

Roundabouts in the US: The Right Solution?

An Overview of the FHWA Roundabout Information Guide



Bruce W. Robinson

Principal Investigator, Kittelson & Associates, Inc.

1-800-878-5230

Agenda

- **Project Overview**
- **Organization of the Guide**
- **Categories of Roundabouts**
- **Highlights**
 - **Planning**
 - **Operations**
 - **Design**
- **Conclusion**



Project Overview

- **Project began October 1997**
- **Variety of sources**
 - **Best practices internationally**
 - **Current research in U.S.**
 - **Adaptation to U.S. standard practice**
 - **Judgment of authors and reviewers**



Project Team

- **Prime: Kittelson & Associates, Inc.**
- **Researchers**
 - University of Florida
 - University of Idaho
 - Penn State University
 - Queensland Univ. of Technology (Australia)
 - Ruhr-University Bochum (Germany)
- **Practitioners**
 - Hurst-Rosche Engineers, Inc. (MD/PA)
 - Buckhurst Fish & Jacquemart, Inc. (NY)
 - Eppell Olsen & Partners (Australia)



Publishing schedule

- **Electronic version**
 - Available on Internet at the Turner Fairbank Highway Research Center website
 - <http://www.tfhrc.gov/safety/00068.htm>
 - Also linked from Kittelson website
 - Roundabouts.kittelson.com
- **Paper version**
 - Fax order requests: (301) 577-1421



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Organization of the Guide

- **Chapter 1: Introduction**
- **Chapter 2: Policy Considerations**
- **Chapter 3: Planning**
- **Chapter 4: Operational Analysis**
- **Chapter 5: Safety**
- **Chapter 6: Geometric Design**
- **Chapter 7: Traffic Design and Landscaping**
- **Chapter 8: System Considerations**



Agenda

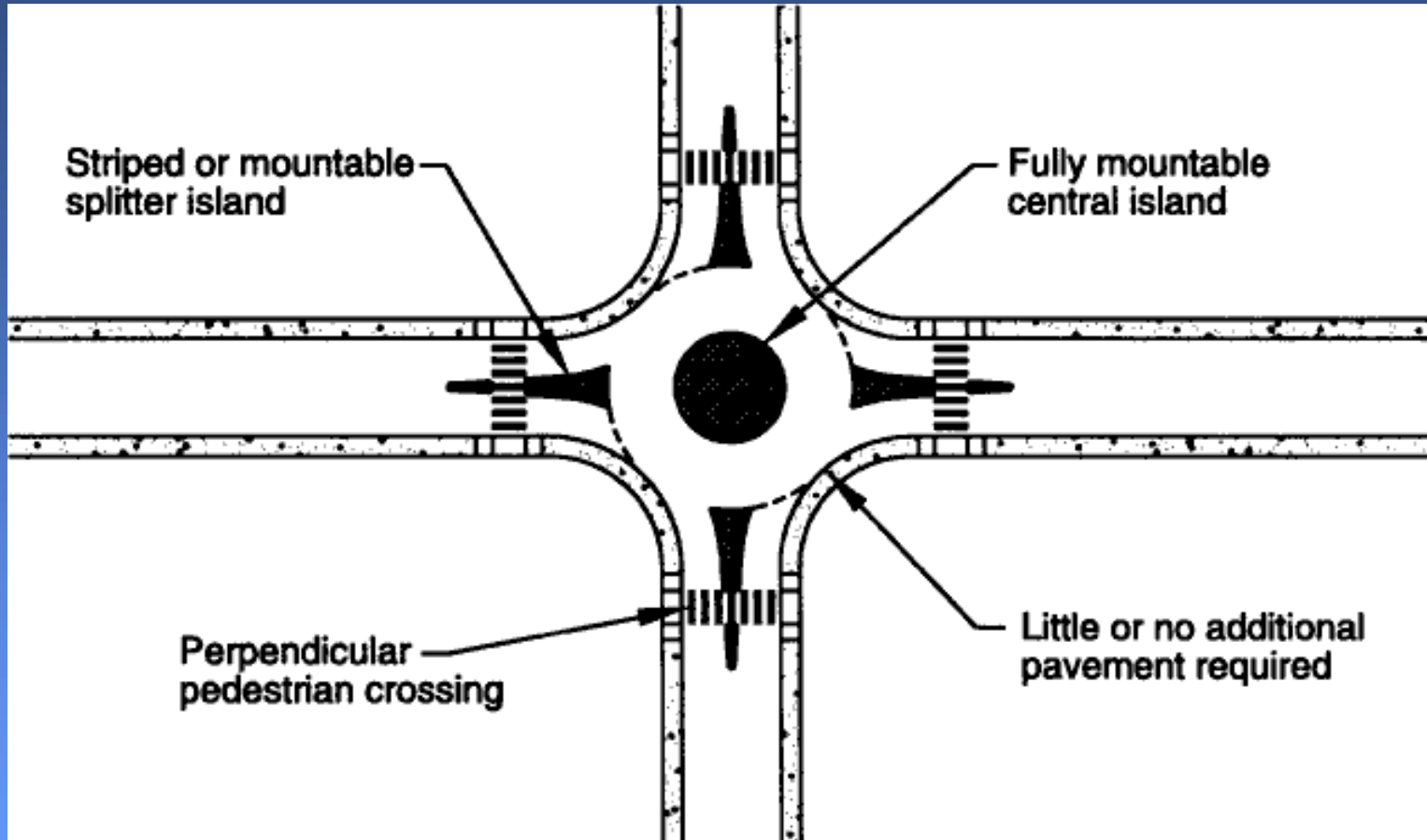
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Categories of Roundabouts

- **Mini-roundabouts**
- **Urban compact**
- **Urban single-lane**
- **Urban double-lane**
- **Rural single-lane**
- **Rural double-lane**

Mini-Roundabout



Mini-Roundabout Examples

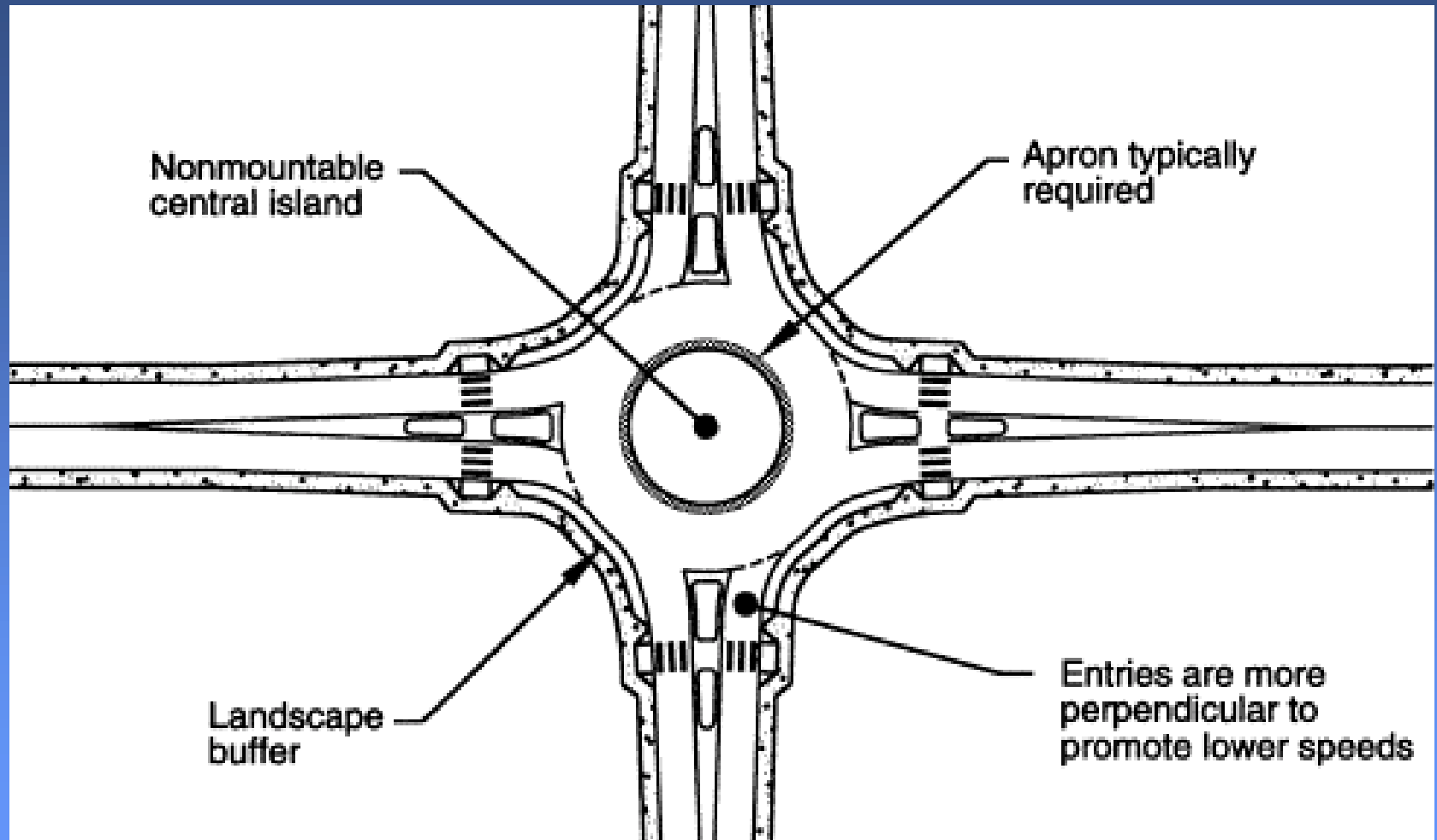
Germany



Photos: Werner Brilon



Urban Compact Roundabouts



Urban Compact Roundabout Examples

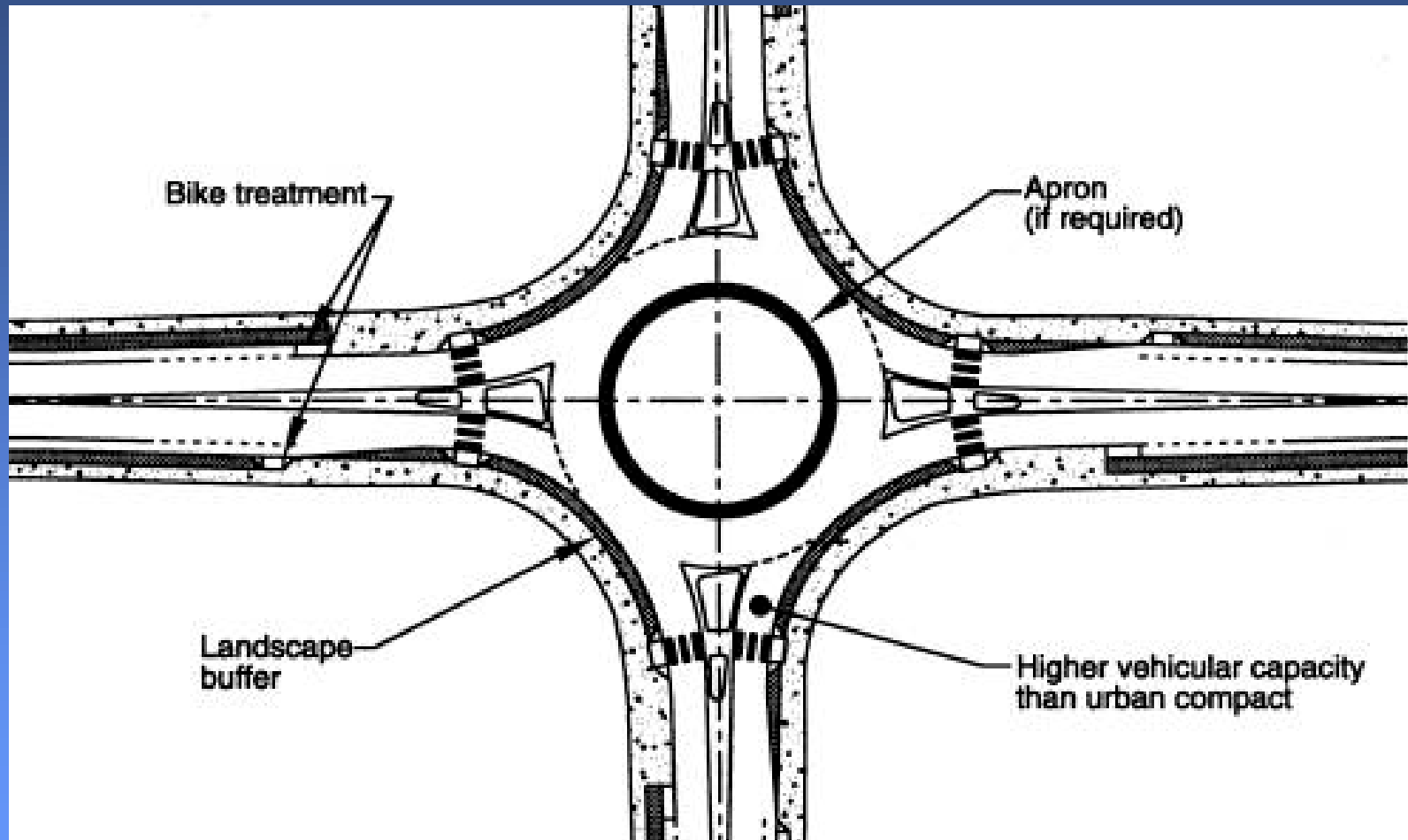


West Boca Raton, FL

Germany



Urban Single-Lane Roundabouts



Urban Single-Lane Roundabout Examples

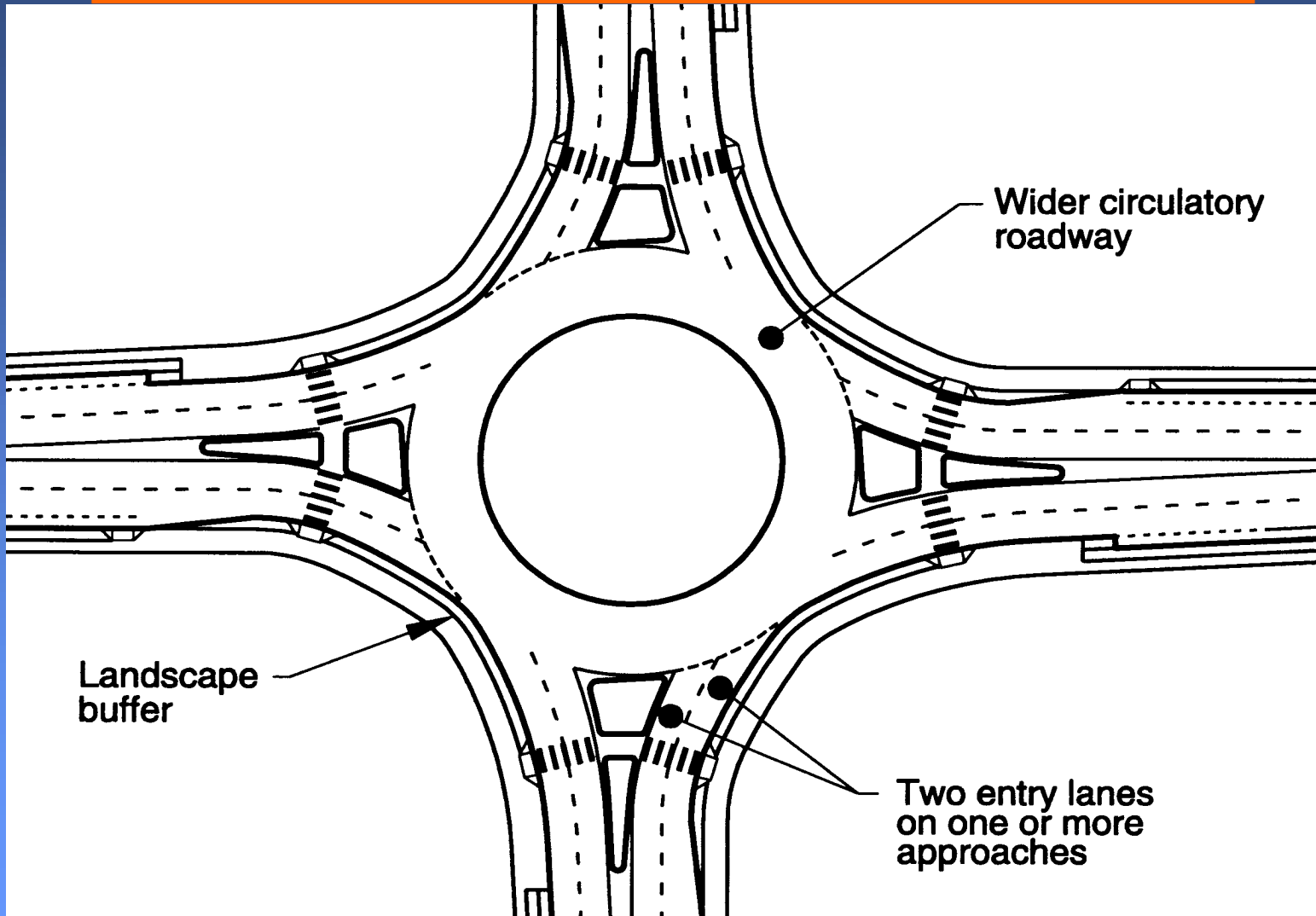


Santa Barbara, CA

Bend, OR



Urban Double-Lane Roundabouts



Urban Double- and Multi-Lane Roundabout Examples

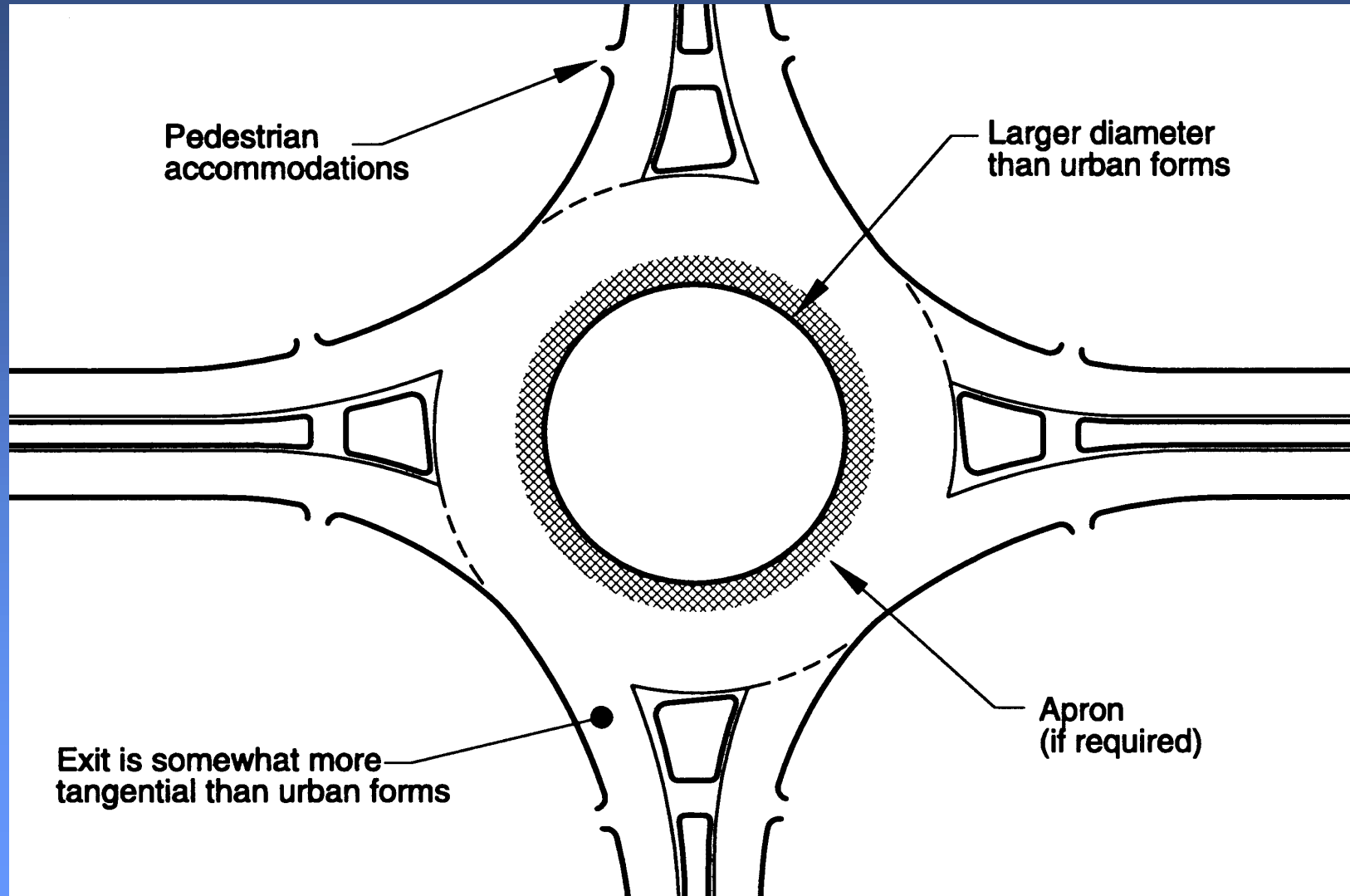


Towson, MD



Avon, CO

Rural Single-Lane Roundabouts



Rural Single-Lane Roundabout Examples

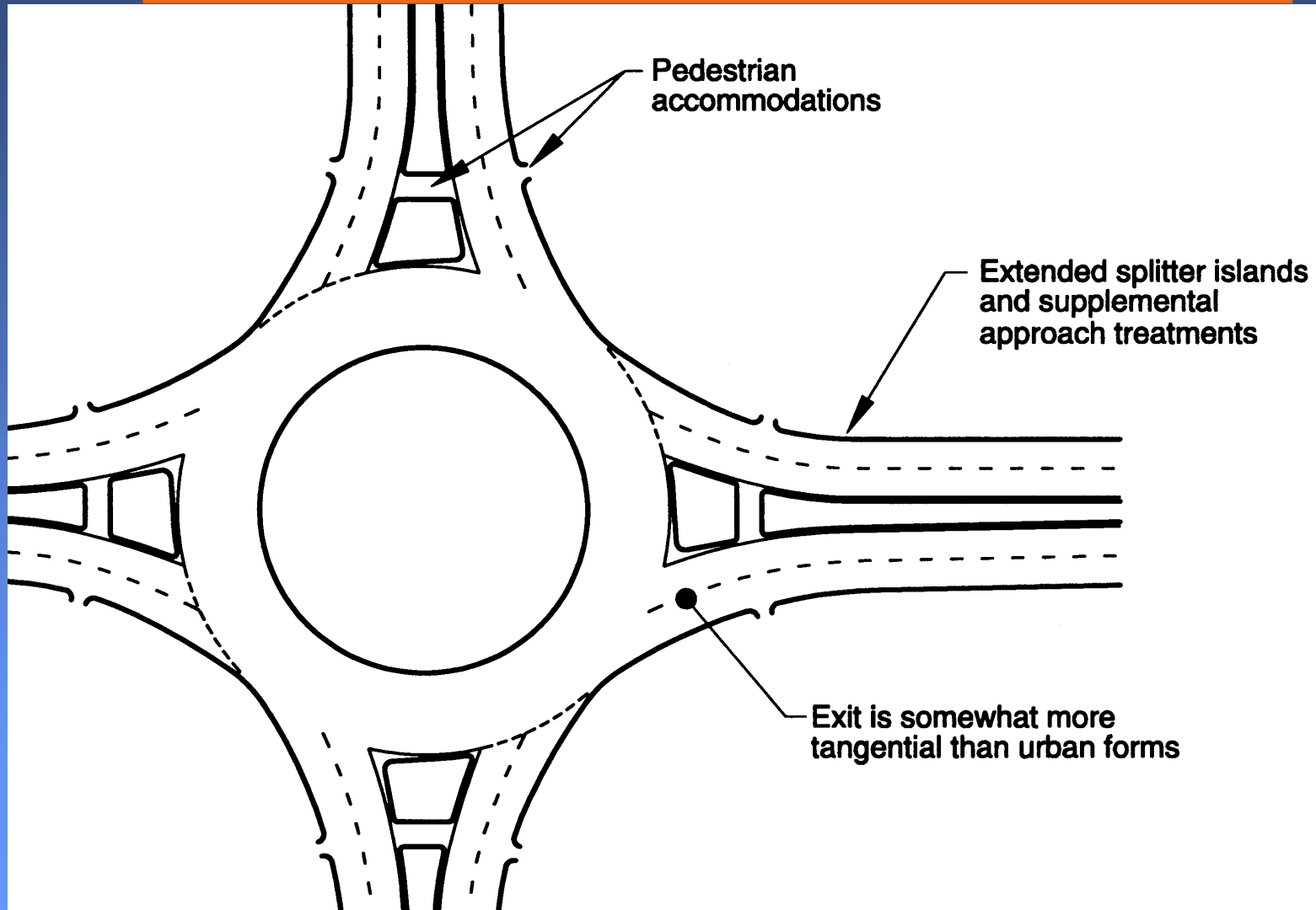


Leeds, MD



Lisbon, MD

Rural Double-Lane Roundabouts



Rural Double-Lane Roundabout Examples



Australia

The Netherlands



Taneytown, MD



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Highlights: Planning

- **Planning steps**
- **Considerations of context**
- **Planning-level volume thresholds**
- **Roundabouts vs. signals**
- **Selection categories**
- **Space requirements**

Planning Steps

- **Identify context**
- **Determine preliminary lane configuration**
- **Identify selection criteria**
- **Perform analysis**
- **Determine space requirements**
- **Perform economic analysis**
- **Initiate public involvement**

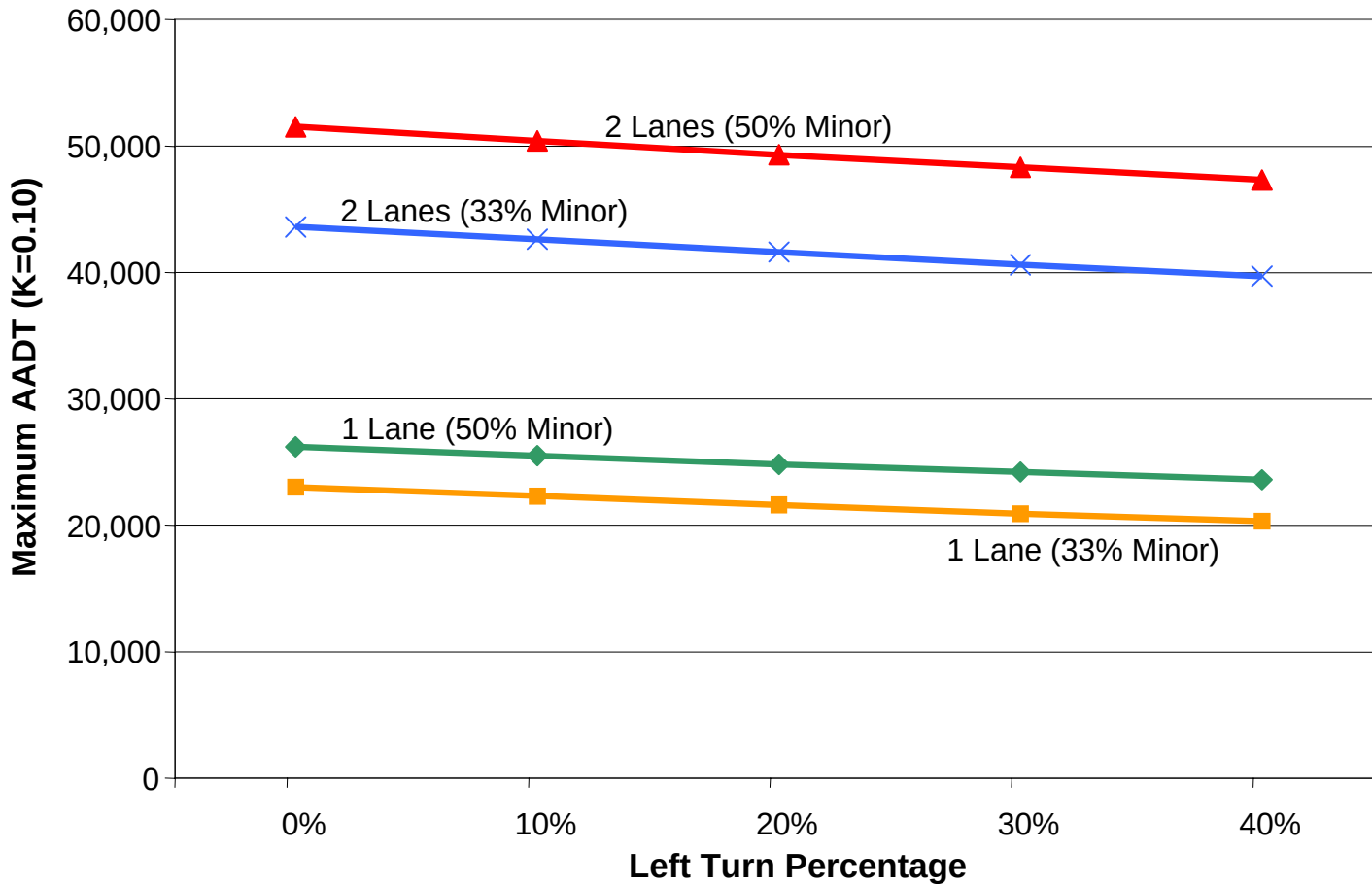


Considerations of Context

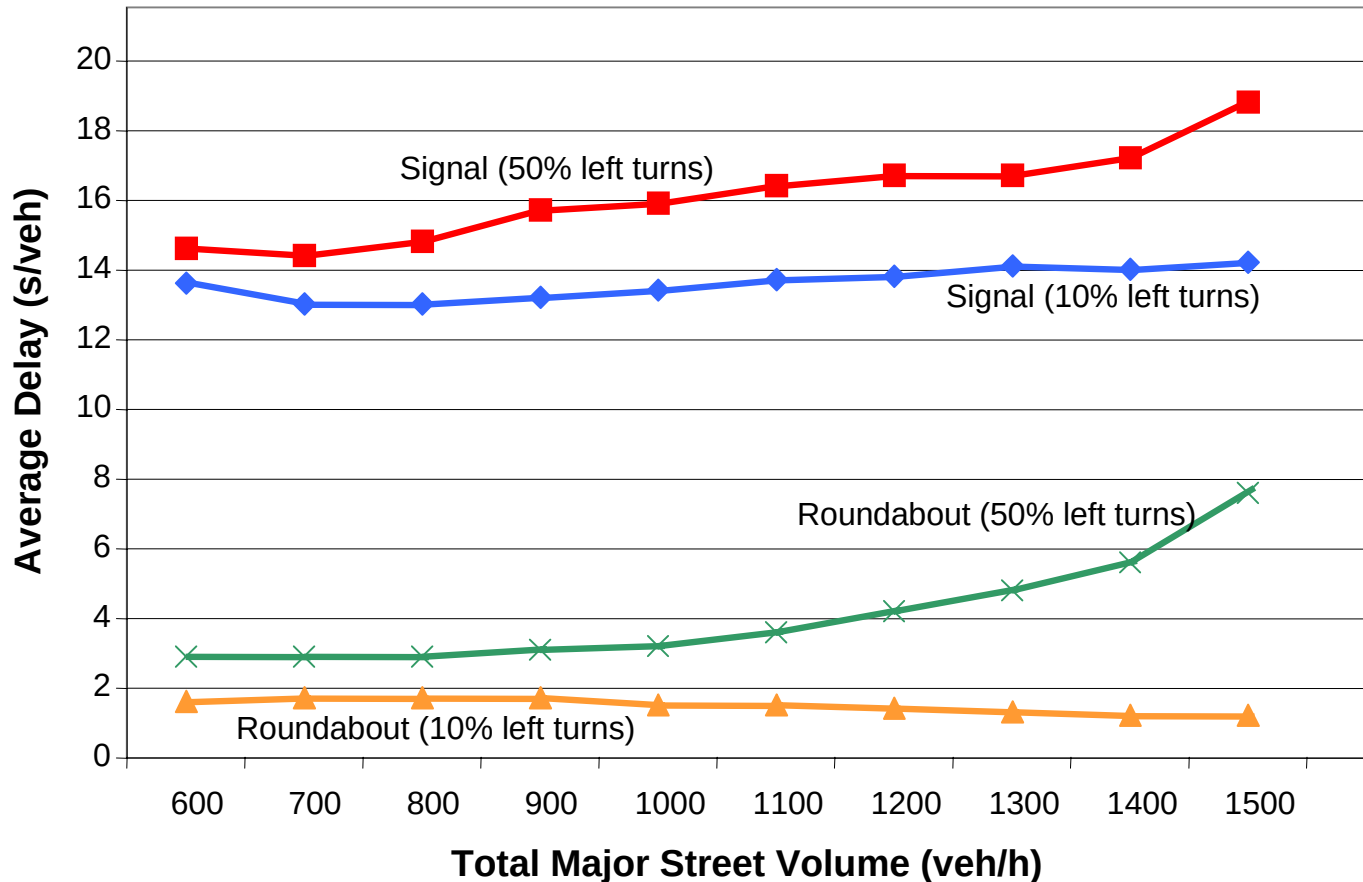
- **Decision Environments**
 - **New Roadway System**
 - **First Roundabout in an Area**
 - **Retrofit to existing intersection (Roundabouts have gained acceptance)**
- **Site Specific Conditions**



Maximum ADT (4-legged intersection)



Roundabouts versus Signals: MUTCD Peak Hour Warrant Levels



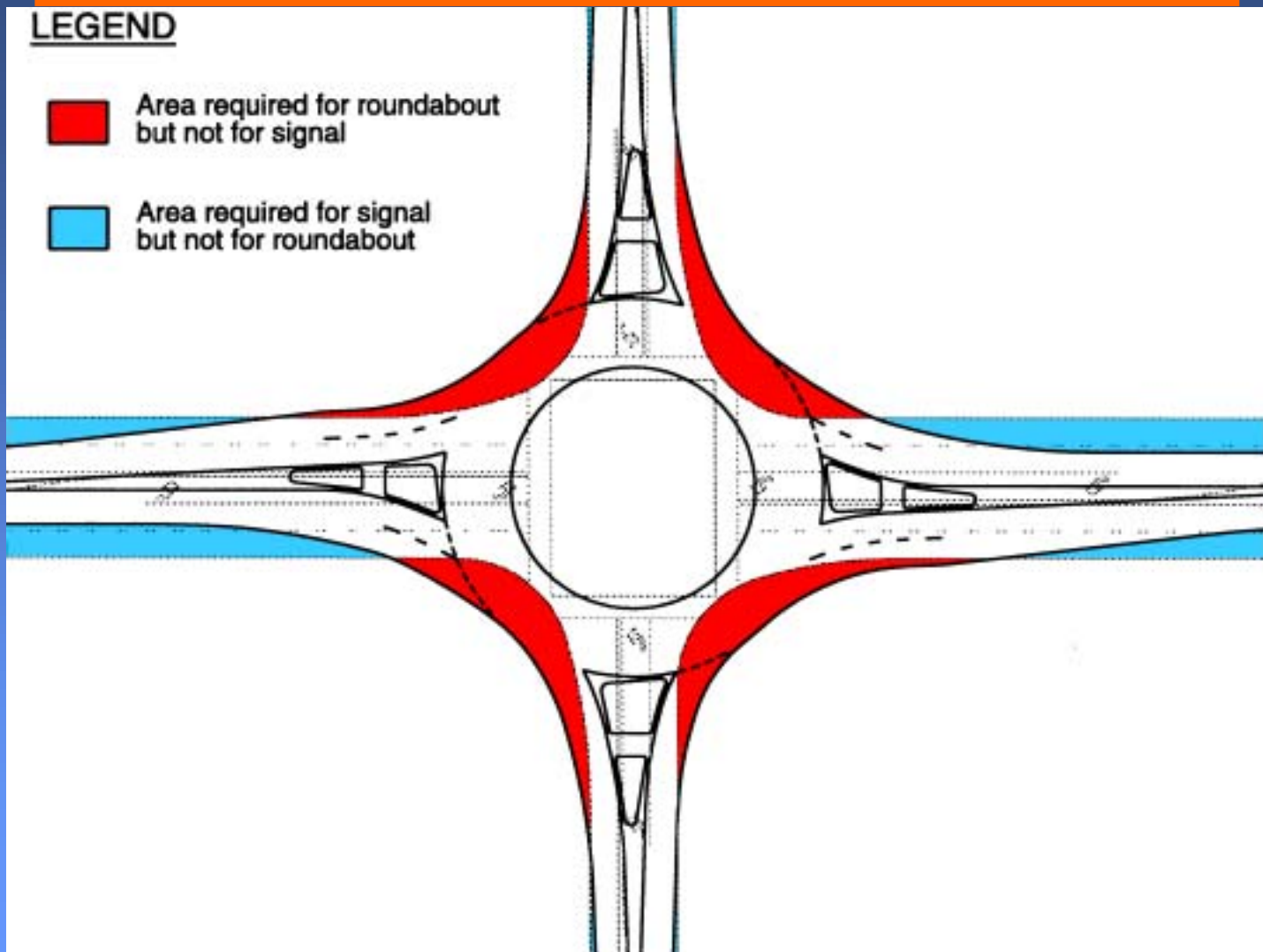
Selection Categories

- **Community Enhancements**
- **Traffic Calming**
- **Safety Improvements**
- **Operational Improvements**
- **Special Situations**



Space Requirements

Urban Flared vs. Comparable Signal



Highlights: Operations

- **Capacity equations correlated to roundabout category**
- **New capacity estimates**
- **Capacity adjustments**
- **Delay**
- **Queues**

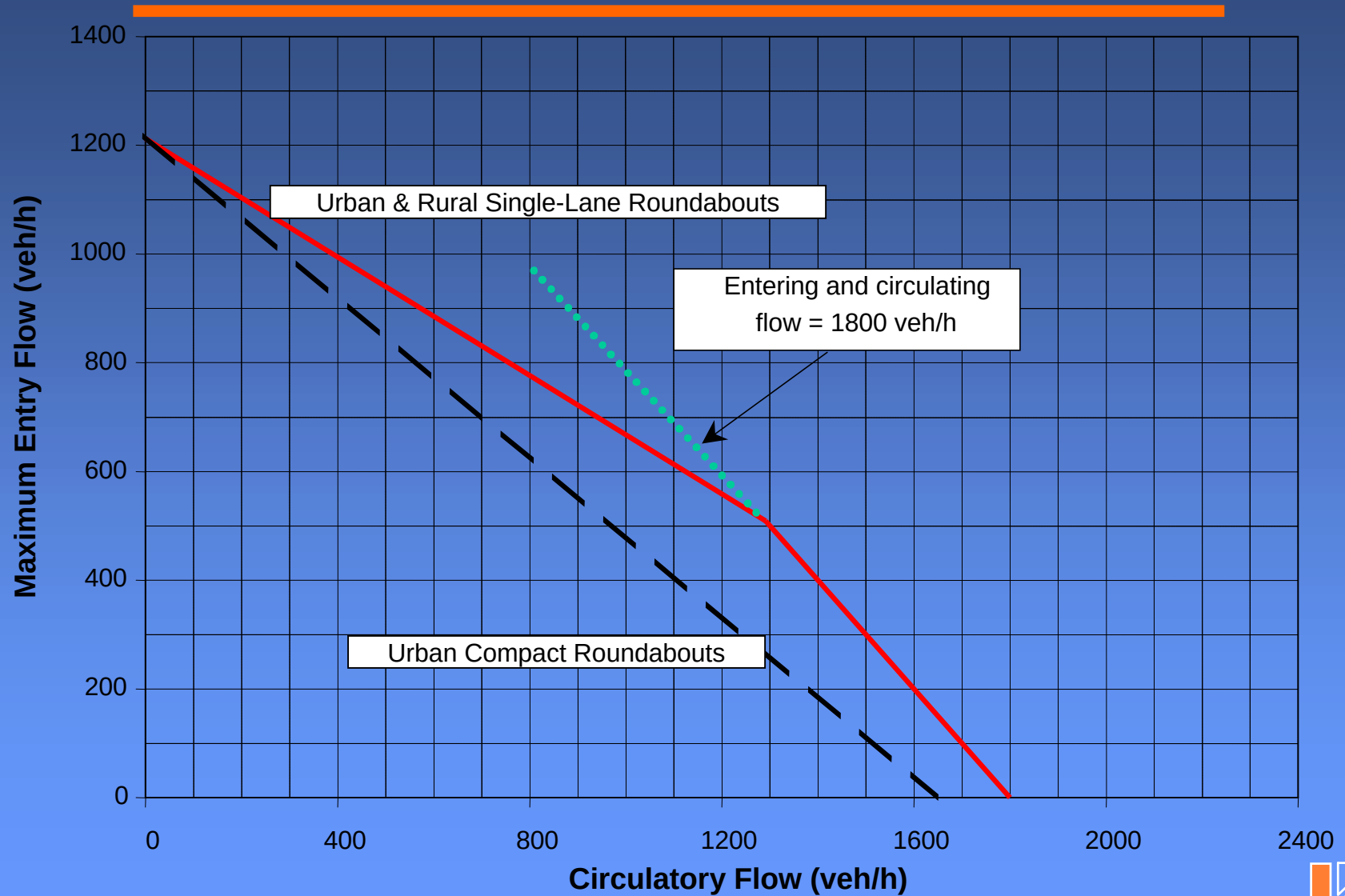


Single-Lane Roundabouts

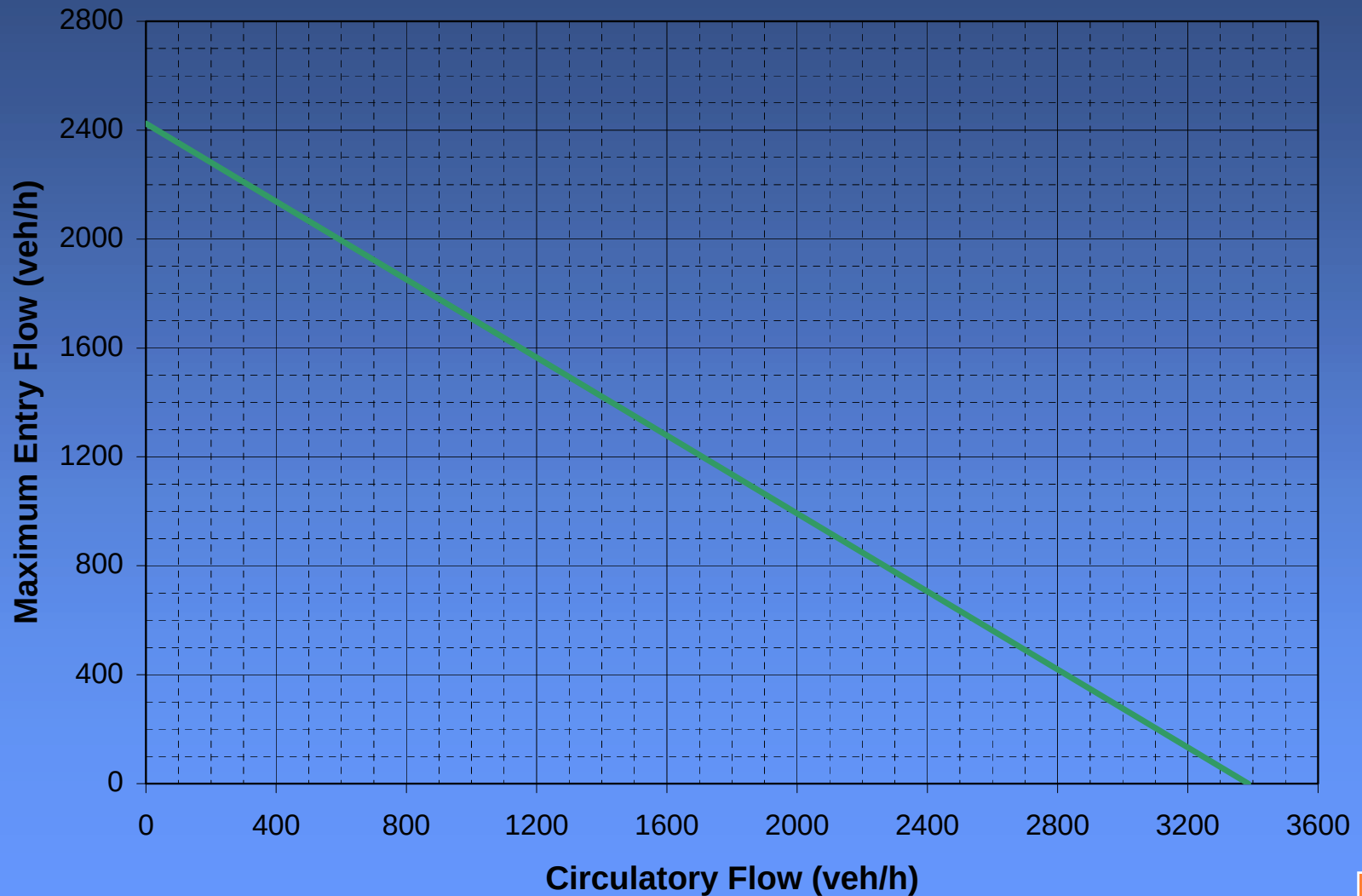
- **Urban compact roundabouts**
 - Design based on German
 - Capacity equation based on German data
- **Single-lane roundabouts**
 - Design based on British, French, and Australian
 - Equation based on British data
- **Double-lane roundabouts**
 - Design based on British, some French and Australian
 - Equation based on British data



Single-Lane Roundabouts



Double-Lane Roundabouts



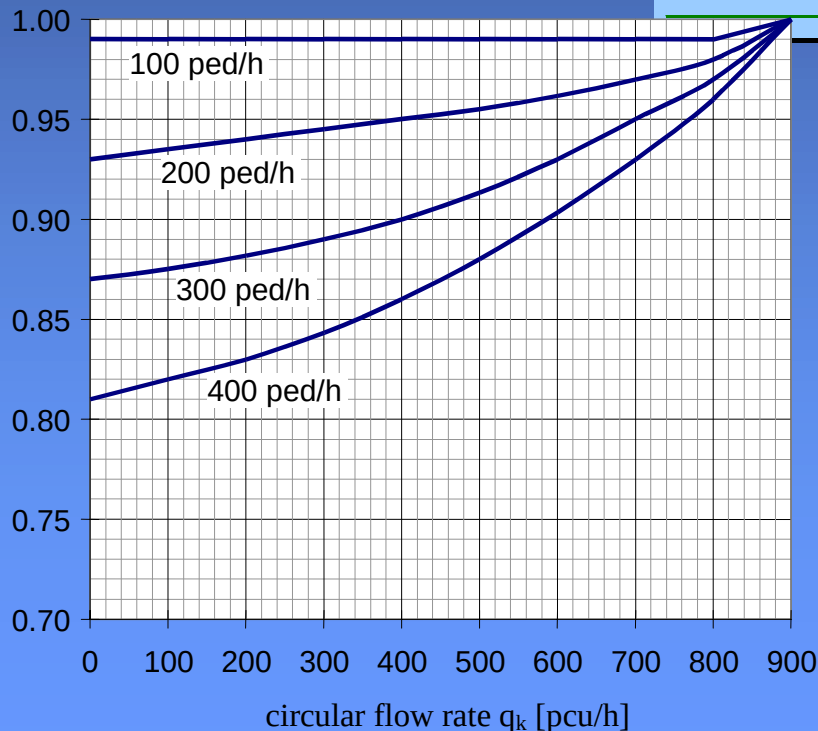
Capacity Adjustments

Short lanes (flare)

No. of vehicle spaces in short lane	Capacity factor (applied to double-lane approach capacity)
0 (single-lane approach)	0.500
1	0.707
2	0.794
4	0.871
6	0.906
8	0.926
10	0.939

Pedestrians

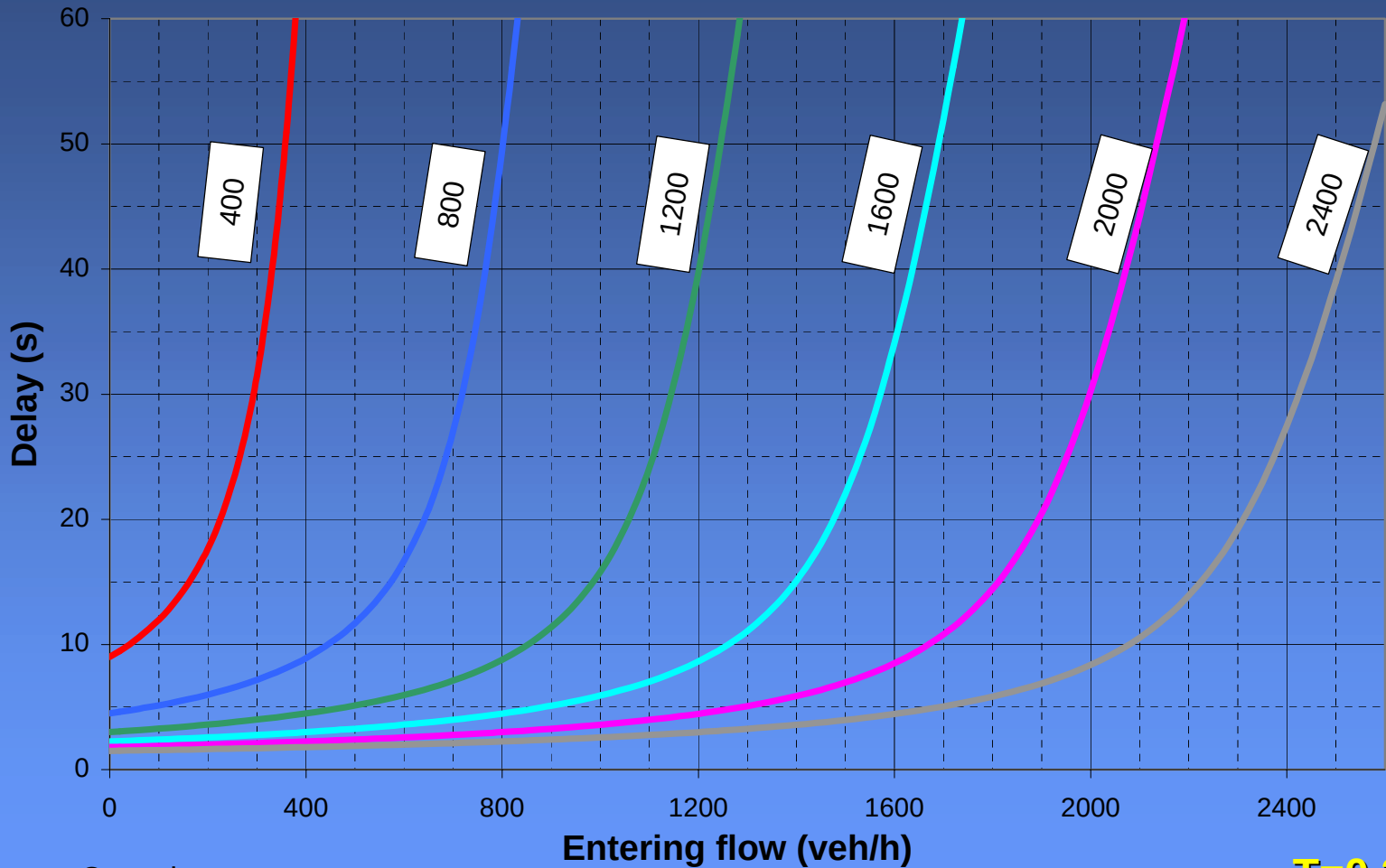
Reduction factor M [-]



Vehicle type

Vehicle Type	Passenger Car Equivalent (pce)
Car	1.0
Single-unit truck or bus	1.5
Truck with trailer	2.0
Bicycle or motorcycle	0.5

Delay



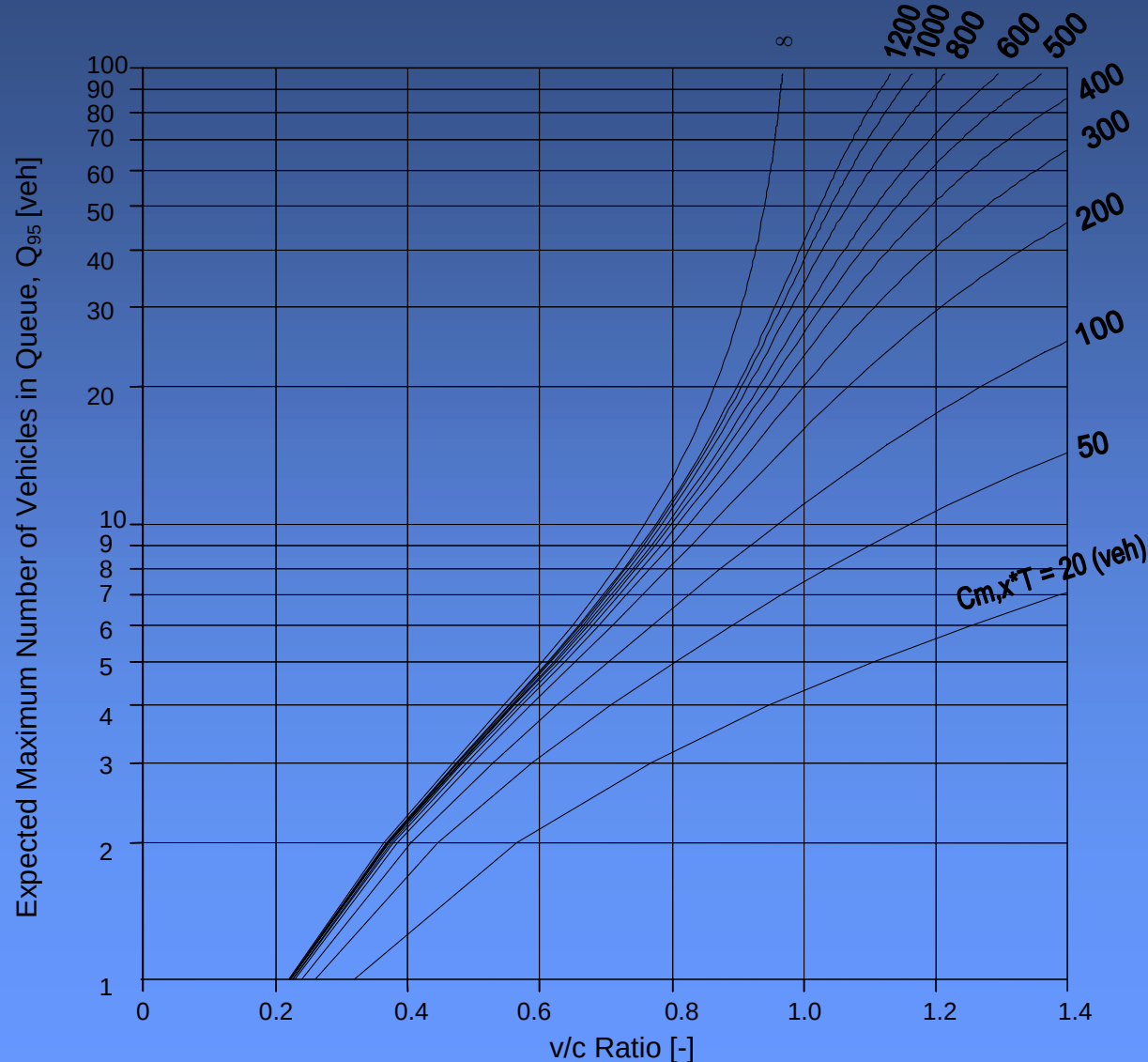
Capacity

— 400 veh/h — 800 veh/h — 1200 veh/h — 1600 veh/h — 2000 veh/h — 2400 veh/h

T=0.25 h



95th Percentile Queue Estimation



Highlights: Design

- **Speed reduction and speed consistency**
- **Design vehicle**
- **Nonmotorized design users**
- **Natural path overlap (multilane roundabouts)**
- **Signing and pavement markings**



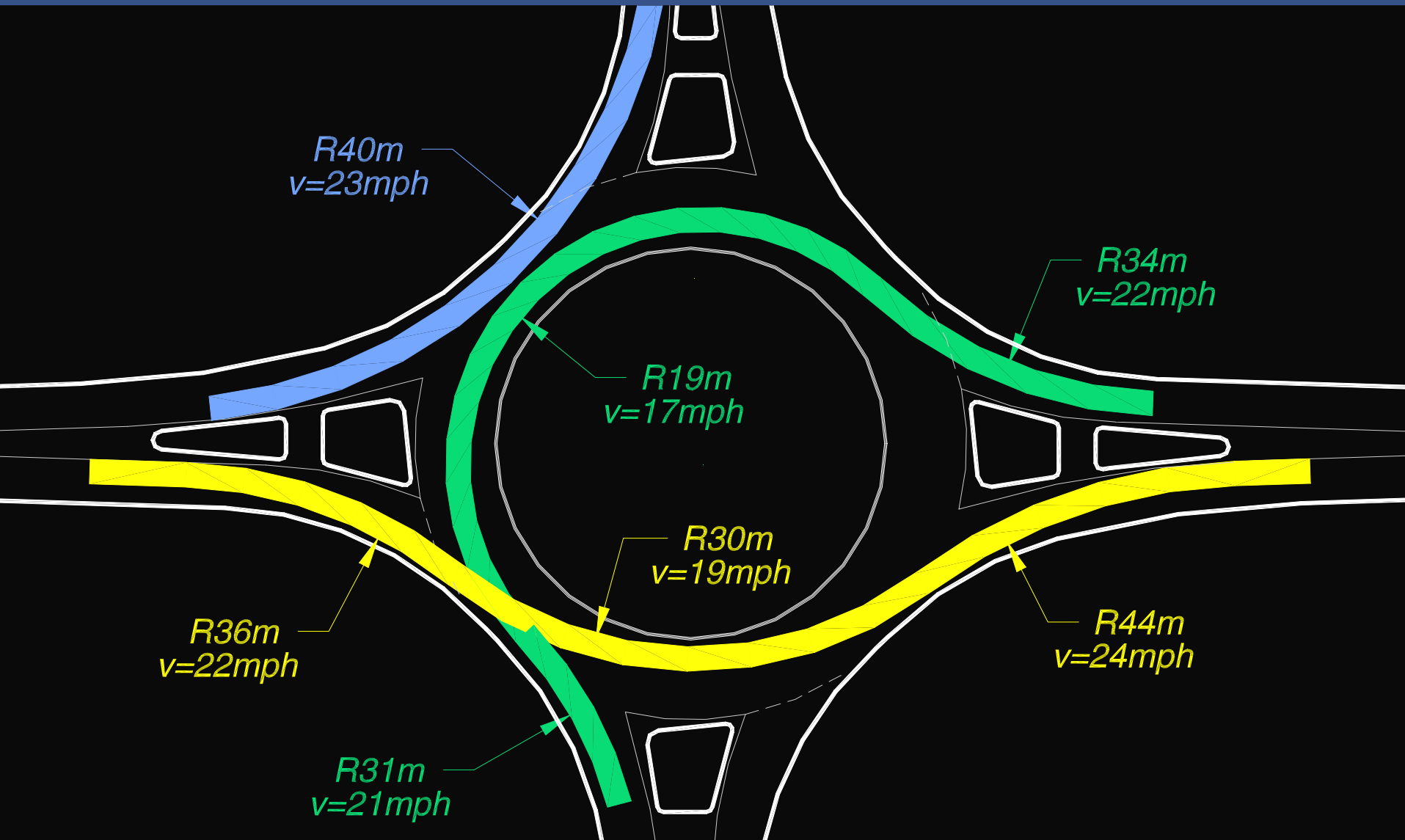
Speed Reduction

- **Low speeds entering the roundabout**

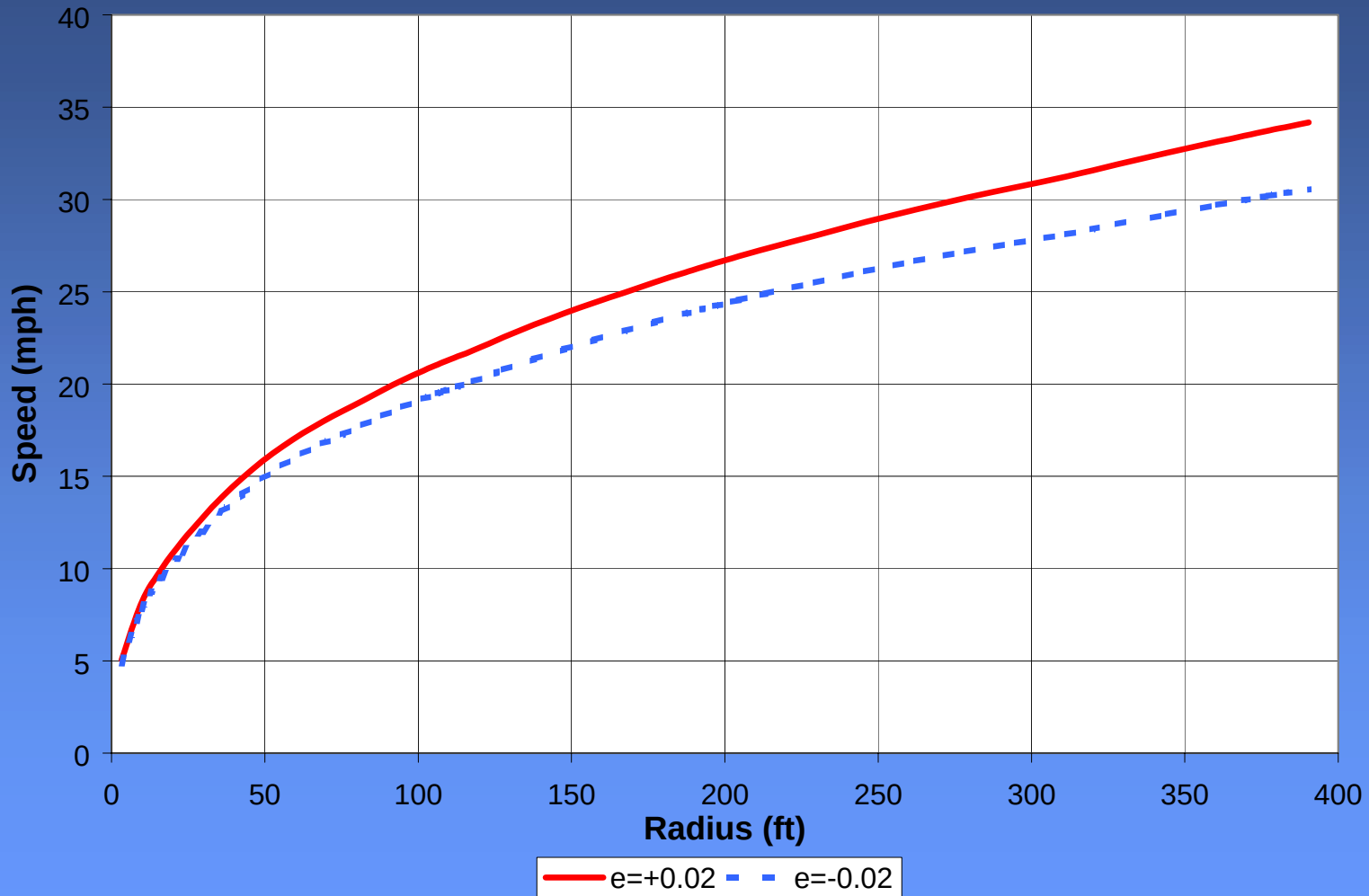
Site Category	Recommended Maximum Entry Design Speed
Mini-Roundabout	25 km/h (15 mph)
Urban Compact	25 km/h (15 mph)
Urban Single Lane	35 km/h (20 mph)
Urban Double Lane	40 km/h (25 mph)
Rural Single Lane	40 km/h (25 mph)
Rural Double Lane	50 km/h (30 mph)



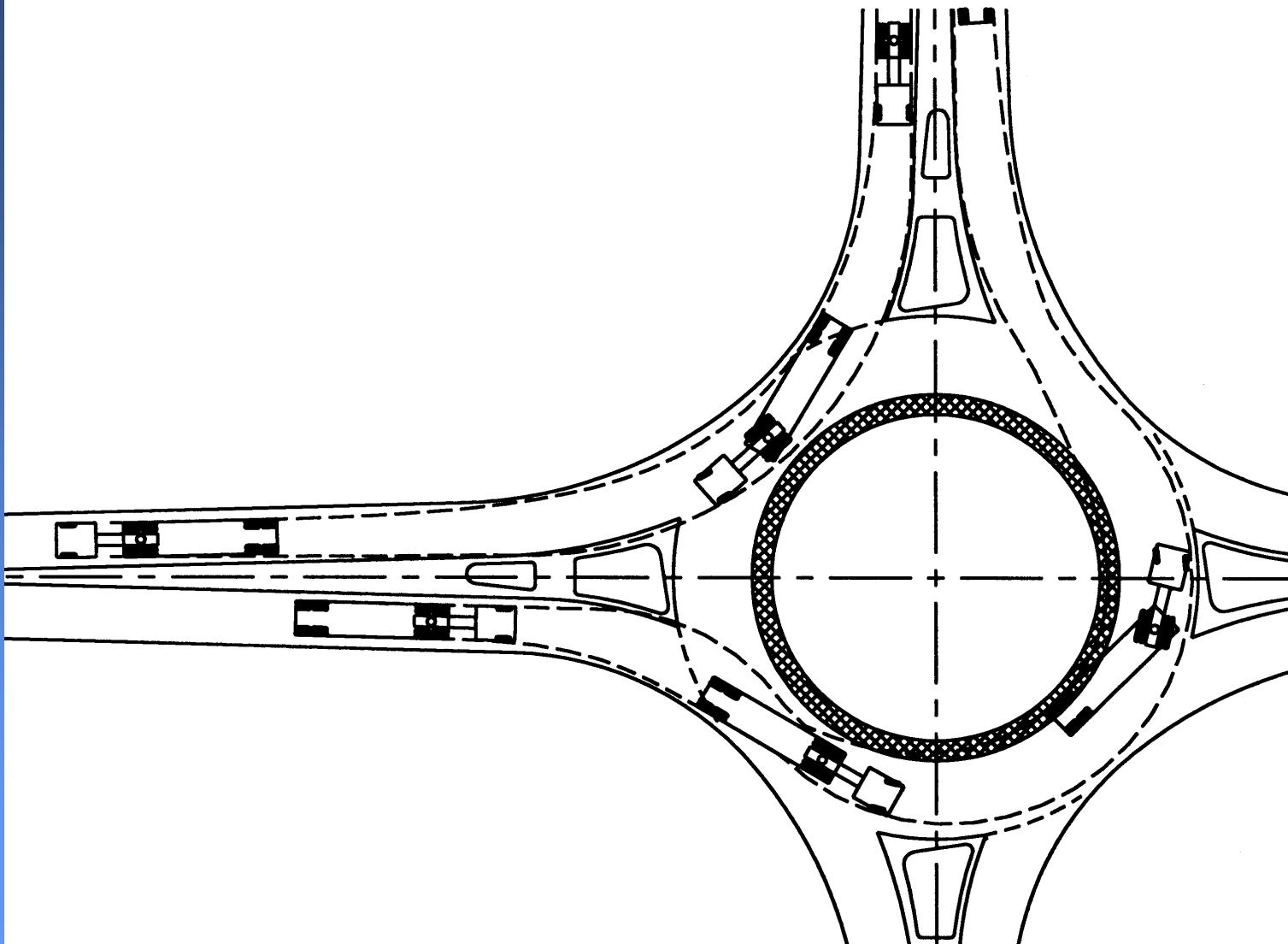
Speed Consistency



Speed-radius relationship (US units).



Design Vehicle



Design Vehicle



Roundabout

- May require use of truck apron
- Minimizes damage to curbs, signs, landscaping



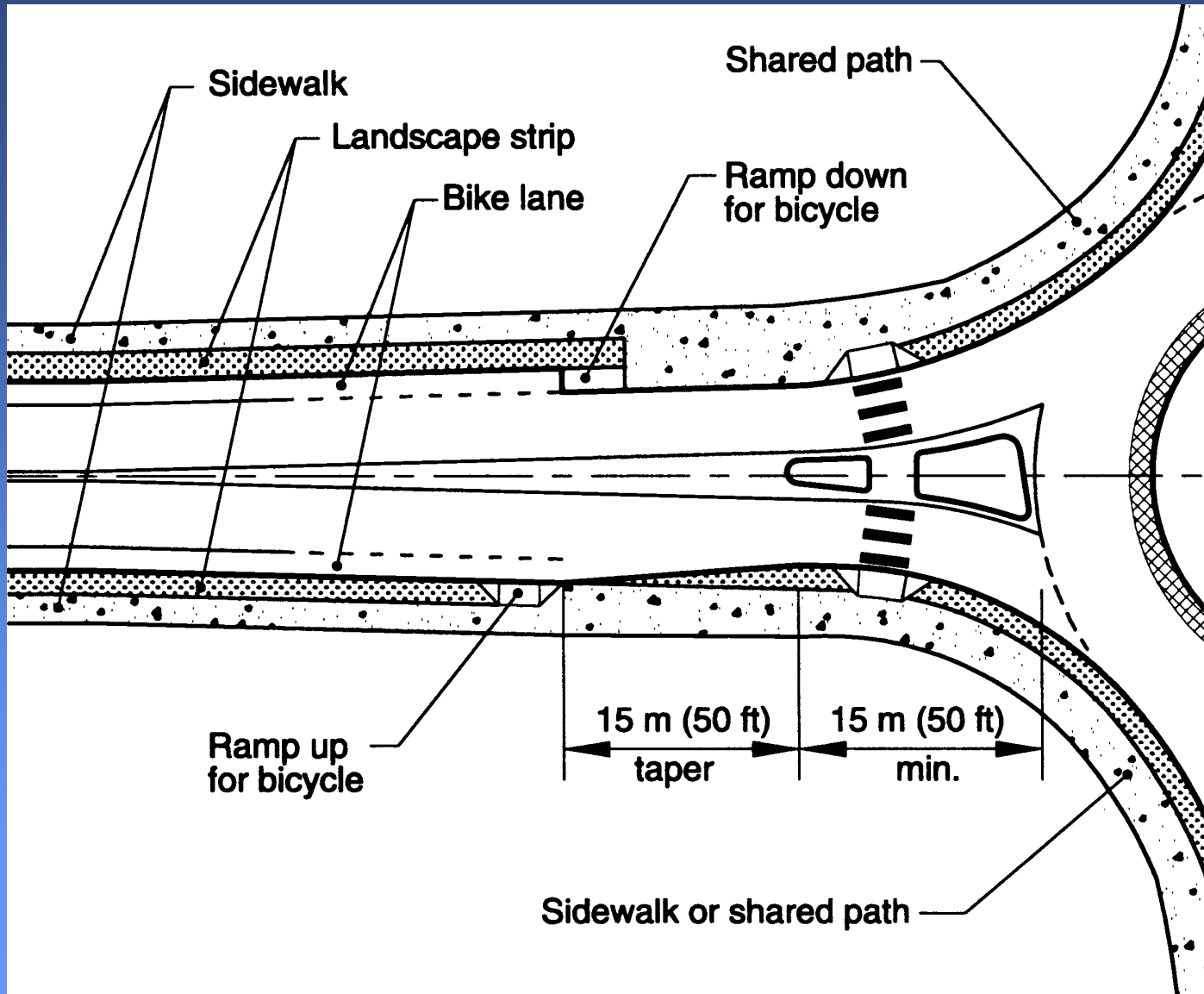
Traffic Circle

Photos: Lee Rodegerdts

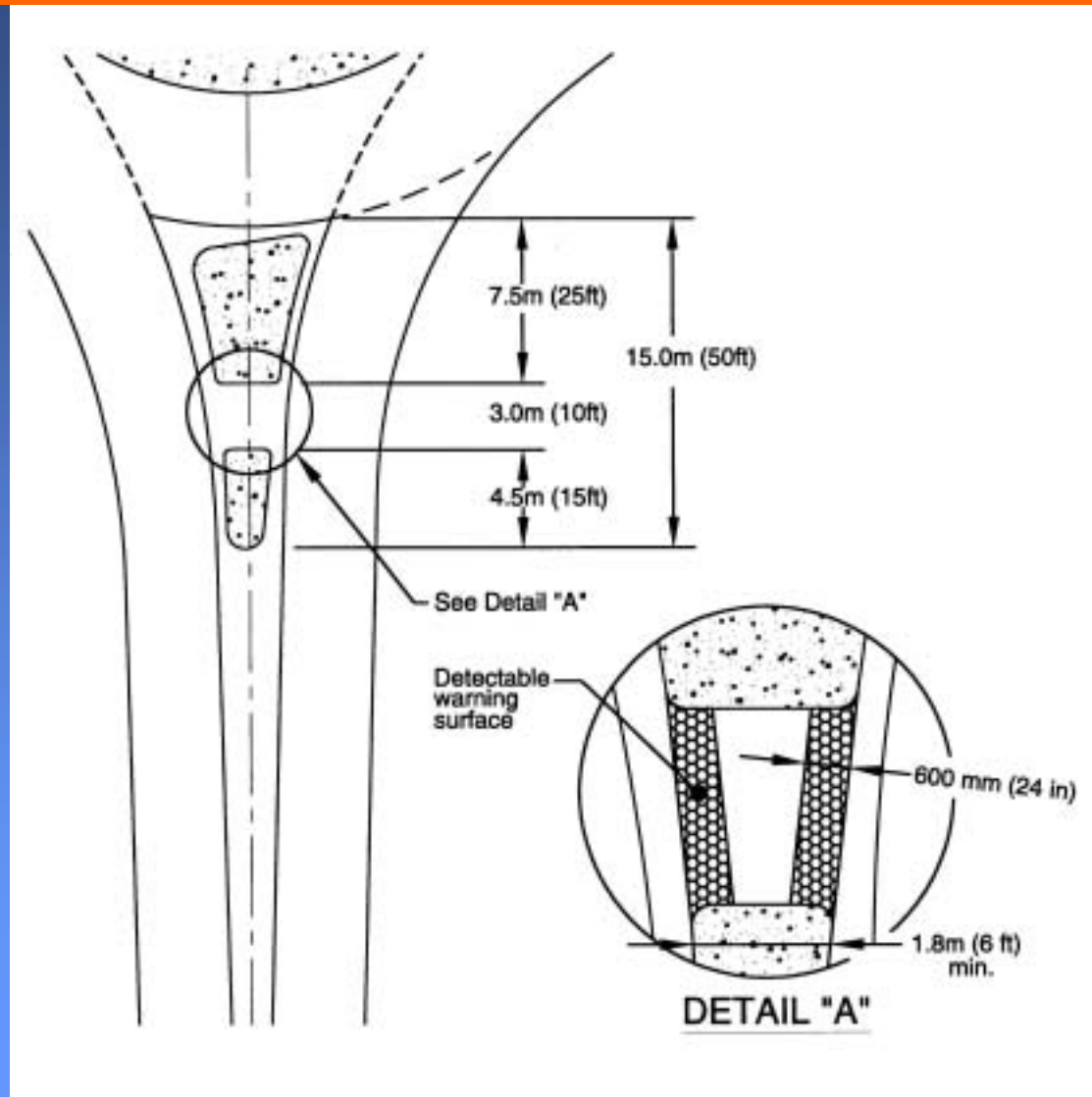
General Design Principles

- **Non-motorized design users**
 - bicyclists
 - pedestrians
 - skaters
 - wheelchair users
 - strollers

Bicycles: Provide Options



Pedestrians: Provide Refuge



Horizontal Geometry

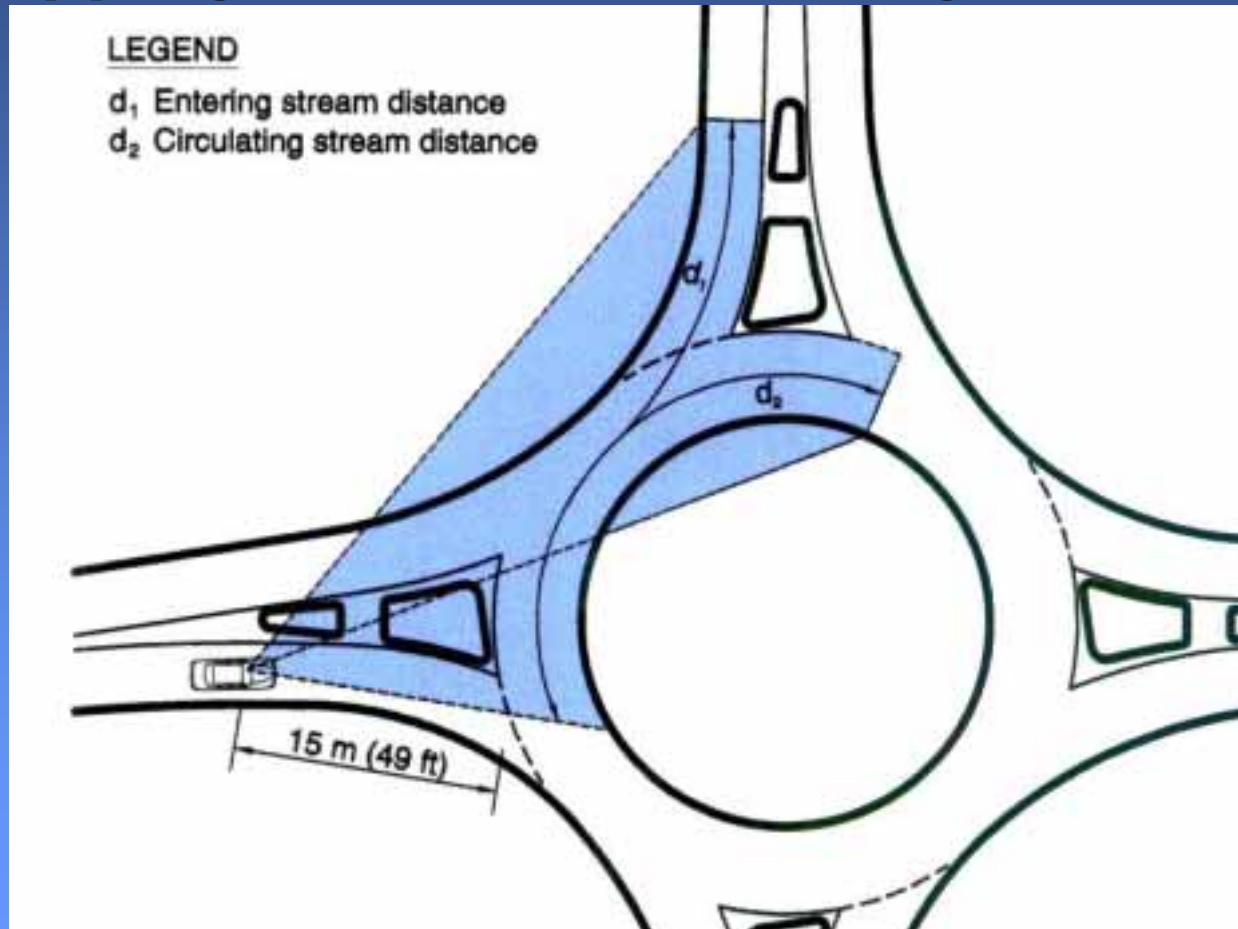
- Inscribed circle diameter**

Site Category	Typical Design Vehicle	Inscribed Circle Diameter Range*	
Mini-Roundabout	Single-Unit Truck	13 – 25 m	(45 – 80 ft)
Urban Compact	Single-Unit Truck/Bus	25 – 30 m	(80 – 100 ft)
Urban Single Lane	WB-15 (WB-50)	30 – 40 m	(100 – 130 ft)
Urban Double Lane	WB-15 (WB-50)	45 – 55 m	(150 – 180 ft)
Rural Single Lane	WB-20 (WB-67)	35 – 40 m	(115 – 130 ft)
Rural Double Lane	WB-20 (WB-67)	55 – 60 m	(180 – 200 ft)

* Assumes 90-degree angles between entries and no more than four legs.

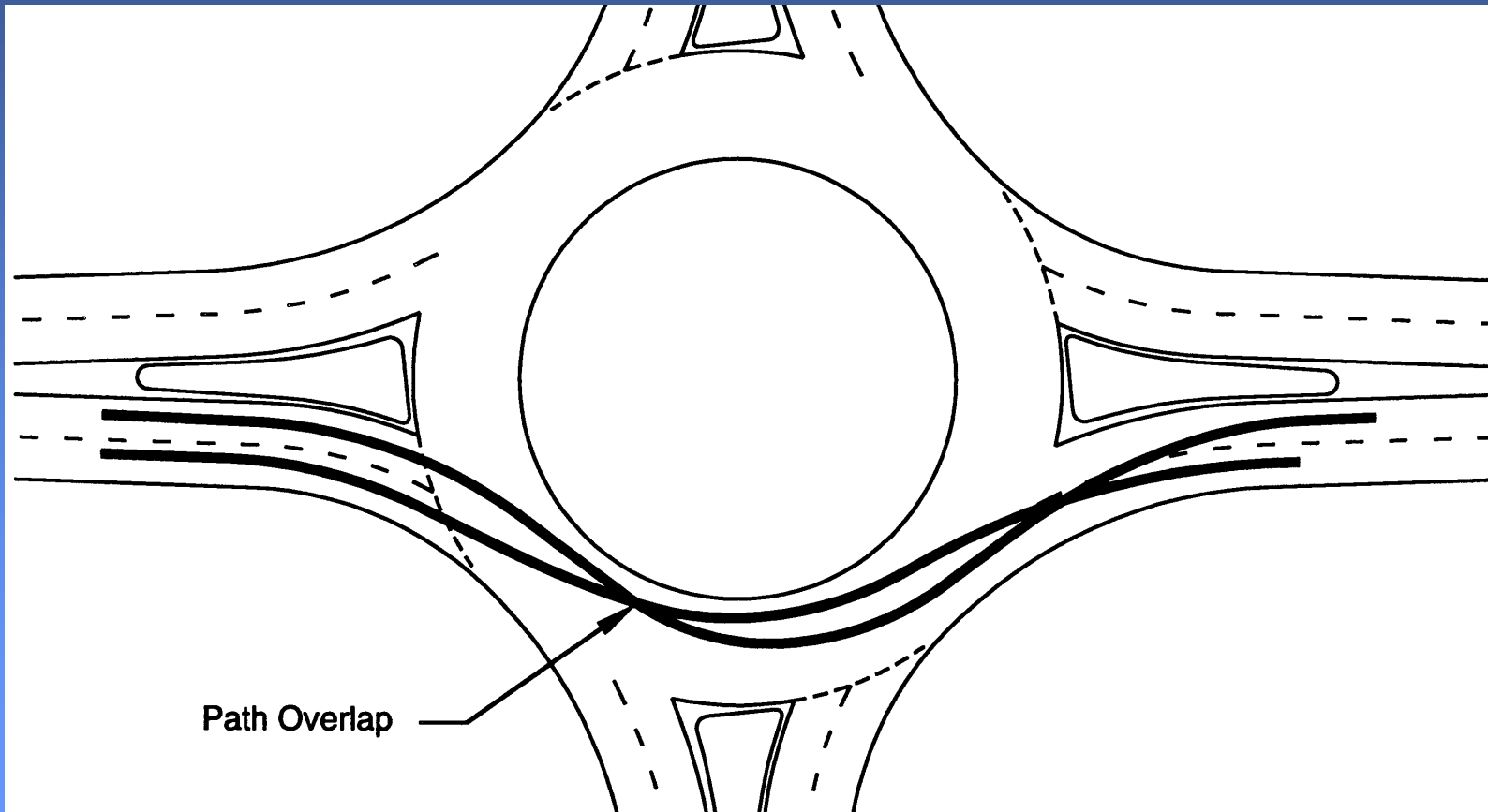
Sight Distance

- **Stopping and intersection sight distance**



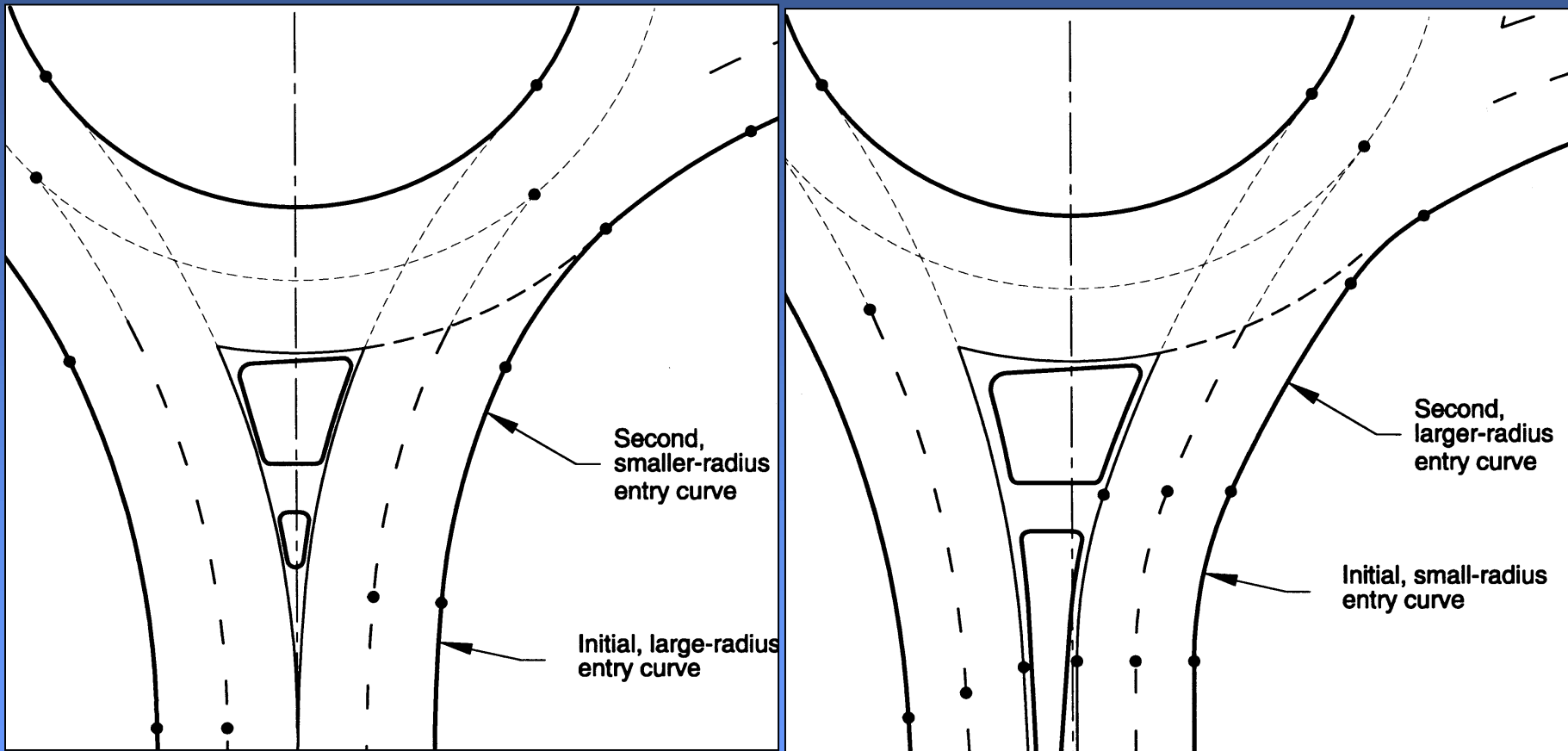
Multilane Roundabouts

- **Vehicle path overlap**



Multilane Roundabouts

- Design methods to avoid path overlap





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Conclusion

- **FHWA Guide allows informed decisions**
- **Supplements but does not replace fundamental documents (AASHTO, MUTCD)**
- **Roundabouts have many potential applications when considered thoughtfully**



The future of roundabouts in the U.S.?



Swindon, England

Kittelson roundabout web site: roundabouts.kittelson.com