

**Figure 3.6.3. Corner Extension at Realigned Intersection**  
(Source: Scott Batson)



**Figure 3.6.4. Corner Extension at Realigned Intersection (Reverse View)**  
(Source: Google Street View)

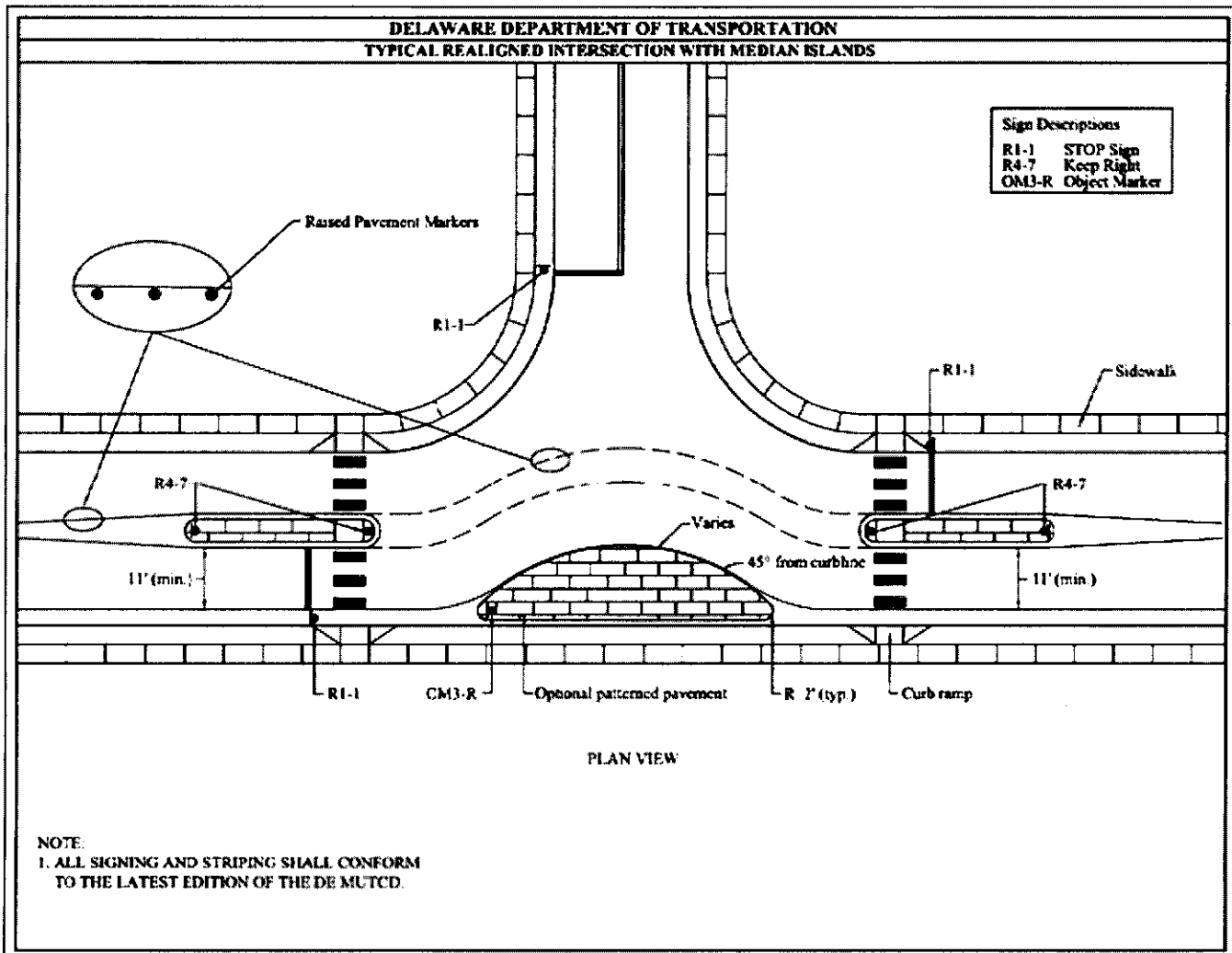
#### ***ADDITIONAL DESIGN CONSIDERATIONS***

Prior to design of a realigned intersection, a traffic review and capacity analysis should be completed for the intersection. The analyses should determine the appropriate traffic controls for the intersection and determine the extent of queuing and delay (vehicle and pedestrian) changes.

As with any intersection, a typical realigned intersection design needs to consider lighting, drainage, pedestrian safety, pedestrian mobility, and bicyclist access.

The curb extension or narrowing at the intersection should include signs or landscaping that draw attention to it. However, adequate intersection sight distance should be maintained.

Figures 3.6.5 and 3.6.6 illustrate sample designs for realigned intersections with and without approach leg medians, respectively.



**Figure 3.6.5. Sample Design for Realigned Intersection with Median Island**  
(Source: Delaware Department of Transportation)



center island. If the local jurisdiction permits the movement, the large vehicle can make a left turn in front of the island. However, some jurisdictions prohibit turning in front of the island.

A traffic circle is typically designed to fit within the travel lanes of an existing intersection. Because of the infrequent large vehicle turning left on the near side of the circle, the intersection approaches do not have splitter islands (see Figures 3.8.1, 3.8.2, 3.9.1, and 3.9.2 for photographs of splitter islands).

A traffic circle can simply be a painted area, but it is most effective when it is defined by a raised curb and landscaped to further reduce the open feel of a street. A traffic circle can be landscaped with ground cover, flowers, and street trees. Figures 3.7.1 and 3.7.2 illustrate two extremes in the amount of traffic circle landscaping.

A traffic circle is usually circular in shape, but may be oval to fit a particular intersection.

An animated video demonstrating pedestrian, bicyclist, and motorist movements at a traffic circle can be accessed at the following hyperlink: <https://www.youtube.com/watch?v=L2WyfWLM53c> (Source: City of Winnipeg, Alberta)

*[A field study of 45 traffic circles measured an average reduction of 4 mph for 85<sup>th</sup> percentile speeds [http://www.safety.fhwa.dot.gov/speedmgt/refmats/engcount/2014/reducing\\_speed.cfm](http://www.safety.fhwa.dot.gov/speedmgt/refmats/engcount/2014/reducing_speed.cfm) (Source: FHWA, Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Speed, July 2014)]*



**Figure 3.7.1. Landscaped Traffic Circle**  
(Source: Scott Batson)



**Figure 3.7.2. Traffic Circle without Landscaping**  
 (Source: Scott Batson)

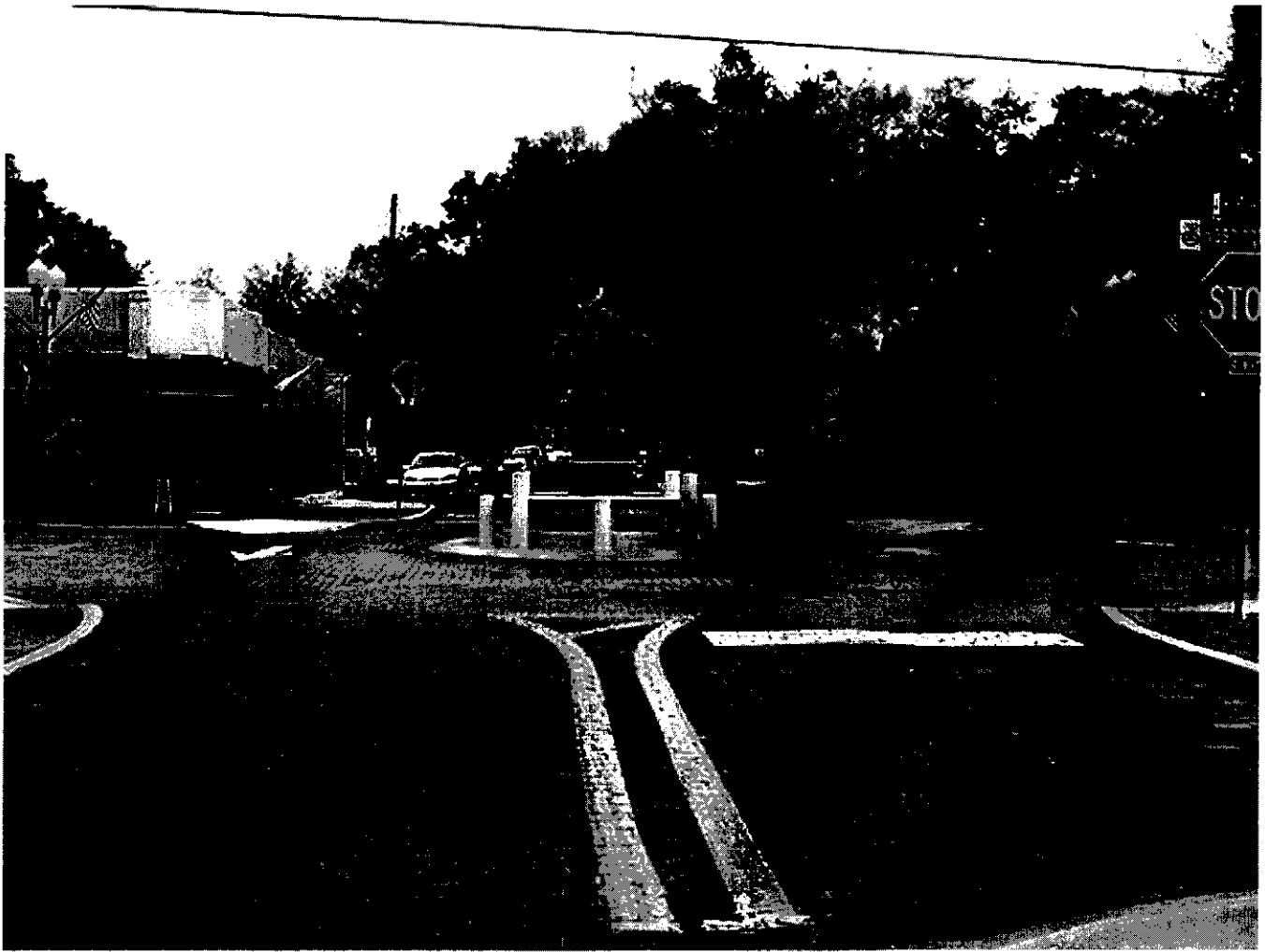
**APPROPRIATE APPLICATION**

<b>Appropriate Application – Traffic Circle</b>	
<b>Type of Street</b>	<p>Appropriate for the junction of two local roads</p> <p>Can be appropriate in both an urban and suburban setting; see Figures 3.7.3 and 3.7.4 for applications in commercial and residential settings, respectively</p>
<b>Intersection or Roadway Segment</b>	<p>Applicable only at an intersection<sup>8</sup></p> <p>Not typically appropriate for an offset intersection</p>
<b>Roadway Cross-Section</b>	<p>Can be used at intersection of both one-way and two-way streets</p> <p>Preferable for roadway to have urban cross-section (i.e., curb and gutter)</p> <p>Can be applied on a cross-section both with and without a bicycle facility; a bicycle lane is not striped within a traffic circle</p>

	Can be applied along a roadway with on-street parking
<b>Speed Limit</b>	Requires a slow approach by vehicles; appropriate only for streets with relatively low speed limits; as examples, Delaware and South Carolina use a 30 mph maximum
<b>Vehicle Traffic Volume</b>	Can be an appropriate measure at low traffic volumes; as an example, Pennsylvania uses a daily volume maximum of 3,500 for each intersection leg
<b>Emergency Route</b>	Not appropriate along a primary emergency vehicle route or on a street that provides access to a hospital or emergency medical services
<b>Transit Route</b>	In general, a transit route should not include a left turn at a traffic circle
<b>Access Route</b>	Typically not appropriate along a primary access route to a commercial or industrial site
<b>Grade</b>	Can be installed on a crest vertical curve only if there is adequate stopping sight distance or warning signs are provided  Maximum grade should comply with local standards and criteria

<sup>8</sup> A traffic calming feature placed midblock and in the middle of a road is considered a median island and is treated as a separate measure in this ePrimer





**Figure 3.7.3. Traffic Circle in Commercial Setting**  
(Source: Scott Wainwright)

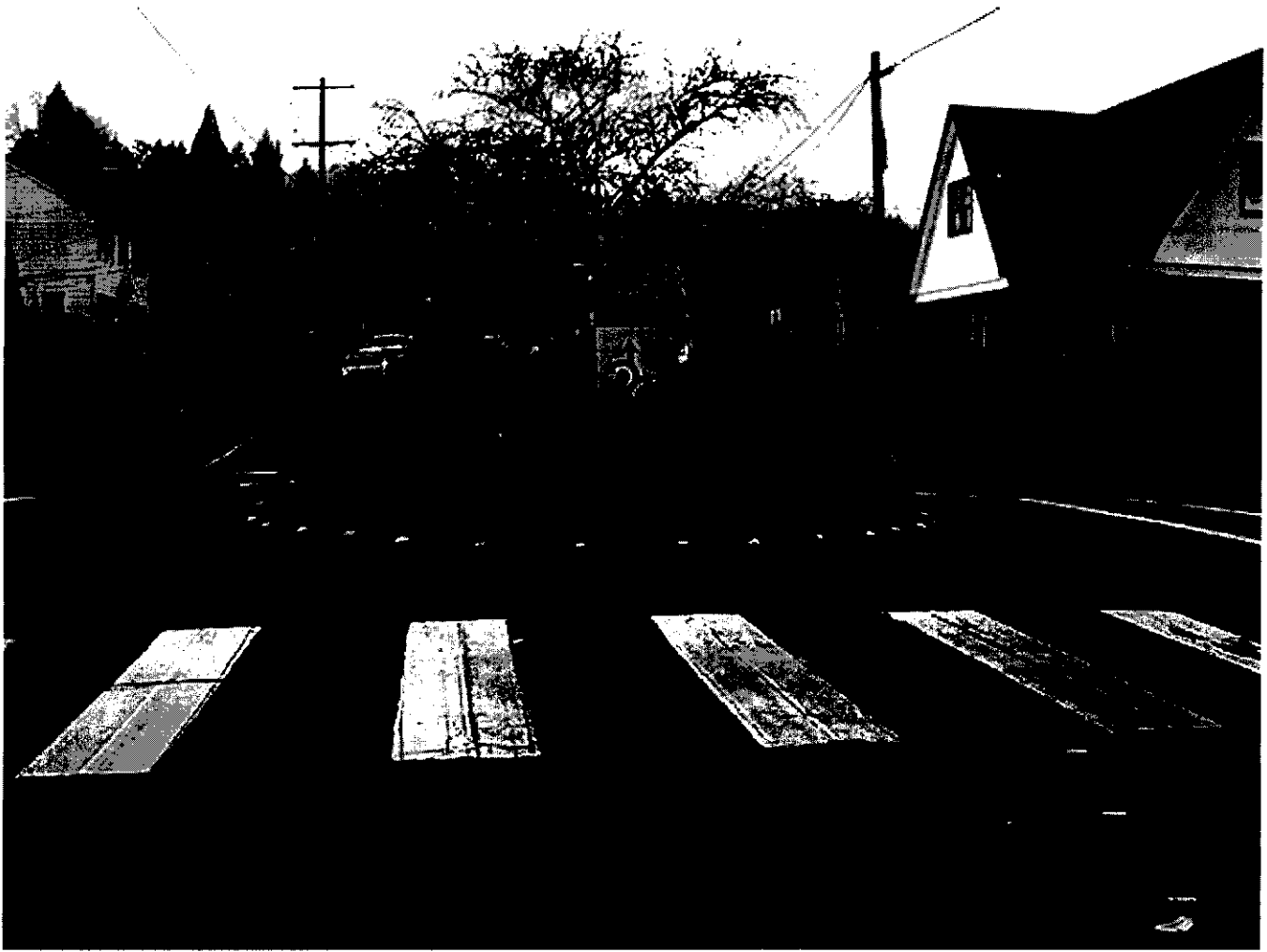


**Figure 3.7.4. Traffic Circle In Residential Setting**  
 (Source: Chris Tzeng)

***EFFECTS AND ISSUES***

<b>Effects and Issues – Traffic Circle</b>	
<b>Vehicle Speed</b>	<p>Traffic speeds within the limits of a traffic circle reduced 5 to 13 mph; in vicinity (i.e., within roughly 200 feet upstream and downstream), a smaller amount (between 1 and 6 mph)</p> <p>Has less of a speed reduction effect than does a small modern roundabout or mini-roundabout because a circle generally does not have splitter islands</p> <p>Most effective in reducing speeds when several are used in a series Refer to Module 4 for additional data</p>
<b>Vehicle Volume</b>	<p>As single traffic calming treatment, has wide-ranging effect on vehicle volume; more effective when placed in series</p>
<b>Pedestrian Safety and Mobility</b>	<p>Depending on geometry of overall intersection, horizontal deflection may force motor vehicle into pedestrian crossing area (see Figure 3.7.5); may be desirable to shift crosswalks slightly in order to prevent vehicles from encroaching on the crosswalk</p>
<b>Bicyclist Safety and Mobility</b>	<p>Bicyclist and motor vehicle share travel lane within the traffic circle (see Figure 3.7.6)</p>

<b>Motorist Safety and Mobility</b>	<p>Minimal impact on motorist comfort</p> <p>Constrained turning radius counterclockwise around circle may necessitate a large vehicle to make a left turn in front of the circle; if turning volume is significant, could create confusion and unexpected vehicle-vehicle conflicts</p>
<b>Emergency Vehicle Safety and Mobility</b>	<p>Fire vehicle can maneuver around traffic circle at slow speed Emergency response times may be affected</p> <p>Constrained turning radius typically necessitates a left turn in front of the circle</p> <p>Refer to Module 5 for additional discussion</p>
<b>Large Vehicle Safety and Mobility</b>	<p>Horizontal deflection could discourage large vehicle operator from using traffic circle if alternative path is available</p> <p>Constrained turning radius counterclockwise around the circle may necessitate a large vehicle to make a left turn in front of the circle</p> <p>Refer to Module 5 for additional discussion</p>
<b>Accessibility of Adjacent Property</b>	<p>Parking should not be permitted close to intersection with traffic circle; distance of 30 feet is commonly used</p> <p>Should not affect accessibility of nearby driveways</p>
<b>Environment</b>	<p>Can be used as a landscaping opportunity</p>
<b>Design Issues</b>	<p>Drainage typically works best if the cross-section slopes away from the traffic circle, creating a reverse superelevation (that in turn can encourage reduced vehicle speeds around the circle)</p> <p>May interfere with and require redesign of access to existing utilities (e.g., a manhole)</p> <p>May require additional street lighting</p>



**Figure 3.7.5. Potential Pedestrian-Vehicle Conflict at Traffic Circle**  
(Source: Scott Batson)



**Figure 3.7.6. Bicyclist Passing Through Traffic Circle**  
(Source: [www.pedbikeimages.org](http://www.pedbikeimages.org) / Dan Burden)

### ***ADDITIONAL DESIGN CONSIDERATIONS***

The center island of a traffic circle is not traversable.

The center island in the traffic circle should be large enough so that all vehicles are required to follow an indirect path, even to proceed straight through the intersection.

The roadway design vehicle for a traffic circle is usually a passenger car. A larger vehicle may need to cross in front of the traffic circle in order to make a left turn.

A narrow truck apron used at a traffic circle should be designed, at a minimum, to provide through movements for a service vehicle (SU-30).

The center island of a traffic circle should be a different pavement type than the surrounding roadways to increase its visibility. Textured or concrete pavement is commonly used to distinguish the center island from the surrounding pavement.

For a traffic circle, the center island pavement is typically 3 inches above the existing street grade. Traffic circles typically maintain all existing street grades and drainage is not often an issue.

If a traffic circle is designed for a T-intersection, the intersection curb should be either extended at the entrance and exit to the intersection or indented within the intersection to ensure adequate deflection of the vehicle path along the top of the T.

Typical complementary signage is a Yield sign on each approach. It is common for Stop sign control to remain in place at a traffic circle, in particular where Stop signs predate installation of a traffic circle.

### **3.8 Small Modern Roundabout and Mini-Roundabout (Not Traffic Circle)**

#### ***DESCRIPTION AND GENERAL PURPOSE***

A small modern roundabout and mini-roundabout is a raised island, placed within an unsignalized intersection, around which traffic circulates. The center island forces a motorist to use reduced speed when entering and passing through an intersection, whether the vehicle path is straight through or involves a turn onto an intersecting street. It is also expected to reduce the number of angle and turning collisions.

Both a small modern roundabout and a mini-roundabout are designed in accordance with roundabout design principles. Both are designed so that all traffic can circulate counterclockwise around or partially over the center island.

The principal difference between a small modern roundabout and a mini-roundabout is found at the center island. For a small modern roundabout, the center island is not traversable and can be landscaped with ground cover, flowers, and street trees. In contrast, the center island of a mini-roundabout is fully traversable.

Both a small modern roundabout and mini-roundabout use splitter islands to direct traffic entering the intersection. In order to accommodate trucks, fire trucks, school buses and vehicles towing trailers, the splitter islands can be either mountable or at-grade.

Traffic entering the intersection yields to vehicles within the roundabout.

The reader should reference the Federal Highway Administration (FHWA) report *Mini-Roundabouts* for a complete description of mini-roundabout characteristics, applicability, and effectiveness. As defined in the FHWA report, "a mini-roundabout is a type of intersection that can be used at physically-constrained locations in place of stop-controlled or signalized intersections to help improve safety problems and reduce excessive delays at minor approaches .... Mini-roundabouts generally have an inscribed circle that is small enough to stay within the existing right-of-way (or within the existing curb lines if adequate space is available). Mini-roundabouts operate in the same manner as larger roundabouts, with yield control on all entries and counterclockwise circulation around a mountable (traversable) [center] island."

A photograph of an example small modern roundabout is shown in Figure 3.8.1.

A video that explains and demonstrates mini-roundabouts can be accessed at the following hyperlink:

<https://www.youtube.com/watch?v=94h1TCK-yNs>

(Source: U.S. Department of Transportation, Federal Highway Administration)



**Figure 3.8.1. Small Modern Roundabout**  
 (Source: Ken Sides)

***APPROPRIATE APPLICATION***

<b>Appropriate Application – Small Modern Roundabout and Mini-Roundabout</b>	
<b>Type of Street</b>	Appropriate for the junction of two local roads or of a local and collector road  Can be appropriate in both an urban and suburban setting
<b>Intersection or Roadway Segment</b>	Applicable only at an intersection <sup>9</sup>  Typically not appropriate for an offset intersection
<b>Roadway Cross-Section</b>	Can be used at the intersection of both one-way and two-way streets  Approach legs must be one lane in each direction (two-lane approaches are addressed through the use of a roundabout)  Typically preferable to have an urban cross-section (i.e., curb and gutter) but there are many built where shoulder cross-section is transitioned to the roundabout

	<p>Can be applied on a cross-section both with and without a bicycle facility; a bicycle lane is not striped within a small modern roundabout or mini-roundabout</p> <p>Can be applied along a roadway with on-street parking</p>
<b>Speed Limit</b>	Requires a slow approach by vehicles; either with a relatively low speed limit or other features on the approaches to warn of the roundabout intersection
<b>Vehicle Traffic Volume</b>	Can be an appropriate measure at lower traffic volume levels than a roundabout (see Figure 3.8.2)
<b>Emergency Route</b>	Appropriate along a primary emergency vehicle route or on a street that provides access to a hospital or emergency medical services
<b>Transit Route</b>	Although a transit vehicle can negotiate the turn, in general, transit route should not include a left turn at a small modern roundabout or mini-roundabout
<b>Access Route</b>	Can be applied along a primary access route to a commercial or industrial site
<b>Grade</b>	<p>Can be installed on a crest vertical curve only if there is adequate stopping sight distance or warning signs are provided</p> <p>Maximum grade should comply with local standards and criteria; as examples, Virginia and Portland OR limit longitudinal street grades to 10 percent</p>

<sup>9</sup> A traffic calming feature placed midblock and in the middle of a road is considered a median island and is considered a separate measure.



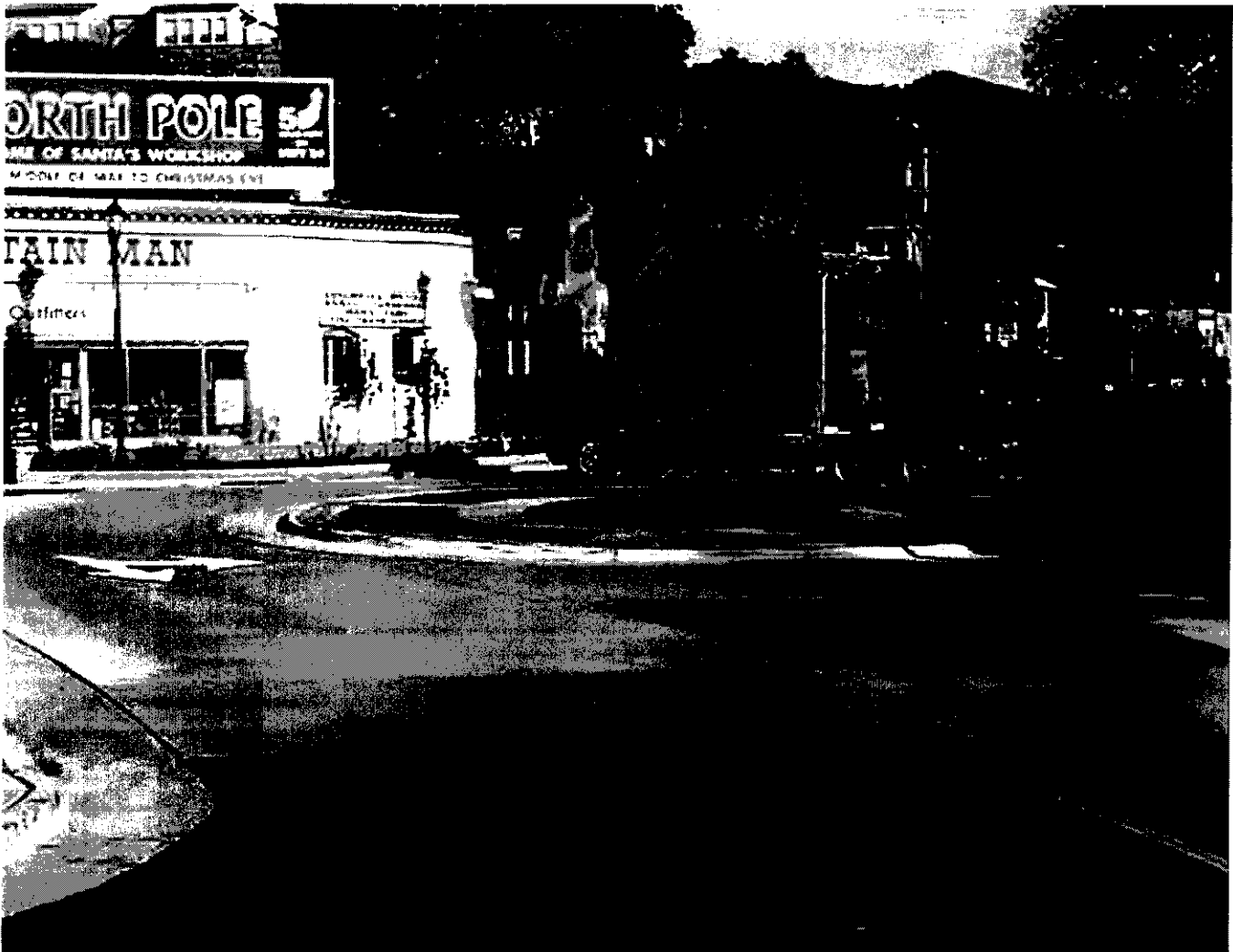


**Figure 3.8.2. Mini-Roundabout with Splitter Islands**  
 (Source: Omni-Means, Ltd. and Google Street View)

**EFFECTS AND ISSUES**

<b>Effects and Issues – Small Modern Roundabout and Mini-Roundabout</b>	
<b>Vehicle Speed</b>	<p>Speed reduction largely dependent on proper design of approach lanes to deflect each vehicle as it passes through intersection; without adequate deflection, motorists can pass through small modern roundabout and mini-roundabout without lowering vehicle speed</p> <p>FHWA publication <i>Roundabouts: An Informational Guide</i> shows travel speeds approximately 40% lower within mini-roundabout than 350 feet away from intersection</p>
<b>Vehicle Volume</b>	As single traffic calming treatment, there is little traffic diversion from the street
<b>Pedestrian Safety and Mobility</b>	<p>Fewer vehicle/pedestrian conflict points than traditional four-leg intersection</p> <p>Depending on geometry of overall intersection, horizontal deflection may force motor vehicles into pedestrian crossing area on the cross street; may be necessary to move crosswalks further away from mini-roundabout to prevent vehicles from encroaching on the crosswalk</p>
<b>Bicyclist Safety and Mobility</b>	Bicyclist and motor vehicle to share travel lane within mini-roundabout
<b>Motorist Safety and</b>	Can improve motorist safety at the intersection; has fewer potential vehicle/vehicle conflicts points than traditional four-leg intersection; left-

<b>Mobility</b>	<p>hand turn crashes eliminated</p> <p>Minimal impact on motorist comfort</p>
<b>Emergency Vehicle Safety and Mobility</b>	<p>Turns made smoothly across small modern roundabout apron or mini-roundabout center island</p> <p>Refer to Module 5 for additional discussion</p>
<b>Large Vehicle Safety and Mobility</b>	<p>Lateral deflection for through movements may discourage large vehicle operator from using small modern roundabout or mini-roundabout if alternative path is available</p> <p>Refer to Module 5 for additional discussion</p>
<b>Accessibility of Adjacent Property</b>	<p>Parking should not be permitted close to a small modern roundabout or mini-roundabout; distance of 30 feet is commonly used</p> <p>Should not affect the accessibility of nearby driveways; Virginia recommends a minimum distance of 100 feet to a driveway</p>
<b>Environment</b>	<p>Small modern roundabout can be used as landscaping opportunity; for a traversable mini-roundabout, color or texture treatment can be used or center island can even be branded to relate to a nearby school, neighborhood, business district, etc. (see Figure 3.8.3)</p>
<b>Design Issues</b>	<p>Drainage typically better if cross-section slopes away from center island; reverse superelevation can reduce vehicle speed</p> <p>May interfere with and require redesign of access to an existing utility (e.g., a manhole)</p> <p>May require additional street lighting</p>



**Figure 3.8.3. Mini-Roundabout Center Island with Color Pavement**  
(Source: Dan Burden)

### ***ADDITIONAL DESIGN CONSIDERATIONS***

The center island of a small modern roundabout is not traversable. The center island of a mini-roundabout is fully traversable.

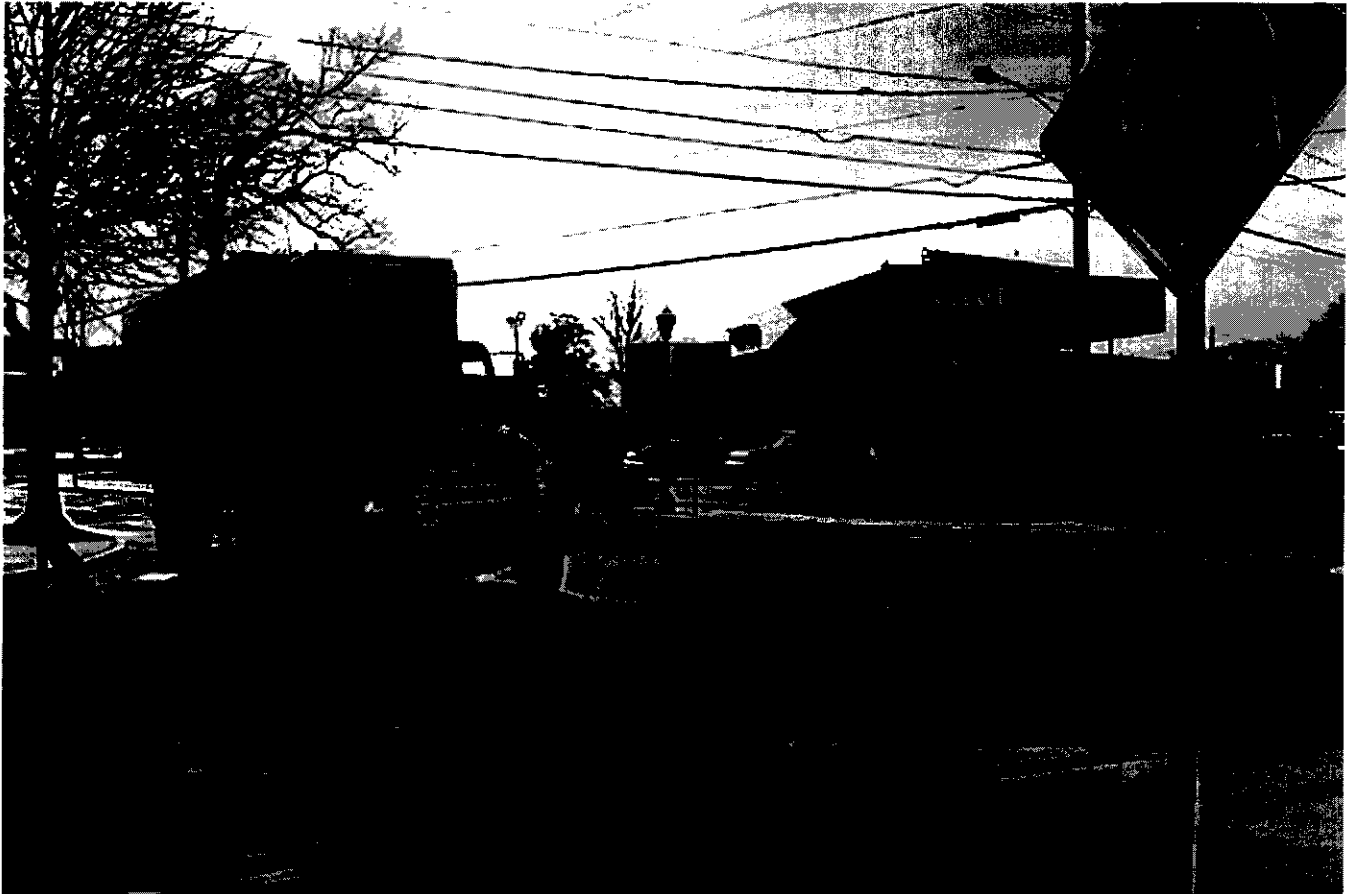
The design vehicle for travel around a small modern roundabout or mini-roundabout is the passenger car. A single-unit truck can pass around either but may need to mount the apron of the center island. A larger truck or bus passing through a small modern roundabout may also need to traverse the center island apron. When a larger truck or bus passes straight through a mini-roundabout intersection, it may have to traverse a portion of the center island. When making a left turn at a mini-roundabout, a larger truck or bus is not able to circulate counterclockwise around the center island, but instead travel over the center island at a slow speed (see Figure 3.8.4).

The center island of a mini-roundabout should be a different pavement type than the surrounding roadways to increase its visibility. Textured or concrete pavement is commonly used to distinguish the center island from the surrounding pavement.

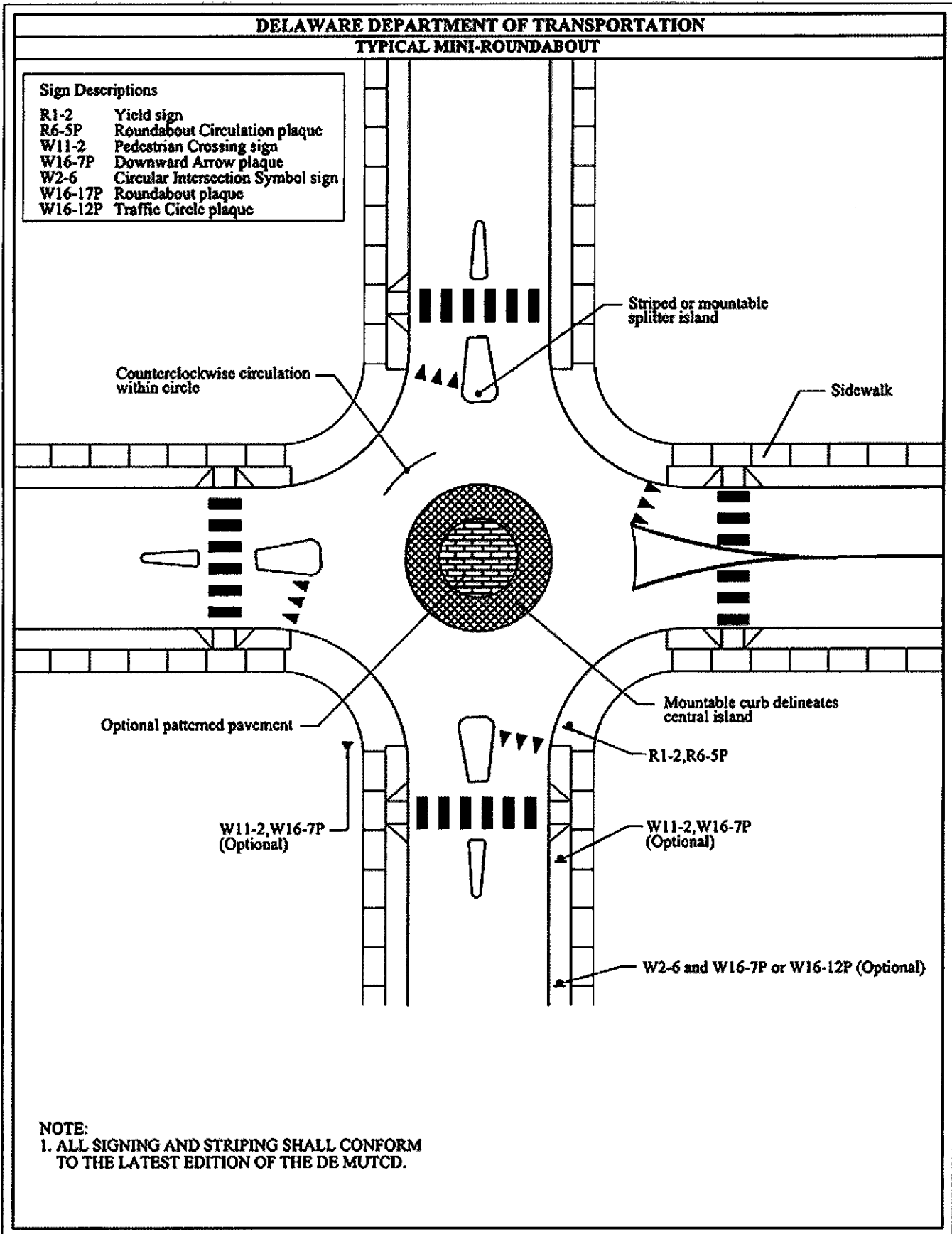
For drainage, the circulating lane of a small modern roundabout and mini-roundabout typically slopes away from the center island at a slope between 1 and 2 percent.

If a small modern roundabout or mini-roundabout is designed for a T-intersection, the intersection curb should be either extended at the entrance and exit to the intersection or indented within the intersection to ensure adequate deflection of the vehicle path along the top of the T.

Typical complementary signage is a Yield sign on each approach. The MUTCD has a sample striping layout for a mini-roundabout. A sample design for a mini-roundabout is presented in Figure 3.8.5.



**Figure 3.8.4. Mini-Roundabout with Truck**  
(Source: Ian Lockwood)



**Figure 3.8.5. Sample Design for Mini-Roundabout**  
(Source: Delaware Department of Transportation)

Note: In order for this design to be ADA-compliant, the splitter island on the right-hand leg of this mini-roundabout must be striped and flush with the pavement.

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