

East Massachusetts Avenue

Pleasant St. & Maple St.

Roundabout Concept Analysis

Andrew Paul

January 11, 2016

Lexington Board of Selectman's Meeting



KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

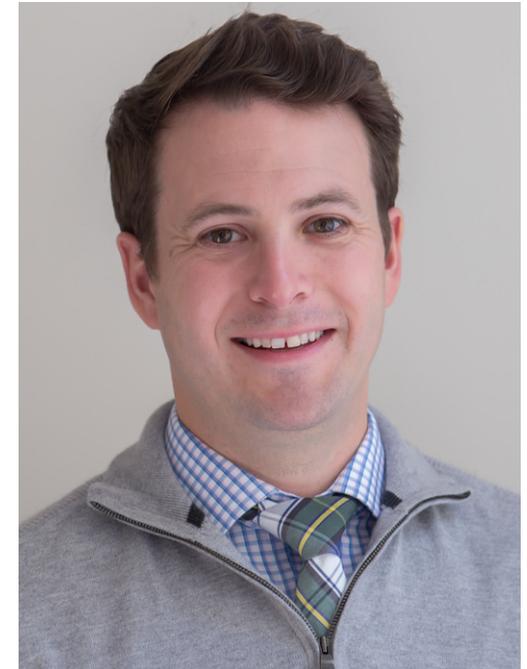
KAI Roundabout Qualifications

- **Over 20 years of roundabout project experience**
 - Total of over 700 feasibility, peer review, and/or final design projects involving roundabouts
 - On-call roundabout contracts with seven state DOTs
 - Recently awarded a roundabout on-call contract with MassDOT
- **Lead author of comprehensive roundabout research**
 - NCHRP Report 572: Applying Roundabouts in the United States
 - NCHRP Report 672: Roundabouts: An Informational Guide
- **Training**
 - 80 courses taught in 22 states and 2 foreign countries
 - 6 courses taught in 2015 in Massachusetts
- **Ongoing research**
 - NCHRP Project 20-05: Roundabout Practice in the U.S.
 - NCHRP Project 17-70: Development of Roundabout Crash Prediction Models and Methods



Andy Paul

- **12 years of engineering experience**
 - 45 roundabout projects
 - 30 roundabouts in Massachusetts
 - **First multilane lane roundabout in Massachusetts**
 - 5 rotary retrofit designs in Massachusetts
 - Roundabout design course instructor
 - **Taught six roundabout in Massachusetts in 2015**
- **11 Years at MassDOT**
 - District 3 Traffic Engineering Section
 - MassDOT Traffic Engineering Section
 - **Served as the State Roundabout Coordinator**
 - MassDOT Highway Design Section

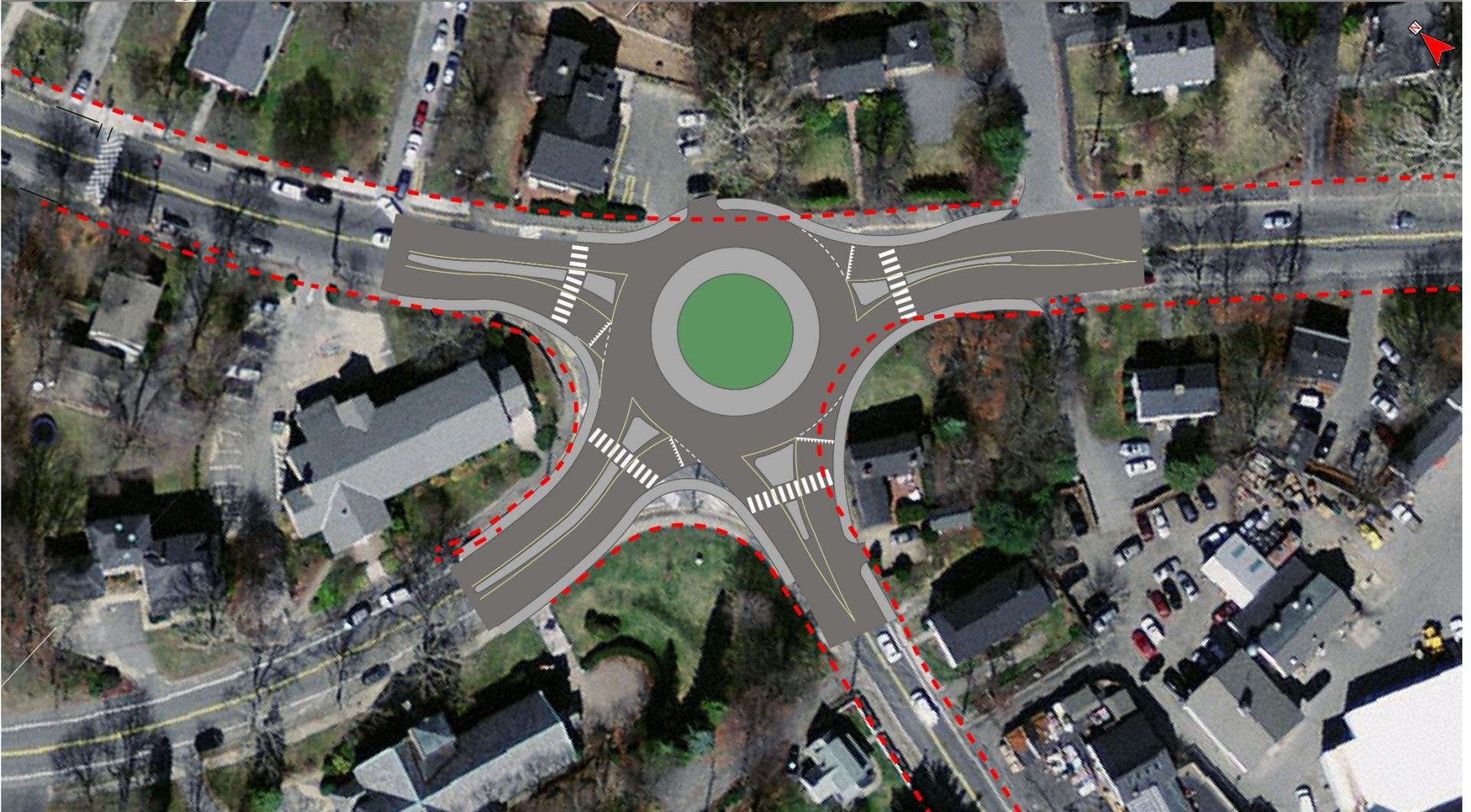


Why Are We Here?

- **Roundabout Concepts at Maple St and Pleasant St**
 - Conceptual design
 - Traffic analysis
- **Comparing Roundabouts and Traffic Signals**
 - Cost
 - Right of way impacts
 - Safety
- **Roundabouts vs. Rotaries**
- **Pedestrians at Roundabouts**
- **Cyclists at Roundabouts**

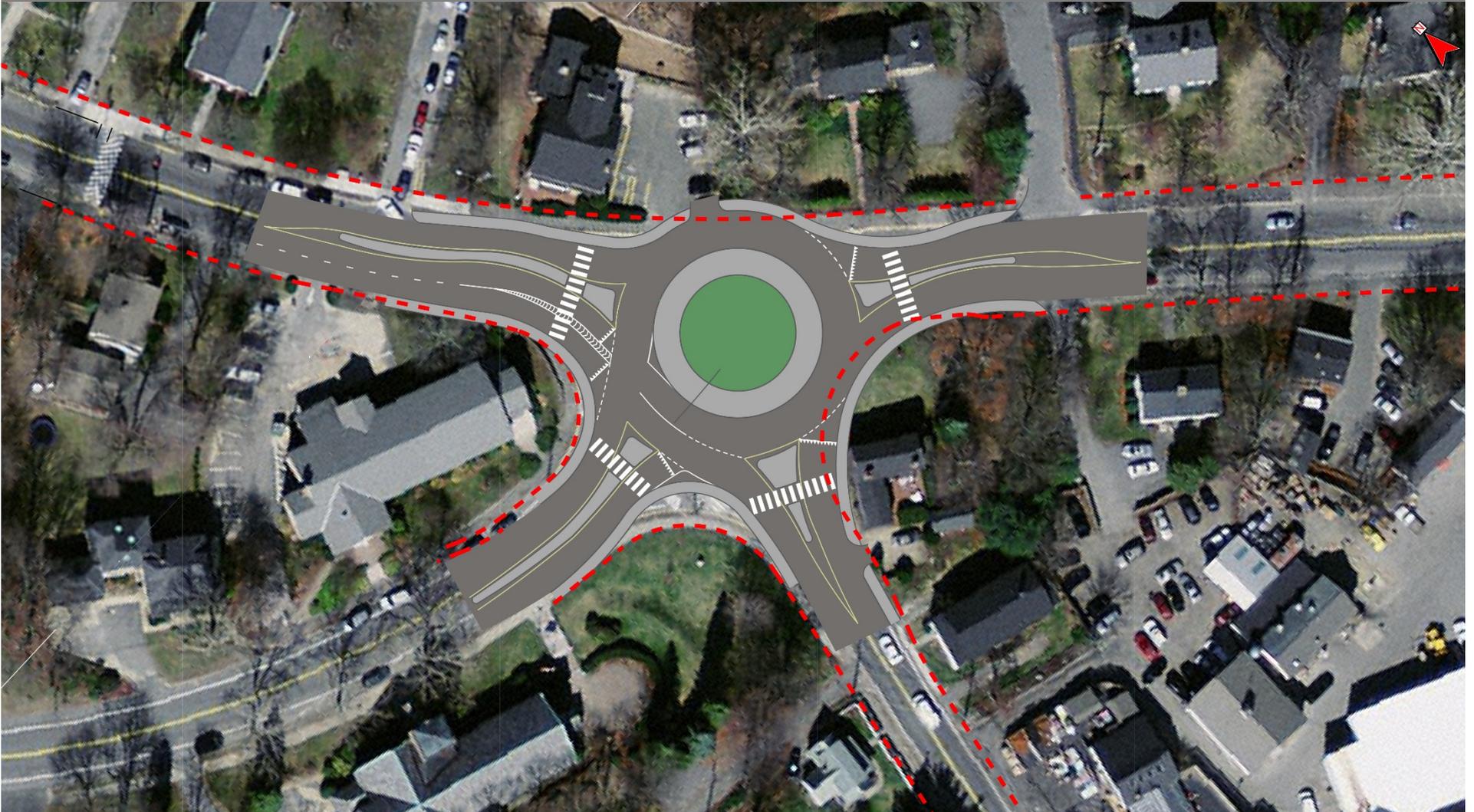


Pleasant St. at Massachusetts Avenue Single Lane Roundabout



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Pleasant St. at Massachusetts Avenue Multi-lane Roundabout



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Roundabout Traffic Analysis: Pleasant Street

Single-lane Roundabout

2023 Morning		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	23	115
Mass Ave SB	74	560
Pleasant St	8	22
Follen Rd	13	7

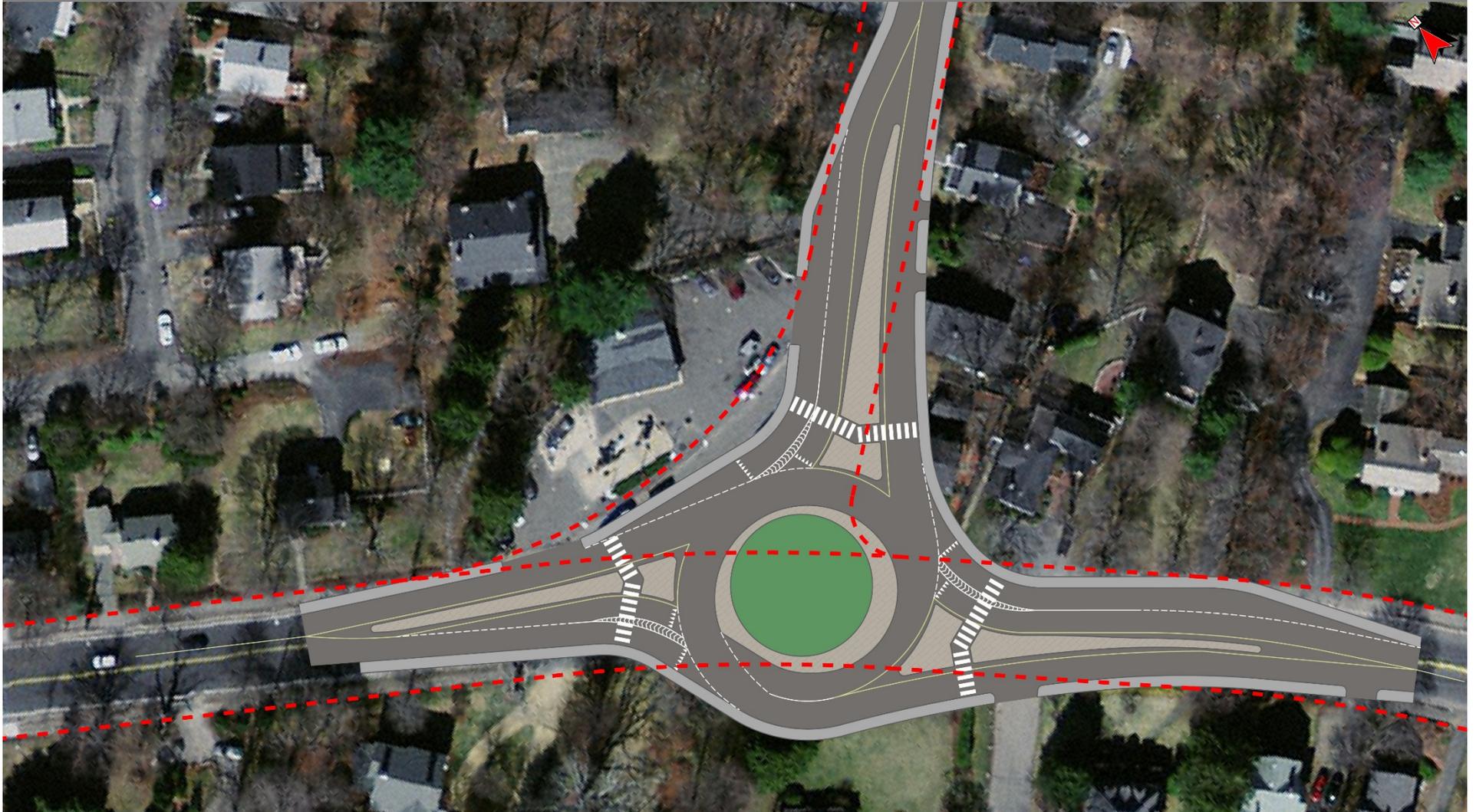
Multi-lane Roundabout

2023 Morning		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	23	115
Mass Ave SB	13	75
Pleasant St	8	22
Follen Rd	11	5

2023 Evening		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	15	87
Mass Ave SB	14	57
Pleasant St	14	50
Follen Rd	8	2

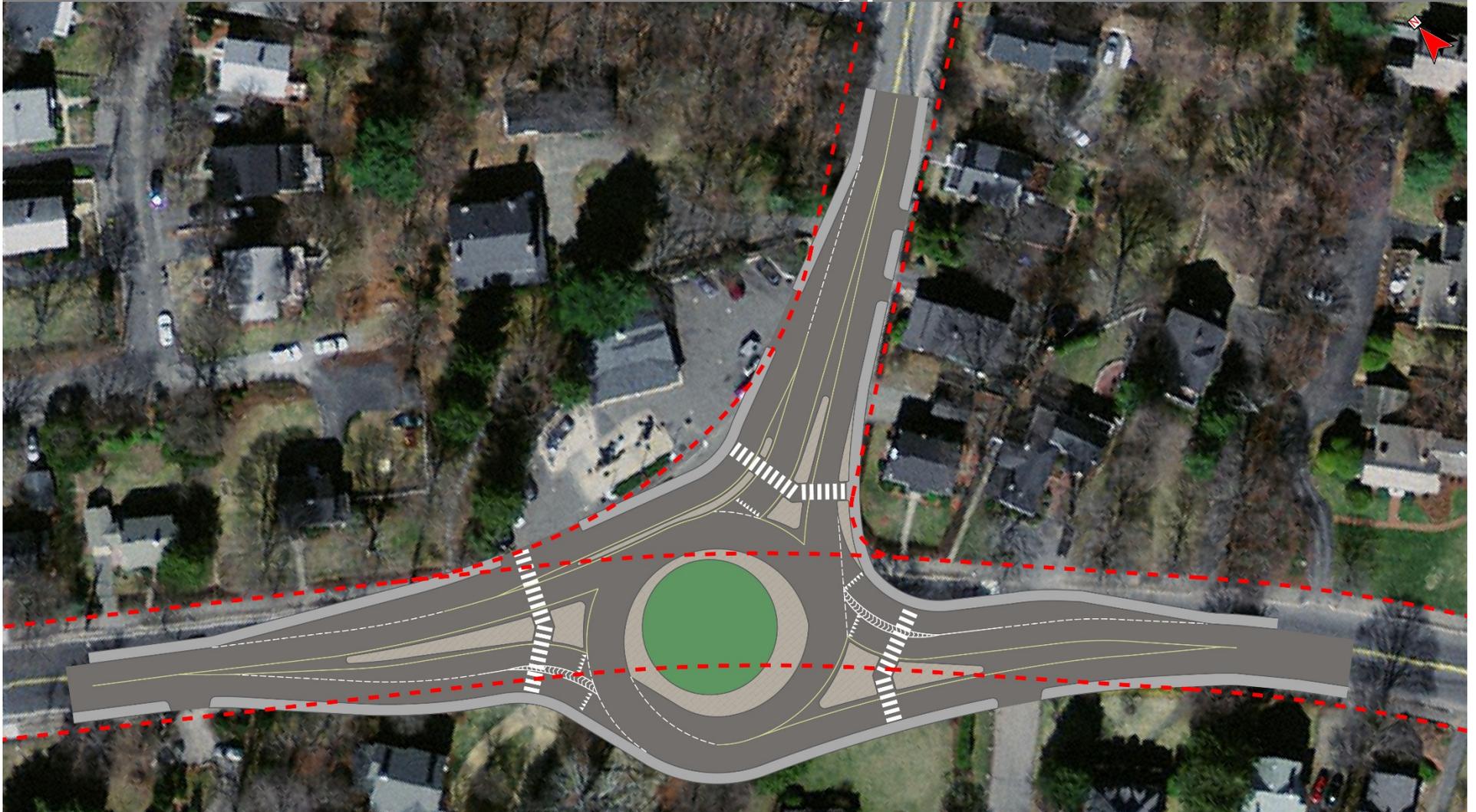
2023 Evening		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	14	57
Mass Ave SB	6	22
Pleasant St	14	50
Follen Rd	7	2

Maple Street at Massachusetts Avenue Multi-lane Roundabout



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Maple Street at Massachusetts Avenue Multi-lane Roundabout with Bypass Lane



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Roundabout Traffic Analysis: Maple Street - Multilane Roundabout w/ Bypass

2023 Morning		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	11	57
Mass Ave SB	53	447
Maple Street	19	60

2023 Evening		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	25	115
Mass Ave SB	11	57
Maple Street	8	12



Comparison: Roundabout and Signal

- **Traffic Operations**
- **Cost**
- **Right of way**
- **Safety**



Comparison: Roundabout and Signal – Traffic Ops Maple Street w/ Bypass

Multi-lane Roundabout

2023 Morning		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	11	57
Mass Ave SB	53	447
Maple Street	19	60

2023 Evening		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	25	115
Mass Ave SB	11	57
Maple Street	8	12

Signal

2023 Morning	
Average Delay (s)	Average Queue (ft.)
24	328
23	563
36	161

2023 Evening	
Average Delay (s)	Average Queue (ft.)
60	484
45	470
35	133

Comparison: Roundabout and Signal – Traffic Ops Pleasant Street

Multi-lane Roundabout

2023 Morning		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	23	115
Mass Ave SB	13	75
Pleasant St	8	22
Follen Rd	11	5

2023 Evening		
	Average Delay (s)	Average Queue (ft.)
Mass Ave NB	14	57
Mass Ave SB	6	22
Pleasant St	14	50
Follen Rd	7	2

Signal

2023 Morning	
Average Delay (s)	Average Queue (ft.)
9	111
14	101
18	99
-	-

2023 Evening	
Average Delay (s)	Average Queue (ft.)
14	124
11	185
21	144
-	-

Comparison: Roundabout and Signal - Cost

Mass Ave at Maple Street - w/ Bypass	
	Cost (\$)
Roundabout	1,295,000
Signal	578,000

Mass Ave at Pleasant Street - Multilane	
	Cost (\$)
Roundabout	849,000
Signal	563,000



Comparison: Roundabout and Signal – R.O.W.

Mass Ave at Maple Street - w/ Bypass	
	Right of Way (sf)
Roundabout	10,455
Signal	0

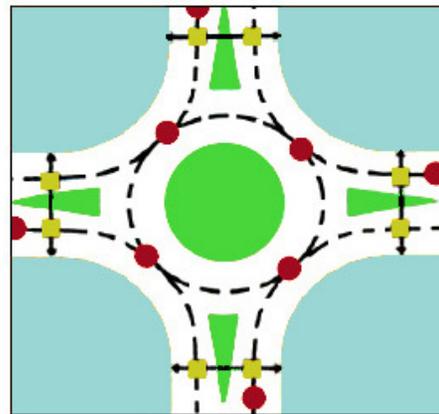
Mass Ave at Pleasant Street - Multilane	
	Right of Way (sf)
Roundabout	1,455
Signal	0



Comparison: Roundabout and Signal - Safety

- **Proven Safety Countermeasure**
- **Fewer conflict points than 4-leg signalized intersections**
 - 75% fewer vehicle-to-vehicle conflict points
 - 67% fewer vehicle-to-pedestrian conflict points

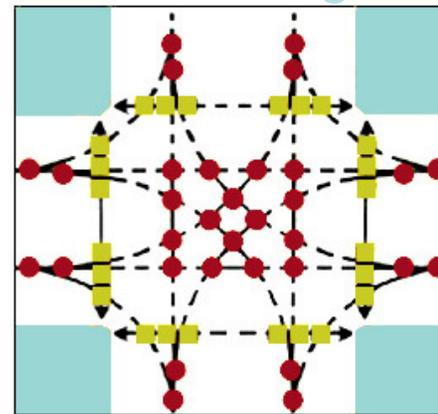
Roundabout



● 8 Vehicle conflicts

■ 8 Pedestrian conflicts

Traffic Signal



● 32 Vehicle conflicts

■ 24 Pedestrian conflicts



Comparison: Roundabout and Signal - Safety

- **National Statistics from NCHRP Report 672**
 - Reduce fatal crashes by 90 percent
 - Reduce injury crashes by 75 percent
 - Reduce pedestrian crashes by 40 percent
 - Reduce bicycle crashes by 10 percent

NCHRP
REPORT 672

**Roundabouts:
An Informational Guide**

Second Edition

TRANSPORTATION RESEARCH BOARD
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NATIONAL
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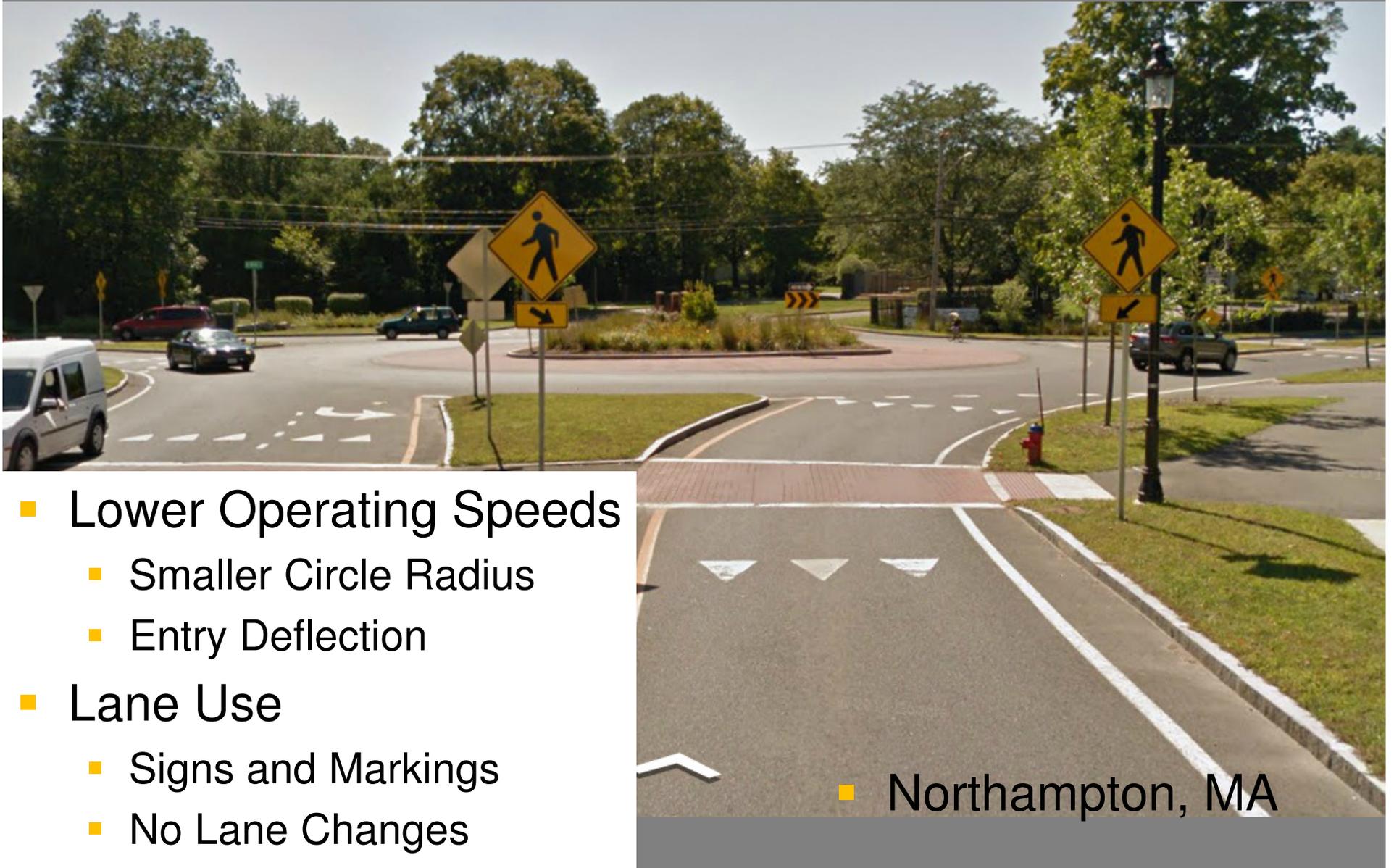
Comparison: Summary

Mass Ave at Maple Street				
	Traffic Operations	Cost (\$)	Right of Way (sf)	Safety
Roundabout	++	-	-	++
Signal	+	+	+	+

Mass Ave at Pleasant Street				
	Traffic Operations	Cost (\$)	Right of Way (sf)	Safety
Roundabout	+	-	-	++
Signal	+	+	+	+



Roundabouts vs. Rotaries



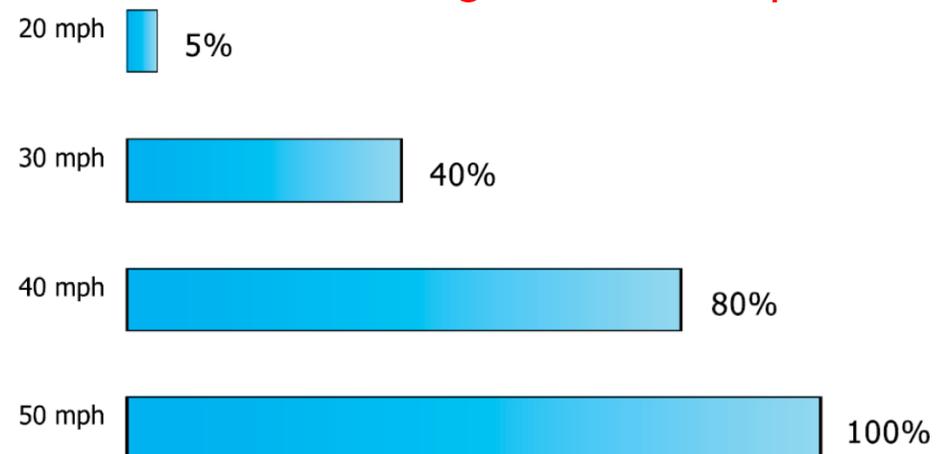
- Lower Operating Speeds
 - Smaller Circle Radius
 - Entry Deflection
- Lane Use
 - Signs and Markings
 - No Lane Changes

■ Northampton, MA

Roundabouts vs. Rotaries

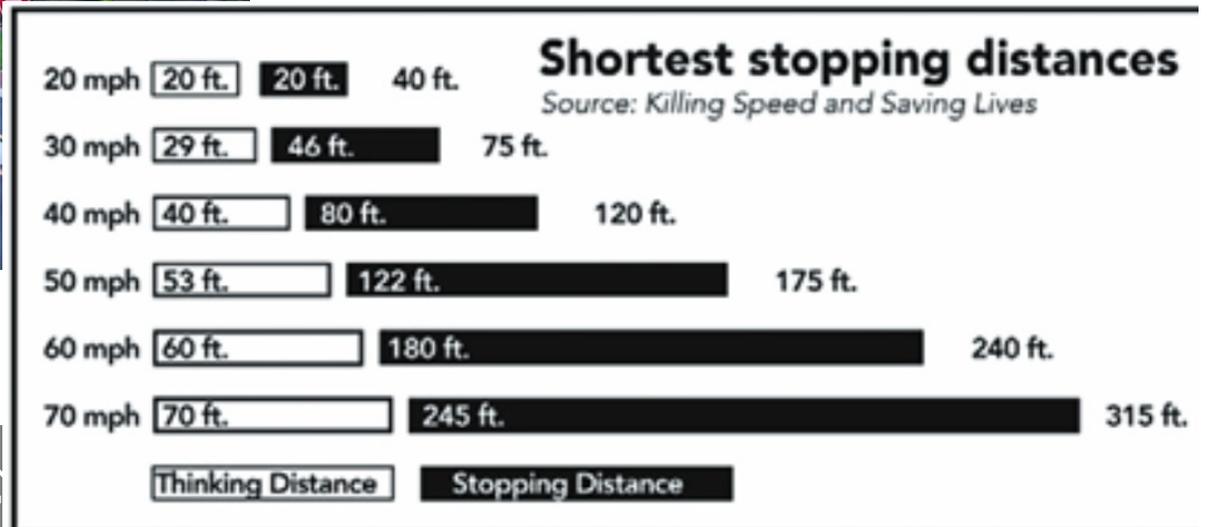
- **Maximum speed of 25 mph**
- **Existing Mass Ave posted speeds of 35 mph**
- **Lower speeds at the roundabouts provide safer conditions for pedestrians and increase comfort for bicyclists**

Chance of pedestrian fatality if hit by a vehicle traveling at various speeds



Pedestrians at Roundabouts

- Pedestrians cross only one direction at a time
- Pedestrian refuge area provided on every approach
- Reduced speed at crossing location



Bicycles at Roundabouts

- **Slower vehicle operating speeds make roundabouts safer and more comfortable for bicyclists**
- **Bicyclists can either use the roundabout as a vehicle or use dedicated ramps to access the crosswalks**



Pedestrian Crossing Treatments at Multilane Roundabouts

- **Raised Crosswalks**
- **Rectangular Rapid Flash Beacon (RRFB)**
- **Pedestrian Hybrid Beacon (HAWK)**



Raised Crosswalk



Rectangular Rapid Flashing Beacon (RRFB)



Pedestrian Hybrid Beacon



Summary

- **Roundabouts at Maple Street and Pleasant Street**
 - Conceptual design
 - Traffic analysis
- **Comparing Roundabouts and Traffic Signals**
 - Cost
 - Right of way impacts
 - Safety
- **Roundabouts vs. Rotaries**
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- **Cyclists at Roundabouts**



Questions and Discussion



Nantucket, MA

