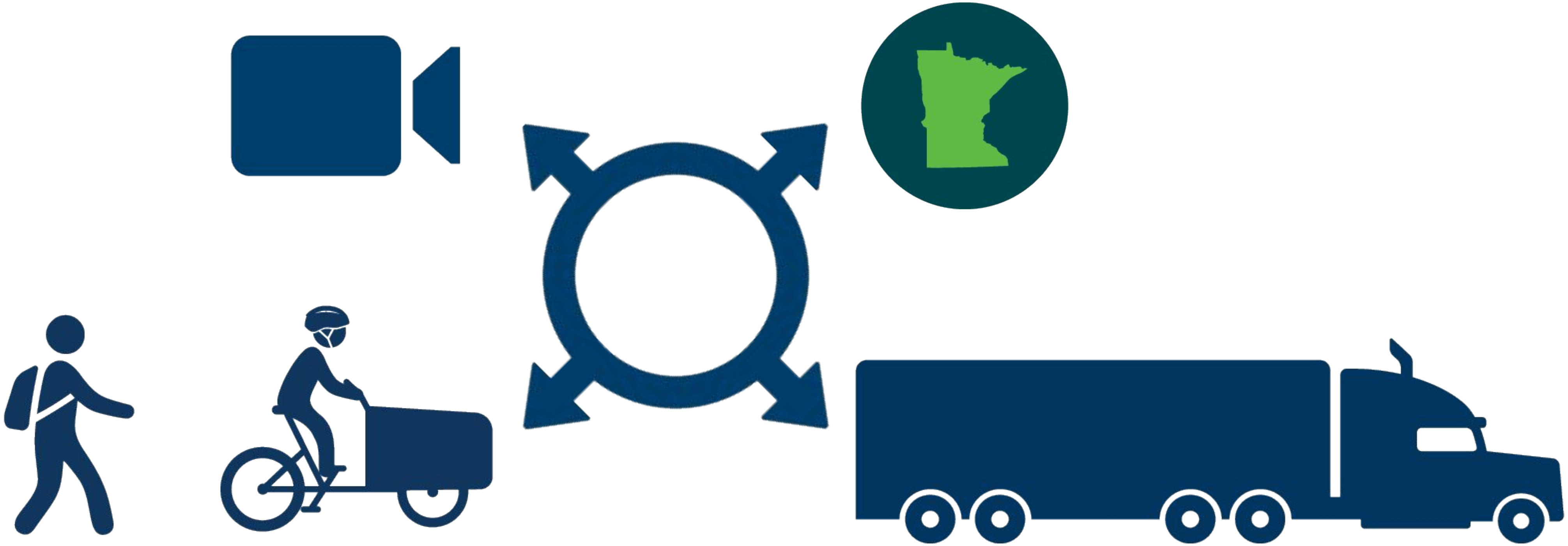


Roundabouts & Research: Pedestrians, Bicyclists, Heavy Vehicles, Speed Safety Cameras, and Traffic Safety & Marijuana

Mark Wagner, PE | MnDOT Office of Traffic Engineering

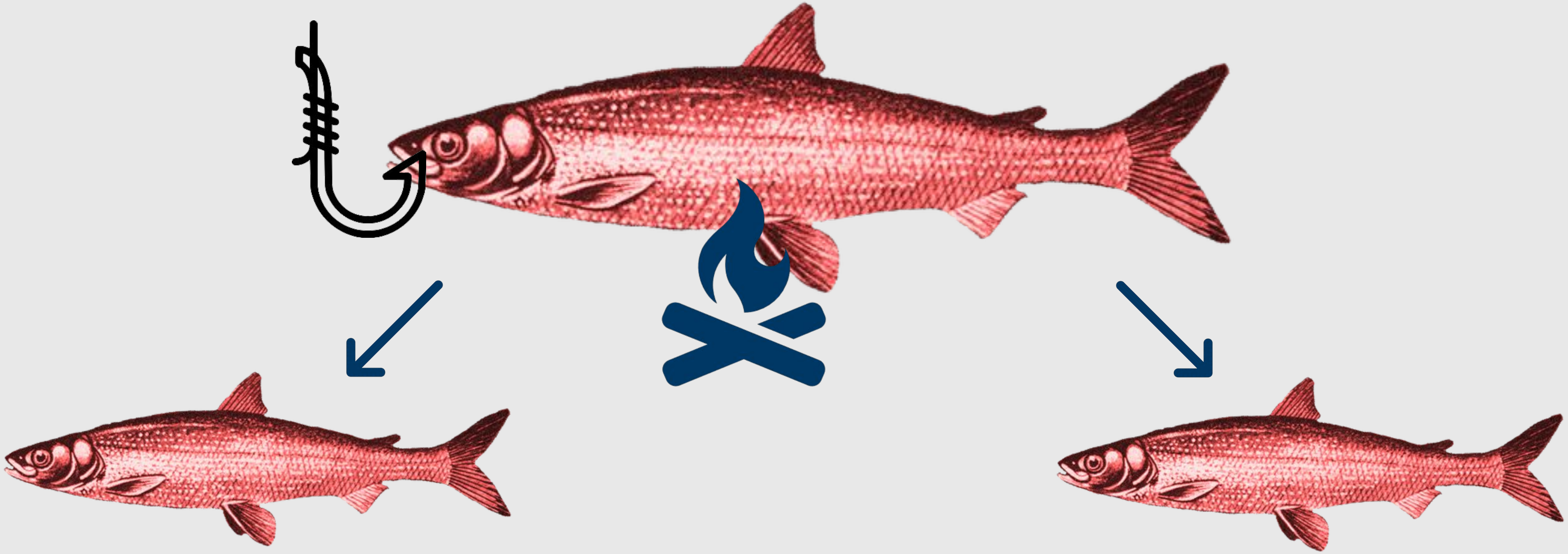
2023 TZD Statewide Conference | November 15, 2023

DEPARTMENT OF TRANSPORTATION

mndot.gov

Roundabouts & Red Herrings

~~“No one knows how to drive these!”~~ ~~“It’s going to back up for miles!”~~ ~~“No one is going to stop!”~~



“They’re not safe for pedestrians!”

“Semis will be tipping like cows!”

Pedestrian and Bike Safety at Roundabouts

Pedestrian and Bike Safety at Roundabouts
Latest Research

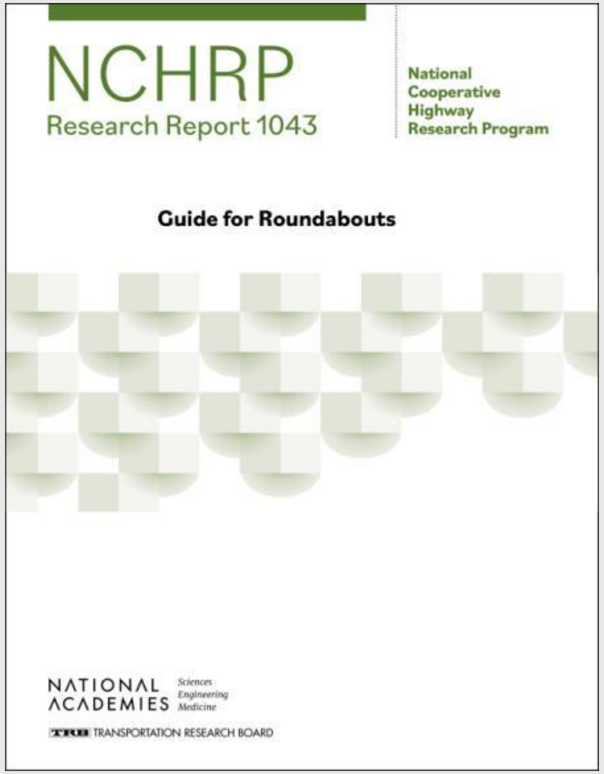


Exhibit 7.14. Bicyclist and pedestrian crashes at US roundabouts.

Crash Type	Number (Percent)		
	Rural	Urban	Total
Bicyclist	14 (0.7%)	60 (1.2%)	74 (1.1%)
Pedestrian	7 (0.4%)	18 (0.4%)	25 (0.4%)
Total reported crashes	1,938 (100%)	4,833 (100%)	6,771 (100%)
Number of sites	105	250	355
Number of study years of data	508	1,580	2,088

SOURCE: Adapted from *NCHRP Research Report 888*, Table 6-38 (*12*).

Exhibit 7.15. Crash modification factors for converting a stop-control or signalized intersection to a roundabout.

Treatment	Setting	Crash Type		Source
		All	Injury	
TWSC to single-lane roundabout	Rural	0.29	0.13	HSM (*1*)
	Suburban	0.22	0.22	HSM (*1*)
	Urban	0.61	0.22	HSM (*1*)
TWSC to two-lane roundabout	Suburban	0.81	0.32	HSM (*1*)
	Urban	0.88	NA	HSM (*1*)
TWSC to single-lane or two-lane roundabout	Suburban	0.68	0.29	HSM (*1*)
	Urban	0.71	0.19	HSM (*1*)
	All	0.56	0.18	HSM (*1*)
AWSC to single-lane or two-lane roundabout	All	1.03	NA	HSM (*1*)
Signalized intersection to single-lane roundabout	All	0.74	0.45	Gross et al. (*6*)
Signalized intersection to two-lane roundabout	Suburban	0.33	NA	HSM (*1*)
	All	0.81	0.29	Gross et al. (*6*)
Signalized intersection to single-lane or two-lane roundabout	Suburban	0.58	0.26	Gross et al. (*6*)
	Urban	0.99	0.40	HSM (*1*)
	Urban	1.15	0.45	Gross et al. (*6*)
	3-approach	1.07	0.37	Gross et al. (*6*)
	4-approach	0.76	0.34	Gross et al. (*6*)
	All	0.52	0.22	HSM (*1*)
	All	0.79	0.34	Gross et al. (*6*)

Note: NA = not available.

According to tracking by Scott Batson, Portland Bureau of Transportation, there were only 10 known fatalities of vulnerable road users out of 7000+ roundabouts in the US in over 18 year's worth of data.

Pedestrian and Bike Safety at Roundabouts
Minnesota Research


Minnesota Department of Transportation

RESEARCH SERVICES

Office of Policy Analysis, Research & Innovation

Investigation of Pedestrian/Bicyclist Risk in Minnesota Roundabout Crossings

John Hourdos, Principal Investigator
Minnesota Traffic Observatory
Department of Civil Engineering
University of Minnesota

September 2012

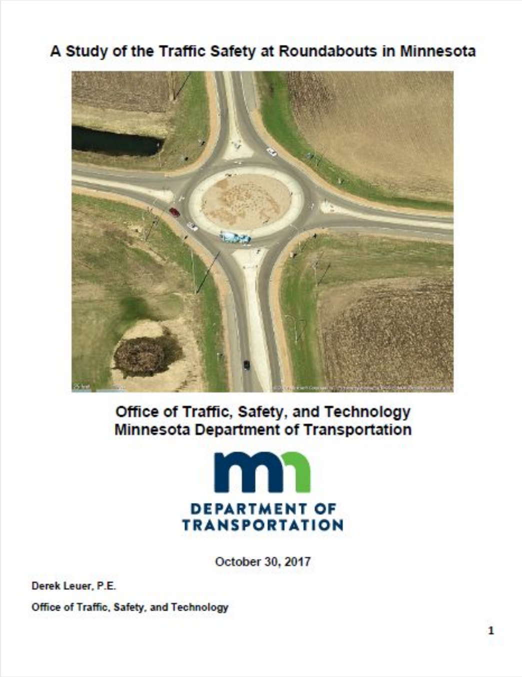
Research Project
Final Report 2012-28

Your Destination...Our Priority

2012 study led by University of Minnesota

- Observational (2 locations)
- Focused on experience of ped/bikes using crossings
- Investigated conditions that could affect driver yielding
- Results
  - Starting location of crossing affects driver yielding
  - Lower yielding by exiting vehicles

Pedestrian and Bike Safety at Roundabouts
Minnesota Research



A Study of the Traffic Safety at Roundabouts in Minnesota

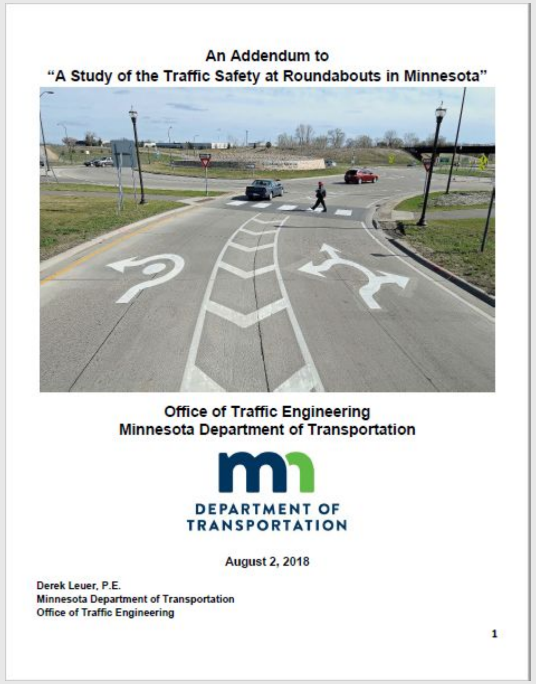
Office of Traffic, Safety, and Technology
Minnesota Department of Transportation

DEPARTMENT OF TRANSPORTATION

October 30, 2017

Derek Leuer, P.E.
Office of Traffic, Safety, and Technology

1



An Addendum to
"A Study of the Traffic Safety at Roundabouts in Minnesota"

Office of Traffic Engineering
Minnesota Department of Transportation

DEPARTMENT OF TRANSPORTATION

August 2, 2018

Derek Leuer, P.E.
Minnesota Department of Transportation
Office of Traffic Engineering

1

Study of Traffic Safety at Roundabouts in Minnesota

- 80%+ reduction in fatal and serious injury crashes
- No multi-vehicle fatal crashes
- Only looked at vehicle crashes

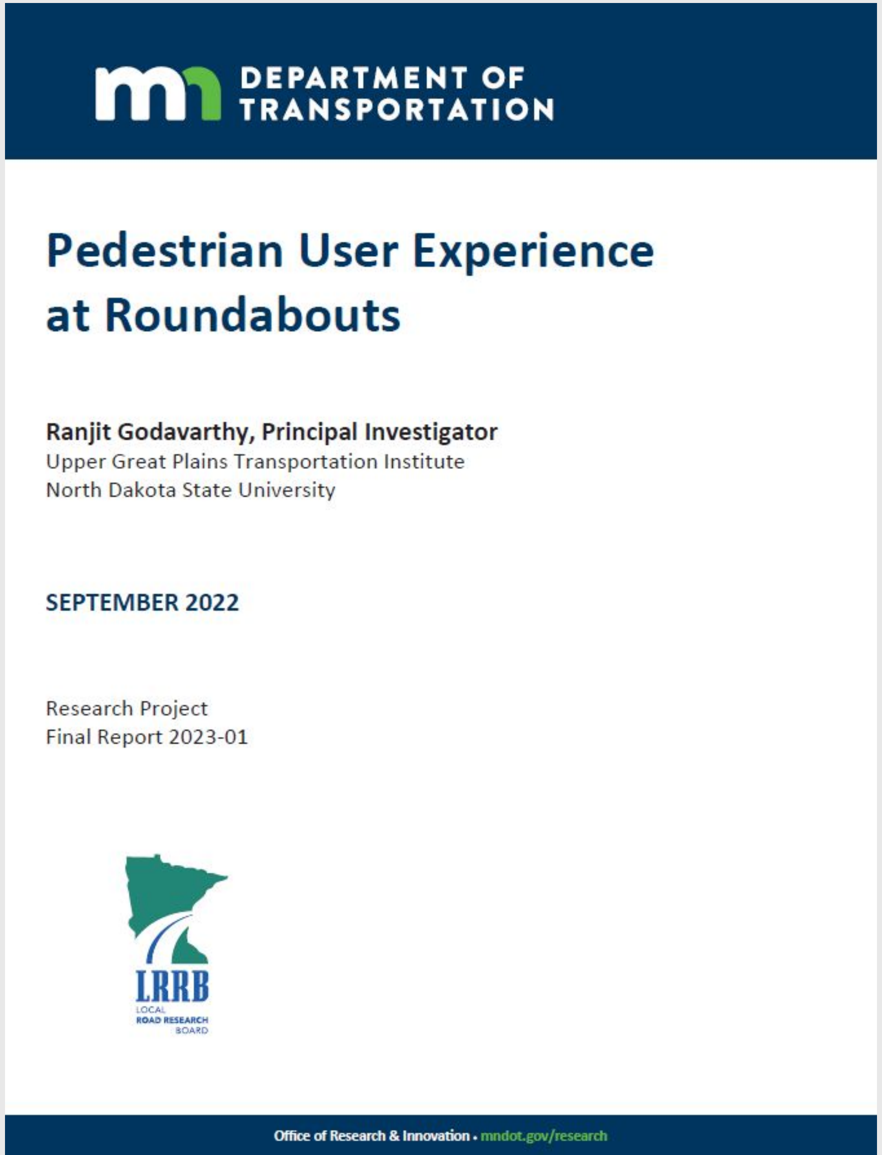
Addendum

- Looked at pedestrian/bike crash rates & density
- 64% lower pedestrian crash density vs comparable sites
- 16% lower bike crash density vs comparable sites

Pedestrian and Bike Safety at Roundabouts
Minnesota Research

2022 study led by NDSU

- Observational case studies(8 locations)
- Focused on pedestrian user experience by measuring
  - Driver behavior towards pedestrians
  - Pedestrian behavior at crossings
  - Pedestrian infrastructure
- Results
  - RRFB increased yielding; in-roadway signs satisfactory
  - Single lane > multi-lane
  - Guidance document developed for practitioners



mn DEPARTMENT OF TRANSPORTATION

Pedestrian User Experience at Roundabouts

Ranjit Godavarthy, Principal Investigator
Upper Great Plains Transportation Institute
North Dakota State University

SEPTEMBER 2022

Research Project
Final Report 2023-01

LRRB LOCAL ROAD RESEARCH BOARD

Office of Research & Innovation • mndot.gov/research

Pedestrian and Bike Safety at Roundabouts Evaluation

What's the purpose of this evaluation?

- Investigate the safety of roundabouts for pedestrians/bicyclists using crash data
- Focus on roundabouts in urbanized areas
- Newer data (through 2021)
- Add urban traffic signal and stop-controlled comparison groups
- Are roundabouts safer for vulnerable users?

Public perception:

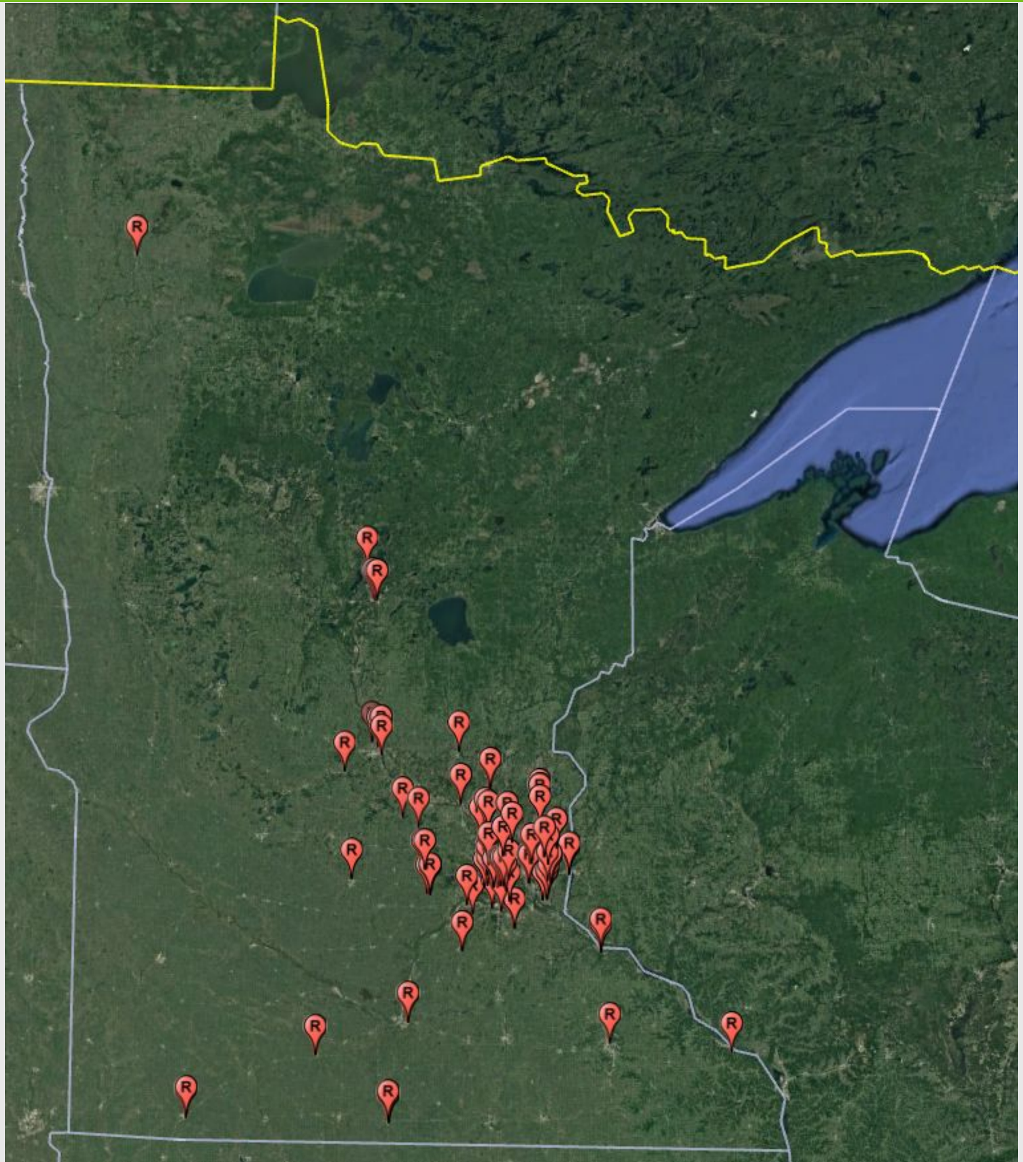
Pedestrian and Bike Safety at Roundabouts
Site Selection

Started with 2022 set of roundabouts from Kittelson & Associates database

Selection Criteria:

- Construction year 2018 or earlier
- Within incorporated city limits
- Adjacent land uses
  - FDOT Context Classification Guide
    - Has fun pictures
    - Classifications C6, C5, C4, C2T, C3R, C3C
  - MnDOT has a land use tech memo (no fun)
- Nearby schools with trail/walk connection
- Near popular walk/bike routes (state/regional trails)

95 roundabouts selected for evaluation



Pedestrian and Bike Safety at Roundabouts
Site Selection

FDOT Context Classifications

FIGURE 5 FDOT CONTEXT CLASSIFICATIONS

C1-Natural
Lands preserved in a natural or wilderness condition, including lands unsuitable for settlement due to natural conditions.

C2-Rural
Sparsely settled lands; may include agricultural land, grassland, woodland, and wetlands.

C2T-Rural Town
Small concentrations of developed areas immediately surrounded by rural and natural areas; includes many historic towns.

C3R-Suburban Residential
Mostly residential uses within large blocks and a disconnected or sparse roadway network.

C3C-Suburban Commercial
Mostly non-residential uses with large building footprints and large parking lots within large blocks and a disconnected or sparse roadway network.

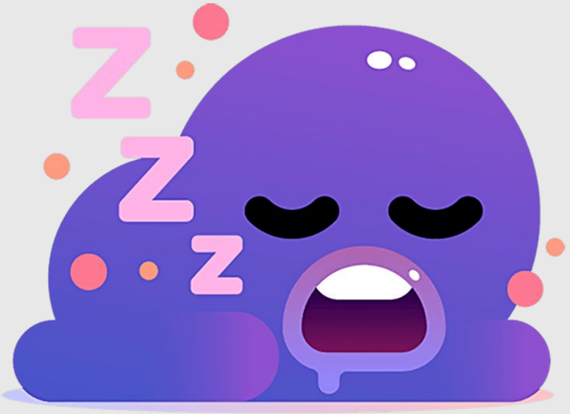
C4-Urban General
Mix of uses set within small blocks with a well-connected roadway network. May extend long distances. The roadway network usually connects to residential neighborhoods immediately along the corridor or behind the uses fronting the roadway.

C5-Urban Center
Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of a civic or economic center of a community, town, or city.

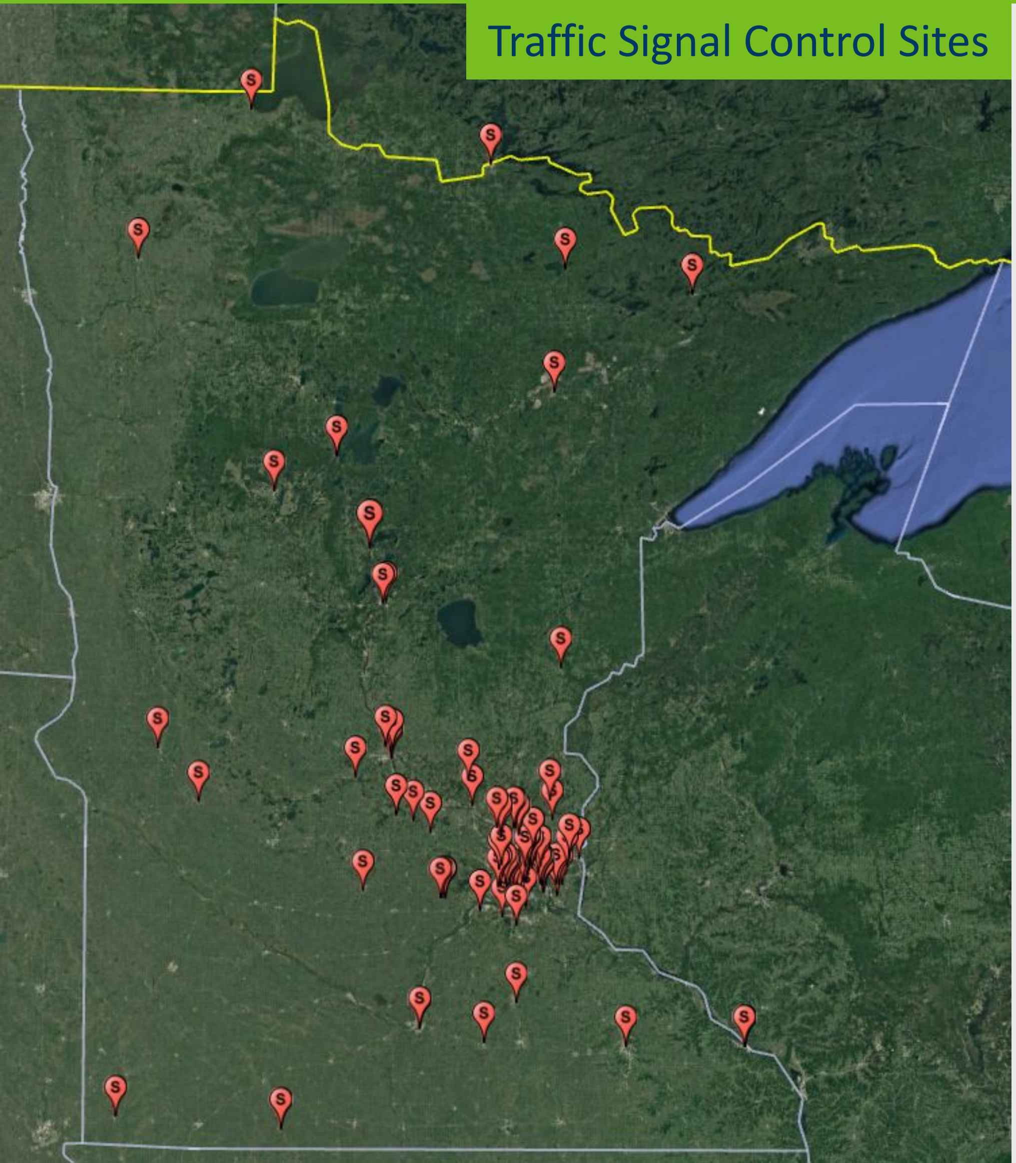
C6-Urban Core
Areas with the highest densities and building heights, and within FDOT classified Large Urbanized Areas (population greater than one million). Many are regional centers and destinations. Buildings have mixed uses, are built up to the roadway, and are within a well-connected roadway network.

Pedestrian and Bike Safety at Roundabouts
Site Selection

MnDOT Land Use Context Types



Pedestrian and Bike Safety at Roundabouts Site Selection



Traffic Signal Control Sites

Selection Criteria:

- In place in 2017
- Within incorporated city limits
- Adjacent land uses
    - FDOT Context Classification Guide
        - Has fun pictures
        - Classifications C6, C5, C4, C2T, C3R, C3C
    - MnDOT has a land use tech memo (no fun)
- Nearby schools with trail/walk connection
- Near popular walk/bike routes (state/regional trails)

93 signalized control sites selected

Urban Stop-Controlled Sites

Selected using MnDOT Intersection Toolkit (internal)

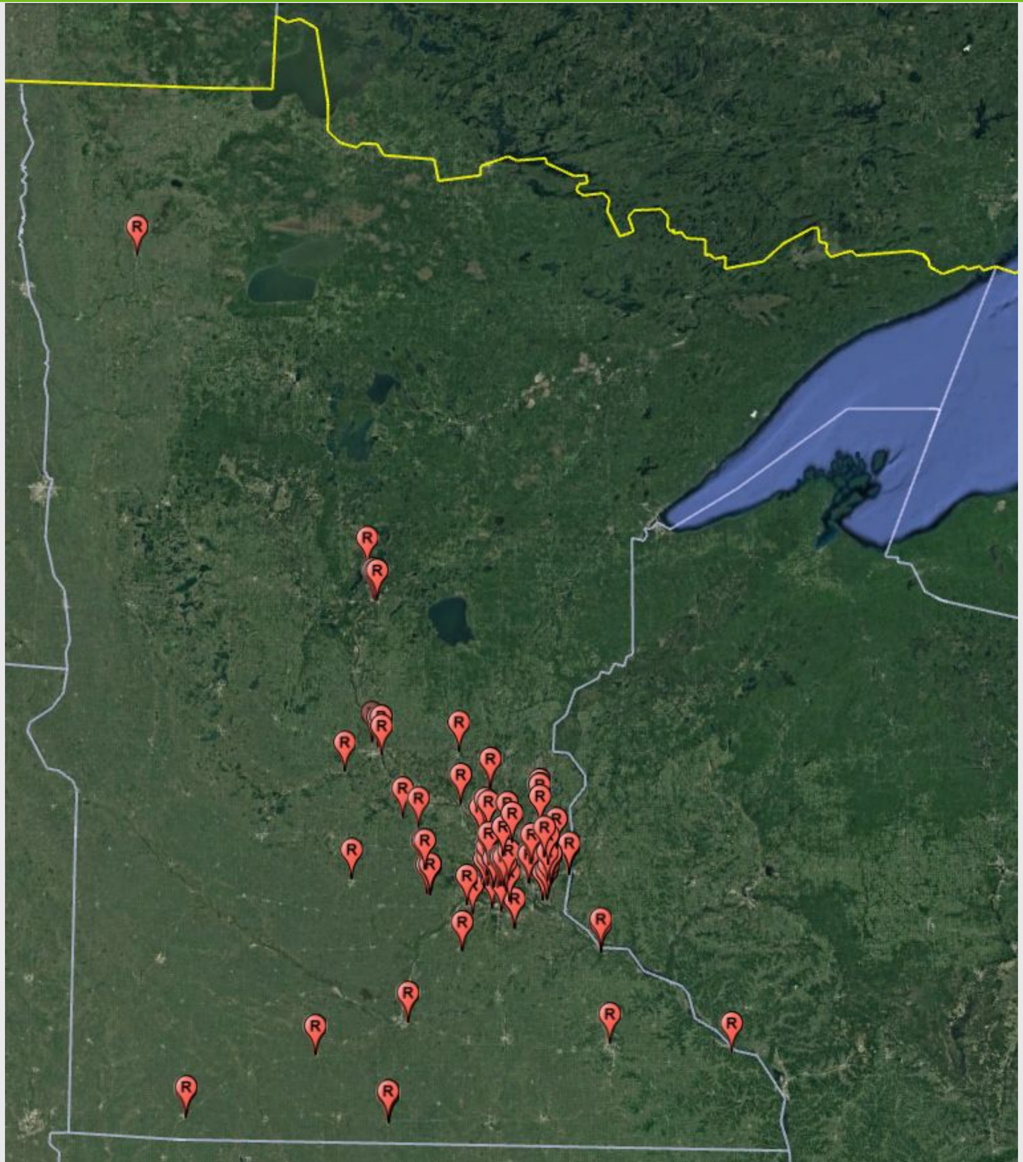
- Database of TH intersections including with county and city roads
- Intersections in All-Way Stop and Thru-Stop, Urban comparison groups
- 76 all-way stop intersections
- 200 thru-stop intersections randomly selected from 7,235 available

Pedestrian and Bike Safety at Roundabouts Data Collection

Roundabout Sites

- Data from 1998 through 2021
  - Wanted to include specific site
- Entering volumes
- Crashes
  - Motorized
  - Non-motorized
- Site characteristics
  - Construction year
  - Number of circulating lanes
  - Number and type of approach lanes
  - Previous control type
  - SPACE score and characteristics

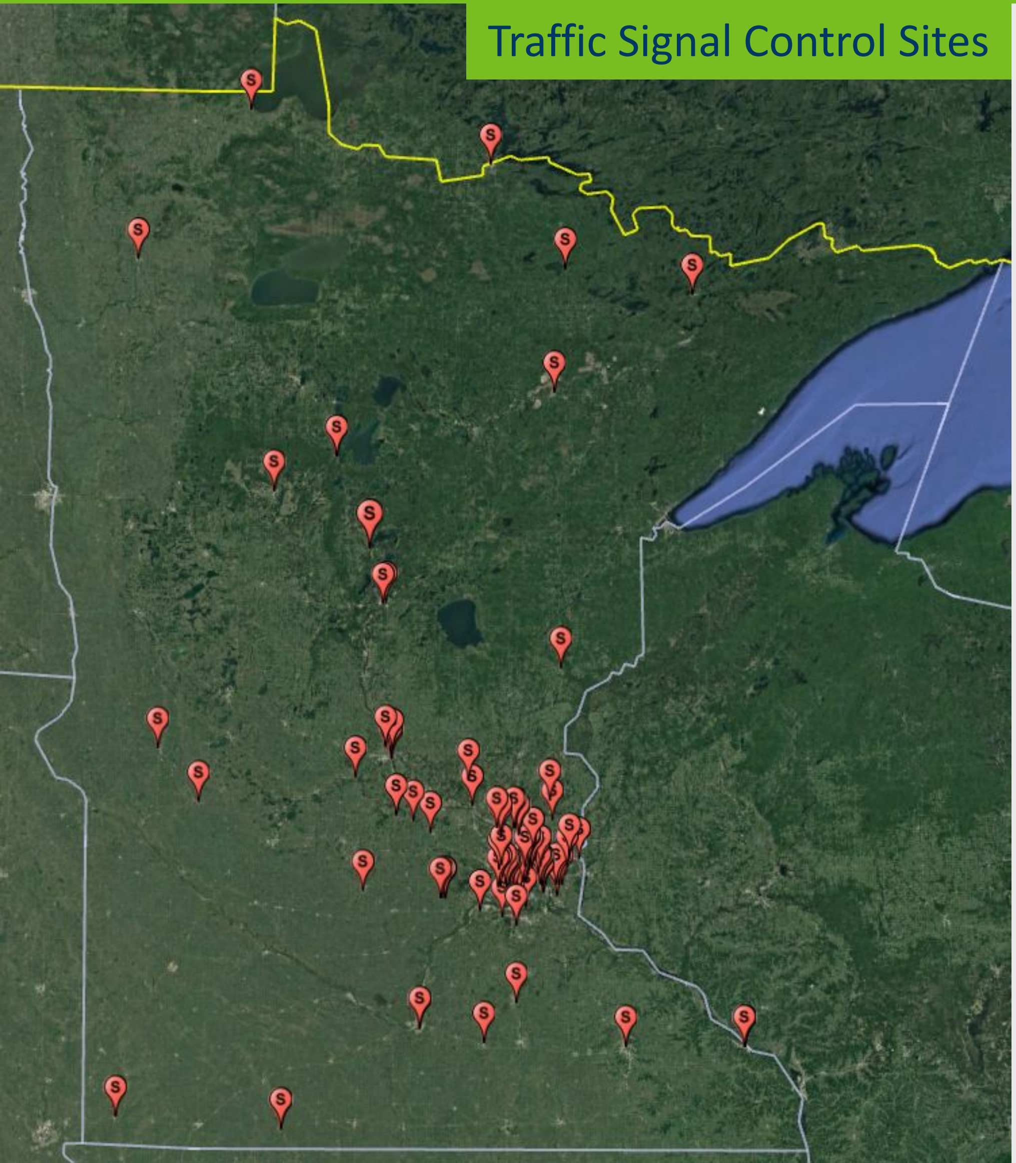
One roundabout removed due to lack of available data (Mdewakanton Sioux lands between two casinos)



Pedestrian and Bike Safety at Roundabouts Data Collection

Minnehaha Ave & Godfrey Pkwy

Pedestrian and Bike Safety at Roundabouts Data Collection



Traffic Signal Control Sites

- Data from 2017 through 2021 (avoids 2016 “bump”)
- Entering volumes
- Crashes
  - Motorized
  - Non-motorized
- SPACE score and characteristics

Urban Stop-Controlled Sites

- Data from 2017 through 2021 (avoids 2016 “bump”)
- Entering volumes
- Crashes
  - Motorized
  - Non-motorized

Pedestrian and Bike Safety at Roundabouts Analysis

Types of Analysis:

- Before-After
  - All years and matched years
  - All users
  - Bike/Ped
- Comparison with traffic signal sites
  - 2017 through 2021
  - All users
  - Bike/Ped
- Comparison with urban stop-controlled sites
  - 2017 through 2021
  - All users
  - Bike/Ped

Pedestrian and Bike Safety at Roundabouts Analysis

Analysis Information Summary				
Analysis	**Years**	**# of Sites**	**Site-Years**	**Entering Volumes**
Before/After (All Years)	1998-2021	94 Roundabouts	1383 Before; 779 After	5.9 billion Before; 3.0 billion After
Before/After (Matched Years)	Matched Per Site	94 Roundabouts	681 Before; 681 After	2.9 billion Before; 2.7 billion After
Traffic Signal Comparison	2017-2021	94 Roundabouts; 93 Signals	447 Roundabout; 465 Signal	1.75 billion Roundabout; 2.4 billion Signal
All-Way Stop Comparison	2017-2021	94 Roundabouts; 76 All-way stops	447 Roundabout; 380 All-way stop	1.75 billion Roundabout; 1.15 billion All-way stop
Thru-Stop Comparison	2017-2021	94 Roundabouts; 200 Thru-stops	447 Roundabout; 1,000 Thru-stop	1.75 billion Roundabout; 656 million Thru-stop

Pedestrian and Bike Safety at Roundabouts Results

Total Crashes - Before/After Matched* Years

Time Period	Metric	K	A	KA	B	C	PDO	Total
Before	# of Crashes	2	29	31	200	462	1547	2240
Before	Crashes/Site-Year	0.003	0.043	0.046	0.294	0.678	2.272	3.289
Before	Crashes/MEV	0.001	0.010	0.011	0.069	0.159	0.533	0.772
After	# of Crashes	1	12	13	115	270	2577	2975
After	Crashes/Site-Year	0.001	0.018	0.019	0.169	0.396	3.784	4.369
After	Crashes/MEV	0.0004	0.0045	0.0049	0.043	0.101	0.962	1.111
% Change in Crash Density		**-50%**	**-59%**	**-58%**	**-42%**	**-42%**	**67%**	**33%**
% Change in Crash Rate		**-46%**	**-55%**	**-55%**	**-38%**	**-37%**	**80%**	**44%**

*Results from All Years analysis are similar and can be found in full report.

Pedestrian and Bike Safety at Roundabouts Results

Ped/Bike Crashes - Before/After Matched* Years								
Time Period	**Metric**	**K**	**A**	**KA**	**B**	**C**	**PDO**	**Total**
Before	# of Crashes	0	5	5	22	23	2	52
Before	Crashes/Site-Year	---	0.007	0.007	0.032	0.034	0.003	0.076
Before	Crashes/MEV	---	0.002	0.002	0.008	0.008	0.0007	0.0179
After	# of Crashes	1	2	3	21	17	6	47
After	Crashes/Site-Year	0.001	0.003	0.004	0.031	0.025	0.009	0.069
After	Crashes/MEV	0.0004	0.001	0.001	0.008	0.006	0.0022	0.0175
% Change in Crash Density		**100%***	**-60%**	**-40%**	**-5%**	**-26%**	**200%***	**-9%**
% Change in Crash Rate		**100%***	**-57%**	**-35%**	**3%**	**-20%**	**225%***	**-2%**

*Results from All Years analysis are similar and can be found in full report.

***Technically*

Pedestrian and Bike Safety at Roundabouts Results

Statistical Testing – Before/After Matched Years

Category	Change in Crash Density	p-value	Change in Crash Rate	p-value	Significant?
K+A Crashes	−	0.023	−	0.299	Yes/No
Injury Crashes	−	0.000	−	0.000	Yes
Total Crashes	+	0.740	+	0.755	No
Ped+Bike K+A Crashes	−	0.122	−	0.110	No
Ped+Bike Injury Crashes	−	0.487	−	0.446	No
Ped+Bike Total Crashes	−	0.591	−	0.607	No

Pedestrian and Bike Safety at Roundabouts Results

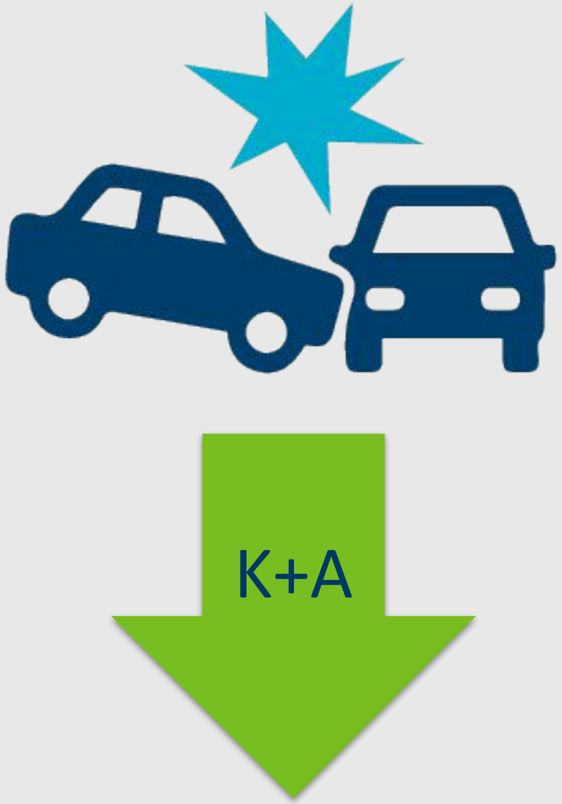
Ped/Bike Comparison Analysis – Traffic Signals								
Control Type	**Metric**	**K**	**A**	**KA**	**B**	**C**	**PDO**	**Total**
Roundabout	# of Crashes	1	1	2	15	11	6	34
Roundabout	Crashes/Site-Year	0.002	0.002	0.004	0.034	0.025	0.013	0.076
Roundabout	Crashes/MEV	0.0006	0.0006	0.001	0.009	0.006	0.003	0.019
Traffic Signal	# of Crashes	2	8	10	25	13	7	55
Traffic Signal	Crashes/Site-Year	0.004	0.017	0.022	0.054	0.028	0.015	0.118
Traffic Signal	Crashes/MEV	0.0008	0.003	0.004	0.010	0.005	0.003	0.023

Pedestrian and Bike Safety at Roundabouts Results

Ped/Bike Comparison Analysis – Stop-Controlled Intersections								
Control Type	**Metric**	**K**	**A**	**KA**	**B**	**C**	**PDO**	**Total**
Roundabout	# of Crashes	1	1	2	15	11	6	34
Roundabout	Crashes/Site-Year	0.002	0.002	0.004	0.034	0.025	0.013	0.076
Roundabout	Crashes/MEV	0.0006	0.0006	0.001	0.009	0.006	0.003	0.019
All-Way Stop	# of Crashes	0	0	0	3	2	1	6
All-Way Stop	Crashes/Site-Year	---	---	---	0.008	0.005	0.003	0.016
All-Way Stop	Crashes/MEV	---	---	---	0.0026	0.0017	0.0009	0.005
Thru Stop	# of Crashes	0	2	2	2	1	4	9
Thru Stop	Crashes/Site-Year	---	0.002	0.002	0.002	0.001	0.004	0.009
Thru Stop	Crashes/MEV	---	0.003	0.003	0.003	0.0015	0.006	0.014

Pedestrian and Bike Safety at Roundabouts
Deep Thoughts

What are these results telling us so far?



Pedestrian and Bike Safety at Roundabouts
Next Steps

Publish Report

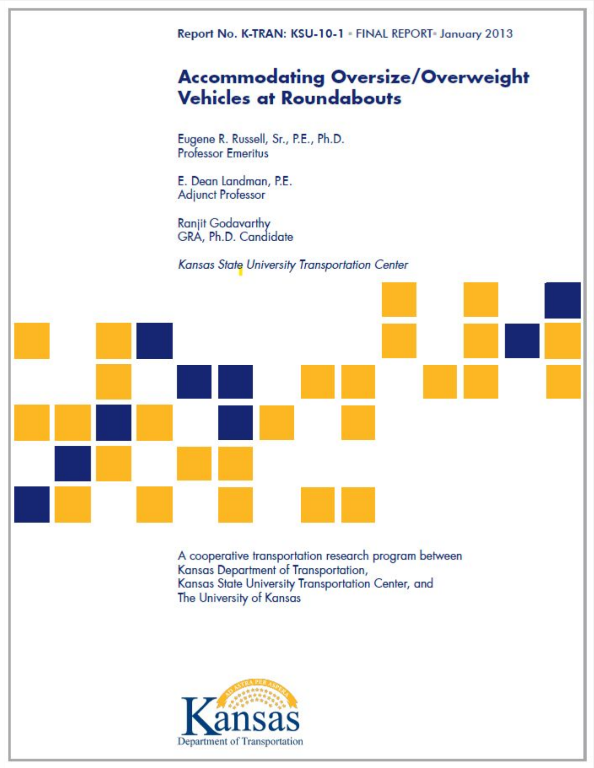
SPACE Analysis

Mini-Roundabouts

[SPACE Analytics]

Heavy Trucks at Roundabouts

Heavy Trucks at Roundabouts Research


Report No. K-TRAN: KSU-10-1 • FINAL REPORT• January 2013

Accommodating Oversize/Overweight Vehicles at Roundabouts

Eugene R. Russell, Sr., P.E., Ph.D.
Professor Emeritus

E. Dean Landman, P.E.
Adjunct Professor

Ranjit Godavarthy
GRA, Ph.D. Candidate

Kansas State University Transportation Center

A cooperative transportation research program between
Kansas Department of Transportation,
Kansas State University Transportation Center, and
The University of Kansas

Kansas
Department of Transportation

Link to Report

Accommodating Oversize/Overweight Vehicles at Roundabouts
Kansas State University Transportation Center, 2013

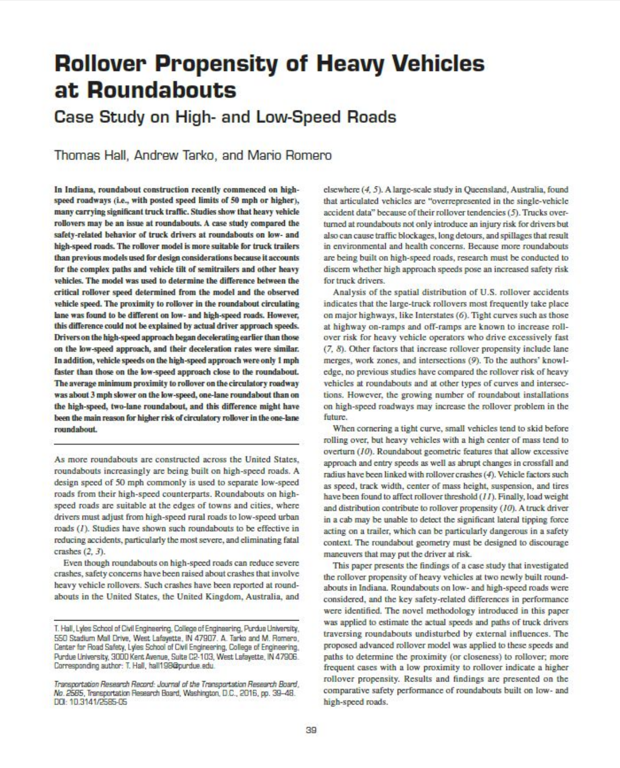
Main Objectives:

- Compile current practice and research by other states and countries into OSOW effects on roundabout location, design, and accommodation
- Fill in information gaps in roundabout design for OSOW vehicles

Results:

- Ground clearance is an issue not given much attention, especially regarding “low-boys”
- Three inches should be maximum curb height for splitter islands, aprons, and curbs
- OSOW simulations showed:
  - Given knowledge of OSOW needs, accommodations can be made provided right of way is available
  - Agency needs to determine economic benefits of accommodating/not.

Heavy Trucks at Roundabouts Research



Rollover Propensity of Heavy Vehicles at Roundabouts

Case Study on High- and Low-Speed Roads

Thomas Hall, Andrew Tarko, and Mario Romero

In Indiana, roundabout construction recently commenced on high-speed roadways (i.e., with posted speed limits of 50 mph or higher), many carrying significant truck traffic. Studies show that heavy vehicle rollovers may be an issue at roundabouts. A case study compared the safety-related behavior of truck drivers at roundabouts on low- and high-speed roads. The rollover model is more suitable for truck trailers than previous models used for design considerations because it accounts for the complex paths and vehicle tilt of semitrailers and other heavy vehicles. The model was used to determine the difference between the critical rollover speed determined from the model and the observed vehicle speed. The proximity to rollover in the roundabout circulating lane was found to be different on low- and high-speed roads. However, this difference could not be explained by actual driver approach speeds. Drivers on the high-speed approach began decelerating earlier than those on the low-speed approach, and their deceleration rates were similar. In addition, vehicle speeds on the high-speed approach were only 1 mph faster than those on the low-speed approach close to the roundabout. The average minimum proximity to rollover on the circulatory roadway was about 3 mph slower on the low-speed, one-lane roundabout than on the high-speed, two-lane roundabout, and this difference might have been the main reason for higher risk of circulatory rollover in the one-lane roundabout.

As more roundabouts are constructed across the United States, roundabouts increasingly are being built on high-speed roads. A design speed of 50 mph commonly is used to separate low-speed roads from their high-speed counterparts. Roundabouts on high-speed roads are suitable at the edges of towns and cities, where drivers must adjust from high-speed rural roads to low-speed urban roads (*1*). Studies have shown such roundabouts to be effective in reducing accidents, particularly the most severe, and eliminating fatal crashes (*2, 3*).

Even though roundabouts on high-speed roads can reduce severe crashes, safety concerns have been raised about crashes that involve heavy vehicle rollovers. Such crashes have been reported at roundabouts in the United States, the United Kingdom, Australia, and elsewhere (*4, 5*). A large-scale study in Queensland, Australia, found that articulated vehicles are "overrepresented in the single-vehicle accident data" because of their rollover tendencies (*5*). Trucks overturned at roundabouts not only introduce an injury risk for drivers but also can cause traffic blockages, long detours, and spillages that result in environmental and health concerns. Because more roundabouts are being built on high-speed roads, research must be conducted to discern whether high approach speeds pose an increased safety risk for truck drivers.

Analysis of the spatial distribution of U.S. rollover accidents indicates that the large-truck rollovers most frequently take place on major highways, like Interstates (*6*). Tight curves such as those at highway on-ramps and off-ramps are known to increase rollover risk for heavy vehicle operators who drive excessively fast (*7, 8*). Other factors that increase rollover propensity include lane merges, work zones, and intersections (*9*). To the authors' knowledge, no previous studies have compared the rollover risk of heavy vehicles at roundabouts and at other types of curves and intersections. However, the growing number of roundabout installations on high-speed roadways may increase the rollover problem in the future.

When cornering a tight curve, small vehicles tend to skid before rolling over, but heavy vehicles with a high center of mass tend to overturn (*10*). Roundabout geometric features that allow excessive approach and entry speeds as well as abrupt changes in crossfall and radius have been linked with rollover crashes (*4*). Vehicle factors such as speed, track width, center of mass height, suspension, and tires have been found to affect rollover threshold (*11*). Finally, load weight and distribution contribute to rollover propensity (*10*). A truck driver in a cab may be unable to detect the significant lateral tipping force acting on a trailer, which can be particularly dangerous in a safety context. The roundabout geometry must be designed to discourage maneuvers that may put the driver at risk.

This paper presents the findings of a case study that investigated the rollover propensity of heavy vehicles at two newly built roundabouts in Indiana. Roundabouts on low- and high-speed roads were considered, and the key safety-related differences in performance were identified. The novel methodology introduced in this paper was applied to estimate the actual speeds and paths of truck drivers traversing roundabouts undisturbed by external influences. The proposed advanced rollover model was applied to these speeds and paths to determine the proximity (or closeness) to rollover; more frequent cases with a low proximity to rollover indicate a higher rollover propensity. Results and findings are presented on the comparative safety performance of roundabouts built on low- and high-speed roads.

T. Hall, Lyles School of Civil Engineering, College of Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN 47907. A. Tarko and M. Romero, Center for Road Safety, Lyles School of Civil Engineering, College of Engineering, Purdue University, 3000 Kent Avenue, Suite C2-103, West Lafayette, IN 47906. Corresponding author: T. Hall, hall198@purdue.edu.

Transportation Research Record: Journal of the Transportation Research Board, No. 2585, Transportation Research Board, Washington, D.C., 2016, pp. 39–48.
DOI: 10.3141/2585-05

[Link to Report]

Rollover Propensity of Heavy Vehicles at Roundabouts: Case Study on High-and Low-Speed Roads

Transportation Research Record, 2016

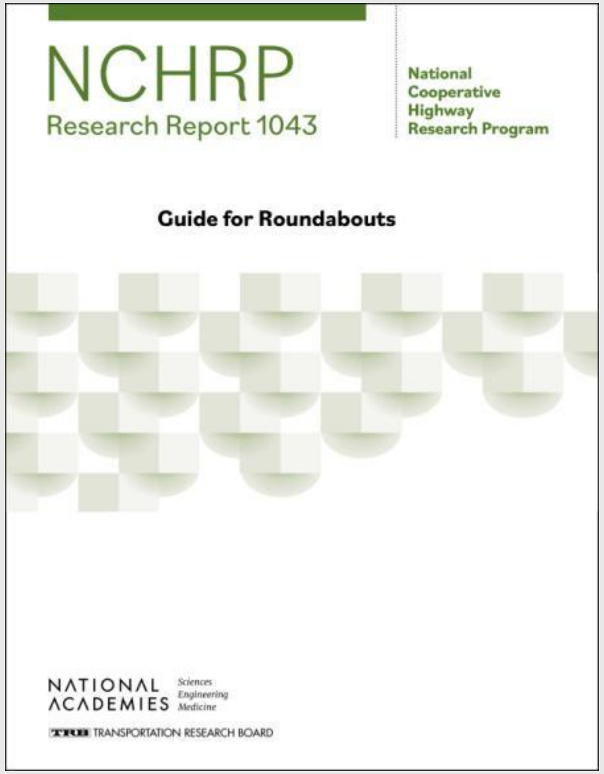
Summary:

- Case study of propensity of semis to overturn on roundabouts on high- and low-speed roads in the same city
- Rollover model suitable for heavy vehicles applied to field-observed speeds and paths to estimate proximity to rollover

Results:

- Approach speed not a rollover factor. Average speed within 350 feet of yield lines was only 1 mph higher on high-speed approach
- Single lane roundabout on low-speed road restricted vehicle path and preferred speed
- Wider circulatory roadway on multi-lane roundabout appeared to slightly reduce rollover propensity by allowing more room to maneuver

Heavy Trucks at Roundabouts
Latest Research



Link to Report

NCHRP Report 1043: Guide for Roundabouts
NCHRP, 2023

Chapter 4 – 4.4 Large Vehicles:

- Designing for Versus Accommodating Large Vehicles
  - Serve specific truck types commonly seen vs. less-frequent but larger vehicles
  - Designing all movements for largest possible truck can negatively affect other users
  - Signs, landscaping, other features can be placed to accommodate

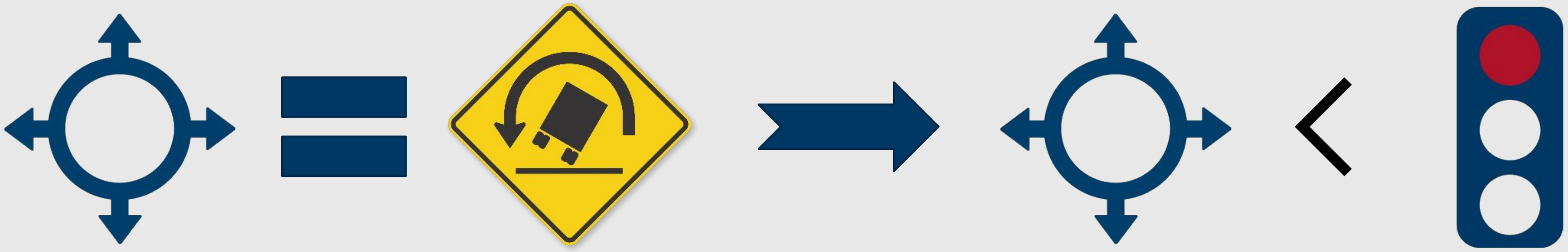
- Standard Trucks
  - WB-62, 67
  - WB-40 and SU-30 for smaller delivery trucks
- OSOW – Engage your stakeholders
- Buses – BUS-40 and BUS-45
- Other Large Vehicles
  - Recreational, vehicles with animal/boat trailers, farm, construction
  - Engage your stakeholders

Heavy Trucks at Roundabouts Evaluation

What's the purpose of this evaluation?

- Are heavy trucks more prone to rollovers in roundabouts?
- Investigate the safety of roundabouts for heavy trucks using crash data
- Compare to traffic signals
- Response to public/stakeholder concerns

What do we hear most often?



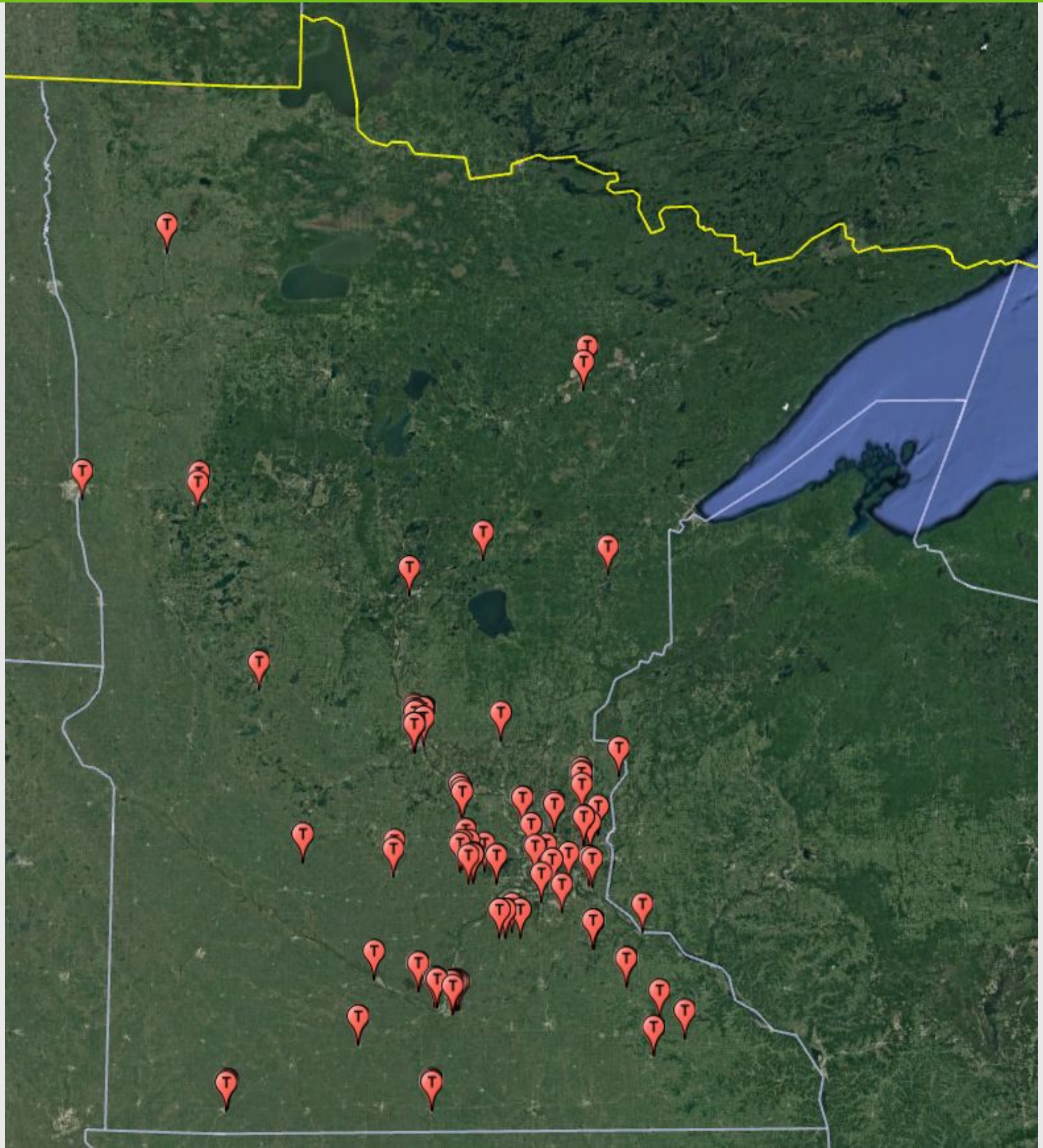
Heavy Trucks at Roundabouts Site Selection

Started with 2022 set of roundabouts from Kittelson & Associates database

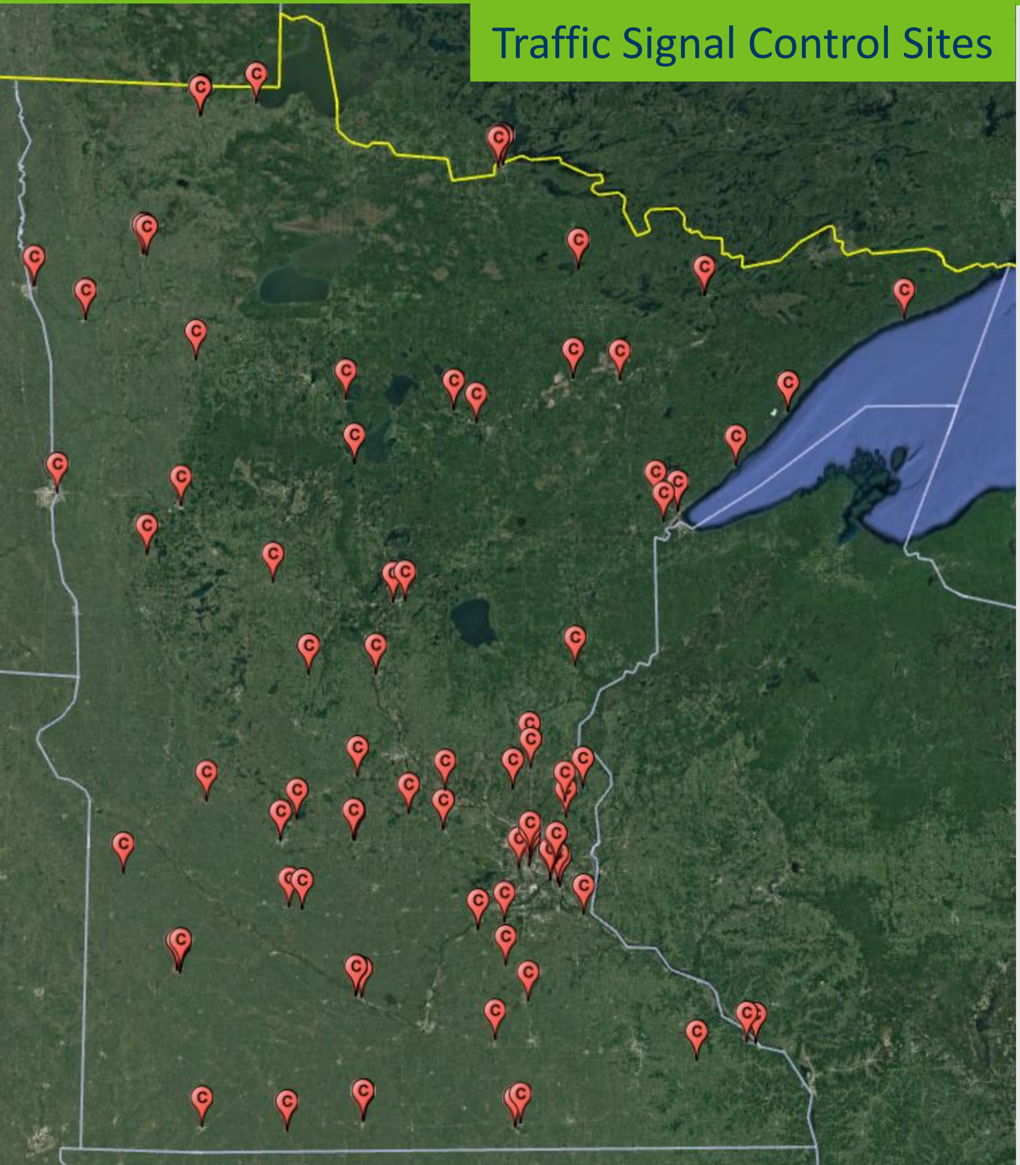
Selection Criteria:

- Fully operational by 2017
- HCAADT available via Traffic Mapping Application
- Some sites had no HCAADT but nearby land use indicating heavy truck traffic
- On TH, CSAH, CR, or MSAS system
- Not located in primarily residential areas (Somewhat subjective)

107 roundabouts selected for evaluation



Heavy Trucks at Roundabouts
Site Selection



Traffic Signal Control Sites

Selection Criteria:

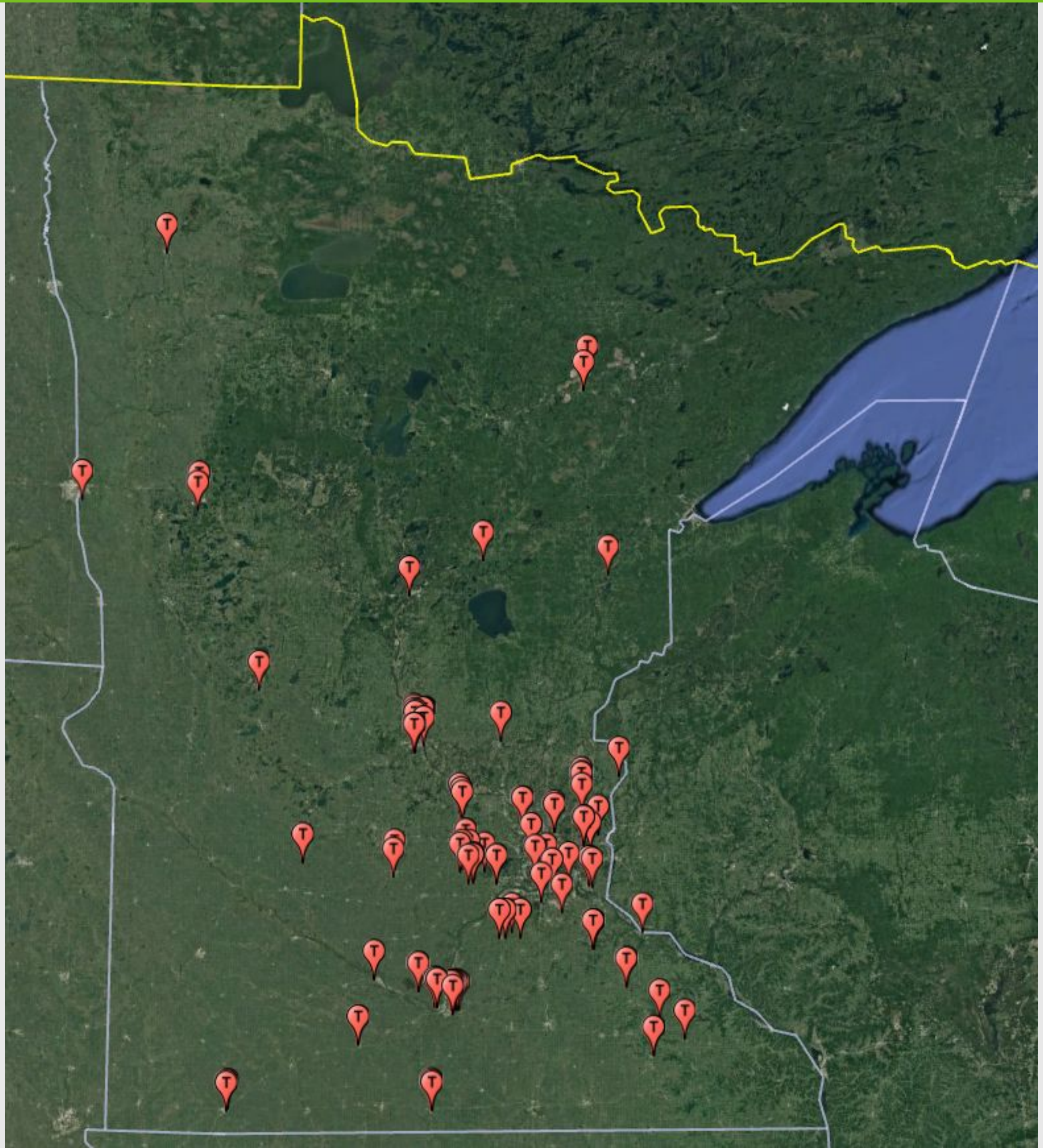
- In place in 2017
- HCAADT available via Traffic Mapping Application
- Some sites had no HCAADT but nearby land use indicating heavy truck traffic
- On TH, CSAH, CR, or MSAS system
- Not located in primarily residential areas (Somewhat subjective)

95 signalized control sites selected

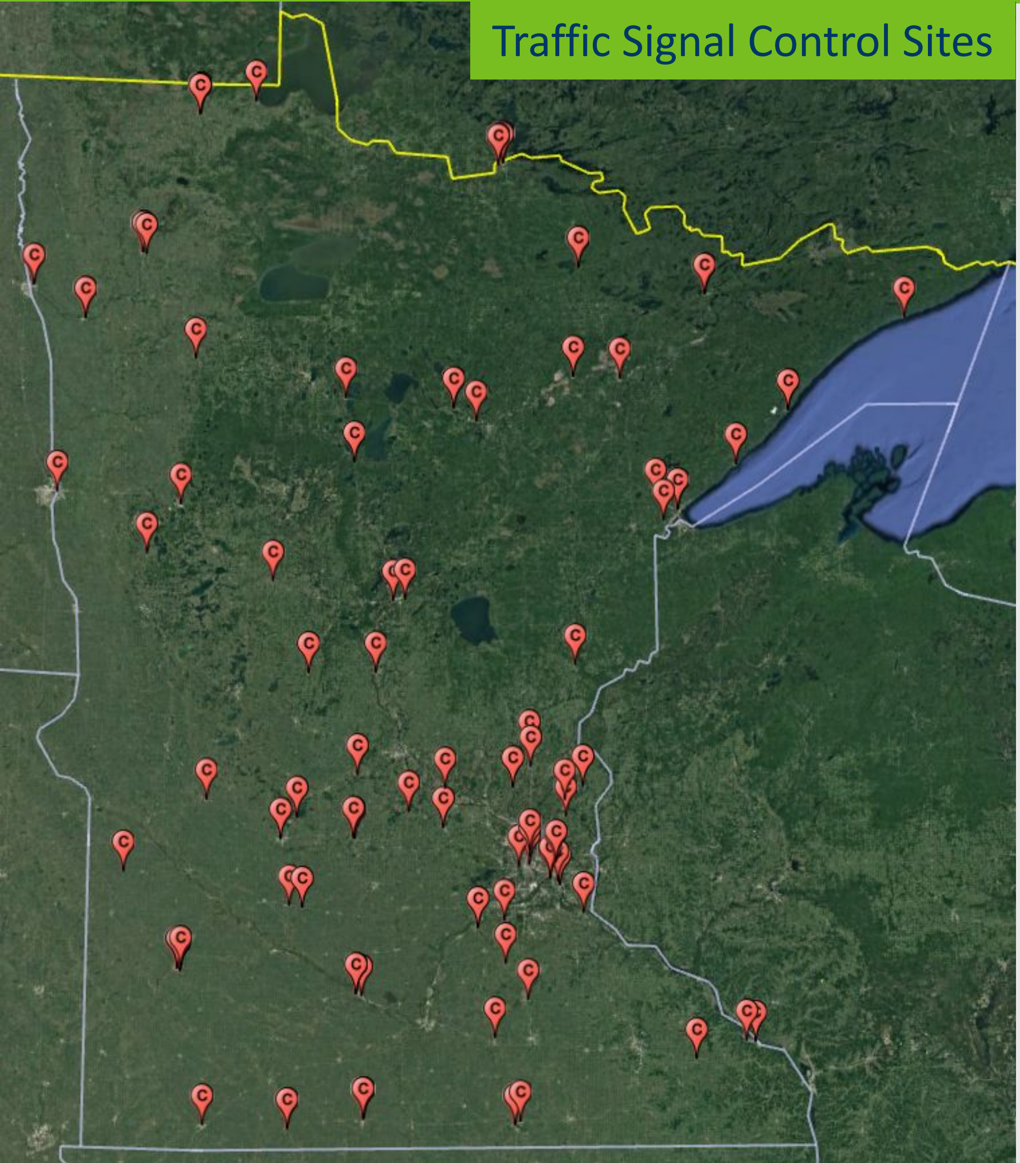
Heavy Trucks at Roundabouts Data Collection

Roundabout Sites

- Data from 2018 through 2022
- Entering volumes
- Crashes
  - All
  - CMV
    - Most Harmful Event
    - Configuration (Bus, SU, semi, etc.)
    - Cargo Body (Dump, Log, Cargo tank, etc.)
    - Pre-Crash Maneuver



Heavy Trucks at Roundabouts Data Collection



Traffic Signal Control Sites

- Data from 2018 through 2022
- Entering volumes
- Crashes
  - All
  - CMV
    - Most Harmful Event
    - Configuration (Bus, SU, semi, etc.)
    - Cargo Body (Dump, Log, Cargo tank, etc.)
    - Pre-Crash Maneuver

Heavy Trucks at Roundabouts Analysis

Types of Analysis:

- Comparison with traffic signal sites
  - 2018 through 2022
  - All vehicle crashes
  - CMV crashes
  - Specific focus on incidence of rollovers

Heavy Trucks at Roundabouts Analysis

Site Characteristics						
Intersection Type	**Sites**	**Total Entering Volume**	**Heavy Commercial Entering Volume**	**Data Years**	**Total Crashes**	**Heavy Commercial Crashes**
Signal	95	1.99 Billion	129 Million	2018-2022	1,585	178
Roundabout	107	2.03 Billion	121 Million	2018-2022	1,834	157

Heavy Trucks at Roundabouts Results

Heavy Commercial Comparison Analysis – Traffic Signals

Control Type	Metric	K	A	KA	B	C	PDO	Total
Roundabout	# of Crashes	1	0	1	8	6	149	164
Roundabout	Crashes per HC Entering	0.82	0.00	0.82	6.59	4.94	122.74	135.10
Traffic Signal	# of Crashes	0	2	2	10	14	156	182
Traffic Signal	Crashes per HC Entering	0.00	1.55	1.55	7.73	10.82	120.58	140.68
% Difference Crashes per HC Entering		**100%**	**-100%**	**-47%**	**-15%**	**-54%**	**17%**	**-4%**

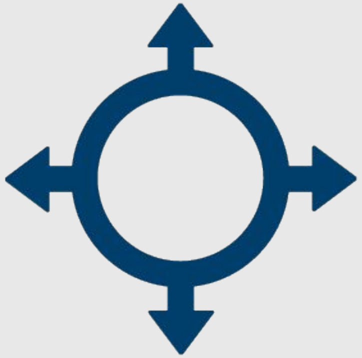
?

Traffic Signals – 1 RO (PDO)

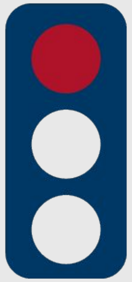
Roundabouts – 15 RO (1 K, 3 B, 11 PDO)

Heavy Trucks at Roundabouts
Deep Thoughts

What are these results telling us so far?

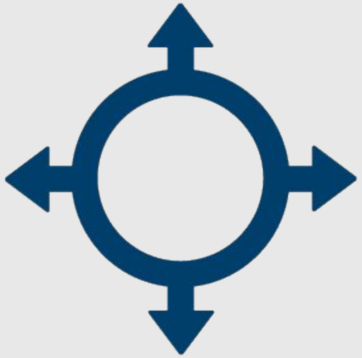


10% of CMV crashes



1% of CMV crashes

So, yes, rollovers are more prevalent at roundabouts.



K+A 47%

Overall, roundabouts appear to increase overall safety compared to signalized intersections

Heavy Trucks at Roundabouts
Next Steps

Report scheduled for delivery Fall 2023!

Comparison with traffic signal sites

- Before-After & Cross-Sectional
- Breakdown by crash characteristics
- Breakdown by geometric features

Speed Safety Camera (SSC) Systems

Administrative Rules and Structures
Transportation Research Synthesis (TRS)

DEPARTMENT OF TRANSPORTATION

Background

Speed Safety Camera (SSC)

A.K.A.

Automated Speed Enforcement (ASE)

Background

1. Minnesota does not currently permit SSCs by law,

…but recent increases in operating speeds, related traffic fatalities, and changing national trends have led community leaders to reassess the use of SSCs on Minnesota roadways.

2. Interest at the legislature and direction from MN Strategic Hwy Plan

…resulted in TRS 2303 to understand the effectiveness of SSCs

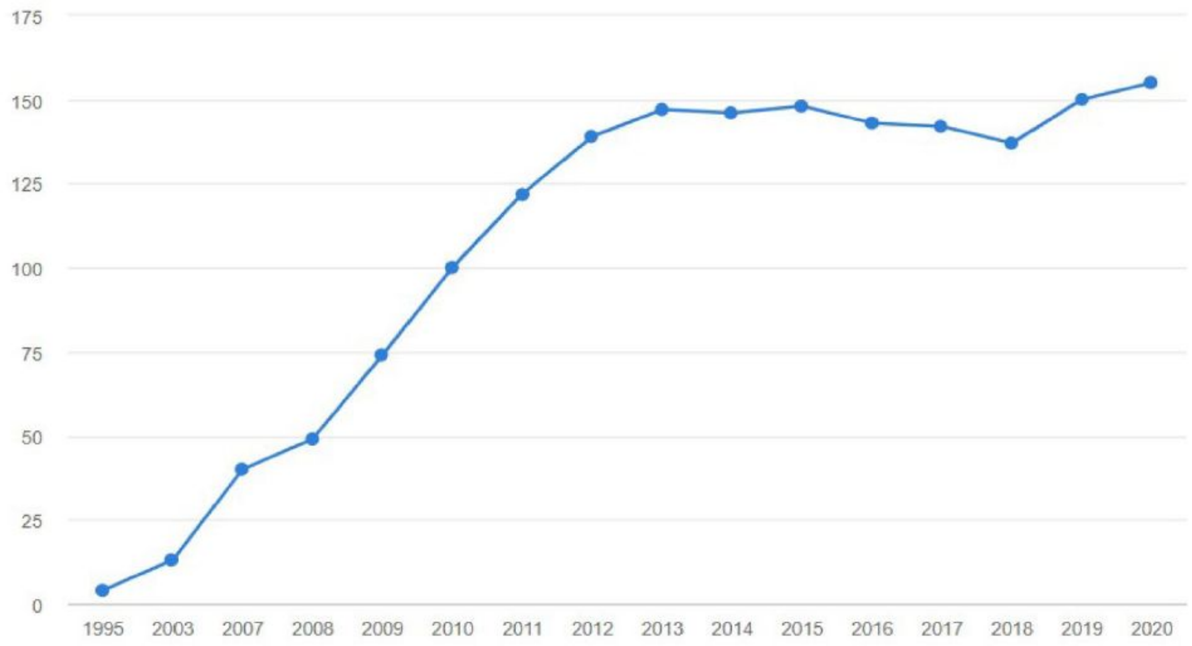
3. Significant safety findings from TRS 2303

…resulted in current research to better understand program implementation best practices

RS 2303 – Effectiveness of SSCs

Trends in SSC usage

Figure 2. Trends in the number of U.S. communities with speed cameras from 1995 to 2020 (Source: IIHS Website)



Speed Reduction

SSCs are an effective countermeasure for reducing motorist speeds.

- Threshold speeding generally resulted in:
  - 60-82% reduction on lower speed limit roadways
  - 24% to 88% reduction on higher speed limit roadways.

Crash Reduction

SSCs are an effective countermeasure for reducing crashes, particularly severe and fatal injury crashes.

- **Injury crashes:** 10-54% reduction
- **Severe Injury and Fatal Crashes:** 19-56% reduction

Current TRS Scope

Developed based on:

- Discussions from TRS 2303 (Effectiveness of SSCs)
- 2023 FHWA Report
  - Speed Safety Camera Program Planning and Operations Guide
- Need for legislative brief for January 2024
- Scope aligns with DPS mandated research

Transportation Research Synthesis (TRS)

- MnDOT process for fact finding
- Will not provide guidance

Research Objectives

Research Objectives:

1. **Provide a summary of 2023 FHWA Speed Safety Camera Program Planning and Operations Guide and 2020 NHTSA Surveys**

2. **Interviews, data collection and literature reviews to answer questions regarding:**

- Equipment and vendors
- Site selection/placement
- Enforcement
- Citation and court system workflow
- Legal requirements
- Commercial vehicles (i.e. masking, rental/commercial vehicle compliance)
- Funding and revenue
- Evaluation and reporting

MN State Statutes (Draft)

Applicable Minnesota Statutes (I.e., Enforcement authority, data collection and privacy)	
Statute Title	**Statute Number / Link**
Automated license plate reader (ALPR) *	Minn. Stat. sec. 13.824
Duties of Responsible Authority (Data collection and storage)	Minn. Stat. sec. 13.05 subd. 5
Automated License Plate Reader Policy	Minn. Stat. sec. 626.8472
Comprehensive Law Enforcement Data	Minn. Stat. sec. 13.82 subds. 2, 3, or 6
Drivers' Licenses and Training Schools (CDLs)	Minn. Stat. sec. 171 .161 through .169
Speed Limits, Zones; Radar	Minn. Stat. sec. 169.14

*** SSCs may be separate from ALPR laws as it's specific to a purpose**

Research Questions

<u>Citation Types:</u>

Petty Offense – Moving Violation

- “Payable offense”, not considered a crime and does not carry a jail sentence
- Reported to Department of Licensing (DOL)
- No states report using this method

Petty Offense - Non-moving Violation

- “Payable offense”, not considered a crime and does not carry a jail sentence
- Specifically ordered not to be reported to the DOL or to insurance companies
- Most common

Administrative Citation

- Contested through a civil process established by the local unit of government
  - Contested citations receive a hearing and rulings by a neutral third party which takes the place of the court system
- Not recorded on a person’s driving record and does not affect driving privileges
- Could be processed through DVS if new processes were in-place
- Avoids court fees and less stress on the court system

Additional Research Questions

- **Site selection and type** (i.e., school zones, work zones)
- **Owner vs driver liability**
- **Would other violations be ignored?**
- **How to account for equity in citation fees?**
- **Does a police officer need to verify, or can a trained representative verify a citation?**
- **Could a centralized unit administer the program?**
- **Existing and potential data privacy laws/implications**
- **Understanding Lead Agencies Roles and Responsibilities**
- **CDL reporting requirements**
- **Business and rental vehicle compliance**
- **Etc.**

TRS Publication

- **Expert Interviews – September to November 2023**
  - MN Court System, DPS, Federal Motor Carriers Safety Administration (FMCSA), Federal Highway Administration (FHWA), State DOTs, Cities, etc.
- **Legislative brief - Est. January 2024**
- **Full TRS Published – Spring 2024**

Traffic Safety & Marijuana Laws

Transportation Research Synthesis (TRS)

DEPARTMENT OF TRANSPORTATION

Background

1. Prior to 2023, recreational marijuana was not legal in Minnesota

2. Legalized by an increasing number of states

Already legal in 19 states and D.C.

3. Interest leading up to the 2023 legislative session

…resulted in current research to better understand program implementation best practices

Trends & Updates

Trends in Legalization of Recreational Marijuana

Recent Updates:

- Legal marijuana use, in some form, is increasingly popular:
    - Ohio recently became the 24th state to legalize recreational use
    - Medicinal use is legal in 38 states
    - 7/10 Americans think recreational use should be legal
        - Gallup poll from 11/8/2023
        - 1,009 people

Current TRS Scope

Developed based on:

- Legislative interest
- Increasing approval from public
- Need to understand traffic safety impacts

Transportation Research Synthesis (TRS)

- MnDOT process for fact finding
- Will not provide guidance

Research Objectives

<u>Research Objectives:</u>

1. **Review of latest research on the traffic safety effects of legalization of recreational marijuana use.**

2. **Online survey distributed to transportation agencies *and* departments of public safety in states where recreational use of marijuana has been legal long enough to be able to assess its impact.**

3. **Follow-up contacts with selected survey respondents for additional information about particularly robust programs**

MN State Statutes (Draft)

Applicable Minnesota Statutes (I.e., Enforcement authority, data collection and privacy)	
Statute Title	**Statute Number / Link**
Automated license plate reader (ALPR) *	Minn. Stat. sec. 13.824
Duties of Responsible Authority (Data collection and storage)	Minn. Stat. sec. 13.05 subd. 5
Automated License Plate Reader Policy	Minn. Stat. sec. 626.8472
Comprehensive Law Enforcement Data	Minn. Stat. sec. 13.82 subds. 2, 3, or 6
Drivers' Licenses and Training Schools (CDLs)	Minn. Stat. sec. 171 .161 through .169
Speed Limits, Zones; Radar	Minn. Stat. sec. 169.14

*** SSCs may be separate from ALPR laws as it's specific to a purpose**

Research Questions

- **Have fatal and serious injury crashes increased since legalization?**
- **What other anecdotal changes or evidence from law enforcement have you gathered regarding changes to driver behavior or citations since legalization?**
- **Does your agency maintain a roadside testing program?**
- **Number of DREs, access, and desired staffing levels?**

TRS Publication

- **November 2023**
  - Results of lit review
  - Survey findings
  - Draft TRS
- **Full TRS Published – January 2024**

Thank you!

Mark Wagner, PE

MnDOT Office of Traffic Engineering

mark.wagner@state.mn.us