Intersection Safety Countermeasures

California Division Office

March 17, 2021

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Learning Objectives

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- Understand why intersection safety countermeasures are critical in reducing fatalities and serious injuries.
- Identify the safety benefits of each safety countermeasure in reducing crashes.
- Case study on roundabouts in Scott County, Minnesota

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Principles of Intersection Safety

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- Principles of Intersection Safety

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Ped and Bike Fatalities in USA, 2014 - 2018

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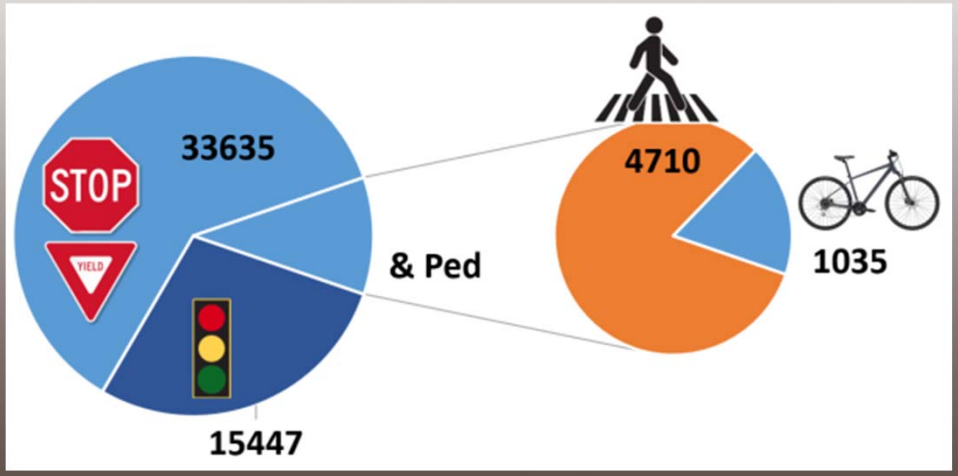

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Source: NHTSA FARS

Intersection Safety Countermeasures

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- Roundabouts
- Backplates with Retroreflective Borders
- Leading Pedestrian Intervals
- Yellow Change Interval
- Reduced Left-Turn Conflict Intersections

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Roundabouts

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- An effective option for:
  - Managing speed
  - Transitioning traffic from high-speed to low-speed environments.
  - Reducing number and severity of crashes.

Example of a single-lane roundabout.

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Roundabouts

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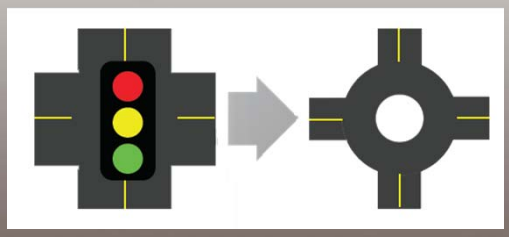
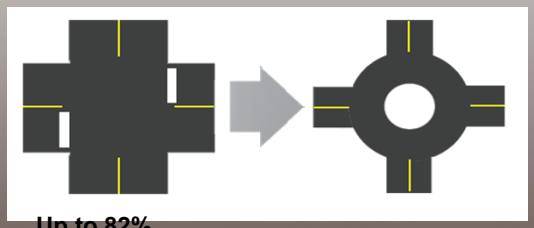


Up to 78%
Reduction in severe crashes



Up to 82%
Reduction in severe crashes

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Backplates with Retroreflective Borders

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- Improves visibility during:
  - Inclement weather
  - Dusk, dawn and dark conditions
  - During power outages.

Safety Benefit: Up to 15% reduction in total crashes.

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Day vs. Night-time Visibility of Signal Heads without Retroreflective Borders

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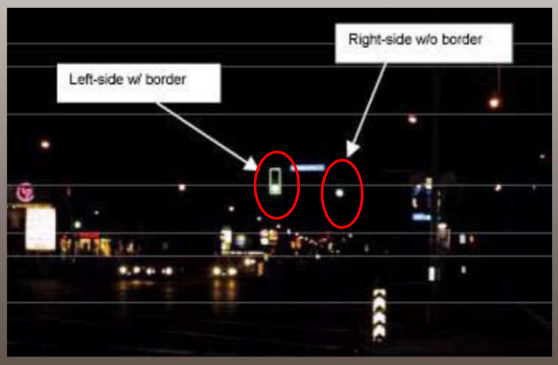

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Yellow Change Interval (YCI)

California Division Office

- Factors that Impact Timing Calculation:
  - Speed of approaching vehicles
  - Driver perception-reaction time
  - Vehicle deceleration rates
  - Intersection width
  - Roadway approach grades

Properly-timed yellow change intervals can reduce red-light running and improve overall intersection safety.

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Yellow Change Interval (YCI)

California Division Office

- Effects of Change Intervals on safety;
  - Studies show an increase in YCI duration to ITE guidelines reduces red-light running by 36% to 50%.
  - Setting change intervals to ITE guidelines reduces total crashes by 8% to 14% and injury crashes by approx. 12%.
  - A possibility of an increase in rear-end crashes when YCI durations are increased.

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Source: NCHRP report 731

Reduced Left-Turn Conflict Intersections

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- Geometric designs that alter left-turn movements to minimize the potential for angle related crashes.
- There are two highly effective designs;
  - Restricted crossing U-turn (RCUT) intersections
  - Median U-turn (MUT) intersections.

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Reduced left-turn conflict intersections

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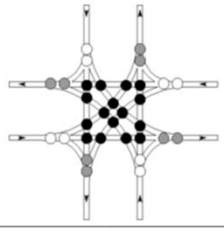
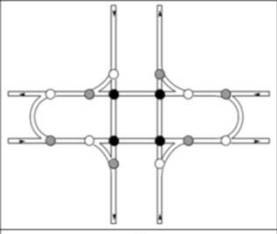
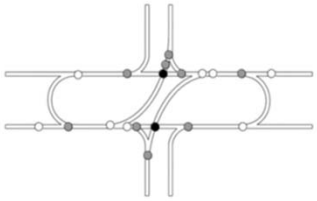
Vehicle-Vehicle Conflict Points	Conventional	MUT	RCUT
● Crossing ● Merging ○ Diverging			
Crossing	16	4	2
Merging	8	6	6
Diverging	8	6	6
Total	32	16	14

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Reduced left-turn conflict intersections

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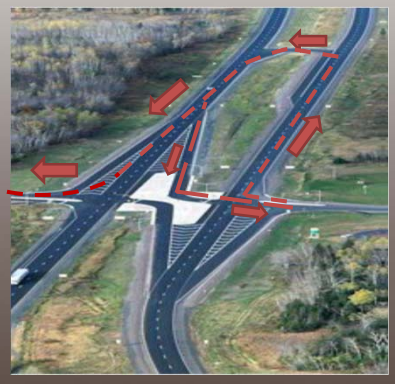
Restricted Crossing U-turn (RCUT)

- Modifies the direct left-turn and through movements from cross-street approaches.
- Minor road through and left-turn movements are re-routed to downstream U-turns on major road.
- Treatment of major road movement is optional.



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Reduced left-turn conflict intersections

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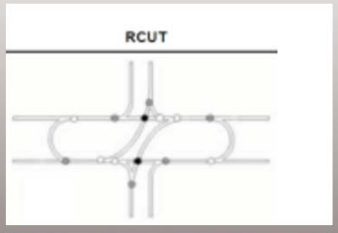
- **Restricted Crossing U-turn (RCUT)**
  - Suitable for rural, high-speed, four-lane, divided highways or signalized routes.
  - An alternative to signalization or constructing an interchange.
  - Works well when consistently used along a corridor, but also effective at individual intersections.
  - Safety Benefit: Up to 54% reduction in injury and fatal crashes.



Example of RCUT intersection.

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Source: https://safety.fhwa.dot.gov/provencountermeasures/

Reduced left-turn conflict intersections

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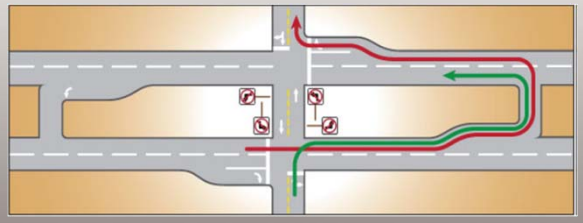
Median U-turn (MUT)

- Major road LT is re-routed to downstream U-turns on major road.
- Minor road LT is routed to downstream U-turns on major road.
- Improves Signal phasing/timing advantages at signalized intersections



MUT Intersection Signal Cycle

Typical Conventional Intersection Signal Cycle

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Reduced left-turn conflict intersections

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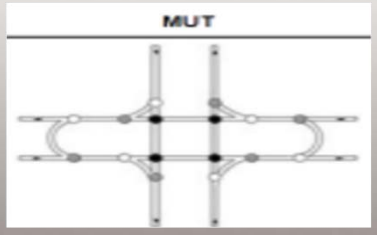
Median U-turn (MUT)

- Excellent choice for heavily traveled intersections with moderate left-turn volumes.
- Reduces delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists
  - When implemented at multiple intersections along a corridor
- Safety Benefit: Up to 30% reduction in intersection-related injury crash rate.



Example of MUT intersection.

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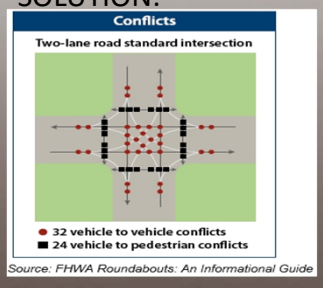
Source: https://safety.fhwa.dot.gov/provencountermeasures/

Case study- Scott Co, MN

California Division Office

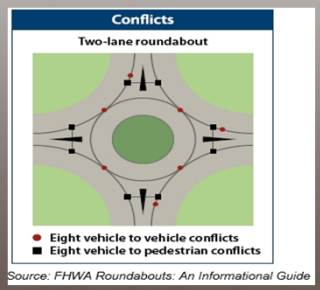
- Converted a two-way STOP control on CR 2 (ADT=4,300) Intersecting with SH 13 (ADT= 4,650) in Scott County, MN to a Roundabout.
  - PROBLEM: Both rural roads have 55 mph speed limits, with 2 fatal crashes and 50 injury crashes in a 5-yr period.

SOLUTION:



Source: FHWA Roundabouts: An Informational Guide

32 Veh Conflict points



Source: FHWA Roundabouts: An Informational Guide

8 Veh Conflict points

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Case study- Scott Co, MN

California Division Office

- Crash reduction results were based on a B-A study, periods were approximately 36 and 24 months respectively.

Table 1: Summary of crash reductions after conversion to a roundabout intersection

Location	Implementation Date	Before				After				Reduction in Crashes per Year		
		Months	Total Crashes	Injury Crashes	Angle Crashes (2)	Months	Total Crashes	Injury Crashes	Angle Crashes	Total Crashes	Injury Crashes	Angle Crashes
State Highway 13 and County Road 2	August 05	36	19	14	18 (1 fatality)	24	3	2	0	76.2%	78.7%	100%

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Resources

California Division Office

http://safety.fhwa.dot.gov/provencountermeasures

https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/case_studies/fhwasa09013/

http://redlightrobber.com/red/links_pdf/NCHRP-Guidelines-for-Timing-RPT-731.pdf

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Thank you

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Cove at Julia Pfeiffer Burns State Park

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Cove at Julia Pfeiffer Burns State Park

1.Roadway approach grades does not impact Yellow Change Interval timing calculation

1. TRUE
2. FALSE?

Correct Answer: FALSE

2.A roundabout an reduce severe crashes by up to
A. 50%
B. 60%
C. 75%
D. 90%
Answer: D

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