



REGION OF WATERLOO

TRANSPORTATION AND ENVIRONMENTAL SERVICES
Transportation

TO: Chair Jim Wideman and Members of the Planning and Works Committee

DATE: March 19, 2013

FILE CODE: T11-60/CM

**SUBJECT: PEDESTRIAN COLLISION COUNTERMEASURE REVIEW AT THE
KING STREET (REGIONAL ROAD 15) AND UNIVERSITY AVENUE
(REGIONAL ROAD 57) INTERSECTION, IN THE CITY OF WATERLOO**

RECOMMENDATION:

THAT the Regional Municipality approve the recommendations to enhance pedestrian safety at the intersection of King Street (Regional Road 15) and University Avenue (Regional Road 57) in the City of Waterloo as outlined in Report E-13-027, dated March 19, 2013.

SUMMARY:

NIL

REPORT:

At the September 11, 2012 Planning and Works Committee meeting, members of the committee requested staff to provide a report addressing pedestrian safety and potential countermeasures to address pedestrian collisions at the King Street (Regional Road 15) /University Avenue (Regional Road 57) intersection, in the City of Waterloo.

King Street and University Avenue is a signalized intersection where King Street runs north-south and University Avenue runs east-west. The estimated daily traffic at the intersection is 40,000 vehicles per day with an average annual daily pedestrian volume of approximately 6,000 pedestrians per day. Figure 1 shows the King Street /University Avenue intersection.

Figure 1: King Street and University Avenue Intersection



Collision Analysis

A review of collisions between September 2007 and September 2012 shows that the King Street /University Avenue intersection experienced a total of 12 collisions involving pedestrians where 2 were expected based on the Region’s collision prediction model. Any pedestrian collision occurring within 50 metres of the intersection has been included within this summary. A summary of the pedestrian collisions by year is shown in Table 1.

Table 1 – Pedestrian Collisions by Year

Year	From Sep. 2007	2008	2009	2010	2011	To Sep. 2012
Pedestrian Collisions	0	1	2	2	4	3

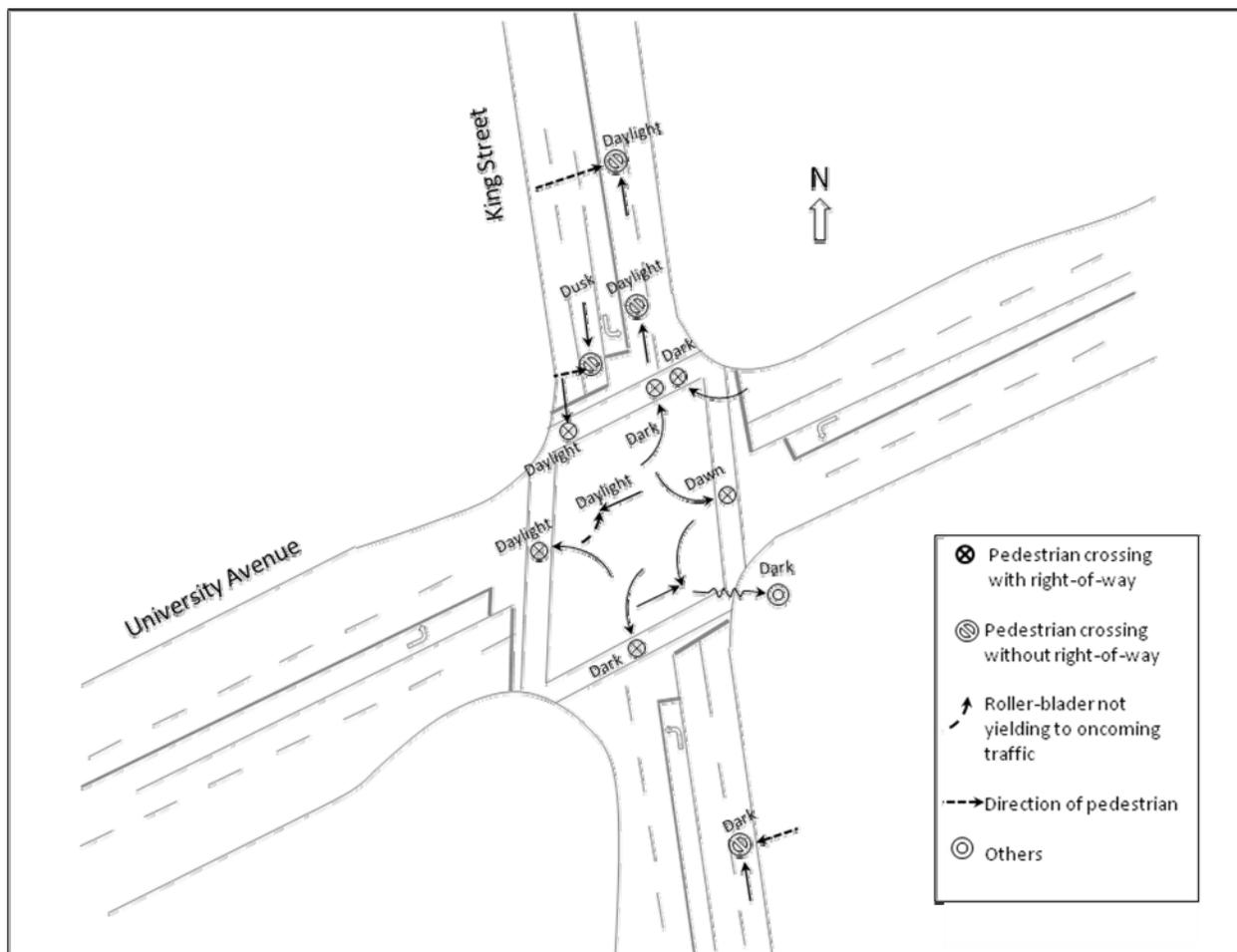
Of the 12 pedestrian collisions, 1 collision occurred in each of the east, west and south crosswalks and 3 collisions occurred in north crosswalk. The collision history also shows that 4 collisions occurred within the midblock section downstream of the intersection (3 just north of the intersection and 1 just south of the intersection). A single collision occurred in the middle of the

intersection involving a roller-blader turning left and not yielding to oncoming traffic. A single collision occurred as a result of 2 cars colliding and careening into waiting pedestrians.

The review identified that 4 collisions involved left-turning motorists and 1 collision involved a right-turning motorist. A detailed assessment of the pedestrian collisions by time of day shows that 8 pedestrian collisions occurred during low light conditions and 4 occurred during daylight conditions. Further review shows that of the 12 total collisions, 6 collisions occurred where the pedestrian had the right-of-way and a motorist failed to yield, and 5 collisions occurred where the pedestrian disobeyed the traffic control.

A diagram of the pedestrian collisions between September 2007 and September 2012 is shown in Figure 2.

Figure 2 – Pedestrian Collision Diagram (September 2007 – September 2012)



This intersection also experienced a total of 121 collisions where 66 were expected between 2007 and 2011 ranking it 6th overall for most unexpected collisions in 2011. The majority of collisions (71%) involve rear-end and turning type collisions.

Countermeasures

Transportation staff considered a number of potential countermeasures to minimize pedestrian collisions at the King Street /University Avenue intersection. Table 2 is a summary of

countermeasures considered.

Table 2: Pedestrian Collision Countermeasures Considered

	Countermeasures	Positive Impacts	Negative Impacts	Crash Reduction Factor (CRF)	Impact on Pedestrian Collisions at King St /University Ave
1	Traffic Signal Operation				
	Fully Protected Left-Turn Phase (All approaches)	1. Remove pedestrian /vehicle conflicts when vehicles turn left 2. Reduce turning movement collisions (33 collisions in 5 years)	1. Reduces the left-turn lane capacity 2. Cause delays to vehicles turning left and increase vehicle queues 3. Increase pollution (noise /carbon) 4. Degrades overall intersection operation	Unknown	Effective
	No Right Turn on Red	1. Remove pedestrian /vehicle conflicts when vehicles turn right	1. Will cause delays to vehicles turning right 2. Enforcement will be required	Unknown	Unknown
	Exclusive Pedestrian Phase (Scramble Pedestrian Phase)	1. Pedestrian has exclusive signal phase in all four directions 2. Eliminate pedestrian /vehicle conflict	1. No turning permitted 2. Increase pedestrian delays 3. Increase vehicles delays 4. Pedestrians would wait longer to get an exclusive phase which may increase non compliance of pedestrians. 5. Increase pollution (noise /carbon) 6. Not coordinated with other signals	Unknown	Unknown
	Pedestrian Countdown Signals	1. Improve pedestrian crossing behaviour, such as fewer pedestrians running or aborting crossings and fewer pedestrians trapped in crosswalks when a signal turns red	1. Not accessible to pedestrians with impaired vision	18%	Minimal
2	Pavement Markings				
	Ladder Marking Crosswalk	1. Ladder crosswalks are more visible to the driver and therefore better define pedestrian areas.	1. Reduced road surface friction	61%	Effective
	Offset Pedestrian Crosswalks	1. Provides space between crosswalk and opposing traffic 2. Increased space for motorist perception /reaction	1. May require slightly longer all-red traffic signal phase	Unknown	Unknown
3	Illumination				
	Flood Lighting the crosswalk	1. It will light the pedestrian and crosswalk beyond Regional standards	1. More energy consumption	62%	Minimal
	LED Street Lighting	1. Brighter light at the crosswalks than existing lighting 2. Less Energy consumption		Unknown	Unknown
	In-Pavement Lighted Markers	1. It will light the crosswalk and make it prominent to vehicles during low light	1. In winter, snow may cover the lights and reduce the visibility	Unknown	Unknown
4	Design Elements				
	Roundabout	1. Slower speeds means drivers have more time to judge and react to pedestrians 2. A pedestrian has two crossings of one-way traffic moving at slower speeds	1. Property requirements and construction cost	40 % to 60 %	Effective
	Median Island	1. Pedestrian refuge 2. Host signal infrastructure 3. Slow down turning motorists	1. Property requirements and construction cost	80%	Effective

Transportation staff recently completed a review of the existing illumination at the King Street /University Avenue intersection. It was identified that street lighting can be added to the northwest corner of the intersection. As such staff has planned the installation of additional street lighting in March 2013.

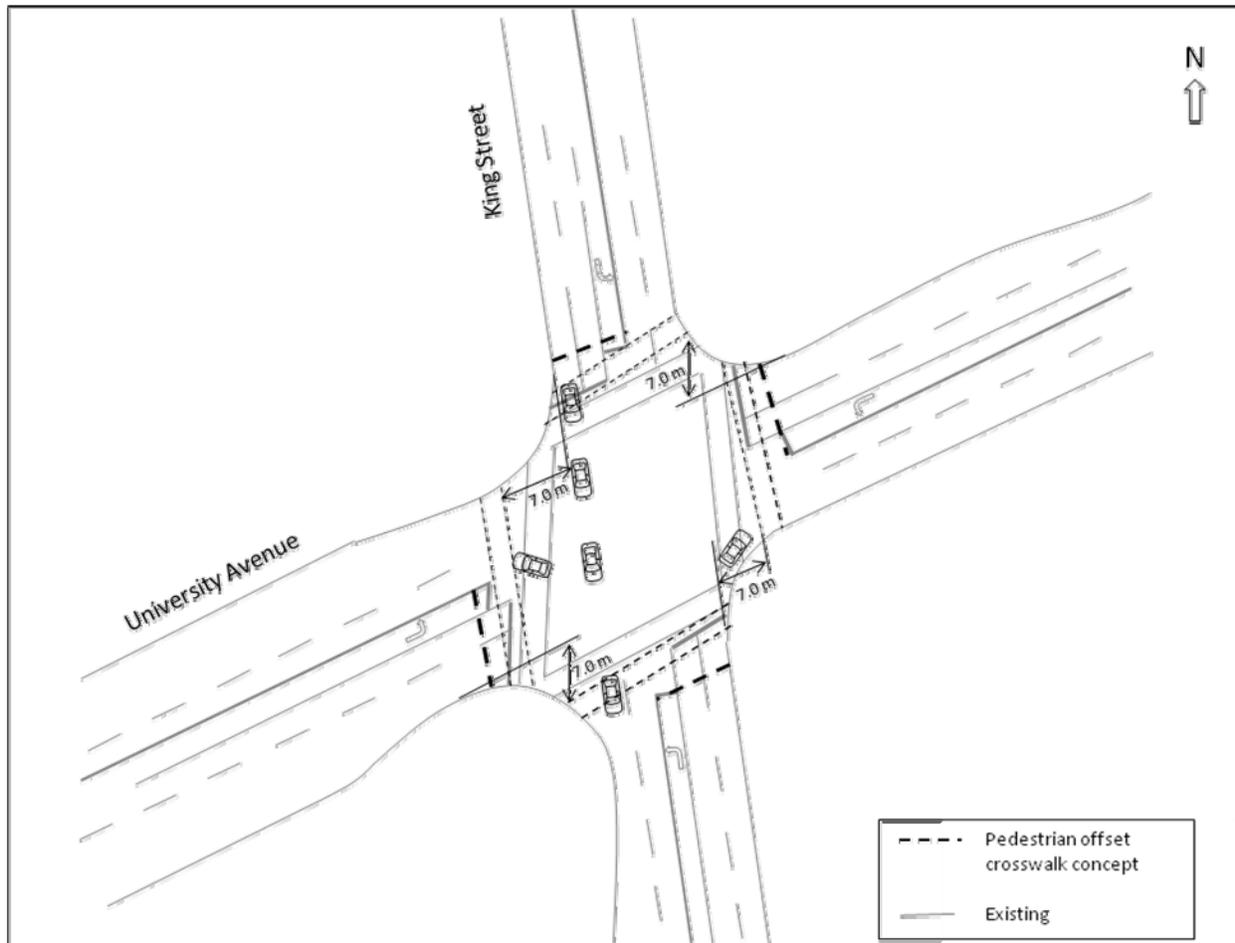
Pedestrian countdown signals (PCS) are already planned to be installed in 2013 at the King Street /University Avenue intersection based on the Region’s annual PCS program. PCS have

shown an 18% decrease in pedestrian collisions at signalized intersections based on Regional studies.

In addition to the aforementioned countermeasures, the King Street /University Avenue intersection warrants the installation of ladder crosswalk markings. Ladder crosswalk markings can potentially reduce pedestrian collisions occurring at intersections by 61% based on Regional studies, however, there are interlocking brick crosswalks at the intersection currently preventing installation of ladder crosswalk markings. As an interim measure, temporary ladder crosswalks can be painted onto the existing crosswalk. Typically plastic markings are used to mark ladder crosswalks for longevity.

Staff also believes setback crosswalks can minimize pedestrian collisions as they will provide motorists more time to react to crossing pedestrians when turning left or right as well as provide room for a motorist to stop and not be in conflict with on-coming vehicles. Like roundabout crosswalks, offset crosswalks at traffic signals provide storage for 1 stopped vehicle and allows pedestrians to cross roadways where the speed of turning vehicles remains slow. Situating the crosswalk further downstream of the intersection would unduly expose pedestrians to higher motorist speed and take pedestrians away from their desired travel path which is not preferred. For these reasons and similar to roundabout design, staff prefer offset crosswalks at traffic signals to be situated no more than 5-7 metres from the conflicting vehicular path. Figure 3 shows a draft concept of the setback design. Similar to ladder markings, the existing interlocking brick is currently preventing installation of offset crosswalks.

Figure 3 – Draft Concept of Setback Crosswalk



Studies have found that the presence of a pedestrian refuge island and or a median island is associated with 40% fewer pedestrian collisions. Local research has found positive results as well. In 2006 a median island was installed on the 4-lane section of Weber Street between Fergus Avenue and Kinzie Avenue to mitigate pedestrian crossing collisions. Over a 5-year period, that stretch of Weber Street saw 5 pedestrians struck by motorists prior to the installation of a median island. By comparison, only 1 pedestrian collision occurred in the 5-year period after the installation of the median island representing an 80% reduction in pedestrian collisions attributable to the median island. Staff believes the presence of median islands at this intersection would slow down turning motorists and provide a place of refuge for pedestrians crossing outside of the intersection, however property constraints prevent the installation of these median islands.

RECOMMENDATIONS:

In addition to pedestrian collision countermeasures already planned for 2013 (additional street lighting and PCS), staff is recommending the following countermeasures to improve pedestrian safety at the intersection of University Avenue and King Street:

- Temporarily paint ladder crosswalks onto existing brick crosswalks, in 2013
- Remove brick crosswalks in 2014; and
- Install offset ladder crosswalks.

Staff expects the pedestrian collision countermeasures planned and recommended for this intersection will reduce the frequency of pedestrian collisions occurring at or near this intersection by a combined total of 68% or more. Staff is also carefully reviewing the concept, impacts and feasibility of constructing raised crosswalks at this location. If feasible, staff may consider incorporating raised crosswalks into the design of this intersection for construction in 2014. At this time staff has no applicable countermeasures to address rear-end and turning movement type collisions that are also occurring at this intersection. A more detailed review of motor vehicle collisions at this intersection will be provided as part of the 2012 annual collision report anticipated to be presented in September 2013.

Staff from the City of Waterloo has been consulted and support these recommendations.

CORPORATE STRATEGIC PLAN:

This report addresses the Region's goal to implement proven roadway safety strategies and education to enhance the safety of our roadways (Strategic Objective 3.3.2).

FINANCIAL IMPLICATIONS:

The estimated cost of implementing the recommended pedestrian collision countermeasures (removal of brick crosswalks and installation of offset ladder crosswalks) is \$75,000. Funding for these countermeasures will be considered in the development of the 2014 Transportation Capital Program. The cost to paint temporary ladder markings on brick crosswalks is \$2,000.00 and is included in the 2013 Transportation Maintenance budget.

OTHER DEPARTMENT CONSULTATIONS/CONCURRENCE:

NIL

ATTACHMENTS:

NIL

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