Appendix D - Roundabouts

What is a Roundabout?

A roundabout is a circular intersection around which vehicles travel in a counter-clockwise direction. Roundabouts are not the same as traffic circles used for traffic calming purposes on local streets, as seen in Vancouver and other communities. Roundabouts are not the same as rotaries, which are high-speed circular junctions as seen in Edmonton and Halifax.

Roundabouts are distinguished by four key characteristics, illustrated in Figure 1 and described below.

Yield on entry. Yield control is used on all entries to a roundabout. No traffic control is used on the circulatory roadway, and circulating traffic has the right-of-way.

Splitter Islands. Splitter Islands are raised islands located on each approach, between opposing directions of traffic. Splitter islands are used to create an appropriate angle of entry, which is a critical element of a roundabout design. Too shallow an angle of entry enables motorists to enter the roundabout at high speeds. Too sharp an angle of entry requires motorists to come to a near stop, even when there is no other traffic in the roundabout. Splitter islands also provide a median area at the pedestrian crossing, enabling pedestrians to cross one direction of traffic at a time.

Deflection. Vehicles travelling through a roundabout intersection are deflected around the centre island. This deflection reduces vehicle speeds and reinforces the yield on entry.

Counter-clockwise circulation. All vehicles circulate around a roundabout in a counter-clockwise direction — even large trucks. On smaller roundabouts, a sloped concrete apron around the perimeter of the central island can be used by large trucks in order to negotiate the roundabout.

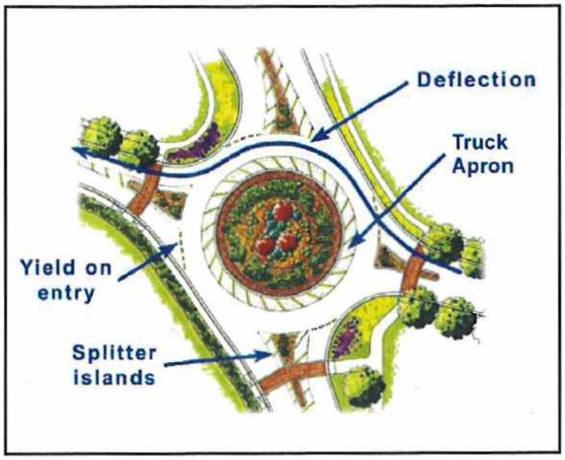

Figure 1 — Roundabout features

The roundabouts proposed for the South Island Highway are single-lane roundabouts, which is the most common type of roundabout. As illustrated in Figure 2, a single-lane roundabout incorporates a single circulatory lane in the roundabout, as well as one lane in each direction on the approach roads. Some single-lane roundabouts incorporate flared entries which widen to two lanes to provide additional storage capacity at the yield line, and additional intersection capacity. Single-lane roundabouts range in diameter from 30 m to 40 m. Typical speeds within a single-lane roundabout are 25 km/h to 35 km/h. Figures 3 and 4 provide examples of single-lane roundabouts.

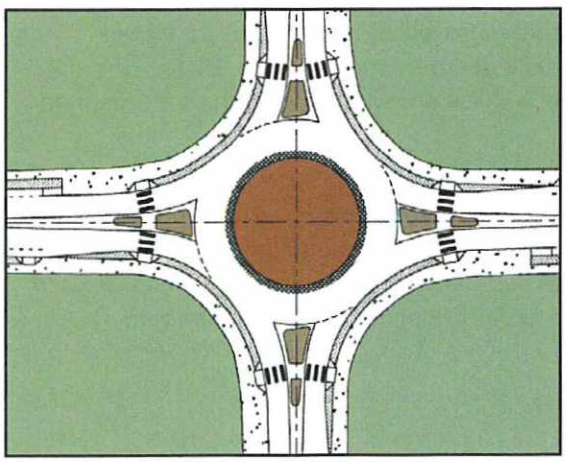

Figure 2 — Single-lane roundabout

Figure 3 — Single-lane roundabout, Hamilton ON

Figure 4 — Single-lane roundabout, Portland OR

Benefits

Roundabouts offer numerous benefits. The primary benefit is safety. Roundabouts reduce vehicle speeds through an intersection, and as a result improve safety for all road users — pedestrians, cyclists and motorists. Key safety benefits include:

Reduced speeds. Speeds through a single-lane roundabout range from 25 km/h to 35 km/h, depending on the size of the roundabout. In all cases, speeds are lower than through conventional intersections, where there are effectively no restrictions on vehicle speeds.

Reduced number of crashes. As a result of lower speeds, the number of crashes at roundabouts is lower than at conventional intersections. The Insurance Institute for Highway

Safety conducted a study of 24 intersections in the U.S. where stop control and traffic signals were replaced with roundabouts. Overall, there was a 39% reduction in crashes following conversion to roundabouts. A study of five intersections in Maryland converted to roundabouts found that the total number of crashes declined from 85 in the three years prior to conversion to 40 afterwards — a reduction of 53%. Numerous European studies have found similar reductions in accidents and lower accident rates at roundabout intersections. Accident rates for roundabouts calculated from European studies are 50% to 60% of the rates for signalized intersections.

Crashes are reduced for pedestrians and cyclists as well as for motorists. A Dutch study of 181 intersections converted to roundabouts found an average reduction in all pedestrian crashes of 73%, and an average reduction in pedestrian injury crashes of 89%. At nine multilane roundabouts in Colorado, there were no pedestrian crashes during the analysis period following conversion to roundabouts (19 to 47 months), compared with two pedestrian crashes during the analysis period before (22 to 36 months). A French study of bicycle crashes at more than 1,200 signalized intersections and almost 200 roundabouts found twice as many injury crashes per year at signalized intersections than at roundabouts.

Reduced severity of crashes. The Insurance Institute for Highway Safety's study of 24 intersections in the U.S. where roundabouts replaced stop control and traffic signals found a significant reduction in the severity of crashes. After converting the intersections to roundabouts, there were 76% fewer crashes involving injuries, and 90% fewer crashes involving fatalities. A study of five intersections in Maryland converted to roundabouts found that the average claim cost per accident decrease from US $117,000 before conversion to US $79,000 after conversion. What these findings mean is that in general, most crashes which occur at roundabouts are low-speed crashes involving property damage only. As well, low-speed collisions with pedestrians are far less likely to result in serious injury or death — in a collision at 30 km/h, there is a 5% chance that the pedestrian will be killed, whereas at 55 km/h the chance of being killed is 50%.

Other benefits of roundabouts include:

Reduced delays to pedestrians. As compared with signalized intersections or actuated pedestrian crossings. Pedestrians crossing a roundabout incur no delay waiting for a signal to walk. By eliminating delays to pedestrians, roundabouts avoid problems associated with signalized intersections, including jaywalking, pedestrians entering the road at the end of the pedestrian clearance interval just before the signals change, and pedestrians who press the signal pushbutton and then cross before the signals change.

Reduced delays for traffic. The Center for Transportation Research and Training at Kansas State University conducted an analysis of intersection delays for various types of intersection control. The conclusion was that with traffic volumes of more than 800 vehicles per hour, delays would be lower at a roundabout than at stop-controlled or signalized intersections. With traffic volumes of 800 vehicles per hour or less, only two-way stop control offers slightly lower delays than a roundabout — all-way stop control and signalized intersections still involve more delay than a roundabout. At higher traffic volumes, average delays at a roundabout would be half the delays at a signalized intersection.

Reduced queue lengths. The Center for Transportation Research and Training also conducted an analysis of queue lengths for various types of intersection control. The conclusion of the analysis was that 95th percentile queue lengths for roundabouts would be less than queue lengths for two-way and all-way stop controlled intersections and signalized intersections, for traffic volumes ranging from 400 vehicles per hour to 1,800 vehicles per hour. At higher traffic volumes, queue lengths at a roundabout would be half the queue lengths at a signalized intersection.

Increased capacity. The Center for Transportation Research and Training also conducted an analysis of the capacity of various types of intersection control, and concluded that roundabouts offer the greatest capacity. Under similar traffic conditions, a roundabout would reach a degree of saturation of 0.85 at 1,900 vehicles per hour. In comparison, a signalized intersection would reach the same degree of saturation at 1,550 vehicles per hour, all-way stop control at 1,200 vehicles per hour, and two-way stop control at 1,000 vehicles per hour.

Reduced traffic noise. Because many vehicles do not stop at a roundabout, do not idle waiting to enter the intersection, and do not accelerate from a stop, traffic noise at a roundabout is typically less than at a conventional intersection. In addition, landscaping and other features of a roundabout also help to deflect and reduce traffic noise.

Reduced vehicle emissions. As with traffic noise, vehicle emissions at roundabouts are reduced because many vehicles do not stop at a roundabout, do not idle waiting to enter the intersection, and do not accelerate from a stop. On average, vehicles spend less time travelling through a roundabout than through a signalized intersection, and as a result emit less pollutants during the time spent travelling though the intersection.

Simplify complex, awkward intersections.
Roundabouts are well-suited to intersections which differ from the conventional four-leg, 90-dgree configuration. A roundabout can incorporate five or more legs. A roundabout can accommodate roads at angles far from perpendicular.

Minimum number of road lanes. The capacity of a road network is determined by the capacity of the intersections. The capacity of the roads is typically far higher than the capacity of the intersections. What this means is that in many cases, although four lanes may be needed on a road at a conventional intersection, only two lanes are needed to accommodate the traffic travelling along the road between intersections. Roundabouts provide an opportunity to construct roads with fewer lanes, and increase road capacity at the intersection by flaring the approach into two lanes and/or constructing a dual-lane roundabout. The result is narrower roads, less pavement, less impermeable surface area, and reduced costs.

Enhanced appearance. Roundabouts typically incorporate landscaping, particularly in the centre island, which enhances the overall appearance of the intersection and adjacent roadways.