April 19, 2021

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Maureen Wilson
Councillor Ward 1
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Dear Ms. Dear and Ms. Wilson

RE: UHOPA-20-012 and ZAC20-016
1107 Main Street West, Hamilton (Ward) 1
Pedestrian/Cyclist Hazard Assessment relating to:

a) failure od Applicant to adhere to minimum rear and side yard setbacks of applicable zoning by-law, and
b) revised location of underground parking garage access ramp

I had previously forwarded to you some of the neighbourhood's concerns for pedestrian safety regarding the proposed development, but I have now obtained a copy of a very detailed and highly relevant report which has direct bearing on the above two Applications.

This Report is entitled "School Transport Walking Hazard Assessment Guidelines, Ottawa, Ontario" and was prepared by the firm of Morrison Hershfield on October 26, 2011 for the Ottawa Student Transportation Authority. It can be accessed on the internet at:
http://www.ottawaschoolbus.ca/wp-content/uploads/2016/06/osta-mh-main-report-26-oct-11.pdf

The Report is extremely pertinent as it is a walking hazard assessment from the perspective of young students and pre-schoolers. Due to the fact that the subject site is adjacent to a City of Hamilton playground parkette as well as the day school known as the Hamilton Hebrew Academy, the issue of 1) safe sidewalks and roadways, and 2) hazards for pedestrian and cyclist safety, should both be examined as part of the planning approval process to determine whether there will be negative impacts as a result of the proposed development.

I have attached a few extracts from the Report and in particular I draw your attention to pages 14-16 which set out "how children view their surroundings and interact with traffic". I have also attached pages 33-36 in which Section 8.2 evaluates pedestrian travel along a sidewalk in a traffic corridor, and Section 8.2.2 evaluates "Accesses" such as the entrance ramp to an underground parking lot.

I have also attached the index pages and a few other pages which give a more detailed understanding of the relevancy of the Report to this proposed development.

Based on the findings and the hazard assessment guidelines for young school aged pedestrians and cyclists contained in the Report, I am of the opinion that the Applicant's request for relief from the minimum setback requirements for both the side yards and rear yard of the proposed development, and the Applicant's relocation of the access ramp of the underground parking garage from the building's midpoint to further south along Cline Avenue South to a point approximately at the site's southerly boundary line, will create unsafe adjacent pedestrian sidewalks for young children walking and cycling to the City of Hamilton parkette or to the day school.

Accordingly, it is my belief that the proposed development is inconsistent with both the Provincial Policy Statement and the public interest provisions of the Planning Act. If you require any further information relating to this Report or to the sources it refers to, or if you need any clarification on any matter raised in this objection letter, please do not hesitate to contact me.

Yours very truly,

[redacted]

John Ross

[redacted]

- Child pedestrians tend to be **overrepresented in certain types of collisions** (particularly midblock crossings, with/without pedestrian crossovers) and also display certain childlike behaviours (e.g. running into the road, playing on the road) that may contribute to collisions. There are several possible reasons for such trends including the limited capabilities of children to deal with traffic as discussed in Section 6.2 and the difficult of drivers in perceiving child pedestrians due to their smaller stature which reduces visibility.

While the above-noted facts and statistics about child pedestrians may seem alarming, this information is not presented in an attempt to discourage walking. Rather, it is intended to provide a greater awareness of the special considerations which are called for when evaluating safety for children.

6.2 Child Pedestrians[10]

Evaluating traffic safety around schools requires an understanding of how children view their surroundings and interact with traffic. Child pedestrians have unique perceptions of the world around them as they mature, and developmental factors play an important role in influencing their abilities to safely navigate the demands of intersections and roads.

According to the SafeKids Canada Child Pedestrian Injuries Report 2007-2008, child pedestrian injuries are a leading cause of injury-related death for Canadian children aged 14 years and younger. There are a wide range of physical, psychological, and behavioural characteristics of children which tend to increase their risk for pedestrian injury and contribute to collisions.

The following summary of "human factors" related to children has been extracted and compiled from a variety of sources, including Jacobsen et al. (2000), Aoki and Moore (1996), Reiss (1977), TAC (1998b), ITE (1999), the National Safe Kids Campaign (2002), and Safe Kids Canada (2008).

- Children have difficulty detecting traffic. Their small size not only makes them **less visible to drivers** but also **less able to see oncoming vehicles**, especially when parked cars impede their vision. In addition, the field of vision of children is one-third narrower than that of adults. As a result, **young children are not able to see out of the corner of their eyes as well as adults** and have a restricted capacity for using information in their peripheral field of vision. Children under the age of 8 also have **difficulty judging the direction and importance of various traffic sounds**, such as sirens. Consequently, they may turn the wrong way searching for a sound, missing important information necessary to react safely.

- Children have difficulty judging safe gaps in traffic and safe places to cross the road. This complex task requires assessments of speed, distance and time that are beyond a

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[10] Much of the write-up in this section has been extracted from a report prepared by Morrison Hershfield for the City of Ottawa in 2002: "Adult School Crossing Guard Program and School Zone Traffic Safety Program Policy Development"

child's capabilities. In general, **children up to approximately 8 years of age have difficulty conceptualizing speed and distance**. Consequently, children may have trouble judging how fast a vehicle is coming towards them or how far away a vehicle is, limiting their ability to choose safe gaps in traffic or recognize situations where a driver is likely to hit them even though the pedestrian has the right-of-way (i.e. failure to stop at a crosswalk or stop sign).

- Children have trouble detecting movement. **Because their sense of perception is different from that of adults, children may think large cars move more quickly than small cars, or that narrow streets are less dangerous than wide streets**. A child may also perceive a small vehicle as being further away than an equidistant truck and may tend to judge noisy cars as going faster than quiet cars. This distorted view of traffic motion is particularly dangerous in light of children's **limited understanding of the physics of a moving vehicle**, and the time and distance required to stop. Furthermore, children frequently base their decision to cross the road on the visible presence of vehicles without regard to sight distance or possible visual obscurement.

- Although children may have been taught to cross the street safely**, they can be easily distracted and may respond impulsively**. Moreover, children tend to focus only on the things that interest them most and more readily attend to new or emotionally engaging information than to information relevant to traffic. **Children also tend to mix fantasy with reality, and are often impatient.** As a result, they have trouble waiting for stoplights to change or for cars to stop at a crosswalk before they step out onto the road.

- **Children need more time to process information and react than adults. Children also have difficulty processing several items of information at the same time** and may be overwhelmed by the complexity of traffic. Indeed, young children are unable to synthesize all of the pieces of information that they need to act appropriately in an emergency situation. Even if children have been taught the rules of the road, their brains are unable to process multiple pieces of information or a complex chain of events. **Lacking the fully developed ability to evaluate complex and potentially hazardous situations, they fall back on prescriptive rules, easily remembered but not always appropriate**. Children's rigid adherence to rules combined with their way of thinking may cause a child to conclude that a pedestrian crosswalk or sign renders them safe without properly evaluating the traffic situation. **Since children tend to concentrate on one thing at a time and are incapable of distributing their attention, they may have only a vague overall impression of their surroundings** despite the complexity of the traffic situation they are encountering.

- **Children cannot understand the driver's point of view** and expect adults to look out for them. They believe that others see what they see and do not realize that drivers may be unaware of their presence. **Young children often have mistaken beliefs about cars**, trusting cars to stop instantly. **Many children believe that the safest way to cross a street is to run. Children also lack a sense of vulnerability**, and do not understand that a car can seriously hurt or kill them. This lack of understanding may translate into unsafe behaviour as children travel within their neighbourhood.

While younger children have certain limitations that hinder their ability to safely react to traffic situations, older children generally have sufficient ability to cope with the dangers of traffic. According to Safe Kids Canada, children older than nine have generally matured sufficiently to be able to walk and cycle safely near traffic, and can therefore be permitted greater independence.

By age eight, children's brains have reached a stage of development that allows them to be more responsible and to make good judgement. As a child's thinking becomes increasingly more sophisticated, the brain develops the ability to process multiple pieces of information at the same time. This allows a child to properly assess a chain of events and respond appropriately – a very important skill when cycling or walking near traffic. As a child ages, he/she begins to develop feelings of vulnerability and therefore is more conscious of the risks and consequences of his/her activities. Reality-based fears begin to surface around age nine [such as the fear of someone dying]. As physical coordination develops, children become more suited to dealing with the hazards of traffic. At the same time, children become less impulsive and are more likely to think before darting out into the street.

Given these limitations, it is generally recognized that children younger than the ages nine to eleven require adult supervision when walking or cycling on community roads (Reiss 1977; National Safe Kids Campaign 2002; Safe Kids Canada 2008). The National Safe Kids Campaign (2002) recommends that children under the age of ten be accompanied by adults or older children when crossing the street. Likewise, Safe Kids Canada (2008) recommends the proper supervision of children under the age of eleven, since younger children generally do not have the ability to make safe decisions when dealing with complex traffic situations, regardless of their level of intelligence. Indeed, parents have a tendency to over-estimate their child's pedestrian skills, without recognizing that their child lacks the cognitive development, behavioural capacity, and physical coordination to safely walk and cycle in traffic, and react to dangerous situations which might arise.

As reported by Jacobsen et al. (2000), teaching children about traffic safety has only limited potential to reduce child pedestrian injuries:

> *While children as young as nine years may be able to learn the skills to cross the street, it is unlikely, because of their cognitive, perceptual and behavioral abilities, that they can be relied upon to use those skills, especially when they are engrossed in play. Interacting with traffic is complex, and the necessary abilities are not fully developed in children until age 11 to 12 years (pg. 71).*

Based on these findings**, an age of eleven was selected as the 'design age' for which hazards will be evaluated** with the given methodology. While children of all ages are encouraged to walk to school within no transport zones, **parental accompaniment/supervision is assumed for all children below the age of eleven**.

Although younger children may not have the ability to make safe decisions when walking or cycling unsupervised, it is still important to expose children to traffic, and to allow them to develop the skills required to safely navigate the road network once they are developmentally ready for the challenge.

Given the above considerations, the proposed methodology is based on a two-part framework to assess situations which are considered to be absolutely unsafe (absolute warrant) as well as situations which are cumulatively felt to increase the exposure to risk (combination warrant).

For each type of hazard, the key factors influencing safety were identified to provide a rationale and basis for developing evaluation measures. Where these underlying factors are difficult to measure, representative proxies for safety are presented to be used in the evaluation process. The following sections describe the various measures proposed for assessing safety, along with a discussion of supporting background research as appropriate.

8.2 Assessing Travel Along Roads (Corridors)

This section deals with the evaluation of conditions where a pedestrian is travelling along a corridor, either directly on a roadway, or using a sidewalk, shoulder or pathway. Figure 2 illustrates the primary types of collisions for pedestrians associated with different types of pedestrian action as well as the potential root cause of these collisions.

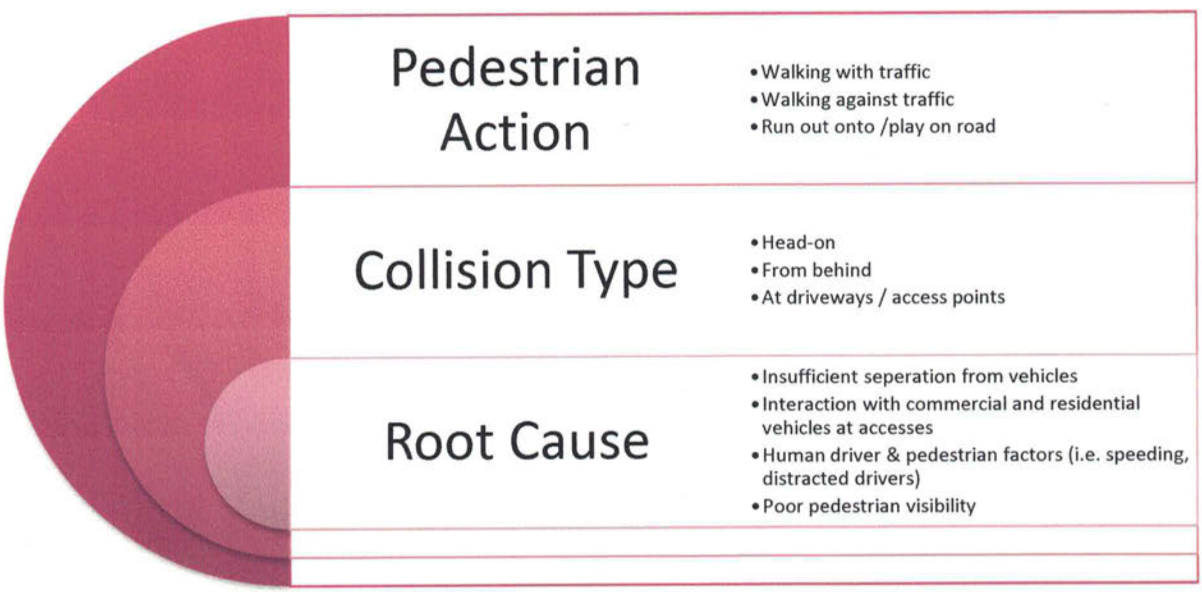

Figure 2 Key Issues of Concern for Corridors

Based on these root causes, a number of measures were identified to assess the safety of travelling along a given corridor. Overall, travel along corridors is assumed to be less critical in terms of safety than travel across roads. This is captured in the evaluation process, in which corridors are weighted less than crossings.

The information presented below is relevant for arterial and collector roads. Since local streets are governed by a different set of design principles and are subject to different operating conditions (typically low speed, low volume traffic), the information presented below may not be applicable. In the evaluation methodology, only collector and arterial roads are to be evaluated for the route to school.

8.2.1 Separation from Traffic

Separation from traffic is most closely related to collisions occurring head-on or from behind. Should a driver swerve to avoid an obstacle or lose control of the vehicle and veer off course, the separation between pedestrians and vehicles will be a key factor in whether a collision occurs.

In evaluating the degree of separation of traffic, two main criteria are used. These are:

1) Type of facility (sidewalk, shoulder, etc.)

2) Width of facility (separation from vehicle lanes)

The type of facility is inherently related to the degree of separation from traffic as well as the perception of pedestrians by motorists. For example, pedestrians are most commonly expected to be seen on sidewalks, so driver awareness is often higher for pedestrians on sidewalks as opposed to a pedestrian walking along the side of a road or shoulder. The speed of traffic is also a key consideration, as higher speeds require longer braking distances for a driver to respond, and are more likely to result in a serious or fatal injury should a collision occur. Speed is incorporated in the evaluation methodology as a qualifier which indicates the required separation from traffic at different posted speeds.

Sidewalks

Sidewalks provide a segregated travel corridor for pedestrians. It has been found that streets with no sidewalks have 2.6 times more pedestrian collisions than expected based on exposure.[11] Although the presence of sidewalks provides a high degree of safety for pedestrians, the quality of the sidewalk also plays a role.

The City of Ottawa's Sidewalk Design Guidelines are summarized in Table 4 below.

Table 4 City of Ottawa Sidewalk Design Guidelines

Width Requirements	Sidewalk	Boulevard
Desirable Minimum	1.8m	Minimum of 1.5m from back of curb, 2.0m preferred (1.0m setback from property line) when there is adequate building setback from the property lines
Absolute Minimum	1.5m	
Arterials & Collectors with right-of-way >26m	2.0m	
Near schools, hospitals, offices, commercial and industrial areas where large pedestrian volumes occur	Consider 2.0 - 2.4m	
In shopping areas and entertainment areas	Consider 2.4 – 3.6m	

Source: City of Ottawa Sidewalk Design Guidelines

[11] ITE Traffic Engineering Council Committee TENC-5A-5. 1998. Design & Safety of Pedestrian Facilities: A Recommended Practice of the Institute of Transportation Engineers. Washington, DC

Table 5 shows the recommended sidewalk widths according to the TAC Geometric Design Guide for Canadian Roads.

Table 5 Recommended Sidewalk & Boulevard Widths

Road Classification	Sidewalk Width	Desirable Boulevard Width	Total Preferred Width (Edge of Road to Edge of Sidewalk)
Arterial	min 1.5m preferred 2 - 3m	3.0	4.5 - 6.5m
Collector / Local Street		2.0	3.5 - 5.0m

Source: TAC Geometric Design Guide for Canadian Roads

Evaluation of sidewalk facilities was based primarily on the width of separation from traffic (distance from the edge of the travel lane to the outer edge of the sidewalk facility), as it relates to the speed of the road. Sidewalks below the desired minimum width with no boulevard therefore represent the worst condition. However, since sidewalks generally provide a high level of accommodation for pedestrian travel along a road, even narrow sidewalks are not felt to be unsafe so much as undesirable, which is reflected in the evaluation methodology.

Shoulders

If a pedestrian is walking along a shoulder, the width of the shoulder will be the main determinant of separation from traffic unless roadside barriers are provided.

Table 6 below indicates design standards for shoulder widths. Obviously, the wider the shoulder, the more separation from traffic. For high speed or high volume roads, shoulder widths which do not meet the minimum requirement are deemed to present a significant safety hazard, and are considered to meet the absolute warrants for the provision of hazard busing. Other shoulder conditions may or may not pose a serious hazard depending on the speed and volume of traffic using the road, and the evaluation methodology has been design accordingly.

Table 6 Shoulder Widths, Rural Undivided Roads

Design Speed (km/hr)	Volume <250	Volume 250- 450	Volume >450
60	1.5m	2.0m	2.5m
70	1.5m	2.0m	2.5m
80+	2.0 - 2.5m	2.5m	2.5 - 3.0m

Source: Adapted from the TAC Geometric Design Guide for Canadian Roads

No Walking Facilities

This situation arises where no shoulders or sidewalks are available and a child is forced to travel on the road itself. The separation from traffic in this case is non-existent. Consequently, this is considered to meet the 'absolute safety' warrant for hazard busing.

Pathway

For the purposes of this project, a pathway is defined as a winter-maintained, off-road facility intended for walking or cycling. An asphalt path in place of a sidewalk is not considered a pathway for this evaluation, but should instead be evaluated as a sidewalk.

Since pathways are segregated from the roadway and do not follow along the path of a road, they are not subject to encroachment by vehicular traffic and therefore there are no safety concerns for these facilities from a traffic safety perspective.

8.2.2 Accesses

Accesses and driveways can increase the risk to pedestrians due to conflicts between the movements of pedestrians and drivers. Since drivers have to negotiate finding a gap in traffic to pull out as well as watching for pedestrians, it is often a complicated manoeuvre. For this reason, commercial accesses are generally considered to be more dangerous than residential driveways as they typically require a higher level of driver attentiveness to other traffic movements on busier streets which may distract from their awareness of pedestrians. In addition, commercial accesses generally see higher traffic volumes than residential driveways. While it is recognized that some types of accesses present higher risks than others (e.g. underground parking lots which may have poor visibility), grouping accesses by the type of adjacent development (residential/commercial) is felt to provide an approximate representation of the inherent risk.

Since the evaluation process considers a corridor which may vary in length, access frequency is a more useful measure of risk than the total number of accesses.

In the evaluation methodology, accesses are considered solely for roads with sidewalks. While it is possible that there are accesses on roads with shoulders only, driveways are typically more common in developed areas where roads have an urban cross-section with curbs instead of shoulders. Since roads with shoulders are already penalized more heavily than sidewalks, no additional weight was given for the presence of accesses.

8.2.3 Route Consistency

While a route may consist primarily of one type of facility i.e. all sidewalks or all shoulders, there may be missing segments or inconsistent quality of treatment (narrower sections, change in surface treatment etc.) Since such inconsistency may negatively impact safety, it is desirable to recognize the hazards associated with route inconsistencies within the evaluation framework.

8.2.4 Lighting

Lighting can play an important role in improving pedestrian visibility and consequently is an important consideration for pedestrian safety. However, lighting is

MORRISON HERSHFIELD

REPORT

School Transport Walking Hazard Assessment Guidelines

Ottawa, Ontario

Presented to:

Blyth Helman
Acting Assistant General Manager

Ottawa Student Transportation Authority
Confederation Education Centre
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Project No. 2114069.00 October 26th, 2011

Executive Summary

This report provides details on a methodology that was developed on behalf of the Ottawa Student Transportation Authority (OSTA) for evaluating where school bus service should be provided – essentially where there are legitimate traffic safety hazards that present a barrier to children walking to school. The methodology is based on a two-part framework:

1. **Absolute warrants** are used to identify situations which are deemed to present such a significant risk to student pedestrians that busing is automatically warranted if no alternative routes exist.

2. **Combination warrants** account for the cumulative impact of multiple hazards along the route to school. While each hazard in isolation may be insufficient to automatically warrant busing, in combination, these hazards may contribute to a level of safety that is less than desirable. To apply the combination warrant, "hazard points" are assigned to reflect the relative risk; where the two greatest hazards have a combined score of 100 points or greater, busing is considered to be warranted.

The proposed system has a number of benefits:

- It is based on quantitative safety indicators, ensuring that the results are unbiased and fair.

- It relies on a series of check-lists and forms, allowing the evaluation to be carried out by OSTA staff who may not have a background in traffic engineering or safety.

- It is based on a thorough review of the literature, and reflects the latest research on pedestrian safety.

- It offers the opportunity to rank hazardous routes in order of priority. While not intended for this purpose, this inherent flexibility ensures that busing is provided where it is most needed in the event that financial constraints limit the amount of busing that can be provided.

The methodology as proposed is intended solely for evaluating the need for hazard busing and should not be applied outside the defined scope of application. In particular, just because a location does not meet the warrants for hazard busing does not necessarily imply that the route is "safe" – the concept of safety is relative, and can be measured in different ways using a variety of indicators. While the methodology is based on sound engineering principles and well-documented research, this document is intended solely as a guideline and should not replace common sense or professional judgement.

Moving forward, the following recommendations are presented to the Ottawa Student Transportation Authority:

- Once the methodology has been applied at several schools, the assignment of hazard points should be reviewed to ensure the results accurately reflect the perceived level of risk as determined by a traffic professional. Based on this review, minor tweaking of the point system may be required. Such review and refinement is considered important given the wide range of conditions likely to be encountered in the field and the challenges inherent in evaluating multiple hazards in combination.

- In applying the methodology, coordination should be carried out with other agencies and groups having an interest in child pedestrian safety. While the methodology is intended to identify whether or not hazards exist, it can also be used to invoke action, by identifying problems to the City of Ottawa or other governing bodies who have the authority to make changes and improvements to the traffic safety environment.

- The methodology is designed to be transparent and objective. Accordingly, it is intended as a public document to be shared with concerned parties i.e. parents, schools, principals etc. The methodology should only be shared in conjunction with the report as presented, since many of the caveats of the methodology are most clearly addressed in the body of the report.

- As new types of hazards emerge in the changing landscape of the urban traffic environment (such as roundabouts), the methodology should be updated to reflect current practice and new research on pedestrian safety.

- For hazards associated with busing which are outside the realm of traffic safety (i.e. personal security), it is recommended that the OSTA develop a framework for responding to requests for busing on a case-by-case basis.

- Over time, all of the schools within the Ottawa-Carleton District School Board and Ottawa Catholic School Board should be reviewed with the methodology to ensure consistency of application with respect to hazard busing.

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6. What is Safe?

Maintaining safety is a paramount consideration in accommodating the mobility needs of all users of the transportation system – be they pedestrians, cyclists, buses or vehicles. While professionals and decision makers may strive for the highest level of safety, what constitutes safe is not always well understood or defined:

> *"It is impossible to make a road completely safe, if by "safe" we mean a road on which we can guarantee that there will never be a collision. We can, however, design a road to provide a reasonable level of safety. Just what is a reasonable level of safety, when we take into account the cost required to build it, is a matter of experience and judgment. In short, the notion of a "safe" (or collision-free) road is a myth. Design should be viewed instead as a process that can result in a road being 'more safe' or 'less safe'."*
>
> -TAC Geometric Design Guide for Canadian Roads

Transportation engineers use engineering judgment in combination with design standards and guidelines when making decisions – the concept of **ultimate safety does not exist**. This is due to the fact that safety can only be understood or defined in a relative sense for the following reasons:

- Users of the transportation system differ widely in terms of their perceptions, speeds and vulnerability. As such, the threshold of what constitutes safe can vary considerably.
- Mobility and safety have to be balanced against each other. Maximizing one cannot be done with total disregard for the other.
- Pedestrian safety is a "Shared Responsibility". The marginal safety benefits to be gained from an incremental improvement in safety reaches a diminishing rate of return at some point.

Although it is impossible to assess absolute safety, for the purposes of this methodology, it is necessary to make a final conclusion about whether a particular walking route is "safe enough". Traditionally, evaluating the safety of pedestrians has been a limited and complicated endeavour. The analysis of collision data is frequently used because it is one of the few numerical measures that is widely available. However, collision data for pedestrians is not as reliable as that for vehicles because it is not always accompanied by associated pedestrian volumes, which are needed to assess exposure (see Section 6.1). In addition, collisions involving pedestrians tend to be rare. Just because no collisions were observed does not imply a safe situation, particularly if pedestrians are avoiding areas they know to be dangerous.

For the purposes of this project, **a number of measures have been selected as a proxy of the actual safety of a pedestrian travelling along a route**. The use of these measures, although based on sound engineering principles and judgement, is still open to interpretation and criticism. Despite the 'subjective' nature of safety, every effort has been made to develop an objective and consistent evaluation process which **seeks to determine whether**

an unacceptable level of risk is faced by a child walking to school under normal conditions. However, it is important to keep in mind that the goal of this evaluation process is to objectively assess the requirement for busing. **Simply because a hazard is not deemed to require busing is not an explicit endorsement of the safety of a child pedestrian walking along a given route.**

> *"Despite the increased promotion of walking and bicycling behaviour and the need for supportive physical environments, "gold standard" tools with known psychometric properties for assessing the suitability of those environments do not yet exist."*
>
> -Reliability and Validity of Two Instruments Designed to Assess the Walking and Bicycling Suitability of Sidewalks and Roads, American Journal of Health Promotion

Perceptions of safety can be very different from the reality of the condition. While both perception and reality are important in influencing decisions about travel mode and route choice, the proposed methodology focuses on factors known to influence actual safety. In addition to safety, there is also the element of "security" which refers to feeling free from threat or danger. Concerns with personal security are not easily quantified and fall outside of the evaluation tools employed by a transportation engineer and thus for the purposes of this report is not considered. However, it is recommended that the OSTA put in place a mechanism for evaluating any security issues that may arise on a case-by-case basis.

6.1 Understanding Collision Data

Collision data is a common measure examined in evaluating the safety of transportation infrastructure. Understanding what types of pedestrian collisions have occurred in the past has obvious benefits for gaining a greater understanding of some of the core issues associated with pedestrian safety. However, collision data has its limitations. For that reason, while the analysis of collisions is useful in providing guidance, it is not to be weighed more heavily than the use of sound engineering judgement. The occurrence of previous collisions may be indicative of a safety hazard, however, a lack of collisions does not necessarily imply that a situation is safe, since pedestrian collisions are relatively rare and are highly influenced by exposure (i.e. the amount of pedestrian activity). For example, a crossing with one pedestrian collision a year may indicate a serious safety hazard if only 10 people use the crossing per day, but may be acceptable if 5000 people use the crossing on a daily basis. Key trends in collision data which have been identified in several studies are presented below for review.

Table 2 was extracted from the City of Toronto's *Pedestrian Collision Study*, which identifies the relative frequency of various types of pedestrian-motor vehicle collisions, based on two years' worth of data.

Table 2 Pedestrian Collisions: Percentage by Collision Type

Collision Types	2002+2003	
	# of Cases	%
Intersection		
1. Vehicle turns left while pedestrian crosses with right-of-way at intersection	632	13%
2. Vehicle turns left while pedestrian crosses without right-of-way at intersection	196	4%
3. Vehicle turns right while pedestrian crosses with right-of-way at intersection	422	9%
4. Vehicle turns right while pedestrian crosses without right-of-way at intersection	117	2%
5. Vehicle is going straight through intersection while pedestrian crosses with right-of-way	232	5%
6. Vehicle is going straight through intersection while pedestrian crosses without right-of-way	654	14%
Total at Intersection	**2,253**	**47%**
Non-Intersection		
8. Pedestrian hit at mid-block location	1.042	22%
9. Pedestrian hit at private driveway	347	7%
10. Pedestrian hit at pedestrian crossover (PXO)	232	5%
11. Pedestrian hit on sidewalk or shoulder	163	3%
Total at Non-Intersection	**1,784**	**37%**
Other / Unknown		
55. Pedestrian hit in parking lot	508	11%
99. Other / Unknown	230	5%
Total at Other/Unknown Category	**738**	**16%**

Source: City of Toronto Pedestrian Collision Study

While this study is not exclusively focused on child pedestrians, it is still useful for examining overall trends in pedestrian collisions. Of interest is the fact that almost half of all pedestrian collision occurred at an intersection. Additionally, mid-block crossings represent the single highest percentage of collision location.

The data in Table 2 was further analyzed to examine the over-representation of certain age groups by collision type (refer to Table 3). For this study, over-representation was determined by plotting the age profile of the group of pedestrians involved in one type of collision against the age profile for all the pedestrians in the entire study sample, to reveal age groups that are "over-represented".

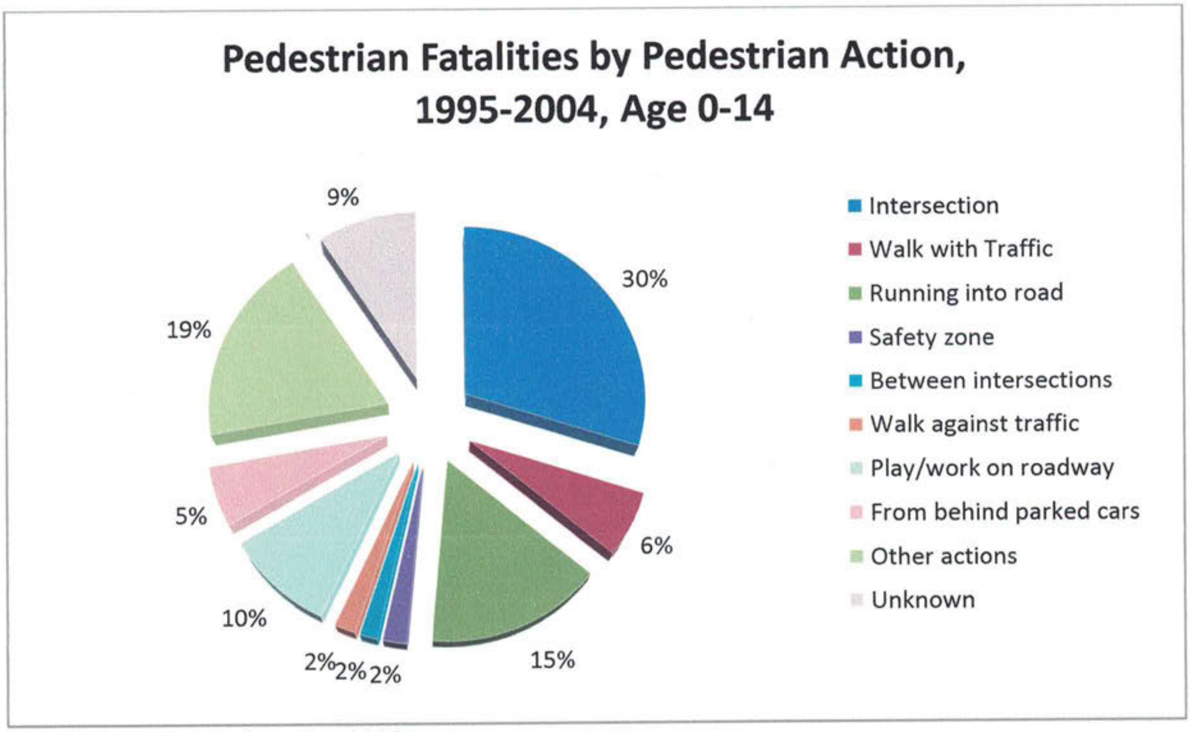
Table 3 Over-Represented Pedestrian Collision Types

Collision Type	Over-Represented Age Group	
	Male	Female
1. Vehicle turns left while pedestrian crosses with right-of-way at intersection	55-64	25-44
2. Vehicle turns left while pedestrian crosses without right-of-way at intersection	55+	-
3. Vehicle turns right while pedestrian crosses with right-of-way at intersection	75+	15-19
4. Vehicle turns right while pedestrian crosses without right-of-way at intersection	25-44;55-64;75+	25-44
5. Vehicle is going straight through intersection while pedestrian crosses with right-of-way	15-19	-
6. Vehicle is going straight through intersection while pedestrian crosses without right-of-way	15-24	5-14
8. Pedestrian hit at mid-block location	5-14	5-14
9. Pedestrian hit at private driveway	55-64; 75+	75+
10. Pedestrian hit at pedestrian crossover (PXO)	5-14	5-14
11. Pedestrian hit on sidewalk or shoulder	25-44	25-44

Source: Adapted from the City of Toronto *Pedestrian Collision Study*, 2007

Over-represented collision types corresponding to child pedestrians are indicated in yellow and include the following: mid-block crossings, pedestrians hit at a pedestrian crossover, vehicles travelling straight through the intersection while pedestrian crosses with the right of way and vehicles travelling straight through intersection while pedestrian crosses without the right of way. These findings suggest that children have particular difficulty in navigating mid-block crossings, pedestrian crossings, and intersections.

Figure 1 provides more detailed information about the action of child pedestrians at the time of collision, based on national collision data from Transport Canada.



Source: Transport Canada, 2009

Figure 1 Pedestrian Fatalities by Pedestrian Action, Age 0-14

According to Figure 1, intersections present the greatest risk to child pedestrians. This is not surprising as intersections are the most complicated elements in a transportation network, with multiple conflicting movements. It is therefore crucial that a methodology which evaluates safety for children gives careful consideration to crossing points.

Factors such as children playing on the road are extremely difficult to address through an analysis of environmental factors contributing to pedestrian safety, beyond recognizing that reduced speeds along roads which are frequently used by children can make it easier for drivers to stop in an emergency. Since this methodology is used for the evaluation of collector and arterial roads only, as children are travelling to school, risks associated with playing in the road or running into the road are not considered in the evaluation methodology. While it is still possible that these actions may occur as children travel to school, such behaviours are not considered sufficient to warrant the provision of busing.

The following conclusions are based on a review of Figure 1 and Table 2 above, as well as a number of additional resources consulted for this report:

- **Crossings and intersections appear to present the greatest hazard for all pedestrians**, including children, with crossings of all types (unprotected, protected with signals, protected with multi-way stops, etc.) resulting in higher collision rates than non-crossing related movements (walking with traffic, walking against traffic, on a sidewalk, etc.)

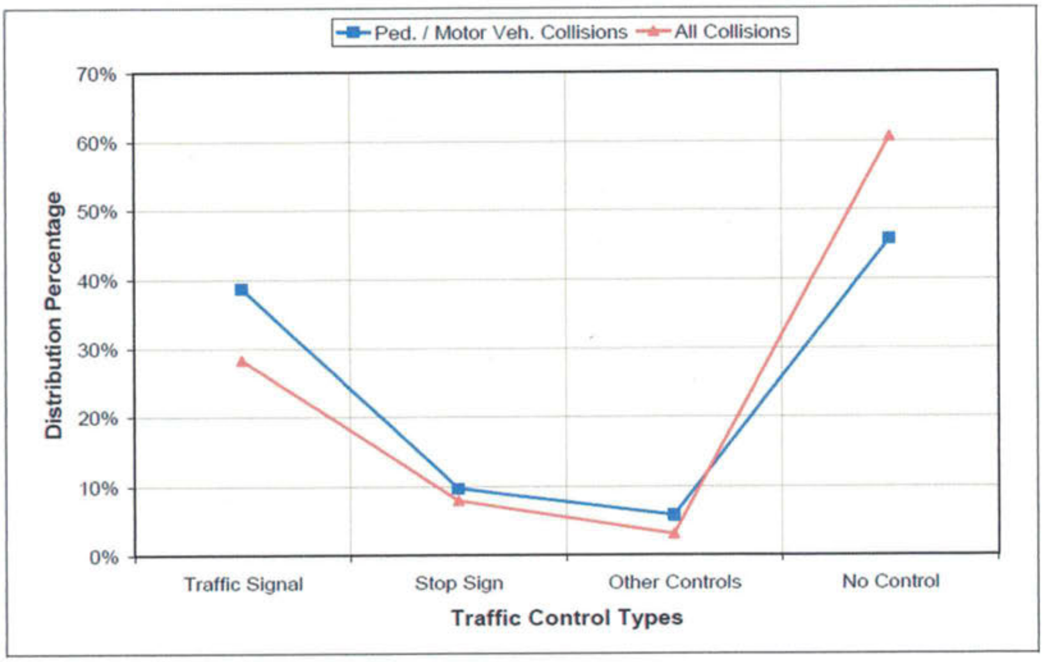
not considered within the evaluation framework because children are not required to walk to school during times when it is dark outside.

8.3 Assessing Travel Across Roads (Crossings)

Road crossings can present unique challenges for child pedestrians. Due to the nature of a crossing, there may be many conflicting movements which must be assessed and understood before a safe crossing can be made. It is important to understand the underlying risks associated with each type of crossing in order to be able to effectively evaluate the level of safety afforded by them.

In assessing safety, a predictive approach has been adopted – based on the presence of key factors influencing safety, is there a strong likelihood that collisions will occur in the future? However, it is also desirable to consider what has occurred in the past since this is perhaps the best indicator of a potential hazard. Thus, in the proposed methodology, collision data is used as an initial verification that the intersection does not pose a proven risk to pedestrians.

Figure 3 indicates the relative distribution of pedestrian collisions by traffic control type, based on data from Toronto. From this figure, it can be concluded that pedestrian collision are most common at crossings with no control, followed by traffic signals. Unfortunately, however, it is impossible to conclude that one type of control is more or less dangerous from another due to a lack of exposure data on the number of people using each crossing type.



Source: City of Toronto *Pedestrian Collision Study*, 2007

Figure 3 Collision Distribution by Traffic Control

Visibility

In engineering terms, sight distance refers to the distance required to safely stop if an obstacle is observed on the road. If the available sight distance is less than the required sight distance (due to an obstacle such as a tree or building), then the driver may not be able to stop in time if a person is crossing the road, posing a serious safety concern. Consequently, sight distance is an essential requirement no matter which type of crossing is being considered. If there is **insufficient visibility** such that drivers cannot see a pedestrian in the crossing and vice versa, then the crossing **should be considered to meet the absolute safety warrant for the provision of hazard busing.**

Sight distances have been calculated with formulae from the TAC Geometric Design Guide for three grades and are presented below in Table 7.

Table 7 Minimum Stopping Sight Distances (m)

Flat	Average Grade	Steep Grade
No grade	Downgrade = 3%	Downgrade = 6%
65	70	70
85	90	95
110	120	125
140	150	160
170	180	195
210	220	240

Adult Crossing Guards

Adult crossing guards are felt to provide an improvement in both real and perceived safety at crossings. According to the Institute of Transportation Engineers (ITE):[12]

> *"In general, **crossing guards and increased enforcement are the best measures for child pedestrian safety.**"*

For the evaluation methodology, the presence of crossing guards, as adults who are trained to help children safely navigate crossings, is felt to improve safety to the degree that hazard bussing is no longer required.

Additional Factors

While it may not be possible to draw conclusions about the safety of each type of intersection from Figure 3, it is recognized that each presents unique challenges for pedestrians. Technical resources generally divide crossings into two categories: controlled and uncontrolled. Because the root causes for safety concern are different for these two

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[12] Institute of Transportation Engineers (ITE). 1999. Traffic Engineering Handbook. J. Pline, Editor. Washington, DC: Institute of Transportation Engineers.

types of treatments, it is desirable to consider each type of crossing treatment separately when analyzing safety hazards.

8.3.1 Mid-Block & Uncontrolled Crossings

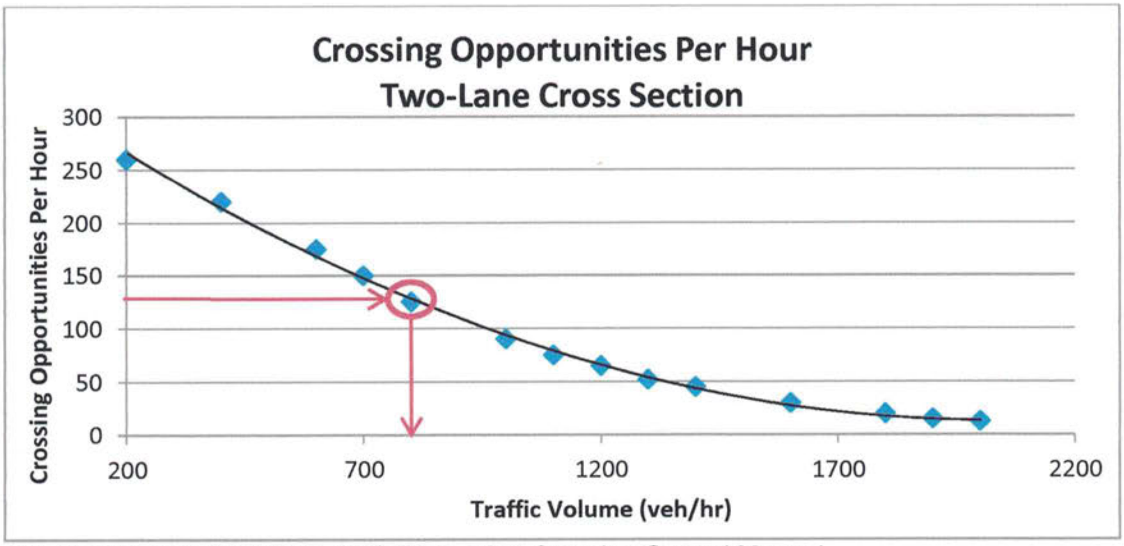
The main issue associated with mid-block and uncontrolled crossings relates to the availability of gaps in the traffic stream to allow the pedestrian to cross safely.

Volume & Crossing Opportunities

The number of crossing opportunities is a function of the volume of the roadway and crossing width. According to the *TAC Pedestrian Crossing Control Manual*, where there are greater than 120 crossing opportunities per hour, no special treatment for pedestrians is warranted. Based on this cut-off value of 120 crossing opportunities/hour, the corresponding hourly volume on the roadway can be used as a threshold for determining whether the crossing can be made safely.

In the case of child pedestrians, it was determined that no more than two lanes of traffic should be crossed in an uncontrolled situation without assistance. Based on the crossing distance for a two-lane road, it is possible to determine the corresponding maximum volume which will provide at least 120 crossing opportunities per hour.

Figure 4 below shows the traffic volumes and corresponding crossing opportunities for a two lane road, assuming 12 seconds are needed to safely cross - 9 seconds of walking time plus 3 seconds of perception-reaction time (i.e. the time required to perceive a gap and assess whether it is safe enough to cross, before stepping out onto the road).

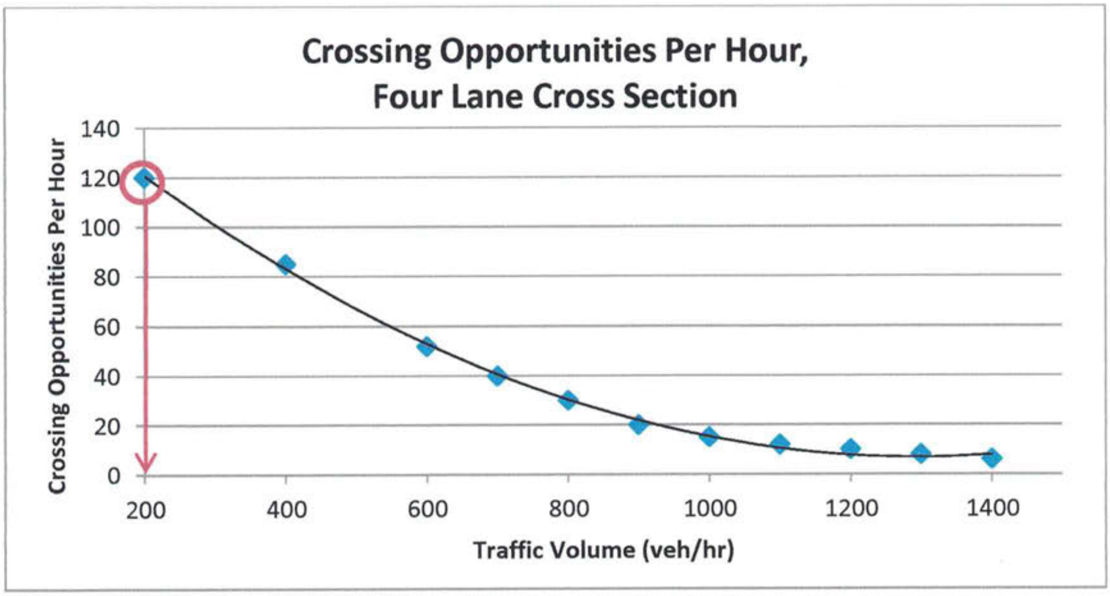


Source: Adapted from the *TAC Pedestrian Crossing Control Manual*

Figure 4 Crossing Opportunities per Hour, Two Lane Cross Section

According to this chart, for any volume less than 800 veh/hr, a pedestrian should not have any difficulty crossing the road. However, in order to account for the additional requirement of children pedestrians, it may be desirable to provide an extra degree of comfort.

Tripling the perception-reaction time (PRT) to 9 seconds would give a total crossing requirement of 18 seconds, allowing for 9 seconds of walking time to cross a two-lane road. This is somewhat similar to the case shown in Figure 5 for a 4-lane cross-section, which also requires an 18 second total crossing time (3 seconds PRT plus 15 seconds walking time). In order to achieve 120 crossing opportunities per hour in this situation, 200 veh/hr is the cut-off volume.



Source: Adapted from the *TAC Pedestrian Crossing Control Manual*

Figure 5 Crossing Opportunities per Hour, Four Lane Cross Section

Taking the average of the two cut-off volumes from the above figures gives 500 veh/hr. This value is considered to represent an appropriately conservative maximum threshold for midblock / unprotected crossings – if the traffic volume is greater than 500 veh/hr, the crossing is deemed to meet the absolute safety warrant for the provision of hazard busing.

Although direct measurements of gap availability have been used in other methodologies for assessing safety hazards (such as the City of Ottawa's School Crossing Guards warrants), this measure is not included in the proposed methodology since it is not easily measured by OSTA staff. Instead, the crossing opportunities evaluation described above is used to capture the ability of pedestrians to safely cross at unprotected crossings.