

Report to/Rapport au:

**Transportation Committee
Comité des transports**

and/et

**Agriculture and Rural Affairs Committee
Comité de l'agriculture et des questions rurales**

and Council / et au Conseil

24 September 2009/le 24 septembre 2009

**Submitted by/Soumis par :
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City Wide/à l'échelle de la ville

Ref N°: ACS2009-COS-PWS-0021

SUBJECT: CITY OF OTTAWA SPEED ZONING POLICY

**OBJET : POLITIQUE DE LA VILLE D'OTTAWA SUR LES ZONES DE
LIMITATION DE VITESSE**

REPORT RECOMMENDATIONS

That the Transportation Committee and Agriculture and Rural Affairs Committee recommend that Council approve:

- 1. The Speed Zoning Policy for Urban and Rural Roads, including: the procedure for setting speed limits on, rural gravel roads, posting 40 km/h speed limits on local residential roads, and establishing school speed zones, as outlined in Attachment 1;**
- 2. The process to review speed limits to expedite responses to speed-related inquiries, based on roadway classification, as defined in the Transportation Master Plan, and as outlined in this report;**
- 3. That speed limit reviews not be undertaken on any road within a three-year time period unless there are major changes in traffic patterns along the roadway in question;**

4. That the Public Works Department submit as part of the future operating budget process \$100,000 to be added to the Sign Maintenance Budget as outlined in the report;
5. That the City request that the Province permit the City to set default speed limits other than 50 km/h on residential roadways;
6. That the City Request that the Province amend the Highway Traffic Act to allow the doubling of fines within a school zone;
7. That as part of the Site Plan Agreement process that currently requires developers to install regulatory and warning traffic signage, 40 km/h signs be included as applicable in new developments.

RECOMMANDATIONS DU RAPPORT

Que le Comité des transports et le Comité de l'agriculture et des affaires rurales recommandent au Conseil d'approuver :

1. la politique sur les zones de limite de vitesse pour les routes urbaines et rurales, comprenant notamment la procédure pour établir les limites de vitesse sur les chemins ruraux en gravier, pour afficher une limite de vitesse de 40 km/h dans les rues résidentielles locales et pour créer des zones scolaires de limitation de la vitesse, telle qu'elle est exposée dans la pièce 1;
2. le processus d'examen des limites de vitesse permettant de répondre rapidement aux demandes de renseignements à ce sujet d'après la classification des routes établie dans le Plan directeur des transports, tel qu'il est exposé dans le présent rapport;
3. l'interdiction de procéder, à intervalle de moins de trois ans, à une révision de la limite de vitesse dans une rue donnée, sauf s'il y a eu des changements majeurs des mouvements de circulation dans la rue en question;
4. la présentation par Travaux publics, dans le cadre de la préparation du futur budget de fonctionnement, d'une proposition d'augmenter de 100 000 \$ le budget d'entretien des panneaux de signalisation, telle qu'elle est résumée dans le présent rapport;
5. une requête adressée à la Province demandant que la Ville soit autorisée à établir des limites implicites de vitesse autres que 50 km/h dans les rues résidentielles;
6. une requête adressée à la Province demandant que le *Code de la route* soit modifié afin de permettre de doubler le montant des amendes dans une zone scolaire;

- 7. la modification du processus de réglementation des plans d'implantation, qui impose actuellement aux promoteurs immobiliers l'obligation d'installer les panneaux routiers de signalisation et d'avertissement, de manière à permettre que des panneaux de limite de vitesse de 40 km/h soient installés, s'il y a lieu, dans les nouveaux projets d'aménagement.**

EXECUTIVE SUMMARY

The City's Speed Zoning Policy was first established over thirty years ago and requires updating to keep in step with best practices for establishing speed limits. The Policy will also, confirm speed zoning methodology, address residential 40 km/h speed limits, establish a community engagement process for setting speed limits on local residential roads, set speed limits on gravel roads, streamline the speed zoning process, implement school speed zones and empower the community by creating an "engagement" approach to setting speed zones.

The original policy sets out a comprehensive engineering criteria for determining the appropriate speed for all classes of roads and considers various physical (road geometry, medians, etc.) and human factors (pedestrian volumes, collision data, etc.). Current best practices for establishing speed limits utilize the 85th percentile speed of the road, based upon the fact that generally the public acts in a safe and appropriate manner. The updated Speed Zoning policy will utilize this method of determining the appropriate speed of a roadway, while retaining the full engineering criteria for complex locations.

Many local residential roads are not signed within the community and the Highway Traffic Act regulates that 50 km/h is the default speed limit and any variation of this requires signing. The City has received numerous requests to implement a 40 km/h speed zone on local residential roads. The Public Works Department recognizes that there are often other factors related to driver and community perception in a residential environment where a 40 km/h limit makes sense. The revised Speed Zoning Policy has a process similar to the one used for parking regulation requests that engages the whole community. Within a residential neighbourhood, the request to change the speed limit on local roads will affect all residents of the street and therefore, it is important to determine if there is a consensus among residents. Where 75% of residents agree with the speed limit change, Public Works will change the speed limit on the local road. For collector roads, it is proposed that the 40 km/h residential speed limit warrant, approved by Council in 2003, be applied to determine the appropriate speed limit. On major collector and arterial roadways, the 85th percentile operating speed will be used as a basis to determine speed limits. It is also recommended that speed limit reviews on any roadway will not be undertaken within a three-year time period unless there are major changes in traffic patterns and development along the roadway in question.

It is widely recognized that motorists must be more diligent around schools, especially on busy arterial and collector roads. A new School Speed Zone program is included in the updated Speed Zoning Policy, including criteria for implementing school speed zone signage and in some cases flashing beacons.

Speed limits are not posted on many collector and gravel roads in the rural area and the default speed limit is governed by the Highway Traffic Act. Most of these roads are lightly travelled and self-regulating and do not require signing. Public Works is proposing to review speed limits on these roads on a case by case basis or where there are other safety concerns present (i.e.: collision data suggests there is a problem). The Speed Zoning Policy includes a process for reviewing gravel roads starting with the 85th percentile criteria above and considering the unique nature that gravel driving surface presents.

Financial Implications:

Funds are in place, within the current signing budget, to cover the cost of implementing a reasonable number of speed limit changes each year, when those changes are substantiated utilizing the criteria outlined in the Speed Zoning Policy. Should the number of requests achieving resident consensus exceed the Department's expectations (installing more than 200 signs in any given year – approximate cost is \$50,000), a budget pressure will be identified during regular budget deliberations.

Funds are in place to install a limited number of school speed zones each year (approximately 5 locations) without flashing beacons within the current signing budget. However, the demand for implementing school speed zones will most likely be higher than this amount and some locations will need to be supplemented with flashing beacons. Therefore, additional funds are required to address school speed zones speed limits. It is recommended that the base signing budget be increased by \$100,000 in the 2011 Operating Budget. This would allow for the installation of approximately 20 additional school speed zones. Additionally, for those locations where a school speed zone review results in the requirement for flashing beacons, this additional funding could result in 3 installations per year.

The operating impact of the installation of new signs is estimated at \$4,400 per year and will be requested in the year following the installation of the signs.

Public Consultation/Input:

Councillors have been consulted regarding The Speed Zoning Policy and Rural Councillors were also consulted regarding establishing speed limits on gravel roadways. Also, both Federal and Provincial transportation organizations and various North American municipalities have provided comments. The Ottawa Police, Legal Services and the Ottawa School Boards were also asked to provide comments. All comments received from stakeholders were supportive of the Speed Zoning Policy.

BACKGROUND

At the 18 October 2006 meeting, Transportation Committee approved the following motion:

“That Staff be directed to bring forward, in the new year, a City of Ottawa Speed Limit Policy, which would build on the 40 kilometres per hour interim speed zone warrants (approved by Council in October 2003), in conjunction with the previously approved Regional Municipality of Ottawa-Carleton (R.M.O.C.) Speed Limit Policy. This policy would set out the methodology to determine appropriate speed limits on all City roadways.”

In addition, the Agriculture and Rural Affairs Committee at the meeting of 12 June 2008, approved the following motion:

"That Traffic and Parking Operations staff be directed to review the criteria for designating reduced speed zones in school zones in rural areas."

Prior to amalgamation in 2001, safe and appropriate speed limits on the arterial road network were determined using the criteria and methodology set forth in the Speed Zoning Policy for Urban and Rural Roads, approved in 1975 by Council of the former Regional Municipality of Ottawa-Carleton. Since then, no significant changes or amendments have since been made resulting in an operating policy that appeared out of date and not always in step with current trends, requirements, or local community needs. Also, there was no formal process for community engagement.

Updating the City's Speed Zoning Policy involved the following five components:

- A process for implementing residential 40 km/h speed limits (approved by City Council in October, 2003), including a formal process to involve local communities;
- Retaining speed warrants for some cases (minor collector roads);
- Revised process to review speed limits and timelines to expedite responses to speed-related inquiries;
- A School Speed Zone program, including the background associated with the Adult School Crossing Guard Program; and
- A procedure for setting appropriate speed limits on rural road sections with gravelled surfaces.

DISCUSSION

Generally, speed zoning is based upon several concepts deeply rooted in our system of government and law including that:

- Driving behaviour is an extension of social attitude, and the majority of drivers respond in a safe and reasonable manner as demonstrated by their consistently favourable driving records;
- The normally careful and competent actions of a reasonable person should be considered legal;
- Laws are established for the protection of the public and the regulation of unreasonable behaviour on the part of individuals; and,
- Laws cannot be effectively enforced without the consent and voluntary compliance of the public majority.

Public acceptance of these concepts is normally instinctive. However, there are also widely held misconceptions regarding speed zoning policy, such as:

- Speed limit signs will slow the speed of traffic;
- Speed limit signs will decrease the collision rate and increase safety;
- Raising a posted speed limit will cause an increase in the speed of traffic; and,
- Any posted speed limit must be safer than an un-posted speed limit, regardless of the traffic and prevailing roadway conditions.

All technical details contained within the revised Policy are based on several sources including extensive research conducted by the United States Transportation Research Board (USTRB) (Special Report 254 - Managing Speed - Review of Current Practice for Setting and Enforcing Speed Limits), but also augmented by the currently accepted 'best practices' used in North American, European, and Australian jurisdictions. Both the USTRB and accepted best practices continually confirm that speed limits are most appropriately based on 85th percentile operating speeds.

Requests to lower posted speeds are most often made in the belief that any reduction in the speed limit will automatically result in a corresponding decrease in the speed of traffic, and thereby, an increase in safety for residents. Although the majority of speed-related complaints originate in residential communities, some involve the collector and arterial roadway system.

The former Municipalities maintained differing positions in determining speed limits on roadways under their jurisdiction to the extent that the Cities of Cumberland, Gloucester, Kanata, and Nepean allowed for 40 km/h speed limits regardless of roadway classification. This disparity in the approach to established posted speed limits, notably on residential roadways, resulted in a perceived inequity in the treatment of neighbourhoods within the amalgamated City of Ottawa and a clear lack of direction for staff on appropriate procedures for reviewing and recommending speed limits on residential streets.

Several municipalities in Ontario have considered and signed lower speed limits on their roadways. In these municipalities, 40 km/h speed limits are posted in school zones, on residential streets, and on minor collectors near schools. The City of Toronto and Hamilton use a warrant criteria for posting 40 km/h speed limits, which is similar to the warrant criteria approved by City Council in 2003, as described in Attachment 2.

The matter of a default speed limit on City of Ottawa roadways without the installation of speed limit signing is addressed by the Province of Ontario Highway Traffic Act, Section 128 (1); *'No person shall drive a motor vehicle at a rate of speed greater than, (a) 50 kilometres per hour on a highway within a local municipality or within a built-up area;'*

Section (2) states that: *'The council of a municipality may, for motor vehicles driven on a highway or portion of a highway under its jurisdiction, by by-law prescribe a rate of speed different from the rate set out in subsection (1) that is not greater than 100 kilometres per hour and may prescribe different rates of speed for different times of day. 2006, c. 32, Sched. D, s. 4 (3).'*

To implement a speed limit other than outlined in Section (1), (for example, 40 km/h) regulatory speed limit signing must be installed at a minimum spacing of 300 m (Ontario Traffic Manual).

Staff reviewed various options/scenarios to address the issue of 40 km/h on residential streets. They included:

1. Petitioning the Province to amend the Highway Traffic Act to allow municipalities to set default speed limits on their roadways;
2. Installing 'gateway' 40 km/h speed limit signing to neighbourhoods;
3. Applying the Council approved 'Residential 40 km/h Warrant' on a case by case basis – i.e. status quo;
4. Implementing 40 km/h speed limits on neighbourhood residential streets with the consensus of 75 % of the residents of said street;
5. Installing 40 km/h signs on all residential streets;
6. Provide 40 km/h speed limits on all collector roadways only; and

7. Developers installing 40 km/h signs all new residential streets prior to handing over ownership of street to City.

Staff comments, describe the effect on enforcement and initial costs and are described in Attachment 3.

In order to obtain information on how other municipalities are dealing with 40 km/hr speed limits on residential streets as well as to aid in completing the City of Ottawa’s speed limit policy review, various municipalities throughout Ontario and Canada were asked specific questions as summarized in the following table along with results (25 municipalities responded to this survey but did not necessarily respond to all questions):

Question	Yes	No
Has your municipality considered a default 40 km/h speed limit without signing?	8	17
If your Province/Territory does not support an unsigned default 40 km/h speed limit, have you considered approaching the Province/Territory?	4	21
Does your municipality support reduced speed limits within neighbourhoods with the installation of 40 km/h speed limit signs on entrance roadways only?	6	19
Is your municipality receiving many requests for reducing speed limits to 40 km/h on residential streets from Councillors or residents? If so, how many on average would your department receive/month?	14 Number of requests range between 1-7.	5

Based on the above-mentioned information, staff is recommending the following guideline be used to determine the speed limit for each class of roadway, as defined in the Transportation Master Plan, within the City of Ottawa.

1. Local Roads - 40 km/h Speed Limit

Within a residential neighbourhood, the request to change the speed limit will affect all residents of the street and therefore, it is important to determine if there is a consensus among residents. The Public Works Department recognizes that there are often other factors related to driver and community perception in a residential environment where a 40 km/h limit makes sense. Setting a lower speed limit has often had a limited impact on traffic flow, as these types of roads do not see large volumes of traffic.

To ensure a fair and equitable response to the numerous speed related inquiries received by the Department within residential communities, on local streets, it is proposed that any review of a speed limit be based not on individual requests, but rather by petition proving consensus that 75% of residents support a change in the speed limit on the roadway in question. Currently, this method has proven successful to assess parking regulations on City of Ottawa roadways. Where consensus is achieved, the Department will proceed to lowering the speed limit to 40 km/h.

2. Minor Collector Roads – 40 km/h Speed Limit

- In October 2003, the Transportation Committee and Council approved a warrant for posting 40 km/h speed limits on residential roadways that meet the criteria. This warrant is included in the attached Speed Zoning Policy as attached. For minor collector roads, which are distinct from local residential roads.

The modified residential 40 km/h speed limit warrant has proven to be a technically sound methodology used with success in establishing posted 40 km/h speed limits. The warrant takes into account various criteria, i.e. schools or playgrounds. It is recommended that the warrant be retained to determine if 40 km/h is an appropriate speed limit for the minor collector roadway being reviewed.

3. Major Collector and Arterial Roads

Within the City, all major collector and arterial roads are currently signed and the speed limit well established (with the exception of non-arterial rural and gravel roads as outlined below). The City does not receive many requests to implement a speed review on these types of roadways.

To determine the appropriate speed limit on a major collector and arterial road, the 85th percentile operating speed will be used as a starting point. The review first determines if anything has changed in the immediate area, such as new development in the area. As per the policy if there are no other mitigating factors, the speed survey confirms the posted speed limit and the ward councillor has been consulted, then generally there will be no further action. Should the ward councillor not agree with the staff recommendation, staff would prepare a report for consideration by Transportation Committee and Council.

Funds are in place, within the current signing budget, to cover the cost of implementing a reasonable number of speed limit changes each year, when those changes are substantiated utilizing the criteria outlined in the Speed Zoning Policy. Given that this is a new policy and under the new policy the demand for speed limit changes are not known, the Department is proposing to proceed without additional funds/resources and undergo an evaluation phase. Should the number of requests achieving resident's consensus exceed the Department's expectations (installing more than 200 signs in any given year – approximate cost is \$50,000), a budget pressure will be identified during regular budget deliberations.

Additionally, it is recommended that further speed limit reviews will not be undertaken within a three-year time period unless there are major changes in traffic patterns along the roadway in question. If however there are new mitigating factors or the speed survey does not confirm the posted speed limit, then under the policy a detailed study would be conducted.

There are other measures that the Department uses to control speed on problem roads, including:

- Radar trailers for arterial and major collector roads showing the actual speed compared to the speed limit to remind drivers to slow down;
- Smaller speed boards for residential neighbourhoods used in the same manner as the radar trailers; and,
- Education campaigns such as *Slow Down/Ralentissez and Speeding Cost You Campaign*.

These education measures, coupled with enforcement programs, are very effective in controlling speed for roads where a lower speed limit cannot be implemented but speeding is still a concern.

4. Default Speed Limit

As a result of requests from Councillors and the public to have a default speed limit of 40 km/h on residential streets and the fact that this can only occur if the province changes the legislation in the Highway Traffic Act, staff have included a recommendation requesting that a resolution from City Council be sent to the Province requesting that the Highway Traffic Act be revised to allow municipalities to set their own default speed limits on residential streets. This would allow the City to erect boundary signage and for non-posted local residential roads and would be a much more cost effective option.

Finally, staff routinely requires developers to install a wide range of regulatory and warning signs as part of the Site Plan Agreement process, prior to roads being assumed by the City. As part of this process, 40 km/h signs will be included (as applicable) in new developments.

The flow chart found in Attachment 4 illustrates the process City staff will follow to review a speed limit related inquiry and the timelines associated with these reviews.

School Speed Zone Program

There are two programs related to traffic safety and schools, the School Area program and the School Speed Zone program. The School Area program consists of warning signs installed in general proximity to a school and can be considered primarily for roadways near elementary and middle schools, where there is a possibility of children entering the roadway. Currently, all primary, middle schools and most high schools within the City have School Area warning signage.

The School Speed Zone program consists of warning signs, a reduced speed limit and in some instances, flashing beacons and is applicable to elementary, middle and high schools. The Transportation Association of Canada (TAC), of which the City of Ottawa is a sponsor, prepared "*School and Playground Areas and Zones: Guidelines for Application and Implementation*" in October, 2006.

The intent of these guidelines is to "*provide engineers and practitioners across Canada with a tool to help them decide where school and playground areas and zones may be considered, and to prioritise the locations which are most in need of such areas and zones. Due to variances in local practices, there is a need for a set of uniform guidelines towards the establishment of school and playground areas and zones and the application of traffic control devices in such areas and zones*".

The factors to be considered in the establishment of School Zones and Areas are:

- School type;
- Road classification;
- Fencing characteristics;
- Property line separation;
- Location of school entrance; and,
- Location of sidewalks.

In some instances there are other mitigating factors present that are not contemplated by the TAC guidelines. These are taken into account on a case-by-case basis, in consultation with the school principal, parent advisory council and student representatives.

Several school speed zone pilot projects are currently underway and have been widely acclaimed by parent advisory council, school officials and Community associations. Preliminary surveys indicate a substantial reduction in vehicle speeds have been attained at St. Mark's High School on Mitch Owens Road during the times students are adjacent to the roadway. St. Mark's High School is a good example of mitigating circumstances not anticipated by the TAC guideline. There is a high pedestrian volume between the school (south side of Mitch Owens) and a fast food establishment (north side of Mitch Owens). As a result, a school zone is in effect during the morning, lunch and the afternoon periods.

The improved school area signing, at both urban and rural schools, has resulted in a higher visibility of school zones for motorists by clearly delineating where a school zone begins, where it ends and the time periods motorists must reduce their speed to ensure the safety of all road users within the designated zone. As a result of these pilot projects, staff are recommending that at schools located on rural arterial roadways, locations meeting the warrants for the school speed zones, be supplemented by flashing beacons to provide higher visibility on these high speed roadways. It is also recommended that for any roadway, the reduction of the speed limit, within a school speed zone, shall never be greater than 20 km/h, in accordance with the Highway Traffic Act. The school area and school zone worksheet is shown in Attachment 5 and an illustration of the signing of a school speed zone is shown in Attachment 6.

Funds are in place to install a limited number of warranted school speed zones each year (approximately 5 locations) without flashing beacons within the current signing budget. However, the demand for implementing school speed zones will most likely be higher than this amount and some locations will need to be supplemented with flashing beacons. Therefore, additional funds are required to address school speed zones speed limits. It is recommended that the base signing budget be increased in the amount of \$100,000 in the 2011 Operating Budget. This would allow 20 school speed zones to be installed, along with three locations with flashing beacons per year. Only schools that meet the warrants set out in the TAC school speed zone guidelines or where there are other mitigating factors present would be eligible. Signing all schools would be costly (approximately \$1,000,000 for all 330 schools in the City of Ottawa) and would potentially create a situation where the effectiveness of the signs would be lost. Flashing beacons shall supplement school zones on high-speed rural roadways (such as Mitch Owens or Bank St) or at locations that meet the warrants as defined in the guidelines. Installing flashing beacons at all schools is not recommended, as again this would be very costly (approximately \$11,000,000).

Finally, it is recommended that a resolution to the Ministry of Transportation of Ontario to amend the Highway Traffic Act to allow for the doubling of fines within school speed zones (currently fines are doubled within construction zones and community safety zones).

Speed Limits on Rural Roadways Other Than Arterials

In the Province of Ontario, since the 1960's or before, if a rural roadway had no speed limit signs posted, the default speed limit was governed by the Highway Traffic Act. Municipalities are permitted to change speed limits, however, that new limit must be both posted in the field, and incorporated into a local by-law.

Currently, many gravel roads and non-arterial roadways in the rural area are not signed and therefore default to the limit prescribed in the Highway Traffic Act. All arterial roads in the rural area have posted limits.

Past practice has been that the Public Works Department conducts a speed study upon request from the public, Councillor or when there are other safety related factors present, i.e. collision statistics indicate a problem. The Public Works Department intends to continue the practice of initiating studies primarily on a request basis.

Traffic volumes, in rural areas, are typically quite low when compared to the volume of traffic on urban roadways and in addition, drivers' speeds are essentially self-controlling on gravel, rough, or narrow paved roads in relatively poor condition, especially when limits are not posted. Gravel roadways, in particular, present a special challenge when deciding a level of speed limit to post as the conditions of these roads can vary dramatically. However, as with other roadways, the recommended speed limit reflects driving under ideal road, weather and traffic conditions.

It is obvious that a narrow, winding, gravel roadway simply cannot sustain the high-speed traffic of a smooth, paved, wide arterial urban road (i.e. 80 km/h). As the population increases in the rural areas of the City of Ottawa there are increasing requests to reduce the speed limit in an effort to reflect driving conditions and the 'residential' nature of the new neighbourhoods.

Similar problems exist for narrow paved roadways across the rural areas of the City. Although the road surface can be a better condition than on gravel roads, the same concerns are expressed but now include comments regarding pedestrian activity as shoulders are too narrow on which to walk or too rough for strollers and bicycles, and if the speed limit were reduced, traffic would become slower, therefore improving the safety of non-vehicle users of the road.

The Speed Zoning Policy recommends that the speed limit on gravel roadways will be reviewed on a case-by-case basis. Should there be a sufficient number of vehicles (typically a minimum of 30 vehicles per direction within a two-hour time period), a spot speed survey will be undertaken to confirm the average speed and 85th percentile speed of traffic to provide a good starting point to assess the level of the speed limit. Experience indicates the minimal study has proven successful in providing a previously unsigned roadway with a speed limit that the majority of drivers will observe. In addition to the speed survey, a thorough review of warning and regulatory signing will be undertaken. The upgraded signing provides drivers, both local and those unfamiliar with the road with a clear indication of the driving environment. Additionally, with police enforcement a posted speed limit will successfully address those drivers who choose to disregard the law and travel at excessive and potentially dangerous speeds.

The Speed Zoning Policy has a mechanism to review speed limits on rural paved roads as the summary tables used to determine the appropriate speed limit on any given roadway take into consideration but are not limited to, 85th percentile speed, pavement width, shoulder width and degree of pedestrian activity, community, Ward Councillor and police input in recommending an appropriate and safe speed limit. Accordingly, this method will continue to be used.

Funds are in place, within the current signing budget, to cover the cost of implementing a reasonable number of speed limit changes each year, when those changes are substantiated utilizing the criteria outlined in the Speed Zoning Policy.

CONSULTATION

As part of the update of the Speed Zoning Policy for the City of Ottawa, staff has consulted with the City Councillors, City Legal Services, Ottawa Police Service, Transportation Association of Canada, Ministry of Transportation of Ontario, other Ontario and Canadian Municipalities, School Boards, and the trucking industry. All comments received were supportive of the Speed Zoning Policy.

In June 2009, City staff met with the principal of St. Mary's School, Ottawa-Catholic School Board, residents of Greely and the Construction Association to review the proposed School Speed Zone guidelines being recommended. All attendees agreed with the proposed guidelines. As well, staff reviewed the warrants for the installation of a school speed zone on Bank Street in the vicinity of St. Mary's school and determined that a school speed zone was indeed warranted and will also be supplemented with flashing beacons. The installation was completed prior to the start of the 2009/2010 school year.

In July 2009, staff sent a copy of the update on the setting of speed limits on rural paved and gravel roadways to the four rural Councillors for their review and comments. In addition, the four rural Councillors were briefed on the report.

LEGAL/RISK MANAGEMENT IMPLICATIONS:

There are no legal/risk management impediments to the implementation of recommendations 1 to 4, and the second part of recommendation 5. However, with respect to the first part of recommendation # 5, while there are no legal impediments to petitioning the Province for a "default speed limit other than 50 km/h", there may be legal implications were the Province to allow municipalities to set default speed limits other than 50 km/h. Were the Province to agree to a default speed limit for municipalities (that is, no signage), and were the City to implement a 40 km/h default speed limit, without signage, there would be some confusion between the HTA default speed of 50 km/h (without signage) and the City default speed of 40 km/h (without signage). While the City By-law would provide for the default speed limit of 40 km/h, and an offence would therefore in technical terms be enforceable, the Courts may pick up on the ambiguity between the Province wide default limit of 50 km/h and the City of Ottawa default limit of 40 km/h, both without signage, and may dismiss charges. While drivers are presumed to "know the law", as it is expressed in the City's Traffic and Parking By-law, in the absence of any signage there will be confusion between the provisions of the HTA and the City By-law.

The City may try to overcome this confusion between the two default speeds by posting "perimeter" or "gateway" signs but City residents and visitors would not necessarily see these, and moreover, it seems that residents are not generally aware of unsigned default speed limits.

FINANCIAL IMPLICATIONS

With respect to Speed Zoning no additional budget authority is being requested.

For School Speed Zones beginning in 2011, Public Works would be directed to submit as part of the 2011 Draft Operating Budget for Council consideration that \$100,000 be added to the Sign Maintenance Budget to allow for the installation of approximately 20 additional school speed zones and supplementing three locations with flashing beacons per year.

In subsequent years following the prior year's installation of additional school speed zones, an annual budget pressure of \$4,400 per year would be added as a budget pressure for maintenance requirements.

SUPPORTING DOCUMENTATION

- Attachment 1 Speed Zoning Policy for Urban and Rural Roads *(Immediately follows the report)*
- Attachment 2 40 km/h Residential Warrants *(Immediately follows the report)*
- Attachment 3 Options to implement 40 km/h speed limit *(Immediately follows the report)*
- Attachment 4 Process to Review Speed Limits and General Timelines to Implement *(Immediately follows the report)*
- Attachment 5 School Area and School Zone Worksheet *(Immediately follows the report)*
- Attachment 6 Illustration of the signing of a school speed zone. *(Immediately follows the report)*

DISPOSITION

Upon Council approving the recommendations contained in this report, action will be taken to assess requests for speed limit changes through the application of the revised City of Ottawa Speed Zoning Policy.

40 KM/H RESIDENTIAL WARRANTS

In 2003, Council of the City of Ottawa approved the following 40 km/h posted maximum speed limit warrants which may be implemented on any street where one or more of the conditions shown in Warrant A are met. In the case of streets 10.5 metres or more in width, Warrant B must also be considered.

Warrant A: (One or more of the following)

1. Elementary or junior high school abuts the road.
2. Parkland abuts the road that is contiguous to and used to gain access to an elementary or junior high school.
3. No sidewalk on either side of the road or a major portion of the road.
4. The sidewalk is immediately adjacent to and not separated from the flow of motor vehicles by long-term parking (3 hours) or bike lanes, and where the travelled portion of the road width is less than 5.7 metres for two-way operation, or less than 4.0 metres for one-way operation.
5. Two or more locations of concern where there are grades greater than 5% and/or safe speed on curves is less than 50 km/h.
6. Lack of sufficient distance to stop safely at two or more locations when travelling at 50 km/h.
7. The number of speed related collisions on local streets equals 3 or more over three years.
8. Where long-term parking (3 hours) is permitted on one or both sides, and the remaining travelled portion of the road is less than 5.7 metres for two-way operations, or 4.0 for one-way operation.
9. A licensed childcare facility or private school abuts the road.

Note: In the case of Warrant A (1) or A (2), the 40 km/h maximum speed limit must extend no less than 150 m beyond the boundary of school property and/or contiguous parkland

Warrant B: (Wide Roads)

1. A 40 km/h maximum speed limit may only be implemented on streets with total pavement width equal to or more than 10.5 metres, if the 85th percentile speed is equal to or less than 50 km/h

Note: Speed limit reductions to 40 km/h on wide roads have negligible impact and in these cases, other measures should be considered to influence driver behaviour to reduce speed, such as geometric changes to the road itself.

Attachment 3

Options to Implement 40 km/h Speed Limits

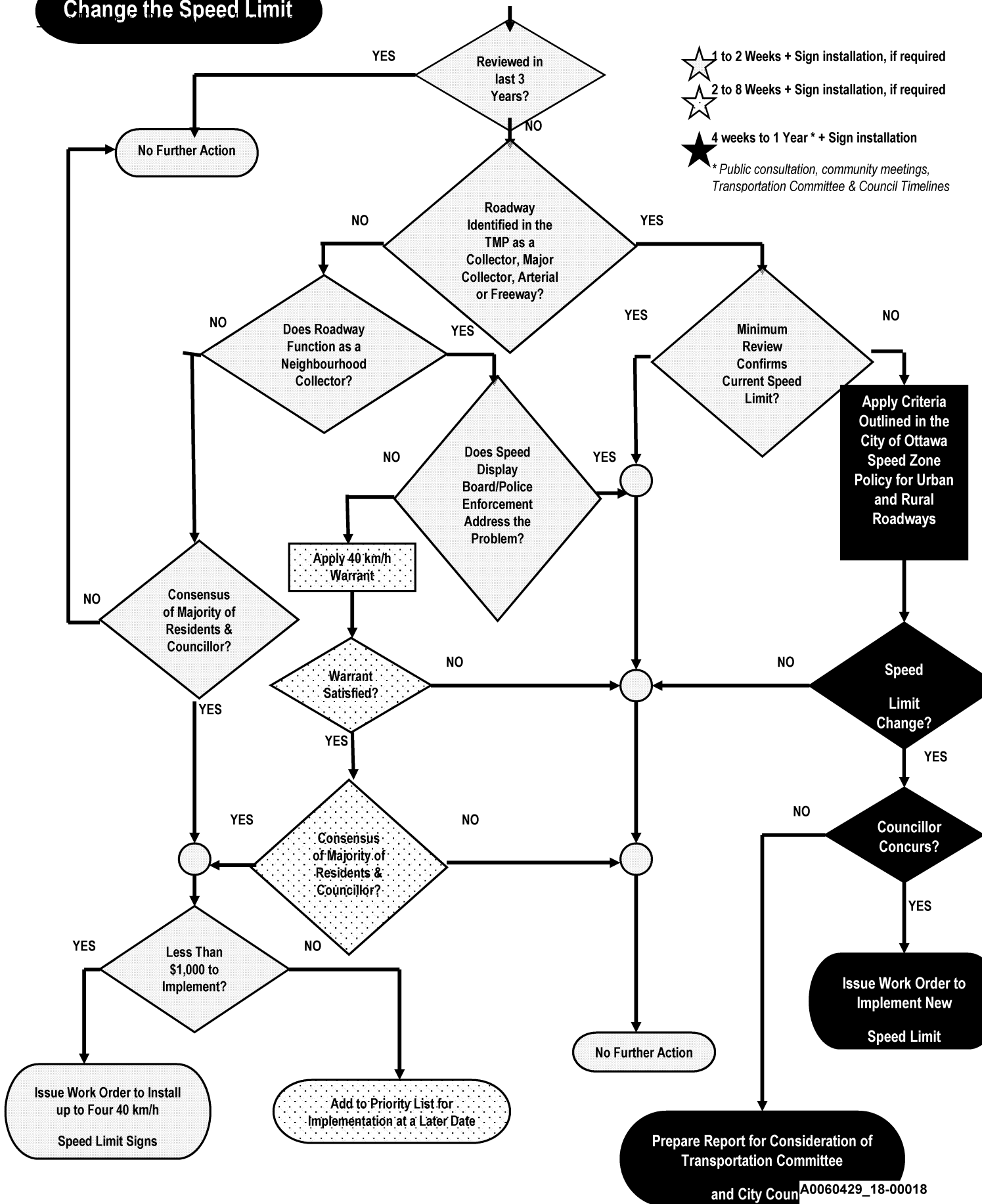
#	Option	Staff Comments	Effect on Enforcement	Initial Cost
1	Request province to amend the Highway Traffic Act to permit 40 km/h speed limits without the need for speed limit signing	<ul style="list-style-type: none"> • Less visual sign pollution • All existing 40 km/h signs could be removed, improving the visual landscape • Increased speed limit signing on previously unsigned 50 km/h collectors and arterials • All rural roads may require speed limit signing • Motorist confusion regarding speed limits • Inconsistent with other communities in Ontario • Continual education costs • Majority of municipalities do not support this option. 	<ul style="list-style-type: none"> • Increased demand on police • Police enforcement requires posted speed limit on every street to successfully convict 	<p>To sign 50 km/h speed limit signing on roadway:</p> <p>\$250,000 for rural roads</p> <p>\$150,000 for urban collectors and arterials</p> <p>Savings of approximately \$20,000 per year as no longer the requirement to install 40 km/h signage</p>
2	Install 40 km/h speed limits on the entrance to communities (Gateway Signing)	<ul style="list-style-type: none"> • Fewer speed limits signs than in Option 5 • Motorist confusion regarding speed limits • Continual education costs • May be difficult to define community boundaries 	<ul style="list-style-type: none"> • Increased demand on police • Police enforcement requires posted speed limit signage with appropriate spacing on every street to successfully convict 	<p>\$200 - \$500 per community entrance, costs depends on size of sign</p>
3	Maintain Status quo – Apply Council approved “Residential 40 km/h Warrant”	<ul style="list-style-type: none"> • Speed limits more appropriate for roadway classification • Improved visual landscape • Public acceptance of speed limits when the 	<ul style="list-style-type: none"> • Minimal enforcement as roadway speeds will mirror speed limit resulting in fewer 	<p>\$500 to \$2000 per roadway (based on roadway length and number of signs required)</p>

#	Option	Staff Comments	Effect on Enforcement	Initial Cost
		<p>limit reflects roadway geometry, adjacent land development, and pedestrian, cycling activity.</p>	<p>complaints from the public</p>	
4	<p>Implement 40 km/h on neighbourhood residential streets with consensus of 75% of the residents of the street.</p>	<ul style="list-style-type: none"> • Provides for consultation with local neighbourhood • Ensures majority of residents of street endorses speed limit • Within existing budget, would have to cap number of requests to \$50,000 per year • Increased maintenance costs 	<ul style="list-style-type: none"> • Increased demand on police for enforcement resulting from increased complaints from the public 	<p>\$500 to \$2000 per roadway (based on roadway length and number of signs required). Ability to fund signage up to \$50,000 per year</p>
5	<p>Implement 40 km/h speed limit signing on all roadways</p>	<ul style="list-style-type: none"> • Substantial increase in the number of speed limit signs in the urban environment • Substantial cost • All roadways will require speed limit signing including all residential roads, formerly unsigned collectors and all rural roads • Increased maintenance costs • Increase in the number of speeding complaints from residents 	<ul style="list-style-type: none"> • Increased demand on police for enforcement resulting from increased complaints from the public • Reduced police presence on major roadways where speeding is an issue 	<p>\$5 million for urban roads plus maintenance costs over 20 year cycle.</p>
6	<p>Provide 40 km/h speed limits signs on all collector roadways only</p>	<ul style="list-style-type: none"> • Fewer speed limits signs than in Option 5 • 40 km/h speed limit may not be appropriate for collector roadways • Motorists confusion regarding speed limits 	<ul style="list-style-type: none"> • Increased demand on police • Police enforcement requires posted speed limit on every roadway 	<p>\$500,000 for collector roadways</p>

#	Option	Staff Comments	Effect on Enforcement	Initial Cost
		<ul style="list-style-type: none"> • Residential roadways would have default to 50 km/h but appear to be 40 km/h 	to successfully convict	
7	Developers install 40 km/h signage on residential streets prior to handing over roadway to City	<ul style="list-style-type: none"> • Additional cost for development industry • Substantial increase in the number of speed limit signs in the neighbourhood environment • Increased maintenance costs • Increase in the number of speeding complaints from residents 	<ul style="list-style-type: none"> • Increased demand on police for enforcement resulting from increased complaints from the public 	No cost to City – Costs are borne by Developer.

Change the Speed Limit

- ★ 1 to 2 Weeks + Sign installation, if required
- ★ 2 to 8 Weeks + Sign installation, if required
- ★ 4 weeks to 1 Year* + Sign installation
- * Public consultation, community meetings, Transportation Committee & Council Timelines



School Area and School Zone Worksheet

Attachment 5



City Operations -- Public Works

School Area and School Zone Worksheet

School Name: _____

Street: _____ Speed Limit: _____ km/h Date: _____

Surveyor: _____ Comments: _____

Installation Criterion	Maximum Point Value (MPV)	Description	Weighting Factor (WF)	Weighting Factor for this School	Score (MPV*WF)
S chool T ype	40	Elementary	1.0		0
		Middle/Junior High School	0.4		
		High School	0.2		
		Post Secondary/ College/ University	0.0		
R oad C lassification	20	Urban Land Use	Rural Land Use		0
		Local	N/A	1.0	
		Minor Collector	Local	0.75	
		Collector	Collector	0.5	
		Major Collector/Minor Arterial	Arterial	0.25	
		Major Arterial/Expressway	Expressway	0.0	
F encing	20	Fully Traversable	1.0		0
		Partially Traversable	0.5		
		Non-Traversable	0.1		
P roperty L ine Separation	10	Abuts Roadway	1.0		0
		Within 50 Metres	0.5		
		Further than 50 Metres	0.0		
S chool E ntrance	5	Main Entrance / Multiple Secondary Entrances	1.0		0
		Secondary Entrance	0.6		
		None	0.0		
S idewalks	5	None or Non-School Side	1.0		0
		School Side	0.6		
		Both Sides	0.0		
TOTAL SCORE (Sum of T, C, F, L, E, and S) =					0

School Zone Results Matrix	
Total Score	Area or Zone ?
0 - 40	Nothing
41 - 64	School Area
65 - 80	School Area or School Zone*
81 - 100	School Zone
<p><i>* Local conditions must be considered in detail in order to determine the appropriate treatment. Wherever possible, mitigation measures should be explored that would reduce the score so that marginal school zones can be avoided. The reasons for the final decision should always be documented.</i></p>	

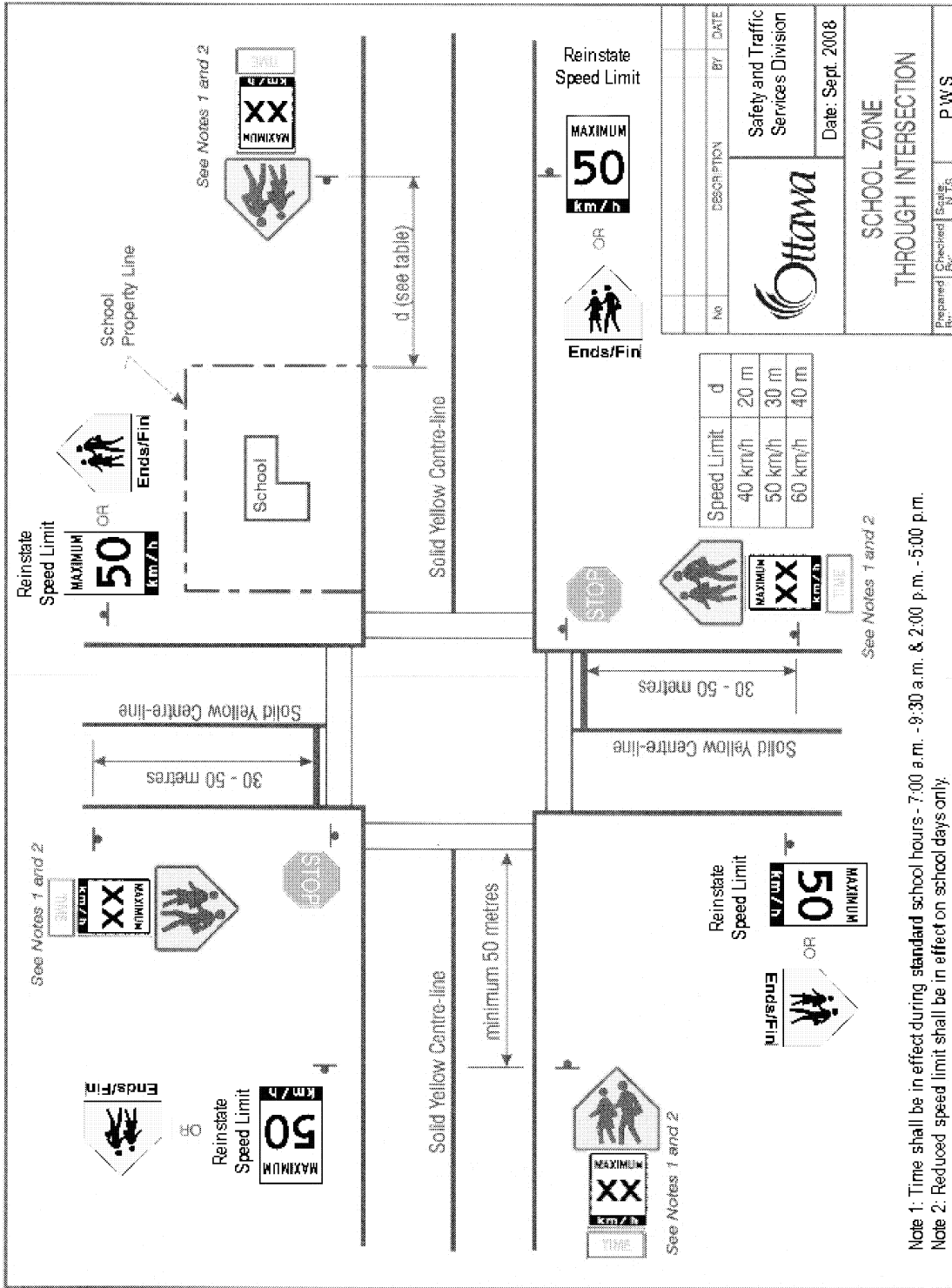


Illustration of the signing of a school speed zone



City Operations

Speed Zoning Policy

For Urban and Rural Roads

2009

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Executive Summary

Prior to amalgamation in 2001, safe and appropriate speed limits on the arterial road network were determined using the criteria and methodology set forth in the Speed Zoning Policy for Urban and Rural Roads approved in 1975 by Council of the former Regional Municipality of Ottawa-Carleton. In the 1980's, staff amended that policy slightly to reflect the national conversion to the metric system, however, no other changes or amendments have since been made resulting in an operating policy that appeared potentially out of date and not always in step with current trends and requirements

In response to current operational needs, this policy has been reviewed establishing the methodology originally approved in 1975 is still valid. It has however, been expanded to consider the following:

- A process for implementing residential 40 km/h speed limits (approved by City Council in October, 2003), including a formal process to involve local communities;
- Provide technical guidance in respect to establishing appropriate speed limits on urban and rural road sections with school zones including the background associated with the Adult School Crossing Guard Programme;
- Address the issues related to the implementation of 30 km/h posted speed limits;
- Retain speed warrants for some cases (minor collector roads);
- Provide technical guidance for setting appropriate speed limits on rural road sections with gravelled surfaces.

All technical details contained within the revised policy are based not only on the extensive research conducted by the United States Transportation Research Board (Special Report 254), but also augmented by the currently accepted 'best practices' used in North American, European, and Australian jurisdictions. That body of extensively researched information continually confirms that speed limits are most appropriately based on 85th percentile operating speeds.

Speed zoning is based upon several concepts deeply rooted in our system of government and law including that:

- Driving behaviour is an extension of social attitude, and the majority of drivers respond in a safe and reasonable manner as demonstrated by their consistently favourable driving records;
- The normally careful and competent actions of a reasonable person should be considered legal;
- Laws are established for the protection of the public and the regulation of unreasonable behaviour on the part of individuals; and,
- Laws cannot be effectively enforced without the consent and voluntary compliance of the public majority.

Public acceptance of these concepts is normally instinctive. However, the same public will often reject these fundamentals and rely instead on more comfortable and widely held misconceptions, such as:

- Speed limit signs will slow the speed of traffic;
- Speed limit signs will decrease the collision rate and increase safety;
- Raising a posted speed limit will cause an increase in the speed of traffic; and,

- Any posted speed limit must be safer than an un-posted speed limit, regardless of the traffic and prevailing roadway conditions.

The former Municipalities maintained differing positions in the determining of speed limits on roadways under their jurisdiction to the extent that the Cities of Cumberland, Gloucester, Kanata, and Nepean allowed for 40 km/h speed limits regardless of roadway classification. This disparity in the approach to posted speed limits, notably on residential roadways, resulted in a perceived inequity in the treatment of neighbourhoods within the amalgamated City of Ottawa and a clear lack of direction for staff on appropriate procedures for reviewing and recommending speed limits on residential streets.

The former Speed Zoning Policy for Urban and Rural Roads was, and continues to be, a very effective tool in its ability to determine a safe and appropriate speed limit within the context of the Highway Traffic Act. While both 30 km/h and 40 km/h residential speed limits were within its scope, its particular focus was with the major collector and arterial roadway network and culminating on 1 October 2003, when the Transportation Committee recommended Council approve posted 40 km/h speed limits on residential roadways that meet the criteria as amended by the following:

- That the warrants specified be adopted as interim warrants until such time as the full review of appropriate speed limits in residential areas is completed and adopted by Council;
- That child care facilities and private schools be part of the warrant system for posted 40 km/h maximum speed limits; and,
- That the interim warrant policy be amended to read: ‘In the case of 10.5 metres or more in width, Warrant B also be considered.

The modified residential 40 km/h speed limit warrant has proven to be a technically sound methodology used with success in establishing posted 40 km/h speed limits on several residential roadways.

Safety First Campaign

“Traffic regulation has probably been the subject of more attention during the past decade than any other question affecting the matter of transportation within large centres of population and many and varied have been the restrictions placed upon vehicular traffic with the object of safeguarding human life”.

The Ottawa Evening Journal, 12 May 1917

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1. BACKGROUND AND INTRODUCTION

This policy represents a fully updated version of the *Speed Zoning Policy for Urban and Rural Roads* of the former Regional Municipality of Ottawa-Carleton appended with both a more comprehensive 40 km/h residential speed limit warrant process to address the concerns of residents regarding the speed of traffic in their neighbourhood and in school zones. Also, new guidelines related to the setting of speed limits on approximately 700 kilometres of gravel roadways within the rural portions of the City has been added.

On 1 January, 2001, the Townships of West Carleton, Goulbourn, Rideau and Osgoode, together with the Village of Rockcliffe Park, the Cities of Cumberland, Gloucester, Kanata, Nepean, Ottawa and Vanier and the Regional Municipality of Ottawa-Carleton amalgamated to form a new, expanded City of Ottawa. As such, the practice of setting speed limits appropriate for the roadway function are addressed in this policy addressing the many issues that arise when a roadway speed limit comes into question.

This policy will propose appropriate speed limits for the major roadway system, as well as for all classes of road including local collectors, residential neighbourhood streets, school zones and rural gravel roadways in an attempt to standardize speed limits for similar types of roads and adjacent development.

Current Practice for Setting Speed Limits

Prior to amalgamation, speed limits were implemented on major arterial roadways, (primarily under the jurisdiction of the Regional Municipality of Ottawa-Carleton) following the guidelines outlined in the *Speed Zoning Policy for Urban and Rural Roads* approved by Regional Council in 1975. In the former City of Ottawa, the speed limit on all streets other than Regional Roads, was governed by the Highway Traffic Act in which, unless otherwise posted, was 50 km/h. The former Cities of Cumberland, Gloucester, Kanata, and Nepean implemented 40 km/h posted speed limits indiscriminately regardless of roadway classification or function. In particular, the City of Gloucester implemented a 40 km/h posted speed limit on many local collector roadways without installing speed limit signing on the connecting residential roadways. This action resulted in a higher speed limit on a local residential street with low vehicle volumes and without sidewalks on either side of the street than on the neighbourhood collector.

The speed of traffic is a subject normally arousing a considerable amount of emotion as exemplified in the famous slogan “Speed Kills”. However, a more appropriate message would be “travelling too slow or too fast for existing conditions is conducive to a collision”, but this is both lengthy and lacking in emotional impact.

There is however, considerable research supporting the latter statement. A review of significant and relevant studies has been undertaken and the findings and some excerpts from these studies are included in this policy.

A list of reference reports and studies is provided in Appendices “A” and “B” to this report. Also provided in Appendix “C” is a glossary of commonly used terms relating to vehicle speeds. Appendices “E” through “Q” provide details regarding the effect on vehicle speeds when a speed limit is either increased or decreased.

In this report, several aspects of the problem of establishing speed zones are discussed in respect to each of the following:

- ◆ Public viewpoint
- ◆ Safety
- ◆ Enforcement
- ◆ Driver
- ◆ Vehicle
- ◆ Road
- ◆ Traffic
- ◆ Driving environment
- ◆ Traffic control devices
- ◆ Education campaigns
- ◆ Special areas of consideration (i.e. - school zones and areas where elderly and disabled persons are present)
- ◆ Legislation

2. SUMMARY AND RECOMMENDATIONS

Although there have been a number of attempts to develop a purely scientific method which would correlate all of the variables inherent in the establishment of a speed limit, no one has been successful in doing so at this time.

The main criteria for determining speed zone regulations are based on finding a safe and reasonable speed limit for existing conditions. Numerous factors relating to the driver, the vehicle, the roadway, traffic and the environment have a determining effect on driving speeds and main element in determining whether or not drivers observe a speed limit is their perception of the reasonableness of the limit.

An important consideration in determining an appropriate speed zone for a given section of road is that the method used in establishing the speed limit results in a high degree of uniformity on road sections where the same set of elements are present.

The most widely supported criterion on which to base a speed limit is the 85th percentile speed (see Appendix C for definition) in conjunction with the design speed of the road.

From a safety standpoint, there is substantial evidence to support the 85th percentile speed criterion as the basis for establishing speed limits. Research has indicated that the use of the 85th percentile in this regard, is likely to result in the lowest rate of collision involvement. Nevertheless, the application of this criterion must take into consideration other elements.

Among these elements is pedestrian activity, and in particular, school children crossing or walking along the roadway. Studies conducted by the former Regional Municipality of Ottawa-Carleton in the early 1980's indicates that there is virtually no benefit in establishing lower speed limits specifically because of an increase in the number of pedestrians. A more detailed study of the effect on vehicle speeds during the time when there are large numbers of school children, including increased vehicular activity associated with dropping off or picking up children at eleven schools in Ottawa between 1994 and 1996 was conducted. The results of the speed surveys conclude that both the average speed of traffic and the 85th percentile speed dropped by up to 16 km/h without a reduction in the posted speed limit. Studies, which have been reviewed, have not attempted to vary the controllable elements and measure the significance of each individual element in respect to its impact on influencing vehicle speed. In the meantime, pedestrian activity in general is considered as one of the elements used in determining an appropriate speed limit.

This report recommends both a method of determining a justified speed limit based on the criteria of speed characteristics and design speed and also a more refined study which recognizes such elements as pedestrian and cycling activity, collision experience, roadside development, road design features, street classification, and parking activity.

Speed limits will be determined as follows:

- 1) By means of the application of the method described in Section 14 of this report with the “minimum study” being used to determine the speed limit on sections of road where there is little or no abutting development with negligible pedestrian activity. A minimal study will also be used on all other classes of roadways as a starting point to determine if the detailed (refined) study is required.
- 2) By means of the “refined study” being used in all other areas including roadways classified in the Transportation Master Plan as collectors, major collectors, arterials and freeways.
- 3) Speed limit regulations on residential roadways including local streets as well as minor collector roadways be determined by applying the 40 km/h residential speed limit warrant as described in Sections 16 and 17.
- 4) Speed limits on gravel and paved rural, non-arterial roadways be determined as outlined in Section 18.
- 5) Cognizance be given to the economics of installing speed limit signing in rural areas to comply with the requirements of the Highway Traffic Act, R.S.O. 1990, Section 128, (1) (a) and (b).

3. SPEED LIMIT VALIDATION

Following completion of a speed zone review and, provided changes to the posted speed limit are found to be warranted, an assessment of vehicle speeds will be undertaken to confirm if, once instituted, drivers are observing the new limit. Spot speed surveys will be conducted on collector and arterial roadways one year after a change has been implemented to ensure there is a high level of compliance and to verify the variation in driving speeds has not increased to a level that could increase collision potential.

There are three results following such a review:

1. No change in the posted speed limit,
2. Reduce the speed limit or,
3. Increase the speed limit.

The lowering of a posted speed limit to a level other than what is recommended or warranted by a speed zone review is most often requested by a resident firm in the belief any reduction in the speed limit will automatically lead to a reduction in the speed of all traffic, ultimately improving safety to all road users. However, an alteration to a traffic regulation, no matter how passionately the argument is presented, does not simply affect the individual requesting the change, but rather impacts thousands upon thousands of road users, whether they are motorists, pedestrians or cyclists, thereby creating a significant financial strain on police resources required to enforce a speed limit that is not respected.

Consequently, should there be no substantive reduction in the average and 85th percentile speed of traffic on given roadways the previously posted and appropriate speed limit will be reinstated.

4. PROCESS TO ADDRESS SPEEDING CONCERNS

Requests to lower posted speeds are most often made in the belief that any reduction in the speed limit will automatically result in a corresponding decrease in the speed of traffic, and thereby, an increase in safety for children and pets. As the majority of speed related complaints originate in residential communities, the following details the measures taken to address these concerns.

4.1. Local Residential Streets

Representative streets include: Sable Run (Stittsville), Binscarth (Glen Cairn), Foster (Hintonburg), Buchan (New Edinburgh), Lawson (Castle Heights), Gatineauview (Rothwell Heights), Buckskin (Convent Glen), Como Crescent (Fallingbrook), Tripp (Old Barrhaven) and Wildmint (Riverside South).

4.2. Neighbourhood Collector Streets

These types of streets are not identified in the Transportation Master Plan (TMP) but function as local collectors within a neighbourhood. Typical streets would include Shirley's Brook (Morgan's Grant), Hartsmere (Stittsville), Meadowbreeze (Emerald Meadows), Springwater (Bridlewood), Pinetrail (Centrepointe), Blossom (Applewood Acres), Fillmore (Beacon Hill North), Lawnsberry (Chatelain Village), Boake Street (Fallingbrook), Markland (Rideaucrest), and Vermillion (Riverside South).

4.3. Typical Comments, Complaints, and Concerns

“Traffic travels too fast on my street (up to 120 km/h); cars are going around the corner on two wheels; children and seniors are at risk; it is a residential street; drivers should slow down before someone is killed; I can't believe the speed limit is 50 km/h on my street; it's 50 km/h on Walkley Road so reduce the speed limit on my street to 40 km/h, 30 km/h, or 20 km/h; children can't play on the street; it's not safe to walk my dog; install a sign indicating 'Children at Play'; I'm frightened to let my child ride his/her bicycle on the street; I never see police enforcing the speed limit; reduce the speed limit so police can issue more speeding tickets”.

4.4. Responses

In the case of local residential streets the complainant generally resides on that street however, on neighbourhood collectors it is not uncommon for the resident expressing concern to live in the area but not necessarily on the roadway in question.

Traffic speeds on local residential streets are typically quite low while on neighbourhood collectors they vary between quite low to moderate in both cases because of roadway geometry, the presence of parked vehicles, narrow road width and general neighbourhood activity. Residents may perceive speeds up to 120 km/h; however, the aforementioned factors prevent even high performance vehicles from attaining high speeds on these streets. All factors considered, the prudent response is 'no further action' or in the case of neighbourhood collectors the application of the residential 40 km/h speed limit warrant.

Most often, only one resident expresses concern regarding speeding on these types of roadways. In most cases, if not the majority, either a conversation or detailed e-mail responding to these concerns results in a satisfactory conclusion with no further action required. Usually a single deployment of the Department's speed display board addresses the concerns to a mutually satisfactory result.

In other instances, the resident, together with one or more of their neighbours, either contacts the Councillor or the Mayor by phone or in several e-mails demanding something be done before someone (especially a child) is injured or worse, killed on their street. As previously noted, no action is required. However, in responding to the demands of the public, the simple solution for local residential roadways is to acquiesce to these requests by assessing (without an on-site evaluation) the number of speed limit signs required and issuing a work order to install them. Shorter streets will typically require only two

signs at a cost of up to \$500.00. However, should more than four speed limit signs be required, it is then necessary to add the street to a priority programme with the necessary signing installed when funds become available. This matter would then be addressed during the budget submission process when additional funds can be requested.

As the request to reduce the speed limit will affect all residents of the street, it is important to determine if there is a consensus among the residents. Accordingly, a majority of 66% will be required. The opinion of a single resident is not always representative of the community and may not be in the best interest of the City to indiscriminately change a posted regulation to the expense of all taxpayers.

Figure 1 illustrates the process and timelines that factor in the review of speed limits on City of Ottawa streets.

4.5. Ramifications of a Change in the Speed Limit in a Local Neighbourhood

1. No effect on vehicle speeds.
2. Significantly increased cost to the City to install and maintain unnecessary speed limit signing.
3. Following a reduction in the speed limit, residents of adjacent streets will request a similar treatment for their street resulting in an increase in both staff workload and cost to the City to install additional, unnecessary signing.
4. Neighbourhood aesthetics compromised.
5. Speed limit signs installed on residential property frontage resulting in complaints from the public to relocate the sign.
6. Police enforcement on local and neighbourhood collector streets will reduce availability on roadways with verifiable speeding or speed-related collision history and other issues including red-light infractions, passing stopped school buses, or disobeying stop signs.
7. Speeding complaints continue.

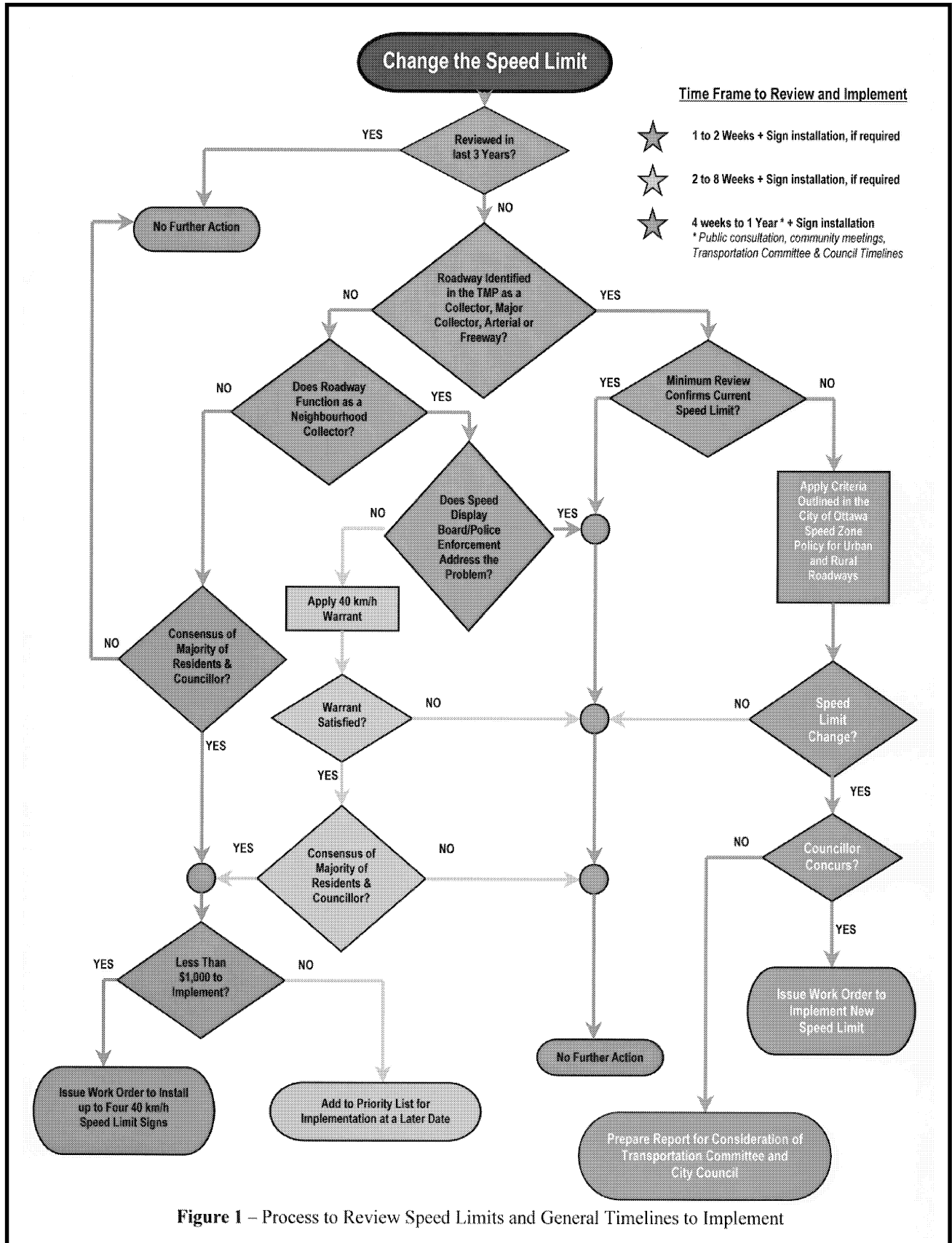


Figure 1 – Process to Review Speed Limits and General Timelines to Implement

5. PUBLIC VIEWPOINT

Numerous requests have been received from citizens of the City of Ottawa in respect to speed limits. With few exceptions, virtually all of these requests are for the establishment of a lower speed limit than which exists at the specific location on a given road or street.

Several reasons are cited in support of these requests, the most frequent being safety, although such factors as noise, difficulties in entering the traffic stream (including entering from private driveways) and being “Splashed” with water by “Speeding” motorists during wet pavement conditions are also offered as a rationale for lowering speed limits.

The public however look upon speed zones in a manner similar to the way they look upon truck routes and bus routes. It considers speed zones as necessary elements of the traffic system as long as they are applied to “my street” in the way in which I would like “my street” used and another way on the other streets, which I might use.

The person who complains of excessive speed on their street seems to take on an entirely different attitude when they are in their car. This is evidenced by the reaction when part of the driving population. A common viewpoint is that the appropriate means of dealing with the matter is to enact a law making the undesirable behaviour illegal and therefore, it would cease. Nowhere, perhaps is the folly of this approach better illustrated than in the case of speed limits. While it might be possible to compel a response to unreasonably low speed limits by the presence of overwhelming enforcement resources, such a level of resource simply does not exist in the City of Ottawa or in any other jurisdiction for that matter.

The chance of a violator being detected and apprehended are so low that the travel speeds are selected by most drivers quite independent of considerations of the illegality of exceeding the speed limit. Studies have shown that unreasonably drivers generally ignore low or high speed limits and samples are included in the appendices. Not all drivers, however, ignore unreasonable limits and this unfortunately results in a wide variation of speeds that are conducive to a collision-producing situation. It appears that, for a speed limit to effectively minimize the safety risk, the limit must be accepted by the majority of drivers as reasonable and must be obeyed. In studies to date, it appears that the driver uses, as their primary determinants in selecting a speed, the road characteristics, traffic characteristics, and weather conditions.

6. SAFETY AND ITS RELATIONSHIP TO SPEED AND SPEED LIMITS

The concern over speed as one of the casual variables in collisions was probably the primary reason for the early development of speed limits. The driving public has been indoctrinated to believe that speed is the cause of most collisions and that if speed can be controlled, collisions will be prevented.

There can be no question that speed is a casual factor in collisions but it is only one of a number of causes and not necessarily the most important.

Speed should be thought of in the following contexts: -

- (i) Very high speed: Approaching and exceeding 160 km/h. Speed factor dominates as a causative agent.
- (ii) Excessive speed for conditions: This category encompasses many of the situations in which traffic tickets are issued in respect to speeding in connection with collisions.
- (iii) Differential Speeds: Includes not only excessive speed but also inadequate speed. Differential speed is seldom, if ever, cited as a contributing cause in collisions, but the factor is implicit in other improper driver actions such as following too close and reckless driving.

The relationship between vehicle speed and the likelihood of collision involvement is a complex one, involving five very different factors - the driver, the vehicle, the road, the traffic, and the driving environment.

In general terms, both absolute speed and the distribution of vehicle speeds are related to collision involvement. High speeds are not inherently dangerous until they exceed the capabilities of the driver to control the vehicle, the mechanical capabilities of the vehicle itself (e.g. - steering, brakes), or the design capabilities of the road (e.g. - surface friction). Studies have shown that collision rates do increase at higher speeds. However, much more significant is the finding that collision rates are closely related to the variation in speed from the mean speed of traffic.

In 2003, Elizabeth Alicandri and Davey L. Warren (*Managing Speed*), state that speeding-related collisions are not just a problem on high-speed roadways as almost one-half the speeding related fatalities occur on lower-speed roadways. Local roads, providing access to residential areas, businesses and farms make up the majority of road miles in the United States and have posted speed limits between 30 km/h and 70 km/h.

The authors note that the “one important measure of the safety of a road system is the rate of fatalities on a per-mile-driven basis. As drivers log more miles on a particular part of the system, they increase their risk of a crash by simply being on the road. Low-speed local roads have the highest fatality rate, while high-speed interstate roads have the lowest fatality rate. The difference in fatality rate by road class reflects differences in road design and use.”

Essentially, the rather startling conclusion that can be drawn is there is a higher risk of collision involvement associated with speeds lower than the average.

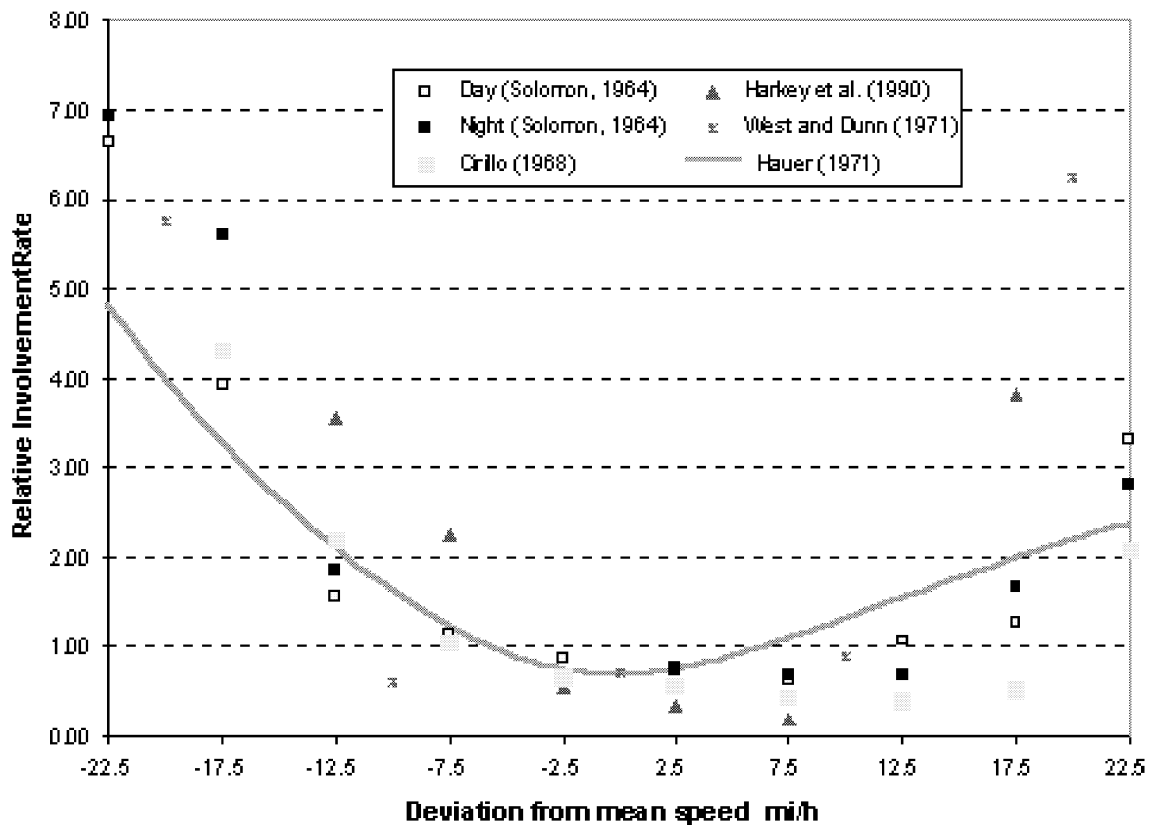


Figure 2

CRASH INVOLVEMENT AND OVERTAKING RATES RELATIVE TO AVERAGE RATE AND SPEED

SOURCE: Stuster, Jack, Coffman, Zail, and Warren, Davey; *Synthesis of Safety Research Related to Speed and Speed Limits*; Publication No. FHWA-RD-98-154, July, 1998.

6.1. Summary of Speed and Collision Studies

Solomon (1964), in a landmark study of speed and crashes involving 10,000 drivers on 970 kilometres of rural highways found a relationship between vehicle speed and crash incidence illustrated by a “U-Shaped” curve. Solomon reported that the results of his study showed that “low speed drivers are more likely to be involved in accidents than relatively high speed drivers”.

Cirillo (1968) in a similar analysis of 2,000 vehicles involved in daytime crashes on Interstate highways, confirmed Solomon’s results, extending the “U-shaped curve to freeways. As these studies, the speeds of vehicles involved in collisions were obtained from police and drivers’ reports and third party estimates – sources subject to error and unknown reliability.

To address these concerns, in 1969, the Research Triangle Institute and the Institute for Research in Public Safety carried out detailed field studies in Indiana using a combination of trained on-scene crash investigators and a system of automated continuous speed monitoring stations using sensors embedded in the roadway pavement to examine the extent to which collision-involved vehicles deviated from the average speeds of surrounding traffic flow. This study also derived a “U” shaped relationship between involvement rate and speed deviation.

The Research Triangle Institute’s report stated: “The likelihood of involvement is estimated to be greater by a factor of about 6 to 21 (depending on the type of road) for large speed deviations as opposed to small (speed) deviations.” The foregoing refers to individual road sections that were studied.

The Research Triangle Institute and Institute for Research in Public Safety studies also gave support to the use of the 85th percentile criterion stating: -

“The standard deviation of speed distribution is from 5 to 7 mph (8 to 11 km/h). Approximately 85 percent of the drivers drive below the mean plus one standard deviation. The drivers having speeds between the mean and one standard deviation above the mean are definitely in a low involvement group. The region between one and two standard deviations above the mean encompasses approximately 10% of the drivers and does not have a significantly greater involvement rate that at the mean speed. This region from the end of the first to the end of the second standard deviation is approximately the tolerance level allowed by police agencies.”

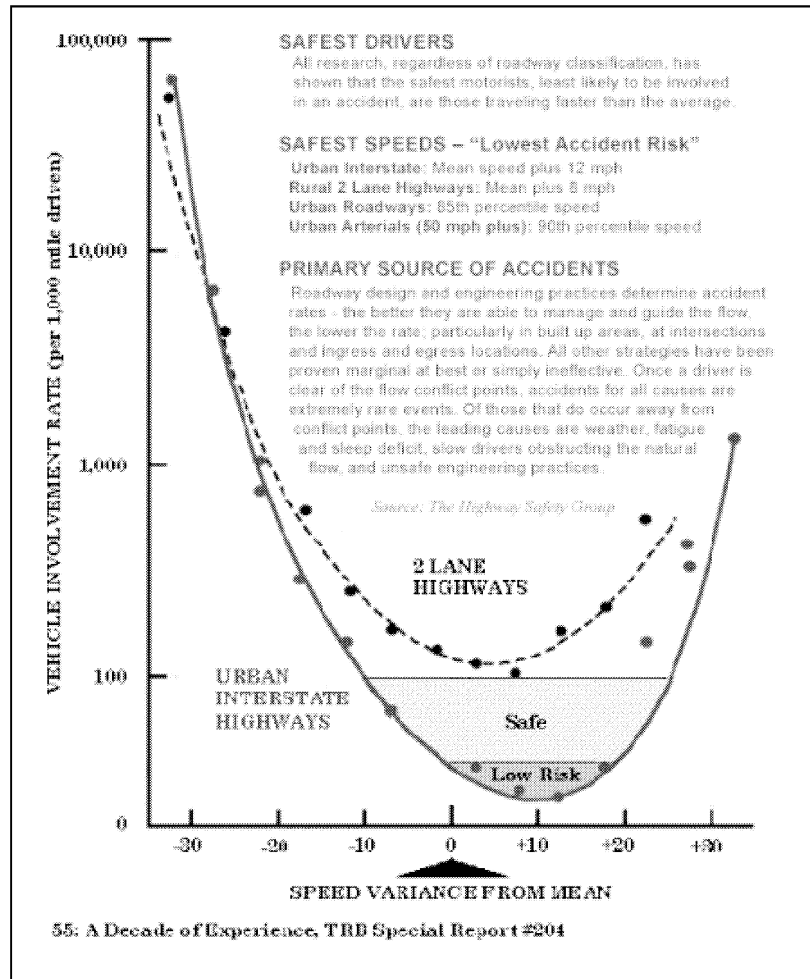


Figure 3
INVOLVEMENT RATE BY TRAVEL SPEED

A Decade of Experience, TRB Special Report 204, 1984

West and Dunn (1971), in their report of the results of the Research Triangle Institute studies, that when excluding crashes involving turning vehicles (44% of all crashes), the “U-shaped” curve was greatly attenuated. They found, as illustrated in Figure 3, crash risk was greatest for vehicles travelling more than two standard deviations above the mean speed and the likelihood of being involved in a crash was extremely flat for vehicles travelling within 25 km/h of the mean speed of traffic. Excluding

turning crashes, the crash risk for vehicles travelling either much faster or slower was six times the average rate.

In 1991, Australian researchers, Fildes, Rumbold, and Leening, using self-reported crash data collected from motorists whose driving speeds has been unobtrusively measured, found a trend of increasing crash involvement for speeds above the mean speed in both urban and rural conditions, similar to the correlations reported in the earlier studies. They did not, however, observe any vehicles travelling at very slow speeds.

Cerrilli (1997)

From the foregoing, it can be seen that there is a definite relationship between speed and safety. It is important to note that the studies emphasize speed variance rather than absolute speed, as the primary culprit in the incidence of collisions..

In “Managing Speed, 2003, “research indicates that the risk of crash involvement is lowest for motorists travelling near the average speed of traffic and is significantly higher for the fastest 2 to 5 percent. Setting speed limits at the 85th percentile speed of traffic, allowing for a tolerance of no more than 8 km/h, would focus enforcement and adjudication on the occasional violators and high-risk drivers.”

Several studies have found that the proportion of single-vehicle collisions increases as the speed increases.

The research in relation to safety supports the use of the 85th percentile speed in establishing speed limits that are likely to result in the lowest rates of collision involvement; however, the application of these criteria must take into consideration other elements.

7. ENFORCEMENT OF SPEED CONTROLS

In the Province of Ontario, the Highway Traffic Act R.S.O. 1990 sets out the four basic functional components - Rule Making, Enforcement, Adjudication, and Sanctioning.

Thus, when the operator of a motor vehicle at a speed inappropriate for existing conditions is identified as a risk to the basic operation of the roadway network, the Highway Traffic Act is called into operation. In general, this is done by the establishment of a speed limit and the enforcement of such a rule with appropriate adjudication and sanctioning of offenders. Theoretically, sanctions act to correct the offender and serve as a deterrent to others similarly inclined.

If traffic laws are to effectively function as a risk management system, the rule-making component must precisely and correctly identify risk. If this is not done, the remainder of the system inefficiently allocates resources in dealing with individuals who technically violated a rule but in fact did not engage in hazardous activity.

An examination of enforcement activity indicates that the bulk of traffic citations are given for speeding offences. Accordingly, the bulk of court activity is taken up with speeding offences and the bulk of sanctions are imposed for speeding.

If it were clearly established that all speed zones were precisely established to define risk, the above-mentioned allocation of resources could be defended as appropriate for a risk management system. Regrettably, the opposite seems to be the case in many instances.

Speed limits that are improperly posted, particularly those set artificially low, tend to be ignored by the majority of drivers and thus, have little effect on risk. At the same time, the limit makes technical violators of a high percentage of drivers. Frequently, the high number of violators draws enforcement presence and concurrent citations.

A limited review of vehicle speeds (1992 and 1993) in Ottawa, Ontario was undertaken at the exact location when police enforcement activity was visibly taking place. Spot speed surveys confirmed that driver compliance with the posted speed limit increased (and thus, the 85th percentile speed decreased) in the immediate vicinity of radar enforcement activity, but returned to normal levels after the police enforcement was stopped.

7.1. Tolerance

The practice of allowing some range of speeds above the posted speed limit before enforcement action is initiated is well known in law enforcement circles and equally well perceived by most drivers.

Unfortunately, the precise nature of the reasoning which governs the formulation of policy on tolerances is not well established or widely known. Attempts to encourage law enforcement policy makers to write or speak on the subject have not been met with much success. The precise tolerance allowed in a particular jurisdiction is a function of many factors, not the least being the particular enforcement officer observing the violation.

*For instance, in *Managing Speed (1998)*, most enforcement tolerates as much as 16 km/h, minimizing the amount of enforcement required. In Ottawa, depending on the experience of the officer and their realization that the posted speed limit may not be appropriate for the roadway classification, tolerance levels may be as high as 25 km/h, particularly on arterial roadways.*

It appears quite clear that the basic concept underlying the decision not to make an arrest in every possible instance when a speed limit is exceeded, is sound. The problem lies in developing a general rule that can be consistently and widely applied.

If one accepts the fact that enforcement resources are quite scarce and should be selectively assigned against highest risk, some of the data takes on particular significance. Examination of the risk curves indicates that while the risk starts to increase at approximately the 85th percentile speed (which is approximately one standard deviation from the mean speed), it increases even more sharply at two standard deviations from the mean speed. Thus, drivers travelling at a speed two standard deviations from the mean speed are a clear risk and should be subject to enforcement response.

In particular cases which were examined in the recent comprehensive research, the standard deviation had a value of about 11 km/h. Thus, a typical distribution on a rural two-lane roadway would have a mean speed of about 93 km/h, a speed limit (at the 85th percentile speed) of 105 km/h, and the second standard deviation would fall at about 116 km/h. The risk curves would suggest 116 km/h as a reasonable point to initiate enforcement action.

What is of perhaps more interest is the fact that the use of the two standard deviation concept gives a rule than can be applied as traffic flow behaviour on a particular roadway changes. Traffic at 8:00 a.m. or at 5:00 p.m. will have a different mean speed than will traffic at 3:00 a.m.

Recognition of this fact might result in the decision to enforce at or close to the posted limit during times when the mean speed dropped and to allow a much wider tolerance during low volume hours when mean speeds are higher.

Available data are not sufficient to allow a precise conclusion that the tolerance should be established at the value associated with two standard deviations from the mean speed. What should be understood is that for a particular highway, the risk does vary as a function of the mean speed. A single tolerance does not satisfy the concept of risk management and selective assignment of scarce law enforcement resources.

8. FACTORS INFLUENCING VEHICLE SPEEDS

In a study by “Mustyn and Sheppard (1980), they found that 75 percent of drivers claimed they drive at a speed that traffic and road conditions permit, regardless of the posted speed limit and did not consider driving 16 km/h over the limit to be particularly wrong.

However, the variables involved between individual drivers and prevailing conditions are many and complex.

8.1. Driver Variables

In an extensive survey of the literature, J. C. Oppenlander, in a report entitled “*Variables Influencing Spot-Speed Characteristics*”, H.R.B. Special Report 89, 1966, reviewed the many driver variables affecting vehicle speed. Dealing with the driver, he states:

“Apparently the individual motorist can focus his attention on only one thing at a time, but he can oscillate his attention very rapidly among several stimuli.”

The ability of the driver to do this is dependent on such variables as sex, age, driving experience, trip distance and physical condition. He concluded that trip distance has the most significant influence on spot-speed characteristics, with the effect of passengers in the car and the sex of the driver affecting speeds to a lesser extent.

Other researchers found that in reviewing human factors, that driver perception of speed is extremely unreliable. It becomes more unreliable as speed increases and that major perception errors occur when

speeds change. Risk taking, for example in over-taking, can be aggravated by frustration, fatigue, or distraction.

The effects of fatigue and alcohol on control skills increase collision potential by limiting the driver's ability to receive and process information. Levels of perception are decreased when the driver's attention is distracted or impaired.

Several researchers discussed the effects of speed change, or adaptation, on driver's speed judgement and found that speed changes, both acceleration and deceleration, affected judgement. At the present time, the vehicle speedometer is a driver's only means of positively identifying his actual speed. Yet a study showed that speedometers were not used by drivers as often as they thought and especially in such critical situations as freeway off-ramps.

The question of problem drivers has been discussed by a number of researchers. In a review of literature on driver behaviour, it was concluded that there is a low correlation between collisions and traffic law violations incurred by the same drivers.

In a study by Webster and Gruen, in their review of the Illinois Vehicular Speed Regulation Research Project, several factors influencing a choice of speed were evaluated. These included human factors, derived from a study of speed behaviour on a two lane rural highway. While rural speeds were consistent, individual drivers were not consistent in their choice of speed through four small urban areas. Experiments with different posted speed limits in these urban areas showed that the posted limits had no realistic influence in controlling the rate of traffic movement. Approximately 15% of the drivers exceeded the posted speed limit at a single location (thus confirming the realism of the limit on the basis of the 85th percentile speed) but 50% of the drivers violated the posted speed limit at one or more of the nine study sites.

More recently, Fildes et al. (1991) unobtrusively measured the speed of vehicles on urban and rural road segments in Australia and found that young drivers, drivers without passengers, drivers of newer cars, drivers travelling for business purposes, and high mileage drivers were more likely to drive faster than average and exceed the speed limit.

It is important, therefore, in the establishment of realistic speed zoning regulations, to take into consideration the foregoing factors.

8.2. The Vehicle Variables

Studies of vehicle variables influencing speeds have been concentrated on those variables which are easily observed and measured. The type of vehicle (passenger car, single-unit truck, combination truck, or bus) and age of the vehicle appear to have predominant effects on spot speeds of highway motor vehicles.

As might be expected, it has been found that newer vehicles travel at higher rates of speed than older vehicles. Passenger cars having low horsepower had higher collision involvements than cars having

higher horsepower. This is likely related to the relatively poor acceleration capability, at highway speeds of cars having low horsepower.

8.3. The Road Variables

Numerous engineering studies have been conducted in an attempt to quantitatively define the influence of roadway characteristics on speed. These characteristics remain constant, regardless of traffic and environmental conditions and are the result of the design, construction and maintenance of a highway facility.

The elements of the road which influence vehicle speeds are:

- 1) Functional classification.
- 2) Horizontal alignment (number of curves, degree of curvature, and minimum sight distance).
- 3) Vertical alignment (number and length of vertical curves, gradients, and length of grades).
- 4) Number of lanes.
- 5) Surface type and condition.
- 6) Frequency and spacing of intersections.
- 7) Lane width.
- 8) Lane position.
- 9) Shoulder width and condition
- 10) Lateral clearances.
- 11) Presence and width of medians.
- 12) Traffic signals and control devices.

Speeds have been found to be most significantly influenced by functional classification, horizontal and vertical curvature, gradient and length of grade, number of lanes, and surface type. Other elements revealed as having some effect are lane position, lateral clearance to obstructions, and frequency of intersections. In an early study, it was found that there were substantial speed reductions when the sight distance was between 300 m and 370 m.

8.4. The Traffic Variables

Considerable attention has been devoted to the subject of how vehicular speeds are controlled by the characteristics of traffic streams and by the operational techniques and devices designed to regulate traffic flows. Results have shown that vehicle volume (including opposing traffic) and traffic density exert pronounced influences on speed.

It has also been found that:

- ◆ Vehicle speeds increased with trip distance.
- ◆ Non-local persons travel faster than local residents
- ◆ Males drive slightly faster than females

- ◆ Drivers without passengers travel faster than those with passengers.

Other elements that influence vehicle speeds are:

- ◆ Percentage of commercial vehicles.
- ◆ Expected arrival time.
- ◆ Frequency of road use.
- ◆ Opinion of the speed limit.
- ◆ Amount of driving connected with the driver's employment.
- ◆ Weather.
- ◆ Passing manoeuvres.

Of the above driver variables which have been identified in the literature reviewed, trip distance has the most significant influence on spot-speed characteristics, while passengers in the car and the sex of the driver alter driving speeds to a lesser extent. The literature also seems to indicate that the driver variables influence speeds to different degrees in various sections of the country.

8.5. The Driving Environment Variables

Environmental elements are independent of the driver, the vehicle and the road and include such factors as:

- 1) Geographic location.
- 2) Type and density of roadside development.
- 3) Presence of pedestrians.
- 4) Presence of sidewalks.
- 5) Frequency and spacing of driveways.
- 6) Parking and loading activities.

It has been found that:

- 1) The introduction of curbed urban street cross-section has an effect on speed patterns.
- 2) Continuous residential development causes a reduction in speed.
- 3) Concentrated commercial development in transition areas causes substantial reductions in speed.
- 4) Restricted sight distance reduces drivers' speed in urbanized areas.
- 5) Faster drivers in rural areas are generally the faster drivers throughout transition areas.
- 6) Speeds of vehicles making trips entirely within a developed area are consistently slower than speeds of vehicles travelling through the developed area.

Also an important factor is the degree to which access to and egress from abutting properties is controlled.

8.6. Credible Speed Limits

In a fact sheet prepared by The Institute for Road Safety Research (SWOV, Leidschendam, the Netherlands, November, 2007) a credible speed limit is defined as ‘*a speed limit that matches the image that is evoked by the road and traffic situation. For example, if a road has a 60 km/h limit, it must not look like a road that would normally have a limit of 80 km/h.*’

In Ottawa, the inconsistent application of a speed limit more appropriate for a local residential roadway results in requests to reduce speed limits even further. Residents commonly express the fact that if speed limit on a collector or arterial roadway is 50 km/h, it obviously must be posted at a much lower level on their local residential street. The following illustrations provide examples of typical roadways in which the speed limit is 50 km/h (either with the installation of appropriate speed limit signing or based on the default speed limit contained in the Highway Traffic Act).



Elvis Lives Lane – 50 km/h



St. Joseph Boulevard – 50 km/h



Lerner Way – 50 km/h



Pineglade Crescent – 50 km/h



Dunning Road – 50 km/h



Walkley Road – 50 km/h



Heron Road – 50 km/h

Figure 4
Examples of 50 km/h Speed Zones

9. Traffic Control Devices

Devices related to the speed control are prescribed in the “*Manual of Uniform Traffic Control Devices for Canada*” and the “*Ontario Traffic Manual*”. The legislative requirements for these devices are contained in the “*Highway Traffic Act*”. The impact on motorists of speed regulations and warning signs has been evaluated in a number of research studies on “*The Influence of Speed Limits on Urban Speed Distribution Parameters*.”

Typical among the findings of speed studies are the conclusions from a study by Professor R. R. Roberts. This study contained findings in respect to research on a 2.4 km section of an outlying urban arterial road in Columbia, South Carolina, on which speed limit signs were changed from “35 miles per hour” (56 km/h) to “40 miles per hour” (64 km/h)”. The study concluded that:

- 1) There was no significant change in the mean speed of vehicles.
- 2) A reasonable posted speed limit based on the 85th percentile speed (that speed at or below which 85% of all drivers travel) appears to stabilize traffic to allow the speed distribution to more closely approximate a normal distribution.
- 3) Motorists observe and respect a reasonable speed limit more so than an unreasonable one.
- 4) The stability of traffic flow on an urban arterial seems to be improved.
- 5) The posted speed limit on an urban arterial street has little or no effect on the inclusive speeds within the 15 km/h pace or the percentage of the total vehicles within this range.
- 6) The task of the police in enforcement of speed limits can be greatly simplified by establishing reasonable speed limits based on the 85th percentile speed together with other necessary considerations.

In a study in the City of Ottawa in 1994 the effect on the operating speeds of motorists of posting a 40 km/h speed limit was compared to the speed of traffic on roadways with a 50 km/h speed limit. Spot speed surveys were conducted on a total of 40 residential collector roadways with similar characteristics and included 20 roadways with a posted speed limit of 40 km/h and a further 20 roadways with either a posted 50 km/h speed limit or default 50 km/h speed limit (no speed limit signs posted).

A summary of the results of the surveys is contained in Table 1.

Speed Limit (km/h)	Number of Free-Flow Vehicle Speeds Recorded	Average Speed (km/h)	85 th Percentile Speed (km/h)	Motorist Compliance with Speed Limit
40	3638	54	62	2.7 %
50	3645	54	62	33.1 %

Table 1 -- Comparison of Vehicle Speeds on 40 km/h versus 50 km/h Collector Roadways

Driver compliance with the 40 km/h speed limit varied between 0.0 % and 6.0 %, whereas, their compliance with a 50 km/h speed limit varied between 11.9 % and 62.1 % and would indicate drivers are actually travelling at or near the actual design speed of the roadway, regardless of the posted speed limit.

Despite a 10 km/h posted speed limit differential, those collector streets with the 50 km/h speed limit resulted in vehicle speeds in terms of both the 85th percentile speed and the average speed virtually the same when compared to those collector streets with a 40 km/h speed limit.

More recently, in 2003 and 2007, the effect on drivers' speeds of reducing a speed limit from an unsigned 50 km/h to 40 km/h on several collector roadways is illustrated in Appendices E, F, and G. The results of these studies confirm those of the earlier observations concluding that drivers' speeds did not reduce to the level desired by area residents.

9.1. Advisory Speed Signs

The Ontario Traffic Manual (2001) Book 6 states “warning signs” (including advisory speed tabs) are intended to provide advance notice to road users about unexpected and potentially dangerous conditions on or near the road. The conditions to which warning signs apply typically require that road users exercise caution, and may require that drivers slow down, in order to travel safely in the presence of the hazard”.

A typical use of an advisory speed is on the approach to a horizontal curve in which a ball-bank test indicates a speed reduction is required for drivers to safely negotiate it. If an advisory speed is set too low, safety may be compromised by reducing driver compliance. For instance, if drivers perceive the advisory speeds can be exceeded by a significant margin without risk, “problems may arise where curves are severe and reduced safety margins apply”.

A reduced regulatory speed limit is not posted for an entire roadway segment should a horizontal or vertical curve be present in which a lower advisory speed is required. However, within a speed zone review, Table C-10 takes into consideration a roadway with a significant number of such curves by stipulating a reduction factor to be included in the overall calculation of a safe and appropriate speed limit for that roadway.

9.2. Speed Limit Signs

Standard traffic signs and regulations related thereto set out hereunder are the standard traffic signs designated for use in the regulation of speed. Figure 5 shows the various traffic signs used to regulate speed.

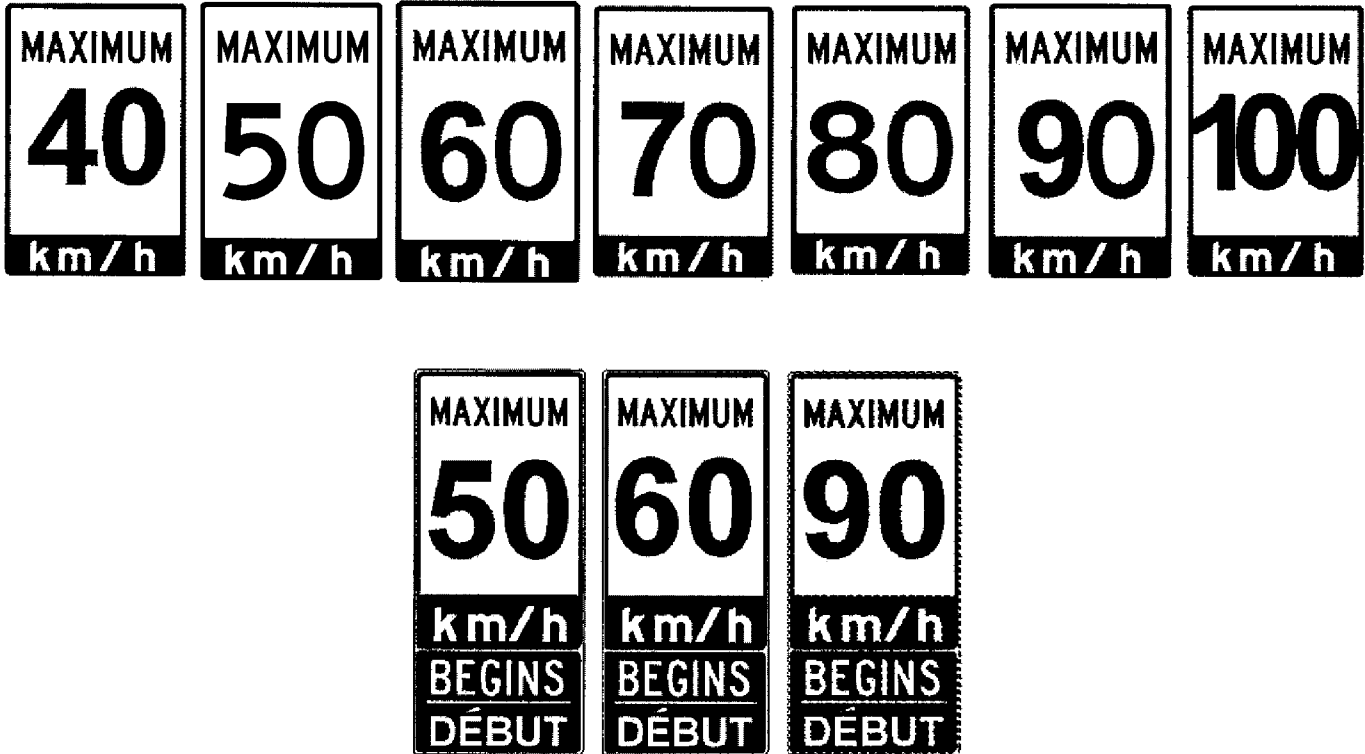


Figure 4
Traffic Signs Used to Regulate Speed

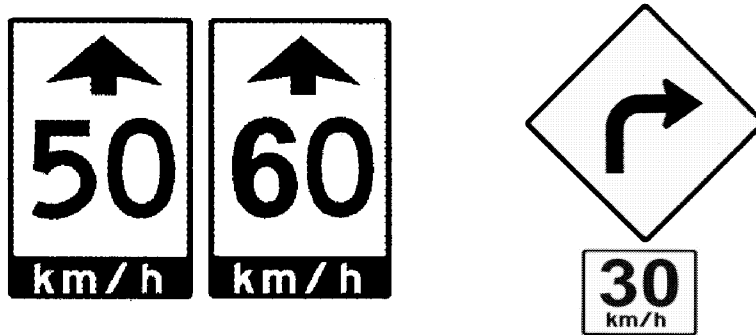


Figure 5
Traffic Signs Used to Regulate Speed

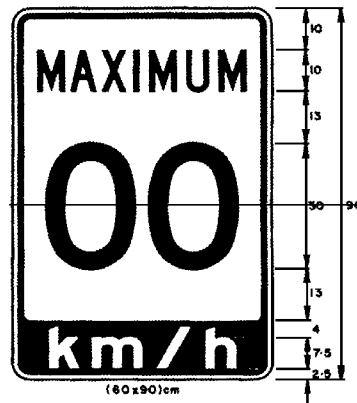
9.3. Highway Traffic Act

What follows are excerpts from the provisions of Regulation 615 under the *Highway Traffic Act* (*Revised Statutes of Ontario - 1990*) regarding the type and placement of speed limit signs.

Section 1

A speed limit sign shall,

- (e) be not less than 60 centimetres in width and 90 centimetres in height;
- (f) bear the word "maximum in black letters not less than 10 centimetres in height on a white retro-reflective background;
- (g) display in black numerals not less than 30 centimetres in height on a white retro-reflective background the prescribed maximum rate of speed; and
- (h) bear the legend "km/h in white retro-reflective letters not less than 7.5 centimetres in height on a black background, as illustrated in the following Figure:



Section 2

2. (1) Subject to section 4, where a maximum rate of speed other than that prescribed by subsection 128 (1) of the Act is prescribed for a highway in a city, town, village, police village or built-up area, speed limit signs shall be erected on the highway, in each direction of travel,

- (a) not more than 600 metres apart where the speed limit prescribed is 60 km/h or less; and
- (b) not more than 900 metres apart where the speed limit prescribed is greater than 60 km/h and not more than 70 km/h.

(2) Where the maximum rate of speed for a highway in a built-up area more than 1,500 metres in length is that prescribed by subsection 128 (1) of the Act, speed limit signs shall be erected on the highway not more than 900 metres apart.

(3) Where the maximum rate of speed for a highway in a built-up area 1,500 metres or less in length is that prescribed by subsection 128 (1) of the Act, speed limit signs shall be erected on the highway not more than 300 metres apart. R.R.O. 1990, Reg. 615, s. 2.

Section 3

The commencement of the part of a highway for which a maximum rate of speed is prescribed shall be indicated by a speed limit sign accompanied immediately below by a sign bearing the word "*begins*" in white retro-reflective letters not less than 12.5 centimetres in height on a black background. R.R.O. 1990, Reg. 615, s. 3.

Section 4

A speed limit sign shall be erected on the right side of the highway, facing approaching traffic, not more than 4.5 metres from the roadway, and the bottom edge of the sign shall be not less than 1.5 metres or more than 2.5 metres above the level of the roadway. R.R.O. 1990, Reg. 615, s. 4.

In 1977, the Province of Ontario converted to the metric system and the conversion of the rate of speed was set out in the Table 3 as per R.S.O. 1990, c. H 8. s. 129. Exact conversions have been included for comparison purposes.

Present Standard	Conversion	Closest Conversion	Best Conversion	Change
20 mph	32.18 km/h	30 km/h	30 km/h	-6.5%
25 mph	40.23 km/h	40 km/h	40 km/h	-0.5%
30 mph	48.23 km/h	50 km/h	50 km/h	+3.5%
35 mph	56.33 km/h	55 km/h	60 km/h	+6.5%
40 mph	64.37 km/h	65 km/h	60 km/h	-6.5%
45 mph	72.42 km/h	70 km/h	70 km/h	-0.5%
50 mph	80.47 km/h	80 km/h	80 km/h	-0.5%
55 mph	88.52 km/h	90 km/h	90 km/h	+2.0%
60 mph	96.55 km/h	95 km/h	100 km/h	+3.5%
65 mph	104.60 km/h	105 km/h	100 km/h	-4.2%
70 mph	112.70 km/h	115 km/h	110 km/h	-2.4%
75 mph	120.70 km/h	120 km/h	120 km/h	-0.5%
80 mph	128.70 km/h	130 km/h	130 km/h	+1.0%

Table 2
Conversion – Imperial Units to Metric Units (SI)

In determining the need to install speed limit signing on a widespread basis, cognizance must be given to the economics of installing such signs on the rural roadway segments of the City of Ottawa following amalgamation. In the Province of Ontario, unless otherwise posted, the default speed limit has been 80 km/h.

10. EDUCATION CAMPAIGNS

Driver safety and driver education programs and campaigns take many forms and have been carried out in varying degrees of intensity.

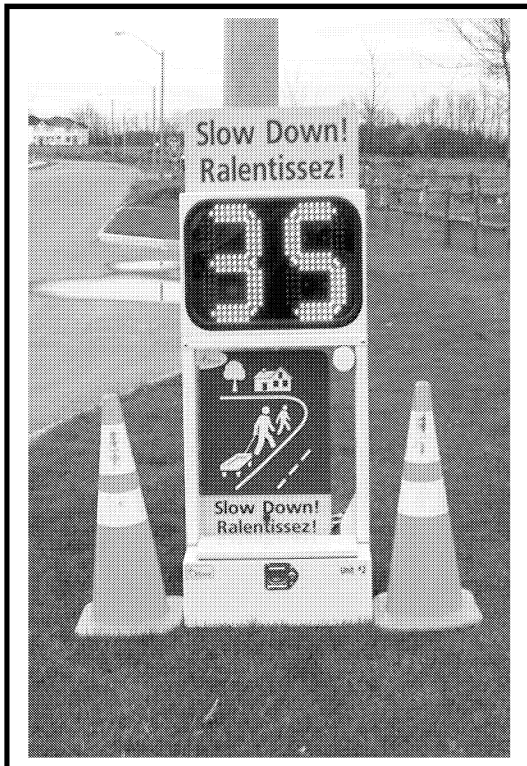
Some studies have concluded that those drivers who had attended driver improvement clinics had lower collision and violation rates following their clinic experience than did those in a controlled group who had not attended a clinic.



In Ottawa, public education campaigns are routinely undertaken and include the residential “Slow Down/Ralentissez” initiative in several communities. Also, the Integrated Road Safety Program (IRSP) conducted two phases of the “Speeding Costs You” campaign – a major initiative aimed at reducing collisions caused by excessive speed on arterial roads.

The education component included the use of bus boards, roadside billboards, signs and information cards and the enforcement component employed a zero tolerance policy for speeding. On the engineering side, the campaign profiled in-vehicle GPS-based devices that warn motorists when their speed exceeds a road’s posted speed limit and made use of radar-equipped digital speed display boards. The results of this campaign were encouraging as speed reductions of up to 6% were recorded.

In the “Speeding Costs You Deerly” campaign, public education was directed towards reducing speeds in light of the significant number of collisions involving wildlife including deer and moose each year.



The use of Radar trailers on collector and arterial roads across the City of Ottawa coupled with the use of smaller digital speed display boards in residential neighbourhoods serve to educate both drivers and residents as the visual indication of speed provides a reminder to drivers to travel in a respectful manner on the City’s roadways. These units have been widely acclaimed by residents, the Police, school officials and Councillors in addressing speeding issues when they arise.

In 2008, these speed displays were again used successfully to address speeding issues across the City of Ottawa as part of a new ‘Anti-Speeding’ Campaign.

← **Figure 6**
Speed Display Signs



In addition to the public acceptance of radar trailers and speed display signs, limited studies confirm their presence serves to reduce the speed of traffic not only during the period of installation (which varies between one and five days at a time), but also for several days thereafter. Table 3 illustrates the effect on vehicle speeds and perhaps more importantly, the overall reduction in the variance between the fastest and slowest drivers, during and immediately following, deployment of a Radar trailer on a major four-lane divided arterial roadway in Ottawa.

Figure 7
Radar Trailer

Before Radar Trailer Deployed		Radar Trailer Deployed			4 Days After Radar Trailer Removed			2 Weeks After Radar Trailer Removed		
85 th Percentile Speed (km/h)	Variance In Vehicle Speeds (km/h)	85 th Percentile Speed (km/h)	% Change ⁽¹⁾	Variance In Vehicle Speeds (km/h)	85 th Percentile Speed (km/h)	% Change ⁽¹⁾	Variance In Vehicle Speeds (km/h)	85 th Percentile Speed (km/h)	% Change ⁽¹⁾	Variance In Vehicle Speeds (km/h)
79 ± 1.9	54	66 ± 1.5	- 16 %	48	77 ± 2.0	- 3 %	44	78 ± 1.8	- 1 %	38

Table 3

The Effect of the Presence of a Radar Trailer on Motorists’ Speed on a Major Arterial Roadway

(1) Percent change when compared to “Before” data.

11. SCHOOL SPEED ZONES

Probably one of the more controversial situations in respect to the determination of speed zoning regulations is that in which pedestrians - particularly children and senior citizens - are walking along or across a roadway on which vehicle operating speeds are considered to be excessive. More specifically, the areas of concern are those in which there is a school or there are school crossings. The emotional aspects of these situations are probably more significant than in any other situation in which vehicle speed is a consideration. The common demand to achieve “safer” conditions in these areas is by means of reducing the speed limit.

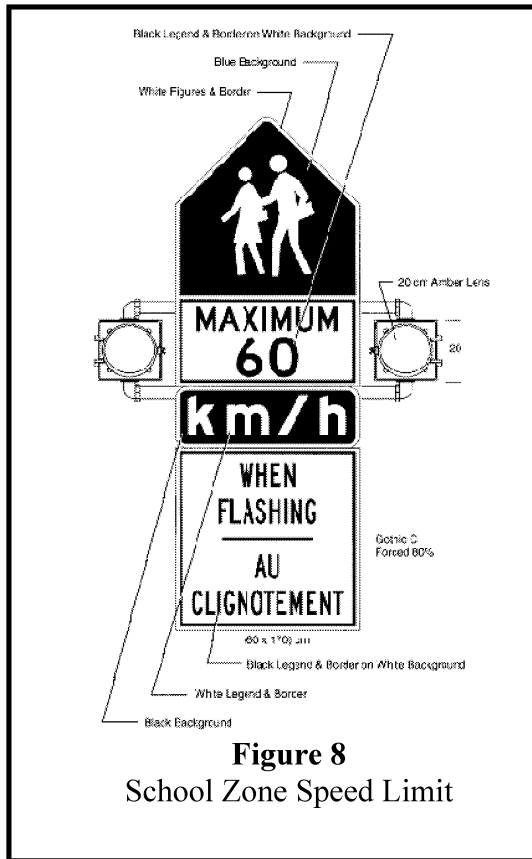


Figure 8
School Zone Speed Limit

Another common request is to install flashing beacons in conjunction with a lower speed limit and these types of installations have been used for many years to make drivers more aware of the presence of school zones.

Many studies have reported that flashing beacons reduce speeds in school zones (Zegeer, Havens, and Deen, 1976; Reiss and Robertson, 1976; Hawkins, 1993; Aggarwal and Mortensen, 1993; Saibel, Salzer, Doane, and Moffat, 1999). A few studies have reported the opposite as well (Burritt, Buchanan, and Kalivoda, 1990; Sparks and Cynecki, 1990).

The general consensus of these studies is that the proper use of flashers (avoiding excessive flashing periods, demonstrating uniformity, and providing adequate enforcement) increases their effectiveness.

Although the ‘quick-fix’ solution in school zones is generally to ‘reduce the speed limit and the problem will be solved’, the State of Minnesota lists this solution as the last method to be used, and only when all other measures to address school safety have been addressed. In the Minnesota ‘Guide to Establishing Speed Limits in School Zones –

2007’, the main objective of the School Route Plan is to establish walking routes to schools minimizing the number of streets crossed and maximizing the safety of approved crossings used by children on their entire trip to school.

Essentially, hazard identification addressed the following nine issues to ensure the safety of children to and from school:

1. Roadway geometry – crossing narrower roads in straight sections with good sight distance increases the safety to pedestrians.
2. Traffic volumes – low volume roads are safer to cross. High volume roads will require adult crossing guards for maximum safety.
3. Pedestrian volumes – number of pedestrians can determine signal timing or necessitate additional traffic control.
4. Parking – parking should be banned in the immediate area of any school crossing.
5. Traffic control devices – these should be reviewed to verify they are operating correctly and signs are not hidden by vegetation.
6. Sidewalks – children walking in the street is dangerous. Continuous sidewalks that do not intermittently disappear and force children into the road are best.
7. Fencing – strategically placed fencing can change walking patterns and prevent dangerous mid-block crossing. At playgrounds, it prevents errant kick-balls from rolling into the street and causing children to chase them from between parked cars.

8. Crash history – crash investigation can reveal locations where remedial measure may not be working and pedestrians should be routed away from these areas.
9. Speed zones – if all other measures have been addressed and a reduced speed is still required to safely navigate the school zone, then a school zone speed limit should be considered. Trained engineering personnel should design speed limits based on the limiting criteria and arbitrary blanket values should be avoided.

This report goes on to state ‘Education is the most important (factor to consider). All the best efforts of engineering and planning will be lost if the pedestrian is unaware of the safe routes and safe practices. Children are rarely involved in crashes while crossing properly. Education is not the singular responsibility of one group or person, it requires a partnership and commitment from all.’

A study in 1974 in Des Moines, Iowa, reported on an investigation of speed limits adjacent to elementary schools and the relationship of these speed limits to collision involvement over a 23-month period. Conclusions of the investigation include: -

- ◆ of the pedestrian collisions involving the elementary age group, 94% occurred outside marked crosswalks or school districts
- ◆ a reduction in the speed limit to 40 km/h adjacent to all elementary schools will not decrease the number of collisions that occur in these areas nor will it provide an additional margin of safety

One interesting observation based on the data summaries contained in the report is that 51% of all collisions analyzed occurred in zones with a 40 km/h speed limit. Also, of the collisions involving school-related trips by elementary age children (5 - 12 years) during the 8:00 a.m. to 5:00 p.m. period on school days, the speed of the vehicles involved was at or below 40 km/h in 88% of the cases in which the approach speed was known.

In Ottawa (1982) a report was prepared on the effectiveness of school speed zones involving the use of a reduced speed limit (40 km/h) supplemented with flashing beacons during school hours. After an intensive evaluation, it was determined they were ineffective in reducing vehicle speeds and it was recommended in 1984 the two 40 km/h school zones be removed and that no further action be taken to establish reduced speed limit zones in the vicinity of schools.

In 1996, a review of driver behaviour at thirteen Ottawa area schools (twelve primary and one high school) confirmed an earlier study in London, Ontario in that motorists reduced their speed between 8 km/h and 16 km/h when school children were present in large numbers along the roadway. This speed reduction occurred **without** a reduction in the posted speed limit as illustrated in Table 4.

School Name And Street Frontage	Speed Limit (km/h)	Speed Survey Results						Change in Vehicle Speeds When Children are Present Along the Road Compared to When They Are Not	
		Children Present ⁽¹⁾			Children <u>NOT</u> Present ⁽²⁾			Average Speed (km/h)	85 th Percentile Speed (km/h)
		Ave. Speed (km/h)	85 th Percentile Speed (km/h)	Compliance with Speed Limit	Average Speed (km/h)	85 th Percentile Speed (km/h)	Compliance With Speed Limit		
Alta Vista - Randall	50	38	46	93 %	49	57	58 %	- 11	- 11
Blossom Park - Sixth	40	39	47	60 %	53	62	7 %	- 14	- 15
Chapel Hill - Forest Valley	40	44	52	34 %	54	61	0 %	- 10	- 9
Devine Infant - Jeanne d'Arc	40	39	46	55 %	52	59	5 %	- 13	- 13
Fielding Drive - Fielding	50	35	43	96 %	51	59	56 %	- 16	- 16
Holy Trinity - Katimavik	50	48	57	58 %	61	70	11 %	- 13	- 13
Immaculata - Main	50	51	58	51 %	62	70	9 %	- 11	- 12
Lamira Dow Billings - Loyola	40	44	50	31 %	53	60	4 %	- 9	- 10
McGreggor-Easson - Dynes	40	45	53	26 %	54	61	1 %	- 9	- 8
Our Lady of Peace - Richmond	40	43	50	37 %	53	59	2 %	- 10	- 9
Pope John XXIII - Knoxdale	40	41	48	51 %	51	57	4 %	- 10	- 9
Prince of Peace - Heatherington	50	47	55	65 %	56	65	29 %	- 9	- 10
Queen Mary - Queen Mary	50	45	52	78 %	57	66	15 %	- 12	- 14

- (1) Speed survey undertaken during school year with relatively large numbers of children present along the roadway or on the sidewalk. Through vehicle speeds only.
- (2) Speed survey undertaken during school year after children arrived at school and are in class. The speed survey was completed on the same day as in (1).

Table 4

The Effect on Motorists’ Speeds Resulting from the Presence of Children in School Zones

The Washington Traffic Safety Commission prepared *Vehicle Speeds in School Zones* (1999) in response to two questions: do drivers slow down for children in school zones, and what factors affect vehicle speeds in school zones during times of school zone activity? This study collected speed data using automatic traffic recorders placed in front of 40 elementary schools and analyzed for the 30-minute critical time periods before the start of the school day and after the close of school.

Their findings noted a “substantial percentage of vehicles were travelling at high speeds through school zones during the critical time periods; about 12% exceeding 35 mph (60 km/h). However, “flashing light” school zones were effective in slowing vehicles with average speeds 5 mph to 7 mph (8 km/h to 11 km/h) slower”.

In conclusion, they found that school speed zone signs with flashing lights were effective in reducing the speed of traffic. As there are higher costs associated with the installation and maintenance of these signs, they should be considered for schools located on roads with higher speed limits.

Limitations to this study were identified including other factors “that were not identified during data collection” including changes in pavement textures on the approaches to the school, other warning devices such as speed bumps or rumble strips or the presence of enforcement in the school zones. The presence of children was assumed during the speed surveys.

In 2004, an evaluation undertaken at one of the reduced speed school zones supplemented with flashing beacons again confirmed the previous study in that 97 % of drivers exceeded the 40 km/h speed limit. It was determined the lack of school related activity on or near the roadway and fact the beacons are set to flash over a continuous nine hour time period during the school year, including professional development days, may be factors in the low level of driver compliance rate.

In 2005 and again in 2007, the results of the speed surveys outlined in Table 4 were corroborated by two additional speed surveys undertaken with one at a school crossing adjacent to an elementary school and the other at a school identified with school area signs (appendices ‘I’ and ‘J’). The presence of school related activity, including school crossing guards and children waiting to cross coupled with parent ‘drop-off’ activity results in a reduction in the 85th percentile speed of 17 km/h. The resultant 85th percentile speed was 35 km/h and driver compliance rate with the unsigned 50 km/h speed limit was 100 % - all without a reduction in the posted speed limit.

At the school without crossing guards, the presence of school related activity resulted in a reduction in the 85th percentile speed of 13 km/h and an increase in driver compliance with the unsigned 50 kilometres again, to 100 %.

Although residents vehemently express their concerns regarding speeding traffic near elementary schools, the fact remains that in the City of Ottawa, fatal collisions involving school children during the specific times and days when children are travelling to school in the morning or leaving school in the afternoon are almost non-existent.

The North Carolina Department of Transportation evaluated the effectiveness of school zone flashers in 2007 at 30 different schools at which the school speed limits varied between 40 km/h and 70 km/h and up to 90 km/h at other times. The findings indicate they were not more effective in reducing speeds in school zones than signing and pavement marking alone with 85th percentile speeds exceeding the speed limit by 20 km/h. Regardless of the presence of flashers, average speeds during school time, while above the school time speed limit, were below the non-school time speed limit. In other words, motorists were making an effort to reduce their speed during school time, but not enough to bring them into compliance.

It was difficult to draw definitive conclusions from the three-year crash history due to small sample sizes. However, with the data available it was noted that crash rates were higher at sites with school area flashers than non-flasher sites during both school and non-school hours with approximately 30 percent of crashes occurring during school hours.

Although there appears to be limited benefit in the provision of reduced speed limits in the vicinity of schools, virtually none of the studies researched outside of Canada resulted in 100 percent driver compliance with the desired speed limit. Within the City of Ottawa, the results of the limited studies to date conclude drivers’ speed vary directly with the magnitude of school related activity, regardless of the posted speed limit. More importantly, drivers travelling at the highest and ultimately, the most dangerous speeds were not observed during the peak student arrival or departure times.

School speed zone reviews will be given the highest priority, applying the principals of sound engineering practices as outlined in this policy. The well being of our most vulnerable road users is

paramount in each review and it cannot be stressed enough that all aspects of engineering, education, and enforcement are applied by all parties concerned to ensure their continued safety.

11.1. Guidelines for the Application and Implementation of a School Zone

The Transportation Association of Canada (TAC), of which the City of Ottawa is a sponsor, prepared ‘*School and Playground Areas and Zones: Guidelines for Application and Implementation*’ in October, 2006. As stated in the executive summary the intent of these guidelines ‘*is to provide engineers and practitioners across Canada with a tool to help them decide where school and playground areas and zones may be considered, and to prioritise the locations which are most in need of such areas and zones. Due to variances in local practices, there is a need for a set of uniform guidelines towards the establishment of school and playground areas and zones and the application of traffic control devices in such areas and zones*’.

The Manual of Uniform Traffic Control Devices for Canada (MUTCDC), while containing both School Area signs (Wc-1) and Playground Ahead signs (Wc-3), no guidance is provided on the conditions that may lead to consideration for the introduction of speed limits in both school and playground zones. Examples of questions where guidance is required as outlined in the TAC report include:

- Which schools (elementary, middle, high) are more in need of school areas or zones?
- When should an area be considered, and when a speed-reduced zone should or should not be considered?
- Are school/playground areas and zones appropriate for all road classes (freeways, arterials, collectors, locals) and ambient speed limits?
- Do urban and rural areas require different considerations?
- How do fencing and/or proximity to the adjacent roads affect the need for school and playground areas/zones?
- What combination of features (playing fields, play equipment) define a playground?
- How should an area that features both a school and a playground be treated?
- How do school and playground areas/zones relate to pedestrian crossing facilities?

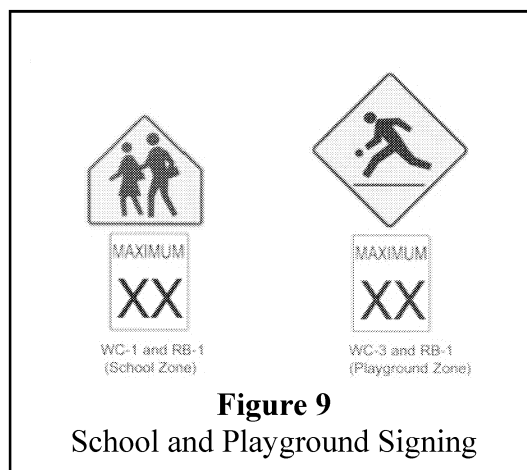


Figure 9
School and Playground Signing

As outlined in the TAC guidelines, the absence of national guidance on these issues resulted with some jurisdictions developing their own policies, creating in a lack of uniformity across Canada. For example:

- *Speed limit.* Some jurisdictions have a speed limit of 30 km/h, others use 50 km/h, and others provide a limit that varies with the ambient speed limit. The reduced speed limit is dictated by the Highway Traffic Act or Motor Vehicle Act in some provinces.
- *Road Class/Fencing.* Some jurisdictions avoid school or playground zones on arterial roads or where the school grounds are fully fenced, while others provide such zones in certain circumstances.
- *Times of effectiveness.* Some jurisdictions provide school zones for specific hours, days and months (which vary significantly) while others are in effect at all times.
- *End of zone signing.* Some jurisdictions provide a sign at the end of the zone while others do not. Signing at the end of the zone varies: some include the word “End”; others re-instate the original speed limit; still others repeat the sign provide at the start of the zone.

Many jurisdictions in Canada have no guidelines at all, resulting in ad-hoc decision making at individual locations.

The TAC guidelines confirm the issues associated near schools and playgrounds – ‘*highly charged and emotionally driven by the community*’. As confirmed by others elsewhere in this policy, ‘*public awareness, by means of educational and safety initiatives, is an important factor in improving traffic safety near school and playground areas and zones.*’

Accordingly, the City of Ottawa Speed Zone Policy utilizes the criteria prepared by TAC to determine if a reduced speed limit should be established in a school zone.

11.2. Establishment of School Zones and Areas

School areas (warning signs) can be considered for roadways near elementary and middle schools, where there is a possibility of children entering the roadway. School areas are generally discouraged for high schools, post secondary installations and pre-schools, due to the widespread recognition of their limited effectiveness for these age groups.

School zones (reduced speed limits near schools) are generally discouraged along “walk-to-school routes” away from the school vicinity, and on roadways where any of the following conditions exist:

- School is located on an arterial or freeway;
- School grounds are fully fenced;
- School is located an appreciable distance (e.g. greater than 50 metres) from an intersection roadway;
- The candidate roadway does not have a school entrance; and,

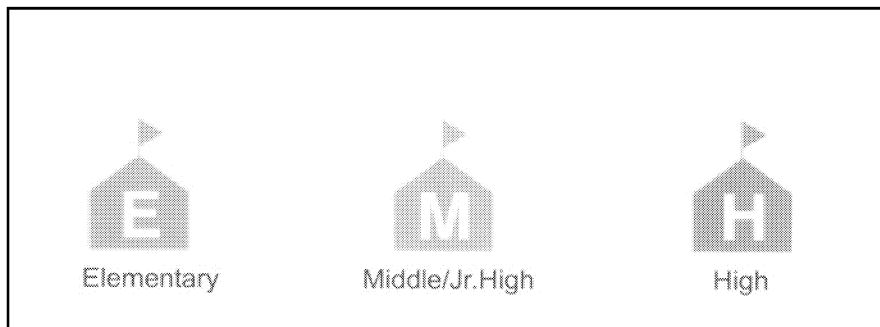
- The length of the school frontage is minimal (e.g. less than 50 metres).

The factors to be considered in the establishment of school zones and areas are:

- School type
- Road classification
- Fencing characteristics
- Property line separation
- Location of school entrance
- Location of sidewalks

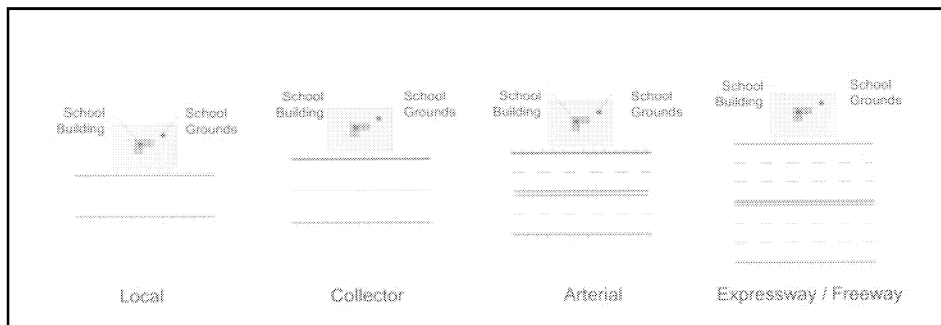
These criteria are described and illustrated as follows, along with some of the possible descriptions and how they influence the need for a school zone. These criteria are to be evaluated for each candidate roadway according to the procedure presented in Section 11.3. The procedure is applicable for both residential and non-residential areas.

11.2.1. School Type



Children of elementary school age, when without parental supervision, are typically considered to be the most vulnerable due to their limited abilities to understand and anticipate vehicular traffic movements and their tendency to accidentally enter the roadway. Children of middle age and high school are typically better able to understand traffic and to control their own movements. School zones or areas are unnecessary at post-secondary institutions.

11.2.2. Road Classification

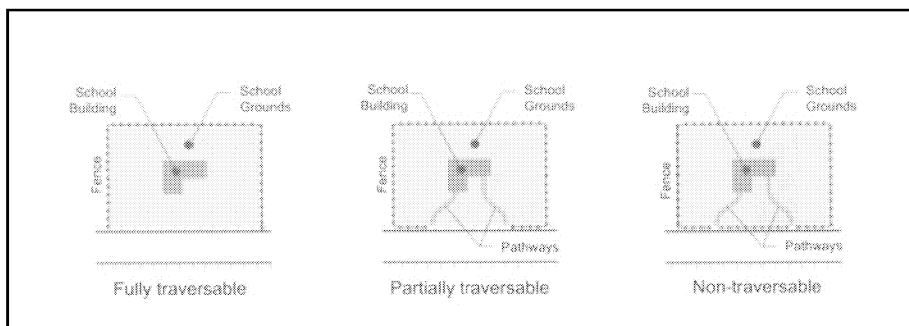


The design classification system used in the *Geometric Design Guide for Canadian Roads* (TAC 1999) separates roads on the basis of differences in land service and traffic service. The terms “rural” and “urban” refer to the predominant characteristics of the adjacent land use and not only to jurisdictional boundaries or features of typical cross sections. The road classification criteria for the evaluation procedure in Section 11.3 are consistent with the design classification system described in the *Geometric Design Guide*.

Arterial roads and expressways/freeways are typically multi-lane roads that carry high volumes of traffic, including trucks, and have posted speed limits of 50 km/h or greater. Collector roads are usually narrower and lower in traffic volumes, and provide direct frontage to developments including schools. Local roads are often still narrower, and are designed for lower speeds.

School zones should be avoided on expressways/freeways and arterial roads. They can appear to motorists as contradicting the roadway function, and hence may be unexpected and disrespected.

11.2.3. Fencing



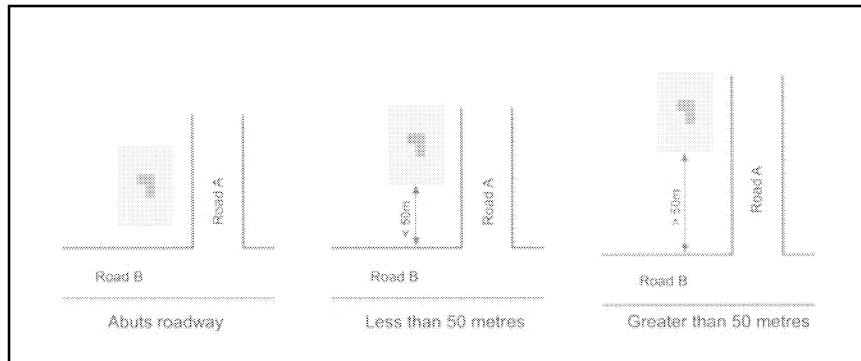
Fencing can significantly reduce the need for a school zone, acting as a physical barrier that can prevent errant pedestrian movements onto the roadway.

The effectiveness of fencing depends on its traversability, i.e. how easily it can be bypassed or traversed.

The traversability of fencing is governed by: extent of fencing between the roadway and the school, the effectiveness of the school’s internal pathway system in guiding children to a safe opening in the fence, and the height and type of fencing. Post and cable type fencing or other low-height fencing, and fencing that contains openings or is easily damaged or mounted, is more traversable.

Fully traversable describes fencing that is absent or easily traversable. Partially traversable can describe fencing that is low-mounted or has several openings (or, for example, widely spaced trees). Non-traversable describes high-mounted fencing with limited openings at defined points (or, for example, dense hedges).

11.2.4. Property Line Separation

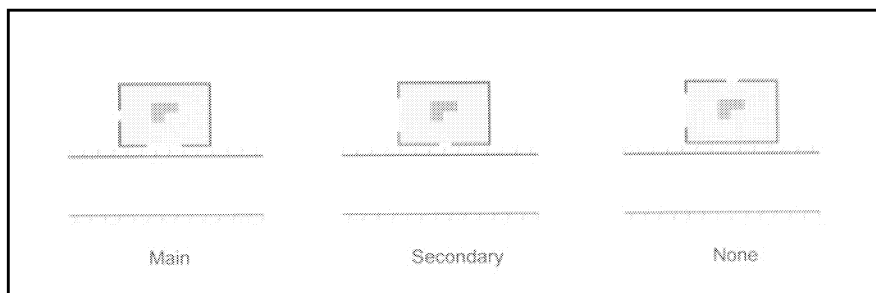


A school typically abuts at least one roadway (road A). If the school is located near an intersection, it may also be located close to an intersecting roadway (road B). School zones may not be required on all candidate roadways surrounding the school. When evaluating the need for school zone on a candidate Roadway, the separation between the property line of the school and the candidate roadway should be considered. The separation influences the likelihood of children entering the candidate roadway, particularly in the absence of fencing along the candidate roadway.

An intersecting roadway that is separated from the school grounds by only a sidewalk or fence is said to abut the roadway. A school that is separated from the intersecting roadway may or may not be within 50 metres.

If the school is located within 50 metres of the intersecting roadway, there is a greater likelihood that children may enter the candidate roadway. The school property line represents the most objective indication of the point where school activity involving children begins. If it is known that the property line is located well before the activity begins, the distance between the intersecting roadway and the point where school activity involving children begins may be considered for the evaluation procedure.

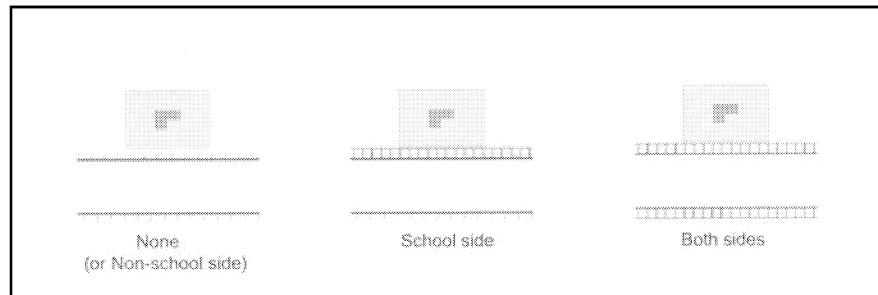
11.2.5. School Entrance



A school entrance can be a driveway to the school, the closest point along the road to the school’s main door, or a designated on-street pick-up and drop-off area. The school entrance becomes a focal point of congestion and pedestrian activity, including vehicle turning movements at the driveway, manoeuvres within the parking lot, stoppages on the roadway and children crossing the road, particularly during

pick-up and drop-off times. Where a school has multiple access points from the road, the activity is typically concentrated at one entrance, referred to as the main entrance. A secondary entrance, if it exists, typically has far less activity than the main entrance.

11.2.6. Location of Sidewalks



The purpose of sidewalks is to provide safe conveyance of children between the school grounds or opening in the fence and a defined crossing point on the roadway, or to provide a link to the surrounding sidewalk network further from the school grounds. If sidewalks are provided between the school and the roadway, children are less likely to walk in the roadway. In rural areas, while raised curb sidewalks are rarely prohibited, wide shoulders or unpaved pathways or walkways are assumed to serve the same function as a sidewalk (although shoulders may not be provided for this purpose).

11.3. Evaluation of School Zones and Areas

A procedure was developed to systematically consider the criteria described in Section 11.2, in order to establish the need for a school zone or school area. The procedure assigns a maximum point value (MPV) to each criterion, reflecting its relative importance. It also assigns a weighting factor (WF) to each selection, with the higher values indicating a greater need for an area or zone. The result of the scoring is a total score out of 100.

The worksheet to be completed is shown in Table 5. The procedure is as follows:

1. For each criterion, select the description that best represents the conditions of the subject roadway.
2. Multiply the associated weighting factor by the maximum point value and enter the product in the far right column.
3. Add up the scores entered for each criterion. Enter the sum at the bottom of the far right column.
4. Using the worksheet results matrix (Table 6), identify the need for a school zone, a school area or neither. Borderline cases should be carefully reviewed. In all cases, engineering judgement and local conditions should be considered.
5. Review the feasibility of providing new facilities or improving existing ones to reduce the need for a zone.
6. Identify, review and implement the signing and marking plan associated with the result. The signing and marking for school zones and areas are described in Section 11.4

11.4. Guidelines for School Zones and Areas

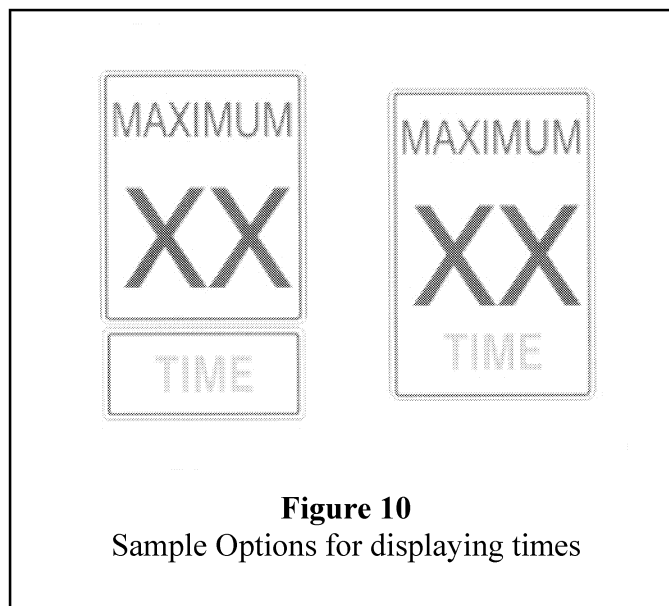
11.4.1. School Areas

At the start, the Wc-1 sign, fluorescent yellow-green in colour, should be provided. The MUTCDC indicates that all new installations are to use the yellow-green sign and all existing installations were to be converted in January 2005.

11.4.2. School Zones

All school zones should display (in addition to the above guidelines for school areas):

- Rb-1 (Maximum Speed sign) below the Wc-1 sign, displaying the reduced speed limit.
- Rb-1 (Maximum Speed sign) at the end of the zone, reinstating the original speed limit (On local roads in residential areas only, the End School Zone sign, yellow in colour, may be used). The end of zone indication may also be the back of the opposing area warning sign.
- The effective times, if these are different from what is stated in the provincial laws and regulations. The hours may still be displayed if they are identical to the hours in the Act. Some indication of the applicable days should also be shown, or “School Days/Jours d’Ecole”. The days and times can be displayed either on a tab below the Maximum Speed sign, or on the speed limit sign itself. Both sample designs are shown in Figure 10. On roads with a speed limit of 70 km/h or greater, the separate tab should be provided for enhanced visibility. Illumination of the Rb-1 sign, or attachments of flashing amber beacons and a “When Flashing/Au Clignotement” tab to the Rb-1 sign, may be used in place of a tab that displays the effective times. Flashing amber beacons should be implemented in accordance with Section B5.7 of the MUTCD.
- “SCHOOL” pavement markings in rural areas may be considered.





City Operations – Public Works
School Area and School Zone Worksheet

School Name: _____

Street: _____ Speed Limit: _____ km/h Date: _____

Surveyor: _____ Comments: _____

Installation Criterion	Maximum Point Value (MPV)	Description	Weighting Factor (WF)	Weighting Factor for this School	Score (MPV*WF)	
School T ype	40	Elementary	1.0		0	
		Middle/Junior High School	0.4			
		High School	0.2			
		Post Secondary/ College/ University	0.0			
Road C lassification	20	Urban Land Use			0	
		Local	N/A			1.0
		Minor Collector	Local			0.75
		Collector	Collector			0.5
		Major Collector/Minor Arterial	Arterial			0.25
		Major Arterial/Expressway	Expressway			0.0
F encing	20	Fully Traversable	1.0		0	
		Partially Traversable	0.5			
		Non-Traversable	0.1			
Property L ine Separation	10	Abuts Roadway	1.0		0	
		Within 50 Metres	0.5			
		Further than 50 Metres	0.0			
School E ntrance	5	Main Entrance / Multiple Secondary Entrances	1.0		0	
		Secondary Entrance	0.6			
		None	0.0			
S idewalks	5	None or Non-School Side	1.0		0	
		School Side	0.6			
		Both Sides	0.0			
TOTAL SCORE (Sum of T, C, F, L, E, and S) =					0	

Total Score	Area or Zone ?
0 - 40	Nothing
41 - 64	School Area
65 - 80	School Area or School Zone *
81 - 100	School Zone

* Local conditions must be considered in detail in order to determine the appropriate treatment. Wherever possible, mitigation measures should be explored that would reduce the score so that marginal school zones can be avoided. The reasons for the final decision should always be documented.

School Area Warranted?	NO
School Zone Optional?	NO
School Zone Warranted?	NO

Comments:

Table 5
School Zone Input Worksheet

TOTAL SCORE	AREA OR ZONE?
0 – 40	Nothing
41 - 64	SCHOOL AREA
65 – 80	SCHOOL AREA or SCHOOL ZONE*
81 - 100	SCHOOL ZONE

***Local conditions must be considered in detail in order to determine the appropriate treatment. Wherever possible, mitigation measures should be explored that would reduce the score so that marginal school zones can be avoided. The reasons for the final decision should always be documented.**

Table 6
School Zone Results Matrix

To ensure driver compliance with a school speed zone, zone limits as outlined in the Alberta guidelines will be utilized as illustrated in Figures 10. Should a reduced speed limit be warranted as per tables 5 and 6, the new speed limit will be implemented on school days only. As school hours vary by individual school regardless of school board, the reduced speed limit will be standardized to encompass both early start times and late end of day times. In this way, drivers will not be confused by seemingly random time periods. Standard hours of operation will also assist police enforcement activity in School Zones.

Accordingly, in urban areas, the operation of reduced school speed zones will be on school days, between the hours of 7:00 a.m. to 9:30 a.m. and between 2:00 p.m. and 5:00 p.m. In rural areas where schools are separated by greater distances, the school principal, in consultation with the school council, will determine the hours of operation. The application of full day, or a full 24-hour time period is to be avoided to reduce driver complacency. There is no safety inherent in the public reliance on a speed limit not actually travelled by traffic.

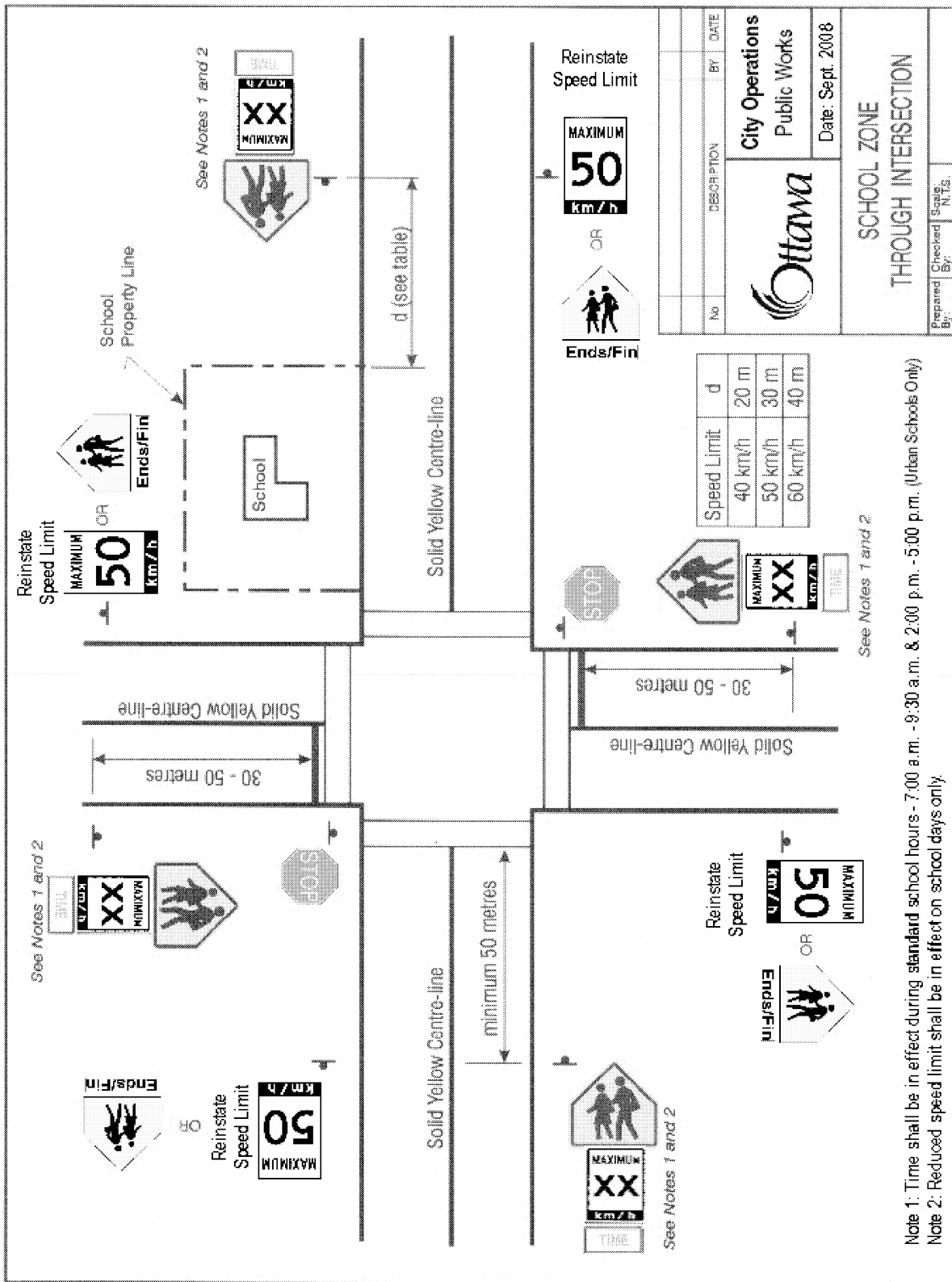


Figure 11
School Speed Zones – Urban Roads – City of Ottawa

12. School Zone Traffic Safety – Crossing Guard Program

In the City of Ottawa there are approximately 150,000 elementary school children, of which a great many choose either walking or cycling as their primary mode of transportation to and from school. The City would like to see the number of children walking or cycling increase for a host of reasons; namely, to decrease hectic traffic conditions around schools, to the promotion of a healthy life style, and, with the potential reduction of vehicles, a view to improved environmental conditions.

To support these activities as a viable and safe travel mode of transport the City has an obligation as a leader, and with partnerships, to assist young children on their journey to and from school. This is particularly the case with children 10 years of age and younger who may lack the cognitive ability to judge and negotiate traffic.

With a proper school zone traffic safety program those children who are required or desire to walk or cycle can do so in a safe manner; one that is associated with a reasonable quality of life, and that allows for parental peace of mind as their children go off to school.

Factors that influence the level of safety in school zones can be many and the behavioural manner of any, or all modes of transportation can play a significant role in our efforts to raise that level of safety to an acceptable or comfortable level. These transportation modes can be recognized at various schools throughout the municipality and can be comprised of one, or a combination of the following:

- General motorists, motorists as parents and motorists as students. (Many elementary schools are located in the immediate area of secondary schools)
- Cyclists as adults or cyclists as students.
- Pedestrians as adults and pedestrians students.
- The factors that surface in school zones range from:
 - Non-compliance to parking and stopping restrictions.
 - Non-compliance to stop signs and traffic signals.
 - Non-compliance to school bus loading zones.
 - Inappropriate driving practises. (U-turns in mid-blocks, backing out of driveways to turn around).
 - Parents and students crossing the roadway in an inappropriate manner.
 - Inappropriate cycling habits by parents and children.
 - Disrespect between each of the travelling modes.

- Speeding. Though speeding may be an issue, typically the factors mentioned above play a more prominent role during the time frame surrounding bell times at schools.

When delivering services in school zones, the City of Ottawa operates on a partnership basis realizing that safety issues are seldom addressed on an individual's effort. Programs currently in place that are used to assist in addressing safety issues are:

12.1. Adult School Crossing Guard Program

As of the Fall 2008, the City of Ottawa will have 83 crossing guard locations in operation throughout the municipality. Every year sites are selected through a priority ranking system creating a list of candidate sites for council approval and evaluated on criteria such as the:

- 85th percentile speed, number of students using the crossing
- Stopping Compliance (for stop controlled intersections)
- Adequate Gaps in traffic (for mid-block crossings)
- Number of Pedestrian/Car turning movement conflicts (for signalized intersections)
- Collision History

12.2. School Child Safety Patroller Program

The School Child Safety Patroller Program is a joint collaboration between participating schools, Ottawa Police Services and the City of Ottawa. Participating schools operate School Child Safety Patrols to increase school zone safety in their area.

The patrollers are grade 5 and 6 volunteers and help assist their fellow classmates cross the road safely. Patrollers are dressed in highly reflective safety vests, and may carry an optional school child safety patroller paddle. They are trained by the Ottawa Police Services, and learn proper crossing techniques, and what to do in case of emergency. Patrollers help their classmates by addressing adequate gaps in traffic and subsequently helping students enter the roadway. Additionally, they emphasize proper crossing techniques to their classmates.

They **DO NOT enter the roadway, nor do they stop traffic**. As of Fall 2006, there are 18 schools in the City of Ottawa with School Child Safety Patrols operating at various locations throughout the city.

12.3. School Zone Parking

Parking in school zones is another safety issue. Parking is prohibited in “No Parking” and “No Stopping” zones - and for a good reason. These zones are located near school entrances/exits. They are designed to maintain visibility for passing motorists and pedestrians. When you block them, children cannot see or be seen by oncoming traffic.

Double and triple parking to let off your children is another dangerous practice. It leads to traffic congestion and hampers visibility. Most schools have ample parking on side streets where parents can park and walk children to the school entrance.

12.4. Placement and Enforcement of Regulatory and Warning Signs

Enforcement of these regulatory and warning signs is paramount in the protection of all road users, particularly when it comes to the safety and protection of your children.

Parents are responsible for the safety of their children getting to and from school. The School Zone Traffic Safety Program helps assist everyone in their safe journey. Regardless of the program in place, set a good example when accompanying your children. Even though it may result in extra walking or driving distances, please make an effort to show your children the safest way to cross a street whether by walking or cycling.

13. Area Traffic Management

Area Traffic Management (ATM) encompasses a process and a set of measures used to ensure that the streets within neighbourhoods are used appropriately. The primary concern is to ensure that the impact of motorized vehicles on these neighbourhoods is minimized, to improve safety and the quality of life of other street users and those impacted by the use of the street.

In order to achieve this, a variety of regulatory measures, physical measures, and programs can be used to address such issues as excessive vehicular speed, higher than desired traffic volumes, and inappropriate driver behaviour. Over the past decade, the term "traffic calming" has become popular in many locations to describe the process of dealing with traffic issues. In Ottawa, the City has chosen to use "area traffic management" as the term to describe the process of dealing with neighbourhood traffic concerns, and "traffic calming measures" as one specific set of physical measures (such as speed humps and mini traffic circles) among a broader set of measures that can be used to achieve the desired improvement. The City also uses other physical measures, regulatory measures (e.g. closures, turning prohibitions), and educational programs (e.g. neighbourhood speed watch) depending on the nature of the problem and the range of options.

It is important to realize that measures used to address problems typically have secondary impacts that can negatively affect some street users or residents. In deciding how to deal with problems, the expected improvement must be balanced against any such impacts that could occur. The net result of any area traffic management initiative should be positive, when all points of view are considered.

13.1. Need for Area Traffic Management Guidelines

The City of Ottawa decided to prepare guidelines for Area Traffic Management due to concerns over the multitude of approaches that were used by the twelve municipal governments before amalgamation in 2001. The new City's staff and council had been left with an assortment of policies and approaches that in some cases were in conflict. The harmonized approach and consistent set of measures, outlined in these Guidelines will ensure that the City can move forward and deal with neighbourhood traffic issues in a consistent and understandable manner.

These Guidelines implement the City of Ottawa's Official Plan and Transportation Master Plan policies as they relate to the impact of motorized vehicle traffic on neighbourhoods.

13.2. Role of Area Traffic Management

In June 2002, Council approved seven principles to guide the development of its Ottawa 20/20 Growth Management Strategy (including the Official Plan and Transportation Master Plan), and to influence subsequent day-to-day decisions.

Several of these principles are related to how the City deals with traffic-related issues in its neighbourhoods:

- **A Caring and Inclusive City** calls for safety and security within communities
- **A Green and Environmentally-Sensitive City** calls for a focus on walking, cycling and transit, and protection of air, water, earth and other natural resources
- **A City of Distinct, Liveable Communities** calls for accessibility of facilities by walking, cycling and transit, ease of mobility within communities, and physical beauty in public spaces
- **An Innovative City Where Prosperity Is Shared Among All** calls for a business-supportive environment, and accessibility to opportunity for individuals
- **A Responsible and Responsive City** calls for municipal leadership, fiscal responsibility, open and participatory processes, community partnerships and public awareness

Transportation systems play a major part in the creation of livable neighbourhoods, and can either help or hinder the achievement of objectives like those listed above. The City's new Official Plan reiterates the need for a balanced transportation system as an integral component of livable communities. Area traffic management is, however, just one of many disciplines through which the City will work to bring transportation into balance with other community needs. These include:

- Public Transit Services
- Community Design Processes
- Cycling and Walking Programs
- Development Approvals
- Transportation Demand Management
- Road Safety Programs
- Parking Services

- Road Design Standards
- Police Fire And Paramedic Services
- Healthy Community Initiatives, and,
- Area Traffic Management.

Area traffic management (ATM) is, therefore, just one of many areas in which the City will work to bring transportation into balance with other community needs. The City's draft Transportation Master Plan defines Area Traffic Management as follows:

"Area traffic management is a term that describes both the process and techniques of preserving neighbourhood livability by mitigating undesirable effects of vehicular travel including excessive volumes and speeds, aggressive driver behaviour and the creation of unfavourable conditions for walking and cycling."

There are three aspects commonly related to the use of motorized vehicles that result in neighbourhood concerns: excessive traffic speeds, excessive traffic volumes (especially through traffic), and inappropriate driver behaviour. These are best examined in terms of their effects on people: how they impact on personal or public safety, and the effect on the livability of neighbourhoods.

The ATM Guidelines also address a secondary problem related to the process by which area traffic concerns are dealt with: the lack of any established process results in an inconsistent approach and inconsistent application of measures, and also does not provide the City with any means to prioritize concerns and deal with the most serious problems.

It is important to recognize that area traffic management is primarily an operational process intended to address existing traffic issues deemed to be of a significant nature (i.e. not easily resolved through an operational review) within neighbourhoods. The ATM Guidelines provide staff with the ability to deal with these significant traffic issues in a consistent manner.

14. LEGISLATION

It is appropriate to understand the legislation which relates to the establishment of speed limits in the Province of Ontario and in this regard, the relevant sections of the *Highway Traffic Act, Revised Statutes of Ontario, 1990* as amended in 2006 are as follows: -

Section 128

- (1) No person shall drive a motor vehicle at a rate of speed greater than
 - (a) 50 km/h on a highway within a local municipality or within a built-up area;
 - (b) despite clause (a), 80 km/h on a highway, not within a built-up area, that is within a local municipality that had the status of a township on December 31, 2002 and, but for the enactment of the *Municipal Act, 2001*, would have had the

- status of a township on January 1, 2003, if the municipality is prescribed by regulation;
- (c) 80 km/h on a highway designated by the Lieutenant Governor in Council as a controlled-access highway under the *Public Transportation and Highway Improvement Act*, whether or not the highway is within a local municipality of built-up area;
 - (d) the rate of speed prescribed for motor vehicles on a highway in accordance with subsection (2), (3.1), (4), (5), (6), (6.1) or (7);
- (2) The council or a municipality may, for motor vehicles driven on a highway or portion of a highway under its jurisdiction, by by-law prescribe a rate of speed different from the rate set out in subsection (1) that is not greater than 100 km/h and may prescribe different rates of speed for different times of the day. 2006. c. 32, Sched. D, s 4(3).
- (13) The speed limits prescribed by this section or by a regulation or by-law passed under this section or set under section 128 (1) do not apply to,
- (a) a fire department vehicle as defined in section 61 while proceeding to a fire or responding to, but not returning from, a fire alarm or other emergency call;
 - (b) a motor vehicle while used by a person in the lawful performance of his or her duties as a police officer; or
 - (c) an ambulance as defined in section 61 while responding to an emergency call or being used to transport a patient or injured person in an emergency situation. R.S.O. 1996, c.H.8, s. 128 (13).
- (14) Every person who contravenes this section or any by-law or regulation made under this section is guilty of an offence and on conviction is liable, where the rate of speed at which the motor vehicle was driven,
- (a) is less than 20 km/h over the speed limit, to a fine of \$3 for each kilometre per hour that the motor vehicle was driven over the speed limit;
 - (b) is 20 km/h or more but less than 30 km/h over the speed limit, to a fine of \$4.50 for each kilometre per hour that the motor vehicle was driven over the speed limit;
 - (c) is 30 km/h or more but less than 50 km/h over the speed limit, to a fine of \$7 for each kilometre per hour that the motor vehicle was driven over the speed limit; and,

- (d) is 50 km/h or more over the speed limit, to a fine of \$9.75 for each kilometre per hour that the motor vehicle was driven over the speed limit. 2005, c. 26, Sched. A, s. 17 (7).

Pursuant to the foregoing, the City of Ottawa Traffic and Parking By-law No. 2003-530 contains the following provisions: -

***Increased and Decreased Speed Limits -
Schedule “XXXVI”***

43. When any highway set out in column 1 of Schedule “XXXVI” to this by-law, between the limits set out in column 2 of the said Schedule “XXXVI”, is marked in compliance with the regulations under the *Highway Traffic Act*, the maximum rate of speed on such highway or part of highway shall be the rate of speed set out in column 3 of the said Schedule “XXXVI”.

***Decreased Speed Limits on
Bridges - Schedule “XXXVIII”***

45. When signs have been erected, no person shall drive, move or operate any vehicle on a bridge or part of bridge set out in column 1 of Schedule “XXXVIII” at a greater rate of speed than the rate of speed set out in column 2 of the said Schedule “XXXVIII” during the times and days set out in column 3 of the said Schedule “XXXVIII”.

It is significant that the City of Ottawa has the authority to establish a speed limit ranging up to 100 km/h on any road under the jurisdiction of the City and when established by by-law, such speed limit supersedes the provisions of the Ontario *Highway Traffic Act* in relation to cities, towns, villages, built-up areas and level railway crossings.

14.1. Bill 203 Safer Roads for a Safer Ontario Act

Effective 30 September 2007, legislation came into effect with tough measures for those who choose to race on Ontario’s roads. These include:

- The maximum fine increases from \$1,000 to \$10,000 upon conviction for street racing, making it the highest penalty in Canada. The minimum fine increases from \$200 to \$2,000.
- Police can issue an immediate seven-day driver’s licence suspension and seven-day impoundment for street racing, participating in a driving contest or stunt driving.
- Courts can impose a driver licence suspension of up to 10 years for a second conviction, if the second conviction occurs within 10 years of the first. For a first conviction, the maximum licence suspension period remains at 2 years.
- The definition of a “driving stunt” includes driving a motor vehicle at 50 km/h or more above the posted speed limit.

- The Act also bans driving a motor vehicle on a highway with a connected nitrous oxide system. Some street racers use nitrous oxide to enhance the acceleration capabilities of their vehicles.

15. ESTABLISHING SPEED LIMITS

The criteria for determining speed zone regulations are based upon finding a safe and reasonable speed limit for existing conditions. The safe speed depends upon the number and type of hazards or conflicts that the driver may encounter at any one time.

Increased safety and smoother traffic flow are indications of the effectiveness of a speed regulation. Effective speed regulations reduce the hazardous differential in speeds of successive vehicles.

The effectiveness of speed regulations may also be measured by the attitude of the driver toward the speed limits. A speed regulation should be almost self-enforcing; therefore, the voluntary compliance with the posted limits preferable should be 80 - 90 percent. The amount of enforcement that is required to obtain a certain level of voluntary compliance may be an expression of the driver's acceptance of the speed limit as a reasonable and safe limit.

In Ontario, unless otherwise posted the default speed limit on urban roadways is 50 km/h and the majority of residential roadways within the City of Ottawa fall under this regulation. Vehicle speeds on the local street system are essentially self-controlling and voluntary compliance by the majority of drivers is quite high. However, despite this high level of compliance, residents often express concern about "speeding" and request a speed limit reduction to 40 km/h, 30 km/h and in some instances even as low as 20 km/h to resolve this problem. Section 16 addresses the 40 km/h option, however, speed limits any less than this rate are not recommended (except under unusual or extremely hazardous roadway geometry).

Much of the driver's attitude that influences his voluntary observance of the legal posted speed limit derived from the wide variation that he finds in the degree of enforcement permitted by the police agencies. Varying differences in enforcement practices on tolerance contribute to the common "speed trap" condition which is associated with unreasonably low speed limits, inadequate and non-uniform signing and insufficient distances in which to reduce speed to a limit dictated by a lower speed limit zone.

Speeds may vary considerably from the normal because the drivers may be reacting to the presence of a nearby police car or an obvious vehicle used by the observer. Local drivers may exercise more caution immediately after a spectacular collision or a period of concentrated police enforcement that may result in, for example, better STOP sign observance and earlier deceleration for red signal indications.

In considering the most rational and best supported approaches to various aspects of establishing speed limits, the following conclusions would seem reasonable: -

- ◆ Many of the basic premises concerning speed behaviour and its control are not new; they appear early in the history of speed regulation and the automobile.
- ◆ Numerous factors relating to the driver, the vehicle, the roadway, traffic and the environment have a determining effect on driving speeds.
- ◆ The main element in determining whether drivers observe a speed limit is their perception of the reasonableness of the limit.
- ◆ Speed limits, taken as a whole, are beneficial, or at least appear to have no detrimental effect on collision occurrence.
- ◆ Speed may play a large role in the severity of collisions, but is merely one of many factors in collision causation.
- ◆ The most widely supported criterion on which to base a speed limit is the 85th percentile speed.

The theory that collisions increase as the value of the standard deviation increases - i.e. - that speed differences play a causative role in collision occurrence, is a promising one, as evidenced by a high collision rate at both low and very high speeds and a lower collision rate around the average or normal driving speed. Based on the foregoing conclusions, a realistic speed zoning policy would achieve the following:

- ◆ Reduce the speed differential in a traffic stream when there is a large variation of speeds. This makes driving easier, increases capacity and reduces the likelihood of collisions by encouraging most drivers to travel at about the same speed.
- ◆ Give enforcement officials a good guide as to what a reasonable and prudent speed is under normal conditions and permits concentration of enforcement against real traffic violators.
- ◆ Give motorists a speed limit they can respect and obey. When drivers respect speed limits in areas with which they are familiar, they are more likely to pay attention to limits in unfamiliar areas.
- ◆ Give local residents a realistic picture of the actual speed of most traffic. There is no safety in blind reliance on a speed limit inconsistent with speeds actually travelled by traffic.

In order to achieve these objectives, maximum speed limits should be derived by firstly, establishing the 85th percentile speed and using this criterion as the basis for determining the maximum speed limit.

A speed limit established in this way would recognize the following factors: -

- ◆ Speed limits are established by the operation of the legal system. Such establishment must be consistent with the objectives of the Traffic Law System.

- ◆ Speed limits are intended to reduce risk within the Surface Road System. Thus, the speed limit must be related to hazard.
- ◆ Drivers tend to ignore limits that are perceived as unreasonable. Thus, an effective limit must be perceived and accepted by the majority of drivers as reasonable.
- ◆ There is an almost unlimited range of variables arising from the man-machine-highway mix that impact on the determination of a reasonable speed limit. Thus, the procedures for establishing limits should be applicable to a wide range of roadways.
- ◆ Few jurisdictions have manpower resources or technology to permit implementation of a method for establishing speed limits requiring sophisticated data collection and analysis. Therefore, the procedures should be capable of being implemented with reasonable resources.

An important consideration in determining an appropriate speed zone for a given section of road is that the method used in establishing the speed limit results in a high degree of uniformity on road sections where the same set of elements are present.

Obviously, various combinations of elements are possible and a different weighting must be given to different elements. Even within each element, the variables are such that a range of weighting factors should be applied.

For the purposes of establishing consistency in the determination of speed zones, an approach that was developed in the State of Illinois' Department of Transportation and is the basis for the course of instruction at the Traffic Institute, Northwestern University, has been used successfully since 1975 in the City of Ottawa.

This approach has been adopted for use, albeit in a slightly modified form, in the State of Illinois and in the State of Ohio and enables the road authority to undertake a minimum study or, where conditions warrant, a more refined assessment. In 2007, the Transportation Association of Canada presented a draft version of a Canada-wide Speed Zoning Policy using a similar approach to determine speed limits for comment. This refined assessment involves the application of adjustment factors to a speed limit that may be determined as being justified on the basis of a minimum study. The more refined study recognizes the elements of the road and environment that are normally of concern to those people who consider that a speed limit determined solely on the basis of speed characteristics does not adequately recognize such elements as pedestrian activity, collision experience, roadside development, etc.

As a minimum, any study should consider the speed characteristics of the users of the road, the design speed of and number of intersecting streets on the road section under consideration, and the length of the speed zone. In many cases, this minimum study may be sufficient to determine the appropriate speed limit.

A more refined study may be justified where unusual roadway or land use characteristics suggest that the speed limit as determined from the minimum study, seems inappropriate.

Firstly, the traffic engineering study that should be undertaken should consist, in part, of a determination of: -

- (i) the existing speed limit
- (ii) the 85th percentile speed
- (iii) the pace speed range containing the largest percentage of vehicles in a survey of spot speeds).

Although attempts have been made to scientifically correlate the above elements and also other elements which have been discussed in this report, there has been no “formulae” developed which can be used to scientifically determine the appropriate speed limit for a given location.

Secondly, under no circumstances should the speed limit over a section of road exceed the limit for which the road is designed although isolated curves on which a lower speed should be used may have a design speed lower than that for the major part of the road section. In these latter cases, curve warning and advisory speed signs should be posted in accordance with the standards contained in the Ontario Traffic Manual

The design speed on a roadway is based on the sight distance limitations imposed on vertical curves (hills) and horizontal curves that are the determinants of the safe stopping distances. Intersection spacing on an arterial roadway is a major element in the operation of a roadway; however, this is not a determinant in establishing the design speed of a road. In establishing a speed limit, however, this element should be recognized in relation to the length of the speed zone under consideration.

Accordingly, as a second part of the minimum study, there should be a determination of: -

- (i) the speed for which the roadway is designed.
- (ii) the average distance between intersections.
- (iii) the length of the road section which is under study and which is representative of the characteristics of item (ii).

The consideration of the two foregoing sets of three, six factors may, in some cases, be sufficient to establish an appropriate speed limit on a road section; however, a more refined assessment may be warranted under certain circumstances.

Additional elements that can be considered in a traffic engineering investigation of speed zoning for a road section include: -

- ◆ number of driveways per kilometre

- ◆ lane width
- ◆ street classification
- ◆ median design
- ◆ shoulder type and width
- ◆ presence of sidewalks and degree of pedestrian and cycling activity
- ◆ parking activity
- ◆ general horizontal and vertical alignment
- ◆ collision rate

Since the speed characteristics of a road section, as determined from spot surveys of vehicle speeds, are indicative of the drivers' behaviour and this behaviour is influenced by the frequency of driveways, pedestrian activity, etc., there is no rationale for applying an adjustment factor to any of the speed characteristic elements.

There is, however, a basis for applying an adjustment factor to a speed limit as determined by the design speed of the roadway and modified by the consideration of the number of intersecting streets in relation to the length of the speed zone. This method should be applied to newly constructed roads.

For this purpose, empirical relationships and adjustment factors have been established to attempt to give some relative weight to each element and show the numerical influence each separate element might reasonably have on the establishment of a speed limit. The factors are set out in Tables C-1 to C-12 inclusive in Appendix D.

15.1. Method to Establish Speed Limits

In the first instance, the measurable elements of the speed characteristics should be determined and applied in respect to the relationship embodied in Table C-1.

Table C-1 is used for both the “*minimum*” study and the “*more refined*” study. Table C-1 is one of the two prime determinants used in establishing a speed limit based on a minimum study. It is also used as a basis for the more refined study. The table is self-explanatory; however, it should be noted that the weighted average of the “*justified speed limit*” is the basis for determining a recommended limit. The method of computing the weighted average is indicated below the table.

A subjective review of the speed characteristics along a substantial length of a road should be undertaken to divide the total length into sections in which the speed characteristic and extent and form of development are somewhat common. The sections will then be the “*length of a proposed speed zone*” which will be one criterion necessary for applying the principles of **Table C-2**.

Table C-2 contains the factors that are considered to be, collectively, a second prime determinant in establishing a speed limit based on a minimum study. In this case, the basic physical characteristics of the roadway are related. The length of the proposed zone, having been determined during the preceding phase of the study, is the initial element to consider and incremental lengths up to one mile (1.6 kilometre) are identified on the table. From the length of the proposed zone as the starting point, ensure that the corresponding “*average distance between intersections equals or exceeds*” the value of column 2. If the actual average distance between intersections is less than the figure that corresponds to the zone length, proceed down column 2 to the first value that is at or below the actual average distance and read the justified speed limit in column 3 opposite. As a final check, ensure that the design speed equals or exceeds the justified speed limit.

The speed limit that should be adopted, based on the minimum study, is the lower of the two speed limits (either the weighted average or justified speed limit) as determined from **Table C-1** and **Table C-2** respectively.

Only in the case of the more refined study are **Tables C-3** to **C-12** used. The more extensive assessment may be justified where unusual roadway or land use characteristics make the speed limit as determined by a minimum study seem inappropriate.

The tables will yield a series of factors (which are in essence, in percent form) that may be either positive (+) or negative (-). Only one factor is obtained from each table and two points are important: -

- ◆ all of the tables should be used (except where noted - i.e. - **Table C-6**) and not just those that will influence the decision in a desired way
- ◆ all of the positive (+) and negative (-) signs must be accurately recorded.

The speed limit, as determined from the speed characteristics, is based on the theory that a motorist in choosing a safe and reasonable speed, adjusts his behaviour to compensate for all of the elements included in the “*more refined study*” The ‘correlation factors’ should only be applied, therefore, to the speed limit as determined by the geometric characteristics of the road in a minimum study.

The factors derived from **Tables C-3** to **C-6** inclusive are related to the speed limit as determined by a minimum study. In each case, a measurable or established element is used to derive a factor.

- Table C-3** provides a factor based on the number of non-commercial driveways intersecting the road section per mile (1.6 kilometres) and the speed limit as determined from the minimum study.
- Table C-4** provides a factor based on the number of commercial driveways intersecting the road section per mile (1.6 kilometres) and the speed limit as determined from the minimum study.
- Table C-5** provides a factor based on the average width of the roadway lanes over the section under study and the speed limit as determined from the minimum study.
- Table C-6** provides a factor based on a relationship between the street classification and the speed limit as determined from the minimum study. This table should be used in the case of studies in urbanized areas only.
- Tables C-7 and C-8** yield factors that are based on the street classification and a measurable element of the road.
- Table C-7** is used to reflect the impact of the presence of a median on a road within one of the classes of streets.
- Table C-8** also provides a factor determined by a measurable or established element, which is based on the street classification and the shoulder type and width.
- Tables C-9 and C-10** require a subjective assessment of variables and non-variable conditions respectively.
- Table C-9** provides a factor based on street classification and a relative measure of parking activity. Since the application of any policy in Ottawa will be in areas for the most part removed from locations with on-street parking, the activity will normally be nil or low.
- Table C-10** provides a factor based on a measurable quantity (number of curves per mile (1.6 kilometres) with a comfortable speed less than the speed limit or determined by the minimum study) and a subjective relative measure of the topography. Generally, however, in Ottawa, the topography would be considered to be either level or rolling and there is virtually no difference in the factors between these two conditions.

The most difficult elements between which relationships are necessary in order to use this system are those in **Tables C-11** and **C-12** which respectively require a subjective assessment related to a measurable quantity and a measurable quantity related to another measurable quantity, both of which can involve time-consuming efforts.

Table C-11 provides a factor based on a subjective assessment of the level of pedestrian activity (related to age of pedestrians - a measurable quantity) and the measurable element - the distance a sidewalk is set back from the edge of the pavement.

Table C-12 provides a factor based on the collision rate (per million vehicle miles - 100 million vehicle kilometres) as a percentage of the area-wide rate for similar facilities. Measurable quantities are involved, however, so also is a considerable amount of analysis to determine firstly the area-wide collision rate for facilities and secondly, the collision rate for the facility under study.

The sum of the factors derived from the application of **Tables C-3 to C-12** inclusive will yield a net factor that may be either positive (+) or negative (-). The result is a factor that is the *percentage* by which the speed limit determined from **Table C-2** should be adjusted to take into consideration, all of the elements referred to in **Tables C-3 to C-12** inclusive.

It is recommended that the speed limit as determined from **Table C-2**, should not be increased (+) or decreased (-) by more than 25% by the application of the overall adjustment factor.

The significance of the influence of the various factors in establishing a speed limit using the approach described in this report has been tested on sections of City roads on which these elements would have some impact in order to evaluate the methodology.

The application of the technique that has been described is relatively straightforward with the exception of the derivation of factors from **Tables C-11 and C-12**. With respect to pedestrian activity, it has been necessary, at this stage, to make a subjective evaluation and, in the case of locations where there is some form of residential development, it was assumed that pedestrian activity would include pedestrians under 12 and a subjective determination of the level of pedestrian activity was made. In locations where there is no development, it was assumed that pedestrian activity is nil for the purposes of deriving a factor from **Table C-11**.

In the absence of a thorough study of collision rates, it is impossible to quantify the collision rate for the total road system and relate it to the rate for each individual road section in order to apply the principles of **Table C-12**. For the purposes of this policy Range II and Range IV (see **Table C-12**) were assumed in order to test the significance.

16. SPEED TRANSITION ZONES

The Wade-Trim report (2003) prepared for the British Columbia Ministry of Transportation addressed speed transition zones and found the current practice in that Province is to use a transition zone in rural areas entering or leaving an urban or built-up area. Typically, they are less than one kilometre in length, but in some cases can be up to two kilometres or more.

Based on their review of transition zones, with limited speed data available, the Wade-Trim report concludes that drivers do not slow down because the speed limit is not based on roadway geometry or

roadside development. They also suggest the elimination of these zones unless the reduction in the speed limit is supported by associated changes in roadway geometry or development.

The City of Calgary (Traffic Operations Policy Manual) indicates that speed zones of less than 300 m in length are not practical and that as speed increases, the length of the speed zone increases.

Technical Memorandum 2, prepared for the Transportation Association of Canada (2008) indicates there is relatively little information available regarding transition zones. Alberta Infrastructure and Transportation provides transition zones when the drop in the speed limit is 40 km/h or greater and the City of Edmonton tries to limit the number of speed transitions with no more than a 20 km/h change whenever possible.

Les Ministere des Transports, Quebec indicates it is preferable to differentiate speed zones in 20 km/h increments to promote uniform operating speeds.

The current (2008) Nova Scotia Traffic Operations Manual indicates it is impractical to post a speed zone of less than 400 m in length.

The former Regional Municipality of Ottawa-Carleton practice was to limit the minimum length of a speed zone to 300 m and these were used on a limited basis when transitioning from an 80 km/h zone to a 40 km/h zone by the use of a 60 km/h transition zone.

In Ontario, the Ministry of Transportation Traffic Manuals (2001) do not specify the use of transition zones. Changes in the posted speed limit are designated by the use of a Maximum Speed Ahead sign (Rb-5) that indicates drivers are approaching a zone with a reduced speed limit.

17. 40 KM/H SPEED LIMITS

In the Province of Ontario, the Highway Traffic Act, Section 128 (1) (a) states that “*No person shall drive a motor vehicle at a rate of speed greater than 50 km/h on a highway within a local municipality or within a built-up area.*” Across Canada, in many State and local jurisdictions across the United States, in Europe and Australia, the default speed limit on local roadways within Cities, Towns and Villages is 50 km/h. In the United States, default speed limits also include 40 km/h and 60 km/h on local roadways and in many cases, that limit is based on the roadway classification.

Some jurisdictions within the now amalgamated City of Ottawa set their speed limit at 40 km/h (former Cities of Nepean, Gloucester, and Kanata), however, a bylaw entry and appropriate speed limit signing was required for each roadway within their jurisdictions in accordance with the specifications contained in the Highway Traffic Act. In each of the former municipalities, the high cost of installation and sign maintenance resulted in 40 km/h being posted on neighbourhood collector and in some cases, major collector roadways, without posting the reduced speed limit on local residential streets. This actions resulted in a default 50 km/h limit on the very streets residents express their concern regarding “speeding traffic” and an extremely low compliance rate (typically between 0% and 10%) with the 40 km/h speed limit on roadways designed for a higher operating speed.

In 1978, the City of Ottawa requested implementing a reduced default speed limit on all City streets. With the resulting controversy between a 40 km/h and 50 km/h speed limit, a compromise 45 km/h limit was proposed and forwarded to the Province of Ontario for consideration. It was not approved and the report recommended that “no speed limit be provided on any roadway under the jurisdiction of the City of Ottawa”.

In 2006, the City of Ottawa again proposed a default 40 km/h speed limit within the City limits and was to forward their proposal to the Province for consideration. Given the propensity of a Canada wide 50 km/h default speed limit coupled with the most recent update to the Highway Traffic Act (October, 2006), it is doubtful the Province will approve this change.

To simply change the default speed limit within the boundaries of the City of Ottawa the speed limit must be posted in each direction on every roadway in accordance with the specifications outlined in the Ontario Traffic Manual, Book 5 – every 300 m (Figure 12). The cost to install thousands upon thousands of speed limit signs with subsequent maintenance is staggering, easily running into several million dollars. In addition, the net result on drivers’ speed is negligible as illustrated in Table 1 and in Appendices E, F, G, and H.

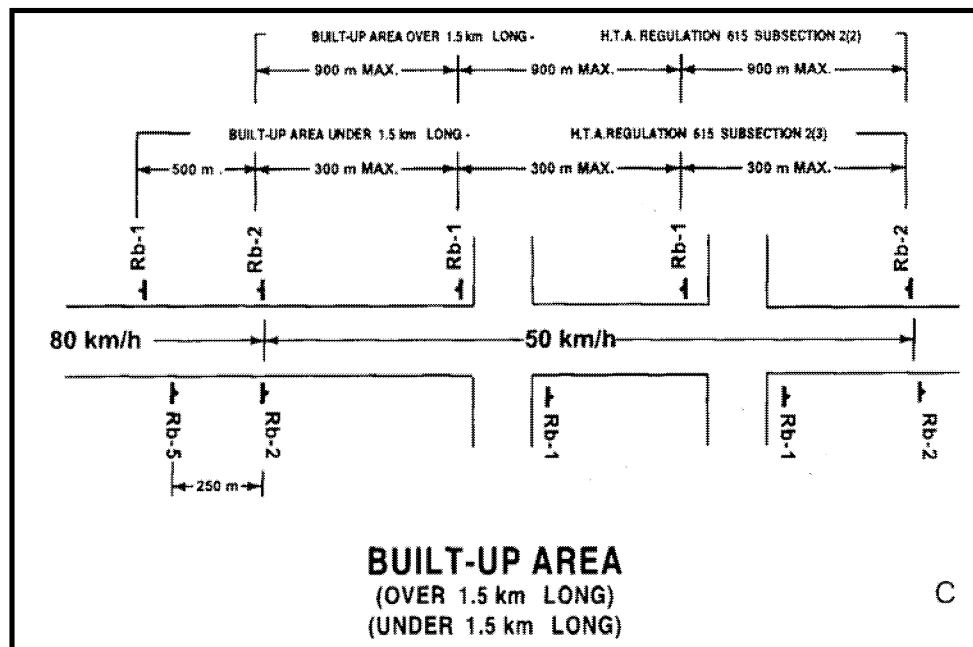


Figure 12

Speed Limit Sign Spacing – Ontario Traffic Manual Book 5, 2000

Residents of Ottawa often request a reduced speed limit to address a “speeding” problem on their street. Typically, the request is to reduce the speed limit to 40 km/h (if the speed limit is at a level higher) and if the limit is already 40 km/h, then simply reduce their request to either 20 or 30 km/h and station a police officer on a twenty-four hour watch to nab every “speeder”.

In *Speed Control in Residential Areas (1998)* produced by the Institute of Transportation Engineers Michigan Section's Technical Project Committee the following information is typical of Ottawa's experience as it relates to speeding traffic in local communities:

“The perception of speeding on local streets is probably the most persistent problem facing residents and traffic officials, alike. Although local or residential streets carry the lowest traffic volumes and suffer the fewest traffic crashes, they are the single largest consumer of a traffic engineer's time and energy. Residents observe vehicles being driven at speeds they perceive are too fast and conclude that the speeds would decrease if stop signs were installed. Speeds considered excessive by residents are considered reasonable by these same persons when they are driving in another neighbourhood. Every traffic engineer has been shaken by these same residents who announce “if something is not done about the traffic problem on my street, someone is going to be killed and it will be your fault.” This is usually followed by a demand for various traffic control measures and often backed up with petitions from residents. Traffic officials then must focus their attention on responding to these pressures, often diverting resources that could be dedicated to solving major capacity and traffic crash problems on other streets.”

In 2007, the City of Bellevue, Idaho passed an ordinance setting the maximum speed limit with the city limits at 40 km/h. However, the Idaho Legislature overturned the ordinance in 2008, at which time the speed limit returned to the previous level of 60 km/h. There was concern that cities create ‘speed traps’ by lowering speed limits unrealistically.

Table 7 provides details regarding default speed limits in urban areas in other countries, essentially confirming the Canadian experience with a 50 km/h urban default limit.

Country	Built-Up Areas (km/h)	Two-Lane Rural (km/h)	Motorways (km/h)	Multi-Lane Divided Less Restricted Access than Motorways (km/h)
Australia	50 – 60	100	110	100 – 110
Austria	50	100	130	100
Belgium	50 – 60	90	120	90 – 120
Czech Republic	60	90	110	N/A
Denmark	50	80	100 – 110	90
Finland	50	80	120	100
France	50 – 60	80 – 90	110 – 130	110
Germany	50	100	130 *	N/A
Great Britain	48	96	112	112
Greece	50	80	100 – 120	100
Hungary	60	80	100	N/A
Ireland	48	88	N/A	96
Italy	50	80 – 110	90 – 140	N/A
Luxembourg	50 – 60	90	120	N/A
Netherlands	50	80	120	100
Norway	50	80	90	N/A
Poland	60	90	110	N/A
Portugal	50 – 60	90	120	100
Rumania	60	70 – 80	70 – 80	N/A
Sweden	50	70 – 90	110	90 – 110
Switzerland	50	70	120	N/A
Spain	50 – 60	90	120	120
Turkey	50	90	90	N/A
United States	40 - 60	90	120	105

Table 7
Summary of Maximum Speed Limits in Other Countries

Source: Based on information from a number of sources including Percy Pallet, PSL Group, and United States National Highway Traffic Safety Administration websites. Also, *Reducing Traffic Injuries Resulting From Excess and Inappropriate Speed*, European Transport Safety Council, Brussels, January 1995.

18. 40 KM/H RESIDENTIAL WARRANTS

In 2003, Council of the City of Ottawa approved the following 40 km/h posted maximum speed limit warrants which may be implemented on any street where one or more of the conditions shown in Warrant A are met. In the case of streets 10.5 metres or more in width, Warrant B must also be considered.

18.1. Warrant A: (One or more of the following)

1. Elementary or junior high school abuts the road.
2. Parkland abuts the road that is contiguous to and used to gain access to an elementary or junior high school.
3. No sidewalk on either side of the road or a major portion of the road.
4. The sidewalk is immediately adjacent to and not separated from the flow of motor vehicles by long-term parking (3 hours) or bike lanes, and where the travelled portion of the road width is less than 5.7 metres for two-way operation, or less than 4.0 metres for one-way operation.
5. Two or more locations of concern where there are grades greater than 5% and/or safe speed on curves is less than 50 km/h.
6. Lack of sufficient distance to stop safely at two or more locations when travelling at 50 km/h.
7. The number of speed related collisions on local streets equals 3 or more over three years.
8. Where long-term parking (3 hours) is permitted on one or both sides, and the remaining travelled portion of the road is less than 5.7 metres for two-way operations, or 4.0 for one-way operation.
9. A licensed childcare facility or private school abuts the road.

Note: In the case of Warrant A (1) or A (2), the 40 km/h maximum speed limit must extend no less than 150 m beyond the boundary of school property and/or contiguous parkland.

18.2. Warrant B: (Wide Roads)

1. A 40 km/h maximum speed limit may only be implemented on streets with total pavement width equal to or more than 10.5 metres, if the 85th percentile speed is equal to or less than 50 km/h

Note: Speed limit reductions to 40 km/h on wide roads have negligible impact and in these cases, other measures should be considered to influence driver behaviour to reduce speed, such as geometric changes to the road itself.

18.3. Exceptions and Special Considerations

Conditions, situations, and events that are local or temporary should generally not have the speed limit adjusted to reflect the condition, but should be addressed by other means. For instance, a sharp curve in the middle of a relatively straight road should not have the speed limit on the entire road lowered to reflect the “safe” speed of the curve. Rather, the appropriate speed limit should be determined by the application of this policy, and the curve should be posted with advisory warning signs that indicate the direction and severity of the curve along with the advisory “safe” speed, as determined by an engineering study.

On “traffic calmed” streets with speed humps in place, vehicle speeds are typically quite low. However, to provide advance notice to drivers, particularly those who may be unfamiliar with the

roadway, advisory speed tabs will be used in conjunction with the appropriate warning signs instead of regulatory speed limit signs.

18.4. Sample Analysis of a 40 km/h Speed Limit Request

To assess the appropriateness of a reduced 40 km/h speed limit a full inventory of the roadway section in completed. This includes not only posted regulatory and warning signing, but also all roadway features such as the presence or absence of sidewalks, location of schools, parks, childcare facilities, and private schools. The following forms provide details in this regard and include photographs taken along the street as a reference to existing conditions.

A spot speed survey is undertaken to determine the average speed of traffic, 85th percentile speed, pace speed range and driver compliance with the legal speed limit. Estimates of potential driver compliance with a range of speed limits are also calculated.

Once all the required information is compiled, the warrant summary is completed. This action may result in either a change in the speed limit or a recommendation to maintain the existing speed limit.

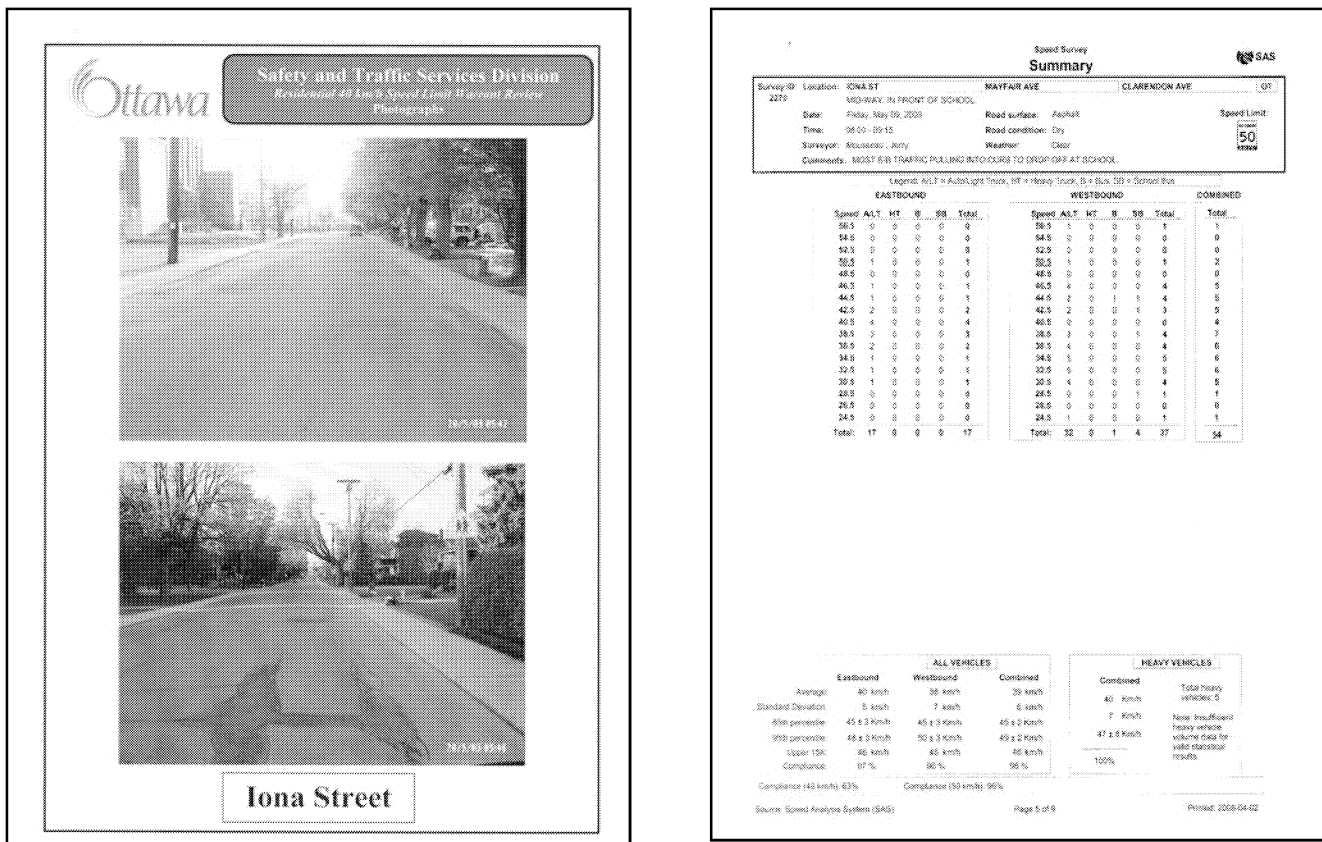


Figure 13 (Also on Page 78)

Residential 40 km/h Speed Limit Analysis

Ottawa Department of Public Works and Services
40 km/h Residential Speed Limit Warrant Analysis - Inventory

Street: IONA STREET Ward: 15 RTS: 13841

Segment Limits: HARMER AVENUE TO ISLAND PARK DRIVE Date: 20 MAY 2003

Roadway Classification:
 Cul-de-sac: Local Residential: Minor Residential Collector: Residential Collector:

Section Length: 0.66 km or 460 m

Roadway Inventory
 Current Speed Limit: 50 km/h. If 50 km/h is speed limit posted? Yes No
 Pavement Width: 27 m Number of Lanes: 2 Lane Width(s): 3.95 m C/L or N
 Sidewalk(s) Yes No If Yes, located on: One side or Both sides
 Sidewalk Details: Along Curb on NORTH side and/or SOUTH side or Setback on: _____ side _____ m and/or _____ side _____ m
 Parking/Stopping Regulations: on NORTH side ADMITTED, 24 HR, N/S 0700-1900 MON-FRI and on SOUTH side ADMITTED, 24 HR, N/S 0700-1900 MON-FRI
 And on ADMITTED, 24 HR, N/S 0700-1900 MON-FRI and ADMITTED, 24 HR, N/S 0700-1900 MON-FRI
 If parking permitted on one side – remaining pavement width: 3.8 m
 If parking permitted on both sides – remaining pavement width: 2.9 m
 Bicycle lanes Yes No Details: _____
 Bus Route Yes No
 School abuts this road? Yes No School Name: ELMDALE PUBLIC SCHOOL
 Private school abuts this road? Yes No School Name: _____
 Park along this road? Yes No Park Name: _____
 Commercial Daycare centre? Yes No If yes, where? _____
 Street Lighting? Yes No If yes, rotated ALONG NORTH SIDE
 Pedestrian Path? Yes No If yes, where? _____

Speed Survey Summary
 Survey location: BETWEEN CLARENDON AVE AND MAYFAIR AVE, AT ELMDALE PUBLIC SCHOOL
 Time Period: 0800-0915 Day: FRI Date: 9 MAY 2003
 Average speed: 39 km/h; 85th Percentile Speed: 45 km/h; Pace range: 31 to 45 km/h
 Number of vehicles in survey: 54; Speed Limit: 50 km/h; Compliance with speed limit: 76 %
 Number of heavy vehicles in survey: Trucks: 0; Buses: 1; School Buses: 4
 Average speed of heavy vehicles: 48 km/h; 85th percentile speed of heavy vehicles: 47 km/h

Page 1 of 2

Ottawa Department of Public Works and Services
40 km/h Residential Speed Limit Warrant Analysis

Street: IONA STREET Ward: 15 RTS: 13841

Warrant Analysis

Warrant A – Pedestrian/Cycling Environment

1. Elementary or Junior High School borders on the road?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
2. Parkland borders on the road, contiguous to and used to gain access to school?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
3. Absence of a sidewalk on either side or along a major portion of road?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
4. Is the sidewalk immediately adjacent to and not separated from flow of motor vehicles by long turn parking (3 hours) or bike lanes, and traveled portion of road is less than 5.7 m for 2-way, or less than 4.0 m for one-way operation?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
5. Are there two or more sites with grades >5% and/or safe speed less than 50 km/h?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
6. Is stopping sight distance at 2 or more sites < 50 km/h?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
7. Number of speed related collisions on local streets = 3 or more over 3 years	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
8. Where long term parking (3 hours) is permitted on one or both sides is the remaining traveled portion of road <5.7 m for two-way, or <4.0 for one-way?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
9. Does a commercial day care centre or private school abut the road?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Warrant B – Wide Roads

10(a). Is pavement width equal to or greater than 10.6 m?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
10(b). Is the operating speed equal to or less than 50 km/h?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

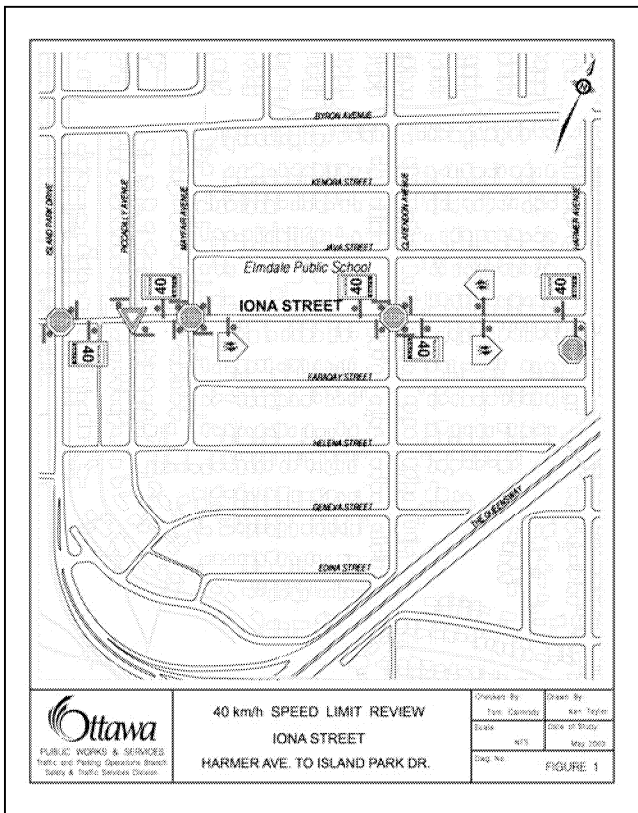
Summary
 Warrant A: Total YES: 3 NO: 6 (if yes > 0, consider implementing a 40 km/h speed limit; considering B)
 Warrant B: If 10 (a) = YES and 10 (b) = YES and Warrant A > 0, consider implementing a 40 km/h speed limit.
 Warrant B: If 10 (a) = YES and 10 (b) = NO and Warrant A > 0, do not consider implementing a 40 km/h speed limit.
 Warrant B: If 10 (a) = NO and 10 (b) = YES and Warrant A > 0, consider implementing a 40 km/h speed limit.
 Warrant B: If 10 (a) = NO and 10 (b) = NO and Warrant A > 0, do not consider implementing a 40 km/h speed limit.

Current speed limit: 50 km/h. Suggested speed limit based on results of speed survey: 50 km/h
(25% per driver speed recorded up to the worked 10 km/h)
 Estimated or current driver compliance with suggested speed limit: 76 % (above);

40 km/h Speed Limit Warranted?
 Warrant A Satisfied? YES (yes or no)
 Warrant B Satisfied? YES (yes or no)
 If yes, speed zone limits: HARMER AVE. TO ISLAND PARK DRIVE
 Potential compliance with 40 km/h limit: 63 %

Work Order
 MS 2388

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Ottawa Transportation, Utilities and Public Works
Traffic and Parking Branch
SUB WORK ORDER

Internal REFERENCE WORK ORDER SUB-WORK ORDER
MS3388

INFRASTRUCTURE SERVICES ACCOUNT# 132523
 TRAFFIC AND PARKING: XXX DATE INITIATED: 28 November 2003 FILE # T97-11-10NA
 UTILITY SERVICES: BILLING DIVISION: Safety and Traffic Services
 SURFACE OPERATIONS:

Location
Iona Street between Harmer Avenue and Island Park Drive

Project
Work To Be Done

1. Install speed limit signing to implement a 40 km/h speed limit on Iona Street between Harmer and Island Park.
 In the **EASTBOUND** direction place one 40 km/h sign approximately 20 m east of Island Park Drive, one approximately 20 to 30 m east of Mayfair, and one 20 to 30 m east of Clarendon.
 In the **WESTBOUND** direction, place one 40 km/h sign approximately 20 m west of Harmer, one approximately 20 m west of Clarendon, and one 20 to 30 m west of Mayfair.
 Ensure that the locations of the new speed limit signs do not significantly impact adjacent residences and adjust the locations slightly as required.

Report To: _____ Efficent: _____ Latest: _____
 Starting Date: _____ ASAC: _____
 Finishing Date: _____

Remarks: Under the authority of the Deputy City Manager pending report to Council
 Sent To: **Kevin Wylie**
 RTS No: **13841**
 cc: **Betty Belford**
 PL: **2003** COUNCIL DATE: **REPORT 9** RELEAS: _____
 Requested By: **Tom Carmody**
 Telephone extension: **21684**
 Approved By: **Kevin Wylie**
 Date: **28 November 2003**

19. Speed Limits on Rural Roadways Other Than Arterials

In the Province of Ontario since the 1960's or before, if a rural roadway had no speed limit signs posted, the default limit was 80 km/h (formerly 50 miles per hour) as governed by the Highway Traffic Act (H.T.A.). Municipalities are permitted to change speed limits, however, that new limit must be both posted in the field and incorporated into a local by-law.

Traffic volumes in rural areas are typically quite low when compared to the volume of traffic on urban roadways and in addition, drivers' speeds are essentially self-controlling on gravel, rough, or narrow paved roads in relatively poor condition. Gravel roadways in particular present a special challenge when deciding a level of speed limit to post as the conditions of these roads can vary almost weekly depending on the weather or the season. However, as with other roadways, the recommended speed limit reflects driving under ideal road, weather and traffic conditions.

Another issue associated with gravel roadways relates to the default 80 km/h speed limit when compared to the same speed limit on upper tier roads or even some two-lane Provincial Highways. Increasingly, speed limit changes are most often requested to address this 'anomaly' as it is obvious a narrow, winding, gravel roadway simply cannot sustain the high speed traffic of a smooth, paved, wide arterial urban road. As the population increases in the rural areas of the City of Ottawa there are increasing requests to reduce the speed limit in an effort to address 'speeders' and to reflect the 'residential' nature of the new neighbourhood.

Similar problems exist for narrow paved roadways across the rural areas of the City. Although the road surface is in far better condition than on gravel roads, the same concerns are expressed but now include comments regarding pedestrian activity as shoulders are too narrow on which to walk or too rough for strollers and bicycles and if the speed limit were reduced, traffic would become slower improving the safety of non-vehicle users of the road. Again, the default speed limit of 80 km/h comes into question as simply too high.

19.1. Setting a Speed Limit on a Rural Paved Road (Other Than an Arterial)

This Policy has a mechanism to review speed limits on rural paved roads as the tables outlined in Annex D take into consideration but are not limited to, pavement width, shoulder width and degree of pedestrian activity in recommending an appropriate and safe speed limit and accordingly, this method will continue.

19.2. Speed Limits on Gravel Roads in Other Jurisdictions

The United States Department of Transportation, National Highway Traffic Safety Administration, 2001 lists a number of states using a different blanket speed limit (BSL) other than the 55 mph (90 km/h) state limit on gravel roadways. Table 8 provides a summary of those limits.

Speed Limit		States and Comments
Mph	Km/h	
35	60	Alabama, Georgia and Virginia
40	60	Massachusetts and South Carolina
45	70	Maine
50	80	Delaware, Iowa (sunset & sunrise), Maryland, Nebraska, Rhode Island (45 mph during the nighttime), Vermont and Washington
60	100	Arkansas (50 mph for trucks), Texas (55 mph during the nighttime)
65	105	Alaska, Arizona, Minnesota (during the daytime), Mississippi (55 mph for trucks or truck-trailers), Tennessee, Wyoming
70	110	Montana (65 mph during the nighttime)
75	120	Nevada and New Mexico

Table 8
List of States Using a Different Blanket Speed Limit
from 55 mph (90 km/h) on Gravel Roads

In a 2007 study prepared for Iowa State University, the speed limits on gravel roads in Kansas were assessed. As part of this study, County engineers were contacted with 48 % confirming they use the blanket speed limit (BSL) as the basis for determining the speed limit. The BSL is equivalent to the default, unsigned speed limit in Ontario. A total of 41% conduct an engineering study and 17 % use professional judgment.

The report concluded that “though the popular belief is that a lower speed limit would contribute to less severe crashes, the crash analysis have not agreed with this point. The roads with speed limits of 45 mph (70 km/h) and 50 mph (80 km/h) had slightly higher percentages of fatal and disabled crashes than 55 mph (90 km/h) roads. If the regulatory speed limit were lowered from 55 mph (90 km/h) to 45 or 50 mph (70 to 80 km/h), no evidence would ensure the decrease of severe crashes on gravel roads”.

In Connecticut, the State Traffic Commission, in cooperation with town officials, establishes speed limits on locally maintained roads. However, speed limits are not normally established on unimproved, dirt or gravel roads because of variations in seasonal roadway surfaces. Roads of insufficient length (usually 300 m or less) do not warrant a speed limit.

The Commonwealth of Massachusetts, establishes speed limits through the Massachusetts Highway Department and the Registry of Motor Vehicles after an engineering and traffic investigation have been conducted. Gravel roadways are not typically speed zoned as it is impossible to establish a consistent road surface and again, the conditions on such roads tend to change over relatively short periods of time.

Massachusetts General Law governs the speed of motor vehicles on unposted roadways stating that “No person, operating a motor vehicle on any way shall run it at a rate of speed greater than is reasonable and prudent, having regard to traffic and the use of the way and the safety of the public” and provides a *prima facie* speed limit of 60 km/h on undivided roadways outside thickly settled districts. However, interpretation of “reasonable and proper” speeds supersedes the above limits, but due to its subjectivity, it is difficult to enforce.

The Oregon Department of Transportation (2003) feels that conditions on gravel roads vary too much for one specific speed limit to be appropriate. The *de facto* speed limit is 55 miles per hour (90 km/h), however, because the condition of these roads can change greatly from day to day during certain season and weather events, the basic speed law regarding driving at speeds “reasonable and proper for existing road conditions” applies.

In Virginia, the speed limit on gravel roads is the same as that of the local highway system – 90 km/h; however, several counties have established a speed limit of 60 km/h following approval by the Virginia General Assembly.

In Kansas, as in Virginia, the speed limit on state roads, whether paved or gravel, is 90 km/h.

In Michigan, the Livingston County Road Commission states “Gravel Roads in Michigan are not considered for absolute speed limits due to the continuously changing conditions on these roadways, which results in continuously changing speed patterns. However, any gravel road that is upgraded to a paved road is subject to consideration of an absolute speed limit”.

In 2006, Missouri established a 45 mph (70 km/h) default speed limit on county gravel, dirt, and other unsurfaced roads regardless of the presence of signs.

North Dakota, in 2003, addressed the issue of inconsistent speed limits as both gravel township roads had the same speed limit as the state’s two-lane highways, by raising the speed limit on the two-lane highways to 65 mph (105 km/h). This action maintained a 55 mph (90 km/h) on North Dakota’s gravel roadways.

Prior to 2007 the default speed limit in Tasmania on rural roads, including gravel, was 100 km/h. In May 2007, the Tasmanian Government released a new *Tasmanian Road Safety Strategy 2007 – 2016*. A demonstration project was initiated to reduce the default limit on gravel roads to 80 km/h and two-lane asphalt roadways to 90 km/h.

In Namibia, the speed limit on a gravel roadway is 100 km/h, however, drivers are cautioned that “a leisurely 60 to 80 km/h is even better”.

In Manitoba, under ideal conditions, the maximum posted speed limit on gravel roads is 90 km/h.

19.3. Setting Speed Limits on Gravel Roads

In Ottawa the speed limit on gravel roadways will be reviewed on a case-by-case basis. Should there be a sufficient number of vehicles (typically a minimum of 30 vehicles per direction within a two-hour time period), a spot speed survey will be undertaken to confirm the average speed and 85th percentile speed of traffic to provide a good starting point to assess the level of the speed limit. Experience indicates the minimal study has proven successful in providing a previously unsigned roadway with a speed limit that the majority of drivers will observe.

In addition to the speed survey, a thorough review of warning and regulatory signing will be undertaken. The upgraded signing provides drivers, both local and those unfamiliar with the road with a clear indication of deficiencies in the driving environment. Additionally, with police enforcement a posted speed limit will successfully address those drivers who choose to disregard the law and travel at excessive and truly dangerous speeds.

Speed limits on gravel roadways will continue to be controversial. Until a given gravel roadway is either rebuilt or paved, sound engineering judgment will be required to address the needs and safety of all road users, ultimately, reaching a consensus of the majority – a difficult measure to achieve given the sensitive and emotional aspects of speed limits in general.

20. 30 Km/h Speed Limits

Public interest regarding the implementation of a default speed limit of 30 km/h on roadways within the residential areas of the City of Ottawa has resulted in an increased number of requests to address speeding concerns and reduce the risk of a child's death. The argument is difficult to refute particularly where it refers to the protection of the most vulnerable road users – pedestrians – and more notably – children. Other benefits often expressed include quieter neighbourhoods, a benefit to cyclists and in some instances, may be better for the environment. Is 30 km/h the magic number? Why not 20 km/h, 10 km/h or even 0 km/h? How low do the numbers on a speed limit have to be to reach the point of diminished returns and when does the number on the speed limit sign simply become a placebo?

20.1. The European Experience

The European Federation for Transport and Environment (2001) fact sheet states that in Belgium, “45% of all pedestrians hit by a car travelling at 50 km/h die, while only 5% die from being hit by a car moving at 30 km/h”. Perception, reaction time, and braking distances vary depending on the speed of the vehicle essentially confirming that, at lower speeds, braking distances are less than at high speeds.

Documentation from The European Transport Safety Council (2005) states that “the speed of motor vehicles is at the core of the road safety problem. Higher speed increases both the risk of crash and the consequence of a crash.” In urban areas, the speed of motor vehicles is critical to the safety of vulnerable road users where as low speeds, drivers have more time to react to an unexpected situation and avoid collisions. Reduced speed limits (30 km/h) can be supported by various physical

modifications including vertical and horizontal deflections, changes in surface colour and texture, reduction in pavement width and various other means including gateways to traffic-calmed areas.

In 1993, the City of Zug, Switzerland, implemented a 30 km/h speed limit in all residential neighbourhoods. At that time, Zug had a population of approximately 22,000 with an entire network of streets consisting of 55 kilometres in total length.

In June 2005, a report appeared in the Institute of Transportation Engineers ITE Journal titled “*Effects on Road Safety of 30 Kilometer-Per-Hour Zone in Residential Districts*”. In Switzerland, 30 km/h zones were imposed ‘on local rather than on a general basis, above all on neighbourhood streets and collector streets in residential areas.; Restrictions to a general implementation included a maximum area (up to 1 square kilometre) and without any main highways and would include that ‘traffic engineering and structural measures are employed within the area itself to reduce motor vehicle speeds.

According to Swiss law, these zones can only be created if a technical report has first confirmed its implementation is appropriate in a specific district and as of 2005, more than 700 districts in Swiss municipalities have implemented 30 km/h zones.

The fundamental expectation is that a 30 km/h zone, coupled with traffic calming measures should produce a reduced level of speeds, translating into an increase in road safety. The report summarizes the results of a review of eleven zones that had been in place for several years in median and large towns. The detailed analysis should decrease in accident numbers with accident severity markedly reduced.

However, accident distributions clearly illustrate that the area-based 30 km/h measure often is not uniquely suitable as the sole measure for achieving a reduction in accident experience. Also, vehicle speeds (both average and 85th percentile) decreased by between 6 and 7 km/h, and, in those locations without structural measures there was either no reduction or only a minimal, almost negligible reduction in drivers’ speeds.

The Swiss report that to convert an average zone of 0.3 square kilometres, the cost for traffic engineering and structural measures results in a cost of between approximately 33,000 Swiss francs (\$32,000 Cdn) and 100,000 Swiss francs ((\$98,000 Cdn).

The findings of this study provide data to include:

- On the basis of a positive cost-benefit ratio only two to three years after implementation of a 30 km/h zone in districts within the residential area of towns and municipalities, this measure enables a sustained increase in road safety in the area. It was recommended that it be implemented rapidly and extensively in Switzerland;
- A substantial and lasting reduction in the speed level of motor vehicles in 30 km/h zones can be achieved only by installing individual and properly located structural measures. Compared to the reduction in the speed limit of 20 km/h obtainable reduction in the speed level between 5 and 6 km/h may appear slight. This reduction, however, manifests itself in the form of about 15 percent fewer accidents and 27 percent fewer accident victims;

- The assessment of the advisability of introducing a 30 km/h zone in a specific, individual area needs to be undertaken carefully, on the basis of an analysis of current accident occurrence and speed level on the area's major streets. If the distribution of accidents is dispersed, the establishment of a 30 km/h zone is particularly advisable. By reference to the evaluation of the existing speed levels for major streets in the area, it is possible to verify which measures need to be implemented when the 30 km/h zone is established.

In the Netherlands, between 1985 and 1997, approximately 10 – 15 % of the urban residential roads were converted to 30 km/h zones. Newly developed residential areas were designed as 30 km/h zones with the roads in these areas redesigned using road humps, road narrowings and mini-roundabouts to ensure the speed limits were respected. In parallel, since 1985, engineering work has also been used on the urban roads where speed limits were not reduced to 30 km/h to maximize separation of vulnerable road users and maintain low traffic speeds (Koornstra et al, 2002).

In 'Speeding' prepared by the European Road Safety Observatory (2006), *'an increasing number of countries apply 30 km/h zones in residential areas, based on the known relationship between speed and the chance for vulnerable road users to survive a collision.'* As in Ottawa, this limit is *'best supported by engineering measures such as speed humps, road narrowings, chicanes and raised areas at intersections.'*

20.2. The Australian Experience

In 1974, the default speed limit in urban areas in Australia was set at 60 km/h. Two studies were undertaken by the Road Accident Research Unit of the University of Adelaide, Australia with one examining the relationship between the travelling speed of a passenger car in a 60 km/h speed limit area and the risk of involvement in a casualty crash. The other study was based on detailed investigations of fatal pedestrian crashes.

Again, confirming that reductions in vehicle speeds reduces the probability of a pedestrian fatality, one of the authors was posed with the following question; *"Can't an even stronger case be made for an urban speed limit of, say, 25 km/h?"*

Craig Kloeden, one of the reports authors responded with the following statement: *"We did not directly address that issue in our study as we did not have vehicles travelling at that speed. However, the basic physical principles and common sense both show that slowing vehicles down will reduce the incidence and severity of crashes. We stress going to 50 km/h in our jurisdiction as we currently have a 60 km/h limit. There are European countries that have 30 km/h limits in built-up areas.*

The other side of the argument is that you get diminishing returns from ever lower limits and increased travel times as well as the political cost of lowering speed limits. So yes, very slow traffic is good from a safety perspective, but ultimately other balancing factors mean that the optimal level is higher than the optimal safety level (zero?).

20.3. The Canadian Experience

The Manual of Uniform Traffic Control Devices for Canada allows for the creation of School and Playground Areas without reduced speed zones. However, as this manual does not provide guidance on the geometric and operations conditions where the introduction of a school or playground area should be considered, the Transportation Association of Canada (TAC) produced ‘Guidelines for Application and Implementation of School and Playground Areas and Zones’. The Province of Alberta Traffic Safety Act states that the speed limit within these areas is 30 km/h and utilizes the TAC guidelines to evaluate the need to implement this lower limit.

In the City of Calgary, 30 km/h school zone speed limits are posted between the hours of 8:00 a.m. to 5:00 p.m. Monday to Friday and playground zones from 8:30 a.m. to until one hour after sunset.

In the City of Gatineau, 30 km/h speed limits are utilized in school zones and adjacent to playgrounds or parks.

In Canada, 30 km/h speed limits are utilized primarily within ‘traffic calmed’ areas and in some jurisdictions within school and playground zones.

20.4. The Ottawa Experience

The City of Ottawa Area Traffic Management Guidelines as outlined in Section 12, provide for a 30 km/h design speed for structural measures. Historically, the speed zoning policy implemented by the former Regional Municipality of Ottawa Carleton in 1975 also provided the ability to propose a 30 km/h speed limit should a detailed analysis of the roadway under review conclude that level would be of benefit to all road users (pedestrians, cyclists, motorists and residents). Until 2006, the Highway Traffic Act of Ontario did not provide Municipalities with the ability to implement this speed limit.

Until the mid-1990’s, a 30 km/h speed limit was posted, without additional traffic calming measures, on a single residential roadway under the jurisdiction of the National Capital Commission in the Glebe. Table 9 illustrates driver compliance and speeds when compared with an adjacent roadway comprised of virtually identical development within the same mid-block section.

Roadway and Speed Limit →	Clemow St. 30 km/h	Powell Ave. 50 km/h
Average Speed	47 km/h	46 km/h
85 th Percentile	54 km/h	54 km/h
Compliance Rate	0 %	77 %

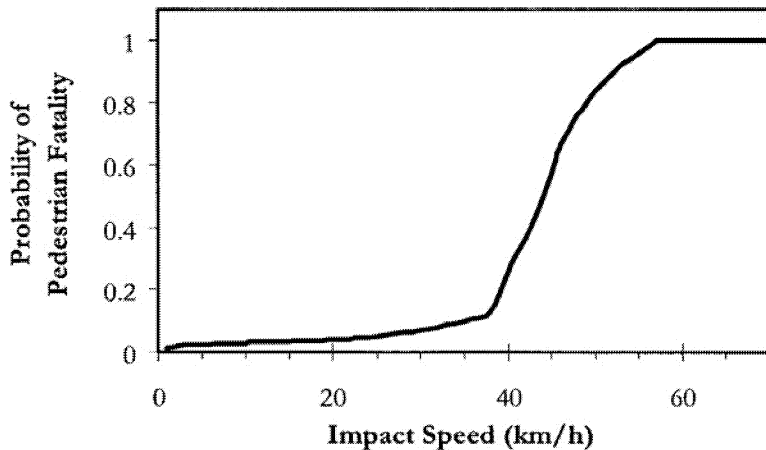
Table 9
Effect of a 30 km/h Posted Speed Limit on Vehicle
Speeds without Additional Traffic Calming Measures

20.5. Pedestrian Safety

One of the primary concerns associated with the speed of traffic is the safety of children in residential neighbourhoods. Across Canada, the United States, Europe and Australia, organizations or school councils advocate speed limit reductions citing research demonstrating fatality rates based on absolute speeds.

In a document prepared for the media by Safe Kids Canada (May 2008) ‘research demonstrates that a child hit by a car travelling at 50 km/h has an 80 per cent chance of being killed. Yet a child hit by a car travelling at 30 km/h, has up to a 95 per cent chance of surviving.’ The emotional impact of these statements is obvious.

The relationship between the probability of a pedestrian fatality and impact speed is illustrated in Figure 14 as outlined in ‘Star Rating School Walking Routes’ prepared by Monash University in May, 2008.



**Figure 14
Relationship Between
Probability of a Pedestrian
Fatality and Impact Speed**

In this report, ‘Corben et al (2006) combined the information on probability of a fatal crash, given that a crash occurred, with the overall probability of crash occurrence to derive a relationship between relative risk of a fatal pedestrian crash and driver speed choice, as shown in Table 10. A speed of 30 km/h has been used as the reference against which to scale risk for higher speed choices, since studies of the biomechanical tolerance of humans to violent forces have shown that an impact at this speed equates to a low risk (i.e. less than 10%) of death to a pedestrian (Anderson et al, 1997; Davis, 2001).

**Table 10
Relationship Between Driver Speed
Choice and Relative Risk of Fatal
Pedestrian Crash**

Speed Choice (speed limit) (km/h)	Relative Risk of a fatal Pedestrian Crash (compared to 30 km/h)
30	1.0
40	4.5
50	18.6
60	30.7
70	40.9
80 and above	> 40.9

Speed choice, as represented by speed limit, is assumed to be the fundamental determinant of crash and injury risk.

20.5.1. Pedestrian Collisions in Ottawa

In Ottawa, collisions involving our most vulnerable road users – namely our children- are quite rare particularly when travelling to or from school on school days. In the three-year period up to and including 2007, no elementary school age children (pedestrians or cyclists) were killed on any roadway within the City Limits.

20.5.2. Pedestrian Fatalities and Injuries in Canada

Transport Canada prepared a summary (2004) of pedestrian fatalities and injuries resulting from collisions with motor vehicles on roadways within Canada for the period 1992-2001. Despite the increase in both the population and number of motor vehicles registered, pedestrian fatalities decreased by 24.1 % over the 10-year period with pedestrian injuries also decreasing by 10.2 % (Figure 15). The report concludes that “*even though pedestrian fatalities and injuries have decreased over the 10-year period, the 65+ age group still accounts for the greatest number of pedestrian fatalities*”.

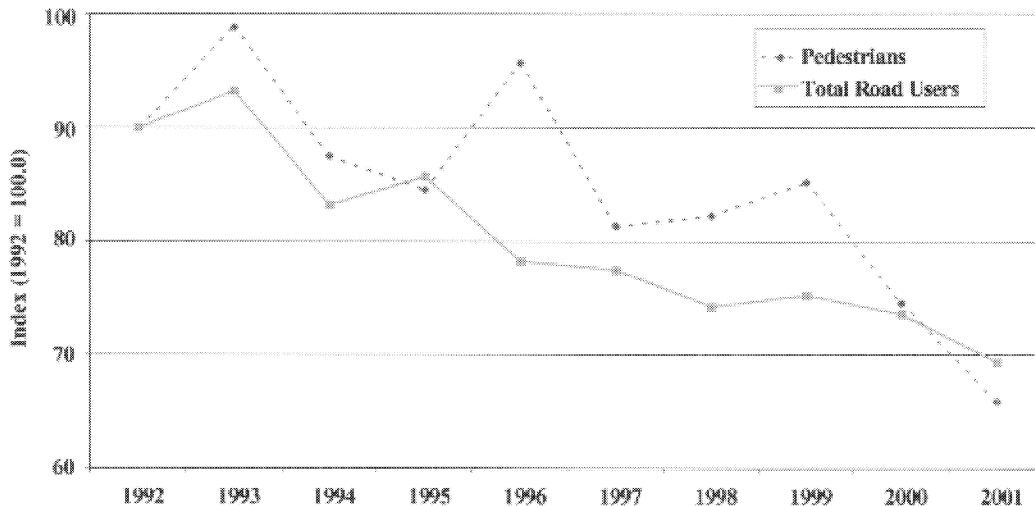


Figure 15
Trends in Pedestrian and Total Road User Fatalities in Canada 1992- 2001

20.6. Fuel Consumption and Exhaust Emissions

A detailed analysis of fuel consumption, exhaust emissions and environment issues can be found in numerous sources and are not within the scope of this policy. However, as some requests to reduce speed limits centre around the cost of fuel, and the potential to reduce both fuel consumption and exhaust emissions and accordingly, reduce the impact of the automobile on the environment some general information is provided here. The United States Department of Transportation website contains a general fuel consumption graph illustrated in Figure 16.

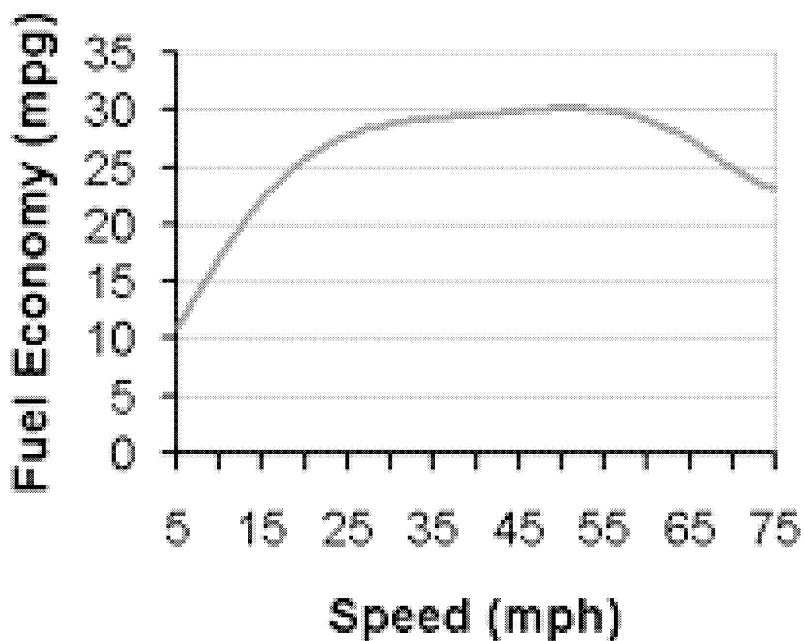


Figure 16
Fuel Economy by Vehicle Speed

As noted in this graph, fuel consumption increases at both lower speeds (<30 m.p.h. or 50 km/h) and higher speeds (>60 m.p.h. or 100 km/h).

Information from Transport Canada (2004 data) provides another interesting statistic obtained from tests involving three different vehicles (sub-compact car, mid-size car, and a half-ton pick-up truck) at static vehicle speeds commencing at 40 km/h, the lowest speed limit evaluated.

The sub-compact used the least amount of fuel at 60 km/h, the mid-size at 70 km/h and the pick-up, 90 km/h. At 40 km/h, the sub-compact produced more total hydrocarbons than at any speed up to 110 km/h, with the mid-size producing more carbon monoxide and carbon dioxide at 40 km/h than at any speed up to 120 km/h, and finally, the pick-up producing more carbon monoxide than at any speed up to 120 km/h and more carbon dioxide than at any speed up to 70 km/h.

From this perspective, the provision of speed limits less than the default 50 km/h speed limit in residential areas may be less beneficial to the environment by increasing both fuel consumption and exhaust emissions.

Appendix “A”

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Appendix “C”GLOSSARY OF COMMONLY USED TERMS RELATING TO
VEHICLE SPEEDS

Sources for this glossary were:

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absolute speed limit:

“A speed above which it is always illegal to drive”. Also known as a maximum lawful limit (I. p. 538)

advisory speed limit:

The maximum safe speed that is posted below a warning sign. “In most states, the advisory speeds are not legally enforceable, but in some courts violation of the advisory speeds is admissible as evidence that the driver was operating in a reckless manner.” (I, p. 541)

average overall speed:

“The average of the overall speeds of all vehicles on a given roadway during a specified period of time.” (II, p. 12)

average overall travel speed:

“The sum of distances divided by the sum of overall travel times (a space-mean speed). (I, p. 159)

average spot speed (mean speed):

“The arithmetic mean of the speeds of all traffic or component thereof, at a specified point.” (I, p. 159)

critical approach speed:

“At an intersection, that speed above which a vehicle does not have sufficient distance to stop in time to avoid collision with another vehicle approaching the intersection on the cross street.” (II, p. 39)

critical speed (on curve):

“The speed above which a vehicle will slide off the curve rather than follow around it.” (II, p. 40)

design speed (of highway):

“A speed selected for purposes of design and correlation of those features of a highway, such as curvature, super-elevation, and sight distance, upon which the safe operation of vehicles is dependent. It is the highest continuous speed at which individual vehicles can travel with safety upon a highway when weather conditions are favourable, traffic density is low, and the design features of the highway are the governing conditions for safety.” (II, p. 48)

85th percentile speed:

“That speed at or below which 85 percent of vehicles travel.” (II, p. 68) [The xth percentile would also have a corresponding definition.]

free-moving vehicle:

“One in which the driver is not restricted in selecting his speed by other vehicles... Some observers classify a free-moving vehicle as one which has not less than 6 - 9 sec. headway from the vehicle ahead of it and is making no apparent effort to overtake and pass the vehicle ahead.” (I, p. 539)

headway:

“The time interval between passages of consecutive vehicles measured from head to head, moving in the same direction as they pass a given point.” (II, p. 91) or “The distance, measured front to front, between consecutive vehicles.” (II, p. 92)

maximum lawful limit:

“A speed above which it is always illegal to drive.” Also known as an absolute speed limit. (I, p. 538)

median speed (of traffic):

“That speed below which 50 percent and above which 50 percent of the speeds occurred.” (II, p. 128) [the 50th percentile]

nominal speed (of traffic):

“A running speed at which drivers operate on a given section of highway in the absence of traffic interference.” (II, p. 140)

operating speed:

“The highest overall speed exclusive of stops at which a driver can travel on a given highway under prevailing conditions without at any time exceeding the design speed.” (II, p. 151)

optimum speed:

“The average speed at which traffic must move when the volume is at a maximum on a given roadway. An average speed either appreciably higher or lower than the optimum will result in a reduction in volume.” (II, p. 152)

overall travel speed:

“The speed over a specified section of highway being the distance divided by overall travel time...” (I, p. 159)

overall travel time:

“The total time of travel, including stops and delays, except those off the travelled way...” (I, p. 159)

pace of traffic:

“The range of speed which includes the greatest number of vehicles for some nominal increment in speed, usually 10 m.p.h. (16 km/h rounded to 15 km/h).” (III, p. 51)

prima facie speed limit:

“A speed above which the driver is presumed to be driving unlawfully but if charged with exceeding it, a driver may show cause to prove that his speed was safe for conditions and, therefore, that he was not guilty of a speed violation.” (I, p. 538)

running speed:

“The speed over a specified section of highway, being the distance divided by running time...” (I, pp. 159, 161)

running time:

“The time the vehicle is in motion...” (I, p. 159)

spot speed:

“The speed of a vehicle as it passes a spot or point on a street or highway.”
(I. p. 159)

ten-mile-per-hour pace:

“The 10 mph (16 km/h rounded to 15 km/h) speed range containing the largest percentage of vehicle in a sample of spot speeds.” (I. p. 159)

Appendix “D”

Table C-1

85 Percentile Speed (km/h)	Upper Limit of 15 km/h Pace	Average Test Run Speed	Speed Limit Justified (km/h)
> 104	> 96	> 94	110
95 - 104	89 - 96	86 - 94	100
85 - 94	81 - 88	76 - 85	90
75 - 84	73 - 80	66 - 75	80
65 - 74	63 - 72	57 - 65	70
55 - 64	53 - 62	49 - 56	60
45 - 54	43 - 52	39 - 48	50
34 - 44	33 - 42	30 - 38	40
< 34	< 33	< 30	30

Weighted Average of the Justified Speed Limit

Warrant	Speed Limit Justified	Factor	Weighted Limits
85th Percentile Speed	x	3	3x
Upper Limit of 15 km/h Pace	y	3	3y
Average Test Run Speed	z	4	4z

$\text{Weighted Average Justified Speed Limit} = (3x + 3y + 4z)/10$

Table C-2
(Length of Proposed Speed Zone/Distance between Intersections)
(Lowest value Prevails)

Design Speed	Average Distance Between Intersections (m)	Length of Speed Zone	Maximum Speed Limit
110 km/h	400 m & over	1.5 km & over	110 km/h
100 km/h	300 - 399 m	1.0 - 1.49 km	100 km/h
90 km/h	250 - 299 m	0.8 - 0.99 km	90 km/h
80 km/h	175 - 249 m	0.7 - 0.79 km	80 km/h
70 km/h	125 - 174 m	0.6 - 0.69 km	70 km/h
60 km/h	100 - 124 m	0.5 - 0.59 km	60 km/h
50 km/h	75 - 99 m	0.4 - 0.49 km	50 km/h
40 km/h	60 - 74 m	0.3 - 0.39 km	40 km/h
30 km/h	45 - 59 m	0.2 - 0.29 km	30 km/h

Table C-3
(Non-commercial Driveways)

Number of Driveway Entrances per kilometre	Speed Limit - Determined in Minimum Study (Table C-2)								
	30	40	50	60	70	80	90	100	110
0 - 3	+15	+15	+15	+10	+10	+5	+5	0	0
4 - 6	+10	+10	+10	+5	+5	0	0	0	-5
7 - 12	+10	+10	+5	0	0	0	0	-5	-5
13 - 21	+5	+5	0	0	0	-5	-5	-10	-10
22 - 30	+5	0	0	-5	-5	-10	-10	-15	-15
31 or more	0	0	-5	-10	-10	-15	-15	-20	-20

Table C-4
(Commercial Driveways)

Number of Driveway Entrances per kilometre	Speed Limit - Determined in Minimum Study (Table C-2) (* Use this line when calculated number/km < 1)								
	30	40	50	60	70	80	90	100	110
0	+15	+15	+15	+10	+10	+5	+5	0	0
0.1 - 0.9*	+10	+10	+10	+5	+5	0	0	0	-5
1	+10	+10	+5	0	0	0	0	-5	-5
2 - 3	+5	+5	0	0	0	-5	-5	-10	-10
4 - 5	+5	0	0	-5	-5	-10	-10	-15	-15
6 or more	0	0	-5	-10	-10	-15	-15	-20	-20

Table C-5
(Lane Width)

Lane Width (Metres)	Speed Limit - Determined in Minimum Study (from Table C-2)								
	30	40	50	60	70	80	90	100	110
< 2.7 m	0	0	0	-5	-5	-10	-10	-10	-15
2.7 - 3.2 m	+5	+5	0	0	0	-5	-5	-5	-10
3.3 - 3.5 m	+10	+10	+5	+5	0	0	0	0	-5
> 3.5 m	+15	+15	+10	+10	+5	+5	+5	0	0

Table C-6
(Street Classification)

Street Classification (Urban Areas Only)	Speed Limit - Determined in Minimum Study (from Table C-2)								
	30	40	50	60	70	80	90	100	110
Local	0	0	0	-5	-10	-10	-15	-15	-25
Collector	+5	0	0	0	-5	-5	-10	-10	-15
Arterial	+10	+5	+5	0	0	0	-5	-5	-10
Expressway	+15	+10	+10	+5	0	0	0	0	-5
Freeway	+25	+20	+15	+10	+5	+5	0	0	0

Table C-7
(Median Type and Width)

Street Classification	N O N E	Median							
		Flush or Painted		Mountable		Barrier		Depressed Unpaved	
		0.6-1.8m	>1.8m	0.6-1.8m	>1.8m	0.6-1.8m	>1.8m	1.8-6.1m	>6.1m
Local	0	+5	+10	---	---	---	---	---	---
Collector	0	+5	+5	+10	+15	---	---	---	---
Arterial	-10	0	0	+5	+10	+15	+20	---	---
Expressway	---	-10	-5	0	0	+5	+10	+15	+20
Freeway	---	---	-10	-10	-5	0	0	0	0

Table C-8
(Shoulder Type and Width)

Street Classification	Shoulder Type and Width			
	None	Turf/Gravel	Stabilized	Paved
Local	0	+5	+10	+20
Collector	0	0	+5	+10
Arterial	-5	0	0	+5
Expressway	-10	-5	0	0
Freeway	-20	-10	-5	0

Table C-9
(Parking Activity)

Street Classification	Parking Activity			
	No Parking	Low Turnover	Medium Turnover	High Turnover
Local	+10	0	-10	-10
Collector	+10	0	-10	-15
Arterial	+15	0	-10	-15
Expressway	0	-10	-15	-20

Table C-10
(Topography)

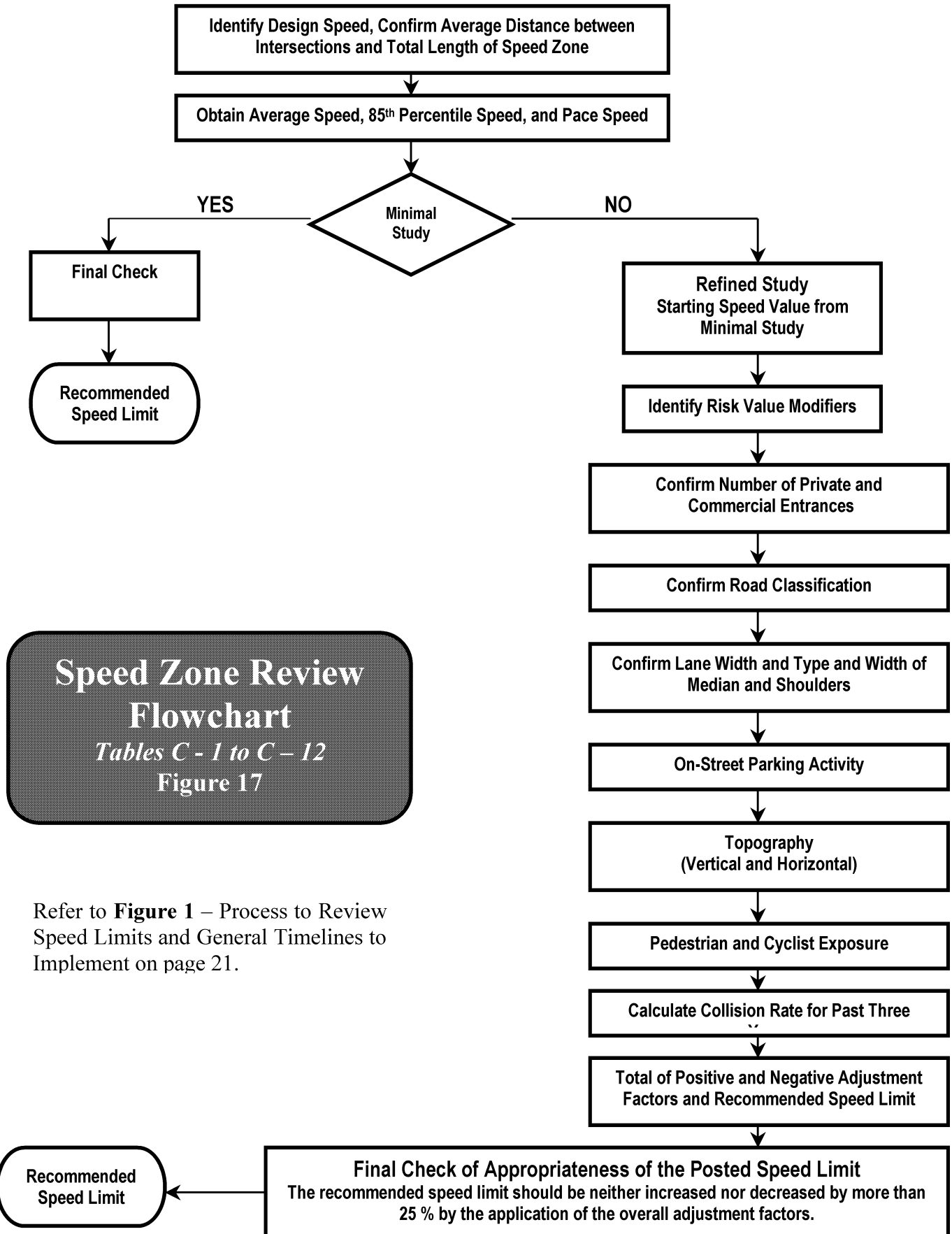
Number of Horizontal Curves per kilometre with a comfortable speed less than the speed limit as determined by the minimum study.	Topography			
	Level	Rolling	Hilly	Mountainous
0	+10	+5	0	0
1	0	0	-5	-5
2	-10	-10	-10	-10
3 or more	-20	-20	-20	-20

Table C-11
(Pedestrian & Cyclist Activity and Sidewalk Setback/Bicycle Lanes)

Pedestrian/Cyclist Activity	Sidewalk Setback from Edge of Pavement/Bicycle Lane Width				
	None	0-0.6 m	0.7-2.4 m	2.5-4.3 m	> 4.3 m
Age < 12	None	0-0.6 m	0.7-2.4 m	2.5-4.3 m	> 4.3 m
Heavy	-25	-20	-15	-10	-5
Medium	-20	-15	-10	-5	0
Light	-15	-10	-5	0	0
↓ If none, consider ages over 12 years old ↓					
Heavy	-10	-5	0	0	0
Medium	-5	0	0	0	0
Light	-5	0	0	0	0
None	0	0	0	0	0

Table C-12
(Collision Rate)

Collision Rate as a % of Area-wide Rate for Similar Facilities		
Range I	< 75 %	+10
Range II	76 % - 125 %	0
Range III	126 % - 200 %	-10
Range IV	> 200 %	-20




Speed Zone Review Flowchart
 Tables C - 1 to C - 12
 Figure 17

Refer to **Figure 1** – Process to Review Speed Limits and General Timelines to Implement on page 21.

Appendix “E”


Example of The Effect on Vehicle Speeds Following the Replacement of an Unsigned 50 km/h Speed Limit with a 40 km/h Speed Limit




City Operations – Public Works

Fairlawn Avenue

Local Residential Roadway – Before/After a change from Unsigned 50 km/h to 40 km/h Speed Limit
Fairlawn Avenue between Lenester Avenue and Queensgrove Road




28/8/03 14:43

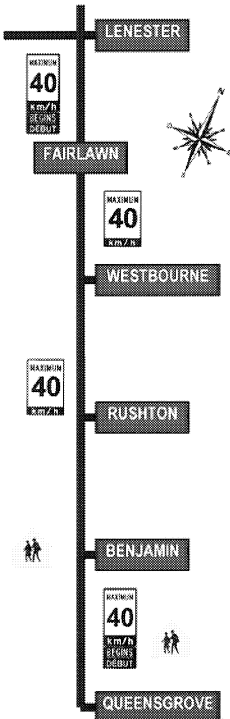



28/8/03 14:47

N/B on Fairlawn Ave. at Queensgrove Rd.

S/B on Fairlawn Ave. at Lenester Ave.







“Before”

Unsigned **50 km/h** Speed Limit
(Survey date – 12 May 2003)

Average Speed = 45 km/h

85th Percentile Speed = 51 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 35 to 50 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 30 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 58 km/h

% Compliance = 84 %
(The percentage of drivers travelling at or below 50 km/h)

“After”

Posted **40 km/h** Speed Limit
(Survey Date – 26 June 2006)

Average Speed = 45 km/h

85th Percentile Speed = 53 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 37 to 52 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 40 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 66 km/h

% Compliance = 29 %
(The percentage of drivers travelling at or below 40 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist - 17 October 2006

Appendix “F”

Example of The Effect on Vehicle Speeds Following the Replacement of an Unsigned 50 km/h Speed Limit with a 40 km/h Speed Limit

City Operations – Public Works

Golflinks Drive

Local Collector Roadway

Golflinks Drive between Fencerow Way and Pondhollow Way

MAXIMUM

50

km/h

W/B on Golflinks Drive approaching Bracewood Way

MAXIMUM

40

km/h

Golflinks Drive

Between Bracewood Way & Pondhollow Way

Thursday, 31 March 2005

Average Speed = 49 km/h

85th Percentile Speed = 55 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 41 to 56 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 32 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 68 km/h

% Compliance = 66 %
(The percentage of drivers travelling at or below 50 km/h)

Golflinks Drive

Between Bentgrass and Fencerow Way

Friday, 9 November 2007

Average Speed = 51 km/h

85th Percentile Speed = 58 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 43 to 58 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 50 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 84 km/h

% Compliance = 5 %
(The percentage of drivers travelling at or below 40 km/h)

Appendix “G”

Example of The Effect on Vehicle Speeds Following the Replacement of an Unsigned 50 km/h Speed Limit with a 40 km/h Speed Limit

City Operations – Public Works

Glebe Avenue

*A Neighbourhood Street – Before/After a change from Unsigned 50 km/h to 40 km/h
Glebe Avenue between Bronson Avenue and Percy Street.*

MAXIMUM
50
km/h

Glebe Avenue – eastbound east of Bronson Avenue

MAXIMUM
40
km/h

Glebe Avenue
Between Bronson Avenue and Percy Street
No Posted Speed Limit
Wednesday, 16 April 2003
Average Speed = 48 km/h

85th Percentile Speed = 54 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 39 to 54 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 26 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 62 km/h

% Compliance = 66 %
(The percentage of drivers travelling at or below 50 km/h)

Glebe Avenue
Between Bronson Avenue and Percy Street
Posted 40 km/h
Wednesday, 28 June 2006
Average Speed = 46 km/h

85th Percentile Speed = 52 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 37 to 52 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 34 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 64 km/h

% Compliance = 12 %
(The percentage of drivers travelling at or below 40 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 17 October 2006

Appendix “H”

Example of The Effect on Vehicle Speeds Following the Replacement of an Unsigned 50 km/h Speed Limit with a 40 km/h Speed Limit

City Operations – Public Works

Riverdale Avenue

Collector Roadway
Riverdale Avenue between Avenue Road and Bank Street

MAXIMUM

50

km/h

1/5/08 12:46

MAXIMUM

40

km/h

Riverdale Avenue
Between Belmont Avenue & Windsor Avenue
Wednesday, 21 June 2006
Average Speed = 46 km/h

85th Percentile Speed = 52 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 37 to 52 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 34 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 62 km/h

% Compliance = 81 %
(The percentage of drivers travelling at or below 50 km/h)

Riverdale Avenue
Between Belmont Avenue & Windsor Avenue
Wednesday, 22 November 2006
Average Speed = 47 km/h

85th Percentile Speed = 54 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 39 to 54 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 44 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 70 km/h

% Compliance = 13 %
(The percentage of drivers travelling at or below 40 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 6 February 2008

Appendix “I”

Example of Vehicle Speeds on a Collector Roadway
With Both a 40 km/h and 50 km/h Posted Speed Limit

City Operations – Public Works

Bathgate Drive

Collector Roadway
Bathgate Drive between Montreal Road and Ogilvie Road

Northbound on Bathgate Drive

MAXIMUM

50

km/h

MAXIMUM

40

km/h

Bathgate Drive
Between Lafayette Priv. & Quigg Priv.
Monday, 18 June 2007
Average Speed = 51 km/h

85th Percentile Speed = 57 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 43 to 58 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 30 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 68 km/h

% Compliance = 44 %
(The percentage of drivers travelling at or below 50 km/h)

Bathgate Drive
Between Leigh Cres. (N) & Rainbow Cres. (N)
Friday, 15 June 2007
Average Speed = 50 km/h

85th Percentile Speed = 57 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 43 to 58 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 30 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 66 km/h

% Compliance = 6 %
(The percentage of drivers travelling at or below 40 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 6 February 2008

Appendix “J”

Example of The Effect on Vehicle Speeds of the Presence of Large Numbers of Children and School Related Activity

City Operations – Public Works

Lockhart Avenue

The Effect of School Related Activity on Vehicle Speeds Without a Decrease in the Speed Limit

28/5/04 08:04

Lockhart Avenue

Drivers **NOT** Affected by School Activity

Average Speed = 44 km/h

85th Percentile Speed = 52 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 37 to 52 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 44 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 66 km/h

% Compliance = 82 %
(The percentage of drivers travelling at or below 50 km/h)

Speed Survey Date
Tuesday, 5 April 2005

Lockhart Avenue

Drivers Affected by School Activity Including Children/Parents Crossing & Drop-Offs

NO CHANGE IN SPEED LIMIT

Average Speed = 28 km/h

85th Percentile Speed = 35 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 21 to 36 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 32 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 44 km/h

% Compliance = 100 %
(The percentage of drivers travelling at or below 50 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 5 April 2005

Appendix “K”

Example of The Effect on Vehicle Speeds of the Presence of Large Numbers of Children and School Related Activity

City Operations – Public Works

Scala Avenue

The Effect of School Related Activity on Vehicle Speeds Without a Decrease in the Speed Limit

24/4/07 16:03

Scala Avenue

Drivers **NOT** Affected by School Activity

Average Speed = 47 km/h

85th Percentile Speed = 53 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 39 to 54 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 28 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 60 km/h

% Compliance = 74 %
(The percentage of drivers travelling at or below 50 km/h)

Speed Survey Dates
Wednesday, 21 Feb 2007
Thursday, 26 Apr 2007

Scala Avenue

Drivers Affected by School Activity Including Children/Parents Crossing & Drop-Offs

NO CHANGE IN SPEED LIMIT

Average Speed = 33 km/h

85th Percentile Speed = 40 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 25 to 40 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 30 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 48 km/h

% Compliance = 100 %
(The percentage of drivers travelling at or below 50 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 3 May 2007

Appendix “L”

Example of The Effect on Vehicle Speeds Following an Increase in the Speed Limit from 50 km/h to 60 km/h

City Operations – Public Works

Spratt Road

A Neighbourhood Collector Roadway – Before/After a change from Unsigned 50 km/h to 60 km/h
Spratt Road between Shoreline Drive – North & South Intersections

MAXIMUM

50

km/h

MAXIMUM

60

km/h

Spratt Road - Before
 Between Shoreline Drive (N & S)
 No Posted Speed Limit
 Friday, 23 April 2004
 Average Speed = 54 km/h

85th Percentile Speed = 61 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 47 to 62 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 36 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 74 km/h

% Compliance = 34 %
(The percentage of drivers travelling at or below 50 km/h)

Spratt Road - After
 Between Shoreline Drive (N & S)
 Posted 60 km/h
 Monday, 27 September 2004
 Average Speed = 53 km/h

85th Percentile Speed = 59 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 45 to 60 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 32 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 68 km/h

% Compliance = 89 %
(The percentage of drivers travelling at or below 60 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist - 20 October 2004

Appendix “M”

Example of the Effect on Vehicle Speeds following an Increase in the Posted Speed Limit from 50 km/h to 80 km/h on a Major Arterial Roadway



City Operations – Public Works

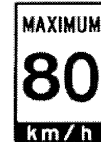
Hunt Club Road
A Four-Lane Arterial Truck Route in Ottawa – Speed Limit Increased from 50 to 80 km/h
Hunt Club Road between Conroy Road and Hawthorne Road



E/B on Hunt Club Road at Malak Street



W/B on Hunt Club Road



Hunt Club Road
 Between Conroy Road
 And Hawthorne Road

Average Speed = 76 km/h

85th Percentile Speed = 86 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 66 to 81 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 62 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 116 km/h

% Compliance = 0 %
(The percentage of drivers travelling at or below 50 km/h)

Hunt Club Road
 Between Conroy Road
 And Hawthorne Road

Average Speed = 77 km/h

85th Percentile Speed = 88 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 68 to 83 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 48 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 106 km/h

% Compliance = 64 %
(The percentage of drivers travelling at or below 80 km/h)

*Prepared by Tom Carmody, Traffic Assessment Specialist
 December 2003*

Appendix “N”

Example of the Effect on Vehicle Speeds following a Reduction in the Posted Speed Limit from 90 km/h to 80 km/h on a Major Arterial Roadway



City Operations – Public Works

Frank Kenny Road
An Arterial Roadway – Before/After a change from 90 km/h to 80 km/h
Frank Kenny Road between Colonial Road and Huismans Road.



S/B on Frank Kenny Road at Centaur Riding Farm



Frank Kenny Road
 Between – Colonial Road and Russell Road

Average Speed = 92 km/h

85th Percentile Speed = 101km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 85 to 100 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 56 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 110 km/h

% Compliance = 40 %
(The percentage of drivers travelling at or below 90 km/h)

Frank Kenny 01.doc

Frank Kenny Road
 Between – Colonial Road and Russell Road

Average Speed = 92 km/h

85th Percentile Speed = 101 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 85 to 100 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 42 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 112 km/h

% Compliance = 9%
(The percentage of drivers travelling at or below 80 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – March 2005

Appendix “O”

**Example of the Effect on Vehicle Speeds Following an Increase
In the Posted Speed Limit from 60 km/h to 70 km/h on an Urban Divided Arterial Roadway**



City Operations – Public Works

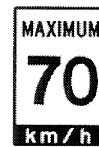
Baseline Road
A Four-Lane Arterial Truck Route – Speed Limit Increased from 60 to 70 km/h
Baseline Road between Greenbank Road and Richmond Road



W/B on Baseline Road west of Greenbank Road



E/B on Baseline Road at Valley Stream Drive



Baseline Road
Between Cornell Street
and Guthrie Street

Average Speed = 68 km/h

85th Percentile Speed = 77 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 60 to 75 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 44 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 94 km/h

% Compliance = 19 %
(The percentage of drivers travelling at or below 60 km/h)

Baseline Road
Between Cornell Street
and Guthrie Street

Average Speed = 67 km/h

85th Percentile Speed = 75 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 60 to 75 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 52 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 98 km/h

% Compliance = 70 %
(The percentage of drivers travelling at or below 70 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist March 2004

Appendix “P”

**Example of the Effect on Vehicle Speeds Following an Increase
In the Posted Speed Limit from 50 km/h to 60 km/h on a Collector Roadway**

City Operations – Public Works

Crestway Drive

*Collector Roadway – Before/After a change from Unsigned 50 km/h to 60 km/h
Crestway Drive between Prince of Wales Drive and Strandherd Drive*

MAXIMUM

50

km/h

E/B on Crestway Drive west of St. Andrew School

MAXIMUM

60

km/h

Crestway Drive

Between – Oldfield to Waterbridge
No Posted Speed Limit
(Survey Date – Tuesday 8 October 2002)
Average Speed = 60 km/h

85th Percentile Speed = 69 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 51 to 66 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 42 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 86km/h

% Compliance = 11%
(The percentage of drivers travelling at or below 50 km/h)

Crestway Drive

Between – Oldfield to Waterbridge
Posted 60 km/h
(Survey Date – Tuesday 1 June 2004)
Average Speed = 55 km/h

85th Percentile Speed = 62 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 47 to 62 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 32 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 72 km/h

% Compliance = 81 %
(The percentage of drivers travelling at or below 60 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 21 February 2005

Appendix “Q”

**Example of the Effect on Vehicle Speeds Following an Increase
In the Posted Speed Limit on a Two-Lane Rural/Urban Arterial Roadway**

City Operations – Public Works

Fallowfield Road

Rural/Urban Arterial Roadway – Before/After a change from 60 km/h to 80 km/h

Fallowfield Road between Barran Street and Larkin Drive

MAXIMUM

60

km/h

E/B on Fallowfield Road between Barran Street and Larkin Drive

No Changes Made to Roadway Geometry

MAXIMUM

80

km/h

Fallowfield Road

Between Barran Street and Larkin Drive
Thursday, 15 December 2005
Average Speed = 72 km/h

85th Percentile Speed = 82 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 61 to 76 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 60 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 108 km/h

% Compliance = 7 %
(The percentage of drivers travelling at or below 60 km/h)

Fallowfield Road

Between Barran Street and Larkin Drive
Wednesday, 7 June 2006
Average Speed = 74 km/h

85th Percentile Speed = 82 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 67 to 82 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 46 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 96 km/h

% Compliance = 79 %
(The percentage of drivers travelling at or below 80 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 8 June 2006

Appendix “R”

**Example of the Effect on Vehicle Speeds Following a Decrease
In the Posted Speed Limit on a Two-Lane Rural/Urban Arterial Roadway**

City Operations – Public Works

Trim Road

Rural/Urban Arterial Roadway – Before/After a change from 80 km/h to 60 km/h
Trim Road between Demeter Street and Valin Street

MAXIMUM

80

km/h

N/B on Trim Road North of Valin
Construction Activity at Innes Road with Flag Persons

MAXIMUM

60

km/h

Trim Road

Approx. 100 m north of Valin Street
Wednesday, 23 November 2005
Average Speed = 69 km/h

85th Percentile Speed = 79 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 63 to 78 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 44 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 96 km/h

% Compliance = 90 %
(The percentage of drivers travelling at or below 80 km/h)

Trim Road

Approx. 100 m north of Valin Street
Tuesday, 18 July 2006
Average Speed = 73 km/h

85th Percentile Speed = 80 km/h
(the speed at OR below which 85% of vehicles travel)

Pace Speed Range = 65 to 80 km/h
(the speed range containing the greatest number of vehicles)

Speed Differential = 44 km/h
(Difference between the slowest and fastest speeds recorded)

Fastest Vehicle Speed = 94 km/h

% Compliance = 2 %
(The percentage of drivers travelling at or below 60 km/h)

Prepared by Tom Carmody, Traffic Assessment Specialist – 19 July 2006

Appendix “S”

Spot Speed Survey Field Sheet



City Operations – Public Works
Spot Speed Survey Field Sheet

TIS

Roadway: _____ Between _____
 Exact Location: _____
 Survey Time: _____ to _____ Day: _____ Date: _____ Speed Limit: _____ km/h
 Weather: Clear ; Cloudy ; Foggy ; Rain ; Snow Road: Asphalt ; Gravel
 Road Surface: Dry ; Wet ; Snow Surveyor _____ Comments: _____

Direction: N/B <input type="radio"/> ; S/B <input type="radio"/> ; E/B <input type="radio"/> ; W/B <input type="radio"/>		Autos/Light Trucks/Vans/SUV's	Heavy Trucks	Buses	School Buses
Speed (km/h)	S				
127.5 – 129.5	128.5				
125.5 – 127.5	126.5				
123.5 – 125.5	124.5				
121.5 – 123.5	122.5				
119.5 – 121.5	120.5				
117.5 – 119.5	118.5				
115.5 – 117.5	116.5				
113.5 – 115.5	114.5				
111.5 – 113.5	112.5				
109.5 – 111.5	110.5				
107.5 – 109.5	108.5				
105.5 – 107.5	106.5				
103.5 – 105.5	104.5				
101.5 – 103.5	102.5				
99.5 – 101.5	100.5				
97.5 – 99.5	98.5				
95.5 – 97.5	96.5				
93.5 – 95.5	94.5				
91.5 – 93.5	92.5				
89.5 – 91.5	90.5				
87.5 – 89.5	88.5				
85.5 – 87.5	86.5				
83.5 – 85.5	84.5				
81.5 – 83.5	82.5				
79.5 – 81.5	80.5				
77.5 – 79.5	78.5				
75.5 – 77.5	76.5				
73.5 – 75.5	74.5				
71.5 – 73.5	72.5				
69.5 – 71.5	70.5				
67.5 – 69.5	68.5				
65.5 – 67.5	66.5				
63.5 – 65.5	64.5				
61.5 – 63.5	62.5				
59.5 – 61.5	60.5				
57.5 – 59.5	58.5				
55.5 – 57.5	56.5				
53.5 – 55.5	54.5				
51.5 – 53.5	52.5				
49.5 – 51.5	50.5				
47.5 – 49.5	48.5				
45.5 – 47.5	46.5				
43.5 – 45.5	44.5				
41.5 – 43.5	42.5				
39.5 – 41.5	40.5				
37.5 – 39.5	38.5				
35.5 – 37.5	36.5				
33.5 – 35.5	34.5				
31.5 – 33.5	32.5				
29.5 – 31.5	30.5				
27.5 – 29.5	28.5				
25.5 – 27.5	26.5				
23.5 – 25.5	24.5				
21.5 – 23.5	22.5				
19.5 – 21.5	20.5				
17.5 – 19.5	18.5				
15.5 – 17.5	16.5				
13.5 – 15.5	14.5				

Direction: N/B <input type="radio"/> ; S/B <input type="radio"/> ; E/B <input type="radio"/> ; W/B <input type="radio"/>		Autos/Light Trucks/Vans/SUV's	Heavy Trucks	Buses	School Buses
Speed (km/h)	S				
127.5 – 129.5	128.5				
125.5 – 127.5	126.5				
123.5 – 125.5	124.5				
121.5 – 123.5	122.5				
119.5 – 121.5	120.5				
117.5 – 119.5	118.5				
115.5 – 117.5	116.5				
113.5 – 115.5	114.5				
111.5 – 113.5	112.5				
109.5 – 111.5	110.5				
107.5 – 109.5	108.5				
105.5 – 107.5	106.5				
103.5 – 105.5	104.5				
101.5 – 103.5	102.5				
99.5 – 101.5	100.5				
97.5 – 99.5	98.5				
95.5 – 97.5	96.5				
93.5 – 95.5	94.5				
91.5 – 93.5	92.5				
89.5 – 91.5	90.5				
87.5 – 89.5	88.5				
85.5 – 87.5	86.5				
83.5 – 85.5	84.5				
81.5 – 83.5	82.5				
79.5 – 81.5	80.5				
77.5 – 79.5	78.5				
75.5 – 77.5	76.5				
73.5 – 75.5	74.5				
71.5 – 73.5	72.5				
69.5 – 71.5	70.5				
67.5 – 69.5	68.5				
65.5 – 67.5	66.5				
63.5 – 65.5	64.5				
61.5 – 63.5	62.5				
59.5 – 61.5	60.5				
57.5 – 59.5	58.5				
55.5 – 57.5	56.5				
53.5 – 55.5	54.5				
51.5 – 53.5	52.5				
49.5 – 51.5	50.5				
47.5 – 49.5	48.5				
45.5 – 47.5	46.5				
43.5 – 45.5	44.5				
41.5 – 43.5	42.5				
39.5 – 41.5	40.5				
37.5 – 39.5	38.5				
35.5 – 37.5	36.5				
33.5 – 35.5	34.5				
31.5 – 33.5	32.5				
29.5 – 31.5	30.5				
27.5 – 29.5	28.5				
25.5 – 27.5	26.5				
23.5 – 25.5	24.5				
21.5 – 23.5	22.5				
19.5 – 21.5	20.5				
17.5 – 19.5	18.5				
15.5 – 17.5	16.5				
13.5 – 15.5	14.5				

Spot Speed Survey Field Sheet – Tom Carmody, Traffic Assessment Specialist – Revised in July 2008, June 2009

Appendix “T”

40 km/h Residential Warrant Inventory Form



City Operations – Public Works
40 km/h Residential Speed Limit Warrant Analysis - Inventory

Street: Ward - TIS -

Segment Limits: _____ Date: _____

Roadway Classification:
 Cul-de-sac ; Local Residential ; Minor Residential Collector ; Residential Collector
 Section Length: _____ km or _____ m

Roadway Inventory
 Current Speed Limit: _____ km/h. If 50 km/h is speed limit posted? Yes → No →
 Pavement Width _____ m Number of Lanes _____ Lane Width(s) _____ C/L → Y or N
 Sidewalk(s) Yes → No → If Yes, located on: One side → or Both sides →
 Sidewalk Details: Along Curb → on _____ side and/or _____ side.
 or Setback on _____ side _____ m and/or _____ side _____ m
 Parking/Stopping Regulations: on _____ side
 And on _____ side
 If parking permitted on one side – remaining pavement width _____ m
 If parking permitted on both sides – remaining pavement width _____ m
 Bicycle lanes → Yes ; No Details _____
 Bus Route → Y ; No
 School abuts this road? → Y ; No School Name _____
 Private school abuts this road? → Y ; No ; School Name _____
 Park along this road? → Y ; No Park Name: _____
 Commercial Daycare centre? → Yes ; No If yes, where? _____
 Street Lighting? → Yes ; No If yes, located _____
 Pedestrian Path? → Yes ; No If yes, where? _____

If there is more than one speed limit (either posted or not posted), complete one set of these sheets for each section.

Speed Survey Summary

Survey location: _____
 Time Period: _____ Day: _____ Date: _____
 Average speed: _____ km/h; 85th Percentile Speed: _____ km/h; Pace range: _____ to _____ km/h
 Number of vehicles in survey: _____; Speed Limit: _____ km/h; Compliance with speed limit: _____ %
 Number of heavy vehicles in survey: Trucks: _____; Buses: _____; School Buses: _____
 Average speed of heavy vehicles: _____ km/h, 85th percentile speed of heavy vehicles: _____ km/h

Appendix “U”

40 Km/h Residential Warrant Analysis Form



City Operations – Public Works
40 km/h Residential Speed Limit Warrant Analysis

Street: Ward - TIS -

Warrant Analysis

Warrant A – Pedestrian/Cycling Environment

Concur?

- | | |
|---|--|
| 1. Elementary or Junior High School borders on the road? | Yes <input type="radio"/> No <input type="radio"/> |
| 2. Parkland borders on the road, contiguous to and used to gain access to school? | Yes <input type="radio"/> No <input type="radio"/> |
| 3. Absence of a sidewalk on either side or along a major portion of road? | Yes <input type="radio"/> No <input type="radio"/> |
| 4. Is the sidewalk immediately adjacent to and not separated from flow of motor vehicles by long term parking (3 hours) or bike lanes, and traveled portion of road is less than 5.7 m for 2-way, or less than 4.0 m for one way operation? | Yes <input type="radio"/> No <input type="radio"/> |
| 5. Are there two or more sites with grades >5% and/or safe speed less than 50 km/h? | Yes <input type="radio"/> No <input type="radio"/> |
| 6. Is stopping sight distance at 2 or more sites < 50 km/h? | Yes <input type="radio"/> No <input type="radio"/> |
| 7. Number of speed related collisions on local streets = 3 or more over 3 years | Yes <input type="radio"/> No <input type="radio"/> |
| 8. Where long term parking (3 hours) is permitted on one or both sides is the remaining traveled portion of road <5.7 m for two-way, or <4.0 for one-way? | Yes <input type="radio"/> No <input type="radio"/> |
| 9. Does a commercial day care centre or private school abut the road? | Yes <input type="radio"/> No <input type="radio"/> |

Warrant B – Wide Roads

- | | |
|---|--|
| 10(a) Is pavement width equal to or greater than 10.5 m? | Yes <input type="radio"/> No <input type="radio"/> |
| 10(b) Is the operating speed equal to or less than 50 km/h? | Yes <input type="radio"/> No <input type="radio"/> |

Summary

Warrant A: Total YES: _____ NO: _____ (If yes > 0, consider implementing a 40 km/h speed limit), considering B.
Warrant B: If 10 (a) = YES and 10 (b) = YES and Warrant A >0, consider implementing a 40 km/h speed limit.
Warrant B: If 10 (a) = YES and 10 (b) = NO and Warrant A >0, do not consider implementing a 40 km/h speed limit.
Warrant B: If 10 (a) = NO and 10 (b) = YES and Warrant A >0, consider implementing a 40 km/h speed limit.
Warrant B: If 10 (a) = NO and 10 (b) = NO and Warrant A >0, do not consider implementing a 40 km/h speed limit.

Current speed limit: _____ km/h. Suggested speed limit based on results of speed survey: _____ km/h
(85th percentile speed rounded up to the nearest 10 km/h)
 Estimated or current driver compliance with suggested speed limit: _____ % (above).

40 km/h Speed Limit Warranted?
 Warrant A Satisfied? _____ (yes or no)
 Warrant B Satisfied? _____ (yes or no)
 If yes, speed zone limits: _____
 Potential compliance with 40 km/h limit: _____ %

Work Order
MS _____

Appendix “V”

Speed Zone Analysis Summary

City Operations - Public Works
Speed Study Analysis Sheet - Collector and Arterial Roadways

Street Name:

Results of Spot Speed Survey(s)				T.I.S.
85th Percentile Speed	0	km/h	0	km/h
Upper Limit 15 km/h Pace	0	km/h	0	km/h
Average Speed	0	km/h	0	km/h
	Survey 1		Survey 2	
Table C-1 (Weighted Average Speed)	0	km/h (a)	0	km/h (a)

Speed Zone Length (m): 0 Number of Intersections: 0

Average Distance between Intersections: 0 M

Table C-2 (Justified Speed Limit) 0 km/h (b) 0 km/h (b)
(Reduce to design speed if necessary)

Design Speed 0 km/h (c) 0 km/h (c)

Choose Lower of A, B, or C 0 km/h (d) 0 km/h (d)

Refined Study Speed Zone Inventory	Table Number	Factor						
		100	90	80	70	60	50	40
a: Non-Commercial Driveways/km	C - 3	0	0	0	0	0	0	0
b: Commercial Driveways/km	C - 4	0	0	0	0	0	0	0
c: Average Lane Width (M)	C - 5	0	0	0	0	0	0	0
d: Street Classification	C - 6	0	0	0	0	0	0	0
e: Median Type/Width	C - 7	0	0	0	0	0	0	0
f: Shoulder Type/Width	C - 8	0	0	0	0	0	0	0
g: Parking Activity/Turnover	C - 9	0	0	0	0	0	0	0
h: Restricted Horizontal Curves/km	C - 10	0	0	0	0	0	0	0
i: Topography	C - 10							
j: Pedestrian Activity <12 years old	C - 11	0	0	0	0	0	0	0
k: Pedestrian Activity >12 years old	C - 11	0	0	0	0	0	0	0
l: Sidewalk Setback (M)	C - 11							
m: Accident Rate	C - 12	0	0	0	0	0	0	0
Adjusted Factor	Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Not >1.25 or <0.75)	(E)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adjusted Speeds		100	90	80	70	60	50	40

Adjusted Speed (b x e) = km/h Adjusted Speed (b x e) = xx km/h

Current Speed Limit - 0 km/h Requested Speed Limit - XX km/h

Potential Compliance Rate with Requested Speed Limit - xx %
Current Driver Compliance Rate with Posted Speed Limit - xx %
Potential Driver Compliance Rate with Absolute Minimum Speed Limit - xx %
Potential Driver Compliance Rate with Ideal Speed Limit - 95 %

The absolute minimum speed and ideal speed limits are based on the measured 85th percentile speed.

Absolute Minimum Speed Limit - xx km/h Ideal Speed Limit - xx km/h

**Appendix “W”
Speed Zone Analysis Checklist**

Speed Zone Analysis Checklist

Based on U. S. DOT Policy Pertaining to 85th Percentile Speed
(January 1999)

Measured 85th P'tile Speed (km/h)	Absolute Minimum Speed Limit to be posted (km/h) (1)	Absolute Minimum Speed Limit Rounded to HTA Spec's (km/h)	Ideal Speed Limit to be Posted (km/h) (2)	Ideal Posted Speed Limit Rounded to HTA Spec's (km/h)
40	27	40	35	40
41	28	40	36	40
42	29	40	37	40
43	30	40	38	40
44	31	40	39	40
45	32	40	40	40
46	33	40	41	50
47	34	40	42	50
48	35	40	43	50
49	36	40	44	50
50	37	40	45	50
51	38	40	46	50
52	39	40	47	50
53	40	40	48	50
54	41	50	49	50
55	42	50	50	50
56	43	50	51	60
57	44	50	52	60
58	45	50	53	60
59	46	50	54	60
60	47	50	55	60
61	48	50	56	60
62	49	50	57	60
63	50	50	58	60
64	51	60	59	60
65	52	60	60	60
66	53	60	61	70
67	54	60	62	70
68	55	60	63	70
69	56	60	64	70
70	57	60	65	70
71	58	60	66	70
72	59	60	67	70

Measured 85th P'tile Speed (km/h)	Absolute Minimum Speed Limit to be posted (km/h) (1)	Absolute Minimum Speed Limit Rounded to HTA Spec's (km/h)	Ideal Speed Limit to be Posted (km/h) (2)	Ideal Posted Speed Limit Rounded to HTA Spec's (km/h)
73	60	60	68	70
74	61	70	69	70
75	62	70	70	70
76	63	70	71	80
77	64	70	72	80
78	65	70	73	80
79	66	70	74	80
80	67	70	75	80
81	68	70	76	80
82	69	70	77	80
83	70	70	78	80
84	71	80	79	80
85	72	80	80	80
86	73	80	81	90
87	74	80	82	90
88	75	80	83	90
89	76	80	84	90
90	77	80	85	90
91	78	80	86	90
92	79	80	87	90
93	80	80	88	90
94	81	90	89	90
95	82	90	90	90
96	83	90	91	100
97	84	90	92	100
98	85	90	93	100
99	86	90	94	100
100	87	90	95	100
101	88	90	96	100
102	89	90	97	100
103	90	90	98	100
104	91	100	99	100
105	92	100	100	100

(1) Absolute minimum posted speed limit based on U. S. DOT policy **SHALL NOT** differ by more than 13 km/h less than the 85th percentile speed. (Based on 8 m.p.h. or 12.872 km/h rounded to 13 km/h)

(2) Ideal posted speed limit based on U. S. DOT policy **SHOULD NOT** differ from the 85th percentile speed by more than 5 km/h. Table above indicates a speed limit of 5 km/h less. (Based on 3 m.p.h. or 4.827 km/h rounded to 5 km/h)

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City of Ottawa

Ottawa Speed Zone Policy Update

Recommendations Report

November 30, 2025

Ottawa Speed Zone Policy Update

Recommendations Report

November 30, 2025

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Appendices

Appendix A: Peer Jurisdictional Review Report

Appendix B: Research and Literature Review Report

Appendix C: Risk Assessment

Appendix D: Data Availability

Acronyms and Abbreviations

AADT	Average Annual Daily Traffic
ASE	Automated Speed Enforcement
BIA	Business Improvement Area
CMF	Collision Modification Factor
CRISP	Capital Region Intersection Safety Partnership
EPDO	Equivalent Property-Damage Only
FMI	Fatal and Major Injury
OTM	Ontario Traffic Manual
PDO	Property-Damage Only
RSAP	Road Safety Action Plan
TAZ	Traffic Assessment Zone
VRU	Vulnerable Road User

Executive Summary

The City of Ottawa retained Arcadis to undertake an update of its Speed Zone Policy. The current policy was last updated in 2009, with parts of the policy since superseded by newer policies. Since 2009, there have been significant changes in the field of transportation engineering. Therefore, there is a need to update the Speed Zone Policy to align with industry best practices and the principles of Vision Zero and the Safe Systems Approach.

The study framework was structured into four parts:

1. Conduct research on best practices from other jurisdictions and review relevant literature to inform the study development.
2. Develop three speed limit setting alternatives: Alternative A, B, and C.
3. Assess the operational, safety and cost impacts for each alternative.
4. Identify the preferred alternative and develop an implementation plan.

More details about these steps are provided below.

Best Practice and Literature Review

At the outset of the project, a peer jurisdiction review was undertaken to identify the speed limit setting practices of other similar jurisdictions in Canada and internationally. In total, the speed limit setting practices in 24 jurisdictions were reviewed, including 11 cities/towns in Ontario, four regional municipalities in Ontario, four cities in Canada outside of Ontario, and three international cities. The peer jurisdiction review also included a review of speed limit setting practices utilized in two countries (Sweden and Netherlands) that are generally regarded as leaders in Vision Zero/Safe Systems Approach.

The results of the peer jurisdiction review indicated that Ottawa's existing speed zone policy results in urban speed limits that are generally consistent with the speed limits set in other jurisdictions. In rural areas, however, Ottawa's arterial speed limits tend to be higher than the speed limits set by other jurisdictions, while Ottawa's rural collector and local road speed limits tend to be lower than other jurisdictions. The peer jurisdiction review also identified that most jurisdictions utilized a data-driven approach to identify areas that warrant speed enforcement, whether automated or manual.

A research and literature review was also undertaken, focusing on five general research topics. The key findings are as follows:

- There is an exponential relationship between changes in operating speeds and changes in both collision frequency (collisions per year) and collision severity (whether a collision results in a fatality or injury). In general, the literature suggests that the odds of a fatality increase significantly at speeds above 30 km/h for collision involving pedestrians or cyclists, at speeds above 50 km/h for side impact collisions (i.e., angle or turning movement collisions), and at speeds above 70 km/h for head-on collisions.
- Road geometry can have a significant impact on both safety and operating speeds. Proper road design can minimize the risk of particular types of collisions occurring, while a "self explaining" road environment helps ensure that the design of the road encourages motorists to follow the speed limit.
- Four methodologies for speed limit setting were identified: the engineering approach, the expert system approach, the optimization approach, and the injury minimization or safe systems approach.

- Speed limit changes alone have some impacts on operating speeds and safety, although not as significant as it would if it were combined with road geometry modifications. Generally, a 10 km/h change in the speed limit, results in an average operating speed change of approximately 2.5 km/h.
- A number of speed enforcement measures were identified, including traditional enforcement, automated speed enforcement, aircraft/drone radar speed enforcement, mobile speed enforcement, speed display devices, and setting traffic signals to a rest-on-red mode.

Speed Limit Setting Alternatives

A speed limit setting process is a series of steps or calculations that are undertaken to determine the speed limit that should be implemented on a given road. This process is a core element of the Speed Zone Policy. For this study, the following three speed limit setting alternatives were developed.

Alternative A

Alternative A attempts to strike a balance between improving safety and minimizing travel time impacts. To incorporate safety in the speed limit selection process, a composite risk profile was developed based on historical collision and speed data. Afterwards, for each road classification and city area, the average safety risk was compared to the average travel time impacts of a hypothetical 10 km/h decrease in posted speed limits. Where the safety risk outweighed the travel time impacts, a 10 km/h decrease in posted speed limit relative to the average existing speed limit was proposed. Otherwise, the average of the existing speed limits was recommended instead.

The speed limit setting process for this alternative uses a speed limit selection matrix to select which speed limit should be implemented on a given road based on its road classification and Transect. The resulting speed limit selection matrix is shown below.

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	40	40	30	30
Inner Urban	50	40	40	30
Outer Urban	50	40	40	30
Suburban	60	50	40	30
Rural Village	60	40	40	30
Rural	70	60	60	30
Greenbelt	70	50	50	30

To utilize the above selection matrix, the road classification should be cross-referenced with the city area to determine the recommended speed limit.

Compared to existing speed limits, Alternative A recommends lower speed limits throughout Rural and Greenbelt Transects, on arterial and collector roads in the Downtown Core Transect, on Inner Urban collector roads, and on arterial and major collector roads in the Outer Urban Transect. For local roads, a 30 km/h speed limit is recommended to align with the Strategic Road Safety Action Plan (RSAP) Update policy.

Alternative B

This speed limit setting process for this alternative is adapted from the 'Right Speed in the City' methodology from Sweden with adjustments implemented to reflect the local context. Four criteria are evaluated to determine the recommended speed limit:

- **Road Character:** This criterion measures the desired degree of mobility for active transportation users. The five categories considered in this criterion are: **High Access Streets** such as local residential streets and streets in areas such as the ByWard Market and Lansdowne, **Moderate Access Streets** which include most major collector and collector roads, **Low Access Streets** such as arterial roads where interactions with vulnerable road users (VRUs) are limited to controlled crossings, **Minimal Access Streets** such as rural roads where the density of adjacent land uses is low and few VRUs are present, and **No Access Streets** such as highways and expressways where access to adjacent land uses is prohibited. In high access environments low vehicle speeds are desirable for vulnerable road user (VRU, i.e., pedestrian and cyclist) safety, while in low access environments higher vehicle speeds are permissible.
- **Road Classification:** This criterion was called 'Accessibility, Car Traffic' in the 'Right Speed in the City' methodology but has been renamed to match typical Canadian terminology. This criterion measures the desired degree of mobility for general and commercial traffic based on the Official Plan road classification: **Arterial, Major Collector, Collector**, and **Local**. In higher road classifications (e.g., arterial and major collector) higher vehicle speeds are desirable, while in lower road classifications (e.g., collector and local) there is less emphasis on mobility and therefore lower vehicle speeds are permissible.
- **Transit Service:** This criterion was called 'Accessibility, Public Transportation' in the 'Right Speed in the City' methodology but has also been renamed to better fit the Canadian context. This criterion measures the desired degree of mobility for transit services based on the highest-order transit service operating on a given street. The three categories considered in this criterion are: **Frequent** which includes transit routes that operate with 15-minute headways during peak hours, **Local** which includes transit routes that operate with headways greater than 15 minutes during peak hours, and **None** for streets with no transit service. Higher speeds are desirable for corridors utilized by higher-order transit service (e.g., frequent and connexion services) to reduce transit travel times, while lower speeds are permissible for lower-order transit service (e.g., local service).
- **Traffic Safety:** This criterion measures the maximum safe speed limit for a road based on the types of collisions that may occur. The categories included in this criterion are: **Vulnerable Road User** for roads where the presence of high volumes of pedestrians and cyclists is a safety concern, **Frequent Intersections/Driveways** for roads where the potential for side impact collisions at intersections and full-movement driveways is a safety concern, **Rigid Obstacles** for roads where the frequency of historical collisions with obstacles along the roadside is a safety concern, **No Median** for roads that lack a median and where front impact collisions are a safety concern, and **None** for roads that don't meet any of the above categories. For each of these categories, there is a maximum safe speed limit and speed limits above this value are discouraged.

To identify the recommended speed limit for a road, it is necessary to calculate the score for each speed limit option (i.e., 30, 40, 50, 60, 70 and 80 km/h) in all four criteria. The speed limit with the lowest score is the recommended speed limit for the road. In the case of a tie, the higher speed limit is the recommended speed limit (e.g., if both 40 and 50 km/h tie for the lowest score, 50 km/h is the recommended speed limit as it is higher than 40 km/h).

Further details regarding the four above criteria and the speed limit scoring process are discussed in Section **Error! Reference source not found.**

An automated process was utilized to estimate speed limits on a city-wide basis using the Gold Standard methodology. The following table summarizes the **average estimated** speed limits based on the Gold Standard methodology, although it should be cautioned that these are estimates only and should not be implemented on roads without first undertaking a detailed site-specific evaluation.

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	40	30	30	30
Inner Urban	40	30	30	30
Outer Urban	40-60	30-60	30-60	30
Suburban	40-60	30-60	30-60	30
Rural Village	60	-	40	30
Rural	70	-	70	30-50
Greenbelt	70	70	70	30-50

Note: There are no major collector roads located within the Rural or Rural Village Transects.

Alternative C

This alternative considers maintaining the current speed limit setting processes used in the City of Ottawa. Currently, there are several policies that govern speed limits which would be consolidated into a single unified policy under this alternative.

The existing process for setting speed limits is summarized as follows:

- **Local Roads:** All new local roads are posted at 30 km/h, while existing roads maintain their existing speed limit.
- **Collector Roads:** A variety of factors such as road width, operating speed, presence of sensitive land uses, historical collisions, road grade and sidewalks are considered to determine if a 40 km/h speed limit is warranted. If the warrant is not met, then a 50 km/h speed limit is applied.
- **Arterial and Major Collector Roads:** The observed 85th percentile speed limit is collected, rounded to the nearest multiple of 10, and used to determine the posted speed limit.

Additionally, a 30 km/h speed limit warrant exists which considers three criteria: Roadway and Traffic Environment, Active Transportation Environment, and a Petition. If all three criteria are met, then a 30 km/h speed limit can be posted.

Given that the above speed limit setting process is identical to the existing suite of policies governing speed limits, it is not expected that there would be any significant change in speed limits under this alternative.

The following table summarizes the average existing speed limits currently implemented within the city.

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	50	40	30	30
Inner Urban	50	50	40	30
Outer Urban	60	50	40	40
Suburban	60	50	40	40
Rural Village	60	-	40	40
Rural	80	-	70	40
Greenbelt	80	60	60	40

Note: There are no major collector roads located within the Rural or Rural Village Transects.

Operational, Safety and Cost Impacts

Detailed analysis was completed for all three alternatives to assess the following impacts:

- **Travel time impacts:**
 - Assessed for the general public, City fleet vehicles and OC Transpo.
 - Impacts to the general public were assessed using historical speed and traffic volume data.
 - City fleet and OC Transpo travel time impacts were evaluated using detailed telematics data.
- **Collision reduction potential:**
 - Estimated the expected relative reduction in collision frequency due to speed limit changes under Alternative A and Alternative B.
 - Alternative C served as the baseline for comparison.
 - The analysis utilized historical collision data and well-known collision modifications factors.
- **Implementation Costs:**
 - Costs were estimated for removing, replacing or installing new signage, as well as for traffic signal retiming and speed display board reprogramming under Alternative A and Alternative B.
 - The Ontario Traffic Manual (OTM) Book 5 and 6 was utilized to determine sign placement and frequency requirements.

The travel time, safety and cost impacts analyses assumed a hypothetical scenario for each alternative in which posted speed limits would change in 2026, to allow for a direct comparison of the alternatives. However, in practice, it is understood that the implementation of the updated policy will occur over an extended period.

For consistency, all alternatives were compared relative to Alternative C, which serves as the baseline condition. The table below summarizes the results of the analysis for each alternative relative to Alternative C.

Evaluation Results (Results are Relative to Alternative C)	Alternative A	Alternative B
Increase in average travel time	3.6% per trip	4.0% per trip
Increase in average trip duration (min:sec)	50 seconds per trip	56 seconds per trip
Increase in average City fleet travel time	4 minutes per day	5 minutes per day
Increase in average OC Transpo travel time	13 minutes per day	18 minutes per day
Increase in average OC Transpo trip duration	Up to 2 minutes per trip	Up to 3 minutes per trip
Reduction in fatal and major injury collisions	6% to 15%	6% to 15%
Reduction in all collisions	3% to 7%	3 % to 8%
Cost of implementation	\$19 to \$21 million	\$19 to \$21 million

Overall, Alternative A is expected to have a lower impact on travel times while still delivering significant safety benefits compared to Alternative B. Alternative B, however, is projected to have a higher reduction in total collisions of all severities compared to Alternative A but will have more significant impacts on travel times. The overall implementation costs for both Alternative A and Alternative B are relatively similar, as they would impact a similar number of roads, despite differences in the proposed speed limits.

Preferred Alternative and Final Methodology

Considering the advantages and disadvantages associated with each of the three alternatives, **Alternative B** was recommended by the consultant team for consideration by the City. Alternative B has the following advantages:

- Only slightly higher impact on travel times for the general public, OC Transpo and City fleet compared to Alternative A;
- Substantially reduces the frequency of all collisions when compared to Alternative C, even after factoring in the substantial ongoing safety improvements that are being implemented as part of the RSAP. Furthermore, the reduction in total collisions of all severities is expected to be higher for Alternative B compared to Alternative A;
- A methodology based on best practices in Vision Zero/Safe Systems Approach which has been modified to fit the local Canadian context; and
- Consideration for traffic safety based on-site specific roadway design is explicitly embedded within the methodology.

Following stakeholder consultation and extensive testing by Project Team on 76 road corridors, the Project Team implemented the following changes to the Alternative B methodology:

- **Frequent Intersections/Driveways:** For this category of the Traffic Safety criteria, the Project Team changed the approach for calculating the average intersection/driveway spacing. Instead of considering all intersections and driveways along a road section, the new approach only considers intersections with public or private roads and driveways for significant traffic generators such as commercial and multi-residential developments. Driveways for single residential dwellings (e.g., single-family homes, townhouses) are no longer considered in the calculation of the average intersection/driveway spacing.
- **Rural Arterials:** For the Road Classification criteria, different scores will be used for rural and urban arterials. The rural arterial scores only apply to arterial roads outside the urban and rural village boundaries.
- **Updated Speed Limit Scores:** The speed limit scores for all criteria were modified by the Project Team. The updated scores are summarized in **Table 11-1** to **Table 11-4**.

1 Introduction

The City of Ottawa retained Arcadis to undertake an update of its Speed Zone Policy in accordance with the principles of Vision Zero/Safe Systems Approach. The current Speed Zone Policy was last updated in 2009 and components of the policy have since been superseded by newer policies. Since the original policy was prepared, there have been significant changes in the field of transportation engineering and there is a need to update the policy to align with current best practices. Hence, the scope of this study includes evaluating three speed zone policy options and identifying the recommended alternative.

The Speed Zone Policy is one element of the City's multidisciplinary approach to speed management. The City's approach includes policies and procedures, design changes to existing roads and intersections, operational changes such as signals and signage, enforcement and public education campaigns.

This report is structured as follows:

- 1. Introduction:** This section summarizes the purpose of the report and provides an overview of the report's structure.
- 2. Peer Jurisdiction Review:** This section summarizes the key findings of a review of speed zone policies in other jurisdictions and internationally, highlighting best practices and benchmarks that could be relevant to Ottawa.
- 3. Research and Literature Review:** This section outlines the findings of the latest research on the relationships between speed and safety, as well as best practices of setting speed limits.
- 4. Risk Profiles:** Historical collision data, traffic data, and speed data were combined to establish risk profiles for city roads. The risk profile identifies which roadways experienced a high rate of collisions or are likely to experience a high rate of collisions in the future due to current high operating speeds. This information informed the development of one of the speed limit setting alternatives and will support the development of the detailed implementation plan (by others).
- 5. Speed Limit Setting Alternatives:** In this section, three alternative approaches to setting speed limits were explored. For each alternative, the process utilized to set speed limits on city roads was summarized and examples were provided illustrating the application of these processes.
- 6. Operational Impacts:** The travel time impacts of the three speed limit setting alternatives on the general public were estimated using historical speed and volume data. Additionally, telematics data was analyzed to determine the anticipated impact to city fleet vehicles and OC Transpo buses.
- 7. Safety Impacts:** Using the well-known power model that relates the average operating speed of the road to collision severity and frequency, the anticipated increase/decrease in collisions associated with the three speed limit setting alternatives was estimated.
- 8. Implementation Cost Estimate:** The cost of replacing speed limit signage and updating signal timings as a result of the speed limit changes proposed for each alternative was estimated.
- 9. Evaluation of Options:** Based on the results of the operational and safety impact analysis and the results of the cost estimates, the recommended speed limit setting alternative was identified.
- 10. Stakeholder Consultation:** The key findings from the stakeholder consultation were summarized and their impacts on the speed limit setting alternatives were discussed.
- 11. Implementation Plan:** An implementation plan was developed to guide the review and replacement of speed limit signage throughout the City with the goal of ensuring a reasonable distribution of work per year while prioritizing high-risk areas that warrant speed limit reductions first. The implementation plan also identifies supporting strategies that should be implemented to compliment the changes in speed limits.

2 Peer Jurisdiction Review

A peer jurisdiction review was undertaken to identify the speed limit setting practices utilized in other cities in Ontario, as well as in other cities in Canada outside of Ontario and internationally. The review included:

- Eleven cities/towns in Ontario;
- Four regional municipalities in Ontario;
- Four cities in Canada outside of Ontario;
- Three cities outside of Canada; and
- The best practices from two other countries generally regarded as leaders in Vision Zero and the Safe Systems Approach.

Additionally, the existing speed zone policies utilized in the City of Ottawa were also reviewed.

Many of the peer jurisdictions reviewed have updated their speed zone policies relatively recently to align with the principles of Vision Zero and the Safe Systems Approach, although a small number of peer jurisdictions have not adopted these principles into their speed zone policies. The peer jurisdiction review found that the following average speed limits are commonly used by peer jurisdictions that have adopted these principles into their speed zone policy:

- **Arterial Roads:** 50 km/h in urban areas and 70 km/h in rural areas
- **Major Collector Roads:** 40-50 km/h in urban areas and 60 km/h in rural areas
- **Collector Roads:** 40-50 km/h in urban areas and 60 km/h in rural areas
- **Local Roads:** 30-40 km/h in urban areas and 40-50 km/h in rural areas
- **School Zones:** 40-50 km/h on arterials and 30-40 km/h otherwise

The above are averages and there is significant variation in the speed limits adopted by different jurisdictions, particularly for rural roads. Further details on the specific speed limits adopted by each peer jurisdiction is provided in the Peer Jurisdiction report.

The existing City of Ottawa speed zone policy generally recommends speed limits in urban areas that are consistent with the above speed limits. In rural areas, however, the existing policy recommends speed limits on arterial roads that are higher than the average of the peer jurisdictions (up to 80 km/h compared to 70 km/h) and lower speed limits on collector and local roads (30 to 40 km/h compared to 40 to 60 km/h).

The peer jurisdiction review did not identify a consistent approach to setting speed limits. The types of approaches identified could generally be classified as one of the following:

- Computation methodologies which use roadway and traffic features to calculate the recommended speed limit.
- Methodologies based on observed driver behaviour such as 85th percentile speeds to set speed limits.
- Default speed limits based on roadway classification.

Each approach has its own strengths and weaknesses. Some approaches are simple to implement but give no consideration to geometric factors that can influence the likelihood of different collision types, while other approaches require more effort to identify the recommended speed limit.

Ottawa Speed Zone Policy Update Recommendations Report

For speed limit enforcement, the peer jurisdiction review found that the majority of peer jurisdictions utilized a data-driven approach to identify locations that warrant targeted enforcement. Arterial roads are often prioritized given the high speeds and volumes on those roadways. A similar data-driven approach is also typically used to identify locations that warrant automated speed enforcement.

The full Peer Jurisdictional Review report is provided in **Appendix A**.

3 Research and Literature Review

Five research topics were researched as part of the literature review to answer the following questions:

1. What is the relationship between safety and vehicle operating speeds?
2. How does roadway geometry impact operating speeds and safety?
3. What are potential methodologies for setting speed limits?
4. How does reducing speed limits impact travel times, safety, and operating speeds?
5. How do different types of speed enforcement impact operating speeds?

Based on the literature reviewed, it is evident that there is a direct and exponential relationship between changes in operating speeds and changes in collision frequency and collision severity. The literature review also identified that the likelihood of a fatality substantially increases at vehicle speeds above 30 km/h in pedestrian collisions, 50 km/h in side impact collisions, and 70 km/h in front impact collisions. As such, higher vehicle speeds increase both the likelihood of collision occurrence as well as collision severity.

Differences in roadway geometry can have various effects on safety and speeds. The literature suggests that there are no (or minimal) negative safety impacts associated with narrow lane widths. Additionally, non-traversable medians substantially reduce collision frequencies while higher driveway densities are correlated with higher collision frequencies. Counter-intuitively, the relationship between pedestrian collision frequency and pedestrian volumes is not linear and the risk that a given pedestrian is involved in a collision decreases as pedestrian volumes increase¹. The speed at which a motorist chooses to drive is also influenced by the road design with road designs that give motorists the impression that they have less space and room for error resulting in lower speeds. This can be achieved through the use of narrow lane widths, street furniture, and trees to create what has been called a “self-explaining” road.

The literature review identified four additional computational methods for setting speed limits: the engineering approach, the expert system approach, the optimization approach, and the injury minimization or safe systems approach.

In the absence of geometric modifications, reducing speed limits is found to have some impact on travel times, speeds and safety, although not as significant as it would if paired with geometric changes. Over the short-term, the literature suggests that a 10 km/h speed limit decrease would increase travel times by approximately 5% but over time this increase would reduce to 1% due to behavioural adaptation (e.g., due to drivers changing travel routes, switching to alternative travel modes and changing the number of trips taken per day). The literature also suggests that speed limit changes alone have been associated with reduced collision frequencies, even though roadway geometry remained the same. The relationship between reducing speed limits and operating speed reductions is not a one-to-one relationship. Rather, the literature suggests that when speed limits are reduced but roadway geometry remains unchanged, the change in operating speeds is equal to only 25% of the speed limit reduction (i.e., a 10 km/h speed limit reduction reduces operating speeds by only 2.5 km/h).

Finally, in terms of speed limit enforcement methodologies, a number of alternative approaches were identified, including traditional enforcement, automated speed enforcement, aircraft/drone radar speed enforcement, mobile speed enforcement, speed display devices, and setting traffic signals to rest-on-red mode.

The full Research and Literature Review report is provided in **Appendix B**.

¹ Jacobsen, P. L., 2003. Safety in numbers: More walkers and bicyclist, safer walking and bicycling.

4 Risk Profiles

The risk profile identifies which streets in the city are at higher risk of speed-related collisions based on historical collision records and observed/projected operating speeds. The risk profile served two purposes:

- The risk profile was utilized in the development of one of the speed limit setting alternatives with the objective of balancing safety improvements against travel time impacts.
- The risk profile is intended to be utilized to determine which roads should be prioritized for speed limit changes and will support the development of the detailed implementation plan (by others).

Consistent with best practices, the collision risk for road segments was calculated using the combination of a reactive and proactive approach. An approach is considered reactive if it is based solely on historical collision data because treatments are only implemented after collisions have occurred (i.e., as a reaction to past collisions). In contrast, a proactive approach estimates the risk of collisions based on the potential for a collision to occur based on the characteristics of the location (e.g., speeding), regardless of whether any collisions have occurred in the past. Combining a reactive and proactive approach provides a quantitative method to balance past safety performance with potential future safety risk.

The risk profile was developed based on the following:

- **Collision Risk** was calculated based on historical fatal and injury collision data (2012-2021) for collision types in which the severity increases as operating speeds increase. This is the reactive risk evaluation approach.
- **Speed Risk** is the proactive risk evaluation approach and is based on the level of speeding observed or projected along road segments. As information on roadway design speed was not available, speeding was measured relative to the existing posted speed limit of the road.

The following subsections describe the analysis that supports the development of the composite risk profile:

1. **Collision Risk** describes the evaluation of the historical collision records, including identifying which collision types experience an increase in severity as operating speeds increase, assessing collision risk for road segments, and assessing collision risk for intersections.
2. **Speed Risk** describes the evaluation of the level of speeding throughout the city and includes a description of the development of the operating speed model.
3. **Composite Risk Profile** combines reactive and proactive approaches to estimating risk and reflects the local Ottawa context.
4. **Analysis Limitations** provides a summary of the gaps in the data utilized in the analysis.

The analyses undertaken to establish the risk profiles was completed using a combination of Microsoft Excel and QGIS.

4.1 Collision Risk

The collision risk component of the risk profile is the reactive approach to measuring risk and highlights roadway segments which have experienced a high rate of fatal and injury collisions in the past. This section of the report describes the collision risk assessment and is subdivided into the following subsections:

1. **Operating Speed and Collision Severity** provides an overview of the relationship between observed operating speeds and collision severity for different collision types. The collision risk only considers the types

of collisions that experience an increase in severity when operating speeds increase to ensure that mitigation measures target the road segments that would experience the greatest benefit from speed limit reductions.

2. **Societal Costs of Collisions** outlines the costs and weights assigned to different collision severities. This allows collisions of different severities to be combined into a single number while providing additional weight for more severe collisions such as those that result in a fatality or injury.
3. **Collision Risk Assessment** provides an overview of the methodology and assumptions used to calculate the collision risk of all roadway segments and intersections.

4.1.1 Operating Speed and Collision Severity

To ensure that the collision risk highlights roadway segments that would most benefit from speed limit reductions, it is important that only the types of collisions (e.g., angle, turning movement, etc.) that experience an increase in severity when operating speeds increase be considered in the collision risk assessment. To identify these collision types, the relationship between 85th percentile operating speeds and collision severity for different types of collisions was evaluated using historical City of Ottawa data.

Collision severity indicates the maximum level of injury that occurred at the time of the collision or within a defined time period following the collision. Collision severity is categorized as follows:

- **Fatal Collision:** A collision in which one of the individuals involved in the collision was killed by injuries sustained in the collision, either at the scene of the collision or within a defined time period following the collision (typically 30 days).
- **Injury Collision:** A collision in which one or more individuals sustained a physical injury in the course of the collision. Injury collisions can be further subdivided into three severity groups:
 - **Major Injury Collision:** One or more individuals were admitted to the hospital for medical care.
 - **Minor Injury Collision:** One or more individuals required medical care but did not require hospitalization.
 - **Minimal Injury Collisions:** One or more individuals were injured (e.g., minor abrasions or bruises) but no medical attention was required.
- **Property Damage Only (PDO):** A collision in which property damage occurred and did not result in any fatalities or injuries.

The City of Ottawa provided collision data for the period of 2012 to 2021, inclusively, and provided speed study results for the period of 2019 to 2024, inclusively. The collision data included the entirety of the city while the speed study results included a total of 2,303 individual roadway segments (approximately 9% of all road segments).

In accordance with the principles of Vision Zero/Safe Systems Approach, the focus of the analysis was on fatal and injury collisions. Under the Vision Zero/Safe Systems Approach framework, the goal is to reduce or eliminate collisions that result in human harm while recognizing that humans make mistakes and so the transportation system must be engineered to be forgiving to human error. As such, property-damage only (PDO) collisions are considered inevitable and of low priority to address.

Figure 4-1 illustrates the percentage of collisions that resulted in injury or death relative to operating speeds (i.e., 85th percentile operating speed).

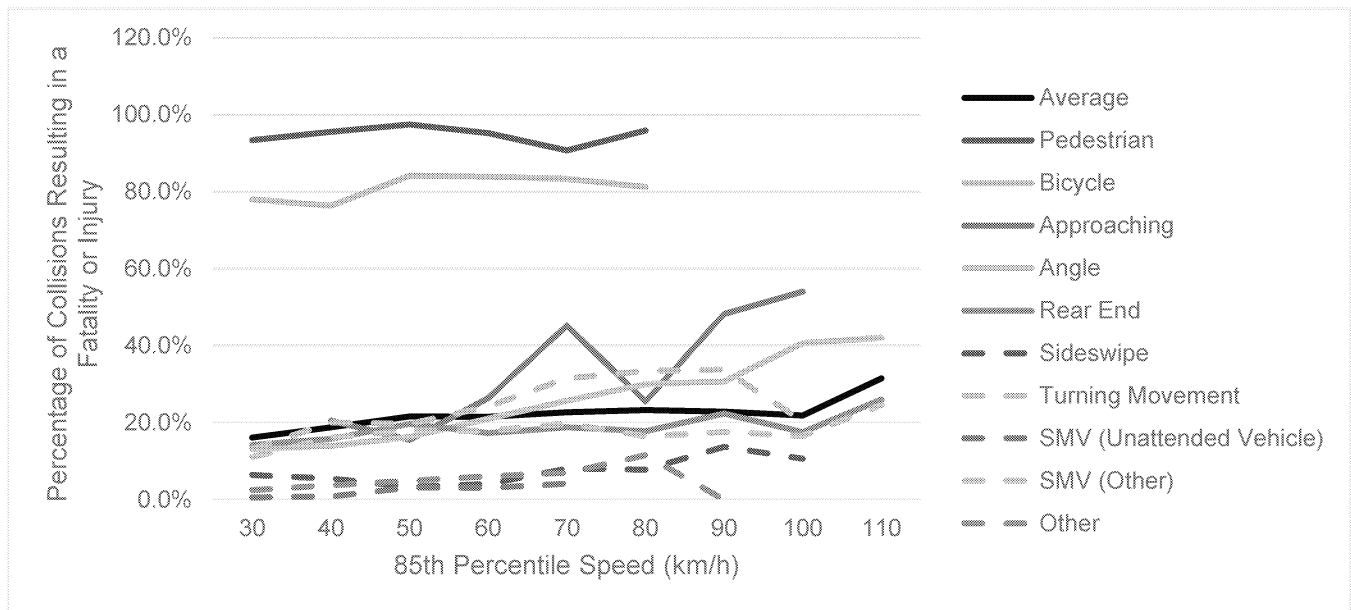


Figure 4-1 Relationship Between Probability of Injury or Death in a Collision and Operating Speed of Road

In general, the types of collisions that are most influenced by the operating speed of the road are collisions involving pedestrians and cyclists, as well as approaching (i.e., head on) collisions, angle collisions, and turning movement collisions. These findings generally align with the findings from the literature review (Section 3). All other collision types tend to be of relatively low severity (i.e., low percentage of fatal or injury collisions) and increases in the operating speed of the road doesn't tend to have a significant impact on the severity of these collisions.

Figure 4-2 to Figure 4-6 provide additional detail regarding the degree of severity for the five collision types noted above relative to the 85th percentile operating speed of the roadway. In these figures, collision severity was subdivided into minimal injury, minor injury, major injury and fatal injury.

Figure 4-2 illustrates the relationship between pedestrian collision severity and the 85th percentile speed of the road. Property damage only collisions are not included in this figure.

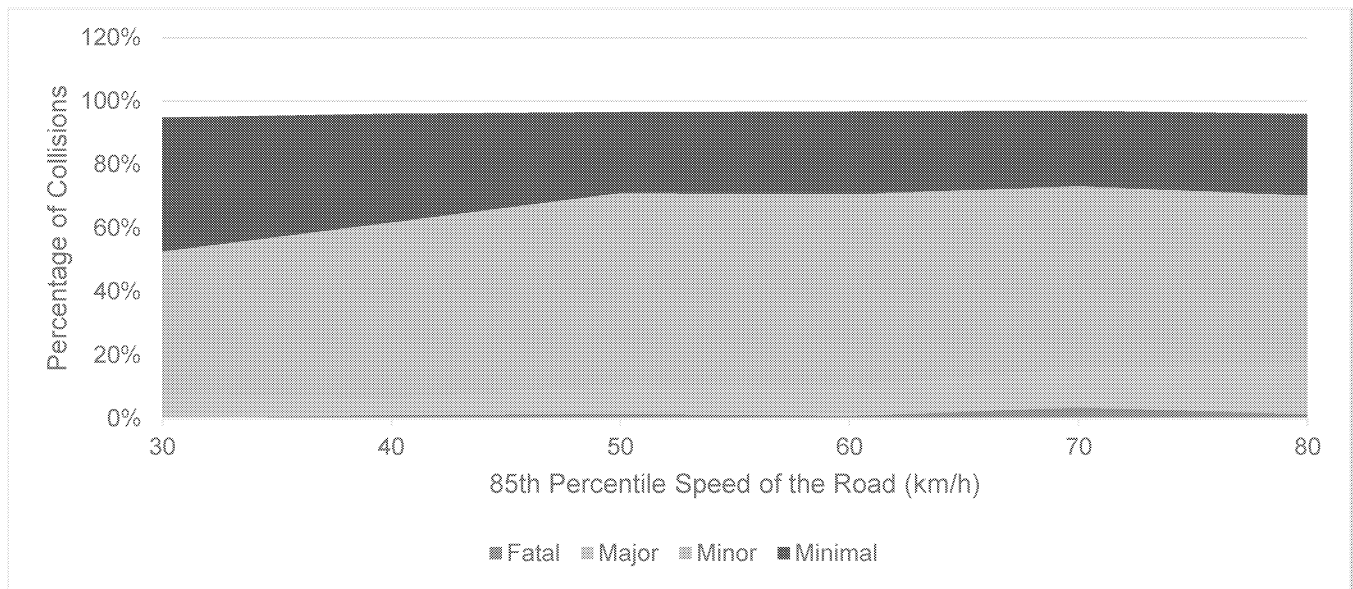


Figure 4-2 Relationship Between Pedestrian Collision Severity and Operating Speed

Collisions involving pedestrians tend to result in some level of injury regardless of operating speed. As operating speeds on roads increase, however, the severity of pedestrian collisions tends to increase slightly with more fatal and major injury collisions occurring on average.

Figure 4-3 illustrates the relationship between bicycle collision severity and the 85th percentile speed of the road. Property damage only collisions are not included in this figure.

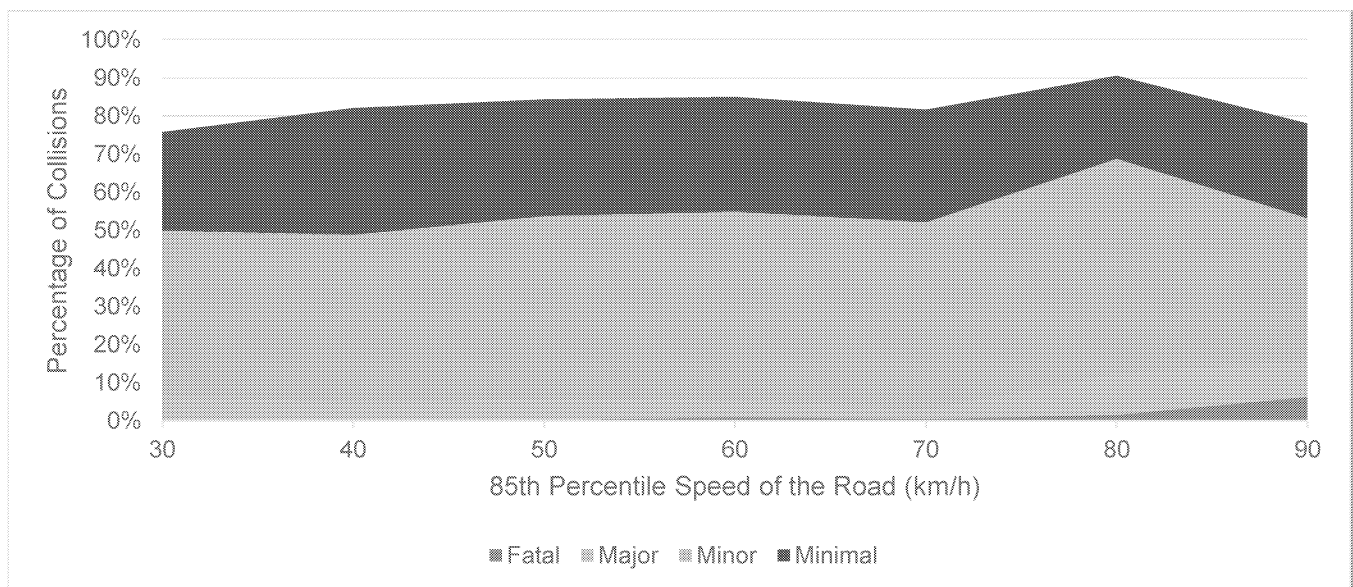


Figure 4-3 Relationship Between Bicycle Collision Severity and Operating Speed

As observed for pedestrian collisions, collisions with bicycles often result in injury regardless of operating speed with the degree of injury increasing slightly as vehicle operating speeds increase. The small bump at 80 km/h is

likely simply due to natural variation in the collision data and the smaller number of bicycle collisions recorded on roads with 85th percentile operating speeds that are that high.

Figure 4-4 illustrates the relationship between approaching collision severity and the 85th percentile speed of the road.

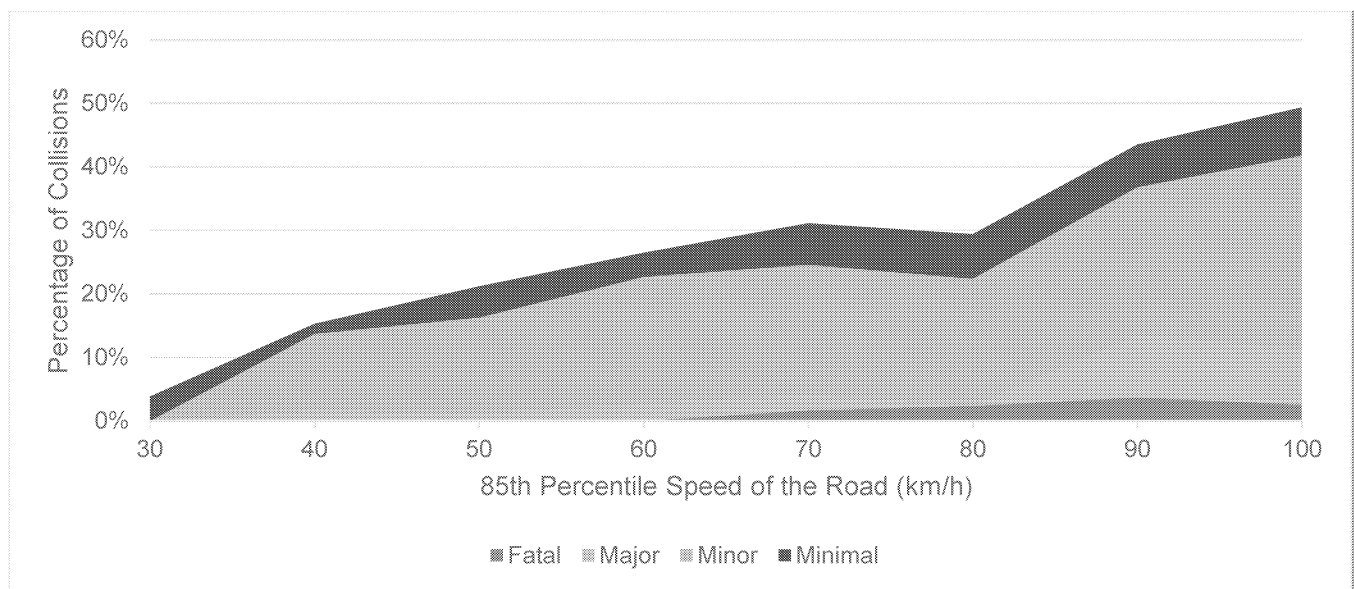


Figure 4-4 Relationship Between Approaching Collision Severity and Operating Speed

Approaching collisions are particularly sensitive to speed, with the proportion of these collisions that are injury or fatal collisions increasing from a low of approximately 5% at 85th percentile operating speeds of 30 km/h to a high of approximately 50% at 85th percentile operating speeds of 100 km/h.

Figure 4-5 illustrates the relationship between angle collision severity and the 85th percentile speed of the road.

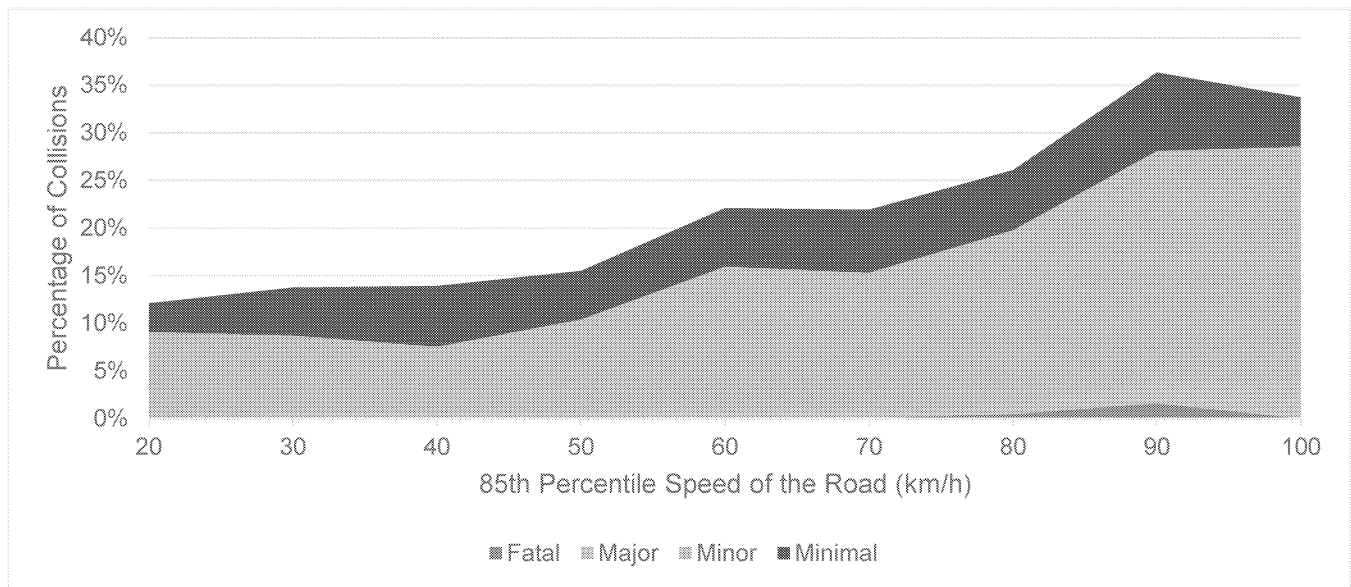


Figure 4-5 Relationship Between Angle Collision Severity and Operating Speed

Angle collisions are also sensitive to speed. At 85th percentile operating speeds of approximately 30 km/h only approximately 15% of angle collisions are injury or fatal collisions but at 85th percentile operating speeds of 100 km/h this increases to approximately 35% of collisions.

Figure 4-6 illustrates the relationship between turning movement collision severity and the 85th percentile speed of the road.



Figure 4-6 Relationship Between Turning Movement Collision Severity and Operating Speed

Of the five collision types noted, turning movement collisions are the least sensitive to the 85th percentile operating speeds of the road. Based on the historical collision data, the average severity of turning movement

collisions tend to increase from approximately 8% at 30 km/h to 30% at 80 km/h. The slight decrease in severity at 100 km/h is likely due to natural variability in the collision data and the smaller number of turning movement collisions recorded on roads with 85th percentile operating speeds that high.

Based on the findings of this evaluation of operating speeds and collision severity, it was determined that five collision types are most sensitive to operating speeds: approaching (head-on), angle, turning movement, pedestrian and bicycle collisions. These collision types were therefore included in the collision risk assessment.

4.1.2 Societal Costs of Collisions

In order to compare the relative collision risk of one location to another, it is necessary for the collision risk to be quantified by a single value. For this study, fatal and injury collisions were converted into equivalent property damage only (EPDO) collisions based on the societal costs of collisions.

The societal costs of collisions used in this report were obtained from the Collision Cost Study Update report by de Leur Consulting Ltd. which was prepared for the Capital Region Intersection Safety Partnership (CRISP). Although the CRISP report was prepared to provide collision costs for the Edmonton area, it is expected that these cost estimates are applicable to the Ottawa context for the following reasons:

- Some of the assumptions utilized to calculate those costs are based on Canada-wide or Ontario-wide data, rather than based on Alberta-specific data, and would therefore be equally applicable to the Ottawa context. This includes many of the assumptions underlying the property damage costs, emergency response costs and legal costs.
- Average incomes in Ottawa are relatively similar to average incomes in Alberta (~3% difference)². As such, travel delay costs, lost productivity costs and human capital costs should be relatively similar between the two regions.
- Per capita healthcare spending in Alberta is slightly higher than healthcare spending in Ontario (~8% difference)³, however, healthcare spending only makes up a small percentage of the total cost per collision (~4% for fatal collisions) and therefore this difference won't have a significant impact.

Table 4-1 summarizes the costs per collisions and associated EPDO weights utilized in this study. The costs per collisions include both direct costs (e.g., property damage, emergency services, etc.) and human capital costs (i.e., lost income) associated with collisions.

Table 4-1 Societal Costs of Collisions

Unit of Measurement	Fatal Injury	Non-Fatal Injury	PDO
Cost per collision	\$2,450,139.00	\$137,749.00	\$14,065.00
EPDO weight	174.20	9.79	1.00

The above EPDO weights were utilized in the collision risk assessment.

² <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110023901>

³ <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1010002401> and <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501>

4.1.3 Collision Risk Assessment

Collision risk was measured using collision rate. Collision rate normalizes the collision frequency by two-way traffic volume and segment length for midblock segments, or by entering traffic volume for intersections. This allows the collision history of two roads (or two intersections) of different length and traffic volume to be compared to one another.

As discussed in Section 4.1.2, it is also important to apply a weighting factor to collisions to reflect the resulting collision severity as the Vision Zero/Safe Systems approach prioritizes preventing fatal and injury collisions over non-injury collisions. As such, the first step in the collision risk assessment was to review the historical collision records, determine the highest severity level that occurred for each collision, and apply the corresponding EPDO weight factor from **Table 4-1**. Property damage only (PDO) collisions were excluded from the collision analysis.

The next step was to review the traffic volume data for every road segment and intersection. The traffic volume data provided by the City covered approximately 24% of road segments. Traffic volumes for the remaining 76% of road segments were calculated as follows:

- A given road is typically composed of multiple segments, where a segment is defined as a portion of a road which extends between two intersections. If a given road had one or more segments with observed traffic volumes, it was assumed that the traffic volumes on the segments without observed traffic volumes would equal the average of the observed volumes on other segments. Using this assumption, traffic volumes on 28% of road segments were calculated.
- For the remaining 48% of road segments, the average annual daily traffic (AADT) volumes from **Table 4-2** were utilized. The values in this table are the average of observed volumes, subdivided by Transect and road classification.

Table 4-2 AADT by Transect and Road Classification

Road Classification	Down-town Core	Inner Urban	Outer Urban	Suburban	Rural Village	Rural	Greenbelt
Arterial	12,587	18,187	22,855	16,367	6,316	4,578	16,597
Major Collector	7,794	7,348	9,321	6,054	1,298	875	6,773
Collector	4,347	3,490	3,960	2,786	1,298	875	3,595
Local	1,692	1,766	1,285	1,037	456	270	1,413

The availability of traffic volume data by road classification and Transect is summarized in **Appendix D**. The AADT volumes for approximately 91% to 97% of arterial, major collector and collector road segments are based on directly observed volumes or the average volumes observed on that road. Only 3% to 9% of AADT volumes are based on the values from **Table 4-2**. In contrast, traffic volumes for approximately 68% of local road segments is based on values from **Table 4-2**.

With the weighting factors applied to the collision data and traffic volume estimates available for all road segments, collision rates for every location in the city can be calculated. Collision rates for all five collision types identified in Section 4.1.1 (approaching, angle, turning movement, pedestrian and bicycle) were calculated for every road segment/intersection, one collision rate for each collision type. The collision rates were calculated using the formulas in **Table 4-3**.

Table 4-3 Collision Rate Formulas

Road Segments	Intersections
$\text{Collision Rate} = \frac{\text{Number of EPDO Collisions}}{\text{AADT} * \text{Length}}$	$\text{Collision Rate} = \frac{\text{Number of EPDO Collisions}}{\text{AADT}}$
<p>Where:</p> <p>Number of EPDO Collisions = The number of EPDO collisions that have been recorded along the road segment</p> <p>AADT = The observed or estimated AADT for the road segment</p> <p>Length = The length of the road segment in kilometres</p>	<p>Where:</p> <p>Number of EPDO Collisions = The number of EPDO collisions that have been recorded at the intersection</p> <p>AADT = The observed or estimated AADT for the intersection</p>

To combine the collision risk and speed risk (discussed in Section 4.2) into a composite risk profile, it was necessary to convert both the collision rates and the speed risk into a common unit. For the purposes of this study, collision rates and speed risk were normalized into a unitless number that ranges from 0 to 1, with 0 indicating no risk and 1 indicating the highest risk. Typically, normalization is completed by dividing all values in a group by the maximum value in the group, however, due to the presence of outliers, the normalization for this study utilized the 99.9th percentile value in the group instead. For values above the 99.9th percentile value, the normalized value was automatically set to 1.

For each of the five collision types, the collision rates calculated previously were normalized using the 99.9th percentile rate. These five normalized collision rates were then summed together for each road segment and for each intersection (i.e., separately).

The final step in the collision risk assessment was to combine the road segment and intersection collision risks together. For each road segment, the intersection collision risk for the two intersections on either end of the segment were averaged and added to the road segment collision risk.

The resulting collision risk is illustrated in **Figure 4-7**. The collision risk identifies which road segments have experienced a high rate of collisions in the past. Additional maps illustrating collision risk by Transect as well as a flow chart describing in more detail the process used to develop the collision risk is provided in **Appendix C**.

Collision Risk: City-Wide



0 7.5 15 km

Data sources: Road names and classification, AADT volumes, segment lengths, and collision records provided by the City of Ottawa on 2024-05-13. Collision costs by severity was obtained from The Collision Cost Study Update (CRISP, 2018). Transect boundaries based on Official Plan Schedule A.
Note 1: Streets in grey are outside City jurisdiction.

Legend

- 0 - 0.25
- 0.25 - 0.5
- - - - 0.5 - 0.75
- 0.75 - 1

Printed on: 2025-03-20

Figure 4-7 Collision Risk: City-Wide

4.2 Speed Risk

The proactive approach of assessing risk is the speed risk. The speed risk was measured based on the level of speeding observed or estimated on every road segment. For the purposes of this study, speeding was measured as the difference between the observed or estimated 85th percentile operating speed and the posted speed limit. If the observed or estimated 85th percentile operating speed on a road segment was below the speed limit, then no speeding was considered to be occurring. The posted speed limit was utilized in lieu of the design speed of the road as information on road design speed is not readily available.

Non-compliance with the posted speed limit is generally considered to be a safety risk, therefore comparing existing operating speeds to the existing posted speed limit can be used to identify areas of high speeding risk. Furthermore, it is well established that most drivers adjust their operating speeds based on the surrounding road environment (e.g., lane width, adjacent land uses, etc.) therefore this approach of using speeding to measure risk accounts for roadway design.

The reason why this approach to measuring risk can be considered proactive is that it does not rely on past collision history to assess risk. As such, road segments that have not experienced collisions in the past but have the potential to experience speed-related collisions in the future can be identified as high-risk locations based to the level of speeding observed.

This section of the report describes the speed risk assessment and is subdivided into the following subsections:

1. **Operating Speeds** provides an overview of the estimation of existing 85th percentile operating speeds throughout the city.
2. **Speed Risk Assessment** describes the methodology used to calculate the speed risk and the resulting speed risk profiles.

4.2.1 Operating Speeds

Operating speed data was provided for approximately 9% of roadway segments. For the remaining 91% of road segments, 85th percentile operating speeds were estimated as follows:

- If a given road had one or more segments with observed 85th percentile operating speeds, it was assumed that the 85th percentile operating speeds on the segments without observed 85th percentile operating speeds would equal the average of the 85th percentile operating speeds observed on the other segments. To confirm that the average of the 85th percentile operating speeds was appropriate, the average was only used if the segments with observed operating speeds were for the same road, with the same road classification, in the same Transect and had the same speed limit. Using this assumption, 85th percentile operating speeds on 27% of road segments were calculated.
- For the remaining 64% of road segments, a multiple regression model was developed using the observed operating speed data. The model can predict 85th percentile operating speeds based on four variables: Transect, road classification, speed limit, and segment length. Several other variables were considered (e.g., presence of median, sidewalks, etc.), however, these variables were not found to be statistically significant. The development of the 85th percentile speed model is described in more detail in Section 4.2.1.1.

The availability of operating speed data by road classification and Transect is summarized in **Appendix D**.

4.2.1.1 85th Percentile Operating Speed Model

The 85th percentile operating speed model is a multiple regression model of the following form:

$$y_i = \alpha + \sum_j^n \beta_j * x_{ij}$$

Where:

- y = Projected 85th percentile operating speed
- α = Intercept
- β = Variable coefficient
- x = Independent variable
- i = i-th road segment
- j = j-th independent variable
- n = number of independent variables

In order to calculate the intercept and variable coefficients for the model, the operating speed data provided by the City was subdivided into two groups: a training dataset and a validation dataset. The training dataset was used to calculate the intercept and variable coefficients, while the validation dataset was used to confirm that the model returned reasonable results. Each data point was randomly assigned to either the training or validation datasets, with 90% of data points assigned to the training dataset. The number of data points by road classification and Transect for both the training and validation datasets is summarized in **Appendix D**.

The intercept and variable coefficients were calculated using the training dataset to develop the following model:

$$y = 24.269 - 2.928 \times C + 1.553 \times A + 0.008 \times L + 0.627 \times S$$

Where:

- y = projected 85th percentile speed (km/h);
- C = roadway classification (1 = arterial, 2 = major collector, 3 = collector, 4 = local);
- A = Official Plan Transect (1 = Downtown Core, 2 = Inner Urban, 3 = Outer Urban, 4 = Suburban greenbelt, 5 = Rural Village, 6 = Rural and Greenbelt);
- L = segment length (m); and
- S = speed limit (km/h)

The resulting model has a coefficient of determination (i.e., R²) of 0.79 (based on the training dataset), which indicates that 79% of the variability in 85th percentile operating speeds is explained by the variation in independent variables included in the model (i.e., Transect, road classification, speed limit, and segment length).

To ensure that the model wasn't overfitted to the training dataset, the model was subsequently applied to the validation dataset. **Figure 4-8** compares the projected operating speeds to the observed operating speeds from the validation dataset to demonstrate the degree of fit of the model.

The results of the comparison suggest that the operating speed model provides a reliable estimate of 85th percentile operating speeds.

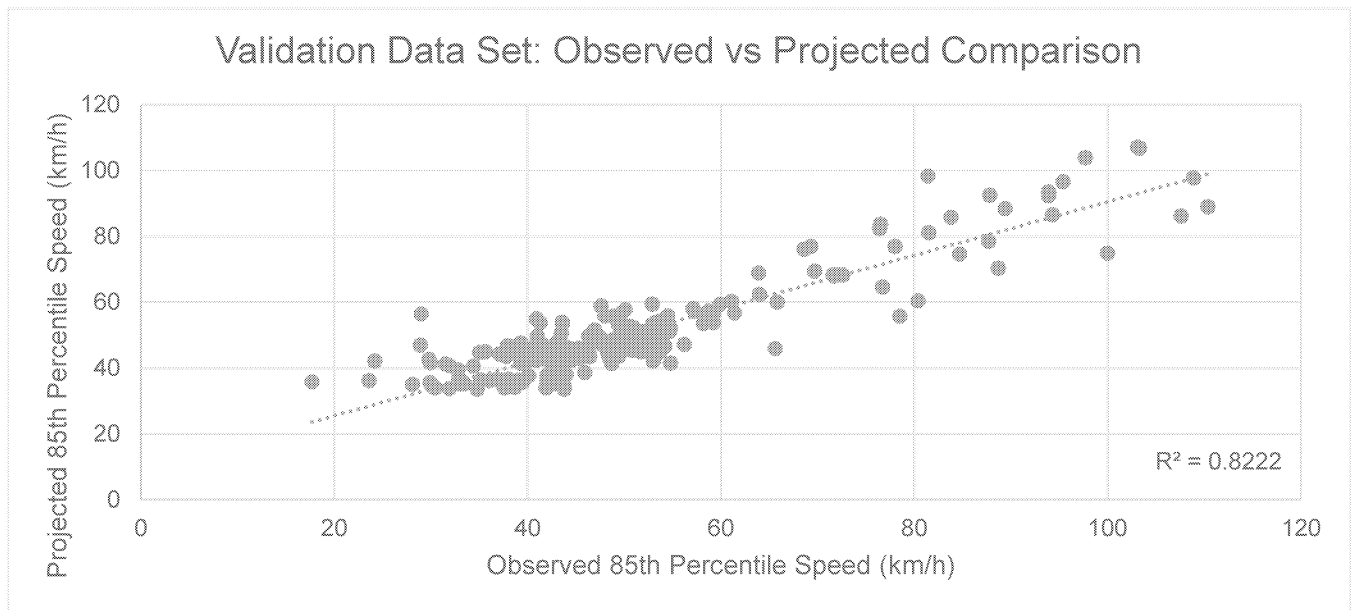


Figure 4-8 Observed and Projected 85th Percentile Speed Comparison

4.2.2 Speed Risk Assessment

The existing observed or estimated operating speeds for each road segment was compared to the existing posted speed limit to assess the level of speeding occurring. For the purposes of this study, speeding was measured as the difference between the 85th percentile operating speed and the posted speed limit. If the 85th percentile speed was less than the posted speed limit then no speeding was considered to be occurring.

As discussed in Section 4.1.3, in order for the collision risk and speed risk to be combined into a composite risk profile, it was necessary to convert both the collision risk and the speeding risk into a common unit. For the purposes of this study, normalization was utilized to convert collision rates and speeding values into a unitless numbers that range from 0 to 1, with 0 indicating no risk and 1 indicating the highest risk. For consistency with the approach utilized for the collision risk, the normalization for this study utilizes the 99.9th percentile speeding amount instead of the maximum speeding amount. For values above the 99.9th percentile value, the normalized value was automatically set to 1.

Road segments were grouped by road classification and Transect and normalized based on the 99.9th percentile value within that group. This accounts for differences in driving behaviour along different road classifications and Transects through the normalization process. **Table 4-4** summarizes the 99.9th percentile speeding value for each group.

Table 4-4 99.9th Percentile Speeding Value by Transect and Road Classification

Road Classification	Down-town Core	Inner Urban	Outer Urban	Suburban	Rural Village	Rural	Greenbelt
Arterial	20.3 km/h	30.4 km/h	26.6 km/h	21.8 km/h	32.1 km/h	45.6 km/h	27.0 km/h
Major Collector	9.6 km/h	22.9 km/h	15.4 km/h	30.3 km/h	-	-	19.7 km/h
Collector	19.1 km/h	20.6 km/h	29.2 km/h	30.4 km/h	32.2 km/h	60.9 km/h	21.6 km/h
Local	22.2 km/h	27.4 km/h	24.0 km/h	20.6 km/h	16.2 km/h	51.5 km/h	33.1 km/h

Note: There are no existing major collector roads in the Rural and Rural Village Transects.

Using the 99.9th percentile speeding values from **Table 4-4**, the speeding risk was calculated for all road segments in the city and the resulting speed risk is illustrated in **Figure 4-9**. Additional maps illustrating speed risk by Transect as well as a flow chart describing in more detail the process used to develop the 85th percentile operating speed model and the speeding analysis is provided in **Appendix C**.

Speed Risk: City-Wide



Figure 4-9 Speed Risk: City-Wide

4.3 Composite Risk Profile

A combined reactive and proactive approach to estimating risk was applied on a city-wide basis. To achieve this balanced approach, the collision and speed risk from **Figure 4-7** and **Figure 4-9** were combined to create a composite risk profile. The composite risk profile was weighted 70% towards the collision risk and 30% towards the speed risk. The rationale for this weighting is twofold:

- The 85th percentile operating speed model was used for nearly 65% of road segments. As described in **Section 4.2.1**, model was developed using four variables and observed speed data. Giving additional weight to the collision risk in the composite risk profile offsets some of the unexplained variation in the operating speed model.
- Traffic volume observations were available for between 91% to 97% of arterial, major collector and collector roads. There is a higher degree of accuracy regarding the collision rates (collisions per vehicle) along these higher order roads.
- Based on engineering judgement, a 70/30 split reflects the relative importance of collision risk (based on recorded collisions) over speed risk (based on observed and estimated speeds) in predicting overall safety. A higher weighting on collision risk prioritizes historical safety performance in the City of Ottawa.

Figure 4-10 illustrates the composite risk profile developed for the city. In general, arterial roads are typically identified as higher risk locations whereas most local roads are lower risk. This is consistent with the literature review findings (**Section 3**) that the likelihood of a fatality substantially increases at vehicle speeds above 30 km/h in pedestrian collisions, 50 km/h in side impact collisions, and 70 km/h in front impact collisions. As such, higher vehicle speeds increase both the likelihood of collision occurrence as well as collision severity.

The Downtown Core, Rural Village and Greenbelt Transects also generally have a number of high-risk locations compared to the Urban, Suburban and Rural Transects. Additional maps illustrating composite risk by Transect is provided in **Appendix C**.

Composite Risk: City-Wide



Figure 4-10 Composite Risk Profile: City Wide

4.4 Summary

Risk profiles were developed to quantify the observed safety performance of road segments and balance that against the potential for future safety risk. Consistent with best practices, the collision risk for road segments was calculated using the combination of a reactive and proactive approach. The reactive approach was based on historical collision records and observed or estimated AADT volumes to identify high risk locations. The proactive approach was based on observed or estimated speeding to identify locations that may experience collisions in the future. In general, arterial roads were identified as higher risk locations, which aligns with research that shows higher vehicle speeds increase both the likelihood of collision occurrence as well as collision severity (**Section 3**).

For the reactive approach, the assessment of recorded collisions focused on the five collision types found to be most sensitive to operating speeds: approaching (head on), angle, turning movement, pedestrian and bicycle collisions. Collision risk was measured using collision rate and focusing on fatal and injury collisions. Collision rates were calculated for all road segments and intersections and then normalized to obtain a collision risk score.

For the proactive approach, the amount of speeding (as measured by the difference between the 85th percentile operating speed and the posted speed limit) was utilized to assess the potential risk of collisions. Where feasible, observed operating speeds were utilized. If observed operating speeds were not available, the custom-built multiple regression model was used to estimate 85th percentile speeds. The magnitude of speeding was identified for all road segments and then normalized to obtain a speed risk score.

The collision and speed risk scores were combined to obtain a composite risk profile. A weight of 70% was assigned to the collision risk, while a weight of 30% was assigned to the speed risk. This reflects the relative importance of collision risk in predicting overall safety. A higher weighting on collision risk prioritizes historical safety performance in the City of Ottawa.

The composite risk profile identified arterial roads as having a higher level of risk compared to other road classifications. The Downtown Core, Rural Village and Greenbelt Transects also generally have a number of high-risk locations compared to the Urban, Suburban and Rural Transects. Additional maps illustrating composite risk by Transect is provided in **Appendix C**. These findings were considered in the development of one of the speed limit setting alternatives and will support the development of the detailed implementation plan (by others).

4.5 Analysis Limitations

Although the analysis utilized the most comprehensive datasets available, there are nonetheless some limitations that should be considered when reviewing the results of the analysis:

- **Collision Data:** It can be expected that collision reporting compliance for higher severity collisions (i.e., fatal and injury) will be nearly 100% as emergency services are often called to the scene. For property damage only collisions, however, it is expected that not all collisions will be reported as required, particularly if damages are small. Similarly, near-miss incidents in which a collision was narrowly avoided are rarely reported. The lack of near-miss incident reports can potentially obscure a problem that is not shown in the collision data. Additionally, decreases in traffic associated with the COVID-19 pandemic in 2020 and 2021 may have altered collision patterns during that time period. This may all contribute to some road segments and intersections being overlooked due to a lack of collision history.

- **Traffic Data:** Data on traffic volumes was only available for 24% of road segments, and could be reliably estimated for an additional 28% of road segments based on traffic volume observations at other locations on the same road. Traffic volumes for remaining 48% of road segments was estimated based on minimal information (Transect and road classification) which reduces the accuracy of the analysis for those road segments. This mostly only impacts local roads, however, as traffic volumes observations were available for the vast majority (91% to 97%) of arterial, major collector and collector roads.
- **Speed Data:** Similar to traffic data, vehicle operating speed data was limited and was only available for 9% of road segments. Operating speeds for an additional 27% of road segments was estimated based on operating speed observations at other locations on the same road, while the remaining 64% of road segments had their operating speeds estimated using an 85th percentile operating speed model. The 85th percentile operating speed model could only explain 79% of the variation in 85th percentile operating speeds, thereby reducing the accuracy of the analysis for those road segments. This again mostly only impacts local roads, however, as operating speed observations were available for the vast majority (50% to 73%) of arterial, major collector and collector roads.
- **Allocation of Intersection Risk:** Attributing intersection collision risk to road segments is imprecise as it is difficult to accurately determine how the operating speeds on each intersection leg contributed to a given collision. The approach utilized in this study to allocate intersection risk to road segments was by necessity simplistic which may result in some road segments being scored higher or lower in risk than they otherwise should.
- **Age of the Data:** The risk analysis completed for this study is based on recent collision, traffic and speed data. Over time, however, changing trends in all three parameters will change the risk profiles of streets. There is therefore a need for ongoing updates to the risk analysis to ensure that it is reflective of the most recent trends.

5 Speed Limit Setting Alternatives

A speed limit setting methodology is a process or series of steps that is used to determine what speed limit should be applied to a given road. The data required for this determination varies depending on the methodology used. Different types of methodology exist, including:

- Computation methods which utilize various roadway and traffic factors to calculate the recommended speed limit.
- Methodologies based on using observed driver behaviour to determine the speed limit. Examples include speed surveys to calculate the average or 85th percentile speed and setting the speed limit accordingly.
- Prescribed speed limits based on basic roadway characteristics (such as road classification) without the need for consideration of other factors such as operating speeds, roadway design, traffic volumes, or collision history.

As part of this study, three speed limit setting alternatives were developed and evaluated:

- **Alternative A:** This alternative attempts to strike a balance between improving safety and minimizing travel time impacts. To develop this option, the typical (average) existing speed limit per road classification was identified for each Transect. Subsequently, an analysis was undertaken to compare the results of the composite risk profile to the potential travel time impacts of reducing speed limits by 10 km/h below the typical existing speed limit. Where the risk of collisions outweighs the travel time impacts, speed limits 10 km/h below the typical existing speed limits were proposed. Where the travel time impacts outweigh the collision risk, it was proposed that the typical existing speed limits be utilized instead. For consistency with recent City policy on local road speed limits, a 30 km/h speed limit was proposed for all local roads regardless of the analysis results.
- **Alternative B:** The Swedish 'Right Speed in the City' methodology identified through the jurisdictional review was used to represent the "Safe Systems Approach" in speed zone policies incorporating Vision Zero and the Safe Systems Approach. For this option, this methodology was adapted to Ottawa's context. As part of this adaptation, quantitative thresholds were introduced to replace the existing qualitative thresholds, where possible.
- **Alternative C:** This option maintains the existing policies that govern speed limits and consolidate them into a single unified policy document for ease of reference. This option assumes that there would be no significant changes in driver behaviour in the future (i.e., operating speeds remain the same as existing).

For all three alternatives, existing safety programs such as the temporary traffic calming program, red light camera program and automated speed enforcement (ASE) program are assumed to continue to be deployed at their current pace and continue yielding the same safety improvements.

Section 5.1 provides a description of the School Zone Policy and how it was applied to all three speed limit setting alternatives. Each of the alternatives is discussed in detail in Sections **Error! Reference source not found.** to REF_Ref192843440 \r \h **Error! Reference source not found.** Additionally, the School Zone Policy has been integrated into assessment of all three speed limit setting alternatives.

5.1 School Zone Policy

The School Zone Policy was previously developed by Arcadis IBI Group in April 2023. Based on this policy, school zones are required on all roadways that meet the following criteria:

- Prevailing posted speed limit of 40 km/h or higher;
- Directly adjacent to an elementary, middle or high school; and
- One or more entrances/exits associated with the school are located along the roadway.

The policy also identifies some situations in which the judgement of a qualified individual can overrule the requirements of the policy.

School zones may only extend 150 m upstream and downstream of the school property. Within school zones, the School Zone Policy requires that the posted speed limit be reduced by between 10 to 20 km/h relative to the prevailing speed limit of the road, as shown in **Table 5-1**. See **Appendix A** for a detailed description of the School Zone Policy.

Table 5-1 School Zone Speed Limits

Prevailing Speed Limit (km/h)	School Zone Speed Limit (km/h)
30	N/A
40	30
50-60	40
70-80	60
90-100	80

As school zone speed limits are based on the prevailing speed limit, school zone speed limits were determined using the following process:

1. The prevailing speed limits were determined based on the processes outlined in Sections 5.2.2, 5.3.2 and 5.4.1. Each speed limit setting alternative uses a different approach for calculating the prevailing speed limit.
2. For each road segment within an existing school zone, the prevailing speed limit was used to calculate the school zone speed limit. As each speed limit setting alternative uses a different approach for calculating the prevailing speed limit, the school zone speed limits were not the same in all three alternatives.

The same process was applied to all three alternatives.

5.2 Alternative A

Alternative A aims to balance safety improvements with travel time impacts. In locations where the safety risk outweighs the potential impacts on travel time, this alternative proposed reducing speed limits. Conversely, in locations where the potential travel time impacts outweigh the safety risk, speed limits were proposed to remain similar to existing speed limits.

The following subsections describe Alternative A:

1. **Alternative Development** summarizes the process utilized to develop Alternative A
2. **Speed Limit Setting Process** describes how speed limits on a given road are set using the process for Alternative A.
3. **Speed Limit Setting Examples** provides examples of setting speed limits on three different roads.

5.2.1 Alternative Development

Alternative A recommends a specific speed limit for all roads based on only two factors: Transect and road classification. For example, this would mean that all arterials within the Suburban Transect would have the same recommended speed limit.

There were three steps undertaken to calculate the recommended speed limits for this alternative which are discussed in the following subsections:

1. **Determine Average Risk**
 - The average risk was determined for each road classification in each Transect of the city, as well as on a city-wide basis to determine which Transects have higher risk, on average.
2. **Assess Travel Time Impacts**
 - Travel time impacts were calculated based on a baseline and a reduced speed limit scenario to determine the potential increase in travel time associated with reducing speed limits. The baseline scenario represents the average of existing speed limits for each road classification in each Transect of the city, while the reduced speed limit scenario considers a 10 km/h reduction in speed limit relative to the baseline scenario.
3. **Compare Risk and Travel Time Impacts**
 - Evaluate the relationship between risk levels and travel time impacts for each road classification in each Transect.
 - Determine whether speed limits should remain at baseline levels or be reduced based on the analysis results.

5.2.1.1 Average Risk

The safety risk was measured based on the composite risk profile developed in **Section 4** and illustrated in **Figure 4-10**. Using this composite risk profile, the average composite risk was calculated for each road classification, subdivided by Transect, as illustrated in **Table 5-2**.

Table 5-2 Average Composite Risk

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	0.20	0.27	0.35	0.18
Inner Urban	0.15	0.17	0.16	0.10
Outer Urban	0.20	0.21	0.12	0.08
Suburban	0.18	0.13	0.12	0.11
Rural Village	0.15	-	0.13	0.18
Rural	0.13	-	0.11	0.09
Greenbelt	0.13	0.19	0.22	0.13
City-Wide Average	0.17	0.16	0.13	0.11

Note: There are no major collector roads located within the Rural or Rural Village Transects.

For each road classification, the average risk per Transect was compared to the city-wide average and the resulting percent difference is summarized in **Table 5-3**. Locations where the average safety risk exceeds the city-wide average were highlighted in red.

Table 5-3 Percent Difference in Average Composite Risk Relative to City-Wide Average

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	23%	69%	174%	65%
Inner Urban	-12%	8%	25%	-7%
Outer Urban	17%	36%	-9%	-24%
Suburban	8%	-20%	-3%	-2%
Rural Village	-11%	-100%	4%	67%
Rural	-22%	-100%	-13%	-19%
Greenbelt	-20%	20%	74%	25%

5.2.1.2 Travel Time Impacts

As discussed previously, two speed limit scenarios were considered as part of the development of this alternative:

- **Baseline Scenario:** This scenario represents existing conditions and was based on the average of existing speed limits as summarized in **Table 5-4**.
- **Reduced Speed Limit Scenario:** Represents a 10 km/h decrease in speed limits relative to the baseline scenario as summarized in **Table 5-5**.

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Table 5-4 Baseline Scenario Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	50	40	30	30
Inner Urban	50	50	40	30
Outer Urban	60	50	40	40
Suburban	60	50	40	40
Rural Village	60	-	40	40
Rural	80	-	70	40
Greenbelt	80	60	60	40

Note: There are no major collector roads located within the Rural or Rural Village Transects.

Table 5-5 Reduced Speed Limit Scenario Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	40	30	30	30
Inner Urban	40	40	30	30
Outer Urban	50	40	30	30
Suburban	50	40	30	30
Rural Village	50	-	30	30
Rural	70	-	60	30
Greenbelt	70	50	50	30

Note: There are no major collector roads located within the Rural or Rural Village Transects.

The aggregate travel time for each scenario was calculated by estimating the total travel time of all vehicles driving along each road segment. These aggregate travel time estimates were then compared to determine the relative impact of each scenario. Aggregate travel time was measured in vehicle-hours of travel time which is obtained using the following formula:

$$Travel\ Time_i = \frac{AADT_i * Length_i}{Speed_i}$$

Where:

- Travel Time = Vehicle-hours of travel time for the segment
- AADT = Average annual daily traffic volume for the segment
- Length = Length of the segment
- Speed = Average operating speed for the segment
- i = i-th road segment

The analysis was limited strictly to road segments in which the average operating speed and AADT data had been observed. This represents approximately 9% of road segments. The availability of both speed and AADT data by road classification and Transect is summarized in greater detail in **Appendix D**.

The analysis was limited to this subset of road segments to ensure that the development of this alternative was based on observed data. The use of estimated speed and AADT values would potentially introduce errors in the analysis due to the lower accuracy of estimated values compared to observed values.

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For the purposes of this study, it was assumed that a change in speed limit would result in a change in average operating speed equal to 25% of the change in speed limit. As such, a 10 km/h decrease in speed limit results in a 2.5 km/h decrease in average operating speed. It was also assumed that average operating speeds would not decrease less than the proposed speed limit.

Vehicle-hours of travel time was calculated for both the baseline and reduced speed limit scenarios, and the results are summarized in **Table 5-6** and **Table 5-7**.

Table 5-6 Vehicle-Hours of Travel Time: Baseline Scenario

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	1,649	399	315	605
Inner Urban	3,833	391	1,039	1,940
Outer Urban	6,265	1,038	2,550	1,515
Suburban	7,423	2,317	2,903	1,286
Rural Village	703	-	382	114
Rural	6,301	-	3,256	158
Greenbelt	2,876	217	114	3
City-Wide Total	29,049	4,362	10,558	5,622

Note: There are no major collector roads located within the Rural or Rural Village Transects.

Table 5-7 Vehicle-Hours of Travel Time: Reduced Speed Limit Scenario

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	1,717	441	315	605
Inner Urban	4,031	413	1,121	1,940
Outer Urban	6,526	1,084	2,730	1,597
Suburban	7,813	2,445	3,081	1,360
Rural Village	733	-	405	121
Rural	6,487	-	3,371	166
Greenbelt	2,945	227	120	4
City-Wide Total	30,252	4,610	11,142	5,793

Note: There are no major collector roads located within the Rural or Rural Village Transects.

The two scenarios were subsequently compared to determine the relative travel time impact of reducing speed limits by 10 km/h. The results are summarized in **Table 5-8**.

Table 5-8 Average Increase in Travel Time

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	4%	11%	0%	0%
Inner Urban	5%	5%	8%	0%
Outer Urban	4%	4%	7%	5%
Suburban	5%	6%	6%	6%
Rural Village	4%	0%	6%	6%
Rural	3%	0%	4%	5%
Greenbelt	2%	5%	5%	7%
City-Wide Average	4%	6%	6%	3%

As was done for the average safety risk assessment, for each road classification, the average increase in travel time per Transect was compared to the city-wide average and the resulting percent difference is summarized in **Table 5-9**.

Table 5-9 Percent Difference in Average Increase in Travel Time Relative to City-Wide Average

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	0%	89%	-100%	-100%
Inner Urban	25%	-4%	44%	-100%
Outer Urban	1%	-22%	27%	76%
Suburban	27%	-3%	11%	91%
Rural Village	2%	-100%	11%	94%
Rural	-29%	-100%	-36%	75%
Greenbelt	-42%	-18%	-10%	128%

5.2.1.3 Comparison of Risk and Travel Time Impacts

As discussed previously, this speed limit setting alternative proposes balancing safety risks against travel time impacts by only reducing speed limits in locations where the relative safety risks exceed the relative impacts on travel time. Where travel time impacts outweigh the safety risks, the existing speed limits were maintained. As such, the proposed speed limits were selected as follows:

- **Where Travel Time Impact < Risk:** Use reduced speed limit from **Table 5-5**.
- **Where Travel Time Impact > Risk:** Use average of existing speed limit from **Table 5-4**.
- **Where Travel Time Impact = Risk:** Use reduced speed limit from **Table 5-5**.

Table 5-10 compares the travel time impacts to the safety risk. To facilitate comparison, cells were coloured red if the travel time impact is less than the risk, green if its greater, and orange if its equal.

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Table 5-10 Comparison of Travel Time Impacts to Safety Risk

Transect	Travel Time Impact vs Safety Risk			
	Arterial	Major Collector	Collector	Local
Downtown Core	0% < 23%	89% > 69%	-100% < 174%	-100% < 65%
Inner Urban	25% > -12%	-4% < 8%	44% > 25%	-100% < -7%
Outer Urban	1% < 17%	-22% < 36%	27% > -9%	76% > -24%
Suburban	27% > 8%	-3% > -20%	11% > -3%	91% > -2%
Rural Village	2% > -11%	-100% = -100%	11% > 4%	94% > 67%
Rural	-29% < -22%	-100% = -100%	-36% < -13%	75% > -19%
Greenbelt	-42% < -20%	-18% < 20%	-10% < 74%	128% > 25%

Based on the results of the analysis, the Transects highlighted in red or orange (travel time impact less than or equal to safety risk) should have their speed limits reduced, while Transects highlighted in green should use the average of the existing speed limits.

Table 5-11 illustrates the proposed speed limits. Additionally, for consistency with recent City of Ottawa policy, a 30 km/h speed limit is proposed for all local roads regardless of the results of the analysis.

Table 5-11 Alternative A Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	40	40	30	30
Inner Urban	50	40	40	30
Outer Urban	50	40	40	30
Suburban	60	50	40	30
Rural Village	60	40	40	30
Rural	70	60	60	30
Greenbelt	70	50	50	30

For school zones, the draft School Zone Policy recommended setting school zone speed limits based on the prevailing speed limits of the road, as summarized in Table 5-12.

Table 5-12 School Zone Speed Limits

Prevailing Speed Limit (km/h)	School Zone Speed Limit (km/h)
30	N/A
40	30
50-60	40
70-80	60
90-100	80

Applying the above school zone speed limits to the proposed Alternative A speed limits yields the school zone speed limits in Table 5-13.

Table 5-13 Alternative A School Zone Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	30	30	30	30
Inner Urban	40	30	30	30
Outer Urban	40	30	30	30
Suburban	40	40	30	30
Rural Village	40	30	30	30
Rural	60	40	40	30
Greenbelt	60	40	40	30

Policy 9-9 of Part 1 of the Transportation Master Plan states that the City should target operating speeds of 30 km/h on local residential streets, less than 50 km/h on “access” streets (i.e., typically collector roads), 60 km/h or less on “flow and capacity” streets (i.e., typically arterial and major collectors) in urban areas, and higher operating speeds on roads travelling through the Greenbelt, the Airport Parkway, and certain roads in the Suburban Transect. The proposed speed limits in **Table 5-11** are generally in accordance with this policy.

5.2.2 Speed Limit Setting Process

The process for setting speed limits under Alternative A is as follows:

1. Select a road whose speed limits will be updated.
2. Subdivide the road into sections at the following locations: a) where the road classification changes, or b) at the boundary to a Transect.
3. For each section of the road:
 - a. Identify the classification of the road section and the Transect it is located in.
 - b. Use **Table 5-11** to identify the recommended speed limit.
 - c. Determine whether there are any school zones along the section of the road (see Section 5.1 for details).
 - d. If there are any school zones, use **Table 5-13** to identify the recommended school zone speed limit.
 - e. Determine whether there are any special circumstances that would require deviating from the recommended speed limit (e.g., presence of a rail crossing). If there are, a qualified individual will need to make a detailed site-specific assessment to determine what alternative speed limit should be implemented in lieu of Alternative A speed limits.
4. Repeat step 3 for each section of the road.

Three examples of applying the above process are provided in the following section.

5.2.3 Speed Limit Setting Examples

Three examples were evaluated using this speed limit setting process to demonstrate how a speed limit is selected using this methodology. The three examples selected were:

- Somerset Street West
- Strandherd Drive
- Parkway Road

The above three streets have also been evaluated under Alternative B in Section 5.3.3.

5.2.3.1 Somerset Street West

Somerset Street West was selected as an example as it represents a typical arterial in the core of the city with high volumes of vulnerable road users. **Figure 5-1** is a Google Streetview image of Somerset Street West near Bank Street.



Figure 5-1 Somerset Street West

Figure 5-2 illustrates the classification of Somerset Street West as well as which Transects it is located within.



Figure 5-2 Somerset Street West Classification and Transect

Somerset Street West can be split into three sections as it spans two Transects and changes road classifications at one location. **Table 5-14** summarizes the details for each section and the prevailing speed limit and school zone speed limit recommended for each section based on **Table 5-11** and **Table 5-13**.

Table 5-14 Somerset Street West: Recommended Alternative A Speed Limits

Section	Road Classification	Transect	Recommended Prevailing Speed Limit	Recommended School Zone Speed Limit
1	Collector	Downtown Core	30	30
2	Arterial	Downtown Core	40	30
3	Arterial	Inner Urban	50	30

5.2.3.2 Strandherd Drive

Strandherd Drive was selected as it represents a typical suburban arterial road. A Google Streetview image of Strandherd Drive is shown in **Figure 5-3**.



Figure 5-3 Strandherd Drive

As illustrated in **Figure 5-4**, Strandherd Drive is classified as an arterial road along its entire length and does not cross any Transect boundaries. As such, based on **Table 5-11** and **Table 5-13** a prevailing posted speed limit of 60 km/h is recommended along the entire length of Strandherd Drive, with a school zone speed limit of 40 km/h recommended for any school zones on Strandherd Drive.

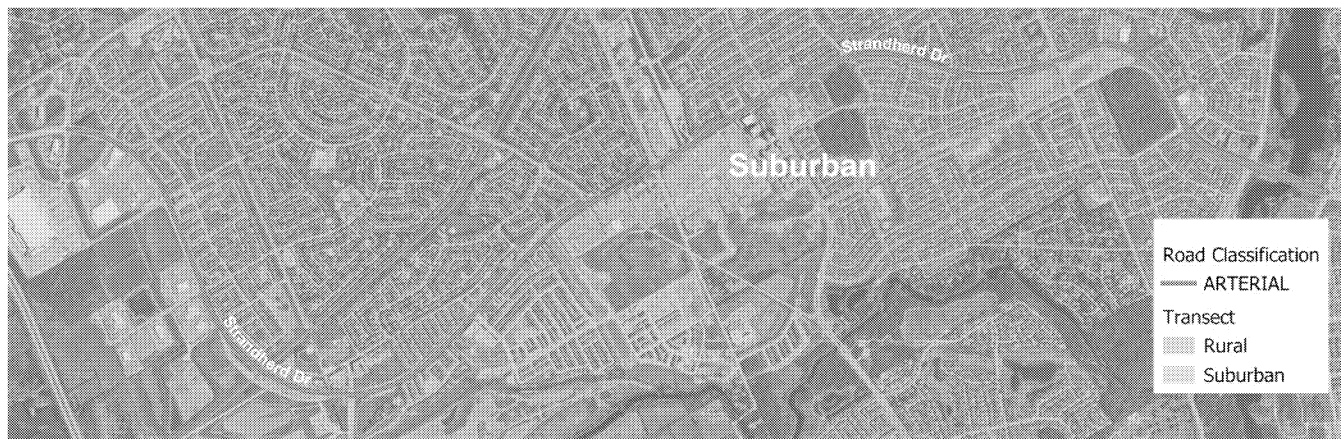


Figure 5-4 Strandherd Drive Classification and Transect

5.2.3.3 Parkway Road

This road was selected as an example to demonstrate the use of this process on rural roads and a Google Streetview image of Parkway Road is provided in **Figure 5-5**.



Figure 5-5 Parkway Road

Figure 5-6 illustrates the classification of Parkway Road and the two Transects it is located within.

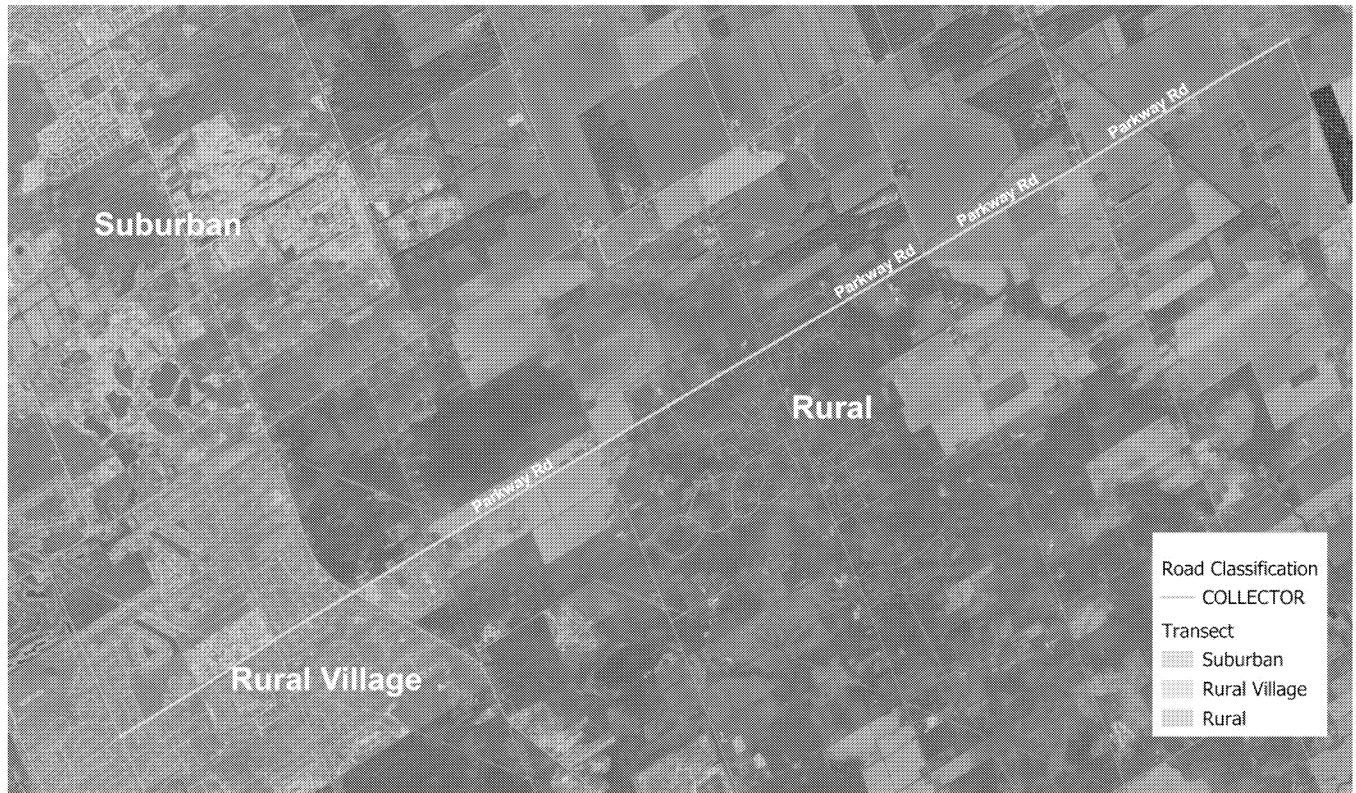


Figure 5-6 Parkway Road Classification and Transect

Parkway Road can be split into two sections as it spans two Transects. **Table 5-15** summarizes the details for each section and the prevailing speed limit and school zone speed limit recommended for each section based on **Table 5-11** and **Table 5-13**.

Table 5-15 Parkway Road: Recommended Alternative A Speed Limits

Section	Road Classification	Transect	Recommended Prevailing Speed Limit	Recommended School Zone Speed Limit
1	Collector	Rural Village	40	30
2	Collector	Rural	60	40

5.3 Alternative B

Alternative B is adapted from the Swedish ‘Right Speed in the City’ method which was discussed in detail in the Peer Jurisdiction Review (see **Appendix A**).

The following subsections describe Alternative B:

1. **Alternative Development** summarizes the modifications to the ‘Right Speed in the City’ methodology to adapt it to the local context.
2. **Speed Limit Setting Process** describes how speed limits on a given road are set using the process for Alternative B.
3. **Speed Limit Setting Examples** provides examples of setting speed limits on three different roads.
4. **Estimated Speed Limits** provides a summary of the estimated speed limits per road classification for each Transect.

5.3.1 Alternative Development

The ‘Right Speed in the City’ methodology uses a score-based approach to evaluate all of the potential speed limit options (30, 40, 50, 60, 70, and 80 km/h) against several different criteria. Scores are assigned based on how well a given speed limit meets the objectives of the criteria, with lower scores indicating that a speed limit better aligned with the objectives of the criteria. Based on the results of the evaluation, one speed limit is selected.

The criteria used in the ‘Right Speed in the City’ methodology have been modified to adapt the terminology to the local context. The customization process for each criteria included:

- **Road Character:** This criterion measures the desired degree of mobility for active transportation users. For these types of users, lower speed limits increase mobility and safety by making the street safer for their use.
- **Road Classification:** This criterion was called ‘Accessibility, Car Traffic’ in the ‘Right Speed in the City’ methodology and has been renamed to match typical Canadian terminology. The categories have been adjusted to align with City of Ottawa road classification terminology.
- **Transit Service:** This criterion was called ‘Accessibility, Public Transportation’ in the ‘Right Speed in the City’ methodology and has also been renamed to better fit the Canadian context. The categories have been revised to align with OC Transpo terminology and classification schemes.
- **Traffic Safety:** Quantitative thresholds were added for the Vulnerable Road Users and Rigid Obstacles categories.

Further details regarding each criterion are discussed in Sections 5.3.1.1 to 5.3.1.4. The scoring process for speed limits is described in Section 5.3.1.5.

The ‘Right Speed in the City’ methodology also included a fifth criterion called ‘Security’ which was measured the same as the Road Character criterion. To eliminate redundancies, this fifth criterion was not included in the Gold Standard methodology.

Additionally, speed limits on gravel roads will be set using a different process. This process is described in Section 5.3.1.6.

5.3.1.1 Road Character

This criterion measures the desired degree of mobility for active transportation users and is based on the degree of access to adjacent land uses, ranging from high levels of access (e.g., a residential street with many driveways and vulnerable road users (VRUs) often near or in the street) to low levels of access (e.g., a highway or expressway where access to adjacent land uses is strictly prohibited). In high access environments low vehicle speeds are desirable for vulnerable road user (VRU, i.e., pedestrian and cyclist) safety, while in low access environments higher vehicle speeds are permissible

The five categories of Road Character utilized in Alternative B are:

- **High Access Streets:** These are streets where there will be a high degree of access to adjacent land uses and pedestrians and cyclists are expected to frequently interact with motorized traffic. Examples of these kinds of streets include pedestrian streets such Sparks Street, streets at Lansdowne and in the ByWard Market where it may be desirable to allow pedestrians to cross at uncontrolled midblock locations, and local residential streets where residents may frequently spend time in the street (e.g., children playing sports on the road or people crossing the street to visit neighbours).
- **Moderate Access Streets:** These are streets where the need for access to adjacent land uses must be balanced with flow and capacity requirements. On these streets, interactions between VRUs and motorized traffic at midblock locations is expected to be relatively infrequent but may occasionally occur. Most collector and major collector roads within the urban area can be considered Moderate Access Streets.
- **Low Access Streets:** These are streets where access to adjacent land uses should be infrequent. Interactions between VRUs and motorized traffic are strictly limited to crosswalks and cross-rides at intersections or controlled-crossings. Arterial roads in the Outer Urban, Suburban and Rural Village Transects are examples of Low Access Streets.
- **Minimal Access Streets:** These are streets in which the density of development is relatively low, distances between properties are large, and there is a low need for access to these streets. VRUs are rarely present and therefore interactions between these users and motorized traffic are infrequent, even in the absence of dedicated pedestrian or cycling facilities. Roads in the Rural and Greenbelt Transects (with the exception of Local roads) are examples of Minimal Access Streets.
- **No Access Streets:** These are streets where access to adjacent land uses is strictly controlled/limited and motorized traffic is completely separate from VRUs. Ottawa Road 174 is an example of a No Access Street.

The selection of a road character category for a road section follows a two-step process:

1. Select an **initial road character category** using the flowchart in **Figure 5-7**.
2. Assess the presence of sensitive land uses (e.g., schools, parks, elder care facilities, childcare facilities, etc.) along the road section. If 25% of the road section is adjacent to these sensitive land uses then the road character category should be increased to the next level (e.g., from Moderate Access Street to High Access Street).

Figure 5-7 illustrates the process for selecting the **initial road character category**. These are simply guidelines, however, and user judgement should be utilized to determine which category is most appropriate.

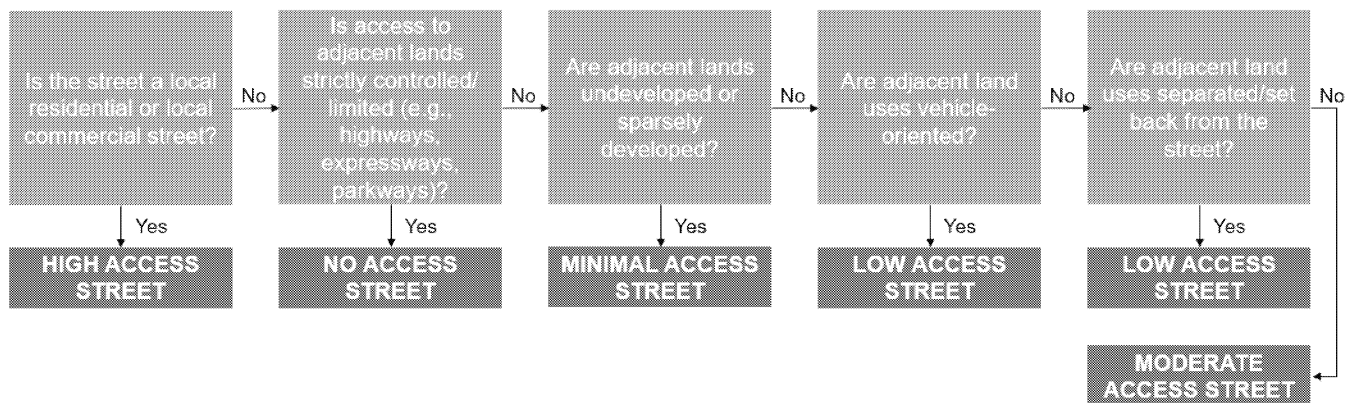


Figure 5-7 Initial Road Character Selection Flowchart

Note: Consider the typical or most common conditions along the road section. Small deviations from typical conditions shouldn't have undue influence on the decision tree.

Note that the following definitions must be considered when using the flowchart:

- Adjacent lands are considered **fully developed** if either of the following conditions are met: 1) 50% or more of road frontage is developed for at least 200 m on one side, or, 2) 50% or more of road frontage is developed for at least 100 m on both sides (Source: OTM Book 5). If adjacent lands do not meet the above criteria then they are considered **undeveloped or sparsely developed**.
- Land uses are grouped into two categories based on the following definitions:
 - **People-oriented land uses** include residential, institutional, office, recreational, and street-oriented commercial (Source: City of Ottawa Transit Oriented Development Guidelines).
 - **Vehicle-oriented land uses** include commercial with drive throughs, vehicle dealerships, gas stations, surface parking lots and vehicle-oriented commercial (Source: Section 6 of the City of Ottawa Official Plan).
- Land uses are also be grouped into two categories based on their orientation:
 - **'Oriented towards the street'** is indicated by doorways facing the street and small building setbacks.
 - **'Separated or set back'** is indicated by fences or other physical obstructions between doorways and the street, or if doorways do not face the street, or if there is a parking lot between doorways and the street.

Following the selection of the **initial road character category**, assess the presence of sensitive land uses along the road section:

1. Measure the centreline length of the entire section.
2. Measure the centreline length in front of sensitive land uses on one or both sides of the section. Sensitive land uses include land uses that are likely to attract youth and/or seniors (e.g., schools, parks, elder care facilities, childcare facilities, etc.). The centreline measurement is the same if sensitive land uses are present on one side or directly across on both sides (i.e., do not count the same section of centreline twice).
3. If the length from Step 2 is equal to or greater than the length from Step 1 then increase the Road Character to the next level (i.e., from No Access to Minimal Access, Minimal Access to Low Access, Low Access to Moderate Access, and Moderate Access to High Access. High Access cannot be increased as that is the highest Road Character level). Otherwise, keep the same Road Character category.

After applying the above three steps, the resulting Road Character category is the category that should be used to score the road section.

The maximum desirable speed limit for each Road Character category is as follows:

- **High Interaction:** 30 km/h is desirable
- **Moderate Interaction:** 30 to 40 km/h is desirable
- **Low Interaction:** 60 km/h or lower is desirable
- **Minimal Interaction:** 70 km/h or lower is desirable
- **No Interaction:** No upper limit for this criterion

The above thresholds are from the 'Right Speed in the City' methodology, with some adjustments to the Low and Minimal Access categories to better align with Policy 9-9 of Part 1 of the Transportation Master Plan. Policy 9-9 states that the City should target operating speeds of 30 km/h on local residential streets, less than 50 km/h on 'access' streets, 60 km/h or less on 'flow and capacity' streets in urban areas, and higher operating speeds on roads travelling through the Greenbelt, the Airport Parkway, and certain roads in the Suburban Transect. The above desirable speed limits therefore align with this policy.

5.3.1.2 Road Classification

This criterion is based on the defined degree of mobility for general and commercial traffic based on the Official Plan road classification. The four classifications are: Arterial, Major Collector, Collector and Local. In higher road classifications (e.g., arterial and major collector) higher vehicle speeds are desirable, while in lower road classifications (e.g., collector and local) there is less emphasis on mobility and therefore lower vehicle speeds are permissible.

The minimum desirable speed limit for each Road Classification category is as follows:

- **Arterial:** 50 km/h or higher is desirable
- **Major Collector:** 50 km/h or higher is desirable
- **Collector:** 40 km/h or higher is desirable
- **Local:** 30 km/h or higher is desirable

The above thresholds are from the 'Right Speed in the City' methodology. These minimum thresholds also generally align with the typical speed limits utilized by peer jurisdictions (Section 2).

5.3.1.3 Transit Service

This criterion is based on the desired degree of mobility for transit services based on the highest-order transit service operating on the street. As multiple transit routes may operate on one road, only the highest order transit service is considered when evaluating this criterion. Higher speeds are desirable for corridors utilized by higher-order transit service (e.g., frequent and connexion services) to reduce transit travel times, while lower speeds are permissible for lower-order transit service (e.g., local service)

From highest to lowest order, the Transit Service categories are:

- **Frequent:** Consistent with the City of Ottawa Traffic Calming Guidelines, a Frequent Transit Service road includes transit routes whose service frequencies are 15 minutes or shorter during the peak hour.

- **Local:** Roads with transit routes with service frequencies of more than 15 minutes during the peak hour are considered Local Transit Service roads.
- **None:** There is no transit service operating on the road.

The minimum desirable speed limit for each Transit Service category is as follows:

- **Frequent:** 50 km/h or higher is desirable
- **Local:** 30 km/h or higher is desirable
- **None:** No lower limit for this criterion.

The above thresholds are from the 'Right Speed in the City' methodology.

5.3.1.4 Traffic Safety

This criterion identifies the maximum safe speed limit for a road based on the types of collisions that may occur due to the design and operation of the road. As discussed in Section 3, if a collision occurs, the likelihood of a fatality increases significantly at vehicle speeds above 30 km/h in VRU collisions, 50 km/h in side impact collisions (e.g., angle and turning movement collisions), and 70 km/h in front impact collisions (e.g., approaching collisions). Where the design of the road does not prevent these collision types, speed limits above the maximum safe speed limit are not desirable.

The Traffic Safety categories are listed below in order of priority. The first category whose threshold is met is selected as the Traffic Safety category for the road (e.g., if the thresholds for both Vulnerable Road Users and Frequent Intersections/Driveways is met, the Vulnerable Road Users category is selected as it is the first in the list).

- **Vulnerable Road Users:** Based on observed traffic and collision data for the City of Ottawa, thresholds of 1,300 pedestrians per 8-hour period or 125 cyclists per 8-hour period were established as the minimum thresholds for the Vulnerable Road Users category. At those thresholds, pedestrian and cycling collisions tend to make up more than 20% of collisions on road segments in the data set. Figure 5-8 and **Figure 5-9** illustrates the relationship between volumes and the percentage of collisions that involve vulnerable road users.

For road sections less than 3 km in length, only one intersection needs to meet this threshold. For sections longer than 3 km in length, the length should be divided by 3 km and rounded to the nearest whole number. The result is the number of intersections that must meet the above thresholds for this category to be selected (e.g. for a 6 km long road section, two intersections ($6/3 = 2$) would need to meet the thresholds for this category to be selected).

The traffic count data used should be recent (i.e., within the last three years) and collected during the cycling season (May to October) on a Tuesday, Wednesday or Thursday. Weekend traffic counts may also be considered if adjacent land uses generate more pedestrian/cycling traffic on weekends. For each intersection being evaluated, at least two 8-hour periods must be evaluated, but not necessarily from consecutive days or the same year.

- **Frequent Intersections/Driveways:** Streets with an average spacing of less than 150 m between intersections and/or full-movement driveways fall within the Frequent Intersections/Driveways category. A full-movement driveway is defined as a private approach where one or more left-turn movements are permitted. When the spacing between intersections and full-movement driveways is below this threshold, the risk of a side impact collision with traffic exiting driveways or crossing intersections is higher. This threshold is from the

'Right Speed in the City' methodology and is supported by the findings of the Literature Review (see **Appendix B**).

- Rigid Obstacles:** A road falls within the Rigid Obstacles category if 10% or more of single-vehicle collisions are collisions with fixed objects such as utility poles, fences, culverts, bridge supports, rock faces, buildings, trees and vegetation, or fire hydrants. For the purposes of this assessment, collisions with pedestrians are not considered single-vehicle collisions. This assessment should be based on the most recent three years of collision data available. The 10% threshold was established based on a review of historical city-wide single-vehicle collision records. This review identified that, on average, 10% of single-vehicle collisions are collisions with fixed objects. Roads that exceed this threshold therefore likely have a high frequency of rigid obstacles near the road edge.
- No Median:** If a road has no dividing median or centre barrier, then it falls within the No Median category. Without division between opposing directions of traffic there is a risk of front impact (i.e., approaching) collisions occurring.
- None:** A road only falls into this category if it does not meet the thresholds for any of the above categories.

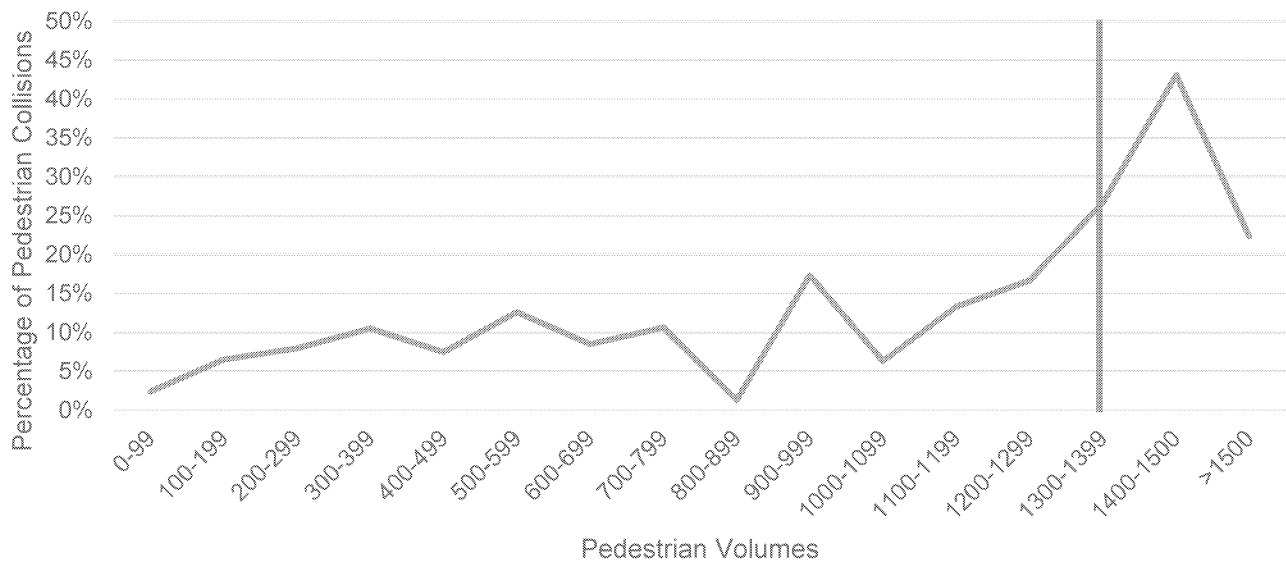


Figure 5-8 Relationship Between Pedestrian Volumes and Collisions

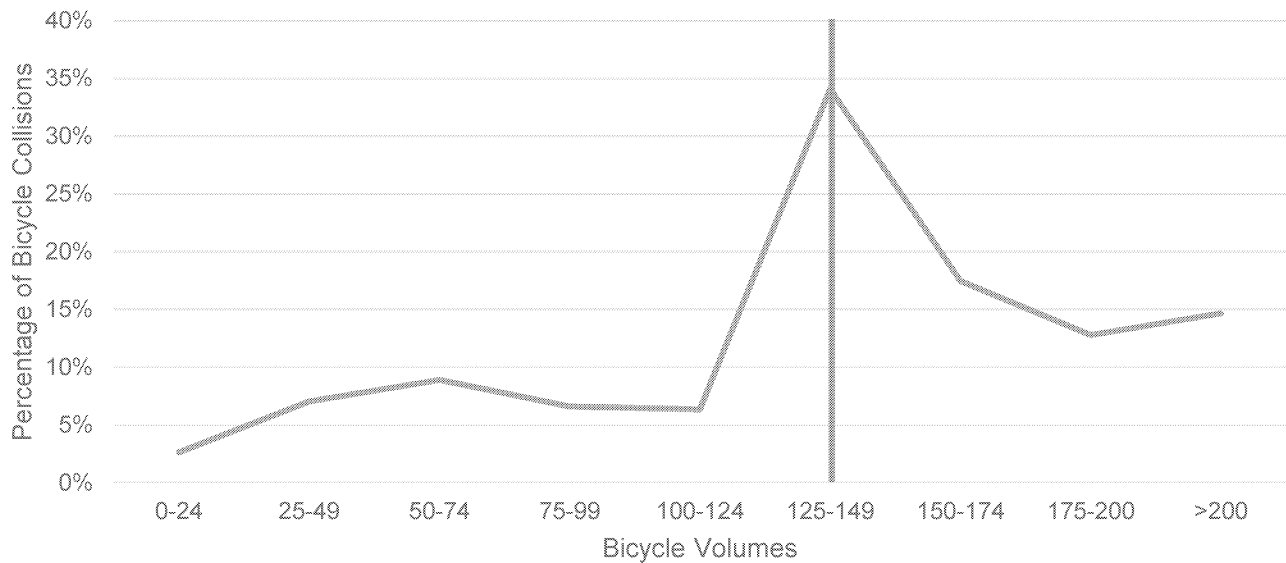


Figure 5-9 Relationship Between Bicycle Volumes and Collisions

The maximum safe speed limit for each Traffic Safety category is as follows:

- **Vulnerable Road Users:** 30 km/h is desirable
- **Frequent Intersections and Full-Movement Driveways:** 50 km/h or lower is desirable
- **Wide Roadways:** 50 km/h or lower is desirable
- **Rigid Obstacles:** 60 km/h or lower is desirable
- **No Median:** 70 km/h or lower is desirable
- **None:** No upper limit for this criterion.

The above thresholds are from the ‘Right Speed in the City’ methodology and are supported by the findings of the Literature Review (see **Appendix B**).

5.3.1.5 Speed Limit Scoring Process

To identify the recommended speed limit for a road, it is necessary to calculate the score for each speed limit option in all four criteria. The speed limit options range from 30 to 80 km/h in increments of 10. The speed limit with the lowest score is the recommended speed limit for the road. In the case of a tie, the higher speed limit is the recommended speed limit (e.g., if both 40 and 50 km/h tie for the lowest score, 50 km/h is the recommended speed limit as it is higher than 40 km/h). Three examples of setting speed limits using this methodology are outlined in Section 5.3.3.

For each speed limit, a numerical score has been assigned for each category of all four criteria. These scores are summarized in **Table 5-16** to **Table 5-19**. Refer to Section 5.3.1.1 to 5.3.1.4 for the description of each category. Note that a road can only fall within one category per criteria.

Table 5-16 Road Character Scores

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
High Access Street	1	10	100	150	150	150
Moderate Access Street	1	1	100	100	100	100
Low Access Street	1	1	1	1	10	100
Minimal Access Street	1	1	1	1	1	10
No Access Street	1	1	1	1	1	1

Table 5-17 Road Classification Scores

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Local Road	1	1	1	1	1	1
Collector Road	10	1	1	1	1	1
Major Collector Road	100	10	1	1	1	1
Arterial Road	100	50	1	1	1	1

Table 5-18 Transit Service Categories

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Local Service	1	1	1	1	1	1
Frequent Service	100	10	1	1	1	1
None	1	1	1	1	1	1

Table 5-19 Traffic Safety Categories

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Vulnerable Road Users	1	10	100	150	150	150
Frequent Intersections/Driveways	1	1	1	10	100	100
Rigid Obstacles	1	1	1	1	10	100
No Median	1	1	1	1	1	10
None	1	1	1	1	1	1

5.3.1.6 Gravel Road Speed Limits

At the City’s request, the following speed limits will be applied to gravel roads:

- **Arterial, Major Collector and Collector Roads:** 70 km/h
- **Local Roads:** 50 km/h

Deviations from the above speed limits will be permitted on a case-by-case basis for special circumstances. In these cases, operating speed data will be collected and engineering judgement will be utilized to determine what speed limit should be applied based on the 85th percentile operating speed of the road.

5.3.2 Speed Limit Setting Process

The process for setting speed limits under Alternative B is as follows:

1. Select a road whose speed limit will be updated.
2. If any portion of the road is unpaved, refer to Section 5.3.1.6 for the pre-set speed limits for gravel roads.
3. For the portion of the road that is paved, collect information on the following:
 - a. Road classification: As per the Official Plan;
 - b. Adjacent land use characteristics: People-oriented versus vehicle-oriented, and oriented towards the street versus separated/set back from the street (see Section 5.3.1.1 for definitions); and
 - c. Road cross-section: Number of traffic lanes and presence of a median. Traffic lanes include general traffic and bus lanes, but do not include auxiliary lanes, bike lanes or cycle tracks. Medians can include vegetated, raised or painted medians. Two-way left-turn lanes are not medians.
4. Split the corridor into sections based on where the road classification, land uses, and/or cross-section changes. The corridor can be split at intersections or between intersections. Any section that is less than 500 m should be combined with the adjacent section that is most similar. If both adjacent sections are similar to each other, consideration should be given to combining the short section with the two adjacent sections into a single combined section. Apply user judgement to avoid frequent speed limit changes on continuous roads, such as two changes in less than 2.0 km in length.
5. For each section of the road:
 - a. Identify the Road Character category that best describes the section (see Section 5.3.1.1).
 - b. Identify the Road Classification category that applies to the section (see Section 5.3.1.2).
 - c. Identify the highest order transit service operating along the section and the corresponding Transit Service category that applies to the section (see Section 5.3.1.3).
 - d. Evaluate the Traffic Safety categories one at a time from top to bottom. The first category whose thresholds or conditions are met is the one that applies to the section (see Section 5.3.1.4).
 - e. Calculate the Road Character, Road Classification, Transit Service and Traffic Safety scores for each speed limit option (i.e., 30, 40, 50, 60, 70 and 80 km/h) based on Table 5-16 to Table 5-19.
 - f. For each speed limit option, calculate the sum of the Road Character, Road Classification, Transit Service and Traffic Safety scores.
 - g. The speed limit option with the lowest score is the recommended speed limit for the section. In the case of a tie, the higher speed limit is the recommended speed limit (e.g., if both 40 and 50 km/h tie for the lowest score, 50 km/h is the recommended speed limit as it is higher than 40 km/h).
 - h. Determine whether there are any circumstances that would require deviating from the recommended speed limit (e.g., presence of a rail crossing). If there are, a qualified individual will need to make a detailed site-specific assessment to determine what alternative speed limit should be implemented in lieu of Alternative B speed limits.
6. Repeat step 5 for each section of the road.

Three examples of applying the above process are provided in the following section.

5.3.3 Speed Limit Setting Examples

The three streets evaluated under Alternative A in Section 5.3.2 were again evaluated using Alternative B to provide a point of comparison between the two options. The three streets evaluated were:

- Somerset Street West
- Strandherd Drive
- Parkway Road

5.3.3.1 Somerset Street West

As noted previously, Somerset Street West was selected as an example as it represents a typical arterial in the core of the city with high volumes of vulnerable road users.

As shown previously in Figure 5-2, this road is classified as an Arterial west of Elgin Street and a Collector east of Elgin Street. It is entirely located within the Downtown Core Transect with the exception of a short segment at the west end that is within the Inner Urban Transect. Land uses along Somerset Street West are generally mixed use commercial and residential along the Arterial portion and primarily residential along the Collector portion. Based on the above, Somerset Street West will be subdivided into two sections: the west of Elgin Street section and the east of Elgin Street section.

The characteristics of Somerset Street West were reviewed to identify which category is met for each criterion and the results are summarized in **Table 5-20**.

Table 5-20 Criteria Evaluation: Somerset Street West

Criteria	Selected Category		Rationale
	West	East	
Road Character	Moderate Access Street	Moderate Access Street	The street is not a local road nor is access strictly controlled/limited. Adjacent lands are fully developed, people-oriented and facing the street. There are few sensitive land uses along the street.
Road Classification	Arterial Road	Collector Road	The City of Ottawa Official Plan identifies this road as an arterial road west of Elgin Street and a collector road east of that point.
Transit Service	Frequent Transit	None	Route 11 operates on this road west of Bank Street.
Traffic Safety	Vulnerable Road Users	Vulnerable Road Users	Pedestrian volumes range from 18 to 4,130 over 8 hours and bicycle volumes range from 11 to 242 over 8 hours. As the first category's threshold is met, the other categories do not need to be reviewed.

Based on the categories selected in **Table 5-20**, the scores were calculated for each speed limit option based on Table 5-16 to Table 5-19. The scores obtained for each speed limit for the west and east sections are summarized in **Table 5-21** and **Table 5-22**.

Table 5-21 Final Scoring: Somerset Street West, West Section

Criteria	Selected Category	Speed Limit (km/h)					
		30	40	50	60	70	80
Road Character Scores	Moderate Access Street	1	1	100	100	100	100
Road Classification Scores	Arterial Road	100	50	1	1	1	1
Transit Service Scores	Frequent Transit	100	10	1	1	1	1
Traffic Safety Scores	Vulnerable Road Users	1	10	100	150	150	150
Total		202	71	202	252	252	252

Table 5-22 Final Scoring: Somerset Street West, East Section

Criteria	Selected Category	Speed Limit (km/h)					
		30	40	50	60	70	80
Road Character Scores	Moderate Access Street	1	1	100	100	100	100
Road Classification Scores	Collector Road	10	1	1	1	1	1
Transit Service Scores	None	1	1	1	1	1	1
Traffic Safety Scores	Vulnerable Road Users	1	10	100	150	150	150
Total		13	13	202	202	202	202

Based on the above results, a speed limit of 40 km/h is recommended for both sections.

5.3.3.2 Strandherd Drive

The same process that was applied to Somerset Street West was applied to Strandherd Drive. Strandherd Drive was selected as it represents a typical suburban arterial road.

Strandherd Drive is relatively homogeneous in cross-section and land uses are generally set back from the road along its entire length. As such, the entire road will be evaluated as a single section.

Characteristics of Strandherd Drive were reviewed to identify which category is met for each criterion and the results are summarized in **Table 5-23**.

Table 5-23 Criteria Evaluation: Strandherd Drive

Criteria	Selected Category	Rationale
Road Character	Low Access Street	The street is not a local road nor is access strictly controlled/limited. Adjacent lands are fully developed, and are a mix of people-oriented and vehicle-oriented land uses. Adjacent lands are set back from the street along the entire length of the road. Approximately 16% of the road is adjacent to sensitive land uses.
Road Classification	Arterial Road	The City of Ottawa Official Plan identifies this road as an arterial road.
Transit Service	Frequent Transit	Route 74, 80, 99, 110, 170, 173, 277 and 283 operate on this road along part of its length. As route 80 is a Frequent route, the Frequent category governs.
Traffic Safety	Rigid Obstacles	Pedestrian and cyclist volumes do not meet the thresholds. The road is divided along most of its length with median breaks and intersections spaced more than 150m on average. Approximately 14% of single-vehicle collisions have been with fixed objects. As such, the threshold for the Rigid Obstacle category has been met.

Based on the categories selected above, the scores were calculated for each speed limit option based on **Table 5-16 to Table 5-19**. The scores obtained for each speed limit are summarized in **Table 5-24**.

Table 5-24 Final Scoring: Strandherd Drive

Criteria	Selected Category	Speed Limit (km/h)					
		30	40	50	60	70	80
Road Character Scores	Low Access Street	1	1	1	1	10	100
Road Classification Scores	Arterial Road	100	50	1	1	1	1
Transit Service Scores	Frequent Transit	100	10	1	1	1	1
Traffic Safety Scores	Rigid Obstacles	1	1	1	1	10	100
Total		202	62	4	4	22	202

Based on the above results, a speed limit of 60 km/h is recommended.

5.3.3.3 Parkway Road

As noted previously, this road was selected as an example to demonstrate the use of this process on rural roads.

Parkway Road has a distinct transition in character east and west of Bank Street and for consistency with the analysis undertaken in Section 5.2.3.3 Parkway Road was separated in two at Bank Street. West of Bank Street, Parkway Road bisects the community of Greely and therefore has a more residential rural village character whereas east of Bank Street it has a rural character. **Table 5-25** summarizes the categories selected for each half of Parkway Road.

Table 5-25 Criteria Evaluation: Parkway Road

Criteria	Selected Category		Rationale
	West	East	
Street Character	Moderate Access Street	Minimal Access Street	The street is not a local road nor is access strictly controlled/limited. West of Bank Street it is fully developed, with people-oriented land uses facing the street. East of Bank Street it is generally sparsely developed. There are few sensitive land uses along either road section.
Road Classification	Collector Road	Collector Road	The City of Ottawa Official Plan identifies this road as a collector road.
Transit Service	None	None	There is no transit service east of Bank Street. West of Bank Street, only Route #304 operates and only once a week. As there is only limited service the road effectively has no transit service.
Traffic Safety	Frequent Intersections /Driveways	No Median	Pedestrian and cyclist volumes do not meet the thresholds along either section. West of Bank Street there are numerous intersections and driveways spaced closely together thereby meeting the frequent intersection/driveway threshold. East of Bank Street, driveways and intersections are spaced far apart, the road has only a two-lane cross-section, and no collisions with roadside fixed objects have been recorded. The lack of a median therefore governs the traffic safety evaluation.

The final scoring table was filled out for each section of the road separately and the results are provided in **Table 5-26** and **Table 5-27**.

Table 5-26 Final Scoring: Parkway Road, West Section

Criteria	Selected Category	Speed Limit (km/h)					
		30	40	50	60	70	80
Road Character Scores	Moderate Access Street	1	1	100	100	100	100
Road Classification Scores	Collector Road	10	1	1	1	1	1
Transit Service Scores	None	1	1	1	1	1	1
Traffic Safety Scores	Frequent Intersections /Driveways	1	1	1	10	100	100
Total		13	4	103	112	112	112

Based on the above results, a speed limit of 40 km/h is recommended.

Table 5-27 Final Scoring: Parkway Road, East Section

Criteria	Selected Category	Speed Limit (km/h)					
		30	40	50	60	70	80
Road Character Scores	Minimal Access Street	1	1	1	1	1	10
Road Classification Scores	Collector Road	10	1	1	1	1	1
Transit Service Scores	None	1	1	1	1	1	1
Traffic Safety Scores	No Median	1	1	1	1	1	10
Total		13	4	4	4	4	22

A score 4 points was obtained for 40, 50, 60 and 70 km/h, the highest of the four (70 km/h) is selected as the recommended speed limit.

5.3.4 Estimated Speed Limits

An automated process was developed for estimating speed limits for Alternative B. The following assumptions were utilized in the analysis:

- Road Character:** This criterion was determined based on **Table 5-28** as detailed data on adjacent land uses was not available. Additionally, Slater Street and streets within the ByWard Market and Lansdowne were assumed to the High Access Streets. The presence of parks and schools was considered to determine if the Road Character for a road section should be increased. The presence of elder care facilities was not considered due to a lack of data.
- Road Classification:** This criterion was based on the data provided by the City of Ottawa on May 13, 2024.
- Transit Service:** This criterion was based on transit route information obtained from OC Transpo via GTFS on May 28, 2024.
- Traffic Safety:** Information on pedestrian and cyclist volumes, and presence of a median was based on the data provided by the City of Ottawa on May 13, 2024. Pedestrian and cyclist volume data was only available for approximately 10% of intersections. Collision data was provided by the City of Ottawa on May 13, 2024. Information on driveway spacing was not available therefore it was assumed that the Frequent Intersections/Driveways criteria was met if a road was not median divided and located within an urban area.
- Road Sections:** Roads were subdivided at locations where either a) the road classification changed, or b) at the boundary to a Transect. Information on adjacent land uses was not available.

Table 5-28 Road Character Assumption by Road Classification and Transect

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	Moderate	Moderate	Moderate	High
Inner Urban	Moderate	Moderate	Moderate	High
Outer Urban	Low	Moderate	Moderate	High
Suburban	Low	Moderate	Moderate	High
Rural Village	Low	Moderate	Moderate	High
Rural	Minimal	Minimal	Minimal	High
Greenbelt	Minimal	Minimal	Minimal	High

Table 5-29 summarizes the estimated average speed limit for each road classification and Transect. These are average values based on the best available data and should not be interpreted as the recommended speed limits. Refer to Section 5.3.2 for the process used to calculate the recommended speed limit for a given road.

Table 5-29 Alternative B Estimated Average Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	40	30	30	30
Inner Urban	40	30	30	30
Outer Urban	40-60	30-60	30-60	30
Suburban	40-60	30-60	30-60	30
Rural Village	60	-	40	30
Rural	70	-	70	30-50
Greenbelt	70	70	70	30-50

Note: There are no major collector roads located within the Rural or Rural Village Transects.

Within the urban core (i.e., the Downtown Core and Inner Urban Transects), Alternative B would on average recommend speed limits of 40 km/h on arterial roads. Most collector roads would have speed limits of 30 km/h, although some may warrant 40 km/h speed limits under this option. Most local roads would be set to 30 km/h.

Within the Outer Urban, Suburban and Rural Village Transects, most arterial roads would be set to 40 or 60 km/h speed limits, most major collector and collector roads would be set to 30, 40 or 60 km/h speed limits, and most local roads would be set to 30 km/h speed limits.

In the Rural and Greenbelt Transects, arterial and collector roads would generally be set to 70 km/h, while most local roads would be set to 30 or 50 km/h.

Policy 9-9 of Part 1 of the Transportation Master Plan states that the City should target operating speeds of 30 km/h on local residential streets, less than 50 km/h on “access” streets (i.e., typically collector roads), 60 km/h or less on “flow and capacity” streets (i.e., typically arterial and major collectors) in urban areas, and higher operating speeds on roads travelling through the Greenbelt, the Airport Parkway, and certain roads in the Suburban Transect. The estimated speed limits in **Table 5-29** are generally in accordance with this policy.

5.4 Alternative C

Currently, there are five separate policies/by-laws that govern speed limits in the City of Ottawa. Alternative C would involve consolidating these separate policies into a single unified policy.

5.4.1 Speed Limit Setting Process

Alternative C would use the following process for setting speed limits:

- **Local Roads:** All new local roads would be designed and posted at 30 km/h using gateway speed limit signs. Existing roads will maintain their existing speed limits unless the 30 km/h warrant is met (see Section 5.4.1.1).
- **Collector Roads:** On roads less than 10.5 m wide, a 40 km/h speed limit will be warranted if one or more of the following conditions are met:
 - An elementary or junior high school abuts the roadway.
 - Parkland abuts the roadway, which is adjacent to an elementary or junior high school and used to access said school.
 - A licensed childcare facility or private school abuts the road.
 - There are no sidewalks on either side of the roadway.
 - Where the roadway width is less than 5.7 m for two-way travel or less than 4.0 m for one-way travel, and sidewalks are immediately adjacent to the travel lanes.
 - There have been three or more speed-related collisions in three years.
 - The roadway lacks the safe stopping distance for 50 km/h at two or more locations.
 - There are two or more locations where grades are greater than 5% and/or safe speed on curves is less than 50 km/h.

For roads wider than 10.5 m, one or more of the above conditions must be met and the 85th percentile speed of the road must be 50 km/h or lower. Where the above warrant is not met, the default speed limit is 50 km/h.

The speed limit on a collector road may also be reduced to 30 km/h if the 30 km/h warrant (see Section 5.4.1.1) is met.

- **Major Collector and Arterial Roads:** The 85th percentile speed will be collected and rounded to the nearest multiple of 10. This would then be reviewed by City staff to determine what speed limit is appropriate for the road based on their professional judgement. Speed limit assessments will not be completed if a prior assessment was completed less than three years prior unless significant changes have occurred in the area. The speed limit may be reduced to 30 km/h if the 30 km/h warrant (see Section 5.4.1.1) is met.

5.4.1.1 30 km/h Speed Limit Warrant

The 30 km/h warrant is applicable to all existing city roads. If the 85th percentile speed of a road is 35 km/h or lower, a 30 km/h speed limit is automatically warranted. For roads with 85th percentile speeds higher than 35 km/h, the following three criteria must be met:

1. The street must meet Roadway and Traffic Environment criteria;
2. The street must also meet the Active Transportation Environment criteria; and
3. A petition must demonstrate that there is sufficient support for a reduced speed limit.

These three criteria are explained in greater detail below.

1. Roadway and Traffic Environment

For a 30 km/h speed limit to be considered, all the following five criteria must be met:

- Roadway classification of a local road and/or strong pedestrian presence of 20 pedestrians per peak hour or 60 pedestrians per 4 hours or 15 elderly/children crossings during peak hour per block
- Infrequent transit operations
- Two-way roadway with one lane in each direction with a combined lane width of 7m or less (excluding parking), or a one-way roadway with no more than two lanes with a combined lane width of 7m or less (excluding parking)
- Speed limit no higher than 50km/h
- Daily traffic volume is identified as less than 2,500 vehicles per day

2. Active Transportation Environment

This assessment determines whether a 30 km/h speed limit is warranted due to the presence of vulnerable road users, such as pedestrians and cyclists. One or more of the following criteria must be met in order to consider a 30km/h speed limit:

- Adjacent elementary or junior high school
- Improved parkland abutting the roadway
- Significant pedestrian generator abutting the roadway
- No dedicated cycling facilities or sidewalks along the roadway
- Existing physical traffic calming measure have been installed to address a speeding issue
- Insufficient stopping sight distance exists for current operating speeds

3. Petition

For single-access roadways and traditional main streets, the policy outlines the a formal petition process which must also be followed:

- For local single-access⁴ residential roadways, the requestor will be given a petition to distribute to the affected households. The requestor must demonstrate that there is support from 66% of affected households. Once the petition has been completed, the next step is to receive the Councillor's concurrence.
- For traditional main streets with a strong pedestrian presence, a petition is not required. However, support must be obtained from the Business Improvement Area (BIA) or Ward Councillor and presented to Traffic Services staff.

A petition is not required for local residential roadways that have multiple potential points of entry.

⁴ A single-access road is a road that connects to the city-wide road network at a single point. For example, a cul-de-sac is an example of a single-access road as there is only one route that can be taken to get to/from residences on that road.

5.4.2 Speed Limit Setting Examples

Similar to the analysis previously completed for Alternative A and Alternative B, three streets were evaluated under Alternative C. These three streets are:

- Somerset Street West
- Strandherd Drive
- Parkway Road

5.4.2.1 Somerset Street West

The arterial portion of Somerset Street West is currently posted at 50 km/h and operating speeds have been collected along the segments between Bay Street and Lyon Street and between Metcalfe Street and Elgin Street. The 85th percentile operating speed observed at these locations is 47.0 km/h and 40.1 km/h, respectively. This suggests that the existing posted speed limit of 50 km/h should be maintained under Alternative C.

Based on **Table 5-1** and the recommended prevailing speed limit above, a school zone speed limit of 40 km/h is recommended for any school zones along Somerset Street West.

5.4.2.2 Strandherd Drive

Operating speeds have been collected at two locations along Strandherd Drive:

- Between Claridge Drive and Beatrice Drive, the posted speed limit is 70 km/h and the observed 85th percentile operating speed is 79.0 km/h; and
- Between Aura Avenue and Chapman Mills Drive the posted speed limit is 60 km/h and the observed 85th percentile operating speed is 79.3 km/h.

As an arterial road, the methodology of Alternative C would suggest that the posted speed limit should be increased to 80 km/h to match with the observed 85th percentile operating speed. For a prevailing speed limit of 80 km/h, a school zone speed limit of 60 km/h is recommended based on **Table 5-1**.

5.4.2.3 Parkway Road

A 40 km/h speed limit is technically warranted for Parkway Road for the following reasons:

- The road width is less than 10.5m in most locations
- There are no sidewalks along most of the road
- Collision records indicate that between 2012 and 2013, there were three speed-related collisions

If the criteria for implementing a 40 km/h speed limit weren't met, then a speed limit of 50 km/h would be technically warranted.

Currently, Parkway Road is posted between 50 km/h and 80 km/h, depending on the segment, with observed operating speeds ranging from 57.4 km/h to 92.0 km/h.

If the prevailing speed limit were set to 40 km/h, a school zone speed limit of 30 km/h would be warranted based on **Table 5-1**. For prevailing speed limits of 50 or 80 km/h, the resulting school zone speed limit would be 40 and 60 km/h, respectively.

5.4.3 Existing Speed Limits

Although the analysis results for the three example roads from Section 5.4.2 suggest that in some cases the speed limit setting process of Alternative C would result in changes to speed limits, for the purposes of this study it has been assumed that under this alternative there would be little to no change in speed limits. **Table 5-30** summarizes the existing speed limits on the local, collector, major collector and arterial road networks.

Table 5-30 Average Existing Speed Limits

Transect	Arterial	Major Collector	Collector	Local
Downtown Core	50	40	30	30
Inner Urban	50	50	40	30
Outer Urban	60	50	40	40
Suburban	60	50	40	40
Rural Village	60	-	40	40
Rural	80	-	70	40
Greenbelt	80	60	60	40

Note: There are no major collector roads located within the Rural or Rural Village Transects.

When comparing the above speed limits to Policy 9-9 of Part 1 of the Transportation Master Plan, it is evident that existing speed limits are generally not in compliance with the policy.

5.5 Summary

A speed limit setting methodology is a process or series of steps that is used to determine what speed limit should be applied to a given road. Three speed limit setting alternatives were developed for evaluation:

- Alternative A** aims to provide a balance between safety and operational impacts by focusing on reducing speed limits in locations where the safety risk outweighs the projected travel time impact. To develop this alternative, the composite risk profile was utilized to estimate the average risk for each road classification on a per Transect basis. Subsequently, the travel time impacts associated with a 10 km/h speed limit decrease relative to a baseline scenario was calculated and averaged for each road classification on a per Transect basis. The average safety risk was compared to the average travel time impacts to determine locations where the safety risks outweighed the travel time impacts. Based on the results of the comparison, the safety risks outweighed the travel time impact for arterial roads in the Downtown Core, Outer Urban, Rural and Greenbelt Transects, for major collector roads in every Transect except for the Downtown Core and Suburban Transections, and for collector roads in the Downtown Core, Rural and Greenbelth Transects. As such, a 10 km/h reduction in speed limit relative to the existing average speed limit was proposed in those locations as part of this alternative. For Transects where the travel time impacts outweighed the safety risks, a speed limit based on the existing average speed limit was proposed. Additionally, a 30 km/h speed limit is proposed for all local roads in accordance with recent City of Ottawa policy.
- Alternative B** is a modified version of the ‘Right Speed in the City’ methodology from Sweden. These modifications include adjusting the terminology for the Road Classification criteria to align with the City of Ottawa road classification scheme, providing detailed guidance for determining the correct Road Character category, aligning the categories and definitions of the Transit Service criteria to align with OC Transpo

classification schemes, providing quantitative thresholds for the Vulnerable Road Users and Rigid Obstacles categories of the Traffic Safety criteria, and changing the scoring methodology to a numerical scoring system.

- **Alternative C** represents existing conditions and assumes that the existing policies governing speed limits would simply be consolidated into a single unified policy for ease of reference. As this alternative represents a continuation of historical practices, it was assumed that existing speed limits would remain unchanged.

For each alternative, three roads were evaluated to illustrate the application of the speed limit setting methodologies. **Table 5-31** provides a summary of the results for each alternative. Overall, Alternative A and Alternative B propose similar speed limits for all three roads with some minor differences due to the different factors considered by each methodology. Alternative C, however, generally proposed higher speed limits than the other two alternatives for Somerset Street West and Strandherd Drive and lower speed limits on Parkway Road.

Table 5-31 Summary of Speed Limit Setting Examples

Road	Section	Proposed Speed Limit (km/h)		
		Alternative A	Alternative B	Alternative C
Somerset Street West	East of Elgin Street	30	40	50
	Elgin Street to O-Train Line 2	40	40	50
	West of O-Train Line 2	50	40	50
Strandherd Drive	Full Length	60	60	80
Parkway Road	East of Bank Street	60	70	40
	West of Bank Street	40	40	40

6 Operational Impacts

One of the key impacts considered in evaluating the three speed limit setting alternatives was the potential impact on travel times. The travel time impacts of the three alternatives was evaluated for three road user groups:

- The general public
- The City fleet vehicles
- OC Transpo buses

The following subsections examines the impacts on each user group separately and outlines the methodology used to estimate these impacts.

This analysis assumes a hypothetical scenario in which the proposed speed limits are implemented city-wide by 2026. This assumption was necessary to enable a direct comparison of the alternatives. However, in reality, it is understood that the implementation of the updated policy will take place gradually over an extended period.

6.1 Impacts to the General Public

The impacts to the general public were estimated using the same overall methodology used to estimate travel impacts for Alternative A (see Section 5.2.1.2). For each alternative, the aggregate travel time was calculated by estimating the number of vehicle-hours of travel time for each road segment using the following formula:

$$Travel\ Time_i = \frac{AADT_i * Length_i}{Speed_i}$$

Where:

- Travel Time = Vehicle-hours of travel time for the segment
- AADT = Average annual daily traffic volume for the segment
- Length = Length of the segment
- Speed = Average operating speed for the segment
- i = i-th road segment

These travel time results were then compared between each alternative to assess the travel time impact relative to existing conditions (i.e., Alternative C). These results were also utilized to estimate the increase in average trip duration.

As discussed previously in Section 4.1.3, AADT data was only available for approximately 24% of road segments. In order to estimate AADT for the remaining segments, the same assumptions utilized in the collision risk assessment (see Section 4.1.3) were applied.

For existing average operating speeds, the following assumptions were made:

- If speed data was available for a road segment, the observed mean operating speed was utilized.
- If a given road had one or more segments with observed mean operating speeds, it was assumed that the average operating speed on segments without observed mean operating speeds would equal the average of the observed mean operating speeds. To ensure that the average of the mean operating speeds was appropriate, the average was only used if the segments with observed operating speeds were for the same road, with the same road classification, in the same Transect and had the same speed limit.

- For the remaining road segments, a multiple regression model was developed to estimate average operating speeds using the same methodology and dataset described in Section 4.2.1.1. The resulting formula for estimating average operating speeds is the following:

$$y = 18.581 - 3.134 \times C + 1.786 \times A + 0.004 \times L + 0.570 \times S$$

Where:

- y = projected average operating speed (km/h)
- C = roadway classification (1 = arterial, 2 = major collector, 3 = collector, 4 = local)
- A = Official Plan Transect (1 = Downtown Core, 2 = Inner Urban, 3 = Outer Urban, 4 = Suburban greenbelt, 5 = Rural Village, 6 = Rural and Greenbelt)
- L = segment length (m)
- S = speed limit (km/h)

The average operating speed model has a R² value of 0.73 which indicates that 73% of the variability in average operating speed can be explained by the model.

The above average operating speed assumptions are identical to the assumptions utilized to estimate 85th percentile operating speeds in Section 4.2.1.

For the purposes of this study, it was assumed that a change in speed limit under Alternative A or Alternative B would result in a change in average operating speed equal to 25% of the change in speed limit. As such, a 10 km/h decrease in speed limit results in a 2.5 km/h decrease in average operating speed. It was also assumed that average operating speeds would not decrease less than the proposed speed limit. This assumption is supported by the findings of the Research and Literature Review (see Section 3).

Utilizing the methodology outlined above, vehicle-hours of travel time were calculated for every road segment in the city for all three alternative. Vehicle-hours of travel time per segment were subsequently summed together on a per Transect basis, as well as on a city-wide basis. The resulting estimates of travel time are summarized in

Figure 6-1.



Figure 6-1 Daily Vehicle-Hours of Travel Time by Alternative

Although Alternative A generally recommends higher speed limits than Alternative B, in the Outer Urban Transect speed limits on arterial roads are generally lower and therefore the resulting travel times in the Outer Urban Transect is higher for Alternative A than in Alternative B.

Figure 6-2 illustrates the percent increase in travel time for Alternative A and Alternative B relative to travel times under Alternative C. Overall, travel times for Alternative C are expected to be lower than for the other two alternatives. Alternative B is expected to have a significant impact to travel times in the Inner Urban and Greenbelt Transects, while Alternative A is expected to have a more significant impact to travel times in the Outer Urban Transect. Overall, Alternative A is expected to increase average travel times by 3.6%, while Alternative B is expected to increase travel times by 4.0%.

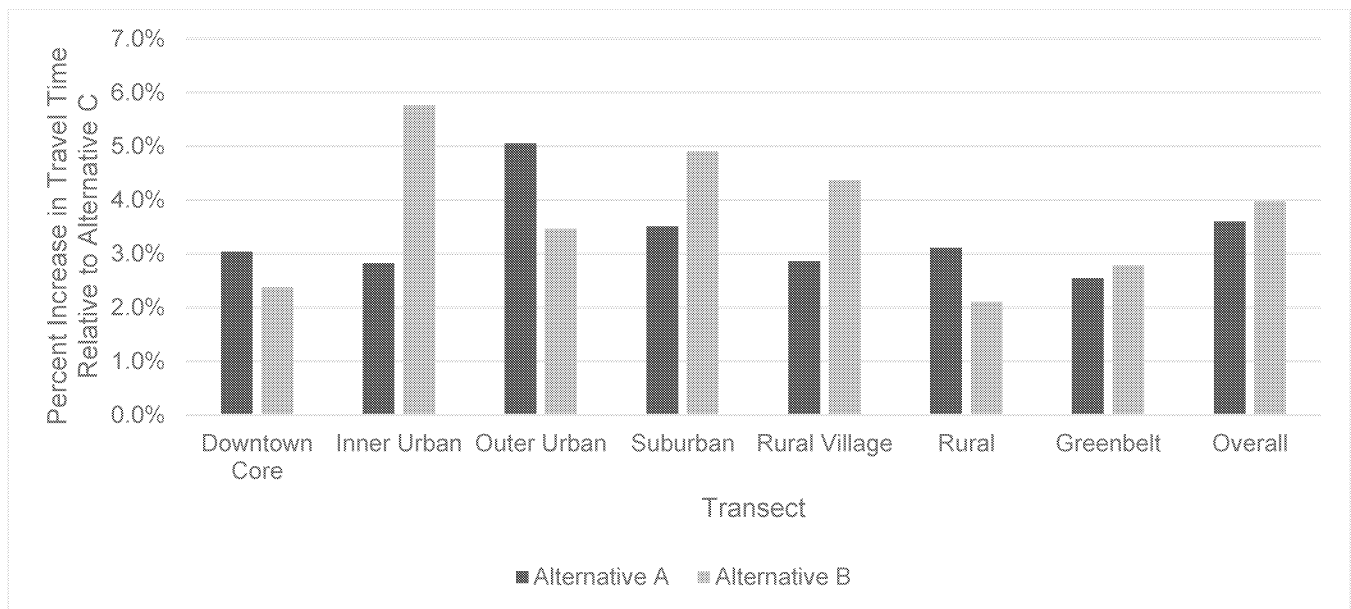


Figure 6-2 Percent Increase in Travel Time

These changes in average travel times were utilized to estimate the impact on an average trip. As discussed in the literature review (see **Appendix B**), the average travel time for an average length trip of 10 km is 23 minutes and 20 seconds. The resulting average trip time under each alternative is summarized in **Figure 6-3**.

Average trip duration under Alternative A is expected to increase by approximately 50 seconds, while under Alternative B it is expected to increase by approximately 56 seconds. As such, the overall impact on an average journey is not expected to be significant.

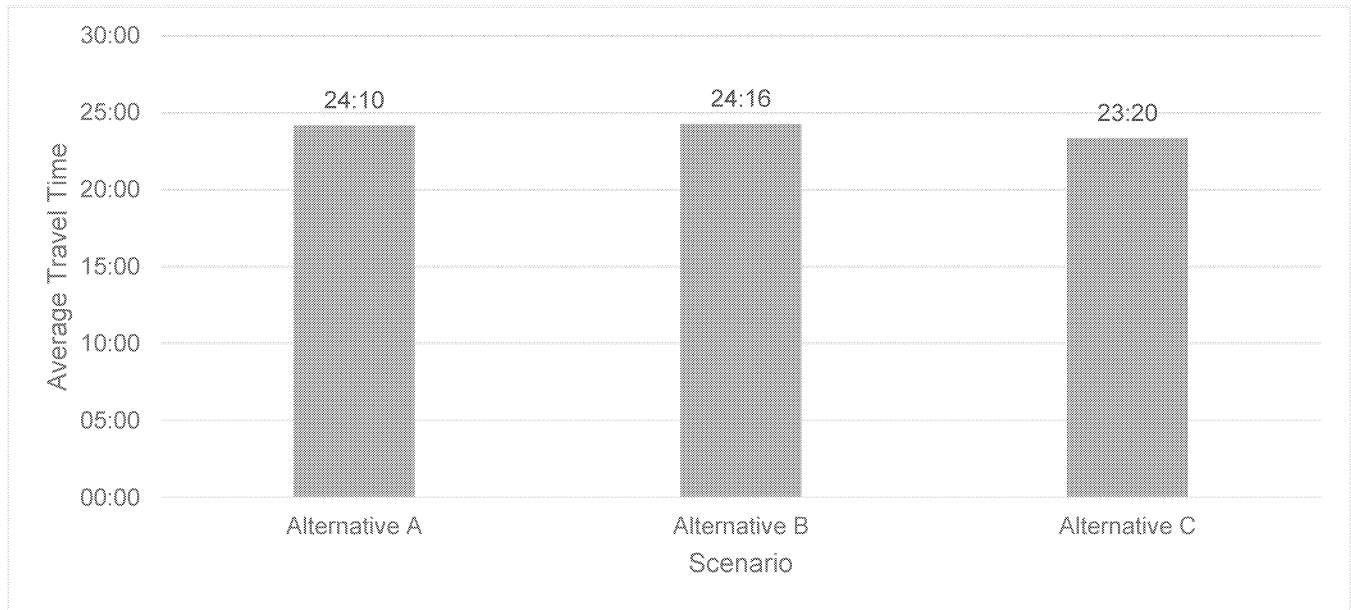


Figure 6-3 Average Trip Duration

6.2 Impacts to City Fleet Vehicles

The City of Ottawa provided a full day of telematics data for their entire vehicle fleet. This included heavy trucks, light vehicles (e.g., sedans, sports utility vehicles, light trucks), garbage trucks, road sweepers and many others. Telematics data for OC Transpo buses was provided separately and discussed in Section 6.3.

The City fleet telematics data included three key data points:

- Vehicle ID number
- Vehicle operating speed records at regular intervals
- Time stamps for operating speed record

City fleet vehicles are required to adhere to the posted speed limits at all times. As such, a decrease in the posted speed limit would result in an increase in travel time. To assess the impacts of the three alternatives on City fleet vehicles, this increase in travel time was calculated.

The first step for calculating the increase in travel time was to calculate the distance travelled by each vehicle between two time stamps. This was completed using the following formula:

$$D_i = (T_i - T_{i-1}) * \frac{V_i + V_{i-1}}{2}$$

Where:

- D = Distance travelled between time stamps
- T = Time
- V = Speed
- i = i-th time stamp

The next step was to calculate the increase in travel time due to the lower speed limits. For each time stamp, the following formula was used calculate the increase in travel time:

$$E_i = D_i / \frac{\min(V_i, L_i) + \min(V_{i-1}, L_{i-1})}{2} - (T_i - T_{i-1})$$

Where:

- E = Increase in travel time
- D = Distance travelled between time stamps
- T = Recorded time stamp
- V = Recorded speed
- L = Proposed speed limit
- i = i-th time stamp

Utilizing the minimum of either the recorded speed or proposed speed limit ensures that only when the vehicle speed recorded exceeds the future proposed speed limit will there be an increase in travel time. If the recorded speed is lower than the proposed speed limit, then the portions of the formula on either side of the minus sign will cancel out, resulting in no change in travel time.

For each alternative, the increase in travel time was calculated for every vehicle based on a full day of telematics data. Average daily travel times for City fleet vehicles under each alternative are illustrated in **Figure 6-4**.

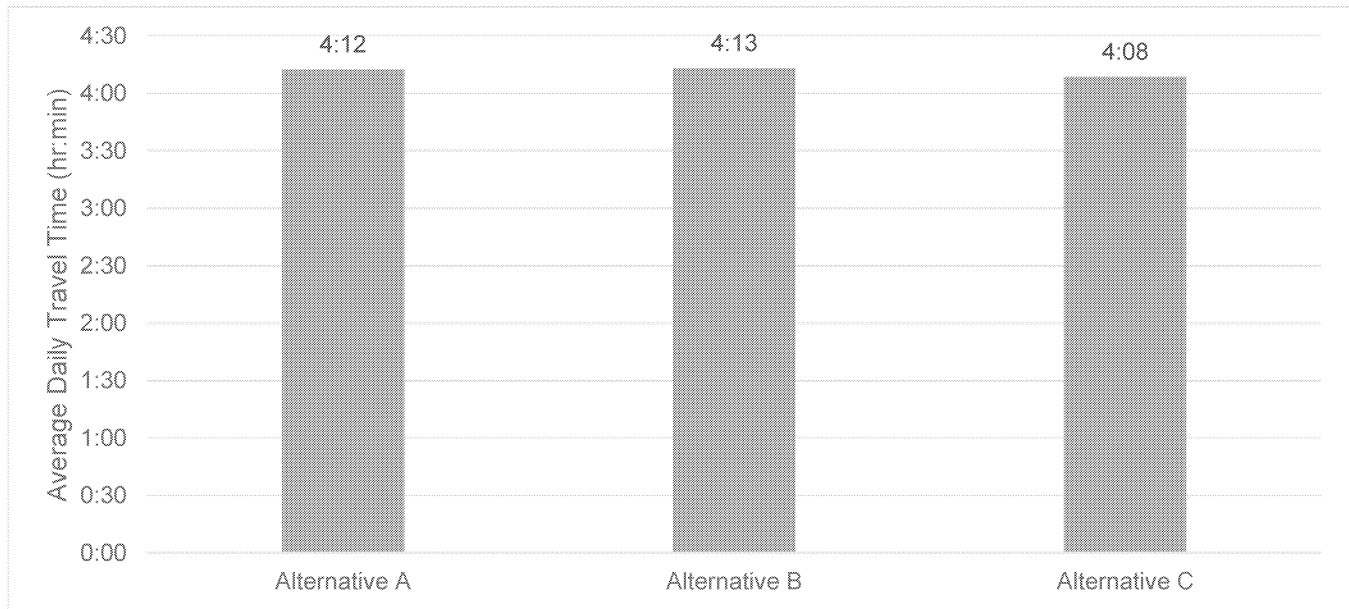


Figure 6-4 Average Daily Travel Time for City Fleet Vehicles

The impacts to City fleet vehicles are expected to be relatively minor with a 4-minute per day increase in travel time under Alternative A compared to Alternative C, and a 5-minute per day increase under Alternative B.

6.3 Impacts to OC Transpo

The City provided telematics data for nine OC Transpo buses for a single day. The telematics data provided included all activity undertaken by the bus. When buses are not actively travelling through their designated transit route and picking and dropping off customers (i.e., in service), they may be doing one of three activities:

- **Pulling out:** Travelling from their parking spot to the first stop on their route.
- **Pulling in:** Travelling from the last stop on their route to their parking spot.
- **Dead heading:** Travelling from the last stop of their previous route to the first stop of their next route.

OC Transpo’s transit service is subdivided into various service types such as Local, Connexion, Frequent, Rapid and School⁵. **Table 6-1** summarizes the 39 bus routes the nine buses were servicing, across five service types. The telematics data analysed included bus operations throughout the city, from the downtown core to the rural areas.

Table 6-1 Bus Routes Served

Service Type	Bus Routes Served
Local	16, 26, 28, 34, 35, 38, 50, 54, 55, 56, 67, 73, 82, 86, 96, 155, 168, 197
Connexion	221, 258, 265, 271, 283
Frequent	11, 12, 25, 51, 88
Rapid	39, 57, 61, 62, 74, 75, 98, 99
School	619, 664, 683

When buses are in service, their operating speed rarely approaches the posted speed limit due to the frequent acceleration and deceleration associated with picking up and dropping off passengers. A key concern with adjusting speed limits will be the impact on travel time when buses are not in service and therefore operating near the posted speed limit.

The same methodology for calculating the increase in travel time for city fleet vehicles was used to assess the impact of the speed limit setting alternatives on OC Transpo vehicles. However, the telematics data for OC Transpo included odometer readings for each time stamp, therefore, there was no need to manually calculate the distance travelled between time stamps.

Figure 6-5 summarizes the average daily travel time per activity under each alternative.

⁵ The ‘New Ways to Bus’ initiative will be implemented on April 27, 2025, and will eliminate the Rapid service type and existing Rapid routes will generally become Frequent routes instead. As the data provided by OC Transpo predates this initiative, the former transit service type classification will be referenced in this study.

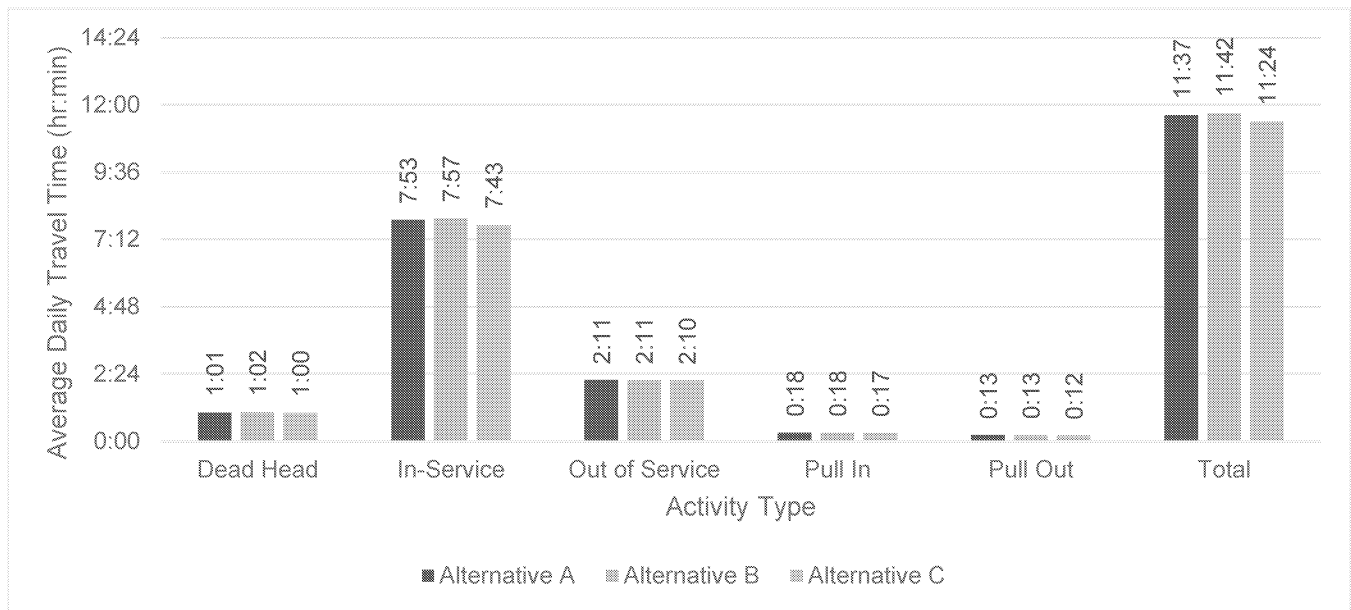


Figure 6-5 Average Daily Travel Time by Activity for OC Transpo Buses

The most significant impacts to OC Transpo travel time will be when buses are in-service. Travel times while buses are in-service will increase by 10 to 14 minutes per day as a result of changes in speed limits.

When considering total travel time per day, it is expected that average travel time will increase between 13 to 18 minutes per day as a result of changes in speed limits.

The increase in travel time was averaged on a per-route basis and the results are illustrated in **Figure 6-6**.

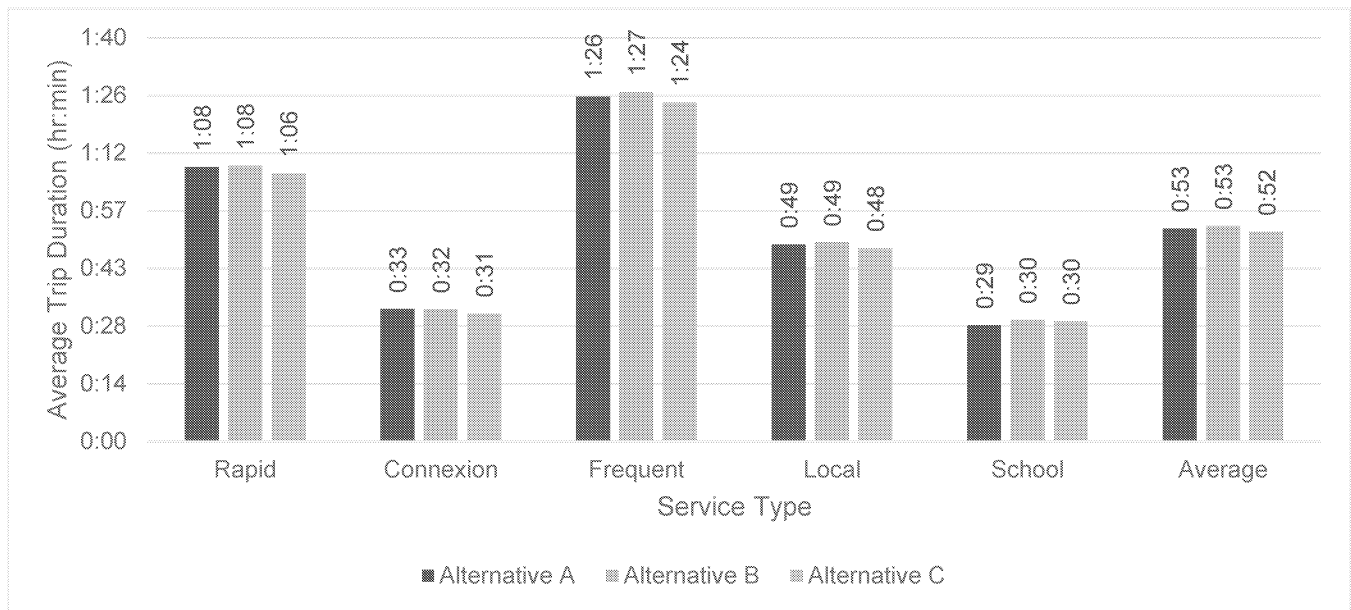


Figure 6-6 Average Trip Duration by Route Type for OC Transpo Buses

Overall, the average travel times for different route types are expected to increase by between one to three minutes on average. This minor increase largely reflects the fact that buses rarely travel near the existing speed limit due to the need to frequently slow down and pick-up/drop-off passengers.

6.4 Summary

One of the key impacts considered in evaluating the three speed limit setting alternatives was the potential impact on travel times. The travel time impacts analysis revealed that:

- Alternative A:** Travel times for the general public are expected to increase by approximately 3.6% for an average vehicle trip. This equates to an increase in average trip duration of approximately 50 seconds. Average daily travel times for City fleet vehicles are expected to increase by approximately 4 minutes, while average OC Transpo travel times are expected to increase by about 13 minutes per day.
- Alternative B:** The travel time impacts of this alternative are on average greater than the impacts of Alternative A. Travel times for the general public are expected to increase by approximately 4.0%, equating to an increase of 56 seconds in average vehicle trip duration. Average daily travel time for City fleet vehicles and OC Transpo are anticipated to increase by five minutes and 18 minutes, respectively.
- Alternative C:** As this alternative represents existing conditions, no increase in travel time is anticipated under this option related to speed zone policy as there would be no changes to the speed zones in place today.

6.5 Analysis Limitations

There are several limitations to this analysis approach, including:

- Lack of consideration for the impacts of congestion and signal delay on travel times.
- Observed traffic and speed data was only available for 24% and 9% of road segments, respectively. Although traffic volumes and average operating speeds were estimated for the remainder of road segments, the accuracy of the travel time impacts is reduced due to the limited observed data and the reliance on estimated values instead.
- The evaluation of OC Transpo bus travel times is based on data for only nine buses for a single day. This small sample size makes it difficult to assess how representative this sample is of the city-wide bus network.

It should be noted that these limitations are, in large part, a symptom of the large city-wide scale of the modelling exercise.

7 Safety Impacts

The key objective of updating the speed zone policy is to reduce the frequency and severity of collisions on a city-wide basis with a focus on fatal and major injury collisions. The relationship between collisions and operating speeds is well established. With lower speeds, drivers have more time to react to unexpected situations and impact forces are reduced. These effects reduce both the probability of a collision occurring as well as the severity of any collision that does occur.

Collision analysis was completed to estimate the potential safety impacts of Alternative A and Alternative B compared to Alternative C. The results of this analysis have been provided separately in a report titled "Ottawa Speed Limit Policy – Safety Impact Analysis". Please refer to this document for detailed information regarding the projected safety benefits of Alternative A and Alternative B.

Overall, the results of the analysis indicate that both Alternative A and Alternative B are expected to generate significant safety benefits. Once fully implemented on a city-wide basis, reductions in collision frequencies of between 3% to 7% are projected for Alternative A, while reductions of between 3% to 8% are projected for Alternative B. When considering the most severe collision classifications such as fatal and major injury (FMI) collisions, the safety benefits are even greater with reductions of between 6% to 15% projected for Alternative A and Alternative B. These reductions are relative to Alternative C and are in addition to the ongoing safety benefits that are occurring as a result of the continued implementation of the RSAP.

8 Implementation Cost Estimate

A key consideration for selecting the recommended alternative is the potential cost of replacing, removing, or installing speed limit signage. High-level cost estimates were developed for each alternative to assess the cost of implementation. The methodology for calculating these cost estimates is outlined in the following subsections:

1. **Unit Prices:** Summarizes the cost for sign removal, replacement, installation and traffic signal retiming.
2. **Signage Placement Guidelines:** Discusses the guidelines from Ontario Traffic Manual (OTM) Book 5: Regulatory Signs and OTM Book 6: Warning Signs regarding the placement and frequency of speed limit and warning signage.
3. **Cost Estimates:** Summarizes the estimated cost of implementation associated with each alternative.

8.1 Unit Prices

Based on data provided by the City of Ottawa, the unit prices listed in **Table 8-1** were used in this study.

Table 8-1 Estimated Cost per Unit

Element	Cost per Unit
Sign Removal	\$250 per sign
Sign Replacement	\$325 per sign
Sign Installation	\$425 per sign
Traffic Signal Retiming	\$150 per signalized intersection
Speed Display Board Reprogramming	\$75 per speed display board

8.2 Signage Placement Guidelines

OTM Book 5 provides guidelines for how frequent speed limit signs should be provided based on speed limits and speed zone lengths. These guidelines are summarized in **Table 8-2**.

Table 8-2 OTM Book 5 Recommended Signage Frequency

Speed Limit (km/h)	Recommended Signage Frequency
≤50	For speed zones less than 1.5 km in length: Every 300m For speed zones greater than 1.5 km in length: Every 900m
60	Every 600m
70	Every 900m
≥80	For speed zones between than 1.5 and 8 km in length: Every 2 km For speed zones greater than 8 km in length: Every 8 km

Additional Signage Placement Guidelines:

- Maximum Speed Limit signs must be provided in both directions at locations where speed limit changes.
- On arterial roads, Maximum Speed Limit signs should be placed downstream of major intersections (i.e., arterial-arterial, arterial-major collector, and arterial-collector intersections).
- At the beginning and end of an arterial, major collector or collector road, a Maximum Speed Limit sign must be provided.
- At the entrances to Gateway Zones, a Gateway Speed Limit sign must be provided in each direction to indicate the start and end of the Gateway Zone. Additional signs are not required within the boundaries of the Gateway Zone.

For cul-de-sacs, Gateway Speed Limit signage is not technically required and a single Maximum Speed Limit sign at the entrance of the cul-de-sac is sufficient. However, for the cost estimation in this study, cul-de-sacs were treated as Gateway Zones due to the difficulty of determining whether a given collection of local road segments had only one entrance and therefore functioned as a cul-de-sac. As Gateway Zone entrances require two signs as opposed to the one sign required for cul-de-sacs, treating both as Gateway Zones ensure a more conservative cost estimate.

For guidance regarding the placement of warning signs, OTM Book 6 was referenced. OTM Book 6 outlines minimum placement distances and sign sizes for different speed limits. With any changes to speed limits, it will be necessary to relocate signs based on the minimum placement distances from OTM Book 6, and it may even be necessary to change the sign entirely depending on the existing sign size and the sign size required for the new speed limit. For the purposes of this study, it has been assumed that all warning signs will require removal and re-installation.

The City of Ottawa provided data on all warning signs in the Rural and Rural Village Transects and provided data on warning signs in urban areas for arterial, major collector and collector roads only. This data was provided on March 3, 2025, and was cross-referenced with the proposed speed limit changes to estimate the number of warning signs that will need to be removed and re-installed.

8.3 Implementation Cost Estimates

Cost estimates to implement Alternative A and Alternative B were calculated using the following steps:

1. **Intersection Signage:** Identify intersection legs requiring Maximum Speed Limit or Gateway Signs, based on the guidelines outlined in Section 8.2.
2. **Traffic Signal Retiming:** Identify intersections where speed limit changes require retiming the traffic signals.
3. **Existing Signage Replacement/Removal:** Identify road segments with existing Maximum Speed Limit or Gateway Speed Limit signs. If there are existing signs, determine whether they need to be replaced or removed.
4. **Signage Frequency Compliance:** For each road, determine whether the average signage frequency meets the guidelines outlined in **Table 8-2**.
5. **Warning Sign Removals and Re-Installations:** For each road, determine whether the existing warning signs need to be removed and re-installed at a new location.
6. **Speed Display Boards:** For each existing speed display board, determine whether it needs to be reprogrammed to match the proposed speed limit.

Using these steps, the number of sign removals, replacements, and installations required as well as the number of traffic signals that require retiming and the number of speed display boards that require reprogramming was tallied for both Alternative A and Alternative B and is summarized in **Figure 8-1**.

As Alternative C does not propose any changes to existing speed limits, there are no implementation costs associated with this option.

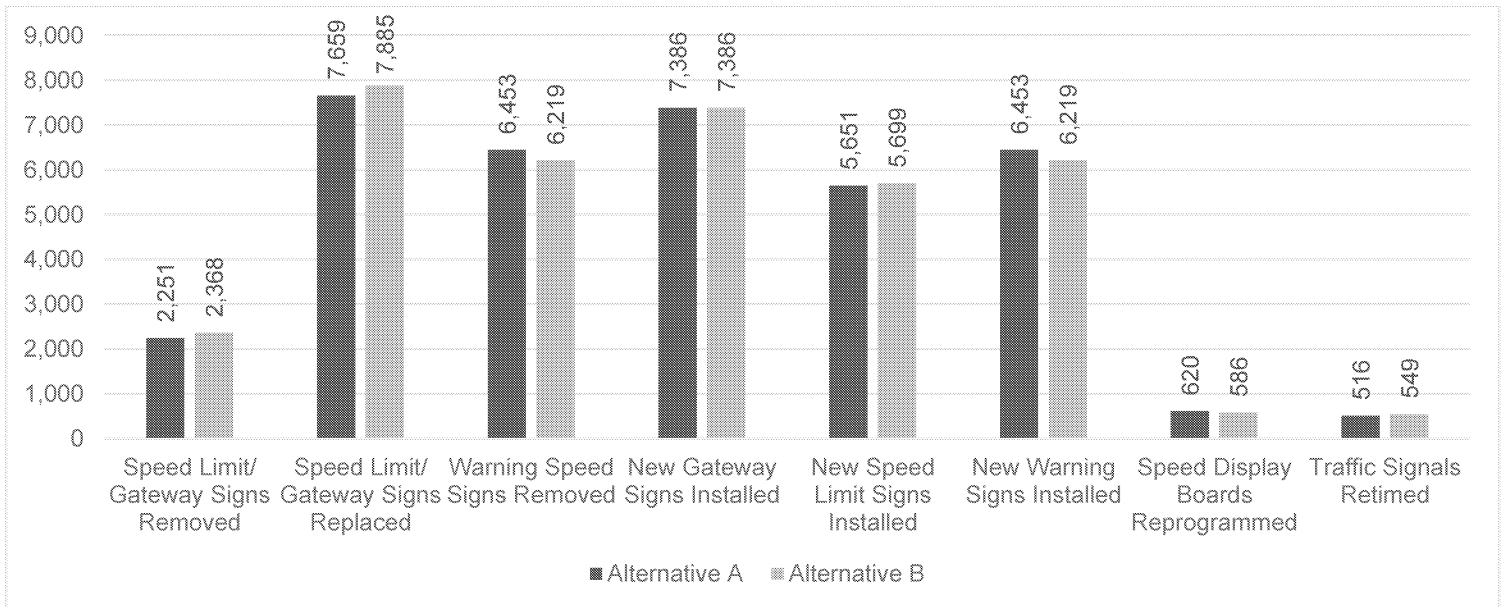


Figure 8-1 Signage and Signal Timing Adjustment Quantities

The resulting speed limits proposed by the two policy alternatives are significantly different in some areas. However, the number of speed zone changes affect a similar number of road segments and intersections. Therefore, the quantities of signs and signals to be changed are relatively similar for the two policy alternatives.

Cost estimates were developed by multiplying the above quantities by the unit prices from **Table 8-1**. As these cost estimates are at a planning level, a 40% to 50% contingency factor was applied, consistent with the typical contingency factors applied for Class D engineering cost estimates.

Overall, the two policy alternatives are expected to have similar implementation costs: Both alternatives have similar costs and difference are marginal.

These implementation cost estimates are based on an approximation of quantities. For the preferred speed zone policy and detailed implementation plan, more detailed cost estimates should be developed on a road-by-road basis.

8.4 Analysis Limitations

Due to the city-wide scale of these cost estimates, there are some limitations that should be taken into account when reviewing the analysis results:

- The number of new speed limit and gateway speed limit signs required for each alternative was estimated using a simple spreadsheet exercise rather than a detailed review of each city road. Factors such as the presence of other signage, road geometry and other factors that may influence the placement of signage was not considered in the analysis. The cost estimates therefore likely overstate the number of new speed limit signs required.
- Identifying which roads are a cul-de-sac is a computationally intensive process to undertake at a city-wide level. However, by treating cul-de-sacs the same as 'gateway areas', there is a slight over-estimation in the cost estimates.
- It is likely that there are gaps in the signage inventory provided by the City of Ottawa for warning signs, particularly for urban local roads.
- There are likely other costs associated with implementing changes to speed limits that were not included in the analysis such as City staff time and/or consultant fees associated with reviewing road speed limits and preparing signage update plans.

In recognition of the above limitations, a 40% to 50% contingency factor was applied to the cost estimates, consistent with typical contingency factors applied for Class D engineering cost estimates.

9 Evaluation of Options

This section summarizes the three speed limit setting alternatives developed in this study as well as the key findings from the operational impact analysis, safety impact analysis, and cost estimating exercises. Additionally, qualitative advantages and disadvantages of each alternative are discussed. Based on the comparison of the three alternatives, the recommended alternative was identified.

9.1 Speed Limit Setting Alternatives

The three speed limit setting alternatives developed in this study are:

- **Alternative A:** This alternative seeks to balance safety risks and travel time impacts. These two factors were compared in order to develop a set of recommended speed limits for each road classification, subdivided by Transect. The resulting speed limit selection matrix is summarized in **Table 5-11**.
- **Alternative B:** This alternative is based on the 'Right Speed in the City' methodology from Sweden, which was adapted to the Canadian context through a number of modifications. To determine the appropriate speed limit for a given road, four criteria are considered: Road Character, Road Classification, Transit Service, and Traffic Safety. A numerical scoring process is applied to determine which speed limit scores the best overall across all four categories, making it the recommended speed limit for the road.
- **Alternative C:** This alternative proposes maintaining the existing speed limit selection process. If selected, the existing policies governing speed limits would be consolidated into a single unified policy for ease of reference.

9.2 Evaluation of Alternatives

Table 9-1 summarizes the results of the quantitative and qualitative assessments of the three alternatives.

Table 9-1 Evaluation of Alternatives

Evaluation Criteria	Alternative A	Alternative B	Alternative C
Quantitative Assessment (Relative to Alternative C)			
Increase in average travel time	3.6% per trip	4.0% per trip	-
Increase in average trip duration	50 seconds per trip	56 seconds per trip	-
Increase in average City fleet travel time	4 minutes per day	5 minutes per day	-
Increase in average OC Transpo travel time	13 minutes per day	18 minutes per day	-
Increase in average OC Transpo trip duration	Up to 2 minutes per trip	Up to 3 minutes per trip	-
Reduction in fatal and major injury collisions	6% to 15%	6% to 15%	-
Reduction in all collisions	3% to 7%	3 % to 8%	-
Cost of implementation	\$19 to \$21 million	\$19 to \$21 million	-
Qualitative Assessment			
Ease of understanding by the general public	The speed selection matrix is easy to understand	The speed scoring process is complex and requires more effort to explain	Generally easy, although general public may not understand percentiles
Ease of application of the methodology	Using the speed selection matrix is easy and requires minimal effort	A high level of effort is required to review each location to determine which categories are met for each criterion	There is some effort required to collect 85 th percentile operating speeds (for arterial and major collectors only) but otherwise the methodology is easy to apply
Consideration of site-specific conditions	This methodology indirectly takes into consideration average area-wide conditions, rather than site-specific conditions	This methodology directly considers road design in the speed limit selection process	This methodology considers site-specific conditions such as existing operating speeds and other contextual elements

Overall, the key findings can be summarized as follows:

- Alternative A is anticipated to result in significant safety improvements that are comparable to that of Alternative B while having a less significant impact on travel times and a similar cost of implementation. The projected reductions in serious collisions (fatal and major injury collisions) is similar to the reductions projected for Alternative B. This alternative is also expected to be easier for the general public and practitioners to understand and implement.
- Alternative B is projected to have a slightly higher safety impact than Alternative A, resulting in fewer total collisions of all severities. This comes at the cost of slightly higher impacts to travel time. This alternative may be difficult for the general public to understand, require greater effort to implement, but ensures that road design is factored into the speed limit setting process.
- Alternative C represents the baseline conditions for this study, and it is expected that overall travel times will remain similar to existing conditions. Road safety may continue improving in the future due to the continued implementation of the RSAP, however, the reduction in collisions will not be as significant as it could potentially be. Compared to the other two alternatives, this alternative is harder for the general public to understand than Alternative A, but easier to understand than Alternative B.

The above findings were considered in the selection of the recommended alternative.

9.3 Recommended Alternative

Considering the advantages and disadvantages associated with each of the three alternatives, the **Alternative B** was recommended by the consultant team for consideration by the City. The Alternative B has the following advantages:

- Only slightly higher impact on travel times for the general public, OC Transpo and City fleet compared to the Alternative A;
- Substantially reduces the frequency of all collisions when compared to Alternative C, even after factoring in the substantial ongoing safety improvements that are being implemented as part of the RSAP;
- A methodology based on best practices in Vision Zero/Safe Systems Approach which has been modified to fit the local Canadian context; and
- Consideration for traffic safety based on-site specific roadway design is explicitly embedded within the methodology.

10 Stakeholder Consultation

A Technical Advisory Council (TAC) meeting was held on April 4, 2025, with City of Ottawa staff from various Departments such as Asset Management, Fleet Services, Infrastructure Services, Ottawa Fire Services, Ottawa Paramedics Services, Ottawa Police Services, Public Works – Business Support Services, Roads & Parking Services, Solid Waste Services, Traffic, Safety and Mobility, Transit Services, and Transportation Planning, to present the three speed limit setting alternatives which were developed and solicit feedback regarding the recommended alternative.

The following feedback was provided by City of Ottawa staff:

- The cost implications of the policy will need to be clearly articulated to City Council in order to obtain approvals. (Asset Management)
- The design approach for new greenfield developments may need to change after the policy is adopted. (Asset Management)
- Some road cross-sections may require changes as a result of the new policy which will have an additional capital cost. (Asset Management)
- Behavioural change amongst drivers will be the greatest challenge and a large-scale communications and change management campaign is recommended by staff to support the policy rollout. (Fleet Services)
- City staff noted that behaviour change may require broader cultural shifts for successful long-term implementation, similar to wearing seat belts. (Fleet Services)
- City staff noted that the safety benefit of speed limit changes will be maximized when paired with physical interventions and that there is a need to acknowledge these limitations and include complimentary measures in communications with Council and the public. (Traffic, Safety and Mobility)
- City staff suggested that the methodology should include a criteria that considers designated pedestrian and bicycle networks to determine speed limits. (Ottawa Fire Services)
- Concerns were raised that lower speed limits could increase travel times for City and OC Transpo vehicles during the off-peak periods which could impact annual operating budgets. (Transit Services)
- It was suggested that the future planned context should also be considered when evaluating speed limits. (Transportation Planning)
- A concern was raised regarding the inclusion of a criteria for transit service in the speed limit setting methodology for Alternative B as well as the fact that the methodology would suggest raising speed limits to 40 km/h on streets such as Elgin Street. (Transit Services)
- A suggestion was made that the frequency of rigid obstacles should be used in the evaluation of speed limits rather than using the frequency of collisions with rigid obstacles. (Ottawa Paramedic Services)
- It was suggested that traffic calming measures should be implemented along with changes to the posted speed limits in specific areas such as community safety zones and locations with higher volumes of vulnerable road users. (Transportation Planning)

11 Final Speed Limit Setting Methodology

Following the stakeholder consultation, the Project Team collaborated to further refine the speed limit setting methodology of Alternative B. The Project Team conducted extensive testing of the methodology for 76 road corridors to identify issues with the process and results of the methodology. Following this extensive testing, the Project Team implemented the following changes to the methodology:

- Frequent Intersections/Driveways:** For this category of the Traffic Safety criteria, the Project Team changed the approach for calculating the average intersection/driveway spacing. Instead of considering all intersections and driveways along a road section, the new approach only considers intersections with public or private roads and driveways for significant traffic generators such as commercial and multi-residential developments. Driveways for single residential dwellings (e.g., single-family homes, townhouses) are no longer considered in the calculation of the average intersection/driveway spacing.
- Rural Arterials:** For the Road Classification criteria, different scores will be used for rural and urban arterials. The rural arterial scores only apply to arterial roads outside the urban and rural village boundaries.
- Updated Speed Limit Scores:** The speed limit scores for all criteria were modified by the Project Team. The updated scores are summarized in **Table 11-1** to **Table 11-4**.

Table 11-1 Road Character Scores

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
High Access Street	1	50	100	150	150	150
Moderate Access Street	1	10	100	100	100	100
Low Access Street	1	1	10	10	100	100
Minimal Access Street	100	100	50	50	100	100
No Access Street	100	100	100	100	1	1

Table 11-2 Road Classification Scores

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Local Road	1	1	1	1	1	1
Collector Road	10	1	1	1	1	1
Major Collector Road	100	50	1	1	1	1
Urban Arterial Road	100	50	10	10	1	1
Rural Arterial Road	100	75	75	55	1	1

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Table 11-3 Transit Service Categories

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Local Service	1	10	10	10	1	1
Frequent Service	10	50	50	50	10	10
None	1	1	1	1	1	1

Table 11-4 Traffic Safety Categories

Category	Speed Limit (km/h)					
	30	40	50	60	70	80
Vulnerable Road Users	1	10	100	150	150	150
Frequent Intersections/Driveways	1	1	10	50	100	100
Rigid Obstacles	1	1	1	1	10	100
No Median	1	1	1	1	1	10
None	1	1	1	1	1	1

12 Summary

The results of the peer jurisdiction review did not identify any consistent approaches to speed limit setting. When comparing existing City of Ottawa speed limits to other jurisdictions it was found that existing urban speed limits are generally consistent with those implemented by other jurisdictions. However, rural arterial road speed limits in Ottawa tend to be higher, while rural collector and local road speed limits tend to be lower than in other jurisdictions.

A comprehensive research and literature review was subsequently conducted, and the key findings confirm a strong link between vehicle operating speeds and collision frequency and severity. Furthermore, road design can impact safety by reducing the risk of certain types of collisions and encouraging lower operating speeds through a “self explaining” design. Even without changes to road design, reducing speed limits alone has been shown to lower both collision frequency and vehicle operating speed but not as significant as when it is coupled with modifications to road design and using additional measures such as speed enforcement.

Following the review of best practices and relevant literature, historical collisions and operating speeds in Ottawa were analyzed to develop a composite risk profile. This risk profile served as the foundation for one of the speed limit setting alternatives (Alternative A) and is intended to help identify high risk roads that should be prioritized for speed limit reductions. The composite risk profile consists of two components: (i) a reactive element, which considered historical collision data, and (ii) a proactive element, which uses operating speed data to assess the safety risks associated with speeding.

Speed Limit Setting Alternatives

Three speed limit setting alternatives were subsequently developed:

- **Alternative A:** This alternative attempts to achieve a balance between improving safety and minimizing travel time impacts. To do this, the risk levels from the composite risk profiles were compared to the travel time impacts of a hypothetical 10 km/h reduction in posted speed limits. For locations where the safety risk outweighed the travel time impacts, a 10 km/h decrease in speed limits was proposed. Otherwise, this alternative proposed utilizing the average of existing speed limits.
- **Alternative B:** This alternative is an adaptation of the ‘Right Speed in the City’ methodology from Sweden, with adjustments to reflect the Canadian context. The adjusted methodology considers four criteria for setting speed limits: Road Character, Road Classification, Transit Service, and Traffic Safety. Based on these four criteria, various speed limit options are scored and compared to determine the optimal speed limit that best balances these four criteria.
- **Alternative C:** This alternative maintains the existing speed limit setting processes by consolidating the existing policies governing speed limits into a single unified policy. As this represents a continuation of existing practices, it assumed that there would be no change in driver behaviour under this alternative.

Analysis of Alternatives

Different analyses were conducted to assess the impacts of each alternative:

- Travel time impacts on the general public were evaluated based on historical operating speed and traffic volume data. The results of the analysis indicate that Alternative A will increase the average trip duration by approximately 50 seconds (3.6%) relative to Alternative C, while Alternative B will increase it by approximately 56 seconds (4.0%).
- Travel time impacts on City fleet vehicles were evaluated using telemetric data of one day. The telematics data utilized in the analysis was based on trip data for 971 City fleet vehicles and included data for an entire day. Relative to Alternative C, Alternative A is expected to increase travel times by 4 minutes per day and Alternative B is expected to increase it by 5 minutes per day.
- Similar to the analyses undertaken for City fleet vehicles, the travel time impacts on OC Transpo buses were evaluated using telemetric data of one day from nine buses. On a per day basis, Alternative A and Alternative B are expected to increase travel times by 13 and 18 minutes per day, respectively, compared to Alternative C. When considering the average increase on a per trip basis, there is a relative increase of up to 2 and 3 minutes per trip, respectively.
- Future collisions were projected for all three alternatives. For Alternative C, historical collision data was reviewed to identify collision trends and forecast future collisions over a 20-year period. For Alternative A and Alternative B, well-known collision modification factors were utilized to estimate the impacts of reducing speed limits on collision frequency, using Alternative C as a baseline. The results indicate that relative to Alternative C, between 6% to 15% fewer fatal and major injury collisions would occur under both Alternative A and Alternative B. The relative reduction in all collisions is lower at between 3% to 7% and 3% to 8% for Alternative A and Alternative B, respectively.
- The cost of removing, replacing or installing speed limit and warning signage as well as the cost of traffic signal retiming and reprogramming speed display boards were estimated for both Alternative A and Alternative B. OTM Book 5 was utilized to identify where and how frequent speed limit signage would be installed, while OTM Book 6 provided guidance on warning sign adjustments. Based on the estimated quantities, the both Alternative A and Alternative B are expected to cost be similar as the difference in cost are marginal. The similar costs for both alternatives reflect the fact that both impact a relatively similar number of roads, even if the recommended speed limits are different.

Recommended Alternative

The **Alternative B** was identified as the recommended alternative for consideration by the City. This alternative achieves higher levels of safety improvements compared to Alternative A while having only a slightly higher impact on travel times. The methodology is based on best practices in Vision Zero/Safe Systems Approach and tailored for the City of Ottawa context. A key advantage of this alternative is the explicit consideration of traffic safety based on site-specific roadway design which is embedded into the methodology.

Stakeholder Consultation

A Technical Advisory Committee (TAC) meeting was held on April 4, 2025, with City of Ottawa staff from various departments. The three speed limit setting alternatives were presented to City staff and concerns and suggestions from City staff were recorded and considered to further refine the recommended alternative.

Final Speed Limit Setting Methodology

City of Ottawa staff conducted extensive testing of the recommended methodology on a total of 76 road corridors. Based on the findings from this testing, three refinements were made by the Project Team to the methodology:

- The approach for calculating the average intersection/driveway spacing was adjusted such that only intersections and significant driveways are considered. Driveways for single residential dwellings are no longer considered in the calculation of the average intersection/driveway spacing.
- A new Road Classification category was introduced for rural arterial roads which includes all arterial roads located outside of the urban and rural village boundaries.
- A speed limit scores were updated by the Project Team. The updated scores are summarized in **Table 11-1** to **Table 11-4**.

Appendix A

Peer Jurisdictional Review Report

SUBJECT
Ottawa Speed Zone Policy Update: Peer Jurisdictional Review

DATE
March 31, 2025

DEPARTMENT
Transportation Engineering

COPIES TO
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TO
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OUR REF
https://arcadiso365.sharepoint.com/sites/146927/InternalDocuments/6.0_Technical/6.23_Traffic/03_Reports/1.JurisdictionalReview/TTM_PeerJurisdictionReview_Final_3.1_2025-03-06.docx

PROJECT NUMBER
146927

From
Prepared by: Eric McLaren, Deputy Project Manager/Technical Lead, Arcadis
Reviewed by: Amr Shalkamy, Project Manager, Arcadis

1. Introduction

The City of Ottawa has retained Arcadis to undertake an update to their Speed Zone Policy, which provides the City direction on setting speed limits on City roads. As part of the Speed Zone Policy update, a peer jurisdiction review was undertaken to identify the speed limit setting practices utilized in other cities in Ontario, across Canada, and internationally. The existing City of Ottawa policies governing speed limits have also been reviewed.

The peer jurisdictions located in Ontario that have been reviewed as part of this report are illustrated in **Figure 1**.

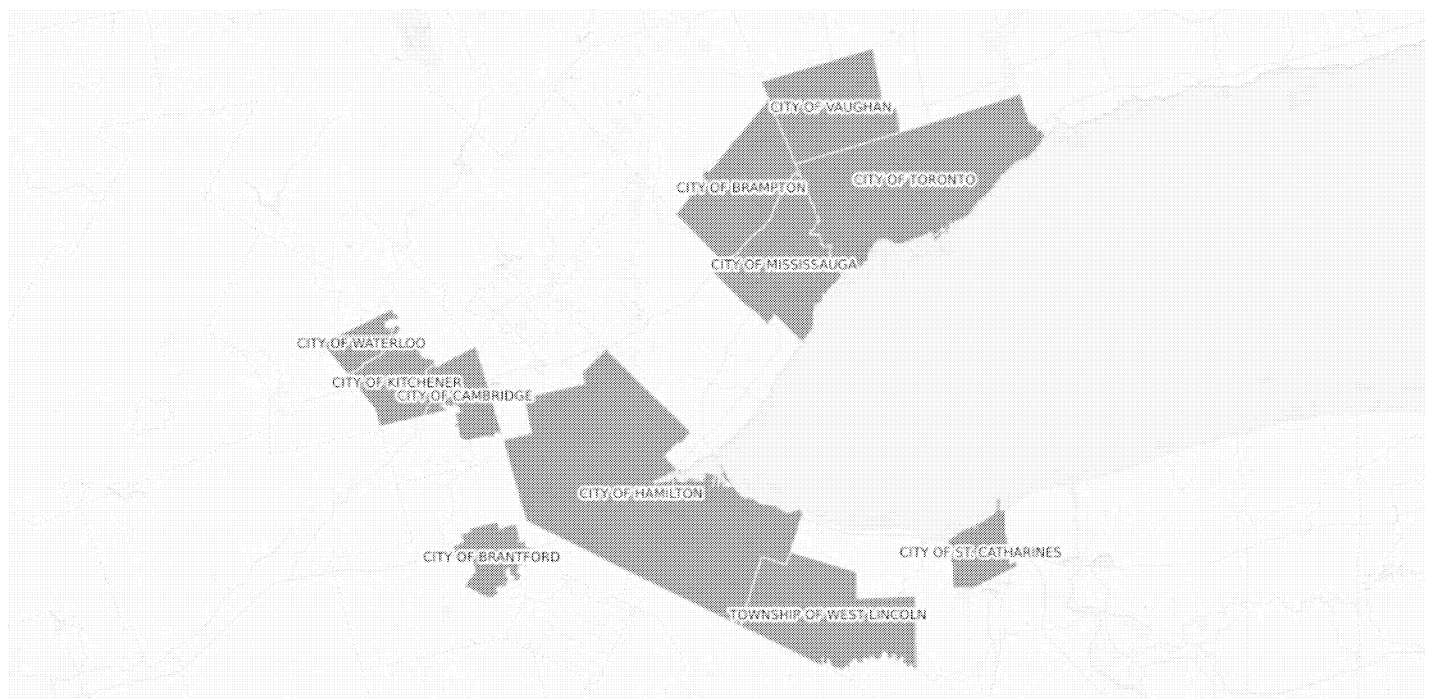


Figure 1 Ontario Peer Jurisdictions

Byron Hemlow
City of Ottawa
March 31, 2025

Not shown in the above figure are the four Ontario regional municipalities reviewed, which include:

- Regional Municipality of Waterloo
- Regional Municipality of Niagara
- Regional Municipality of Peel
- Regional Municipality of York

Outside of Ontario, policies and practices from following national and international jurisdictions have been reviewed:

- Canadian Jurisdictions:
 - City of Vancouver
 - City of Edmonton
 - City of Calgary
 - City of Montreal
- International Jurisdictions:
 - City and County of San Francisco
 - City of New York
 - City of Auckland
 - Sweden
 - Netherlands

The following sections of the report are organized as follows:

- **Section 2 (Existing Policies)** summarizes the policies the City of Ottawa currently has governing the setting of speed limits on City roads, as well as the key regulations of the Highway Traffic Act that also need to be considered.
- **Section 3 (Provincial and National Peers)** summarizes the speed zone policies and practices utilized by other municipalities in Ontario and in other Canadian provinces.
- **Section 4 (International Best Practices)** discusses the speed limit practices used by jurisdictions outside of Canada, including from two well recognized leaders in the application of Vision Zero and the Safe Systems Approach.
- **Section 5 (Summary)** provides an overall summary of the findings of the peer jurisdiction review.

2. Existing Policies

This section summarizes the existing policies for the City of Ottawa and how they outline the process for determining appropriate speed limits for roadways within the City. Currently the following policies govern speed limits in the City of Ottawa:

Table 1 Existing Speed Zone Policies

Policy	Year Adopted
City of Ottawa Speed Zoning Policy	2009
Policy for Posting a 30 km/h Speed Limit on an Existing Roadway	2017
Gateway Speed Limit Signage Area By-law	2018
Local Residential Streets 30 km/h Design Toolbox	2019
School Zone Policy	Pending

Speed Zoning Policy

The City of Ottawa Speed Zoning Policy was adopted in 2009, and it applies to all roadways under the City's jurisdiction. The 2009 update uses three methodologies for setting speed limits:

- Local residential roads:** A 40 km/h speed limit is warranted by default, however, in order for the speed limit to be reduced to 40 km/h, a petition must be provided, demonstrating that at least 66% of residents support the reduction in speed limit. If sufficient support is not obtained, then the statutory speed limit of 50 km/h would be applied instead.
- Minor collector roads:** On roads less than 10.5m in width, one or more of the following conditions must be met to warrant a 40 km/h speed limit:
 - An elementary or junior high school abuts the roadway.
 - Parkland abuts the roadway, which is adjacent to an elementary or junior high school and used to access said school.
 - A licensed childcare facility or private school abuts the road.
 - There are no sidewalks on either side of the roadway.
 - Where the roadway width is less than 5.7m for two-way travel or less than 4.0m for one-way travel, and sidewalks are immediately adjacent to the travel lanes.
 - There have been three or more speed-related collisions in three years.
 - The roadway lacks the safe stopping distance for 50km/h at two or more locations.
 - There are two or more locations where grades are greater than 5% and/or safe speed on curves is less than 50km/h.


For roads wider than 10.5m, one or more of the above conditions must be met, and the 85th percentile speed of the road must be shown to be 50 km/h or lower. If a 40 km/h speed limit is not warranted, then the statutory speed limit of 50 km/h would be applied instead.

- Major collector and arterial roads:** The selection of a speed limit on a major collector and arterial road is determined through a review of the 85th percentile speed. The speed zone policy states that speed limit reviews will not be completed if a previous review was completed less than three years prior unless major changes in the area are identified. If a review of a road speed limit is warranted, the first step is determining

Byron Hemlow
 City of Ottawa
 March 31, 2025

whether there have been any significant changes in the immediate area. Then, a speed study is conducted to confirm the 85th percentile speed. If the speed study confirms that the posted speed is appropriate, then no further action is taken. However, if the speed study provides results that differ from the posted speed limit, a detailed study will follow to determine appropriate measures.

In addition to the above methodologies for setting speed limits on different roadway classifications, the speed zoning policy also provided a warrant for establishing school speed zones which is illustrated in **Figure 2**.



City Operations -- Public Works
 School Area and School Zone Worksheet

School Name: _____

Street: _____ Speed Limit: _____ km/h Date: _____

Surveyor: _____ Comments: _____

Installation Criterion	Maximum Point Value (MPV)	Description	Weighting Factor (WF)	Weighting Factor for this School	Score (MPV*WF)	
S chool T ype	40	Elementary	1.0		0	
		Middle/Junior High School	0.4			
		High School	0.2			
		Post Secondary/ College/ University	0.0			
C lassification	20	Urban Land Use	Rural Land Use		0	
		Local	N/A			1.0
		Minor Collector	Local			0.75
		Collector	Collector			0.5
		Major Collector/Minor Arterial	Arterial			0.25
		Major Arterial/Expressway	Expressway			0.0
F encing	20	Fully Traversable	1.0		0	
		Partially Traversable	0.5			
		Non-Traversable	0.1			
P roperty L ine S eparation	10	Abuts Roadway	1.0		0	
		Within 50 Metres	0.5			
		Further than 50 Metres	0.0			
E nterance	5	Main Entrance / Multiple Secondary Entrances	1.0		0	
		Secondary Entrance	0.6			
		None	0.0			
S idewalks	5	None or Non-School Side	1.0		0	
		School Side	0.6			
		Both Sides	0.0			
TOTAL SCORE (Sum of T, C, F, L, E, and S) =					0	

School Zone Results Matrix	
Total Score	Area or Zone ?
0 - 40	Nothing
41 - 64	School Area
65 - 80	School Area or School Zone *
81 - 100	School Zone

* Local conditions must be considered in detail in order to determine the appropriate treatment. Wherever possible, mitigation measures should be explored that would reduce the score so that marginal school zones can be avoided. The reasons for the final decision should always be documented.

School Area Warranted?	NO
------------------------	-----------

School Zone Optional?	NO
-----------------------	-----------

School Zone Warranted?	NO
------------------------	-----------

Comments: _____

School Area and School Zone Worksheet
Tom Carmody, Traffic Assessment Specialist - Revised 14 June 2009

Figure 2 Existing School Zone Warrant

The existing speed zoning policy does not specify what speed limit should be implemented within school zones.

Policy for Posting a 30 km/h Speed Limit on an Existing Roadway

In 2017, the City established a policy for posting a 30 km/h speed limit on existing roads. For roads with 85th percentile operating speeds of 35 km/h or lower, a 30 km/h speed limit is warranted automatically. For roads with 85th percentile operating speeds greater than 35 km/h, three criteria must be met:

1. The street must meet the Roadway and Traffic Environment criteria;
2. The street must also meet the Active Transportation Environment criteria; and
3. A petition must demonstrate that there is sufficient support for a reduced speed limit.

The three criteria are explained in greater detail below.

Roadway and Traffic Environment

For a 30 km/h speed limit to be considered, all five of the following criteria must be met:

- Roadway classification of a local road and/or strong pedestrian presence of 20 pedestrians per peak hour or 60 pedestrians per 4 hours or 15 elderly/children crossings during peak hour per block
- Infrequent transit operations
- Two-way roadway with one lane in each direction with a combined lane width of 7m or less (excluding parking), or a one-way roadway with no more than two lanes with a combined lane width of 7m or less (excluding parking)
- Speed limit no higher than 50km/h
- Daily traffic volume is identified as less than 2,500 vehicles per day

Active Transportation Environment

This assessment determines whether a 30 km/h speed limit is warranted due to the presence of vulnerable road users, such as pedestrians and cyclists. One or more of the following criteria must be met in order to consider a 30km/h speed limit:

- Adjacent elementary or junior high school
- Improved parkland abutting the roadway
- Significant pedestrian generator abutting the roadway
- No dedicated cycling facilities or sidewalks along the roadway
- Existing physical traffic calming measure have been installed to address a speeding issue
- Insufficient stopping sight distance exists for current operating speeds

Petition

A formal petition process must also be followed according to the policy, which includes two separate processes for different roadway contexts.

- For local residential roadways, the requestor will be given a petition to distribute to the affected households. The requestor must demonstrate that there is support from 66% of affected households. Once the petition has been completed, the next step is to receive the Councillor's concurrence.
- For traditional main streets with a strong pedestrian presence, a petition is not required. However, support must be obtained from the Business Improvement Area (BIA) or Ward Councilor and presented to Traffic Services staff.

Gateway Speed Limit Signage Area By-law

In 2017, the Province of Ontario passed the Safer School Zone Act 2017 which amended the Highway Traffic Act and permitted municipalities to change the default speed limit within an area through the use of gateway speed limit signage at the entrances/exits of a neighbourhood.

The Gateway Speed Limit Signage Area By-law eliminated the requirement for a petition for lowering the speed limit to 40 km/h for neighbourhoods with existing gateway speed limit signage and established that 40 km/h gateway speed limit signage would be installed in all new subdivisions going forward. The by-law identifies three situations where gateway speed limit signage is not permitted:

- On arterial roads;
- On major collector roads, unless currently posted at 40 km/h; and
- Any roadway with a single point of entry/exit to an arterial or major collector road which does not connect to any other roadways beyond the entry/exit point.

Local Residential Streets 30 km/h Design Toolbox

In 2019, City Council approved the Strategic Road Safety Action Plan (RSAP) Update which established a policy that all new local residential streets be designed for a 30 km/h operating speed. The policy also applies to existing local residential streets that are being reconstructed. To support this policy, a design toolbox was developed to provide guidance in designing streets that meet the 30 km/h operating speed target.

School Zone Policy

The School Zone Policy was recently updated by Arcadis IBI Group in April of 2023. The policy will be incorporated into the new Speed Zone Policy and has therefore not been adopted as of yet.

The policy stipulates that school zones shall be implemented on all roadways that meet the following criteria:

- Posted speed limit of 40 km/h or higher;
- Directly adjacent to an elementary, middle or high school; and
- One or more entrances/exits associated with the school are located along the roadway.

The reduced speed limit within the school zone is based on the prevailing speed limit of the road. **Table 2** summarizes the school zone speed limits recommended by the policy.

Table 2 Recommended School Zone Speed Limits

Prevailing Speed Limit (km/h)	Recommended School Zone Speed Limit (km/h)
30	N/A
40	30
50-60	40
70-80	60
90-100	80

The policy also allows limited exemptions to the above directives for locations that meet one or more of the following criteria:

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- Physical measures will be or have been implemented to limit the risk of vehicle-pedestrian collisions;
- Rural context;
- Adjacent roadway has four or more lanes; or
- 85th percentile operating speeds are equal to or greater than 10 km/h above the prevailing posted speed limit.

Under these circumstances, the policy allows qualified individuals to undertake a review of the safety benefit of implementing a school zone speed limit and decide whether a school zone is required or if a higher than recommended speed limit is appropriate.

Highway Traffic Act

The Highway Traffic Act allows municipalities to prescribe speed limits on roads within their jurisdictions up to 100 km/h. Where a posted speed limit is not provided, the statutory speed limit shall be as follows:

- 50km/h on a highway within a local municipality or within a built-up area;
- 80km/h on a highway, not within a built-up area, that is within a local municipality that had the status of a township on December 31, 2002;
- 80km/h on a highway not within a local municipality or within a built-up area; or
- 80km/h on a highway designated by the Lieutenant Governor in Council as a controlled-access highway under the Public Transportation and Highway Improvement Act, whether or not the highway is within a local municipality or built-up area.

As the present City of Ottawa was amalgamated in 2001, the first clause noted above applies to the entire area within the City boundaries, despite the rural character of the areas outside the urban boundary. As such, any road within the City of Ottawa without a posted speed limit has a default speed limit of 50 km/h.

3. Provincial and National Peers

This section provides information about speed limit setting policies and practices utilized in other cities in Ontario and across Canada.

Ontario

The peer jurisdiction review of Ontario municipalities was generally accomplished by reviewing publicly accessible documents or reaching out to municipal staff directly. A survey was also issued to the members of the Road Safety Committee of Ontario (ROSCO) to solicit input from committee members regarding their municipality's speed zone policies. A total of five municipalities responded to the survey and the results of the survey are incorporated within the subsections below. The five municipalities that responded to the survey are:

- Regional Municipality of Waterloo
- City of Mississauga
- Regional Municipality of York
- City of Vaughan
- City of Brantford

City of Toronto

The City of Toronto uses road classification to determine the posted speed limit of a street. The City's Speed Management Strategy recommends the following speed limits:

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- **Major Arterial Roads:** With the exception of major arterial roads near highways and industrial areas, a 50 km/h posted speed limit is recommended. A 60 km/h speed limit is recommended otherwise.
- **Minor Arterial Roads:** With some limited exceptions, minor arterial roads are recommended to be posted at 50 km/h.
- **Collector Roads:** The Strategy recommends a posted speed limit of 40 km/h on collector roads except for some limited exceptions.
- **Local Roads:** With the exception of local roads in non-residential areas, a posted speed limit of 30 km/h is recommended. The Strategy recommends using area speed limit signs to sign entire neighbourhoods at 30 km/h rather than signing each street individually.

The City of Toronto “*Update on Vision Zero Speed Management Strategy and Related Initiatives*” report indicates that their speed management strategy is comprised of seven speed reduction tools, including revised speed limit setting practices, road design improvements, enhanced police enforcement, proactive deployment of Watch Your Speed signs, speed limit reductions, automated enforcement and public education. The speed management strategy prioritizes arterial roads as these are the roadways where 80% of injury and fatal collisions in the City of Toronto occur. Predictive analytics are used to identify which mid-block road segments should be prioritized for the implementation of countermeasures, including enhanced police enforcement. These predictive analytics also help identify which road segments to prioritize for road reconstruction as the most effective opportunity to modify the design of a road is during road reconstruction.

For manual speed enforcement, the City of Toronto has created a dedicated traffic enforcement team in the Toronto Police Service which focuses on enforcement of “The Big Four” driver behaviours that result in fatal or injury collisions: aggressive driving, distracted driving, impaired driving and speeding. Toronto Transportation Services provides this unit with data on speed, volume and collision history to inform effective deployment of these resources.

For automated speed enforcement, the City of Toronto uses a two-step process for identifying which community safety zones (CSZs) should be selected. The first step ranks each CSZ based on: collisions involving children, fatal and injury collisions with vulnerable road users, vehicle speed data, traffic volume data, percentage of students within walking distance, and requests from police or the public. The second step involves a manual review of each site to ensure that it is suitable for data collection. This assessment includes ensuring that: there are no obstructions for the equipment, there is space for the equipment, there is no planned road work that will impact the equipment, no sharp curves or grades, no planned speed limit reductions, there is sufficient distance from speed limit transitions, and the location is not in an area with a flashing 40 km/h speed limit reduction sign.

City of Hamilton

The City of Hamilton last updated its Policy for Setting Speed Limits in 2009. The policy uses the Transportation Association of Canada (TAC) Canadian Guidelines for Establishing Posted Speed Limits for establishing the recommended speed limit on City roads. This guideline considers various contextual elements such as roadway geometry, lane widths, roadside hazards, pedestrian and cyclist exposure, pavement surface, on-street parking, and the number of driveways and intersections in selecting an appropriate posted speed limit. The minimum and maximum speeds recommended by the guidelines for different classifications and contexts are summarized below in **Table 3**.

Table 3 Range of Speed Limits Recommended by the TAC Canadian Guidelines for Establishing Posted Speed Limits

Roadway Classification	Urban	Rural
Freeways, Expressway and Highways	50 km/h to 130 km/h	50 km/h to 130 km/h
Arterial Roads	50 km/h to 90 km/h	50 km/h to 110 km/h
Collector Roads	40 km/h to 80 km/h	40 km/h to 90 km/h
Local Roads	40 km/h to 50 km/h	40 km/h to 60 km/h

In February 2019, City Council approved the Hamilton Strategic Road Safety Program and Vision Zero Action Plan, identifying the need for reduced speed limits on local roads and in designated school zones. This has led to a city-wide speed limit reduction to 40 km/h across all its local roads and minor collector roads in July 2019, marking a step up from the experiment of the 40 km/h zones on local roads which began on a street-by-street basis in 2015. Designated school zones on local roads have their speed limits reduced to 30 km/h.

There is one neighbourhood in the city that has a 30 km/h speed limit. As part of the City’s North End Traffic Management Plan, the speed limits in the neighbourhood have all been reduced to 30 km/h.

Similar to the City of Toronto, the City of Hamilton’s Strategic Road Safety Program and Vision Zero Action Plan 2019-2025 indicates that the city plans to establish a Traffic Enforcement Unit and implement targeted enforcement at high speed, high collision locations.

Regional Municipality of Waterloo

The Region of Waterloo does not have a policy for setting posted speeds, except for in school zones. The current practice is to set the posted speed limit at the average travel speed.

City of Waterloo

In February 2023, the City of Waterloo approved the Speed Management on Residential Streets – Proposed 30 km/h Speed Limit Implementation Plan. The plan aims to reduce the speed limit to 30 km/h on local roads and in all school zones, to 40 km/h on all minor collector roads, and to 50 km/h on major collector roads.

City of Cambridge

City of Cambridge began a pilot project to evaluate the effectiveness of neighbourhood wide 40 km/h speed limits in four Cambridge neighbourhoods in 2021. The pilot study found that the 85th percentile operating speeds in the four neighbourhoods were reduced between 0.5 km/h and 2.7 km/h. In March 2023, this was expanded to include all neighbourhoods in the City. A new Speed Limit Policy was also implemented that uses an objective based assessment to establish speed limits on City owned roads. The policy changed speed limits to:

- 40 km/h in Neighbourhood Areas.
- 30 km/h adjacent to schools and extending 150 metres in either direction beyond the limits of the school frontage.
- 40 km/h in playground zones, which would be established based on TAC’s School and Playground Areas and Zones: Guidelines for Application and Implementation.

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For all other roadways the speed limit is established based on the methodology from TAC's Canadian Guidelines for Establishing Posted Speed Limits.

City of Kitchener

As of 2019, the speed limits in the City of Kitchener are as follows:

- 30 km/h on three road segments adjacent to parks;
- 40 km/h on 18 road segments in school zones and 35 road segments implemented due to speeding concerns
- 60 km/h on four road segments, which are City arterial roads with higher speed geometry and limited driveway accesses; and
- 80 km/h on one road segment which is not within a built-up area of the City.

For roads with no posted speed limit, the default speed limit is 50 km/h.

In 2019, the City of Kitchener began the Neighbourhood Speed Limit Review by piloting a speed limit reduction from 50 km/h to 40 km/h in three Neighbourhood Speed Limit Areas and 30 km/h in school zones within the pilot areas. The pilot found a decrease of between 1 and 4 km/h in the 85th percentile operating speed in these areas.

In September 2021, the City of Kitchener permanently reduced the speed limit in all residential neighbourhoods from 50 km/h to 40 km/h, with all school zones and signed neighbourhood bikeways inside the neighbourhoods reduced to 30 km/h following the pilot in 2019.

Regional Municipality of Niagara

In 2005, Niagara Region adopted a speed limit policy which utilizes two different methodologies for setting speed limits in urban and rural areas.

Niagara Region defines an urban area as locations with more than 40 driveways per kilometre with significant pedestrian and cyclists' activity. For controlled access arterial roads (i.e., no private driveways permitted directly onto the roadway) with a sidewalk on at least one side, a 60 km/h speed limit is recommended. A 50 km/h speed limit is recommended otherwise. For collector and local roads, a 50 km/h and 40 km/h speed limit are recommended, respectively.

In rural areas, the policy recommends setting the speed limit based on the 85th percentile operating speed, up to a maximum of 80 km/h. The policy also provides a methodology for setting the speed limit based on geometric and traffic factors, as summarized in **Table 4**.

Table 4 Niagara Region Rural Road Speed Limit Assessment

Factor	Criteria	Recommended Speed Limit (km/h)		
		60	70	80
Pavement Width	Less than 6.5m	Yes	Yes	No
	Greater than or equal to 6.5m	No	Yes	Yes
Alignment	Substantially straight (sight distance \geq 200m)	No	Yes	Yes
	Moderately curvilinear (150m \leq sight distance < 200m)	No	Yes	No
	Curvilinear (100m \leq sight distance < 150m)	Yes	#	#
	Severely curvilinear (sight distance < 100m)	#	#	#
Segment Length	Greater than or equal to 1 km	Yes	Yes	Yes
	Less than 1 km but greater than or equal to 500m	Yes	Yes	No
	Less than 500m	Yes	No	No
Traffic Volumes	Greater than or equal to 10,000 AADT	No	Yes	Yes
	Less than 10,000 AADT but greater than or equal to 2,000 AADT	Yes	Yes	Yes
	Less than 2,000 AADT	Yes	Yes	Yes
Number of Accesses per kilometre	More than 40 per km	Refer to policy for urban roads		
	Less than 40 per but greater than or equal to 20 per km	Yes	Yes	Yes
	Less than 20 per km	No	No	Yes
Pedestrian Traffic	High	Yes	Yes	No
	Medium	Yes	Yes	Yes ¹
	Low	No	Yes	Yes
Cyclist Traffic	High	Yes	Yes	No
	Medium	Yes	Yes	Yes ²
	Low	No	Yes	Yes

= A safety study should be undertaken to improve the roadway alignment.

¹ If there is a sidewalk on at least one side of the road, otherwise 'No'.

² If there are partially paved shoulders, otherwise 'No'

With the above methodology, the number of 'Yes' answers per column is tallied and the column with the highest number of 'Yes' answers is deemed to be the appropriate speed limit.

Township of West Lincoln

West Lincoln's current speed limit is 50 km/h within the urban boundary and 80 km/h in the rural areas unless otherwise posted. The town published a 3-step guide in 2020 for reviewing speed limits upon receiving a request.

First, a traffic count and speed survey are completed along the subject road segment to determine the average daily traffic (ADT) volume and the 85th percentile speed. The traffic count and speed survey are completed over the course of a full week (7 days) with favourable weather conditions.

Second, road characteristics, traffic count data, and speed data are entered into the TAC Speed Limit Guideline Spreadsheet to calculate a risk score for the road segment. The risk score produces a recommended posted speed limit. If the 85th percentile speed is within 10 km/h of the speed limit in an urban environment (50 km/h or

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less) or within 20 km/h of the limit in a rural environment (80 km/h), it is not recommended to change the speed limit. If the 85th percentile is outside of the 10 km/h or 20 km/h tolerance, the policy recommends conducting further investigation to determine the factors that may be contributing to speeding and adjusting the speed limit if necessary. The policy recommends using the speed limits recommended by the TAC spreadsheet when adjusting speed limits. When a road section is outside the urban boundary and considered a rural road, the Niagara Region Speed Limit Policy is also used to compare against the recommended speed from the TAC spreadsheet.

Lastly, if a speed limit change is warranted, a report will go to council to approve the speed limit change through a by-law amendment.

City of St. Catharines

St. Catharines maintains a default speed limit of 50 km/h on all streets within the urban area. In 2022, the City Council approved a speed limit reduction to 40 km/h on residential streets, aligning with the Niagara Region's Vision Zero initiative. Unlike many other cities who are phasing in the reduced residential speed limits by ward due to budget concerns, St. Catharines aims to reduce speed limits on all residential streets in one phase in 2024.

Regional Municipality of Peel

Peel Region has adopted Vision Zero and developed a Road Safety Strategic Plan (RSSP) to identify how the Region will reduce roadway fatalities and injuries. The RSSP has identified the need to develop a speed limit policy and implement speed limit reviews in all areas to address aggressive driving, although the updated policy is not available as of now.

To support the effective use of police enforcement, the Peel Region RSSP indicates that data analysis will be completed to determine which driver behaviours and locations should be prioritized for police enforcement. Red light cameras and automated speed enforcement are also being deployed to discourage red light running and supplement manual speed enforcement. Education and media campaigns are also planned to highlight the dangers of speeding, aggressive and distracted driving to the public.

City of Mississauga

In 2018, the City of Mississauga officially adopted Vision Zero and their Vision Zero Action Plan (VZAP) was published in 2021. The VZAP identifies a goal of reducing speed limits on local roads from 50 km/h to 40 km/h, and the speed limits in school zones from 40 km/h to 30 km/h. The VZAP also indicates that the City should explore changing speed limits on arterial and collector streets, although there is no formal policy as of yet for these classes of roads, as confirmed through the City's response to the ROSCO survey.

School zones, neighborhood areas, and community safety zones are areas where speed enforcement is prioritized as they are more likely to experience incidents that pose heightened risk to pedestrians, residents, and children. Locations for speed enforcement are also identified and prioritized based on factors such as traffic volumes and collision history. Similar to the Region of Peel, the City of Mississauga has recently been implementing ASE to support the enforcement of speed limits in areas with high numbers of vulnerable road users.

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City of Brampton

The City of Brampton follows the Vision Zero framework in designing, maintaining, and operating its transportation system. In 2023, the City began a pilot program to reduce the posted speed limits in five neighbourhoods to 40 km/h.

The City of Brampton was one of the first municipalities in Ontario to utilize ASE to supplement manual speed enforcement.

Regional Municipality of York

York Region recently updated their policy within the last few years to align it with Vision Zero/Safe System Approach principles. Their updated policy was not obtained on time for inclusion in the draft version of this report, however, based on their responses to the speed zone policy survey issued to the ROSCO members, the following factors are considered by their policy to determine the appropriate speed limit for a road:

- Roadway classification (arterial, collector, local)
- Average annual daily traffic (AADT)
- Pedestrian/cyclist volumes
- On-street parking
- Presence of pedestrian/cyclist facilities
- Roadway width
- Lane width
- Number of lanes
- Shoulder width and type
- Presence of street objects (e.g., street furniture, bus stops, trees, etc.)
- Presence of school zones and community safety zones, number of access driveways, visibility, etc.

Similar to other Ontario municipalities, York Region's strategy for the enforcement of speed limits and aggressive and distracted driving relies on the use of targeted enforcement and automated speed enforcement. Locations and time periods prone to speeding and aggressive and distracted driving have been identifying which will be utilized to identify locations that warrant enhanced enforcement.

City of Vaughan

The City of Vaughan recently updated their speed zone policy in 2021 as part of its MoveSmart Mobility Management Strategy. The policy recommends the following procedure for determining speed limits for City owned roads:

Rural Roads: The speed limit on rural roads is determined using the TAC Canadian Guidelines for Establishing Posted Speed Limits.

Urban Roads: The default speed limit on urban roads is 50 km/h. A 40 km/h speed limit is warranted if both Criteria A and B are met:

- Criteria A – Roadway Environment: The roadway segment under consideration is greater than 150m in length and one of the following is met:
 - If the pavement width is greater than 10.5m, and the 85th percentile speed is equal to or less than 50 km/h.

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- The pavement width is greater than 10.5m but bicycle lanes or edge lines narrow the vehicle travel lanes to 8.0m or less.
- The pavement width is less than 10.5m.
- Criteria B – Pedestrian/Cycling Environment: One of the following is met:
 - On-street parking on both sides of the road is restricting on-street cycling.
 - The pavement width is less than 8.0m in width and on-street parking is restricting traffic flow.
 - There are no sidewalks on either side of the road.
 - There are no curbs or sidewalks and the traveled portion (excluding shoulders) is less than 7.0m wide.

The policy also contains direction regarding the application of school zone speed limits and stipulates a maximum speed limit of 30 km/h for public laneways.

Furthermore, the policy specifies that 40 km/h area speed limit signage will be used if at least 50% of roads meet the criteria for 40 km/h speed limits or school zone speed limits. The area speed limit will apply to all local roads, all collector roads currently signed at 40 km/h, and all collector roads not currently signed at 40 km/h that have an 85th percentile speed no greater than 50 km/h. Area speed limit signs are not permitted by the policy for major collector roads or arterial roads unless they are currently posted at 40 km/h.

City of Brantford

The City of Brantford is planning to update their Speed Limit Policy within the next six months to better align with Vision Zero. Currently, however, the following speed limits are applied to City roads:

- Arterial Roads: 50 km/h to 70 km/h
- Collector Roads: 40 km/h to 60 km/h
- Local Roads: 30 km/h to 50 km/h

The City of Brantford also typically uses area speed limit signage to sign areas at 40 km/h.

Other Provinces

Policies and practices for setting speed limits used in other Canadian provinces are summarized in the following sections.

City of Vancouver

Beginning in 2016, the Vancouver City Council showed strong support for the Vision Zero initiative and has since progressively embraced the principles of Vision Zero. Currently, Vancouver is reviewing its speed limit policy to improve road safety and end traffic fatalities and injuries. Unless otherwise posted, the default speed limit for a given roadway is outlined in **Table 5**.

Table 5 City of Vancouver Default Speed Limits

Area	Speed Limit (km/h)
Laneways	20
School and Playground Zones	30
Street Bikeways	30
City Roads	50

A recent article published in the Vancouver Sun outlines the City's intentions to lower the speed limit to 30 km/h on all local streets¹.

City of Calgary

In 2019 the City of Calgary adopted the Vision Zero movement through the Safer Mobility Plan 2019-2023. The Safer Mobility Plan incorporates increased enforcement of speed limits and the investigation of reducing operating speeds to remain consistent with the Safe Systems Approach.

The City of Calgary also updated their policy on neighbourhood speed limits in 2021. Now the default unposted speed limit on both residential local and collector roads is 40km/h, as opposed to the original 50km/h.

The remaining roadways have speed limits that are set based on the Alberta Traffic Safety Act (Government of Alberta, 2023), as outlined in **Table 6**.

Table 6 Alberta Traffic Safety Act: Speed Limit Restrictions

Area	Speed Limit (km/h)
Provincial Highway (not within urban area)	Maximum 100
Provincial Highway (within urban area)	Maximum 80
School Zone / Playground Zone	30
Major Highways	Maximum 100

The Minister and the Council may prescribe maximum speed limits that differ from those outlined in **Table 6** if the situation requires it.

City of Edmonton

The City of Edmonton produced the Safe Mobility Strategy 2021-2025, which outlines the goals for the City to reach Vision Zero by 2032. The main managing force described in the Safe Mobility Strategy is vehicle speeds as both the likelihood of a collision and the severity of a collision increases as vehicle speeds increase. Through research and analysis of different areas within the city, it was identified that areas with more arterial streets produced more collisions due to wider street widths and low traffic volumes outside of peak hours, resulting in higher operating speeds than the posted speed limits of 50-60km/h. Because of this, speed limit reductions are a key action within the Safe Mobility Strategy including reducing the default residential speed limit to 40km/h and implementing the Safe Speeds Toolkit. The Safe Speeds Toolkit contains tools for the communities to manage

¹ <https://vancouversun.com/news/local-news/vancouver-considers-30-km-h-limit-on-all-local-streets>

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speed limit reductions such as creative signage options and location specific data to educate about speeding issues.

The Charter Bylaw 19283 amended the Speed Zone Bylaw to include the default speed limit of 40km/h for all residential streets. The default speed limits for all street classifications are shown in **Table 7** below.

Table 7 City of Edmonton Speed Limits per Roadway Classification

Road Type	Maximum Speed Limit (km/h)
Local Residential	40
Collector	50
Arterial (no median)	50
Arterial (with median)	60

City of Montreal

The City of Montreal adopted the Vision Zero initiative in 2016. News reports dating from 2019 indicate that the City was planning on implementing 40 km/h speed limits on main streets and 30 km/h speed limits on residential streets, although it is unknown if the City proceeded with this plan.

4. International Peers

This section summarizes the speed limit practices applied in jurisdictions outside of Canada, including by well-recognized leaders in the application of Vision Zero and the Safe Systems Approach such as Sweden and the Netherlands.

City and County of San Francisco

According to speed limit data provided by the City and County of San Francisco, approximately 75% of streets do not have an official speed limit. Of the streets that do have an official speed limit, approximately 50% of streets have a speed limit of 25 mph (40.2 km/h) and another 25% have a speed limit of 30 mph (32.2 km/h). The remaining 25% of streets have speed limits of 30-35 mph (48.3-56.3 km/h). A very small number of streets have speed limits of 40-45 mph (64.4-72.4 km/h).

The Vision Zero SF Action Strategy 2021-2024 has identified a number of streets where speed limits will be reduced to 20 mph (32.2 km/h). The streets that have been identified for speed limit reductions include a number of arterial roads and are highlighted in brown in **Figure 3**.

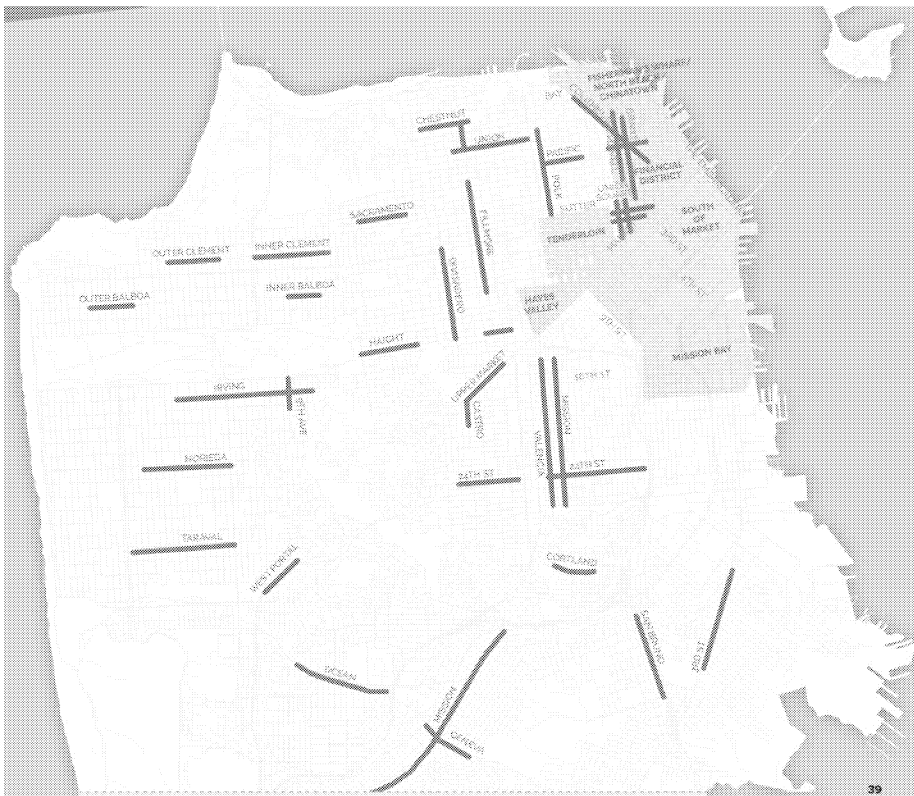


Figure 3 Planned Speed Limit Reductions in San Francisco

In terms of enforcement, the Vision Zero SF Action Strategy 2021-2024 recommended the following strategies:

- Issue 50% of citations for the top five causes of collisions
- Monthly on-going speed enforcement that rotates through the various high injury corridors in the city
- Conduct high visibility traffic safety events (HVTSE) actions along the high injury corridors in the city each month. HVTSE are coordinated efforts that combine prevention, education and enforcement with a coordinated communication strategy that is designed to educate the public and promote compliance with the law.

City of New York

In 2014, State law was amended to permit the City of New York to set a default speed limit of 25 mph (40.2 km/h) on City streets (unless posted otherwise). **Figure 4** illustrates the posted speed limits for all City streets. Not shown in the figure are streets with no posted speed limit which default to a 25 mph (40.2 km/h) speed limit.

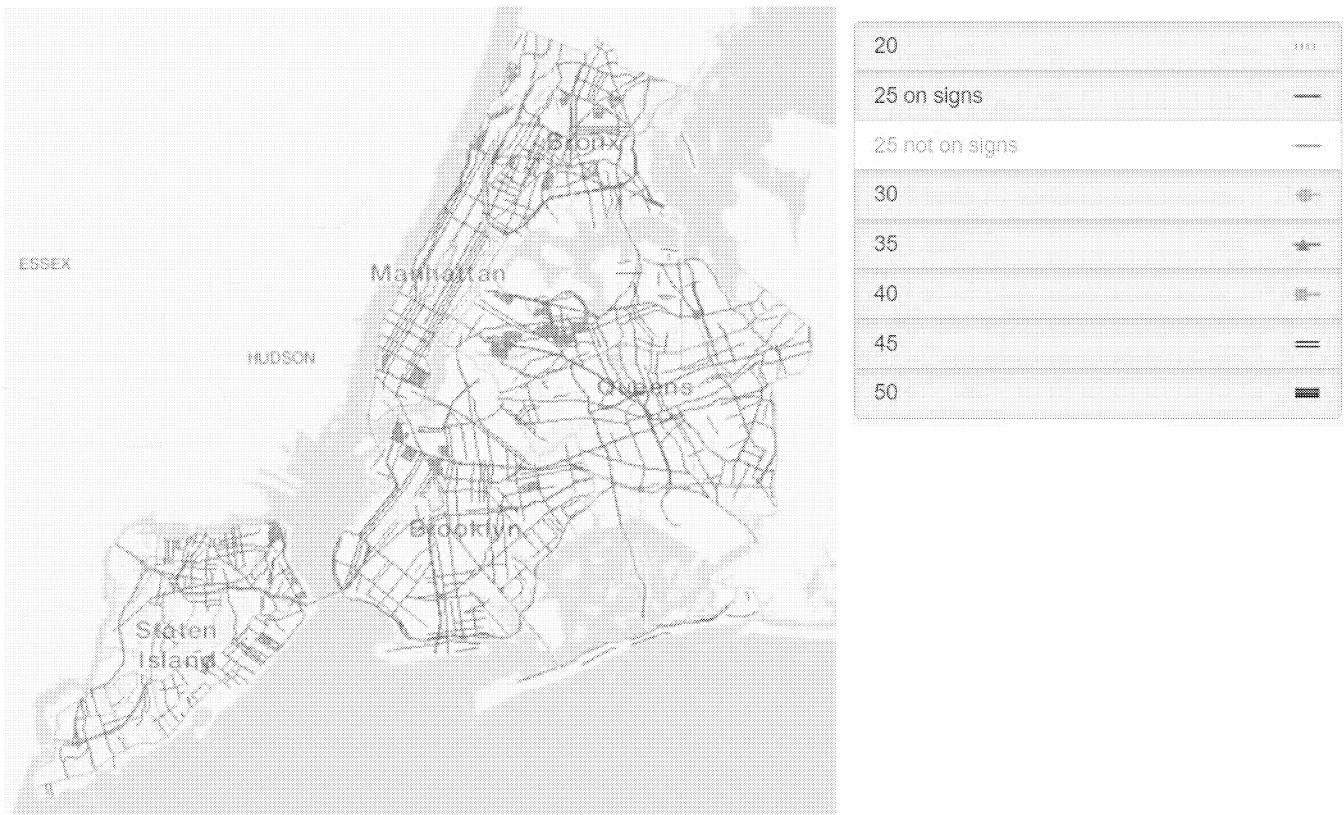


Figure 4 New York Speed Limits

In general, most streets, including most arterial and collector streets, have a speed limit of 25 mph (40.2 km/h). Generally only interstates and expressways have speed limits greater than 25 mph (40.2 km/h).

The City of New York also identified a number of arterial streets as part of their Arterial Slow Zones program. This program combines tools such as lower speed limits, signal timing changes, distinctive signage, and enhanced enforcement to improve safety and reduce fatalities on high collision streets. Temporary speed radar signs were also used to alert motorists of the new speed limits.

The New York City Police Department (NYPD) focuses its enforcement activities on drivers committing the following driving infractions:

- Speeding
- Failure to yield to pedestrians
- Signal violations
- Improper turns
- Disobeying signage
- Distracted driving

Weekly meetings called TrafficStat meetings are held to review pedestrian, bicycle and motor vehicle collision data. These meetings include a number of stakeholders from the police department, the City and other transportation agencies. These meetings focus on identifying the factors behind collision-prone locations and have been found to increase the number of traffic violations that are ticketed.

In addition to targeted enforcement as part of the Arterial Slow Zones program, the City of New York also utilizes automated speed enforcement cameras to enforce speed limits in school zones.

City of Auckland

The City of Auckland, New Zealand, is in the process of implementing the final phase of its Safe Speed Programme. As part of this program, speed limits within certain residential neighbourhoods have been reduced to 30 km/h, while speed limits in rural areas are generally being reduced to 60 km/h, with 40 km/h and 80 km/h speed limits being implemented on certain roads. Phase One of the plan focused on the city centre, certain residential areas and high risk urban and rural roads. Phase Two focused primarily on rural roads and roads near schools. Phase Three includes approximately 1,500 roads, including residential streets, rural roads and all roads on the island of Waiheke.

In general, the City of Auckland appears to be applying 50 km/h speed limits in all urban areas, with 30 km/h speed limits selectively applied to certain residential areas and the downtown core. Outside of urban areas, speed limits of 60 km/h predominate with some streets posted 80 km/h.

In terms of enforcement, the Vision Zero for Tamaki Makaurau indicates that the key risk areas are speed, impairment, intersections and distracted driving.

Sweden

Vision Zero was initiated in Sweden in the 1990s, and it has since spread to other countries. According to “*Speed Management: A Road Safety Manual for Decision-makers and Practitioners (2008)*”, Sweden’s methodology to setting speed limit has evolved over time. Limits were initially established based on driver behaviour, presuming that drivers would make rational choices, thus, focusing on the 85th percentile speed. As speed-related collisions increased, factors such as road design began to be considered in setting speed limits. Later, economic elements played a role in setting speed limits as investments in highways with higher speed limits were justified by cost-benefit analyses, considering time savings. Now, with its Vision Zero initiative, Sweden prioritizes safety in setting speed limits. **Figure 5** demonstrates the criteria utilized for setting speed limits over different periods of time.

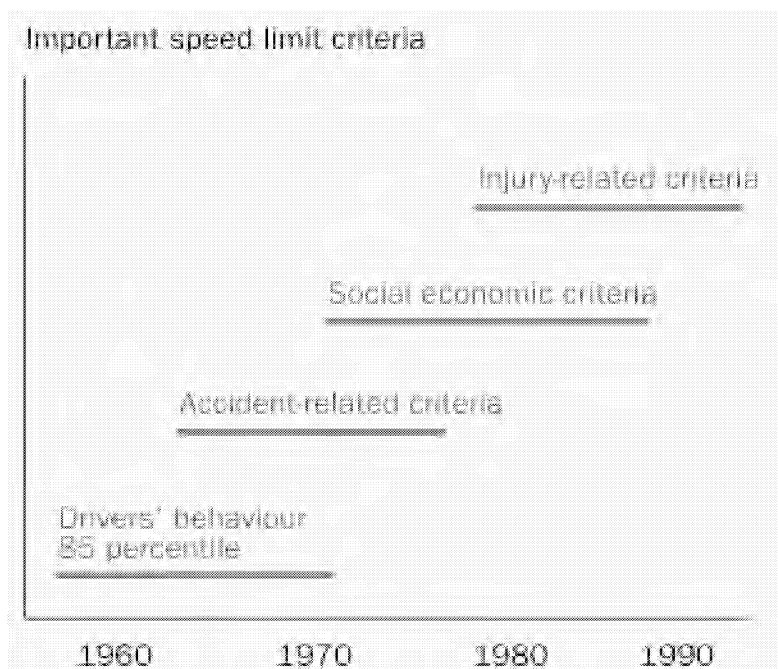


Figure 5 The Evolution of Speed Limit Criteria Over Time

In 2008, the Right Speed in the City manual was developed on behalf of the Swedish Associations of Local Authorities and Regions and the Road Administration (now called the Transportation Administration). This manual is currently used to set speed limits in the City of Gothenburg and the Uppsala Municipality. The manual uses a scoring system to determine how well a speed limit fits the existing or intended purpose of the street. There are five criteria considered for identifying the most appropriate speed limit:

1. Street Character:

- a. **Free Space (F)** is a space for pedestrians and cyclists to stay without worrying about motorized traffic. Examples include playgrounds, public squares, and parks.
- b. **Integrated Free Space (IF)** is a space where pedestrians and cyclists are prioritized with limited possibility for motorized traffic to stay. These streets typically are typically located near central public city spaces.
- c. **Common Space (C)** represents the most common streets in the city where all road users interact. The function of the street is to allow pedestrians and cyclists to easily move both longitudinally and transversely (i.e., they can cross the street easily).
- d. **Integrated Traffic Space (IT)** can accommodate pedestrians and cyclists, but they have a low need to cross the street and crossing opportunities can be limited to intersections.
- e. **Traffic Space (T)** pedestrians and cyclists are kept at a safe distance from motorized traffic, and there is no demand for crossing the street.

2. Accessibility, Car Traffic: Considers whether the street is part of the local, main or regional road network.

3. Accessibility, Public Transportation: Considers whether the street is part of the city bus, main bus or regional bus network.

4. Security: This criterion uses the same categories as Street Character.

5. Traffic Safety:

- a. Pedestrian and cyclist traffic on the roadway, or crossings for pedestrians and cyclists occur regularly at intervals of 50m or less
- b. Intersections/driveways occur regularly at intervals of 150m or less
- c. Rigid obstacles along the street (e.g., trees, light poles, etc.)
- d. Oncoming motor traffic

For each street, the goal is to select a speed limit that minimizes the number of 'less good' and 'low' scores. The speed limits that correspond to the 'good', 'less good' and 'low' scores for each criterion are summarized in **Table 8**.

Table 8 Right Speed in the City Speed Limit Scoring System

Criteria/Score	Speed Limit (km/h) Corresponding to the Score				
Character	F	IF	C	IT	T
Good	-	Walking speed	≤ 30	≤ 50	-
Less Good	-	20	40	60	-
Low	-	≥ 30	≥ 50	≥ 70	-
Accessibility, Car Traffic	Local Network	Main Network	Regional Network		
Good	≥ 30	≥ 50	≥ 60		
Less Good	< 30	30-40	40-50		
Low	-	≤ 20	≤ 30		
Accessibility, Public Transportation	City Bus	Core Bus	Regional Bus		
Good	≥ 30	≥ 40	≥ 60		
Less Good	20	30	40		
Low	10	20	30		
Security	F	IF	C	IT	T
Good	-	≤ 10	≤ 30	≤ 50	-
Less Good	-	20	40	60	-
Low	-	≥ 30	≥ 50	≥ 70	-
Traffic Safety	Pedestrian and Cyclist Traffic	Intersections/ Driveways	Rigid Obstacles	Oncoming Traffic	
Good	≤ 30	≤ 50	≤ 60	≤ 70	
Less Good	40	60	70	80	
Low	≥ 50	≥ 70	≥ 80	≥ 90	

Applying the above scoring system to a typical street in Ottawa would likely result in a recommended speed limit of 30 km/h on local streets, 40 to 50 km/h on collector roads, 50 km/h on undivided arterial roads and 60 km/h on divided arterial roads.

The speed zone policy for the City of Stockholm was not obtained, however, reportedly the City typically uses speed limits of 80, 60, 40, and 30 km/h on City streets.

Netherlands

The Dutch approach to Vision Zero is called “Sustainable Safety” and was adopted across all levels of government in 1997. The current speed limits typically used across the country are shown in **Table 9**.

Table 9 Typical Speed Limits in the Netherlands

Roadway Classification	Speed Limit (km/h)	
	Urban Areas	Rural Areas
Local Roads	30	60
Other Roads	50	80

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In late 2023, Amsterdam implemented a new change to the speed limits on the majority of the roads within the city, reducing them from 50 to 30 km/h.

5. Summary

The peer jurisdiction review shows that a range of methodologies are used for setting speed limits. While some jurisdictions use computational means of setting speed limits (e.g., the TAC Canadian Guidelines for Establishing Posted Speed Limits) or set speed limits based on observed driver behaviour (e.g., 85th percentile speeds or average operating speed), an equal number of municipalities employ default speed limits for roads based on classification with little consideration for site-specific factors (e.g., existing operating speeds or traffic volumes).

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Table 10 summarizes the typical speed limits other jurisdictions use in urban and rural areas. The typical school zone speed limits used in other jurisdictions has also been provided.

Table 10 Summary of Typical Speed Limits

Peer Jurisdiction	Last Policy Update	Policy Based on Vision Zero ⁴	Urban Areas				Rural Areas				School Zones ⁵		
			Arterial	Collector Major	Collector Minor	Local	Arterial	Collector Major	Collector Minor	Local	Arterial	Collector Major	Local
City of Ottawa (Existing)	2009	No	85 th Perc.Speed	40-50	30	85 th Perc.Speed	40-50	30	40-60		40		
City of Toronto	2019	Yes	50	50	40	30	-	-	-	40 (minor arterials only)	30		
City of Hamilton	2009	No	50-90 ¹	40-80 ¹	40-50 ¹	50-110 ¹	40-90 ¹	40-60 ¹	-	-	-		
Region of Waterloo	-	-	Average Speed				-	-	-	-	-		
City of Waterloo	2023	Yes	-	50	40	30	-	-	-	40 (with some exceptions)	-		
City of Cambridge	2021	No	50-90 ¹	40-80 ¹	40	50-110 ¹	40-90 ¹	40	-	-			
City of Kitchener	2019	No	60	-	-	40	60	-	-	40	30		
Niagara Region	-	-	50-60	50	40	60-80	60-80	40	-	-			
Township of West Lincoln	2020	No	50-90 ¹	40-80 ¹	40-50 ¹	60-80	60-80	40	-	-			
City of St. Catharines	2022	Yes	50	50	50	40	-	-	-	-			
Peel Region	-	-	-	-	-	-	-	-	-	40			
City of Mississauga	2021	Yes	-	-	-	40	-	-	-	40	30		
City of Brampton	-	Yes	-	-	-	40	-	-	-	40	10 km/h below prevailing speed limit		
York Region	-	Yes	-	-	-	-	-	-	-	-	10 km/h below prevailing speed limit		
City of Vaughan	2021	Yes	50	50	50	40	50-110 ¹	40-90 ¹	40-60 ¹	-			
City of Brantford	-	Yes	50-70	40-60	30-50	-	-	-	-	-			
City of Vancouver	-	Yes	50	50	50	30	-	-	-	-			
City of Calgary	2021	Yes	-	40	40	40	-	40	40	-			
City of Edmonton	2020	Yes	50-60	50	40	50-60	50	40	-	-			

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Peer Jurisdiction	Last Policy Update	Policy Based on Vision Zero ¹	Urban Areas				Rural Areas				School Zones ⁵		
			Arterial	Collector Major	Collector Minor	Local	Arterial	Collector Major	Collector Minor	Local	Arterial	Collector Major	Local
City of Montreal	2019	Yes	-	40		30	-	-	-	-		-	
City and County of San Francisco, USA	2021	Yes	30-50	30-50		-	-	-	-	-		-	
City of New York, USA	2014	Yes	40	50		30-40	-	-	-	-		-	
City of Auckland, New Zealand	2020	Yes	50	50		30-50	80	60		60		-	
City of Stockholm, Sweden	-	-	60-80	40		30	-	-	-	-		-	
City of Gothenburg, Sweden	2008	Yes	50-60	40-50		30	-	-	-	-		-	
Netherlands	-	-		50		30		80		60		-	
		Simple Average	50-60	50	50	30-40	70-80	60-70	60-70	40-50	40-50	30-40	30-40
		Weighted Average²	50-60	50	40-50	30-40	70-80	60	60	40-50	40-50	30-40	30-40
		Vision Zero Average³	50	40-50	40-50	30-40	70	60	60	40-50	40-50	30-40	30-40

¹ Range of speed limits recommended by the TAC Canadian Guidelines for Establishing Posted Speed Limits.

² The weighted average speed limit was calculated by assigning extra weight to more recent speed limit policies as well as policies based on Vision Zero.

³ Average speed limit of policies that are based on Vision Zero.

⁴ Speed limit policy claims or appears to have been developed in alignment with Vision Zero principles.

⁵ Source: School Zone Policy Review (Arcadis IBI Group, April 2023).

85th Perc. Speed = Speed limit is set based on the 85th percentile speed.

Average Speed = Speed limit is set based on the average operating speed.

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In general, the speed limit policies recommend speed limits in urban areas from a high of 60 km/h on arterial roads to a low of 30 km/h on local roads. A recent trend that has been widely adopted in numerous peer jurisdictions is to allow and apply lower speed limits, particularly in residential contexts, regardless of the existing operating or design speed. In rural areas, the speed limits are generally set 10 km/h higher than they would otherwise be in an urban area. The City of Ottawa's policy recommends speed limits in the urban areas that are generally in alignment with the Vision Zero average, with the notable exception of suburban arterial roads which tend to be higher than the Vision Zero average. In rural areas, the policy currently recommends speed limits on local and collector roads that are lower than what is typically used in other peer jurisdictions and recommends speed limits on arterial roads that are higher than what is typically used in other peer jurisdictions.

In terms of speed enforcement, the peer jurisdiction review indicated that most Vision Zero plans suggest using a data-driven approach to targeted enforcement whereby network screening is utilized to identify locations and time periods prone to the types of driver behaviour (e.g., speeding, aggression, distraction) that contribute to fatal and injury collisions. These locations and time periods are then prioritized for enforcement. A similar screening process is often used for identifying which locations should be prioritized for automated speed enforcement, although its use is limited to areas such as school zones and community safety zones (CSZs). Due to the higher speeds and volumes on arterial roads, these roadways tend to be prioritized more often for speed enforcement.

The findings from this jurisdictional review, as well as data analyses including risk profiles will be used to inform and help shape the updated speed zone policy for the City of Ottawa.

Appendix B

Research and Literature Review Report

SUBJECT

Ottawa Speed Zone Policy Update: Research and Literature Review

DATE

September 16, 2024

DEPARTMENT

Transportation Engineering

COPIES TO

Alex Culley, Project Co-Lead, City of Ottawa
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TO

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OUR REF

https://arcadiso365.sharepoint.com/sites/Projects5/146927/Internal Documents/6.0_Technical/6.23_Traffic/03_Reports/2.Literature Review/TTM_Research_LiteratureReview_2.0_2024-09-16.docx

PROJECT NUMBER

146927

NAME

Prepared by: Eric McLaren, Deputy Project Manager/Technical Lead, Arcadis
Reviewed by: Amr Shalkamy, Project Manager, Arcadis

Introduction

The City of Ottawa has retained Arcadis to undertake an update to their Speed Zone Policy, which provides direction on setting speed limits on City roads. A literature review has been completed to help develop the updated Speed Zone Policy based on the latest research findings. The literature review will also provide the data required to assess the potential impacts of the updated Speed Zone Policy on safety and traffic operations. The literature review has focused on five general topics or questions:

1. What is the relationship between safety and vehicle operating speeds?
2. How does roadway geometry impact operating speeds and safety?
3. What are potential methodologies for setting speed limits?
4. How does reducing speed limits impact travel times, safety, and operating speeds?
5. How do different types of speed enforcement impact operating speeds?

The first two topics/questions provide the necessary basis for identifying what the safe speed limit is under different contexts and what roadway geometric features impact collision probability and risk. The third topic/question identifies potential speed limit setting methodologies that can be implemented in the updated policy. The last two topics/questions are useful in identifying how changing speed limits impacts the transportation network and how speed limit compliance can be improved.

Each of the above topics/questions are explored in greater detail in the following sections.

Relationship Between Operating Speed and Safety

The relationship between operating speed and road safety involves multiple variables. Operating speeds have an impact on collision risk, collision frequency, collision severity, the vulnerability of road uses, and the types of collisions that occur. The faster a vehicle is driven, the higher risk of being involved in a collision. This increased risk can be attributed to the longer braking distance required at higher speeds, as well the reduced time available for drivers to process information and react to the driving environment. The following section reviews the relevant literature on the impact of operating speeds on collision occurrence and severity.

Relationship Between Operating Speed and Collision Frequency

The Power Model, originally proposed by Goran Nilsson in 1981, describes the relationship between the change in speed and the change in the number of collisions at different levels of injury severity. It states that the effect of speed on collision energy increases exponentially, where low speed crashes result in a relatively low severity collisions, while high-speed collisions result in a relatively high severity. The Power Model is presented as the following widely-cited form, which has since been refined by Nilsson (2004) and Elvik (2013) to include ranges for the exponent for each type of collision or injury severity.

$$\frac{\text{Collision frequency after}}{\text{Collision frequency before}} = \left(\frac{\text{Speed after}}{\text{Speed before}}\right)^{\text{Exponent}}$$

The exponents recommended by Elvik (2013) are summarized in **Table 1**.

Table 1 Power Model Exponents

Collision Severity	Rural Roads/Freeways	Urban/Residential Roads	All Roads
Fatal	4.1	2.6	3.5
Serious injury	2.6	1.5	2.0
Slight injury	1.1	1.0	1.0
Injury (all)	1.6	1.2	1.5
Property damage only	1.5	0.8	1.0

The higher exponents for fatal and injury collisions indicate that the frequency of fatal and injury collisions is more sensitive to changes in speeds than property damage only collisions. For example, a speed decrease from 80 km/h to 70 km/h on a rural road would result in a 58% decrease in fatal collisions, a 71% decrease in serious injury collisions, an 86% decrease in slight injury collisions and an 82% decrease in property damage only collisions. Conversely, increases in speeds would increase the frequency of fatal and injury collisions far more than the frequency of property damage only collisions.

Relationship Between Operating Speed and Severity

Mackay (1997) stated that there is no simple relationship between collision severity and operating speed from a biomechanics of impacts point-of-view, typically measured by the change in velocity to the severity of injuries. Unprotected pedestrians may sustain fatal or serious injuries at impacts at speeds as low as 30 km/h, whereas

occupants of a vehicle are protected and generally unharmed in a frontal crash at the same speed. However, vehicle occupants may experience whiplash injuries at 15-20 km/h if the vehicle is rear ended. Despite the lack of clear-cut relationship, there is no doubt that the probability of fatal or serious injury occurring increases dramatically as impact speed increases, as shown in **Figure 1**.

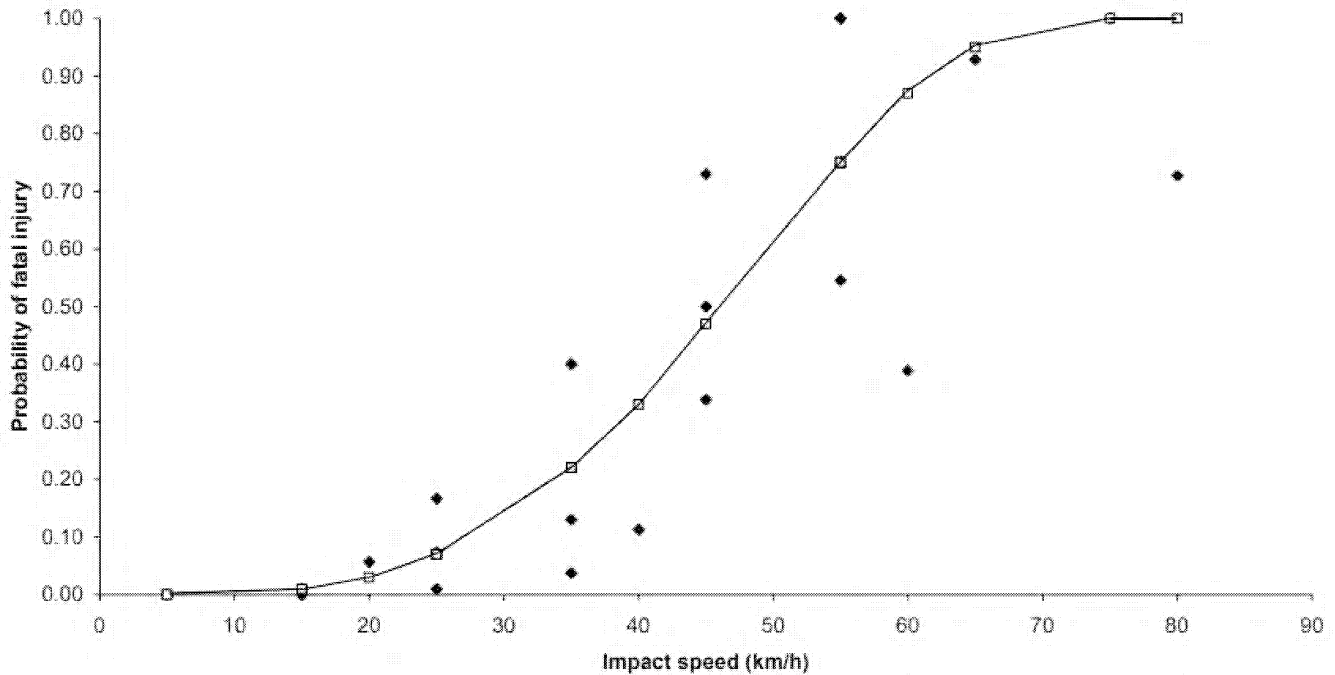


Figure 1 Probability of Fatal Injury to Pedestrians as a Function of Impact Speed

It is important to note that the number of fatal and major injury pedestrian and bicycle collisions is much lower compared to the number of minor injuries. Therefore, it may be more insightful to look into overall injuries as they depict a better representation of collisions between vehicles and pedestrians. Rosen (2013) investigated the German In-Depth Accident Study (GIDAS) for car-to-pedestrian and car-to-bicyclist collisions. Cumulative distributions of the impact speed classified by injury severity can be found in **Figure 2** and **Figure 3**. Using data from Rosen & Sander (2009) and Rosen et al (2010), the risks of severe injury or death for collisions between vehicles and pedestrians or bicyclists were determined and are illustrated in **Figure 4** and **Figure 5**.

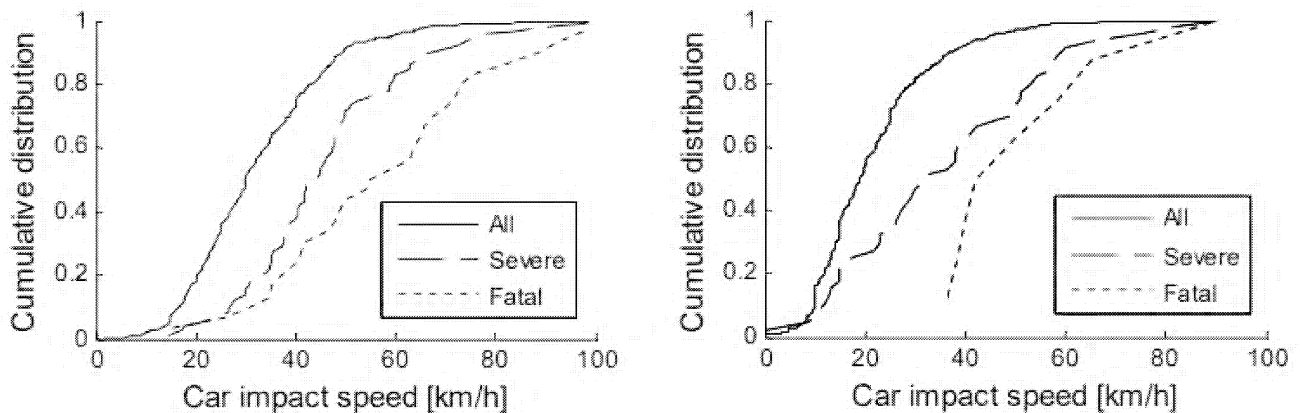


Figure 2 Cumulative Distribution for Vehicle-Pedestrian Collisions

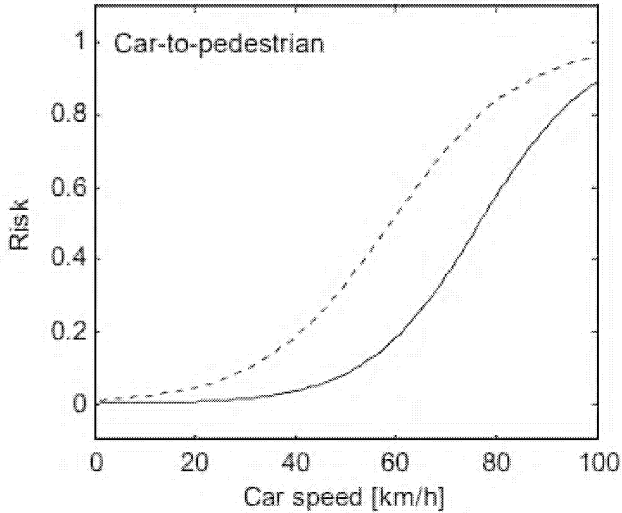


Figure 3 Cumulative Distribution for Vehicle-Bicycle Collisions

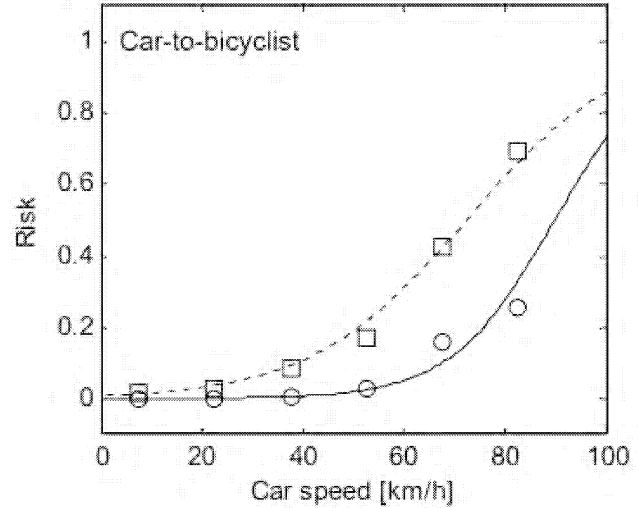


Figure 4 Vehicle-Pedestrian Collision Risk Curves

Figure 5 Vehicle-Bicycle Collision Risk Curves

Dashed Lines are Risk of Severe Injury, Solid Lines are Risk of Fatal Injury

For vehicle-to-vehicle collisions, injury risk is typically correlated to the difference in velocity between the two vehicles. Stigson et al (2012) found the following relationships for frontal collisions between injury risk and the change in velocity, mean acceleration, and peak acceleration as shown in **Figure 6**, **Figure 7**, and **Figure 8**, respectively. Note that MAIS2+ refers to the Maximum Abbreviated Injury Scale (AIS) with a value of two or greater, where AIS value of two means a moderate injury. Gabauer & Gabler (2006) also explored the relationship between the probability of serious injury (MAIS 3+ in this research) and the difference in velocity between vehicles, as shown in **Figure 9**.

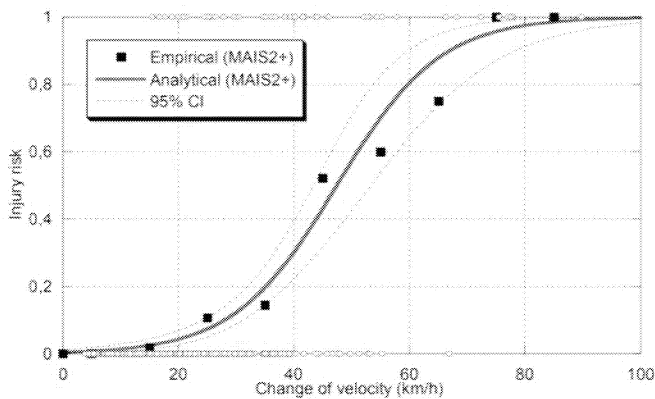


Figure 6 Risk of MAIS2+ Injury in Frontal Impacts as a Function of the Change in Velocity

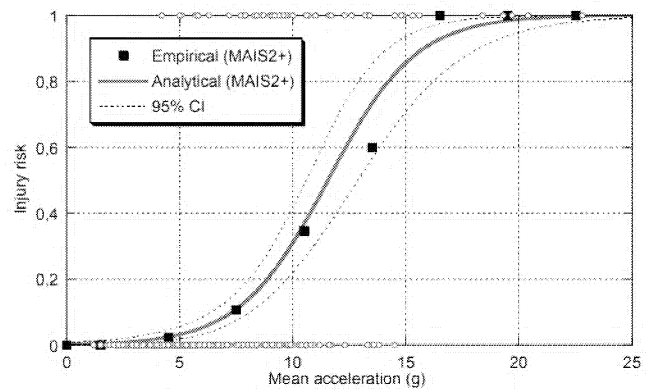


Figure 7 Risk of MAIS2+ Injury in Frontal Impacts as a Function of Mean Acceleration

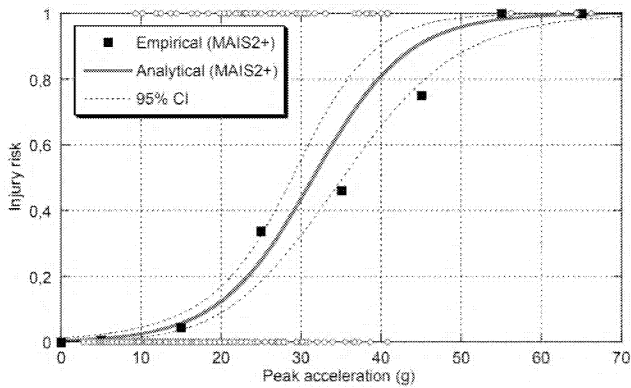


Figure 8 Risk of MAIS2+ Injury in Frontal Impacts as a Function of Peak Acceleration

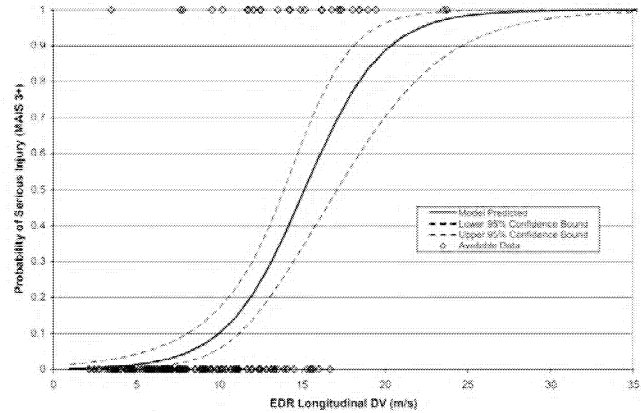


Figure 9 Risk of MAIS3+ Injury in Frontal Impacts as a Function of the Change in Velocity

Richards (2010) used the On the Spot (OTS) study and police fatal files from the United Kingdom to estimate the relationship between impact speed and pedestrian injury severity. **Figure 10** illustrates the relationship between the probability that a given pedestrian collision at different impact speeds results in slight, severe or fatal injury. Approximately half of the fatally injured pedestrians in the analyzed dataset were hit at an impact speed of 30 mph (48 km/h) or less. **Figure 11** and **Figure 12** further show the relationship of collision severity relative to the difference in speed between two vehicles in front impact and side impact collisions, respectively.

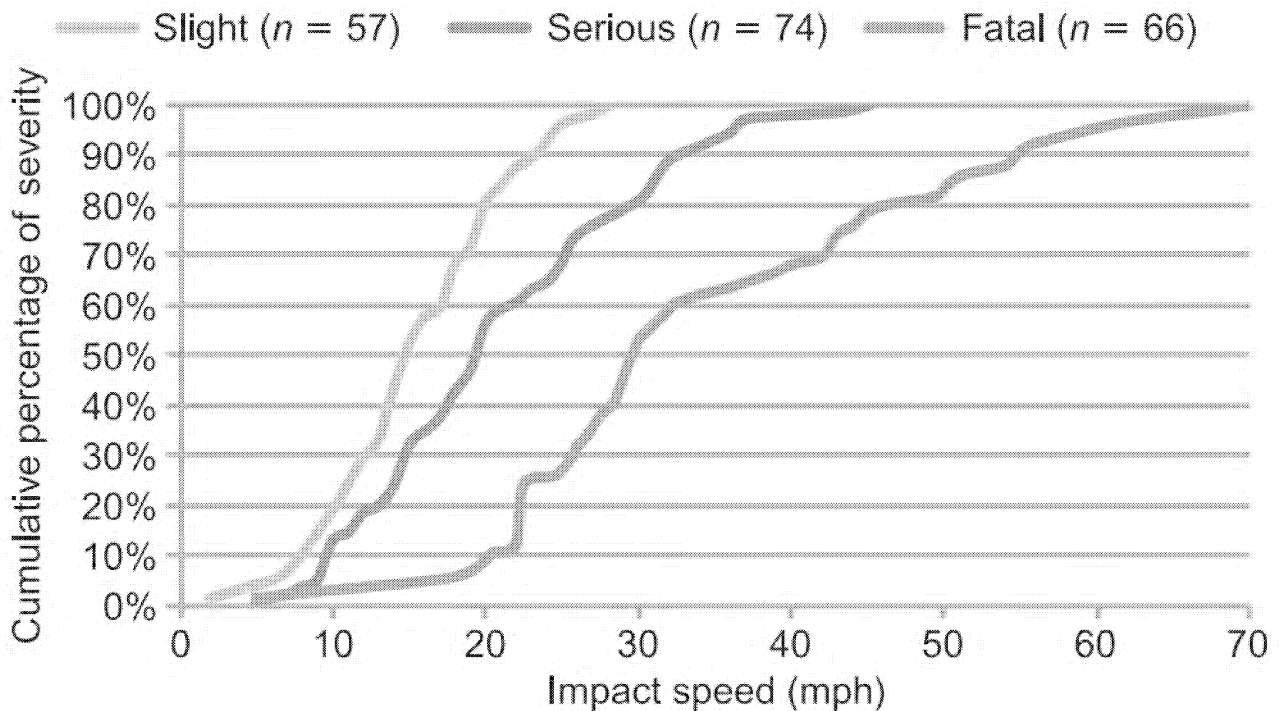


Figure 10 Cumulative Probability of Severity for Pedestrian Collisions as a Function of Impact Speed

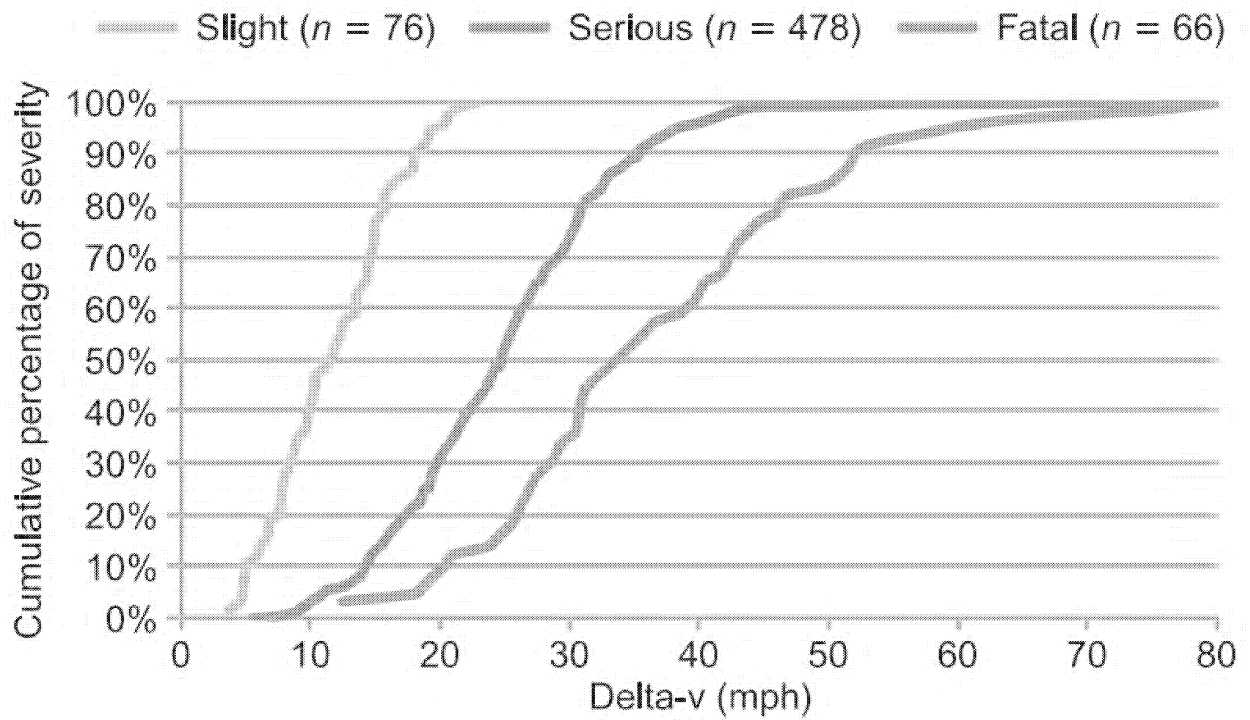


Figure 11 Cumulative Probability of Severity in Front Impact Collisions as a Function of the Difference in Speed

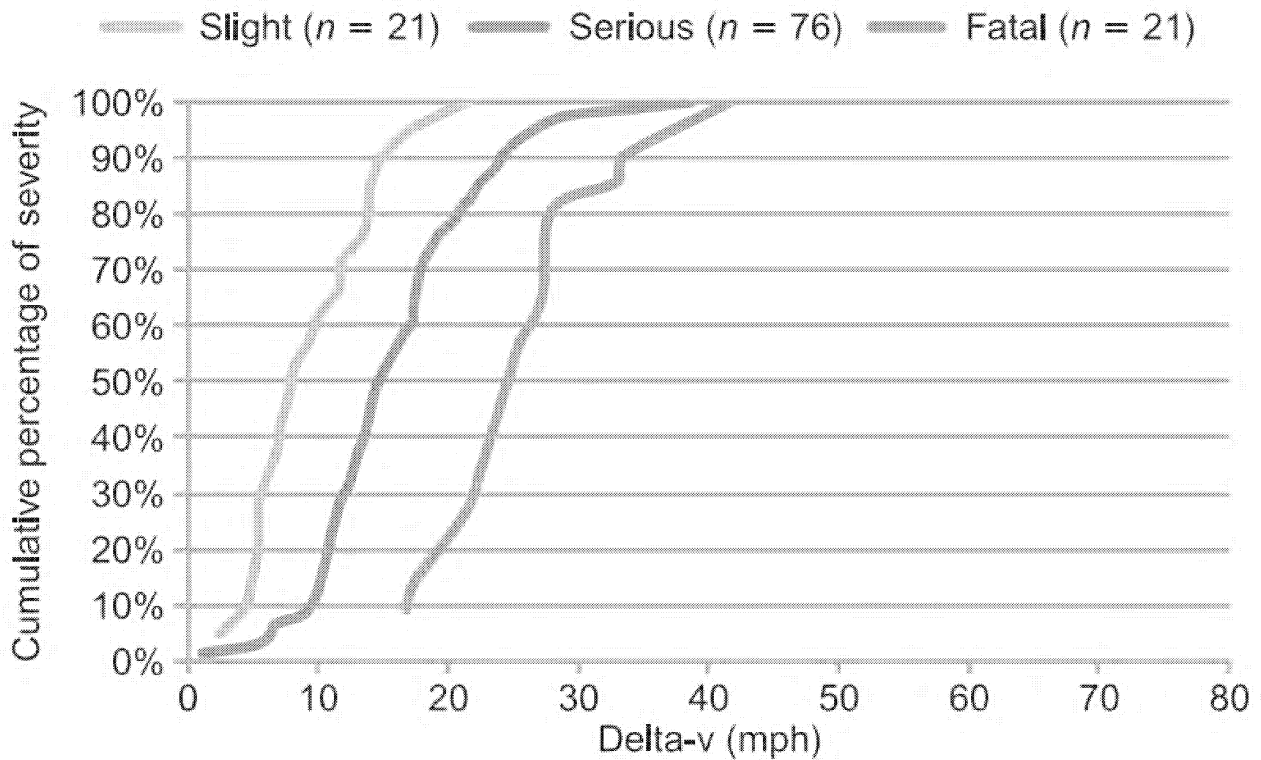


Figure 12 Cumulative Probability of Severity in Side Impact Collisions as a Function of the Difference in Speed

While the speed differential (delta-v) between two vehicles is an important metric to look at for collisions between vehicles, another important metric to consider is the operating speed itself rather than the difference between the speeds. Wrangborg (2005) developed a model to represent the relationship between fatality probability and vehicle collision speeds, as shown in **Figure 13**. According to this relationship, there is a 10% chance of a fatality occurring when vehicle speeds are at 30 km/h in pedestrian/cyclist collisions, 50 km/h in side impact collisions, and 70 km/h in head-on collisions. According to Jurewicz et al (2015), these are often quoted as the maximum impact speeds which can be tolerated in situations where pedestrian/bicycle, side and front impact collisions are likely to occur.

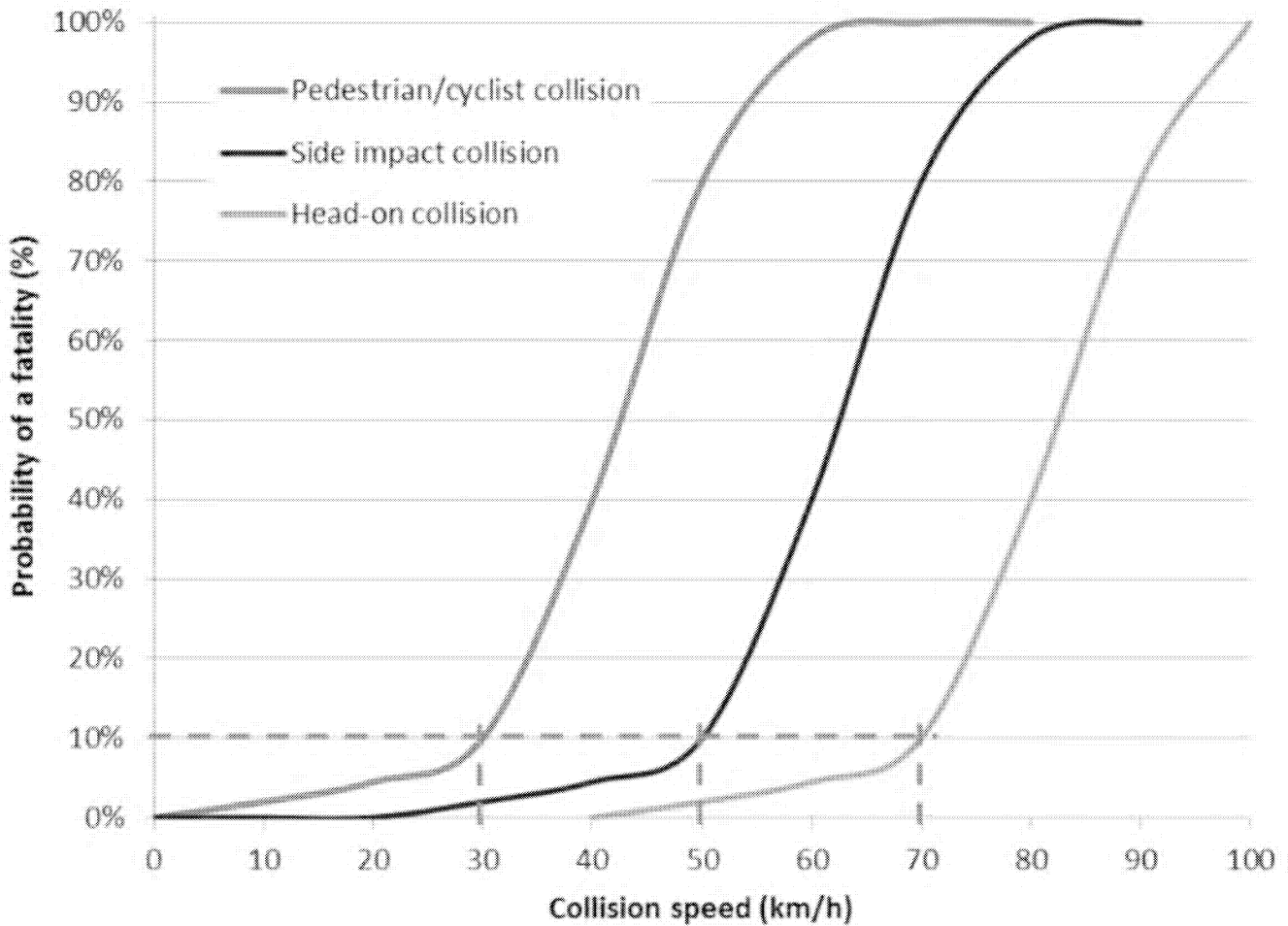


Figure 13 Probability of a Fatality by Collision Type as a Function of Vehicle Speed

The Institute of Transportation Engineers (ITE) article, *Speed as a Safety Problem*, notes that for every 5 mph (~8 km/h) increase in posted speed limit, the fatality rate on highways increases by 8.5%. Additionally, speeding is associated with between 23% to 37% of all fatal collisions. Speed-related collisions involving vulnerable road users were found to occur most often on local roads (23%), on roads with speeds between 30-35 mph (~48-56 km/h) (31%), and at midblock locations (54%).

Coroner's Report

The Ottawa Fatal Collision Review Committee's 2020 Annual Report¹ provides a summary of all fatal collisions that have occurred in the City of Ottawa between 2017 and 2020, inclusively. The report found that fatal collisions were most common in areas with lower built density, higher travel speeds and fewer transportation options, such as the rural and outer suburban areas of the city. However, fatal collisions involving vulnerable road users represented a larger percentage of fatal collisions in the denser parts of the city.

The report further notes that, of the 128 drivers involved in a fatal collision, the speed of the vehicle at the time of the collision was determined for 109 of them. Nearly half (45%) were found to be speeding at the time of the

¹ <https://www.ontario.ca/document/ottawa-fatal-collision-review-committee-2020-annual-report>

collision, and 31 (28%) were travelling at least 20 km/h or more over the speed limit. One of the key recommendations of the report is that the City of Ottawa should update its speed zone policy to better align speed limits with the principles of the Safe Systems Approach. The report also recommends increased use of automated speed enforcement (ASE), increased education on the risks associated with speeding, and continued targeted enforcement by Ottawa Police Services during the spring and summer months, as well as increased targeted enforcement in lower-density and rural areas.

The Pedestrian Death Review by the Office of the Chief Coroner for Ontario focuses specifically on pedestrian fatalities that occurred in Ontario in 2010. The report found that 67% of deaths occurred on roads with speed limits of 50 km/h or higher, while only 5% occurred on roads with speed limits lower than 50 km/h. The speed limit was unknown for the remaining collisions. The report recommends reducing speed limits on residential streets to 30 km/h, adopting speed limits of 40 km/h on other streets, and implementing speed reduction strategies on streets where speed has been implicated in the death of a pedestrian.

A similar report was prepared by the Office of the Chief Coroner for Ontario focusing on cyclist deaths. The Cycling Death Review (Office of the Chief Coroner for Ontario, 2012) found that speeding contributed to up to 30% of fatal cyclist collisions, with the majority of collisions involved a vehicle attempting to pass a cyclist.

Impact of Road Geometry on Operating Speeds and Safety

The design of a road can have significant impacts on operating speeds. The width of lanes and the presence of street furniture, trees and vulnerable road users all subconsciously influence a driver's experience of driving and can influence the speed at which they choose to drive. The design of a road can also impact safety by physically separating road users, thereby reducing the probability that a collision occurs. The following section comprises a review of the literature to identify the impact road geometry has on operating speeds and safety.

Impact of Lane Widths

Fildes, Fletcher & Corrigan (1987) found that a reduction in lane widths and the number of lanes can lead to lower operating speeds. With respect to the impact of lane widths on safety, Heimbach, Cribbins & Chang (1983) found that collision rates were reduced by 2 to 2.5% for every 0.25m of lane width reduction. McLean (1997) indicated the opposite and stated that lane width does not have a large effect on crash rates on arterial roads in an urban environment under typical lane widths.

The John Hopkins Bloomberg School of Public Health published a study in November of 2023 titled "A National Investigation on the Impacts of Lane Width on Traffic Safety" which investigated the links between lane widths and other roadway design features and collisions. The study found the following relationships between lane widths and safety:

- For streets with speed limits of 20-25 mph (32-40 km/h), the study found that there was no difference in collision rates for lanes widths between 2.75m to 3.65m.
- For streets with speed limits of 30-35 mph (48-56 km/h), the study found that roadways with 2.75m wide lanes perform significantly better in terms of safety than roadways with 3.05-3.65m wide lanes.
- For streets with speed limits of 40-50 mph (64-80 km/h), the study again found that there was no difference in safety for different lane widths, although the sample data only contained lane widths between 3.05m and

3.65m. As such, it is not possible to comment on the safety impact of narrowing lane widths to 2.75m on roadways with these speed limits.

Overall, the results of the study suggest that there are cases where narrowing lane widths has no impact on safety while for streets with speed limits of 50 km/h, narrowing lanes to 2.75m in width may in fact improve safety.

Impact of Medians

The “A National Investigation on the Impacts of Lane Width on Traffic Safety” study also reported on the impacts of medians on roadway safety. The study found that streets with traversable medians (e.g., two-way left-turn lanes) were associated with a higher rate of collisions than streets with no median, while streets with non-traversable medians (e.g., raised medians, guardrails, etc.) were associated with significantly lower rates of collisions. The study suggests that traversable medians increase the likelihood of traffic conflicts on the street, while non-traversable medians provide a refuge area for pedestrians and reduce the likelihood of traffic conflicts by physically separating opposing streams of traffic.

Impact of Access Point Density

The density of access points (i.e., driveways) has a significant impact on collision rates. A study by Mouskos et al (1999) in New Jersey found that approximately 30% of collisions on multilane highways occur in mid-block sections due to the presence of access points, and about 25% of the merging and diverging traffic at accesses have an impact on traffic flow which could result in collisions. Karlaftis et al (2000) also found that the roadway features with the most significant impact on collisions was the presence of access points and medians, followed by pavement condition. A model developed by Gluck, Levinson & Stover (1999) aimed to find the relationship between access point density and collision rates and suggested that a road with 20 access points per mile (~12 access points per kilometre) has a collision rate that is 40% higher than a road with 10 access points per mile (~6 access points per kilometre). This rate triples when comparing a road with 60 access points per mile (~37 access points per kilometre) to one with 10 (~6 access points per kilometre).

A study by Chakraborty and Gates (2021) found that driveway density and land use type was positively correlated with collision rates, as demonstrated in **Table 2**.

Table 2 Percent Increase in Collision Rates as a Function of the Number of Driveways per Mile

Driveway Type	Percent Increase in Collision Rate per Driveway per Mile			
	Rural Highways		Rural Arterial Roads	
	Fatal/Injury Collisions	Property Damage Only Collisions	Fatal/Injury Collisions	Property Damage Only Collisions
Residential driveways	1.4%	0.9%	0.5%	0.5%
Commercial driveways	2.4%	1.7%	0.9%	0.5%
Industrial driveways	0.8%	1.1%		

A study by Williamson and Zhou (2014) found similar relationships for driveways on five-lane urban arterials with two-way left-turn lanes. The study found that driveways to developments with drive-thrus, commercial driveways and industrial/institutional driveways experienced collision rates that are 6.66, 4.63 and 2.55 times higher than residential driveways.

Impact of Road Surface Material

Road surface roughness is typically quantified using the International Roughness Index (IRI) which measures the vertical displacement of a vehicle’s suspension system as it travels over a road. It is typically reported in metres per kilometre or millimetres per kilometre. Higher roughness levels can reduce tire-road contact, leading to decreased friction and increased stopping distances. This can result in a higher likelihood of collisions, particularly in adverse weather conditions. Furthermore, rough surfaces can induce driver fatigue and reduce vehicle stability, contributing to a higher incidence of crashes (Elkins & Peterson, 2000).

The quality of a road surface material can also be measured in terms of its friction number (FN) and the mean value of the material’s macrotexture depth (mean profile depth, or MPD). The friction number is obtained using a locked-wheel testing device which represents the average coefficient of friction measured over a test interval at a designated speed (typically 60 km/h, FN60).

Table 3 summarizes average FN60, MPD and IRI values observed in North America.

Table 3 Average Roughness by Road Surface Material

Road Surface Material	FN60	MPD (mm)	Observed IRI (m/km)
Asphalt	Dry = 0.80 to 0.90, Wet = 0.50 to 0.70 (Wong, J. Y., 2022)	0.5 to 1.5 (Asphalt Institute, 2013)	0.81 to 1.03 (Smith, K. D., & Ram, P., 2016)
Concrete	Dry = 0.80 to 0.90, Wet = 0.80 (Wong, J. Y., 2022)	0.5 to 1.0 (Khatri, K., & Mamlouk, M., 2011)	0.89 to 1.13 (Smith, K. D., & Ram, P., 2016)
Gravel	0.60 (Wong, J. Y., 2022)	Can vary widely: 2.0 to 10.0 (Hiller, M., & Turner, R., 2015)	5.51 to 7.28 (Žuraulis, V., Sivilevičius, H., Šabanovič, E., Ivanov, V., & Skrickij, V., 2021)

Generally, asphalt and concrete have a significantly lower roughness than gravel.

Tighe, Li, Cowe Falls, and Haas (2000) discussed the significant impact of road surface roughness, measured by IRI, on accident rates for single-vehicle and multiple-vehicle incidents. As shown in **Figure 14** below, the research

demonstrates that as the IRI increases, the single-vehicle accident rate decreases, suggesting that rougher roads reduce the likelihood of single-vehicle accidents. While this seems counterintuitive, this result is potentially due to rougher roads lowering driving quality, causing traffic operational speeds to decrease and thereby reducing the chances of single-vehicle accidents.

However, the multiple-vehicle accident rate increases with higher IRI values. The increased multi-vehicle accident risk on rougher roads can be explained by two factors: first, the lateral variation in vehicle paths increases with road roughness, reducing the clearance distance between vehicles and raising the probability of collisions. Second, rough roads often have defects like potholes and cracks, which force drivers to change speeds abruptly, increasing the likelihood of multiple-vehicle accidents.

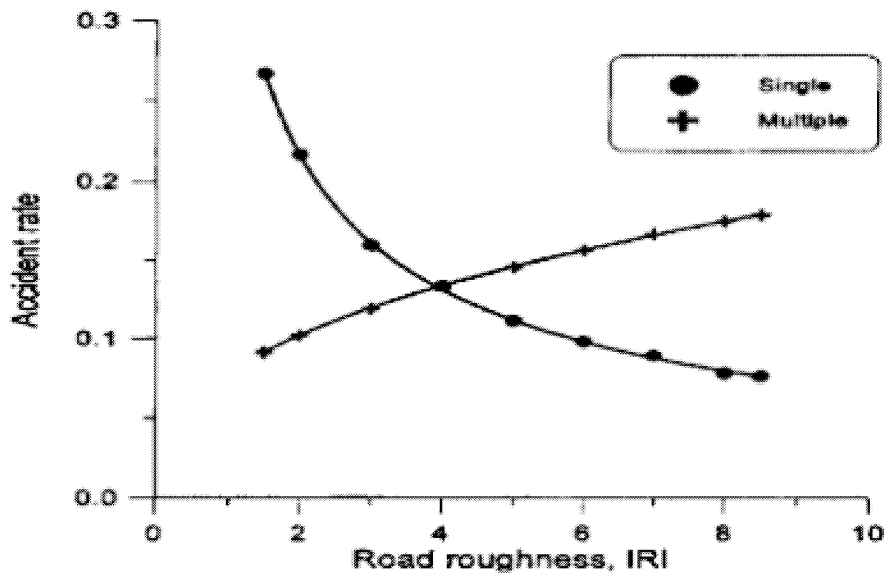


Figure 14 Relationship Between Road Collision Rate and Road Roughness, Tighe, Li, Cowe Falls, and Haas (2000).

The research concluded that maintaining an IRI below 5 m/km is beneficial, as it balances reducing single-vehicle and multiple-vehicle accident rates. By referring to the findings in **Table 3**, it can be concluded that generally, the IRI of asphalt and concrete is most conducive to minimizing single-vehicle and multiple-vehicle accident rates.

Gothie (1996) further supported these findings, demonstrating that wet crash rates increased by at least 50% when moving from a roadway section with friction levels greater than 0.60 to a section with a friction number less than 0.50. Furthermore, a reduction in friction number of 0.05 led to an approximate 50% increase in the risk and severity of crashes. Thus, indicating crashes on surface materials with lower friction number also increases the risk of severe crashes alongside the frequency of crashes.

Ihs, A. (2005) also investigated the relationship between IRI and collision rates and found that an increase in IRI corresponded to an increased collision rate, as illustrated in **Figure 15**. **Figure 15** provides a separate line for each speed limit. The solid portion of the line indicates the range of observed IRI values while the dashed portion of the line is an extrapolation.

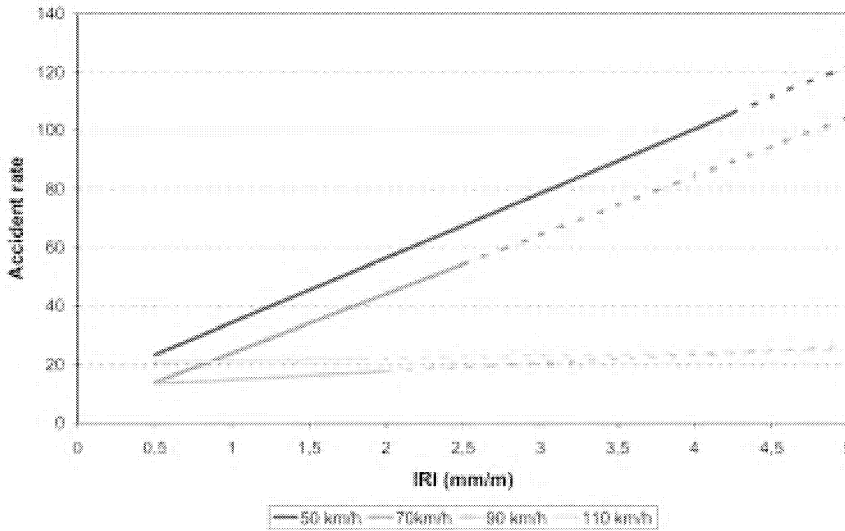


Figure 15 Relation Between IRI and Collision Rate (Number of Collisions per 100 Million Axle Pair Kilometres) in Different Speed Limit Classes, Ihs, A. (2005)

The 50 and 70 km/h groups demonstrate the significant impact increased roughness has on collision rates. The 90 and 110 km/h groups are unlikely to be gravel roads and therefore exhibited a narrow range of IRI values which may explain the relatively flat relationship observed.

Chandra (2005) investigated the impact on road surface roughness on free flow speed and observed that the free flow speed decreased with the surface roughness, and the free flow speed of passenger cars was greater than heavy vehicles for the same roughness, as shown in **Figure 16**.

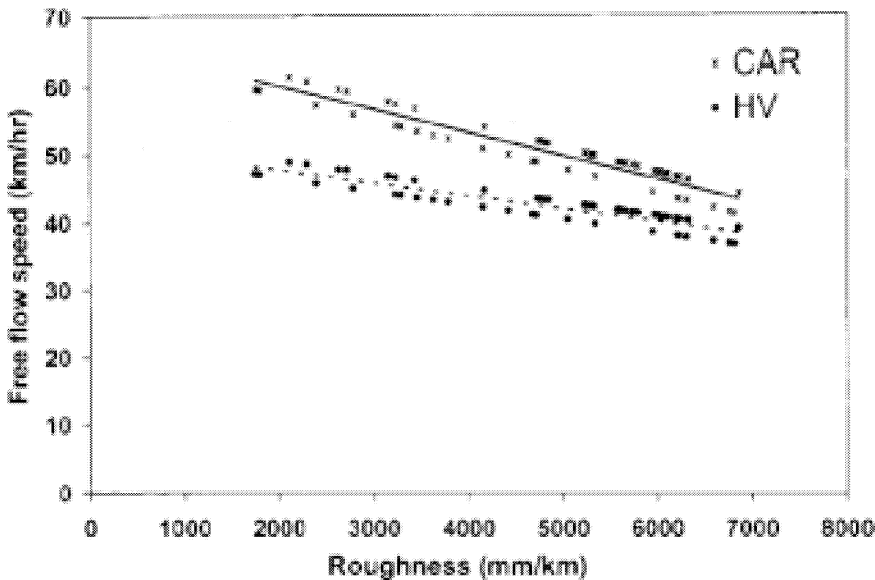


Figure 16 Relationship Between Surface Roughness and Free Flow Speed, Chandra (2004)

As asphalt and gravel typically have IRI values of 0.81 to 1.13, free flow speeds on paved roads can be expected to be approximately 70 and 50 km/h for cars and heavy vehicles, respectively. Conversely, gravel roads typically

have IRI values between 5.51 and 7.28 which corresponds to free flow speeds in the range of approximately 40 to 50 km/h.

Yu, J., Chou, E. Y., & Yau, J. T. (2006) suggested road surface roughness limits that are compatible with each speed limit which are illustrated in **Table 4**.

Table 4 Suggested IRI Limits, Yu, J., Chou, E. Y., & Yau, J. T. (2006)

Ride Quality	Iri (m/km ²)	IRI Threshold at Different Speeds (m/km)				
		120 km/h	100 km/h	80 km/h	70 km/h	60 km/h
Very good	<6.5	<0.95	<1.14	<1.43	<1.63	<1.90
Good	10.2	0.95-1.49	1.14-1.79	1.43-2.24	1.63-2.57	1.90-2.99
Fair	12.9	1.50-1.89	1.80-2.27	2.25-2.84	2.58-3.25	3.00-3.79
Mediocre	18.4	1.90-2.70	2.28-3.24	2.85-4.05	3.26-4.63	3.80-5.40
Poor	>18.4	>2.70	>3.24	>4.05	>4.63	>5.40
		50 km/h	40 km/h	30 km/h	20 km/h	10 km/h
Very good	<6.5	<2.28	<2.86	<3.80	<5.72	<11.44
Good	10.2	2.28-3.39	2.86-4.49	3.80-5.99	5.72-8.99	11.44-17.99
Fair	12.9	3.60-4.54	4.50-5.69	6.00-7.39	9.00-11.39	18.00-22.79
Mediocre	18.4	4.55-6.25	5.70-8.08	7.60-10.80	11.40-16.16	22.80-32.32
Poor	>18.4	>6.25	>8.08	>10.80	>16.16	>32.32

With IRI values between 0.81 and 1.03, asphalt roads can be expected to provide good or very good ride quality for speeds up to 120 km/h. In contrast, gravel roads can only be expected to provide a fair ride quality for speeds of up to 30 to 40 km/h. Combined with the findings that free-flow speeds on gravel roads tend to range between 40 to 50 km/h and that collision rates increase significantly with higher roughness, a case could be made that lower speed limits should be implemented on gravel roads.

Protection of Vulnerable Road Users

Cycling and pedestrian facilities help keep vulnerable road users safe from motorized vehicles, but not all of these facilities are created equal in terms of safety. Road design and physical objects such as large offsets from motorized traffic, curbs, parked cars, and landscaping improve the feeling of safety for pedestrians. For cyclists, Minikel (2012) and Lusk et al (2013) found that bicycle boulevards and cycle tracks consistently decrease collision risk, whereas other treatments had mixed results. Some studies (Metropolitan-Orlando, 2010; Moritz, 1998; Teschke et al, 2012) found potential reduction for other types of bike lanes, while other studies found no relationship or an increase in collisions involving bikes after bike lane installation (Jensen, 2008). Overall, there is inconsistent evidence on the safety impact of cycling facilities.

Ewing & Dumbaugh (2009) found that that the strongest countermeasure for vulnerable road user safety is when more people are walking and cycling. Jacobsen (2003) concluded that a doubling in the volume of pedestrians only results in a 32% increase in serious pedestrian collisions (as opposed to a doubling of the number of collisions). This suggests that the risk of a given pedestrian being involved in a collision decreases as the number of other pedestrians increases.

Relationship Between Road Geometry and Operating Speed

A “self-explaining road” is a road where its geometric elements, layout and features inform the driver what type of road it is and what can be expected. These road environments allow the drivers to navigate the road at their desired speed safely. Their speed choice can be altered through changes in road design to keep it self-enforced rather than having to rely on signage. Roadway geometric elements all play roles in the design speed of a road, which is the speed which the road is designed to accommodate and is different from the posted speed limit.

Cameron (1980) found that 26% of drivers in urban areas were unaware of the speed limit and were observed to be driving faster than others. If a road is not self-explaining, then simply posting the speed limit will not be effective at enforcing the limit. Richards & Dudek (1986) noted that speed limit signage is just a passive speed control and only efficient in areas where the hazards are obvious, such as at construction zones where drivers accept the lower speeds.

The ITE “Designing Walkable Urban Thoroughfares: A Context Sensitive Approach” identifies a number of roadway design elements that can influence the speed that drivers choose to drive at:

- Setting signal timing for moderate progressive speeds from intersection to intersection.
- Using narrower travel lanes.
- Using physical measures such as curb extensions and medians to narrow the travel way.
- Providing on-street parking to create side friction.
- Providing minimal or no horizontal offsets between the inside travel lane and median curbs.
- Eliminating superelevation.
- Eliminating shoulders in urban environments.
- Providing smaller curb radii at intersections and eliminating or redesigning high-speed channelized right-turns.
- Implementing textured pavement materials.
- Use of speed limit and warning signs to gradually transition speeds when approaching and traveling through a walkable area.
- Providing street trees. Naderi et al (2008) found that the presence of street trees reduced operating speeds in suburban environments by an average of 4.87 kilometres per hour.
- Enclosure of the roadway by the proximity of building walls.

Edquist (2009) has also noted that the following factors also influence a driver’s perception of their speed and thereby result in decreased speeds:

- The presence of houses and driveways can lead to drivers slowing down in anticipation of potential conflicts with other road users.
- Locating fixed objects near the edge of the roadway, combined with limiting the options for drivers to increase their offset from these objects (e.g., through narrow lanes), results in drivers slowing down.

Methodologies For Setting Speed Limits

Establishing methodologies for determining context-sensitive speed limits has become essential in the effort to enhance road safety. According to Safe Systems Approach and Vision Zero, speed limits must be set with consideration of local conditions and user behaviors. This ensures that the speed limits reflect the safe speed for the environment. The following section comprises a review of the literature with the aim of identifying methodologies for establishing speed limits and the related data utilized in the process.

An informational guide “Methods and Practices for Setting Speed limits: An Informational Report” released by the Federal Highway Administration (FHWA) in collaboration with the Institute of Transportation Engineers (ITE) provides practitioners with guidance on the different methods used for setting speed limits. The report has outlined four different approaches for establishing speed limits:

1. **Engineering Approach:** This method requires the use of engineering judgment based on engineering and traffic analysis and consists of two sub-methods, the operating speed method and the road risk method, which are completed in a two-step process. Initial speed limits are determined based on factors such as the 85th percentile speed and road design specifications or other relevant criteria. Subsequently, the base speed limit is adjusted to account for factors such as traffic volume, pedestrian activity, and infrastructure features like medians. **Figure 17** below provides a summary of the steps taken to determine speed limits.
2. **Expert System Approach:** Speed limits are set using computer programs that mimic the decision-making process of engineers. The programs have a knowledge base that stores all the accumulated expertise, paired with a set of rules for applying the knowledge to specific situations. An expert system is typically developed based on results from previous research, feedback from practitioners through web-based surveys on hypothetical scenarios, input from experts from panel meetings, and lessons learned from first generation expert systems. **Figure 17** shows an outline of the process involved in determining speed limits.

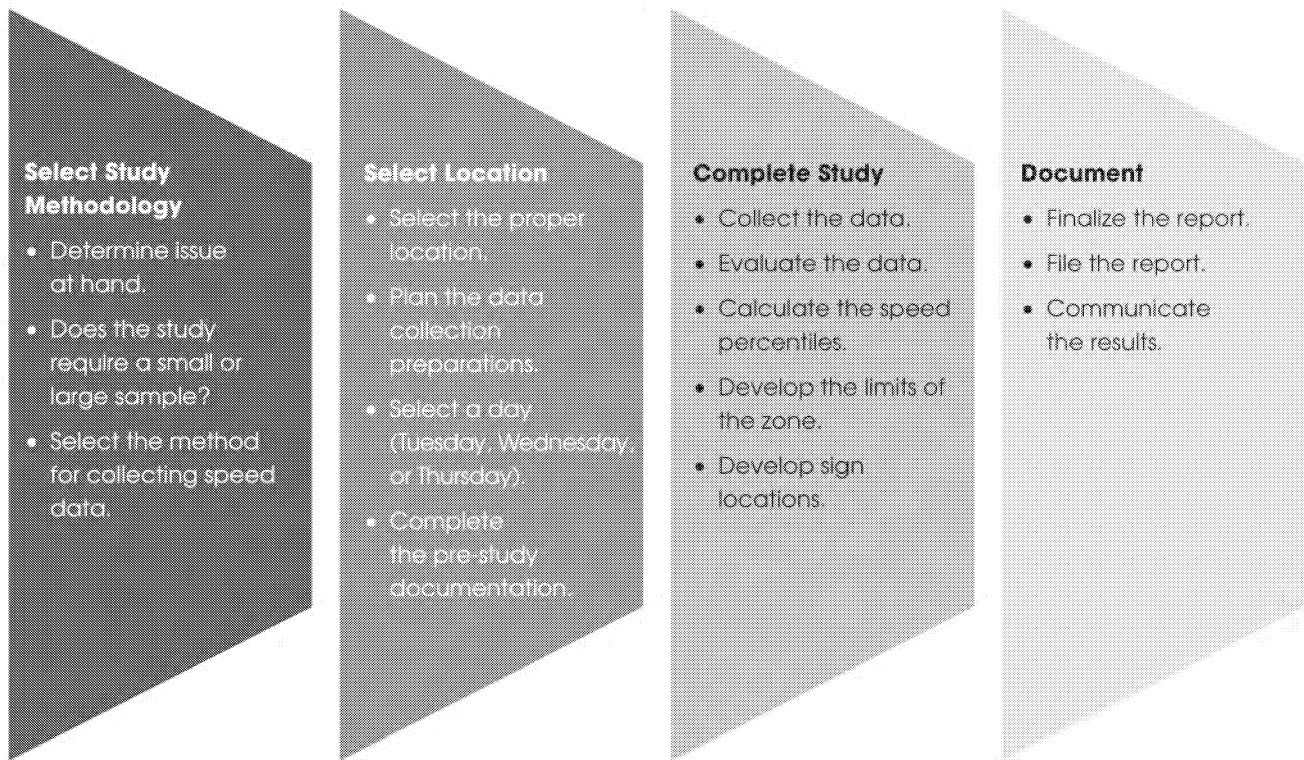


Figure 17 Speed Limit Study Process for both Engineering and Expert Systems Methods

3. **Optimization:** The aim of this approach is to minimize the societal costs associated with transportation. Factors such as travel time, vehicle operating costs, collisions, traffic noise, and air pollution are considered in the setting of speed limits. The figure below shows the Yang model that is used for calculating the optimal speed limits. The flow chart includes the factors considered throughout process.

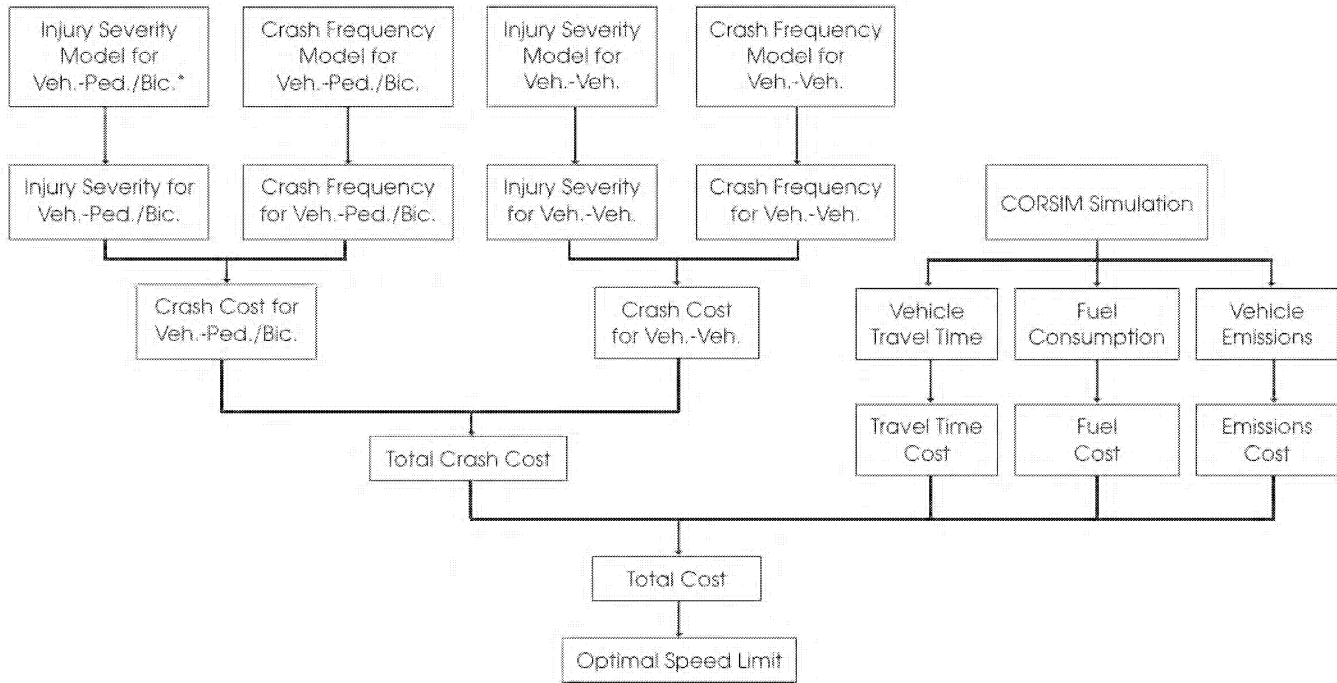


Figure 18 Optimization Speed Limit Study Process

4. **Injury Minimization or Safe System Approach:** Speed limits are set based on the types of collisions that are likely to occur, the resulting impact forces, and the capacity of the human body to withstand these forces. The “Safe System Approach to Speed Limit Setting-Case Studies Report and Recommendations” report discusses a recent project conducted by Caltrans (2023) to develop a new, context-sensitive initiative for setting speed limits. The aim of the project was to enhance the safety on city roadways. In searching examples of safe system strategies to adopt, the following key findings were identified:

- Some agencies prioritize a context-based strategy instead of solely relying on the 85th percentile when determining speed limits. They consider several factors such as roadway type, collision history, pedestrian and bicycle activity, and land-use context.
- The systematic approach that sounds to be the most effective in reducing operating speeds includes combining speed limit reductions with automated monitoring systems, such as automated speed enforcement cameras. This has been shown to decrease the number and severity of collisions, particularly in areas with high pedestrian activity.

Depending on the location of the roadway, multiple speed limit setting factors were accounted when reducing speed limits. These include:

- Functional class
- Average daily traffic volumes
- 50th percentile speeds
- Collision history and collision rate
- Adjacent land uses
- Pedestrian and bicycle activity
- Proximity to schools

- Survival rate of pedestrians in collisions occurring at 20 vs 25 mph (the likelihood of a pedestrian surviving a collision is doubled when the vehicle is travelling at 20 mph)
- Community input and needs

Impacts of Speed Limit Reductions

The following section examines the relationship between speed limit changes and travel time, collision frequency, and operating speeds. Multiple pieces of literature were reviewed to allow for a comprehensive understanding of this topic.

Relationship Between Speed Limit Change and Travel Time

The correlation between travel time, speed limits, speeding behavior, and safety is complex and often misunderstood by drivers. Motorists often think driving faster will reduce travel time, nevertheless, in an urban environment, elements such as regulatory control at intersections, pedestrian crossings, school zones, and congestion compel motorists to slow down and stop. Thus, the reduction of speed limit has minimal impact on travel time.

Some studies suggest that reductions in speed limits are unlikely to significantly affect travel times. Research indicates that travel time is more influenced by factors such as congestion, roadway design, and geometry rather than the posted speed limits. In conditions of medium congestion, where traffic intermittently moves at or near the speed limit, a lower speed limit could potentially decrease overall travel time by promoting a smoother flow of traffic. This is because lower speeds reduce the necessary safe distance between vehicles. Furthermore, in urban road environments, average speeds on arterial roadways are typically much lower than the posted speed limits due to the stop-and-go nature of traffic influenced by congestion and roadway design, rather than the speed limits themselves.

A news article published in 2024 by CTV News Ottawa revealed that new data from the TomTom Traffic Index survey indicates that the average travel time for a 10 km drive in Ottawa increased 50 seconds in 2023 to an average of 15 minutes. Based on the TomTom data, the worst times to travel in Ottawa are Tuesdays and Thursdays between 4 pm and 5 pm, with an average travel time of 23 minutes and 20 seconds and 21 minutes and 50 seconds, respectively, to travel 10 km during these periods.

The 2011 TRANS Origin-Destination Survey Report indicates that for vehicle-trips, the average distance travelled ranges from 9.1 km to 10.7 km. Approximately 50% of vehicle trips are equal to or less than 7 km in length.

Figure 19 illustrates the cumulative distribution of trips by distance recorded in the survey.

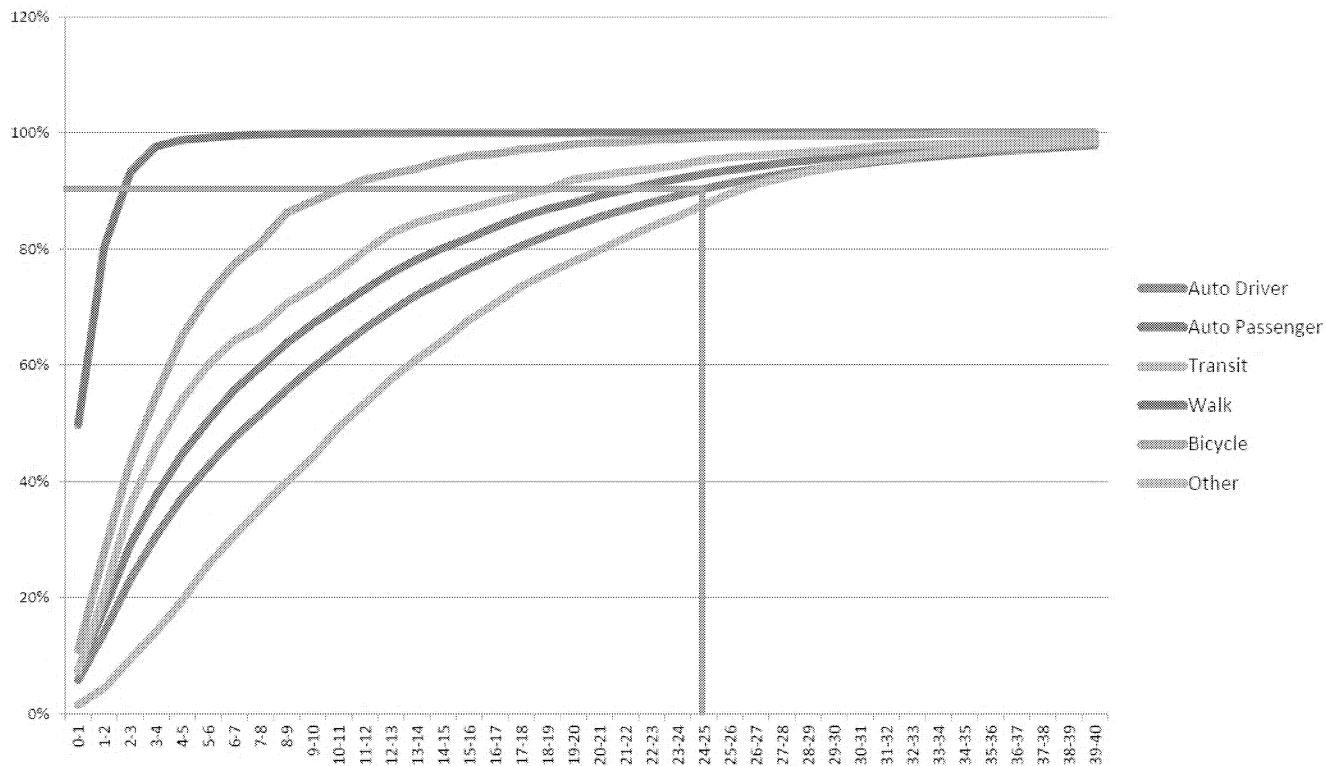


Figure 19 Cumulative Distribution of Trip Distance by Mode

Approximately 90% of vehicle trips are 25 km long or less. Combining these trip distances with the travel time data from the TomTom Traffic Index suggests that an average trip between 4pm and 5pm on Thursday takes approximately 23 minutes and 90% of trips take less than approximately 54 minutes.

The 2011 TRANS Origin-Destination Survey Report also provided the cumulative distribution of trip durations by time period which is illustrated in **Figure 20**.

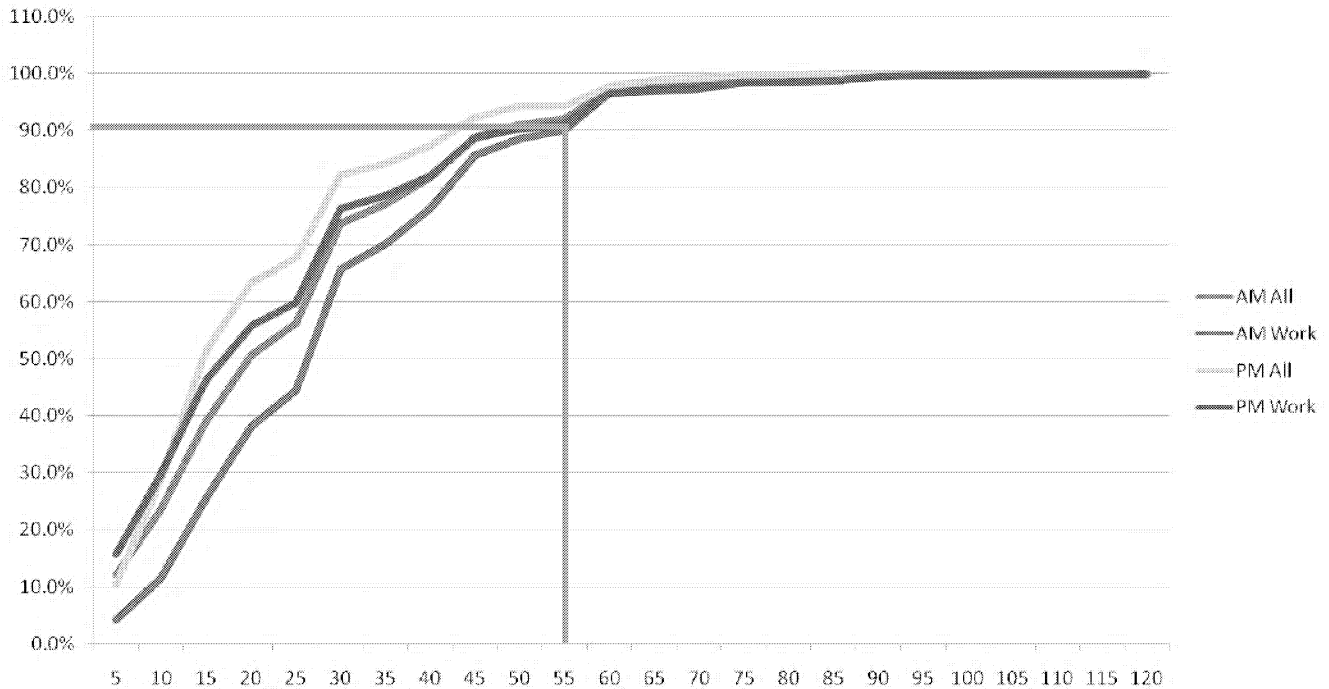


Figure 20 Cumulative Distribution of Trip Duration by Time Period

The data from the 2011 TRANS report corroborates the findings noted above, with 90% of trips taking 55 minutes or less.

Research on previous speed limit reduction initiatives suggests that reducing speed limits have negligible effects on travel time but can result in a significant decrease in collisions. Research conducted by SMEV and NARIN (1999) simulated the effect of reducing cruising speed on travel time for Melbourne traffic during morning peak hours. Findings revealed that reducing speed limits by 10 km/h would increase travel time by 5%, in the short term, and 1% in the long term due to behavioral adaptation. This reduction in speed limit would also lead to a 13.5% drop in collisions.

Extending the above finding to Ottawa suggests that a 10 km/h decrease in speed limits may only increase travel times in the short term by approximately one minute on average and increase 90th percentile travel times by approximately 2-3 minutes. Over the long term, a 1% increase in travel time would only extend travel times by approximately 30 seconds for the 90th percentile trip.

A more recent study by Zargiannaki et al (2024) used a mesoscopic model to simulate the impact of speed limit reductions on vehicle operating speeds and travel times in Berlin, Germany. The study analyzed two alternative options for speed limits as well as three scenarios for speed limit compliance for a total of 7 scenarios (including a 'Do Nothing' scenario). The two alternative speed limit options considered gradually greater decreases in speed limits, while the speed limit compliance scenarios considered a) a 10 km/h decrease in speed limit equates to a 2.5 km/h decrease in operating speed, b) free flow speed equals the speed limit (this scenario essentially assumes that roadways are rebuilt to reinforce the posted speed limit), and c) only 90% of drivers adhere to the posted speed limit on 30 km/h roads while on higher speed limit roads the compliance rate is 100%. The results of the study suggested that as speed limits decrease, the percentage of people using transit instead of cars would increase, as shown in **Figure 21**.

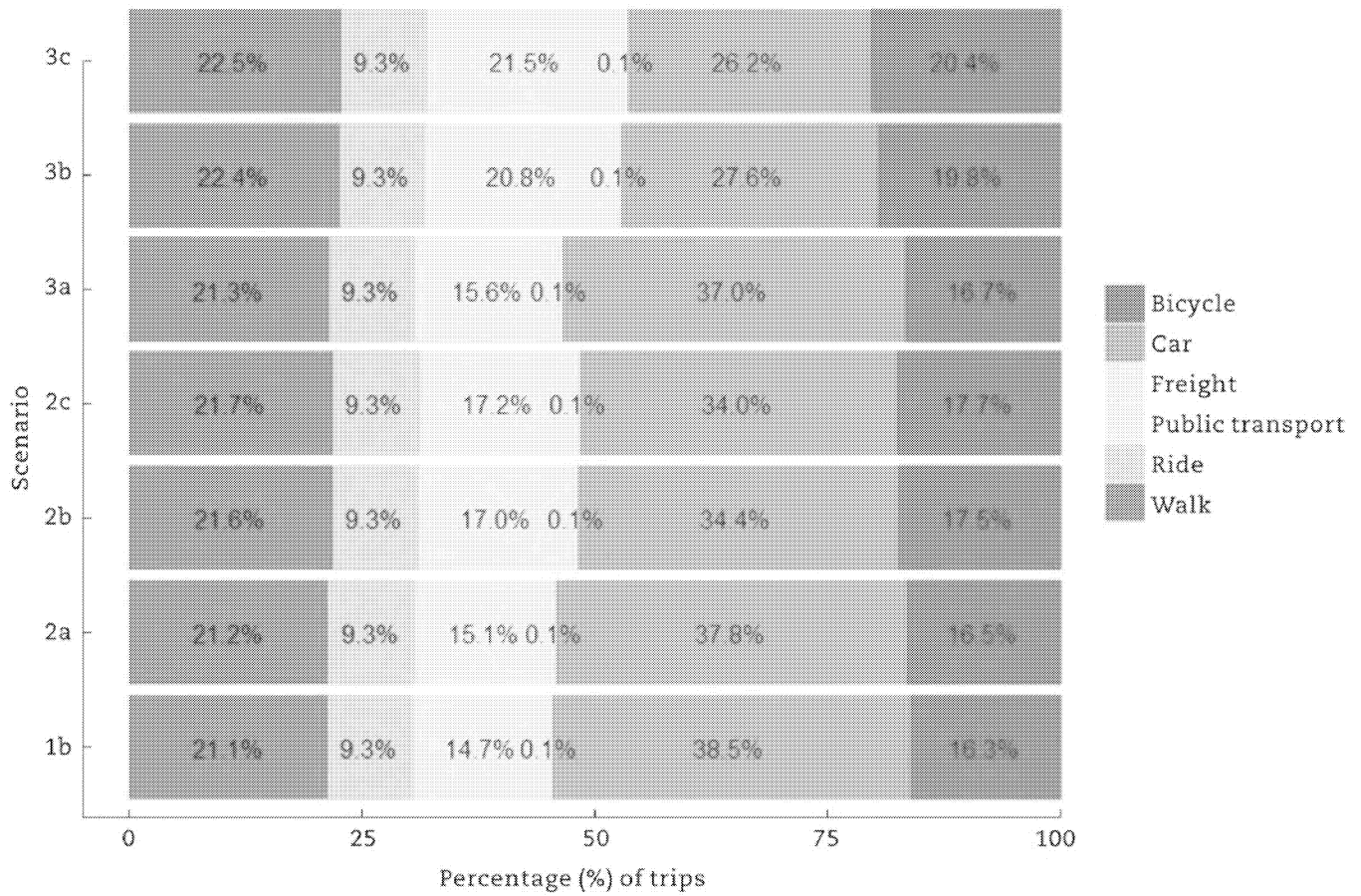


Figure 21 Project Impact of Speed Limit Decreases in Berlin on Mode Choice

In general, the study suggests that people living more centrally would transition to public transit, while those living further away would continue driving. With fewer short car trips, the average travel time and travel distance for cars increases (since only longer car trips remain) but average operating speeds would remain unchanged, as shown in **Figure 22**. It can therefore be concluded that reducing speed limits will have a negligible impact on travel time for those that continue to choose to drive.

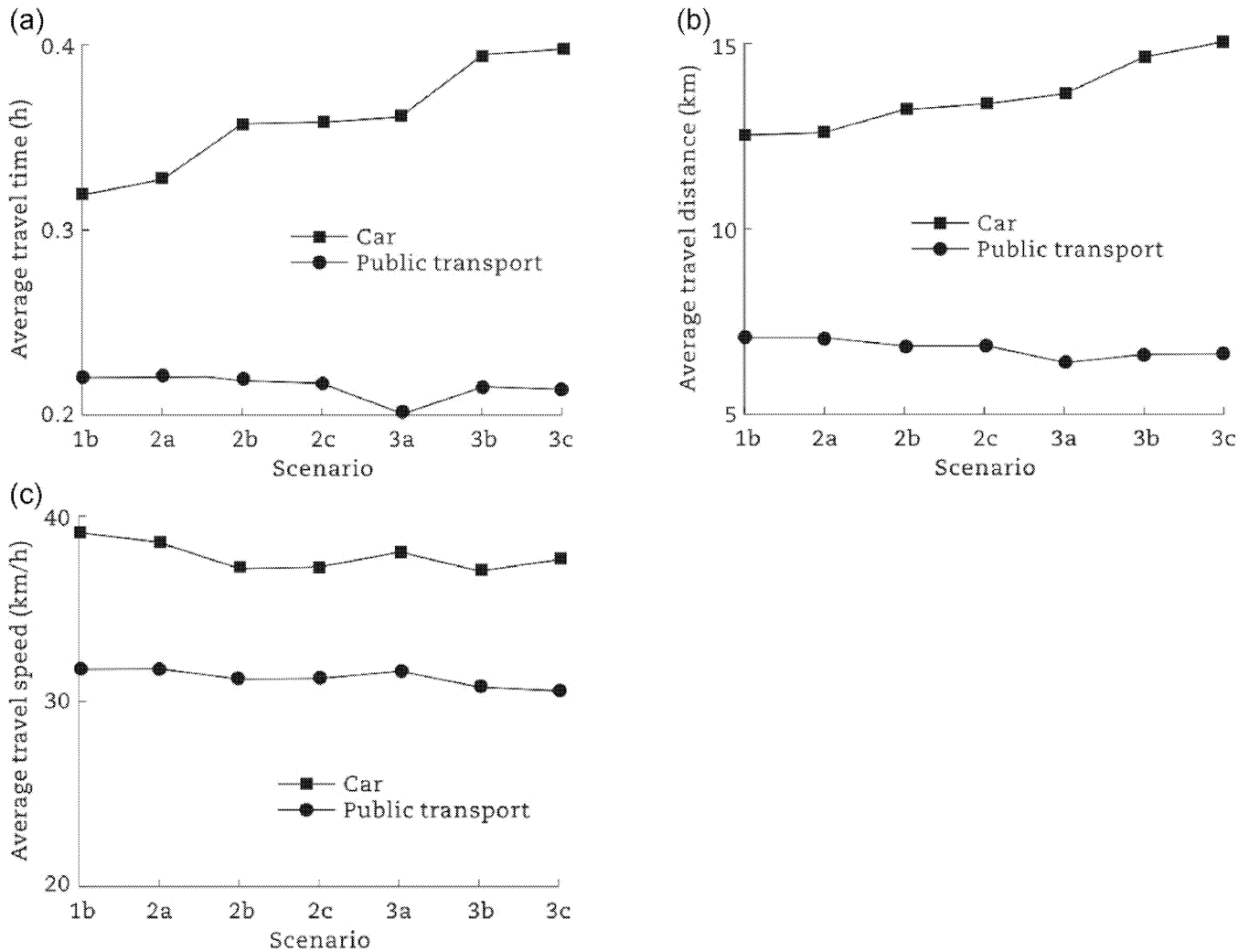


Figure 22 Project Impact of Speed Limit Decreases in Berlin on Travel Time, Distance and Speeds

Relationship Between Speed Limit Change and Collision Frequency

Previous research has shown varied results in assessing the impact of speed limit changes on crash frequency. Scharping (1994) observed a decline of 10% in the total number of collisions after a reduction of speed limits to 30 km/h, and a 16% drop in the number of collisions with injuries or death, in a study conducted in Hamburg, Germany. It is unknown what the speed limit was prior to being lowered to 30 km/h. Conversely, Parker (1997) studied the impacts of raising and reducing speed limits in different states in the United States and concluded that there was not sufficient evidence to deduce that collision frequency is associated with speed limit changes. Peltola (2000) examined the impacts of seasonal speed limit changes in a 2-year study, revealing a 14% decrease in collisions.

A study by De Pauw et al. (2014) explored the safety effects of reducing the speed limit from 90 km/h to 70 km/h on highways in Belgium. Using a before-and-after analysis, the study examined the changes in the number and severity of collisions following the speed limit reduction. The findings revealed a significant decrease in collisions

and injuries, with no increase in travel time. The authors determined that lowering the speed limit can effectively enhance road safety on rural roads.

In Sweden, between 2008 and 2009, speed limits were changed across 20,500 km of roads. Among these, approximately 2,700 km had their speed limits raised, while 17,800 km had their speed limits lowered. A study conducted by Vadeby & Forsman (2018) revealed that reducing speed limits by 10 km/h, from 90 km/h to 80 km/h, led to a decrease in fatalities, especially on roads with low safety standards. In contrast, there was an increase in injuries when the speed limit was raised from 110 km/h to 120 km/h. The aggregate result of these speed limit increases and decreases saved a total of 17 lives annually between 2008 and 2009. The study also discovered that these increases and decreases in the speed limits were associated with corresponding changes in the average driving speed.

Relationship Between Speed Limit Change and Operating Speeds

Reducing speed limits is seen as a short-term measure that can be swiftly implemented, but it's not as impactful as longer-term initiatives like redesigning roadways, which require several years for planning, programming, design, and execution.

The “Methods and Practices for Setting Speed Limits” report by FHWA explains how an alteration in the speed limit typically results in a change in the average speed of traffic, although these changes are not always directly proportional. Generally, the shift in the mean speed of traffic resulting from a speed limit adjustment is approximately 25 percent of the alteration in the speed limit itself. In simpler terms, a decrease or increase of 10 km/h in the speed limit leads to an approximate 2.5 km/h decrease or increase in the average speed, respectively. When considering this statistic alongside the power formula correlating changes in average speed with crash risk, it becomes evident that reducing the speed limit will lower crash risk, whereas raising the speed limit will elevate crash risk.

Benefits of Reducing Speed Limits in Canadian Jurisdictions

A study by Ahohassan et al (2024) on the impact of speed limit reductions from 50 km/h to 40 km/h on residential streets in Edmonton, Alberta, indicated that average and 85th percentile operating speeds decreased by 1.1 km/h and 1.6 km/h, respectively. Additionally, the study found that relative to conditions prior to the COVID-19 pandemic, collision frequencies decreased by 9.8% overall following the decrease in speed limits. When considering total injury/fatal collisions and vulnerable road user fatal/injury collisions, the collision frequency decreases further to 11.6% and 33.3%, respectively.

Friedman et al (2023) evaluated the impacts of lowering posted speed limits on local roads in Toronto, Ontario, from 40 km/h to 30 km/h. The study found that streets where the posted speed limit was lowered experienced a 28% decrease in total pedestrian collisions and a 67% decrease in major and fatal injury pedestrian collisions.

Toulouse et. al (2020) studied the relationship between speed limit changes and driver behavior using a spatial lag model. The study took place in Quebec, Canada, focusing on provincial highways (excluding freeways) between 2000 and 2018. Results demonstrated that while reducing speed limits generally decreases driving speeds, drivers adjust their speeds only to a partial extent. **Figure 23** illustrates the variance in the 85th percentile speeds (after speed limit change minus before speed limit change), where n indicates the number of sites. This boxplot shows a nonlinear trend in changes in driver speed behavior. Drivers neither complied with the speed limit nor adjusted their speed by the same magnitude as the speed limit change.

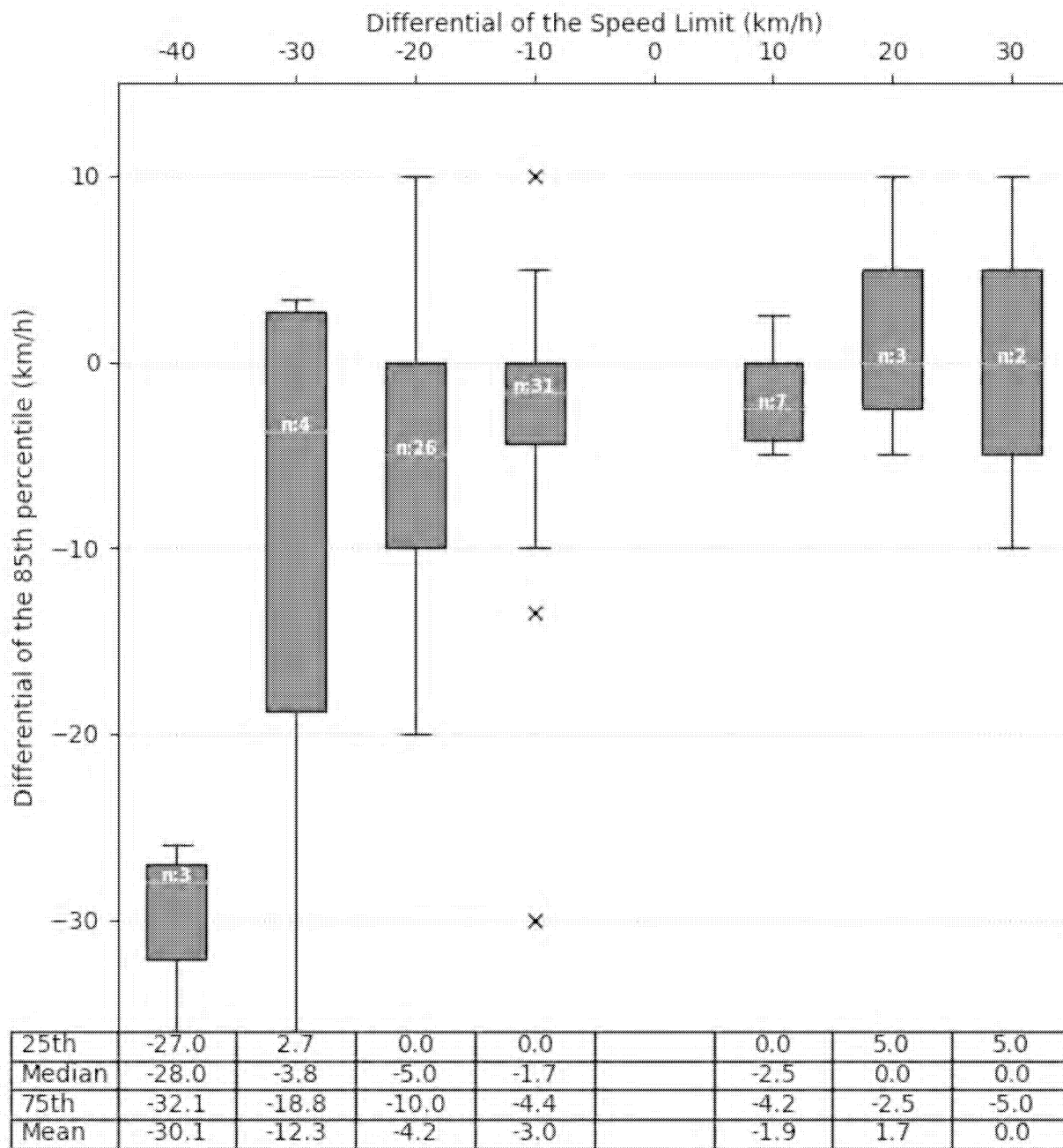


Figure 23 Boxplots Representing the Variations in the 85th Percentile of Average Speeds Corresponding to Changes in Speed Limits

Measures to Support Speed Limit Reductions

ITE suggests a combination of strategies to help improve compliance and provide a lasting impact for reducing speed limits. These strategies include:

Traditional Enforcement

Traditional enforcement involves patrol officers monitoring locations with a history of speeding-related crashes or violations. Consistent enforcement is essential for sustained effectiveness of reduced speed limits, with data shared among transportation professionals to help evaluate and improve road designs. Transportation professionals should also participate in traditional enforcement to ensure signs are correctly posted and to support the overall speed management program.

A study conducted by Simpson (2023) in Western Canada found that traditional enforcement measures resulted in a significant speed reduction on highways and freeways. However, the study also stated that reduction in behavior may only be temporary (compliance decreased when police presence ceased), aligning with previous research findings. For instance, during the post-test period when the unoccupied police vehicle was no longer present, both vehicle speeds and the proportion of speeding vehicles increased.

Automated Speed Enforcement (ASE)

ASE uses a camera and a speed measurement device to identify and photograph vehicles exceeding the speed limit. This system complements other strategies, such as engineering measures, educational initiatives, and traditional police enforcement, aiming to change driver behavior, reduce speeding, and enhance safety. Provincial Offence Officers review the images, and tickets are issued to the vehicle's owner, regardless of who was the driver during the violation. ASE locations are chosen based on evidence of vehicle speeding and historical collisions, and may only be deployed in community safety zones or school zones.

The presence of ASE cameras, which capture and penalize speeding vehicles, increases compliance with speed limits as drivers are aware that exceeding these limits will result in fines. This enforcement strategy leads to habitual speed reduction over time, encouraging drivers to consistently adhere to speed regulations. The average speed reduction ranges from 8-14 km/h in the areas close to the ASE installation points. Provided that the speed thresholds are sufficiently low and the penalties are appropriately enforced, the ASE program is likely to remain effective in the long term. By lowering vehicle speeds, ASE significantly contributes to improving road safety, reducing the frequency and severity of speed-related collisions by 20 to 48% for conspicuous fixed camera sites. ASE also help create safer environments for pedestrians and cyclists. ASE systems complement other measures such as road engineering improvements, educational campaigns, and traditional police enforcement, enhancing their overall effectiveness. In cities like Toronto, the strategic deployment of ASE based on vehicle speed and collision data has led to notable improvements in driver behavior and road safety.

The second edition of ITE "Canadian Guide to Traffic Calming" also mentions some enforcement measures that can aid in improving compliance with posted speed limits, including:

Aircraft/Drone Radar Speed Enforcement

Aircraft/Drone radar speed enforcement involves an aircraft or drones monitoring vehicle speeds on highways or freeways using transverse pavement markings placed on the road. Aircraft calculate vehicle speeds by timing intervals and measuring the distance between pavement markings, then alert ground-based personnel to enforce speed regulations. This method is applicable on highways, freeways, urban and rural roadways but is costly as it requires a fixed wing aircraft with a police officer and a second officer on the ground.

These methods can cover multiple roadways simultaneously, increasing the likelihood of detecting speed violations and discouraging speeding, as drivers are aware that enforcement can occur anywhere within the monitored region. Studies cited in ITE Canadian guide to Traffic Calming have shown that the use of aircraft and drone radar enforcement can lead to a reduction in excessive speeders (15 km/h or more over the speed limit) by approximately 6-33%. This reduction is achieved as drivers become more cautious and adhere to speed limits,

knowing that these advanced technologies can detect speeding violations across a broad area, ensuring consistent and effective speed enforcement. This measure, however, requires constant surveillance and presence of an aircraft and law enforcement personnel.

Mobile Speed Enforcement

Mobile speed enforcement utilizes radar photography units mounted in vehicles or trailers to enforce speed limits in areas where speed enforcement is needed. Marked or unmarked inconspicuous vehicles can be used in presence of a legal provision. This method is applicable on highways, freeways, school zones, construction zones, urban, and rural roadways. It involves a single van operating almost continuously, which includes staffing the camera unit, managing operating costs, overseeing the processing center to review and issue citations, handling prosecutions, conducting court sessions, and following up on offenders.

Mobile speed enforcement significantly impacts vehicle operating speeds by providing flexible and unpredictable monitoring of roadways. Studies have shown that mobile speed enforcement can lead to reductions in average vehicle speeds by approximately 2-6 km/h. A study conducted by Rutting (2008) concluded that the proportion of drivers travelling more than 16 km/h above the speed limit declined by approximately:

- 70% at locations with both warning signs and speed camera enforcement
- 39% at locations with warning signs but no speed cameras
- 16% on residential streets with neither warning signs nor speed cameras

Speed Display Devices

Speed display devices on the roads are electronic signs designed to inform drivers of their current speed as they pass by. These devices are strategically placed along roadways, including highways, urban streets, and residential areas. These devices display the current speed of an approaching vehicle, often accompanied by a message encouraging drivers to slow down if they are exceeding the speed limit. The real-time feedback provided to drivers, encourages them to adhere to the posted speed limits and promotes safer driving behavior. This measure improves compliance with speed limits, particularly in high-risk areas such as school zones and residential neighborhoods. These devices are a cost-effective alternative to police enforcement when considering long-term use.

North American studies such as Hallmark (2012) indicate that the use of speed display devices can result in a reduction in 85th percentile speed of between 3-14 km/h. This reduction occurs because the feedback prompts drivers psychologically to adjust their speed, leading to safer driving behaviors and improved compliance with speed limits, particularly in high-risk areas such as school zones and residential neighborhoods.

Traffic Signal Timings (Rest-On-Red Signal Phasing)

In the absence of vehicles at an intersection, the controller can be set to "rest-on-red" mode, displaying the red signal for all approaches. Once vehicle demand is detected or a pedestrian push button is pressed, the controller promptly switch to a green signal for the corresponding phase. After fulfilling the demand, and if no further demand arises, the intersection reverts to displaying red signals on all approaches. The green signal timings do not necessarily require vehicles to come to a complete stop. Hence, the purpose of rest-on-red phasing is to reduce vehicle speeds and severity of collisions.

Traffic signal timings with rest-on-red signal phasing can reduce average vehicle speeds by creating more frequent stops, leading to lower overall speeds as drivers anticipate red signals and adjust their driving behavior accordingly. According to Hillier (2016), this method can lead to a reduction in average vehicle speeds by up to approximately 11 km/h and a reduction in intersection collisions by approximately 45%.

It should be noted that rest-on-red signal phasing is not a practical measure to implement in every circumstance. Care should be taken in implementing this type of signal phasing only in locations where the benefits outweigh the negative impacts on traffic operations.

Average or Point-to-Point Speed Enforcement

Average speed enforcement, also known as point-to-point speed enforcement (PTPSE), is a modern speed management strategy aimed at improving road safety over extended road segments. PTPSE uses a network of cameras to capture images of vehicle license plates at multiple points along the road and calculate the average speed of vehicles by dividing the distance between two camera locations by the time it takes vehicles to travel between them. If a vehicle's average speed exceeds the legal limit, the system generates an infringement notice (Dredge & Minton, 2006; Wood & Williams, 2004). PTPSE operates by dissuading drivers from speeding not just at specific points but over an entire section of the road, thereby promoting sustained compliance with speed limits (Soole, Watson, & Fleiter, 2013).

The implementation of PTPSE systems has demonstrated positive effects on operating speeds and collision rates. For instance, in the UK, PTPSE installations led to a 10% reduction in average speeds on monitored roads (Ison & Farrington, 2006). Additionally, PTPSE has been associated with significant reductions in collision rates. A study conducted in Sweden reported a 20% decrease in injury collisions and a 35% reduction in fatalities following PTPSE implementation (Forsman & Linder, 2015). PTPSE systems also reduce speed variation among vehicles, contributing to smoother traffic flow and a decrease in collisions caused by sudden speed changes (Hauer, 2004). These findings suggest that PTPSE not only improves speed compliance but also enhances overall road safety.

The report of *Effectiveness of Average Speed Cameras in Great Britain* by Owen, Ursachi and Allsop (2016), discusses the complex relationship between PTPSE installation and its effectiveness in reducing road collisions. Initial analyses comparing collision rates before and after PTPSE implementation indicated substantial reductions: fatal or serious collisions (FSCs) decreased by 50%, while personal injury collisions (PICs) dropped by 25% (Transport for London, 2024). However, these results may be influenced by site-selection bias and the overall trend of reduced collisions during the evaluation period. A more refined analysis of PTPSE sites installed specifically for collision reduction showed a notable yet more modest reduction of 36.4% in FSCs and 16% in PICs (Smith & Jones, 2024). In both analyses, the effectiveness of PTPSE did not significantly differ between high and low-speed limit areas for FSCs, though there was a greater improvement on reducing PICs at lower-speed sites (Brown et al., 2024). Overall, this report concludes that PTPSE has demonstrated effectiveness in reducing collisions, particularly at lower-speed sites.

PTPSE's effectiveness is also reflected in its influence on driver behavior beyond just compliance with speed limits. The system's capability to enforce speed limits over an extended road section, rather than at a single point, helps to mitigate the "halo effect," where drivers only slow down near enforcement camera points and then speed up afterward (Hess, 2004). By encouraging consistent speeds over a longer distance, PTPSE reduces speed variability, which is a known factor in crash risk (Kloeden et al., 2002). The consistent enforcement over time also reduces the likelihood of drivers avoiding detection through site-learning or short-term behavioral changes (Freeman & Watson, 2006).

Additionally, PTPSE systems have been associated with broader public health and environmental benefits. The reduction in speed variability and the overall decrease in vehicle speeds can lead to reduced vehicle emissions and noise pollution (Chenery, 2006). Additionally, public acceptance of PTPSE tends to be high, particularly when the systems are implemented transparently and in locations with a history of speed-related collisions (Corbett & Simon, 1999).

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Ontario's Highway Traffic Act (HTA) provides the legislative framework for traffic enforcement in the province, including the use of automated enforcement systems (Ontario Highway Traffic Act, 1990). However, the Act does not explicitly authorize the use of PTPSE systems that calculate a vehicle's average speed over a distance. Instead, the HTA primarily governs the use of point-based speed cameras, which capture a vehicle's speed at a specific location. This has led to a situation where PTPSE, which requires continuous monitoring over multiple points, lacks a clear legal foundation under current provincial law.

Another key challenge to the implementation of PTPSE in Ontario relates to privacy concerns and data management. PTPSE systems rely on capturing and processing large amounts of vehicle data, including license plate recognition and tracking of vehicles over distances. In particular, the collection and storage of data over extended distances and time periods, as required by PTPSE, necessitates stringent data protection measures to comply with federal and provincial privacy laws (Office of the Privacy Commissioner of Canada, 2021).

PTPSE has been effectively integrated into the legal frameworks governing traffic enforcement in many countries, demonstrating its widespread use and acceptance globally.. PTPSE has gained significant traction globally, emerging as a key tool in the efforts to improve road safety across various jurisdictions. Countries that have implemented PTPSE include the Netherlands, the UK, Italy, Austria, Belgium, France, Switzerland, Norway, Spain, Australia, and New Zealand, among others. Experience from these countries indicate that the technology is effective on highways as well as in urban areas.

Conclusion

As discussed in the introduction, the goal of the literature review was to address the following five topics/questions:

1. What is the relationship between safety and vehicle operating speeds?
2. How does roadway geometry impact operating speeds and safety?
3. What are potential methodologies for setting speed limits?
4. How does reducing speed limits impact travel times, safety, and operating speeds?
5. How do different types of speed enforcement impact operating speeds?

The following summarizes the key findings of the literature review:

- Collision frequency are directly related to changes in operating speeds, with the number of collisions increasing exponentially as speeds increase.
- Collision severity is also directly related to vehicle speed where, in general, the probability of fatalities occurring begins to increase substantially once vehicle speeds exceed 30 km/h, 50 km/h and 70 km/h for pedestrian, side impact and front impact collisions, respectively.
- Coroner reports suggest that speeding is a factor in nearly half (45%) of fatal collisions in Ottawa. On an Ontario-wide basis, speeding is a factor in 30% of cyclist collisions. Additionally, 67% of pedestrian deaths in Ontario occur on roads with speed limits of 50 km/h or higher.
- The literature suggests that, in urban environments, lane widths have no or minimal impacts on collision frequency. The presence of non-traversable medians is found to substantially reduce collision frequency, while increased access point density is associated with higher collision frequencies.
- Road surface material has a significant impact on safety and operating speeds. Roads with rougher surfaces are associated with higher rates of collisions and lower free-flow speeds. Based on the findings of the literature review, a case could be made for lower speed limits on gravel roads which tend to have significantly rougher road surfaces than asphalt or concrete roads.
- The evidence on the safety impact of active transportation facilities is mixed, although there is evidence that a 100% increase in the number of pedestrians does not result in a 100% increase in pedestrian collisions. Rather, pedestrian collisions only increase by 32%, suggesting that an individual person walking is at a lower risk overall when there are more pedestrians.
- Increasing side friction through narrowing lanes, locating street furniture and trees near the road, and other measures to give drivers the impression that they have less space and less room for error can decrease the speed that drivers choose to drive at and contribute to creating “self-explaining” roads.
- Four methodologies for setting speed limits were identified: the engineering approach, the expert system approach, the optimization approach, and the injury minimization or safe systems approach.
- Models from the literature suggest that in urban conditions, reducing speed limits by 10 km/h would only increase travel times by 5% in the short-term, and reduce it by only 1% in the long term. Based on existing travel times in Ottawa, this corresponds with an average increase in travel time of only one minute. The 90th percentile trips might see travel times increase by 2-3 minutes. Over the long term these travel time increases would decrease to approximately 30 seconds for the 90th percentile trips.
- Reducing speed limits has been consistently shown to reduce collision frequency.
- In the absence of geometric changes, studies indicate that reducing speed limits alone decreases operating speeds, however, the decrease in operating speeds only equates to 25% of the decrease in the speed limit. Stated another way, a 10 km/h decrease in the speed limit is expected to only reduce operating speeds by 2.5 km/h on average.

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- A number of enforcement methodologies have been identified that can support speed limit reductions and improve compliance, including traditional enforcement, automated speed enforcement, average or point-to-point speed enforcement, aircraft/drone radar speed enforcement, mobile speed enforcement, speed display devices, and setting traffic signals to rest-on-red mode.

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