

Understanding Driver Acceptance of Restricted Crossing U-Turn Intersections

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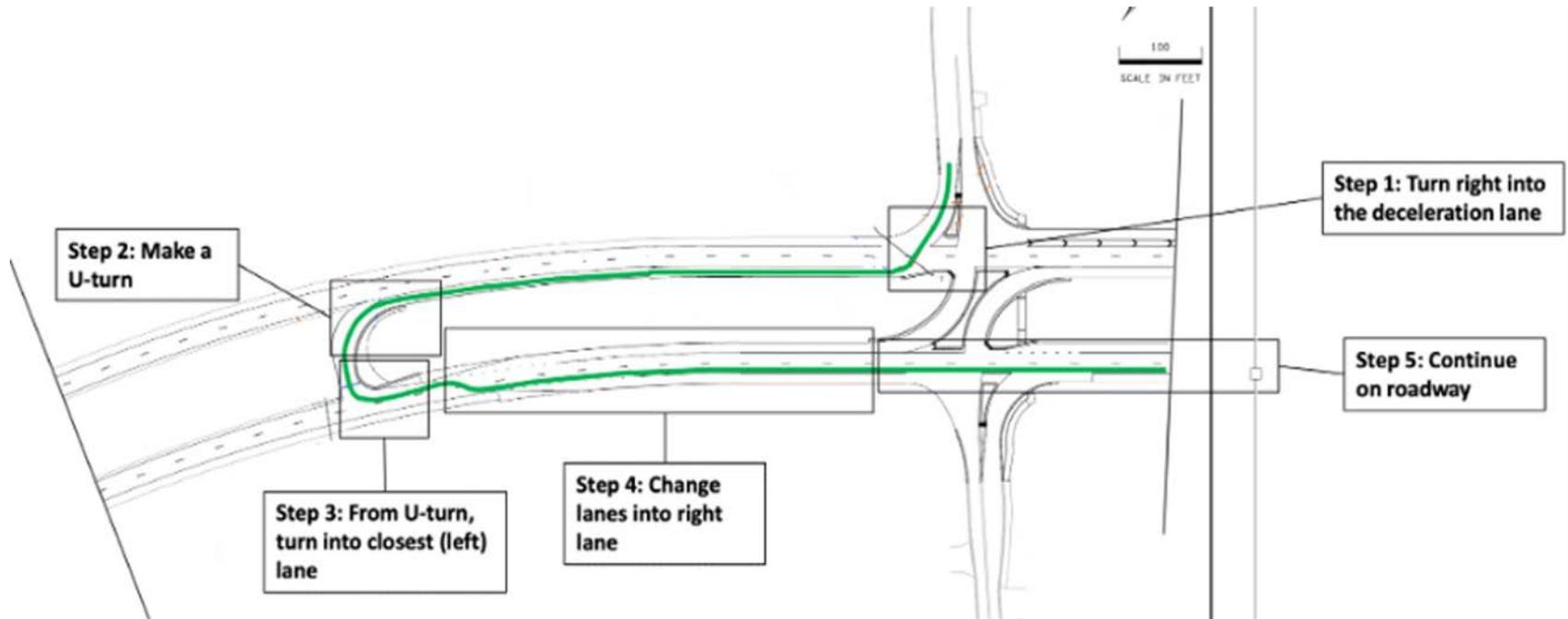
Research Objectives

- Develop clear and reproducible methods for engaging community members and stakeholders related to RCUTs and other non-traditional, relatively novel traffic treatments to increase buy-in and public acceptance

Simulated RCUT Driving Performance Test

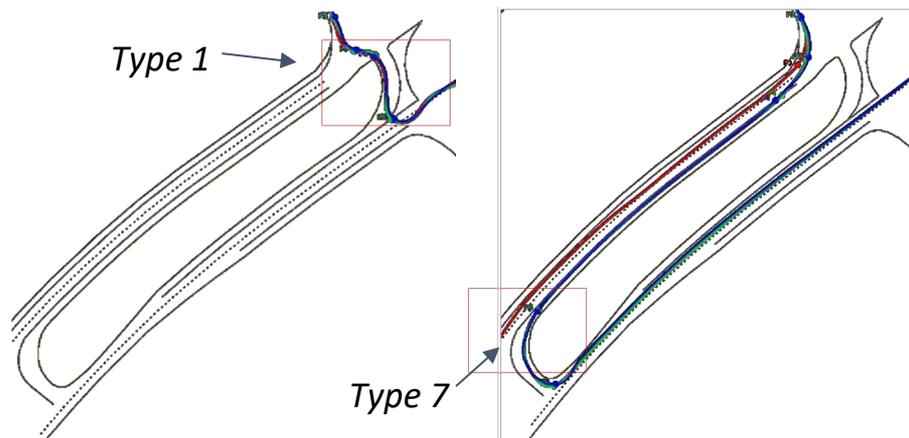
Understanding novice driver performance at RCUTs and role of signage levels on performance

RCUT optimal path and driving coding errors



Effect of the novice exposure to an RCUT

- Critical errors



	First-time Use		Subsequent Uses	
	<i>N</i> = 36 drives	<i>N</i> = 68 drives	<i>n</i>	%
Type 1: Drove through center	1	2.8	2	2.9
Type 7: Did not make a U-turn	6	20.7	0	0.0

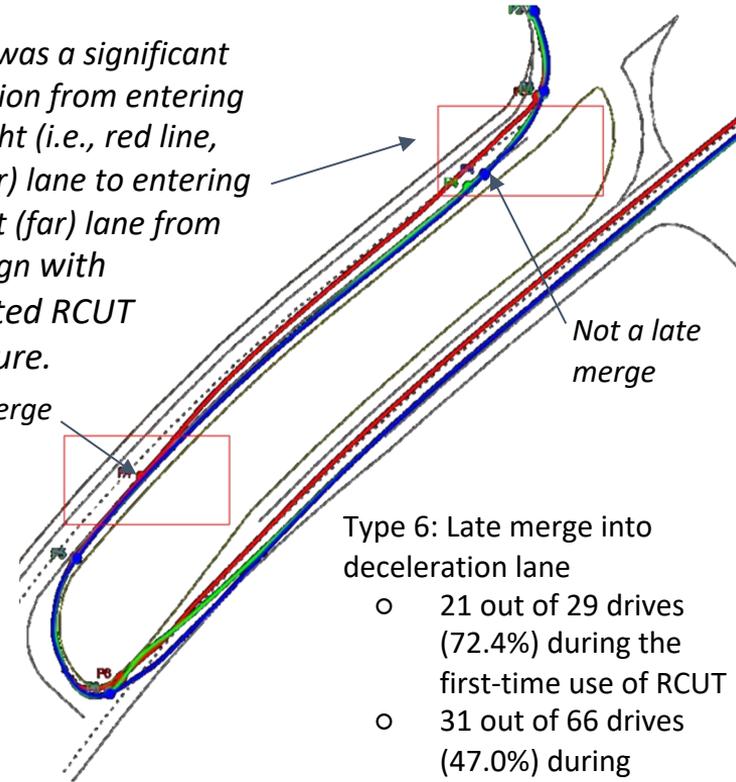
Effect of the novice exposure to an RCUT

- Non-critical errors

	First-time Use		Subsequent Uses	
	N	%	n	%
Type 2: Entered left (far) lane from stop sign	6	20.7	35	53.0
Type 3: Entered right (near) lane from stop sign	20	69.0	30	45.5
Type 6: Late turn into deceleration lane (< = 250 feet away from the U-turn)	21	72.4	31	47.0

There was a significant transition from entering the right (i.e., red line, or near) lane to entering the left (far) lane from stop sign with repeated RCUT exposure.

Late merge



Intersection Subjective Measures Results

	Conventional	Minimum Signage	Moderate signage	Maximum signage
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)
Mental Workload	55.00 (25.33)	56.08 (34.54)	54.70 (32.16)	63.12 (34.09)
Irritating	2.72 (1.25)	2.57 (1.38)	2.45 (1.23)	2.47 (1.24)
Easy to navigate	3.00 (1.14)	3.14 (1.35)	3.36 (1.22)	3.09 (1.19)

Participants' verbal feedback results

Theme	Sample Feedback	n (%)
Deceleration lane uncertainty	<i>Not sure what to do with my turn signals. Didn't feel safe merging across two lanes of traffic. Felt uncomfortable crossing traffic. Difficult to cross over.</i>	13 (56.5)
Support for RCUTs or roundabouts	<i>Feels faster and safer. Only had to watch traffic one direction at a time. RCUTs are preferable on very busy roads. It is clear what you need to do.</i>	13 (56.5)
Need for additional information	<i>Include a sign with a symbol to show you what to do, add painted lines on the roadway (e.g., arrows). Provide instruction prior to U-turn. Bold and darken signage words. Use lights.</i>	11 (47.8)
Learning experience	<i>First time navigating RCUT was tough but got the hang of it on the second attempt. This was a very educational experience. Much more comfortable with the RCUT after the initial drive. A lot easier and less confusing [the 2nd and 3rd time].</i>	7 (30.4)
Preference for conventional intersections	<i>The conventional intersection feels like I have more control.</i>	4 (17.4)
No difference in RCUT signage levels	<i>Did not notice difference between sign levels</i>	4 (17.4)

Takeaway messages from the simulator study

- Common driving errors include
 - 1) failure to make the U-turn,
 - 2) late turns into the deceleration lane, and
 - 3) failure to turn into the correct lane on the highway.

Takeaway messages from the simulator study

- In general, driving performance improved with repeated RCUT exposure.
- The level of signage had little effect on driving performance; however, some segment-specific driver speeds and self-reported workload measures (not significant) suggested the moderate level of signage to be potentially the most appropriate.
- However, simulated driving experience on RCUTs was not powerful enough to improve attitudes towards RCUTs.

Evaluation of Persuasive Messaging Techniques

Testimonial Study and Large Sample Study

Overview RCUT Knowledge and Experience

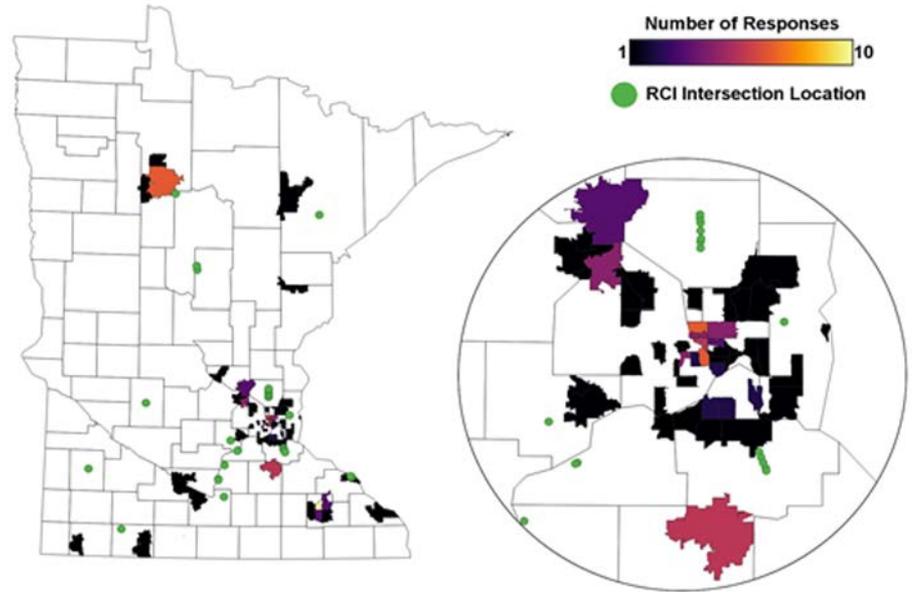
	Testimonial Study		Large Sample Study	
	<i>n</i>	%	<i>n</i>	%
Knowledge of RCUTs				
I have never heard of RCUTs	53	33.5	126	31.3
I have heard of RCUTs but am not very familiar	31	19.6	99	24.6
I have heard of RCUTs and am somewhat familiar	53	33.5	125	31.1
I have heard of RCUTs and am very familiar	21	13.3	52	12.9
Experience with RCUTs				
I have never crossed an RCUT	57	36.1	126	31.3
I have crossed an RCUT once or twice	53	33.5	132	32.8
I occasionally cross RCUTs	42	26.6	120	29.8
I frequently cross RCUTs	6	3.8	24	6.0

Note. Testimonial Study *N* = 158; Large Sample Study *N* = 402.

Testimonial Study

162 participants participated in the study

- 59.3% reported living in the seven-county metro and the
- 40.7% lived in greater Minnesota.
- Average age = 49.59 (20-81 years old SD = 16.94), Median = 50



Testimonial Video Descriptions

Video	Speaker Description	Length (sec)	Speaker Gender	Speaker Age Group	Location	Story Type
A	Grocery Operations Manager	68	Female	Older Adult	Jordan, MN	Personal Story
B	City Administrator	78	Male	Middle-Aged Adult	St. Peter, MN	Informational
C	Grocery Store Owner	85	Male	Middle-Aged Adult	Jordan, MN	Informational
D	Young Driver	87	Male	Young Adult	Minneapolis, MN	Personal Story/Opinion
E	Vehicle Sales General Manager	89	Male	Middle-Aged Adult	St. Peter, MN	Informational, Personal Opinion
F	State Trooper	100	Male	Older Adult	Shakopee Region	Informational
G	Older/Parent Driver	108	Male	Older Adult	Willmar, MN	Personal Story/Opinion
H	Restaurant General Manager	102	Male	Young Adult	Jordan, MN	Personal Story/Opinion

Informed Consent



Introduction Slides

Pre-RCUT Attitudes

Demographics



Transportation, Cognitive Response, Cognitive Processing, Affective Response, Perception of Speaker, Perception of Message

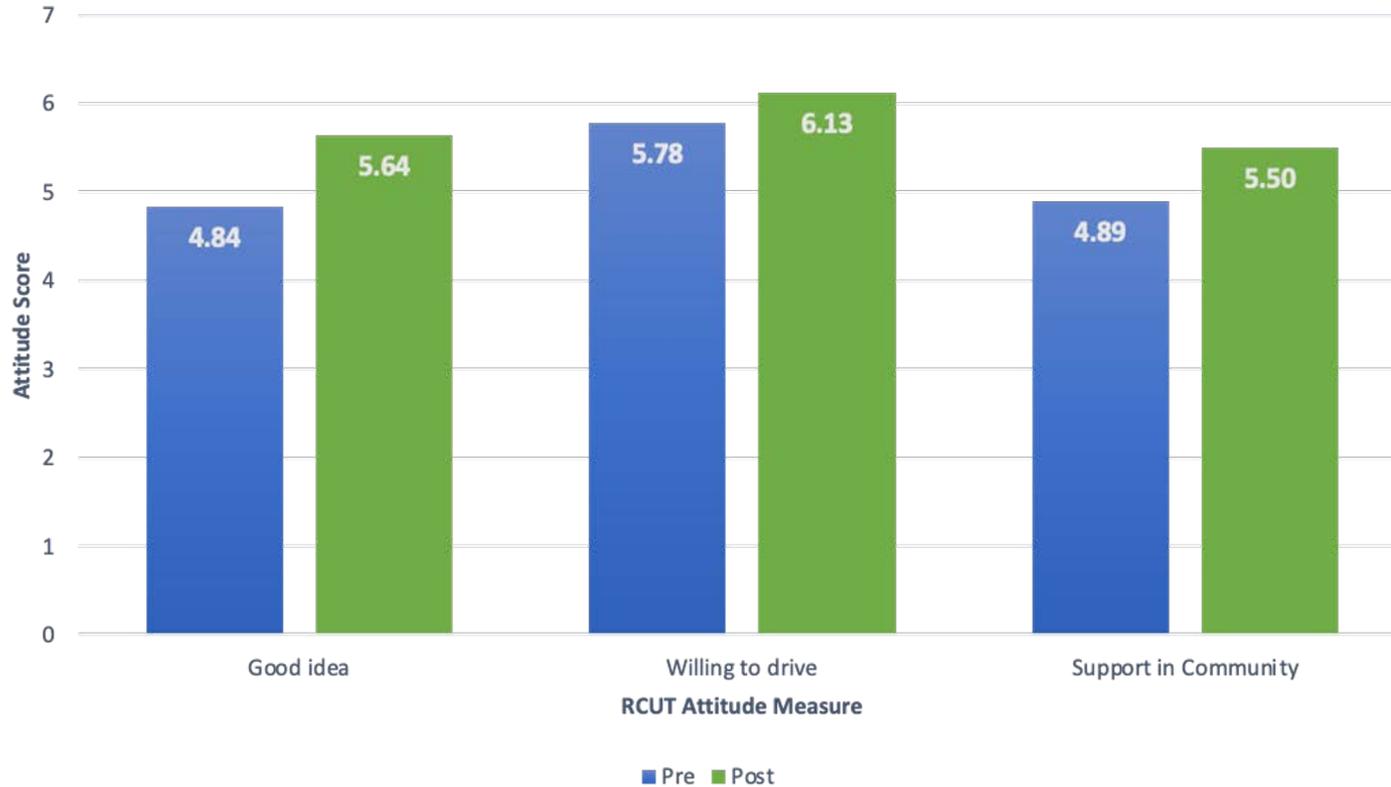
Post-RCUT Attitudes

Roundabout
Acceptance

James Erwin
Alumacraft Boats
St.Peter, MN

Willmar, MN
Art Benson

Attitude Change





	<u>Transportation</u>	<u>Affective 1 Response*</u>	<u>Cognitive Response</u>	<u>Cognitive Processing</u>	<u>Perception of Speaker</u>	<u>Perception of Message</u>
Video	M	M	M	M	M	M
Video A	3.94 (1.17)	3.20 (.83)	3.18 (.90)	3.53 (.94)	4.76 (1.27)	4.49 (1.65)
Video B	4.08 (1.43)	3.62 (.87)	3.46 (1.04)	3.69 (1.09)	5.64 (1.26)	5.24 (1.66)
Video C	4.25 (1.28)	3.74 (.87)	3.48 (1.02)	3.94 (1.07)	5.12 (1.33)	5.15 (1.55)
Video D	4.66 (1.09)	3.70 (.79)	3.62 (.85)	3.91 (.94)	4.94 (1.02)	4.85 (1.43)
Video E	4.27 (1.09)	3.89 (.87)	3.49 (.93)	4.03 (1.02)	5.68 (.99)	5.66 (1.27)
Video F	4.41 (1.06)	3.67 (.81)	3.78 (.73)	3.88 (1.01)	5.83 (1.01)	5.52 (1.17)
Video G	5.03 (1.10)	3.67 (.86)	3.78 (.89)	4.07 (.95)	5.47 (.97)	5.70 (1.19)
Video H	4.23 (1.27)	3.52 (.85)	3.38 (.87)	3.98 (.96)	5.17 (1.12)	5.11 (1.45)

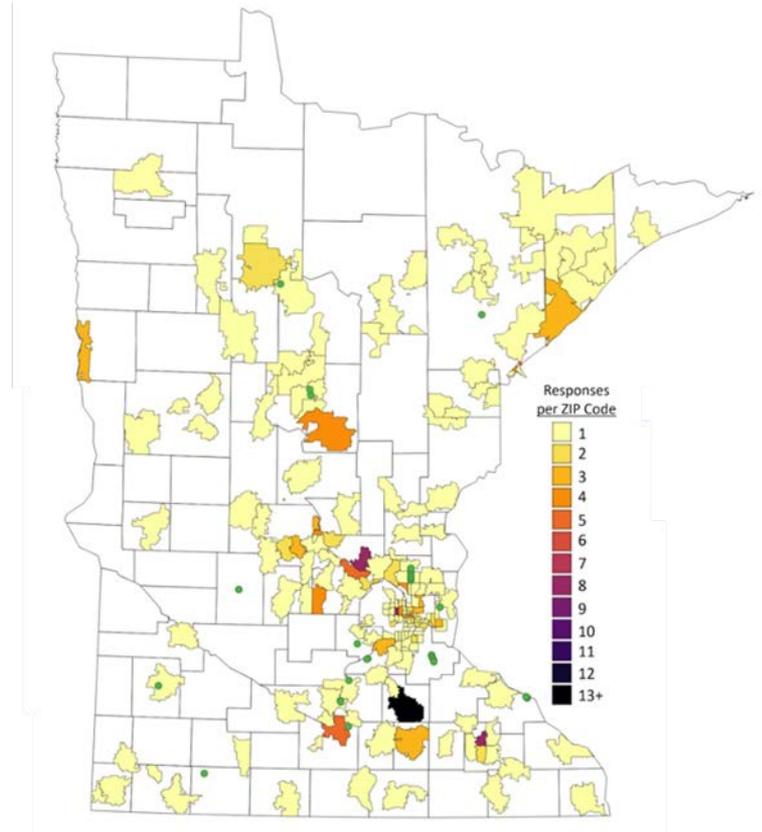
Large Sample Study

$N = 403$ (45.7% female)

- Age $M = 41.36$ ($SD = 16.10$), range 19 to 83 years)

Recruited across MN using mixed-method approach

- Urban area $n = 112$ (27.9%)
- Suburban area $n = 146$ (36.3%)
- Rural area $n = 144$ (35.8%)

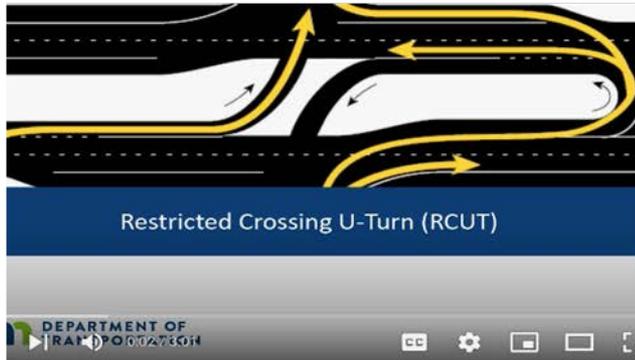




Simulation ($n = 91$)



Informational Video ($n = 109$)



PowerPoint ($n = 104$)



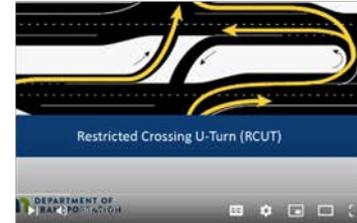
Narrative Storytelling ($n = 99$)

Informed
Consent



Demographic
Information

Pretest Measures
(Attitudes, Personal
Involvement)

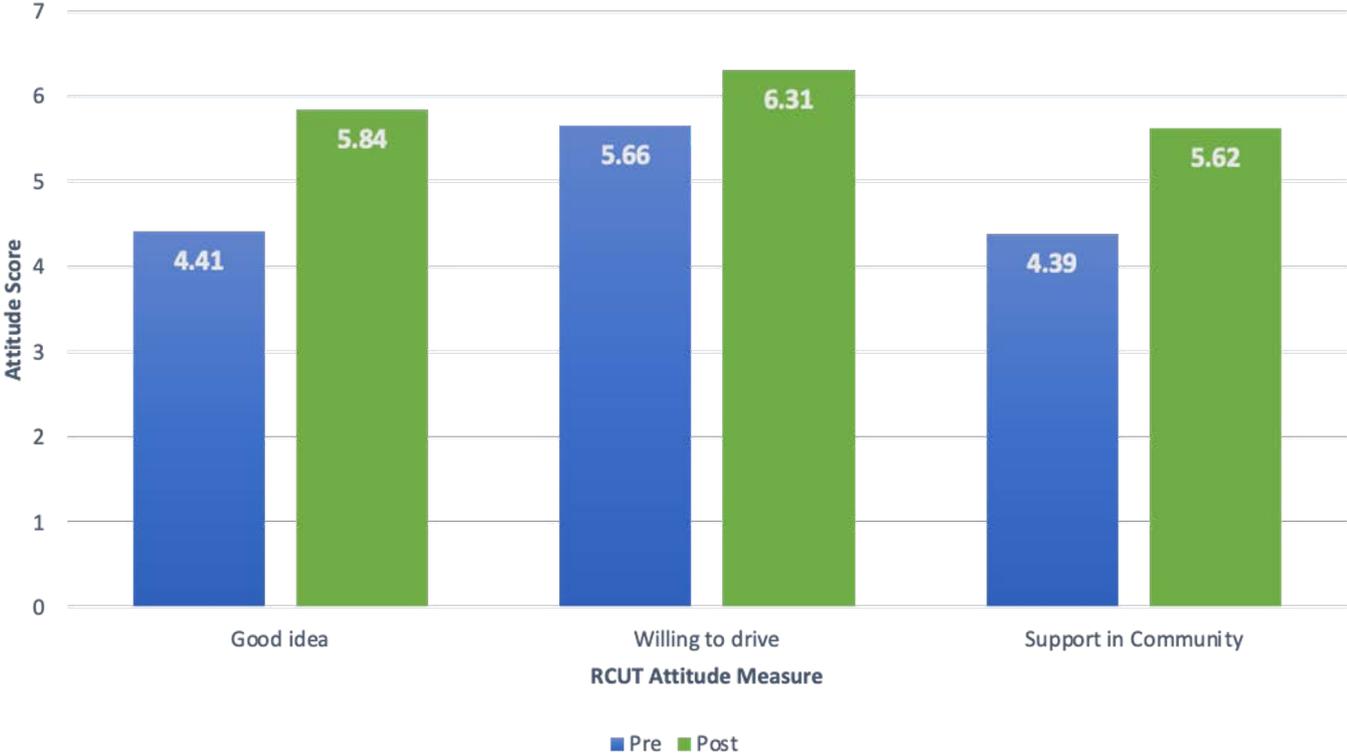


Level of Transportation, Cognitive Response,
Perception of Presentation, Perception of Message

Posttest Attitudes

Acceptance of
Roundabouts

Attitude Change



Presentation Method



Informational Video



Urban

($M = 4.77$, $SD = 3.46$)



Narrative Storytelling



Suburban

($M = 3.90$, $SD = 3.58$)



Simulation



Rural

($M = 3.75$, $SD = 3.01$)

Presentation Evaluation



Condition	<i>n</i>	<u>Transportation</u> <i>M</i>	<u>Cognitive Response</u> <i>M</i>	<u>Perception of Message</u> <i>M</i>	<u>Perception of Presentation</u> <i>M</i>
Simulation	91	5.85 (.91)	3.68 (.58)	5.81 (1.18)	5.96 (1.15)
Informational Video	109	5.54 (1.13)	3.73 (.62)	5.70 (1.43)	5.58 (1.44)
PowerPoint	104	5.44 (1.05)	3.86 (.61)	5.62 (1.48)	5.46 (1.39)
Narrative Storytelling	99	5.40 (1.03)	3.73 (.59)	5.90 (1.26)	5.58 (1.47)

Note: Transportation, perception of message, and perception of presentation on 7-point scales. Cognitive response on 5-point scale. Standard deviations in parentheses.

Discussion

- Attitudes towards RCUTs significantly improved from pre- to post-treatment across both studies
- Multiple effective presentation modalities that increase buy-in and support for RCUTs at the community level
- Participants may be more willing to drive on RCUTs than support in the community
- Support for roundabouts predicts support for RCUTs

Discussion

Testimonial Study

- Those living outside of the seven-county metro who thought about how RCUTs could affect their own lives showed greater attitude change
- Those living inside the seven-county metro more swayed by testimonials that immersed them in the story and contained a credible and trustworthy speaker

Discussion

Large Sample Study

- Attitudes are influenced by the importance of safety in roadway design
- Urban residents influenced by informational video or Powerpoint presentations (i.e., message-relevant thinking)
- Suburban residents influenced by testimonials (i.e., unbiased messages)
- Rural residents influenced by testimonials or simulation (i.e., immersive experiences)

Conclusions and Recommendations

Recommendations for Persuasive Messaging

1. Utilize a mixed-method messaging strategy when communicating upcoming roadway changes
 - a. Informational and educational materials
2. Find ways to get people to be personally involved prior to presenting educational information
3. For less-invested individuals, shorter persuasive messages are better
4. Lead the persuasive message with information about RCUT benefits, so benefits are upfront while the individual considers how to navigate an RCUT

Recommendations for RCUT Signage

1. Full and minimum tested signage levels can be confusing and lead to inefficiency driving behavior
2. A moderate level of signage *is appropriate*
3. Exposing drivers to RCUTs through simulation or immersive videos through engagement activities may achieve improved performance and reduced workload

Recommendations for Persuasive Messaging

5. When making decisions about reducing presentation content, testimonials should not be removed to meet time constraints
6. Testimonials are effective, but require credible messengers for the audience
7. Audiences can differ and have different dispositions towards RCUTs

Questions?

Thank you!