# SCHOOL CROSSING GUARD WARRANT DEVELOPMENT - CITY OF HAMILTON 



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### 1.0 Background

WSP was retained by the City of Hamilton to assist with the development of a new school crossing guard warrant methodology for various types of crossings in the City. The main goal of this project is to collect data on existing school crossing guard locations and develop a warrant methodology that is objective, traceable and can be implemented throughout the City for the evaluation of future candidate school crossing guard locations.

The City of Hamilton currently serves approximately 230 crossing guard locations to support safer student crossing around these elementary schools. This study was completed in collaboration with the City's school crossing guard supervisor. Their input was essential to understand the crossing locations and the specific intersection legs the guards are currently assigned to.

### 2.0 Methodology to Develop an Exposure Index Warrant

WSP worked on behalf of the Ontario Traffic Council (OTC) in 2022 to develop an updated School Crossing Guard Guide. This Guide (herein referred to as the 2023 OTC SCGG) will be released early in Q1 2023. The best practices from this guide were used as a reference for the review and input to the City's School Zone Management Plan. In the Guide, a warrant known as the Exposure Index was developed for controlled crossings. In the transportation industry, the Exposure Index warrant is commonly used in crossing assessments related to safety and impacts to road users. The Exposure Index is derived by multiplying the volumes of two modes of travel (such as vehicles, trains, walking or cycling) to arrive at a product. The product at various crossing locations are then compared quantitatively. The Exposure Index warrant is a two-part process: development and application. The development of the warrant is based on data collected at existing locations with a crossing guard in operation. The warrant is designed to create an $85^{\text {th }}$ percentile threshold of the existing locations, meaning that $15 \%$ of the existing data points collected will fall beneath the warrant. It should be noted that this does not imply that the $15 \%$ of the existing locations need to be adjusted, but rather forms a more conservative warrant. In the context of Hamilton, this warrant is applicable to five types of intersections:

- Signalized intersections;
- All-way stop-controlled intersections;
- Minor-street stop-controlled (through) intersections;
- Intersection pedestrian push signal (PPS) and pedestrian crossovers (PXO); and
- Roundabouts

With the development of the Exposure Index warrant for each type of crossing, the City can now collect data at new candidate locations for school crossing guards and determine whether the locations meet the warrant. The Exposure Index warrant, along with site visits and considerations of other factors as noted in the OTC 2023 SCGG, will help in the decision-making process regarding the need for a crossing guard. For example, as noted in Section 3 of the OTC 2023 SCGG, school crossing guards can only be assigned if the speed limit is equal to or less than $60 \mathrm{~km} / \mathrm{h}$. This report focuses on the controlled crossings where the Exposure Index can be applied.

### 3.0 Consultation with City Staff

As part of this study, WSP met with the City's school crossing guard program staff on the following occasions:

- Kick-off meeting on June 2, 2022 for introductions and purpose of the study/background;
- Progress meeting \#1 on July 25, 2022 to discuss study methodology, guard surveys and site visit;
- Progress meeting \#2 on August 29, 2022 to discuss data collection and initial findings; and
- Progress meeting \#3 on December 5, 2022 to discuss evaluation findings, study template and study deliverables.


### 4.0 Data Collection

The City provided a master list of all of the existing school crossing guard locations organized by district and intersection control type. Given the magnitude of the school crossing guard program, a meaningful sample size of each control type was selected for the data collection and input to the development of the Exposure Index warrant. WSP worked closely with the City to consider the following factors in identifying a meaningful set of 75 locations to be surveyed:

- Adequate representation of each control type: for the signalized, all-way stop and minor-street stop/through locations, there were ample of existing locations. Therefore, approximately $30 \%$ of these locations were selected. As for intersection PPS and PXO, there are a limited number of intersection PXOs. Moreover, both intersection PPS and PXOs operate very similarly when it comes to school crossing guard operations and defining conflicting vehicular patterns. As a result, the intersection PPS and PXO data will be combined to develop one set of Exposure Index warrant. Lastly, since there are only 3 roundabouts in the City currently with school crossing guards, all three locations have been included. The following summarizes the control type distribution:
- All-way stop: 21 of 61 existing locations selected;
- Signalized: 26 of 74 existing locations selected;
- Minor-street stop: 18 of 56 existing locations selected;
- Intersection PPS \& PXO: 7 of 19 existing locations selected; and
- Roundabouts: 3 of 3 existing locations selected.
- Year that the school crossing guard was implemented: wherever possible, more recently implemented school crossing guard locations were selected over those implemented 10 to 20 years ago. The reason is that over the lapse of time, the general criteria for determining the need for a school crossing guard has likely changed significantly. In addition, over a longer period of time, the characteristics of a neighbourhood changes. For example, there may have been a high student demand in a particular neighbourhood 20 years ago, but the children have since grown up resulting in lower student demands.
- Ward representation: there are 15 wards in the City and as per the equity aspect of transportation planning, best efforts were made to capture an even representation of each ward.
- Proximity from high school: since the school crossing guard program is intended to serve those from JK to Grade 6, locations that are more than 1km away from a high school was prioritized. This is so that in the count of student volume from the videos that high school students are excluded to the greatest extent possible to establish a representative student baseline.
- It is also worth noting that the locations involved with the Vince Ramelli Project were also prioritized since WSP understands that they are locations with potentially higher crossing demands. Moreover, locations with atypical lane configurations were not included since the reason for implementing a school crossing guard may not be related to the level of conflicting traffic but rather geometric design.

The 75 existing crossing guard locations that were selected and the type of intersection control are summarized in Table 1. WSP then proceeded to review each location to better understand the site-specific context of each guard location, and how to better orient the survey equipment. WSP then retained Ontario Traffic Inc. (OTI) to install 75 video cameras at the crossing guard locations. Consistent with the principles of the OTC 2023 SCGG, the video data collection was completed on typical Tuesday to Thursdays between September 13 and October 6, 2022. The video at each crossing guard location recorded the crossing guard activity, the number of student crossings, and the vehicular movements. Only the weekday morning and afternoon crossing periods were surveyed since these periods generally represent the busiest times when students are either arriving at or departing from school. The intersection IDs are based on the City of Hamilton school crossing guard IDs. The table is organized by intersection types.

Table 1 - City of Hamilton School Crossing Guard Operation Summary

| ID \# | Intersection | Approach(es) that SCG Serves in Morning Period | Approach(es) that SCG Serves in Dismissal Period | SCG Present (Yes/No) |
| :---: | :---: | :---: | :---: | :---: |
| All-way Stop |  |  |  |  |
| 1 | Anson Ave \& Carson Ave | South \& East | South \& East | Yes |
| 13 | Amberly Blvd \& Concerto Cr | North \& West | North \& West | Yes |
| 39 | Braeheid Ave \& Riley St | North \& West | North \& West | Yes |
| 46 | Britania Ave \& MacLaren Ave | North \& East | North \& East | Yes |
| 63 | Charlton Ave E \& Walnut Ave S | North \& East | North \& East | Yes |
| 78 | Delawana Dr \& Riverdale Dr | South \& East | South \& East | Yes |
| 80 | Maplewood Ave \& Sherman Ave S | South \& East | South \& East | Yes |
| 108 | Ferrie St E \& John St N | South \& East | South \& East | Yes |
| 109 | Fiddlers Green Rd \& Jerseyville Rd | West | West | Yes |
| 113 | Greenhill \& Glen Vista Dr | North \& West | North \& West | Yes |
| 119 | Green Rd \& Hemlock Ave | South \& East | South \& East | Yes |
| 130 | Herkimer St \& Locke St | South \& North \& West | South \& North \& West | Yes |
| 155 | Locke St N \& Peter St | North \& East | North \& East | Yes |
| 196 | Ferguson St \& Young St | North \& West | North \& West | Yes |
| 229 | Charlton St W \& Kent Ave | North \& West | North \& West | Yes |
| 241 | Beaconsfield Dr \& Currie St | South \& East | South \& East | Yes |
| 287 | Royal Vista Dr \& Templemead Dr | South \& West | South \& West | Yes |
| 326 | Barton St \& Lewis Rd | South \& West | South \& West | Yes |
| 391 | Kilbourn Ave \& Royce Ave | North \& West | North \& West | Yes |
| 461 | Valiant Circle \& Fall Fair Way | South \& East | South \& East | Yes |
| 465 | Greeningdon Dr \& Hester St | South \& West | South \& West | Yes |


| ID \# | Intersection | Approach(es) that SCG Serves in Morning Period | Approach(es) that SCG Serves in Dismissal Period | SCG Present (Yes/No) |
| :---: | :---: | :---: | :---: | :---: |
| Minor-Street Stop Controlled |  |  |  |  |
| 50 | Melvin Ave \& Osborne St | North \& West | West | Yes |
| 52 | Cameron Ave \& York Ave | -- | -- | No |
| 67 | Citation Cres \& Meadowlands Blvd | -- | -- | No |
| 68 | Cochrane Rd \& Montrose Ave | East \& South \& West | East \& South \& West | Yes |
| 86 | Dundana Ave \& Old Ancaster Rd | East \& South \& West | East \& South \& West | Yes |
| 116 | Gordon Drummond Ave \& Kennard St | South \& West | South \& West | Yes |
| 141 | Jay St \& Upper Wellington St | North \& East | North \& East | Yes |
| 163 | Melville St \& Sydenham St | North \& West | North \& West | Yes |
| 193 | Upper Ottawa \& Tenth Ave | North \& West | North \& West | Yes |
| 236 | Kitty Murray Ln \& Bridgeport Cres | South | South | Yes |
| 263 | Bond St \& Glen Rd | -- | -- | No |
| 269 | Chedmac Dr \& Rice Ave | West | West | Yes |
| 285 | Glen Rd \& Longwood Rd N | East \& South | East \& South | Yes |
| 300 | Cannon St E \& Elgin St N | East | East | Yes |
| 329 | Pumpkin Pass \& Blue Ribbon Way | North \& West | North \& West | Yes |
| 348 | Beechwood Ave \& Sherman Ave N | North \& East | North \& East | Yes |
| 375 | Burke St \& Humphrey St | South \& East | South \& East | Yes |
| 396 | Elcho St \& Inverness E | North \& East | North \& East | Yes |
| Signalized |  |  |  |  |
| 51 | Burlington St N \& John St N | South \& East | South \& East | Yes |
| 72 | Courtland Ave \& Stonechurch Rd W | North \& East | North \& East | Yes |
| 112 | Garth St \& Stone Church Rd W | West | West | Yes |
| 115 | Glenholme Ave \& King St E | South \& East | South \& East | Yes |
| 121 | Greenhill Ave \& Mt. Albion Rd | North \& East | North \& West | Yes |
| 131 | Hester St \& Upper Wellington St | North \& West | North \& West | Yes |
| 135 | Highway \#8 \& Green Rd | South \& East | South \& East | Yes |
| 151 | King St W \& Strathcona Ave | North \& East | North \& East | Yes |
| 156 | Barton St E \& Sherman Ave N | -- | -- | No |
| 157 | Main St E \& Sherman Ave S | -- | -- | No |
| 162 | McNiven Rd \& Mohawk Rd W | -- | -- | No |
| 165 | Mohawk Rd W \& Rice Ave | South \& West | North \& West | Yes |
| 180 | Quinn Ave \& Stonechurch Rd E | North \& West | North \& East \& West | Yes |
| 201 | Royal Vista Dr \& Upper Gage Ave | South \& West | South \& West | Yes |
| 226 | Loconder \& Upper Gage Avev | South \& East | North \& East | Yes |


| ID \# | Intersection | Approach(es) that SCG Serves in Morning Period | Approach(es) that SCG Serves in Dismissal Period | SCG Present (Yes/No) |
| :---: | :---: | :---: | :---: | :---: |
| 301 | Ferguson Ave N \& Wilson St | -- | -- | No |
| 325 | Aberdeen Ave \& Locke St S | North \& West | North \& West | Yes |
| 417 | Burke St \& Dundas St E | South \& East | South \& East | Yes |
| 422 | Cannon St E \& Kenilworth Ave N | North \& East | North \& East | Yes |
| 426 | Queenston Rd \& Kenora Ave | South \& West | South \& West | Yes |
| 427 | King St E \& New Mountain Rd | North \& East | North \& South \& East | Yes |
| 430 | Paramount Dr \& Old Mud St | South \& East | South \& East | Yes |
| 433 | Stone Church Rd E \& Upper Ottawa St | North \& West | North \& West | Yes |
| 438 | Up Wentworth St \& Mohawk Rd E (West Leg) | All | All | Yes |
| 450 | Ogilvie St \& Governors Rd | -- | -- | No |
| 452 | Garth St \& Rymal Rd W | South \& West | South \& West | Yes |
| Intersection PPS and PXO |  |  |  |  |
| 120 | Green Forest \& King St E | North \& East | North \& East | Yes |
| 137 | Hunter St W \& Locke St S | South \& West | -- | Present in AM, absent in PM |
| 147 | King St E \& Wexford Ave S | South \& West | South \& West | Yes |
| 149 | King St \& Maple Ave | North \& East | North \& East | Yes |
| 185 | Southbend Rd \& Upper Wellington St | South \& West | South \& West | Yes |
| 190 | Atherley Dr \& Upper Sherman Ave | South \& West | South \& West | Yes |
| 237 | Tyrone Dr \& West $5^{\text {th }}$ St | North \& East | North \& East | Yes |
| Roundabout |  |  |  |  |
| 331 | Pumpkin Pass \& Fall Fair Way | North \& South | North \& South | Yes |
| 387 | Bradley Ave \& Windwood Dr | North \& East | North \& East | Yes |
| 393 | Raymond Rd \& Whittington Dr | South | South | Yes |
| $\begin{gathered} \text { A- } \\ 11448 \end{gathered}$ | Seggar Ave and Sabbe Cr Westacott Cr <br> (Town of Ajax) | North | North | Yes |
| $\begin{gathered} A- \\ 12342 \end{gathered}$ | Williamson Dr and Middlecote Dr (Town of Ajax) | East | East | Yes |
| $\begin{gathered} \text { A- } \\ 13172 \end{gathered}$ | Williamson $\operatorname{Dr} \mathrm{E}$ and Gillett Dr (Town of Ajax) | North \& West | North \& West | Yes |

### 5.0 Data Interpretation

As per the OTC 2023 SCGG, the crossing guard locations need to be evaluated based on the type of intersection control, and to achieve "Apples to Apples" evaluation based on a common time interval known as the common school duration. For example, a location may have a crossing guard deployed for an hour, while another location has a crossing guard deployed for half an hour. Under this circumstance, the minimum common internal would be half an hour. Based on the schedule of guard operations, a common school duration of 20 minutes was established for all control types.

Accordingly, WSP staff watched the videos for all the locations and identified the 20minute period at each location that had the highest product of conflicting vehicular movements and student crossings. In addition, WSP observed the crossing guards serving multiple approaches of an intersection. Under this circumstance, the busiest approach served by the guard in terms of volumes were identified first, followed by the distinction of the busiest 20 minutes.

The data recorded at each crossing location including the student and conflicting vehicle volume for the approach served by the crossing guard are documented in the following appendices:

- All-way stop controlled intersections - Appendix A;
- Minor-street stop-controlled intersections - Appendix B;
- Signalized intersections - Appendix C;
- Intersection PPS and PXO - Appendix D; and
- Roundabouts - Appendix E

It should be noted that parents and adults were not included in the pedestrian volume count. Best efforts have been made in the data collection process to consider students as those in Junior Kindergarten (JK) to Grade 5, as per the OTC 2023 SCGG. The vehicular volumes recorded in the data review are based on the conflicting vehicle definitions in the OTC 2023 SCGG. This is an important distinction since not all the vehicular turning movements relate to the safety of student crossing. Excerpts from the OTC 2023 SCGG on identifying conflicting vehicular movements are provided below.

## All-way stop controlled intersections

In the corresponding figure, the conflicting vehicular movements for the pedestrian crossing south leg of the All-way control intersection are:

- All northbound movements
- Westbound left turns
- Eastbound right turns and
- Southbound through movements



## Minor-street stop-controlled intersections

In the figure at the right, the conflicting vehicular movements for the pedestrian crossing south leg of the minor street at twoway stop controled intersection are:

- All northbound movements
- Westbound left turns
- East bound right turns and
- Southbound through movements


In the corresponding figure, the conflicting vehicular movements for the pedestrian crossing west leg of the major street at two-way stop controled intersection are:

- All eastbound movements
- Southbound right turns
- Northbound left turns and
- Westbound through movements



## Signalized controlled intersections

In the figure to the right, the conflicting vehicular movements for the pedestrian crossing north leg of the signalized intersection, during east west green iinterval

- Southbound right turn on red
- Eastbound left turns during the permissive phase and
- Westbound right turns during the permissive phase


## Intersection PPS and PXO

In the figure to the right, the conflicting vehicular movements for an intersection PPS are the left and right-turns from the stopcontrolled minor-street approaches that cross the pedestrian crosswalk.

In the figure to the right, the conflicting vehicular movements for an intersection PXO are the left and right-turns from the stopcontrolled minor-street approaches that cross the pedestrian crosswalk. It should be noted that when a PXO is present at a roundabout, the exposure index for the roundaobut would be used since the exposure index developed for PXOs is for an intersection rather than a roundabout. Moreover, the vehicular pattern at a roundabout with PXO will still be influenced
 primarily by the roundabout design.

## Roundabout

In the figure to the right, the conflicting vehicular movements for a roundabout are all of the movements that cross the crosswalk of the approach being evaluated.


### 6.0 Data Summary

The resulting peak product of the student crossing volume and the conflicting vehicle volumes at each of the location during the peak 20 minute periods are summarized in Table 2. It should be noted that locations that are deemed to have student volumes that are too low for consideration for developing a City-wide warrant have been noted in red. These locations are not included in the Exposure Index graph development.

Table 2 - City of Hamilton School Crossing Guard Operation Summary

| ID \# | Intersection | \# of Students Crossing | Conflicting Vehicular Volume | Exposure Product |
| :---: | :---: | :---: | :---: | :---: |
| All-way Stop |  |  |  |  |
| 1 | Anson Ave \& Carson Ave | 13 | 79 | 1027 |
| 13 | Amberly Blvd \& Concerto Cr | 23 | 112 | 2576 |
| 39 | Braeheid Ave \& Riley St | 24 | 83 | 1992 |
| 46 | Britania Ave \& MacLaren Ave | 5 | 46 | 230 |
| 63 | Charlton Ave E \& Walnut Ave S | 43 | 62 | 2666 |
| 78 | Delawana Dr \& Riverdale Dr | 49 | 129 | 6321 |
| 80 | Maplewood Ave \& Sherman Ave S | 55 | 96 | 5280 |
| 108 | Ferrie St E \& John St N | 19 | 68 | 1292 |
| 109 | Fiddlers Green Rd \& Jerseyville Rd | 9 | 167 | 1503 |
| 113 | Greenhill \& Glen Vista Dr | 11 | 224 | 2464 |
| 119 | Green Rd \& Hemlock Ave | 6 | 139 | 834 |
| 130 | Herkimer St \& Locke St | 46 | 120 | 5520 |
| 155 | Locke St N \& Peter St | 55 | 55 | 3025 |
| 196 | Ferguson St \& Young St | 66 | 78 | 5148 |
| 229 | Charlton St W \& Kent Ave | 63 | 81 | 5103 |
| 241 | Beaconsfield Dr \& Currie St | 52 | 31 | 1612 |
| 287 | Royal Vista Dr \& Templemead Dr | 86 | 53 | 4558 |
| 326 | Barton St \& Lewis Rd | 23 | 205 | 4715 |
| 391 | Kilbourn Ave \& Royce Ave | 62 | 83 | 5146 |
| 461 | Valiant Circle \& Fall Fair Way | 42 | 102 | 4284 |
| 465 | Greeningdon Dr \& Hester St | 34 | 185 | 6290 |
| Minor-street Stop Controlled |  |  |  |  |
| 50 | Melvin Ave \& Osborne St | 35 | 55 | 1925 |
| 52 | Cameron Ave \& York Ave | 117 | 117 | 13689 |
| 67 | Citation Cres \& Meadowlands Blvd | 1 | 140 | 140 |
| 68 | Cochrane Rd \& Montrose Ave | 14 | 92 | 1288 |
| 86 | Dundana Ave \& Old Ancaster Rd | 33 | 309 | 10197 |
| 116 | Gordon Drummond Ave \& Kennard St | 20 | 85 | 1700 |
| 141 | Jay St \& Upper Wellington St | 1 | 356 | 356 |


| 163 | Melville St \& Sydenham St | 20 | 155 | 3100 |
| :---: | :---: | :---: | :---: | :---: |
| 193 | Upper Ottawa \& Tenth Ave | 19 | 450 | 8550 |
| 236 | Kitty Murray Ln \& Bridgeport Cres | 107 | 143 | 15301 |
| 263 | Bond St \& Glen Rd | 40 | 32 | 1280 |
| 269 | Chedmac Dr \& Rice Ave | 37 | 110 | 4070 |
| 285 | Glen Rd \& Longwood Rd N | 23 | 111 | 2553 |
| 300 | Cannon St E \& Elgin St N | 18 | 362 | 6516 |
| 329 | Pumpkin Pass \& Blue Ribbon Way | 114 | 120 | 13680 |
| 348 | Beechwood Ave \& Sherman Ave N | 31 | 115 | 3565 |
| 375 | Burke St \& Humphrey St | 15 | 120 | 1800 |
| 396 | Elcho St \& Inverness E | 28 | 105 | 2940 |
| Signalized |  |  |  |  |
| 51 | Burlington St N \& John St N | 12 | 25 | 300 |
| 72 | Courtland Ave \& Stonechurch Rd W | 9 | 20 | 180 |
| 112 | Garth St \& Stone Church Rd W | 21 | 85 | 1785 |
| 115 | Glenholme Ave \& King St E | 6 | 5 | 30 |
| 121 | Greenhill Ave \& Mt. Albion Rd | 18 | 54 | 972 |
| 131 | Hester St \& Upper Wellington St | 9 | 35 | 315 |
| 135 | Highway \#8 \& Green Rd | 24 | 35 | 840 |
| 151 | King St W \& Strathcona Ave | 5 | 28 | 140 |
| 156 | Barton St E \& Sherman Ave N | 8 | 18 | 144 |
| 157 | Main St E \& Sherman Ave S | 7 | 51 | 357 |
| 162 | McNiven Rd \& Mohawk Rd W | 23 | 37 | 851 |
| 165 | Mohawk Rd W \& Rice Ave | 22 | 40 | 880 |
| 180 | Quinn Ave \& Stonechurch Rd E | 5 | 7 | 35 |
| 201 | Royal Vista Dr \& Upper Gage Ave | 30 | 31 | 930 |
| 226 | Loconder \& Upper Gage Avev | 6 | 24 | 144 |
| 301 | Ferguson Ave N \& Wilson St | 70 | 39 | 2730 |
| 325 | Aberdeen Ave \& Locke St S | 24 | 19 | 456 |
| 417 | Burke St \& Dundas St E | 9 | 9 | 81 |
| 422 | Cannon St E \& Kenilworth Ave N | 4 | 17 | 68 |
| 426 | Queenston Rd \& Kenora Ave | 25 | 29 | 725 |
| 427 | King St E \& New Mountain Rd | 5 | 92 | 460 |
| 430 | Paramount Dr \& Old Mud St | 5 | 22 | 110 |
| 433 | Stone Church Rd E \& Upper Ottawa St | 2 | 103 | 206 |
| 438 | Up Wentworth St \& Mohawk Rd E (west leg) | 14 | 175 | 2450 |
| 450 | Ogilvie St \& Governors Rd | 6 | 55 | 330 |
| 452 | Garth St \& Rymal Rd W | 3 | 72 | 216 |


| Intersection PPS and PXO |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| 120 | Green Forest \& King St E | 11 | 7 | 77 |
| 137 | Hunter St W \& Locke St S | 12 | 8 | 96 |
| 147 | King St E \& Wexford Ave S | 22 | 8 | 176 |
| 149 | King St \& Maple Ave | 9 | 60 | 540 |
| 185 | Southbend Rd \& Upper Wellington St | 8 | 24 | 192 |
| 190 | Atherley Dr \& Upper Sherman Ave | 10 | 12 | 120 |
| 237 | Tyrone Dr \& West $5^{\text {th }} \mathrm{St}$ | 17 | 16 | 272 |
| Roundabout |  |  |  |  |
| 331 | Pumpkin Pass \& Fall Fair Way | 25 | 89 | 2225 |
| 387 | Bradley Ave \& Windwood Dr | 52 | 114 | 5928 |
| 393 | Raymond Rd \& Whittington Dr | 61 | 155 | 9455 |
| $\begin{gathered} \text { A- } \\ 11448 \end{gathered}$ | Seggar Ave and Sabbe Cr/Westacott Cr (Town of Ajax) | 43 | 231 | 9933 |
| $\begin{gathered} \text { A- } \\ 12342 \end{gathered}$ | Williamson Dr and Middlecote Dr (Town of Ajax) | 153 | 97 | 14841 |
| $\begin{gathered} \text { A- } \\ 13172 \end{gathered}$ | Williamson Dr E and Gillett Dr (Town of Ajax) | 32 | 200 | 6400 |

### 7.0 Warrant Methodologies

Based on the Exposure Index process described in Section 2, along with the data summary in Section 6, the Exposure Index graph for each types of controlled crossings are summarized in the following sections. Future use of the respective graph of each type of intersection entails doing the survey at candidate locations as discussed in Section 5 and identifying the peak 20 -minute period. The resulting vehicular volume and student crossing volume can then be plotted on the Exposure Index graph via the Excel template provided. If the intersection of the vehicular volume and the student crossing volume is above or on the red line of the Exposure Index graph, then that indicates that the candidate approach/location meets the Exposure Index warrant. If the intersection of the student and vehicular volumes is below the red line, then the Exposure Index Warrant is not met. Please note the Exposure Index results need to be considered with the site visit and other factors as well.

### 8.0 All-way Stop Controlled Intersection Exposure Index Warrant

For the 21 all-way stop intersections that were observed, the number of students crossing during the critical 20 -minute period ranged from 5 to 86 , and the number of conflicting vehicles ranged from 31 to 224 . Excluding the two locations that yielded low student crossing volumes, the Exposure Index threshold is 1,471 and the graph for allway stop controlled intersections is shown below.

It is recommended that the City consider a minimum student volume threshold in the future to help prioritize resources. The OTC 2023 SCGG notes that the minimum number of students crossing during the common school duration should be set at a threshold of 40 students and that a lower minimum student threshold may be used at the discretion of each municipality. Based on the 40 average student crossings observed at the existing all-way stop locations (excluding the 2 outliers) during the peak 20 -minute period, a minimum student threshold of 40 students is recommended for the warrant of future allway stop locations. This means that in addition to the Exposure Index warrant, if the number of student crossing is lower than 40 during the peak 20 minute period, then the City has the discretion to not assign a school crossing guard at that location.


### 9.0 Minor-street Stop-controlled Intersection Exposure Index Warrant

For the 18 minor-street stop-controlled intersections that were observed, the number of students crossing during the critical 20 -minute period ranged from 1 to 117, and the number of conflicting vehicles ranged from 32 to 450 . Excluding the two locations that yielded low student crossing volumes, the Exposure Index threshold is 1,725 and the Exposure Index graph for minor-street stop-controlled intersections is shown below.

Based on the 42 average student crossings observed at the existing minor-street stop locations (excluding the 2 outliers) during the peak 20-minute period, a minimum student threshold of 40 students is recommended for the warrant of future minor-street stop locations. This means that in addition to the Exposure Index warrant, if the number of student crossing is lower than 40 during the peak 20 minute period, then the City has the discretion to not assign a school crossing guard at that location.


### 10.0 Signalized Intersection Exposure Index Warrant

For the 26 signalized intersections that were observed, the number of students crossing during the critical 20 -minute period ranged from 2 to 70 , and the number of conflicting vehicles ranged from 5 to 175 . Excluding the four locations that yielded low student and conflicting vehicle volumes, the Exposure Index threshold is 149 and the Exposure Index graph for signalized intersections is shown below.
Based on the 16 average student crossings observed at the existing signalized locations (excluding the four outliers) during the peak 20 -minute period, a minimum student threshold of 15 students is recommended for the warrant of future signalized locations. This means that in addition to the Exposure Index warrant, if the number of student crossing is lower than 15 during the peak 20 minute period, then the City has the discretion to not assign a school crossing guard at that location.


### 11.0 Intersection PPS and PXO

For the 7 PPS and PXO intersections that were observed, the number of students crossing during the critical 20 -minute period ranged from 9 to 22 , and the number of conflicting vehicles ranged from 7 to 60. The Exposure Index threshold is 94 and the Exposure Index graph for intersection PPS and PXOs is shown below.
Based on the 13 average student crossings observed at the existing all-way stop locations (excluding the four outliers) during the peak 20-minute period, a minimum student threshold of 10 students is recommended for the warrant of future PPS and PXO locations. This means that in addition to the Exposure Index warrant, if the number of student crossing is lower than 10, then the City has the discretion to not assign a school crossing guard at that location.


### 12.0 Roundabout

For the three roundabouts that were observed in the City, the number of students crossing during the critical 20 -minute period ranged from 25 to 61 , and the number of conflicting vehicles ranged from 89 to 155 . Based on the desire to expand the baseline for developing an Exposure Index warrant, the three locations from the Town of Ajax have been included as well and based on the range of product values as shown in Table 2 , this is an appropriate approach. With consideration of the Town of Ajax roundabouts as well, the Exposure Index threshold is 5,002 and the graph for roundabout locations is shown below.

Based on the 46 average student crossings observed at the existing roundabouts (excluding those from the Town of Ajax) during the peak 20-minute period, a minimum student threshold of 45 students is recommended for the warrant future roundabout locations. This means that in addition to the Exposure Index warrant, if the number of student crossing is lower than 45, then the City has the discretion to not assign a school crossing guard at that location.


### 13.0 Summary \& Next Steps

The following summarizes the findings of the review of 75 existing school crossing guard locations in the City:

- Individual Exposure Index warrants have been developed for all-way stop, minorstreet stop, signalized, PPS\&PXO and roundabout locations;
- The development of the Exposure Index excludes outlier locations that are deemed to have student and conflicting volumes that are too low;
- Minimum student thresholds have been developed for each control type;
- That the City apply the Exposure Index warrants for future locations;
- As it relates to the nine existing locations that are vacant (at the time of the field data collection), WSP has reviewed the respective Exposure Index values relative to the thresholds for each type of control as defined in Sections 8 through 12. Table 3 summarizes how SCG allocation to these vacant locations may be prioritized based on the relative magnitude of Exposure Index product:

Table 3 - City of Hamilton School Crossing Guard Operation Summary

| ID \# | Intersection | SCG <br> Present <br> (Yes/No) | Surveyed <br> Exposure <br> Index <br> Product | Suggested <br> Priority <br> (Relative <br> Order) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Minor-street Stop (Exposure Index Threshold: 1,725) |  |  |  |  |  |  |  |  |  |
| $\mathbf{5 2}$ | Cameron Ave \& York Ave | No | 13,689 | 1 |  |  |  |  |  |
| $\mathbf{6 7}$ | Citation Cres \& Meadowlands Blvd | No | 140 | 9 |  |  |  |  |  |
| $\mathbf{2 6 3}$ | Bond St \& Glen Rd |  |  |  |  | No | 1,280 | 8 |  |
| Signalized (Exposure Index Threshold: 149) |  |  |  |  |  |  |  |  |  |
| $\mathbf{1 5 6}$ | Barton St E \& Sherman Ave N | No | 144 | 7 |  |  |  |  |  |
| $\mathbf{1 5 7}$ | Main St E \& Sherman Ave S | No | 357 | 4 |  |  |  |  |  |
| $\mathbf{1 6 2}$ | McNiven Rd \& Mohawk Rd W | No | 851 | 3 |  |  |  |  |  |
| $\mathbf{3 0 1}$ | Ferguson Ave N \& Wilson St | No | 2,730 | 2 |  |  |  |  |  |
| $\mathbf{4 5 0}$ | Ogilvie St \& Governors Rd |  |  |  |  |  | No | 330 | 5 |
| Intersection PXO and IPS (Exposure Index Threshold: 94) |  |  |  |  |  |  |  |  |  |
| $\mathbf{1 3 7}$ | Hunter St W \& Locke St S | Present in <br> AM, absent <br> in PM | 96 | 6 |  |  |  |  |  |

- For guidance regarding the removal of school crossing guards at existing locations (i.e., the eight locations noted in Table 2 that yielded very low student volume and conflicting vehicle products), it is recommended that the City follow the best practices that will be detailed in the upcoming OTC 2023 SCGG (anticipated to be related in early Q1 2023). In general, two non consecutive days of evaluation will need to be conducted following the same process as outlined in Section 5 of this report. Both days of results need to not meet the Exposure Index before the removal is recommended. The results collected in presented in Table 2 for these eight locations may be considered one set of data for that process.

If the City does proceed to remove the school crossing guards at these locations, it should be done so at key points of the school year (at the end of a school term/ school year or major breaks in school such as March break) and not abruptly in the school period. All the relevant stakeholders should be notified along with sufficient education for staff, students and parents on alternative routes to take.

In certain scenarios, a school crossing guard may be removed without the need to re-evaluate the school crossing location and/or removed immediately. These scenarios include when a school is closed or significantly downsized and when a school boundary changes in such a way where students are no longer required to cross at the existing school crossing guard location.

- For future communications with requestors for new school crossing guards, the following provides a suggested template for responding to requestors for locations that do not meet the City's warrant.

Thank you for submitting a school crossing guard request. The City's Parking Enforcement and School Safety division has reviewed the candidate school crossing guard location at $\qquad$ (insert location) and found that it does not meet the mandatory criteria for a location to be eligible for a school crossing guard. In particular, the $\qquad$ (can be multiple aspects).

The blank above can be filled with one of the following options:

- posted speed limit in the vicinity of the school crossing is higher than what is permitted for a school crossing guard to operate (maximum of $60 \mathrm{~km} / \mathrm{h}$ ) as per the Highway Traffic Act.
- age group of the school that would be served by the school crossing guard does not correspond to the junior kindergarten to grade 5 range that school crossing guards serve in the City.
- subject location has already been reviewed within the past 3 years for a school crossing guard and the previous results did not meet the requirements for a school crossing guard. The City's policy is that a location that has been assessed within the past 3 years and found not to be warranted is not eligible unless there has been a significant change in the study area from a transportation perspective.
- location is in proximity to another school crossing guard that is already in operation and serving the same population as the requested location.
- the surveyed student crossing volume and conflicting vehicular volume does not meet the City's Exposure Index threshold for this type of crossing location.
- the minimum student threshold at the candidate location does not meet the minimum threshold for this type of crossing location.

Exposure Index Graph for All-way Stop Intersections

columns for data input
ool crossing period is based on the common interval of schol crossing guard supervision. Please see Part A-Step 3 of the instructions for more information





Nat




































## Appendix B - Minor-street Stop

| ${ }^{10}$ | Exity of Hamilton |  | Probuct |
| :---: | :---: | :---: | :---: |
|  | $\underset{\substack{\text { conilicing } \\ \text { movenents }}}{\text { a }}$ |  |  |
| 116 | 85 | 20 | 1,700 |
| 141 |  |  |  |
| 193 | 450 | 19 | 8,550 |
| 236 | 143 | 107 | 15,301 |
| 263 | 32 | 40 | 1,280 |
| 269 | 110 | 37 | 4,070 |
| 285 | 111 | 23 | 2,553 |
| 300 | 362 | 18 | 6,516 |
| 329 | 120 | 114 | 13,680 |
| 348 | 115 | 31 | 3,565 |
| 375 | 120 | 15 | 1,800 |
| 396 | 105 | 28 | 2,940 |
| 50 | 55 | 35 | 1,925 |
| 52 | 117 | 117 | 13,689 |
| 67 |  |  |  |
| 68 | 92 | 14 | 1,288 |
| 86 | 309 | 33 | 10,197 |
| 163 | 155 | 20 | 3,100 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |



85th percentile curve

columns for data input
School crossing period is based on the common interval of schol crossing guard supervision. Please see Part A-Step 3 of the instructions for more information.




























## Appendix C - Signalized

Exposure Index Graph for Signalized Intersections


columns for data input
*School crossing period is based on the common interval of schol crossing guard supervision. Please see Part A-Step 3 of the instructions for more information.



































Appendix D - Intersection PXO \& IPS


Exposure Index Graph for PPS \& intersection PXOs
94










## Appendix E - Roundabout


**Scol columns for data input
*School crossing period is based on the common interval of schol crossing guard supervision. Please see Part A-Step 3 of the instructions for more information.


| Time period | \# of conflicting Vehicles | \# of students | 20 min product |
| :---: | :---: | :---: | :---: |
| 7:20:00 AM |  |  | $\cdots$ |
| 7:25:00 AM |  |  | - |
| 7:30:00 AM |  |  | $\cdots$ |
| 7:35:00 AM |  |  | 0 |
| 7:40:00 AM |  |  | 0 |
| 7:45:00 AM |  |  | 0 |
| 7:50:00 AM | 26 | 3 | 78 |
| 7:55:00 AM | 54 | 7 | 800 |
| 8:00:00 AM | 43 | 14 | 2952 |
| 8:05:00 AM | 58 | 11 | 6335 |
| 8:10:00 AM | 45 | 0 | 6400 |
| 8:15:00 AM |  |  | 3650 |
| 8:20:00 AM |  |  | 1133 |
| 8:25:00 AM |  |  | 0 |
| 8:30:00 AM |  |  | 0 |
| 8:35:00 AM |  |  | 0 |
| 8:40:00 AM |  |  | 0 |
| 8:45:00 AM |  |  | 0 |
| 8:50:00 AM |  |  | 0 |
| 8:55:00 AM |  |  | 0 |
| 9:00:00 AM |  |  | 0 |
| 9:05:00 AM |  |  | 0 |
| 9:10:00 AM |  |  | 0 |

Start time of count:

End time of count

| Time period | \# of conflicting Vehicles | \# of students | 20 min product |
| :---: | :---: | :---: | :---: |
| 7:20:00 AM |  |  | -- |
| 7:25:00 AM |  |  | .- |
| 7:30:00 AM |  |  | -- |
| 7:35:00 AM |  |  | 0 |
| 7:40:00 AM |  |  | 0 |
| 7:45:00 AM |  |  | 0 |
| 7:50:00 AM | 23 | 2 | 46 |
| 7:55:00 AM | 35 | 8 | 580 |
| 8:00:00 AM | 69 | 3 | 1651 |
| 8:05:00 AM | 71 | 2 | 2970 |
| 8:10:00 AM | 50 | 1 | 3150 |
| 8:15:00 AM |  |  | 1140 |
| 8:20:00 AM |  |  | 363 |
| 8:25:00 AM |  |  | 50 |
| 8:30:00 AM |  |  | 0 |
| 8:35:00 AM |  |  | 0 |
| 8:40:00 AM |  |  | 0 |
| 8:45:00 AM |  |  | 0 |
| 8:50:00 AM |  |  | 0 |
| 8:55:00 AM |  |  | 0 |
| 9:00:00 AM |  |  | 0 |
| 9:05:00 AM |  |  | 0 |
| 9:10:00 AM |  |  | 0 |


| Afternoon Observations (Approach 1) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Time period | \# of conflicting Vehicles | \# of students | 20 min product |
| Start time of count: | 2:30:00 PM |  |  | -- |
|  | 2:35:00 PM | 19 | 11 | - |
|  | 2:40:00 PM | 36 | 15 | - |
|  | 2:45:00 PM | 39 | 1 | 2538 |
| End time of count | 2:50:00 PM | 23 | 1 | 3276 |
|  | 2:55:00 PM |  |  | 1666 |
|  | 3:00:00 PM |  |  | 124 |
|  | 3:05:00 PM |  |  | 23 |
|  | 3:10:00 PM |  |  | 0 |
|  | 3:15:00 PM |  |  | 0 |
|  | 3:20:00 PM |  |  | 0 |
|  | 3:25:00 PM |  |  | 0 |
|  | 3:30:00 PM |  |  | 0 |
|  | 3:35:00 PM |  |  | 0 |
|  | 3:40:00 PM |  |  | 0 |
|  | 3:45:00 PM |  |  | 0 |
|  | 3:50:00 PM |  |  | 0 |
|  | 3:55:00 PM |  |  | 0 |
|  | 4:00:00 PM |  |  | 0 |
|  | 4:05:00 PM |  |  | 0 |
|  | 4:10:00 PM |  |  | 0 |
|  | 4:15:00 PM |  |  | 0 |
|  | 4:20:00 PM |  |  | 0 |


Instruction: anything in red is to be updated

| Intersection ID: | 12342 |
| :--- | :---: |
| Intersection Name: | Williamson Dr and Middlecote Dr |
| Date of video: | 27 -Sep |
| Intersection Control: | Roundabout |
| Approach counted: | 1 |




| Afternoon Observations (Approach 1) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Time period | \# of conflicting Vehicles | \# of students | 20 min product |
| Start time of count: | 2:30:00 PM |  |  | $\cdots$ |
|  | 2:35:00 PM | 17 | 0 | .- |
|  | 2:40:00 PM | 24 | 0 | -- |
|  | 2:45:00 PM | 17 | 2 | 116 |
|  | 2:50:00 PM | 14 | 1 | 216 |
|  | 2:55:00 PM | 21 | 0 | 228 |
|  | 3:00:00 PM | 12 | 6 | 576 |
|  | 3:05:00 PM | 20 | 8 | 1005 |
|  | 3:10:00 PM | 26 | 4 | 1422 |
|  | 3:15:00 PM | 30 | 10 | 2464 |
|  | 3:20:00 PM | 32 | 4 | 2808 |
|  | 3:25:00 PM | 23 | 2 | 2220 |
|  | 3:30:00 PM | 16 | 38 | 5454 |
|  | 3:35:00 PM | 26 | 109 | 14841 |
|  | 3:40:00 PM | 14 | 10 | 12561 |
|  | 3:45:00 PM | 10 | 0 | 10362 |
| End time of count | 3:50:00 PM | 19 | 2 | 8349 |
|  | 3:55:00 PM |  |  | 516 |
|  | 4:00:00 PM |  |  | 58 |
|  | 4:05:00 PM |  |  | 38 |
|  | 4:10:00 PM |  |  | 0 |
|  | 4:15:00 PM |  |  | 0 |
|  | 4:20:00 PM |  |  | 0 |



| Afternoon Observations (Approach 1) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Time Period | \# of conflicting Vehicles | \# of students | 20 min product |
|  | 2:30:00 PM |  |  | -- |
|  | 2:35:00 PM |  |  | -- |
|  | 2:40:00 PM |  |  | -- |
|  | 2:45:00 PM |  |  | 0 |
| Start time of count: | 2:50:00 PM |  |  | 0 |
|  | 2:55:00 PM | 27 | 16 | 432 |
|  | 3:00:00 PM | 63 | 31 | 4230 |
|  | 3:05:00 PM | 43 | 7 | 7182 |
|  | 3:10:00 PM | 26 | 2 | 8904 |
|  | 3:15:00 PM | 23 | 1 | 6355 |
|  | 3:20:00 PM | 35 | 3 | 1651 |
|  | 3:25:00 PM | 12 | 1 | 672 |
| End time of count | 3:30:00 PM | 19 | 0 | 445 |
|  | 3:35:00 PM |  |  | 264 |
|  | 3:40:00 PM |  |  | 31 |
|  | 3:45:00 PM |  |  | 0 |
|  | 3:50:00 PM |  |  | 0 |
|  | 3:55:00 PM |  |  | 0 |
|  | 4:00:00 PM |  |  |  |
|  | 4:05:00 PM |  |  | 0 |
|  | 4:10:00 PM |  |  | 0 |
|  | 4:15:00 PM |  |  | 0 |
|  | 4:20:00 PM |  |  | 0 |






