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Figure 710.A  Wheelpath Control Points

N.T.S.

Notes:
'd' VARIABLE - MINIMUM 6.0 m
'D' VARIABLE - MINIMUM 14.0 m
The actual Design Vehicle turning path template will govern if larger than the above minimum dimensions.

● Denotes Control Points
* For Bikeway Design, minimum 1.5 m
** Place stop bar to allow for crosswalk, existing or not.
*** If the quadrant islands have pedestrian ramps, the crosswalk should be centered on the ramp letdowns.

Hollow arrows for information only, they do not indicate pavement markings.

Refer to TAC Section 9.17 for discussion on clearance between opposing left turn movements.
Figure 710.B.1 Intersection Layout - 4 Lane Design

N.T.S.

FOR DESIGN SPEED < 80 km/h

SEE FIGURE 710.B.2 FOR NOTES

FOR DESIGN SPEED ≥ 80 km/h
Figure 710.B.2 Intersection Layout - 2 Lane Design

N.T.S.

Notes (for Fig. 710.B.1 and 710.B.2):

1. Refer to Table 430.A for lane widths.
2. For multiple left turn lanes, refer to TAC Section 9.17.5.
3. See Figure 710.A for wheelpath control points.
4. All curb radii to be 0.5 m when using extruded curb on quadrant islands.
5. Minimum 13.0 m arc length (R2 and R4).
6. Radii to be determined by using the Design Vehicle wheelpath template.
7. Width 'e' is measured to the island face and will be determined by using the Design Vehicle wheelpath plus 1.0 m. Wheelpath tracking to be accommodated within the lane width.

¥ If the quadrant islands have pedestrian ramps, the crosswalk should be centered on the ramp ledowns.

* Turning Lane width 'd': use Design Vehicle wheelpath template plus 1.0 m (min. 6.0 m).
** For bikeway design, min. 1.5 m - refer to Table 430.B.
*** Place stop bar to allow for crosswalk, existing or not.
**** Initial design of islands should anticipate future modification to Minor Road left turn slots, if appropriate. (See Inset on Fig. 710.F) Otherwise, minimum tangential dimension of island face is 5.0 m on any side.

Hollow arrows for information only, they do not indicate pavement markings.
Figure 710.C Typical Left Turn Lane Layout

N.T.S.

**URBAN**

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>DIMENSION A (m)</th>
<th>DIMENSION A* TAPER RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>54</td>
<td>30:1</td>
</tr>
</tbody>
</table>

* When designing off-centre turn slots
  DIMENSION A is calculated using the taper ratio from the Urban or Rural Table.

DIMENSION C - Length required for Vehicle Storage.

DIMENSION D - Length required for Vehicle Turning Path.

**RURAL**

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>DIMENSION A (m)</th>
<th>DIMENSION B_{LT} (m)</th>
<th>DIMENSION A* TAPER RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>54</td>
<td>35</td>
<td>30:1</td>
</tr>
<tr>
<td>60</td>
<td>72</td>
<td>35</td>
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<tr>
<td>70</td>
<td>81</td>
<td>40</td>
<td>45:1</td>
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<tr>
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<td>90</td>
<td>45</td>
<td>50:1</td>
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<td>90</td>
<td>99</td>
<td>50</td>
<td>55:1</td>
</tr>
<tr>
<td>100</td>
<td>108</td>
<td>55</td>
<td>60:1</td>
</tr>
</tbody>
</table>
Use of this intersection treatment must be approved by the Senior Traffic Operations Engineer.

**NOTES:**
1. See Figure 710.A for wheelpath control points. See Figures 710.B.1 and 710.B.2 for information on ‘D’ and ‘E’ distances.
2. The through lane widths shall be in accordance with Table 430.A.
3. ‘D’ length required for vehicle storage (minimum 30 m). A parallel deceleration length may also be required. See the appropriate Fig. 710.G or 710.H for lengths.
4. ‘C’ and ‘J’ distances to be determined based on design vehicle wheelpath turning templates.
5. The start of the ‘B’ dimension is the minimum extent of this raised island.
6. Adjustments to the ‘B’ dimension due to grade shall be as noted on Figure 710.L.

---

**Table 710.D.1**

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>A (m)</th>
<th>A Ratio</th>
<th>B (m) for AADT ≤ 12,000 vpd</th>
<th>G (m)</th>
<th>H (m)</th>
<th>T (m)</th>
<th>P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>54</td>
<td>20:1</td>
<td>77</td>
<td>30</td>
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<td>80</td>
<td>135</td>
<td>50:1</td>
<td>82</td>
<td>55</td>
<td>15</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>202</td>
<td>75:1</td>
<td>87</td>
<td>70</td>
<td>20</td>
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<td>100:1</td>
<td>92</td>
<td>85</td>
<td>25</td>
<td>50</td>
<td>120</td>
</tr>
</tbody>
</table>

注：AADT 以20年设计期限为基础

---

**Table 710.D.4**

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>C (m)</th>
<th>D (m)</th>
<th>E (m)</th>
<th>F (m)</th>
<th>F Ratio</th>
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<td>70</td>
<td>12</td>
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<td>15</td>
<td>30</td>
<td>45</td>
<td>135</td>
<td>50:1</td>
</tr>
<tr>
<td>90</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td>148</td>
<td>55:1</td>
</tr>
<tr>
<td>100</td>
<td>15</td>
<td>30</td>
<td>50</td>
<td>162</td>
<td>60:1</td>
</tr>
</tbody>
</table>
Supplement to TAC Geometric Design Guide

Figure 710.D.2 Protected Left Turn Intersection (for AADT > 12,000 VPD)

Use of this intersection treatment must be approved by the Senior Traffic Operations Engineer

NOTES:
1. See Figure 710.A for wheelpath control points. See Figures 710.B.1 and 710.B.2 for information on 'd' and 'e' distances.
2. The through lane widths shall be in accordance with Table 430.A.
3. 'D' length required for vehicle storage (minimum 30 m). A parallel deceleration length may also be required. See the appropriate Fig. 710.G or 710.H for lengths.
4. 'C' and 'J' distances to be determined based on design vehicle wheelpath turning templates.
5. The start of the 'B' dimension is the minimum extent of this raised Island.
6. Adjustments to the 'B' dimension due to grade shall be as noted on Figure 710.L.

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>A (m)</th>
<th>A Ratio</th>
<th>B (m) for AADT* &gt;12,000 vpd</th>
<th>G (m)</th>
<th>T (m)</th>
<th>P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>54</td>
<td>20:1</td>
<td>77</td>
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<td>280</td>
<td>100</td>
<td>50</td>
<td>120</td>
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</tbody>
</table>

* - AADT is based on the 20 year design horizon

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>C (m)</th>
<th>D (m)</th>
<th>E (m)</th>
<th>F (m)</th>
<th>F Ratio</th>
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<td>100</td>
<td>55</td>
<td>162</td>
<td>80:1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTES:
1. See Figure 710.A for wheelpath control points.
2. d, e, R1, R2, R3 and R4 are variable, depending on Design Vehicle
3. When designing off centre intersections, maintain Dimension "A" Taper Ratio for
given design speed
4. Width 'e' is measured to the island face and will be determined by using the
design vehicle wheelpath plus 1.0 m. Wheelpath tracking to be accommodated
within the lane width. The actual Design Vehicle turning path template will govern.
5. Island Offsets: Equal to the Design Shoulder Widths
   but no less than 2.0 m Rural, 1.5 m Urban.
6. In some circumstances, the quadrant islands may be omitted.
   Engineering justification is required.
7. Hollow arrows for information only, they do not indicate pavement markings
8. See Figures 710.F to 710.I for varying lengths of PL

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>A</th>
<th>T1</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(km/h)</td>
<td>Ratio</td>
<td>(m)</td>
<td>(m)</td>
</tr>
<tr>
<td>50</td>
<td>30:1</td>
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<tr>
<td>100</td>
<td>60:1</td>
<td>80</td>
<td>50</td>
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</table>
Notes:
1. See Figure 710.4 for wheelpath control points.
2. 'C' Length required for vehicle storage.
3. Traffic analysis will indicate when a parallel right turn deceleration lane is warranted.
4. Traffic analysis will indicate left turn requirements and type of treatment. (see inset).
5. Island Offsets: Equal to the Design Shoulder Widths but no less than 2.0 m Rural, 1.5 m Urban.
6. Width 'e' is measured to the Island face and will be determined by using the Design Vehicle wheelpath plus 1.0 m. Wheelpath tracking to be accommodated within the lane width.
7. The "D" & "d" distances are site specific and require the designer to overlay the appropriate Design Vehicle wheelpath turning template in each situation. "d" shall be 6.0 m minimum.
8. R, R1, and R2 are site specific and require the designer to overlay the appropriate Design Vehicle wheelpath in each situation.
9. Initial design of islands should anticipate future modification to Minor Road left turn slots if appropriate (see inset). Otherwise, minimum tangential dimension of island face is 5.0 m on any side.
10. Deceleration is assumed to occur mostly in the through lanes. Turning lanes function mainly as storage areas.
12. Hollow arrows for information only, they do not indicate pavement markings.
13. The typical maximum intersection skew angle ranges from 70° to 110°.
### Notes:

1. See Figure 710.A for wheelpath control points.
2. C'Length required for vehicle storage.
3. Traffic analysis will indicate when a right turn parallel deceleration lane is warranted. Storage may also be required at higher right turn volumes.
4. Traffic analysis will indicate left turn requirements entering collector. See Figure 710.F (Inset).
5. Island Offsets: Equal to the Design Shoulder Widths but no less than 2.0 m Rural, 1.5 m Urban.
6. Width 'e' is measured to the island face and will be determined by using the design vehicle wheelpath plus 1.0 m. Wheelpath tracking to be accommodated within the lane width.
7. The "D" & "d" distances are site specific and require the designer to overlay the appropriate design vehicle wheelpath turning template in each situation.
8. R, R1, and R2 are site specific and require the designer to overlay the appropriate design vehicle wheelpath in each situation.
9. Initial design of islands should anticipate future modification to Minor Road left turn slots if appropriate. See Figure 710.F (Inset). Otherwise, minimum tangential dimension of island face is 5.0 m on any side.
10. Some of the necessary deceleration is assumed to occur in advance of the parallel lane.
11. High turning volumes or strategic corridor plans may indicate the need for a right turn acceleration lane. A Regional Traffic Operations Engineer and Regional Planning Engineer should be consulted to determine if an acceleration lane is required. See Figure 710.L for acceleration and taper lengths, and grade adjustments.
12. Shoulder width on auxiliary lanes may be 1.0 m less than normal shoulder width, but must be at least 1.5 m.
13. Hollow arrows for information only; they do not indicate pavement markings.
14. For 4-lanes with design speed < 80 km/h, see Fig. 710.B.1 for lane widths.
15. For 2-lane designs, see Fig. 710.B.2 for lane widths.
16. The typical maximum intersection skew angle ranges from 70° to 110°.

### Table: Left or Right Turn Parallel Deceleration DIRECT TAPER

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>A Ratio</th>
<th>B1 (m)</th>
<th>B2 (m)</th>
<th>C (m)</th>
<th>P.L. (m)</th>
<th>P.L. (m)</th>
<th>T1 (m)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>55</td>
<td>50</td>
<td>60</td>
<td>15</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

For upgrades > 5% SUBTRACT P.L.2 from P.L.
For upgrades > 3% SUBTRACT P.L.1 from P.L.
For downgrades > 3% ADD P.L.2 to P.L.
For downgrades > 5% ADD 2 x P.L.2 to P.L.

**DECELERATION LENGTHS ARE APPLICABLE TO 2 OR 4 LANE DESIGNS**
Notes:
1. See Figure 710.A for wheelpath control points.
2. C Length required for vehicle storage.
3. Traffic analysis will indicate when a right turn parallel deceleration lane is warranted.
   Storage may also be required at higher right turn volumes.
4. Traffic analysis will indicate left turn requirements entering collector. See Figure 710.F (Inset).
5. Island Offsets: Equal to the Design Shoulder Widths
   but no less than 2.0 m Rural, 1.5 m Urban
6. Width 'e' is measured to the Island face and will be determined by using the design vehicle wheelpath plus 1.0 m.
   Wheelpath tracking to be accommodated within the lane width.
7. The "D" & "d" distances are site specific and require the designer to overlay the appropriate design vehicle
   wheelpath turning template in each situation.
8. R, R1, and R2 are site specific and require the designer to overlay the appropriate design vehicle wheelpath in
   each situation.
9. Initial design of islands should anticipate future modification to Minor Road left turn slots if appropriate.
   See Figure 710.F (Inset). Otherwise, minimum tangential dimension of island face is 5.0 m on any side.
10. Some of the necessary deceleration is assumed to occur in advance of the parallel lane.
11. High turning volumes or strategic corridor plans may indicate the need for a right turn acceleration lane. A
    Regional Traffic Operations Engineer and Regional Planning Engineer should be consulted to determine if an
    acceleration lane is required. See Figure 710.L for acceleration and taper lengths, and grade adjustments.
12. Shoulder width on auxiliary lanes may be 1.0 m less than normal shoulder width, but must be at least 1.5 m.
13. Hollow arrows for information only; they do not indicate pavement markings.
14. For 4-lanes with design speed ≥ 80 km/h, see Fig. 710.B.1 for lane widths.
   For 2-lane designs, see Fig. 710.B.2 for lane widths. 2-lane designs would not typically have a raised median.
15. The typical maximum intersection skew angle ranges from 70° to 110°.
NOTES

1. See Figure 710.A for wheelpath control points.
2. 'C' Length required for vehicle storage.
3. Right Turn Vehicle Storage may also be required.
4. Bicycle safe grades must be used.
5. Width 'e' is measured to the island face and will be determined by using the design vehicle wheelpath plus 1.0 m. Wheelpath tracking to be accommodated within the lane width. R₀ shall be 25 m or larger.
6. Initial design of islands should anticipate future modification to Minor Road left turn slots if appropriate. See Figure 710.F (inset). Otherwise, minimum tangential dimension of island face is 5.0 m on any side.
7. Barrier placement and end treatment shall be as per Figure 710.K.
8. Maximum intersection skew range from 75° to 105°.
9. All deceleration is accomplished in the "B" and "P.L." distances.
10. The "D" & "d" distances are site specific and require the designer to overlay the appropriate design vehicle wheelpath turning template in each situation.
11. High turning volumes or strategic corridor plans may indicate the need for a right turn acceleration lane. A Regional Traffic Operations Engineer and Regional Planning Engineer should be consulted to determine if an acceleration lane is required. See Figure 710.L for acceleration and taper lengths, and grade adjustments.
12. Shoulder width on auxiliary lanes may be 1.0 m less than normal shoulder width, but must be at least 1.5 m.
13. Hollow arrows for information only, they do not indicate pavement markings.
14. For 4-lanes with design speed < 80 km/h, see Fig. 710.B.1 for lane widths. For 2-lane designs, see Fig. 710.B.2 for lane widths. 2-lane designs would not typically need median barrier.
Notes:

1. Transition from 810 mm CMR barrier to CLB barrier should occur as close to 15 m from the start of the deceleration lane as the Hook and Eye pairings will allow, using CTB-1 & CTB-2, see SP641 for details.

2. The "D" & "d" distances are site specific and require the designer to overlay the WB20 design vehicle wheel path turning template in each situation.

3. Use WB20 template + 1.0 m for "d" width. See Figure 710.A for wheel path control points.

4. Design width 'e' is for WB20 vehicles and is measured to the island face.

5. Maximum intersection skew range 80° to 100°

6. All acceleration and deceleration occurs within the parallel auxiliary lanes.

7. All islands to be valley curbs, see SP582-01.03. Where superelevation or drainage problems prevent valley curbs, use mountable curbs, see SP582-01.02.

8. For barrier detail, refer to Figure 710.K

9. See TAC Table 10.6.3 for Grade Adjustment Factors for Accel and Decel Lanes
Figure 710.1 LLT Intersection for 2-Lane Roads

**LEFT TURN SLOT**

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>A (m)</th>
<th>A Ratio</th>
<th>B (m)</th>
<th>B Ratio</th>
<th>C1 (m)</th>
<th>C2 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>153</td>
<td>45:1</td>
<td>135.5</td>
<td>45:1</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>80</td>
<td>170</td>
<td>55:1</td>
<td>145.0</td>
<td>55:1</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>90</td>
<td>187</td>
<td>65:1</td>
<td>154.5</td>
<td>65:1</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>100</td>
<td>204</td>
<td>75:1</td>
<td>164.0</td>
<td>75:1</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>

**RIGHT TURN SLOT**

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>T (m)</th>
<th>P.L. (m)</th>
<th>P.L.1 (m)</th>
<th>P.L.2 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>65</td>
<td>40</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>80</td>
<td>70</td>
<td>40</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>90</td>
<td>75</td>
<td>45</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>100</td>
<td>80</td>
<td>45</td>
<td>55</td>
<td>65</td>
</tr>
</tbody>
</table>

**Notes:**

- C use for up and down grades less than 3%.
- C1 use for upgrades of 3% or more.
- C2 use for downgrades of 3% or more.

* For AADT ≤ 6000, use C values.
  For AADT > 6000, use P.L. values and grade adjustments from Fig. 710.1H for the C distances.

**Notes:**

1. "d" variable. See Figure 710.A for Wheel Path Control Points. See Section 720 for discussion on LLT design vehicle.
2. "e" is measured to the island face and will be determined by using the Design Vehicle wheelpath plus 1.0 m.
3. R1, R2, R3 & R4 are site specific and require the designer to overlay the appropriate Design Vehicle wheelpath in each situation. Wheelpath tracking to be accommodated within the lane width.
4. Whenever Islands are installed, they shall be laid on top of finished pavement to allow for possible future removal.

**LEFT-TURN TRUCK ISLAND DETAIL**

**T - INTERSECTION TYPICAL LEFT-TURN LAYOUT**

See above for Exit and Entrance details on the Minor Road.
**NOTES:**

1. For details of all barrier types see Standard Specification SP941 drawings.

2. CTB-1 is to be positioned as close to the beginning of the storage lane as the CRB H&E pairings will allow. CRB units are not to protrude into the storage lane section by more than one half of a CRB pair.

3. CTB-2 unit is to be positioned at the beginning of the left turn slot. Increase or decrease the number of CRB units by H&E pairs to match dimension 'B' while accommodating the needs expressed in Note 2.

4. For unsignalized intersections, the position of the CTB-2 unit will have to be set further away from the intersection to meet approach sight distance needs. Designer should check field conditions to obtain dimension. This check is also required for signalized intersections where the left turn movement from the main roadway is not on a separate phase. See TAC Geometric Design Guide section 9.9 for a description of intersection sight distance requirements.

5. Incorporate parallel left turn deceleration lane as recommended by the Senior Traffic Operations Engineer.
Figure 710.L  Typical Parallel Acceleration Lane

N.T.S.

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>T (m)</th>
<th>PARALLEL LANE - P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RAMP SPEED (km/h)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STOP</td>
</tr>
<tr>
<td>60</td>
<td>55</td>
<td>80</td>
</tr>
<tr>
<td>70</td>
<td>65</td>
<td>115</td>
</tr>
<tr>
<td>80</td>
<td>70</td>
<td>165</td>
</tr>
<tr>
<td>90</td>
<td>80</td>
<td>220</td>
</tr>
<tr>
<td>100</td>
<td>85</td>
<td>295</td>
</tr>
<tr>
<td>110</td>
<td>90</td>
<td>375</td>
</tr>
</tbody>
</table>

The Parallel Lane lengths were derived from 2011 AASHTO Figure 2-24 "Acceleration of Passenger Cars, Level Conditions" based on a vehicle attaining 85% of the Design Speed.

Notes:

1. All grades less than 3% use P.L.
2. Upgrades 3-5% use P.L. x 1.4
3. Upgrades over 5% use P.L. x 1.6
4. Downgrades over 3% use P.L. x 0.6
5. This figure is not to be used for expressway or freeway acceleration lanes.

For Expressways, see Figure 710.l.
For Freeways, see TAC Chapter 10.
Figure 710.M Intersection Layout - Smart Channel Right Turn with Open Shoulder

N.T.S.

EXIT

INTERSECTION ANGLE
70° ≤ Δ_a ≤ 110°

ENTRANCE

INTERSECTION ANGLE
70° ≤ Δ_b ≤ 110°

Notes:
1. Refer to Table 430.A for lane widths.
2. See Figure 710.A for wheelpath control points.
3. All curb radii to be 0.5 m when using extruded curb on quadrant islands.
4. Radii to be determined by using the appropriate Design Vehicle wheelpath templates.
5. R3 may or may not be required depending on the minor road configuration and intersection angle.
6. R4 should allow an Intercity Bus (I-BUS) to negotiate the turn into the rightmost highway through lane without mounting the truck apron.
7. R5 and R6 should typically accommodate a WB-20 turning into the rightmost highway through lane with approximately 1.0 m between the rear trailer wheelpath and the right edge of the truck apron.
8. The Smart Channel Right Turn is an alternative treatment for urban and suburban intersections.
   Rural intersections should use Figure 710.B.1 and 710.B.2.

¥ If the quadrant islands have pedestrian ramps or cut-throughs, the crosswalk should be centered on the ramp letdowns or cut-through openings.

* Turning Lane width 'd': use Design Vehicle wheelpath template plus 1.0 m (min. 6.0 m).
** For bikeway design, min. 1.5 m - refer to Table 430.B.
*** Place stop bar to allow for crosswalk, existing or not.

Hollow arrows for information only, they do not indicate pavement markings.
Figure 710.N Intersection Layout - Smart Channel Right Turn with Curb & Gutter

N.T.S.

Notes:
1. Refer to Table 430.A for lane widths.
2. See Figure 710.A for wheelpath control points.
3. All curb radii to be 0.5 m when using extruded curb on quadrant islands.
4. Radii to be determined by using the appropriate Design Vehicle wheelpath templates.
5. R5 may or may not be required depending on the minor road configuration and intersection angle.
6. R3 and R4 should allow an Intercity Bus (I-BUS) to negotiate the turn into the rightmost highway through lane without mounting the truck apron.
7. R6 and R7 should typically accommodate a WB-20 turning into the rightmost highway through lane with approximately 1.0 m between the rear trailer wheelpath and the right edge of the truck apron.
8. The Smart Channel Right Turn is an alternative treatment for urban and suburban intersections. Rural intersections should use Figure 710.B.1 and 710.B.2.
9. Island cut-throughs require detectable warning mats. Both the cut-through and mats should be aligned with the opposing ramp.

Hollow arrows for information only, they do not indicate pavement markings.
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720 DESIGN VEHICLES

720.01 DESIGN VEHICLES
Design vehicles are selected motor vehicles with the dimensions and operating characteristics used to establish highway design controls. For geometric design, each design vehicle has larger physical dimensions and a larger minimum turning radius than almost all vehicles in its class. The principal dimensions of these vehicles are shown in the TAC Geometric Design Guide for Canadian Roads.

Good design practice requires that the geometric layout of an intersection and interchange should be checked to ensure that it can accommodate the principal class of vehicle using the road system.

In addition to the current suite of TAC vehicles, the Ministry continues to use a special long-load logging truck (LLT) design vehicle (see Section 720.02) and the WB-15(BC) design vehicle which has been modified from the Ministry's previous version. The WB-15 (BC) vehicle now represents a tractor with a 48’ (14.7 m) semi-trailer.

720.02 DESIGN VEHICLE SELECTION
The trend towards longer and heavier vehicles requires that the WB-20 Design Vehicle shall be used on all Freeways and Expressways and on those Arterials with a predominant mobility requirement as opposed to access. Over-length configurations may also need to be accommodated (see Section 720.04).

Certain areas of the province have been identified as requiring intersection and/or interchange designs based on the specific needs of the logging industry to ensure the safety of the driving public. For such areas, the LLT design vehicle may be used for designing appropriate intersections on the logging routes.

The LLT design vehicle represents an envelope created by both the worst load sweep of all vehicles tested (LG3 Tractor Triaxle Trailer) and the worst offtracking of all vehicles tested (LG5 Tractor Tandem Jeep/Pole Trailer). This effectively addresses the path requirements for all currently permitted Long-load Logging Trucks in B.C. Figure 720.A provides the dimensions for the LG3 and LG5 vehicles so that they can be modelled in a vehicle tracking software program.

The WB-15 design vehicle represents a significant section of the truck fleet; therefore, it should be used for the balance of the road system, unless local fleet characteristics dictate otherwise. Figure 720.B provides the dimensions for the WB-15 (BC).

At a minimum, all turning movements should accommodate emergency vehicles; I-BUS, the TAC Inter-city bus is representative of such vehicles.

720.03 DESIGN VEHICLE TURNING CHARACTERISTICS
Although vehicle tracking software programs can allow for unlimited choices of radii, only a limited number of design radii should be used, to simplify intersection design and checking. The standard radii are indicated in Table 720.A and suggest the typical turning conditions for three speed ranges, i.e.:

1. The vehicle begins to turn from a stationary position and negotiates the turn at speeds up to 15 km/h;
2. The vehicle begins a turn at speeds from 15 km/h to 25 km/h as in a turning manoeuvre right or left from a main highway to a secondary road;
3. The vehicle begins a turn at speeds from 25 km/h to 35 km/h as on a separate turning roadway or ramp.
### Table 720.A Turning Radii of Design Vehicles

<table>
<thead>
<tr>
<th>DESIGN VEHICLE</th>
<th>I-BUS</th>
<th>WB-15 (BC)</th>
<th>WB-20</th>
<th>LLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-15 km/h</td>
<td>15.2</td>
<td>13.7</td>
<td>14.5</td>
<td>13.6</td>
</tr>
<tr>
<td>15-25 km/h</td>
<td>19.8</td>
<td>17.7</td>
<td>17.7</td>
<td>17.7</td>
</tr>
<tr>
<td>25-35 km/h</td>
<td>19.8</td>
<td>22.3</td>
<td>22.3</td>
<td>22.3</td>
</tr>
</tbody>
</table>


Refer to the TAC Geometric Design Guide for the characteristics of other design vehicles.

#### 720.04 DESIGN VEHICLE OVER-LENGTH CONFIGURATIONS

Although the TAC WB-20 tractor-semitrailer is the typical design vehicle for ministry roadways, there are larger vehicles that may need to be accommodated. The trailer wheelbase for the WB-20 is 12.4 m; however, under the Commercial Transport Policy, the maximum allowable wheelbase from the king-pin to last trailer axle is 18.3 m. This longer vehicle configuration is allowed to operate under permit from CVSE on almost all roads in the province. One of the typical configurations with this 18.3 m wheelbase is for hauling a “fixed equipment” load. Fixed equipment with a conveyor is one common type of load for gravel, asphalt and redi-mix concrete plants. These trailers can also have a long rear overhang. When this vehicle turns, its substantially longer wheelbase will result in a wider swept path for the inside rear trailer tires. The rear overhang will also swing significantly outside of the trailer wheel path.

A schematic showing the dimensions for a 9-axle Expando vehicle configuration which may need to be accommodated at some intersections is provided in Figure 720.C. Actual configurations may have fewer axles and different dimensions than shown in Figure 720.C. The dimensions shown in Figure 720.D have been simplified to represent the worst case for ministry design checking purposes. This configuration has been designated as “WB-24” and is representative of the maximum allowable wheelbase and rear overhang for path tracking analysis.

Generally, the WB-24 vehicle is expected to be able to travel on its own side of the road (i.e. no counterflow movements). Many heavy haul configurations larger than this typically have steerable trailer axles that may be maneuverable enough to track within the WB-24’s swept path; however, some may have to travel counterflow.

Configurations ≥ 27.5 m long usually require one or more pilot vehicles. They also require traffic control if they need to travel in the opposing traffic lanes. There are some exceptions for using pilot cars with over-length configurations such as Long Combination Vehicles (LCV’s). LCV’s are not allowed to travel in the opposing lanes. Currently, routes that are approved for LCV’s are located in the Kamloops/Lower Mainland corridor and on Vancouver Island [Rocky Mountain Doubles (max. 32 m overall length) and Turnpike Doubles (max. 41 m overall length)] and in the Peace River Area [Rocky Mountain Doubles only (max. 31 m overall length)]. A list of the approved routes for these vehicles is provided on form CVSE1014 available at www.th.gov.bc.ca/forms/getForm.aspx?formId=1260.

Vehicles larger than the typical design vehicle (WB-20) may need to be checked for their ability to negotiate some intersections. This could include, but not be limited to, the following design vehicles: WB-24, Tractor & Mobile Home, Rocky Mountain Double, and Turnpike Double. There are over-size/over-weight configurations that can be even larger. This can have significant implications for designing roundabouts in order to accommodate these extraordinary loads. Designers should consult with their local CVSE office, HQ engineering staff, and the BC Trucking Association to identify the worst case configuration for path tracking analysis. Designers should also check whether there are stakeholders (e.g. manufacturing plants or other
industrial facilities) within the area that would haul oversize loads through any intersection being considered for reconstruction.

Table 720.B lists the new PathTracker files (name.veh) which have been created based on the ministry’s Commercial Transport Procedures Manual and input from our CVSE engineer.

Table 720.B  Over-length PathTracker Vehicles

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W24</td>
<td>WB-24: 17.6 m trailer wheelbase, rear trailer overhang of 9.5 m (see Figure 720.D). This trailer wheelbase length assumes a spacing of 0.7 m from the centre of a dual axle assembly to the rear-most axle.</td>
</tr>
<tr>
<td>RMD31</td>
<td>Rocky Mountain Double, 31 m overall length (see Figure 720.E)</td>
</tr>
<tr>
<td>RMD32</td>
<td>Rocky Mountain Double, 32 m overall length (see Figure 720.F)</td>
</tr>
<tr>
<td>TPD41</td>
<td>Turnpike Double, 41 m overall length (see Figure 720.G)</td>
</tr>
</tbody>
</table>

The WB-20 will still be the primary design vehicle, but the WB-24 vehicle should be used to check that there is sufficient room at all locations with tight constraints where this vehicle could be expected (e.g. protected-T intersections and roundabouts). The overall size and layout of an intersection (typically based on accommodating a WB-20) may not necessarily have to be adjusted, provided that this larger vehicle can maneuver without driving over non-mountable raised curbing or off the paved surface. Rather than enlarging an intersection, some turning movements for the WB-24 vehicle may be accomplished by over-tracking briefly into adjacent and/or opposing lanes which is acceptable for some rural locations. Consult with your ministry Traffic Engineer regarding how much over-tracking is allowable at each specific intersection.

At single lane roundabouts, entry and exit legs may need to be widened; however, to maintain positive guidance and promote slow entry speeds for smaller vehicles, the use of right side mountable truck aprons or left side mountable splitter islands may be appropriate. Vehicles larger than the WB-24 configuration may need to be accommodated with other solutions (e.g. designing to allow counterflow movements, wider truck aprons, or a gated central island pass-through).

When checking the swept path envelope for any multiple-unit vehicle not listed in TAC section 2.4, it is recommended that the minimum turn radius results in about 3 m of distance between the centre point of the turn and the inside rear-most trailer axle assembly. For the four vehicles listed in Table 720.B, the minimum design turning radii are shown in Table 720.C. These radii correspond to the vehicle beginning a turn from a stationary position and negotiating the turn at speeds up to 15 km/h.

Table 720.C  Turning Radii of Over-length Vehicles

<table>
<thead>
<tr>
<th>Vehicle Name</th>
<th>Degree of Turn</th>
<th>Centre of Axle</th>
<th>Outside Front Wheel</th>
</tr>
</thead>
<tbody>
<tr>
<td>W24</td>
<td>90</td>
<td>13.0</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>180</td>
<td>16.8</td>
<td>18.0</td>
</tr>
<tr>
<td>RMD31</td>
<td>90</td>
<td>11.9</td>
<td>13.0</td>
</tr>
<tr>
<td>RMD32</td>
<td>180</td>
<td>14.9</td>
<td>16.0</td>
</tr>
<tr>
<td>TPD41</td>
<td>90</td>
<td>13.4</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>180</td>
<td>17.1</td>
<td>18.2</td>
</tr>
</tbody>
</table>

On routes that have LCV’s, any reconstruction at intersections where these vehicles are turning should be checked using the appropriate Rocky Mountain Double or Turnpike Double design vehicle to check that there is sufficient room. Some LCV turning movements are expected to utilize adjacent lanes on their own side of the road to ensure that they do not track into opposing lanes. Rather than designing an excessively large intersection based on the LCV, designing for a WB-20 may be adequate provided there is sufficient roadway width on the approach and departure legs.
Figure 720.A  LLT Design Vehicle (use LG3 for sweep and LG5 for offtracking)

**LG3 – MoT Tri-Axle Trailer Logging Truck**

![LG3 Diagram]

<table>
<thead>
<tr>
<th>Trailer</th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.80 m</td>
<td>1.10 m</td>
<td>2.76 m</td>
<td>-2.76 m</td>
</tr>
<tr>
<td>1</td>
<td>3.99 m</td>
<td>0.50 m</td>
<td>0.50 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>2</td>
<td>4.65 m</td>
<td>0.50 m</td>
<td>2.42 m</td>
<td></td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailor Width = 2.60 m  
Log Width = 2.60 m

Distance Between Log Bunks = 10.35 m  
Log Length FORWARD of Bunk = 2.50 m  
Log Length AFT of Bunk = 3.85 m

*Trailer telescopes to allow vehicle articulation*

**LG5 – MoT Tractor Tandem Jeep / Pole Trailer**

![LG5 Diagram]

<table>
<thead>
<tr>
<th>Trailer</th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.90 m</td>
<td>1.10 m</td>
<td>1.80 m</td>
<td>0.32 m</td>
</tr>
<tr>
<td>1</td>
<td>6.59 m</td>
<td>0.70 m</td>
<td>1.60 m</td>
<td>-1.60 m</td>
</tr>
<tr>
<td>2</td>
<td>5.95 m</td>
<td>0.00 m</td>
<td>1.85 m</td>
<td></td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailor Width = 2.60 m  
Log Width = 2.60 m

Distance Between Log Bunks = 10.80 m  
Log Length FORWARD of Bunk = 4.20 m  
Log Length AFT of Bunk = 1.80 m

*Trailer telescopes to allow vehicle articulation*

---

*Note: LG3 and LG5 are the designations used within the Ministry's PathTracker software program. The Ministry is no longer providing this software program to non-governmental agencies.*
Figure 720.B  WB-15 (BC) Design Vehicle

**W15 – MoT WB-15 Tractor Semi-Trailer**

<table>
<thead>
<tr>
<th>Trailer</th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.50 m</td>
<td>0.90 m</td>
<td>1.20 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>1</td>
<td>11.00 m</td>
<td>1.55 m</td>
<td>2.15 m</td>
<td>0.00 m</td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailer width = 2.60 m

Note: The W15 designation used within the Ministry’s PathTracker software program is for a vehicle that has a longer trailer wheel base than the dimension used prior to 2007. The Ministry is no longer providing this software program to non-governmental agencies.
Figure 720.C 9-Axle Expando Vehicle

Figure 720.D W24 PathTracker Design Vehicle Schematic

(Overall Length 34.7 m)

<table>
<thead>
<tr>
<th></th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor</td>
<td>6.60 m</td>
<td>1.00 m</td>
<td>2.00 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer</td>
<td>17.60 m</td>
<td>0.50 m</td>
<td>9.50 m</td>
<td></td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m
Trailer Width = 2.60 m
**Figure 720.E  RMD31 PathTracker Design Vehicle Schematic**

![Diagram](image1)

<table>
<thead>
<tr>
<th></th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor</td>
<td>5.00 m</td>
<td>1.00 m</td>
<td>1.20 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 1</td>
<td>12.50 m</td>
<td>1.90 m</td>
<td>1.80 m</td>
<td>-1.80 m</td>
</tr>
<tr>
<td>Dolly</td>
<td>2.10 m</td>
<td>0.00 m</td>
<td>0.60 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 2</td>
<td>7.50 m</td>
<td>0.60 m</td>
<td>1.10 m</td>
<td>0.00 m</td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailer Width = 2.60 m

**Figure 720.F  RMD32 PathTracker Design Vehicle Schematic**

![Diagram](image2)

<table>
<thead>
<tr>
<th></th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor</td>
<td>5.00 m</td>
<td>1.00 m</td>
<td>1.20 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 1</td>
<td>12.50 m</td>
<td>1.90 m</td>
<td>1.80 m</td>
<td>-1.80 m</td>
</tr>
<tr>
<td>Dolly</td>
<td>2.10 m</td>
<td>0.00 m</td>
<td>0.60 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 2</td>
<td>8.50 m</td>
<td>0.60 m</td>
<td>1.10 m</td>
<td>0.00 m</td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailer Width = 2.60 m

**Figure 720.G  TPD41 PathTracker Design Vehicle Schematic**

![Diagram](image3)

<table>
<thead>
<tr>
<th></th>
<th>Wheelbase</th>
<th>Front Overhang</th>
<th>Rear Overhang</th>
<th>Pin Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tractor</td>
<td>6.20 m</td>
<td>1.32 m</td>
<td>1.45 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 1</td>
<td>12.50 m</td>
<td>0.91 m</td>
<td>2.69 m</td>
<td>-2.69 m</td>
</tr>
<tr>
<td>Dolly</td>
<td>3.07 m</td>
<td>0.00 m</td>
<td>1.26 m</td>
<td>0.00 m</td>
</tr>
<tr>
<td>Trailer 2</td>
<td>12.50 m</td>
<td>0.91 m</td>
<td>2.69 m</td>
<td>0.00 m</td>
</tr>
</tbody>
</table>

Tractor Width = 2.60 m  
Trailer Width = 2.60 m
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730 PRIVATE ACCESSES

730.01 DEFINITION

A “private access” (or simply “access”) is a private driveway or a private road intersecting a public road. The following are not covered by Section 730 but should be designed according to Section 710 of the BC Supplement to TAC:

- accesses that have peak hour traffic (total of entering and exiting vehicles) that exceeds 100 vph;
- signalized accesses;
- all other types of intersections that do not meet the private access definition or that exceed a right turn volume from the highway of 30 vph.

730.02 ACCESS EVALUATION

1. Prior to finalization of a design project, a set of preliminary plans shall be submitted to the Regional Approving Officer with a copy of the memo to the ‘Senior Engineering Manager, Highway Design Services’ or ‘Manager, Highway Design Services’, requesting assessment of access. The plans shall show all cadastral and existing entrances, together with the proposed treatment of accesses.

2. A summary of all accesses and their proposed treatment shall accompany the above plans. State whether each individual entrance is retained, relocated, closed and/or connected to an existing or proposed access road.

3. A copy of the final summary shall be sent to the appropriate Regional Property Agent at the time the plans are submitted to the Regional Director for approval.

4. Major Projects that cross more than one Region must treat accesses in each Region separately and deal with each Regional Approving Officer, ‘Senior Engineering Manager, Highway Design Services’ or ‘Manager, Highway Design Services’, and Property Agent.

730.03 ACCESS TYPES

Accesses should not generally be permitted where traffic exiting or entering the highway would be unsafe or compromise the operational characteristics associated with the specific Classification. Sight Distance and traffic volumes are major considerations in locating and designing driveway accesses.

Freeways and Expressways have no private access. As we move down the Classification System, access becomes a growing part of the character of the highway, finally being the prime function for a local road or street.

Some rationale is required to supply access without unduly impacting mobility requirements. Access treatments should vary according to the type and volume of traffic.

Table 730.A below indicates the appropriate right-off and right-on treatment type for various access conditions.

As well as the treatments shown, turning sight distances should be provided as documented in section 9.9 of the 2017 TAC Geometric Design Guide for Canadian Roads. Where these treatments are not feasible, advance notice and Stopping Sight Distance are required on the highway.

Table 730.A Access Types

<table>
<thead>
<tr>
<th>Peak hour Right-turn Volume from the Highway into the Access (Use only if peak entering plus exiting traffic is 100 vph or less)</th>
<th>AADT on the Highway (Total of two directions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 vph</td>
<td>1A</td>
</tr>
<tr>
<td>5 ≤ vph &lt; 15</td>
<td>1A</td>
</tr>
<tr>
<td>15 ≤ vph &lt; 30</td>
<td>2A</td>
</tr>
</tbody>
</table>

See Figures 730.A through 730.D for details of access types and typical cross sections.
Figure 730.A Type 1 Driveways
N.T.S.

**TYPE 1A**

For Commercial driveways use 9 metres for both the Radius and Throat.

**TYPE 1B**

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>T₁ (m)</th>
<th>P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>70</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>80</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>90</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>100</td>
<td>45</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peak hour Right-turn Volumes</th>
<th>Throat Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 vph</td>
<td>6</td>
</tr>
<tr>
<td>5 ≤ vph &lt; 15</td>
<td>9</td>
</tr>
</tbody>
</table>

**NOTE:**
The radius and throat widths noted are minimum dimensions. A wheel path tracking template should be used to verify that the largest expected design vehicle that occurs with some frequency can be accommodated.
Figure 730.B Type 2 Driveways
N.T.S.

**TYPE 2A**

**TYPE 2B**

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>T₁ (m)</th>
<th>P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>80</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>90</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
<td>55</td>
</tr>
</tbody>
</table>

**NOTE:**

The radius and throat widths noted are minimum dimensions. A wheel path tracking template should be used to verify that the largest expected design vehicle that occurs with some frequency can be accommodated.
Figure 730.C  Type 3 Driveways
N.T.S.

TYPE 3

<table>
<thead>
<tr>
<th>DESIGN SPEED (km/h)</th>
<th>$T_1$ (m)</th>
<th>P.L. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
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<tr>
<td>90</td>
<td>55</td>
<td>75</td>
</tr>
<tr>
<td>100</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

NOTE:
The radius and throat widths noted are minimum dimensions. A wheel path tracking template should be used to verify that the largest expected design vehicle that occurs with some frequency can be accommodated.
Figure 730.D Driveway Cross Section

N.T.S.

![Diagram of Driveway Cross Section]

TYPICAL CUT SECTION

![Diagram of Typical Cut Section]

TYPICAL FILL SECTION

Notes:

1. Driveway width variable. Refer to Fig. 730.A to 730.C

2. See 2017 TAC Geometric Design Guide section 7.4.2.4 for end treatments for culverts ≥ 600 mm diameter.

3. The 6:1 slope is not required for opposing traffic on divided highways.

4. Transverse slopes steeper than 6:1 may be considered for urban areas or for low-speed facilities.
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ROUNDABOUTS

740.01 INTRODUCTION

The 2017 TAC Canadian Roundabout Design Guide (CRDG) is the ministry’s key resource for roundabout design guidance. The CRDG was compiled from national and international best practice documents. The two principle sources of information for the CRDG were:


The TAC CRDG and this section (740) shall be utilized and applied to all roadways under BC MoTI jurisdiction. Where more detailed information or an explanation beyond what is provided in these two sources is required, the preferred source will be the FHWA publication Roundabouts: An Informational Guide, Second Edition (NCHRP Report 672). The FHWA guide is well documented as to why their design principles exist.

Many of the parameters in roundabout design publications are predicated on urban roadways where there are relatively few large trucks; however, the Ministry primarily deals with provincial and inter-provincial roadways that handle significant volumes of large trucks. Past experience has shown that trucks have not been given enough consideration with respect to designing an appropriate inscribed circle diameter (ICD) and truck apron. The recommendations in this chapter are intended to preserve mobility on Ministry roadways and improve accommodation of large trucks. This chapter also outlines some specific design guidelines for roundabouts in general.

Regardless of who pays for the construction works, or if even one leg of the roundabout belongs to the ministry, being the most senior form of government (unless the federal government is involved), the ministry is considered responsible. Consequently, the ministry’s design guidelines are to be applied, unless an agreement is written giving design and operational authority to another stakeholder.

740.02 GENERAL

Background:

The Ministry has gained and continues to gain experience with the principles of roundabout design. As roundabouts are still relatively new on provincial roads there is a benefit to be gained from including HQ engineering in projects and designs handled by MoTI regions and districts whether they are from consultants, municipalities, land developers, or developed in-house. HQ’s engineering role is to review and provide feedback on the geometric design, traffic signing, and pavement marking of roundabouts with the goal of achieving province wide harmonization for roundabouts. This process will also allow for 1) applying “lessons learned” to avoid past operational problems, and 2) providing designers with design principles, which due to the evolving nature of roundabout design, have yet to be included in the BC Supplement to TAC Geometric Design Guide.

Policy:

Roundabouts shall be considered as the first option for intersection designs where a greater degree of traffic control than a two-way stop is required. If an intersection treatment other than a roundabout is recommended, the project documentation should include a reason why a roundabout solution was not selected for that location. This “roundabouts first” policy supports the province’s Climate Action Program of 2007.
Roundabouts are an effective form of intersection control; however, there are some locations that may not be suitable. The following is a list of typical locations which will require a suitability evaluation. Roundabouts proposed for locations listed below would require approval of the Chief Engineer to proceed.

1. Expressways and Freeways (roundabouts at interchange ramp terminals are okay).
2. Multi-lane highways identified for future development as expressways or freeways.
3. Rural provincial numbered highways where the design or posted speed is ≥ 100 km/h.
4. Where the preservation of a high speed through highway is both highly desirable and feasible.
5. Highways with AADT ≥ 20,000 or those expected to reach this volume within 5 years.
6. Where highway traffic volumes are greater than 90% of the total traffic entering the intersection.
7. Signalized multi-lane corridors where adding a roundabout would be out of character with all the other intersections.

All roundabout designs must be reviewed by the Chief Engineer’s Office for provincial consistency. The review starts at the Conceptual Design stage allowing for HQ engineering input prior to any roundabout drawings being developed.

Procedure:

After initial discussion with Regional or District MoTI staff, all roundabout documentation is to be sent to the attention of the Traffic Standards and Policy section at BC MoTI Headquarters. This shall be coordinated through the primary Ministry contact for a project in the Regional Design office (or District office). All comments and recommendations from HQ will be sent to the Ministry contact.

Submissions should include the following documentation:

1. Background information/history for need of traffic control
2. Intersection control analysis (Ministry’s signal and/or 4-way stop control analysis)
3. Roundabout Geometric Design Information Sheet (including estimated volume by vehicle class and bicycle volume/route information)
4. Roundabout design drawings (in Adobe PDF and AutoCAD DWG format) including, but not limited to: the roundabout superimposed on an aerial photograph if photos are available; design vehicle turning movements; geometrics and laning; profiles; typical sections; signing and pavement markings
5. SIDRA roundabout analysis provided to MoTI with an electronic copy of the SIDRA project file. See Appendix B for the Default SIDRA Settings.
6. In British Columbia, roundabouts are a relatively new form of traffic control in some areas of the province which may lead to some resistance from the public on their use. Consequently, there should be a communication plan established for educating stakeholders and gaining acceptance of a roundabout in a community (e.g. discuss with elected officials, hold public meetings and open houses, distribute brochures, post roundabout information on City and Ministry websites, have computerized simulations of traffic operations, place newspaper advertisements, make Public Service Announcements, make presentations to seniors groups, provide all media outlets with background information, etc.)

The review of the roundabout by HQ staff will deal with the traffic analysis and general layout, geometric design, traffic signing, and the pavement marking. Reviews will be done at the conceptual design stage for any proposed roundabout and will continue on through the submission stages until the final design submission.

A list of key items that will be reviewed by HQ is shown in Appendix A.
This roundabout review process does not replace the designer’s/design team’s quality management process, nor does it relieve the Engineer of Record of their responsibility. For consultant designs, the roundabout review by HQ does not preclude any requirements for review and acceptance of the entire project by the Regional Traffic and Design offices or the District office.

740.03 INTERSECTION ANALYSIS
Refer to CRDG Chapter 4

The Ministry’s software analysis tool is SIDRA. When roundabout drawings are first submitted to the Ministry for review, a digital copy of the SIDRA project file is to be part of the submission.

Default settings for SIDRA are listed in Appendix B.

740.04 GEOMETRIC DESIGN
Refer to CRDG Chapter 6

Design Vehicle:
Refer to CRDG Section 6.2

On all numbered highways, a roundabout shall be designed with a sufficient inscribed circle diameter and truck apron width to accommodate a WB-20 (or possibly a WB-24) unless otherwise agreed upon by the Ministry and documented in the roundabout geometric design information sheet. The design vehicle shall be determined based on several factors, including but not limited to, the classification of roadways involved, their location (e.g. urban or rural, commercial/industrial or residential), and the vehicle classes (i.e. % of trucks) and volume of vehicles using the intersection. In some instances, this may result in a design vehicle that is smaller or larger than a WB-20. Refer to Section 720.04 for a discussion on over-length configurations.

Some provincial highways (e.g. Highway 5 and Highway 16) serve as “Heavy Haul Corridors” where permitted extraordinary loads (i.e. over-width or over-length) need to be accommodated.

Inscribed Circle Diameter:
Refer to CRDG Section 6.3

The BC MoTI recommended ranges for inscribed circle diameter (shown as $f$ in Figure 740.A) are as follows:

<table>
<thead>
<tr>
<th>Roundabout Configuration</th>
<th>Typical Design Vehicle</th>
<th>Common ICD Range (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Lane</td>
<td>WB-20</td>
<td>40 – 60</td>
</tr>
<tr>
<td>Multi-lane (2 lanes)</td>
<td>WB-20</td>
<td>50 – 67</td>
</tr>
<tr>
<td>Multi-lane (3 lanes)</td>
<td>WB-20</td>
<td>67 – 100</td>
</tr>
</tbody>
</table>

Figure 740.A provides turning width requirements for a WB-20 design vehicle for a variety of ICDs. The values provided in Figure 740.A are based on the Surface Transportation Assistance Act (STAA) design vehicle which is similar to the dimensions of the TAC WB-20 design vehicle.

The $f$ and $g$ values in Figure 740.A were derived by converting imperial measurements to metric.

Where design vehicles such as a WB-24 or larger need to be accommodated, increased dimensions for the ICD or truck apron width may be required.

It should be noted that in design, the anticipated swept path of the design vehicle may be allowed to encroach by up to 0.3 m into either the inner or outer 1 m clearance allowance (width ‘e’ in Figure 740.A).
**Number of Lanes:**

*Refer to CRDG Section 6.2*

On two-lane provincial numbered routes, the main highway approach legs shall be developed with two-lane entries. The exit legs may be either one or two lanes depending on traffic volumes and turning movements. Figures 740.K, 740.L, 740.M and 740.N are sketched examples of roundabouts with one- and two-lane approaches and exits. When utilized, two-lane exits shall be carried a minimum of 175 m beyond the roundabout before tapering back to a single lane. Lengths less than 175 m must be approved as a design exception with the appropriate Ministry sign off.

(Note: a “numbered” route refers to a road that has an official guide sign route marker; ex. Hwy 3, Hwy 5, Hwy 97, etc.)

Single lane roundabouts are typically used on two-lane un-numbered roadways under the jurisdiction of the Ministry.

Four-lane and six-lane highways will have two or three entry and circulating lanes.

Figure 740.B provides an indication of expected capacities of single and multi-lane roundabouts. Figure 740.B is based on the acceptable degree of saturation being less than 0.8.

**Bypass Lanes:**

Bypass lanes provide both safety and efficiency to roundabout operations. They function similar to right turn channelized lanes utilized by the ministry at conventional intersections.

Bypass lanes are an option that should be considered when Peak Hour Volumes for right turns is greater than 30 vehicles per hour. If there is a significant volume of logging trucks or tractor-trailer vehicles or

---

**Figure 740.A Required Turning Widths**

(from “Roundabout Design Guidelines” Ourston Roundabout Engineering 2001)

<table>
<thead>
<tr>
<th>Inscribed Circle Diameter (metres)</th>
<th>Design Vehicle WB-20 (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>79.2</td>
<td>7.2</td>
</tr>
<tr>
<td>73.2</td>
<td>7.5</td>
</tr>
<tr>
<td>67.1</td>
<td>7.8</td>
</tr>
<tr>
<td>61.0</td>
<td>8.1</td>
</tr>
<tr>
<td>57.9</td>
<td>8.4</td>
</tr>
<tr>
<td>54.9</td>
<td>8.7</td>
</tr>
<tr>
<td>51.8</td>
<td>9.0</td>
</tr>
<tr>
<td>48.8</td>
<td>9.3</td>
</tr>
<tr>
<td>45.7</td>
<td>9.8</td>
</tr>
<tr>
<td>42.7</td>
<td>10.1</td>
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<tr>
<td>39.6</td>
<td>11.1</td>
</tr>
<tr>
<td>36.6</td>
<td>12.2</td>
</tr>
<tr>
<td>33.5</td>
<td>13.7</td>
</tr>
<tr>
<td>30.5 **</td>
<td>**</td>
</tr>
<tr>
<td>29.0 **</td>
<td>**</td>
</tr>
</tbody>
</table>

**Design Vehicle requires larger ICD**

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(Note: a “numbered” route refers to a road that has an official guide sign route marker; ex. Hwy 3, Hwy 5, Hwy 97, etc.)
if traffic projections based on overall volumes and delay warrant a bypass lane within 10 years from the opening date, the bypass lane should be constructed as part of the initial project. If a bypass lane will be warranted beyond 10 years, sufficient right-of-way should be protected to accommodate the future construction. The preferred bypass lane design options are shown in CRDG Figures 6.25 and 6.26.

**Figure 740.B Required Number of Entry and Circulating Lanes**
(from the 1993 Austroads Guide to Traffic Engineering Practice, Part 6 - Roundabouts)

Entry Flow: volume of traffic entering from one leg
Circulating Flow: volume of traffic passing in front of the entry leg
(The shaded bands indicate conditions in which either treatment may be suitable depending on the geometry and acceptable operating conditions.)

**Circulatory Roadway:**
*Refer to CRDG Section 6.2 and 6.3*

The gutter portion of concrete curbing is not considered to be part of the circulatory width or ICD. The circulatory width also does not include the truck apron or mountable curb.

For two lane roundabouts with significant truck volumes, the total circulatory (i.e. paved) width should, at a minimum, accommodate the largest frequent design vehicle (typically a WB-20) side by side with a passenger car. This does not necessarily mean that the truck must stay within its painted lane.

For two lane roundabouts, the lane width options for marking circulatory lane lines are:

1. Position lane lines to divide the circulatory roadway equally, or
2. Make the inner circulatory lane width 4.0 to 4.5 m with the outer lane taking the remaining width. This option will reduce the amount of off-tracking by trucks into the inside lane.
For single lane roundabouts, the paved circulatory width should accommodate an intercity bus (TAC I-BUS) which is also representative of large emergency vehicles (i.e. fire trucks). Vehicles larger than the TAC I-BUS are expected to utilize the truck apron.

Camel-backs should be avoided. A smooth transition between the entry and adjacent exit lane is preferred. The two main benefits this offers are:

1. It provides self-evident visual cues for the expected drive path. On multi-lane roundabouts, this will prevent an entry path overlap hazard.
2. A camel-back accumulates debris due to the minimal amount of traffic driving through this area thereby increasing road cleaning maintenance.

Figures 740.C.1 and 740.C.2 show an example of where the circulatory roadway is not being utilized in the camel-back area. The natural drive path for right turning vehicles does not pass through the camel-back area.

**Figure 740.C.1 Example of a Camel-back**  
(from 2003 Kansas Roundabout Guide Exh. 6-25)

**Figure 740.C.2 Example of a Camel-back**  
(from 2003 Kansas Roundabout Guide Exh. 6-25)

**Exits:**

*Refer to CRDG Section 6.2 and 6.3*

Further to the CRDG discussion on exits, the exit curb radius may be greater than 100 m to provide a relaxed exit path, provided that the entry and circulating paths have been designed to ensure a low operating speed. Larger exit radii are typically required to accommodate large trucks.

In the excerpt quoted below, the fastest path radii ($R_2$ and $R_3$) refer to the circulatory and exit vehicle paths shown in Figure 740.D.

**Figure 740.D Vehicle Path Radii**  
(from NCHRP Report 672 Exhibit 6-46)
“The designer should consider the driver’s stopping sight distance and pedestrian decision and crossing time. The pedestrian needs to interpret the drivers’ intentions (to exit or circulate) with adequate time to complete the crossing. With a relaxed exit path, the driver’s intentions are apparent to the pedestrian earlier. The pedestrian crossing is also visible to the driver earlier, so the stopping sight distance is improved. If vehicle speed is reduced prior to the entry, and the Inscribed Circle Diameter (ICD) is smaller, cars will tend to circulate slower, and if the pedestrian is clearly visible (as they are on a more tangential exit), reasonable drivers do not accelerate at them as they begin their exit.

Exit speed can be calculated based on circulating speed and acceleration rate, starting from the circulating speed at the point where drivers round the central island and begin their exit path curve.

On multi-lane roundabouts at off-peak times, the fastest-path exit speed depends not on R3 (too large to have any effect) but on the following:

- the circulatory radius, R2;
- the distance from the end of the R2 radius to the exit crosswalk; and
- the acceleration from the end of R2 to the exit crosswalk.

This assumes that drivers accelerate immediately as they reach the end of R2. (This is very aggressive and usually there is a time lag.) The acceleration rate is about 3.5 ft/sec/sec (it may vary depending on the initial R2 speed).” (1)

In most situations, the relatively short distance at the exit between the circulating roadway and the pedestrian crossing will typically result in an acceleration of 5 to 10 km/h. Figure 740.E shows an example of large radius exits. Due to the entry deflection (see Figure 740.G), the east bound exit speed was calculated to be only 30 km/h.

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**Figure 740.E Example of Large Radii Exits at a 3-Legged Roundabout**

(Okemos, Michigan)

Note: Signing and lighting shown in this picture do not meet Ministry guidelines.

**Multi-lane Entry Design:**

Refer to CRDG Section 6.2 and 6.3

The preferred design to increase entry deflection shall be an approach alignment “offset left” of the roundabout center as shown in NCHRP Report 672 Exhibits 6-30 and 6-31, and Figure 740.F. When designing for large trucks, consideration should be given to using an entry curve radius that is large enough to avoid trailers dangerously overtracking into the adjacent lane prior to the yield line. This could require entry curve radii of 30 m or more, but it is also important that the radii not be so large as to allow excessive entry speeds.

Figure 740.F shows a 2-lane entry technique that uses gore striping which will reduce the wheel path conflicts between cars and large trucks. A truck can utilize the gore area without encroaching into the adjacent lane. The actual dimensions used may vary depending on the individual design. For example, two possible options are:

- two 3.6 m lanes and a 1.8 m wide gore area for an entrance with a total width of 9 m.
- two 4.0 m lanes and a 2.0 m wide gore area for an entrance with a total width of 10 m.
Vehicles should be directed toward the proper circulatory lane at the approach entrance (yield) line. This can be achieved by providing a short section of tangent between the entry curve and the circulatory roadway.

Grading and Drainage:

Refer to CRDG Section 6.8

The preferred drainage design is to have the roundabout graded to drain outwards. At locations where a constant grade must be maintained through the intersection, the circulatory roadway may be constructed on a constant-slope plane. This means, for instance, that the cross slope may vary from +3% on the high side of the roundabout (sloped toward the central island) to −3% on the low side (sloped outward). Special consideration may be required for roundabouts on flat terrain. It is suggested that the entire roundabout be tilted at 0.5% to 1.0% to ensure drainage is directed towards a specific catch basin location.

In consideration of low-boy trailers where ground clearance may be an issue, creating a crown in the roundabout perpendicular to the circulatory roadway should be avoided to prevent these trailers from high centering.

Curbs, Pavement Design, and Truck Aprons:

Curb and pavement designs shall be in accordance with the MoTI Standard Specifications for Highway Construction. Where required, splitter island curbing should be designed to resist snowplow activity.

The outer edge of the circulatory roadway and the central island shall be constructed with combined curb and gutter in accordance with SP582-01.01. Modifications, as required, shall be made to the central island gutter slope to ensure drainage does not accumulate against the central island curb. Alternatively, the central island may be constructed with extruded concrete curb in accordance with SP582-01.04.

When roundabouts are installed on an open shoulder rural highway, curbs shall be constructed to provide the driver with visual cues of an impending requirement to adjust their speed and path.
Curb and gutter for approach roads should desirably be started a ‘comfortable deceleration distance’ from the roundabout as shown in Figure 740.H and Table 740.B. As a minimum, curb and gutter should extend back the same distance as the splitter island.

Another technique to reduce approach speeds is a longer splitter island as shown in Figure 740.H.

**Figure 740.H Extended Splitter Island Treatment and Curb Length**
(from TAC CRDG Figure 6.35)

![Diagram of Extended Splitter Island Treatment and Curb Length](image)

**Table 740.B Comfortable Deceleration Distance**
(based on 2018 AASHTO Fig. 2-34)

<table>
<thead>
<tr>
<th>Design Speed of Approach Road (km/h)</th>
<th>Deceleration Distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>60</td>
<td>70</td>
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<tr>
<td>70</td>
<td>85</td>
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<td>125</td>
</tr>
<tr>
<td>100</td>
<td>145</td>
</tr>
<tr>
<td>110</td>
<td>165</td>
</tr>
</tbody>
</table>

A minimum 2.0 m wide central island truck apron shall be installed at all roundabouts (even at large roundabouts where a truck apron is not necessarily required). This will create a visually distinct feature for MoTI roundabouts. Truck aprons should be sized to accommodate the design vehicle turning path with approximately 1.0 m clearance between the vehicle’s tire track and the central island curb.

Truck aprons are occasionally needed along the outside curb between an entry and adjacent exit leg to accommodate right turn movements. This is typically due to a skewed intersection angle that requires significantly more turning width to handle a truck. The truck apron mountable curb provides physical guidance to smaller vehicles to promote slow speed right turns.

On highways where over-length and over-width loads are expected, special design treatments will be required. The largest anticipated oversize vehicle configuration should be accommodated. This may be achieved in a variety of ways such as widening the truck apron on one side or both sides, or building a pass-through lane across the central island. Designing a treatment on only one side of the roundabout is acceptable. In this situation, oversize vehicles would be expected to travel counterflow with appropriate traffic control.

Truck aprons shall be constructed with mountable curb and gutter in accordance with SP582-01.02 “Roundabout Truck Apron Mountable Curb”. The mountable curb height shall be 50 mm.

The slope of the truck apron should typically be 1% to 2% away from the central island. Slopes of 1% are recommended for locations frequented by low-boy trailers to prevent them from bottoming out.

The apron shall be built with contrasting materials (texture and color) for better visibility during both day and night conditions. The texture and colour of the material used for the apron shall be different than the material used for the sidewalks so that pedestrians are not encouraged to cross the circulatory roadway. Textures vary from inlaid and stamped asphalt brick patterns to stamped concrete “cobblestones”.

April, 2019
**Pedestrian Considerations:**
*Refer to CRDG Section 6.2*

Detectable warning surfaces should be installed at the curb letdowns and at the entrances/exits of the pedestrian refuges in the splitter islands. “Cut throughs” are recommended in the splitter island.

The width of sidewalks shall be 1.8 m minimum, but the width must be increased where shared use by pedestrians and cyclists is expected. 3.0 m is the typical minimum width provided for a shared use facility.

A landscaping buffer should be provided between the sidewalk and circulatory roadway (see Figure 740.G). This buffer will provide better delineation of the sidewalk for the visually impaired, will deter pedestrians from crossing to the central island, and will provide room for sign installations. The preferred set back distance for the buffer from the back of curb to the sidewalk is 1.5 m; however, a minimum set back distance of 0.6 m is acceptable. Right-of-way constraints at some locations may restrict the use of a buffer; however, this treatment should be utilized wherever possible. The width required for the placement of signs should be taken into consideration to prevent signs from intruding into the roadway or sidewalk space.

The area between the road and the sidewalk can be planted with grass, flowers, or low shrubbery. This area is not to have trees and shrubs that impact sightline visibility or trunks greater than 100 mm in diameter. If the minimum 0.6 m set back is used, a coloured and/or stamped concrete/asphalt treatment may also be considered.

**Design Exceptions**

All design exceptions to the above guidelines must be documented in the roundabout geometric design information sheet and approved by the Ministry.

**740.05 LANDSCAPING**
*Refer to NCHRP Report 672 Chapters 6 and 9*

**Landscaping Considerations:**

Safety is paramount at roundabouts; therefore, landscape vegetation must be positioned so that sight lines to pedestrians and to vehicles approaching on adjacent legs are maintained.

The hatched portions in Figure 740.I are areas that should be clear of large obstructions that may hinder driver visibility. Objects such as low growth vegetation, poles, sign posts, and narrow trees may be acceptable within some of these areas provided that they do not create a hazard for errant vehicles or significantly obstruct the visibility of other vehicles, pedestrians, the splitter islands, the central island, or other key roundabout components.

**Figure 740.I Example Sight Distance Diagram**
(from NCHRP Report 672 Exhibit 6-60)

Vegetation on Ministry roundabouts should be self-sustaining. Irrigation provided in urban areas would be maintained by the local municipal jurisdiction.

The use of landscaping at a roundabout is one of the distinguishing features that give roundabouts an aesthetic advantage over traditional intersections. Landscaping can provide an opportunity for gateway treatments that promote community themes/branding or identification.

**740.06 BICYCLE DESIGN CONSIDERATIONS**
*Refer to CRDG Section 7.3.3 and NCHRP Report 672 Section 6.8.2*

The straight-line entry and exit bicycle ramps shown in CRDG Figure 7.4 *Bicycle Lane at a Roundabout with a Bicycle Bypass* are not recommended. Straight line entry ramps can give cyclists the impression the bike ramp and sidewalk is the recommended path of travel through the roundabout. The BC MoTI design layout for bicycle ramps is shown in Figure 740.J.
Figure 740.J Treatments for Bicycles
(from NCHRP Report 672 Exhibit 6-67)
740.07 TRAFFIC CONTROL DEVICES

Refer to CRDG Chapter 7

PAVEMENT MARKING:

A variety of layout configurations are shown in Figures 740.K through 740.N. There are numerous other possible roundabout configurations. Refer to NCHRP Report 672 Appendix A for additional examples.

Pavement marking guidelines for line patterns and lane use arrows are shown in Figures 740.K, 740.M and 740.R.

Regular paint lines tend to wear out within a year; therefore, it is recommended that thermoplastic type markings be used at the following locations:

- Circulatory lane lines
- Yield lines
- Pedestrian crossing zebra markings
- Lane use arrows on the approach legs and within the circulatory lanes
- For entry legs, all lane lines within approximately 35 m of the Yield line
- Gore markings on the entry legs
- For exit legs, lane lines to approximately 15 m beyond the pedestrian crossing
- Route shields and airplane symbols

SIGNING LAYOUT:

The Ministry’s sign layout guidelines for single lane and multi-lane roundabouts are shown in Figures 740.O and 740.P, respectively.

Roundabouts follow the same principles as those at intersections and interchanges where sign placement is prioritized in the following order: regulatory, warning, then guide signs. Other signs, such as service & attraction, may be added as space permits.

GUIDE SIGNS: (2)

Intersection Destination/Direction Signs

Use intersection destination/direction style signs in all single lane approach roundabouts for rural locations and in urban/suburban areas where space allows and is appropriate. The diagrammatic style guide sign is preferred over the text style sign; examples of both are shown in Figure 740.Q.1. The circular shape in a diagrammatic guide sign provides an important visual cue to all users of the roundabout. Diagrammatic guide signs are preferred because they reinforce the form and shape of the approaching intersection and make it clear to the driver how they are expected to navigate the intersection. If lack of right-of-way width or longitudinal location spacing are issues, use a text style sign or overhead diagrammatic guide sign.

Overhead Lane Guide Signs

In general, overhead lane guide signs are encouraged at roundabouts with multiple approach lanes. By giving destination guidance to the motorist in advance, the motorist will be able to be in the correct lane at the roundabout approach and be discouraged from making a lane change within the roundabout. Qualifying criteria for overhead lane guide signs would include two or more approach lanes, higher vehicle ADT’s, lane splits approaching roundabouts, dual turn lanes, if the major route is turning, closely spaced roundabouts, unfamiliarity of drivers, and lane drops within the roundabout. Since these are lane use guide signs, they would have an up arrow. A sign is placed over each travel lane (see multilane layout example in Figure 740.P and 740.Q.2 Alternative A). Coordinate sign designs with the regional Senior Traffic Operations Engineer and the BC MoTI Provincial Sign Shop. If overhead guide signs are used on an approach, then the circular diagrammatic guide sign may not be needed. The circular diagrammatic guide sign is good for showing destinations and directions; however, it does not depict proper lane assignments like the overhead lane guide signs do.

There may be situations in urban, multilane roundabout approaches where the overhead lane guide signs may not be feasible (e.g. space constraints). Alternative B for overhead guide signing using lane control signs is shown in Figure 740.Q.2. Senior Traffic Operations Engineer approval is required to use this option.

Use a dot with the left arrow to designate the roundabout. The dot shall only be used to depict the left-most lane of the approach. Use an ONLY plaque over thru lanes that become turn lanes. The ONLY plaque is optional elsewhere.
Generally, use cantilevered overhead sign supports, not sign bridge trusses.

**Exit Guide Signs - In Splitter Island**

Exit guide signs reduce the potential for disorientation. Use them to designate the destinations of each exit from the roundabout. The arrow is slanted up and to the right. Signs are placed in the splitter island facing the circulating traffic.

Where a major destination or important route is located via continuing to a following exit, a guide sign(s) with an arrow slanted up and to the left may be added beneath the exit right sign.

At a minimum, there is one destination signed per exit. However, some roundabouts serve as gateways to important destinations; therefore, a maximum of four destinations can be signed at an exit using the appropriate right or left arrow to provide wayfinding to the correct exit. The need and choice of destinations is the responsibility of the regional Senior Traffic Operations Engineer.

**Central Island Considerations**

Central island monuments and other landscaping treatments are popular with municipalities and other stakeholders as they often symbolize things unique to the area. Regulatory signs on the central island are required to enhance safe operation of the roundabout; therefore, central islands must be designed to accommodate their use.

### 740.08 ILLUMINATION

Lighting should be provided at all roundabouts. Perimeter mounted lighting systems are recommended over centre mounted lighting systems. For further information, refer to the TAC Canadian Roundabout Design Guide, Illuminating Engineering Society Design Guide for Roundabout Lighting, and the TAC Guide for the Design of Roadway Lighting – Chapter 11.

### 740.09 REFERENCES


2. Wisconsin Department of Transportation, *Facilities Development Manual*, 2018
Figure 740.K  Roundabout Pavement Marking – Line Patterns and Lane Use Arrows
(See Figure 740.M for ‘Left Turn Only’ Lane Use Arrow & Text Marking Layout, and Dotted Lane Line pattern for spiraling lane guidance)

Layout Example - Intersection of Two Major Routes
Two-Lane Entries and Exits on All Legs

Yield Line Detail
Set front edge to match circulatory paint line edge

Zebra Markings
per Fig. 7.2 of BC MoTI
Manual of Standard
Traffic Signs & Pavement Markings

Circulatory Lane Line
Dash Pattern:
2 m line, 1 m gap
100 mm or 150 mm wide

Yield Line
Dash Pattern:
0.6 m line, 0.6 m gap,
0.4 m wide

Lane Lines
Urban Dash Pattern:
3 m line, 6 m gap (shown)
or
Rural Dash Pattern:
5 m line, 8 m gap

6 - 7 m
Yield Line to X-walk

15 m
Solid Line

50 to 60 m

30 m
Solid Line

0.6
0.6

0.4
Figure 740.L Roundabout Layout Example – Intersection of Major Route with Minor Route

Two-Lane Entries and Exits on Major Route
One-Lane Entries and Exits on Minor Route
Figure 740.M Roundabout Layout Example – Intersection of Major Route with Minor Route

Two-Lane Entries and One-Lane Exits on Major Route
One-Lane Entries and Exits on Minor Route

Example of one-lane approach flaring to two lanes at entry.

Dashed lane line.
If one lane is dominant, direct traffic into that lane.
Otherwise, start dashed line in the centre of the road where the total lane width is 6 m.

Splitter island may need to be cut back on exit leg to accommodate oversize trucks

Dotted Lane Line (spiraling lane guidance)
Dash Pattern:
0.3 m line, 1 m gap
100 m or 150 m wide

Truck apron extended to achieve single lane circulating width

Splitter island moved forward to achieve single lane circulating width

ONLY
Figure 740.N  Roundabout Layout Example – Intersection of Two Major Routes

Two-Lane Entries and One-Lane Exits on All Legs
“Left Turn Only” Lane on All Legs

Truck apron extended to spiral traffic to outside lane
Figure 740.O  Signing for a Single Lane Roundabout

G-001, G-007, or G-011 Width To Suit x 60 cm
Custom destination, local road names, or route shields.

G-005 Text Style Sign
Width and Height to Suit (side mounted)
Custom destination, local road names. This is an alternative to a diagrammatic sign on minor roads where there are space constraints or where the road serves a local residential area.

R-002 75 cm x 75 cm, or 90 cm x 90 cm
This sign should be placed as near as practicable to the yield line.
* If needed for better prominence, a second sign may be placed on the splitter island.

G-005 “Variable Size - Fit to Location”
Minimum Size 244 cm x 122 cm
Large Size ≥366 cm x ≥183 cm
The Diagrammatic Advance Directional Sign should be provided on major approaches, and shall use “Route Arms” similar in design to those in FHWA’s MUTCD.

Where space is insufficient for large diagrammatic signs, a custom sign approved by MoTI HQ can be used. Sign location should be determined in the field to ensure separation from other signs, and to provide adequate “Decision Time.”

ALTERNATIVE TO G-005 AND Rb-W-500
Custom Roundabout Ahead Sign 90 cm x 90 cm or larger with G-007 Street Name Tab
With approval from MoTI HQ, this may be used for single lane roundabouts instead of the G-005 and Rb-W-500 signs. A tab with the cross street name is required. The custom signs shall be placed where the G-005 would have been located.

Rb-W-500-Tb Advisory Speed Tabs
may be used where requested by the Sr Traffic Operations Engineer

Rb-W-500 90 cm x 90 cm or larger
The Rb-W-500 gives the initial warning of a roundabout ahead. A Rb-W-500-Ta tab can be used in combination with the Rb-W-500 symbolic roundabout sign as an “educational supplement” where required (e.g. a new roundabout installation). Rb-W-500 sign is optional for low speed urban residential roundabouts.
Figure 740.P Signing for a Multi-Lane Roundabout

Rb-R-500-3 60 cm x 150 cm – “Typical” Place sign facing traffic approaching the roundabout, aligned approximately with the middle of the approach lanes. The minimum height from the ground to the bottom of the sign is 0.6 m; the height can be adjusted for areas known for heavy snow. The maximum height is 1.5 m.

R-002 75 cm x 75 cm, or 90 cm x 90 cm This sign should be placed as near as practicable to the yield line. A sign is required on the splitter island for multi-lane approaches.

PS-003-L or R 60 cm x 75 cm Height of bottom of sign to be 200 cm.

* Spacing between Rb-R-510 signs These are the minimum desirable distances. To facilitate driver readability, the minimum spacing should not be reduced.

April, 2019
Figure 740.Q.1 Guide Sign Examples

G-005 Diagrammatic Guide Sign
(Side Mount or Overhead)
**Width and Height to Suit**
- Custom destination, local road names.
- Use on approach lanes for single lane roundabouts.
- It may also be used on the approach to a multi-lane roundabout if space permits.

G-005 Text Style Guide Sign
(Side Mount)
**Width and Height to Suit**
- Custom destination, local road names.
- May be used on single lane approaches.
- This is an alternative to the diagrammatic sign on minor roads where there are space constraints or where the road serves a local residential area.

G-001, G-007, or G-011 Guide Signs
(Mounted on Splitter Islands)
**Width and Height to Suit**
- Custom destination, local road names, or route shields.
- Max. 4 lines of information.
- Used at exit lanes.
Figure 740.Q.2  Guide Sign Examples

ALTERNATIVE A

G-005 (Overhead Lane Use Signs)
Width and Height to Suit
Separate sign for each approach lane.
Custom destination, local road names.

* When green and white overhead guide signs are used, side mounted lane use signs (Rb-R-510 series) shall be placed as well.

** An additional lane use sign may be placed on the left side as well for additional emphasis if space permits. The additional sign should be placed when volumes are high, any time when the sign may have a greater chance of being blocked by passing vehicles, or for approaches of three or more lanes. Consult the regional Senior Traffic Operations Engineer for additional guidance.

ALTERNATIVE B

R-081, 082, or 083 (Overhead Lane Control Signs)
Separate sign for each approach lane.

When overhead guide signs are not feasible, overhead lane control signs (R-081, 082, or 083 series) should be used. Route shield directional guide sign assemblies (G-011-2 series) should be mounted to the structure upright or ground-mounted adjacent to the overhead structure. An advanced street name sign (G-007-2) shall also be installed on the cross-arm for additional directional guidance.
Figure 740.R Roundabout Approach Pavement Marking Arrows
(Dimensions in mm)
APPENDIX A – Key Items that MoTI HQ Engineering Reviewers Check

SIDRA Analysis

- Have ministry default settings been used?
- Is the Measure of Effectiveness (MOE) acceptable? MOE’s in descending order of importance are:
  - Each lane group generates no more than 0.85 – 0.9 v/c
  - Queue length is reasonable given local conditions
  - Delay time
  - Level of Service

Layout

- Correct number of entry and circulating lanes?
- Is a bypass lane required?
- Appropriate entry geometry to accommodate the design vehicle(s)?
- If needed, have extraordinary (i.e. over-length, over-width) loads been accommodated?
- Smooth geometry from entry leg to adjacent exit leg? (i.e. no camel-backs)
- Appropriate circulating lane widths?
- Large exit radii to accommodate trucks (typically R ≥ 100 m)?
- Truck apron sized appropriately?
- Does truck apron have acceptable cross fall to avoid lowbed trailer strikes?
- Crosswalks set back from yield line approx. 6 to 7 m?
- Splitter islands large enough for pedestrian refuge? (min. 1.8 m at the crosswalk, refer to NCHRP Report 672 Exhibit 6-12)
- Detectable warning surfaces (a.k.a. tactile walking surface indicators) at sidewalk ramp letdowns and splitter islands?

Traffic Signing

- Are the appropriate ministry signs shown?
- Are the signs in the correct location? (i.e. sequence, spacing, position)
- Is the Guide Sign messaging correct? (i.e. are all appropriate destinations shown? This is especially important at interchanges where exit legs may have more than one primary destination.)

Pavement Marking

- Are the lane assignment arrows correct for the intended movements?
- Is the size and shape of painted arrows correct?
- Are the arrows placed at the appropriate locations on the approach and circulatory lanes?
- Are the proper dashed lane line patterns shown and labelled correctly?
APPENDIX B – Default SIDRA Settings

**MOVEMENT DEFINITIONS - Site1**

<table>
<thead>
<tr>
<th>Movement Classes</th>
<th>Origin - Destination Movements</th>
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</thead>
</table>

**Standard Classes**

**Always Included (Standard)**

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<thead>
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<th>Name</th>
<th>ID</th>
<th>Model Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Vehicles</td>
<td>LV</td>
<td>Light Vehicle</td>
</tr>
<tr>
<td>Heavy Vehicles</td>
<td>HV</td>
<td>Heavy Vehicle</td>
</tr>
</tbody>
</table>

**Select to Include (Standard)**

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<thead>
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<th>Name</th>
<th>ID</th>
<th>Model Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buses</td>
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<td>Heavy Vehicle</td>
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<tr>
<td>Bicycles</td>
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</tr>
<tr>
<td>Large Trucks</td>
<td>TR</td>
<td>Heavy Vehicle</td>
</tr>
<tr>
<td>Light Rail / Trams</td>
<td>LR</td>
<td>Heavy Vehicle</td>
</tr>
</tbody>
</table>

- Select Large Trucks

**LANE GEOMETRY - Site1**

For all approach lanes, check boxes where lane movement is allowed

- Rearranged the order of tables and diagrams for better readability.
Environment Factor = 1.10 for opening year and 1.00 for horizon year

30 m Radius typically needed to accommodate Large Trucks
Enter site specific % for each approach for Heavy Vehicles and Large Trucks.

Exclude Geometric Delay: uncheck
HCM Delay Formula: uncheck

These parameters should already be unchecked if the Roundabouts > Options dialog parameters were changed as shown on the previous page.