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# **Arterials and Streets Infrastructure and Operations**

**for Mobility, Access, and Community  
In Metropolitan Chicago**

**Part IIIa: Roundabouts**

**January, 2009**

CMAP Congestion Management Process

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## Table of Contents

List of Figures .....	i
Introduction to Roundabouts .....	1
Components of Roundabouts .....	2
Caveat Regarding Accessibility .....	4
Bicycle Travel.....	4
Resources for Design and Implementation .....	5
Summary and CMAP Role.....	6

## List of Figures

Figure 1. Roundabout Geometric Features.....	2
Figure 2. Truck Negotiating Roundabout with Rear Wheels on Truck Apron, Illustrating Good Design .....	3
Figure 3. Aerial Photo Showing Bicycle Lanes Ending at Roundabout Approach; and Bicycle Path Routing Bicyclists around Periphery.....	5

# Arterials and Streets

## Infrastructure and Operations: Roundabouts

### Introduction to Roundabouts

Modern roundabouts are a safer, more efficient design option that can often be used in place of traffic signals or stop signs. Early studies of U.S. roundabouts showed that small roundabouts have lower injury and total crash rates than conventional intersections.<sup>1</sup> More recent before-after studies show a 77% reduction in injury crashes at previously signalized intersections, and a 48% reduction in total crashes at these intersections; roundabouts converted from two-way stops had an 82% reduction in injury crashes and a 44% reduction in total crashes.<sup>2</sup> However, roundabouts converted from all-way stops showed a 28% increase in injury crashes, and a 3% increase in total crashes.<sup>3</sup>

Roundabouts are also more efficient than conventional intersections. For example, conventional intersections converted to roundabouts saw motorist delay reductions of more than 75%.<sup>4</sup> European field measurements also have shown that roundabouts reduce vehicle emissions and energy consumption.<sup>5</sup>

The FHWA's *Roundabouts: an Informational Guide* offers the following definition of a roundabout:

*Roundabouts are circular intersections with specific design and traffic control features. These features include yield control of all entering traffic, channelized approaches, and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 50 km/h (30 mph). Thus, roundabouts are a subset of a wide range of circular intersection forms.*<sup>6</sup>

Modern roundabouts are superior to their similar predecessors (traffic circles or rotaries), which had circulating traffic yielding to entering traffic, causing high-speed entries but also sometimes bringing gridlock.<sup>7</sup> Roundabouts also differ

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<sup>1</sup> Georges Jacquemart. *Modern Roundabout Practice in the United States*. NCHRP Synthesis of Highway Practice 264. Transportation Research Board. National Academy Press, 1998. p. 25.

<sup>2</sup> Rodegerdts, et al. *Roundabouts in the United States*. NCHRP Report 572. Transportation Research Board. National Academy Press, 2007. P. 42.

<sup>3</sup> Ibid.

<sup>4</sup> Jacquemart, op. cit., p 2.

<sup>5</sup> Jacquemart, op. cit., p. 12.

<sup>6</sup> Bruce Robinson, et al. *Roundabouts: an Informational Guide*. Federal Highway Administration. 2000. p. 5

<sup>7</sup> Ibid., p. 2

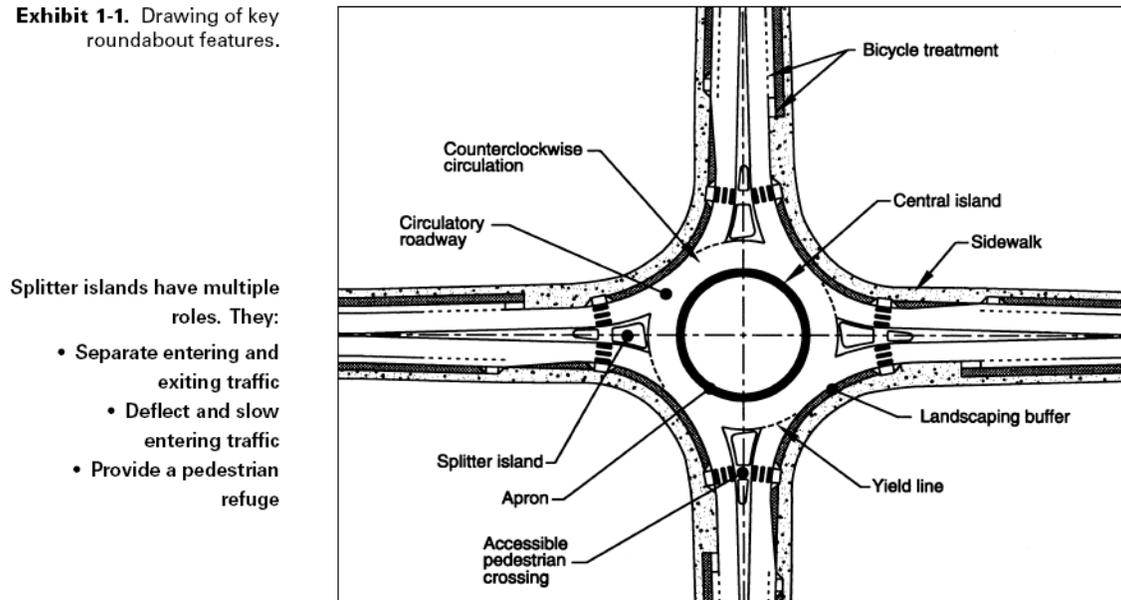
from traffic calming circles, often found in neighborhood areas with local streets and low volumes.<sup>8</sup>

## Components of Roundabouts

The important geometric features of a roundabout are shown in Figure 1.

Figure 1. Roundabout Geometric Features

**Exhibit 1-1.** Drawing of key roundabout features.



Splitter islands have multiple roles. They:

- Separate entering and exiting traffic
- Deflect and slow entering traffic
- Provide a pedestrian refuge

Source: Robinson, *Roundabouts: an Informational Guide*. Federal Highway Administration. 2000

The components of modern roundabouts work in tandem. These components include the following:

- **Central Island.** The central island is the raised area in the center of a roundabout around which traffic circulates. The central island can be landscaped. No motorized or non-motorized traffic is to encroach on the central island.
- **Truck Apron.** The truck apron surrounds the central island. The outside edge of the truck apron delineates the circulatory roadway. The truck apron itself allows large vehicles to travel freely on the circulatory roadway without encroaching on the central island. Truck aprons are composed of a different material texture than the circulatory roadway, such as brick or cobble stones, to discourage routine use by smaller vehicles or pedestrians.
- **Circulatory Roadway.** Traffic flows counter-clockwise along the circulatory roadway, exiting to the right upstream of the splitter island.
- **Splitter Island.** The splitter island separates the points of entry and exit for the roundabout. The primary purpose of the splitter island is to deflect entering traffic to facilitate typical circulating speeds of 20 mph; in no case

<sup>8</sup> Ibid., p. 5

more than 30 mph. Bicycle and pedestrian crossings of entering and exiting traffic lanes cross the splitter island, which is designed to be suitable as a pedestrian refuge. Traffic entering the roundabout stops at a yield line where the entering traffic intersects the circulating roadway.

- **Walking and Cycling Accommodations.** Accessible pedestrian crossings should be provided at all roundabouts. The pedestrian crossing location is typically set one car length back from the yield line.
- **Landscaping buffer** - provided at most roundabouts to separate vehicular and pedestrian traffic and to encourage pedestrians to cross only at the splitter islands. Landscaping buffers can also significantly improve the aesthetics of the intersection.<sup>9</sup>

Careful geometric design allows roundabouts to accommodate many different modes of transportation with improved safety and less delay. To accommodate large vehicles, roundabouts feature suitable turning radii and truck aprons (see Figure 2). Narrow entry widths, yield control for entering vehicles, and splitter island deflection assure speeds appropriate for walking, cycling, and passenger vehicles. Parking is prohibited in roundabouts to assure vehicle flows and motorist safety.<sup>10</sup>

Figure 2. Truck Negotiating Roundabout with Rear Wheels on Truck Apron, Illustrating Good Design



Source: <http://www.wsdot.wa.gov/Projects/roundabouts/>

Mini-roundabouts are smaller versions of modern roundabouts and are suitable for intersections that are stop-controlled, signalized and physically constrained. The central island for mini-roundabouts is typically about 13' in diameter and is mountable for trucks and large vehicles. Mini-roundabouts also have an

<sup>9</sup> Robinson, et al, op. cit., p 9.

<sup>10</sup> Florida Department of Transportation. *Florida Roundabout Guide*. 2007. p. 9.

inscribed diameter of 50' as opposed to the larger roundabouts with an inscribed diameter as large as 490'.<sup>11</sup>

Roundabouts improve pedestrian safety. Pedestrian crossings are placed at the splitter island, reducing vehicle-pedestrian conflicts to only one movement at a time. The crosswalk is placed one car length back from the “yield line” in single-lane roundabouts, and one-to-three car lengths back in multi-lane roundabouts. This separates pedestrian-vehicle conflict points from vehicle-vehicle conflict points at the yield line, and allow vehicles at the yield line to proceed into the roundabout when there is a gap without any pedestrian conflict.<sup>12</sup>

***Caveat Regarding Accessibility:*** Although roundabouts improve safety for pedestrians, pedestrians with disabilities may find roundabouts particularly challenging. The United States Access Board found that blind pedestrians are especially challenged at crossing modern roundabouts. These users rely on sounds associated with traditional traffic patterns to determine when crossing a roadway is safe. At roundabouts, traffic is required to yield but is not required to stop before entering the roundabouts, so determining a safe time to cross is a challenge. The failure of motorists to yield to blind pedestrians at multi-lane roundabouts is problematic, given the higher speeds at such roundabouts, and multiple threats, so regulations may require pedestrian signalization at multi-lane roundabouts.<sup>13</sup> Other accessibility regulations being considered by the Access Board include the following:

- well-defined walkway edges
- separated walkways, with landscaping at street edge to preclude prohibited crossings to center island
- tactile markings across sidewalk to identify crossing locations
- bollards or architectural features to indicate crossing locations
- detectable warnings (separate at splitter islands) at street edge
- perpendicular crossings; where angled, use curbing for alignment cues
- high-contrast markings
- pedestrian lighting.<sup>14</sup>

***Bicycle Travel.*** Bicycle circulation can also be accommodated in modern roundabout design through bike paths along the periphery of the roundabout (see Figure 3). Bicycle lanes should not be used in roundabouts. *Roundabouts, an Informational Guide* states, “the complexity of vehicle interactions within a roundabout leaves a cyclist vulnerable, and for this reason, bike lanes within the

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<sup>11</sup> American Association of State Highway and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets*. Washington, D.C.: AASHTO. 2004. p. 575.

<sup>12</sup> Robinson, et al, op. cit., p 32.

<sup>13</sup> United States Access Board presentation. “Update: Public Rights-of-Way Rulemaking.” June 19, 2007. [www.transportation.org/sites/scote/docs/Windley-PROWAGUpdate.scott.June07.ppt](http://www.transportation.org/sites/scote/docs/Windley-PROWAGUpdate.scott.June07.ppt)

<sup>14</sup> United States Access Board. “Pedestrian Access to Modern Roundabouts: Design and Operational Issues for Pedestrians who are Blind.” p. 3.

circulatory roadway should never be used.”<sup>15</sup> The *Informational Guide* also suggests that for double lane roundabouts, bicycle accommodations should be separated or an alternate route should be provided. Communities should be aware that several studies have shown that the number of bicycle related crashes is higher at roundabouts than standard intersections.<sup>16</sup>

Figure 3. Aerial Photo of Roundabout Showing Bicycle Lanes Ending at Roundabout Approach; and Bicycle Path Routing Bicyclists around Periphery



Source: Michael Ronkin and Fred Ranck. *Designing Streets for Pedestrian Safety*. Soles and Spokes Workshop. Chicago Illinois, June, 2006.

**Resources for Design and Implementation.** Numerous states and counties have published guidelines for roundabout design.

*USDOT.* Roundabouts: an Informational Guide, has been cited above. It is posted at <http://www.tfhr.gov/safety/00068.htm> (Accessed December, 2008).

*New York State:* The New York State Department of Transportation has published an extensive guideline on their website. The guide separates the guidelines into three distinct categories: motor vehicles, bicycles and pedestrians. Each section includes illustrations and videos for guidance to roundabouts users and design engineers. The web site features videos of snowplowing a roundabout and an oversized load (trailing a modular home) making a left turn through a roundabout: <https://www.nysdot.gov/main/roundabouts>. Accessed December 2008

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<sup>15</sup> Robinson, et al, op. cit., p. 34.

<sup>16</sup> Robinson, et al, op. cit., p. 116.

*State of Florida.* FDOT has also published an extensive roundabout guide. Sections of the report include a “Roundabout Justification Study” that communities can use to determine if a roundabout would be effective; performance analysis; geometric design, and operational considerations: [http://www.dot.state.fl.us/TrafficOperations/Doc\\_Library/PDF/roundabout\\_guide8\\_07.pdf](http://www.dot.state.fl.us/TrafficOperations/Doc_Library/PDF/roundabout_guide8_07.pdf) Accessed December 2008.

*State of Wisconsin.* State of Wisconsin roundabout information is at: <http://www.dot.wisconsin.gov/safety/motorist/roaddesign/roundabout-design.htm> and <http://www.dot.wisconsin.gov/safety/motorist/roaddesign/roundabout-works.htm>. Wisconsin’s design guidance gives strong support for roundabouts, stating:

*If an intersection warrants a signal or a four-way stop within the design life of the proposed project, the modern roundabout shall be evaluated as an equal alternative. Where there is an existing four-way stop or signal and there are operational problems with the current control, then the roundabout shall be considered as a viable alternative. As stated above the roundabout may be a viable alternative for a two-way stop control in certain circumstances. In either case, roundabouts are a potential intersection control strategy until such time that the evaluation indicates that the roundabout alternative is not appropriate.<sup>17</sup>*

Other guidelines have been issued by many states including Washington State, Oregon, Wisconsin, Alaska, Arizona, Minnesota, Michigan, California and Maryland. Other states such as Iowa have addressed roundabouts in their intersection design guidelines, similar to the Illinois Department of Transportation’s “BDE Chapter 36.” Illinois has not issued any guidelines on roundabouts.

Several roundabouts have been created in the Chicago region including those in Elgin, Plainfield and Hoffman Estates. The Village of Hoffman Estates published a guide on how to use a roundabout with explanations for drivers and pedestrians: <http://www.hoffmanestates.org/index.aspx?page=150>

**Summary and CMAP Role.** Roundabouts are a cost-effective, community-friendly method of improving safety, aesthetics and traffic efficiency at intersections. Roundabouts directly benefit freight, buses, passenger cars, and pedestrians. Special design consideration is required for blind pedestrians and bicyclists to assure their safety in a roundabout.

Potential CMAP roles in developing roundabouts in metropolitan Chicago include:

- Long Range Planning:

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<sup>17</sup> Wisconsin Department of Transportation. *Wisconsin Roundabout Guide*. P. 1. Posted at <http://www.dot.wisconsin.gov/safety/motorist/docs/guide-wisdotrab.pdf>. Accessed December, 2008.

- Screen projects to assure implementation of roundabouts, where appropriate.
- Establish goals, objectives, and policies promoting and requiring roundabouts being evaluated as viable alternatives to signalization.
- Facilitate and endorse strategies as laid out below.
- Congestion Management and Programming
  - Program funds set aside for safety and congestion-reduction strategies to specifically address roundabouts as alternatives to stop and signal control.
- Visioning:
  - Envision roundabouts as elements of urban, suburban, and rural environments.
  - Address roundabouts within the community conversations process.
- Address Roundabouts in Special Studies:
  - Corridor Studies
  - Sub-Area Studies
  - Thoroughfare Plans
- Technical Assistance:
  - Provide “about” and “how-to” information regarding roundabouts.
  - Provide information for higher-level bodies, such as the legislature and departments of transportation, for policy consideration.
  - Provide educational outreach and training.
  - Form and inform a key group of regional stakeholders and champions.
- Project Review:
  - During any conceptual design review in which the MPO participates, promote roundabouts where appropriate.