Technical Summary

Mini-Roundabouts

U.S. Department of Transportation
Federal Highway Administration

FHWA-SA-10-007

Safe Roads for a Safer Future
Investment in roadway safety saves lives

Foreword

This technical summary is designed as a reference for State and local transportation officials, Federal Highway Administration (FHWA) Division Safety Engineers, and other professionals who may be involved in the design, selection, and implementation of mini-roundabout intersections. Because experience with mini-roundabouts is limited in the United States, the information presented here draws primarily upon guidance and experience from other countries with reference to American guidance as appropriate. This technical summary explores the unique characteristics of mini-roundabouts while reinforcing the need to apply the principles-based approach common to all roundabout design. It provides readers with an overview of the key considerations for planning, analysis, and design of single-lane mini-roundabouts.

Section 1 of this document summarizes the characteristics of mini-roundabouts. Section 2 presents benefits of mini-roundabout intersections compared to alternative intersection solutions. Sections 3-6 provide an overview of user, location, operational and design considerations respectively.

The information presented herein is a summary of principles outlined in the FHWA document *Roundabouts: An Informational Guide* [1] and the forthcoming 2nd Edition [2] (hereafter referred to as the Roundabout Guide), which is in progress at the time of this writing and due to be published in 2010. Specific considerations for single-lane and multilane roundabouts are summarized in a separate FHWA document titled *Roundabout Technical Summary* [3]. Figures are from the Roundabout Guide unless otherwise noted.

This publication does not supersede any publication; and is a Final version.

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Introduction

Mini-roundabouts are a type of roundabout characterized by a small diameter and traversable islands (central island and splitter islands). Mini-roundabouts offer most of the benefits of regular roundabouts with the added benefit of a smaller footprint. As with roundabouts, mini-roundabouts are a type of intersection rather than merely a traffic calming measure, although they may produce some traffic calming effects. They are best suited to environments where speeds are already low and environmental constraints would preclude the use of a larger roundabout with a raised central island. Mini-roundabouts are common in the United Kingdom (U.K.) and France and are emerging in the United States (including states such as Maryland and Michigan), Germany, and other countries.

This technical summary focuses on single-lane mini-roundabouts. Because experience with mini-roundabouts is limited in the United States, the information presented here draws primarily upon guidance and experience from other countries with reference to American guidance as appropriate. This technical summary explores the unique characteristics of mini-roundabouts while reinforcing the need to apply the principles-based approach common to all roundabout design. It provides readers with an overview of the key considerations for planning, analysis, and design of mini-roundabouts.

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Section 1: Characteristics of Mini-Roundabouts

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 [1]. Figure 1 illustrates the design features of a mini-roundabout; these features are described further later in this summary. 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) central island.

Mini-roundabouts are distinguished from neighborhood traffic circles primarily by their traversable islands and yield control on all approaches, which allows them to function as other roundabouts do. Neighborhood traffic circles are typically built at the intersections of local streets for reasons of traffic calming and/or aesthetics. They typically are operated as two-way or all-way stop-controlled intersections and frequently do not include raised channelization to guide approaching traffic into the circulatory roadway. At some neighborhood traffic circles, left-turning vehicles must turn in front of the central island, potentially conflicting with other circulating traffic.

To help promote safe operations, the design of mini-roundabouts generally aligns passenger cars on the approach in such a way as to naturally follow the circulatory roadway and minimize running over the central island to the extent possible. Due to the small footprint, large vehicles are typically required to over-run the fully traversable central island (as shown in Figure 1).

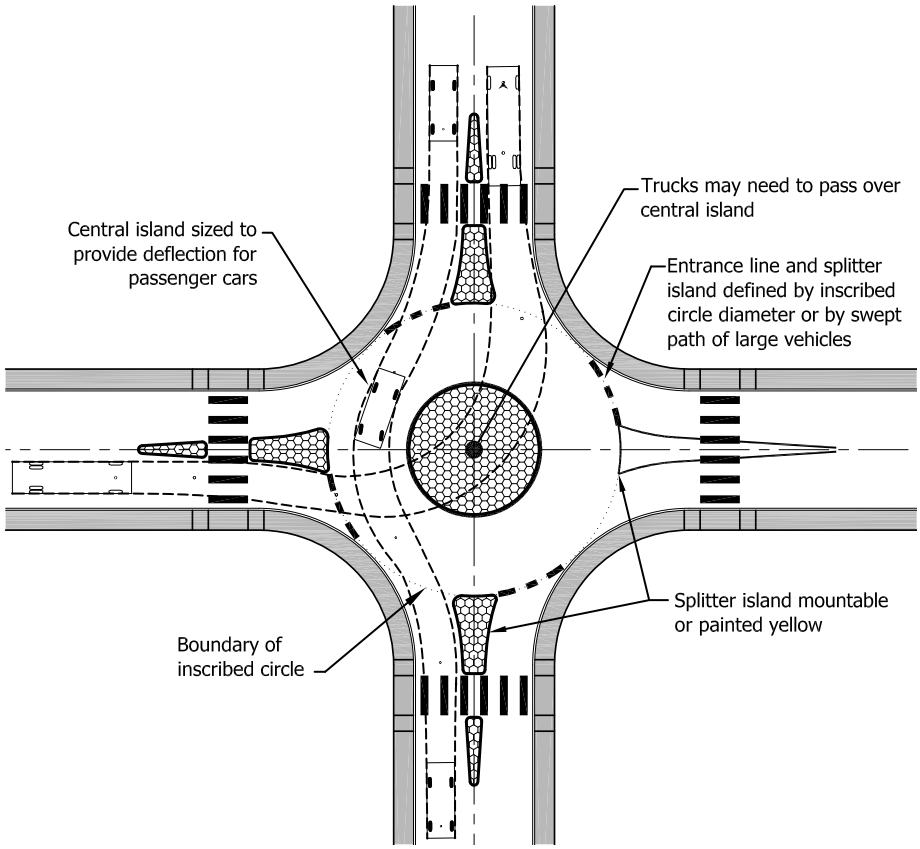


Figure 1: Design Features of a Mini-Roundabout

Section 2: Benefits of Mini-Roundabouts

Mini-roundabouts are emerging in the United States as a potential intersection type. They may be an optimal solution for a safety or operational issue at an existing stop-controlled or signalized intersection where there is insufficient right-of-way for a standard roundabout installation. Of course, mini-roundabouts are not always feasible or optimal solutions for every problem. The benefits of mini-roundabouts, and some constraining factors (derived largely from international experience, particularly in the U.K., where mini-roundabouts were invented), are described below [4].

- **Compact size –** A mini-roundabout can often be developed to fit within existing right-of-way constraints. Note that mini-roundabouts are generally not recommended for intersections with more than four legs. However, in some cases there may be adequate spacing between legs to allow for two closely-spaced mini-roundabouts.
- **Operational Efficiency –** A mini-roundabout may provide less delay for a critical movement or for an overall intersection in comparison to other intersection alternatives. However, as with all roundabout types, mini-roundabouts do not provide explicit priority to specific users such as trains, transit, or emergency vehicles.
- **Traffic Safety –** Mini-roundabouts have been used successfully in the U.K. to improve safety at intersections with known crash problems, with reported crash rate reductions of approximately 30 percent as compared to signalized intersections [5].
- **Traffic Calming –** Designed properly, a mini-roundabout reduces speeds and can be implemented as part of a broader traffic calming scheme. The low-speed environment also enhances the intersection for non-motorized users. However, mini-roundabouts cannot provide the same level of speed reduction as their larger counterparts and thus are less suited for roadways with speeds exceeding 30 to 35 mph (50 to 55 km/h).
- **Access Management –** A mini-roundabout can be used to provide efficient access to a new or existing development. However, in the cases of large trucks and other large vehicles, the diameter may be too small to accommodate U-turn maneuvers that would be readily accommodated at a larger roundabout.
- **Aesthetics –** In comparison to full-size roundabouts, mini-roundabouts do not allow opportunities for landscaping in the central island. As with comparably sized traditional intersections, landscaping opportunities are limited to the periphery of the intersection.
- **Environmental Benefits –** A mini-roundabout may offer an environmental benefit compared to conventional intersections through reduced delay, fuel consumption, and vehicle emissions.

Section 3: User Considerations

The various user types of a mini-roundabout have unique characteristics that should be considered in the planning and design process. Some of the characteristics of four user groups—motorists, pedestrians, bicyclists, and emergency vehicles—are discussed here; a more complete discussion can be found in the Roundabout Guide.

3.1 Motorists

As with other types of roundabouts, mini-roundabouts can enhance the safety for drivers, including older drivers, by:

- Allowing more time to make decisions, act, and react;
- Reducing the number of directions in which a driver needs to watch for conflicting traffic; and
- Reducing the need to judge gaps in fast traffic accurately.

Attention should be paid to the placement of signs and pavement markings to make them clear, visible, and

unambiguous to all users, including older drivers. Trucks and other large vehicles can be accommodated at a mini-roundabout by using mountable islands. Further details on design vehicles are provided later in this technical summary.

3.2 Pedestrians

Pedestrians are accommodated at pedestrian crosswalks around the perimeter of the mini-roundabout. The splitter islands at mini-roundabouts typically do not provide the same degree of refuge as those at other roundabouts, thus typically requiring pedestrians to cross the street in one stage (as with many conventional intersections).

The Americans with Disabilities Act requires that all new and modified intersections, including roundabouts, be accessible to and usable by people with disabilities. The accessibility of mini-roundabouts to pedestrians with vision disabilities has not been specifically researched but is not expected to require treatments beyond those provided for similar single-lane roundabouts. Further discussion can be found in the Roundabout Guide.

3.3 Bicycles

Mini-roundabouts are generally located in environments where bicyclists are comfortable negotiating the roundabout as a motor vehicle. In the event a bicyclist desires to navigate the intersection as a pedestrian, sidewalks and crosswalks are provided.

3.4 Emergency Vehicles

Because of the traversable design of the central island and splitter islands, emergency vehicles are unlikely to have significant difficulty negotiating a mini-roundabout.

Section 4: Location Considerations

As noted previously, mini-roundabouts are an intersection form that may have some traffic calming properties. Because of their design characteristics, mini-roundabouts are most effective in lower speed environments in which all approaching roadways have posted speed of 30 mph or less and an 85th-percentile speed of less than 35 mph (55 km/h) near the proposed yield and/or entrance line [6]. For any location with an 85th-percentile speed above 35 mph (55 km/h), the mini-roundabout can be included as part of a broader system of traffic calming measures to achieve an appropriate speed environment.

There are a number of locations where mini-roundabouts are commonly found to be advantageous and a number of situations that may adversely affect their feasibility. As with any decision regarding intersection treatments, care should be taken to understand the particular benefits and trade-offs for each project site.

4.1 Common Site Applications

Mini-roundabouts can be used at existing intersections to replace two-way stop control, all-way stop control, or a traffic signal. Mini-roundabouts can improve the operation of an intersection by reducing the dominance of the traffic flow from one direction over others, facilitating access and reducing delay to minor street movements, and improving overall intersection capacity [4].

Mini-roundabouts generally have a narrower range of applications than other types of roundabouts. The following applications represent some of the situations at which mini-roundabouts may be advantageous (further discussion can be found in the Roundabout Guide):

- **Space-constrained locations with reasonable approach speeds (30 mph [50 km/h] or less) –** Because mini-roundabouts require less space than larger roundabouts, they may be a solution where a larger roundabout will not fit, provided that speeds are reasonable.
- **Residential environments –** Mini-roundabouts offer a low-speed, low-noise intersection option that requires little ongoing maintenance.

- **Intersections with high delay –** A roundabout can be an ideal application to reduce delay at stop-controlled intersections that do not meet signal warrants.

4.2 Site Constraints

Due to their smaller proportions, mini-roundabouts are not suitable for all locations. Certain site-related factors may significantly influence the design, requiring that a more detailed investigation of some aspects of the site be carried out. A number of these factors (many of which are valid for any intersection type) are listed below:

- High volumes of trucks will significantly reduce the capacity of a mini-roundabout, as trucks will occupy most of the intersection when turning [1]. Additionally, high volumes of trucks overrunning the central island may lead to rapid wear of the roadway markings.
- Mini-roundabouts are not recommended in locations in which U-turn truck traffic is expected, such as at the ends of street segments with medians or other access restrictions. However, in the expectation that U-turns are likely to occur, the design of a mini-roundabout should accommodate U-turns for passenger cars. Due to the small inscribed circle diameter, larger vehicles may not be capable of making a U-turn movement.
- Locations with light volumes of minor street traffic may not provide a suitable location for a mini-roundabout. Major street vehicles may become conditioned over time to ignore the intersection control due to a lack of minor street vehicles presence, which requires major street drivers to slow and proceed cautiously through the intersection. One rule of thumb used in the U.K. is to have at least 10 percent of the total intersection volume generated from the minor street [7]. Another measure used in the U.K. is that mini-roundabouts should not be considered at intersections with volumes below 500 daily vehicles on the minor street [6].
- Challenges for other types of roundabouts, including physical complications, proximity to significant generators of traffic, and proximity to other traffic control devices (e.g., signalized intersections, at-grade rail crossings) or bottlenecks, etc., may make it politically or economically infeasible to construct a mini-roundabout. These and other conditions are discussed further in the Roundabout Guide and in the Technical Summary on Roundabouts.

The existence of one or more of these conditions does not necessarily preclude the installation of a mini-roundabout. Experience in the United States is limited to date, but there may be comparable conditions in other countries where mini-roundabouts have successfully overcome one or more of the conditions listed above. To address these conditions, additional analysis, design work, and coordination with affected parties may be needed to resolve conflicts and help in the decision-making process. In some cases, the conditions identified above cannot be overcome, and another intersection type may be more suitable.

Section 5: Operational Analysis

Mini-roundabouts are generally recommended for intersections in which the total entering daily traffic volume is no more than approximately 15,000 vehicles. While a mini-roundabout may perform acceptably at higher volume locations, there has been limited experience for such sites in the United States. Multilane mini-roundabouts have been used in the U.K. but are rare elsewhere.

Operational performance models for mini-roundabouts have not been developed for U.S. conditions as of this writing. The calibration to U.S. drivers of international models, such as those from the U.K., has not been determined as of this writing.

Section 6: Design Considerations

The geometric design of a mini-roundabout, as with other types of roundabouts, requires the balancing of competing design objectives. Roundabouts operate most safely when their geometry forces traffic to enter and circulate at slow speeds. Poor roundabout geometry has been found to negatively impact roundabout operations by affecting driver lane choice and behavior through the roundabout. Many of the geometric parameters are governed by the maneuvering requirements of the design vehicle and the accommodation of nonmotorized users. Thus, designing a roundabout is a process of determining the optimal balance between safety provisions, operational performance, and accommodation of design users. For these reasons, roundabout design techniques are difficult to standardize, and there is rarely only one "right" way to design a roundabout.

Mini-roundabout design applies many of the same principles used for other types of roundabouts, including:

- Provide slow entry speeds and consistent speeds through the roundabout by using deflection;
- Provide smooth channelization that is intuitive to drivers;
- Provide adequate accommodation for the design vehicles;
- Design to meet the needs of pedestrians and bicyclists; and
- Provide appropriate sight distance and visibility.

The Roundabout Guide and/or the Technical Summary on Roundabouts provide more detailed design guidelines [2, 3]. The remainder of this document focuses on the design aspects and considerations that are unique to mini-roundabouts.

6.1 Horizontal Design

Mini-roundabout design applies many of the same principles and details of the design of larger roundabouts but with different emphasis areas. Given that the central island of a mini-roundabout is fully traversable, the overall design should provide channelization that naturally guides drivers to the intended path. Sub-optimal designs may result in drivers turning left in front of the central island (or driving over the top of it), improperly yielding, or traveling at excess speeds through the intersection. The following key horizontal design areas for considerations are highlighted below: size, design vehicle, design speed, central island, entrance line placement, and splitter islands.

6.1.1 Size

A mini-roundabout is often considered as an alternative to a larger, single-lane roundabout due to a desire to minimize impacts outside of the existing intersection footprint. Therefore, the existing intersection curb line is a typical starting point for establishing the mini-roundabout inscribed circle diameter. Mini-roundabouts should be made as large as possible within the intersection constraints. However, a mini-roundabout inscribed circle diameter generally should not exceed 90 ft (30 m). Above 90 ft (30 m), the inscribed circle diameter is typically large enough to accommodate the design vehicles navigating around a raised central island. A raised central island provides physical channelization to control vehicle speeds; therefore, a single-lane roundabout design is preferred where a diameter greater than 90 ft (30 m) can be provided.

6.1.2 Design Vehicle

The location and size of a mini-roundabout central island (and the corresponding width of the circulatory roadway) is dictated primarily by passenger car swept path requirements. The island location should be at the center of the left-turning inner swept paths which will be near, but not necessarily on, the center of the inscribed circle. The off-tracking of a large design vehicle should be accommodated by the footprint of the central island; meanwhile, passenger cars should be able to navigate through the intersection without being required to over-run the central island.

As with single and multilane roundabouts, it is desirable to also accommodate buses within the circulatory roadway to avoid jostling passengers by over-running

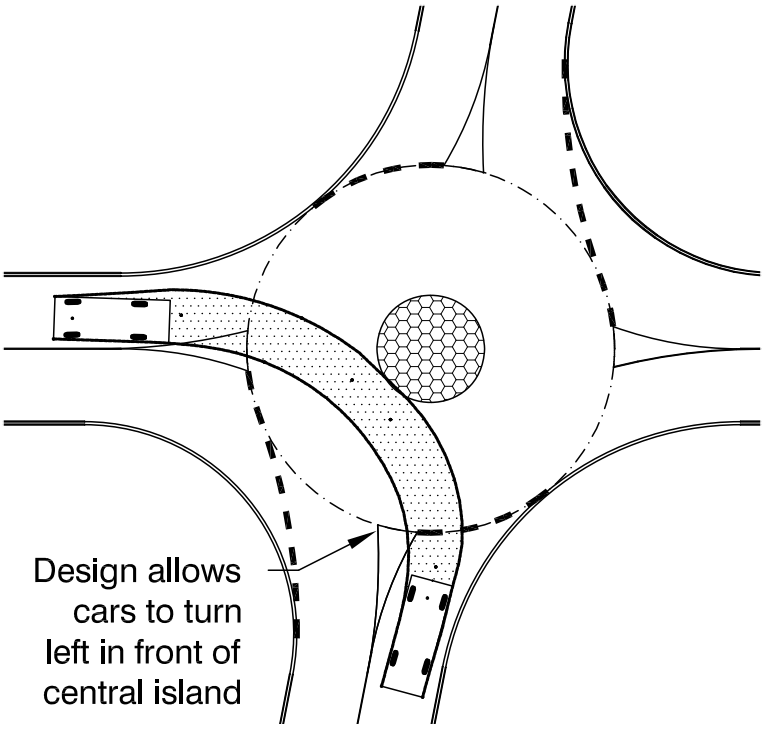


Figure 2: Undesirable Design that Allows Left Turns in Front of Central Island

the central island. However, for very small inscribed circle diameters, the bus turning radius is typically too large to navigate around the central island while staying within the circulatory roadway, thus requiring buses to travel over the central island. The potential trade-off to designing for a bus instead of a passenger car is that the design may result in a wider circulatory roadway and smaller central island.

6.1.3 Design Speed

The location of the central island should allow for all movements to be accommodated at the intersection with counterclockwise circulation. Designing the central island size and location to provide deflection through the roundabout will encourage proper circulation and reduced speeds through the intersection.

6.1.4 Central Island

The central island is typically fully traversable and may either be domed or raised with a mountable curb and flat top for larger islands. Although painted central islands are commonly used in the U.K., flush central islands are discouraged in other countries to maximize driver compliance. Composed of asphalt concrete, Portland cement concrete, or other paving material, the central island should be domed using 5 to 6 percent cross slope, with a maximum height of 5 in (12 cm). Although fully mountable and relatively small, it is essential that the central island be clear and conspicuous. Islands with a mountable curb should be designed in a similar manner to truck aprons on normal roundabouts.

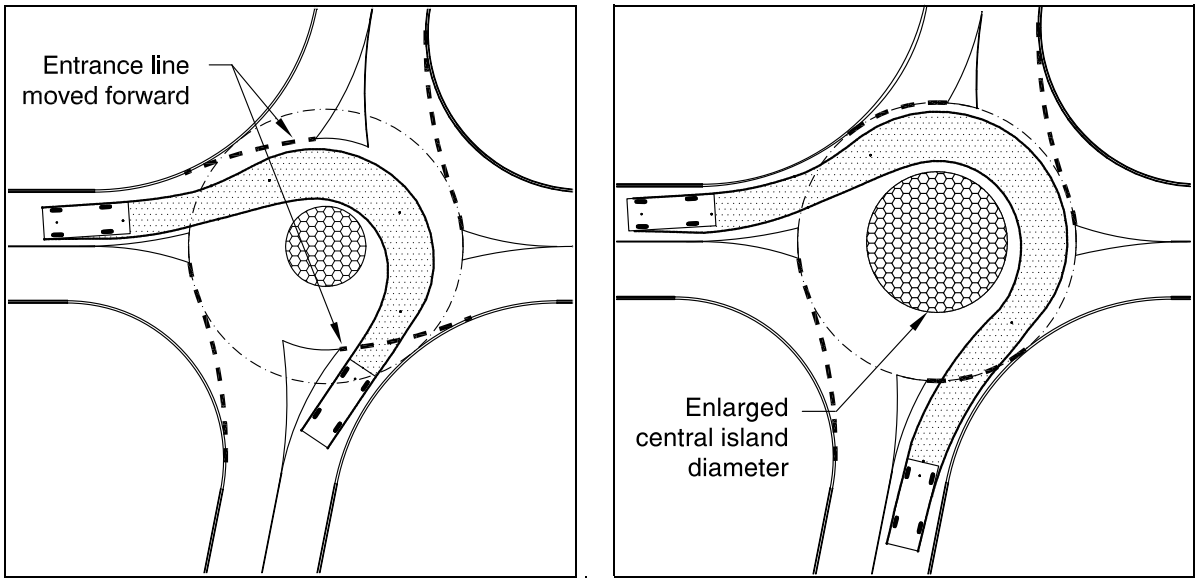
6.1.5 Placement of Entrance Line

The entrance line is integral to the geometric design of a mini-roundabout, and incorrect placement can introduce undesirable driver behavior. Figure 2 illustrates one particular situation where the design allows passenger cars to turn left in front of the central island. In this case, the combination of the intersection skew angle, small size of the central island, small size of the splitter islands, and large width of the circulatory roadway makes it comfortable for a driver to turn left in front of the central island instead of navigating around it introducing the risk of drivers taking this undesirable action.

Two possible design improvements are illustrated in Figure 3: (a) advancing the entrance line forward, or (b) simultaneously enlarging the central island and reducing the circulatory roadway width, with the entrance line coincident with the inscribed circle of the roundabout. For the option of advancing the entrance line forward, the outer swept path of passenger cars and the largest vehicle likely to use the intersection are identified for all turning movements, and the advanced entrance line is placed at least 2 ft (0.6 m) outside of the vehicle paths. Skewed approaches are one particular situation where advancing the yield line may be beneficial to discourage vehicles from making a left-turn in front of the central island. However, this may result in a reduction of capacity, as advancing the yield line may affect yielding behavior at the entry.

6.1.6 Splitter Islands

As with larger roundabouts, splitter islands are generally used at mini-roundabouts to align vehicles, to encourage deflection and proper circulation, and to provide pedestrian refuge. Splitter islands are raised, mountable, or flush depending upon the size of the island and whether trucks will need to track over the top of the splitter island to navigate the intersection. In general,



(a) Move entrance line forward

(b) Enlarge central island

Figure 3: Possible Design Improvements

raised islands are preferred over flush islands. The following are general guidelines for the types of splitter islands under various site conditions:

- Consider a **raised (nontraversable)** island if one or more of the following conditions exist:
  - All design vehicles can navigate the roundabout without tracking over the splitter island area;
  - Sufficient space is available to provide an island with a minimum area of 50 ft^2 (4.6 m^2); and
  - Pedestrians are present at the intersection with regular frequency.
- Consider a **mountable (traversable)** island if:
  - Some design vehicles must travel over the splitter island area and truck volumes are minor; and
  - Sufficient space is available to provide an island with a minimum area of 50 ft^2 (4.6 m^2).
- Consider a **flush (painted)** island if:
  - Vehicles are expected to travel over the splitter island area with relative frequency to navigate the intersection;
  - An island with a minimum area of 50 ft^2 (4.6 m^2) can not be achieved; and
  - The approach has low vehicle speeds (preferably no more than 25 mph [40 km/h]).

Figure 4 displays recommended longitudinal dimensions for splitter islands at mini-roundabouts. In some cases it may not be feasible to achieve the dimensions in Figure 4 due to narrow approach widths. Where necessary, the islands may only extend between the entrance line and the crosswalk. More details related to the design of the pedestrian refuge area are discussed in the next section on Pedestrian Design Treatments.

In some cases, sufficient space may be available to provide a raised island within the pedestrian refuge area, but does not extend fully to the entrance line. An example of a raised island being terminated prior to the entrance line to accommodate the design vehicle

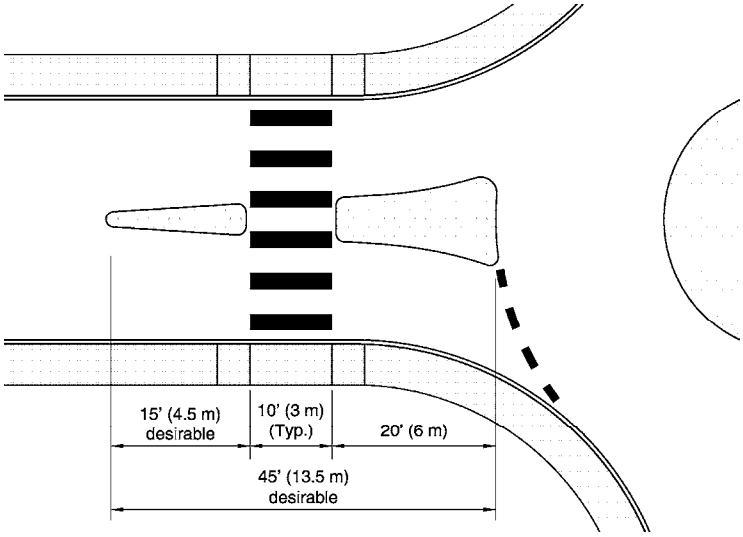


Figure 4: Recommended Longitudinal Dimensions for Splitter Islands at Mini-Roundabouts

is illustrated in Figure 5. If raised islands are used, care should be taken to ensure that they are visible to approaching motorists.

Photo: Lee Rodegerdts (used with permission)

Figure 5: Raised Splitter Island Terminated in Advance of the Entrance Line

6.2 Pedestrian Design Treatments

At conventional intersections, pedestrian ramps and pedestrian crossings are typically located near the curb returns at the corners of the intersection. When converting to a mini-roundabout, these corner pedestrian crossing locations will likely require relocation. The pedestrian crossing is recommended to be located 20 to 25 ft (6.1 to 7.6 m) upstream of the entrance line to accommodate one vehicle queue ahead of the crossing.

Where a mountable or raised splitter island is used, the walkway through the splitter island should be "cut-through" instead of ramped. This is less cumbersome for wheelchair users and allows the cut-through walkway to be aligned with the crosswalks, providing guidance for all pedestrians, but particularly for those who are visually-impaired. The cut-through walkway should be approximately the same width as the crosswalk, ideally a minimum width of 10 ft (3 m).

Sidewalk ramps are provided to connect to the sidewalks at each end of the crosswalk. Wherever sidewalks are separated from the roadway by a planting strip, ramps do not need flares and instead can have curbed edges aligned with the crosswalk, which provide alignment cues for pedestrians with visual impairments. A detectable warning surface consisting of raised truncated domes, as required by the Americans with Disabilities Act, should be applied to each ramp.

Where a minimum splitter island width of 6 ft (1.8 m) is available on the approach, a pedestrian refuge can be provided within the splitter island. In some cases, the available roadway width may not be sufficient to provide an adequate refuge area, in which case pedestrians will need to cross in one stage. Where a pedestrian refuge is provided, the refuge area must be defined with detectable warning surfaces that begin at the curb line and extend into the cut-through area a distance of 2 ft (0.6 m). This results in at least 2 ft (0.6 m) of clear space between detectable warning surfaces on a splitter island. Detailed standards for detectable warning surfaces can be found in the ADA Accessibility Guidelines (ADAAG) and through the U.S. Access Board [8].

6.3 Bicycle Design Treatments

Since typical on-road bicycle travel speeds are approximately 12 to 20 mph (20 to 30 km/h), the speeds of vehicles approaching and traveling through mini-roundabouts are similar to those of bicyclists. Bicyclists are encouraged to navigate through a mini-roundabout as if they were a vehicle. Where bicycle lanes are provided on the approaches to a mini-roundabout, they should be terminated to alert drivers and bicyclists of the need for bicyclists to merge into traffic. One suggested practice is to terminate the bike lane at least 100 ft (30 m) upstream of the entrance line, provide a 50-ft (15-m) taper ending prior to the crosswalk at the roundabout entry, and use a dotted bike lane stripe for the last 50 to 200 ft (15 to 60 m) prior to the beginning of the taper [1]. For a more detailed description of bicycle design techniques, refer to the Roundabout Guide.

6.4 Sight Distance and Visibility

The principles of sight distance and visibility at mini-roundabouts are consistent with other roundabouts and other intersections. Detailed guidelines for evaluating sight distance and visibility are provided in the Roundabout Guide [2] and the Technical Summary on Roundabouts [3].

6.5 Vertical Design

Mini-roundabouts should generally be designed to be outward draining to place the central island at the highest point of the intersection for maximum visibility. This technique of sloping outward is recommended primarily because it:

- Promotes safety by raising the height of the central island and improving its visibility;

- Promotes lower circulating speeds;
- Minimizes breaks in the cross slopes of the entrance and exit lanes; and
- Drains surface water to the outside of the roundabout.

This is consistent with most standard intersection grading, where the high-point is located near the center of the intersection and slopes towards the outer curbs. Therefore, in most retrofit situations, installation of a mini-roundabout would not necessarily require significant grade modifications to the intersection.

6.6 Pavement Markings and Signs

At mini-roundabouts, pavement markings and signs work together to create a comprehensive system to guide and regulate road users. Pavement markings and signs are simpler at mini-roundabouts than at other types of roundabouts.

The Federal Highway Administration has published the 2009 Edition of the *Manual on Uniform Traffic Control Devices,* which includes major revisions and additions related to signage and markings at roundabouts. For more detailed guidelines, designers should refer to the 2009 MUTCD and the Roundabout Guide [2, 9].

6.6.1 Pavement Markings

Pavement markings for mini-roundabouts are largely similar to those for other roundabouts. However, because the islands may be either flush or mountable, additional pavement markings can be used to improve the visibility of key features, including the direction of circulation and splitter islands. A sample pavement marking plan for a mini-roundabout is given in Figure 6. A wide white dotted line is used to designate the entrance location, similar to other roundabouts. Some optional features include the following (not necessarily shown on Figure 6):

- Pavement marking arrows in the circulatory roadway in front of each entry to indicate the direction of circulation;
- Yield lines and/or legends;
- For flush splitter islands, an appropriate hatching pattern (e.g., a diagonal hatch similar to those used for marking obstructions, such as those shown in Figure 3B-15 of the 2009 MUTCD [9]) within the splitter island envelope to further emphasize the splitter island location;
- Rumble strips or raised pavement markers within the envelope of a flush splitter island to discourage light passenger vehicles from driving over top of the islands; and
- Yellow color over the entire central island.

If the entire center island is colored yellow, an anti-skid surface is recommended to increase surface friction and avoid slick surfaces, particularly for bicycles and motorcycles. A textured surface that provides a visible differentiation from the circulatory roadway and is accompanied by a solid yellow line may also be used. Note that vehicles overrunning a textured surface may create additional noise, which may be perceived as a problem in residential areas.

6.6.2 Signing

The principal difference in signing at mini-roundabouts compared to other roundabouts is that no signs can

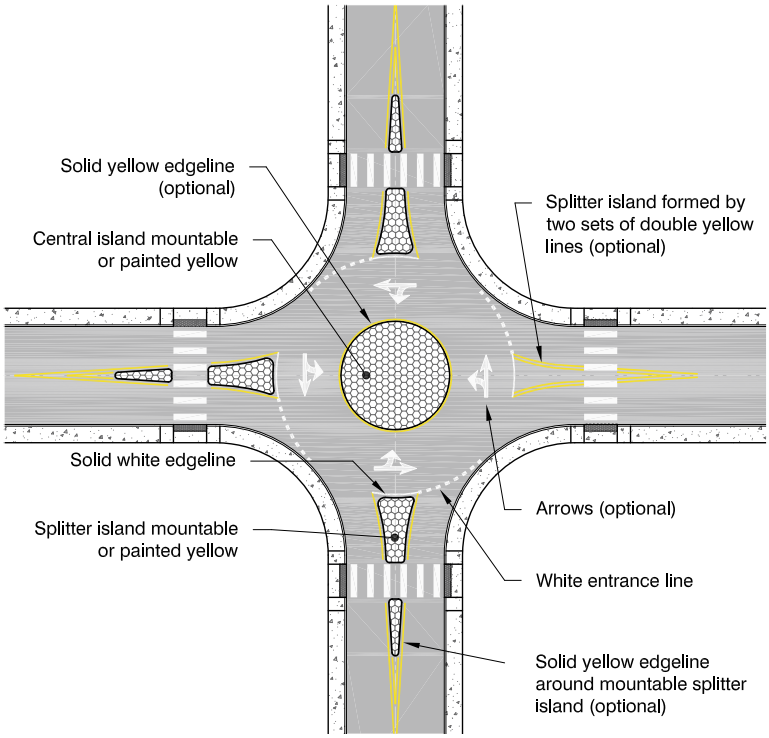


Figure 6: Sample Pavement Marking Plan for a Mini-Roundabout

be located within the fully mountable central island. As a result, the Circular Intersection (W2-6) warning sign is typically used on each approach in advance of the YIELD sign. YIELD signs are typically placed as close as practical to the entrance line and can be supplemented with a Roundabout Circulation plaque (R6-5P). Advance directional guide signs and exit guide signs are typically unnecessary given the size of the mini-roundabout and the nature of the approach roadways (generally low-speed local streets). However, standard street name signs should be used and are typically mounted on the same posts as the yield signs (similar to conventional intersections). Figure 7 gives a sample signing plan for a mini-roundabout.

For splitter islands that are either painted or are fully mountable, KEEP RIGHT signs cannot be used. KEEP RIGHT signs may be provided for raised non-mountable islands, particularly where a pedestrian refuge is provided; however, care should be taken to ensure the sign does not obscure the view of the central island approaching the mini-roundabout. Some agencies are experimenting with illuminated bollards to mark splitter islands.

6.7 Lighting

It is important that mini-roundabouts, including their pedestrian crossing areas, be visible to approaching drivers. Consideration needs to be given to ensuring the intersection is conspicuous at night, which may mean providing additional street lighting. The Design Guide for Roundabout Lighting [10], published by the Illuminating Engineering Society, is the primary resource that should be consulted in completing a lighting plan for all roundabout types including mini-roundabouts. The Roundabout Guide also provides a summary of lighting principles, and the same principles for lighting traditional intersections apply to mini-roundabouts.

6.8 Landscaping

Landscaping of mini-roundabouts is minimal due to the traversable nature of the central island and (often) splitter islands. However, it is possible to provide landscaping around the perimeter of the intersection. Any landscaping that is provided should be designed to minimize roadside hazards and to maintain adequate stopping and intersection sight distance throughout the roundabout.

6.9 Other Design Details and Applications

More design details and applications of mini-roundabouts exist than are covered in this technical summary; however, some of the more notable considerations are described below:

- **Right-turn bypass lanes –** Roundabouts and mini-roundabouts can employ right-turn bypass lanes similar to those used at conventional intersections. Bypass lanes are designed either to yield to exiting traffic or to form an additional lane next to exiting traffic (which may then merge into the exiting traffic).
- **Access management –** Driveways in the vicinity of roundabouts and mini-roundabouts may experience restrictions in access similar to those in the vicinity of signalized intersections. Mini-roundabouts may offer the opportunity to include driveways as a curb cut or a fully developed approach with splitter islands depending on the volume characteristics and other factors.

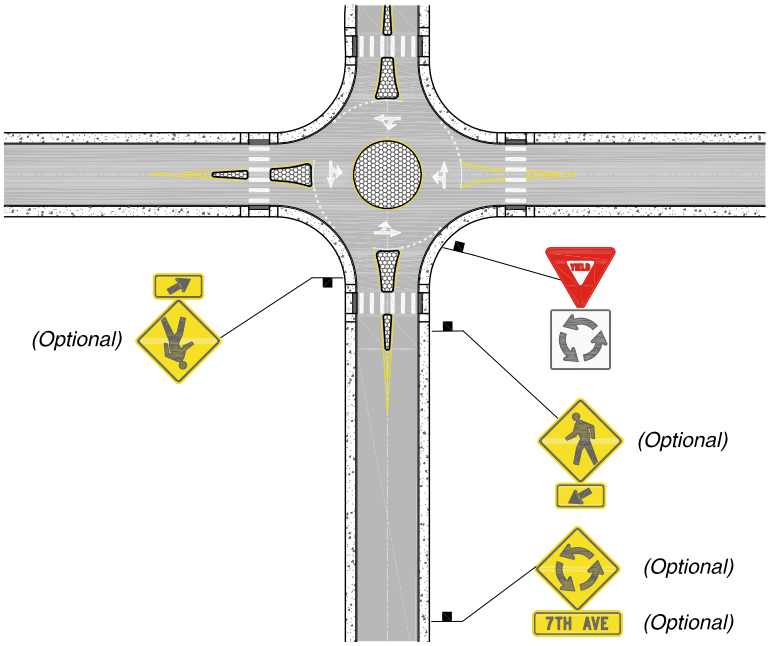


Figure 7: Sample Signing Plan for a Mini-Roundabout

- **At-grade rail crossings –** At-grade rail crossings through or near a mini-roundabout introduce challenges related to the control of the rail crossing itself, queue clearance on the tracks, and the associated effects on the mini-roundabout. Mini-roundabouts have been installed near at-grade rail crossings in the U.K.
- **Evacuation routes –** Mini-roundabouts can be located on evacuation routes by using similar manual control treatments (e.g., flagging, police control) that are used at other types of intersections. Vehicles are allowed to travel over the central island, if necessary.
- **Bus stops –** Bus stops can be provided on either the entry or exit side of a mini-roundabout. Bus stops should not be provided within the circulatory roadway. Pedestrian access to and from the bus stop, including the location of the bus stop relative to the nearest crosswalk, should be carefully considered.

Refer to the Roundabout Guide for additional information on these and other topics.

Section 7: Costs

Construction costs for mini-roundabouts vary widely depending upon the extent of sidewalk modifications or other geometric improvements and the types of materials used. In most cases, mini-roundabouts have been installed with little or no pavement widening and with only minor changes to curbs and sidewalks as shown in the example in Figure 8. Construction costs have ranged from about $50,000 for an installation consisting entirely of pavement markings and signage to $250,000 or more for mini-roundabouts that include raised islands and pedestrian improvements.

A benefit-cost analysis may be useful for programming purposes, as it is recognizes that not all of the benefits and costs can be quantified by pure construction costs. The safety, operational, and environmental benefits of mini-roundabouts can be quantified and compared to the initial construction and ongoing maintenance cost over the life cycle of the roundabout. Although research is needed on the service lives of mini-roundabouts in the United States, they are likely to be comparable to the intersections they replace, depending on construction materials, weather conditions, traffic conditions, and other factors. When compared to signalized intersections, mini-roundabouts are likely to have longer service lives due to less maintenance. More detail can be found in the Roundabout Guide.

Photo: Maryland State Highway Administration (used with permission)

Figure 8: Example Mini-Roundabout

Section 8: References

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For More Information

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