

March 30, 2010

Ms. Samantha Piper
Public Safety Specialist
City of Chilliwack
8550 Young Road
Chilliwack, BC
V2P 8A4



Our File: 90156

Dear Ms. Piper:

**Re: TRAFFIC SAFETY STUDY AT THE INTERSECTION OF UNSWORTH ROAD AND KEITH
WILSON ROAD – LETTER REPORT**

Opus International was retained by the City of Chilliwack (City) to conduct a traffic safety study, which includes a signal warrant analysis, at the intersection of Unsworth Road and Keith Wilson Road. This study also assesses traffic safety concerns at the Unsworth Elementary School, which is located approximately 250 metres north of the study intersection.

1. BACKGROUND

The study intersection of Keith Wilson Road and Unsworth Road is located in the Sardis area of the City of Chilliwack, south of Highway 1. The intersection, which is STOP controlled on Unsworth Road, provides a marked crosswalk as an access to the Unsworth Elementary School located at 5685 Unsworth Road. An aerial photograph of the study area is provided in FIGURE 1.

Based on discussion with the City and with members of the elementary school, it is understood that many parents feel that the existing marked crosswalk is insufficient and that an upgraded pedestrian crossing control, such as a traffic signal, should be provided at the study intersection. In addition to the crossing at the study intersection, the City and members of the Unsworth Elementary School also cited safety concerns along Unsworth Road, particularly during the school's drop-off and pick-up hours.

This study identifies the safety and operational concerns of the study area, which includes both the study intersection and along Unsworth Road, and determines if the intersection is warranted for a full signal or a pedestrian signal. In the situation where neither signals are warranted, other improvement measures to enhance safety will be evaluated and identified.



Note: The aerial photograph is from 2006, which predates some features.

FIGURE 1 STUDY AREA

2. PHYSICAL CHARACTERISTICS

The existing layout of the study intersection is shown in FIGURE 2, and photographs of each of the intersection's approaches are shown in FIGURE 3.

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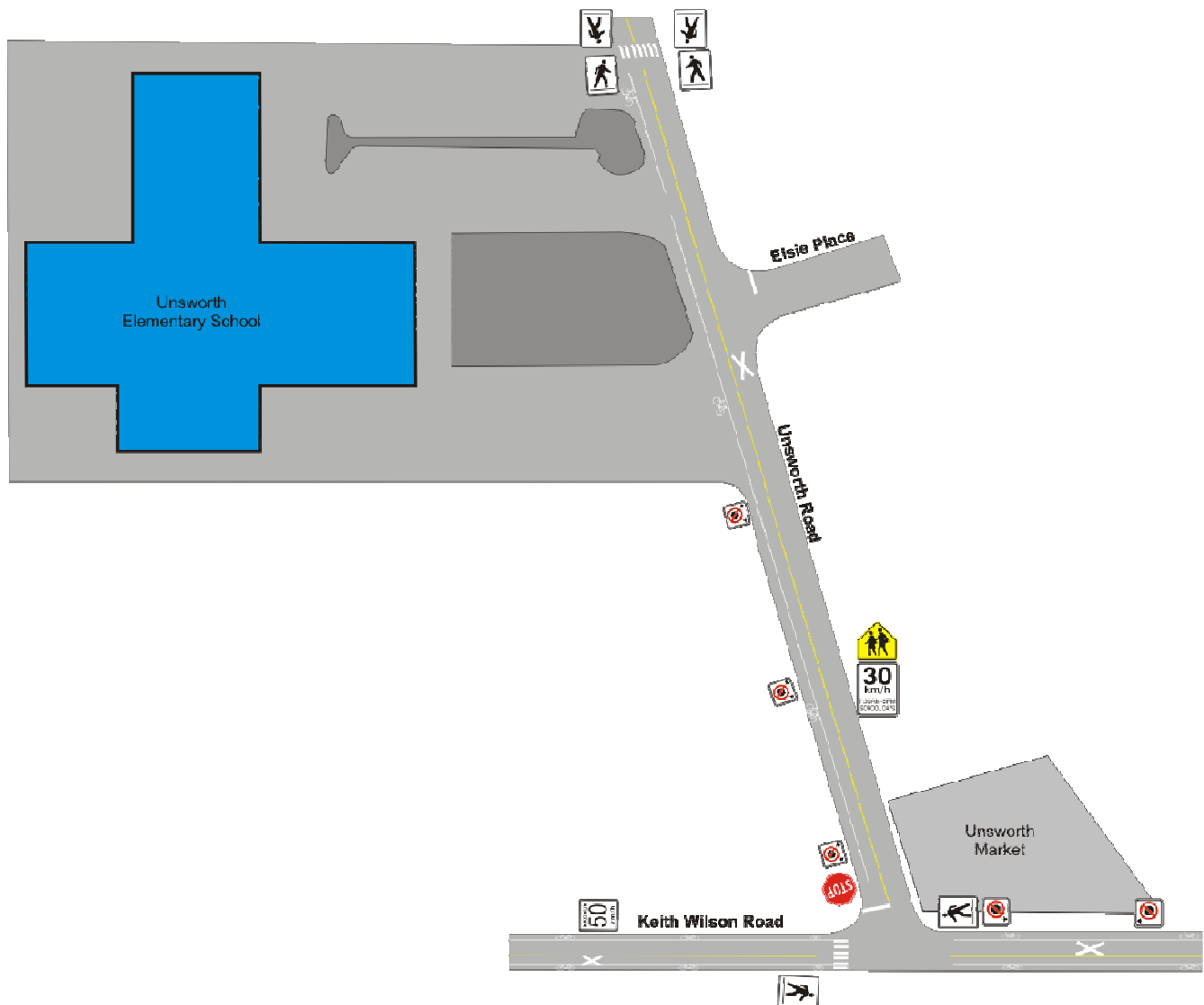


FIGURE 2 INTERSECTION LAYOUT



FIGURE 3 PHOTOGRAPHS OF INTERSECTION APPROACHES

The physical characteristics of the study intersection are as follows:

- The study intersection is a T-intersection with Unsworth Road forming the southbound approach and Keith Wilson Road forming the eastbound and westbound approaches.
- Unsworth Road is a major collector road with one travel lane in each direction and a designated bicycle lane on the west side of the roadway. The northbound lane is about 4.5 metres wide, which is wide enough for a single travel lane, but too narrow to allow street parking. Due to the proximity of the Unsworth Elementary School, a posted speed limit of 30 km/hr is in effect on school days between 7:30 AM and 5:00 PM.



- Keith Wilson Road is a minor arterial road with one travel lane in each direction and a designated bicycle lane on both sides of the roadway. A signed and marked crosswalk to facilitate pedestrian movements across Keith Wilson Road is located in the west leg. At the study intersection, the posted speed limit on Keith Wilson Road is 50 km/hr. Keith Wilson Road is also a designated truck route.
- The Unsworth Market (convenience store) is located in the northeast corner of the study intersection. The driveway access of the convenience store is located on Keith Wilson Road.
- A sidewalk is provided on the south side of Keith Wilson Road from the study intersection to the intersection of Webster Road. On Unsworth Road, a sidewalk is provided on the east side of the roadway from the study intersection to the marked crosswalk at the elementary school. Currently, the existing sidewalk configuration does not provide a continuous link to the existing crosswalk at the study intersection. However, City staff have indicated that pedestrians are allowed to use the designated bicycle lane on the west side of the road.
- Parking restrictions are posted on the west side of Unsworth Road to prohibit stopping along the bicycle lane. There are no posted parking restrictions on the east side of Unsworth Road. On Keith Wilson Road, parking restrictions are posted on the north side in front of the Unsworth Market.

3. TRAFFIC AND SAFETY CHARACTERISTICS

A. Intersection Traffic Volumes

Traffic volume and pedestrian counts were conducted on February 10, 2010 for a six-hour period between 7:00 AM and 6:00 PM. A vehicle gap study was also conducted along Keith Wilson Road during the peak periods to determine the average number of crossing opportunities at the intersection.

Based on the counts, the morning and afternoon peak periods were determined to be between 8:00 AM and 9:00 AM, and between 2:00 PM and 3:00 PM respectively. These peak hours are reflective of pick-up and drop-off activity at the school. The turning movement counts collected during the peak periods are summarized and shown in FIGURE 4.

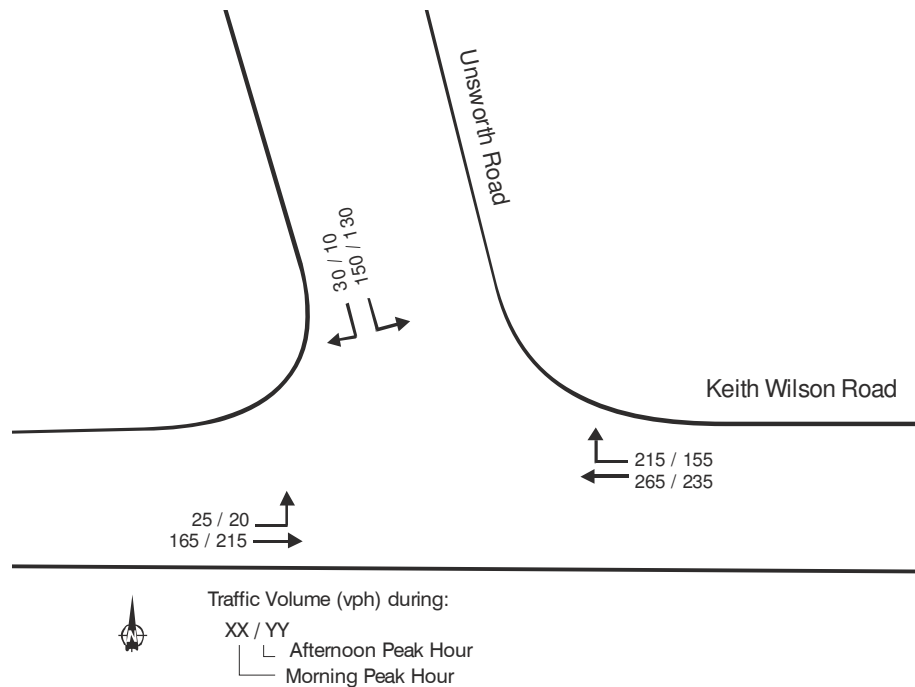


FIGURE 4 TURNING MOVEMENT COUNTS

A review of the turning movement counts indicates the following:

- The peak hours of the study intersection are impacted by the elementary school's hours of operation, which are between 8:45 AM and 2:35 PM. During the peak periods, the study intersection experiences high southbound left-turn and westbound right-turn volumes. Throughout other parts of the day, these volumes do not exceed 50 vehicles per hour.
- Through volumes on Keith Wilson Road are relatively similar throughout the day. Based on data obtained from the City's automatic traffic counts for the year 2009, a 24-hour two-way total of about 7,400 vehicles were observed on Keith Wilson Road west of the study intersection.
- A total of 15 and 27 pedestrians crossed at the marked crosswalk during the morning and afternoon peak periods respectively. During both peak periods, over 65 percent of those pedestrians were children.
- The gap study determined that there are approximately 115 crossing opportunities per hour at the study intersection. It was also observed that the maximum time a pedestrian had to wait in order to cross was approximately 50 seconds.



B. Intersection Capacity

Based on the turning movement counts shown in FIGURE 4, capacity analysis was conducted on the study intersection using Synchro 7.0 software, which conforms to the methodologies outlined in the Transportation Research Board's *Highway Capacity Manual*. The software evaluates the capacity in terms of levels of service, which are assigned on a scale of "A" to "F" with "A" being little or no delay to "F" indicating that the movement exceeds theoretical capacity.

The results of the capacity analysis during the morning and afternoon peak periods are summarized in TABLE 1. During both peak hours, the eastbound and southbound approaches operate at levels of service A and C respectively. Based on the results of the analysis, the capacity of the study intersection is sufficient to accommodate existing demands.

TABLE 1 SUMMARY OF STUDY INTERSECTION CAPACITY – PEAK HOURS

Intersection	Lane Group	Weekday AM Peak Hour				Weekday PM Peak Hour				
		Volume (vph)	Movement Capacity (vph)	Control Delay	Level of Service	Lane Group	Volume (vph)	Movement Capacity (vph)	Control Delay	Level of Service
Keith Wilson Road and Unsworth Road	EBLT	207	1045	1.3	A	EBLT	255	1135	A	0.9
	SBLR	196	454	18.8	C	SBLR	152	457	C	16.8

Note: Westbound movements are uncontrolled and therefore have no measurable delay.

As pick-up and drop-off activity generally occurs over a 15-minute period, the capacity of the intersection was analyzed for the peak 15-minute intervals to gauge the delay levels during these periods. This was estimated by factoring the volumes using the respective peak hour factors. The results of the capacity analysis for the peak 15-minute interval are shown in TABLE 2. The capacity analysis indicates that there are no operational issues along Keith Wilson Road. However, the high left-turn volumes resulted in long delays, particularly during the morning peak period, in the southbound approach. However, it should be noted that this situation only occurs during the busiest 15-minute period.

**TABLE 2 SUMMARY OF STUDY INTERSECTION CAPACITY – 15-MINUTE PEAKS**

Intersection	Equivalent Weekday AM Peak Hour					Equivalent Weekday PM Peak Hour				
	Lane Group	Volume (vph)	Movement Capacity (vph)	Control Delay	Level of Service	Lane Group	Volume (vph)	Movement Capacity (vph)	Control Delay	Level of Service
Keith Wilson Road and Unsworth Road	EBLT	244	907	1.5	A	EBLT	304	1008	1.1	A
	SBLR	273	367	38.5	E	SBLR	254	365	34.5	D

Based on the *Keith Wilson Area Development Transportation Review* (Urban Systems, 2005), traffic on Keith Wilson Road was forecasted to increase by 90 percent between 2005 and 2010, and is expected to increase by another 110 to 170 percent by the year 2020 due to future development between Webster Road and Janis Road, just west of the study area. Although the study only extended as far west as Webster Road, traffic volume increases are anticipated at the study intersection. As well, the *Webster Road Area Plan* (MVH Urban Planning & Design Inc, 2009) indicates that the development is expected to have up to 455 housing units (with a vehicle trip to/from each unit during the peak periods), with a portion likely to use Keith Wilson Road through the intersection. To determine the expected longer delays due to the future potential traffic growth on Keith Wilson Road, through volumes on Keith Wilson Road were incrementally increased. Based on the capacity analysis, the southbound approach can be expected to operate at levels of service E or worse throughout the afternoon peak period by the year 2015.

C. Collision Characteristics

Collision claim summaries were provided by the Insurance Corporation of British Columbia (ICBC) from January 1, 2000 to December 31, 2009. Each summary contains information on the date, time and location, severity of collisions, as well as descriptions provided by claimants that may identify contributing factors. However, it should be noted that the descriptions are provided by claimants and may be subjective and contain inaccuracies.

During the 10-year period for which the collision data was provided, a total of 15 collisions were reported. With an average of just over one collision per year, the study intersection has a relatively low collision frequency. While a detailed analysis of the claim summaries did not reveal notable collision trends, one westbound rear-end collision occurred on Keith Wilson Road as a result of a pedestrian crossing the road.



4. TRAFFIC SAFETY AND OPERATIONAL ISSUES CITED BY CITY AND UNSWORTH ELEMENTARY SCHOOL STAFF

The City and members of the Unsworth Elementary School have noted that traffic safety and operational concerns exist at the study intersection and on Unsworth Road. The following issues were cited by the City and by the elementary school staff and parents:

- The existing marked crosswalk is insufficient in facilitating pedestrian movements across Keith Wilson Road;
- Traffic volumes are high and vehicles travel above the posted speed limit, resulting in minimal crossing opportunities for pedestrians waiting to cross;
- Limited sight distance for southbound left-turn drivers increases the risk of left-turn collisions;
- Long southbound left-turn delays result in long queues that extend from the study intersection to the Unsworth Elementary School;
- Pedestrians are walking in the designated bicycle lane located on the west side of Unsworth Road;
- Vehicles are parked on both sides of Unsworth Road and force pedestrians and cyclists onto the roadway; and,
- The existing sidewalks are discontinuous and discourage its use by pedestrians.




5. SITE OBSERVATIONS

A site visit was conducted on February 10, 2010 to confirm the safety and operational issues that were cited by the City and by the parents and staff of Unsworth Elementary School. In addition, human factors that may be contributing to the concerns were also identified. The observations of the site visit are summarized in TABLE 3.

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TABLE 3 SITE OBSERVATIONS

PHOTO	OBSERVATION
AT STUDY INTERSECTION	
	<p>The marked crosswalk on the west leg does not connect with the sidewalk on Unsworth Road. Pedestrians may not be aware that they are encouraged to use the designated bicycle lane on the west side of Unsworth Road, which connects to the marked crosswalk. The discontinuous sidewalk may also discourage the use of the marked crosswalk as pedestrians may find it more convenient to cross midblock between Unsworth Road and Webster Road. Pedestrians crossing between Unsworth Road and Webster Road were observed throughout the day.</p>
	<p>“No Stopping Anytime” parking restrictions are in effect in the east leg (north side) just before the marked crosswalk. However, the shoulder lane and gravel is easily mountable and resulted in some customers of the Unsworth Market parking in the restricted area. Vehicles parked close to the crosswalk and intersection may limit the view between westbound drivers and pedestrians waiting to cross, as well as between southbound left-turn drivers and westbound through drivers. The limited visibility may contribute to pedestrian-related collisions and left-turn crossing collisions. Secondary collisions, such as rear-end collisions, may also increase when westbound drivers stop abruptly for pedestrians and left-turning vehicles.</p>
	<p>Customers of the Unsworth Market were observed to park on the sidewalk along the east side of Unsworth Road. During the afternoon pick-up period, parents were also observed to park on the east side and mount the sidewalk of Unsworth Road. This increases pedestrian exposure to vehicle traffic, as well as increases their risk of conflicts as pedestrians are forced to walk on the roadway to avoid parked cars.</p>

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The sight distance looking to the west is limited from the southbound approach of the study intersection. In order to obtain a sufficient view of eastbound vehicles on Keith Wilson Road, southbound left-turn drivers need to pull out beyond the stop bar onto the roadway of Keith Wilson Road. This increases the exposure of southbound left-turn vehicles to traffic on Keith Wilson Road, and may increase the risk of left-turn crossing collisions, and other secondary collision types, such as rear-end collisions.



During the afternoon peak period, adult crossing guards were observed to facilitate school children crossing activity at the marked crosswalk. With the assistance of the crossing guards, children experienced minimal delays and conflicts crossing Keith Wilson Road. However, based on discussion with staff at the school, it was indicated that the school does not have an Adult Crossing Guard Program and that the crossing guards operate on a volunteer basis. The crossing guards help create gaps for school children crossing the road and also raise driver awareness of children waiting to cross. When there are no crossing guards at the study intersection, it may be difficult for children inexperienced in using a marked crosswalk unaided to cross Keith Wilson Road during peak times, increasing the risk of pedestrian-related conflicts.

AT SCHOOL



“No Stopping Anytime”: parking restrictions are posted on the west side of Unsworth Road. Despite the parking restriction, parents parked in the designated bicycle lane during the afternoon pick-up period. Vehicles parked on the designated bicycle lane force cyclists onto the roadway, increasing the risk of cyclist collisions. As the designated bicycle lane is also used by pedestrians, parked vehicles would also force pedestrians onto the roadway and would similarly increase the risk of pedestrian-related collisions.

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Many parents parked on Elsie Place to pick-up their children. Some vehicles were observed to be parked close to the intersection, limiting the corner clearance at the intersection. The insufficient corner clearance may impact traffic efficiency as northbound right-turn vehicles are delayed, and may also increase the risk of sideswipe collisions between the parked vehicle and a right-turning vehicle.



Many parents crossed mid-block after picking up their children from the school. The view of pedestrians may be obstructed by vehicles queued at the intersection. As such, pedestrians crossing illegally increase their risk of being involved in a collision. In addition, pedestrians crossing mid-block may also contribute to congestion on Unsworth Road as drivers need to stop to allow pedestrians to cross.



Limited sight distance, high volumes, high vehicle speeds make it difficult for southbound left-turn movements to be made at the study intersection. This resulted in congestion on Unsworth Road during both the morning and afternoon periods parents drop-off/pick-up their children. During the peak pick-up and drop-off times, approximately 20 vehicles were queued from the intersection to the school driveway.



6. IDENTIFIED SAFETY ISSUES

Based on discussion with the City and the school, and on the findings of the site observations, traffic safety and operational concerns at the study intersection and along Unsworth Road were described below. An issues diagram summarizing the safety and operational concerns is shown in FIGURE 6.

Issue 1: Discontinuous Sidewalk

Based on a survey conducted at Unsworth Elementary School for the *Unsworth Elementary School Road Safety Plan* (Unsworth Elementary School, 2008), walking is a significant mode choice by students of the school. As such, pedestrian facilities near the school should be continuous and convenient to encourage its use and to remove pedestrians from the roadway. However, during the site visit, it was identified that sidewalks are currently only provided on the east side of Unsworth Road and on the south side of Keith Wilson Road between Unsworth Road and Webster Road. As the marked crosswalk is located on the west leg of the study intersection, the existing sidewalk on Unsworth Road does not provide a continuous or convenient connection to the marked crosswalk. Pedestrians are therefore encouraged to walk along the designated bicycle route, which provides a more convenient connection to the marked crosswalk. In fact, the Safer City *Best Walking Route* map, as shown in FIGURE 5, highlights the west side of Unsworth Road as a preferred walking route to school. However, as pedestrians may not be aware of this allowance, they may cross midblock across Unsworth Road and across Keith Wilson Road at locations other than at the marked crosswalk.

During the site visit, it was also observed that there is an eastbound bus stop for school buses located approximately 50 metres east of the study intersection. As the students who waited at the stop are older, it is reasonable to assume that they are not students of Unsworth Elementary School. However, due to the lack of continuous sidewalk, these students, who originated on Unsworth Road, travelled along the sidewalk and then crossed midblock on Keith Wilson Road between the study intersection and Webster Road.



FIGURE 5 SAFER CITY BEST WALKING ROUTES TO SCHOOL MAP

Issue 2: Speeding

Excessive speeds on Keith Wilson Road were cited by staff and parents of Unsworth Elementary School. Speeding not only contributes to higher crash severity but also increases the risk of pedestrian collisions by giving speeding drivers less time to react when pedestrians cross the road unexpectedly. Based on discussion with the elementary school staff, most parents felt that it is unsafe for children to cross Keith Wilson Road and that the existing marked crosswalk is insufficient in facilitating pedestrian movements across the road.

Issue 3: Limited Sight Distance

During the site visit, it was observed that sightlines at the study intersection may be limited. As a result of limited sight distance, southbound left-turn drivers had to pull out onto Keith Wilson Road in order to detect gaps from eastbound Keith Wilson Road. The limited view of conflicting traffic increases the risk of left-turn crossing collisions at the intersection. Vehicles parked close to the intersection in the “No Stopping Anytime” zone on Keith Wilson Road were also observed to block sightlines between drivers and pedestrians. The limited sightlines increases the risk of pedestrian collisions as pedestrians need to step out onto the roadway to observe traffic.



Issue 4: Illegal Parking on Unsworth Road

As cited by the City and the elementary school, vehicles were observed to be parked along both sides of Unsworth Road during the afternoon peak hour to pick-up students during school dismissal. On the west side, which is signed “No Stopping Anytime”, the parked vehicles obstructed the bicycle lane, forcing cyclists and pedestrians to travel on the roadway. On the east side, which does not have posted parking restrictions, the parked vehicles mounted the sidewalk due to narrow roadway and forced pedestrians walking along the sidewalk to walk onto the roadway as well as to walk along the road between parked cars. When pedestrians are forced onto the roadway, their exposure to vehicle traffic is increased, and when pedestrians walk between parked vehicles, their visibility is limited. Parked vehicles on Unsworth Road may also force northbound vehicles to encroach into the southbound travel lane, increasing the risk of sideswipe collisions.

Issue 5: Unsafe Pedestrian Activity

Both cited and observed were pedestrians jaywalking across Unsworth Road, particularly during the afternoon peak period. For convenience and to avoid delays crossing at the marked crosswalk on Unsworth Road, many parents picked-up their children and crossed mid-block on Unsworth Road between queued vehicles to where they parked their cars. Although pedestrians may feel that the stopped vehicles create sufficient crossing gaps, pedestrians may be unaware that drivers along Unsworth Road are likely experiencing high driver frustration and impatience due to congestion and delay and may be more prone to committing risk taking behaviour that may put pedestrians at risk. High driver workload (watching for pedestrians and vehicles) that drivers may be facing along Unsworth Road may also increase the risk of pedestrians being involved in a collision.

Issue 6: Congestion and Long Southbound Delays on Unsworth Road

Based on the turning movement counts, approximately 130 to 150 vehicles made southbound left-turn movements from Unsworth Road to Keith Wilson Road during the morning and afternoon peak hours. Due to high volumes and high vehicles speeds, southbound left-turn drivers were observed to experience significant delays while waiting for a sufficient gap. According to the capacity analysis, the southbound approach was determined to operate the equivalent of levels of service E and D during part of peak portion of the morning and afternoon peak periods respectively, and is expected to operate at E throughout the afternoon peak period by 2015. In addition to causing driver frustration and impatience, queued vehicles on Unsworth Road make it difficult for drivers to access/egress the elementary school's driveway. This adds to the overall congestion of the corridor as school traffic cannot enter or exit the parking lot. As already discussed, congestion in both directions of Unsworth Road also creates the impression that pedestrians can cross safely between stopped vehicles, which may increase their risk of being involved in conflicts.



FIGURE 6 SUMMARY OF ISSUES



7. MITIGATION MEASURES

To address the identified safety and operation issues, improvement strategies were developed and are described in detail below.

A. Upgrade Intersection Crossing Control

As it is felt that the existing marked crosswalk is insufficient in facilitating pedestrian movements across Keith Wilson Road, the City can consider upgrading the study intersection's crossing control device. Based on the request of the City and of the elementary school, Opus undertook warrant analyses for both a pedestrian signal and a full traffic signal using the methodologies outlined in the following manuals and guidelines:

- *Manual of Uniform Traffic Control Devices for Canada* and the Ministry's traffic signal warrant for a full signal; and
- *Pedestrian Crossing Control Manual* for a pedestrian signal

A description of each of the methodologies is provided in APPENDIX A. A summary of each warrant's results is provided below:

- The analysis for a pedestrian signal, which is based on pedestrian demand and the number of crossing opportunities, indicates that the study intersection currently does not meet the criteria for a pedestrian signal. Currently, the study intersection is only warranted for a signed and marked crosswalk, which already exists at the study intersection. Both higher pedestrian volumes crossing the crosswalk and vehicle volumes along Keith Wilson Road are required to meet the pedestrian signal warrant. As mentioned in the *Keith Wilson Area Development Transportation Review* and the *Webster Road Area Plan*, traffic volumes are expected to increase along Keith Wilson Road. Based on incremental increases in the traffic volume, it is expected that volumes along Keith Wilson Road may warrant the possibility of a pedestrian signal by 2017. However, the number of pedestrians (expected to typically be school children) would also need to increase by about 115 percent over the existing crossing volumes. It is unlikely that this pedestrian volume will be reached before 2017; therefore, a pedestrian signal would not be warranted until after 2017.



- Warrants are achieved when volumes reach documented threshold or when movements experience delays with levels of service E or worse. Based on the warrants for a full signal, neither the existing traffic and pedestrian volumes nor the resulting delays for the southbound movements at the study intersection currently warrant the need for a full signal. However, future volumes on the Keith Wilson Road are expected to increase due to future developments and would result in increased delays at the study intersection. As discussed earlier, the southbound approach can be expected to operate at levels of service E or worse throughout the afternoon peak period by the year 2015. Level of service E represents significant delays, and results in driver impatience, risk-taking, and increased safety risks, and the expected volumes would warrant a full traffic signal by then. A full signal in the future would also help relieve congestion and queuing on Unsworth Road.

Based on the above analysis, it is suggested that the City plan for installation of a full signal by the year 2015. The signal should include pedestrian signal heads with push-button control for all legs, as well as the appropriate crosswalk pavement markings and curb letdowns.

B. Provide Continuous Sidewalk

Inconvenient or poorly connected sidewalks were identified as a contributing factor to pedestrians walking on the roadway or not crossing at the marked crosswalk. According to the Safer City *Best Walking Routes* map, the bicycle lane is currently a preferred walking route to school. Based on discussion with the City, it is recognized that bicycle lanes should be shared by pedestrians and cyclists in the absence of sidewalks. As a short-term measure to clear the confusion over pedestrian/cyclist right-of-way, it is suggested that the City install signs informing both users groups that the bicycle lane is intended to be shared between both pedestrians and cyclists. As of the time of this writing, the City has installed these signs.

Ideally, in the long-term, it is recommended that sidewalk be constructed on the west side of Unsworth Road alongside the bicycle route to provide better connection to the existing marked crosswalk. It is recognized that sidewalk improvements in the area are underway and are included in the City's Capital Plan. As the bicycle lane is a preferred walking route, it is therefore suggested that the City continue to make efforts to prioritize and seek funding for this segment of Unsworth Road to accommodate the pedestrian needs of students and parents at Unsworth Elementary School.



C. School Safety Patrol Program

During the site visit, parent volunteers acted as crossing control guards during the afternoon peak period. Based on observations made by Opus staff, the parent volunteers effectively raised awareness of students and parents crossing the study intersection and alleviated crossing by creating gaps for pedestrians. However, based on conversation with the elementary school, it was indicated that the school does not have sufficient funding to implement a Safety Patrol Program. As such, adult crossing guards may not operate on a regular basis. Without their assistance, elementary school children, who may lack the ability to identify sufficient gaps, may find it more difficult to cross Keith Wilson Road.

It is therefore recommended that the elementary school seek funding to implement a Safety Patrol Program to supervise and to facilitate crossing at the marked crosswalk. Based on *Pedestrian Crossing Control Manual*, adult crossing guards should be considered when an arterial roadway is involved, when volumes range between 300 and 500 vehicles during the peak pedestrian periods, and crossing flows are between 20 and 50 children per hour. According to the data collected during the site visit, the criteria for crossing guards are met at the study intersection.

The *Pedestrian Crossing Control Manual* also suggests that adult crossing guards can be considered at signalized intersections if there are very young pedestrians (Grade 3 students or younger) as their correct use of a traffic signal control may not be adequate. The generally high vehicle speeds along Keith Wilson Road exacerbates the safety risk for pedestrians. Should a full traffic signal be installed at the intersection, there will still likely be young school pedestrians crossing at the intersection. It is therefore recommended that adult crossing guards still be considered to assist school pedestrians crossing Keith Wilson Road.

D. Improve North Side of Keith Wilson Road

To address the current illegal on-street parking on the north side of Keith Wilson Road east of the intersection, the City can consider either making the on-street parking more difficult or formally provide the parking.

Currently, the combination of a paved shoulder used as a bicycle lane along with a gravel shoulder does not impede vehicles from parking on the street and off the westbound Keith Wilson Road travel lane. It is therefore suggested that curb-and-gutter be installed to physically restrict vehicles from parking on-street. To provide greater respect for the no-stopping control, it is also suggested that a sidewalk and landscaped boulevard be considered. The existing bicycle lane can remain on the roadside, as the narrow width of it is unlikely to result in vehicles parking on it; however, moving the bicycle lane onto the curb could also be considered.

As a long term plan should the parking demand increase in the area, the City may also formally consider providing a parking lane on the north side of Keith Wilson Road. The parking lane will need to be designed to accommodate a bicycle lane, such as designing the bicycle lane between the travel lane and the parking lane. Currently, the City of Vancouver has a similar configuration for arterial bicycle lanes. The formalized bicycle lane will also allow vehicles that are currently parking in front of the Unsworth Market to park legally rather than illegally. However, the sight distance issues related to the on-street parking will remain.

E. Improve Sight Distance

Inadequate sight distance at the study intersection was identified as a safety concern that may be contributing to left-turn crossing and pedestrian conflicts and collisions. Sight distance triangles, as shown in FIGURE 8, can be used to determine the area that needs to be clear of obstructions to ensure adequate sight distance. As sight distance at the intersection is partially restricted due to landscaping, it is recommended that the City ensure that the trees, shrubs, and hedges in the northwest corner be maintained on a regular basis. It should be noted that the City may need to negotiate with the property owner to improve the sight distance on the northwest corner.

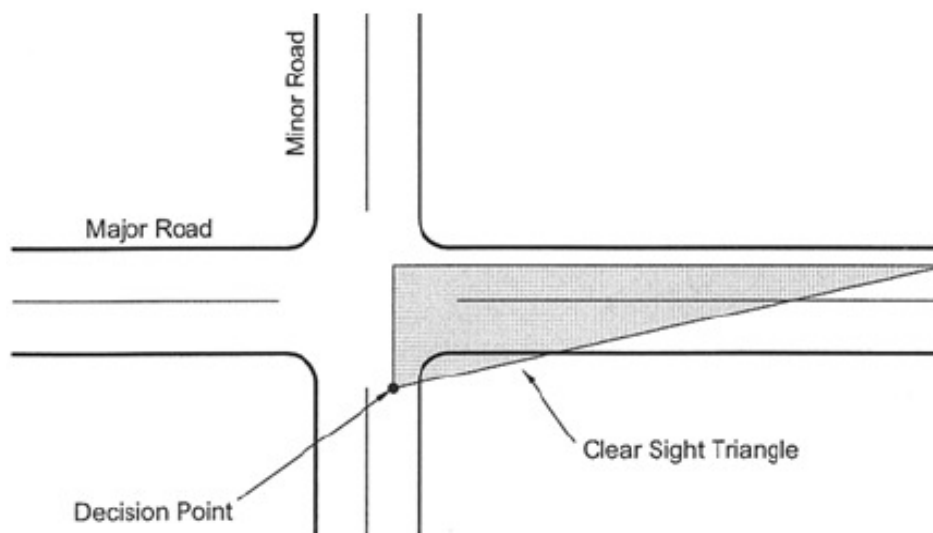


FIGURE 8 SIGHT TRIANGLE FOR DRIVER LOOKING RIGHT

It should be noted that should parking be physically restricted along the north side of Keith Wilson Road as described in the previous suggested mitigating measure, there will be improved sight distance for the southbound vehicles looking towards the east.

F. Speed Watch and Enforcement

Speeding along Keith Wilson Road was cited by City staff as well as parents and staff of the Unsworth Elementary School. Based on observations made by Opus staff, traffic generally travelled within the speed limit throughout the day; speeding was observed briefly during the morning and afternoon peak periods.

The City indicated that Speed Watch volunteers periodically set-up along Keith Wilson Road west of the study intersection to increase driver awareness of driving speeds. Periodically, the police will work together with Speed Watch crews and ticket drivers who do not alter their speeds after passing the speed reader boards. The City believes that the current Speed Watch and enforcement efforts along Keith Wilson Road are effective in maintaining the posted speed limit. It is therefore suggested that the City continue its enforcement efforts to target the study intersection. In the future, when volumes along the corridor increase and limit the number of crossing opportunities at the study intersection, it may be increasingly more important to ensure that speeds along the corridor do not exceed the posted speed limit of 50 km/hr. In addition to the existing Speed Watch Program that is operated by volunteers, the City can also consider implementing a Speed Reader Board Program that does not require volunteers. A speed reader board that provides instant feedback on driving speeds can be set-up near the study intersection to raise awareness of driving speeds. The Speed Reader Boards will also further reinforce the posted speed limits at non-school crossing times when volunteers are not present. A photograph of a speed reader board is presented in FIGURE 9.



FIGURE 9 SPEED READER BOARD



G. Parking Restrictions

During the site visit, parking along both sides of Unsworth Road was observed during the afternoon pick-up period.

On the east side of Unsworth Road, vehicles were observed to park partially onto the existing sidewalk, as the existing roadway width of 4.5 metres is insufficient to accommodate both a travel and a parking lane. Any vehicle parking on the street could also impede northbound vehicles and force them to travel onto the southbound travel lane. To address the safety issues, it is recommended that the City either reduce the northbound lane width to a maximum of 3.7 metres and install “No Stopping Anytime” signs restrict northbound on-street parking along Unsworth Road, or slightly widen the northbound lane by 1.1 metres to a width of at least 5.6 metres (3.2 metres for a travel lane consistent with a major collector road and 2.4 metres for on-street parking). The provision of northbound on-street parking can be considered as a long-term improvement should the parking demand around the school increase.

On the west side of Unsworth Road south of the school, “No Stopping Anytime” signs are already posted. At the time of this writing, school staff have been notifying drivers of the parking restriction with satisfactory compliance. It is suggested that the school and the City continue to monitor the on-street parking situation.

The issues on both sides of the road are due to limited parking on school property for student pick-up manoeuvres. To reduce the likelihood of illegal parking, parents should be encouraged to park on Elsie Road provided they are not blocking residents’ driveways and are not violating parking restrictions that may be posted on Elsie Road. At the time of the site visit, some parents were also observed to park on the east shoulder of Unsworth Road north of the marked crosswalk (sidewalk end north of the marked crosswalk). As there is sufficient width to accommodate parking on the shoulder, the school can consider informing parents and directing parents to the available parking spaces north of the marked crosswalk.

8. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the traffic safety study for the intersection of Keith Wilson Road and Unsworth Road and along Unsworth Road, it is suggested that the City consider the following recommendations:

- *Plan for Provision of Full Traffic Signal Control* – The existing traffic and pedestrian volumes at the study intersection currently do not warrant the need for a full signal or a pedestrian signal. However, with higher vehicle volumes in the future, it will likely warrant a full traffic signal by approximately 2015. The traffic signal will provide assured gaps for pedestrians crossing Keith Wilson Road, as well as reduce delays for southbound Unsworth Road traffic. The signal should also provide pedestrian signal heads with push-button control.
- *Provide Continuous Sidewalk* - To provide better connection to the existing marked crosswalk, it is recommended as a long term measure that a sidewalk be constructed on the west side of Unsworth Road alongside the bicycle route. In the meantime, the City should install signs indicating that the bicycle route is currently to be shared between both pedestrians and cyclists to clear the confusion over right-of way. The sidewalk would be consistent with the Safer City *Best Walking Route* for the school.
- *School Safety Patrol Program* - It is recommended that the elementary school seek funding to implement a Safety Patrol Program to supervise and to facilitate crossing at the marked crosswalk.
- *Install Curb-and-Gutter on North Side of Keith Wilson Road* – To address the illegal on-street parking on the north side of Keith Wilson Road east of Unsworth Road, it is suggested that a curb-and-gutter be installed. Appropriate landscaping and/or sidewalk should also be considered. As a long-term improvement measure, the City can consider providing a parking lane on the north side of Keith Wilson Road.
- *Improve Sight Distance* - As sight distance at the intersection is partially restricted due to landscaping, it is recommended that the City ensure that the trees, shrubs, and hedges in the northwest corner be maintained on a regular basis. The City may need to negotiate with the property owner to improve the sight distance on the northwest corner. The curb-and-gutter installation restricting westbound on-street parking along Keith Wilson Road will also improve the sightlines for southbound drivers.
- *Speed Watch and Enforcement* - It is therefore suggested that the City continue its enforcement and Speed Watch efforts to target the study intersection. The City can also consider implementing a Speed Reader Board Program that does not require volunteers.

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- *Parking Restrictions* - It is recommended that the City install "No Stopping Anytime" signs on the east side of Unsworth Road to ensure that drivers are aware that Unsworth Road is not intended for parking. As well, observation of vehicles illegally parking on the west side of Unsworth Road on the bicycle lane should continue. Due to limited parking on school property, parents should also be encouraged to park on Elsie Road provided they are not blocking residents' driveways and are not violating parking restrictions that may be posted on Elsie Road. As there is sufficient width to accommodate parking on the east shoulder north of the marked crosswalk, the school can consider informing parents and directing parents to the available parking spaces. The City can in the future consider widening Unsworth Road by at least 1.1 metres to allow for northbound on-street parking.

We trust that this letter report adequately documents the safety and operational issues currently occurring at the intersection of Keith Wilson Road and Unsworth Road as well as occurring Unsworth Road related to school operations. Please do not hesitate to contact us if you have any questions or wish to discuss any next steps related to this intersection.

Yours truly,

OPUS INTERNATIONAL CONSULTANTS (CANADA) LIMITED

A. APPENDIX A CROSSING CONTROL WARRANTS

A.1 Manual of Uniform Traffic Control Devices – Full Signal Warrant

Signal warrant analysis, conforming to methodologies outlined in the Transportation Association of Canada's *Manual of Uniform Traffic Control Devices* was undertaken to determine if the intersection is warranted for a full signal. The warrant identifies the need for a traffic signal based on the potential of conflict (vehicle-vehicle, and vehicle-pedestrian) and takes into consideration exposure (number of traffic lanes) and other roadway characteristics. Rather than using the average annual daily traffic (AADT) for an intersection, the methodology requires traffic counts over specific time periods. As such, the signal warrant analysis was conducted using traffic and pedestrian volumes that were collected over a six-hour period on February 10, 2010.

The traffic signal warrant for the study intersection, which shows that current traffic and pedestrian volumes do not warrant the need for a full signal, is displayed in FIGURE A.1.

It is noted that new developments in the area will likely increase traffic volumes along Keith Wilson Road. Using expected percent traffic increases as documented in the *Keith Wilson Area Development Transportation Review* (Urban Systems, 2005) and the *Webster Road Area Plan* (MVH Urban Planning & Design Inc, 2009), it is expected that an additional 630 and 590 vehicles per hour will use the intersection by 2015. This increase, when distributed over the existing volumes, will just warrant a full signal, as shown in FIGURE A.2.

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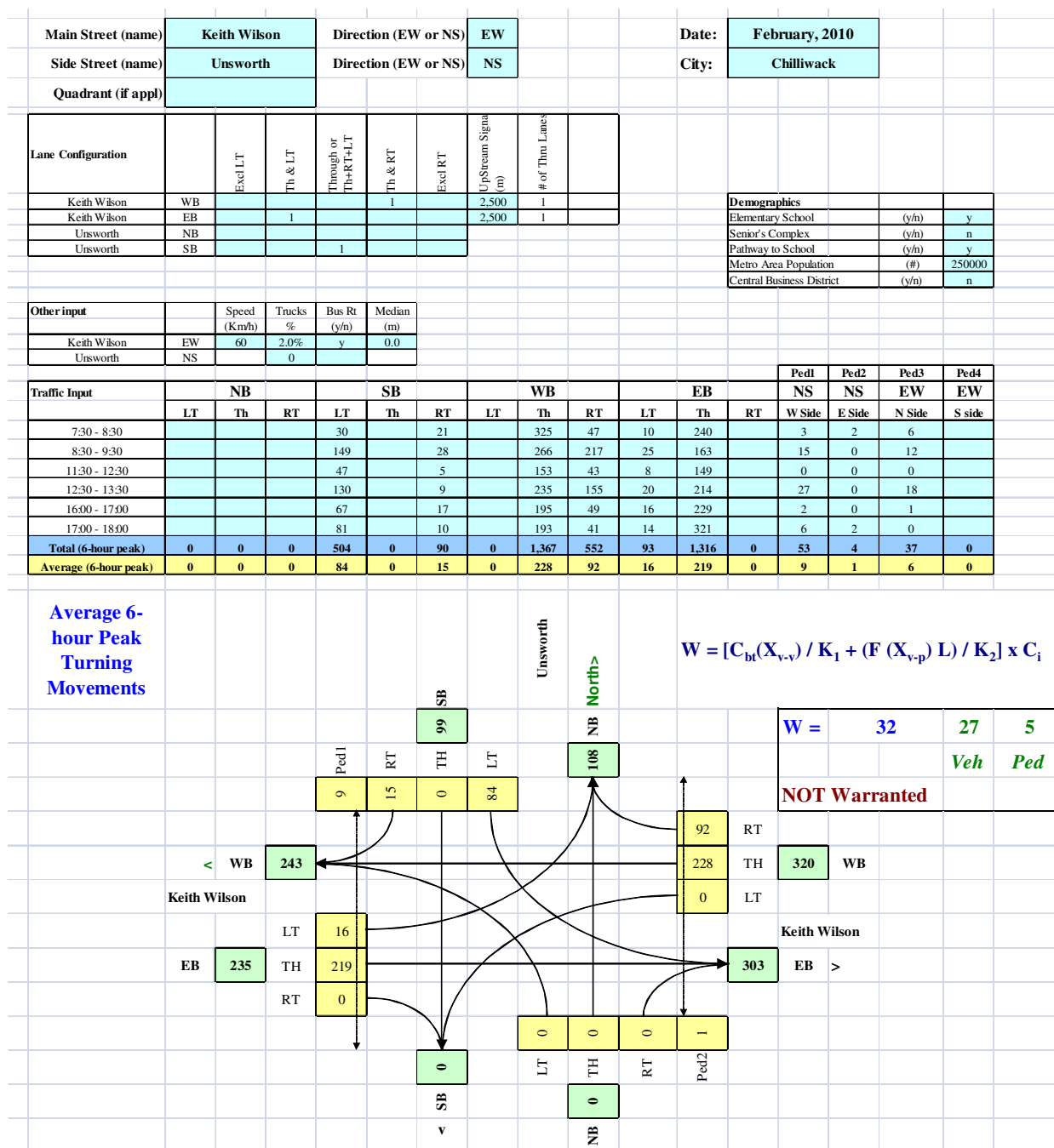


FIGURE A.1 TRAFFIC SIGNAL WARRANT – EXISTING VOLUMES

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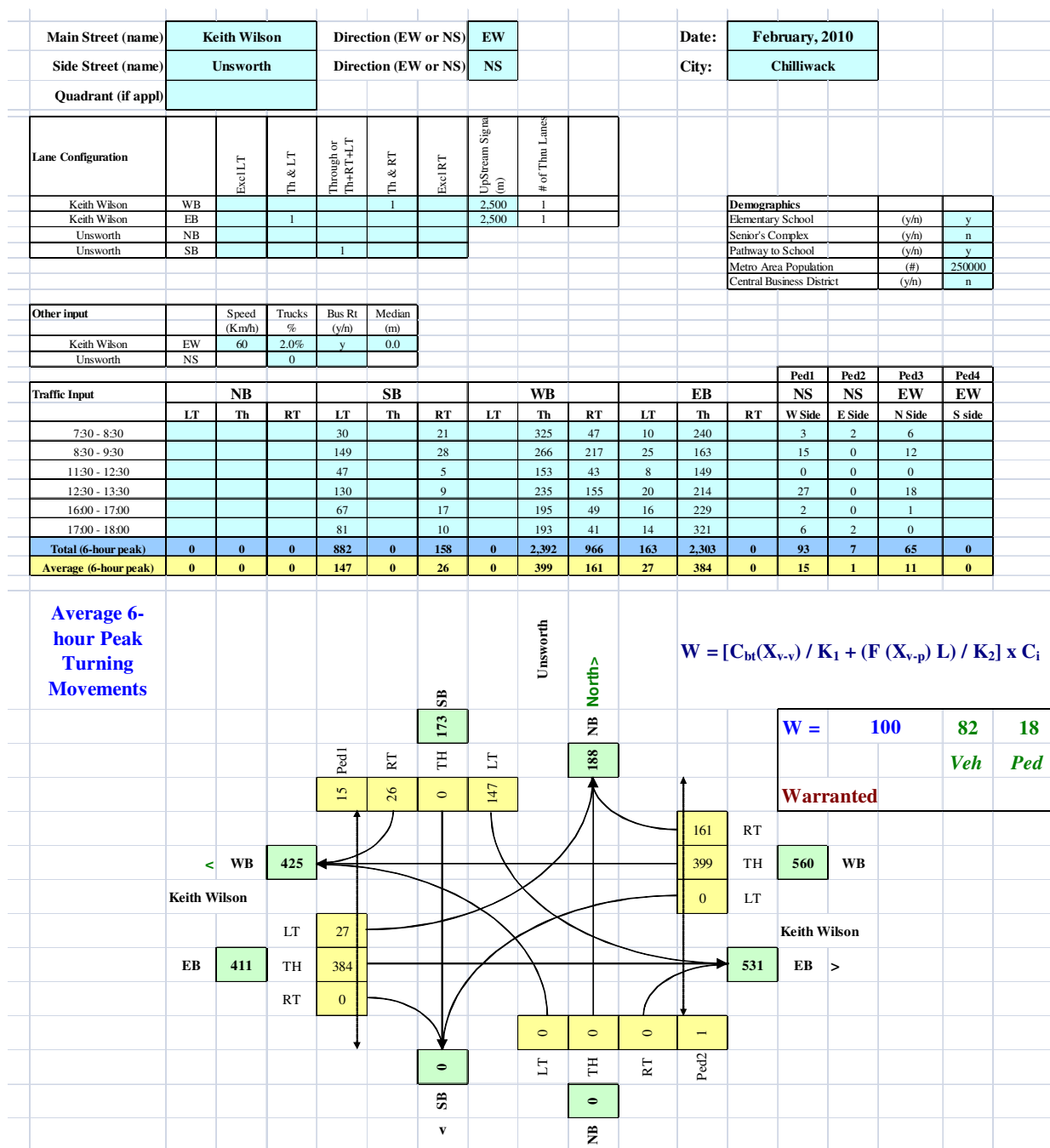


FIGURE A.2 TRAFFIC SIGNAL WARRANT – ESTIMATED 2015 VOLUMES

A.2 Pedestrian Crossing Control Manual – Pedestrian Signal Warrant

As a full signal is currently not required at the study intersection, additional analysis was conducted to determine if a pedestrian signal is warranted. The pedestrian signal warrant analysis was conducted according to the methodologies outlined in the Transportation Association of Canada's *Pedestrian Crossing Control Manual*. The methodology identifies various traffic control devices based on crossing opportunity and pedestrian volume, which is adjusted according to pedestrian age (child, adult, senior) to reflect crossing abilities. The adjusted pedestrian volumes are referred to as equivalent adult units (EAUs).

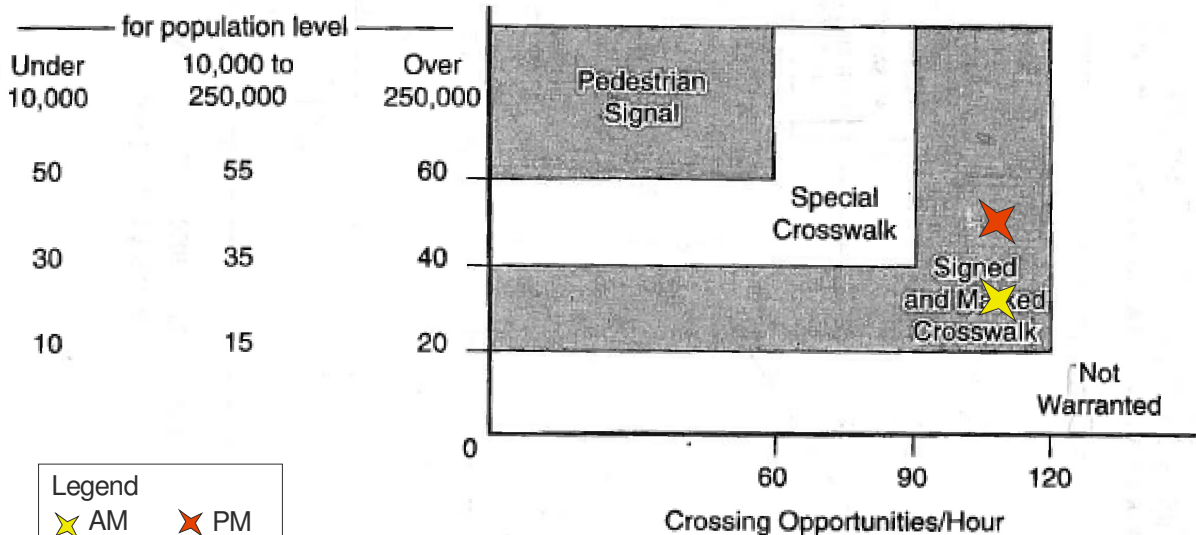
The equivalent adult units for the study intersection during the peak periods, which are based on the pedestrian count conducted on February 10, 2010, are summarized in TABLE A.1.

TABLE A.1 EQUIVALENT ADULT UNITS AT STUDY INTERSECTION

	Morning Peak Period			Afternoon Peak Period		
	Number	Factor	EAU	Number	Factor	EAU
Children	11	2	22	18	2	36
Adults	4	1	4	9	1	9
TOTAL EAU	26			45		

The pedestrian signal warrant was applied based on the adjusted pedestrian volumes and the number of crossing opportunities. As already mentioned, the gap study determined that there are approximately 115 crossing opportunities per hour at the study intersection. The pedestrian crossing control warrant chart for this study location is shown in FIGURE A.3.

Number of Pedestrians Per Hour (EAU)



1258-7

FIGURE A.3 PEDESTRIAN CROSSING CONTROL WARRANT – EXISTING VOLUMES

- At present, pedestrian activity and the number of crossing opportunities do not warrant the need for a pedestrian signal at the study intersection.
- As crossing opportunities is a function of traffic volumes, it is estimated that two-way traffic volumes of approximately 1,200 vehicles will result in less than 60 crossing opportunities per hour. Traffic volume growth along Keith Wilson Road would need to increase by about 60 percent to reach the required number to consider a pedestrian signal. As well, the number of crossing pedestrians would need to increase by 25 percent. These values are not expected to be reached until 2018.