Best Practice

The City's Standards and Specifications Manual prescribes minimum pavement widths for Local (8.5 m) and Minor Collector (9.75 m) roads, with on-street parking on only one side of the road. For Major Collector, Industrial and Arterial Roads, on-street parking is not considered on either side of the road.

Additionally, The City's Standards and Specifications Manual is currently being updated and is expected to prescribe lane widths ranging from 3.0 m to 3.3 m for through lanes (minimum 3.3 m for curb lanes on transit routes) and 2.0 m to 2.5 m for parking lanes.

d. Policy / Implementation Criteria

"No Parking Anytime" signage should be installed on all Municipal urban roads, accompanied by the corresponding Municipal Code amendment, as specified in the following table:

Road Classification	Pavement Width (m)	Parking Prohibited
Local	< 8.0 m ≥ 8.0 m and < 10.0 m	Both Sides One Side
Minor Collector	< 8.5 m ≥ 8.5 m and < 11.0 m	Both Sides One Side
Major Collector	Any	Both Sides
Industrial	Any	Both Sides
Arterial	Any	Both Sides

The above-noted criteria are applicable only for 'typical' roadway cross-sections on existing roads.

On existing rural roads or where special elements such as bicycle lanes, two-way left-turn lanes, medians, etc. are present, the decision to permit or prohibit parking should be based on an individual review of the subject road segment and based on sound engineering judgment.

On new roads, particularly within subdivisions, the necessary parking regulations should be determined at the design stage, in accordance with the City Standards and Specifications Manual, and the corresponding signage should be included as part of the Composite Utility Plans (CUP). The corresponding parking regulation by-law amendments should also be undertaken as part of the subdivision process.

e. Implementation Considerations

Cross Section

The side of the road where parking is permitted should not alternate between different sides of the road, unless justified by sound engineering judgment.

On road segments where directional dividing line pavement markings are provided, the directional dividing line should be shifted off-centre to prevent conflicts between vehicles travelling in opposing directions. The position of the directional dividing line should be determined by considering a 2.5 metre wide parking lane and dividing the remaining width equally between the two travel lanes, provided that the resulting lane widths are not less than 3.0 m (3.3 m on transit routes).

In areas with a higher demand for on-street parking (such as in front of parks, commercial plazas or schools), staff may consider delineating the parking lane with a solid white line.

Implementation Plan

The side of the road where on-street parking remains permitted should be the one that maximizes parking supply, unless this would create unsafe conditions (e.g., on-street parking should be discouraged on the inside of a horizontal curve).

Prioritization of locations to implement retrofitted parking restrictions should be based on reported or potential parking activity that may obstruct two-way traffic and/or emergency vehicle access. Examples of reported parking activity include traffic inquiries by residents or emergency services; examples of potential parking activity include proximity to schools, parks, recreational facilities, etc.

On local roads, the implementation of parking restrictions should be undertaken for groups of streets within the same subdivision or neighbourhood to ensure residents are treated fairly (i.e., so that residents of a street are not ‘singled-out’). The extent of each group is to be determined by staff based on reasonable boundaries (e.g., surrounding road network, natural features, substantial change in land use or road characteristics, etc.).

On collector roads, detailed reviews may be necessary to determine potential impacts of introduced parking restrictions. This may include migration of on-street parking to nearby roads, considerations for pedestrian safety (e.g., if near pedestrian generators, desire lines could be created for crossing the collector road), etc.

10. Oversize Parking and Stopping Regulation Signs

a. Background

Violations of parking/stopping regulations are most prevalent at locations with a high frequency of pick-up/drop-off (PUDO) activities such as schools and parks/recreation facilities – particularly if regular signs (30cm x 30cm) are overlooked amidst sign clutter.

Image Source: OTM Book 5

b. Target Issue

- On-street parking violations in areas with a high frequency of pick-up/drop-off (PUDO) activities

c. Engineering / Best Practice

OTM Book 5

The standard size (300 mm x 300 mm) sign should be used where posted speed is 60 km/h or less.

The oversize (600 mm x 600 mm) sign should be used where posted speed is 70 km/h or greater.

As oversize signs are not to be used on low-speed roads (i.e., a roadway with a posted speed limit of 60 km/h or less) per OTM Book 5, it is typically not appropriate to use oversize NO PARKING/NO STOPPING signs to improve visibility of the signage/emphasize no parking or stopping.

However, as noted in OTM Book 1, the traffic practitioner's fundamental responsibility is to exercise engineering judgment and experience on technical matters in the best interests of the public and workers. Guidelines are provided in the OTM to assist in making those judgments, but they should not be used as a substitute for judgment. Therefore, in situations where there is a need to highlight a NO PARKING or NO STOPPING restriction, it may be considered appropriate.

d. Policy / Implementation Criteria

Where recurring/persistent NO PARKING or NO STOPPING violations are observed on a regular basis, City staff may consider the use of oversize parking and stopping regulation signs on Municipal roads near schools, parks, community centres and other traffic generators, if the typical activity causes a substantial disruption to traffic operations and/or safety (i.e., congestion, blockages, bottlenecks, conflicts between parking manoeuvres and through traffic, etc.).

Oversize parking and stopping regulation signs should only be considered if the following alternatives have been determined not to be effective, are not feasible due to physical constraints, or are expected to aggravate existing or create new problems:

- Provide proper on-street pick-up/drop-off parking spaces;
- Place obstructions (e.g., planters, bicycle stalls, fence) on curbsides to prevent PUDO activities;
- Encourage school officials to conduct public education campaigns with parents/guardians;
- Re-evaluate the need for other, existing signs in the area, and remove unnecessary signs, or relocate those that are not location-specific; and
- Reduce the spacing of regular-sized signs (as long as this does not create or aggravate an existing sign clutter problem).

e. Implementation Considerations

Per OTM Book 5, in urban areas, oversize NO PARKING/NO STOPPING signs should be spaced at 50m or less. If sign spacing is reduced, a minimum spacing of 15m should be maintained between signs to avoid sign clutter.

H

Appendix H – Resource and Reference List

Reference	Short Name:	Published by:	Year	Predominantly Used for Guidance on:
OTM Book 11 - Pavement, Hazard and Delineation Markings	OTM Book 11	MTO	2000	Main reference for pavement markings
OTM Book 1A - Illustrated Sign and Signal Display Index	OTM Book 1A	MTO	2001	Quick reference
OTM Book 1B - Sign Design Principles	OTM Book 1B	MTO	2001	Sign position requirements (height, lateral offset, etc.)
OTM Book 1C - Positive Guidance Toolkit	OTM Book 1C	MTO	2001	Fundamental principles
OTM Book 6 - Warning Signs	OTM Book 6	MTO	2001	Main reference for warning signs
OTM Book 1 - Introduction to the Ontario Traffic Manual	OTM Book 1	MTO	2005	Fundamental principles, interpretation, engineering judgment, liability, etc.
Guide to In Service Road Safety Reviews	ISRSR Guide	TAC	2004	In Service Road Safety Reviews
Canadian Guidelines for Establishing Posted Speed Limits	TAC Speed Limit Guide	TAC	2009	Speed limits
Synthesis of Current Practices for Enhancing Traffic Signal Conspicuity	n/a	TAC	2009	Signal conspicuity
OTM Book 8 - Guide and Information Signs	OTM Book 8	MTO	2010	Main reference for guide and information signs
Highway Safety Manual	HSM	AASHTO	2010	Safety countermeasures
OTM Book 12 - Traffic Signals	OTM Book 12	MTO	2012	Main reference for traffic signals
Bikeway Design Manual	MTO Bikeway Manual	MTO	2014	MTO's Bikeway Design Manual
OTM Book 15 - Pedestrian Crossing Treatments	OTM Book 15	MTO	2016	Main reference for pedestrian treatments
Traffic Engineering Handbook (7th Edition)	ITE Handbook	ITE	2016	Ball Bank studies. Travel time surveys.
Geometric Design Guide for Canadian Roads	TAC Design Guide	TAC	2017	Main reference for sight distance assessments, secondary reference for cycling facilities, clear zones
Road Safety Fundamentals - Concepts, Strategies, and Practices that Reduce Fatalities and Injuries on the Road	FHWA Road Safety Fundamentals	FHWA	2017	Overview of safety
School Crossing Guard Guide	OTC Guide	OTC	2017	Crossing guard warrants and assessments
Canadian Roundabout Design Guide	TAC Roundabout Guide	TAC	2017	Main reference for roundabout assessments. MUTCDC and OTM also used for signs/pavement markings
Roadside Design Manual	n/a	MTO	2017	Clear zones and roadside protection systems
Canadian Guide to Traffic Calming	TAC Traffic Calming Guide	TAC	2018	Main reference for traffic calming measures
Pedestrian and Cycling Planning & Design Guidelines	n/a	York Region	2018	Secondary reference for cycling facilities
Grade Crossing Handbook	n/a	Transport Canada	2019	Railway crossings
Countermeasures that Work: A Highway Safety Countermeasure Guide	Countermeasures that Work	US NHTSA	2020	Safety countermeasures
OTM Book 5 - Regulatory Signs	OTM Book 5	MTO	2021	Main reference for regulatory signs
OTM Book 18 - Cycling Facilities	OTM Book 18	MTO	2021	Main reference for cycling facilities
Manual for Uniform Traffic Control Devices for Canada (6th Edition)	MUTCDC	TAC	2021	Secondary reference for when OTM does not provide guidance
Micromobility Facility Design Guide	n/a	ITE	2021	Secondary reference for cycling/micromobility facilities
Parametric Estimating Guide	PEG 2021	MTO	2021	Cost estimates
Highway Capacity Manual; Sixth Edition	HCM	AASHTO	2022	Main reference for traffic operational performance (mostly applied via Synchro)
Speed Reduction Techniques - A Proposed Recommended Practice	n/a	ITE	2022	Safety countermeasures

Reference	Short Name:	Published by:	Year	Predominantly Used for Guidance on:
Restaurant Patio Guidelines within ROW	n/a	OTC	2022	Safety countermeasures
Hostile Vehicle Mitigation Measures		OTC	2022	Safety countermeasures
CMF Clearinghouse	n/a	FHWA	Ongoing	Safety countermeasures
TAC - Online Road Safety Training	n/a	TAC	Ongoing	Road safety course

Appendix I – Recommendations Table

The following table outlines the recommendations for future policies, projects, programs and initiatives that were identified as a result of the work undertaken in Task 3. The following is noted with regard to the organization of the table for each recommendation:

The recommendations are shaded green for policies, blue for projects, orange for programs and yellow for initiatives.

- Each are grouped into short term (for implementation in 2023), medium term (for implementation in a 1-to-3-year range) or long term (for implementation in greater than 3 years)
- A start year is provided
- A broad category is indicated, either:
    - Administration
    - Automated Speed Enforcement
    - Community Safety Zones
    - Inquiry Review Process
    - Pedestrian Crossovers
    - Public Awareness and Education
    - Road Safety Program
    - School Crossing Guards
    - Speed Management
    - Traffic Data Management
- A short title is provided for each
- A description is provided for each
- The benefit to the City is indicated for each
- Additional stakeholders that would be impacted by each recommendation is indicated
- The cost implications are indicated, either the consultant or contractor costs or capital purchases
- The resource implications of each are indicated, rounded to the nearest 0.02 full time equivalent or FTE (roughly the equivalent of one week of staff time)
- The frequency of the implementation of the recommendation (ongoing, annually or every 5 years)
- The implementation channel (staff, consultant or contractor) and
- Additional notes associated with each recommendation.

Further details on the recommendations can be found in Section 4.0 of this report.

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
Initiative	Short Term	2024	Administration	Resource and Reference Materials Library	Assemble a digital library and obtain / purchase copies of provincial (MTO), national (TAC) and international (FHWA, AASHTO) manuals on traffic safety and operations	Ensures that staff are using resources and reference materials that represent best practice	-	$2,500.00	0.00	Ongoing	Staff	
Initiative	Short Term	2024	Administration	Traffic Safety and Operations Project & Program Delivery Report	Use enhanced annual performance template to report on accomplishments of Traffic Safety and Operations staff	Uniform and consistent approach to reporting on Traffic Safety and Operations accomplishments	-	$0.00	0.04	Ongoing	Staff	
Initiative	Medium Term	2025	Administration	Annual Traveler Safety Report	Contribute collision data to Region's for their use in Annual Traveler Safety Report	Consistent approach to reporting on City's collision performance and comparator to other municipalities	-	$0.00	0.02	Ongoing	Staff	May be overriden by York Region's Traffic Data Warehouse and as part of the Region's Traveller Safety Strategy
Project	Medium Term	2025	Administration	Transportation Data and Assets GIS Database	Develop Open Data platform that would include traffic data and assets such as signals, PXOs, crosswalks, school crossings, traffic calming treatments. This would be integrated with York Data Warehouse as much as possible.	Open data platform acts as a resource for external stakeholders.	-	$20,000.00	0.04	Ongoing	Consultant	
Initiative	Short Term	2024	Automated Speed Enforcement	Prepare for Implementation of Automated Speed Enforcement	- Assess and Define Operational Parameters and Cost Estimates for the ASE Program - Develop Candidate Site Selection Criteria and Prioritization Methodology (refer to Community Safety Zone Network Screening) - Enter Agreements with City of Toronto, MTO and ASE Equipment Vendor - Configure Road Network to Accommodate ASE	Ensures that City is fully prepared for the implementation of ASE technology	Community Standards Public Works Operations York Regional Police	$0.00	0.20	One-time	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
Program	Medium Term	2025	Automated Speed Enforcement	Automated Speed Enforcement	Implement ASE at Community Safety Zones and School Zones	Enforcement of appropriate operating speeds	Community Standards Public Works Operations York Regional Police	$520,000.00	0.50	Annually	Staff	Assuming 4 cameras with no ticket revenue. First year includes an additional $30,000 per camera for initial setup.
Policy	Short Term	2024	Community Safety Zones	Community Safety Zone Warrant	Revised warrant for establishing Community Safety Zones	Immediate use of revised warrant that is customized to City needs	Public Works Operations York Regional Police	$0.00	0.00	Ongoing	Staff	
Project	Short Term	2023	Community Safety Zones	Community Safety Zone Network Screening	Conduct network screening to identify candidate locations for Community Safety Zones	Ranked list of candidate locations best suited for Community Safety Zones	Public Works Operations York Regional Police	$30,000.00	0.06	One-time	Consultant	Includes site assessment for Automated Speed Enforcement implementation
Program	Medium Term	2024	Community Safety Zones	Community Safety Zone Implementation	Implement CSZs at top ranked locations	Implementation of CSZs based on network screening ranking	Public Works Operations York Regional Police	$0.00	0.10	Annually	Staff	Implementation through operating budget
Policy	Short Term	2024	Inquiry Review Process	Traffic Inquiry Prioritization Tool	Prioritize public inquiries in accordance with priority matrix (in consideration of inquiry type and whether a specific event occurred)	Allows City staff to prioritize inquiries in a consistent manner, manage workload and workflow internally	-	$0.00	N/A	Ongoing	Staff	
Project	Medium Term	2025	Inquiry Review Process	Traffic Inquiry Geolocating Tool	Develop dynamic and interactive inquiry maps using software programs with geolocating features such as ArcGIS and Microsoft Power BI (linked to City's Excel spreadsheet)	Allows inquiries to be visually displayed spatially	-	$20,000.00	0.04	One-time	Consultant	
Project	Medium Term	2026	Inquiry Review Process	Public Inquiry Web App	Develop a web-based app to collect public inquiries that is linked to a database	- Allows inquiries to be received in a more consistent manner - Can be linked to City's existing Excel tracking sheet	Access Richmond Hill	$20,000.00	0.04	One-time	Consultant	
Program	Short Term	2024	Pedestrian Crossovers	PXO Implementation	Continue with existing implementation of PXOs	Continuity until medium term project can be implemented	Infrastructure Delivery Public Works Operations	$0.00	0.00	Annually	Staff	Separate capital budget to be requested each year based on needs

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
							Asset Management					
Project	Medium Term	2025	Pedestrian Crossovers	Review and Prioritization of PXO Candidate Locations	- City wide review to identify candidate locations; collect necessary data to apply warrant - Ranking of candidate locations based on connectivity, demand and safety	- Systematic review across entire City - Data will be used to prioritize locations - Objective means of prioritizing locations	Infrastructure Delivery Public Works Operations Asset Management	$45,000.00	0.02	5 years	Consultant	Data collection assumes pedestrian counts only; speed data costs shown in Speed Management Project
Initiative	Short Term	2024	Public Awareness and Education	Continue to Support Active School Travel Program	Continue to support program and distribute walkability and bike-ability checklists	Collaboration with School Boards and local schools	York Region District School Board York Catholic District School Board	$0.00	0.00	Ongoing	Staff	
Program	Short Term	2024	Public Awareness and Education	SLOW DOWN lawn sign program	Establish criteria for launching SLOW DOWN lawn sign program	Consistent use of SLOW DOWN lawn signs	Communications Community Standards	$25,000.00	0.02	Ongoing	Staff	Cost for pilot ‘Slow Down Lawn Sign Program’. Additional medium to long-term costs may apply depending on the success of the program.
Initiative	Short Term	2024	Public Awareness and Education	Road Watch Program	Continue to support York Regional Police Road Watch program and local Road Watch committee and raise awareness of road safety public awareness and education road programs	Continued support of existing program	-	$0.00	0.02	Ongoing	Staff	
Initiative	Medium Term	2025	Public Awareness and Education	Calendar of Road Safety Events	Develop an integrated Region/City calendar as part of York Region Traveller Safety Strategy	- In collaboration with Region and other local municipalities - Increased awareness of regional and provincial safety events	Communications	$0.00	0.02	Annually	Staff	
Initiative	Long Term	2028	Public Awareness and Education	Expansion of Road Watch Committee Mandate	Broaden Road Watch Committee mandate to consider City’s Transportation Master Plan, specifically active	Broaden scope for committee	-	$0.00	0.02	Ongoing	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
					transportation and micromobility							
Policy	Short Term	2024	Road Safety Program	STOP Sign Visibility Enhancements	- Adopt policy relating to the use of STOP AHEAD signs, additional left hand side signs, oversize STOP signs and tiger-trial signs - Compile and maintain STOP sign compliance database to determine 85th percentile compliance rate	Enhanced and consistent approach to the implementation of STOP sign visibility improvements	Public Works Operations Engineering Subdivisions	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	Crosswalk Markings	Adopt policy relating to the use of crosswalk markings	Enhanced and consistent approach to the implementation of crosswalk markings	Public Works Operations Engineering Subdivisions	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	All-way STOP Sign Warrant	Adopt policy relating to nearly warranted all-way STOP signs	Flexible criteria relating to the use of All-way STOP sign controls compared to OTM warrants	Public Works Operations Engineering Subdivisions	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	Conversion from All-way STOP Minor Road STOP Control	Adopt policy relating to conversion of all-way STOP sign warrant to minor STOP control	Standardized procedure for converting all-way STOP sign warrant to minor STOP control	Public Works Operations	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	Intersection Sight Distance at Local Road Intersections	Adopt policy relating to intersection sight distance requirements at local road intersections	Flexible criteria and standardized procedure for evaluating the need for sightline improvements at local road intersections	Public Works Operations Risk Management	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	PXOs at Roundabouts	Adopt policy relating to the use of PXOs at City roundabouts	Standardized procedure for use of PXOs at City roundabouts	Public Works Operations Engineering Subdivisions Asset Management	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	School Zones	Adopt policy relating to the use of School Zone signing near schools	Standardized procedure for use of School Zones	Public Works Operations York Regional Police York Region	$0.00	0.00	Ongoing	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
							District School Board York Catholic District School Board					
Policy	Short Term	2024	Road Safety Program	Directional Dividing Lines	Adopt policy relating to the use of directional dividing line delineation	Standardized procedure for use of directional dividing line delineation	Public Works Operations Engineering Subdivisions	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	On Street Parking Regulations Retrofitting	Adopt policy relating to implementing parking regulations across the City, restricting on-street parking based on cross section width, transit, and land use in accordance with City Standards and Specification Manual	Standardized procedure for implementing on-street parking regulations	Public Works Operations Community Standards	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Road Safety Program	Oversize Parking Regulation Signs	Adopt policy relating to allowing the use of oversize NO STOPPING and NO PARKING signs	Standardized procedure for use of oversize NO STOPPING and NO PARKING signs	Public Works Operations Community Standards	$0.00	0.00	Ongoing	Staff	
Initiative	Short Term	2024	Road Safety Program	City Standards and Specifications Updates	Integrate the following items into the City Standards and Specifications so that staff, designers and developers are aware of new policies that affect design, including: - STOP sign visibility considerations - Crosswalk and directional dividing line marking criteria - Widening of curb ramps - All-way STOP warrant criteria - PXO requirements at roundabouts - Parking regulation	Expedite design process by reducing the amount of reviews to correct elements not in accordance with new policies	Infrastructure Delivery Engineering Subdivisions	$0.00	0.02	Ongoing	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
					requirements - Traffi calming measures							
Project	Medium Term	2025	Road Safety Program	Network screening	- Collect and assemble necessary data - Develop Safety Performance Functions (SPFs) - Conduct Network Screening using Empirical Bayes Method - Identify sites with higher Potential for Safety Improvements (PSI)	Develop ranked list of priority locations within City based on potential for safety improvement	-	$45,000.00	0.04	5 years	Consultant	$30,000 for SPF development + $15,000 for Network Screening Cost is likely to be lower if the City joins York Region's Traffic Data Warehouse and as part of the Region's Traveller Safety Strategy
Project	Medium Term	2025	Road Safety Program	Systemic road safety evaluation	- Collect and assemble necessary data - Identify risk factors and assign to sites - Identify and rank sites with one or more risk factors - Identify systemic safety treatments	- Develop ranked list of priority locations within City based on risk factors - Identify treatments best suited to address risk factors	-	$40,000.00	0.04	5 years	Consultant	Cost is likely to be lower if the City joins York Region's Traffic Data Warehouse and as part of the Region's Traveller Safety Strategy
Project	Medium Term	2025	Road Safety Program	Conflict Analysis	Based on a jurisdictional / industry scan, establish criteria for recommending video conflict analysis at specific sites, in the context of in-service road safety reviews and/or complex traffic inquiries. Include considerations for timing and duration of analyses	Standardized criteria for assessing the need for conflict analysis as a supplementary tool for conducting in-service road safety reviews and/or reviewing complex traffic inquiries	-	$15,000.00	0.02	One-time	Consultant	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
Program	Medium Term	2026	Road Safety Program	In-service Road Safety Reviews	Develop and implement a program to conduct in-service road safety reviews at top ranked locations in the City (5 locations per year assumed)	Identify deficiencies and associated treatments based on in depth office review and field investigation	-	$50,000.00	0.06	Annually	Consultant	Assuming 5 locations per year
Policy	Short Term	2024	School Crossing Guards	School Crossing Guard Warrrant	- Use pre-selection criteria for identifying candidate crossing guard locations - Use modified Exposure Index for warrant (in addition to Gap Study) - Implement additional sign, pavement marking and pedestrian improvements as per revised policy at crossing guard locations	Use of warrant and implementation guidance that is customized to City needs and based on current engineering practice	Public Works Operations York Region District School Board York Catholic District School Board	$0.00	0.00	Ongoing	Staff	
Program	Medium Term	2024	School Crossing Guards	School Crossing Guard Annual Review	Conduct annual reviews to identify new candidate locations or to confirm continued need for crossing guards	Continued and consistent application of policy	Public Works Operations York Region District School Board York Catholic District School Board	$0.00	0.04	Annually	Staff	
Initiative	Medium Term	2025	School Crossing Guards	Refine School Crossing Guard Exposure Index	Develop local exposure index based on Richmond Hill data (or in combination with other municipalities in York)	Use of local Exposure Index that accounts for local traffic patterns	-	$0.00	0.02	Annually	Staff	
Policy	Short Term	2024	Speed Management	Speed Limit Policy	Establish base speed limits throughout City, including area speed limits (40 km/h or 50 km/h)	Consistent approach to posting speeds	Public Works Operations York Regional Police	$0.00	0.00	Ongoing	Staff	
Policy	Short Term	2024	Speed Management	Traffic Calming Toolbox	Adopt traffic calming toolbox for the selection of treatments for locations identified as suitable for traffic calming	Selection of treatments based on operating speeds, collision performance and cross section of roadway	Infrastructure Delivery Public Works Operations Asset Management York Regional	$0.00	0.00	Ongoing	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
							Police Fire and EMS					
Program	Medium Term	2024	Speed Management	Before-After Studies	Before-after study determining effects of traffic calming implementation based on performance indicators	Insight into effectiveness of traffic calming measures implemented	-	$20,000.00	0.04	Annually	Consultant	
Project	Medium Term	2025	Speed Management	Network-wide Speed Limit Review	- Evaluate need for adjustments to base speed limits on collector roads and 'grid' local roads - Identify streets suitable for Area Speed Limits	Refinements to base speed limits based on industry practice	Public Works Operations York Regional Police	$25,000.00	0.04	One-time	Consultant	
Project	Medium Term	2025	Speed Management	Speed Data Collection for Traffic Calming Network Screening	Collect speed data on all collector roads and 'grid' local roads, as needed to supplement data collected through the City's regular count program	Required data for network review of base speed limits	-	$25,000.00	0.02	One-time	Contractor	
Project	Medium Term	2025	Speed Management	Traffic Calming Network Screening	Establish a formal process for identifying candidate locations for traffic calming based on speed, collision performance and other factors	Approach to selecting candidate locations for traffic calming that is objective and defendable	Infrastructure Delivery Public Works Operations Asset Management York Regional Police Fire and EMS	$20,000.00	0.04	5 years	Consultant	
Program	Long Term	2026	Speed Management	Long-term Speed Limit Monitoring	Monitor locations within new subdivisions or existing roads with a significant change in land use or function	Continued surveillance of locations that may require speed limit adjustments	Public Works Operations York Regional Police	$0.00	0.04	Annually	Staff	

Type	Time Frame	Start Year	Category	Recommendation	Description	Benefit to City	Additional Stakeholders Impacted	Cost Implications	Resource Implications (FTE)	Frequency / Recurrence	Implementation Channel	Notes
Initiative	Short Term	2024	Traffic Data Management	Refinements to Data Collection Periods and Seasons	Implement refinements to data collection periods and locations	Align City's methodologies for data collection with best practice	-	$0.00	0.04	Ongoing	Staff	
Project	Medium Term	2025	Traffic Data Management	Traffic Count Program Needs Assessment	- Implement further refinements to data collection periods and seasons - Determine optimal locations for the count program - Develop conversion factors for time of day, day of week and month	- Improve City's understanding of traffic flow patterns and growth rates - Ensure adequate spatial and temporal coverage to provide high-quality input for other projects and programs	-	$35,000.00	0.04	One-time	Consultant	
Project	Medium Term	2025	Traffic Data Management	Expand Pedestrian and Cyclist Count Program	Explore and adapt different technologies for collecting pedestrian and cyclist counts	- Improve City's understanding of pedestrian and cyclist activity on the local road network - Application for PXO and crossing guard warrants	-	$10,000.00	0.04	One-time	Consultant	
Project	Medium Term	2026	Traffic Data Management	Development of Growth Factors	Develop growth factors using the common growth factor method	Improve City's understanding of traffic flow patterns and growth rates	-	$20,000.00	0.02	5 years	Consultant	