

Only single-lane and two-lane modern roundabouts are to be constructed on the SHS. Partial three-lane roundabouts may be acceptable under certain conditions.

Roundabout designs must be submitted to the Central Office for review as early as practical, but no later than Phase II design submittal. See **FDM 301.4** for the roundabout review submittal requirements. The design for a roundabout on the SHS requires the approval of the State Roadway Design Engineer.

213.1.1 Roundabout Evaluation

Modification for Non-Conventional Projects:

Delete **FDM 213.1.1** and see RFP for requirements.

Modern roundabouts provide substantial safety and operational benefits under a wide range of traffic conditions. FHWA has designated roundabouts as one of nine proven safety countermeasures because of their ability to substantially reduce the types of crashes that result in severe injury or loss of life. Studies show that modern roundabouts provide a higher level of safety than any other intersection type; including pedestrian and bicycle modes.

The Department is committed to installing modern roundabouts on the SHS where it makes sense to do so. A roundabout alternative must be evaluated in accordance with **FDM 116** when:

- New signalization is proposed
- Major reconstruction of an existing signalized intersection is proposed
- A change in an un-signalized intersection control is required.

An evaluation is not required for minor operational improvements such as changes to signal phasing, or for signal replacement projects where the primary purpose is to upgrade deficient equipment and installations.

To construct a modern roundabout on the SHS, one of the following must be met:

- (1) **MUTCD** traffic signal warrants 1 or 2 is met,
- (2) Documented high frequency of severe crashes,
- (3) Context appropriate operational improvement on low speed facilities, or
- (4) Need for speed management when transitioning from a high speed context classification to a lower speed context classification.

While roundabouts may provide a community enhancement, they are not to be constructed on SHS solely for this purpose.

Use 20-year design traffic volumes for roundabout evaluation and design.

213.1.2 NCHRP 672

The criteria contained in the *FDM* are supplemented by guidance provided in the [National Cooperative Highway Research Program \(NCHRP\) Report 672, Roundabouts: An Informational Guide](#).

213.1.3 Design Vehicle

Roundabouts typically accommodate a WB-62FL design vehicle for the through movements on the SHS. A smaller design vehicle may be appropriate for turning movements connecting off-system roads. See *FDM 201.5* for additional information on design vehicle.

213.2 Swept Paths

Swept path diagrams assure that there is adequate pavement to accommodate the maneuvers of design vehicle through the roundabout without over-tracking the curb. AUTOTURN is a CADD-based vehicle turning path program that is often used to determine the swept path of the design vehicle.

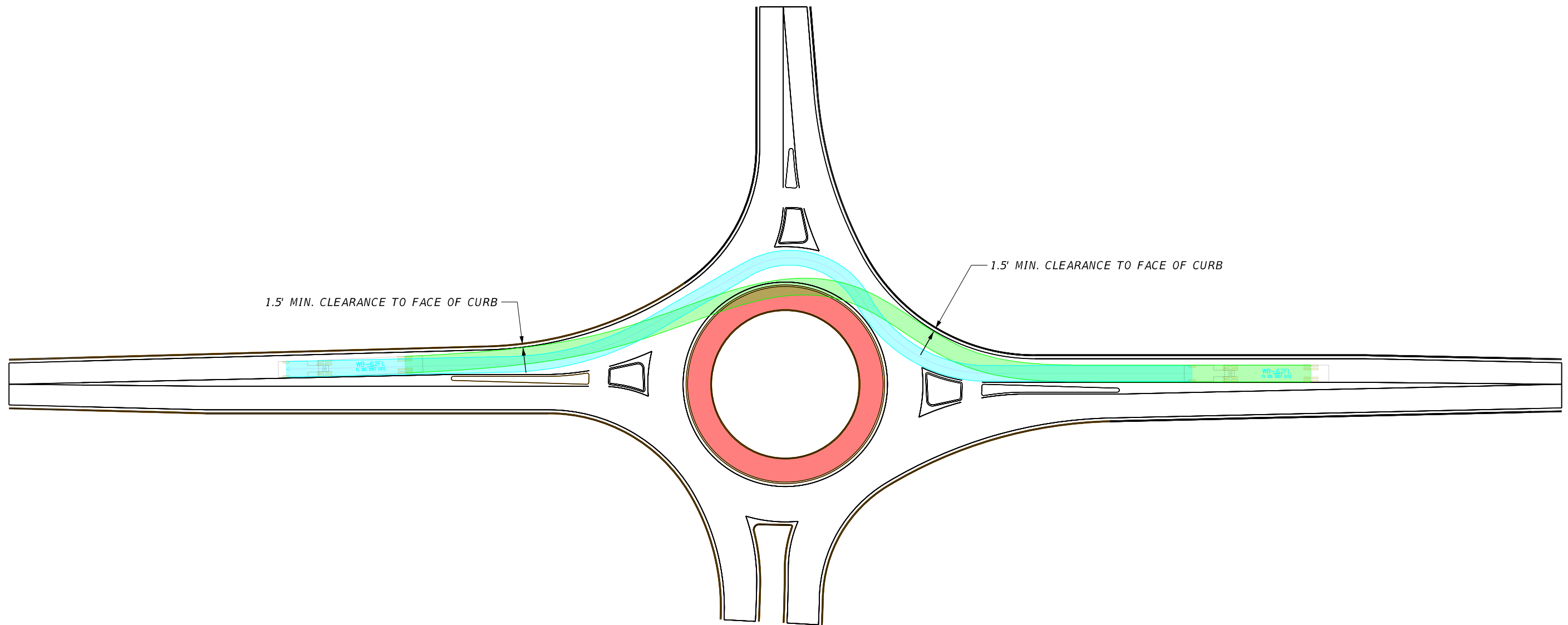
Provide swept path diagrams for the design vehicle for all turning movements. Develop travel paths using continuous smooth spline curve alignments representative of travel paths experienced in the field.

Provide a minimum 1.5-foot clearance between the outside edge of the design vehicle's tire track and the face of curb.

213.2.1 Single-Lane Roundabout

The swept path design vehicle is required to stay within the travel lane and is prohibited from encroaching on the outside gutter pan. The truck trailer is allowed to cross over the inside gutter pan and mount the truck apron. *Exhibit 213-1* illustrates a WB-62FL design vehicle swept path for a single-lane roundabout.

SINGLE LANE ROUNDABOUT SWEPT PATH EXAMPLE



NOT TO SCALE

EXHIBIT 213-1
01/01/2018

213.2.2 Two-lane Roundabout

Provide adequate pavement area for the simultaneous passage of the design vehicle and a passenger vehicle through the roundabout and for turning movements. The design vehicle swept paths must stay within the travel lanes without encroaching on the inside and outside gutters, with the exception of the inside gutter of the circulatory roadway. Develop swept path diagrams for all turning movements in the following combinations:

- Design vehicle in the outside lane and passenger vehicle in the inside lane
- Design vehicle in the inside lane and passenger vehicle in the outside lane

It is acceptable for the design vehicle path to encroach on the adjacent travel lane within the circulatory roadway as long as there is sufficient space for the passenger vehicle plus two feet of clearance between the two vehicles. When truck volume is very low, consider allowing the truck-trailer to command both lanes to complete the maneuver.

213.3 Speed Control

Controlling entry, circulating, and exit speeds of vehicles as they navigate through a roundabout has a significant impact on safety and operations. Design roundabouts that limit the speed of approaching traffic and promote consistency in the relative speeds between conflicting traffic streams.

Roundabout design features that serve to control vehicular speeds include:

- (1) **Prominent landscaping in the central island:** Prominent landscaping serves to increase visibility of the central island and provide a visual queue to approaching drivers that they are entering a low speed environment. See **FDM 228** for landscape design requirements.
- (2) **Raised splitter islands and roadside curb:** The segment of roadway adjacent to a roundabout, characterized by the splitter island in the median with curb and gutter on the outside, provides a speed transition zone that promotes slower speeds. Lengthening this transition zone on high speed facilities can be an effective strategy for slowing down traffic prior to entering a roundabout.
- (3) **Hard Geometry:** The most effective way to control vehicular speeds at roundabouts is to introduce hard geometric features designed to slow drivers down. These features control speeds by introducing deflection and curvature into the path of the driver. Design parameters have a dramatic impact on the driver's entry, circulating, and exit speeds; e.g., inscribed circle diameter, lane width, entry width, curb locations.

213.3.1 Fastest Path

The effectiveness of speed control within a roundabout can be determined by conducting a fastest path performance check. The fastest path is defined as the smoothest, flattest path possible for a single vehicle, in the absence of other traffic and ignoring all lane markings, traversing through the entry, around the central island, and out the exit. A detailed discussion of the fastest path performance check is provided in [NCHRP 672](#).

Entry speed for a single-lane approach is restricted to 25 mph or less. Entry speed for a 2-lane approach is restricted to 30 mph or less. The relative difference between entry and exit speeds is to be no more than 10 mph.

213.4 Bicycle and Pedestrian Accommodation

Exhibit 213-2 includes standard details for splitter islands, pedestrian facilities, and bicycle facilities. The following requirements for bicycle and pedestrian facilities apply:

- (1) Provide sidewalks in accordance with **FDM 222** for projects with pedestrian facilities on the approach roadways.
- (2) Provide crosswalks at every approach leg when sidewalks are present.
 - (a) Provide curb ramps consistent with **FDM 222** and [Standard Plans, Index 522-002](#).
 - (b) Orient crosswalks perpendicular to the roadway to minimize pedestrian crossing distance.
 - (c) At each crosswalk location provide a minimum 6-foot wide and 10-foot long pedestrian refuge area within the splitter island. Locate the refuge area approximately 20 feet from the outside edge of the circulatory roadway.
 - (d) Provide detectable warning surfaces in accordance with **FDM 222** at each curb ramp and pedestrian refuge area.
 - (e) Provide pedestrian crossing lighting in accordance with **FDM 231**.
- (3) For 2-lane roundabouts, terminate bicycle lanes or shoulders approximately 100 feet from the circulatory roadway and provide bail-out ramps. Installation of bicycle bail-out ramps is optional for single-lane roundabouts. When bicycle bail-out ramps are provided, the desired sidewalk width is 10 feet, but should not be less than 8 feet.

213.5 Splitter Islands

See **Exhibit 213-2** for an illustration of splitter island details. Splitter islands are to use a traffic separator or Type E curb.

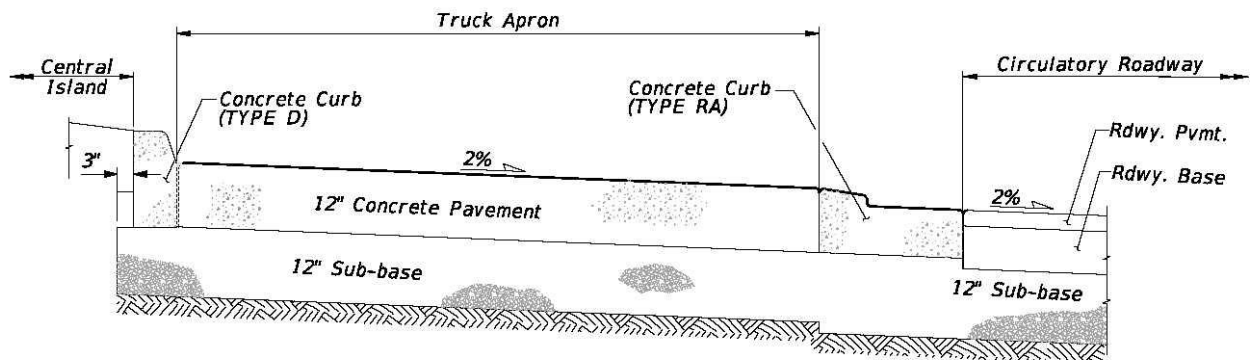
Provide raised splitter islands that are a minimum 100 feet in length and a minimum of 6 feet wide at the crosswalks. An island less than 100 feet in length, but not less than 50 feet, may be considered for roundabouts located on a highway with a design speed of 35 mph or less. Provide an island at least 150 feet in length for roundabouts located on a highway with a design speed of 50 mph or greater.

Extend the splitter island beyond the end of the exit curve to discourage exiting traffic from crossing into the path of approaching traffic.

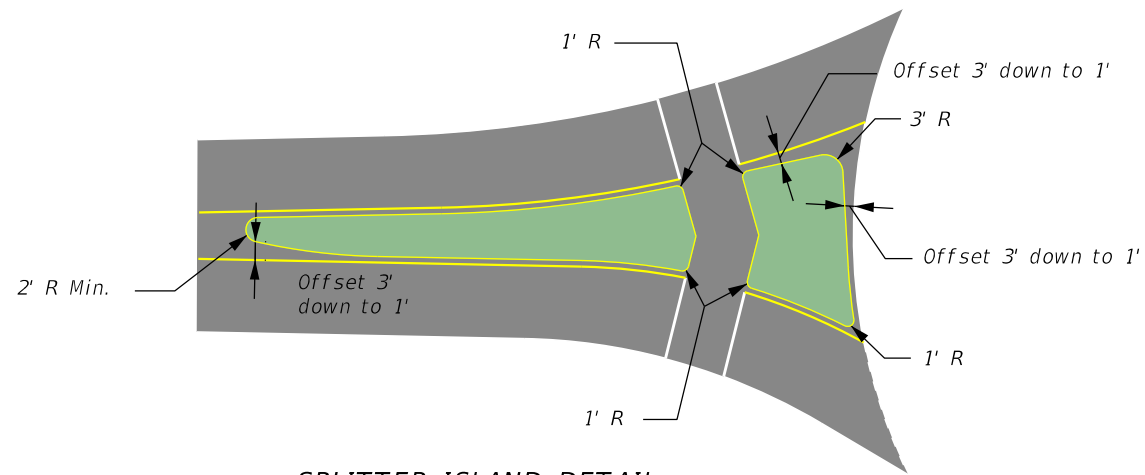
213.6 Truck Apron

Use the standard truck apron design illustrated in **Figure 213.6.1**. When circulatory lanes are concrete pavement, use red color additive to the concrete truck apron to provide a contrast.

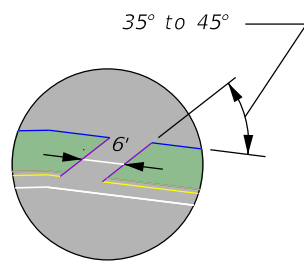
Figure 213.6.1 Standard Truck Apron Design



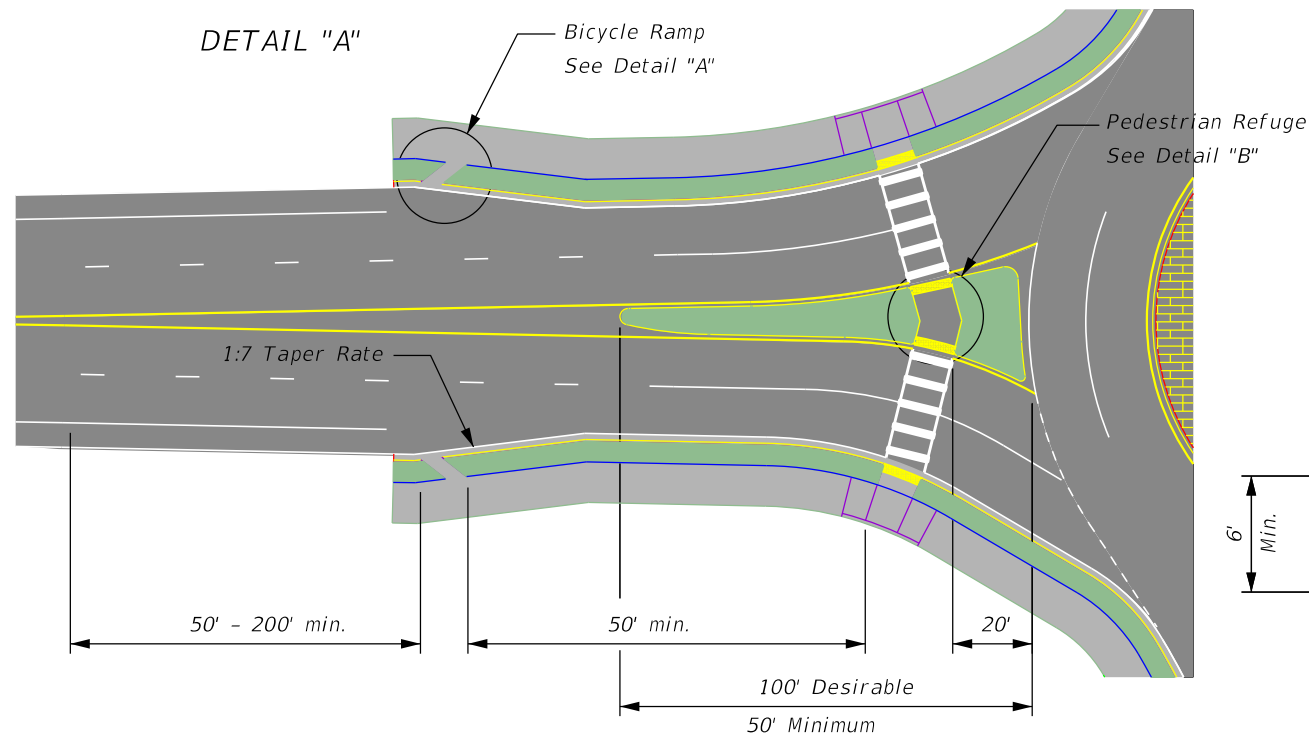
ROUNDABOUT DETAILS



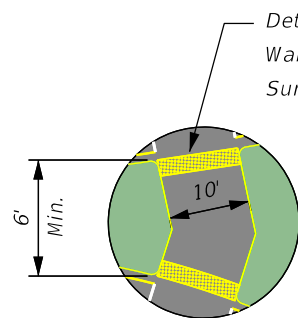
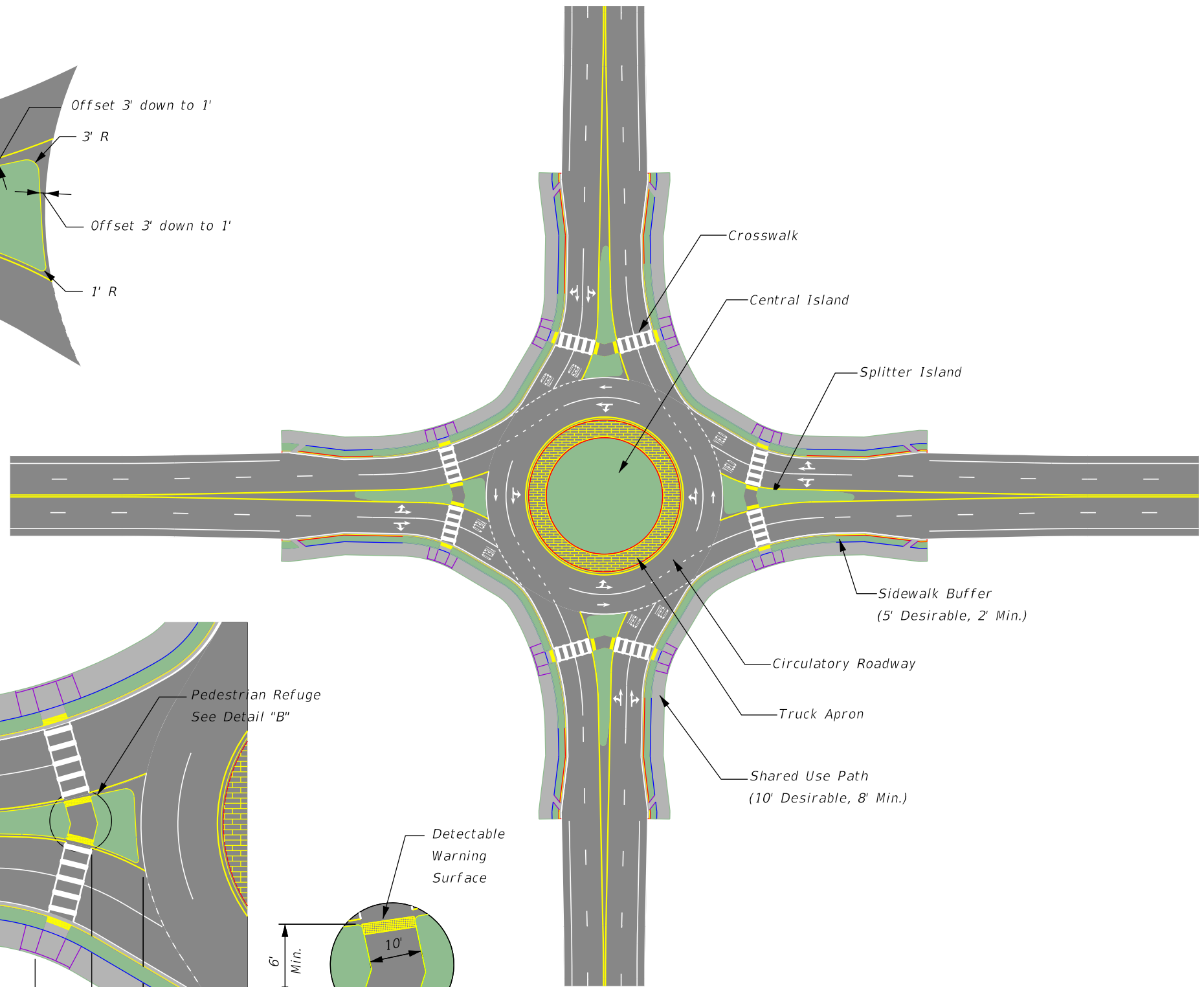
SPLITTER ISLAND DETAIL



DETAIL "A"



BICYCLE AND PEDESTRIAN DETAIL



DETAIL "B"

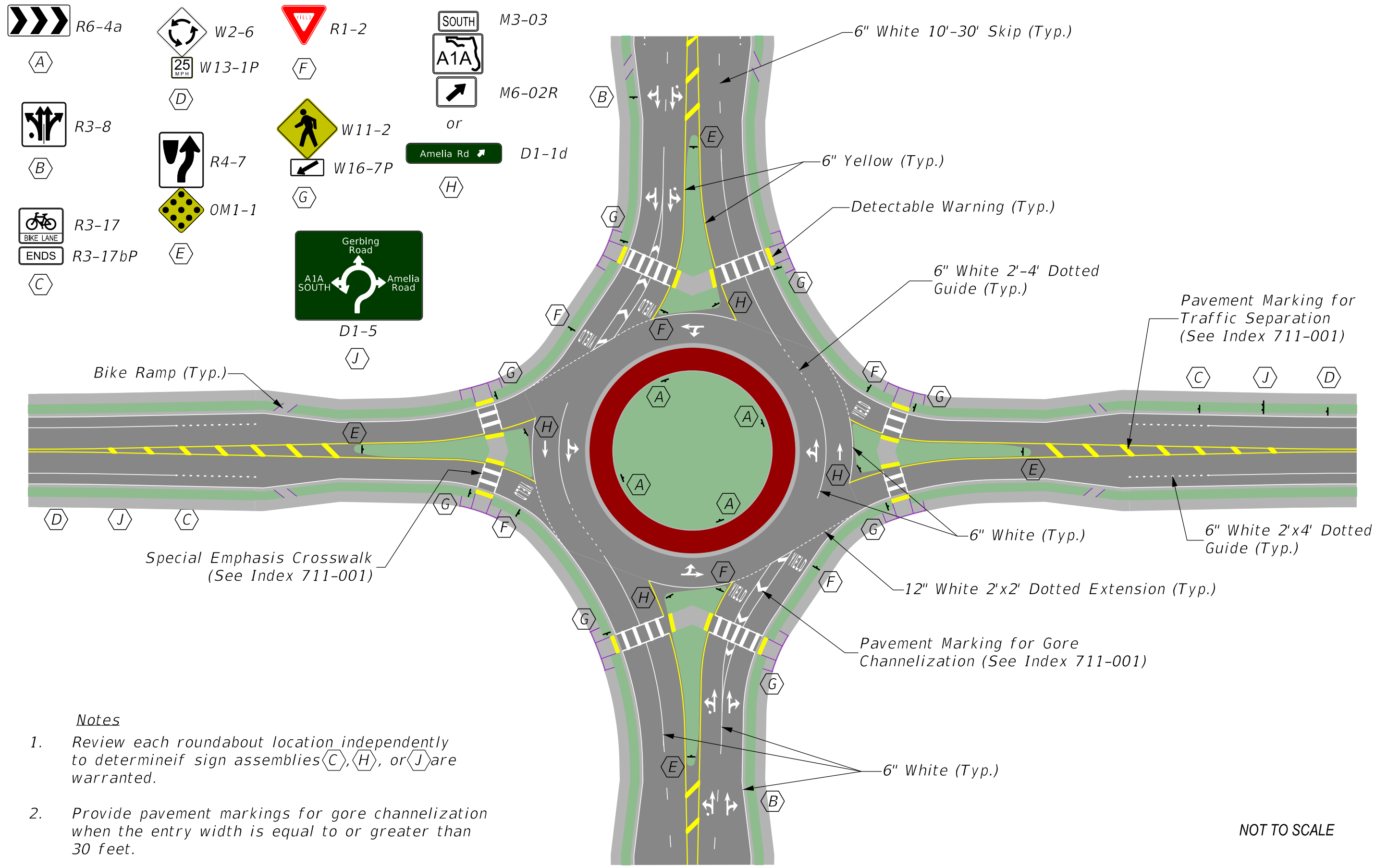
NOT TO SCALE

213.7 Signing and Pavement Markings

Well-designed signing and pavement markings will enhance safety and traffic operations by clarifying the rules of the road and proper lane assignments to drivers as they navigate through the roundabout.

Follow the details presented in **Exhibits 213-3, 213-4, and 213-5** when developing roundabout signing and pavement marking plans to promote consistency throughout the state.

Use the standard left-turn arrow with a circular dot on the left-most lane of the approach to multi-lane roundabouts as shown in [Standard Plans, Index 711-001](#). Use standard arrows within the circulatory roadway.






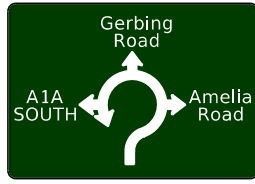



















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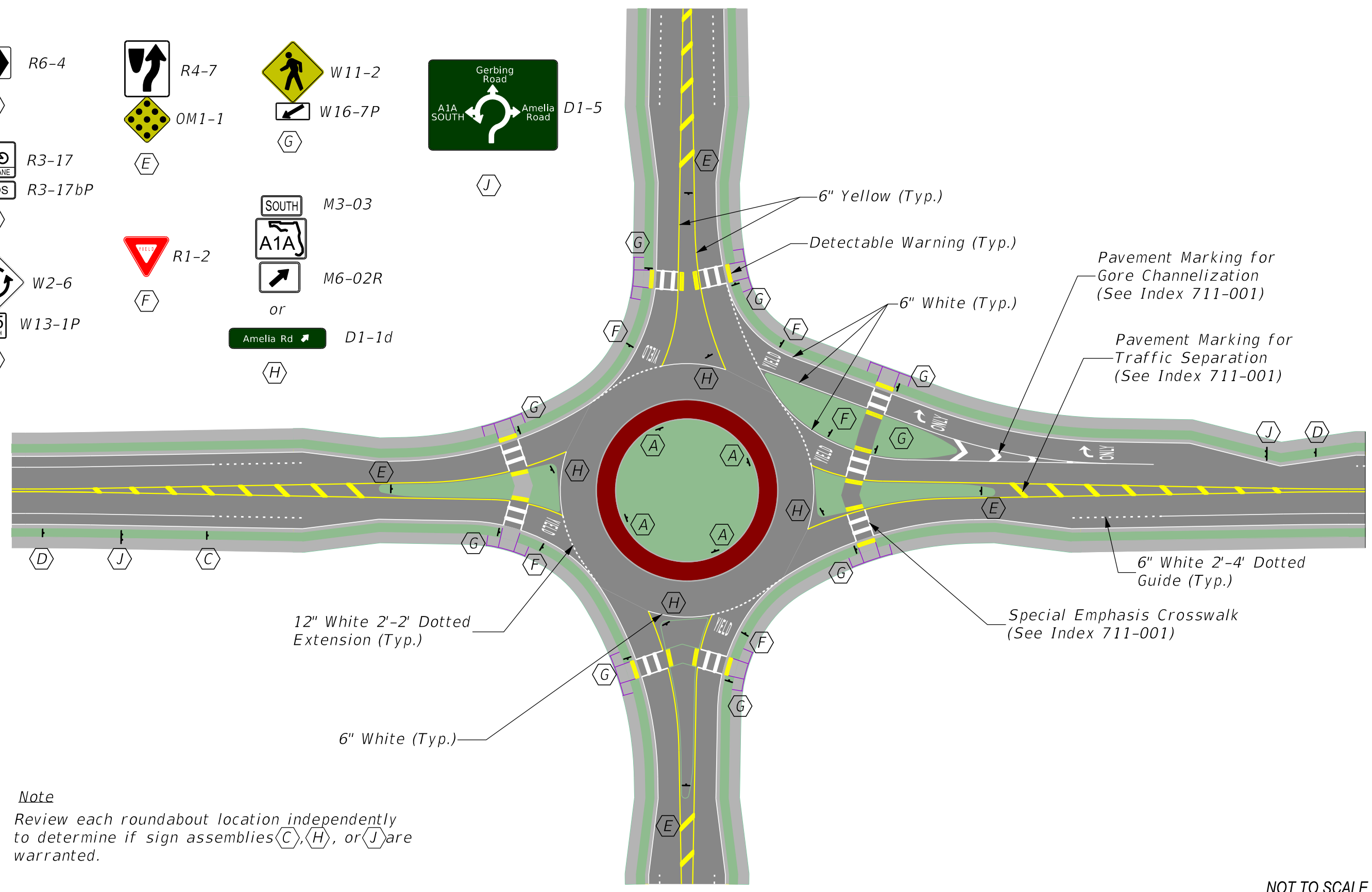
1. Review each roundabout location independently to determine if sign assemblies C, H, or J are warranted.
2. Provide pavement markings for gore channelization when the entry width is equal to or greater than 30 feet.

NOT TO SCALE




**1x2 ROUNDABOUT
SIGNING AND PAVEMENT MARKINGS**

**EXHIBIT 213-3
01/01/2018**

 R6-4	 R4-7	 W11-2	 D1-5
 A	 OM1-1	 W16-7P	
 R3-17	 E	 G	 J
 R3-17bP		 M3-03	
 C	 R1-2	 A1A	
 W2-6	 F	 M6-02R	
 W13-1P		or	
 D		 D1-1d	
		 H	



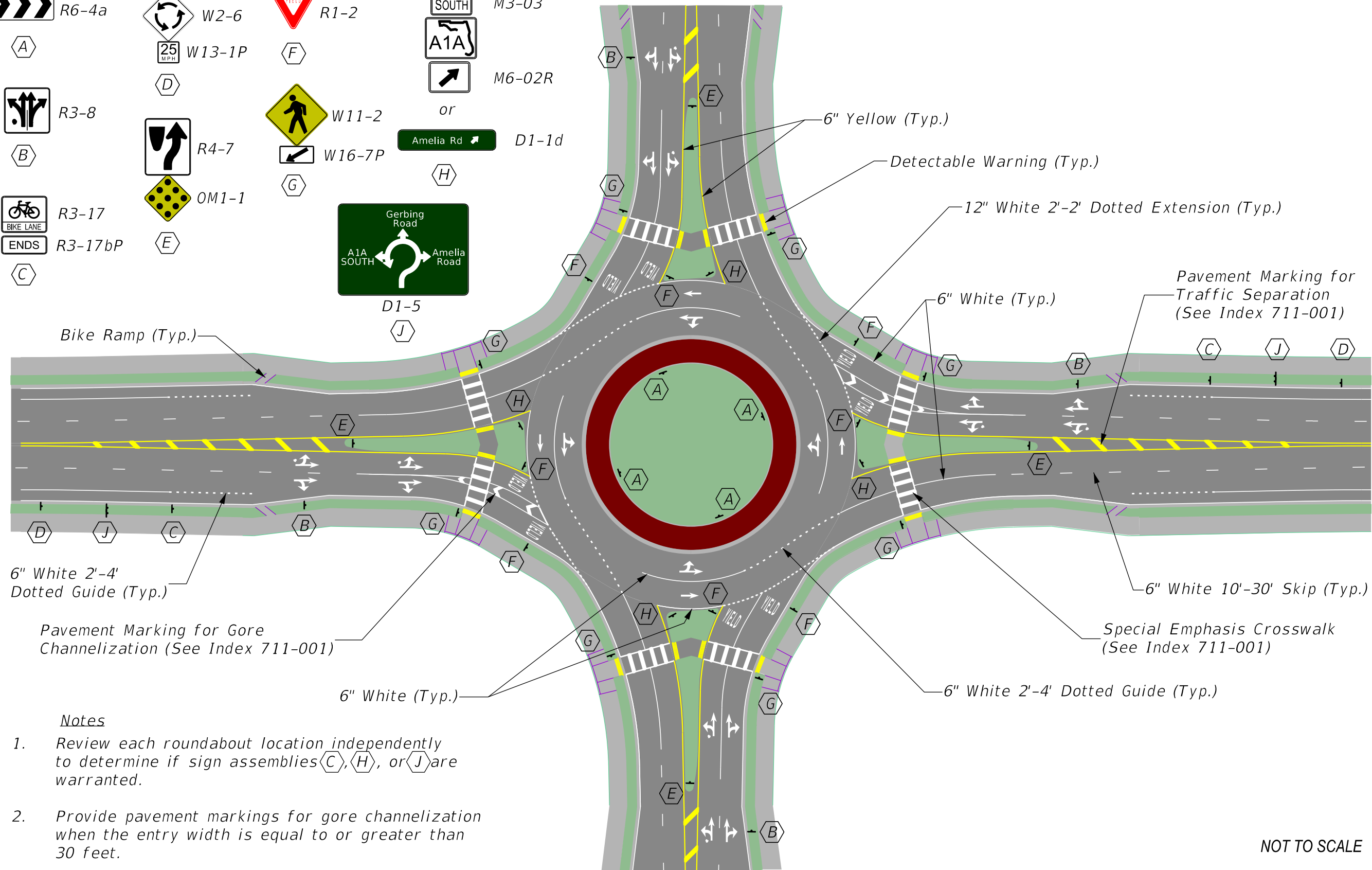
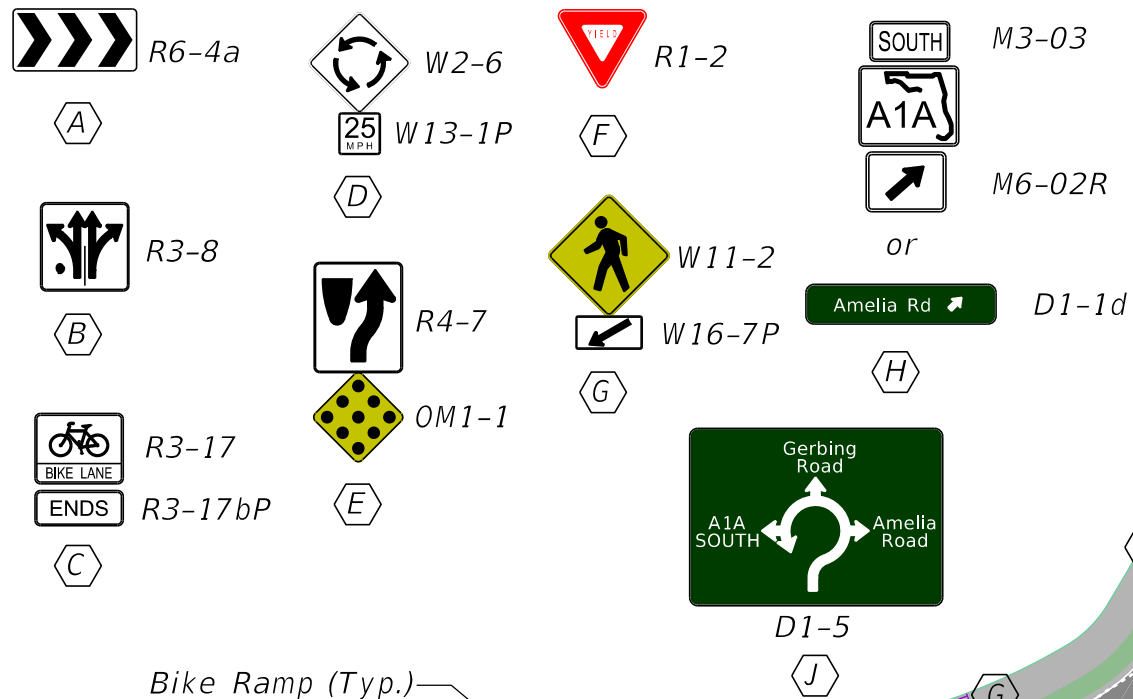
Note

1. Review each roundabout location independently to determine if sign assemblies , , or  are warranted.

1X1 ROUNDABOUT WITH BYPASS LANE
TYPICAL SIGNING AND PAVEMENT MARKINGS

NOT TO SCALE

EXHIBIT 213-4
01/01/2018



Bike Ramp (Typ.)

6" White 2'-4' Dotted Guide (Typ.)

Pavement Marking for Gore Channelization (See Index 711-001)

6" White (Typ.)

6" Yellow (Typ.)

Detectable Warning (Typ.)

12" White 2'-2' Dotted Extension (Typ.)

6" White (Typ.)

Pavement Marking for Traffic Separation (See Index 711-001)

6" White 10'-30' Skip (Typ.)

Special Emphasis Crosswalk (See Index 711-001)

6" White 2'-4' Dotted Guide (Typ.)

- Notes**
1. Review each roundabout location independently to determine if sign assemblies C, H, or J are warranted.
 2. Provide pavement markings for gore channelization when the entry width is equal to or greater than 30 feet.

NOT TO SCALE

**2X2 ROUNDABOUT
SIGNING AND PAVEMENT MARKINGS**

**EXHIBIT 213-5
01/01/2018**

213.8 Lighting

Nighttime illumination of roundabouts is required. Provide a minimum 1.5 foot-candles on the roadway surface within the circulatory roadway and at least 200 feet in advance of the splitter islands.

See **FDM 231.3.3** for additional lighting requirements when pedestrian facilities are provided.

213.9 Landscaping

Create a mounded central island that slopes toward the truck apron using a 1:10 slope. Provide varying height landscaping in the central island to enhance driver recognition of the roundabout upon approach. Provide quality space above and below ground for trees and other desirable vegetation to grow. Place trees near the center of the central island and not less than 6 feet from the face of curb.

Use low-maintenance vegetation and trees. If more decorative plantings are requested by local agency or groups, a maintenance agreement should be obtained.

Additional information regarding roundabout landscaping is in Chapter 9 of [NCHRP 672](#).

Coordinate the landscape design in the early stages of plans development to assure that landscaping will be fully integrated into the roundabout design and sight distance requirements will be satisfied.

213.10 Community Aesthetic Features

Communities commonly desire to place public art or other large aesthetic objects within the central island; e.g., statues, monuments, gateway features. These types of features are acceptable provided that:

- Objects are located outside the sight triangles,
- Not less than 6 feet from the inside edge of the truck apron, and
- Approval is granted through the process outlined in **FDM 127**.

Fountains, or other water spraying features are not permitted.