J-Turn

An Intersection Safety Improvement

Purdue Road School 2016

Tuesday, March 8, 2016

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US 231 and SR 62 and SR 68

US 231 and SR 62 Intersection

Traffic Data

- Traffic Data (2013)
  - US 231/SR 62 Intersection
    - US 231 AADT = 5675 with 29% Trucks
    - SR 62 AADT = 1543 with 5% Trucks
  - US 231/SR 68 Intersection
    - US 231 AADT = 6015 with 28% Trucks
    - SR 68 AADT = 2106 with 6% Trucks

Intersection Concern

- Crashes
  - Above average crash rate since opening in 2010.
  - Overwhelming majority of severe crashes has been from the minor road traffic crossing or turning left.

US 231 and SR 62

Crash Data

Crash Analysis for US 231 and SR 62						
SEVERITY	2010	2011	2012	2013	2014	Total
Property Damage	6	3	3	0	0	12
Non-Incapacitating Injury	3	2	3	1	3	12
Incapacitating Injury	1	0	0	0	0	1
Fatal	0	2	0	0	1	3
TOTALS	10	7	6	1	4	28

Crash Analysis for US 231 and SR 68						
SEVERITY	2010	2011	2012	2013	2014	Total
Property Damage	1	2	3	3	3	12
Non-Incapacitating Injury	0	4	3	2	3	12
Incapacitating Injury	0	0	0	0	0	0
Fatal	0	1	0	0	0	1
TOTALS	1	7	6	5	6	25

Improvements Prior to J-turn

- Increase size of stop signs.
- Refreshed pavement markings.
- Added beacons to the stop signs.
- Added extra speed limit signs.
- Added shark teeth yield line in the median.

Improvements Prior to J-turn

- Removed the left-turn only at minor roads. Created a thru/left lane.

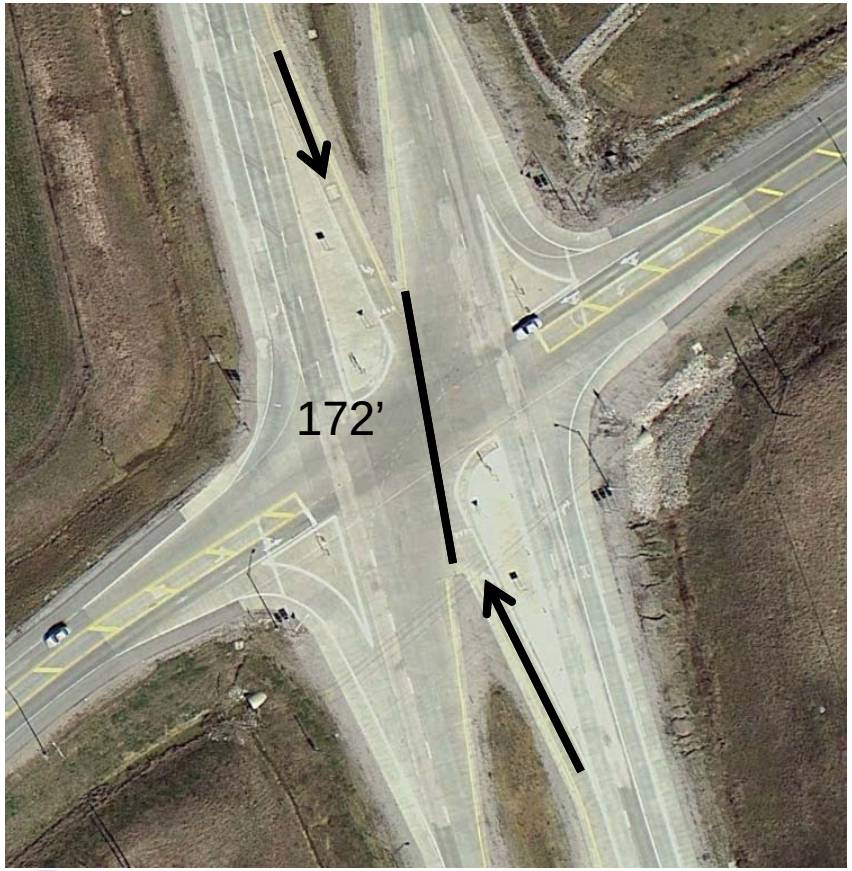
Before

After

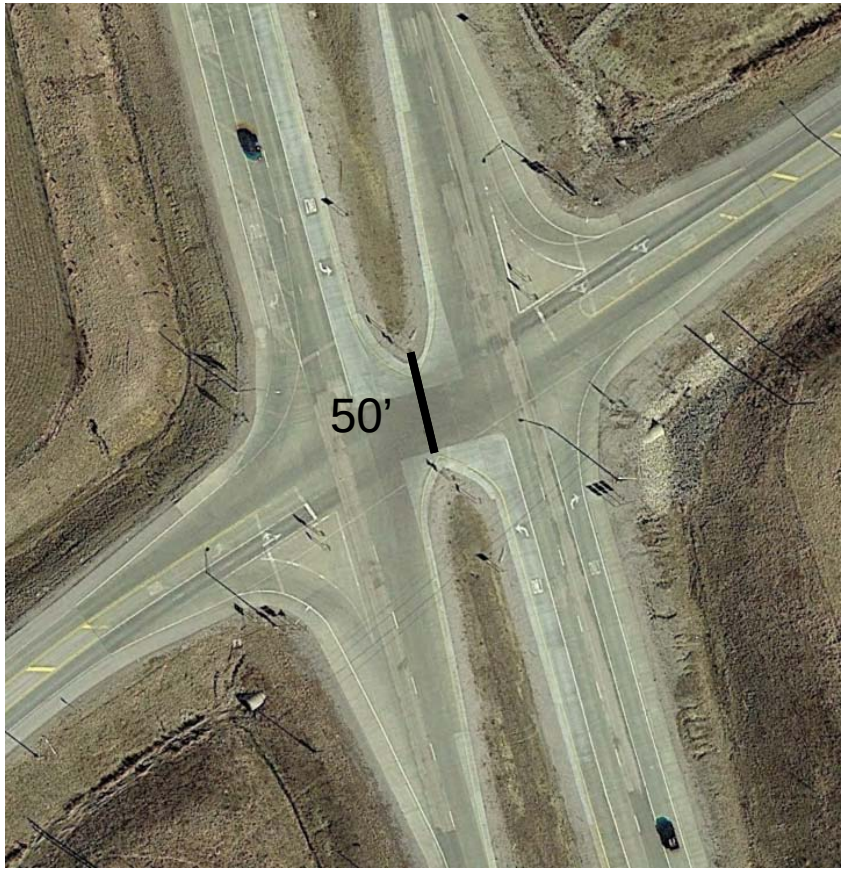
Improvements Prior to J-turn

- Removed slotted left turns to reduce median footprint.

Before



After



Alternatives Considered

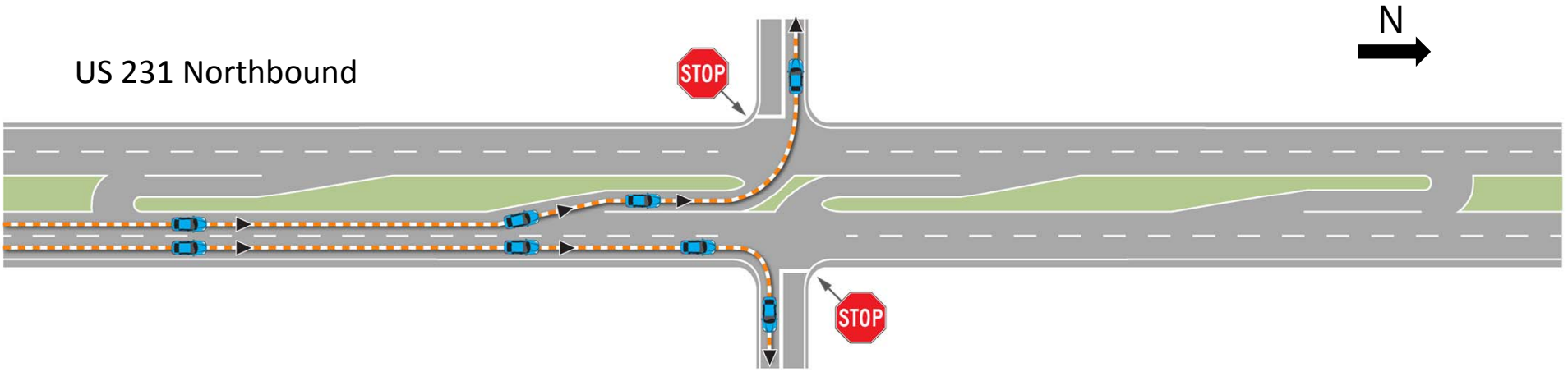
Alternatives analyzed during preliminary engineering assessment

- No-Action
- Lowering speed limit
- Install additional signage to warn drivers
- Install intersection control beacon
- Realign intersections
- Construct overpass
- Close median openings
- Roundabouts
- Build interchange
- Install traffic signals
- J-turn Intersection (Selected)

What is a J-turn?

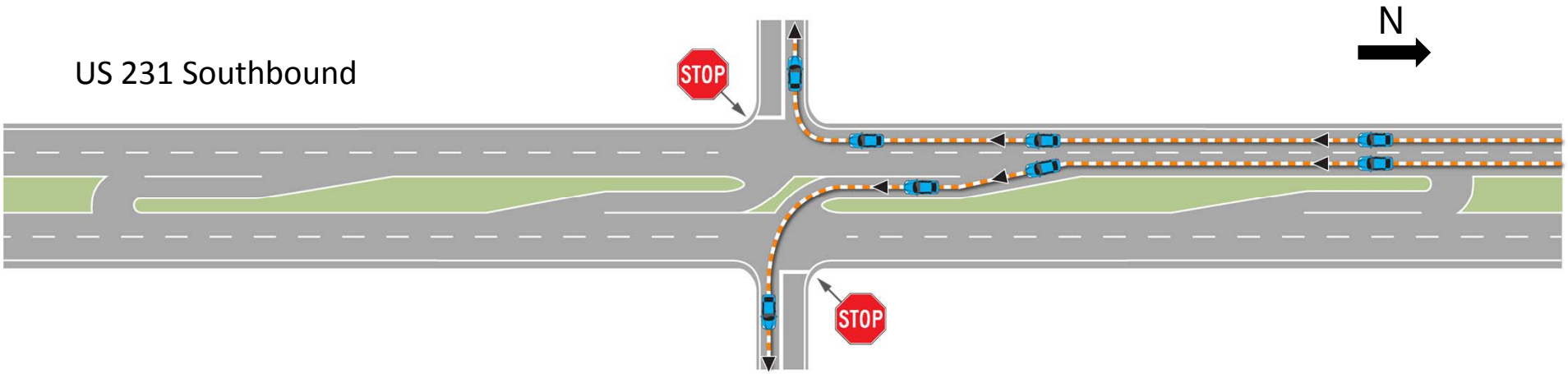
- A J-turn is an intersection that prevents direct crossing and left-turn movements from the minor approach roadway.
- J-turns are a variation of the Restricted Crossing U-turn (RCUT)

J-Turn Intersection



J-Turn Intersection

How does a J-turn work?



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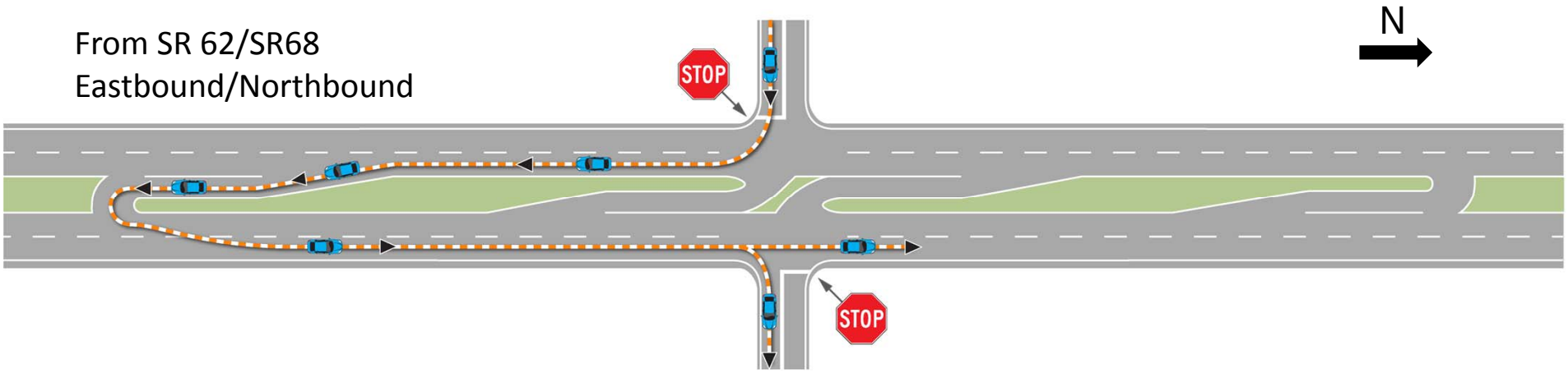

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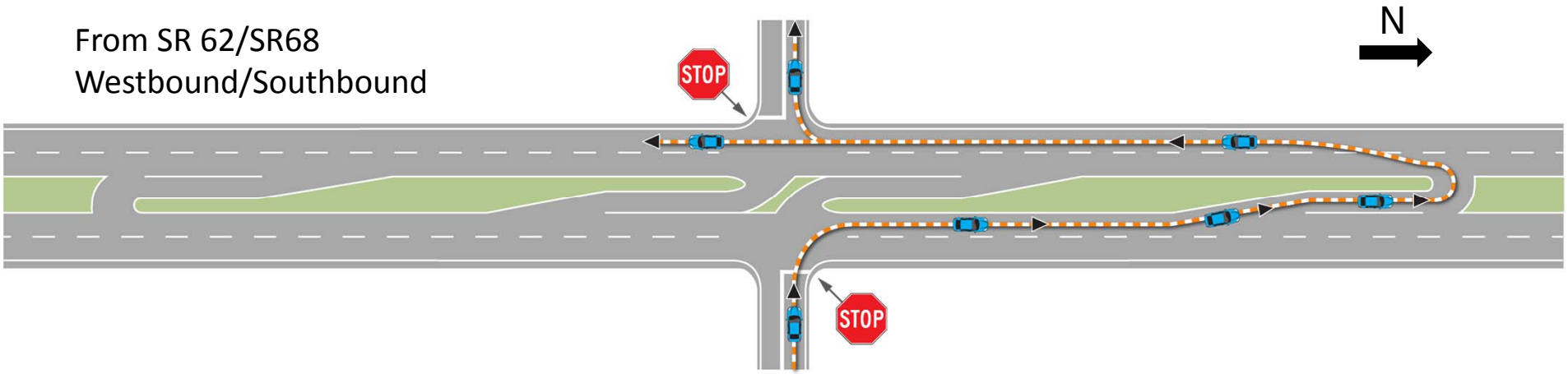
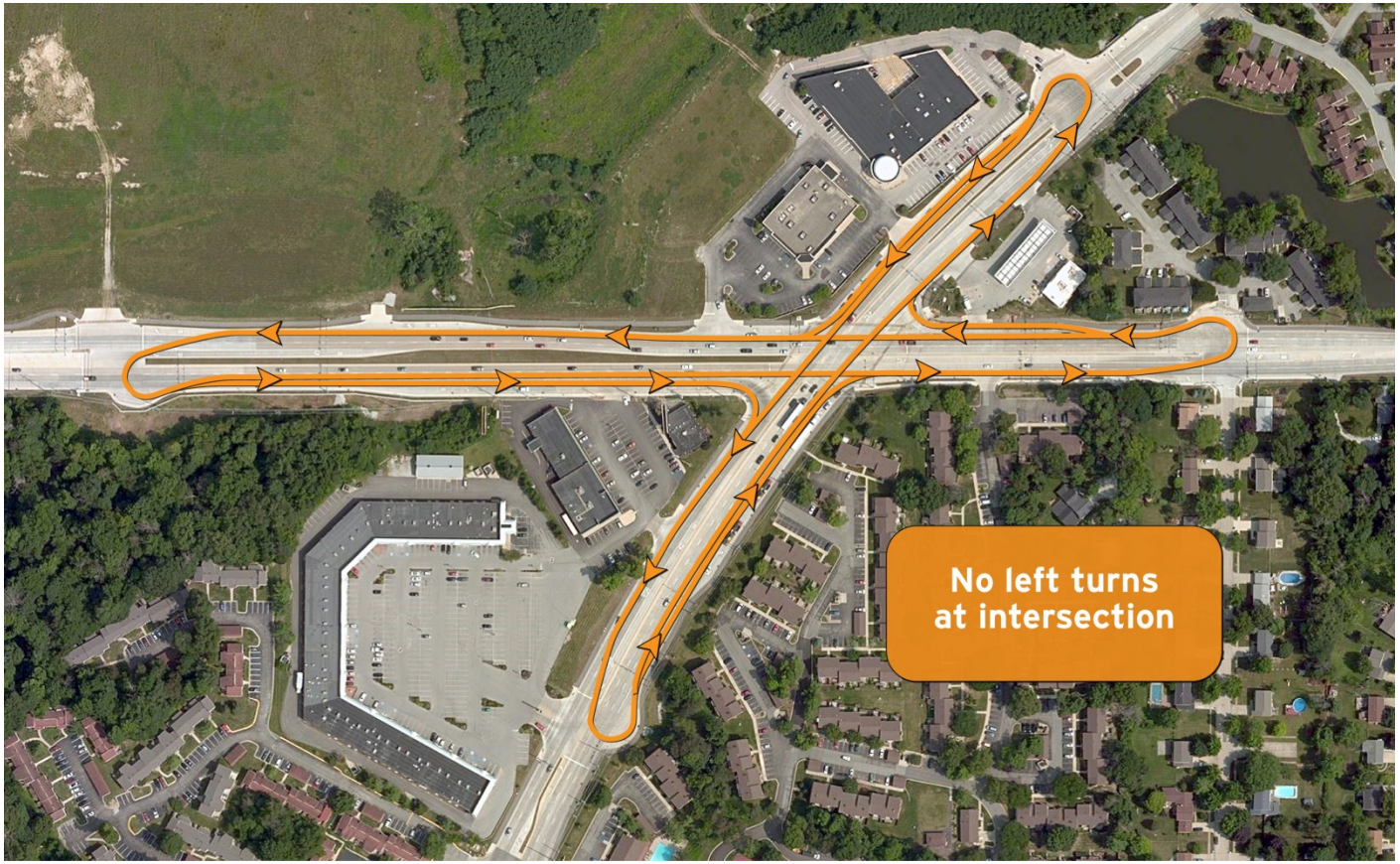


RCUT/Superstreet

- Signalized RCUT/Superstreet in Troy, MI

Michigan Left

- No left turns allowed from the major minor.



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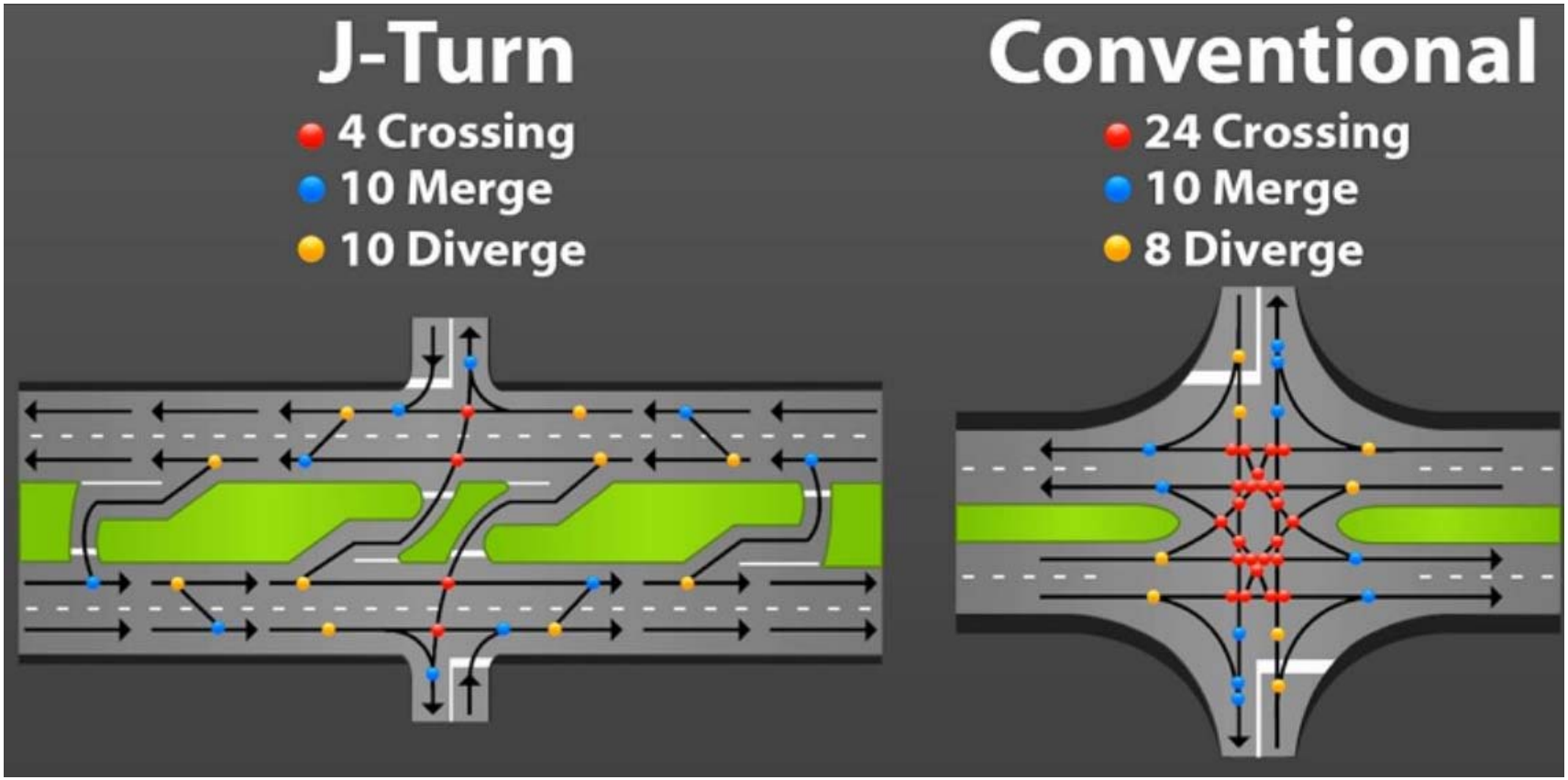


J-Turn Intersection

- J-turns reduce a significant number of crashes.

Case Studies Collision Summary by Type			
	Before	After	%Change
Rear End	13	8	-38%
Angle	47	0	-100%
Turning	32	10	-69%
Sideswipe	8	3	-63%
TOTALS	100	21	-79%

Source
"Spot Safety Project Evaluation",
#02-00-208/02-00-209
#11-99-210
#14-97-018
NCDOT Safety Evaluation Group, 2005 and 2006

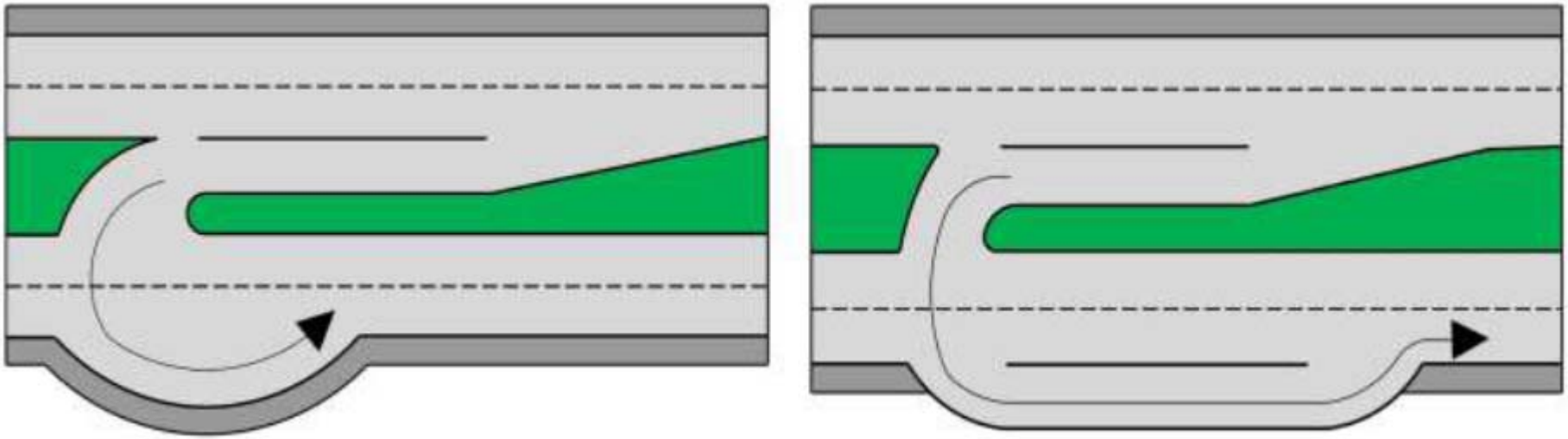
Case Studies Collision Summary by Severity			
	Before	After	%Change
Injury	56	10	-82%
Fatality	2	1	-50%

J-Turn Design

- Design Speed – typically 65 mph. Will vary per site conditions.
- Design Vehicle – WB-62
- Superelevation – per IDM and AASHTO
- Clear Zone – per roadway classification and IDM
- Sight Distance – per IDM

J-Turn Design

- Median Width and impacts on design
- Medians less that 64’ require additional consideration
  - Use of shoulders for the u-turn
  - Installation of a loon for the u-turn.



J-Turn Design

- Median Widths and Design Vehicle usage

Design Vehicle	Median Width		
	40’	64’	100’+
Bus (40’)	Shoulder Only	Inside Lane	Inside Lane
WB-40 (40’)	Loon Required	Outside Lane	Inside Lane
WB-50 (50’)	Loon Required	Shoulder Only	Inside Lane
WB-62 (62’)	Loon Required	Shoulder Only	Inside Lane
WB-67 (67’)	Loon Required	Shoulder Only	Inside Lane

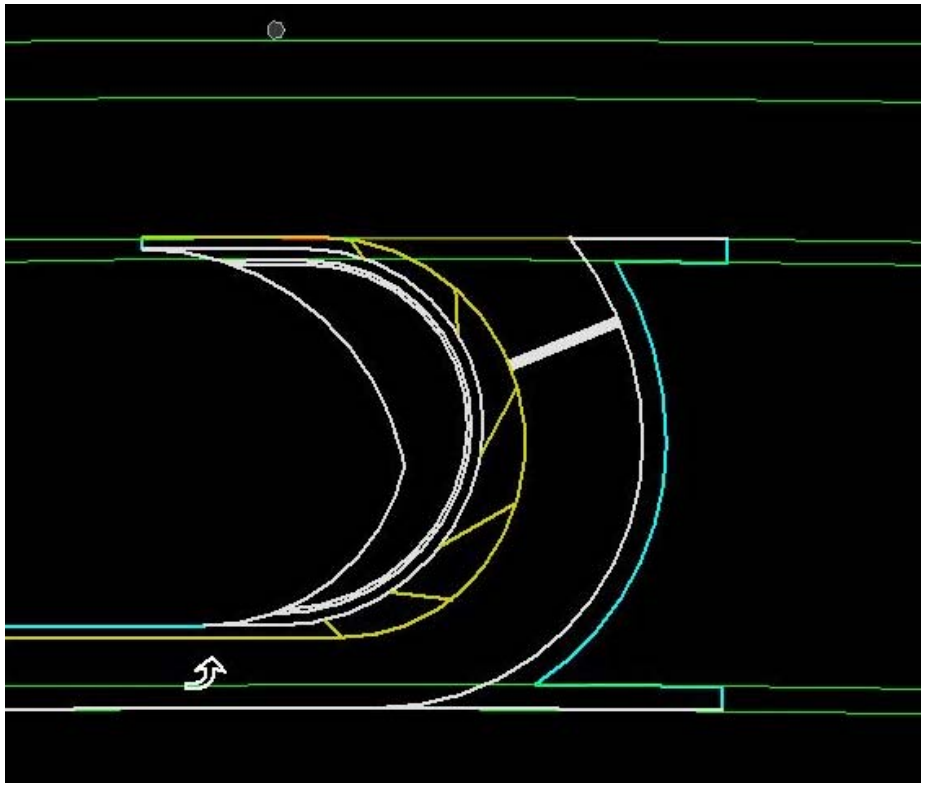
J-Turn Design

- Location of u-turns considerations
  - Storage and Deceleration for left turn at major and at u-turn.
  - Intersection sight distance for u-turn location

J-Turn Design

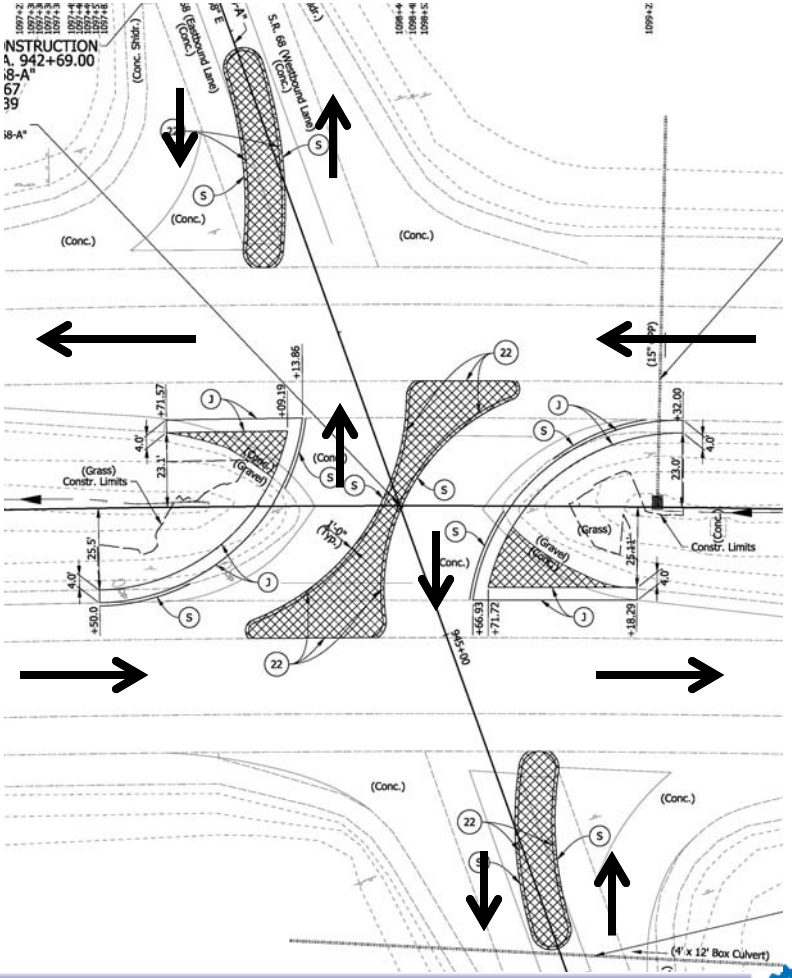
- U-turn design – the divided highway may require special consideration for design of the u-turn lane in the median.
- Designs should consider truck apron

- Lane width to accommodate WB-40.
- Additional striping for a WB-50.
- Utilize Truck Apron for vehicles greater than WB-50



J-Turn Design

- Intersection should utilize raised islands to position motorists correctly.



J-Turn Design

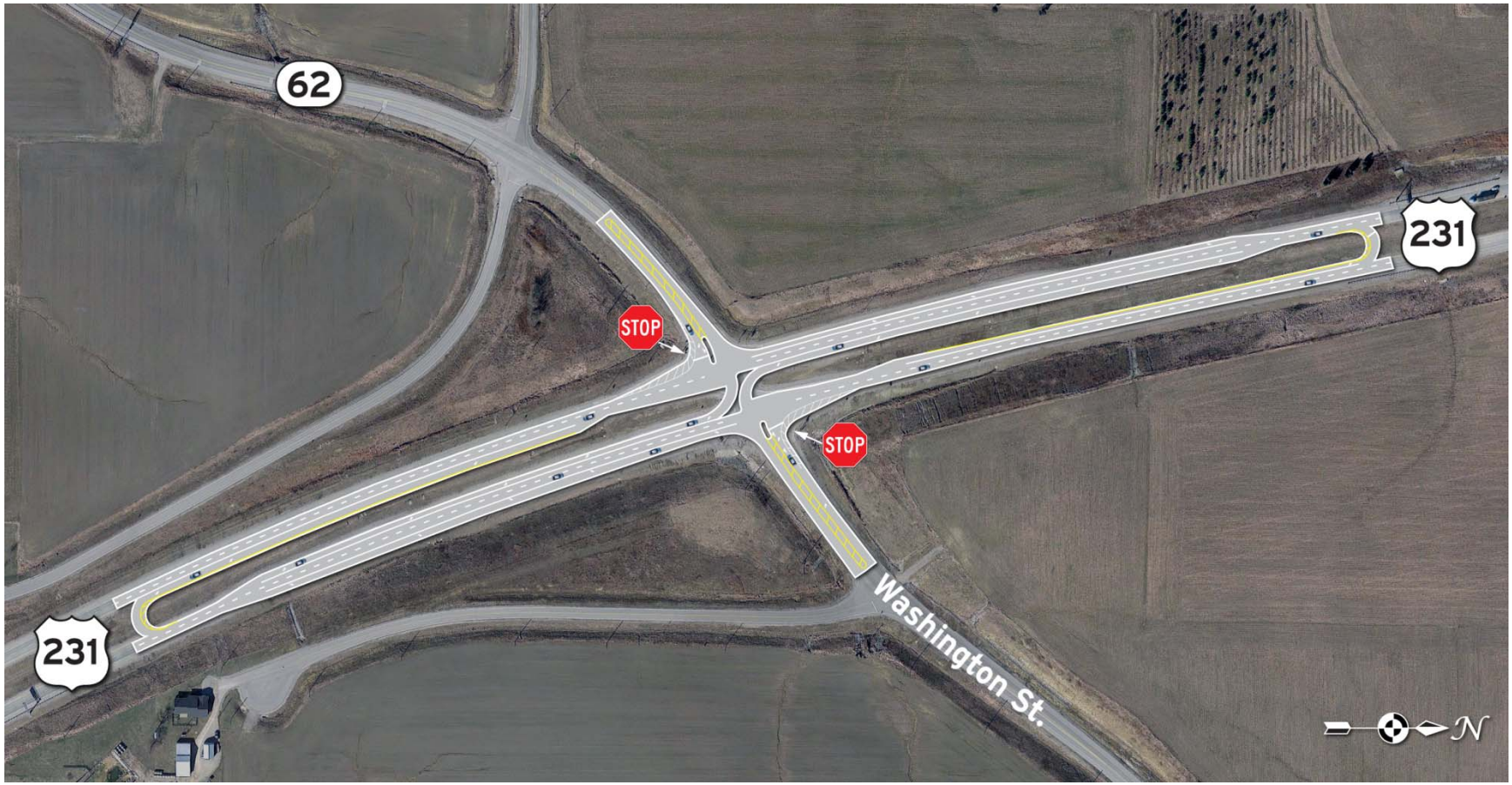
- Specialized signing on the minor roads.

Additional Modifications

- Considerations for local farmers

Additional Modifications

- Lighting



Thank You / Questions