

# DESIGN BULLETIN #68/2010 (Supersedes Bulletin # 31)

## Roundabout Design Guidelines on Provincial Highways

### February 25, 2011 Amendment to Design Bulletin #68/2010

- Policy #4, 3<sup>rd</sup> and 5<sup>th</sup> Bullets, Page 2 of 3.
- Technical Guideline, Capacity and Safety Analysis, added NCHRP Report 672 method.
- Geometric Design Guidelines, horizontal and vertical alignment to conform to NCHRP Report 672, added NCHRP Report 672 as the general design guide and curbing guideline
- References, added NCHRP Report 672, deleted "FHWA, Roundabout: An Informational Guide"

### October 29, 2010 Amendment to Design Bulletin #68/2010

- Technical Guideline, deleted Item 5, Page 2 of 4. Refer to Attachment 1
- Plan DWG D-10.1a, Revision1. Refer to Attachment 4

### June 9, 2010 Amendment to Design Bulletin #68/2010

- Drawing and or page numbers added to Figures.
- Apron colour added to Drawings TCS-A7-100.1 and TCS-A7-100.2

#### PURPOSE

This Bulletin supersedes Bulletin 31 concerning the policy and guidelines for the use of roundabouts on roadways under Alberta Transportation's direction and control.

#### BACKGROUND

Modern roundabouts have been successfully implemented in countries throughout the world. Benefits realized by both transportation agencies and road users include reduction in severity of crashes, traffic calming, reductions in vehicular delays and reduced greenhouse gas emissions. Roundabouts provide opportunities to build more aesthetically pleasing junctions while also being functionally superior to conventional intersections in many ways. Roundabouts continue to effectively move traffic during power outages.

#### POLICY

1. Roundabouts shall be considered as the first option for intersection designs where, in the exclusive judgment of the department, a greater degree of traffic control than a two-way stop is required on a paved roadway e.g. a signalization or 4 Way stop control. If a different intersection treatment is recommended, the project documentation should include a reason why a roundabout was not selected for that location. Roadway design, capacity analysis and traffic engineering with respect to roundabouts shall be carried out in accordance with the Technical Guidelines attached (See attachment 1).
2. 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. Locations where roundabouts may be favoured:
  - Where there is a need for traffic calming such as at the boundary between urban and rural environments, in low speed urban environments, between high speed and lower speed roadways and/or between divided highways and undivided highway (such as interchange ramp terminals).
  - Where there is a desire to provide a corridor with a series of consistent intersection layouts (all roundabouts) such as at all interchange terminals along a route or at all at-grade intersections along an arterial roadway (this is frequently used in Europe especially for arterial roadways by-passing urban centres).
4. Locations where the Department would not wish to use roundabouts (this list is intended to save unnecessary analysis and debate):
  - Existing Freeways.
  - Divided highways which are identified as "future freeways" unless the use of a roundabout for an interim stage is compatible with the staging plan.
  - National highway **core** routes where the posted speed is expected to be at least 90 km/h unless the roundabout with lower speed is considered compatible with a staged plan (for example, in a low speed urban environment where the ultimate plan is to by-pass the urban centre).
  - Where the preservation of a high speed through highway is both highly desirable and feasible (using options other than a roundabout).
  - Where geometric conditions are unsuitable e.g. where gradients on the through alignments or approaches are unacceptably steep (refer to NCHRP Report 672, Roundabouts: An Informational Guide – Second Edition”, Section 6.8.7 - “Vertical Considerations” for vertical alignment guidelines) or where the sight lines on approaches are unacceptable (where decision sight distance cannot be provided in advance of the roundabout).
5. The timing of roundabout installation may be triggered by 1) the need to provide a higher degree of traffic control than a "two-way stop control", 2) a clear economic benefit based on safety and other considerations under current traffic conditions or 3) implementation of a traffic calming measure based on sound engineering judgment.
6. If an intersection warrants a signal or a four-way stop control within 10 years of the proposed project, the modern roundabout shall be evaluated. Where there is an existing four-way stop control or signalized intersection and there are operational and safety problems with the current traffic control, then the roundabout shall be considered.
7. If a capacity analysis shows a heavy right-turn volume and a Level of Service (LOS) analysis shows the LOS will be lower than D for this segment of the roundabout, a right-turn channelized turning roadway may be considered. Other special circumstances may also be considered to warrant a separate right turning roadway.
8. There is no change in Access Management Guidelines as a result of using a roundabout.

## **METHODOLOGY**

The methodology shall be to follow the standard considerations used by the department on typical projects i.e. safety, geometrics, operations, consistency with driver expectations, level-of-

service, mobility, access, economics etc. The economic analysis tool to be used is the department's Benefit Cost Analysis Guide. The standard indicators of Internal Rate of Return, Benefit/ Cost Ratio, Net Present Value / Capital Cost etc shall be considered for each option.

Recommended:

Approved:



Bill Kenny, P. Eng.  
Director,  
Design, Project Management and Training  
Date 24 FEB 2011.



Moh Lali, P. Eng.  
Executive Director, Technical Standards Branch  
Date FEB. 25/11

**Attachments:**

1. **Technical Guidelines, February 2011.**
2. **Roundabout Typical Signing at Single-Lane Roundabout (Urban), TCS-A7-100.1.**
3. **Roundabout Typical Signing at Single-Lane Roundabout (Rural), TCS-A7-100.2.**
4. **Roundabout and Cross Section Details Drawing, D-10.1a, Revision 2, February 2011**

## TECHNICAL GUIDELINES

### CAPACITY AND SAFETY ANALYSIS

Single-lane roundabout shall be the first solution to be considered when the sum of Design Year peak hour circulating and entering flow rate is less than 1,100 veh/hr at each entry approach.

Double-lane roundabout shall be the first solution to be analyzed when the sum of Design Year peak hour circulating and entering flow rate is less than 1,900 veh/hr but more than 1,100 veh/hr at any entry approach.

Roundabouts may be designed with a combination of single lane and double lane on various segments depending on traffic demand. By-pass lanes may also be used where justified by a particularly high right turn movement however it is preferred to avoid the additional complexity of by-pass lanes where feasible.

Level of Service (NCHRP Report 672 method) of critical movements at critical lanes at entry approaches not lower than D during Design Year peak hour should be considered acceptable. Level of Service is determined by the control delay for each lane.

If a capacity analysis shows a heavy right-turn volume and a Level of Service (LOS) analysis shows the LOS is lower than D, the provision of a separate right turn channelized roadway may be considered.

Available roundabout capacity and safety analysis software packages include RODEL, ARCADY, SIDRA, SYNCHRO, VISSIM and PARAMICS, etc. Engineers shall be aware that analysis results from different software packages may be different for the same roundabout capacity analysis. Field calibration is needed for software application. If field data is not available, the recommended parameters in NCHRP Report 572 should be used. It is required that the recommended capacity models in NCHRP Report 672 shall be calculated for comparison also. It shall be noted that the 2010 Highway Capacity Manual is expected to include a chapter on roundabouts as well as an embedded software package; most content of this new chapter will be based on the NCHRP Reports 572 and 672.

### GEOMETRIC DESIGN GUIDELINES

Generally, roundabout design principles include: properly designed entries and exits, site specific design, truck capabilities, proper deflection, properly sized inscribed circle diameter (ICD), positive driving experience and comfort for the public. Roundabout design is a complex task which will generally produce a “custom” design for each location (based on unique traffic flow, intersection roadway geometry and physical constraints). Designers shall use design standards to guide the site specific design instead of attempting to apply standard design solutions.

Roundabout geometric design shall follow the guidelines in this bulletin with particular reference to the following:

1. Design Vehicle: design vehicle shall follow the requirements in Alberta Highway Geometric Design Guide (1999); specifically the truck apron must be designed to accommodate the off-tracking of long combination vehicles and/or oversized vehicle and/or log haul truck, depending on the project detailed requirements. Oversized vehicles may include

construction equipment. For vehicles that use an intersection on a regular basis, the “medium” turning template should be used. If the movement is very occasional such as a piloted oversized load, then the “minimum” turning template may be used.

2. Alignment of approaches and entries: Alberta Transportation prefers the following:
  - Preferred—“Alignment Offset Left”
  - Acceptable—“Radial Alignment”
  - Unacceptable—“Alignment Offset Right”

The benefits of “offset left” include: easy to achieve desired deflection at entry approaches; easy to remove “entry path overlap” at multi-lane roundabout approaches; and easy to design larger radius exits to increase exit speeds and capacity.

Refer to NCHRP Report 672, Section 6.3.2 - “Alignment of Approaches” for horizontal alignment guidelines of the approach legs.

3. The maximum grade along the vehicle travelling direction within a roundabout shall be limited to +2% but not steeper than -2%, due to winter conditions in Alberta.  
Refer to NCHRP Report 672, Section 6.8.7 - “Vertical Considerations” for vertical alignment guidelines.
4. It is desirable to avoid designing roundabouts where grades through the roundabout are between -1% and +1% to facilitate surface drainage.
5. The gradient on the entering roadway should be between 1% and 2% falling away from the roundabout, consistent with the vertical alignments for major and minor road intersecting roadways in Figure D-3.3a and Figure D-3.3b of the Highway Geometric Design Guide respectively.
6. The circular roadway in a roundabout shall not be superelevated. A constant 2% cross fall shall be provided with the centre of the circle being the high side.  
The slope of the truck apron should generally be no more than 2%. Refer to NCHRP Report 672, Section 6.8.7 - “Vertical Considerations” for crossfall guidelines for single-lane and multi-lane roundabouts.
7. Aprons shall be provided with a steeper cross slope than the travel lane (typically 3% or 4%). Refer to NCHRP Report 672, Section 6.8.7 - “Vertical Considerations” for truck apron guidelines. A different texture than the travel lane and a mountable concrete curb shall be used to provide definition of the boundary between travel lane and apron.
8. It is desirable to design wider entry width and longer flare length at entry approaches.
9. It is desirable to design larger than standard exit radii.
10. It is desirable to use NCHRP Report 672: Roundabouts: An Informational Guide – Second Edition” as the general design guideline.
11. Curbing: Contrary to NCHRP Report 672, Section 6.8.5.2 Curbing, it is undesirable to install curbs on roundabout’s outside edges of pavement on open rural highways, due to the long winter season with snow, icing and winter maintenance activities, and the high-speed approaches. However, consideration for outside edge curbs should be given if pedestrians are expected to cross the roadway at the roundabout in low speed environments.

## **SIGNING AND PAVEMENT MARKINGS AND ILLUMINATION**

### **GUIDE SIGNAGE**

#### Single lane roundabout:

- Ground-mounted
- Diagrammatic advance guide sign
  - Include highway route markers and destination information as outlined in Highway Guide and Information Sign Manual for standard guide signage
  - Roundabout diagram/symbol should utilize arrowheads (not pointers), no dot in the centre, thinner line width for minor roads (i.e., local roads/accesses)

- Guide signs within roundabout
  - Visible in advance of the exit point
  - Should provide highway route marker
  - Should provide destination information if applicable, according to Highway Guide and Information Sign Manual
  - Should be standard rectangular shape with standard arrow
  - Should be placed either on the splitter island or on the right side of the roundabout, depending on the characteristics of the roundabout (angle between approach legs, number of lanes, presence of sidewalk, etc.). Care should be taken to ensure that these signs do not obstruct the view of users entering the intersection (pedestrians, cyclists, and vehicles).
- Confirmation destination sign a minimum of 100 m beyond any tapers

Multi lane roundabout:

- Diagrammatic advance guide sign
  - Include highway route markers and destination information as outlined in Highway Guide and Information Sign Manual for standard guide signage
  - Roundabout diagram/symbol should utilize arrowheads (not pointers), no dot in the centre, thinner line width for minor roads (i.e., local roads/accesses)
- Potential use of overhead signage, perhaps where there is a right turn channelized roadway or more complex roundabout arrangement
- Guide signs within roundabout
  - Visible in advance of the exit point
  - Should provide highway route marker
  - Should provide destination information if applicable, according to Highway Guide and Information Sign Manual
  - Should be standard rectangular shape with standard arrow
  - Should be placed either on the splitter island or on the right side of the roundabout, depending on the characteristics of the roundabout (angle between approach legs, number of lanes, presence of sidewalk, etc.). Care should be taken to ensure that these signs do not obstruct the view of users entering the intersection (pedestrians, cyclists, and vehicles)
- Confirmation destination sign a minimum of 100 m beyond any tapers

***TOURIST RELATED DIRECTIONAL SIGNAGE***

TODS/attractions signage:

- Shall be the same sign placement as if the intersection were a typical 'T' or '+' intersection, with directional signs in advance of the roundabout (none within the roundabout).
- If confusion develops (determine on case-by-case basis), additional TODS confirmation directional signage may be considered on the downstream intersection leg(s)

***REGULATORY, WARNING AND INFORMATIONAL SIGNAGE***

Regulatory:

- Speed limit signage as required in advance of the intersection and downstream on each intersection leg (50 m beyond confirmation destination sign)
- RA-7 Roundabout Yield sign at each yield point/roundabout entrance
- Keep Right assembly on the near side of raised median/splitter islands

Warning:

- WA-39 Roundabout Ahead sign 250-300 m in advance of intersection
- Advisory speed tab sign below WA-39 if deemed necessary
- (Optional) WB-2 Yield Ahead sign 50-150 m in advance of intersection
- WA-38 Roundabout Directional Sign, orientated directly in line with the path of approaching traffic at each entrance leg, within the roundabout island.
- Keep Right assembly as noted above.

Informational:

- Highway route marker/junction signage 50 m in advance of destination directional (diagrammatic) sign
- Highway route marker signage approximately 30 m downstream of the intersection on each leg

**PAVEMENT MARKINGS**

Durable markings should be considered for all markings for roundabouts.

Single-lane roundabouts:

- Wide dotted white lines at yield point.
- Aprons should be made very conspicuous by using a mountable concrete curb on the border with the travel lane and by providing a different texture, cross-slope and color compared to the travel lane. Hatching (using yellow markings or colored concrete) is very desirable and shall be reviewed and accepted by the department prior to installation.
- Centerline, shoulder, etc. lines should use principles in the Highway Pavement Marking Guide.

Multi-lane roundabouts:

- Potential of using the fish hook arrow lane designation pavement markings, as used by BC. Further investigation of the use of these markings is required.

**INTERSECTION ILLUMINATION**

- All roundabouts should be adequately illuminated.
- Illumination should be designed in accordance with Chapter 11 of the Transportation Association of Canada Guide for the Design of Roadway Lighting.

Typical roundabout signing and pavement markings for urban and rural single-lane roundabouts are shown in Attachment 2.

**RECOMMENDATIONS**

The guidance as shown here is to be implemented immediately as per the usual practice.

Date of Issue: May 17, 2010

Effective Date: May 17, 2010.

Revised Date (1): June 9, 2010

Revised Date (2): October 29, 2010

Revised Date (3): February 25, 2011.

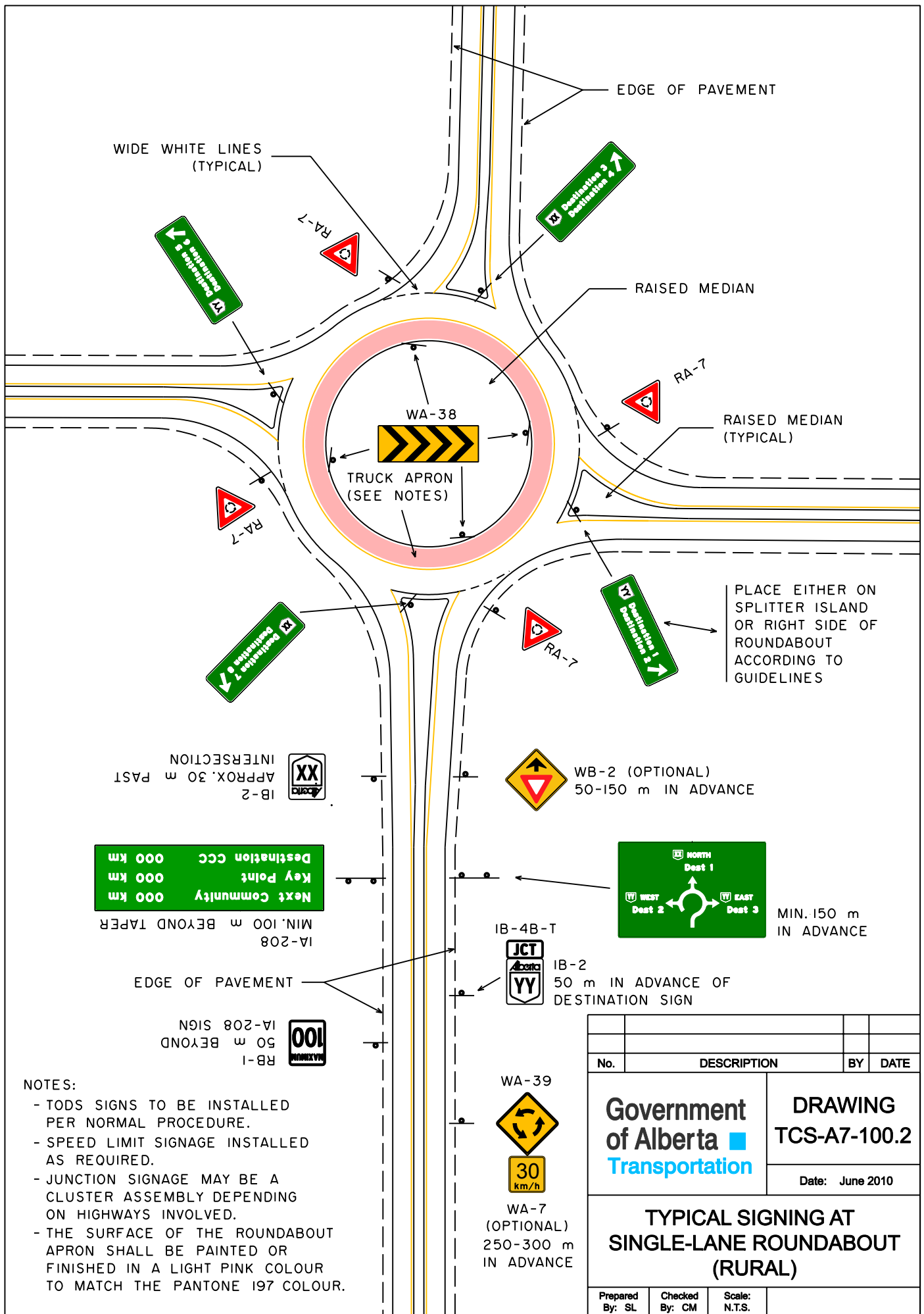
## **CONTACT**

Peter Mah at (780) 427-7129 or Jeffrey Xu at (780) 415-1049  
Technical Standards Branch, Alberta Transportation.

## **REFERENCES**

Alberta Transportation Highway Geometric Design Guide (1999)  
Alberta Transportation Roadside Design Guide  
Alberta Transportation Highway Pavement Marking Guide  
Alberta Transportation Highway Guide and Information Sign Manual  
Tourism Highway Signage Initiative Technical Details Package  
~~FHWA, Roundabout: An Information Guide~~  
NCHRP Report 572: Roundabouts in the United States  
Highway Capacity Manual (2000)  
TAC Geometric Design Guide  
AASHTO, A Policy on Geometric Design of Highways and Streets  
TAC Manual of Uniform Traffic Control Devices for Canada  
TAC Guide for the Design of Roadway Lighting  
NCHRP Report 672: Roundabouts: An Informational Guide – Second Edition  
[http://www.trb.org/Main/Blurbs/Roundabouts\\_An\\_Informational\\_Guide\\_Second\\_Edition\\_164470.aspx](http://www.trb.org/Main/Blurbs/Roundabouts_An_Informational_Guide_Second_Edition_164470.aspx)  
Canada's National Highway System, Condition Report, January 2009  
<http://www.comt.ca/english/NHS-Condition09.pdf>



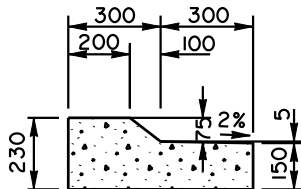
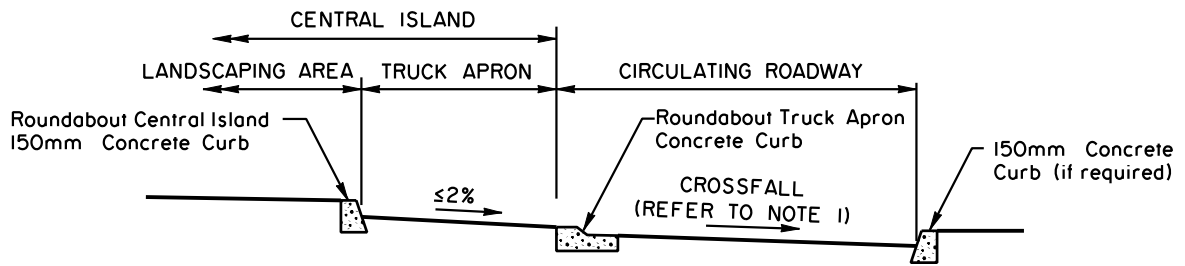
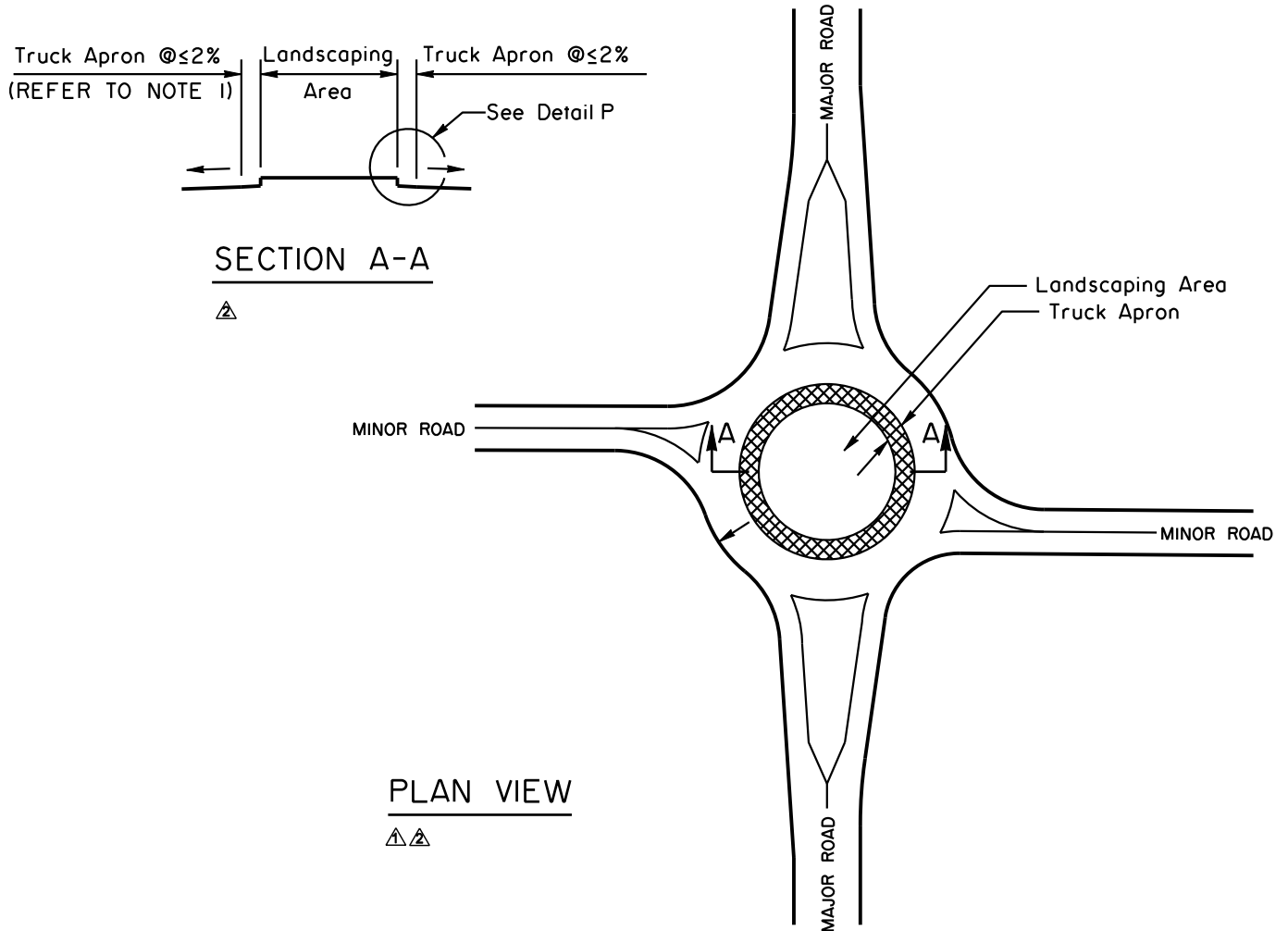


**NOTES:**

- TODS SIGNS TO BE INSTALLED PER NORMAL PROCEDURE.
- SPEED LIMIT SIGNAGE INSTALLED AS REQUIRED.
- JUNCTION SIGNAGE MAY BE A CLUSTER ASSEMBLY DEPENDING ON HIGHWAYS INVOLVED.
- THE SURFACE OF THE ROUNDABOUT APRON SHALL BE PAINTED OR FINISHED IN A LIGHT PINK COLOUR TO MATCH THE PANTONE 197 COLOUR.

PLACE EITHER ON SPLITTER ISLAND OR RIGHT SIDE OF ROUNDABOUT ACCORDING TO GUIDELINES

| No.  | DESCRIPTION    | BY   | DATE |
|--|----------------|--|------|
| <b>Government of Alberta</b><br><b>Transportation</b>    |                | <b>DRAWING</b><br><b>TCS-A7-100.2</b><br>Date: June 2010 |      |
| <b>TYPICAL SIGNING AT SINGLE-LANE ROUNDABOUT (RURAL)</b> |                |  |      |
| Prepared By: SL  | Checked By: CM | Scale: N.T.S.  |      |



**ROUNDABOUT TRUCK APRON  
CONCRETE CURB DETAIL**

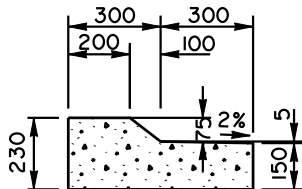
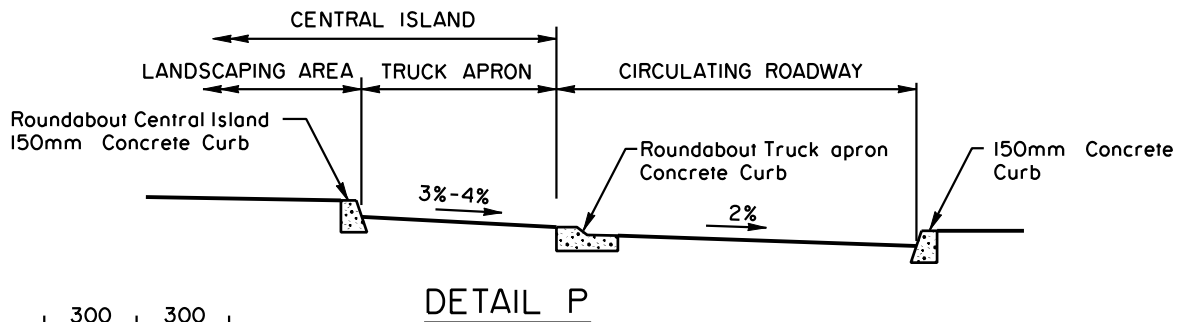
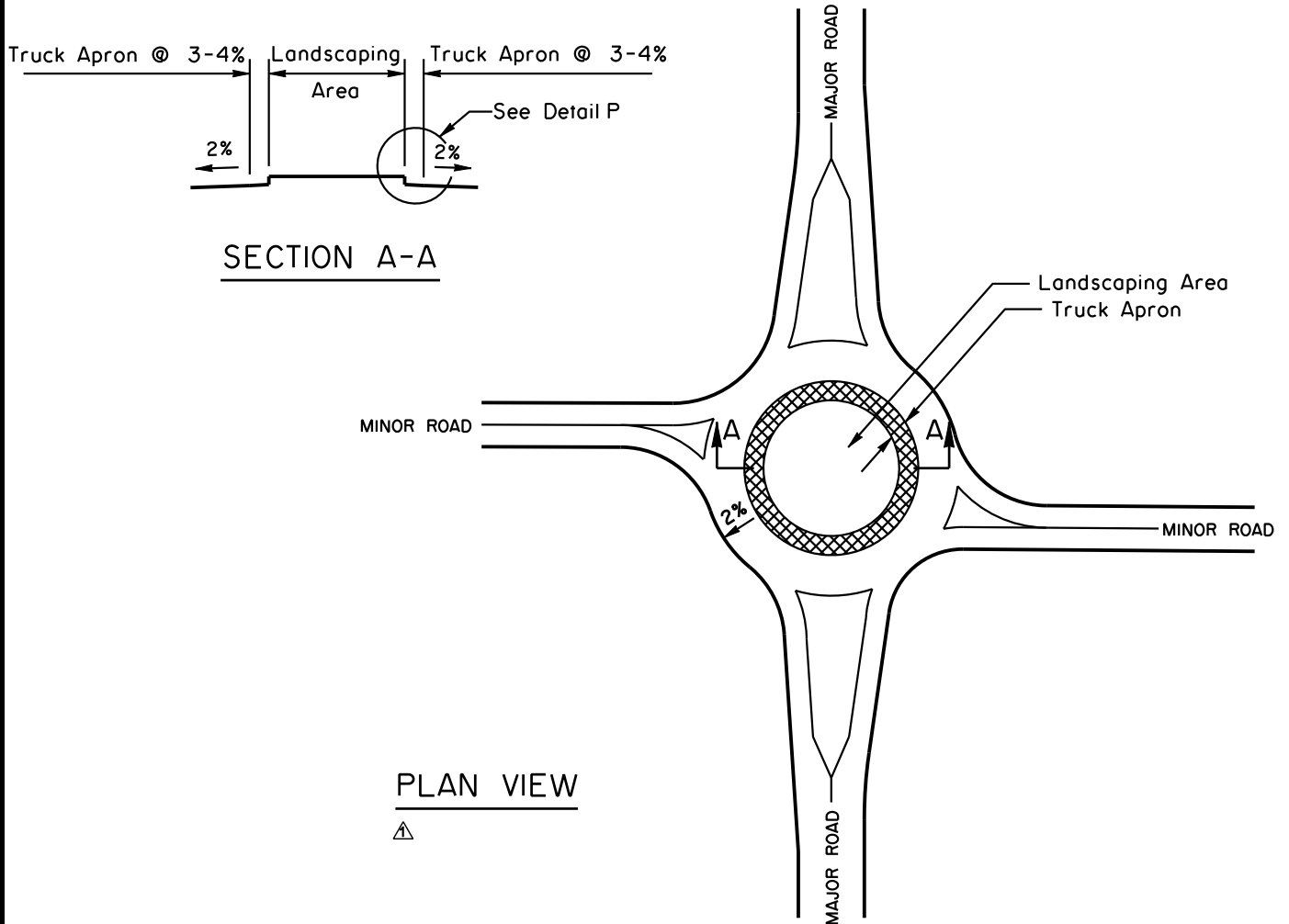
NOTES:  $\triangle$

1. REFER TO NCHRP REPORT 672 FOR GUIDELINES ON:
  - VERTICAL AND HORIZONTAL ALIGNMENT
  - CIRCULATING ROADWAY AND TRUCK APRON CROSSFALL
2. CENTRE AREA MAY BE USED FOR AESTHETIC IMPROVEMENTS.
3. OBJECTS IN CENTRE MUST BE CRASH-WORTHY.
4. SIGHT LINES MUST BE PRESERVED.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.

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| $\triangle$ | NOTES, ROADWAY CROSSFALL AND APRON     | P.M. | 18 FEB 11 |
| $\triangle$ | REFERENCE TO D-3.3a AND D-3.3b DELETED | J.X. | 1 NOV 10  |
| No.         | REVISIONS                              | BY   | DATE      |

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| Approved:  | <b>Government of Alberta</b><br>Transportation |
| LLOYD ATKIN<br>for Executive Director,<br>Technical Standards Branch |  |
| Date: May, 2010  |  |

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|---|----------------|------------|------------------|
| <b>ROUNDABOUT AND<br/>CROSS SECTION DETAILS</b> |                |            |                  |
| Prepared By: GEC                                | Checked By: BK | Scale: NTS | Dwg No.: D-10.1a |



**ROUNDABOUT TRUCK APRON  
CONCRETE CURB DETAIL**

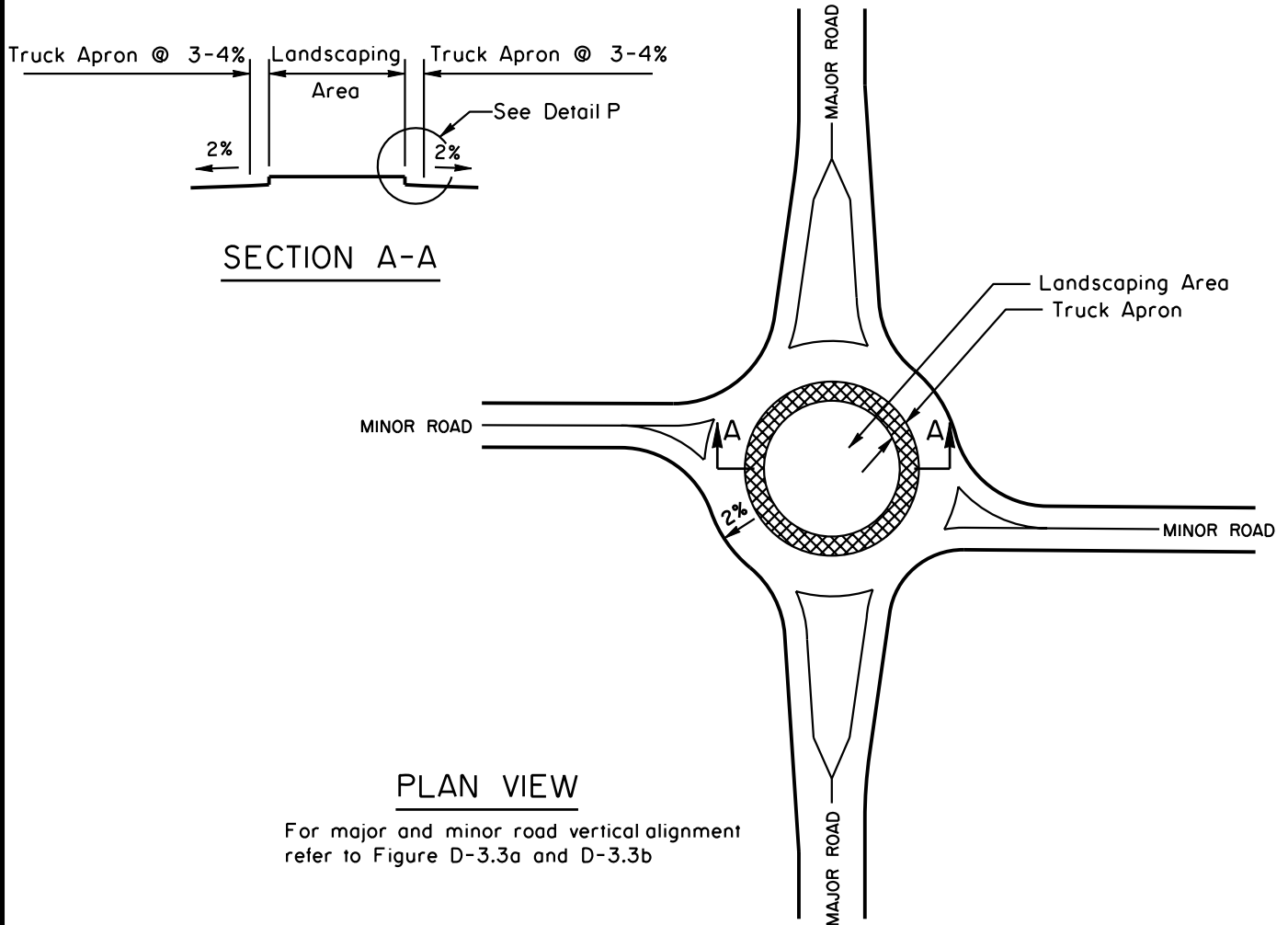
**NOTES:**

CROSSFALL IN CIRCLE IS 2%.  
 LONGITUDINAL GRADE IN CIRCLE IS NOT GREATER THAN 2%.  
 CENTRE AREA MAY BE USED FOR AESTHETIC IMPROVEMENTS.  
 OBJECTS IN CENTRE MUST BE CRASH-WORTHY.  
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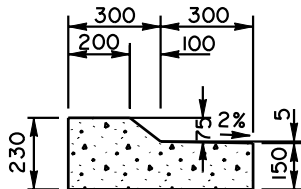
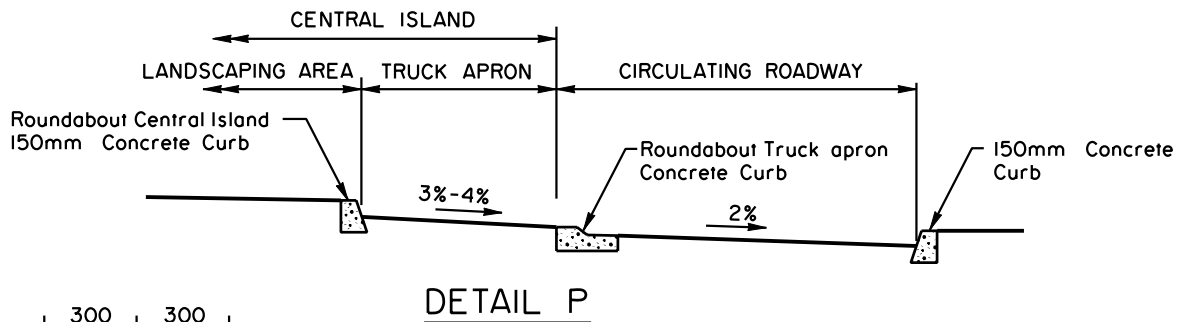
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| △   | REFERENCE TO D-3.3a AND D-3.3b DELETED | J.X. | 1 NOV 10 |
| No. | REVISIONS                              | BY   | DATE     |

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|--|----------------|--|
| Approved:  |                | <b>Government of Alberta</b><br>Transportation |
| LLOYD ATKIN<br>for Executive Director,<br>Technical Standards Branch |                |  |
| Date: May, 2010  |                |  |
| <b>ROUNDABOUT AND CROSS SECTION DETAILS</b>                          |                |  |
| Prepared By: GEC   | Checked By: BK | Scale: NTS                                     |
| Dwg No.: D-10.1a   |                |  |

**SUPERSEDED**



For major and minor road vertical alignment refer to Figure D-3.3a and D-3.3b



**ROUNDABOUT TRUCK APRON  
CONCRETE CURB DETAIL**

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| Approved:  | <b>Government of Alberta</b><br>Transportation |
| LLOYD ATKIN<br>for Executive Director,<br>Technical Standards Branch |  |
| Date: May, 2010  |  |

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| <b>ROUNDABOUT AND<br/>CROSS SECTION DETAILS</b> |                |            |                  |
| Prepared By: GEG                                | Checked By: BK | Scale: NTS | Dwg No.: D-10.1a |

**SUPERSEDED**