THE REGIONAL MUNICIPALITY OF DURHAM

DESIGN SPECIFICATIONS FOR ROADS, STRUCTURES AND ENTRANCEWAYS

WORKS DEPARTMENT

April 2025

Table of Contents

1. Introduction

The following section is to be read in conjunction with the information provided through the S-300 Series – Roads Standard Drawings and S-600 Series – Roundabout Design. Consultants are to familiarize themselves with the content of the standard drawings prior to beginning preliminary or detailed design.

In general, the geometric design of Durham's regional roads shall follow the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (most recent version) and the regional policies and specifications listed here.

To create safer roads for road users, Durham under its Vision Zero Strategic Road Safety Action Plan has identified emphasis areas and recommended several counter measures. The geometric design shall consider those recommendations as applicable in the planning and design of Durham roads.

A design criteria document is required to be prepared for each project. The document shall include the criteria used for the various project components and any deviation from the standards, with the applicable justification for the deviations and proposed mitigations.

The design criteria document shall be submitted to the Region for approval.

Details shall be provided for any approved special provisions required due to unique physical conditions on the site or for existing or future design conditions such as retaining walls, slope protection, culverts, bridges or special crossfall conditions.

2. Geometric Design

The design speed shall be selected in consultation with the Region, based on Section 2.3 of the TAC Geometric Design Guide for Canadian Roads, which considers the following:

1. General terrain and physical features of the road (horizontal & vertical alignment lane & shoulder width, etc.).
2. The operating speed (85th percentile), existing and anticipated post construction.
3. Adjacent land use and character of the road (urban or rural).
4. Road classification.

Considering context sensitive design, the design speed may be reduced to be 10 kilometres per hour (km/h) over the posted speed when the posted speed is 50 km/h.

In each case, the existing and planned roadway corridor characteristics should be considered, as well as the target speed for urban environments (TAC Chapter 2, section 2.3.7). The designer should consult the Region's Official Plan (OP), the Transportation Master Plan (TMP), and the Regional Cycling Plan (RCP), most current editions, for corridor needs and characteristics.

Regional Roads shall be designed to satisfy safe sight distance requirements per TAC Chapter 2, section 2.5.

Longitudinal profile grade changes (algebraic difference) in excess of one per cent are to include vertical "K" curves. The vertical curvature shall be based on TAC Chapter 3. Multiple breaks or splined profiles shall not replace vertical curves.

Horizontal curvature shall be based on TAC Chapter 3. On rural roads and high-speed urban arterials (design speed greater than or equal to 70km/hr) the use of spiral curve between the tangent and circular curve is recommended. For low-speed urban arterials (design speed less than 70km/hr) and retrofit situations, spiral curves are not typically used.

Pavement widening on curves especially on designated truck routes to accommodate the off-tracking of the design vehicle should be considered.

Allowable horizontal deflections shall be located away from intersections. Refer to Section 4 below.

Each alignment in a project shall be assigned a unique chainage, such as 10+000, 20+000 etc. Chainage should progress south to north and west to east.

The combination of the horizontal and vertical geometry of the road, and the cross-section consistency shall be reviewed for safety based on TAC.

2.1 Regional Roads Design Criteria

The general characteristics of Type “A”, Type “B” and Type “C” arterial roads are defined in the Regional Official Plan (Schedule E. Table ‘E7’).

	Regional Arterial Type "A"	Regional Arterial Type "B"	Regional Arterial Type "C"
Minimum Grade:			
• Road profile	0.50%	0.50%	0.50%
• Curb & gutter (along road)	0.50%	0.50%	0.50%
• Curb & gutter (in intersections)	0.60%	0.60%	0.60%
• Bridge decks	0.60%	0.60%	0.60%
Maximum Grade:			
• Road profiles	8.00%	8.00%	8.00%
• Through an intersection	2.50%	3.00%	3.00%
• Intersection grade difference	2.00%	2.00%	2.00%
Right-of-Way Width	36 > 50 m	30 > 36 m	26 > 30 m
Minimum Intersection Angle	70°	70°	70°
Pavement Crossfall (typical)	2%	2%	2%
Minimum Cross-fall (bridge decks)	2%	2%	2%
Shoulder Rounding Minimum*	0.5	0.5	0.5
Super Elevation Maximum (urban/rural)**	4/6%	4/6%	4/6%

* When guiderail is used, one metre rounding is required.

** Apply cross-fall transitions per TAC Chapter 3. The combination of minimum longitudinal grades and flat pavement cross-fall should be avoided, specifically through intersections.

To make sure no water is trapped under the road, the bottom of Granular B (top of subgrade) shall be kept at a minimum 3% cross-slope except during superelevation and the transition between the Tangent runout and the Reversed crown sections.

2.2 Road Allowance Cross-Sections

The road allowance cross-section shall be based on details S-300.010 and S-300.020 or as specified by the Region. Transit infrastructure shall be incorporated in accordance with Durham Region Transit (DRT) Transit Stop Guidelines and S-500 series standard drawings. Sidewalk and multi-use path shall comply with area municipality, TAC and OPSD standards. Where MUP or Sidewalk is located directly behind curb, an additional 0.5m hard surfacing buffer shall be provided in addition to the required standards.

Lane widths shall be in accordance with section 4.2 of TAC. Typical lane and shoulder dimensions are listed below:

1. Through Lanes:
   - Rural 3.5 metres
   - Three lane urban 3.5 metres
   - Four and six lanes urban 3.5 metres
2. Auxiliary Lanes:
   - Left Turn no median 3.5 metres
   - Left Turn with median 3.3 metres
   - Right Turn 3.5 metres

When determining lane and shoulder width, consideration should be given to the needs of agricultural vehicles using the road section.

Shoulder width to be selected in accordance with TAC Chapter 4, section 4.4.2. In addition, when guiderail is used, the minimum shoulder width is 2.5 metres.

The minimum width of the paved portion of the shoulder shall be 1.5 metres.

In instances where forecast AADT (20-year horizon) is estimated less than 4500, reduced paved shoulder widths of minimum 1.2 metres may be considered if the engineering assessment shows that a significant premium cost will result in achieving the additional 0.3 metres width (i.e., utility relocations, property, etc.) At rural intersections, provide a paved width of one metre minimum adjacent to the semi-mountable curbs, as per S-300.030.

2.3 Structures (Bridges and Culverts)

1. The cross-section and horizontal clearances of roads over new or rehabilitated structures shall be in accordance with TAC Chapter 4, Section 4.10.

2. The minimum width of sidewalk on all new or rehabilitated structures shall be 1.8 metres where feasible.

3. The minimum width of multi-use path on all new or rehabilitated structures shall be three (3) metres where feasible.

For superelevated sections of urban roadway, standard curb, and gutter (not superelevated) with drainage inlets, where required, shall be placed on the high side to reduce sheet flow across the road due to boulevard drainage, snowmelt, etc.

A review of the roadside safety for each road shall be completed in accordance with the Traffic section in these design specifications. Where guide rail is used, details should be provided listing the guide rail type selected, justification, the hazard location and length of need calculation.

3. Road Pavement

The pavement design for arterial roads will be determined for each project based on a geotechnical (soils) investigation for the project site. Pavement design for arterial roads shall also be determined for localized Regional Road improvements constructed for development and for road restoration for sewer, watermain and utility construction on Regional Roads. A geotechnical investigation may be waived by the Region if a recent and applicable geotechnical report is available.

The investigation shall include road borehole samples at critical locations, as well as pavement cores, test pits, groundwater monitoring wells, and other means as approved by the Region. A geotechnical report will be prepared to document the analysis of the existing and proposed conditions and to provide recommendations for the design and construction. The method of analysis shall be based on applicable and industry acceptable guidelines such as AASHTO Guide for Design of Pavement Structures and ‘Guideline for Professional Engineers Providing Geotechnical Engineering Services' (1993) published by Professional Engineers Ontario. The composition and thickness of the road pavement shall be designed considering the following factors:

1. Mechanics of the subgrade soils (including strength, chemical/physical parameters, drainage, and frost susceptibility).
2. Existing/proposed local drainage characteristics.
3. The pavement Structural Number (SN) and Design Service Life (15 and 20 year normally).
4. The future volume and class of traffic expected to use the pavement (ESAL).
5. Other project-specific factors (i.e., adjacent land use, plans for future widenings or buried infrastructure, etc.).

For road widening projects, rehabilitation of the existing pavement shall be considered based on the geotechnical investigation, a pavement condition survey, and consultation with regional staff. At least two alternative rehabilitation strategies shall be presented and evaluated by the Geotechnical Engineer in a draft (preliminary) report. In consultation with the Region of Durham, a suitable option will be selected and presented in the final report.

The proposed pavement structure for the road widening shall match or exceed the existing pavement structure.

As a minimum, a typical hot-mix asphalt road structure will include:

1. Type A arterial roads:

    - 160mm Hot Mix Asphalt
    - 150mm Granular A (Increased to 250mm for road widening only projects)
    - 600mm minimum Granular B Type 1 Modified

2. Type B and C arterial roads with AADT over 2,500:

    - 140 mm Hot Mix Asphalt
    - 150mm Granular A
    - 600mm minimum Granular B Type 1 Modified

3. Type B and C arterial roads with AADT under 2,500:

    - 110 mm Hot Mix Asphalt
    - 150mm Granular A
    - 450mm minimum Granular B Type 1 Modified

The bottom of the subbase course (Granular B Type 1 Mod.) shall match the existing subgrade depth, up to 1.2 metres below the proposed road surface.

For all rural roads, include a minimum of 0.5 metres of full depth pavement beyond the edge of the travelled lane. The additional width of partially paved shoulder will consist of a minimum of two asphalt courses.

The Geotechnical report will include, but not be limited to, the following sections:

1. Field Investigation

    - Existing pavement condition survey (with photos)
    - Existing drainage condition assessment
    - Geotechnical investigation
    - Pavement coring (with photos)
    - Rutting Investigation

2. Soils and Pavement Analysis

    - Existing pavement structure (for each road segment)
    - Topsoil and organics (locations and depth)

- Subgrade soils (types, depths, and variances)
- Groundwater (depths and variances)
- Pavement coring at strategic locations
- Rutting evaluation

3. Laboratory Testing

   - Physical characteristics of granular base/subbase and subgrade soils (grain size, moisture content, and Atterberg Limits where appropriate)
   - Environmental chemical analysis results (soil and water where appropriate)

4. Recommendations

   The discussion and recommendations in each report will vary based on site-specific requirements; however, in most cases the following items will be required:

   1. Traffic loading and structural analysis
   2. Proposed pavement structure and rehabilitation, including cost analysis in support of at least two proposed designs
   3. Crack repairs, as applicable
   4. Stripping depth of topsoil/organic materials
   5. Subgrade preparation, proof rolling
   6. Asphalt mix types
   7. Construction, use of earth cut, compaction requirements
   8. Drainage recommendations
   9. Groundwater and water taking control
   10. Pavement transitions
   11. Additional information such as Borehole (BH) plans, BH logs / records (with station, offset and elevations), asphalt core data with photos, grain size distribution curves, etc.

Consideration should be given in the investigation to alternative road construction materials, such as concrete pavement, where appropriate.

4. Surface Drainage

See Design Specifications section 03 Storm Drainage for detailed guidance on storm drainage along or intersecting regional roads.

The sizing of road and bridge crossing culverts shall be generally in accordance with MTO Highway Drainage Design Standards (2008), with regulatory agency inputs and additional considerations as noted in section 03 Storm Drainage.

To improve the resilience of road and storm structures against current and future flood risks, Durham Transportation Master Plan has identified emphasis areas and recommendations to consider as applicable in the planning and design of Durham roads.

Along arterials with on-road cycling facility, side-inlet-catch basins in place of standard curb-inlet catch basins shall be considered to prevent cyclists circumventing the catch basins and wandering into driving lanes.

Where culverts and sewers are designed within the frost depth, granular frost tapers shall be specified. Typical frost depth is 1.2 metres south of Highway 407: 1.5 metres north of Highway 407.

The bottom of a rural ditch is to be 0.5 metres below the subgrade where possible. The minimum depth of ditch is 0.3 metres.

Where concerns regarding water quality at the outlet exist, consideration should be given to incorporation of Low Impact Development (LID) methods such as flat bottom ditches and bio swales.

Ditch back-slopes fronting residential properties should be 4:1 or flatter to allow for lawn maintenance.

For locations on rural roadways with more than one lane of traffic draining to the ditch (i.e., two lane roadway, superelevated locations, or locations with turn lanes) consideration should be given to reinforce the fill or fore-slope of the roadway to prevent erosion during storms. The appropriate shoulder treatment should be selected in consultation with a geotechnical engineer.

5. Intersections

Details S-300.030 to S-300.050 and OPSD 300.010 to 300.020 should be used as guides for intersection design. The road grades, earth grading and the drainage around the intersection shall be developed based on these, the guidelines in TAC and site-specific conditions.

It is desirable to locate intersections on a tangent for increased visibility and safety. As a guide, the length of tangent approaching the intersection should be:

1. For type “A” and type “B” arterial roads, a 200 metre long tangent at the approach to an intersection is desirable; as a minimum, the tangent shall be equal to the stopping sight distance.

2. For type “C” arterial roads and municipal roads, a tangent length equal to the stopping sight distance at the approach to an intersection is desirable; as a minimum, the tangent shall be 20 metre long beyond the projected edge of pavement.

No deflection of the alignment will be allowed through the intersection. Locations where this is not preventable shall be discussed with the Region’s Project manager and an exemption should be obtained.

A review of the proposed sight lines and sight triangles at the intersection based on TAC Chapter 9 requirements is to be prepared and submitted to the Region.

Daylight triangles requirements for infrastructure may govern the R.O.W. requirements. Any deviations from desired daylight triangle requirement shall be noted in the design criteria as an exception.

5.2 Intersection Grades

The maximum grade of minor roadway profiles at intersections with Regional Roads shall be based on TAC.

Side road profile grade changes approaching crownline of main road shall not exceed an algebraic difference greater than two per cent if the intersection is to be signalized as part of the project or potentially in the future.

At the intersection of two roads, transition of the minor classification road shall have minimal impact on the major road. The profile and cross-fall of the major road is to be maintained to the extent possible.

The rate of change of crossfalls (or cross-slope) approaching an intersection should not exceed 0.5 per cent change over 10 metres. If physical or operational constraints are present, steeper rates may be used in accordance with TAC Table 9.7.1. The transitions from the standard cross-slope shall occur outside the intersection, beyond the intersection plane, defined by the four outer edges of the through lanes. All cross-slope key points shall be noted on the Pavement Elevations drawings.

This intersection splining design shall have regards for ride and major and minor drainage.

5.3 Turning Lanes

Left Turns:

Left-turning vehicles should have sufficient sight distance to select gaps in oncoming traffic and complete left turns for the design speed as recommended in Chapter 9 of the TAC. The measurement of the sight distance to oncoming vehicles for left turns at 4-legged signalized intersections shall account for the reduced visibility caused by vehicles queued in the left turn lane on the opposing intersection leg where raised centre median islands create a negative offset in the alignment of the left turn lanes.

Partial slotted left turn lanes shall be implemented at all signalized intersections in consultation with the Region. The negative offset in opposing left turn lanes shall be reduced or eliminated sufficiently to provide the minimum sight distance to oncoming vehicles for left turning motorists. Positive offset left turn lanes may be applicable when the required minimum left turning sight distances are restricted due to:

1. The intersection being located on, or close to, a horizontal curve with lanes approaching in a counterclockwise direction.
2. The roadway being flared or widened through the intersection.
3. Three or more through lanes being present on opposing intersection approaches.

Positive offset left turn lanes may also be applicable when:

1. An overrepresentation of turning movement type collisions exist involving left turns and opposing through movements.
2. The left turning movement will operate at LOS F or v/c ratio is 1.0 and opposing left turn and through volumes are considered high.

Right Turns:

Consider the need for right turn lanes and/or tapers on regional roads. The need will be assessed on a site by site basis and should generally follow the guidelines in the table below.

The geometric design of these should follow the Region Standard S-300.050.

TABLE 1 – Right turn lanes on Regional Roads

Arterial Function	Type	Design Approach Volumes (vehicles per hour)	Right-Turn Lane Threshold (vehicles per hour)	Right-Turn Direct Taper Threshold (vehicles per hour)
Type A	Urban or Rural	800 to 1000	50 (four-lane)	10 (four-lane)
Type A	Urban or Rural	800 to 1000	40 (two-lane)	All (two-lane)
Type B	Urban	700	50 (four-lane)	20 (four-lane)
Type B	Urban	700	40 (two-lane)	20 (two-lane)
Type B	Rural	700	70 (four-lane)	20 (four-lane)
Type B	Rural	700	40 (two-lane)	20 (two-lane)
Type C	Urban	500	50 (two-lane)	20 (two-lane)

5.4 Intersection Turning Radius

In general, turning radii at intersections should be kept to a minimum considering functionality for the design vehicle and desirable vehicle speeds. The typical turning radius at an intersection of two arterial roads is 15 metres. The typical radii used for other intersections are 12 metres and nine metres. Vehicle turning path checks using the design vehicle are to be completed for all intersections and documented in the project file. The design vehicle shall be determined in consultation with the Region. The design shall consider the project environment: urban/rural; number of receiving lanes; intersection angle; bus routes; location of driveways; cycling / truck route etc.

In some situations, the turning radius will be different than the curb/edge of pavement radius (i.e., where there are bike lanes on one or both roadways).

In urban environments on multi-lane roads, trucks may use the two outside receiving lanes for the turns.

If a radius larger than 15 metres is deemed necessary, the use of a compound curve may be considered. Refer to S-300.030 for details.

At an urban intersection, the use of a compound curve is less desirable. The use of a smaller radii and a wider receiving lane of 4.25m tapered down at 30:1 to the standard lane width of 3.50m, should be considered as a design alternative.

5.5 Roundabouts

Rural Roundabout Design Criteria

This Roundabout Design Criteria is to be read in conjunction with the Roundabout Design Drawings S-600 series. The design criteria are intended to supplement and supersede where necessary National Cooperative Highway Research Program (NCHRP) Report 672, *Roundabouts: An Informational Guide, Second Edition*, as well as the Transportation Association of Canada (TAC) *Canadian Roundabout Design Guide* published in January 2017.

Roundabout Design Principles

Speed Control

Pioneering research undertaken in the United Kingdom concluded that motor vehicle speed is a useful proxy for safety performance at a roundabout. If vehicle speeds are not sufficiently controlled, then the likelihood of drivers yielding on entry is reduced. This in turn increases the potential for entry-circulating crashes. However, if speeds are overly controlled then this increases the potential for approach (rear-end and loss-of-control) crashes. Thus, a balance is needed. The balance is a function of site context, as rural roundabouts with high-speed approaches, high truck percentages and no pedestrian traffic should be expected to operate at higher speeds than more urban roundabouts.

Entry path radius is a useful proxy for motor vehicle speed. Entry path radius is a measure of the lateral deflection imposed on a vehicle entering a roundabout. It is different than entry radius, which is the curb radius at an entry. Entry path radius needs to be within a certain range to trade off the potential for entering-circulating versus approach crashes, and therefore minimize total crash potential. An illustration of this relationship out of the original UK research is shown in Figure 1.

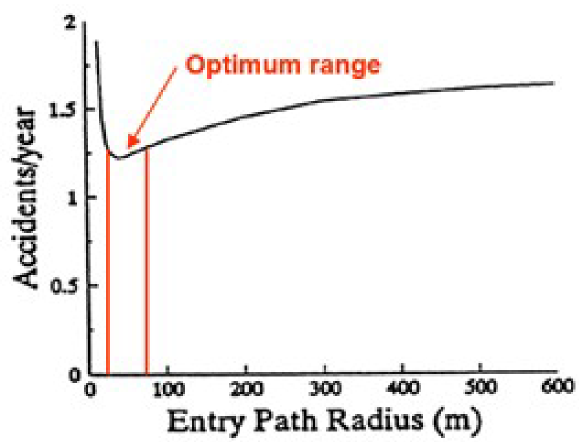


Figure 1 – Optimum Range for Entry Path Radius

Entry path radius is determined by drawing a “fastest-path”, the fastest possible path allowed by geometry for a passenger car through a roundabout in the absence of other traffic and ignoring all pavement markings. Usually, the fastest path is the through movement, the straightest path that cuts close to the outer curb and central island, and out the opposite exit. If the roundabout is on a skewed intersection, then sometimes it can be the right-turn movement. Fastest-path speeds are theoretical attainable speeds, not expected or design speeds.

A vehicle is assumed to be 2 m wide and maintain a minimum clearance of zero metres from a roadway centreline and 0.5 metres from face of curb. When designing a roundabout this width is reduced to a line path, and the minimum offsets then become one metre from centreline and 1.5 metres from face of an inner or outer curb (or truck apron). No clearances should be assumed from any curb gutters, painted lane lines or edge lines.

The path should start a minimum of 50 metres from the yield line. The smallest radius along this path as it bends to the right through the entry is called the entry path radius. The entry path radius can be measured by applying a best fit circular curve or arc over a length of 20 to 25 metres at the location of most curvature. Refer to Region of Durham Drawing S-620.010. Entry path radii should be checked for all approaches.

The most natural way to represent the fastest path is with a cubic spline (“spline” command in AutoCAD, create “B-spline curve” in Microstation). Each bend in the spline affects the others and gives a correct uniform change in radius. Arcs and tangents shall not be used, as they may not correspond to realistic driving paths and the arcs can usually be artificially set to achieve lower entry path radius values. In Figure 2 the diagram on the left shows the use of arcs and tangents with a resulting entry path radius of 41 metres. The diagram on the right shows a spline with a resulting entry path radius of 52 metres. The spline provides the more correct estimation of the fastest path.

Entry path radius is sometimes referred to as R1. There are also R2 to R5, where R2 is the circulating path radius, R3 is the exit path radius, R4 is the left-turn path radius, and R5 is the right-turn path radius. Although all five path radii should be determined, it is the entry path radius (R1) that is most important and will govern other path radii at a roundabout. The exception is the case of a skewed intersection, where the right-turn path radius (R5) may be higher than R1.

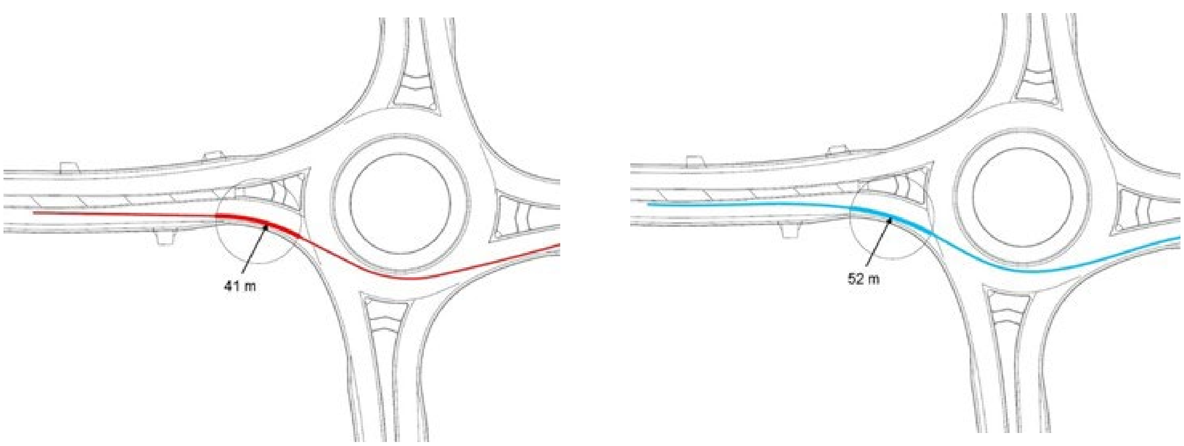


Figure 2 – Comparison of Arcs and Tangents (left) vs. Splines (right)

Path radii can be converted to fastest-path speeds using speed-radius equations. NCHRP Report 672 recommends a maximum fastest-path entry speed of 40 km/h for a single-lane roundabout. Preferred in the Region of Durham is be within the range of 35 to 42 km/h, depending on traffic distribution and site context.

Background information can be found in the UK Transport Research Laboratory (TRL) publications LR1120, *Accidents at 4-Arm Roundabouts* (1984) and TD 16/07 *The Geometric Design of Roundabouts* (2003).

Design Vehicle Accommodation

Like all intersections, roundabouts must accommodate a design vehicle, or largest vehicle expected to travel through on a regular basis. In the Region of Durham all rural roundabouts must be able to accommodate a WB-20 tractor semi-trailer, a highway bus, and a wide farm tractor. Details of these vehicles, and their means of accommodation, can be found in Drawing S-620.020.

In support of large agricultural farming equipment utilizing the roads within the Region, a lane width of 5.5 metres to the curb faces combined with semi-mountable curb (with wide gutter) adjacent the splitter islands, has been selected as an ideal design solution. Refer to Drawing S-600.040.

Vehicles may be plotted in AutoTurn or Autodesk Vehicle Tracking using default values for Lock-to-Lock Time, Trailer Angle Lock and Steering Angle Lock. An Arc Path drawing method should be used with a minimum design speed of 25 km/h for through movements and 15 km/h for turning movements.

Although central island truck aprons are common with single-lane roundabouts, outer truck aprons are not to be part of a roundabout design without the approval of the Region. Right-turn bypasses may be used at skewed intersections where the geometry is too restrictive for trucks to turn right within the roundabout.

The vertical design of a roundabout, including the central island truck apron, shall not cause lowboy trailers to bottom out.

The Region will advise should any special vehicles need to be accommodated at a roundabout such as long combination vehicles (LCVs) or over-dimensional loads; alternatives will need to be presented to the Region for consideration and approval.

Sight Distance

Sight distances shall be checked with a roundabout design in accordance with NCHRP Report 672 and Drawing S-620.030. Drivers' eye height is 1.08 metres, and object heights 1.08 metres for intersection sight distance (ISD) and zero metres for stopping sight distance (SSD). If a crest vertical curve is present and SSD cannot be met with an object height of zero metres, then an object height of 0.38 metres may be used with approval from the Region.

The ISD and SSD envelopes should be shown on a Combined Sight Distance Diagram so that objects and landscaping are not located where they will restrict sightlines. However excessive sight distance beyond these envelopes is discouraged. UK research has shown it can lead to higher speeds and less observance of the yield condition at entry.

High-Speed Approach Design

Transition and Approach Zone Treatments

Ideally, at high-speed rural intersections (posted or operating speed of 80 km/h or more) drivers should be travelling at a low speed at the back of any expected queue. The speed reduction should occur within a "transition zone". Physical measures such as horizontal curvature through the entry of a roundabout are the most effective at reducing speed, but also the most dangerous if traversed at speed. Therefore, there should be an "approach zone" upstream of the transition zone that contains warning devices and other measures. The leading bullnose of the splitter island can be used to demarcate the two zones.

Transition zone treatments for a roundabout consist of extended splitter islands and a transition from a rural cross section with paved shoulders to an urban cross section with curb and gutter to provide a visual "funnel". Refer to Drawing S-600.030. The length of the splitter island should correspond to the reduction needed from the approach speed to the entry speed. As a general rule splitter islands for approaches previously under no control or traffic signal control, where approach speeds could be high, should be between 60 and 120 metre long depending on the 85th percentile speed and geometric conditions. Longer splitter islands may be necessary on horizontal curves to maintain SSD of the leading bullnose. Splitter islands for approaches previously under stop control should be a minimum of 30 metre long for low-speed and 60 metre long for high-speed facilities. The leading bullnose of the splitter island should always be upstream of any channelized right-turn island.

Outer curbs should typically extend the length of the splitter islands on the approach lane but can be relaxed on the departure lane to a minimum of 30 m from the roundabout, depending on horizontal alignment and ensuring that positive guidance is provided. Shorter lengths based on site conditions may be used with approval from the Region.

Approach zone treatments consist of warning devices and psychological measures such as roadside features, advance signs, and illumination. Note that these treatments alone are not adequate for high speed reduction.

High-speed rural design applies in the approach zone but should transition to low-speed urban design within the transition zone. This includes maintaining a normal crown through as much of the transition zone as possible. It may not be possible to maintain this with roundabouts on long left-hand horizontal curves. In this case the end of full superelevation should be at the leading splitter island bullnose. Superelevation runoff and tangent runout may occur within the splitter island, but there should be no full superelevation within the transition zone.

If successive reverse curves are employed to achieve speed control, then these curves must maintain SSD of the entry and not contain superelevation or violate minimum horizontal radii for urban design as shown in Drawing S-600.030.

Central Island Treatments

An additional treatment applicable for all roundabouts, and in particular roundabouts having high-speed approaches, is a conspicuous central island. An earth berm and landscaping in the central island, within the unrestricted height area denoted by the Combined Sight Distance Diagram, is strongly recommended to limit sightlines through a roundabout and headlight glare from oncoming traffic.

Appropriate treatments for the central island consist of earth slopes no steeper than 6:1, short grass and plants, small deciduous trees and small to medium coniferous trees (less than 100 millimetre caliper at maturity) and fixed objects only when protected by approved crash cushions. Fixed objects shall not include brightly lit or reflective objects that can cause driver distraction, or long poles that may be struck and fall onto the circulatory road. When selecting plantings, keep in mind their long-term growth potentials and that they will not encroach on required sight distances as per the Combined Sight Distance Diagram. Consider plantings with minimal maintenance requirements. The Region shall have final say on any landscaping plan for the central island of a roundabout.

Access Management Considerations

As a general rule, minimum spacing between a roundabout and an adjacent intersection or access driveway should be determined by the predicted 95th percentile queue spillback for each. On a Regional Road the nearest edge of a driveway should be a minimum of 30 metres from the nearest end of the roundabout yield line, subject to determined splitter island lengths and/or pedestrian and cyclist facilities. The Region shall have final say on where an intersection or driveway may be located relative to a roundabout, or vice-versa.

In cases where an existing or planned driveway is within the length of a splitter island, a depressed curb may be provided in the island to permit access. Where there may be multiple accesses, measures need to be taken to minimize the number of depressions where possible and vise-versa for the number of accesses. There may be cases during the design of a roundabout where the depressed curb will be near the end of the splitter island. Normally the splitter island should be lengthened for guidance; alternatively, it may be shortened prior to the driveway with approval from the Region, eliminating the need for the depressed curb in the splitter island. Refer to Drawing S-630.010.

Roundabouts can be located on either end of a road section and a continuous splitter island (median) provided in between to restrict driveways to right-turns-only. Left turns can be made via a right turn and U-turn at the nearest roundabout.

Pedestrian and Cyclist Facilities

Pedestrian facilities at a roundabout will be implemented once volumes warrant them. Prior to the need for these facilities curb depressions shall be constructed and splitter islands shall be depressed where future crosswalks will be located. The Region will specify whether one or more Level 2 Pedestrian Crossovers (PXO's) are to be installed at a roundabout in accordance with Ontario Traffic Manual (OTM) Book 15. If so then a type (Type B, C or D) shall be recommended for approval by the Region. Note that crosswalks are typically located six metres from the nearest end of the yield line, whereas with PXO's the distance is 12 metres.

Once warranted, sidewalk is to be constructed following local standards and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA) at time of installation and include tactile warning surface indicators. Crosswalks shall be aligned perpendicular to the road. Refer to Drawing S-600.020. Detectible edges through the splitter islands may be achieved by a grade change and use of coloured impressed concrete outside the sidewalk areas.

Pedestrian refuge areas on splitter islands shall be a minimum 2.4 metre wide (three metre desirable) as measured between curb faces at the narrowest part of the refuge area.

Cyclist facilities will be implemented once volumes warrant them or if the roundabout is on a designated cyclist route. Prior to the introduction of these facilities cyclists will be able to mount the boulevard if so desired and not have to travel through the roundabout. Refer to Drawing S-600.020. Where cyclist facilities are required, they shall be constructed in accordance with OTM Book 18.

5.6 Roundabout: Vertical Design

The following section is to be read in conjunction with the information provided through the S-600 series - Roundabout Design Drawings. Consultants are to familiarize themselves with the content of the standard drawings prior to beginning preliminary or detailed design.

Design Elements

This section focuses on the design procedures and domains dealing with vertical design of a roundabout, to ensure coordination of critical design elements at a roundabout, including longitudinal grades, crossfall and drainage. Longitudinal gradient and crossfall combine to provide the necessary slope to ensure surface water is adequately drained and thus the value and direction of the greatest slope must always be taken into account when considering drainage.

Longitudinal Grades

The vertical design of a roundabout begins with the development of the roundabout approach profiles and circulatory roadway profiles.

Roundabout Approach Profile

Steep gradients should be avoided at roundabout approaches or limited to a maximum of two to three per cent within the last 20 metres of the roundabout approach, with two per cent being desirable, see Figure 1.

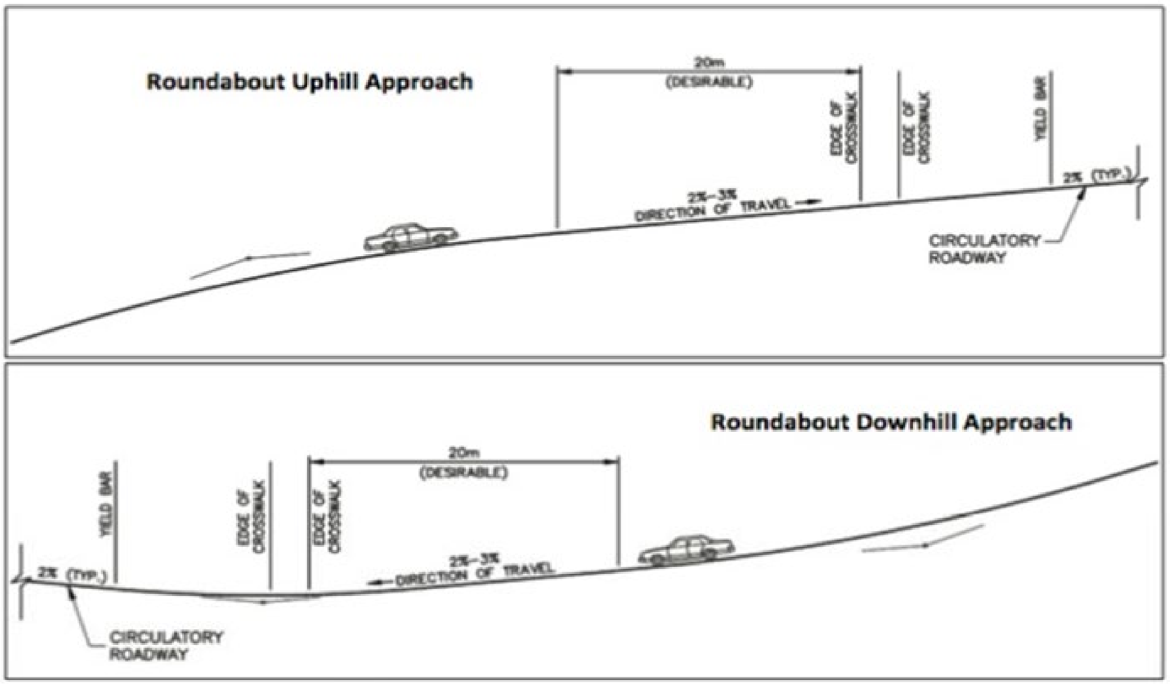


Figure 1 – Roundabout Approach Grade Profiles

- **For an uphill approach** - a crest curve will be required to create a relatively flat staging area (two to three per cent) which should be provided on the immediate approach to the roundabout (approximately 20 metres from the outer edge of the circulatory roadway). The flat area will assist heavy vehicles to enter the roundabout into gaps, ensure the capacity is not reduced significantly, and assist with sight distance.
- **For a downhill approach** – a sag curve will be required to create a relatively flat staging area (two to three per cent maximum) which should be provided on the immediate approach to the roundabout (approximately 20 metres from the outer edge of the circulatory road).

Care must also be taken with grading of the approach profile(s) to ensure that adequate sight distance is provided for the intersection and entry per TAC Chapter 2, section 2.5.

Circulatory Road Profile

The development of the circulatory road profile is an iterative process that involves tying the elevations of the roundabout approach profiles into a smooth profile around the central island, for a single-lane roundabout (see multi-lane roundabout for the development of crown profiles).

Each approach profile should be designed to the point where the approach baseline intersects with the central island as shown in Figure 2. A profile for the central island is then developed that passes through these four points (in the case of a four-legged roundabout). The roundabout approach profiles are then readjusted as necessary to meet the central island profile. The shape of the central island profile is generally in the form of a sine curve.

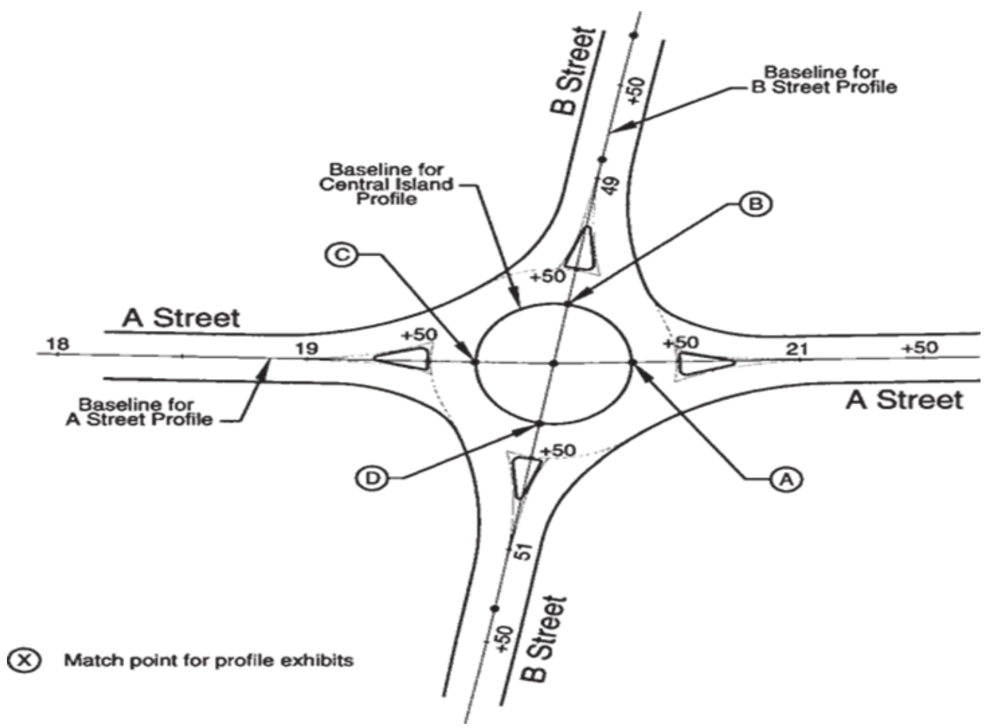
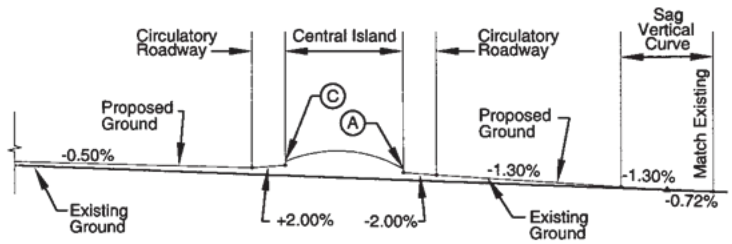
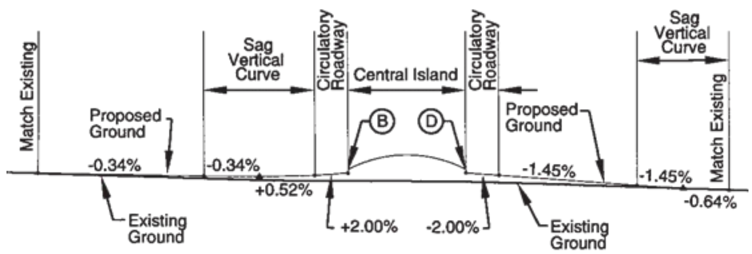


Figure 2 – Single-Lane Roundabout Circulatory Road Profile

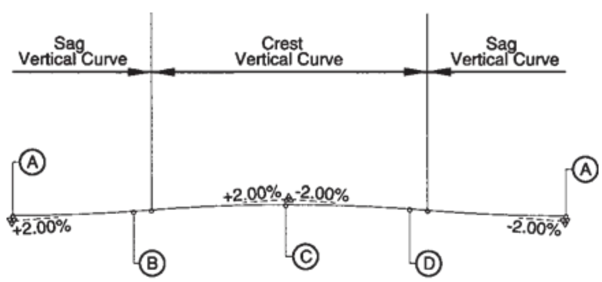


Profile: A Street



Profile: B Street

(X) See plan view for match point locations



Profile: Central Island

In addition to the approach and central island profiles, additional profiles should be created around the inscribed circle of the roundabout and along outer curbs to allow quick verification of cross slopes and drainage.

To avoid ponding, longitudinal edge profiles should have a minimum grade of 0.67 per cent. The design gradients do not in themselves ensure satisfactory drainage, and therefore the correct siting and spacing of catchbasins is also critical.

Crossfall

Normal crossfall for drainage on roundabouts should be 2 per cent, outwards from the central island unless otherwise directed by the Region’s Project Manager. Care must be taken to ensure that adequate surface drainage is provided but does not result in sharp grade changes or adverse crossfall, which can lead to driver discomfort and may in some instances cause instability for large trucks and their loads.

Single-Lane Roundabout

The circulatory roadway of a single-lane roundabout should be graded 2 per cent outwards from the central island to:

1. Promote safety, by raising the elevation of the central island, making the island and any treatments more conspicuous.
2. Promote lower circulating speeds.
3. Minimize grade breaks in the cross slopes of the entrance and exit lanes.
4. Ensure surface water is drained to the outside of the roundabout – catchbasins and subdrains would not be required around the central island.

For roundabouts on sloping topography, there may be a benefit to designing the roundabout as a tilted plane with a crown line.

Multi-line roundabout

There are two primary approaches to grading and drainage of the circulatory roadway, within a multi-lane roundabout:

1. Constant Crossfall: The first approach in some cases for roundabouts with small ICD’s is identical to that used with single-lane roundabouts, with the entire circulatory roadway graded outwards from the central island as shown in Figure 3. This method is not recommended and should be discussed with the Region’s Project Manager.

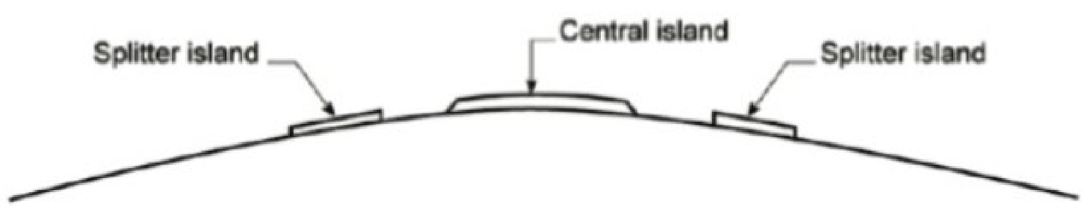


Figure 3 – Circulatory Roadway Graded Outwards

2. Crowned Circulatory Roadway: To assist vehicles traversing multi-lane roundabouts, a crown line can be used where the entry and exit roads meet the conflicting crossfall of the circulatory road. The crown line can either join the end of the splitter islands from entry to exit as shown in Figure 4.

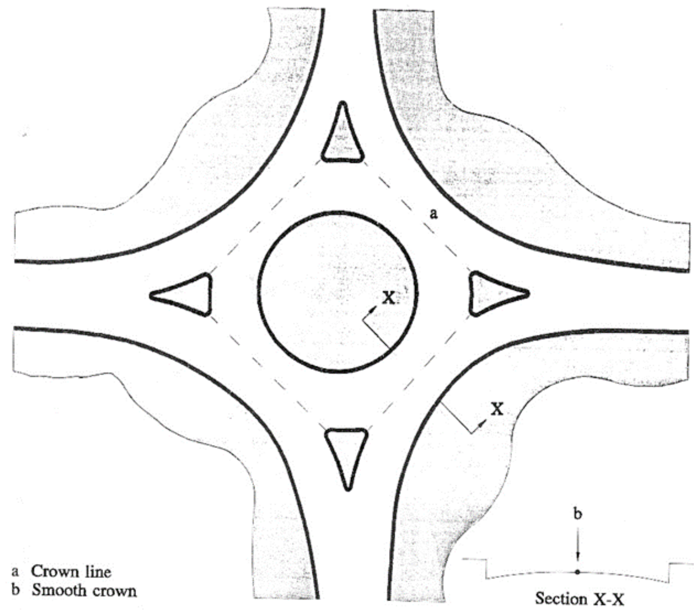


Figure 4 – Multi-Lane Roundabout Splitter Islands Crown Line

Alternatively, a crown line can be used to divide the lanes intended for left-turning and through traffic, and those intended for right-turning traffic at a factor of 2:1 internal to external. Typically, this places the crown line at two-thirds between the outer edge of the central island (including any truck apron) and the outer curb of the circulatory roadway as shown in Figure 5. The maximum recommended cross slope is 2 per cent.

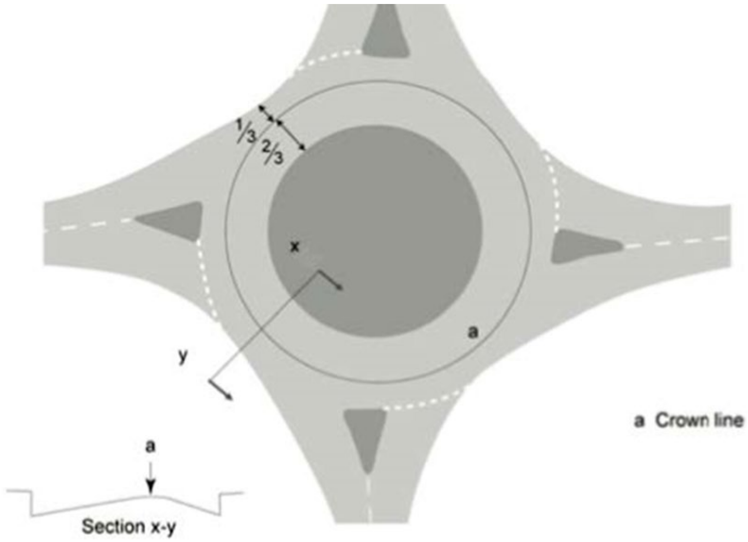


Figure 5 – Multi-Lane Roundabout Circulatory Crown Line

The entry and exit crown lines should be defined using a smooth curve from the centre lines of each of the legs and ensure that a point of tangency with the circulatory crown line is achieved. It is essential that the entry crown line of one leg does not overlap with the exit crown line of the next leg (Figure 6).

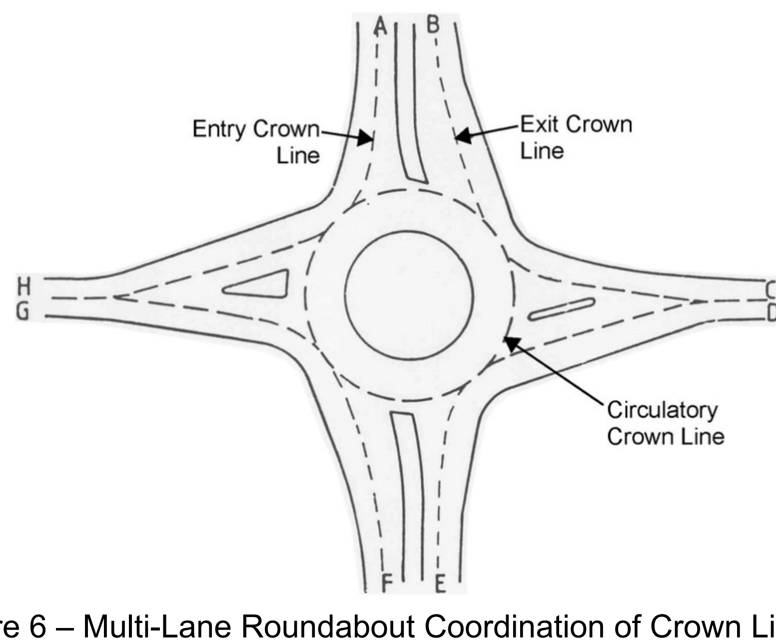


Figure 6 – Multi-Lane Roundabout Coordination of Crown Lines

As is the case with the vertical design of single-lane roundabouts, the development of crown profiles for a multi-lane roundabout is an iterative process. It is good practice to generate profiles for all crown lines to provide a visual guide of the existing ground conditions, along each crown and highlight any problematic areas for special consideration during vertical design.

Upon review of the profiles for the entry and exit crowns a suggested profile can then be created for the circulatory crown, ensuring that the profile matches the entry and exit profiles, at the respective point of tangency, generally in the form of a sine curve.

The central island and outer curb profiles can then be created by applying a constant rate of crossfall or elevation difference. It is important to ensure the central island curb does not result in excessive variation in elevation, if this occurs then the circulatory crown profile should be flattened to reduce the degree of variation (Figure 7).

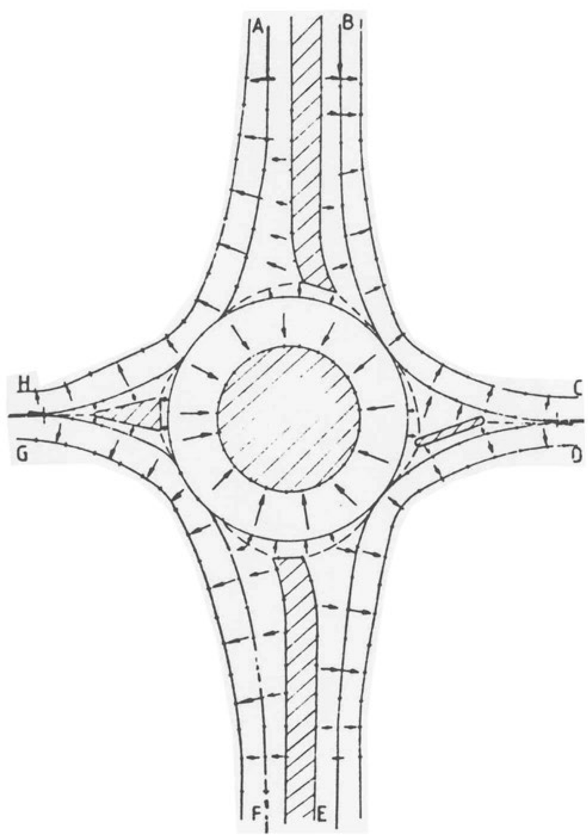


Figure 7 – Multi-Lane Roundabout Application of Crossfall

The conflicting crossfalls at the crown lines have an effect on driver comfort and may also be a factor in load shedding. The maximum recommended algebraic difference in crossfalls is four per cent although lesser values are desirable, particularly for roundabouts with a smaller ICD. Providing a circulatory crown, with inward and outward crossfall, will require catchbasins and subdrains around the central island, in addition to the outer curbs.

5.7 Roundabout Submission Requirements

Roundabout designs submitted to the Region fall under two categories: functional / preliminary design and detailed design.

1. Functional / Preliminary Design

   A roundabout functional / preliminary design is typically developed as part of an initial feasibility study, Intersection Control Study (ICS) or Class Environmental Assessment (EA). In all cases the functional design shall achieve appropriate speed control and accommodate the design vehicles such that there should be little change in footprint with further design. This is so property impacts, and a reasonable construction cost estimate can be determined. However further development is usually required to optimize the horizontal geometry in terms of capacity, safety and cost. Diagrams depicting path radii (R1 to R5) with corresponding fastest-path speeds, and accommodation of the design vehicles, shall accompany the functional design submission.

   The vertical profiles should also be investigated to determine there are not any significant vertical grade issues that will inhibit the intersection designs. Profile drawings including vertical sight distance checks should also be provided in the submission. Horizontal stopping and intersection sight distances shall be checked as they may impact footprint and the cost estimate, and a Combined Sight Distance Diagram shall be included.

2. Detailed Design

   The detailed design is typically developed as part of a 30 per cent / 60% / 90% design submission. It verifies the functional design and represents the final horizontal geometry of the roundabout subject to any unforeseen constraints identified during detailed design.

   30 Per Cent Design Submission:

   This submission shall include a Roundabout Design Checks Package that contains diagrams detailing speed control, accommodation of the design vehicles, entry angles and a table of path radii (R1 to R5) with corresponding fastest-path speeds. A Property Request Plan shall be provided if necessary.

The vertical profiles should also be investigated to determine there are not any significant vertical grade issues that will inhibit the intersection designs. Profile drawings including vertical sight distance checks should also be provided in the submission. Horizontal stopping and intersection sight distances shall be checked as they may impact footprint and the cost estimate, and a Combined Sight Distance Diagram shall be included. The horizontal geometry should be approved by the Region before further roundabout design takes place, such as vertical design and grading, to avoid possible rework.

A Roundabout Capacity Analysis Package shall accompany the 30 per cent design. Acceptable software currently consists of RODEL and ARCADY. Both shall be used with the default model and not the Highway Capacity Manual (HCM) model. Results shall be shown with no capacity adjustment, and with a 10 per cent downwards y-intercept adjustment of the capacity prediction or equivalent. SIDRA may be used when comparing delay and emission outputs for traffic signals and roundabouts. Right-turn bypasses should be noted if required for improving capacity or with an intersection skew.

60 Per Cent & 90 Per Cent Submissions:

The 60 per cent and 90 per cent design submissions for a roundabout are to include the same drawings as those required for road projects (i.e., alignment, removals, plan and profile drawings, sections, details, etc.). Pavement elevations shall include grades. Additional drawings specific to the roundabout shall be included for alignments, layout, signage, pavement markings, illumination, and construction staging, plus the Combined Sight Distance Diagram. Staging drawings shall detail how sightlines, grades and illumination levels are to be maintained during construction.

6. Entranceway/Driveway Design

Entranceway refers to any private road, laneway, driveway, gate or other structure or facility constructed as a means of access to a Region of Durham road.

Review and document the sight lines at the driveway locations and address any deficiencies.

6.1 High Volume Entranceway

Refers to an entranceway providing access to and/or egress from:

1. An office, retail, or institutional building.
2. An apartment building containing more than five dwelling units.
3. An employee or other parking lot.
4. An industrial facility, warehouse, or trucking terminal.
5. A community or regional shopping centre.
6. A recreational complex or other public facility.

The design of a high-volume entranceway should generally follow the criteria in Section 4 above - Intersections. Positive offset left turn lanes should be considered at high volume entranceways in consultation with the Region when the required minimum left turning sight distances are restricted.

6.2 Low Volume Entranceway

Refers to an entranceway providing access to and/or egress from:

1. A single-family residence.
2. An apartment building containing not more than five dwelling units.
3. A small farmer’s field consisting of not more than four hectares, or a field forming part of a farm field and used exclusively for the passage of animals and crops.

Other entranceways serving land uses not covered above are subject to interpretation by the Region of Durham as to whether the “high volume” or “low volume” entranceway requirements will be applied.

6.3 Basic Entranceway Dimensions

Basic widths, curb spacing, radii and angles of entranceway for various land uses in urban and rural areas are given in the following Table 2. Methods of measurement can be found in the following Table 2 and are illustrated in TAC Chapter 8 Figure 8.9.2.

For the purpose of Table 2 below, “Urban” refers to a curbed cross section and “Rural” refers to open ditch construction.

The design values given may be adjusted by the Region of Durham as required to handle expected traffic conditions.

TABLE 2 – Entranceway Geometry

Entranceway Geometrics	Dimension reference (see TAC Figure 8.9.2)	Urban residential	Urban commercial	Urban industrial	Rural residential	Rural commercial	Rural industrial	Rural farm
Width (metres) at property line	W							
Minimum		3.5	4.5	6.0	4.9	5.5	6.0	6.0 (2)
Maximum (2 Lane)		7.5	8.0	12.0	9.0	9.0	12.0	15.0
Maximum (3 Lane)		7.5	11.0	12.0	9.0	11.0	12.0	15.0
Right Turn Radius (metres)	R							
Minimum		(1)	4.5	6.0	3.0	4.5	7.5	7.5 (3)
Maximum		(1)	12.0	15.0	7.5	24.0	24.0	24.0
Minimum Spacing (metres)								
From property line	P	R	R	R	R	R	R	
Between driveways	E	7.5	25.0	25.0	7.5	25.0	25.0	

Notes:

1. In Urban areas, all residential entrances shall have a minimum 1.5 metres approaching and one metre departing flare in addition to the entrance width shown in the table above.

2. Recommended minimum width of eight metres to accommodate larger farm equipment is used. Access width to be reviewed with the farm owner/operator.

3. Minimum radius for farm entrances should consider the farm equipment used (in consultation with the farm owner/operator) and consider the Regional Road AADT.

OPSD 351.010 (latest revision) shall be used as a guide for urban residential design with the exception of approaching / departing flare dimensions. For commercial entrances use OPSD 350.010, with the exception of the dimensions specified above. The minimum width of commercial and industrial driveways is intended to apply to a one-way operation. The driveway width is to be measured at the edge of road pavement between the inner limit of the curb return radius or between the curb return radius and the near edge of a curbed island. Curbed islands shall have a surface area of at least 30 square metres.

In urban areas with pedestrian or bicycle facilities in the boulevard, the driveway width and radius dimensions should reflect the lower range of values provided in Table 2.

The desirable angle for any entrance should be 90 degrees. The minimum acute angle for any entranceway, measured from the centreline of roadway should be 70 degrees.

OPSD 301.010 and OPSD 301.020 shall be used as guides for rural entrance design.

At entrances in rural locations, curbs within the ROW shall not be used without prior consultation and permission from the Region.

At new or reconstructed entrances in rural locations, consideration should be given to the following:

1. Providing asphalt to a minimum of three metres from the edge of pavement, to avoid granular spilling into roadway.

2. Providing a 60m taper of paved shoulder beyond the standard 1.5 metres paved shoulder at the approach and departure from the rural driveway.

6.4 Minimum Pavement Structure Requirements for Entranceways

The following are the minimum consolidated depth requirements:

Residential Driveways (both rural and urban)

1. Asphalt
   - 50 mm of HL 3 (PG 58-28) surface course and
   - 150 mm Granular A
2. Granular
   - 300 mm of crushed stone

Rural non-residential / farm

1. Asphalt
   - 40mm of HL3 surface course (PG 58-28)
   - 50mm of HL8 base course (PG 58-28)
   - 300mm Granular A
2. Granular
   - 300mm of Granular A

Light Industrial, Commercial, Multi-Residential and Apartments

1. Asphalt
   - 40 mm of HL 3 surface course (PG 58-28)
   - 50 mm of HL 8 base course (PG 58-28)
   - 300 mm Granular A
2. Granular
   - 150 mm of crushed
   - 300 mm of Granular B Type 1 modified

Heavy Industrial Driveways (Geotechnical investigation recommended)

1. Asphalt

   - 40 mm of HL 3 surface course (PG 64-28)
   - 80mm (40+40) of HL8 base course (PG 64-28)
   - 150 mm Granular A
   - 300 mm Granular B Type 1 modified

6.5 Entranceway - Intersection Design Considerations

For criteria and design parameters of turning lanes at entrances from the Regional Road refer to TAC and the criteria in Section 4 - Intersections.

Where signalization is required for a proposed entranceway onto a Regional Road, the design should follow the guidelines for intersection design detailed above.

The width of curb cut for residential driveways shall be as specified by the Region of Durham. The width of curb cut for apartment, commercial and industrial driveways shall take into account the basic width of the driveway and the radius of curvature as further outlined below. Where mutual driveways are constructed between two adjoining properties, the curb cut shall be continuous.

Continuous sidewalk, curb and gutter should be provided across any un-signalized driveway, including a private street, where sidewalk is present at the approaches.

If a driveway or private street is an approach to a signalized intersection, it should generally be designed according to the above practice for public streets.

There may be reasons to vary this approach on a site-specific basis. These cases should be discussed with the Region.

For new developments, the maximum grade permissible for an access driveway, from the sidewalk to the garage shall be 10 per cent. This maximum grade is not recommended and should be employed only in exceptional cases where physical conditions prohibit the use of lesser grades. There shall be a minimum grade of two percent towards the road from the property line to the curb line.

When the entrance design includes a right turn lane or taper, a 1.5 metres setback should be provided between the back of the curb and the sidewalk or Multi Use Path (MUP).

The profile of the entrance should slope up from the road toward the property line to maintain the sidewalk profile across entrances and to address overland flow containment. Refer to OPSD 310.050, Partially Depressed option as a guide.

The profile of the entrance should be designed to achieve sufficient under or ground clearance (distance from the bottom of the vehicle body to the ground) to prevent dragging and scraping on the vertical profile grade changes. Sharp breaks are to be avoided.

6.6 Turn Restrictions

Where a high-volume entranceway will enter onto a regional road, the Region of Durham may require, as a condition of access, the restriction of left turn movements into and/or out of the access. This will be determined based on site-specific conditions.

Control of turn restrictions will normally require the provision of raised median along the Regional Road through the entranceway, extending at least 25 metres past the curb returns at the entranceway to restrict left-turning traffic. If feasible, the median should be extended from the closest existing raised median. At these locations the engineer shall ensure that road lighting levels meet the requirements.

In some cases, only when raised median provision is not possible, a trumpet island design can be provided, and should be designed based on TAC Chapter 8 Figure 8.9.1.

6.7 Sight Distance at Entranceways

Minimum sight distance requirements at high volume entranceways will be the Minimum Decision Sight Distance, based upon the appropriate design speed, as set out in TAC Chapter 9, Figure 9.10.1.

The minimum sight distance requirements at low volume entranceways will be the Minimum Stopping Sight Distance, based upon the appropriate design speed, as set out in TAC Chapter 9, Figure 9.10.1.

Sight distance requirements are typically based upon 1.08 metres eye height and 1.3 metres height of object.

6.8 Entranceway Spacing / Corner Clearance

Entranceway spacing in urban areas is generally set out in the Regional Official Plan (Schedule E-Table E7) based on the Arterial Type. The minimum spacing is set out in

Table 2 above is applicable only where greater spacing is not possible due to physical constraints.

Corner clearance is the distance between an intersection and an entranceway either upstream or downstream. Minimum corner clearance dimensions are set out in TAC Chapter 8 Figure 8.8.2, depending upon the road category and the type of intersection.

Typically, the Region requires entranceways to be located outside of the functional intersection area and located outside of auxiliary turn lanes required for the intersection.

6.9 Entranceway Drainage

Entranceways should be designed to prevent site drainage entering the Regional road. In addition, drainage from the Regional road should be collected within the road right of way and not spill onto the adjacent private property.

Entrance culverts shall be designed for a 25-year storm event and as per Durham Region’s standards and shall have a minimum size of 450 millimetre. For areas with known drainage concerns the road authority may require additional design calculations and/or a larger culvert size.

The length of culvert shall be determined using the depth of ditch and 4:1 side slopes or flatter especially at rural locations. Longer culverts may be required to avoid steep slopes at the inside corner between driveway and the road. Culverts shall be designed to accommodate minimum of highway (H-20) loading and soil conditions.

6.10 Entranceway Permits

A property owner must have an “Application for Property Access” approved by the Region prior to the installation of a new or modified entranceway. Applications are to be made via the Region’s online portal at **www.durham.ca/permits.**

7. Structures (Bridges, Culverts and Retaining Walls)

Discuss and review bridge and retaining wall railing type and height with the Region’s Project Manager, especially adjacent to pedestrian or cyclist facilities.

Allowance for embedded ducts within barrier/parapet walls, curbs or sidewalks shall be reviewed and approval with the Region’s Project Manager and Traffic staff. Third-party utilities shall not be allowed or approved within the Region’s structures, without further discussion with the Region’s Project Manager.

Any retaining wall or similar structure within the Region’s Right of Way (R.O.W.), where the difference between the top of the walking surface and the top of the adjacent structure surface is more than 600mm, shall be reviewed and approved by the Region’s Project Manager. Evaluation of applicable code requirements for a pedestrian barrier along such retaining wall or structure is required.

Retaining walls within the Regions Right-of-Way (R.O.W.) shall be of cast-in-place concrete design, or similar, unless approved by the Region’s Project Manager. The Region will not accept the use of a retained soil systems (RSS) wall or mechanically-stabilized earth (MSE) wall. Consideration of a RSS or MSE wall shall warrant additional discussion and approval by the Regions Project Manager and Region Structural staff.

8. Fences and Noise Barriers

Regional roads are not typically fenced. Fences and noise barriers not originally constructed by the Region are privately owned or owned by the local area municipality and should not be within the Region Right-of-Way (R.O.W.).

Where noise barriers are constructed by the Region, they shall be installed in accordance with the Region of Durham Noise Barrier Policy and Guidelines.

Fencing reinstated as part of a regional project are privately owned and are to be located outside the Regional Right of Way.

Chain-link fencing proposed for use within the Region’s Right-of-Way (R.O.W.) where pedestrian or cyclist facilities are located, shall follow OPSD 972.130 with top wire, for improved traffic safety, and shall be discussed and approved by the Region’s Traffic department.