KITTELSON & ASSOCIATES

TRENDS IN ROUNDABOUT DESIGN & IMPLEMENTATION

Online Education Series
#KittelsonPlusPerspectives

HOUSEKEEPING

MUTED

All attendees are muted

QUESTIONS?

Submit questions through the questions box throughout the presentation and
we'll field them at the end

Take the follow-up survey for **PDH** forms!

WEBINAR PREVIEW

WHERE WE CAME FROM

- Roundabouts: An Informational Guide (2000)
- NCHRP Report 672: Roundabouts: An Informational Guide, Second Edition (2010)
- Many other research efforts, guides, and publications…

MASSDOT'S ROUNDABOUT GUIDE

- Advancing innovations in bicycle and pedestrian design, especially for those with visual disabilities
- Updating language about designing for and accommodating large vehicles

STREAMLINING ROUNDABOUT IMPLEMENTATION

- Maintaining key roundabout design principles while seeking creative implementation strategies, resulting in limited utility, environmental, and right-of-way impacts

INTRODUCTION

Krista Purser

Engineering Associate
Portland Office

Roundabouts, transit planning, bikeshare site design, and more

My First “Roundabout”

My First Roundabout

My First Roundabout-Inspired Bulletin Board

ABOUT KITTELSON

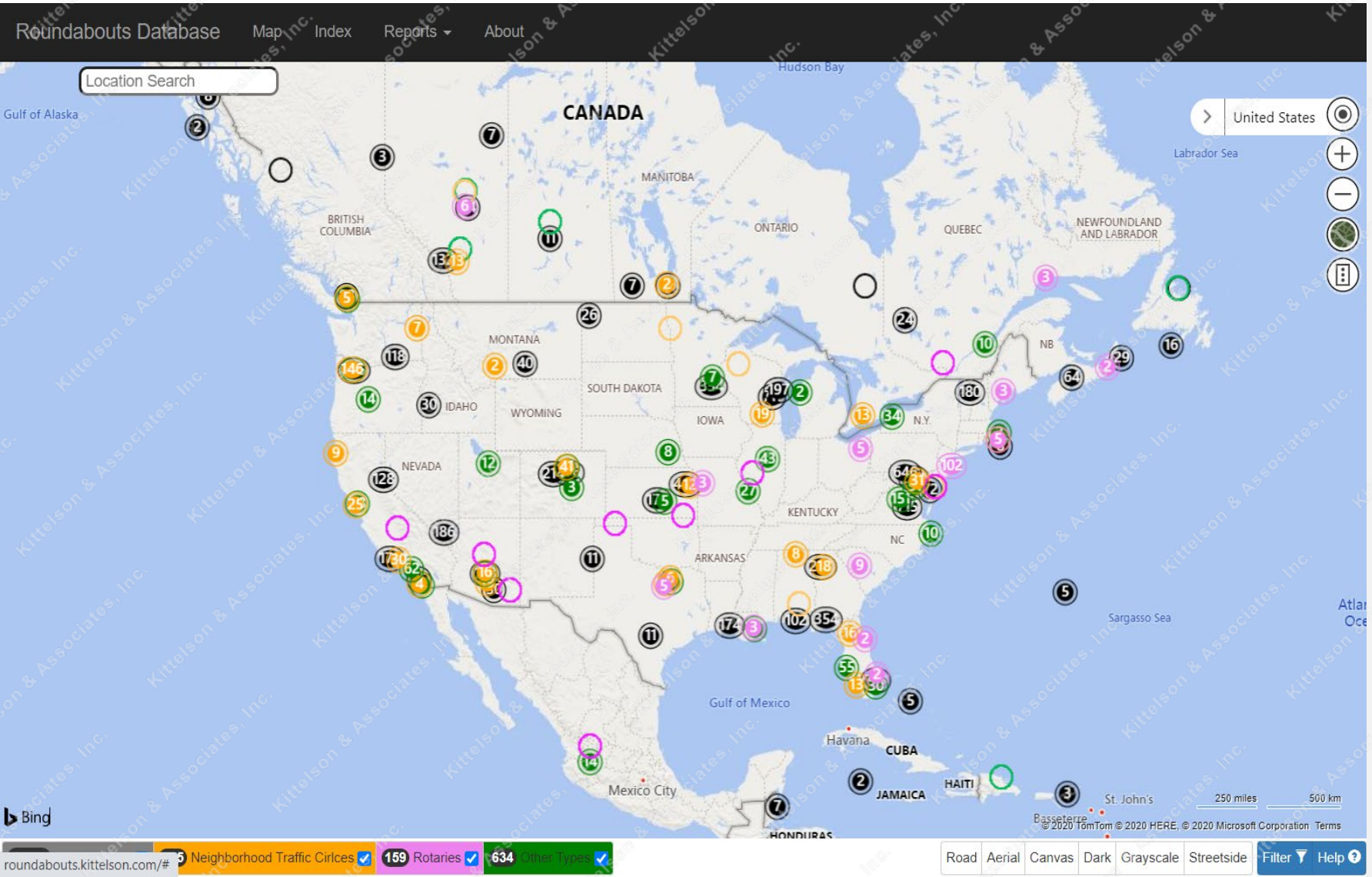
250+
transportation professionals

26
offices

Providing engineering, planning, and research services to both public and private organizations

We’re practitioners but 20% of our work is applied research—from the Highway Capacity Manual to roundabout guides

ROUNDABOUT DATABASE



Lee Rodegerdts, Principal Engineer at Kittelson, has been curating this database since 1997

Launched as a public service and an outgrowth of the research project that created the first edition of *Roundabouts: An Informational Guide*

roundabouts.kittelson.com

POLL

How many roundabouts are in the United States (through 2019)?

ROUNDABOUT DATABASE

71%
of roundabouts in the database are single-lane

64%
of roundabouts have four legs

32%
of roundabouts have three legs

Less than
5%
everything else

Database has coverage of Canada and expanding to other countries

Contributions from volunteers, including 2,700 from one “super user” volunteer

Looking to machine learning to expand database to worldwide

INTRODUCING

Radu Nan

Associate Engineer
Boston Office

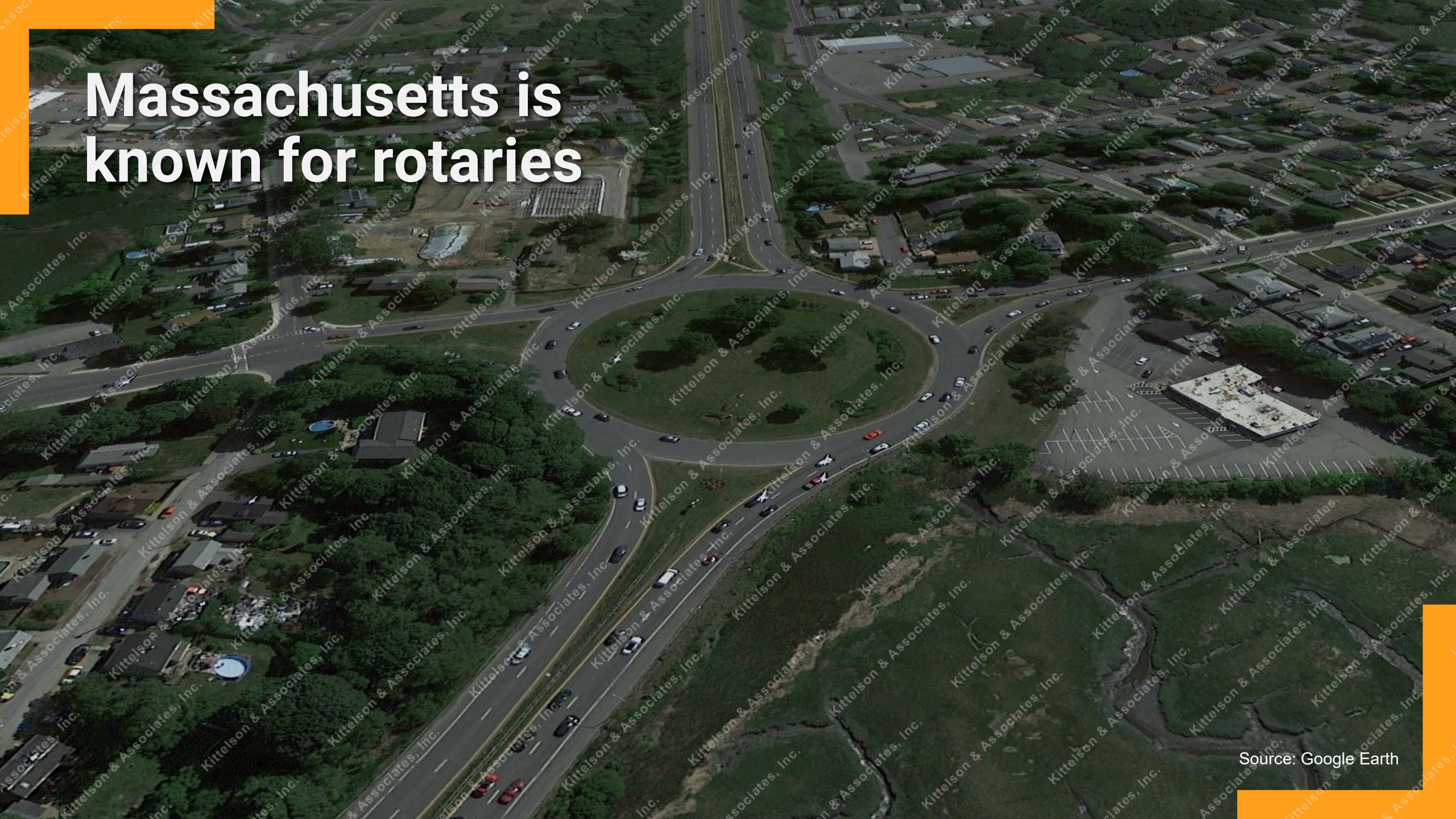
Radu has roadway engineering experience from a wide geographic area including historic New England towns and new western American cities. His focus is on designing streets for people walking and biking and facilitating their safe mobility throughout the roadway network.

Andy Duerr

Senior Principal Engineer
Harrisburg Office

Andy has extensive and diverse experience in planning, operations, and design projects throughout the Eastern US. Andy is an expert on roundabouts and innovative intersections, road and intersection safety, and complete streets / Vision Zero planning & design.

Massachusetts is known for rotaries



Source: Google Earth

…but recent construction is introducing drivers to roundabouts in diverse contexts

Source: Google Earth

… and fitting in nicely in the tangled street network

Source: Google Earth

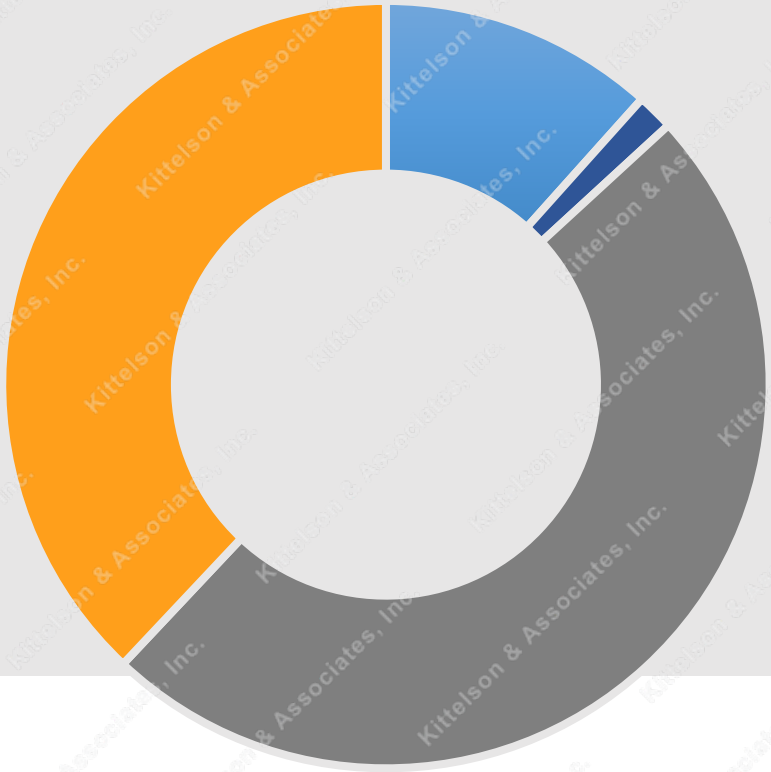
PURPOSE & NEED FOR ROUNDABOUT GUIDELINES IN MASSACHUSETTS

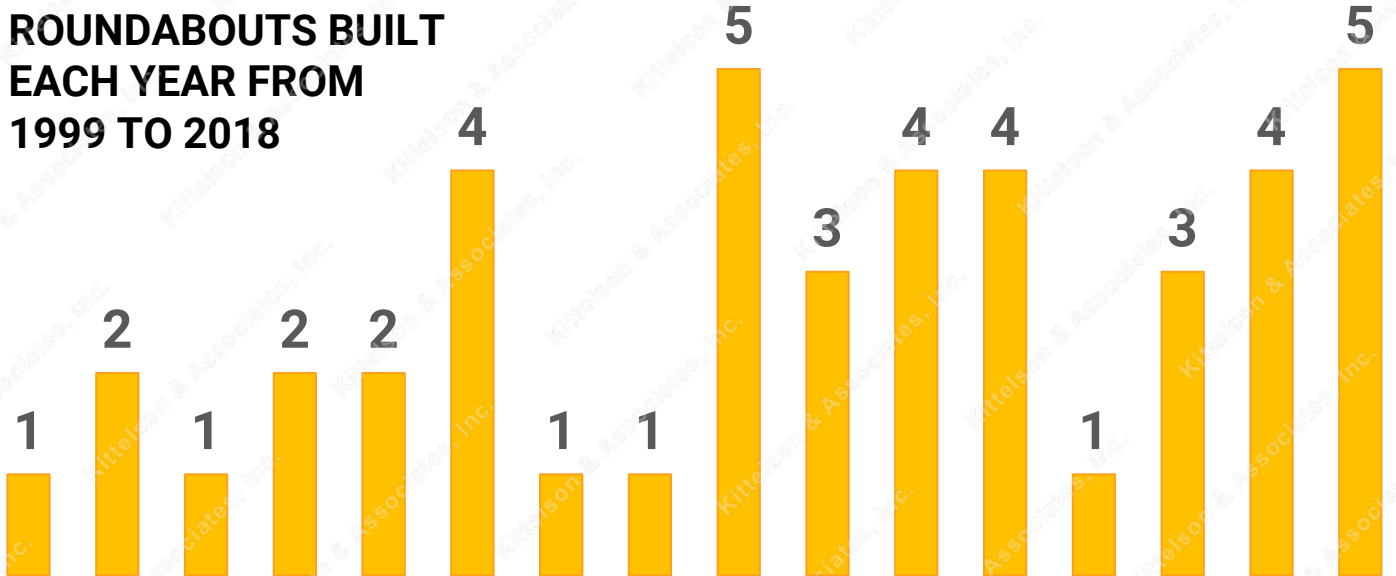
Massachusetts is building roundabouts at a steady pace since 2010

Build on the robust framework provided by the FHWA guide: NCHRP Report 672 – Roundabouts: An Informational Guide Second Edition

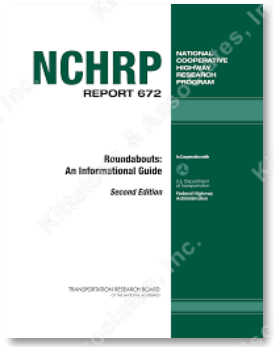
Incorporate new national guidelines that emerged or were updated since 2010

Provide Massachusetts specific examples and context





TECHNICAL DOCUMENTATION UPDATES SINCE NCHRP REPORT 672

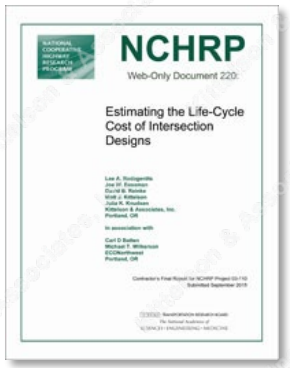


NCHRP Report 672

Current national guidance

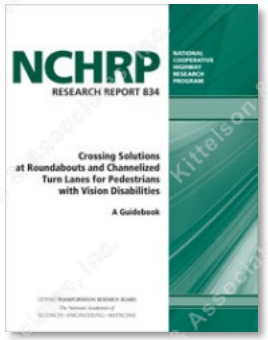
MassDOT Separated Bike Lane Planning & Design Guide

FHWA Highway Capacity Manual 6th Edition



NCHRP Project 3-110

Estimating the Life-Cycle Cost of Intersection Designs



NCHRP Report 834

Crossing Solutions at Roundabouts and Channelized Turn Lanes

2010 2015 2016 2017

SPECIFIC TECHNICAL SECTIONS UPDATED FOR MASSDOT

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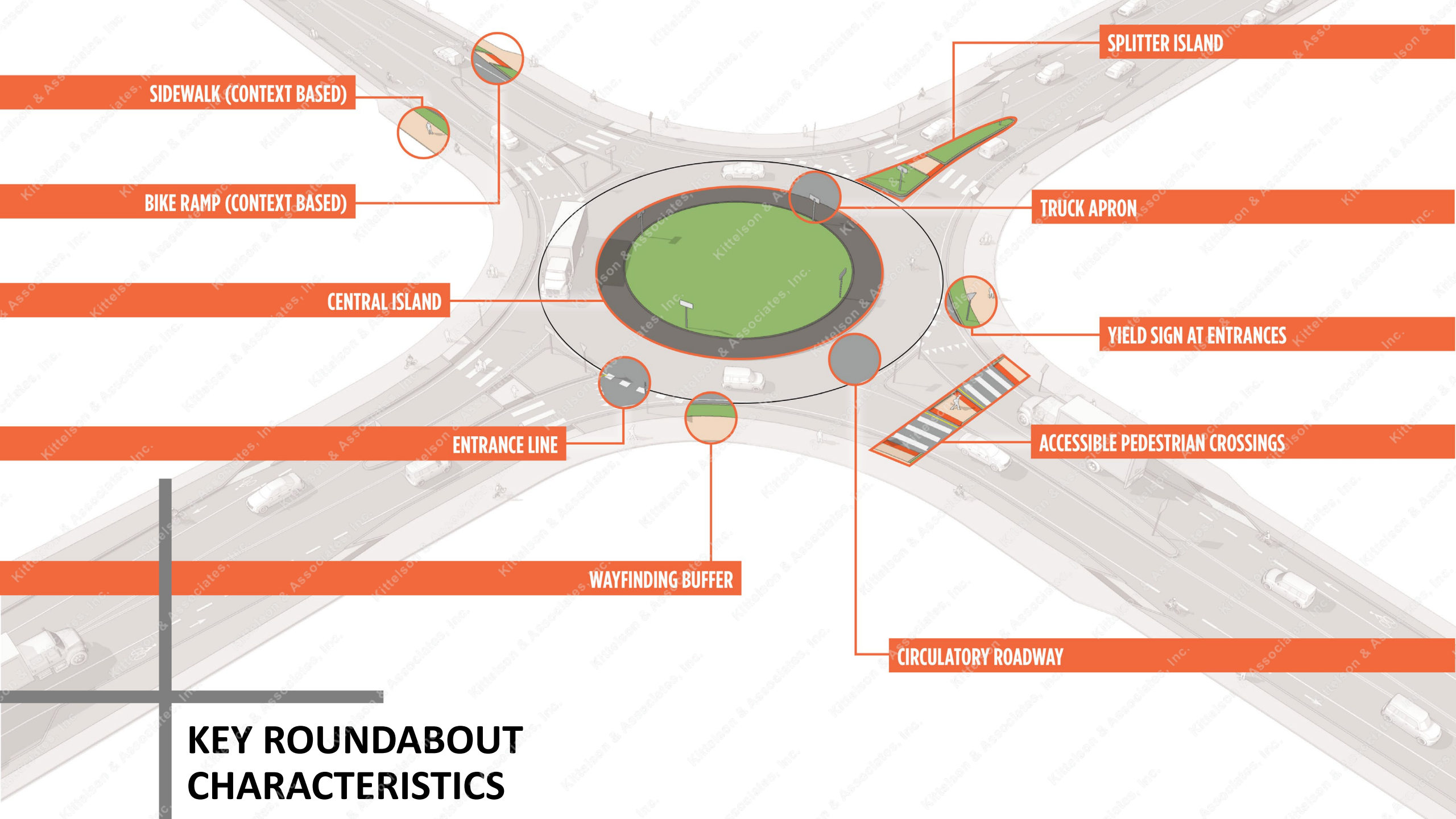


KEY ROUNDABOUT CHARACTERISTICS

CROSSWALKS & WAYFINDING DETAILS

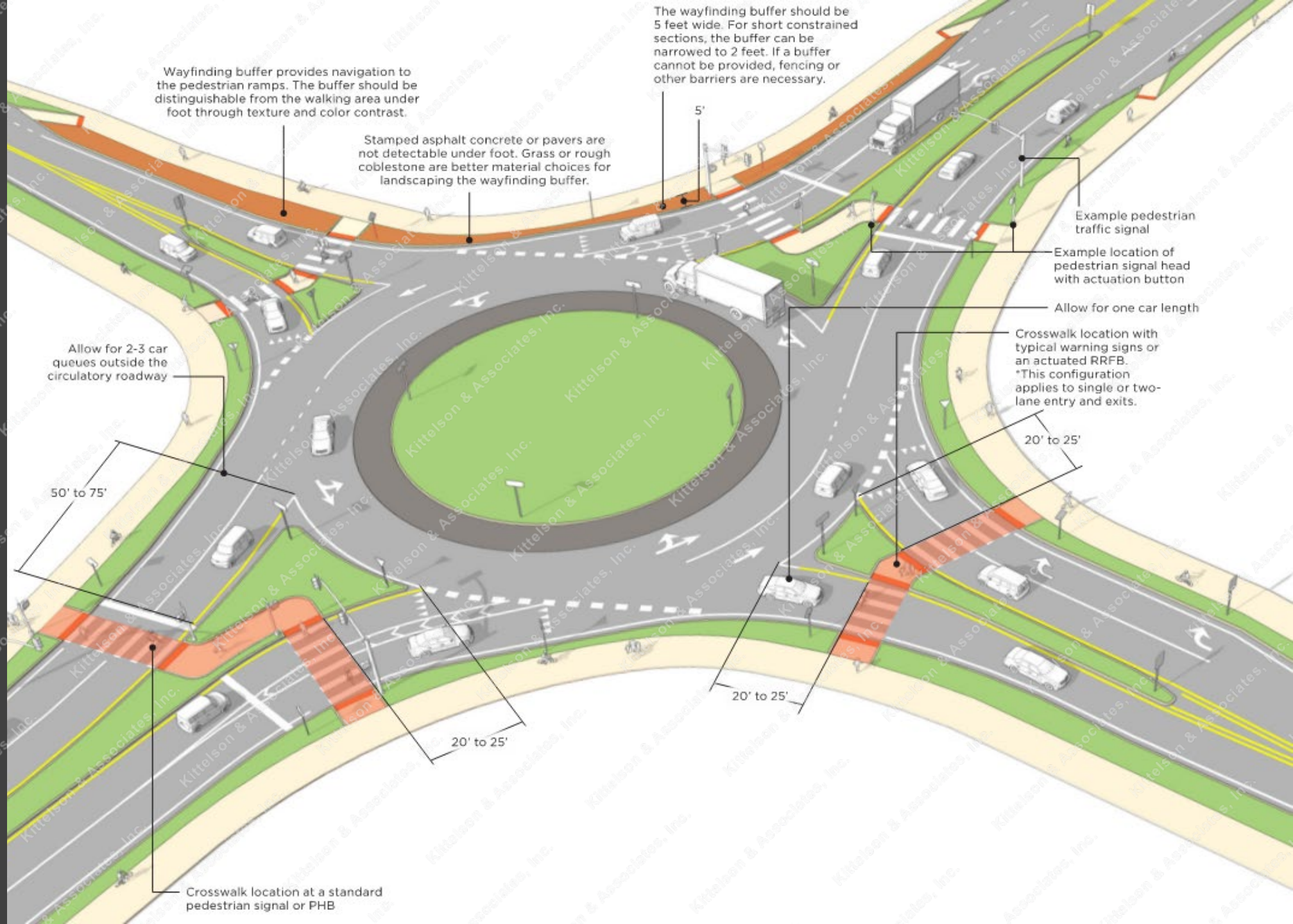
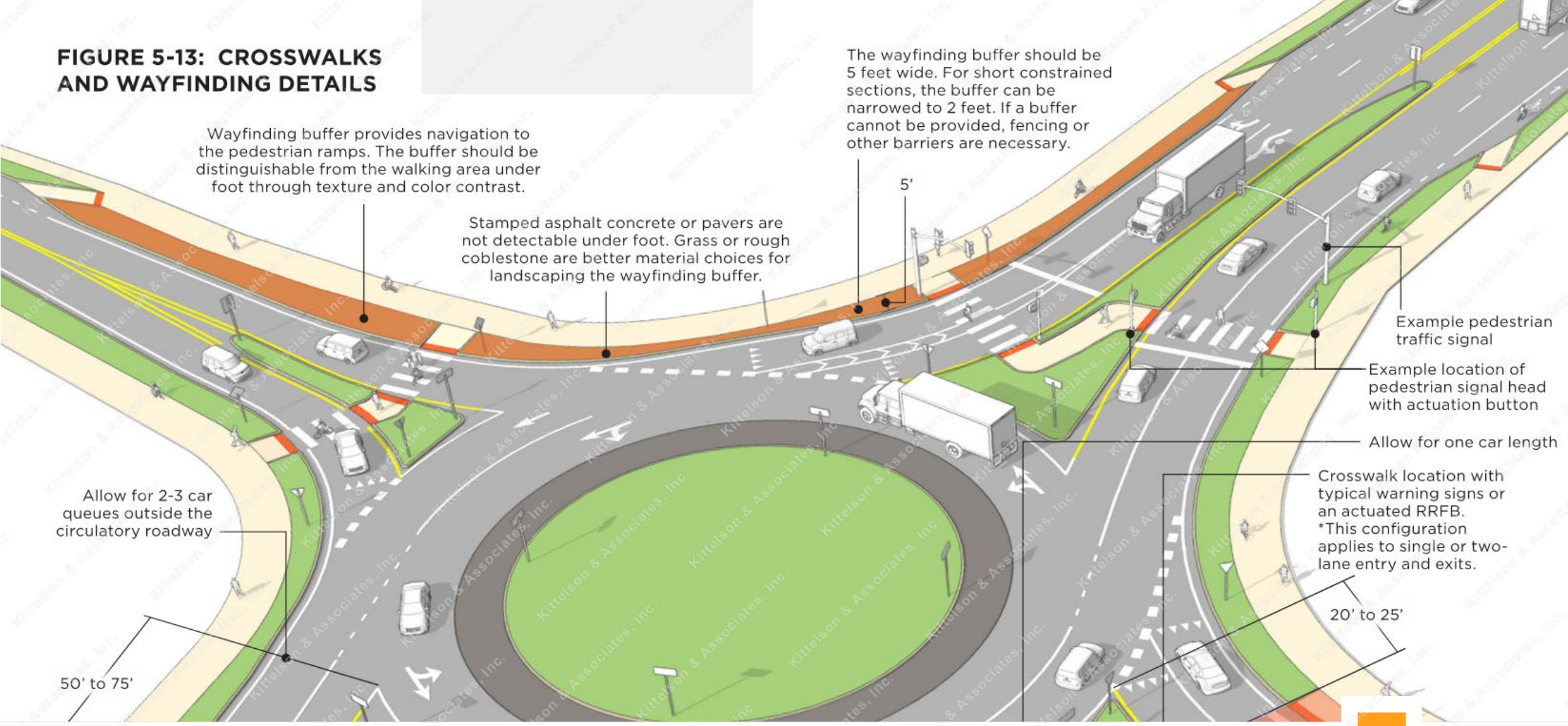
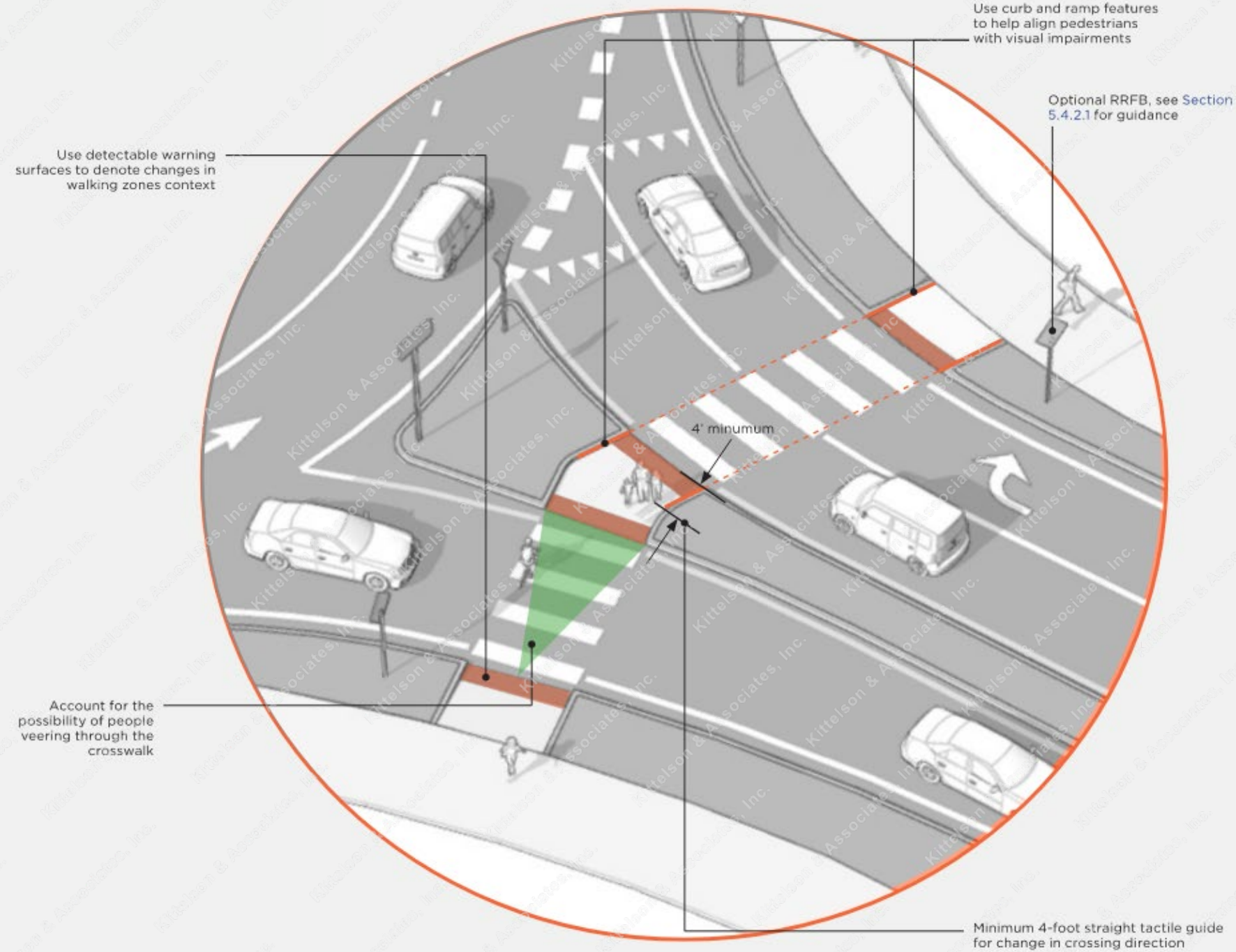


FIGURE 5-13: CROSSWALKS AND WAYFINDING DETAILS



WAYFINDING BUFFER FUNCTION AND DETAILS

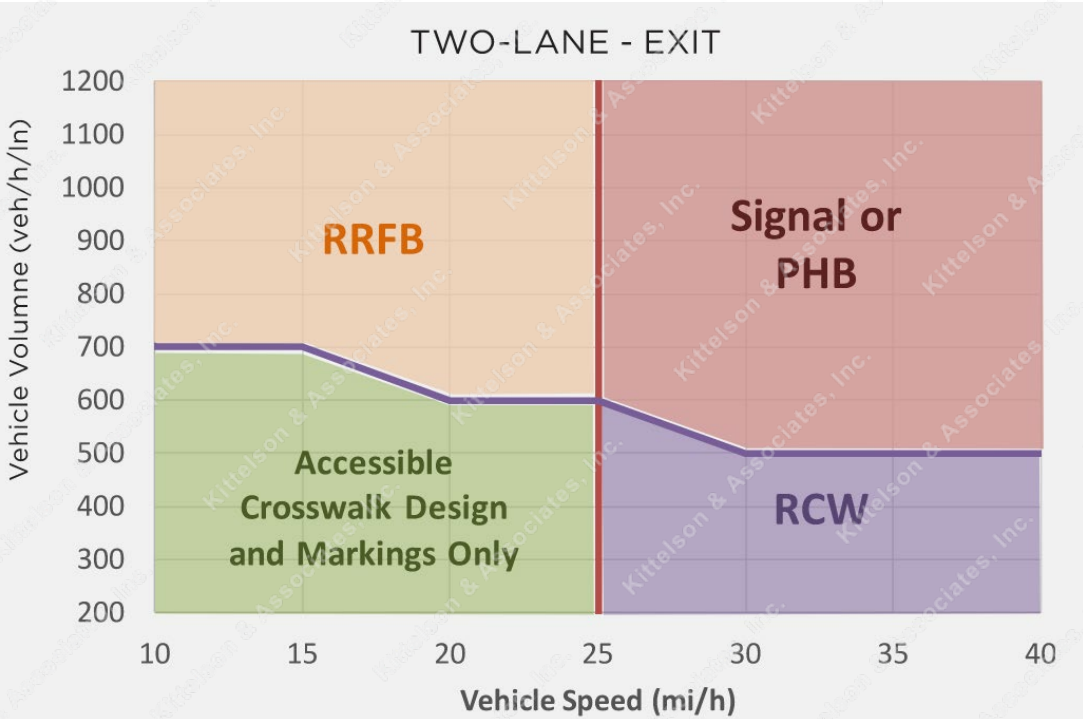
CROSSWALK & RAMP DETAILS TO ACCOMMODATE PEDESTRIANS WITH VISUAL IMPAIRMENTS



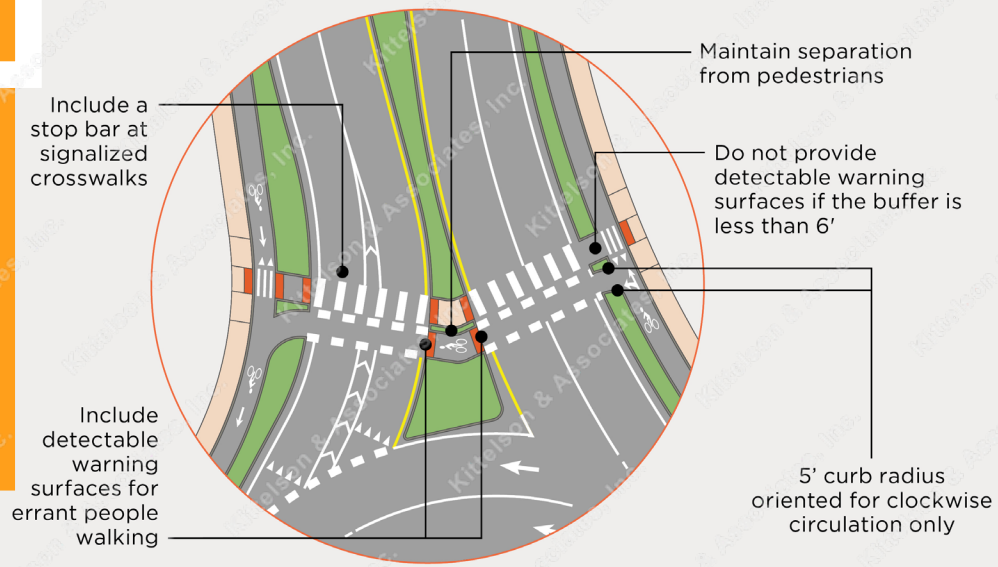
CROSSING SOLUTIONS

NCHRP Report 834, Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities (5) provides four major types of crosswalk treatments to limit the risk experienced by pedestrians with visual impairments: (A) standard pedestrian signal, (B) pedestrian hybrid beacon (PHB), pedestrian activated warning device, such as (C) rectangular rapid flashing beacon (RRFB), and (D) a raised crosswalk (RCW).

CROSSWALK IMPROVEMENT RECOMMENDATIONS FOR TWO-LANE ROUNDABOUT EXITS IN LOW NOISE ENVIRONMENTS



BICYCLE FACILITY OPTIONS AT A ROUNDABOUT



DO ANY OF THE FOLLOWING CRITERIA APPLY ON ANY ROUNDABOUT APPROACH?

- Does the approach have more than one lane entering or exiting the roundabout?
- Does the approach have operating speeds greater than or equal to 40 mph?
- Is the approach roadway classified as a corridor with a High Potential for Everyday Biking as defined in the Massachusetts Bicycle Transportation Plan?
- Does the approach experience volume greater than or equal to 10,000 vehicles per day?
- Does the approach have conventional bike lanes on roads with high pedestrian or bicycle volumes?
- Does the approach have a buffered bike lane?

YES → Are there separated bike lanes on the approach roadway?

- **YES** → Provide separated bike lanes around the roundabout
- **NO** → On-street bike facility (if present) transitions in advance of the roundabout

  AND either:
  Shared-use path around the roundabout accessed by a provided angled bicycle ramp

  OR
  Separated bike lane provided around the roundabout

NO → Are there bicycle facilities on the approach roadway?

- **NO** → No bicycle facility provided at the roundabout.
- **YES** → Are sidewalks planned or provided on the roundabout approaches?
  - **NO** → No bicycle facility provided at the roundabout.
  - **YES** → Is a shared-use path feasible?
    - **PREFERRED** **YES** → A shared-use path (10 ft or wider) around the roundabout → Transition on-street bike facility using angled bicycle ramps to allow people biking to access the shared-use path.
    - **NO** → Sidewalks around the roundabout → Transition on-street bike facility using perpendicular pedestrian ramps to allow people biking to access the sidewalk.

      Note that bicycle riding is generally not permitted on sidewalks in urbanized and commercial areas. Design should emphasize the need to travel through the roundabout either as a vehicle in the circulatory roadway or as a pedestrian.

Using contemporary language to discuss accommodations for various vehicles sizes

FIGURE 5-19: DESIGN VEHICLE TYPES

1

Large vehicles without trailers including single-unit trucks, fire trucks without turntable ladders, transit vehicles (buses), and school buses. In general, roundabouts should be designed to allow these vehicles to navigate the roundabout without using the truck apron. An SU-30 or B-40 design vehicle serves as a good proxy for these vehicles.

2

Large vehicles with trailers including fire trucks with turntable ladders. Roundabouts should be designed to allow these vehicles' rear trailer to use the truck apron around the central island. In general, it should not be necessary or anticipated that the cab of the truck would use the truck apron. A fire truck, WB-50, or WB-67 design vehicle are generally used to test these vehicles.

WB-40 articulated trucks are appropriate for local streets that are not used by large tractor-semitrailers and for access roads to ports and train yards where container traffic may be predominant.

3

Oversize/overweight (OSOW) vehicles require special accommodations to navigate a roundabout beyond the design for the vehicles described above. Custom vehicles found in most CAD-based design software allow for OSOW vehicles to be tested. OSOW vehicles should be evaluated for both horizontal path and underside vertical clearance. Examples of OSOW vehicles include modular building transporters and windmill blade transporters.

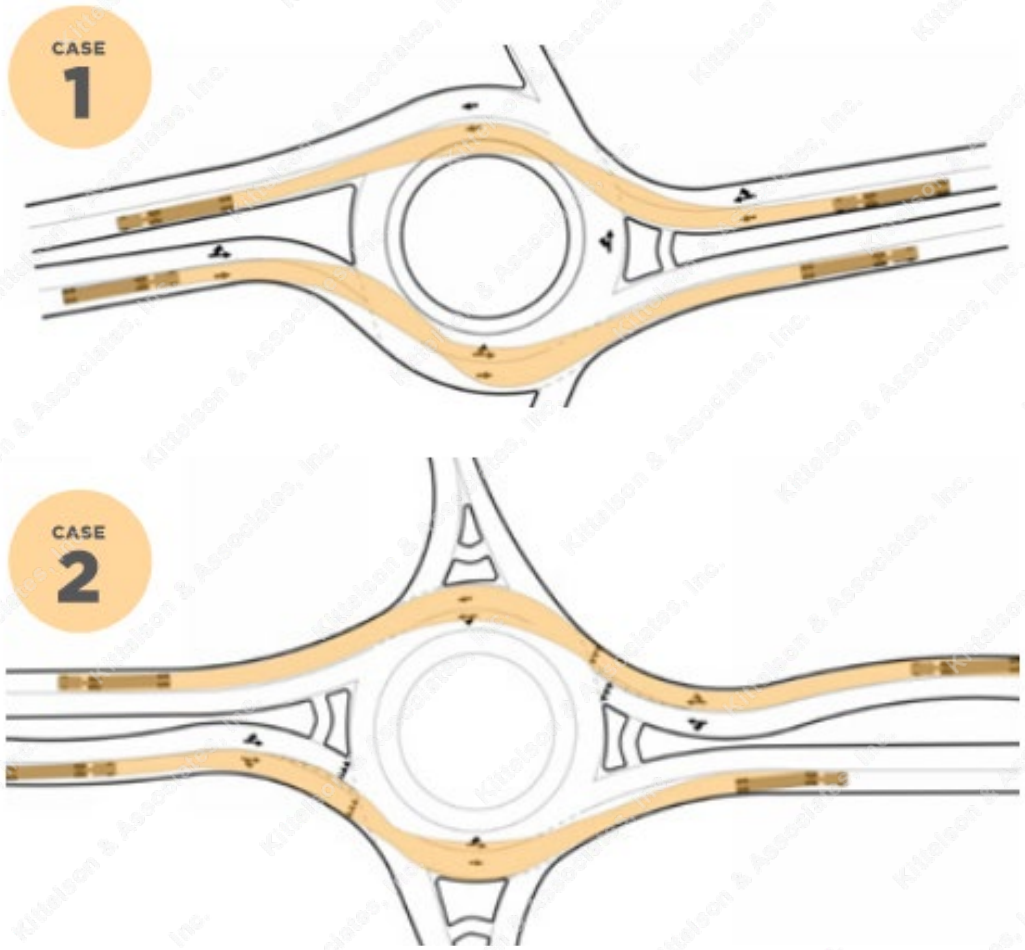
Design Vehicle

The design vehicle is the largest vehicle that is expected to frequently make specific movements through an intersection.

Control Vehicle

The control vehicle is an infrequent large vehicle for which specific movements need to be accommodated through an intersection.

FIGURE 5-20: MULTILANE TRUCK ACCOMMODATION CASES



CASE 1 — TRUCKS USE MULTIPLE LANES TO ENTER AND TO CIRCULATE AT A ROUNDABOUT

CASE 2 — TRUCKS REMAIN IN THEIR LANE ON ENTRY INCLUDING A STRIPED BUFFER IF IT EXISTS AND CAN TRAVEL SIDE-BY-SIDE WITH A PASSENGER CAR; HOWEVER, TRUCKS STILL USE MULTIPLE LANES TO CIRCULATE ONCE IN THE ROUNDABOUT

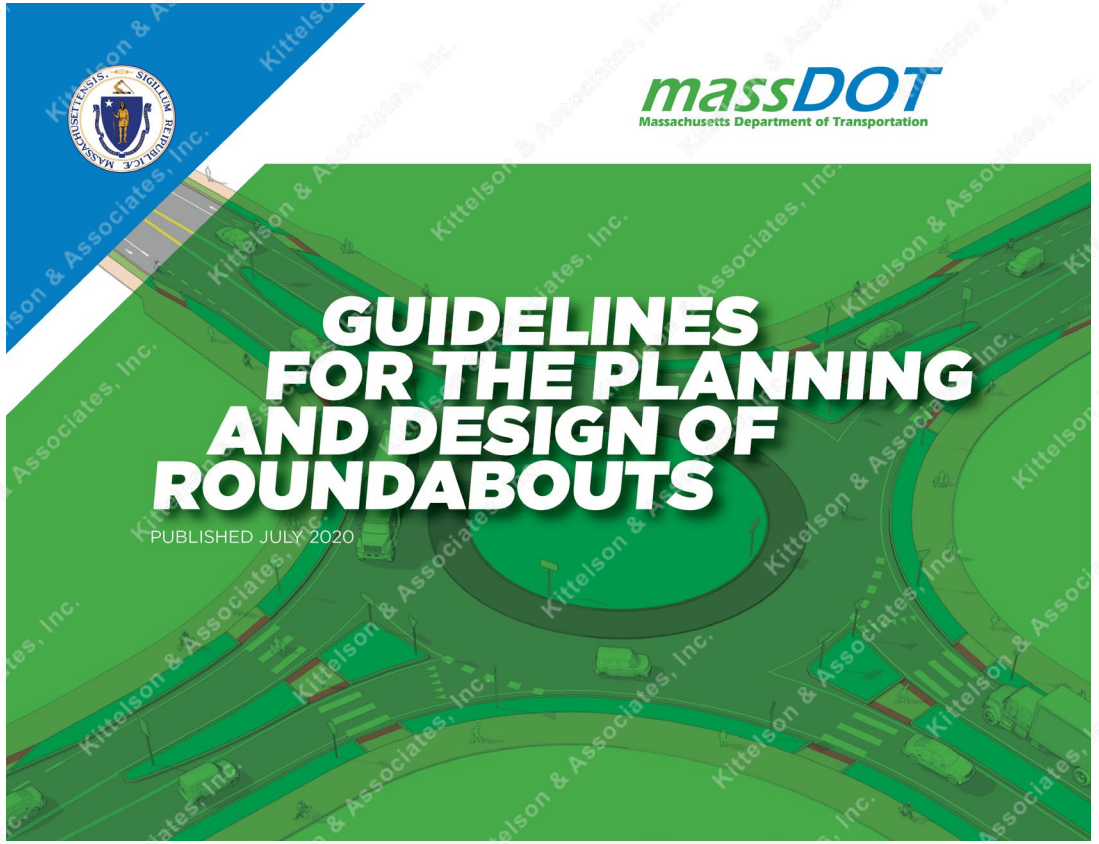
WHAT'S NEXT?

The MassDOT GPDR is a key resource in the Departments plan to use objective Intersection Control Evaluations to select project improvements

The GPDR and associated resources provide a framework and tools to communicate the benefits of roundabouts to the public throughout the planning and design process

Roundabouts are great tools in enhancing intersection safety and promoting active transportation

Practitioners in Massachusetts and nationwide now have a technical source that brings together key research and advancements developed in the last 10 years



ROUNDABOUT DESIGN

Evolution of Roundabout Design – 1990's to the Present

Emerging Guidance & Competing Pressures

- Prioritizing vulnerable road users
- Utilize flexibility in design
  (e.g. practical design, design exceptions)
- Consider impacts and life cycle costs
  (intersection control evaluations - ICE)
- Tight budgets & increasing costs
- Don't cut corners with performance goals
  (e.g. fast paths, design vehicles, and sight distance)

RIGHTSIZING ROUNDABOUTS

Often Focused on Construction Cost

- Reduce roundabout size
- Optimize lane configurations (multi-lane)
- Stage build-out (multi-lane)

Streamlining design – Use flexibility to meet project Purpose & Need without overdesigning or cutting corners

Resist the temptation to compromise design principles to minimize impacts?

STREAMLINING
ROUNDABOUT DESIGN

Document critical decisions early in design
(e.g. design and control vehicles, ped/bike facilities, design exceptions)

Get creative in design – look for emerging technology

Typical issues that extend design duration

- Stormwater management
- Environmental permits & clearance
- Utility coordination/relocation
- Right-of-way acquisition

Streamlined Design Elements:

Minimized SWM Requirements
No Environmental Considerations
Avoided Utility Impacts
No Right-of-Way Required

Met Purpose & Need – Won Safety Award

“Instant” Roundabout

Poland Road and Edgewater Street
South Riding, VA

Photo credit: VDOT NOVA District

Permanent Roundabout

Poland Road and Edgewater Street
South Riding, VA

Photo credit: VDOT NOVA District

Temporary Mini-Roundabout

Lancaster, PA

Photo Credit: City of Lancaster

Streamlined Design Elements:

No SWM Required
No Environmental Considerations
Avoided Utility Impacts
No Right-of-Way Required

Has gained majority support from stakeholders over time

Streamlined Design Elements:

Minimized SWM Requirements
Reduced Environmental Considerations
Minimized Utility Impacts
Minimized Right-of-Way Needs
Exercised Design Flexibility (grades)

Compact Oval Roundabout on Grade

Kalispell, MT

Rendering/VR Credit: Kittelson

Otterdale Road at Hampton Park Drive
Chesterfield County, VA

Photo Credit: VDOT

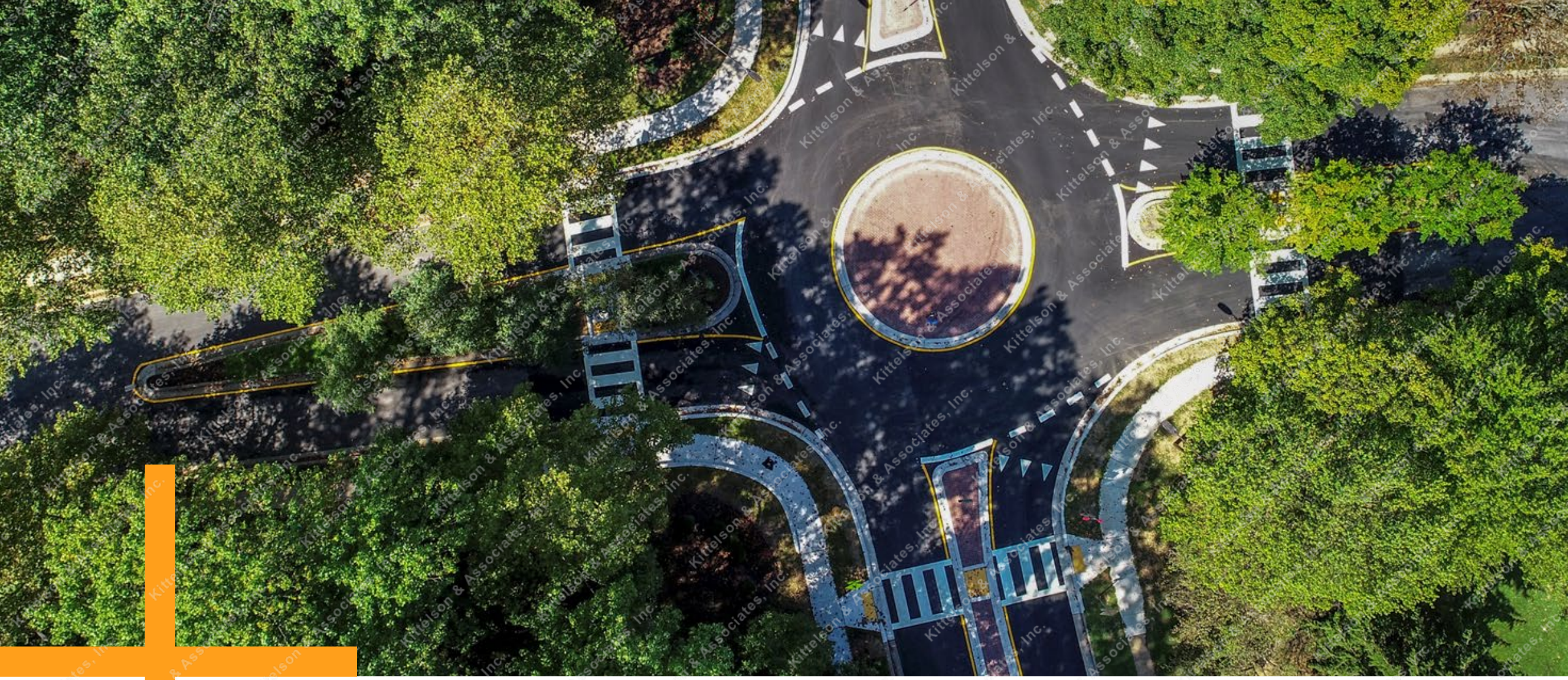
Modular Roundabouts

Photo Credits: VDOT

Streamlined Design Elements:

No SWM Required
No Environmental Considerations
Avoided Utility Impacts
No Right-of-Way Required

FHWA Pilot Initiative – 3 Weeks to Construct

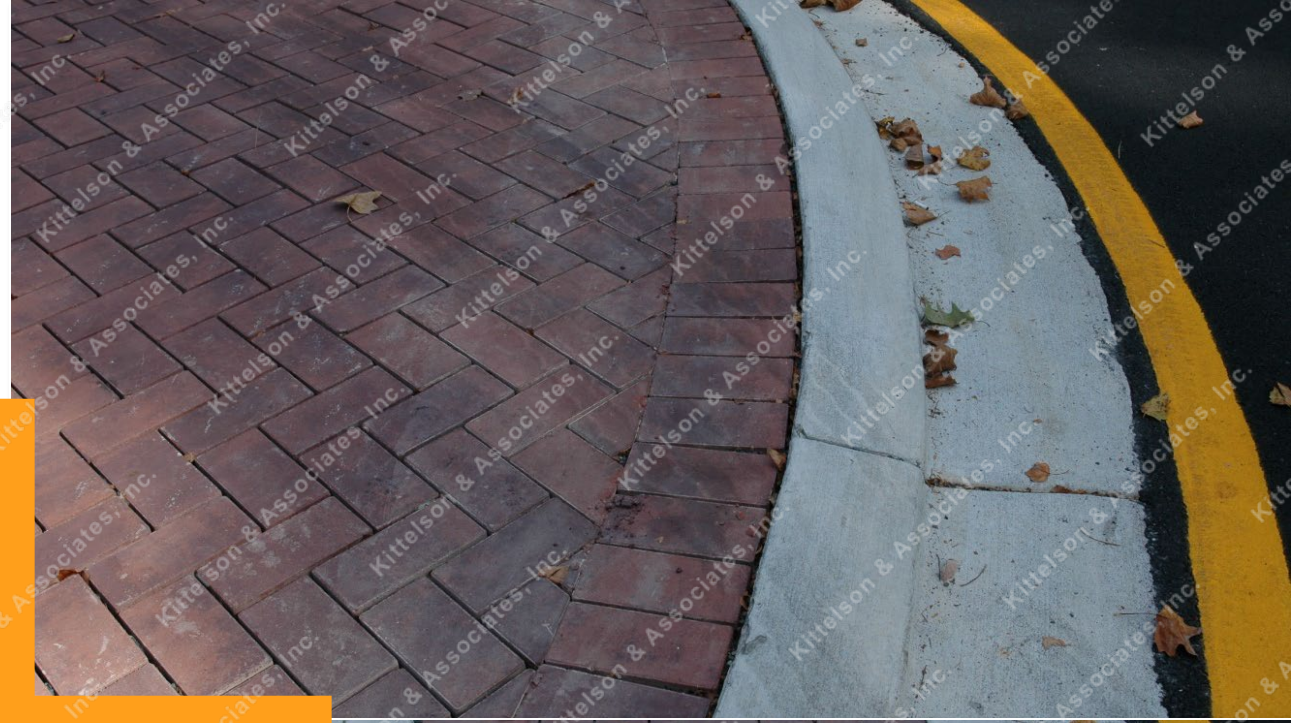


Mini-Roundabout With Permeable Pavers Howard County, MD

Photo Credit: Howard County DPW

Permeable Pavers in Mini-Roundabouts

Photo Credit: Andrew Duerr



Streamlined Design Elements:

Met SWM Quantity & Quality Requirement
Environmental Considerations limited to Tree Impacts
Avoided Utility Impacts
No Right-of-Way Required
Utilized Standard Bid Items

One roundabout designed in 4 Months

Mini-Roundabout With Permeable Pavers Howard County, MD

Photo credit: Diane Durscher

STREAMLINING
ROUNDABOUT DESIGN

Document critical decisions early in design

Be creative!

Don’t cut corners with performance goals

Utilize flexibility

Focus on critical path items like:

- Stormwater management
- Environmental permits & clearance
- Utility coordination
- Right-of-way acquisition

QUESTIONS & DISCUSSION

KITTELSON & ASSOCIATES

THANK YOU

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