SUBJECT: Use of Roundabouts in the City of Hamilton (PW08078) - (City Wide) Public Works Outstanding Business List

RECOMMENDATION:

(a) That the policy for installing modern roundabouts as per “Installation of Modern Roundabouts”, outlined in Report PW08078 as Appendix A, be adopted;

(b) That the policy for installing neighbourhood mini-roundabouts as “Installation of Neighbourhood Mini-Roundabouts”, outlined in Report PW08078 as Appendix B, be adopted;

(c) That initial installations of neighbourhood mini-roundabouts be funded from the Annual Traffic Calming capital budget, up to a maximum amount of $50,000, subject to funding availability;

(d) That the item relating to implementation of roundabouts in Ward 4 be removed from the Public Works Committee Outstanding Business List.

Scott Stewart, C.E.T.
General Manager
Public Works

EXECUTIVE SUMMARY:

This report recommends a comprehensive policy for the installation of both modern roundabouts, primarily designed for arterial and collector road systems, and neighbourhood mini-roundabouts, used on local, residential streets. Modern roundabouts are designed primarily as traffic control devices, while neighbourhood mini-roundabouts are primarily to be used as traffic calming devices, or to replace all-way...
stop control. Either device can be used to assist in rectifying safety issues, operational problems or to make environmental improvements.

Unlike older style and much larger traffic circles, modern roundabouts have evolved into a highly efficient, safe and environmentally responsible form of intersection control in North America. While there may be only a few dozen in Canada, the USA now has over 1000 modern roundabouts. Jurisdictions in both countries have ambitious programs to expand the use of roundabouts. The Insurance Corporation of British Columbia (ICBC) sponsors a funding program for roundabout installation in order to help reduce serious crashes, particularly crashes involving bodily injury. The Regional Municipality of Waterloo has established a policy to consider roundabouts at new and existing intersections in order to enhance public safety.

The unique design characteristics of a modern roundabout inherently produce advantages over traffic signal or stop controlled intersections. The primary benefits include:

- Improved safety by virtue of design elements which encourage slower vehicle speeds and significantly reduce the number of conflict points. North American studies have shown injury collisions to be diminished by up to 90%.
- Higher efficiency when compared to intersections with similar volumes. Roundabouts consistently outperform traditional intersection resulting in shorter queueing, reduced delays and improved traffic flow.
- Lower environmental impact due to the efficiency advantage of roundabouts. The community benefits from lower fuel consumption and reduced greenhouse gas emissions.
- Opportunity for improved aesthetics as compared to other types of intersections. Communities, or entrances to neighbourhoods, can be highlighted and enhanced through landscaping or the presence of centre pieces such as statues and fountains within the roundbout.

Although the recommendation is not to carry out a widespread retrofit conversion of existing intersections and replace them with roundabouts, there are opportunities within current practices to implement roundabouts rather than traditional intersection controls in order to take advantages of the benefits. When justified, roundabouts are recommended for installation at the following locations:

- Existing intersections which may be experiencing capacity problems, those operating at poor levels of service or those which have collision problems are locations which could be improved by conversion to roundabouts.
- Given the overall benefits of roundabouts, all locations which meet or will meet future all-way stop or traffic signal warrants should be studied for feasibility of installing roundabouts as a first option.
- Capital Works program: as part of the annual roadway improvement capital program, locations which will be subject to major reconstruction should be considered candidates for roundabout conversions and should be reviewed to determine the feasibility of roundabout implementation.
- Development-related intersections: the best opportunities to implement roundabouts will occur through the development process where major issues, such as land requirements and construction costs, can be most easily dealt with, and roundabouts can be integrated into the overall design concept.
At neighbourhood intersections where traffic signals have been installed and may not be warranted, resulting in traffic patterns with unnecessary delays, and therefore increased vehicle emissions.

The mini-roundabout is a scaled down, retrofit version of the modern roundabout, with similar design elements but simplified to be specific to lower volume, narrower roadways. This is the device which is appropriate for neighbourhood applications as intended by the outstanding business list item requesting to implement roundabouts in Ward 4. A City-wide policy has been developed for the applicability of the neighbourhood mini-roundabouts. The neighbourhood mini-roundabout can be used to enhance safety and environmental issues which currently may not be addressed by existing traffic controls. The application of neighbourhood mini-roundabouts complements the evaluation process of the City’s Traffic Calming policy. It is proposed that installation be responsive and based on specific problems, as it would be too expensive to carry out on a widespread replacement program at this time. Both all-way stop and traffic signal controls could potentially be replaced with neighbourhood mini-roundabouts in order to alleviate safety and/or delay problems.

Based on current practice and experience with roundabouts in North America and within the Hamilton area, modern roundabouts can have an important role to play in safely managing traffic while providing an environmentally responsible service. In order to ensure best use of roundabouts, it is critical that a comprehensive intersection control study, reviewing the factors listed as outlined in Report PW08078 as Appendix C, be undertaken before they are recommended for implementation. It is equally important to consult with key user groups to further maximize their effectiveness and to acquire community buy-in. In addition to public consultation, staff will be requesting input from a number of internal and external agencies.

The current process for reviewing requests and opportunities for roundabout installation on major roadways involves following Class Environmental Assessment (EA) regulations to ensure public input and thorough site assessment, although it is not required to submit a full project file report to the Ministry of Environment. As public exposure to roundabouts increases, the need for the lengthy and costly public information centre (PIC) process could eventually be replaced by a City wide public relations program including media campaigns, a comprehensive roundabout website, information brochures etc.

**BACKGROUND:**

The information/recommendations contained within this report have city wide implications.

**History**

Modern roundabouts are circular intersections with specific design elements and traffic control features which together result in a safer and more efficient intersection layout than traditional traffic controls. The first roundabouts were originally constructed in France, the United States and Great Britain in the early 1900's. However, the widespread use of roundabouts began when the British re-engineered the traffic circle in the mid-1960’s to overcome its limitations of capacity and for safety issues. Thus, the ‘modern roundabout’ was born.
Roundabouts or Traffic Circles

Many people in North America confuse modern roundabouts with old-style traffic circles. Unfortunately, our experience is primarily based on rotary style interchanges, such as the former QEW/Hwy 20 (see Figure 1), as well as the larger traffic circles as seen at Queenston Rd./Main St./Strathearn Ave. (Figure 2). The design at both of these intersections does not slow traffic before entering the circle and also operates with the right-of-way in favour of the entering vehicles. Those motorists which happen to be travelling within the circle must yield before making their exit. This type of operation reduces overall safety and results in a less efficient traffic flow. The Highway 20/QEW interchange, in particular, had large weaving sections which resulted in high collision frequencies.

While both a traffic circle and a modern roundabout are circular intersections, the similarities end there. A modern roundabout such as Southern Ontario’s first, constructed in Ancaster in 2002 (Figure 3) eliminates the problems associated with its predecessors, namely high vehicle speeds, weaving, high collision frequency and yield of circulating vehicles.

Traffic calming circles or mini-roundabouts are small traffic circles in residential areas. Large vehicles are usually accommodated only through special provisions, or must turn left in advance of the circle in opposition to other traffic. Splitter islands are often not provided. An example of a mini-roundabout is shown in Figure 4.
Modern roundabouts integrate design parameters to help reduce vehicle speeds both on approaches as well as in the circulatory road. They are also configured to improve efficiency and help to reduce air pollution. More specifically, roundabouts have three features that distinguish them from traffic circles and rotaries: Yield on Entry, Deflection, and Approach Flare:

- **Yield on Entry**: Yielding takes place on all entries, so traffic is stored there rather than in the circle. No weaving is necessary because motorists chose their lane before entering.
- **Deflection**: Motorists from all approaches are deflected around the central island, which slows traffic, promotes yielding, and increases safety.
- **Flare**: The approaches often flare at entry to increase capacity where it's needed. This means roundabouts can be compact and not require road widening upstream.

**Modern Roundabouts in North America**

Despite the tens of thousands of roundabouts in operation around the world, there are relatively few in Canada. However, given the huge positive impact roundabouts are having on safety and traffic congestion, numerous are planned or undergoing feasibility studies. Until recently, roundabouts have been slow to gain support in this country. Those that are currently in operation have been reported to be performing favourably, when compared with conventional controlled intersections (i.e., stop signs or traffic signals), resulting in improved safety, shorter delays, increased capacity, and improved aesthetics.

The Regional Municipality of Waterloo is recognized as the Country's modern roundabout leader. Following the lead set by the installation of the Ancaster roundabout, Waterloo Region now has 11 modern roundabouts constructed on Regional roadways alone. Several others are found on City streets. Ira Needles Boulevard is a new five kilometre long arterial road corridor on the west side of Kitchener-Waterloo. A unique feature of Ira Needles Boulevard is that it has five consecutive roundabouts and no traffic signals along its entire length, making it one of the first arterial roads of its kind in Canada.

There are now well over 1000 modern roundabouts in the USA and the number is continuing to grow at a considerable pace. The primary reason for the increasing presence of roundabouts is their ability to improve intersection safety. Figure 5 below highlights some of the key components that make up a modern roundabout.
Where to Consider Roundabouts

Because of their physical characteristics and flexibility in design, roundabouts can resolve difficult design problems such as unconventional geometry or unusual conditions. There are, however, circumstances in which a roundabout may not be desirable and therefore requires further review. Appendix C highlights a detailed list of preferred conditions as well as factors which may recommend against the installation of roundabouts.

The conditions which will be considered as preferred locations (subject to the considerations in Appendix C) for roundabout implementation in the City Of Hamilton are as follows:

- Where capacity or safety problems have been identified at an existing intersection. As identified previously, roundabouts have the ability to provide greater capacity than traffic signals or stop controlled intersections. Overall safety is also improved by slower intersection speeds and by reducing the number of conflict points from 32 for a typical four leg intersection to 12 for a roundabout. The types of collisions which do occur are generally less severe than those at right-angle intersections.

- Where traffic signals or all-way stops are warranted or expected to be warranted in the near future at existing or proposed intersections. If feasible, implementing properly designed roundabouts rather than all-way stops or traffic signals provides safety, efficiency and environmental benefits for all users.

- Where, as part of a larger capital project, suitable intersections are identified as potential sites. There is a potential significant cost savings associated with this
option as planned roadway re-construction usually requires removal of existing asphalt, granular material, curbing, sidewalks etc.

- Where, through the development process, new intersections are introduced. The biggest challenge to roundabout installation normally is the land requirement. Development submissions can be approved subject to conditions such as provision of sufficient property to accommodate construction of a roundabout. In most cases there would be no or little cost to the City under this process.

**Neighbourhood Mini-roundabouts**

At the Public Works Committee meeting of October 4, 2004, staff was directed to (review the traffic calming options and) report back on the feasibility of installing roundabouts in Ward 4.

Mini-roundabouts are smaller in size, (13-25m in overall outside diameter). They are designed as a traffic control method for lower volume roadways experiencing less than 10,000 vehicles per day. Typically mini-roundabouts have the features of roundabouts but designed to have a painted or mountable central island in order to allow large vehicles, such as school buses, delivery and maintenance vehicles, full access through the intersection (see Figure 6). One drawback to this type is that deflection is encouraged mainly through pavement markings rather than a physical deflector. The Hamilton version of a mini-roundabout will be referred to as a “neighbourhood mini-roundabout”, which will allow design variations to accommodate large vehicles while maintaining slower vehicle speeds.

Requests for neighbourhood mini-roundabouts are normally received because of their capacity to address neighbourhood speeding concerns; however, they do not come without challenges. Often a choice must be made between providing access for large trucks or maximizing reduction of vehicle speeds. While accessibility for large trucks may be an important requirement at some locations, the use of mini-roundabouts can often compromise the ability to reduce vehicle speeds if the central island is painted only or mountable. The type of speed reduction typically preferred on neighbourhood roadways is better accomplished by mini-roundabouts with splitter islands and a raised central island to allow for vehicle deflection, thus designed for slower speeds. The TAC publication “Canadian Guide to Traffic Calming” indicates that traffic circles with raised central islands have a significant impact on reducing speeds, particularly when two or more a placed in succession.

Neighbourhood mini-roundabouts are the preferred intersection control currently being recommended in planning act applications, where they can be incorporated in the design eliminating issues with land availability. In established neighbourhoods, where there is little room for widenings, it may be desirable to implement a hybrid type of mini-roundabout having a small raised central island and mountable splitter islands to allow larger trucks to turn to the left of the central island as in Figure 6. This would provide a combination of, both, the traffic calming effect as well as access to larger vehicles. Experience with this type of design in Ancaster (Figure 7) revealed that there is some deliberate non-compliance by local drivers intentionally turning to the left of the central island simply for convenience. While this occasional defiance causes concern for some locals, the roundabouts’ safety record is excellent.
The selection criteria for neighbourhood mini-roundabouts are outlined in the policy document “Installation of Neighbourhood Mini-Roundabouts” (Appendix B).

This policy will allow the flexibility of selecting the final design of neighbourhood mini-roundabouts depending on the physical characteristics of the intersection combined with the preferred design vehicle. A feasibility study will be conducted for each class of intersection to determine whether a neighbourhood mini-roundabout should consist of mountable or raised islands, or possibly a combination of both. Where possible, a landscape treatment for the central island will be included. Staff will work closely with the Forestry and Horticulture Section to determine the most feasible treatment.

Locations Currently Under Review, Being Planned or Scheduled for Construction

There are a number of locations currently under review or consideration for roundabout installation. In addition, staff continues to recommend the use of roundabouts through development reviews and site plan approval processes. Staff are currently following Class EA guidelines for ongoing projects to ensure public input and thorough site assessment, although it is not required that a full project file report be submitted to the Ministry of Environment.

Following are some of the locations under review, being planned, being designed or scheduled for construction:

- Regional Road 52/Jerseyville
- Regional Road 52/Regional Road 99
- Governors/Davidson
- Stone Church/Omni
- Regional Road 56/Fall Fair Way
- Fall Fair Way/Future collector road
- Several intersections on East Mountain – Rymal Rd. corridor as part of EA
- Garner Road as part of EA
- Binbrook settlement area as part of EA
- Wilson/Jerseyville
- Wilson/Shaver
- Bullock’s Corners
- Peter’s Corners (MTO)

Other locations which could, and should, be considered are on existing roadways where the number of lanes has been reduced because of excess capacity, and to implement
Some of the intersection controls on these roadways would function better in terms of reduced speeds and reduced delays to both cyclists and motorists, as well as reduced environmental impact, over the existing all-way stops and traffic signal controls. The locations include, but are not limited to, sections of the following roadways:

- Stone Church Rd.
- West Fifth St.
- Upper Paradise Rd.
- Sterling St.
- Lawrence Rd.

Public Awareness Campaign

Without adequate public consultation and education, the public will often have a natural hesitation to resist changes in their driving, walking and cycling environment. Therefore it is recommended that one or more of the following educational and public awareness initiatives be taken prior to construction of roundabouts on major roadways:

- Public Information Centres
- Public meetings (formal or informal)
- Information booths at local shopping malls
- Presentations at local schools
- Information brochures and videos
- Media announcements
- Website updates

Staff will commence with public information centres (PIC) during the assessment for each potential location. As of the writing of this report, there are currently three locations actively being considered:

Highway 52 at Jerseyville Road  
PIC complete; project file report is out for public review

Governors Road at Davidson Boulevard  
PIC scheduled for September; consultant retained for intersection control study

Wilson Street at Shaver Road  
Development related project; Public meeting held in 2007; construction expected in 2008; media campaign planned prior to completion

Following approval of this report, staff will initiate a public service announcement to advise residents of the new policy and that additional information will be made available, though brochures and the City's web site, in coming months.

ANALYSIS/RATIONALE:

Reasons for Using Roundabouts

Intersection Safety

Given their safety record, the use of properly designed roundabouts is seen as a traffic control measure which can reduce the number and severity of motor vehicle collisions compared to stop control or traffic control signals. There are three reasons why motorists are safer at roundabouts:
Lower vehicle speeds: There is more time to avoid a crash, and if a crash does occur it will be less severe.

Fewer conflict points: A four-way intersection has 32 vehicle and pedestrian conflict points (Figure 8). A roundabout, by contrast, has only 12 vehicle and pedestrian conflict points (Figure 9).

Less severe collision types: The most serious crashes – head-on and right angle – cannot occur at roundabouts. Roundabouts experience potentially less serious types such as rear-end, sideswipe and loss of control crashes.

A 2000 study by the Insurance Institute for Highway Safety (IIHS) entitled “A Study of Crash Reductions Following Installation of Roundabouts in the United States” looked at changes in motor vehicle crashes after the conversion of 24 intersections from Stop sign or traffic signal control to roundabouts. In 2007 the National Cooperative Highway Research Program (NCHRP) produced Report 572 which collected before/after data at 55 converted intersections in the USA. Combined data from the studies concluded that roundabouts:

- Reduced collisions of all types by 37%.
- Reduced injury collisions by 76%.
- Reduced fatal and incapacitating collisions by 90%.

Pedestrian Safety and Pedestrian Amenities

There have been few studies of pedestrian safety at roundabouts in North America and these are not conclusive because of insufficient data. Studies internationally have shown that roundabouts can lessen the frequency and severity of pedestrian-involved collisions by 50 to 80 percent.

There are four reasons why pedestrians are safer at roundabouts:
Shorter crossing distances: Pedestrian crossing distances are often shorter because extra lanes are not needed on an approach, and where splitter islands are present the crossing is done in two-stages.

Look in One Direction Only: Pedestrians only have to look in one direction for oncoming traffic whereas at traffic signals cars approach a crosswalk from the left and the right, often at steep angles outside of peripheral vision.

Lower vehicle speeds: There is more time to make eye contact with a motorist and avoid a crash, and if a crash does occur it will be less severe.

Fewer conflict points: For a single-lane roundabout, there are 2 vehicle-pedestrian conflict points on each leg, as opposed to 4 otherwise. At multi-lane roundabouts, as at other intersections, an additional conflict is added for each additional lane that a pedestrian must cross. While illegal movements are less likely to occur at stop signs and traffic signals, they are potentially the most severe for a pedestrian.

Despite this, the public often perceives that roundabouts are less safe for pedestrians because they do not have right-of-way priority and because there is no positive control. They are equating the perception of security with actual safety. In reality other forms of control are less safe than expected. In Hamilton about 100 pedestrians are struck at signalized intersections annually, most of who are crossing with the right-of-way. This is generally due to conflicts with motorists turning right or left across the crosswalk. The City Of Hamilton has over 30 roundabouts or traffic circles of various types, most of which have been in place for more than five years. There is no record of any pedestrian collisions related to any of the roundabouts, which supports the pedestrian safety assessment above.

Cyclist Safety

Studies internationally are less conclusive about bicyclist safety at roundabouts. Most show they are safer at single-lane roundabouts than at other intersections, but not always safer at multi-lane roundabouts. In either case, collisions that do occur are less severe because of lower vehicle speeds.

Where a roundabout is placed along a bicycle route, the standard design will be consistent with that approved by the TAC roundabout design guidance, presently being developed. Staff will be working with the Hamilton Cycling Committee among other user groups during design stages.

Traffic Operations

Roundabouts are not only safer than traditional means of intersection control, but offer other advantages. Examples include:

- Intersection efficiency: Roundabouts usually operate with lower delays and shorter queues than stop control or traffic signals.
- Traffic calming: Roundabouts can reduce vehicle speeds and act as traffic calming measures and improve conditions for non-motorized users. They can be used at the transition between rural and urban, or high-speed and low-speed, areas as their presence informs motorists of a change of driving environment. The Ancaster roundabout is an example which has resulted in significant speed reduction within 100 metres of approaching the roundabout on Wilson St.
Improved access: Because of lower speeds, driveway access does not have to be restricted to the same extent close to roundabouts compared to traffic signals. Roundabouts can facilitate safe U-turns. Queues are usually shorter with roundabouts, and therefore less likely to impact nearby access driveways or structures such as overpasses or underpasses.

Environmental Benefits

Roundabouts are typically the “greenest” method of operating an intersection with significant traffic volumes. The advantages include:

- Fuel consumption and emissions: It is proven and measurable that roundabouts reduce fuel consumption and lessen vehicle emissions by reducing vehicle delays, acceleration/deceleration, and time spent idling. With increasing concerns over greenhouse gas emissions, the price of fuel, and the reliability of power supplies, environmental reasons will play an increasingly important role in the consideration of roundabouts in the future. Staff have corresponded with McMaster University’s SMART (Student Math Action Research Team) who have developed a calculation to determine the level of greenhouse gas (GHG) emissions at Hamilton intersections based on volume and delay. The exercises which were conducted revealed an average GHG emissions reduction of about 60% when a roundabout control is utilized rather than a traffic signal. Even a modest reduction in vehicle delay has a major impact on the environment. An example of this is shown in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Highway 56/Fall Fair Way - Vehicle Emission Comparisons</th>
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<tbody>
<tr>
<td>SMART (Student Math Action Research Team) Formula, McMaster University</td>
</tr>
<tr>
<td>Average Delays (sec.)</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Traffic Signal</td>
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<tr>
<td>Roundabout</td>
</tr>
<tr>
<td>Reduction (60%)</td>
</tr>
<tr>
<td>2020 Volume = 25,250</td>
</tr>
</tbody>
</table>

Aesthetics

Roundabouts can offer opportunities for landscaping and creating gateways or centrepieces for communities and can be proposed as part of community enhancement projects. Such projects are often located in commercial and civic districts as a gateway treatment to convey a change of environment and to encourage motorists to slow down. The central island provides an opportunity for landscaping treatments such as flower beds, shrubs and trees, flagpoles and statues. The Ancaster roundabout demonstrates a pleasant landscaping feature (see Figure 10). Other options are possible depending on the community’s preference as long as the sightline and safety requirements are met and pedestrians are not attracted to the central island. The current standard for central island treatments is shown in Report PW08078 as Appendix D.
These environmental benefits correlate with Vision 2020, as a “sustainable community” where social, health, economic and environmental issues are jointly considered in the City's decision-making processes. This includes attaining the City’s climate change goals and working with Clean Air Hamilton.

**ALTERNATIVES FOR CONSIDERATION:**

Committee could choose not to approve the recommendations in this report. In that case, modern roundabouts would continue to be installed on an ad hoc basis, when opportunities could be presented individually to Committee and Council. However, clear direction to staff would be lacking. Without clear direction to staff, the choice of roundabouts as a primary option for intersection control will not happen consistently, and the environmental, safety and other benefits of roundabouts will not be taken advantage of as a matter of routine.

Much of the benefit for neighbourhood mini-roundabouts would be the environmental savings generated from replacing inefficient all-way stop controls. Committee could direct an immediate large-scale program, but this would only be possible at the expense of other, important capital projects. Alternately, an easily implemented, interim alternative to all-way stop control could be to revert such locations back to one- or two-way stop controls.

**FINANCIAL/STAFFING/LEGAL IMPLICATIONS:**

Roundabouts are more expensive than stop control, and usually cost more to construct than traffic signals. However, they can sometimes be less expensive than traffic signals when an intersection is being newly developed or completely reconstructed. In some cases the costs can be fully absorbed through development charges. Another financially responsible application is where an overpass or underpass normally needs to be widened because of the introduction of left turn or right turn lanes at a nearby intersection. A roundabout may not require the additional approach lanes (and thus the overpass or underpass widening), because of lower delays and shorter queues. Some of the first roundabouts in the United States, at highway interchanges in Avon and Vail, Colorado, were constructed for this reason.
The approximate cost to construct the Ancaster roundabout in 2002 was $365,000 compared to the estimated cost of $250,000 for a traffic signal. Both costs include all roadway construction as well as the traffic device itself. The more recently constructed (2007) roundabouts on Binbrook Road at Fall Fair Way and on Fall Fair Way were both fully funded through development charges.

Neighbourhood mini-roundabouts are much less expensive and are estimated to cost between $5,000 and $50,000 for most applications. Staff anticipates utilizing the current traffic calming budget up to a maximum annual amount of $50,000 to finance construction of mini-roundabouts. It should be noted, however, that there are a number of other outstanding traffic calming features to be implemented as priority items also financed by the annual Traffic Calming capital budget which was budgeted at $300,000 in 2008.

While modern roundabouts may be more expensive initially they are generally less expensive over time because they do not require power for signal equipment, periodic preventative and emergency maintenance, and regular signal timing updates. They have the advantage of continuing to function during power failures. They are also usually less expensive because of the reduced societal costs associated with injury crashes, health impacts of air pollution and motor vehicle fuel. The extra construction cost will usually more than be recovered on the basis of direct and indirect costs. An expert consultant provided a 20 year life cycle cost analysis for traffic control alternatives at the intersection Hwy 56 and Fall Fair/Way outlined in Table 2.

<table>
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<tr>
<th>Item</th>
<th>Traffic Signal</th>
<th>Roundabout</th>
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<tr>
<td>Total Estimated Capital Cost</td>
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<tr>
<td>Property Costs</td>
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<td>$29,500</td>
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<tr>
<td>Injury Crash Costs</td>
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<td>Annual Maintenance</td>
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<td>Future Traffic Signal Replacement</td>
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<tr>
<td>Total</td>
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<td>$794,350</td>
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**POLICIES AFFECTING PROPOSAL:**

The Public Works Strategic Plan, “Innovate Now”, identifies Vision 2017 “to be recognized as the centre of environmental and innovative excellence in Canada”. The Policy for the Installation Modern Roundabouts meets both the environmental and innovative factors of the Vision 2017 statement. This policy is also consistent with the “Communities” and “Processes” vision drivers of Innovate Now, as well as one of its top priorities to be a leader in ‘greening’ and stewardship in the City, by virtue of the providing safer, more efficient and environmentally responsible methods of traffic control.

Roundabouts are in alignment with Vision 2020 as they maintain environmental integrity and have been proven to help improve economic prosperity when located in the vicinity of commercial developments. Furthermore, roundabouts contribute to quality of life issues by improving safety, enhancing the landscape and rejuvenating the environment.
Consultation with Key User Groups

Public Works staff has been in contact with key user groups to provide them with general information on design and operation of roundabouts as it relates to their associated function, and to solicit feedback from their unique perspectives. These included:

- Advisory Committee for Persons with Disabilities (ACPD)
- Canadian National Institute for the Blind (CNIB)
- Emergency Services - Fire, EMS
- Hamilton Police Services
- Hamilton Cycling Committee
- Road Operations and Maintenance Section
- Forestry and Horticulture Section
- Hamilton Street Railway (HSR)
- Planning and Economic Development
- SMART (Student Math Action Research Team), McMaster University

Generally most groups support the use of roundabouts and indicated that the benefits far outweigh the drawbacks, that disruption to their service was minimal, and in many cases would be improved. Roundabout designs allow some flexibility to address most of the concerns which were raised. Staff will continue to consult with the various user groups as roundabouts are proposed and will work towards developing a balanced design for all users.

Staff met with ACPD in October of 2007 on the site of the Ancaster roundabout located at Wilson and Meadowbrook Dr. /Hamilton Dr. where the group had an opportunity to personally experience pedestrian accessibility throughout the roundabout. The ACPD expressed concerns with pedestrian crossing safety for those with disabilities. There were also concerns with apparent restricted visibility within a roundabout both from the driver’s perspective and from the pedestrian’s view. Staff reassured members of the committee that there are strict visibility requirements which must be met as part of the roundabout design.

CITY STRATEGIC COMMITMENT:

By evaluating the “Triple Bottom Line”, (community, environment, economic implications) we can make choices that create value across all three bottom lines, moving us closer to our vision for a sustainable community, and Provincial interests.

Community Well-Being is enhanced. ☑ Yes ☐ No
Provides increased safety for motorists and pedestrians.

Environmental Well-Being is enhanced. ☑ Yes ☐ No
Reduces fuel consumption and greenhouse gas emissions.

Economic Well-Being is enhanced. ☑ Yes ☐ No
Reduced fuel costs for motorists and reduced societal costs resulting from fewer collisions.

Does the option you are recommending create value across all three bottom lines? ☑ Yes ☐ No

Do the options you are recommending make Hamilton a City of choice for high performance public servants? ☑ Yes ☐ No
1. **Description and Purpose**

This policy document provides guidelines for the use of modern roundabouts on arterial and collector roadways. Modern roundabouts have been increasing in popularity in North America, primarily based on their aptitude to improve traffic safety. The unique circular design characteristics of roundabouts reduce the number of conflict points by 75% over traditional intersection design and therefore results in lowering collision experience.

Modern roundabouts can be utilized as an alternative form of intersection traffic control rather than the use of all-way stops or traffic signals which currently are the most common form of traffic control at major intersections. Their design encourages slower vehicle speeds and the yield on entry control allows circulating traffic to have the right-of-way which minimizes congestion resulting in a more efficient operation with fewer delays. As a result, vehicle greenhouse gas emissions are significantly reduced. Furthermore, roundabouts can be used as aesthetic gateways into communities or to provide a transition zone from a rural to an urban setting to accommodate the required reduction in vehicle speeds.

The overall goal for implementing modern roundabouts is to provide an intersection control which improves safety, efficiency and environmental impacts for all affected users.

2. **Scope**

The Traffic Engineering and Operations Section, through a consultative process with the public, internal and external agencies, and Ward Councillors, will be responsible for investigating, evaluating and recommending to Committee and Council for their consideration, modern roundabout installations in the City Of Hamilton. A comprehensive feasibility study will accompany all proposed locations to ensure that roundabouts are workable.

When designing roundabouts, one size does not fit all. The size and shape of a roundabout will vary according to the traffic demand, type of traffic, geometry and classification of intersection. As a general design guideline the City of Hamilton will be referencing two documents as guidelines for best practice. The USA based Federal Highway Administration publication named “Roundabouts: An Informational Guide” (FHWA-RD-00-067) will be utilized in conjunction with the “Synthesis of North American Roundabout Practice”, soon to be released by the Transportation Association of Canada (TAC). Staff will also be soliciting assistance from Canadian and American Municipalities which have had experience in the installation of roundabouts, in addition to working with expert consultants on detailed design. The preferred software to aid in designing is RODEL which is an empirical based modeling program. In the case of development related roundabout installations, staff will provide typical design standards for the corresponding roadway right-of-way widths.

**Applies to:** ✅ All sections or □ Roads □ Parks □ Forestry □ Traffic □ Horticulture □ Cemeteries □ Business Services
3. Definitions

The following is a partial list of more commonly used definitions associated with modern roundabouts installation:

**Modern Roundabouts** – a circular intersection varying in size depending on traffic volumes and roadway geometry, and typically found on major roadways. The key elements include a raised central island placed at the center of an intersection, raised splitter islands located at each entry to the intersection, counter clockwise circulation, yield control at all approaches to the intersection. They may have a single or multiple circulating lanes of traffic. Roundabouts are generally used in place of traffic signals on major roadways. The benefits of roundabouts are that they slow traffic and reduce the number of right-angle and turning movement collisions, while providing a more efficient and environmentally-friendly operation.

Features described below illustration:

**Inscribed Circle Diameter** – Measure of the size of a roundabout. Governed by number of entry and exit lanes, size of design vehicle, and property constraints.

**Yield Line** – Denotes where entering drivers give way to circulating traffic, and generally inscribes the outside diameter of the roundabout.

**Circulatory Road** – The minimum width is equal to the widest entry. In multi-lane roundabouts pavement markings in the circulatory road are usually used to denote lane use, recognizing that trucks may need to take up more than one lane.

**Central Island** – A central non-overrun area. Sightlines shall be maintained around the outside, but blocked through the middle using landscaping or other means.
**Truck Apron** – An overrun area for trucks. Usually necessary for single-lane roundabouts to avoid a very wide circulatory road or small central island.

**Entry Radius** – The smallest curb radius before or at the yield line. Not the same as entry path radius or deflection.

**Entry Angle** – Half the angle between the entry and the next exit. A higher angle means the entry is more perpendicular to the circulatory road. If the angle is too flat entering drivers will have to turn too much to the left to see circulating traffic.

**Entry Width** – Width at the roundabout entry, measured to curb face. Must be sized to accommodate design vehicle, yet not be overly large at single-lane roundabouts. The distance over which the approach widens to the entry is the flare length.

**Exit Width** – Width at the roundabout exit, measured to curb face. Two exit lanes can reduce to one lane over a 15:1 to 20:1 taper depending on volume and speed of traffic.

**Splitter Island** – Directs drivers to circulate counter-clockwise, and provides refuge area for pedestrians.

**Pedestrian Crossing** – Two-stage crossing located one car length, or multiple behind the yield line.

**Bicycle Lane Termination and Re-Entry** – Forces bicyclists to choose between navigating roundabout as a vehicle by taking the traffic lane, or as a pedestrian by providing access to a sidewalk.

### 4. Responsibility

The Traffic Engineering and Operations Section of the Public Works Department will be responsible for overseeing the evaluation and implementation of roundabout installations. The Capital Planning and Implementation Division will continue to spearhead all major Environmental Assessments and neighbourhood traffic studies with input from the Traffic Engineering and Operations Section. A formal EA is no longer required but public consultation is still a key element of this process. Where roundabouts are considered at new intersections identified as potential sites as part of a capital project. These intersections are identified and screened by Traffic Engineering and Operations in consultation with Strategic and Environmental Planning. Where roundabouts are considered through the Planning or Development review process, these intersections are identified and screened by Traffic Engineering and Operations in consultation with Community Planning and Design and Development Engineering staff.

### 5. Policy Details

a) Modern roundabouts will be installed wherever possible, where a study confirms they are feasible, appropriate and advantageous in terms of traffic flow, traffic safety, community design functions or environmental considerations, under the following conditions:

(i) Capacity or safety problems have been identified at existing intersections necessitating substantial improvements.

(ii) Traffic signals or all-way stops are warranted or expected to be warranted in the near future at existing or proposed intersections.

(iii) As part of a larger capital project, suitable intersections are identified as potential sites.

(iv) When, through planning approvals, new intersections are to be created.
An evaluation process as listed in sections (b) and (c) below will be undertaken to determine feasibility of roundabouts. A life cycle cost comparison table as shown in Table 2 of the report will be generated to present a snapshot comparison of overall costs for the various alternatives.

b) Implementation of Roundabouts Resulting from Safety Problems, Capacity Issues, Signal Warrants, All-way Stop Warrants to be Processed Through the Capital Projects Program.

Screening Criteria:

Roundabouts should be considered where safety problems, capacity issues and signal or all-way stop warrants dictate intersection improvements. Locations scheduled for capital projects should be included in such evaluations. Those which qualify and are recommended for roundabout installation can be scheduled as future capital projects with associated funding. An initial screening is required to confirm whether a roundabout is feasible. Following the screening process, an intersection control study (ICS) is conducted by Traffic Engineering and Operations or an outside consultant to compare a roundabout and other types of traffic control. If a roundabout is selected as the preferred alternative, then Traffic Engineering and Operations asks for comments from other departments on the location and design of the roundabout concept as proposed through the ICS. Although roundabouts are not specifically subject to the Class Environmental Assessment (EA) process, stakeholders will be contacted and the public advised of any roundabouts planned as part of a capital project. Public information centres (PIC) should be held to allow for public input until such time that Committee and Council has the comfort level to proceed with notifications of intersection improvements only.

Criteria useful for an initial screening of roundabouts at existing or new intersections as part of a capital project include:

1. **Right-of-way**: Is there enough space for a roundabout, or is additional right-of-way or property required? The size of a roundabout will depend on the design vehicle to be accommodated, and traffic flows that dictate whether the roundabout is single-lane or multi-lane.
2. **Intersection geometry**: Does the intersection have an offset, high skew angle, or more than four legs? Roundabouts can accommodate unusual geometry if there is sufficient right-of-way.
3. **Safety**: Are there high numbers of angle and turning movement collisions that could be mitigated with a roundabout?
4. **Delays or queues**: Are there high delays or long vehicle queues being experienced that could be mitigated with a roundabout?
5. **Traffic flows**: Are existing or forecast traffic flows relatively balanced between approaches? (Unbalanced flows do not necessarily mean a roundabout is not a suitable alternative, as there are other benefits to roundabouts such as safety.) Is there a high percentage of turning movements? High left turn flows, for instance, favours roundabouts because of signal lost time.
6. **Nearby structures or traffic control**: Is the location near a structure? A roundabout may not require additional approach lanes, and therefore not require that a nearby overpass or underpass be widened. Is it near a signalized intersection where queues may spill back into the roundabout? Is it located near a railway crossing, where queues may block the railway tracks? Traffic signals can be interconnected with a railway crossing, but not a roundabout.
7. **Nearby driveways**: Do any driveways need to be relocated because of splitter islands?
8. **Land use context**: Is there a land use transition where a roundabout could notify motorists of a change in the road environment? Can they be used at either end of a commercial corridor to accommodate U-turns, allowing access driveways to be right turns only? This can mean more commercial sites served with driveways spaced closer together.
9. Traffic calming: Are high traffic speeds being experienced, or likely, due to the design of the road and the surrounding land uses?
10. Vulnerable road users: Does the intersection have high numbers of bicyclists, or are there visually impaired pedestrians? Traffic signals are sometimes preferred in these cases.
11. Technical constraints: Are there any steep grades, unusual drainage, possible difficulties with meeting sight distance requirements, etc. that may preclude a roundabout?

If a roundabout passes an initial screening a more detailed evaluation is undertaken for existing or new intersections, not subject to the development review process, through an Intersection Control Study. An ICS is a technical comparison of traffic signals and a roundabout at a given location so that a preferred alternative can be selected.

The following table shows example performance measures for a minimum study and an in-depth study. Traffic Engineering and Operations will determine the level of study effort in consultation with stakeholders.

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<thead>
<tr>
<th>Performance Measure</th>
<th>Priority and Level of Effort</th>
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<td><strong>Quantitative Criteria</strong></td>
<td>Minimum Study</td>
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<td>Collision Frequency Reduction (Injury + Fatal Crashes/Year)</td>
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<td>Level of Service Delay, Queue Reach</td>
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<td>Design Vehicle Space, Stopping Sight Distance, Intersection Sight Distance, etc.</td>
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<td>Railways</td>
<td>Queuing Distance, Crossing Duration</td>
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<td>Driveway Location and Restrictions</td>
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<tr>
<td><strong>Qualitative Criteria</strong></td>
<td>Minimum Study</td>
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<td>Users</td>
<td>Pedestrians, Bicyclists, Mobility or Visually Impaired Persons</td>
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<td>Environmental Impacts</td>
<td>Natural, Social Impacts</td>
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<td>Aesthetics</td>
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c) Implementation of Roundabouts Through Planning and Development Review Process

Roundabouts should be considered where new intersections are introduced through the development review process. A formal intersection control study is not required for site selection in new development, but a screening is still appropriate as described in section (b).
When a roundabout is proposed by an applicant, the process will be as follows:

- For Official Plans, Zoning or Site Plans, Community Planning and Development Engineering asks for comments from other departments on the suitability of the roundabout in terms of several screening criteria (discussed in the next section). In the case of official plan or zoning applications, Community Planning also advises the applicant of the potential need for road widenings or additional right-of-way to accommodate the roundabout. Typical roundabout design standards, as provided by Traffic Engineering and Operations will determine the amount of land required to fit a properly designed roundabout within the intersection right-of-way.

- For Draft Plans of Subdivision, Community Planning and Development Engineering asks for comments from other departments on the suitability of the roundabout in terms of several screening criteria (as above).

- If Traffic Engineering and Operations determines the roundabout is suitable at the proposed location, then the engineering drawings are reviewed to determine compliance with the City’s standard drawings and good design principles for roundabouts.

When no roundabouts are proposed, but are asked to be considered through comments received from other departments, the recommended process is as follows:

- Traffic Engineering and Operations determines if a roundabout is suitable at the subject location through an initial screening using the screening criteria (as above). In many cases the initial request to consider a roundabout will originate with Traffic Engineering and Operations.
- If the location passes the initial screening, Community Planning or Development Engineering provides the applicable standard drawings and requests that the applicant consider roundabouts by setting aside property or right-of-way, and relocating driveways as necessary.
- Once a roundabout is accepted by the applicant and shown on the engineering drawings, the drawings are reviewed to determine compliance with the City’s standard drawings and good design principles for roundabouts.

7. Associated Documents

The following is a list of resource material used in the development of this policy document.

- The TAC/ITE Canadian Guide to Neighbourhood Traffic Calming; MUTCDC; OTM
- The Ontario Highway Traffic Act
- Federal Highways Administration publication: “Roundabouts: An Informational Guide”
- City of Hamilton Traffic Calming Policy

8. Revision History – this is a new policy; hence there is no revision history.

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1. Description and Purpose

This policy document outlines prerequisites, minimum criteria and the selection process for neighbourhood mini-roundabouts on local and minor collector roadways. The primary use of neighbourhood mini-roundabouts is for the purposes of traffic calming and as such, this policy will be consistent with that of the “Traffic Calming/Traffic Management” Policy.

Most current intersection controls such as all-way stops and traffic signal controls are not, nor are they intended as, an effective method for traffic calming. The Traffic Calming Policy, although it defines roundabouts, covers mainly the mid-block type traffic calming features such as chicanes, curb extensions, speed humps etc. Studies of unwarranted all-way stop controls in the City have indicated a violation rate of over 80% is commonplace. Extensive use of unwarranted all-way stop controls have generated numerous complaints from residents who feel that pedestrian safety, in particular, may be at higher risk as a result of motorists not obeying the stop controls. While all-way stops are relatively benign for motorists, collision records do, in fact, indicate that pedestrians have a higher likelihood of being involved in a collision at an all-way stop intersection rather than a two-way stop controlled intersection. Furthermore, all-way stops increase air pollution and create nuisance noise in the immediate area due to the high number of vehicle stops/starts.

The goal of introducing neighbourhood mini-roundabouts is to provide a viable intersection control which will assist in reducing speeds, improving overall safety and reducing the impacts on the environment.

2. Scope

The Traffic Engineering and Operations Section, in consultation with residents, Emergency Services, the Hamilton Street Railway, the Ward Councillor(s), and other relevant agencies, will be responsible for investigating, evaluating and recommending to Committee and Council for their consideration, neighbourhood mini-roundabout installations on residential and minor collector streets.

Applies to: ☑ All sections or □ Roads □ Parks □ Forestry □ Traffic □ Horticulture □ Cemeteries □ Business Services

3. Definitions

The following is a partial list of more commonly used definitions associated with neighbourhood mini-roundabouts installation:

**Neighbourhood Mini-Roundabouts** – varying in size, at the neighbourhood level, have features that are consistent with modern roundabouts more typically found on major roadways. The key elements may include raised or mountable islands placed at the center of an intersection, raised or mountable splitter

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### Table

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islands located at each entry to the intersection, counter clockwise circulation, yield control at all intersection legs. Roundabouts in neighbourhoods are generally used in place of all-way stop control or traffic signals with lower volumes. The benefits of roundabouts are that they slow traffic and reduce the number of right-angle and turning collisions, while providing a more efficient and environmentally-friendly operation, compared to stop signs. They reduce the number of potential conflict points at an intersection from 32 down to only 12, increasing safety.

85th Percentile Speed – is the speed at which 85 percent of the motorists travel at/or below on a given road.

Heavy Vehicles – Large trucks which have a minimum gross vehicle weight of 4,500 kilograms.

4. Responsibility
The Traffic Engineering and Operations Section of the Public Works Department will be responsible for overseeing the evaluation and implementation of neighbourhood mini-roundabout installations on local residential or minor collector roadways. The Capital Planning and Implementation Division will continue to spearhead all major Environmental Assessments and neighbourhood traffic studies with input from the Traffic Engineering and Operations Section. A formal EA for minor traffic calming projects is no longer required but the public consultation process is still a key element of this process.

5. Policy Details
a) Prerequisites: The prerequisites (i. through vi.) inclusive must all be met in order for a neighbourhood mini-roundabout request to proceed to the data collection stage.

i) An informal survey/poll conducted by the Ward Councillor or a petition indicating a reasonable level of support must be submitted by the abutting residents on the subject section of street indicating support for neighbourhood mini-roundabouts. In order to even begin the process of evaluation, which uses staff time and/or contract resources, it is reasonable to expect a minimum starting level of public acceptance of any traffic calming measures. Therefore, it is necessary to gauge and obtain consent or consensus from the abutting residents on the subject street.

ii) The subject intersection must be located on a local residential street or minor collector roadway. A parallel program for larger dimensioned modern roundabouts requiring reconstruction will be considered on major collector and arterial streets which are designed to carry larger volumes of traffic. A full intersection control study must be undertaken in such cases to properly determine whether a modern roundabout is feasible.

iii) Must have support from EMS, HSR and Road Maintenance Divisions. Neighbourhood mini-roundabouts will not be supported on streets that may pose a problem on primary EMS response routes, HSR routes or where maintenance would be difficult to carry out.

iv) The roadway gradient must not exceed 5%. Due to possible inclement winter weather conditions, neighbourhood mini-roundabouts should not be used on roadways with grades exceeding 5%.

v) A minimum stopping distance visibility approaching the mini roundabouts must be maintained. The stopping sight distances will be based on the speed limit of each roadway.
The intersection must be clearly visible and recognizable to approaching drivers, cyclists and pedestrians. This will ensure that users have sufficient time to react and to properly judge their course of action.

vi) If one or more of the approaches to the intersection has more than one lane it will require a reduction to a single lane approaching the roundabout. Neighbourhood mini-roundabouts are designed to have a single lane entering the roundabout. In some cases neighbourhood collector roadways have been designed and constructed with four lanes of traffic (two per direction) in anticipation of future growth. In many cases, the expected traffic volume increases have not been realized. This may provide an opportunity to reduce the overall number of through lanes while maintaining a centre turning lane and adding bike lanes. A careful review must be undertaken by staff to determine whether reduction from two approach lanes to one lane is feasible.

b) **Technical Criteria for Neighbourhood Mini-Roundabouts**: Technical criteria (i. through vi.) must all be met for a street to be considered for *neighbourhood mini-roundabouts*.

i) The minimum 24 hour intersection volume on the subject street must be at least 750 vehicles per day (vpd) for a local road and between 2,500 – 5,000 vpd for a minor collector roadway and minor street volume is not less than 15% of major street volume. The “industry standard” is between 750 and 1,500 vehicles per day before traffic calming measures are considered. Hamilton’s policy will use the lower standard in determining this warrant. Residential, local or minor collector streets should be carrying a minimum of 750 vehicles per day to justify the impacts of *neighbourhood mini-roundabouts*.

ii) The 85\textsuperscript{th} percentile speed must be at least 8 km/h above the posted or default speed limit. In cases where the 85\textsuperscript{th} percentile speed is at least 15 km/h above the posted speed, no minimum volume threshold is required. *In order for neighbourhood mini-roundabouts to be effective as traffic calming measures, there must be a documented speeding problem.* The “industry standard” has been that the 85\textsuperscript{th} percentile speed must be 8 to 15 km/h above the posted speed limit. Hamilton’s policy will use the lower standard in determining this warrant.

iii) There must be a sidewalk on at least one side of the road. *To ensure pedestrian safety, there should be a continuous sidewalk on at least one side of the roadway where neighbourhood mini-roundabouts are proposed. If no sidewalk exists, consideration should be given to proving a sidewalk on at least one side of the road before implementation.*

iv) The minimum public approval criteria of a positive response from 70% of all directly affected. The “affected” areas will be determined by staff in consultation with the Ward Councillor(s). *Experience has shown that citizens often do not truly understand what the impacts of a new intersection control such as neighbourhood mini-roundabouts are. Issues such as yield on entry, parking or emergency service impacts are not recognized until after implementation.* The minimum approval criteria requires that 70% of residents abutting the subject street or residents that have no alternative to using the street in question to access their homes, must indicate support. *This ensures a high likelihood of success.*

v) Where there is a high proportion of heavy vehicles (20% or greater) a neighbourhood mini-roundabout should not be considered.
A constant flow of heavy vehicles would be negatively impacted by mini-roundabouts as they would not typically have sufficient turning radii to accommodate proper turning within the circulating roadway. Drivers of large trucks would normally select to make left turns to the left of the central island, which could potentially cause safety problems of pedestrians and other motorists.

vi) Where there is a high pedestrian or cyclist volume a neighbourhood mini-roundabout should not be considered. Staff will determine through studies and observations whether a neighbourhood mini-roundabout can sustain existing volumes. In cases where there is high pedestrian and/or cyclist volume a full redesign and reconstruction may be required. A feasibility study will determine whether there is sufficient land to accommodate a properly designed roundabout for such unique locations.

c) Warrant Scoring: In order to prioritize or rank candidate neighbourhood mini-roundabout locations which have met the criteria detailed in Sections a) and b) and a warrant scoring system has been established. Every location will be scored out of 100 maximum points.

- **Stop Control** (max. 30 points) - an unwarranted all-way stop control will score 30 points. While a warranted all-way stop will score 20 points. A one or two-way stop control will score 15 points.

- **Signal Control** (max. 15 points) - an unwarranted traffic signal will score 15 points while a warranted signal will score 10 points.

- **Consistency** – (5 points) - where other mini-roundabouts exist at adjacent intersections.

- **Speed Warrant** (max. 20 pts) – 1 point will be awarded for every km/h the 85th percentile speed is above 50 km/h to a maximum of 30 points. Where there is an existing all-way stop, the studies prior to its installation will be used. In the absence of such studies, approach speeds, on the major roadway, 75 metres in advance of the intersection will be measured.

- **Volume Warrant** (max. 20 pts) – 2 points will be awarded for every 100 vehicles of daily traffic for local roads and 2 points for every 250 vpd over 2,500 on minor collector roadways to a maximum of 20 points in either case.

- **Collision Warrant** (max. 10 pts) – 2 points will be awarded for every reported preventable collisions in the past 3 years at the subject intersection.

d) Priority Setting: It is necessary to prioritize or rank candidate neighbourhood mini-roundabout locations which have met the criteria. Ranking will be in descending order of the point ratings. Projects will be implemented in this order subject to the availability of funds. Only if two projects have identical ratings will the original date of the request be considered. In that case, the oldest request will have priority. The only exception will be a street that qualifies near the top of the list, and is on the capital construction list for resurfacing or reconstruction. In that case, if significant cost savings might be realized by coordinating the neighbourhood mini-roundabout installation with the construction project, the priority might be increased.

7. **Associated Documents**

The following is a list of resource material used in the development of this policy document.

- The TAC/ITE Canadian Guide to Neighbourhood Traffic Calming; MUTCD; OTM
8. **Revision History** – this is a new policy; hence there is no revision history.

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Developed By: Ron Gallo
Title: Senior Project Manager, Signals and Systems

Approved By: Hart Solomon
Title: Manager of Traffic Engineering and Operations

Signature
Date: May 5, 2008
Locations Where Roundabouts May Be Considered or May Require Further Review

Roundabouts are a preferred type of traffic control at the following locations:

- At intersections with historical safety problems.
- At intersections with relatively balanced traffic flows.
- At intersections with unusual layouts such as offsets, high skew angles or more than four legs.
- At intersections with a high percentage of turning movements.
- At intersections where widening one or more approach may be difficult or costly, like overpasses or underpasses.
- Along roads with excessive speeds, or where traffic calming is desired.
- Where the speed environment of the road changes (i.e. between urban and rural areas, or between residential and commercial land uses).
- At gateways or entries to a neighbourhood, commercial development or urban area.
- At freeway ramp terminals for both safety and efficiency.
- At existing two-way stop-controlled intersections with high side-street delays (particularly those that do not meet signal warrants).
- Where U-turns need to be accommodated.

Roundabouts May be Difficult to Implement at Sites with the Following Site Conditions

- Locations with insufficient property or difficult grades
- Locations in close proximity to a signalized intersection where queues may spill back into the roundabout.
- Locations near a railway crossing, where queues may spill back across the railway tracks.
- Intersections located within a coordinated arterial signal system, where roundabouts can disrupt traffic platoons.
- Intersections with heavy bicycle volumes.
- Intersections where there is a significant amount of pedestrians who have disabilities.

Intersection Control Studies

An Intersection Control Study (ICS) shall be undertaken to compare alternative types of intersection control. The ICS will evaluate the relative merits of alternative controls based on the following quantitative measures of performance:

- Safety, i.e. predicted collision frequency.
- Capacity, i.e. level of service and delay.
- Construction Feasibility.
- Cost and benefit over the usable life of the project that accounts for collision reduction savings, energy savings, maintenance, construction costs and property costs.

Additionally, an ICS study would identify context sensitive issues and provide a qualitative comparison of alternative controls that accounts for the following:

- Vulnerable road users, i.e. pedestrians, bicyclists and disabled or visually impaired pedestrians.
- Air quality.
- Aesthetics of the intersection area.
- Proximity to school sites.
- Corridor considerations, i.e. transit and emergency vehicle usage.

Studies can be categorized as minimal or extensive depending on the location considerations. Staff will determine the level of effort and methods of quantifying the comparison.
Typical Central Island Landscape Treatment for Modern Roundabout