

APPENDIX I – ROUNDABOUT DESIGN MANUAL

I.1 MODERN ROUNDABOUTS

Modern Roundabouts shall be specially designed to the specific need on high traffic volume streets and used to improve traffic flow. Refer to **Federal Highway Administration, Roundabouts: an Informational Guide** for typical layout. Also refer to Figure 8-21 for typical roundabout layout features. The following are certain minimum requirements:

I.1.1 Design Vehicle

Modern roundabouts shall be designed to accommodate WB-67 trucks. The design vehicle is to be accommodated by maintaining a 2-foot separation between the truck and the curb face. A truck apron shall be provided around the circulatory island. The WB-67 vehicle may use the truck apron for left turn (R-5) movements and may use the truck apron for right-turn movements (R-1) if necessary.

I.1.2 Horizontal Configuration

The roundabout layout shall be determined by the Expert Designer (as defined in Item 9 below) and approved by the Local Entity Engineer.

I.1.3 Roadway Width

The circulatory roadway width shall be a minimum of 1.0 to 1.2 times the width of the widest entering roadway. This width may include the truck apron when approved by the Local Entity Engineer.

I.1.4 Truck Apron

1. The width of the truck apron shall be a minimum of 8-feet to allow for emergency or maintenance vehicles. The truck apron shall be constructed of colored concrete (Davis Tile Red # 1117 at 3 lbs /sack). The apron surface shall have a broom finish. Pressed surface patterned will not be allowed. Final truck apron design shall be based on truck turning analysis plus a two-foot buffer. The designer shall provide clear and understandable jointing pattern plan to control shrinkage cracking.
2. The truck apron shall have a 4% to 6% Cross Slope to allow utility and maintenance vehicles access and discourage any pedestrian use.
3. A 6-inch mountable curb with a 1:1 slope face (18" barrier curb, CDOT Type 2 mountable without the pan). This curb shall be portland grey in color. No expansion material shall be specified between the back of curb and the truck apron.
4. Truck apron pavement thickness shall be developed with the Final Pavement Design and may required subgrade stabilization if swelling soils exist.

I.1.5 Pedestrian Access Ramps for Bikes

1. Bicycle traffic shall be assisted / encouraged to leave the roadway prior to the roundabout by construction of bicycle exit and re-entrance ramps as shown on Figure 8-21.
2. The multi-modal pathway adjacent to the roundabout shall be constructed with a ten-foot wide concrete path detached from the back of curb by ten feet. A low, non-sight obscuring vegetative barrier shall be planted between the path and back of curb between the pedestrian ramps to prevent pedestrian from crossing to the central island.

I.1.6 Pedestrian Crossings

1. The pedestrian crossing through the splitter island shall be set back 25-feet from Yield Line at the nose of the splitter island pending sight triangle analysis. The pedestrian crossing and ramps shall meet the ADA requirements for accessible pathways.
2. A 7 to 8-foot wide of opening pedestrian refuge opening shall be provided in the splitter island.
3. The pedestrian crossing shall cross both the entry and exit roads along a single tangent roughly perpendicular to the centerline of the splitter island as shown on Figure 8-21.
4. Pedestrian ramps shall be lined up directly with the crosswalk A two-foot wide truncated dome surface shall be located perpendicular to the pedestrian crossing at each location where pedestrians are designated to enter the traffic way including the splitter island refuge.
5. The pedestrian ramps and splitter island pedestrian refuge shall be contained by six-inch vertical curbs to give direction at the crossing as shown on Figure 8-21.

I.1.7 Drainage

1. All drainage within the roundabout shall drain away from the center island at a slope of 2% min. (1% min. for concrete). A crowned circulatory roadway shall be designed for all multi-lane roundabouts unless a variance is granted by the Local Entity Engineer.
2. Drainage towards the center island shall be collected by inlets located around the center island with standard 2-foot catch gutter provided to contain flows and conveyed away from the roundabout in appropriately sized storm sewer.
3. No pavement swales or drainage crosspans shall be allowed to take storm drainage away from center island or across roundabout entry or exit alignments. Drainage directed to the roundabout from adjacent legs must be intercepted by storm drain inlets to minimize encroachment into the circulatory roadway.

I.1.8 Where Allowed

Modern roundabouts may be allowed on any roadway as approved by the Local Entity Engineer.

I.1.9 Design Experience

The design shall be performed or directed, checked and stamped by a registered Professional Engineer who has designed a minimum of five multi-lane modern roundabouts. A scoping meeting between the roundabout designer and the Local Entity Engineer is required for all proposed modern roundabouts in order for the Local Entity to determine whether the roundabout designer has met the qualifications. The Applicant is required to contact the Local Entity to arrange for the roundabout scoping meeting.

I.1.10 Horizontal Roundabout Design Report

A horizontal roundabout design report is required to be submitted and sealed by the same qualified registered Professional Engineer who attended the scoping meeting with the Local Entity Engineer prior to the start of vertical design. The roundabout design report should at a minimum provide the following:

1. Input parameter development to the roundabout design software (ARCADY or RODEL)
2. Excerpts from the Traffic Impact Study showing the AM and PM Short and Long Range and non-traditional peak hour traffic volumes projections.
3. The following geometric parameters of the proposed roundabout should be defined as per the most current RODEL 1 design manual for each entry path: half width “V”, entry width “E”, flare length “L”, entry radius “R”, entry angle “ Φ ”, and inscribed circle diameter “D”. The design report should include drawings showing these parameters.
4. The fastest path analysis shall be included on a separate drawing for each leg. Also, indicate the entry path radius deflection “R1”, circulating radius “R2”, exit path radius “R3”, left turn radius “R4”, and right turn radius “R5”. Fastest paths shall be evaluated by drawing a splined line maintaining 5-foot offsets from hard obstacles and 3-foot from the center stripe or lane line (which ever path produces the more conservative alignment). The pathway shall start as a tangent a minimum of 300-feet before the inscribed circle. The fastest path shall ignore all striping. The length of the controlling radius shall be an arc with a minimum length of 60-feet fitted to the spline line.
5. Include a separate plan showing the proposed roundabout geometry with positive horizontal and vertical construction control.
6. Make sight distance recommendations for the entire roundabout
7. Include a separate drawing template for the critical WB-67 turning movement.
8. Include the proposed striping and signing plan demonstrate que lengths and lane use assumptions.

I.1.11 Design Software

The roundabout design shall be completed with the aid of computer software. Acceptable products include the latest versions of ARCADY or RODEL. VISSIM or other simulation software may be used for public presentation. The specific application of the product must be approved on a case-by-case basis by the Local Entity Engineer. The Local Entity Engineer is authorized to require the use of a specific software package when warranted by the needs of a specific intersection. The Design Engineer shall have specific knowledge of how to control the software and be able to demonstrate that understanding to the Local Entity Engineer.

I.1.12 Right-of-way

The Local Entity will require additional right-of-way to be dedicated by the Developer to accommodate the roundabout. In Loveland (GMA and city limits), additional right-of-way must be dedicated as shown in Figure 8-16L within new projects adjacent to existing and future major intersections.

I.1.13 Splitter Islands

Raised splitter islands shall be required on all approaches. Where the approach leg has a central turning land or median, the splitter island shall be extended to connect to the median or a sufficient distance from the pedestrian refuge to provide confinement of the entering and exit movements and control of the fastest paths (125-feet is suggested). The vertical face of the raised splitter island shall be set back approximately 3-feet from the approach edge of a median nose and 1 to 1.5-feet at the trailing edge (down traffic).

I.1.14 Signage

The signage shall be in accordance with Chapter 14, Traffic Control Devices.

I.2 TRAFFIC CALMING ROUNDABOUTS (MINI ROUNDABOUTS)

Traffic Calming (TC) Roundabouts may be allowed in a neighborhood setting for traffic calming. See Figures 8-13, 8-14, 8-15 and 8-21.

I.2.1 Where Allowed

TC roundabouts may be used on Local Streets and Minor Collectors.

I.2.2 Design Basis

The design shall be performed in accordance with Roundabout Design Guide FHWA Standards for an Urban Compact Roundabout, or other design criteria approved by the Local Entity Engineer.

I.2.3 Roadway Width

The circular roadway shall be a minimum of 20-feet wide flowline to flowline, and the approach legs shall be 16-feet wide minimum.

I.2.4 Truck Aprons

Refer to Figure 8-15.

I.2.5 Design Vehicle

TC roundabouts shall be designed to accommodate a WB-50 vehicle with a WB-67 using the truck apron. Encroachment onto the truck apron and adjoining sidewalks may be approved by the Local Entity Engineer.