A PILOT STUDY EVALUATING TECHNIQUES FOR COMPARING ROUNDABOUTS TO ALL-WAY STOP CONTROLLED INTERSECTIONS

by

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Executive Summary

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This report is a pilot study using existing traffic evaluation techniques to compare roundabout intersections with all-way stop controlled (AWSC) intersections. The study will examine two intersections, quite near to each other in a suburban neighbourhood in the City of Vaughan, north of Toronto, Ontario. The area was selected due the presence of a roundabout intersection, which will be compared with an all-way stop controlled intersection sharing a common collector street. Roundabout intersections, while still fairly rare, are becoming more common in North America. Because both intersections are located in the same neighbourhood many of the potential influencing factors from the surrounding community would be relatively equivalent, leaving the differences to be those caused by the properties of each intersection type.

The all-way stop control intersection is a standard in many suburban communities, with a stop sign at each leg entering the intersection. The roundabout differs by having

each lane yield before entering the circular path, then exiting to the outside of the circle at the desired exit.

The methodology used was divided into four main sections:

1. Vehicular Performance
2. Accidents Rates / Safety
3. Pedestrian Interaction and
4. Streetscape / Neighbourhood Fit.

The main objective of the first section was to analyze the intersections from a purely objective performance perspective. The intersections were the subject of a traffic study, which monitored the vehicular flow through both intersections at peak times and monitored delays and queue length. Data from the traffic study showed that the roundabout had a peak traffic flow of 212 vehicles per hour, while the AWSC intersection handled 192 vehicles per hour. This is significantly lower than their calculated capacities. The roundabout's calculated capacity had a range of between 1,266 to 2,071 depending on which leg was analyzed and the AWSC was calculated to have a capacity of 1,220 vehicles per hour. This analysis also showed that while the roundabout handled a slightly higher volume of traffic, it had lower numbers of delays and they were shorter. Although the following table does not apply to roundabouts specifically, the roundabout scored a higher level of service using the delay criteria shown.

Exhibit A – Level of Service Criteria for Un-signalized Intersections

Level of Service	Delay
A	0-5 seconds
B	> 5-10 seconds
C	> 10-20 seconds
D	> 20-30 seconds
E	> 30-45 seconds
F	> 45 seconds

Source: *Chapter 10, HCM-94,* Transportation Research Board 1994

Both the roundabout and AWSC intersections were well within their calculated capacity. Using the criteria for the table the roundabout had a service level of 'A', while the AWSC intersection had a level of service rating of "B" due to longer delays as multiple vehicles had to stop before proceeding. Other studies have also shown that over a given range of traffic volume, roundabouts have higher level of service than AWSC intersections.

The second major section of comparison was Accident Rates and Safety. While not much information was available for the two intersections being compared, there have been significant studies in other areas comparing accident rates at roundabouts with other intersection types. In one study, stop sign controlled intersections were converted to roundabouts, with accident rates studied for a period afterwards and compared to an equivalent period before conversion. The results showed a decrease of 37% in total accidents, and a 77% drop in 'serious' accidents involving injury. Other studies showed similarly that accidents were fewer, and those accidents that did occur were less serious 'sideswipe' type accidents instead of head-on or side-impact collisions.

One accident study done in France, however, indicated that bicycles might be worse off in roundabouts compared to other intersection types. With traffic constantly moving in

a roundabout, and the nature of accidents being sideswipe-type accidents, cyclists (relying on balance at slow speeds) are quite susceptible to accidents, and had more severe accidents. The two intersections being compared did not have any data available on cyclist activity, so it is not certain how relevant cyclist accident data might be for these two intersections.

The third section of the report focused on the Impact on Pedestrians. Pedestrian movement is important in residential communities, and the characteristics of the intersections can affect the quality of the environment for pedestrians. This is particularly relevant when crossing the street. AWSC intersections require all vehicles to stop, but the crossing is longer and must be done all at once. The roundabout intersection had a shorter crossing distance, has fewer conflict points making crossing less complicated for pedestrians, and has a center island at mid-crossing to allow slower pedestrians to pause if a vehicle should approach.

While all the data was not available for a modified Pedestrian Level of Service mathematical formula, several of the criteria were subjectively used to compare the intersections. While the AWSC intersection has the advantage of sidewalks that follow straight paths along the length of the block, roundabouts have small pedestrian islands allowing half the street to be crossed at a time. These islands mean that the pedestrian to watch only one leg of traffic at a time, and has more time to safely cross the intersection. Based on the level of service criteria, the roundabout seemed to be more favourable to pedestrians.

The final aspect of the comparison involved the streetscape and neighbourhood fit. This affects the quality of life for the residents who live in the area, and see and use the intersections on a regular basis. A roundabout may become a feature for the neighbourhood. It is visually engaging, and provides a sense of presence not found with the standard AWSC intersection.

Roundabout maintenance may become an issue. The central garden feature is a positive addition to the area while properly maintained, but could easily become an eyesore if not kept up. Although maintenance is often though to be a problem for roundabouts, many jurisdictions operating with roundabouts in snowy conditions simply cited a period of adjustment, but no real problems.

Overall, the pilot study to compare the two intersections found that the roundabout functioned very well in the given neighbourhood. The study not only showed that the roundabout could give planners a functional alternative for residential community planning, but showed that the comparison of roundabouts and other intersection types can be useful using standard traffic analysis methods.