SYNTHESIS OF ROUNDABOUT IMPLEMENTATION PRACTICES

Presenting Author

Phil Weber, P.Eng.
GHD Inc.
(The Home of Ourston Roundabout Engineering)
11 Allstate Parkway, Suite 310
Markham, ON L3R 9T8
Phone (905) 952 4352
E-mail: phil.weber@oghd.com

Co-Author

Andy Duerr, P.E.
GHD Inc.
(The Home of Ourston Roundabout Engineering)
1240 North Mountain Road
Harrisburg PA 17112 USA
Phone (717) 585 6394
E-mail: andrew.duerr@ghd.com

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TABLE OF CONTENTS

Figures

Tables

1.0 INTRODUCTION

Roundabouts are a relatively new type of intersection control in Canada, and as such there is growing interest in how they compare relative to established types of control using stop signs and traffic signals. Roundabouts have a clear set of advantages and disadvantages compared to these traditional intersections, which are set out in Section 2 of this paper.

Intersections play an critical role in the operation of a road network. Therefore it is important to make sound defensible decisions about type of intersection control, both when implementing a new intersection and when modifying an existing intersection (or road section) due to motor vehicle capacity or user safety issues. When stop and traffic signal control were the only alternatives this process was straightforward and accomplished using traffic signal warrants based on side street delay and historic safety performance. Now that roundabouts are a possible alternative the process is potentially much more complicated. A number of road agencies in Canada and the United States have developed practices to aid in making a decision about type of control. A selected range of these practices is described in Section 3 of this paper as well as practices in Australia, which is a country with similar density and road network characteristics as Canada and the US but a much longer history of roundabout implementation.

Section 4 of this paper synthesizes the various roundabout implementation practices descried in Section 3 as being either basic intersection-level, “enhanced” intersection-level, or network-level.

2.0 BACKGROUND ON ROUNDABOUTS

2.1 ADVANTAGES

2.1.1 Safety for All Users

The most significant advantage of roundabouts is safety. Roundabouts are statistically safer for motorists than other at-grade intersections because of lower vehicle speeds, fewer conflict points, and reduced crash angles (where angle and head-on crashes are eliminated or replaced by less-injurious side-swipe and rear-end crashes).

A major study in the United States in 2007 looked at changes in motor vehicle crashes after 55 intersections were converted from stop or traffic signal control to roundabouts. It concluded that the roundabouts:

- Reduced crashes of all types by 35 percent.
- Reduced injury crashes by 76 percent.
- Reduced fatal and incapacitating crashes by about 90 percent.[1]

Roundabouts tend to be statistically safer for pedestrians as well because of shorter crossing distances, slower-moving motor vehicle traffic that is only approaching from one direction at a time, and good sightlines between motorists and pedestrians. There have been no conclusive studies of pedestrian safety at roundabouts in Canada or the US because of insufficient data. Studies internationally have shown that roundabouts can lessen the frequency and severity of pedestrian-involved crashes compared to signalized intersections by between 50 and 80 percent.

Studies internationally are less conclusive about cyclist safety at roundabouts. Most show that cyclists are safer at single-lane roundabouts than at other intersections, but not always safer at multi-lane roundabouts. Care should be taken in interpreting cyclist safety data because the roundabouts may have been older designs allowing higher traffic speeds, or having different cyclist facilities than what is typically implemented with modern designs.

2.1.2 Delay for All Users

For the same number of lanes roundabouts almost always result in lower vehicle delays and shorter queues than signalized intersections. This is because there is no lost time (like the all-red interval at a signalized intersection) and because drivers are free to proceed when there is no opposing traffic. At signalized intersections drivers may be stopped at a red light even when there is no traffic on the cross street.

Pedestrian delays tend to be shorter at roundabouts as well. During off-peak periods they can cross when there is a gap in traffic. During peak periods they can assert themselves and create a gap in traffic, or if there is traffic queued on an approach they can simply cross between queued vehicles.

1 NCHRP Report 572, *Roundabouts in the United States*, National Cooperative Highway Research Program, 2007, Table 28.

2.1.3 Access Management

Roundabouts can potentially manage intersections or access driveways along a corridor in two ways:

- They produce lower speeds and usually result in shorter queues. Therefore access driveways can be located closer if the intersection is a roundabout.
- They provide opportunities for U-turns. If a roundabout is installed at either end of a corridor and access in between is restricted to right turns only, then drivers could turn left by making a U-turn at the nearest roundabout. An example of this, from Golden, Colorado, is seen in Figure 2.1.

A follow-up study in Golden, Colorado, showed that collisions were significantly reduced throughout the corridor with roundabouts. Travel speeds and travel times were also both reduced during peak and off-peak periods because of slower, more uniform speeds between intersections and less delay at the intersections.

Figure 2.1 Left Turn From Right-Turns-Only Driveway Using Roundabout

2.1.4 Environmental and Social Benefits

It seems intuitive that roundabouts should result in lower fuel consumption and emissions because of lower vehicle delays. Also, speeds are slower and more uniform at roundabouts, with less starting and stopping and less idling. This is especially the case during off-peak periods. Unfortunately at this time few studies have attempted to quantify these environmental benefits.

Another environmental benefit of roundabouts is reduced pavement area, which means less untreated groundwater runoff. Roundabouts can have social benefits as well, such as increased opportunities for gateway treatments and landscaping.

2.1.5 Life Cycle Costs

Costs over a life cycle tend to be lower with roundabouts than signalized intersections because of less need for ongoing maintenance. They can be significantly lower if the societal costs of motor vehicle collisions are taken into account. For example the Ministry of Transportation Ontario (MTO) uses human capital costs of $8,000 per property-damage-only crash, $59,000 per non-fatal injury crash, and $1,582,000 per fatal crash in transportation studies. If a roundabout is predicted to eliminate 1 injury crash every 2 years, if safety performance is equivalent otherwise then over a 20-year life cycle that can amount to a present cost savings of over $6 million. Note however that this savings would be a societal savings, as not all of it could be directly recouped by the road agency

2.2 DISADVANTAGES

2.2.1 Construction and Property Costs

Construction costs are usually higher for roundabouts, particularly in retrofit situations. This is because of more road structure in total, and more concrete for curbs, splitter islands and the central island.

Although a roundabout often results in less pavement area than a comparable signalized intersection it usually requires more space, and will encroach outside a typical right-of-way due to its size and alignment of the exits. In looking at the examples in Figures 2.2 and 2.3, both the 3-leg and 4-leg roundabouts require property outside the right-of-way of the intersection.

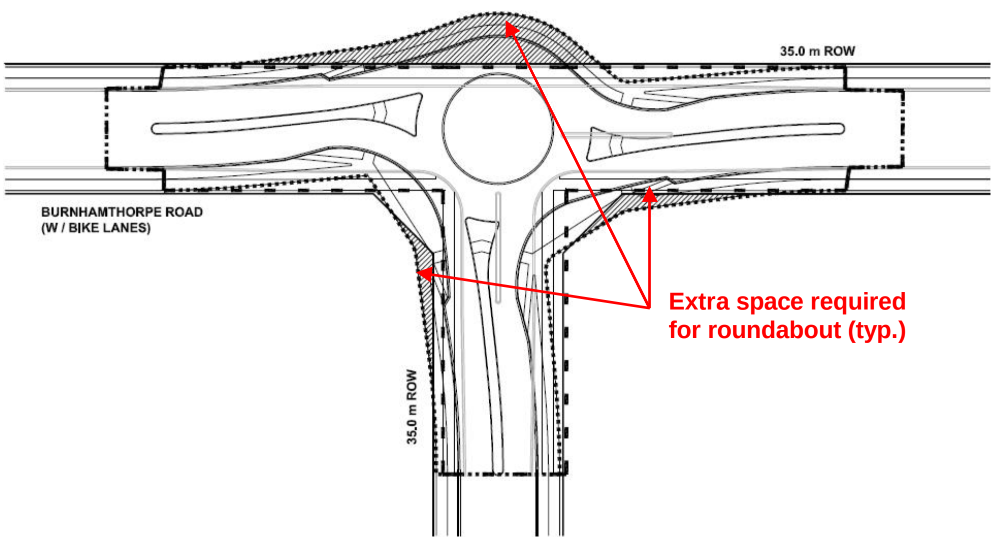

Figure 2.2 Typical Footprint Comparison – 3-Leg Intersection

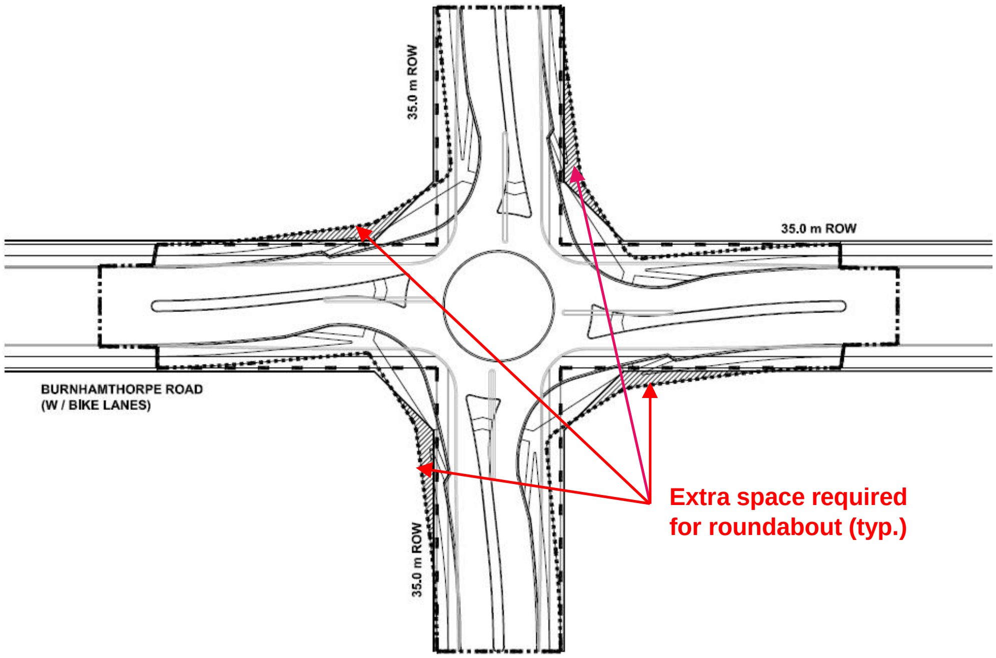

Figure 2.3 Typical Footprint Comparison – 4-Leg Intersection

2.2.2 Constructability

When a stop-controlled intersection meets warrants for traffic signals, it can be a relatively straightforward process to convert it to a signalized intersection. Sometimes left-turn lanes need to be added, but often all that is required is that the traffic signal plant be installed. The underground plant for the traffic signals may already be in place in anticipation of a future warrant for signalization.

However converting an existing unsignalized or signalized intersection to a roundabout is a complex and often expensive task. Full road reconstruction will be necessary for areas needed for a roundabout that are not already in place for the existing intersection, and additional property outside the right-of-way often has to be acquired.

2.2.3 Operational Considerations

Unlike signalized intersections, where signal timings can be altered to account for changes in traffic demand, a roundabout must be designed in anticipation of varying demands throughout the day and over time. This makes them difficult to modify in response to unanticipated changes in demand in the future.

As mentioned, for the same number of lanes roundabouts almost always result in lower vehicle delays and shorter queues than signalized intersections. However, if traffic flows are extremely heavy along the major road or corridor, then there can be the perception that side street motorists will have a difficult time entering a roundabout against the heavy opposing flows. Lengthy delays and queues can be more evenly distributed among all the approaches with signalized intersections, and there is the possibility that good signal progression could be achieved along the corridor.

Transit priority can be more difficult to achieve with roundabouts because they lack signal control. Plus the curvilinear alignments and more distant bus stop locations at roundabouts can increase operator workload compared to the linear alignments and standard bus stop locations at signalized intersections.

2.2.4 Accommodating Pedestrians and Cyclists

Even though pedestrian safety at roundabouts is statistically high, many do not perceive them to be as safe for pedestrians due to the absence of a positive exchange of right-of-way priority by a traffic signal. They are equating the perception of security with actual safety. When crossing a signalized intersection with a Walk signal, pedestrians can be in conflict with motorists legally turning right or left across the crosswalk.

That being said, pedestrians should make sure traffic has stopped before they cross at a roundabout, just as they should at other types of intersections. They should use positive body language to make sure drivers know their intent to cross. It is acknowledged that some user groups, such as young children and seniors, will find that task more difficult than others. And visually-impaired pedestrians will find it even more difficult. The likelihood of these groups using the intersection should be considered, and balanced against the other benefits a roundabout will provide.

Note that although traffic signals control right-of-way priority at signalized intersections, some of the worst crashes can occur when that priority is violated (i.e. a red light run), or when drivers are not looking in the direction of a pedestrian (i.e. looking left while turning right, or looking for oncoming traffic while turning left).

2.2.5 Public Outreach and Perception

The introduction of roundabouts in any area where they are new requires extensive public outreach. The main component of the outreach is educating users on how to drive, walk or cycle through a roundabout. Another is informing the public about what a roundabout is, what benefits roundabouts can provide, and why they are different from older traffic circles or rotaries they may have experienced.

3.0 ROUNDABOUT IMPLEMENTATION PRACTICES

3.1 IN THE UNITED STATES

3.1.1 Overview

The United States currently has approximately 4,000 roundabouts (not considering small ones in residential areas). The first so-called "modern" roundabouts were constructed in the early 1990's, although the US has a history of older traffic circles and rotaries dating back to the 1950's.

Roundabouts gained momentum during the late 2000's, in part because of a Federal Highway Administration (FHWA) 2008 *Guidance Memorandum on Consideration and Implementation of Proven Safety Countermeasures* that included the statement:

> Roundabouts are the preferred safety alternative for a wide range of intersections. Although they may not be appropriate in all circumstances, they should be considered as an alternative for all proposed new intersections on Federally-funded highway projects, particularly those with major road volumes less than 90 percent of the total entering volume. Roundabouts should also be considered for all existing intersections that have been identified as needing major safety or operational improvements. This would include freeway interchange ramp terminals and rural intersections.

By now most states have a roundabout policy. The most common is one that states that roundabouts may, should or shall be "considered" in some form. According to a 2010 research paper, a total of:

- 9 states make no mention of roundabouts at the department of transportation (DOT) level.
- 12 states mention that "roundabouts may be considered".
- 19 states have language to the effect that locations where traffic signals are or are expected to be warranted should be considered for roundabouts.
- 6 states specify that roundabouts shall be considered an alternative for new intersections, existing locations that need significant operational or safety modifications, or where traffic signals are warranted.
- 5 states have a "roundabouts first" policy, or require that formal justification be given if a roundabout is not selected as a preferred alternative.[2]

According to the paper the number of roundabouts constructed to date in a given state can be related to the strength of that state's roundabout policy when adjusted for population, vehicle miles travelled, and length of road network, although many of the roundabouts implemented in a state may have been at the local (non-DOT) level. States that are leaders in the implementation of roundabouts also tend to have a "champion" that took the lead in promoting roundabouts during the early stages of a program.

[2] Pochowski, Alex, L, *An Analytical Review of Statewide Roundabout Programs and Policies*, Georgia Institute of Technology Master's Thesis, December 2010, Chapter 3.

In addition to state-level policy, means to implement roundabouts in the US include the allocation of Highway Safety Improvement Program (HSIP) or Congestion Mitigation and Air Quality (CMAQ) Improvement Program funds administered by the FHWA, and local efforts aimed at access management or economic initiatives.

National Cooperative Highway Research Program (NCHRP) Report 672, *Roundabouts: An Informational Guide, Second Edition*, contains a chapter that discusses planning considerations for roundabouts. It includes sections on Potential Applications, Planning-Level Sizing and Space Requirements, Comparing Performance of Alternative Intersection Types, and Economic Evaluation.

3.1.2 Pennsylvania, Wisconsin and New York

Pennsylvania is a state where policy specifies that roundabouts *should* be considered. According to PennDOT, roundabouts should be considered at the following locations prior to other sites:

- Intersections where traffic signals are proposed.
- Intersections where beacons are existing.
- Intersections where widening for turn lanes is proposed.
- Intersections with 4-way stop control within 5 years of signal warrant capacity.
- Intersections where safety improvements are proposed.

According to PennDOT, roundabouts should be avoided at the following locations:

- Locations that would require excessive right-of-way impacts.
- Intersections close to (within 1,000 feet/300 metres) of signalized intersections.
- Corridors with frequent signalized intersections unless looking at entire corridor.
- Intersections close to active railway crossings (use 1,000 feet/300 metres).
- Intersections with high pedestrian activity (i.e. city centres).
- Intersections that oversize loads must use.

Wisconsin is a state having a stronger policy that specifies roundabouts *shall* be considered. From the 2013 Facilities Development Manual, WisDOT policy states that:

> In general terms, any intersection, urban or rural, that meets the criteria for a four-way stop condition or a traffic signal, also qualifies for evaluation as a modern roundabout.

Central to the evaluation of roundabouts is an Intersection Control Evaluation (ICE) that uses a series of worksheets to undertake Scoping for whether a roundabout is feasible, and Alternatives Selection to assist in determining a recommended alternative. The Alternatives Selection documents safety performance analysis, operational analysis, right-of-way impacts, costs (consisting of construction, property acquisition, operations and maintenance costs) other considerations (such as impacts on businesses, parking and utilities), pedestrians and cyclists, oversize or overweight vehicle accommodation, and environmental impacts.

New York state goes even further. NYSDOT policy states that:

> When the analysis shows that a roundabout is a feasible alternative, it should be considered the Department's preferred alternative due to the proven substantial safety benefits and other operational benefits.

The "roundabouts first" policy requires documentation if a roundabout is not selected as the preferred alternative.

3.1.3 Ada County, Idaho

In an effort to look at roundabouts on more of a network level, in 2011 the Ada County Highway District in the state of Idaho carried out a Countywide Roundabout Preservation Plan to preserve right-of-way at intersections where future roundabouts are feasible. The plan recognized that roundabouts are often ruled out as a possible alternative because their footprints differ significantly from other intersections. The plan evaluated nearly all existing and future planned intersections within Ada County with more than two roadway approaches classified as a collector or arterial (a total of 785 intersections). The plan:

- Looked at forecast peak hour total entering volumes to predict the number of lanes needed for a roundabout.
- Classified intersections as either being candidates for a single-lane roundabout, partial two-lane roundabout, full two-lane roundabout, three-lane roundabout or (if the forecast volumes exceeded those that could potentially be handled by a three-lane roundabout) no roundabout.
- Created roundabout templates to quickly assess whether an intersection could physically accommodate a roundabout of the necessary size, and if so then set aside the necessary right-of-way (even if it could not be immediately acquired). Some intersections had skewed or offset alignments, or more than four legs, and so were identified as unique locations.
- Evaluated the anticipated right-of-way impact at each intersection based on extent of impact, existing land use and redevelopment potential, imminent development, and topological and geographic constraints. Intersections that clearly did not fit within the geometric constraints, were recently improved, or were unlikely to be significantly altered in the future were removed from consideration for roundabout right-of-way preservation.
- Considered the surrounding network, given that a roundabout may not be the best alternative within a coordinated signal network, close to a high-volume intersection with long queues, or in the midst of a consistently signalized corridor. It was determined that most coordinated traffic signal corridors would not be good candidates for roundabouts.

The Countywide Roundabout Preservation Plan is expected to save the county significant property costs through early identification of potential roundabout locations and timely acquisition of right-of-way. It also provides a level of predictability for the development community.

3.2 IN CANADA

3.2.1 Overview

Canada currently has approximately 300 roundabouts (not considering small ones in residential areas). Similar to the US the first modern roundabouts were constructed in the 1990's, although there are a number of older traffic circles and rotaries dating back to the 1950's. Largely as a result of the level of activity in the US roundabouts are becoming increasing popular in Canada.

Some provinces have informal or formal roundabout policies in place:

- In Nova Scotia, roundabouts are usually constructed at new intersections on the provincial highway system if it can be demonstrated they will be less expensive than a signalized intersection of similar capacity.
- In Ontario the Ministry of Transportation now has language in Requests for Proposals to the effect that "roundabouts and traffic signals shall be considered at all of the intersections", and requires "a description of the Service Provider's proposed approach to evaluating signalized intersections and roundabouts in order to determine a technically preferred alternative."
- British Columbia and Alberta "roundabouts first" policies, the former since 2008 and the latter since 2010.

The BC Ministry of Transportation policy states:

> Roundabouts shall be considered as the first option for intersection designs where a greater degree of traffic control than a two-way stop is required. If a different intersection treatment is recommended, the project documentation should include a reason why a roundabout solution was not selected for that location. Roundabouts shall be considered on all roadways including high speed (70 km/h or greater) corridors. Roundabouts may be considered for intersections with interchange ramps.

3.2.2 Region of Waterloo and City of Ottawa

Since 2003 the Region of Waterloo has required that an Intersection Control Study (ICS) comparing a signalized intersection and a roundabout be undertaken for:

- New intersections on Regional Roads.
- Existing intersections where traffic signals are warranted.
- Existing intersections where capacity or safety problems have been identified.

Before proceeding to an ICS, an intersection will be subjected to an Initial Screening Tool to ascertain whether a roundabout can be screened out. The main part if the tool is an economic evaluation that requires the rough estimation of construction costs and the societal costs of motor vehicle collisions for the alternatives. If the results are close or in favour of a roundabout then an ICS is conducted.

The ICS compares alternatives in terms of several economic and non-economic criteria. The economic criteria comprise construction and study period costs (the latter of which include maintenance costs and the societal costs of motor vehicle collisions). In addition to future peak hour traffic operations, the non-economic criteria may include access management, conditions for pedestrians and cyclists, impacts to transit services, environmental benefits, etc.

The City of Ottawa recently adopted a similar policy. A Roundabout Initial Feasibility Screening Tool asks a series of questions regarding suitability factors and contra-indications to determine whether to proceed with an ICS. The evaluation criteria used in an ICS depend on whether a location is rural, semi-urban/suburban or urban, as seen in Table 3.1, and would be assigned weights from 1 to 4 based on their subjective importance at a location. The weights would be established by a project team at the start of the ICS. Then during the ICS each criteria would be assigned a score from 1 to 5, such that the score for two alternatives would have to add to 6.

Table 3.1 – City of Ottawa Intersection Evaluation Criteria

Rural Intersections	Semi-Urban/Suburban Intersections	Urban Intersections
Construction Cost	Construction Cost	Construction Cost
Safety	Safety	Safety
Capacity	Capacity	Capacity
	Pedestrians and Cyclists	Pedestrians and Cyclists
	Environmental	Environmental
	Property Impacts	Access Management
		Transit
		Property Impacts

Some of the criteria, namely Construction Cost, Property Impacts and Capacity, can be evaluated objectively using cost estimation and intersection capacity analysis software. The Safety criterion should be evaluated using models to predict the frequency and severity of collisions that would occur during a specified study period following implementation of the alternatives. Safety performance could be further weighted by assigning human capital costs to motor vehicle collisions, as is done by the MTO and some other agencies. The remaining criteria would be evaluated subjectively, although reasons for assigning scores should be documented.

3.3 IN AUSTRALIA

3.3.1 Overview

Australia has over 9,000 roundabouts with a population approximately two-thirds that of Canada. Overall there are more signalized intersections than roundabouts, and they continue to be installed at a greater rate. Further, where one type of control replaces another it is usually traffic signals replacing a roundabout. The extent to which all three are the case varies considerably by region and state. Roundabouts have been a type of intersection control in Australia since the 1970's.

Most states implement roundabouts in accordance with guidelines set out by the federal road authority Austroads. Table 3.2 describes the suitability of types of traffic control for different road classifications according to the Austroads *Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings*. The Austroads guide also suggests key considerations for installing unsignalized intersections, signalized intersections and roundabouts.

Table 3.2 – Austroads Suitability of Types of Traffic Control

Road Type	Primary Arterial	Secondary Arterial	Collector/Local Crossing Road	Local Street
Traffic Signals				
Primary Arterial	A	A	O	X
Secondary Arterial	A	A	O	X
Collector/Local Crossing Road	O	O	X	X
Local Street	X	X	X	X
Roundabouts				
Primary Arterial	O	O	X	X
Secondary Arterial	O	O	O	X
Collector/Local Crossing Road	X	O	A	O
Local Street	X	X	O	A
Stop Signs or Yield Signs				
Primary Arterial	X (O)	X (O)	A	A
Secondary Arterial	X (O)	X (O)	A	A
Collector/Local Crossing Road	A	A	A	A
Local Street	A	A	A	A

A = Most likely to be an appropriate treatment
O = May be an appropriate treatment
X = Usually not an appropriate treatment

3.3.2 Victoria and Queensland

In addition to the Austroads guide, in Victoria the state road authority, VicRoads, may also base decisions using Traffic Management Note No. 22, *Roundabouts and Traffic Signals: Guidelines for the Selection of Intersection Control*. The Note has information on the various considerations of using traffic signals or roundabouts, plus a section that summarizes them in a tabular format. The considerations are:

- Physical Controls (space, topography, access).
- Road Environment (rural, outer urban/fringe, inner urban, and whether there are any high-speed approaches).
- Road Users (pedestrians, cyclists, large vehicles).
- Traffic Management (area strategies, traffic flow patterns, public transport).

The indicators L, M or U (representing Likely, May be, or Unlikely to be an appropriate form of control) can be applied to the considerations to aid with determining an appropriate form of control.

According to the Note, in general:

- In rural areas roundabouts are preferred because of safety concerns with traffic signals in high-speed environments.
- In rural towns and cities with short peak periods roundabouts are usually preferred and operate with low delays. They would also facilitate U-turns. Traffic signals may be needed in areas of high pedestrian activity.
- In outer urban and fringe areas either traffic signals or roundabouts are usually appropriate, although roundabouts would generally provide safety advantages and lower off-peak delays.
- In inner urban areas traffic signals are usually preferred for signal coordination and pedestrian accommodation.

In addition to the Austroads guide, in Queensland the Department of Main Roads may also refer to the *Road Planning and Design Manual* to aid the decision-making process. The Manual includes a table on the use of roundabouts at various intersections, and lists of Appropriate and Inappropriate Sites for Roundabouts.

The Manual also provides an analytical method for determining the preferred type of intersection. The method involves a direct comparison between a base case and each alternative using selected performance criteria. The minimum criteria, and means of evaluation, are as follows:

- Safety is predicted for the alternatives using statistical methods, observed collisions, or a combination of both, and expressed economically using societal costs based on Queensland data. The alternatives are then ranked, with priority given to those that minimize crossing (angle) movements, maximize the visibility of pedestrians and cyclists, and promote good driving behaviour rather than shift problems to other areas of the road network.
- Delay is looked at in terms of control delay and geometric delay. Delays may be related to established delay costs, and pedestrians and cyclists may be brought into the evaluation.
- Site Suitability can encompass driver expectancy, transit operations, compatibility with adjacent land uses, environmental considerations, etc. The alternatives would be ranked against them, perhaps on a weighted basis.
- Financial Considerations can include construction cost, benefit-cost ratio, operating and maintenance costs, constructability, and cost of future expansion.

These criteria can be weighted to give emphasis to those deemed particularly important for a location, and summarized in an evaluation matrix.

4.0 TYPES OF IMPLEMENTATION POLICIES

4.1 BASIC INTERSECTION-LEVEL

The most common practice for the possible implementation of roundabouts is for road agencies to have a basic policy stating that roundabouts are to be "considered" on a per-intersection basis, without specifying details about how they are to be considered. This type of policy is in effect in some form in over 30 states including Pennsylvania, and several Canadian provinces including Nova Scotia and Ontario.

A benefit of a basic intersection-level policy is that it maintains simplicity and flexibility, which are important in the early stages of implementation when road agencies are gaining experience with the advantages and disadvantages of roundabouts. The most significant drawback is that the method by which roundabouts are considered can vary depending on the project team and experience of the service provider. This can lead to good candidate locations for roundabouts being screened out or not considered, perhaps because of inappropriate capacity analysis software or unrealistic roundabout footprints.

The ultimate case of a basic intersection-level policy is the "roundabouts first" policies in place in New York state, BC and Alberta. Although this type of policy can result in greater likelihood of roundabouts being implemented, the method by which roundabouts are considered can vary as well unless it is specified.

4.2 ENHANCED INTERSECTION-LEVEL

A few road agencies in Canada and the US have employed "enhanced" intersection-level policies. They include the state of Wisconsin and several others, plus the Region of Waterloo and City of Ottawa. Here, aspects of how roundabouts are considered are specified by the road agency. This can include what to include in a comparison, use of capacity analysis software, whether to consider the societal costs of motor vehicle crashes (and if so then what costs) and method of benefit-cost analysis.

An obvious advantage of an enhanced intersection-level policy is there is less likelihood of good candidate locations for roundabouts being screened out or not considered. A disadvantage is that it makes selection of type of intersection control more complicated unless different aspects of how roundabouts are considered can be made to apply in different circumstances. For example, the possible addition of left-turn lanes at a rural stop-controlled intersection should probably not be subject to consideration as a roundabout to the same extent as several signalized intersections potentially being widened as part of a major corridor project.

4.3 NETWORK-LEVEL

The next step is a policy implemented at a network level, so that numerous intersections can be considered simultaneously. Ada County, Idaho, implemented this type of policy by evaluating nearly all intersections within the county. Agencies with larger road networks may have to screen locations first, perhaps by examining safety performance and setting aside those with higher-than-expected crash frequency, before evaluating all candidate locations. Embarking on such an undertaking would be time and labour intensive but could protect right-of-way at potential roundabout locations and allow for comparison, ranking and prioritization.

Once agencies in Canada have attained a certain level of experience with roundabouts it may be possible to transition to a practice whereby roundabouts are automatically deemed preferred under certain conditions, such as at specific types of intersections (i.e. arterial/collector) and within specific areas (i.e. at rural four-way intersections). This is generally the case in Australia. New intersections can also be constructed as one type or another as part of a master-planning process. Roundabouts are especially suitable in the following applications:

- To keep motor vehicle speeds low (i.e. traffic calming).
- To manage the potential for high left-turn demand or sudden changes in demand.
- For the purposes of access management, by placing roundabouts on either end of a corridor and restricting driveways to right-turns-only via a continuous centre median.
- To provide aesthetics, landscaping or a civic feature, or to achieve a sense of place.

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