SINGLE LANE, MULTI LANE AND MINI ROUNDABOUTS: The Operational Aspects

Presented by
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Meet Your Instructor

- Course instructor for UC Berkeley on classes concerning on roundabouts
- Reviewer of many roundabout projects for five public agencies
- Responsible for implementing many mini-roundabouts in London
- Reviewed many roundabout locations both before and after construction of the roundabouts
- Provided peer review of roundabout designs by other transportation professionals
- Specialized expertise on designing roundabouts for all road users

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Webinar Outcomes

- How to use to use the tools already in existence to design better roundabouts
- Learn about most critical components of roundabout design that affect crash rates
- Become familiar with the most current research about on roundabouts from various publications
- Learn from case studies of roundabouts that were not designed well and resulted in problems

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Continuation from Geometric Design Webinar

- Signing and Striping
- Illumination
- Landscaping
- Aesthetics
- Pedestrians
- Bicyclists
- Trains
- Case Studies

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4

Participants - Be Ready to Answer Questions About Fixing Broken Roundabouts!

5

Why is Signing and Striping so Important?

6


Because its not obvious to every driver which way to circulate!
05.12.2005
7

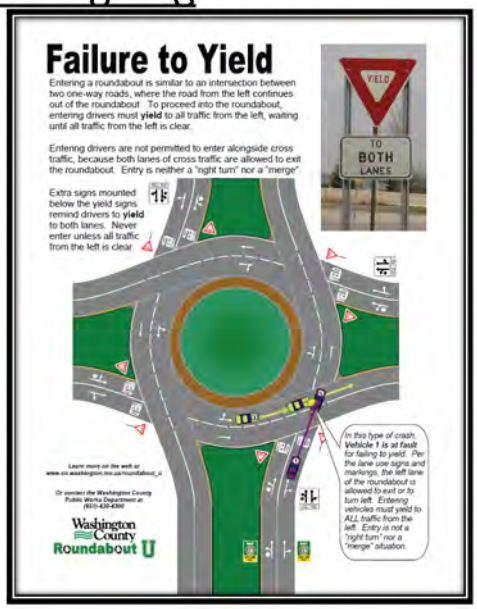

YIELD
Participants -what is broken here?
8

What Does the MUTCD Say?

9

Roundabout Signing

- Yield signs mandatory
- Black and white chevrons
- W1-6 large black arrow on yellow background not allowed on island
- Advance guide signs
- Place pedestrian crossing signs in splitter island to improve visibility of yield signs.



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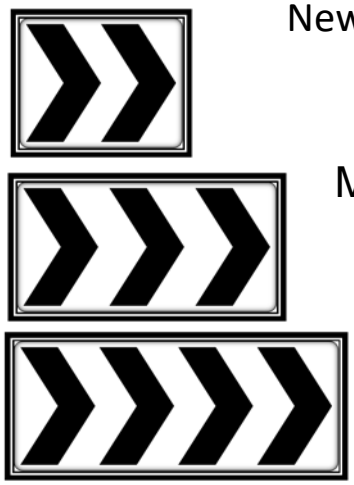
New regulatory signs for use at roundabouts

See Page I-4 of MUTCD for Compliance Dates



Roundabout Directional Arrow signs (on central island)

Roundabout Circulation sign (with YIELD sign at mini-roundabouts)

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Markings Guidance in the MUTCD

Section 3C.02 White Lane Line Pavement Markings for Roundabouts

Standard:

01 **Multi-lane approaches to roundabouts shall have lane lines.**

02 **A through lane on a roadway that becomes a dropped lane (mandatory turn lane) at a roundabout shall be marked with a dotted white lane line in accordance with Section 3B.04.**

Guidance:

03 *Multi-lane roundabouts should have lane line markings within the circulatory roadway to channelize traffic to the appropriate exit lane.*

Standard:

04 **Continuous concentric lane lines shall not be used within the circulatory roadway of roundabouts.**

Support:

05 Section 9C.04 contains information regarding bicycle lane markings at roundabouts.

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Markings Guidance in the MUTCD

Section 3C.03 Edge Line Pavement Markings for Roundabout Circulatory Roadways

Guidance:

01 *A white edge line should be used on the outer (right-hand) side of the circulatory roadway.*

02 *Where a white edge line is used for the circulatory roadway, it should be as follows (see Figure 3C-1):*

A. A solid line adjacent to the splitter island, and

B. A wide dotted line across the lane(s) entering the roundabout.

Standard:

03 **Edge lines and edge line extensions shall not be placed across the exits from the circulatory roadway at roundabouts.**

Option:

04 A yellow edge line may be placed around the inner (left-hand) edge of the circulatory roadway (see Figure 3C-1) and may be used to channelize traffic (see Drawing B of Figure 3C-4).

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Markings Guidance in the MUTCD

Section 3C.04 Yield Lines for Roundabouts

Option:

01 A yield line (see Section 3B.16) may be used to indicate the point behind which vehicles are required to yield at the entrance to a roundabout (see Figure 3C-1).

Section 3C.05 Crosswalk Markings at Roundabouts

Standard:

01 **Pedestrian crosswalks shall not be marked to or from the central island of roundabouts.**

Guidance:

02 *If pedestrian facilities are provided, crosswalks (see Section 3B.18) should be marked across roundabout entrances and exits to indicate where pedestrians are intended to cross.*

03 *Crosswalks should be a minimum of 20 feet from the edge of the circulatory roadway.*

Support:

04 Various arrangements of crosswalks at roundabouts are illustrated in the figures in this Chapter.

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Markings Guidance in the MUTCD

Section 3C.06 Word, Symbol, and Arrow Pavement Markings for Roundabouts

Option:

01 Lane-use arrows may be used on any approach to and within the circulatory roadway of any roundabout.

02 YIELD (word) and YIELD AHEAD (symbol or word) pavement markings (see Figure 3C-1) may be used on approaches to roundabouts.

03 Word and/or route shield pavement markings may be used on an approach to or within the circulatory roadway of a roundabout to provide route and/or destination guidance information to road users (see Figure 3C-14).

Guidance:

04 *Within the circulatory roadway of multi-lane roundabouts, normal lane-use arrows (see Section 3B.20 and Figure 3B-24) should be used.*

05 *On multi-lane approaches with double left-turn and/or double right-turn lanes, lane-use arrows as shown in Figures 3C-7 and 3C-8 should be used.*

Option:

06 If used on approaches to a roundabout, lane-use arrows may be either normal or fish-hook arrows, either with or without an oval symbolizing the central island, as shown in Figure 3C-2.

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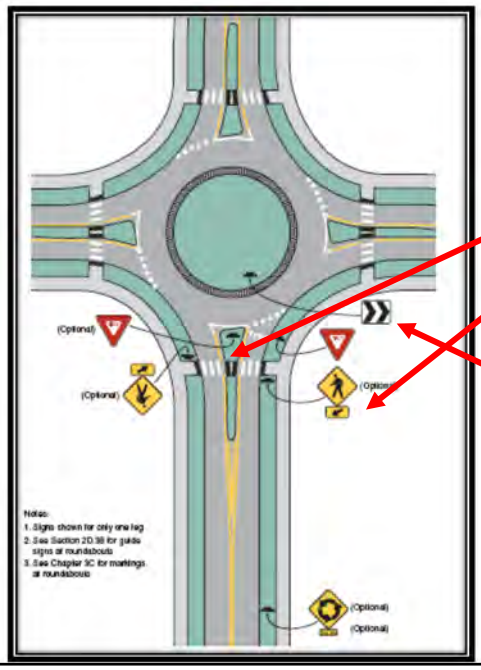
What's Important About Signing and Striping for Single Lane Roundabouts?

16

Regulatory and Warning Signs for a One -lane Roundabout



Suggest Pedestrian Warning signs be located in splitter to improve Yield sign compliance

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Poor Sight Distance Caused by Landscaping and Signage on the Center Island

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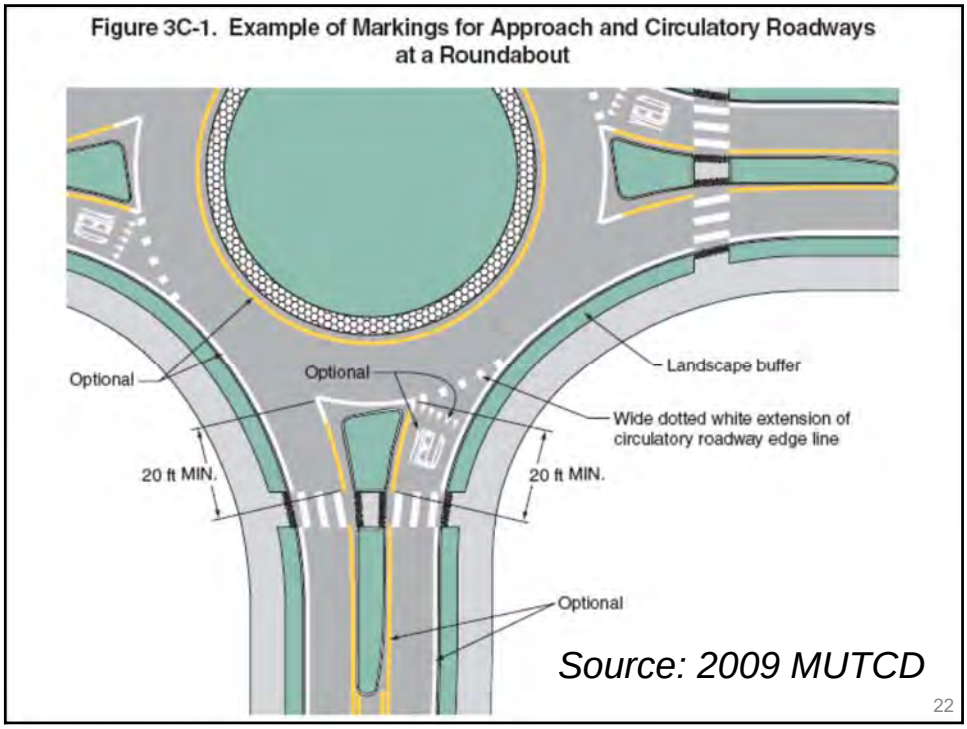
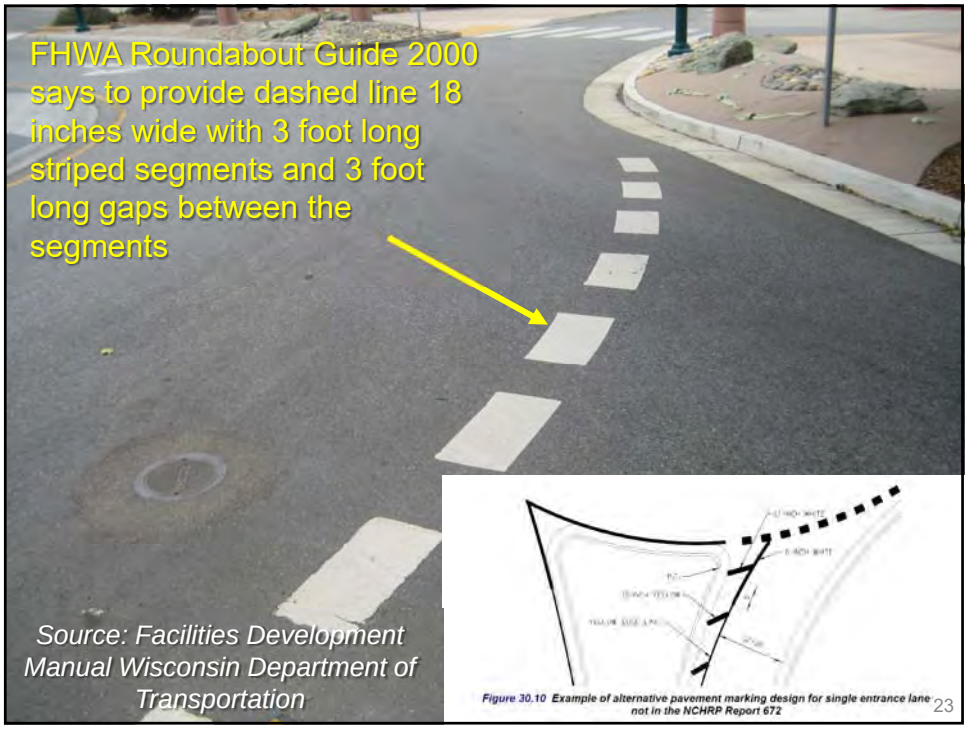


Figure 3C-1. Example of Markings for Approach and Circulatory Roadways at a Roundabout
Optional
Optional
Landscape buffer
Wide dotted white extension of circulatory roadway edge line
20 ft MIN.
20 ft MIN.
Optional
Source: 2009 MUTCD
22



Drivers' Understanding of Innovative Roundabout Traffic Control Devices

THE 2009 EDITION OF THE *MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES* CONTAINS INNOVATIVE SIGN AND PAVEMENT MARKING TREATMENTS TO ASSIST DRIVERS WITH NAVIGATING ROUNDABOUTS. THE HUMAN FACTORS LABORATORY STUDY DESCRIBED IN THIS PAPER WAS UNDERTAKEN TO DETERMINE DRIVER UNDERSTANDING OF THE NEW DEVICES.

BY FRED R. HANSCOM, P.E.

INTRODUCTION

The 2009 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) contains a number of innovative signing and pavement marking options for application at roundabouts.[1] These devices are designed with the specific intent to convey geometric features to assist drivers in the navigation of roundabouts. Figures 1 and 2 illustrate the use of fishhook pavement markings and curved-stem guide sign arrows, respectively.

Due to the absence of preexisting data regarding driver understanding of the roundabout traffic control device concepts that were considered in the development of the 2009 MUTCD, a relevant human factors study was funded by the National Cooperative Highway Research Program (NCHRP). This study was based on research needs identified by the MUTCD authoring committee. Key devices of interest were fishhook roundabout-entry pavement markings, curved-stem arrows on advance guide signs, and specific central island signing characteristics (e.g., black-on-yellow warning and black-on-white chevrons regulatory signs).

LABORATORY STUDY PROCEDURE

Twenty-eight combinations of advance guide signs and pavement marking alternatives were tested in a laboratory study. The laboratory consisted of a theater-type surrounding that projected high-resolution images that replicated traffic control device legibility (e.g., sign letter height to driver distance ratio) found in actual highway driving. Laboratory participants viewed sequen-

priate to reach an intended destination and (2) confidence in choice decisions (i.e., not sure, somewhat sure, or very sure). These confidence ratings provided an added degree of sensitivity to the evaluation procedure.

The study methodology was based on a classical Federal Highway Administration (FHWA) study that determined the design of diagrammatic guide signs.[2] This study utilized short time-exposure presentations depicting highway scenes, whereby laboratory participants made lane-choice decisions based on their intended destination. A recent FHWA roundabout signing study applied similar measures (i.e., decision choice and confidence ratings by laboratory subjects) in response to brief exposures to highway scenes.[3]

Specific traffic control device conditions, based on candidates for inclusion into the MUTCD, were selected for laboratory testing and are listed below. Device treatments were separately tested under right, left and through intersection-movement driver route-choice conditions. Tested devices were the following:

1. Pavement Marking Conditions
   a. Fishhook;
   b. Turn and through-lane arrows, both entry lanes;
   c. Left-turn only arrow, left lane; right-turn, and through-lane arrows, right lane;
   d. Through lane-use arrow, left lane; turn and through-lane arrows, right lane; and
   e. No pavement markings.
2. Guide Sign Conditions
   a. Conventional arrows; and

Published in the July 2010 ITE Journal

What's Important About Signing and Striping for Two-Lane Roundabouts?

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Diagrammatic Sign for Two Lane Roundabout

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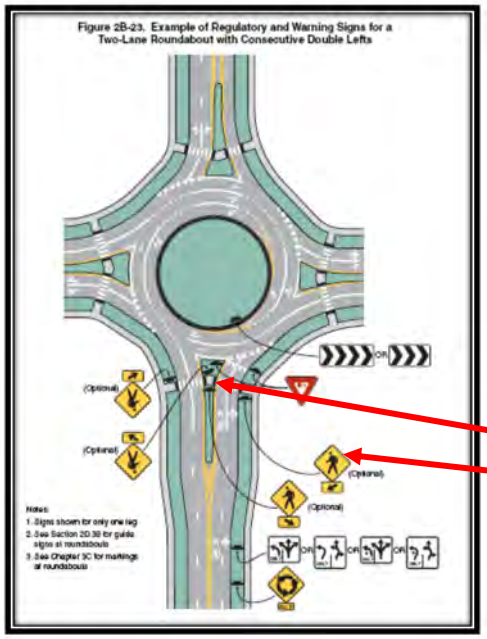


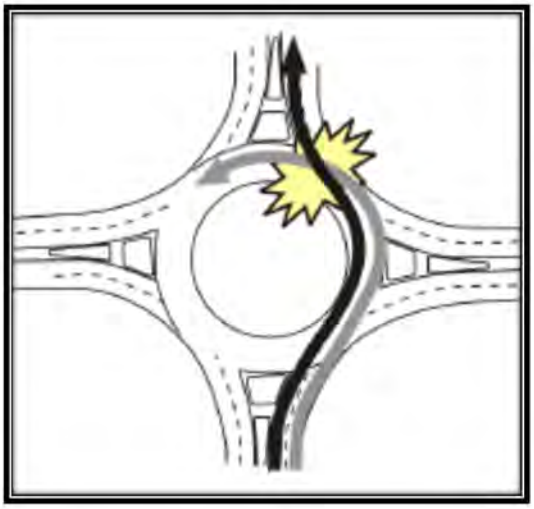
Regulatory and warning signs for use at a two-lane roundabout

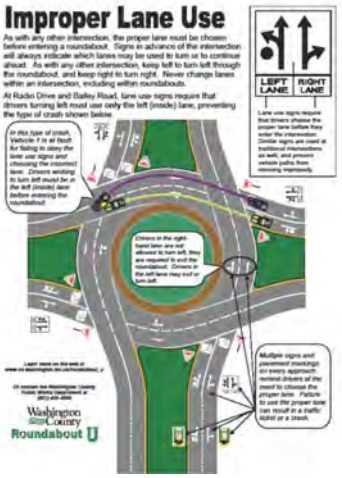
Suggest Pedestrian Warning signs be located in splitter to improve Yield sign compliance

Source: 2009 MUTCD

28

Exits at Multilane Roundabout are Problematic and Require Special Treatments





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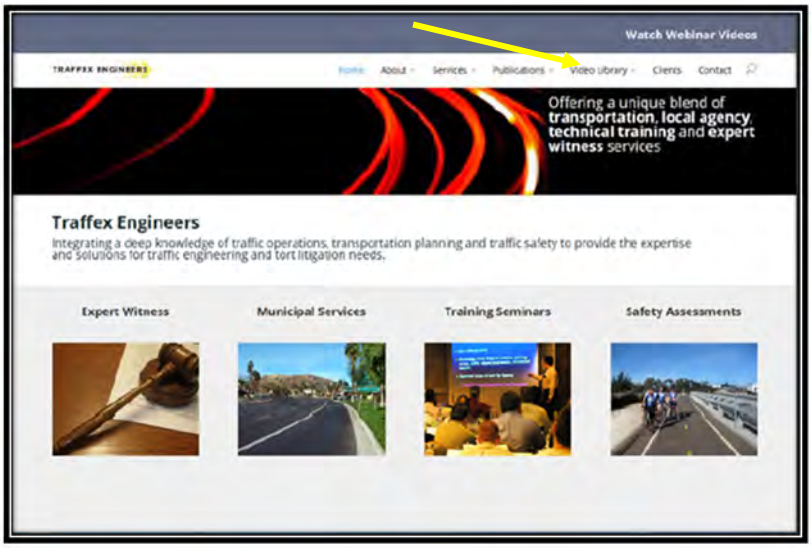

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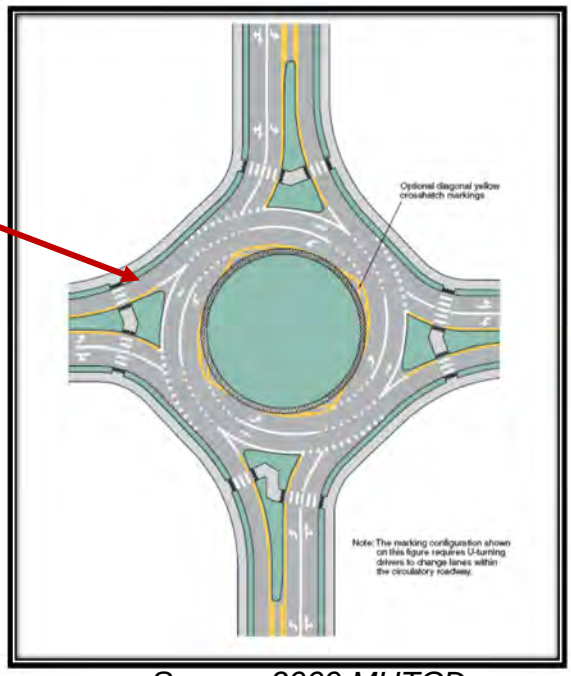
Two-lane Roundabouts with One Lane Exits



Source: 2009 MUTCD

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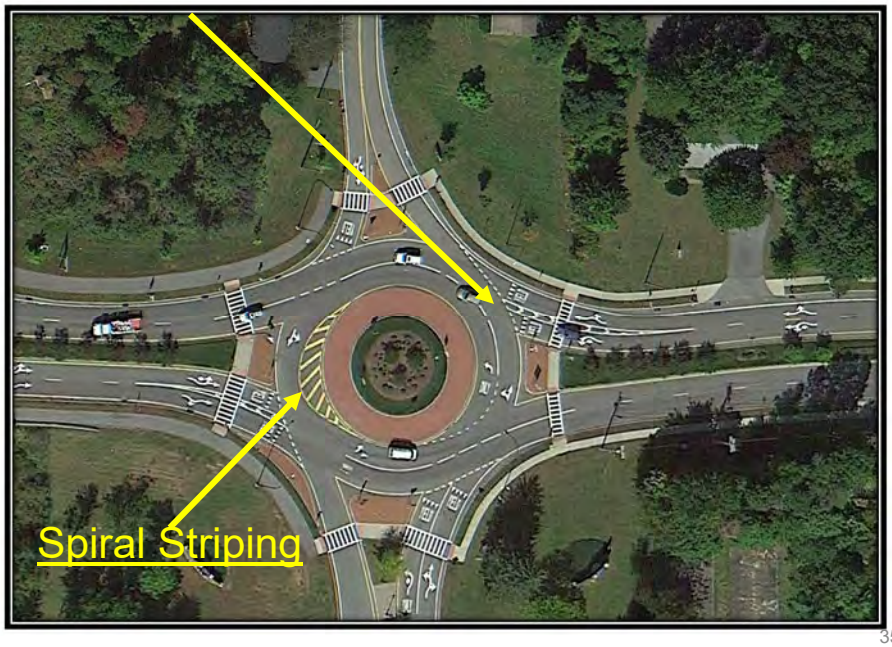
Approach Markings Narrowed to a Single Lane on Multi-lane Roadway with More Gradual Transition

Vane Striping at a Multi-lane roundabout



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Destination Signing
89A
NORTH
MILE
349
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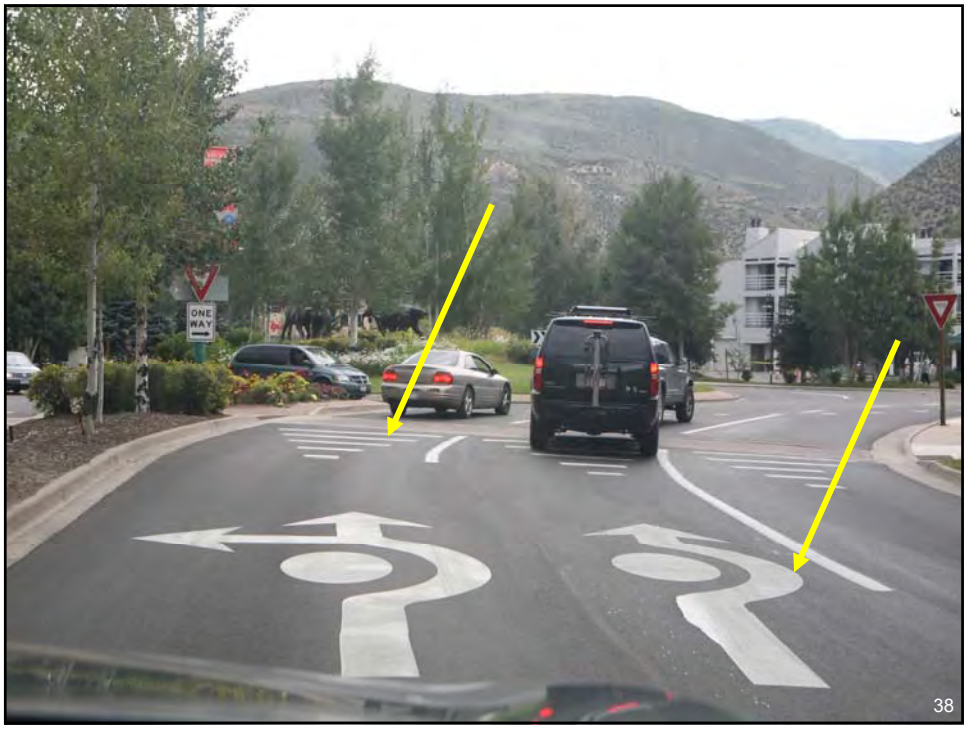
ONE WAY
38

What's Important About Signing and Striping for Three or More Lane Roundabouts?

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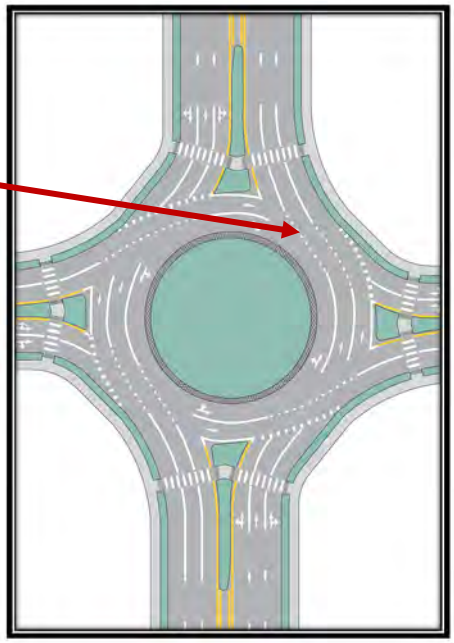
Three-lane Roundabouts - More Difficult to Avoid Exit Side Conflicts



Source: 2009 MUTCD

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SUMMARY REPORT

An Evaluation of Signing for Three-Lane Roundabouts

FHWA Publication No.: FHWA-HRT-10-030

FHWA Contact: Joe Bared, HRDS-05, (202) 493-3314, joe.bared@dot.gov

Introduction

Since the introduction of the modern roundabout to North America nearly two decades ago, roundabout acceptance has continued to grow. As of 2007, there are more than 1,000 roundabouts in North America, and that number is growing rapidly.[1] This acceptance is attributed to the superior operational and safety performance of roundabouts relative to conventional signalized intersections in appropriate conditions.[2-4] Although multilane roundabouts have been found to be safer than conventional alternatives, especially with respect to injury and fatal crashes, they are not without safety challenges. One of these challenges is getting motorists to select and stay in their proper lanes as they navigate the roundabout. Some motorists take the fastest path through roundabouts by entering in the right lane, crossing to the center lane midway through the circular roadway, and then crossing back into the right lane at the exit.[5,6] This behavior creates a risk of sideswipe crashes. Another challenge for both safety and operational efficiency is that motorists sometimes have difficulty interpreting lane-control arrows in the roundabout context.[7,8] Even with these unresolved issues, the safety and operational advantages of one- and two-lane roundabouts are so substantial that engineers have begun to introduce three-lane roundabouts where traffic cannot be accommodated in one or two lanes.[9] Figure 1 shows a three-lane roundabout in Michigan.

Figure 1. Michigan three-lane roundabout.

Source: Michigan Department of Transportation Photography Unit

FHWA-HRT-10-030

Findings:

- Overhead signing reduces inappropriate lane changes
- "Turbo" type treatments may be needed to eliminate such movements – discussed later in the webinar

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What's Important About Signing and Striping for Mini Roundabouts

42

Mini-Roundabouts for the United States

THIS FEATURE EXAMINES THE HISTORY, SUCCESS AND SOME FAILURES OF MINI-ROUNDABOUTS IN THE UNITED KINGDOM. THE MAIN PRINCIPLES REGARDING DESIGN, SAFETY AND GENERAL OPERATION ARE DISCUSSED FOR THEIR POTENTIAL APPLICATION IN THE UNITED STATES. THE BASIS FOR SITE SELECTION IS CLARIFIED, INCLUDING SINGLE AND MULTIPLE USE OF MINI- OR SMALL ROUNDABOUTS IN SMALL NETWORKS. EFFECTS ON VULNERABLE USERS ARE ALSO CONSIDERED.

BY CLIVE SAWERS, MA, MICE, C.ENG.

INTRODUCTION

Many Americans have been fascinated by the United Kingdom's large numbers of modern roundabouts, particularly mini-roundabouts. Americans have often found them difficult to drive because they are not used to living with roundabouts. What are mini-roundabouts? Why might their development apply to the United States?

A mini-roundabout may be considered at an intersection where the available right of way is not sufficient to install a normal roundabout with a solid central island.

A mini-roundabout is a small form of modern roundabout that is fully over-runnable, where all traffic should yield on entry to vehicles circulating around it. On entering the circulation, all vehicles must pass to the correct side of the central island unless they physically cannot do so, when the trailing part of the vehicle may pass over and to the "wrong" side of the central island.

A mini-roundabout is the same as a modern roundabout but there is no solid central island, only a truck apron. The only other difference is the scale of the intersection; the inscribed circle is less than around 28 meters (90 feet). Otherwise the operational characteristics are much the same as a normal modern roundabout with a central island. This is dependent upon making the truck apron—now a stand-alone device—work properly. That is where problems have arisen in the United Kingdom because the overrunnable island is limited to a 4-meter diameter.

BRIEF HISTORY

because they were no longer looked up. Tests in 1973 showed that large roundabout layouts did not work well even with the yield rule. Further tests on smaller three-arm roundabouts proved that the mini-roundabout with its nominal central island would work at appropriate sites and would yield much higher capacity than equivalent traffic signals.

Mini-roundabouts proved easy and inexpensive to install. They reduced the numbers and severity of crashes and had a good local speed reduction effect. They replaced "priority" junctions effectively, particularly where these tended to become knotted up. In the United States, many all-way stop intersections do not perform well. These represent opportunities for mini-roundabout retrofits.

BACKGROUND IN THE UNITED STATES

Historically, there are many circular intersections of various sizes in the United States and Canada. Commonly known as traffic circles, these with small solid islands as residential road intersections operate well for their intended purpose, i.e., to allow turning movements at slow speeds. Their larger relations—rotaries—have become notorious. They operate too fast and have poor capacity and a poor crash rate.

For these and other reasons, the modern roundabout, with its very different actual operation but its apparent similarity to traffic circles, is viewed with skepticism in the United States. It is only a matter of time before sufficiently well-designed modern roundabouts confirm the benefits that are so different from the rotaries that preceded them. Compared with traffic signals, roundabouts can operate with much

"At mini-roundabouts the situation is somewhat better, but all two-wheelers remain vulnerable at mini-roundabouts, mostly where deflection has not been adequately provided. The two-wheeled casualty has usually been the one with priority while the other vehicle has usually failed to yield. However, this does not mean bicyclists are in grave danger at mini-roundabouts. Correctly designed schemes have casualty rates among two-wheeled machines that are no higher than other forms of control."

Published in the February 2009 ITE Journal

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Tried these flat minis in London – found them to be much less effective

Mini Roundabouts

Hillary Isebrands, PE
FHWA Resource Center

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Design vehicle needs still have to be addressed

Source: Phil Demosthenes

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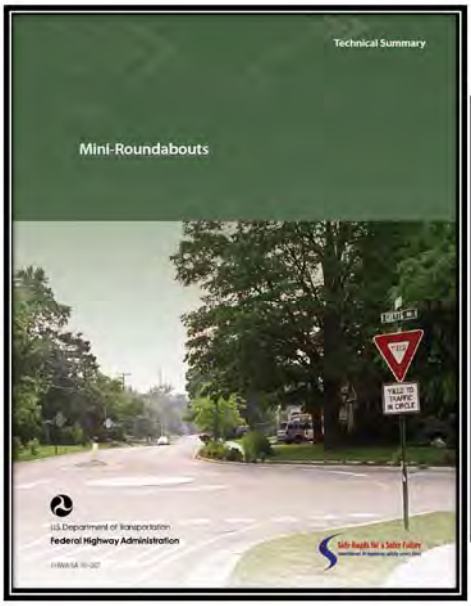
Signing for Mini Roundabout



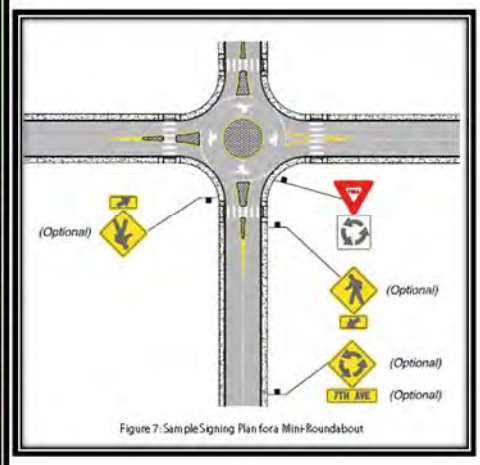


Figure 7: Sample Signing Plan for a Mini-Roundabout

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NACTO Urban Street Design Guide

"A mini roundabout on a residential street is intended to keep speeds to a minimum. Provide approximately 15 feet of clearance from the corner to the widest point on the circle"

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Aerial View (24 ft pavement)

Application Criteria

- Lower speed roads (max 35 mph).
- Total entering intersection volumes from all approaches less than 1,600 veh/hr.
- Junctions of two-lane roads.
- Junctions without nearby commercial entrances.
- Low truck and bus volumes.
- Expected lower construction costs since footprint is within existing travelway boundaries.

Perspective view of a reverse curve splitter island

FHWA Research Contract

The Federal Highway Administration (FHWA) has sponsored a research project, entitled "Field Testing, Marketing, and Crash Analyses for Mini-Roundabouts," Contract No. DTFH61-09-C-00027. The objectives of the contract include before vs. after evaluation of 10 mini-roundabouts to be implemented in the United States. FHWA is looking for Agencies who are willing to fund and construct mini-roundabouts soon. The traffic operational and safety effects of the mini-roundabouts will then be evaluated by the research team for FHWA.

Perspective view of flush approach splitter islands and flush central island with post-mounted delineators

If you wish to participate or need more information please contact:

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ram@vhb.com

Mini-Roundabouts

Properly designed modern roundabouts have been demonstrated worldwide to be effective in reducing intersection crashes. One version of roundabouts that has not yet been implemented widely in the U.S. is the mini-roundabout.

The mini-roundabout features a much smaller inscribed diameter, on the order of 50 to 80 ft, and a relatively small circular central island (e.g., 16 ft to 45 ft diameter) that is traversable. One of the promising aspects of a mini-roundabout is its small footprint and relatively low implementation cost, which allows it to be a viable treatment for urban and suburban intersections of lower speed, two-lane roads. In most cases, mini-roundabouts can fit within existing travelway boundaries. All channelizations will be added within existing boundaries.

The mini-roundabout should be primarily designed for passenger cars that are expected to use the circular roadway around the central island, which can be raised or flush. Buses and trucks may traverse over the central island to complete turning maneuvers due to restricted intersection geometry. For flush central islands, additional physical deterrent boundaries, such as raised pavement markers or rumble strips, are needed to enhance conspicuity and encourage drivers of passenger cars to stay within the circular travelway of the mini-roundabout. It is also desirable to narrow lanes to 10 ft on the approach to a mini-roundabout to ensure a reduction in speed.

U.S. Department of Transportation
Federal Highway Administration

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TRB WEBINAR PROGRAM

Mini-Roundabouts: Is the US Ready to Take Advantage of Their Benefits?

Tuesday, March 21, 2017
1:00-3:00 PM ET

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What's Important About Roundabouts at Interchanges?

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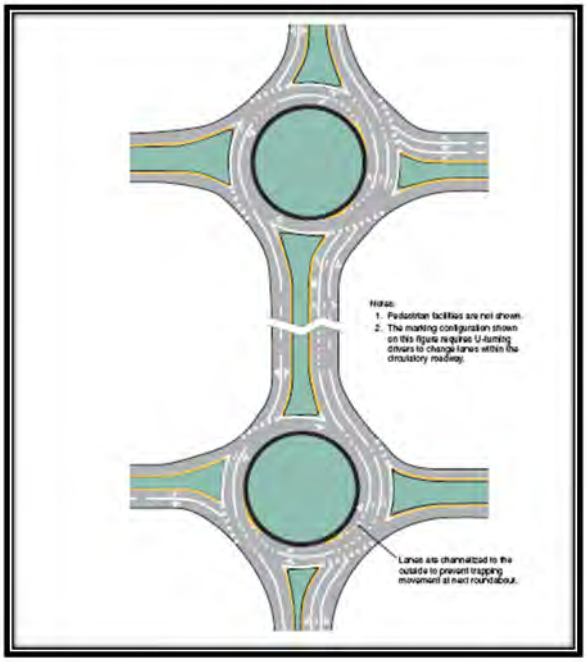
Linked Roundabouts – Usually Used at Interchanges



Source: 2009 MUTCD

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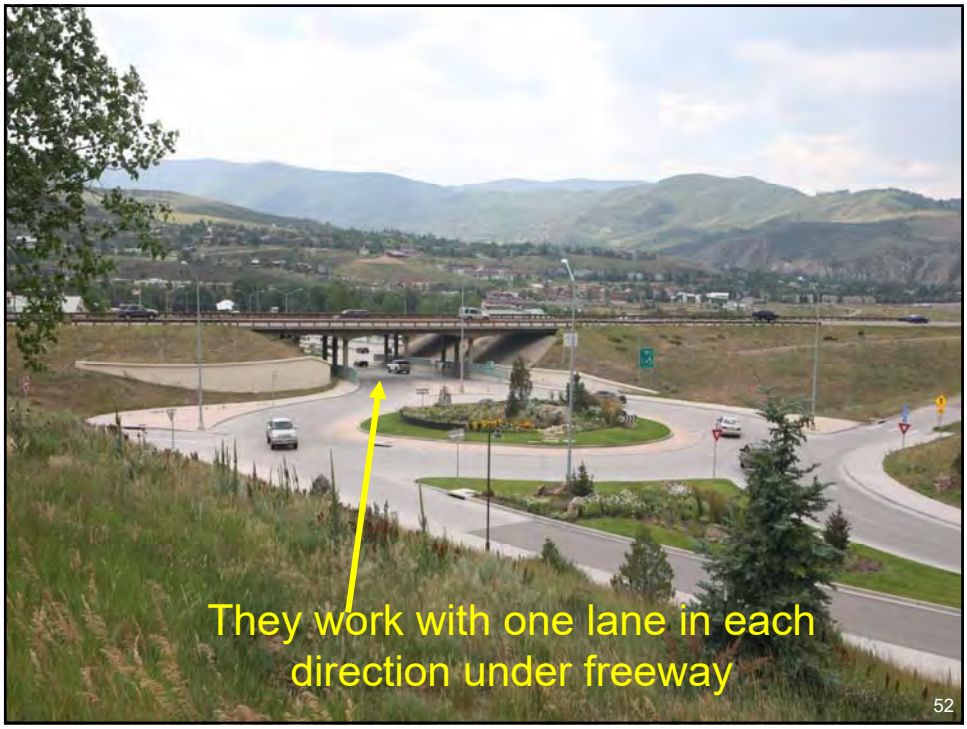

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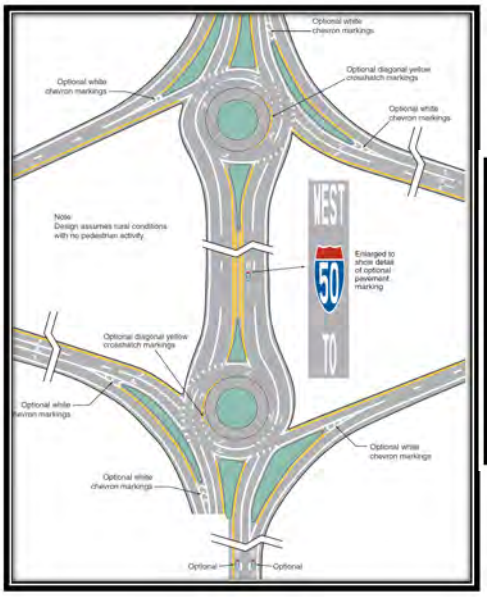

Source: 2009 MUTCD

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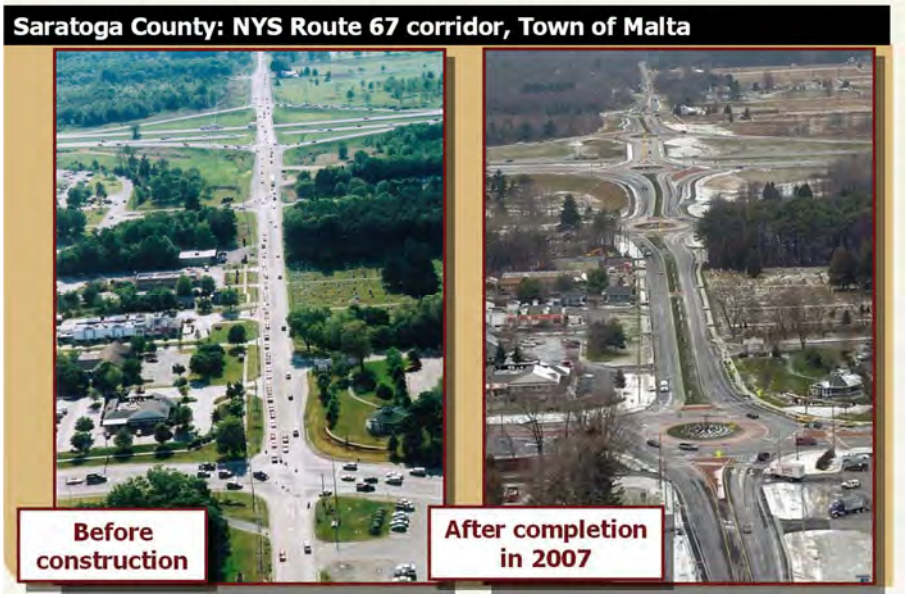
Roundabout series
Golden and Avon, CO

55



Source: NY DOT

56


Participants -what signage is most critical here?
57


Freeway Off Ramp
Participants -what signage is missing here?
58

Important Visual Cues to Minimize Wrong Way Driving

59

Roundabout Above a Freeway in Chile

60

Is Signing and Striping Effective for Approach Speed Reduction?

61

Highly Visible Chevron Signs Provide Advance Warning of Central Island

Source: www.roundabouts.us (Scott Ritchie)

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Transverse Yellow Bar Speed Reduction Markings

Source: www.roundabouts.us (Scott Ritchie)

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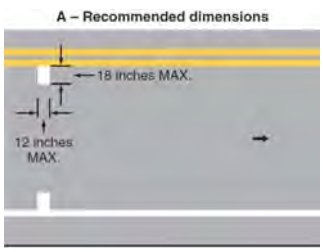
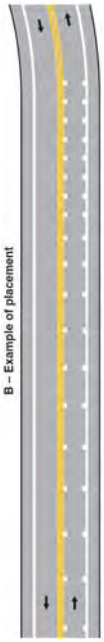
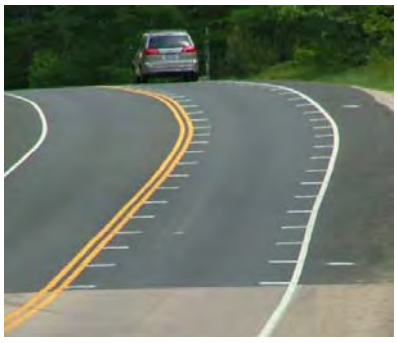
Section 3B.22 – Speed reduction markings added as an Option







Source: MUTCD

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What About Other Road Users?

65

What is Best for Bicycles?

(Source: Bicycles at Roundabouts

State of the Practice - Moule)

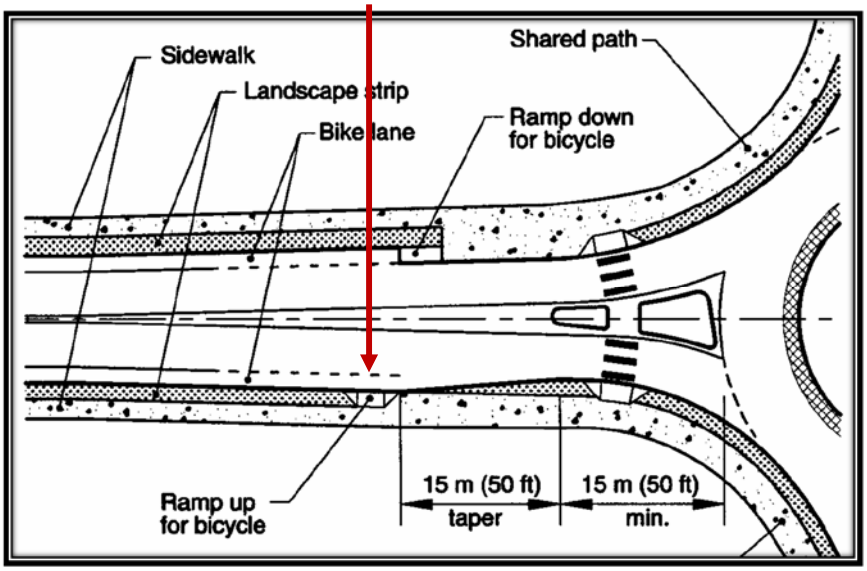
66

Some Cyclists Use the Road

67

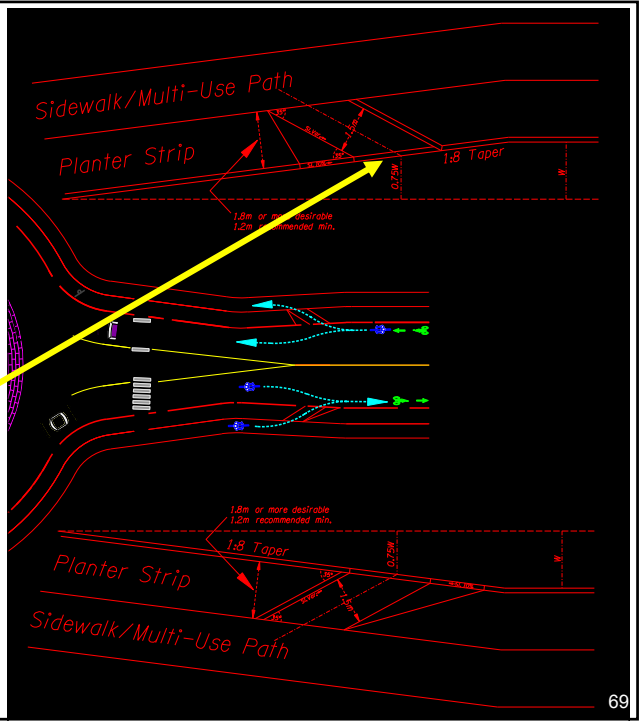
This Bike Ramp Detail

is no longer recommended



68

Oregon DOT Bike Ramp Detail

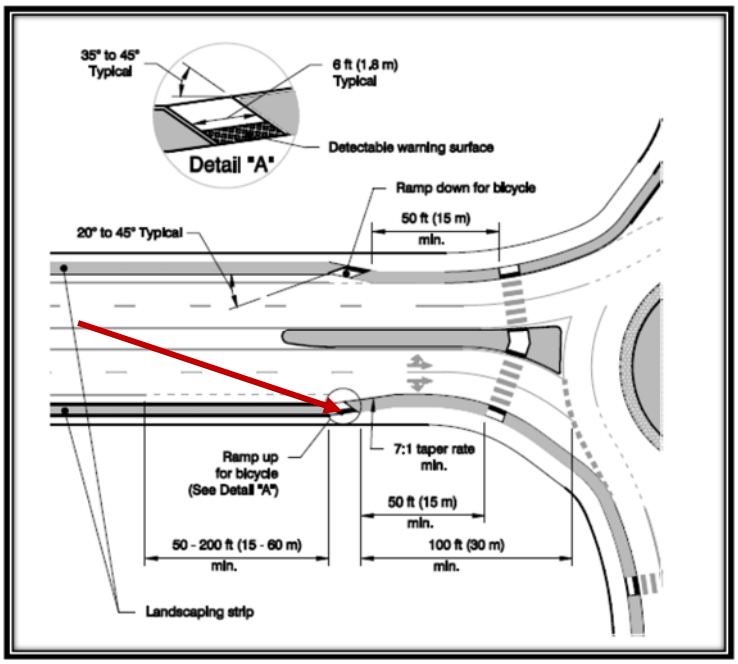


35° angle; 1:8 taper, located after taper starts

69

Ramp With ODOT Design

70

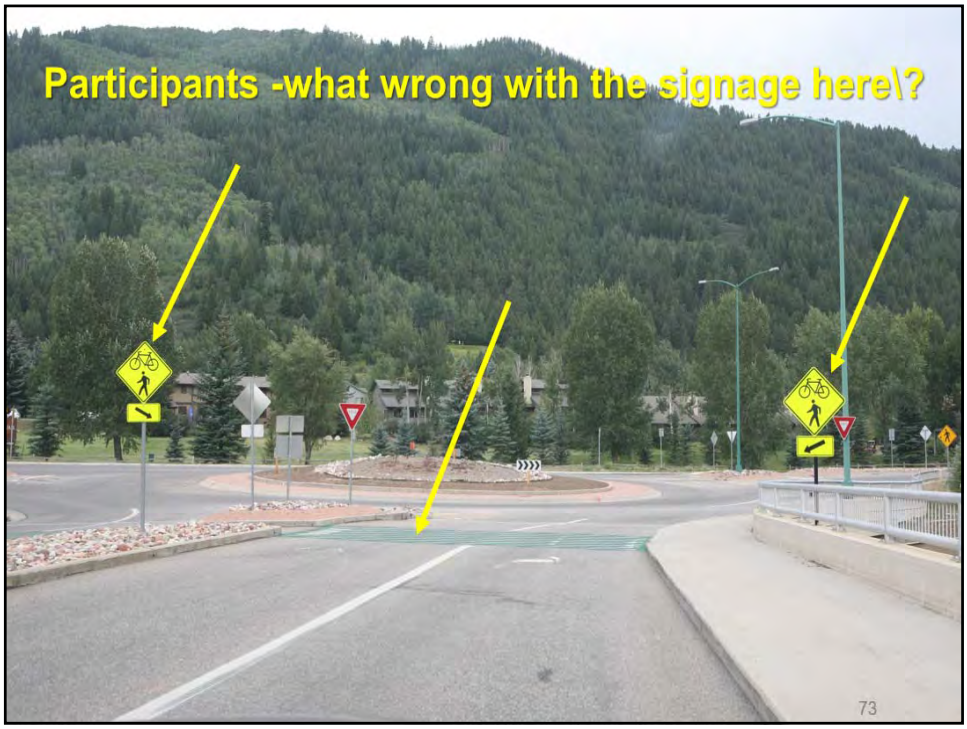


Source: NCHRP 672

71

Photo of Ramp with Wallwork Design (Grand Junction, CO)
Short Taper – Closer to Ped Ramp

72


Participants -what wrong with the signage here\?
73


Separated bike lane at a roundabout
74


Separated bike lane
75


Access ramp can serve
peds and bikes
76

Bike Roundabout, UC Davis

77

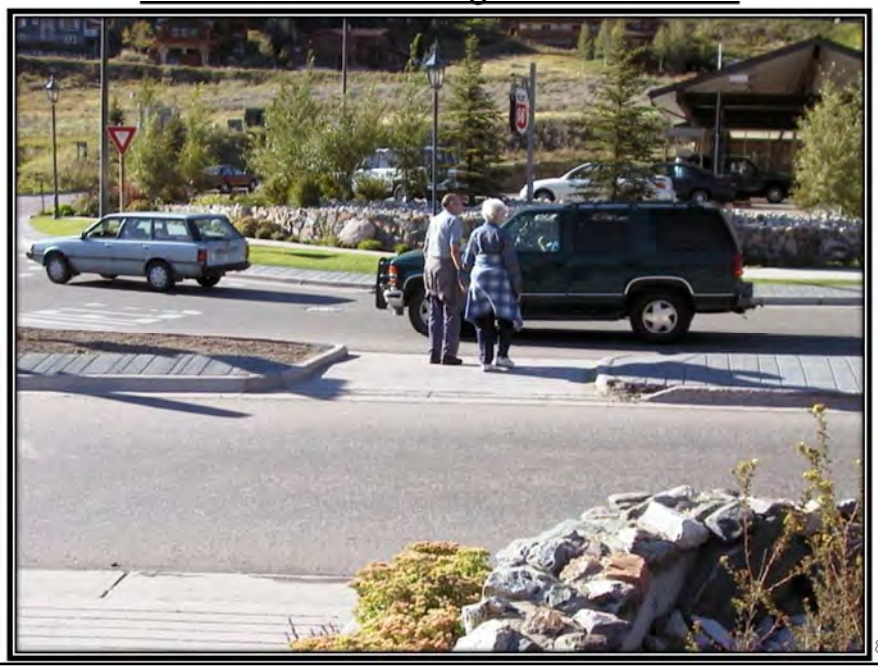
Participants – there is one sign too many – which one?

78

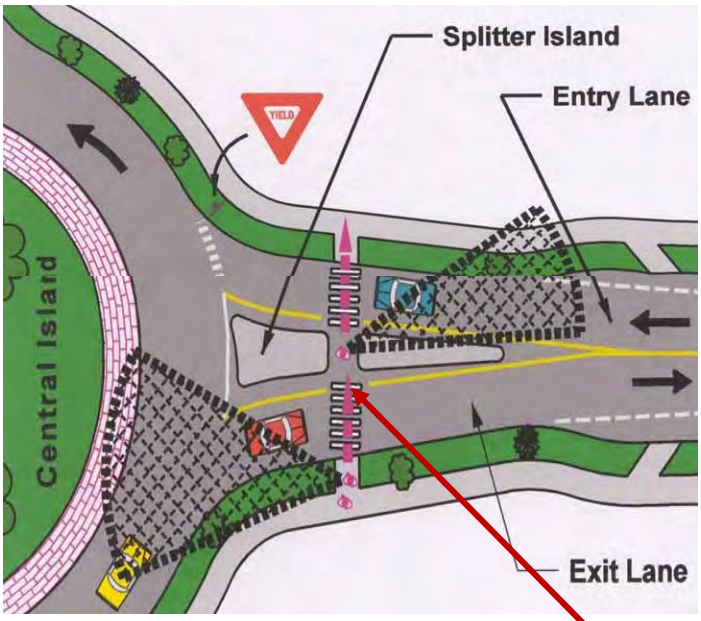
What is Best for Pedestrians?

79

Vehicles Not Yielding to Pedestrians

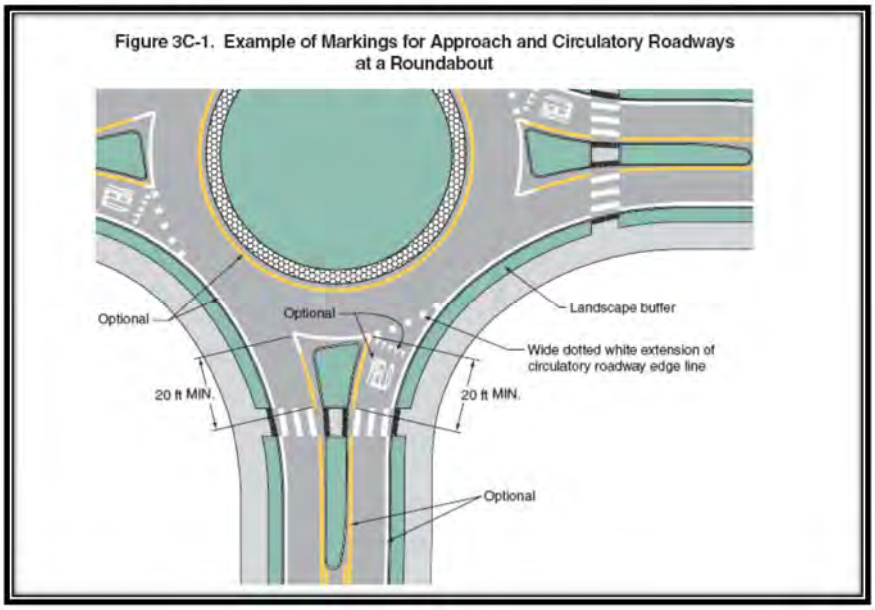


80



Pedestrians should be able to cross in two stages

81

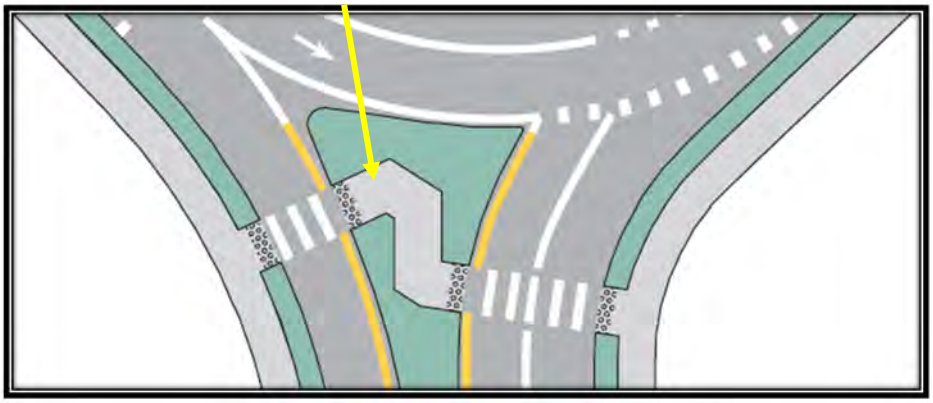


Source: 2009 MUTCD

82

Offset Crosswalks

Pedestrians cross in two stages and can make eye contact with approaching drivers



Source: 2009 MUTCD

83

84

Pedestrian Friendly Design

- Well-defined crossings; single lane preferred
- Entry speeds less than 20 mph
- One car length from the circulatory roadway
- Splitter islands; slow speeds/adequate deflection
- No pedestrian access to central island
- Prohibit parking to improve sight distance
- Signs/landscaping should not block sight distance
- Lighting illuminates roundabout and approaches

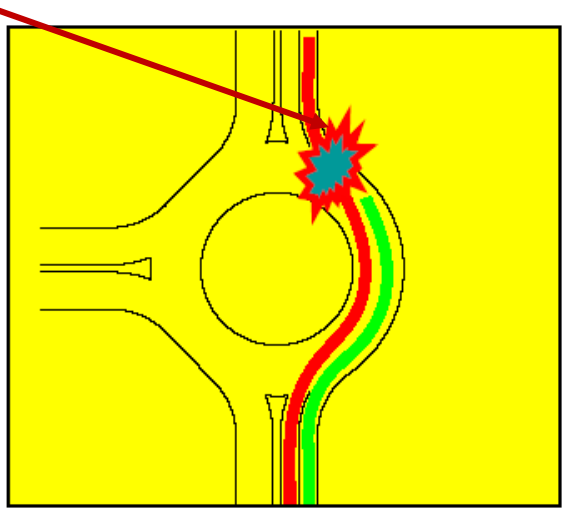
85

Pedestrian Studies

- Tight-exit design shows little benefit for pedestrians by reducing speed
- Studies in Europe show that most pedestrian crashes occur at roundabout entries
- No relationship has been reported between pedestrian collisions and exit radius.
- Both British and Australian roundabout collision studies show significant reduction in pedestrian injury and fatal collisions with roundabouts

86

Exit Crash Due to Overlap at MLR With Tight R3 Radius



Source: Alternate Design Methods for Pedestrian Safety at Roundabout Entries and Exits (Baranowski)

87

How Does a Blind Person Cross?

88

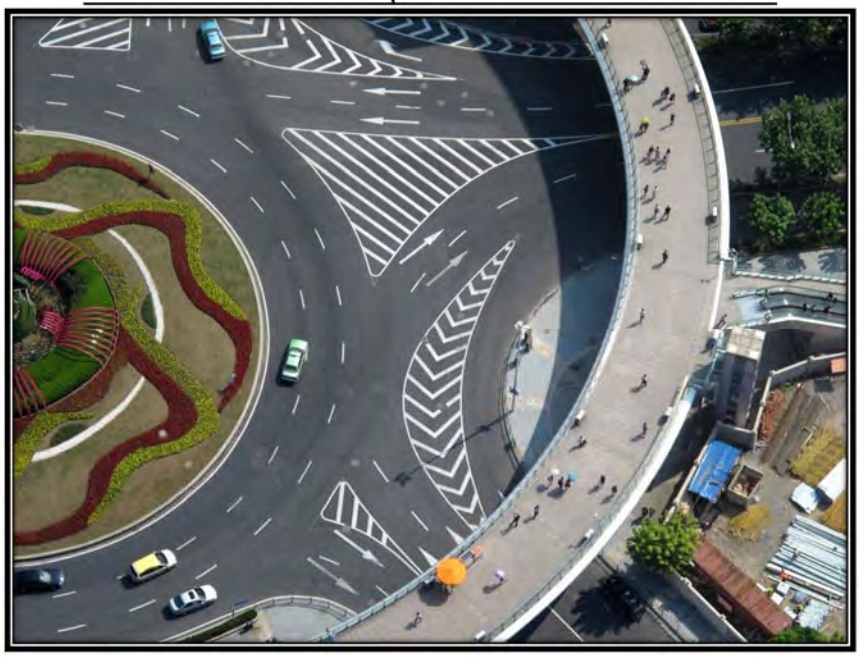
Roundabout Without Landscape Between Sidewalk and Curb Strip Does Not Provide Proper Guidance

89

Detectable Warnings at Splitter Island
Grass Landscaping Provides Guidance

90

Pedestrian Grade Separation at a Roundabout



91

Signalized Pedestrian Crossing at Roundabout

92

Question: “Is the Access Board insisting on HAWKs or some kind of pedestrian signals on the approaches to two lane roundabouts. Are there any updates to the NCHRP reports on accessible crossings at roundabouts?”

Response: “The Access Board is requiring that all crossings be accessible. The proposed rule says a "pedestrian-activated signal" which the HAWK, with accessible pedestrian signals installed, would meet.

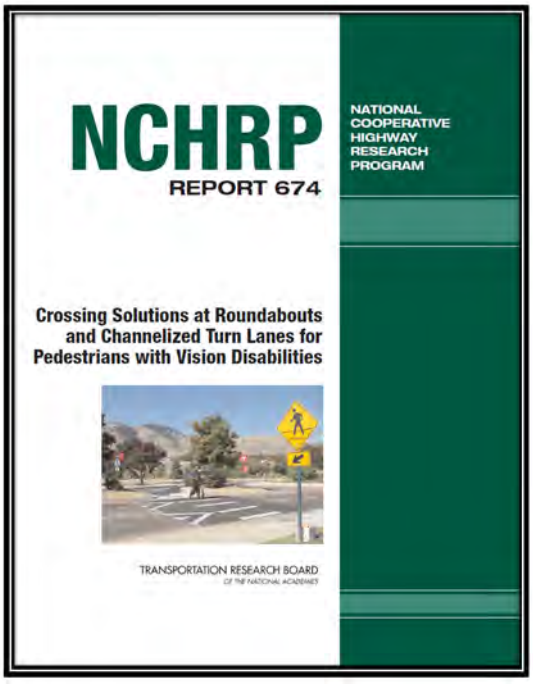
As has been true all along, an agency can use some other treatment that provides access that is equivalent under the "equivalent facilitation" provisions of the ADA regs.

And NCHRP 3-78b project was charged with providing guidance on a range of treatments for making roundabouts accessible.”

Report has been published as NCHRP Report 674

Janet Barlow
Barlow Design
About Accessible Design for the Blind

93



Raised Crosswalks

Pedestrian Hybrid Beacons

RRFBs? – Not confirmed yet

94

U.S. Department of Transportation
Federal Highway Administration

Pedestrian and Bicycle Information Center

Pedestrian Safety and Accessibility Considerations at Modern Roundabouts

Presented by:

Dr. Bastian Schroeder
Institute for Transportation Research and Education (ITRE) at North Carolina State University

Dr. Hillary Isebrands
Safety and Design Technical Service Team, FHWA Resource Center

March 7, 2012

95

"Specifically, a ped/bike crossing that **starts in the island** has a higher probability for a driver yielding

If **the vehicle is exiting the roundabout,** there is a lower probability the driver will yield.

We can hypothesize the following explanations:

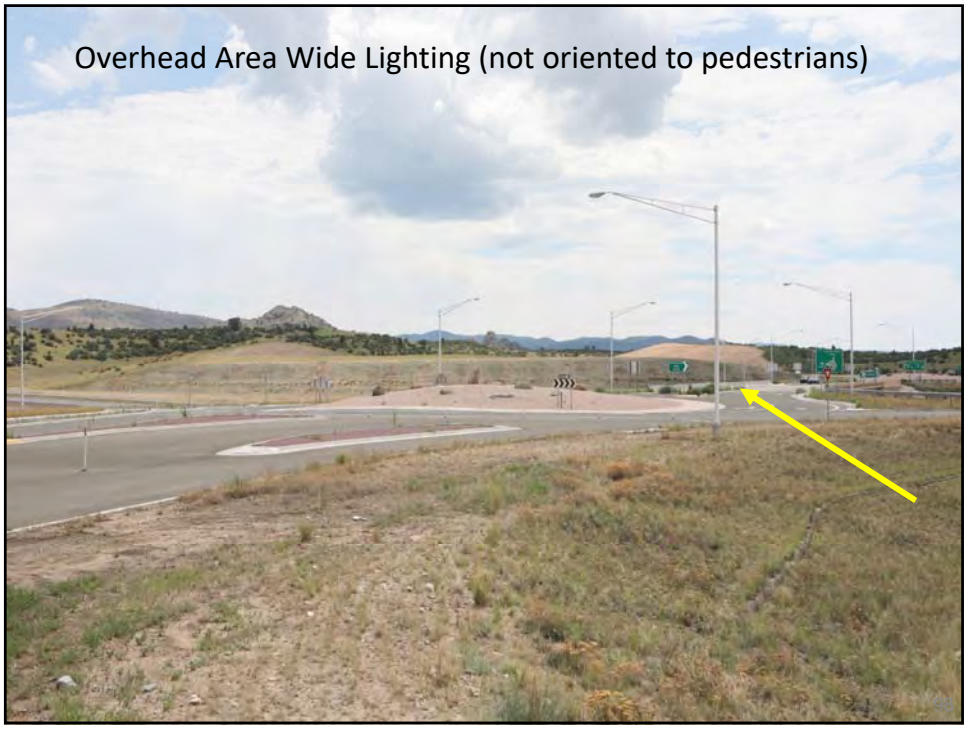
In the case of the pedestrian being in the island any ambiguity of his or her intention to cross is reduced, so drivers are more obliged to yield.

In the case of the vehicle direction, the result may be indicative of increased pressure on the part of the driver to clear the roundabout as soon as possible, and therefore selecting not to yield to the pedestrian."

96

What Kind of Illumination Should a Roundabout Have?

97



Light Levels for Roundabouts

Type of Lighting Assembly	Typical Wattage	Typical Distribution	Common Mounting Height
Cobra-style	75 W–400 W HPS	Type II or III (full or semi cutoff)	30 to 50 ft (9 to 15 m)
Ornamental	75 W–200 W HPS	Type V (360° spread)	14 to 20 ft (4 to 6 m)
High-Mast	400 W–1,000 W HPS	Type V (360° spread)	50 to 100 ft (15 to 30 m)

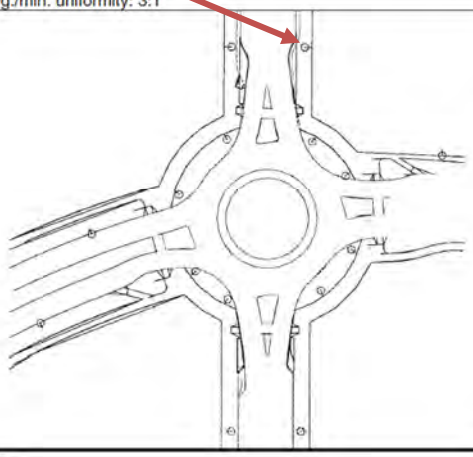
W = watts; HPS = High Pressure Sodium
Source: Kansas Roundabout Guide (*9*)

99

Inscribed Circle Diameter:	140 ft (43 m)
Equipment:	Cobras over circulatory roadway: 200 W HPS, Type M-C-III, 30 ft (9.1 m) mounting height Pedestrian-level luminaires: 200 W HPS, Type V,14 ft (4.3 m) mounting height
Photometric Requirements:	Avg. illuminance: 2.0 fc (20 lux) Avg./min. uniformity: 3:1
Layout:	

Source: Kansas Roundabout Guide (*9*)

100

Inscribed Circle Diameter:	120 ft (37 m)
Equipment:	Pedestrian-level luminaires: 250 W HPS, Type V, 18 ft (5.5 m) mounting height
Photometric Requirements:	Avg. illuminance: 2.7 fc (27 lux) Avg./min. uniformity: 3:1
Layout:	

Source: Kansas Roundabout Guide (*9*)

101

Developing Effective Standards and Guidelines for Roundabout Lighting

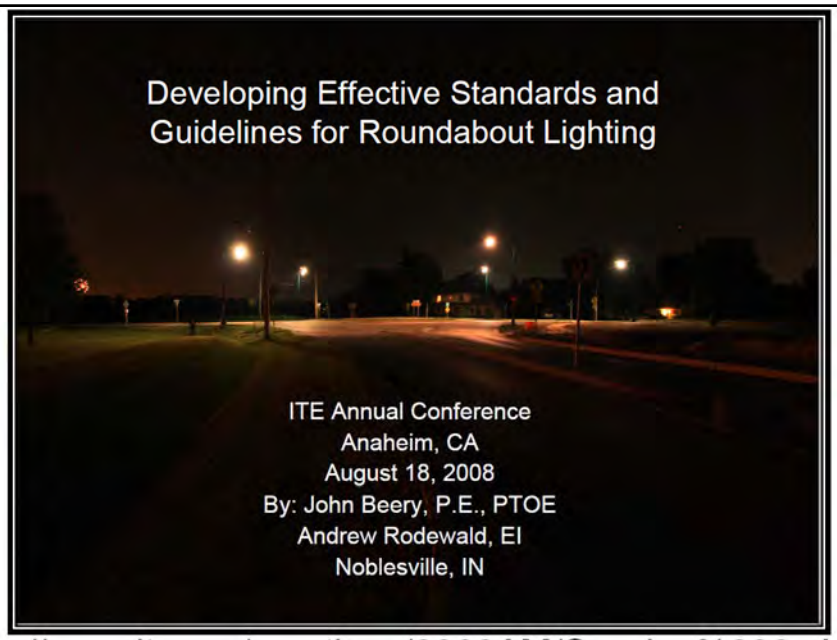
John Beery, P.E., PTOE and Andrew Rodewald

1. Identify and establish a standard luminaire and mounting height to provide consistent and cost effective illumination. Attempt to accommodate both aesthetics and function.
2. Establish preliminary lighting locations adjacent to the conflict points of the roundabout, including crosswalks.
3. Single lane roundabouts can typically be lit from the exterior of the intersection. Two-lane roundabouts typically require pole placement within the inner circle near the 45°, 135°, 225°, and 315° points for the inner circle conflict points.
4. Two-lane roundabouts may require closer pole spacing or more intense luminaires when lit from the inner circle to improve intensity and to reduce the number of lights.
5. Observe IES guidelines for illumination levels based on the type of intersection.
6. Adjust the type of pole, its location, and the base depending on clear zone requirements

102

Pedestrian Oriented Lighting at Crosswalks – Slightly Ahead of the Crosswalk is Preferred

103



http://www.ite.org/meetings/2008AM/Session%202_John%20M.%20Beery.pdf

104


Participants -what is broken here?
105


And Here?
106

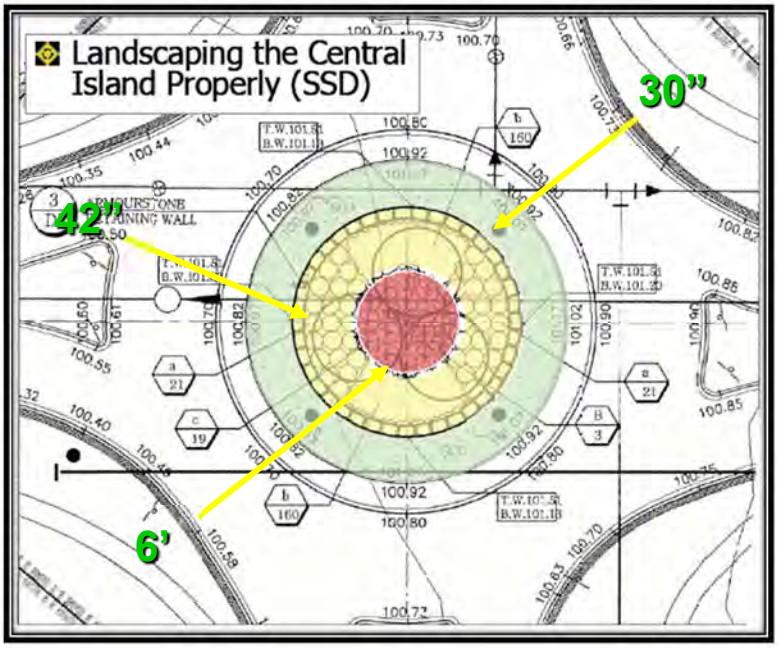
Does Landscaping Matter?

107

Why Provide Landscaping?

- Make the central island more conspicuous
- Improve the aesthetics of the area
- Minimize introducing hazards to the intersection
- Avoid obscuring roundabout or the signing to the driver
- Maintain adequate sight distances – Fire Departments want it!
- Clearly indicate drivers not to pass straight through
- Discourage pedestrian traffic through the central island
- Help visually blind pedestrians find sidewalks/crosswalks

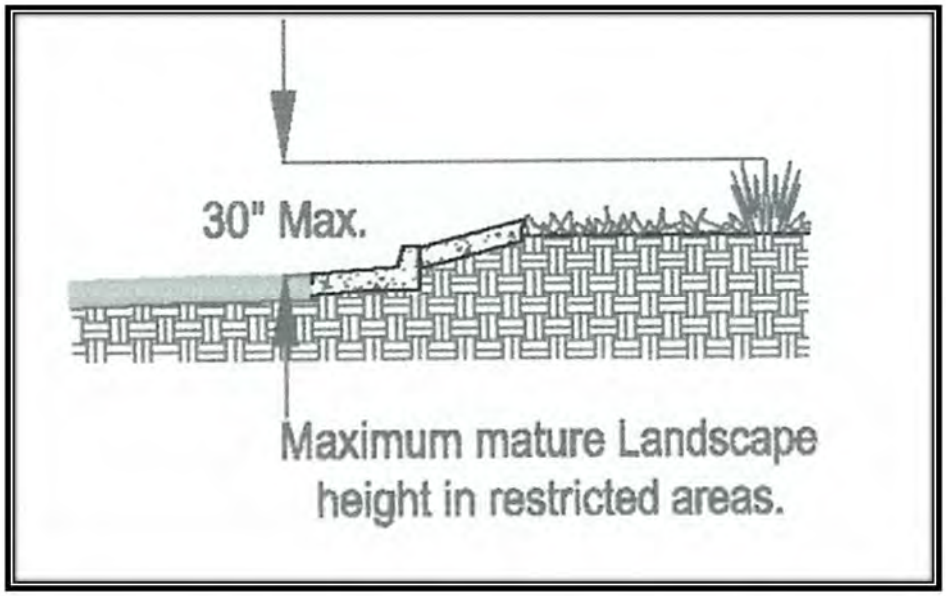
108



Source: www.roundabouts.us (Scott Ritchie)

109

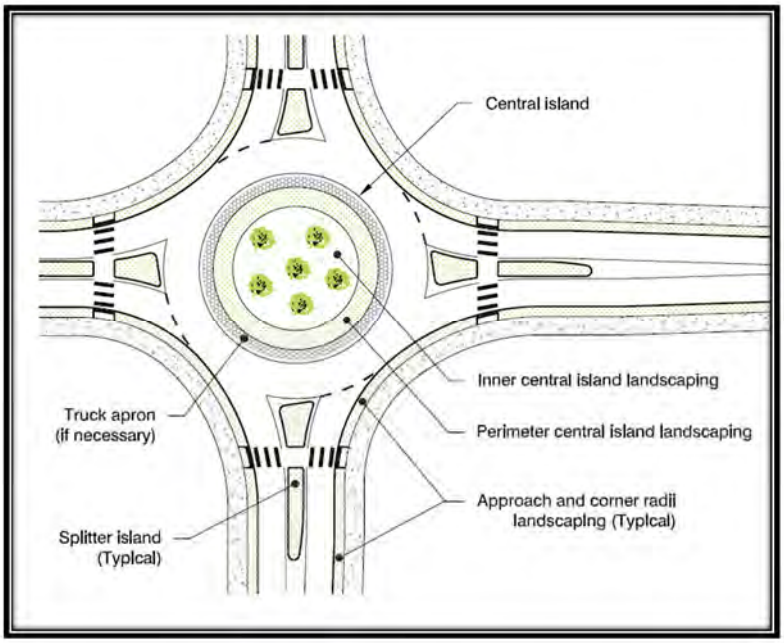
Curbing and Planting Detail



Source: Roundabout Design Standards - City of Colorado Springs

110

Landscaping Zones (NCHRP 672)



111

Landscaping Design For Roundabouts

Source: www.roundabouts.us (Scott Ritchie)

112

What about Emergency Vehicles?

114

Fire Departments Uneasy about Roundabouts

Source: Omni Means to City of La Quinta

115

What is a Roundabout?

A roundabout is a type of circular intersection, but is quite unlike a neighborhood traffic circle or large rotary. Roundabouts have been proven safer and more efficient than other types of circular intersections.

Figure 1. Modern Roundabout Schematic

Roundabouts have certain essential distinguishing features:

- **Counterclockwise Flow.** Traffic travels counterclockwise around a center island.
- **Entry Yield Control.** Vehicles entering the roundabout yield to traffic already circulating.
- **Low Speed.** Curvature that results in lower vehicle speeds (15-25 mph) throughout the roundabout.

FHWA identified roundabouts as a **Proven Safety Countermeasure** because of their ability to substantially reduce the types of crashes that result in injury or loss of life. Roundabouts are designed to improve safety for all users, including pedestrians and bicyclists. They also provide significant operational benefits compared to conventional intersections.

On average, roundabouts reduce severe crashes – those resulting in injury or loss of life – by 78-82%[1]

[1] Highway Safety Manual, American Association of State Highway and Transportation Officials, Washington, DC, 2010

Educational Resources

Wisconsin Guidance on Reacting to Emergency Vehicles in Roundabouts
http://dot.wi.gov/safety/motorist/roaddesign/roundabouts/docs/br-emergencyveh.pdf

Minnesota DOT Roundabout Animation
www.dot.state.mn.us/roundabouts/emergency.html

Washington State DOT Videos on Roundabouts and How to Drive Them
https://www.youtube.com/watch?v=P1k85u55-EE
http://www.youtube.com/watch?v=-MywmtskFiii

British Columbia MOT Video on Navigating a Roundabout with Emergency Vehicles
https://www.youtube.com/watch?v=Tk9n1uAlaRI.E

Strengthening Partnerships

Incorporating EMS into Strategic Highway Safety Plans
http://safety.fhwa.dot.gov/hsip/shsp/ems/connection/

For More Information

Jeffrey Shaw, P.E., PTOE, PTP
FHWA Office of Safety
708.283.3574 or jeffrey.shaw@dot.gov

Hillary Isebrands, P.E., PhD
FHWA Resource Center
720.963.3222 or hillary.isebrands@dot.gov

To learn more about roundabouts, please visit:
safety.fhwa.dot.gov

Publication number: FHWA-SA-14-068

U.S. Department of Transportation
Federal Highway Administration

ROUNDABOUTS
& First Responders
Saving Lives Together

116

Are Aesthetics Important?

117

Roundabouts – High End Aesthetics

118


Jurassic Roadrunner with lighting helps with conspicuity
119


ONE WAY
120

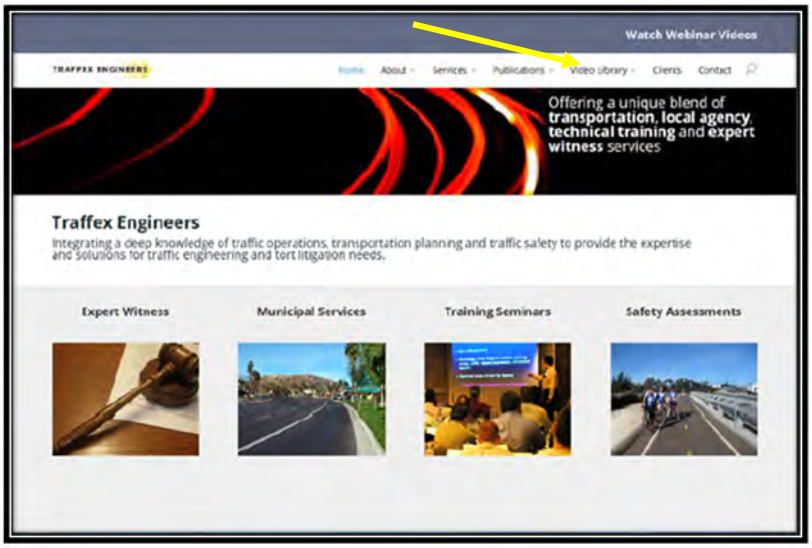
Are Roundabouts Compatible with Railroad Crossings?

121

122

123

www. traffexengineers.com



124


Forty long freight trains per day close the crossing backing traffic up into the roundabout
125


Producers
RR
126

Light Rail Thru Roundabout in Utah

127

What About Snow Removal and Work Zone Traffic Control?

128

"Snow Removal from Center Island Outward" - (NCHRP 672)

Source: Roundabouts and Light Rail: An Innovative Intermodal Solution (Baranowski)

"Study on the Securement of Smooth Traffic Flow on Roundabouts in Cold, Snowy Regions"

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Work Zone Traffic Control

- With all traffic diverted away from the work area
- With some traffic diverted, or
- Under full traffic
- Example from Chapter 10 of NCHRP 672 shows stage construction with roads partially open

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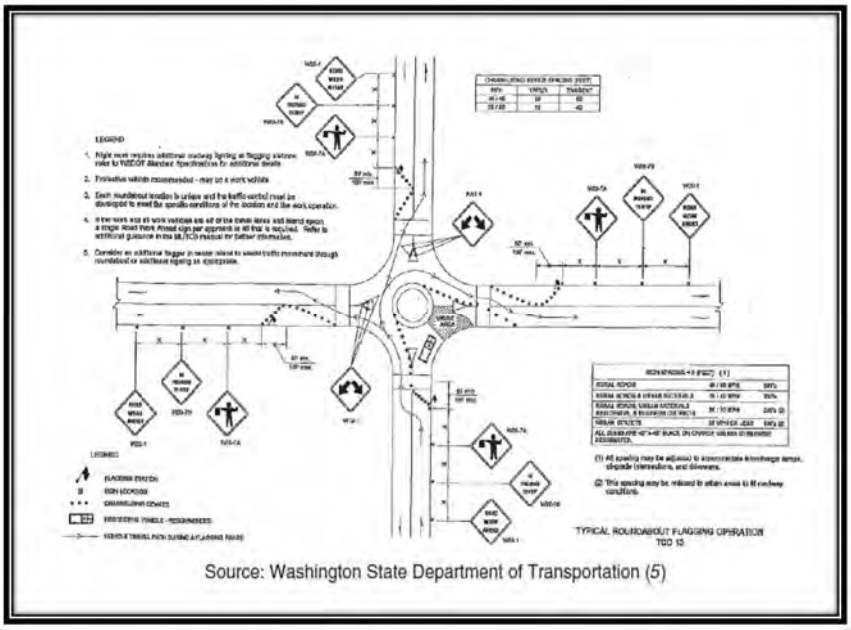
Maintenance Project Staging Area (NCHRP 672)



Source: Washington State Department of Transportation (5)

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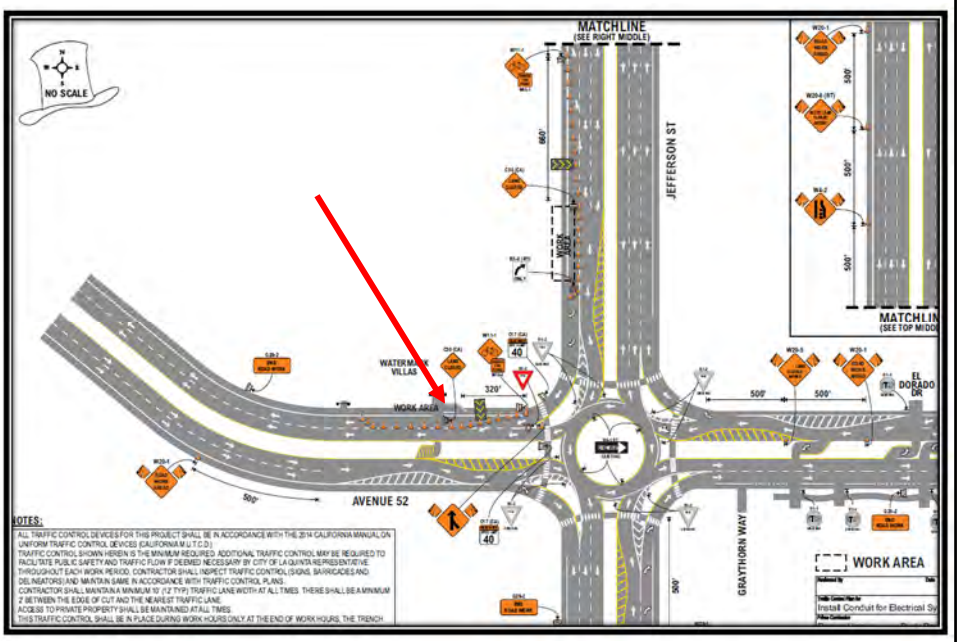
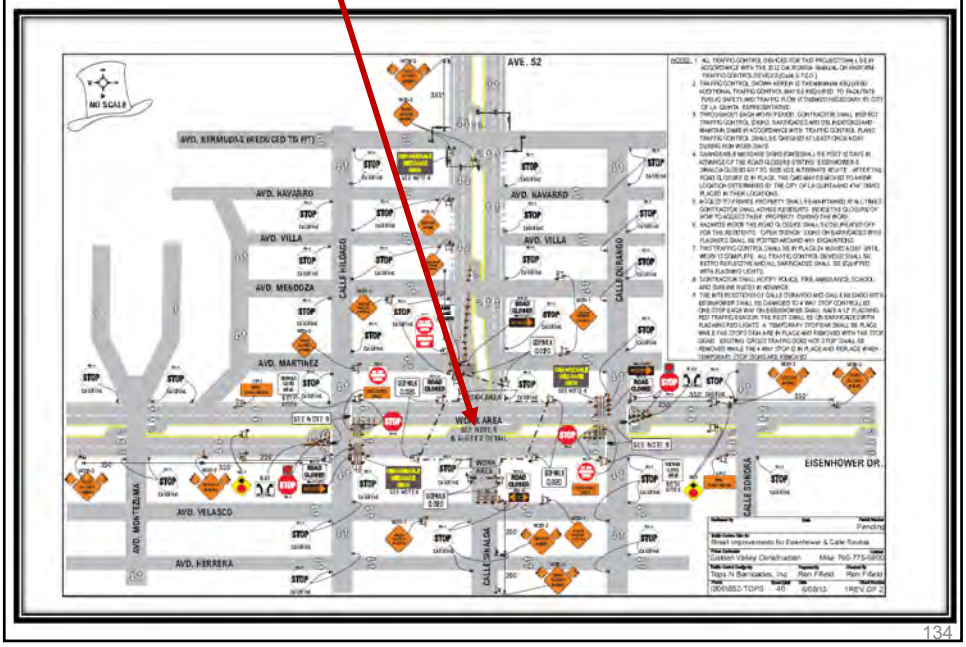


133

Full Road Closure for Construction of Roundabout



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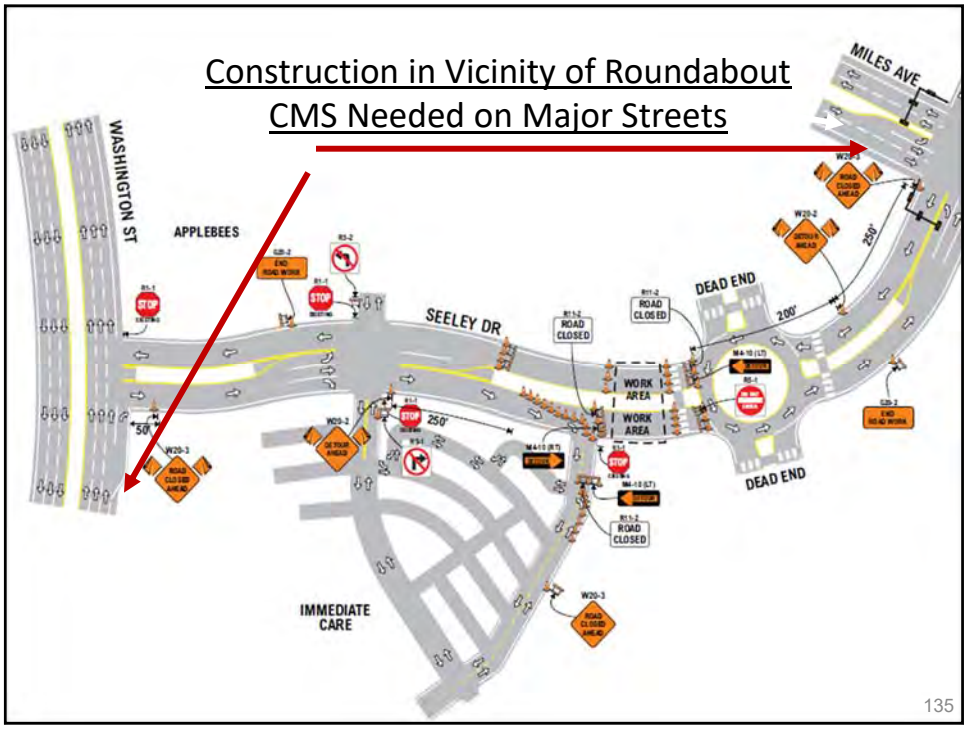

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CASE STUDIES

136

Case Study I

(Calle Sinaloa and Eisenhower Drive)

137

City Council Decides

138

Discussion Topics

- Safer & Continuous Flow
- Less Pollution
- Allows for Art & Landscaping
- Reduced Electrical Costs
- Reduced Maintenance Costs
- Residence on four corners favor roundabout

139


La Quinta Public Works Director Tim Jonasson (left) and engineer Bryan McKinney show residents on Thursday a plan for a proposed roundabout at Eisenhower Drive and Calle Sinaloa at the entrance of the La Quinta Cove.

City proposal for roundabout gets mixed reviews

Some Cove residents express doubts, but others like the plan

By Nicole C. Brambila
The Desert Sun

LA QUINTA — Cove residents got a first-time look Thursday at a proposed roundabout near the entryway of their neighborhood.

Reaction to the new road design at Eisenhower Drive and Calle Sinaloa, which would replace a four-way stop, was mixed.

Donna Osborne said she prefers a traffic signal at the busy neighborhood intersection.

Paul Luna said he wants the roundabouts, which are are widely used throughout Europe.

Camilla Rojas said she doesn't want either.

"I don't think it would work in a residential area," Osborne said. "It seems like it's already a done deal, that we don't get any say-so."

About a dozen people turned out for an informal meeting with city staff to go over the proposed roundabout and possible landscape designs. One includes a piece of art that would function as an entryway into the cove.

La Quinta staff has worked for more than a year to create the roundabout, which would slow drivers to about 25 mph as they approach one of two streets.

The roads, which require approaching vehicles to slow down and yield to circulating traffic, are becoming more popular in the United States.

Please see ROUND, B8

The plan envisions a roundabout to replace the four-way stop at Eisenhower Drive and Calle Sinaloa.

ROUNDABOUT IN THE COVE

To see animation of the proposed roundabout at Eisenhower Drive and Calle Sinaloa, go to www.la-quinta.org/index.aspx?page=26.

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Calle Sinaloa/Eisenhower Roundabout

NOTICE OF INTENT TO START WORK

The Calle Sinaloa/Eisenhower Roundabout is scheduled to begin construction in Mid-June to Early-July of 2013.

The City of La Quinta is currently in the process of awarding contracts and scheduling the work. The Contractor is currently creating the schedule and planning the traffic control plan, closures, and detours.

City staff may be contacting you in the next few weeks to discuss the project and access to your residence. If you have any questions, please feel free to contact Bryan McKinney at (760)777-7045 or Leonard R. St. Sauver at (760)777-7048.

Thank You

The City of La Quinta Public Works Department

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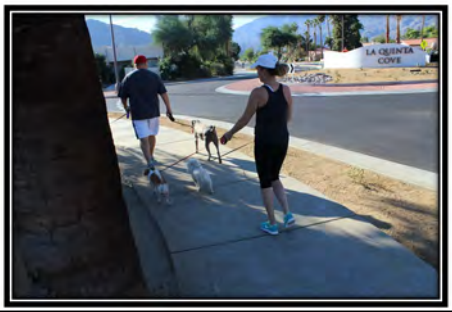
142


During
143


After
YIELD
YIELD
Source: Leonard St. Sauver
144

145



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What Lessons Learned?

- New roundabouts can be drunk driver traps
- Roundabout designer reviews final plans
- Final audit once roundabout is constructed is good idea
- Check chevron signs to make sure located correctly
- Consider installing ped crossing signs in splitter island
- Consider not installing diagrammatic signs in residential areas
- Be ready for comments from detractors and supporters

147

148


149


Check Visibility at Night
02 02 2016
150

Case Study II

Auto Center Drive

151

Problems with Roundabout

- Non compliant signings and markings
- Signing inconsistent among the four approaches
- Very wide circulatory roadway
- 90 degree parking in the roundabout
- Use of brick pavers in circulatory roadway
- No proper consideration for pedestrians
- Signed and Stamped Made Design Plan Prepared Before Changes

152


15
MPH
Participants -what is wrong here?
153


Circulatory Road 40 feet wide
Participants -what is wrong here?
154


20 mph advisory
sign added
After
155


After
156

Case Study III

A Troubled Mini

157

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Best Sources of Information

- Roundabout Guide – NCHRP Reports 572/672
- NCHRP Report 674 on Pedestrian Crossing Solutions at Roundabouts
- Florida, Kansas, Oregon and New York Roundabout Guides
- Section 915 of the WSDOT Design Manual
- TRB Roundabout Conference Carmel, Indiana, 2011

http://www.teachamerica.com/RAB11/

Kansas City, 2008: http://www.teachamerica.com/RAB08/

- Webinar Reference List

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More Information on Web Sites

NYSDOT
www.dot.state.ny.us/roundabouts/round.html

Arizona DOT
www.dot.state.az.us/CCPartnerships/Roundabouts/index.asp

Kansas State University
www.ksu.edu/roundabouts/

Florida DOT
whttp://www.dot.state.fl.us/trafficoperations/Research/pdf/Florida_Roundabout_guide_2nd_Ed.pdf

Maryland DOT www.sha.state.md.us/safety/oots/roundabouts/index.asp

Oregon DOT
www.odot.state.or.us/techserv/engineer/pdu/Roundabouts/Rndbt index.htm

Federal Highway Administration www.fhwa.dot.gov
www.tfhrc.gov/safety/00068.htm

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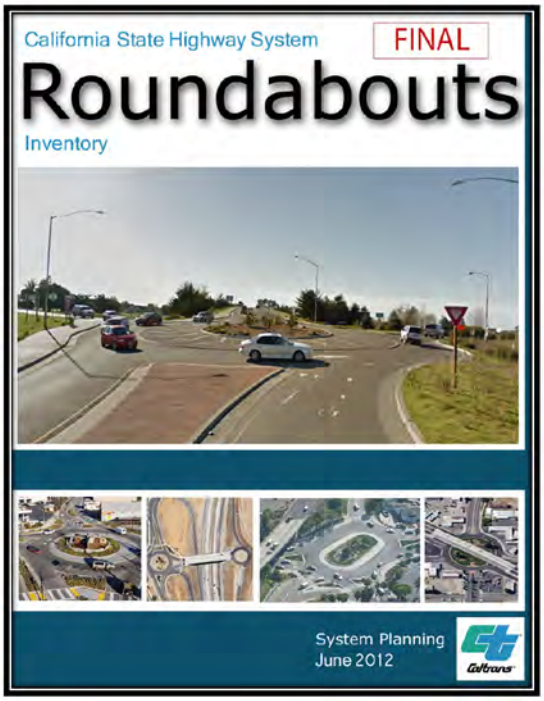

Very Recent Report Providing:

✓ Benefits of Roundabouts

✓ Typical Roundabout Designs

✓ Roundabout Geometric Standards

✓ Existing Roundabout Descriptions and Photos

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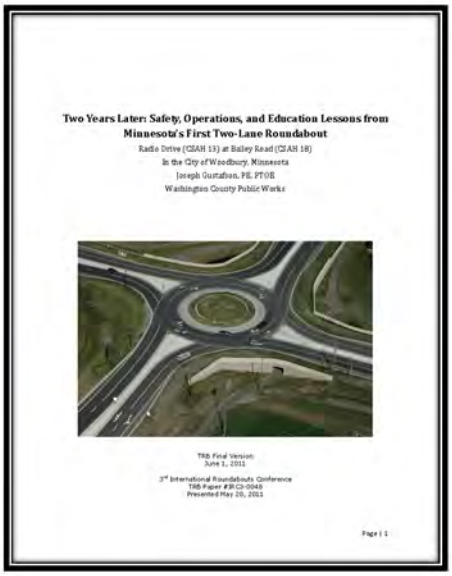

"Other recommendations for future multi-lane roundabout projects would include the following:
1. Never characterize roundabout entries and exits as right turns, either verbally or in print, unless
a driver is actually making a right turn, such as entering northbound and departing eastbound.
a. Do not use right turn arrows on approaches to single-lane roundabouts.
b. Do not stripe across the exits of roundabouts.
c. Do not recommend that drivers use a right turn signal to exit a roundabout.
2. Ensure that proper striping is available upon the opening of a roundabout to traffic.
3. Be aware of other circular-shaped intersections, both locally and elsewhere, that may shape
driver perceptions of proper behavior at a roundabout.
4. Avoid providing more capacity than is needed. Doing so may increase drivers entry speeds and increase the potential for improper lane use maneuvers.
5. Work closely with other agencies, driver educators, and local media to ensure that a consistent message is shared with the public."162

Future Webinars

Pedestrian and Bicycle Safety Assessment Studies	**Thursday, August 17, 2017 | 12:00 p.m. - 1:30 p.m. Eastern Time**
Roadway Geometric Design for Improved Safety and Operations	Friday, September 8, 2017 | 11:30 a.m. - 1:00 p.m. Eastern Time
Work Zone Temporary Traffic Control	Friday, September 15, 2017 | 12:00 p.m. - 1:30 p.m. Eastern Time
Traffic Calming: The Lumps and the Bumps	Friday, September 22, 2017 | 12:00 p.m. - 1:30 p.m. Eastern Time

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