Geometric Design of Roundabouts

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PDH: 5

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Roundabouts: An Informational Guide

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the core iterative design steps and principles required to balance safety, capacity, and design vehicle accommodation.
- **Select** appropriate inscribed circle diameters and approach alignments based on site-specific contexts (urban vs. rural).
- **Evaluate** roundabout performance using fastest-path analysis and sight distance checks to ensure low, consistent speeds.

Executive Summary: Roundabout design is an iterative process requiring a delicate balance between safety, operational capacity, and design vehicle requirements. The primary objective is to maintain low and consistent speeds through geometric deflection while ensuring lane continuity and safe accommodation for all road users, including pedestrians and cyclists.

Introduction

Roundabout design involves trade-offs between safety, operations, and accommodation of the design vehicle. Some roundabout features are uniform, while others vary depending on the location and size of the roundabout.

The Iterative Design Process

The geometric design of a roundabout requires the balancing of competing design objectives. Roundabouts operate most safely when their geometry forces traffic to enter and circulate at slow speeds. Many of the geometric parameters are governed by the maneuvering requirements of the **design vehicle**.

- **Site Specificity:** Design outcomes depend on the surrounding speed environment, desired capacity, available space, required numbers and arrangements of lanes, and the design vehicle.
- **Environmental Differences:** In **rural environments**, approach speeds are high and pedestrians may be minimal. In **urban environments**, bicycle and pedestrian safety are primary concerns.
- **Design Flexibility:** Maximizing performance requires the engineer to think through the design rather than rely upon a design template.

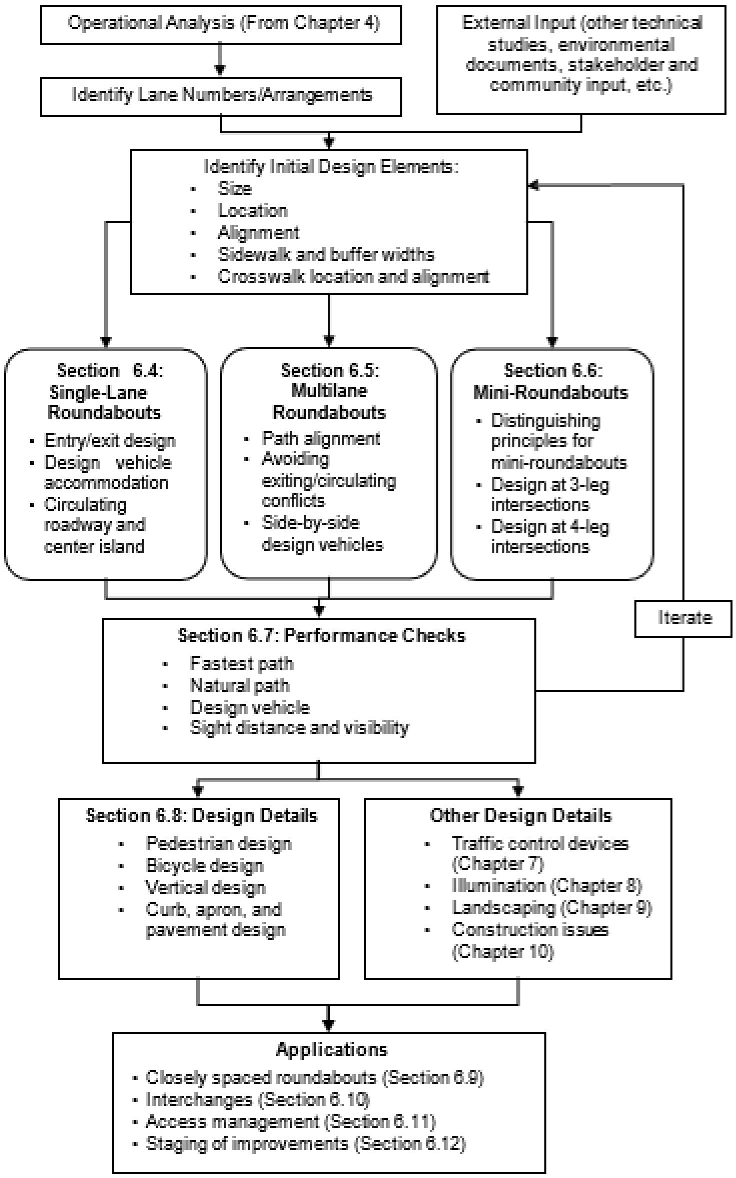

Exhibit -1: General Design Process

Principles and Objectives

Several overarching principles should guide the development of all roundabout designs. Achieving these principles should be the goal of any design:

- Provide **slow entry speeds** and consistent speeds through the roundabout by using deflection.
- Provide the appropriate **number of lanes** and lane assignment to achieve capacity, lane volume balance, and lane continuity.
- Provide **smooth channelization** that is intuitive to drivers.
- Provide adequate **accommodation for the design vehicles**.

- Design to meet the **needs of pedestrians and cyclists**.
- Provide appropriate **sight distance and visibility**.

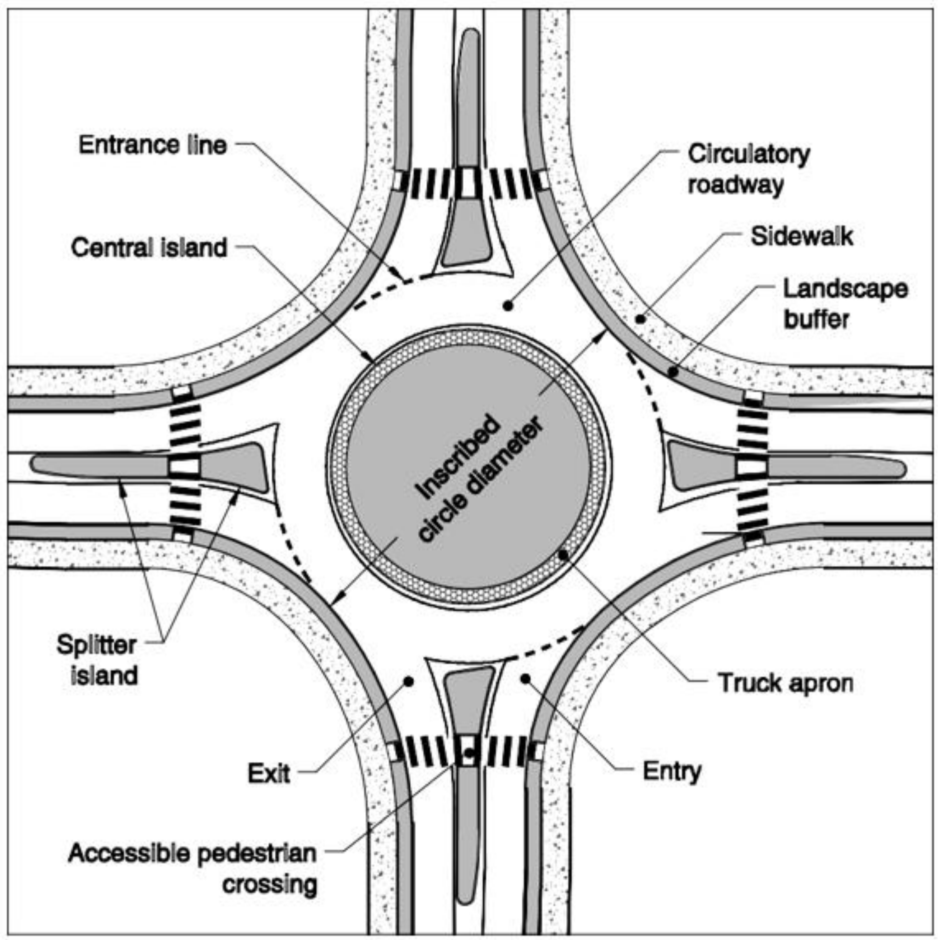

Exhibit -2: Basic Geometric Elements of a Roundabout

Speed Management

The operating speed of a roundabout is its most important attribute regarding safety performance. While crash frequency is tied to volume, the **severity of crashes is directly tied to speed**.

- **Maximum Theoretical Entry Speeds:**
  - **Single-lane:** 20 to 25 mph (32 to 40 km/h).
  - **Multilane:** 25 to 30 mph (40 to 48 km/h).

💡 **Design Tip:** Reducing the vehicle path radius at the entry decreases crash rates but can create path overlap in multilane designs if not well-designed.

Exhibit -3: Example of Using Geometry to Manage Vehicle Speeds

Lane Arrangements

(Note: Source text uses duplicate numbering for Lane Arrangements)

Operational analysis dictates the required number of entry lanes. Designers must ensure **lane continuity** within the circulatory roadway and on each exit.

- **Continuity Principle:** A driver should be able to select the appropriate lane upstream of the entry and stay within that lane through the roundabout to the intended exit without lane changes.
- **Phased Design:** If future traffic volumes (e.g., 20-year projections) require more lanes than current volumes, consider a phased solution that initially uses fewer lanes to maximize safety during early years.

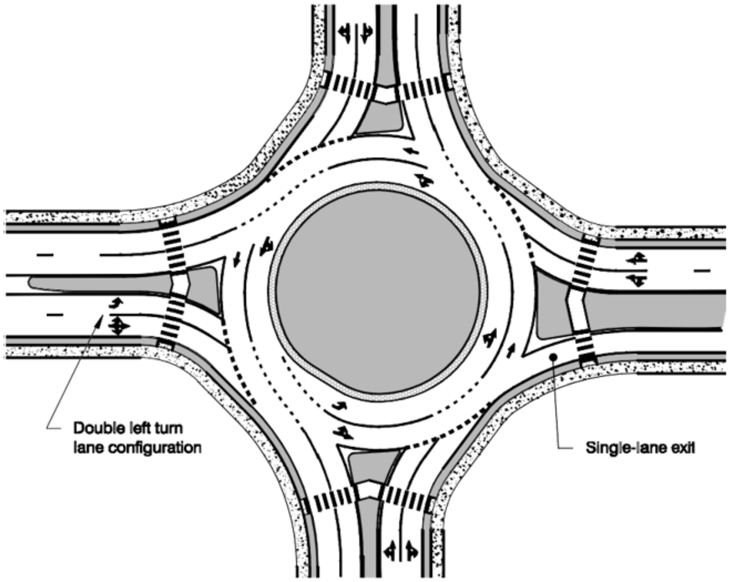

Exhibit -4: Lane Configuration Example

Appropriate Path Alignment

At the yield point, vehicles continue along their **natural trajectory**. If the natural path of one lane interferes or overlaps with the natural path of the adjacent lane, safety and efficiency are compromised.

- **Path Overlap:** Occurs when the natural path of one traffic stream overlaps another. This reduces capacity as vehicles avoid using one or more entry lanes and increases the potential for sideswipe crashes.

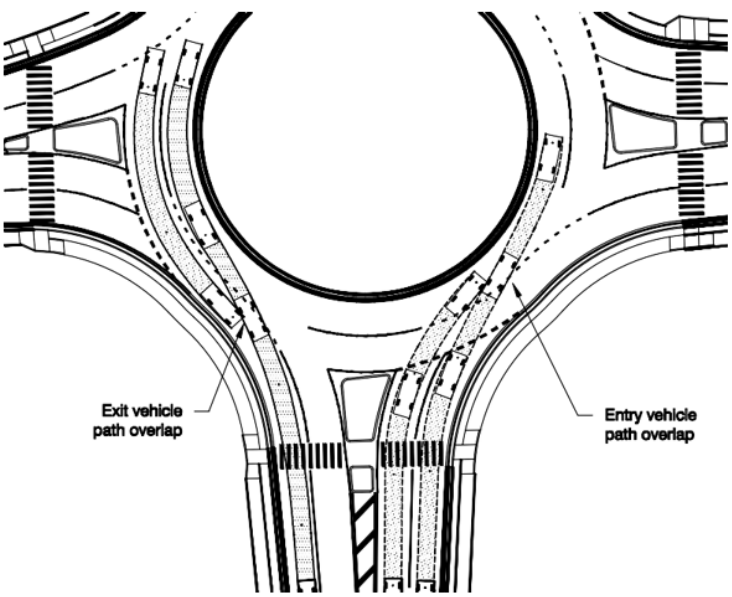

Exhibit -5: Path Overlap at a Multilane Roundabout

Purchase this course to see the remainder of the technical materials.