



City of Hamilton

**Development of Policy Papers for Phase Two of the
Transportation Master Plan for the City of Hamilton
WARRANTS POLICY PAPER**

FINAL REPORT

JANUARY 2005



DOCUMENT CONTROL

Client:	City of Hamilton
Project Name:	Development of Policy Papers for Phase II of the Transportation Master Plan for the City of Hamilton
Report Title:	Development of Policy Papers for Phase Two of the Transportation Master Plan for the City of Hamilton WARRANTS POLICY PAPER
IBI Reference:	T0-1173
Version:	2
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1. INTRODUCTION

1.1 Study Background and Objectives

The City of Hamilton *City-wide Transportation Master Plan* will provide inputs to the *Growth Related Integrated Development Strategy* (GRIDS) and make recommendations to Council on the adoption of a City-wide Transportation Policy that is cognisant of Vision 2020 and other City of Hamilton long-term planning objectives. The project has been divided into three distinct phases. The first phase consisted of the technical calibration of the existing transportation model to reflect current transportation conditions in Hamilton. The second phase, which is the object of this and other policy papers, will focus on the development of 23 policy papers in the following areas: Travel Demand, Urban Development, System Performance, Infrastructure Planning and Infrastructure Financing. Following the completion of the Policy Papers, the City will proceed to develop transportation scenarios (Phase 3 of the project) based upon the results of the policy work performed in Phase 2 and the land use scenarios developed through the broader GRIDS study, and will test the efficiency and viability of these scenarios by integrating them into the calibrated model.

1.2 Description of Warrants

The driving, cycling and walking tasks require constant assessment and reassessment of the travelling environment and responding to potential conflicts and conditions. A road user's reaction to "unexpected" events or situations is generally slower and thus provides them with less time to recognize the eminent decision and to properly react to it. The uniform application of traffic and pedestrian control devices (hereafter, collectively referred to as traffic control devices) simplifies road user tasks as it aids in the timely recognition and understanding of the situation.

Accordingly, standards and guidelines have been developed to provide uniform implementation and application of traffic control devices. The Manual of Uniform Traffic Control Devices for Canada (Canadian MUTCD) provides standards and guidelines concerning the design and use of traffic control devices, including signs, markings and devices. The use of a "standard" traffic control device or sign does not by itself constitute uniformity or a typical installation. In fact, a standard device used in an inappropriate application or location may cause confusion among the various road users, contribute to poor decisions and increase conflict potential. Included in Exhibit 1.1 are examples of poorly placed traffic signs, which created road user confusion.

Exhibit 1.1: Poor Sign Applications



“Keep Right” sign placed on median island as opposed to a “Do Not Enter” application



Stop control on major roadway

For specific devices such as traffic signals, all-way stops, marked and unmarked crosswalks, speed limits signs, and traffic calming devices, warrants have been created on a national, provincial and/or jurisdictional level. Historically, warrants were minimum criteria that needed to be met before a specific traffic control or roadway device would be installed. Today, a warrant provides qualitative and quantitative threshold conditions to transportation professionals to evaluate the potential operational or safety benefits (and disbenefits) of traffic control devices, based on average conditions.

Warrants assist in determining the need for a particular control device to guide:

- **Logical and Consistent Application** - the best means to achieve effective and safe traffic and pedestrian control is through the uniform application of realistic policies and standards within a municipality, region and/or province;
- **Priority Installations** – As with other infrastructure and capital improvements, the available funding for traffic control devices is limited. For more costly devices such as traffic control signals and pedestrian signals, a jurisdiction may need to prioritize their installation based on available capital funds, staff resources and on-going maintenance resources. The City can make use of traffic control warrants to determine potential needs and responsibilities for overall growth. Distinguishing between warranted and unwarranted traffic control devices is an additional tool in these decision processes; and
- **Funding Responsibilities** – There are many circumstances where changes in land use, access or the area road network will change traffic or pedestrian volumes at a particular location, thus creating a warranted traffic control device. The City can make use of traffic control warrants to determine potential needs and responsibilities.

It is important to stress that regardless of the location, the best means to achieve effective and safe traffic control is through the uniform application of realistic policies and standards within a municipality. Warrants for traffic control devices assist in attaining these goals.

2. REVIEW OF EXISTING CITY OF HAMILTON POLICIES

2.1 Current Roles and Responsibilities

Warrants for traffic control devices are developed and administered by the Operations and Maintenance Division in the Public Works Department. Both the traffic operations and transportation planning sections of the City of Hamilton employ the warrants in their duties of assess existing and future road network operations. Provided below in Exhibit 2.1 is a summary of typical applications of traffic control device warrants in the City.

Exhibit 2.1: Department Responsibilities

Department	Warrants Application/Considerations
Public Works Operations and Maintenance	Establishing appropriate warranting procedures. Assessment of appropriate traffic control along existing corridors and in existing areas.
Planning and Development Development	Determination of traffic control requirements resulting from new development Determination of funding responsibility for local or area-wide development Traffic calming/management requirements along new corridors or within new development areas
Planning and Development Long Range Planning and Design	Determination of traffic control requirements resulting from new development or future traffic volumes Determination of funding responsibility for local or area-wide development
Public Works Capital Planning and Implementation	Determination of funding responsibility for local or area-wide development

2.2 Review of Existing City of Hamilton Policies

The City of Hamilton has a number of current policies and warrants in place for traffic control devices. The sources document for each is outlined in Exhibit 2.2.

Exhibit 2.2: Available Traffic Control Warrants in the City of Hamilton

Device	Warrant Applied and Source
Traffic Signal	Installation Policy for Full Traffic Signals, City of Hamilton, 2001
Intersection Pedestrian Signal	Installation Policy for Intersection and Mid-Block Pedestrian Signals, City of Hamilton, 2001
All-way Stop	Installation Policy for All-way Stop Control at Intersections, City of Hamilton, 2001
Speed Limit Setting	Speed Limit Policy, 2001
Traffic Calming Devices	Use of Speed Humps on Residential Streets, 2000

Provided below is a summary of the major aspects of each existing City warrant. Included in Section 4 includes a comparison of City warranting procedures to other jurisdictional standards and guidelines.

Traffic Signal Warrants

The City 's current warranting procedure for full traffic signal control at an intersection is based on the current Ontario warrant outlined in Ontario Traffic Manual Book 12 (OTM Book 12) published by the Province of Ontario.

Under this warrant, a traffic control signal would be technically supported if one of the following five following justification are fulfilled:

- **Justification 1** – Minimum Vehicle Volumes – Sets minimum volume criteria on all approaches and on side street approaches. Separate volume criteria are presented for restricted flow (urban) and free flow (rural) conditions.
- **Justification 2** – Delay to Cross Street – Sets minimum volume criteria to reflect conditions where traffic volumes on the main road are so heavy that road users on the minor road suffer excessive delays. Separate volume criteria are presented for restricted flow (urban) and free flow (rural) conditions.
- **Justification 3** – Collision Experience – Sets a minimum number of collisions “preventable” by traffic signal control over a three year period. Five or more collisions in each of the three preceding 12 month periods is used as justification.
- **Justification 4** – Combination Justification – Makes provisions for conditions where 2 or more of Justifications 1, 2 or 3 are met 80% of the time.
- **Justification 5** – Pedestrian Volume – Sets minimum pedestrian volumes and delays at a location for the installation of a traffic control device. This warrant is applicable to an intersection or mid-block location.

The City applies the warrant with a modification to the number of design hours that the threshold volume indicators noted above, must be met. The Ontario warrant stipulates the volume warrants

for each and every of the eight highest hours of the day. The City has reduced this requirement to encompass a volume warrant for the seven highest hours of the day. As the first and last eight hour periods (typically off-peak periods) determines the justification for a traffic signal, the City estimates that the customized Hamilton warrant is 10 to 20% more likely to achieve than the Provincial Standard.

The City has developed a separate warrant for a mid-block or intersection pedestrian signals (IPSs), as outlined in the following section.

Intersection Pedestrian Signal/Mid-Block Signal/Pedestrian Crossings

The City of Hamilton stipulates that all formal pedestrian crosswalks must include a higher form of traffic control, i.e., traffic signals, IPS or a mid-block signal. Pedestrian crosswalks consisting solely of pavement markings are not endorsed in the City.

The City warranting policy for pedestrian signals is based on an in-house procedure that requires the fulfillment of four sections. These are outlined below:

- **Section 1** – Distance to Nearest Protected Crossing – Ensures that the proposed pedestrian signal location has an adequate separation distance from adjacent traffic control devices that together may cause conflicting messages to the road users. This criteria also takes into account the availability of appropriate crossing opportunities in the area.
- **Section 2** – Minimum Pedestrian Volume – Sets minimum pedestrian volume criteria to at or adjacent to the proposed location to justify the need for a higher form of pedestrian/traffic control. A threshold of 100 pedestrians crossing at the location or in the immediate vicinity in a seven hour period of the day.
- **Section 3** – Justification Section – The justification is based on a point scoring system that based on four criteria measures, namely, the volume and delay of pedestrians, number of pedestrian collisions in the past 10 years, distance to other controlled crossing opportunities and operating speed on the roadway to be crossed.
- **Section 4** – Use of Adult Crossing Guard at Pedestrian Signal Location – Should Sections 1 through 3 be fulfilled and the proposed location currently has a adult crossing guard on duty during school travel periods, this criteria reflects the intent to have the crossing guard services discontinued upon installation. The rationale for this criterion is that two forms of traffic control are not required at a single location, and that the pedestrian signal provides an appropriate level of control.

All-Way Stop Control

The City's current all-way stop warrant is comprised of two sections, which outline prerequisites for installation and warranting criteria, respectively. The prerequisites are listed below in Exhibit 2.3:

Exhibit 2.3: All-Way Stop Warrant – Prerequisite Requirements

Prerequisites	Rationale
Speed limit of at least 50 km/h	All-way stop control is unnecessary on roads with 40 km/h speed limits
No other traffic control device located within 700 metres of intersection on arterial roads and 250 metres of intersection on secondary roads.	Placing traffic control devices in close proximity one another may create driver confusion and increase collision potential.
Intersection has three or four legs with no more than two lanes on each approach. Each leg of the intersection must be a minimum of 150 metres in length.	Multi-lane approaches may create driver confusion or pedestrian safety issues associated with reduced sight lines for motorists due to adjacent vehicles. All-way stop control should not be placed on accesses to short cul-de-sac
For arterial roadways, the minor street traffic (including pedestrians) must be at least 40% of the total intersection traffic For secondary roadways, the minor street traffic must be at least 25% of the total intersection traffic for a three-way intersection and 35% for a four-way intersection.	For an all-way stop to be warranted and effective, there must be sufficient traffic on the side street to create some level of compliance, i.e., a need for the major street traffic to stop for opposing traffic.
<p>Notes:</p> <p>(1) An arterial intersection is defined by a major street of the intersection with the primary function of traffic movement carrying a minimum daily traffic of 5,000 vehicles per day (vpd)</p> <p>(2) A secondary intersection is defined by the major street with a primary function of property access and daily traffic on the major street of less than 5,000 vpd.</p>	

Once the above requirements are met, the following warrants must be satisfied for all-way stop control:

- **Warrant 1 – Visibility Condition** – Based on minimum visibility requirements from the Ontario Traffic Manual, which are a function of operating speed and other site specific location criteria.
- **Warrant 2 – Collision History** – The following criteria must be met:
 - Collision rate of 1.5 collisions per million vehicles entering the intersection;
 - 12 or more correctable collisions at an arterial road intersection in a three year period; and
 - 5 or more correctable collisions at a secondary intersection in a three year period.

- **Warrant 3 – Traffic Volume Warrant** – A minimum vehicle volume in the seven peak hours of the day of 500 vehicles for an arterial intersection and 200 vehicles for a secondary intersection. The side street traffic and pedestrian volume must be 40% of the total traffic during the same seven hours.
- **Warrant 4 – Pedestrian Exposure Warrant** – If an intersection is within 150 metres of a major pedestrian destination that generates 50 pedestrians across the major street in any three hours of the day at a secondary intersection and any six hours of the day at an arterial road intersection.
- **Warrant 5 – Combination Warrant** – The intersection satisfies any combination of Warrants 2, 3, or 4, which are met to the extent of 80% of the stated values.

Speed Limits

The City of Hamilton has a current policy for determining speed limits on rural roads, urban roads and roadways traversing school areas. The policy for speed limit setting for rural roads includes the following criteria:

- Pavement width;
- Visibility;
- Roadway length;
- Daily traffic volume;
- Number of accesses; and
- Pedestrian traffic.

In urban areas the speed limit setting policy reflects the roadway type (arterial versus non-arterial road), sidewalk availability, access provisions, and the presence of sub-standard geometric features.

In school areas, 40 km/h speed limit zones (time of day limit active during school hours) may be considered on roads that are contiguous to a school and for 150 metres along the road on either side of the school property.

Traffic Calming Devices

The City does not have formal warrants for traffic calming devices with the exception of the speed hump policy. The speed hump policy outlines criteria for the installation of speed humps on a local residential street:

- Local residential street/alley with no more than two travel lanes and at least 300 vpd;
- The 85th percentile speed must be at least 8 km/h higher than the speed limit;
- Visibility of these devices must be at least 200 metres in either direction and must be at least 75 metres from the nearest traffic signal;
- The proposed location must be a minimum of 75 metres to the nearest stop control;

- The proposed location must not be on an emergency service or HSR bus route; and
- The proposed location must have curb and gutter.

3. SUPPORTING INFORMATION AND ANALYSES

3.1 Trends

Traffic control device warrants for various devices were developed with the purpose of providing standardization and common ground for a jurisdiction or number of jurisdictions to apply like rules and applications. In the recent past, a number of research activities and manual updates have recognized a change in approach to establishing and applying warrants for traffic control devices. These shifts in philosophy are outlined below.

Warrants Application – In the past a warrant provided quantitative threshold conditions to a transportation professional in determining the need for a particular traffic control device, essentially, and “if ... then” scenario. Specifically for traffic signal control, the Ontario MUTCD warrant once served as a determinant in establishing funding from the Ministry of Transportation of Ontario for installation. Revisions OTM Book 12 and recent revisions to the Canadian and US MUTCD, have tended to move away from hard and fast “break points” to guidance type warranting criteria and engineering judgement. This trend recognizes that fact that a “one size fits all” approach cannot be applied to traffic control from one location to the next.

Current warranting procedures provide the transportation professional with a “tool” to evaluate the potential operational or safety benefits (and disbenefits) of traffic control devices, based on normal conditions.

Safety Versus Security and Capacity – In many cases, traffic control devices/changes such traffic signals, speed limit reductions, all-way stops and pedestrian signals are viewed as the “cure all” for many of the operational and safety concerns on our road networks. In many cases, the original intent of the request was to “improve safety”; however, if incorrect measures are applied, the net safety of the location may be reduced. The focus of recent research activities has centred on real safety impacts and benefits of a particular traffic control device, to counter the “it will improve safety” type request. An example of this would be the installation of an all-way stop control on a four lane major roadway with a minor residential street to improve pedestrian safety. In this case, pedestrian safety is actually decreased due to “multiple threat” of the two vehicle approaches, reduced sight lines and low motorist compliance on the major street due to low side street volume.

Road User Behaviour Considerations - Road users build expectancies about future roadway and traffic control operations and treatments, based on past experiences. The general road user has little or no knowledge of the warranting procedures outlined in our engineering manuals, but what they do know, is based on a relatively constant application of personal expectancies of where traffic signals, stop controls and pedestrian crossing may be encountered. When an atypical traffic control device is installed at a location, the road user may be ill-prepared to perceive and react to the situation or hazard. One of the primary purposes of warranting procedures is to provide a relatively consistent approach to traffic control within and among jurisdictions. There are many examples of municipalities and jurisdictions installing supplementary warning and information signs in an attempt to address motorist misunderstanding of a poorly designed or placed traffic control devices. Examples include:

- All-way stop control at multilane arterial roadway intersection with a minor residential street where side street traffic is infrequent and road users on the major roadway exhibit poor compliance. Other poor applications include the placement of all-way stop

control at private driveways to municipal roadways or on a ninety degree corner in a residential area;

- A mid-block pedestrian crossing provided at a location where motorists become accustomed to few interrupts by pedestrians (low crossing pedestrian volume), and are surprised when the crossing is used;
- Closely spaced traffic signal controls that cause motorists to become confused by viewing contradicting signal displays from downstream signals; and
- Unreasonably low posted speed on a major roadway cause significant speed differentials between compliant road users and those proceeding at a comfortable speed.

4. REVIEW OF PRACTICES IN OTHER JURISDICTIONS

4.1 Traffic Signal Control

The City currently applies a customized version of the Ontario warrant for traffic signal control (OTM Book 12) for traffic signal control installations. Provided below are other major guidelines that are applied in North America for traffic signal control.

Canadian MUTCD

During the development of the new Canadian Traffic Signal Warrant Procedure (TAC 2003), a literature review of North American and international jurisdictions was undertaken. The majority of the Canadian provinces and municipalities used the existing TAC MUTCD warrant for traffic signals. An exception being, the Province of Ontario and many of its jurisdictions, like Hamilton, use the Ontario warrant or a customization of it.

The 2003 TAC warrant recommends the application of the a Cumulative Factors Methodology (CFM), where the following factors are incorporated into an overall score:

- Vehicle/vehicle conflict factor – calibrated cross-product of main street and side street volumes;
- Pedestrian/vehicle conflict factor – calibrated cross-product of main street traffic volumes and crossing pedestrian volumes;
- Roadway characteristic factors – includes adjustments for intersection spacing, vehicle classification, posted speed and geographic area;
- Pedestrian demographic factor – accounts for the presence of a school and or seniors centre in the area

A collision warrant or warranting factor has not been recommended or included in the recent revision of the 2003 TAC signal warrant. Based on our review, a number of Ontario and Canadian municipalities continue to use frequency based collision warrants such as the one included in the 1998 Canadian MUTCD (i.e., 4 or 5 collision per year that are considered “correctable” by the installation of a traffic control signal, for a 1 to 3 year period). To date, the City of Hamilton has evaluated the potential use of the second iteration of the 2003 TAC warrant; however, the results have been “mixed”. The 2003 TAC warrant is based on six highest hours of volume data.

US MUTCD

Many of US State and municipal jurisdictions use the US MUTCD traffic signal warrant or an adapted warrant that is in “substantial compliance” with the US MUTCD guidelines. The US guidelines include eight warranting factors:

- Warrant 1 – Eight-hour vehicular volume – intended to be applied to locations with a high volume of traffic;
- Warrant 2 – Four-hour vehicular volume – intended to be applied to locations where the volume of side street traffic is the principal reason for considering the traffic signal;
- Warrant 3 – Peak hour – to be applied where, for one hour, the side street traffic suffers considerable delays. The warrant is intended to be applied in special

circumstances, such as office complexes, manufacturing plants, transit terminals that discharge large numbers of vehicles in a short-period of time (i.e., GO Station), etc.;

- Warrant 4 – Pedestrian volume – considered at locations where the volume of traffic on the major road creates undue delays to crossing pedestrians;
- Warrant 5 – School crossing – applied in cases where the fact that school children cross the major street is the principal reason to consider installing the signal;
- Warrant 6 – Coordinated signal system – applied in cases where, in the interest of creating a coordinated platoon of vehicles along a major road, a traffic signal is used to cumulate side street traffic volumes entering the major road;
- Warrant 7 – Crash experience – intended for locations where the frequency and severity of collisions is the primary reason for traffic signal control;
- Warrant 8 – Roadway network – applied in case where it is desirable to encourage the concentration and organization of traffic flow on a particular roadway network, i.e. on the arterial or major road network.

Based on our review of the US MUTCD, Warrants 3, 5, 6, and 8 above appear to be qualitative considerations to apply transportation professional judgement, rather than warranting criteria.

4.2 All-Way Stop

The use of all-way stop control to address safety and security issues associated with vehicle speeds, traffic infiltration and pedestrian safety is a subject that has received considerable attention in many North American jurisdictions. The “ease” and cost of implementation in most municipalities make all-way stop control a resident and elected-official remedial solution to numerous traffic issues.

The warrants that have been developed by the Canadian, US and other local authorities have attempted to define situations where the net benefit of all-way stop control to all road users can be achieved. Misuse of all-way stop control in many jurisdictions have led to excessive motorist restrictions leading to driver frustration, low compliance, reduced pedestrian safety, increased mid-block speeds and environmental impacts. One of the primary safety concerns of all-way stop control is associated with pedestrians, cyclists and other road users expecting other road users, specifically motorists, to stop.

Given the extensive attention that all-way stop control has received, there is a wide-range of warranting factors and thresholds values included in jurisdictional guidelines. Provided below is a summary of major warranting factors identified in Exhibit 4.1.

Exhibit 4.1: All-Way Stop Warrant - Criteria

Criteria	Warranting Value/Measure	Jurisdiction
Minimum vehicular volumes on all approaches	Function of roadway type and hours of count. Typically 500 vehicles per hour for the peak 7 to 8 hours of the day (arterials) and 180 to 350 vehicles per hour for local roadways	All jurisdictions
Minimum vehicular volumes on minor street	Function of roadway type and hours of count. Typically 80 to 200 vehicles per hour for the peak 7 to 8 hours of the day (arterials) and 50 to 80 vehicles per hour for local roadways	All jurisdictions
Volume split between major and minor roads	70/30 to 65/35 depending on roadway type and configuration	OTM, Canada MUTCD, US MUTCD, Ottawa, Mississauga, Markham, Ajax
Collision frequency	3 to 5 collisions correctable by all-way stop control per 12 month period	OTM, Canada MUTCD, US MUTCD, Ottawa, Markham, Ajax, Winnipeg
Sight restrictions	Various	Markham, Nepean, Ottawa, Ajax, Winnipeg
Maximum number of lanes on approach	Maximum of 2 lanes	OTM, US MUTCD, Canada MUTCD, Ottawa, Nepean, Ajax
Minimum traffic control spacing	250 to 300 metres on arterial roads	All jurisdictions

Other criteria noted include cases where all-way stop control should not be used:

- Solely as a speed control device;
- Solely to protect pedestrians, especially school aged children;
- Solely to reduce traffic infiltration potential;
- Where off-set intersection, poor geometry or more than four-legs exist;
- Where progressive signal timing systems existing; and
- Higher speed roadways (posted speeds greater than 60 km/h).

4.3 Pedestrian Crosswalks

Historically, warrants for pedestrian control and pedestrian crosswalks have generally been based on vehicular and crossing pedestrian volumes in the area. These criteria typically do not reflect the nature or operations of the traffic on the roadway.

Pedestrian Crossing Control

There are a number of forms of pedestrian crossing control used in North America:

- Mid-Block Pedestrian Crossings;
- Intersection Pedestrian Signals (IPS); and
- Pedestrian Crossovers (PXOs).

OTM Book 12 provides warrants for these devices as part of their traffic signal warrants, namely Warrant 5 and justification 5A (volume justification) and 5B (delay justification). Both the delay and volume justifications are a function of vehicle and pedestrian volumes and both must be fulfilled. Provided in Exhibit 4.2 below is a summary of the Ontario warrants, as well as, those applied in other jurisdiction.

Exhibit 4.2: Pedestrian Crossing Warrants

Jurisdiction	Pedestrian Warrant Summary
US MUTCD	<ul style="list-style-type: none"> • Minimum of 100 pedestrians for each of the four peak hours of the day or 190 pedestrians in the peak hour • Shall not be considered where the distance to the nearest traffic control signal along the major street is less than 90 metres • Considered where fewer than 60 gaps per hour are available in the traffic stream.
Canadian MUTCD	<ul style="list-style-type: none"> • No specific warrants for pedestrian signals, i.e., justified through the pedestrian factors in the Traffic Signal Warrant Procedure (TAC 2003)
OTM Book 12	<ul style="list-style-type: none"> • Justification is based on volume and delay of pedestrians • Generally a minimum of 200 pedestrians is required in an eight hour period to justify a higher form of control
Region of York (IPS)	<ul style="list-style-type: none"> • 215 metres from other traffic control device • Posted speed less than 60 kmh/ • Minimum of 100 pedestrians crossing main street during the seven highest hours of the day • Less than 5,000 vpd on intersecting side street • Warrant based on points system, which is a function of pedestrian volume and delay, collisions, nearest protected crossing and vehicle operating speeds.
British Columbia	<ul style="list-style-type: none"> • Warrant based on pedestrian volumes, available crossing opportunities and community size. • The threshold a pedestrian signal is approximately 50 to 60 pedestrians per hour. • Consideration is given to adjacent traffic control devices/pedestrian crossings, operating speeds, collision history, signal progression and roadway cross-section, although not a formal part of the warrant.

Marked Pedestrian Crossings

The Canadian MUTCD indicates that pavement markings should not be used as stand-alone devices to indicate a pedestrian crossing, i.e., the pedestrian crossing should not be marked unless another form of traffic control, such as traffic signals, overhead flashers or mid-block pedestrian signals are in place at the location. The Pedestrian Crossing Control Manual for British Columbia and City of Ottawa policies support these guidelines.

Recent research by Zegeer et al, ITE Journal, January 2004, included a safety analysis of marked versus unmarked crosswalks in 30 American cities. The major findings of the study indicated that:

- Pedestrian collisions are relatively rare at uncontrolled pedestrian crossings;
- Marked crosswalks on two-lane roadways and lower volume multi-lane roadways were not found to have a negative or positive impact on pedestrian collisions;
- Marked crosswalks alone, without other substantial treatments, are generally not recommended on three or four lane roadways with Annual Average Daily Traffic (AADTs) greater than 12,000; and
- There are some situations, such as pedestrian crossing of two-lane streets in downtown areas, where marked crossings may assist in consolidating pedestrian crossing activities.

4.4 Speed Limits

Ontario Traffic Manual Book 5 on regulatory signs makes reference to OTM Book 14 (Speed Zoning and Speed Controls) for determining maximum speeds. OTM Book 14 has not been published to date.

The Canadian MUTCD provides little guidance regarding the warranting procedures for speed limits. Provided in Exhibit 4.3 are example criteria used in speed limit policies from other jurisdictions in North America. Based on current research, it appears that the majority of the US jurisdictions use the 85th percentile speed as a major consideration in speed zone setting.

Exhibit 4.3: Speed Limit Policy Warrant Criteria

Warranting Criteria	Jurisdiction				
	Halifax	Halton	York	Durham	US MUTCD
85 th percentile speed	Yes	Yes	Yes	Yes	Yes
Roadway geometry	Yes	-	-	Yes	Yes
Collision history	Yes	-	-	Yes	Yes

Warranting Criteria	Jurisdiction				
	Halifax	Halton	York	Durham	US MUTCD
Adjacent land use	Yes	Yes –schools	Yes – schools, driveways	-	Yes
Roadway Type	-	Yes		-	-
Pedestrian Volume/Activity	-	-	Yes	-	Yes

4.5 Other Warrants

Based on our review, a number of additional warrant-type procedures were identified; however, were not documented in detail, for the reasons noted in Section 5.1:

- School crossings/school crossing guard;
- Traffic calming devices; and
- Audible Pedestrian Signals (APS).

5. IDENTIFICATION OF POLICY OPTIONS

Based on a review of the existing City of Hamilton warrants and those being applied in other jurisdictions, three policy options were identified:

- Provide additional warrants for traffic control devices not currently covered by the City's warranting procedures;
- Modify existing City warrants to adhere to provincial/federal standards and/or recent research findings; or
- Maintain existing City warrants.

Each of these options is outlined below.

5.1 Additional Warrant Applications

The City's existing traffic control device warrants encompass the major traffic control devices, which typically have formal warranting procedures. Based on a review of other jurisdictional practices, a review of new warrants, for consideration by the City of Hamilton, is provided below:

- **School crossing/school crossing guard** – The Ontario Traffic Conference is currently finalizing a review of school crossings and related warrants. The results of this exercise may need to be worked into future policies for Hamilton.
- **Traffic calming devices** – A number of jurisdictions were identified as having warrants for one or more forms of traffic control devices. The two most recent guideline documents for traffic calming in North America are the Canadian Guide to Neighbourhood Traffic Calming (TAC/ITE, 1998) and Traffic Calming: State of the Practice (ITE/FHWA, 1999). Neither of these documents support the use of warrants such as: "when operating speed is 'X' km/h over posted speed, then traffic calming measure 'Y' should be used." Countering the "standardization" argument for providing definitive warrants for traffic calming, are those who feel traffic calming is a "package" of improvements to address one or more traffic related concerns, as opposed to a discrete improvement for a single intersection or road section. The **Traffic Calming Policy** paper addressed the need and justification mechanisms for traffic calming; however, it is not recommended that distinct warranting criteria for specific traffic calming devices be established in the City;
- **Audible pedestrian signals (APS)** – Jurisdictions across Canada and the US have established policies for installing APS, ranging from general guidelines to highly structured rating systems with minimum point systems, such as San Diego and Los Angeles. The City of Toronto, like many other jurisdictions, rely on less "value or numbers based" approach to prioritize their APS installations through a committee selection process with representatives for the visually impaired community. From current research efforts in the area of APS, it appears that the latter process of guidelines paired with a committee-recommended priority listing, is the preferred method. As such, it is not recommended that an APS device "warrant" be established.
- **Marked pedestrian crossings** – A number of jurisdictions permit the use of marked pedestrian crossing locations at uncontrolled locations, with the inclusion of pedestrian crossing signs. Currently, the City does not permit these uncontrolled applications. Recent research (Zegeer et al) indicates there may be situations such as on low

volume two-lane roads or in low speed situations such as downtown areas, where marked crossings at uncontrolled locations may be permitted. In these cases, no net benefit in safety was identified. In light of these findings, the City should maintain their position of no marked crossings at uncontrolled locations.

In summary, it is not recommended that the City pursue the development of formal warrants beyond those that they currently have in place.

5.2 Modify Existing Warrants

A review of the City's existing warrants was undertaken in light of current warrant revisions and research. Based on the reviewed a number of deviations/customizations were identified when compared to similar warrants in other North America jurisdictions; however, the City's warranting procedures appear to be logical and reasonable. There were no components of the City's existing warrants, which were considered overly "restrictive" or "relaxed". Accordingly, no major changes to the City's warrants are recommended.

5.3 Maintain and Support Existing Warrants

The City's existing warrants appear to represent fair and consistent guidelines for traffic control device application. The City should monitor any developments in the area of traffic control warrants, to determine the need to update their policies based on any future research.

It is recognized that warrants are established to apply to "typical" or "normal" roadway, intersection or road user operating conditions. As every site/location must be reviewed

There may be instances the warrants are not met and where engineering judgement must prevail due to special circumstances or site-specific conditions. These may include, but not be limited to, situations where:

- Atypical physical or operational road or pedestrian network characteristics exist;
- Positive guidance or human factors considerations prevail over the standard warranting procedures from a road user safety perspective; and
- Road users in the area have special needs, i.e., older pedestrians, cyclists or motorists, young pedestrians or cyclists or pedestrians with visual or hearing impairments.

6. RECOMMENDED POLICY AND IMPACTS

It is recommended that the City maintain their existing traffic control device warrants. By maintaining and supporting the City's existing traffic control device warrants, the following benefits may be realized:

- Provide a relatively consistent application of traffic control ;
- Establish priority funding of traffic control devices in a fair and logical approach ;
- Reduce cases where traffic control is excessive, which causes additional person-delay and emissions;
- Reduce the potential for road user apathy and non-compliance, which may lead to an increase in collision potential;
- Facilitates the ability to effectively regulate and enforce traffic regulations and by-laws; and
- Provide the development community with a benchmark for establishing appropriate traffic control devices related to their development proposal impact.

In terms of implementing this directive, it is recommended that City staff continue to provide advice and documentation to Council on the appropriateness of proposed traffic control devices and that the impacts of varying from approved warrants be clearly documented.

In addition, the City should pursue opportunities to educate the public with regards to proper transportation control applications and the reasons behind the warrants that they have established. The City's existing web site has valuable resource information relating to such transportation matters such as the Speed Watch Program, Red Light Cameras, truck routes, the bicycle network, etc. The City's web site and public correspondence (i.e., public information centres, responses to resident inquiries) are good opportunities to provide the general information to inform residents of the rationale behind their warranting procedures.