Evolution of Roundabout Design and Planning

2018 Ohio Transportation Engineering Conference

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BURGESS & NIPLE
Engineers ■ Architects ■ Planners

Ideas in motion.

Really Quick Roundabout History

- 1966 – Give-way rule changed in UK
- Roundabout explosion (not in US)
- 1990's – Roundabouts introduced in US
- 2018 – Roughly 5000 roundabouts in US!

Myth 1: They built a bunch of roundabouts in NJ in the 60's and now they're ripping them out!

Reasons for roundabouts growing

- **Safer**
- **More efficient (less delay)**
- More aesthetic design opportunities
- Reduced vehicle emissions – greener!
- Access management (provides U-turn location)
- Less ROW required for approach lanes
- To deal with odd intersections

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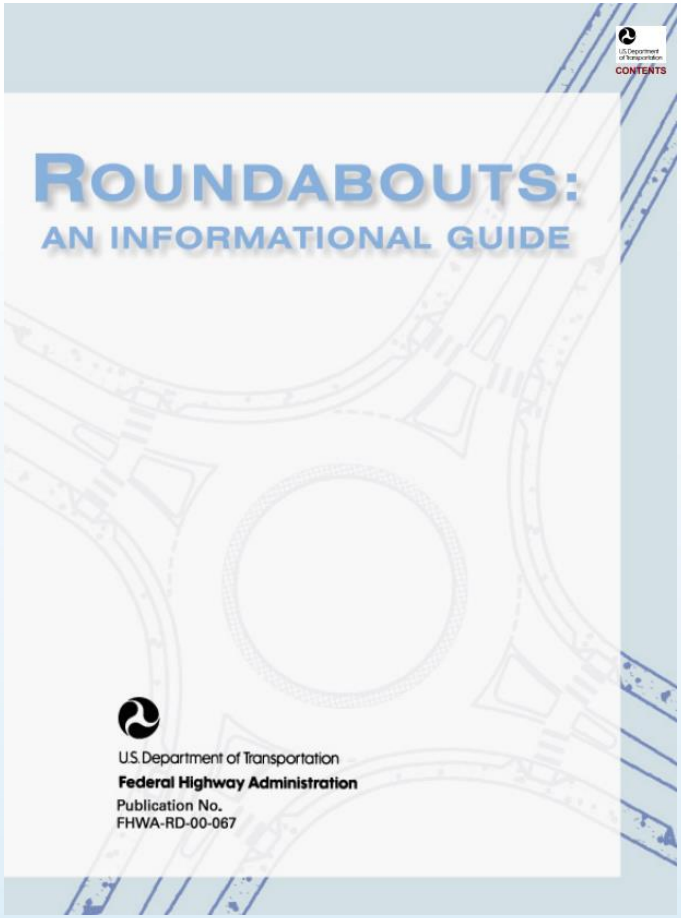
Available resources are growing

- TRB Standing Committee on Roundabouts (ANB75)
  - Primary roundabout research committee in U.S.
  - Annual Meeting – January in D.C.
  - Mid-year web meeting, webinars, workshops
  - Led development of NCHRP 672
  - Information Resource Center

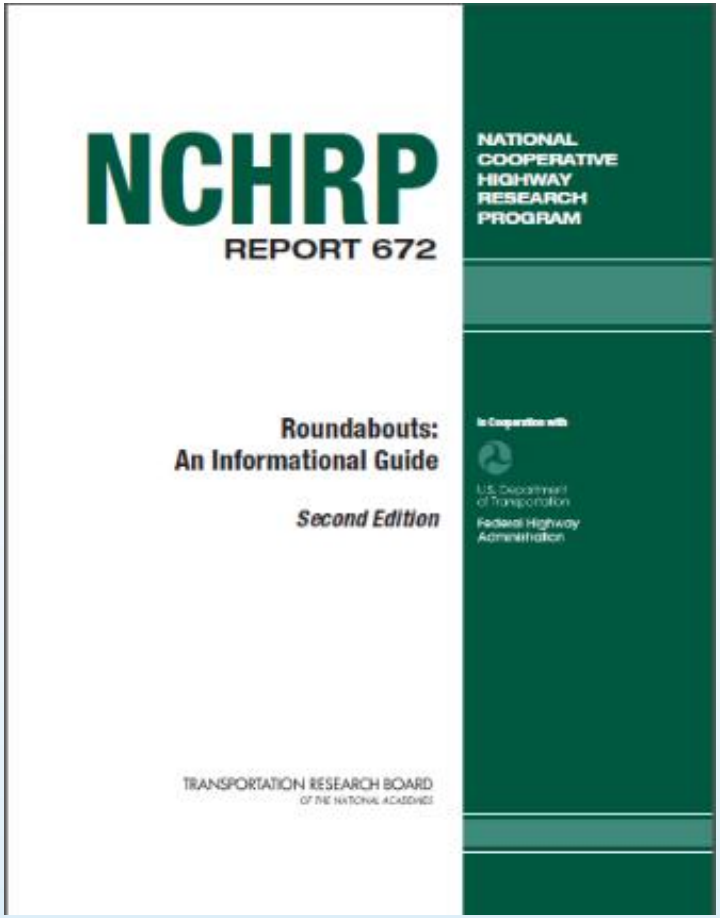
    http://www.trb.org/ANB75/ANB75.aspx
- Listserv
  - http://trbroundabouts.com/listserv/

US Design and Planning Resources

2000



2010



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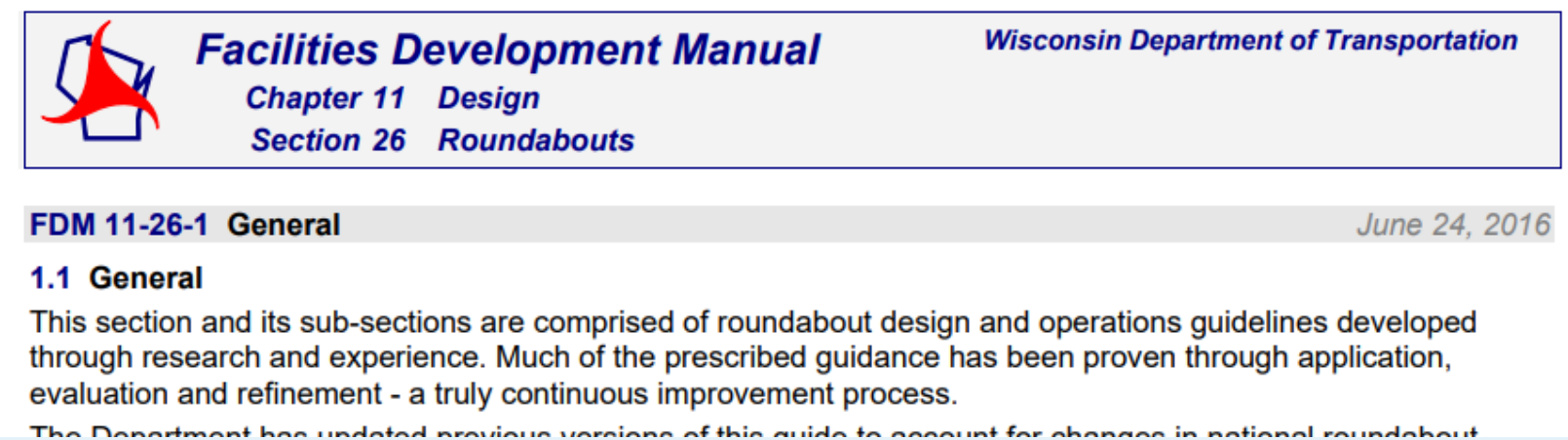
Other resources/guidance

- States and local governments
- Wisconsin DOT – good design resource



Facilities Development Manual — Wisconsin Department of Transportation

Chapter 11 Design

Section 26 Roundabouts

FDM 11-26-1 General June 24, 2016

1.1 General

This section and its sub-sections are comprised of roundabout design and operations guidelines developed through research and experience. Much of the prescribed guidance has been proven through application, evaluation and refinement - a truly continuous improvement process.

The Department has updated previous versions of this guide to account for changes in national roundabout

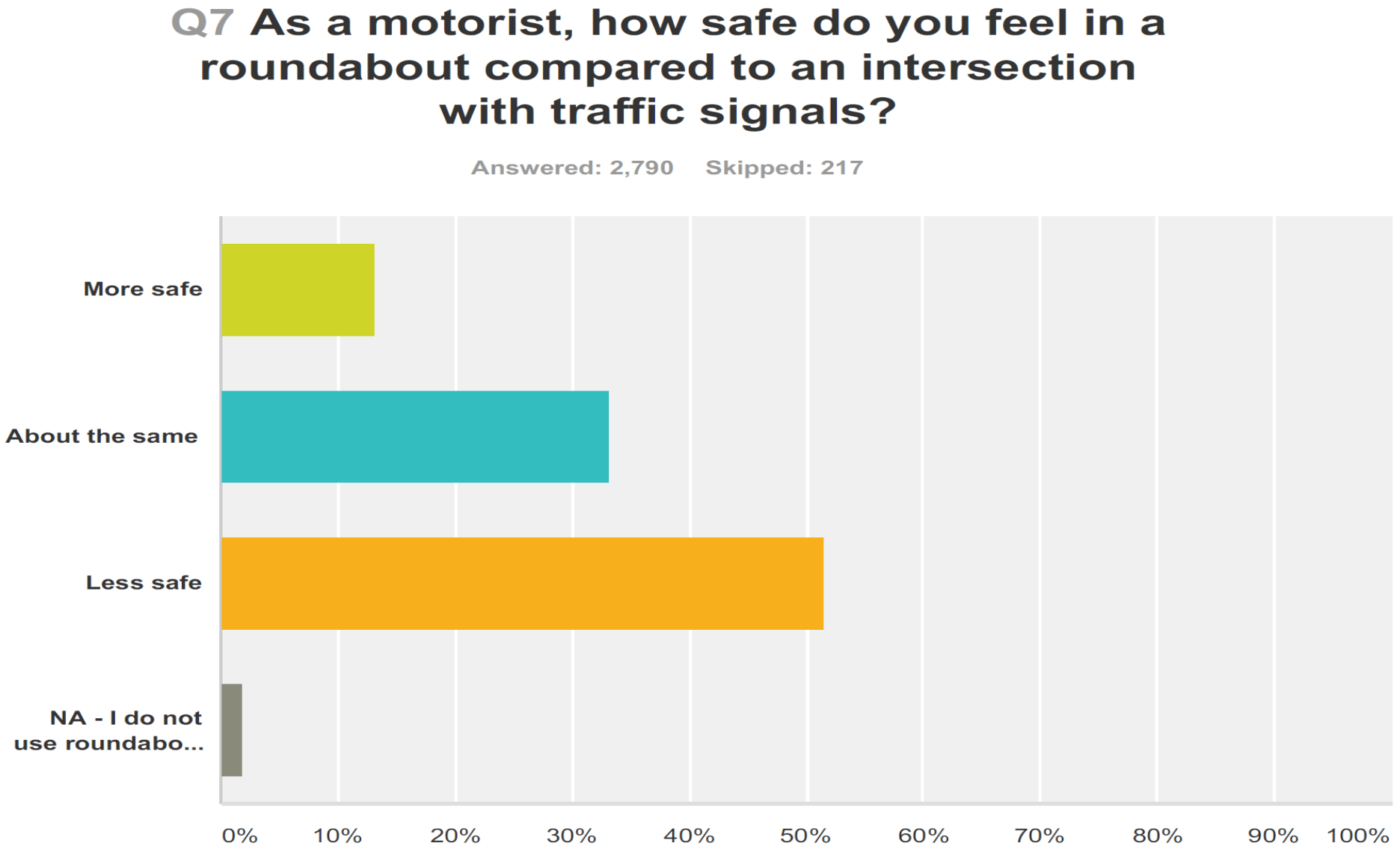
NCHRP research reports available

- NCHRP 674 - **Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities** (2011)
- NCHRP 834: **Guidelines for the Application of Crossing Solutions at Roundabouts and Channelized Turn Lanes to Assist Pedestrians with Vision Disabilities** (2017)
- NCHRP 772 - **Evaluating the Performance of Corridors with Roundabouts** (2014)
- NCHRP 03-110: **Life Cycle Cost Analysis of Intersections** (2015)
- NCHRP 488 Synthesis: **Roundabout Practices** (2016)

Ongoing/future NCHRP research

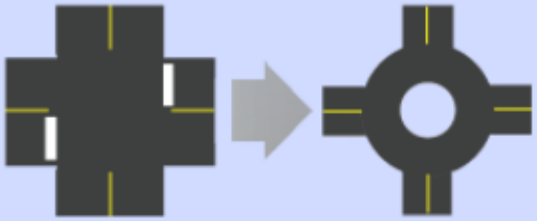
- FHWA - **Mini Roundabout Safety and Operational Study** (Anticipated 2018)
- NCHRP 17-70: **Development of Roundabout Crash Prediction Models and Methods** (Anticipated 2018)
- NCHRP 03-130 **Update to the Roundabout Informational Guide** (start date mid 2018)

Myth 2: Roundabouts are not safe!



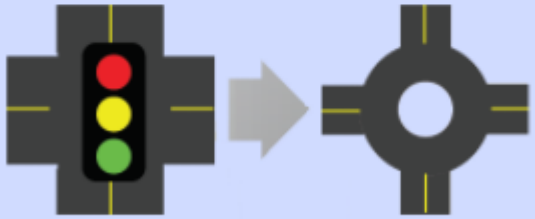
Safety benefits are better defined now

Two-Way Stop-Controlled Intersection to a Roundabout



82%
Reduction in severe crashes

Signalized Intersection to a Roundabout



78%
Reduction in severe crashes

Source: *Highway Safety Manual*

Available Crash Modification Factors

Area Type/Severity	CMF
All/Injury	0.68
Urban/Injury	0.4
Suburban/All	0.33
All/All	0.52
All/Injury	0.22
Suburban/All	0.79
Urban-Suburban/All	0.34
Suburban/All	0.58
Suburban/Injury	0.26

Myth 3: # of crashes will always decrease when converting to a roundabout

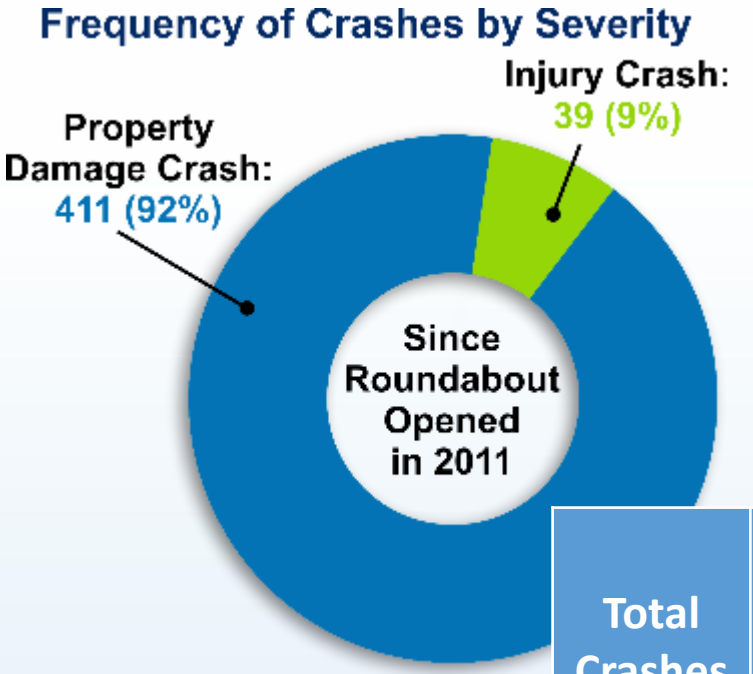
- Property damage crashes could increase!
  - Especially at multilane roundabouts
  - **Most especially at “2x2” roundabouts**

MORPC top-100 high-crash intersections

Location	Rank	3-year Crash Frequency	Severity Rank (EPDO/ MEV)	Notes
Cemetery Rd & Main St	34	262	152th (1.40)	2x2 on all 4 approaches
Main St & Scioto Darby Rd	40	140	140th (1.81)	Skew issue
E. Bridge & Riverside Dr	46	173	147th (1.62)	3x2 NB Approach
Riverside Dr & Home Rd	51	112	149th (1.51)	2x2

EPDO range for other intersections 1.62 – 4.72

“Safe” or not?



- Absolutely “safer” than other intersection types in terms of risk of serious injury!

Total Crashes	Fatality	Total Injury	Injury Severity			EMS Transp
			Serious Injury	Minor Visible Injury	No Visible Injury	
231	0	18	0	7	11	2

2014-2016 (3 years)

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Capacity analysis methods evolving

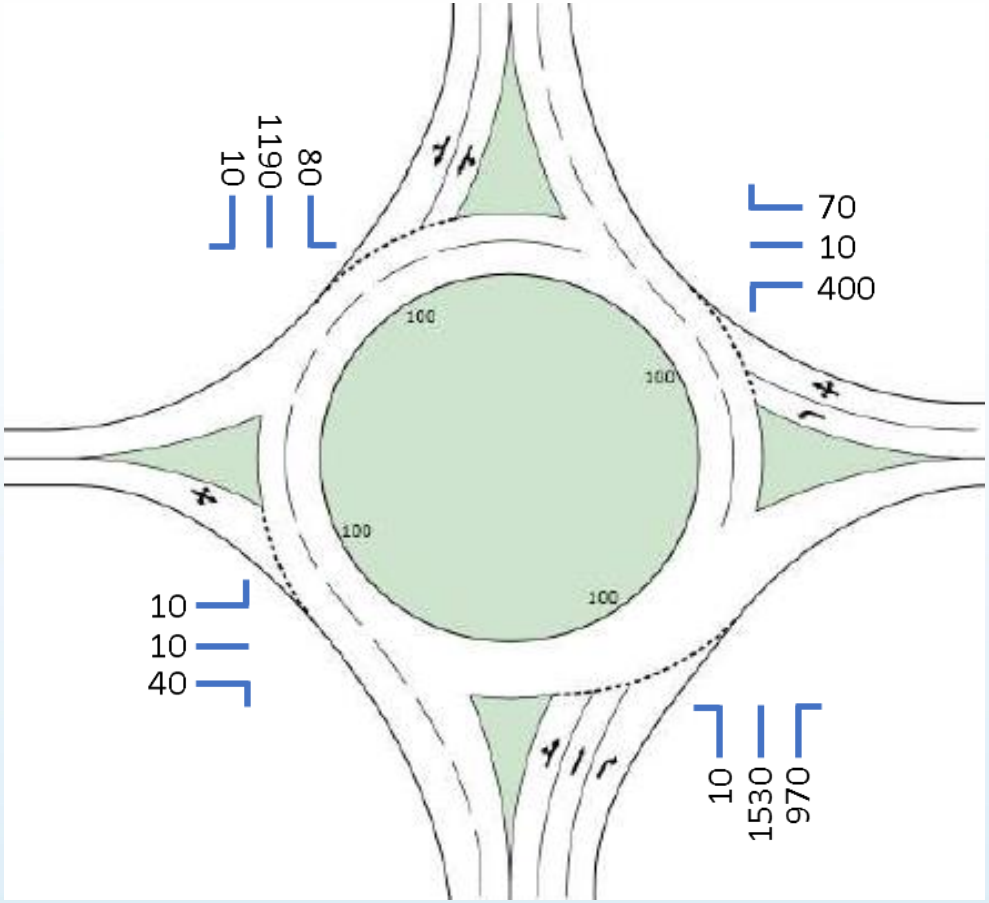
- **Highway Capacity Manual**
  - HCM 2010 model based on NCHRP 3-92
  - HCM 6th Edition model based on NCHRP-572
  - Empirical (linear regression), lane based
  - Effect of geometry determined to be negligible
- **Sidra**
  - Australian data
  - Lane-based gap acceptance theory model
  - Effect of geometry included
- **RODEL**
  - UK TRL Empirical Model
  - Significantly influenced by geometry
  - Approach based
- **Simulation** (VISSIM, TransModeler, others)

Software Results Comparison

PM Peak Average Delay/Vehicle

	NB	WB	SB	EB
HCM 2010	40.2	42.5	30.2	15.4
HCM 6th Edition	15.2	51.4	19.1	16.2
Sidra w/1.1 Env. Factor	7.1	18.6	9.4	13.9
VISSIM (Isolated)	2.1	43.6	6.2	93.3
RODEL1 for Windows*	9.3	6.4	5.5	6.7
*w/ estimated effective width	2.6	10.9	31.1	14.7

12’ lanes



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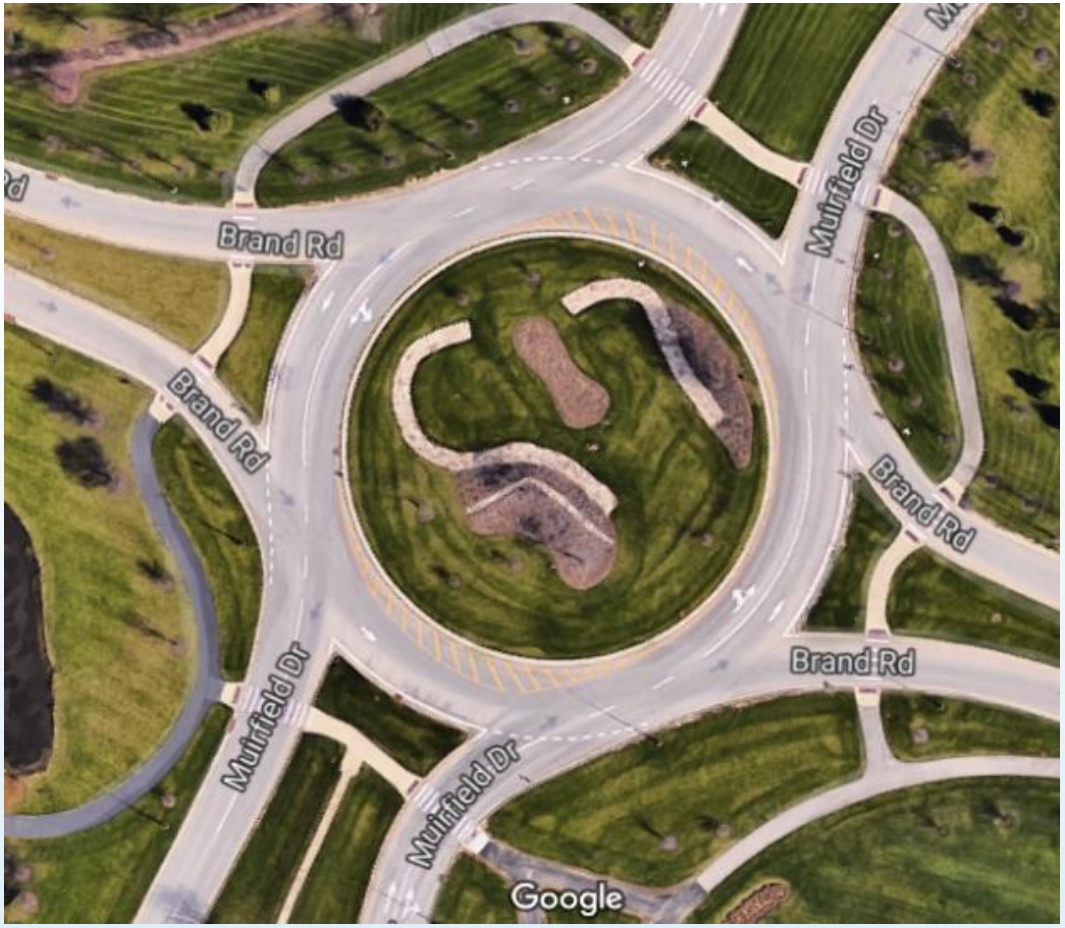
More agencies are starting smaller, expanding later



Life-cycle benefits being considered

Life Cycle Benefit/Cost Ratio		
Safety Benefit of a Roundabout	$	2,903,623
Delay Reduction Benefit of a Roundabout	$	2,600,555
Total Benefits	**$**	**5,504,178**
Added Operations&Maintenance Costs of a Roundabout	$	(41,161)
Added Capital Costs of a Roundabout	$	350,000
Total Costs	**$**	**308,839**
Life Cycle Benefit/Cost Ratio		**17.8**
		Roundabout Preferred

Example using FDOT Roundabout B/C Procedures

ADA options expanding

- Current Proposed PROWAG Rules Language

  R306.3.2 Pedestrian Activated Signals. At roundabouts with **multi-lane pedestrian street crossings**, a pedestrian activated signal complying with R209 shall be provided for each multi-lane segment of each pedestrian street crossing, including the splitter island. Signals shall clearly identify which pedestrian street crossing segment the signal serves.

- "Equivalent Facilitation"
  - NCHRP 674
  - Rectangular Rapid Flashing Beacon (RRFB)
  - Raised crosswalks

Myth 4: Most people hate roundabouts

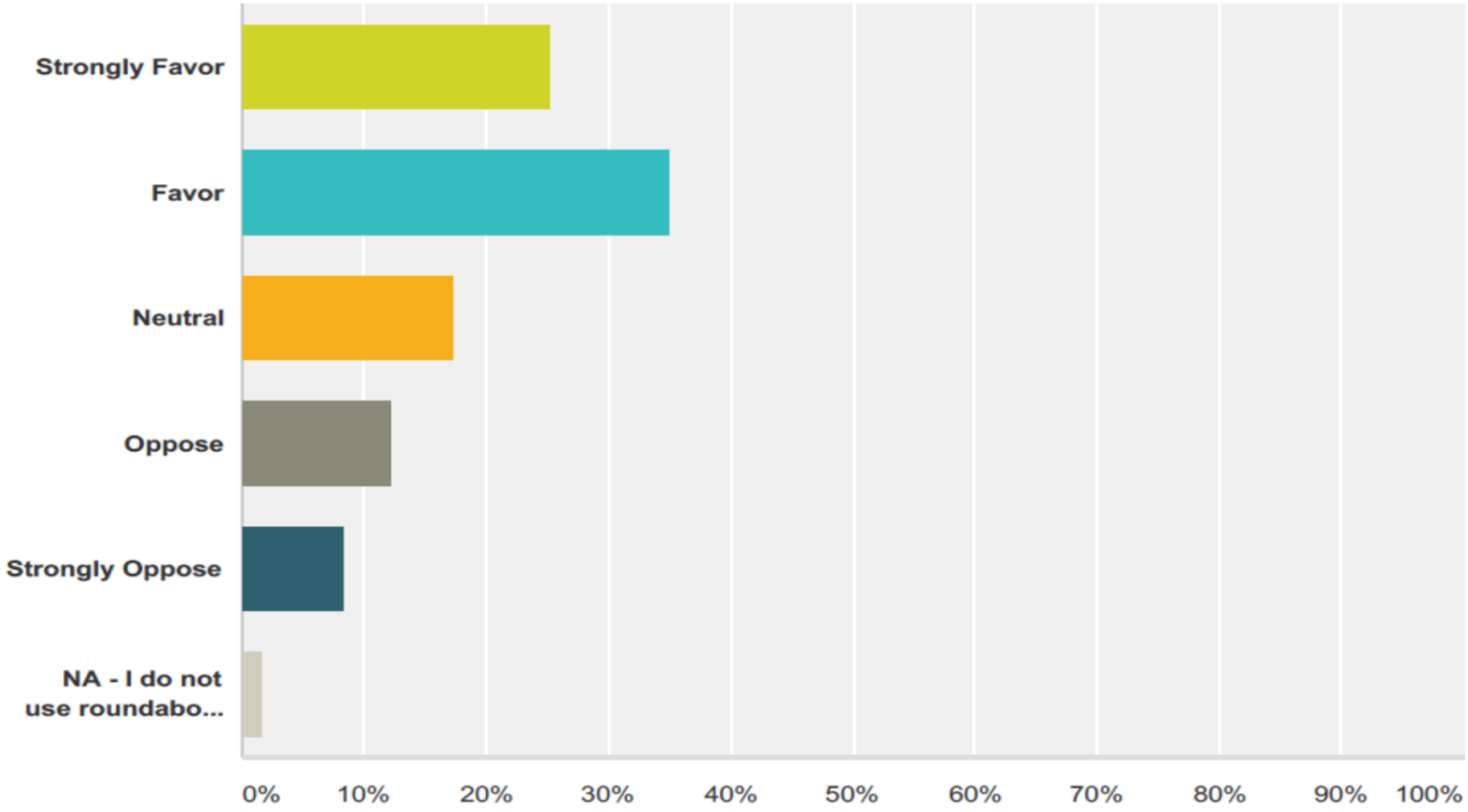
It's called kick backs people, doesn't have to be effective, just as long as everyone gets a piece of the tax payer pie!

Yes they are stupid. Whose idea was it to start with? Some kid that was playing a computer game for the last 10 years? LOL get a real engineer!

They are the circle of death! I hate those things!

Q3 As a driver, how would you rate your general opinion of roundabouts?

Answered: 2,789 Skipped: 218



More roundabouts built = more believers

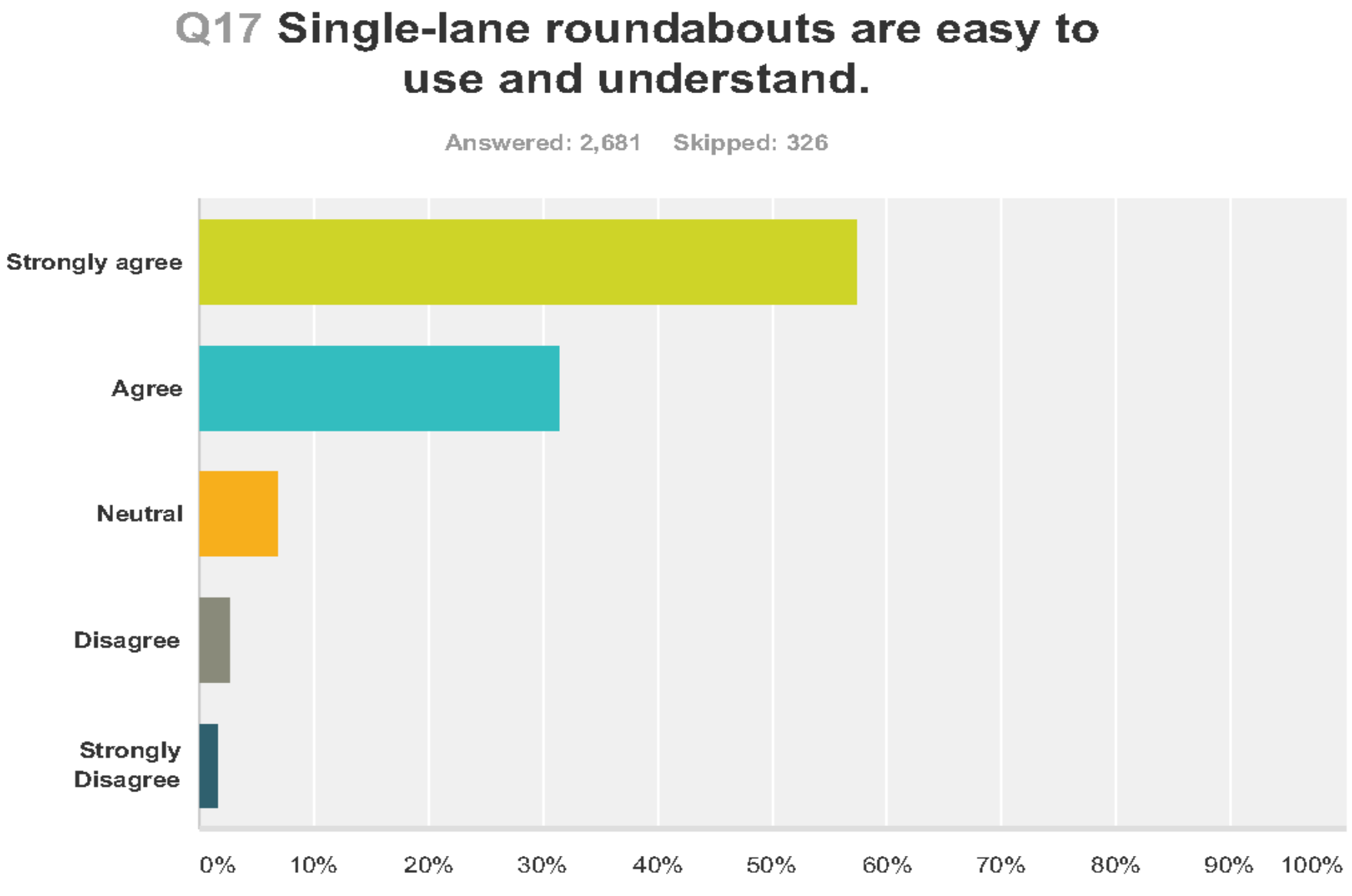
Managing Editor of Athens Messenger

When you're wrong, you're wrong. And when it comes to the Richland Avenue roundabout, I'm woman enough to admit I was wrong.

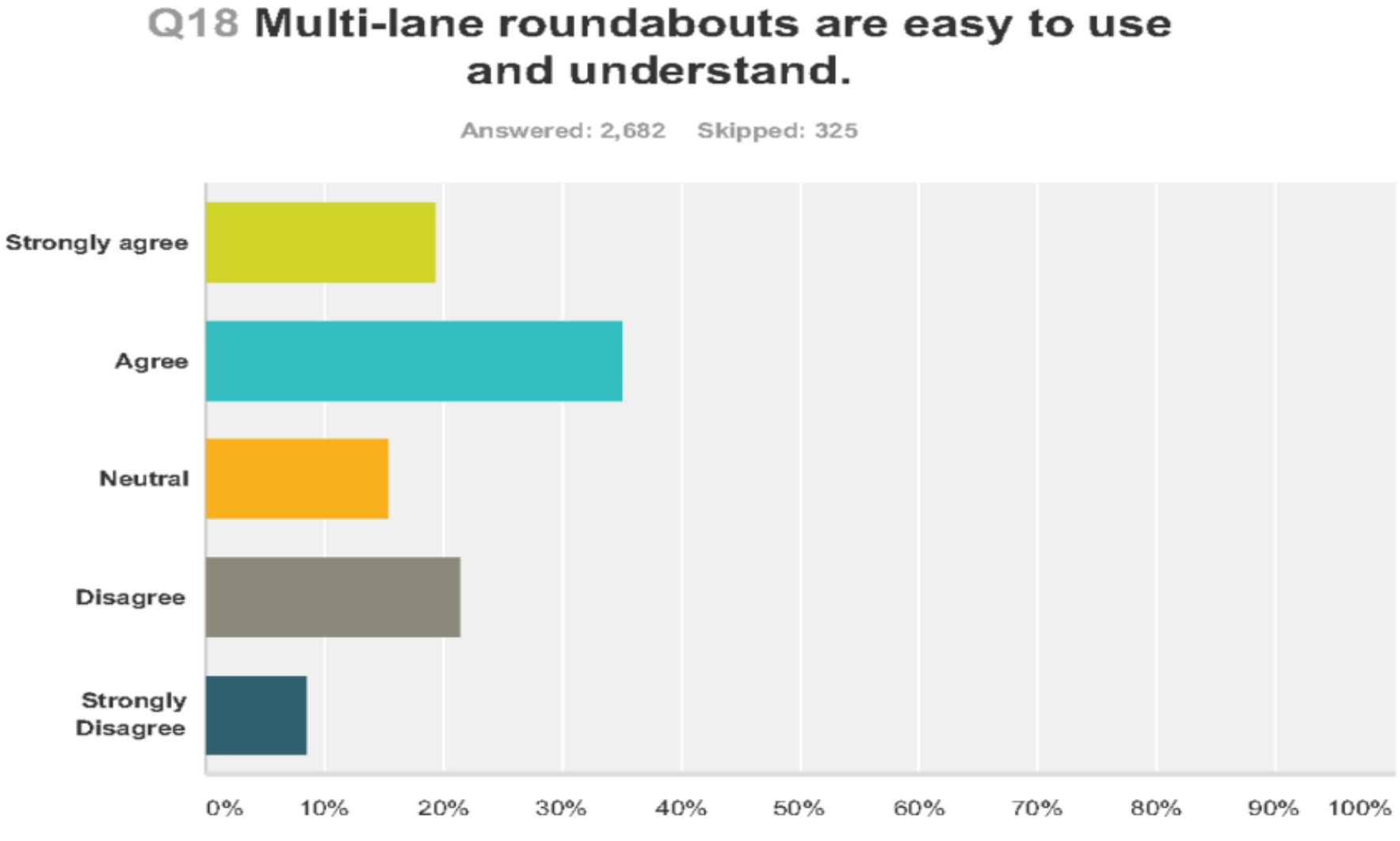
It seems as though the engineers behind the roundabout knew exactly what they were doing when they brought the roundabout concept to Athens.

I will gladly attend the dedication ceremony… and personally thank the individuals behind the project.

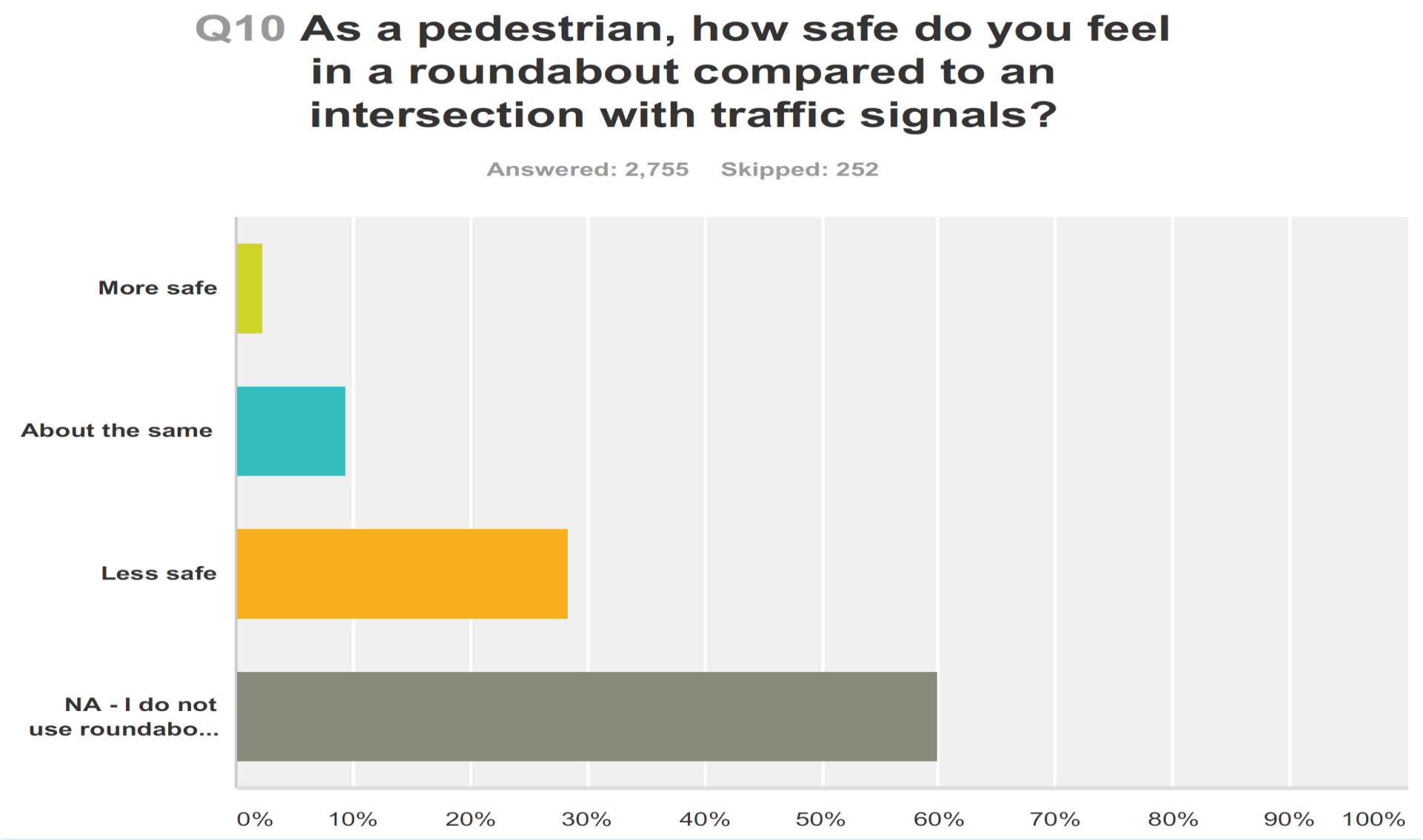
Truth: Single lane roundabouts are easy!



Truth: Most people are OK with multilane roundabouts

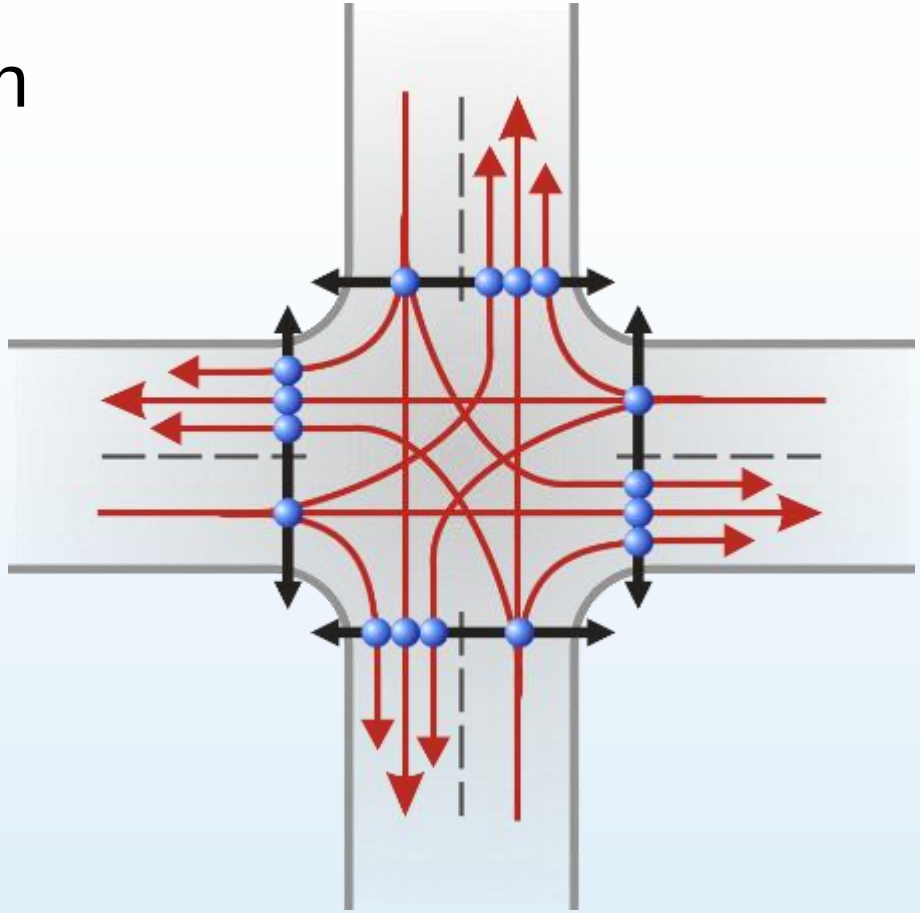


Myth 5: Roundabouts are not safe for pedestrians



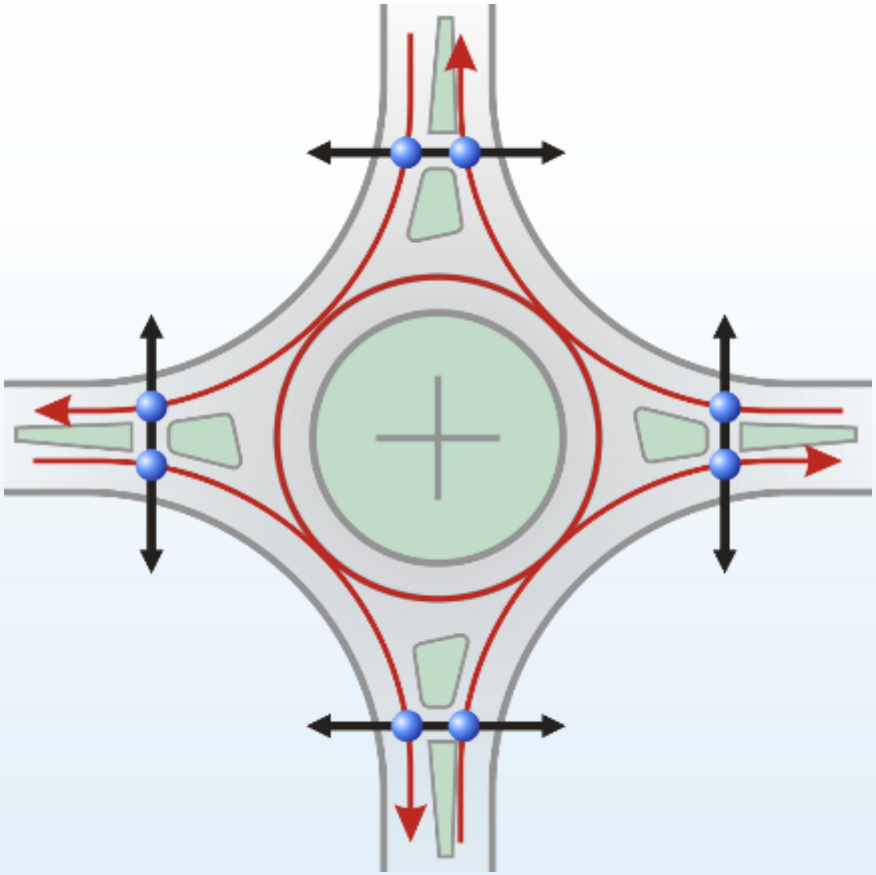
Do signalized intersections really feel safer?

- Key vehicle/pedestrian conflicts:
  1. Right turns on green (legal)
  2. Crossing movements on red (high-speed, illegal)
  3. Left on green (legal for permitted phasing)
  4. Right on red (typically legal)



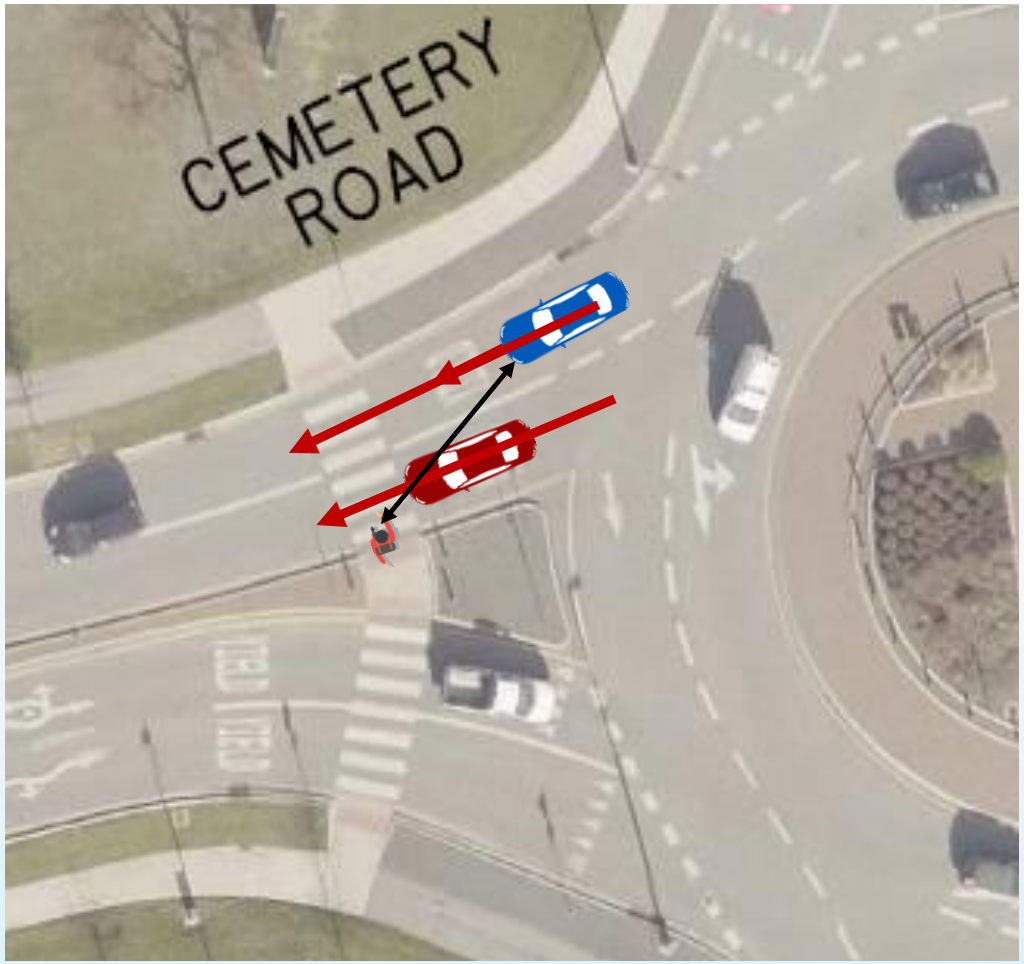
Roundabouts are easy for pedestrians to cross (but there are some challenges)

- 2 conflicts exist for each crossing
  - Conflict with entering vehicles
  - Conflict with exiting vehicles

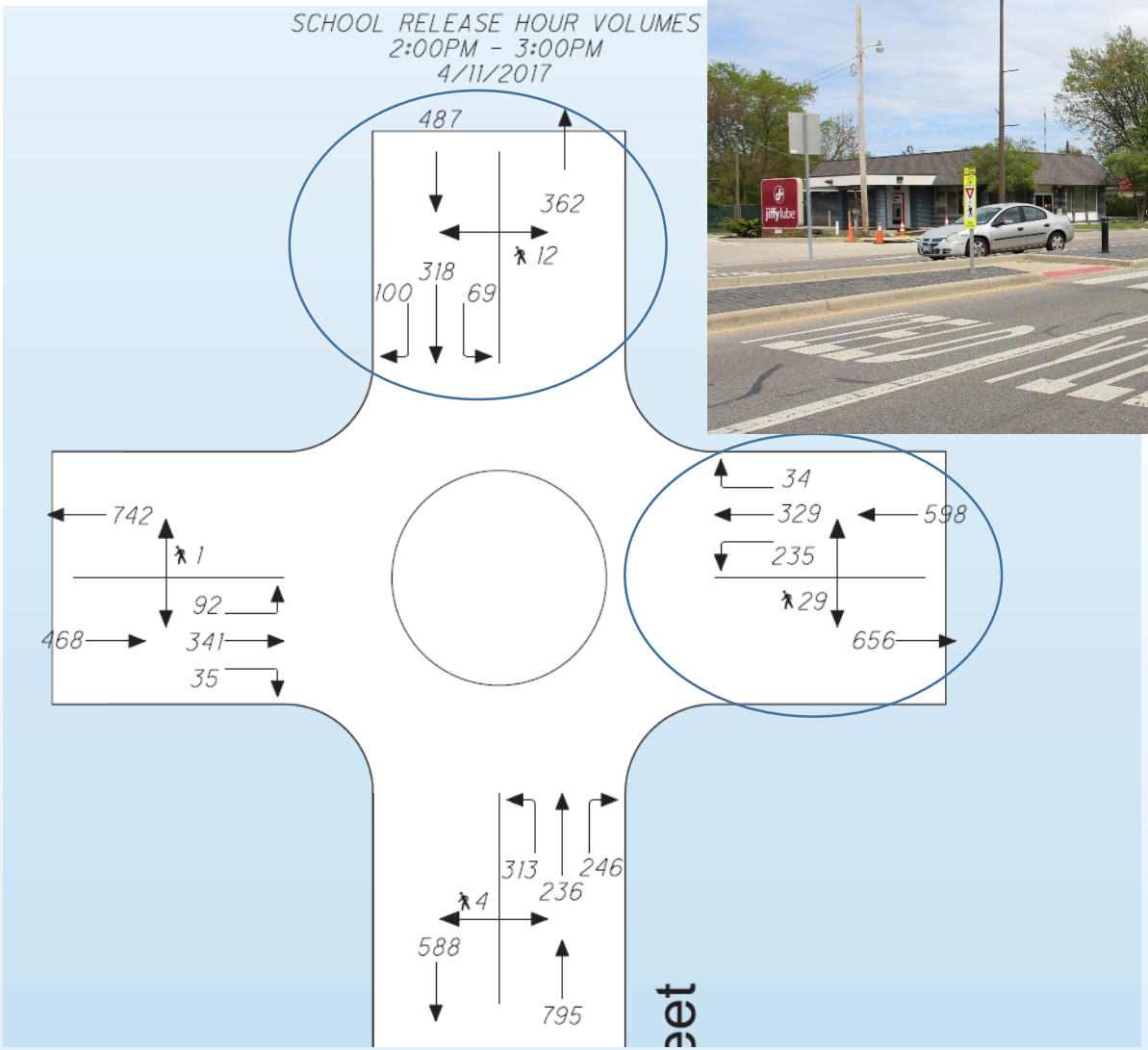


Biggest pedestrian concerns

- Lack of yielding, especially on exits
- Accelerating speeds on exits
- Vehicle in "2nd Lane"



Case in point



Public involvement approaches improving

- Use good visuals — put the project in context
- Bust myths and misconceptions with facts and studies
- Emphasize the safety benefits
- Use models to illustrate the efficiency
- Be genuine and honest
- Know your stuff!
- Use multimedia

Presentation Online

www.burgessniple.com/event/2018/otec

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