

Life After Innovative Intersections



Carrie Nelsen
D9 PD Engineer

Innovative Intersections



These designs REDUCE severe crashes while IMPROVING efficiency



Why Innovative Intersections?

Intersections represent about
 $\frac{1}{4}$ of all traffic fatalities...

...and **HALF** of all
severe crashes

Intersections are a major safety issue and may become bottlenecks along high volume roadways

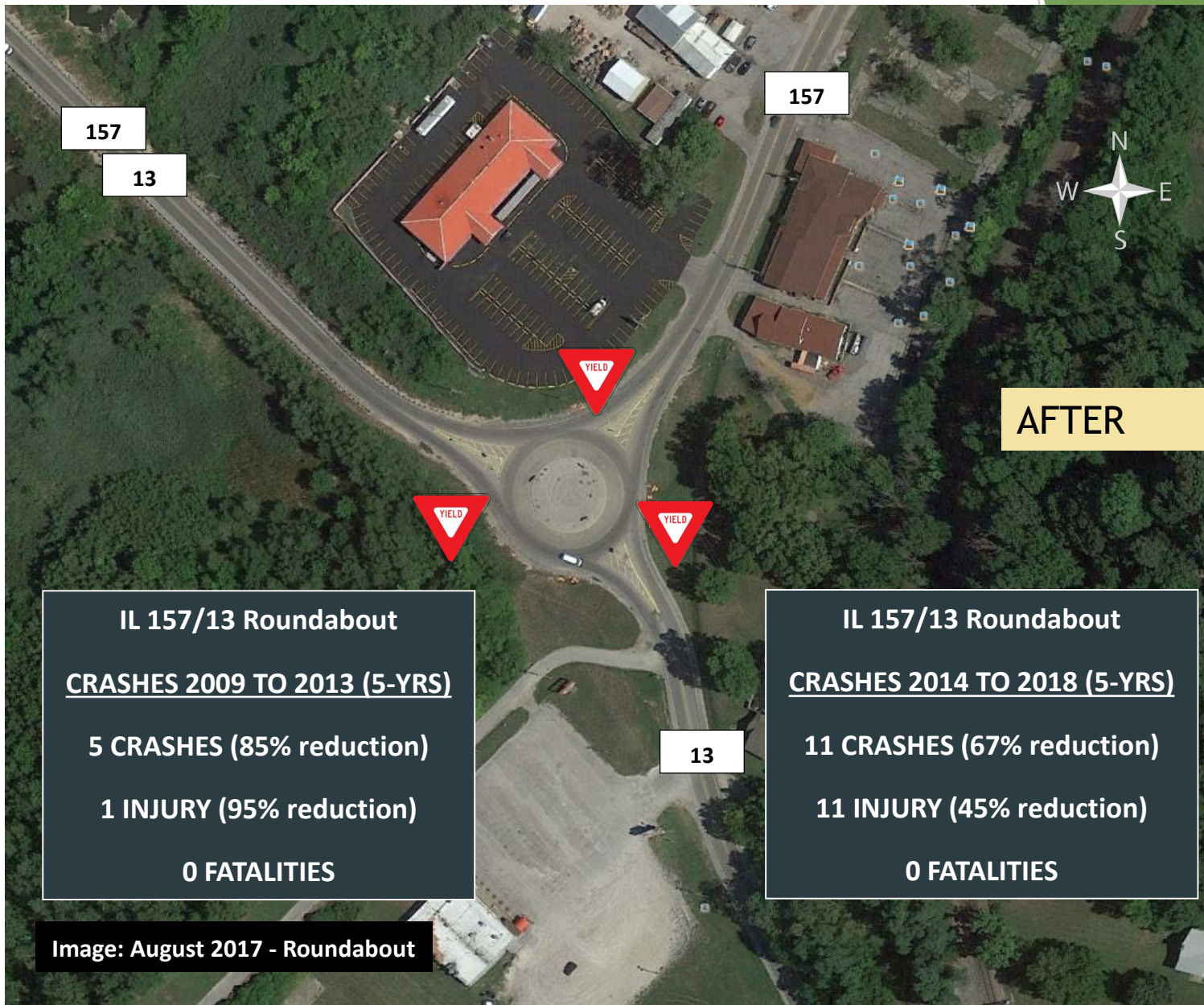
Roundabouts



Intersection of IL 157/13



Intersection of IL 157/13



Intersections of IL 13, IL 15 ramps, IL 158 and sideroads (Belleville)

2010 – Signalized Intersections at Interchange Ramps



CRASHES AT INTERSECTIONS

2003 to 2007
(5-YRS)

94 CRASHES
20 INJURIES
0 FATALITIES

NOTE: Average 19 Crashes/Year



15 EAST
←
Mt Vernon

Intersections at Interchange Ramps and Adjacent Roadways Combined Into Roundabouts



13

Southern Intersections Combined To Form 3-Legged Roundabout



Northern Intersections Combined To Form 6-Legged Roundabout



15

158

Whiskey Road



CRASHES AT ROUNDABOUTS

2015

(1st Full Year Operable)

10 CRASHES (47% REDUCTION)

1 INJURY

0 FATALITIES

2016

(2nd Full Year Operable)

2 CRASHES (89% REDUCTION)

1 INJURY

0 FATALITIES

2017

(3RD Full Year Operable)

3 CRASHES (84% REDUCTION)

2 INJURY

0 FATALITIES

2018

(4th Full Year Operable)

5 CRASHES (74% REDUCTION)

2 INJURY

0 FATALITIES



IL 13/154 WYE INTERSECTION

CRASHES 2010 TO 2014 (5-YRS)

15 CRASHES

5 INJURY CRASHES

0 FATALITIES

IL 13 and IL 154 in Pinckneyville



154

13

CRASHES AT IL 13/154 ROUNDABOUT

2017

(1st Full Year Operable)

0 CRASHES (100% REDUCTION)

0 INJURY

0 FATALITIES

2018

(2nd Full Year Operable)

1 CRASHES (93% REDUCTION)

0 INJURY

0 FATALITIES

IL 156 and Lakeview Dr next to IL 3 in Waterloo



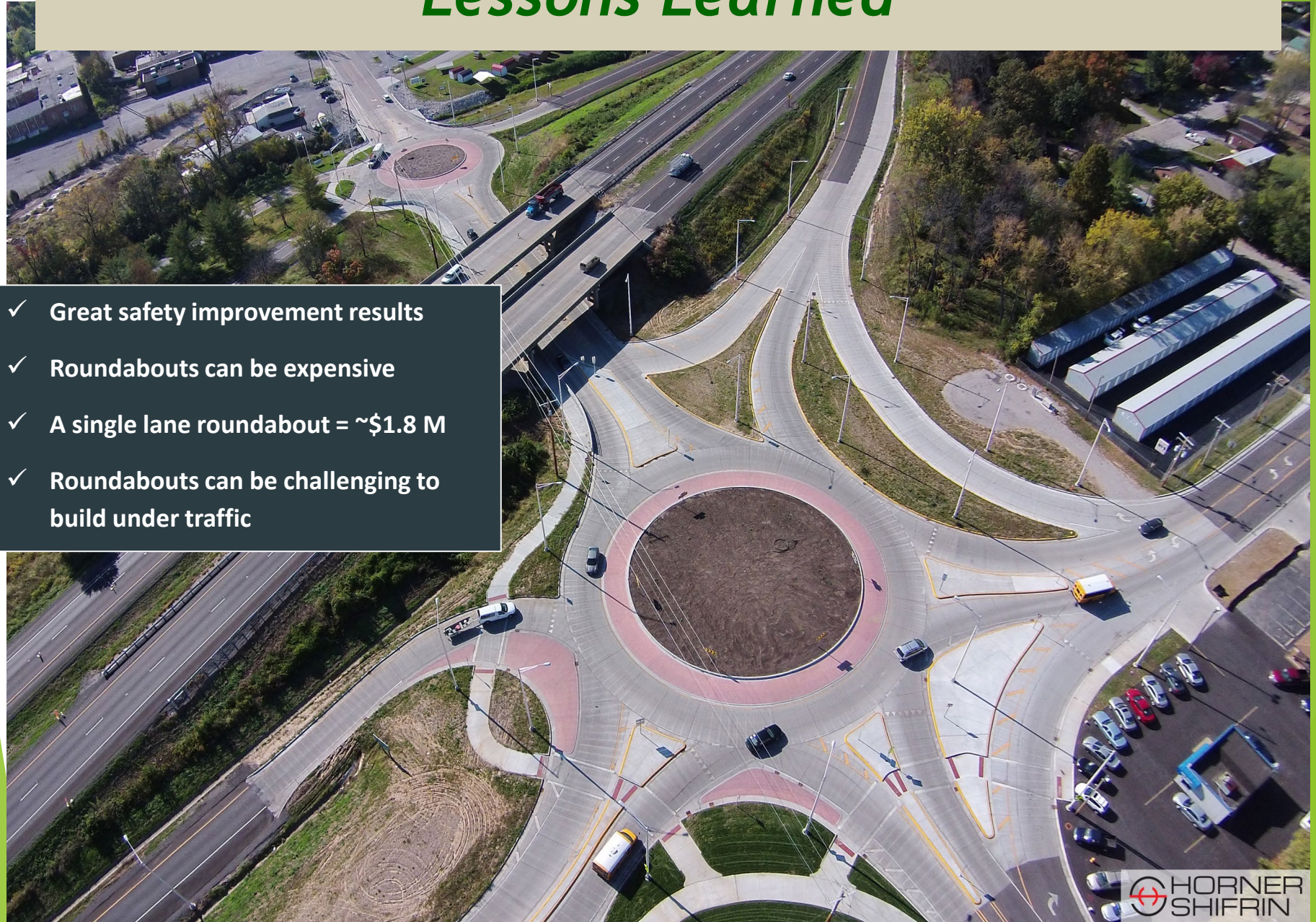
CE

CE

Gas Station

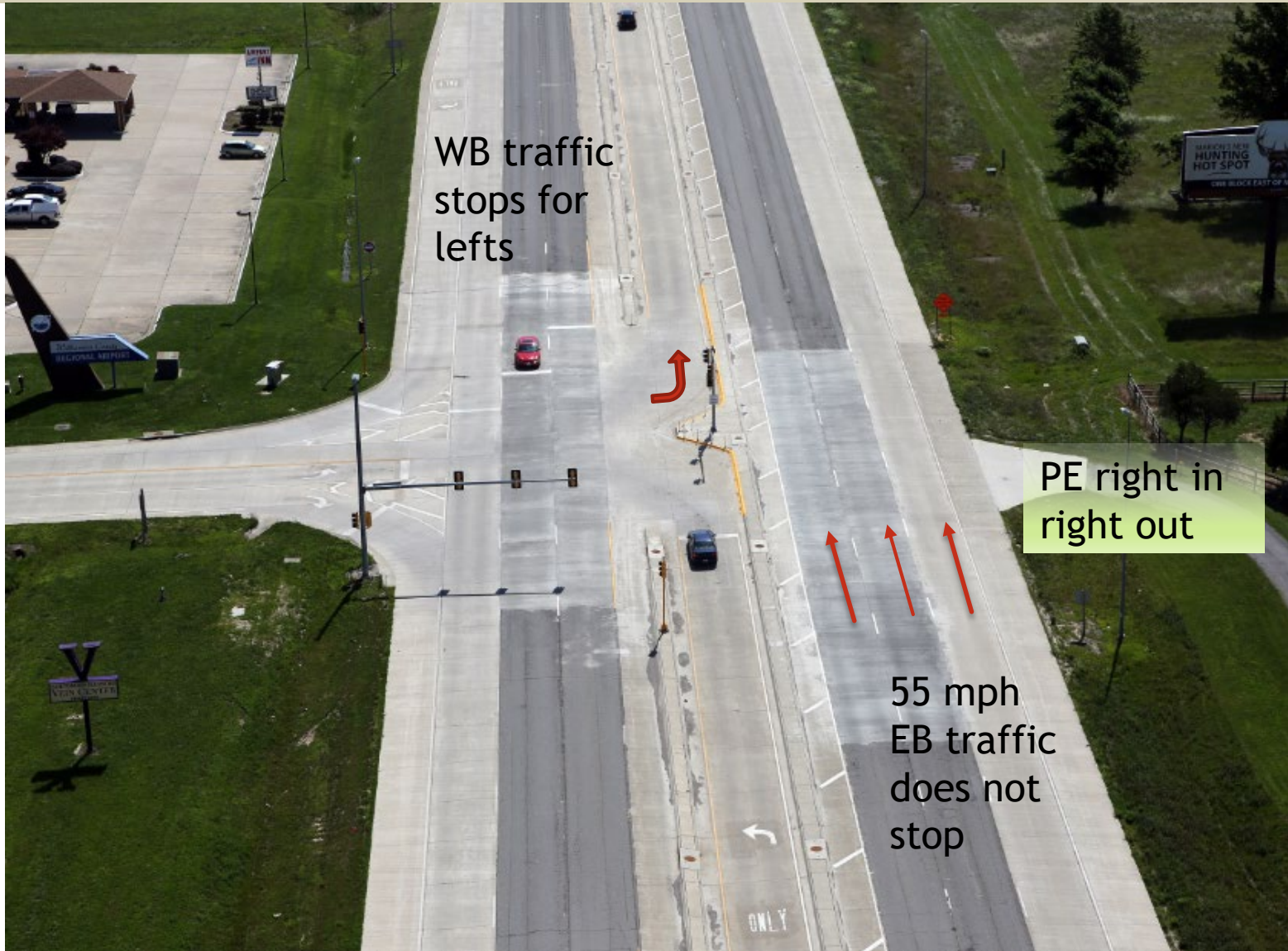


Lessons Learned



- ✓ Great safety improvement results
- ✓ Roundabouts can be expensive
- ✓ A single lane roundabout = ~\$1.8 M
- ✓ Roundabouts can be challenging to build under traffic

Continuous Green Time Intersection (CGT) or SUPER T IL 13 and Terminal Drive



WB traffic
stops for
lefts



PE right in
right out



55 mph
EB traffic
does not
stop

Continuous Green Time Intersection / Super T IL 13 and Pentecost Drive

- Pentecost & IL 13 was 4 legged intersection with stop control on the side road.
- Developers wanted a traffic signal and Safety was an issue
- Pentecost Dr and Terminal are 2000' apart
- The compromise was the Continuous Green Time (CGT) intersection



ILL 13 - PENTECOST DR.

YEAR	REAR END	TURNING / ANGLE	OTHER	TOTAL	INJURY CRASHES
2005	3	3	0	6	2
2006	4	9	0	13	5
2007	3	9	1	13	3
2008	5	8	2	15	4
<u>2009</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>7</u>	<u>2</u>
5 Year TOTAL	17	32	5	54	16
CONTRACT LET - JANUARY 2010					
2012	2	1	0	3	0
2013	5	1	1	7	2
2014	4	0	1	5	2
2015	1	0	1	2	1
2016	4	0	0	4	2
2017	3	1	1	5	2
2018	<u>6</u>	<u>1</u>	<u>0</u>	<u>7</u>	<u>1</u>
5 year TOTAL	18	2	3	23	8

Crashes @ IL 13 and Pentecost Dr

IL 13/ Pentecost INTERSECTION

CRASHES 2005 TO 2009 (5-YRS)

54 CRASHES

16 INJURIES

0 FATALITIES

IL 13/ Pentecost INTERSECTION

CRASHES 2014 TO 2018 (5-YRS)

23 CRASHES (57% reduction)

8 INJURIES (50% reduction)

0 FATALITIES

Crashes @ IL 13 & Terminal Dr

ILL 13 -TERMINAL DR.

YEAR	REAR END	TURNING / ANGLE	OTHER	TOTAL	INJURY CRASHES
2005	1	2	0	3	1 B-INJURY
2006	1	0	0	1	0
2007	0	2	0	2	0
2008	0	0	2	2	0
<u>2009</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>0</u>
5 year TOTAL	3	4	3	10	1

CONTRACT LET - JANUARY 2010

2012	0	0	0	0	0
2013	0	1	0	1	0
2014	0	1	0	1	1 C-INJURY
2015	1	0	1	2	1 B-INJURY
2016	2	1	0	3	0
2017	1	0	0	1	<u>0</u>
2018	3	2	1	6	1 B-INJURY
5 year TOTAL	7	4	2	13	3

IL 13/ Terminal INTERSECTION CRASHES 2005 TO 2009 (5-YRS)

10 CRASHES

1 INJURIES

0 FATALITIES

IL 13/ Terminal INTERSECTION CRASHES 2014 TO 2018 (5-YRS)

13 CRASHES (30% increase)

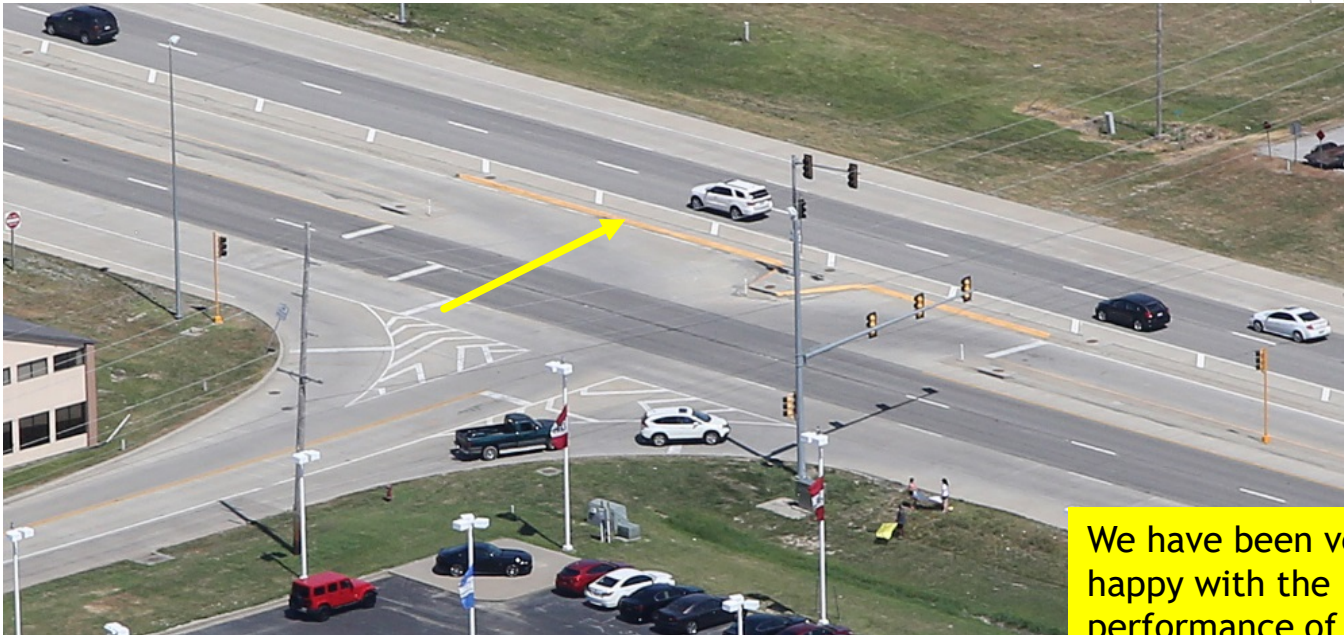
3 INJURIES (200% increase)

0 FATALITIES

Lessons Learned

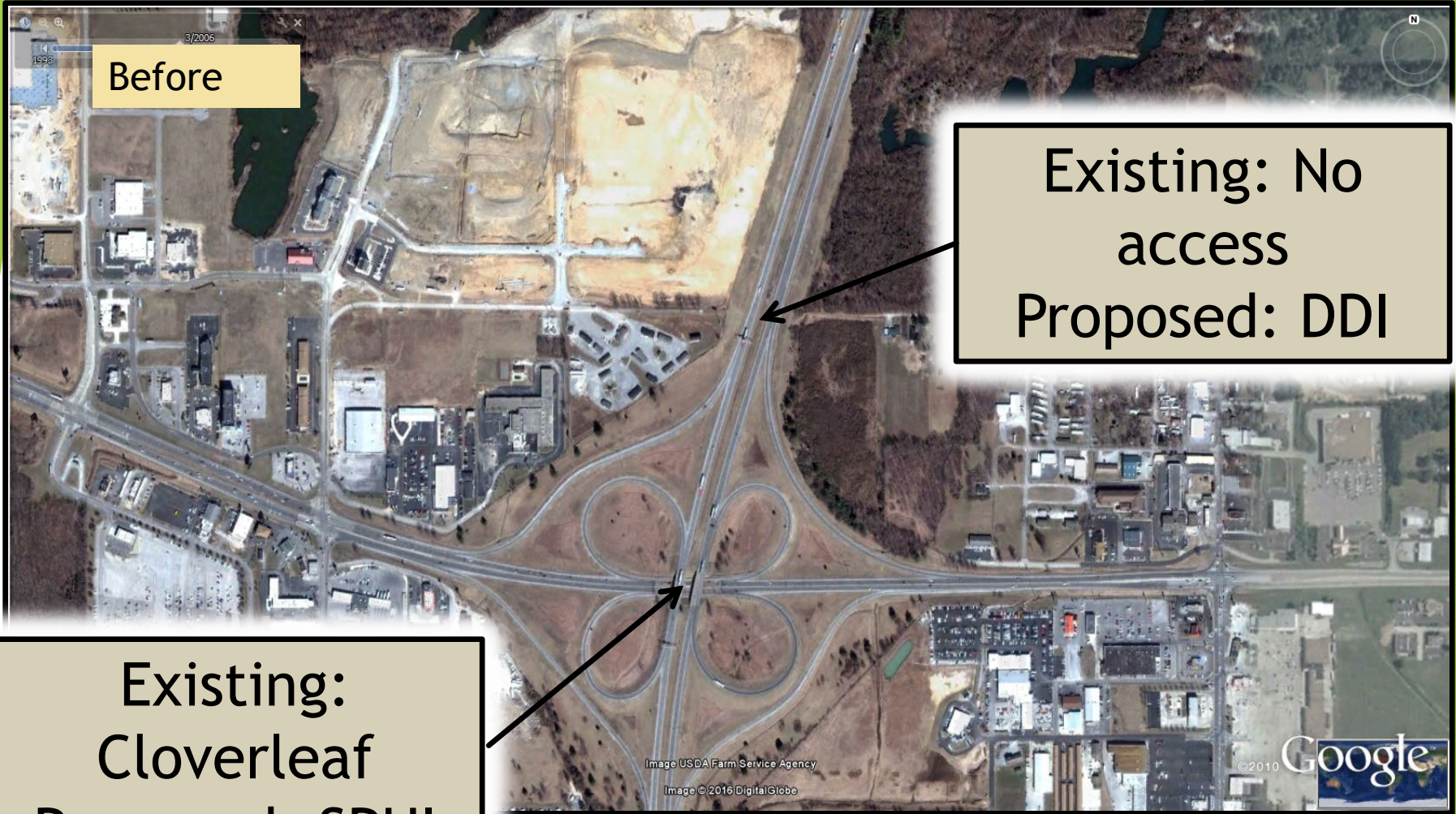
DELINEATE THE CURB TO PREVENT LEFT TURNERS FROM JUMPING CURB INTO THROUGH LANES

- ▶ D9 applied yellow paint to the curb after construction to delineate median
- ▶ Best practice would be to use colored concrete on the median surface



We have been very happy with the performance of the CGT intersections!

Existing Conditions: Interstate 57 & IL 13 and I-57 & The Hill Ave



Before

Existing: No access
Proposed: DDI

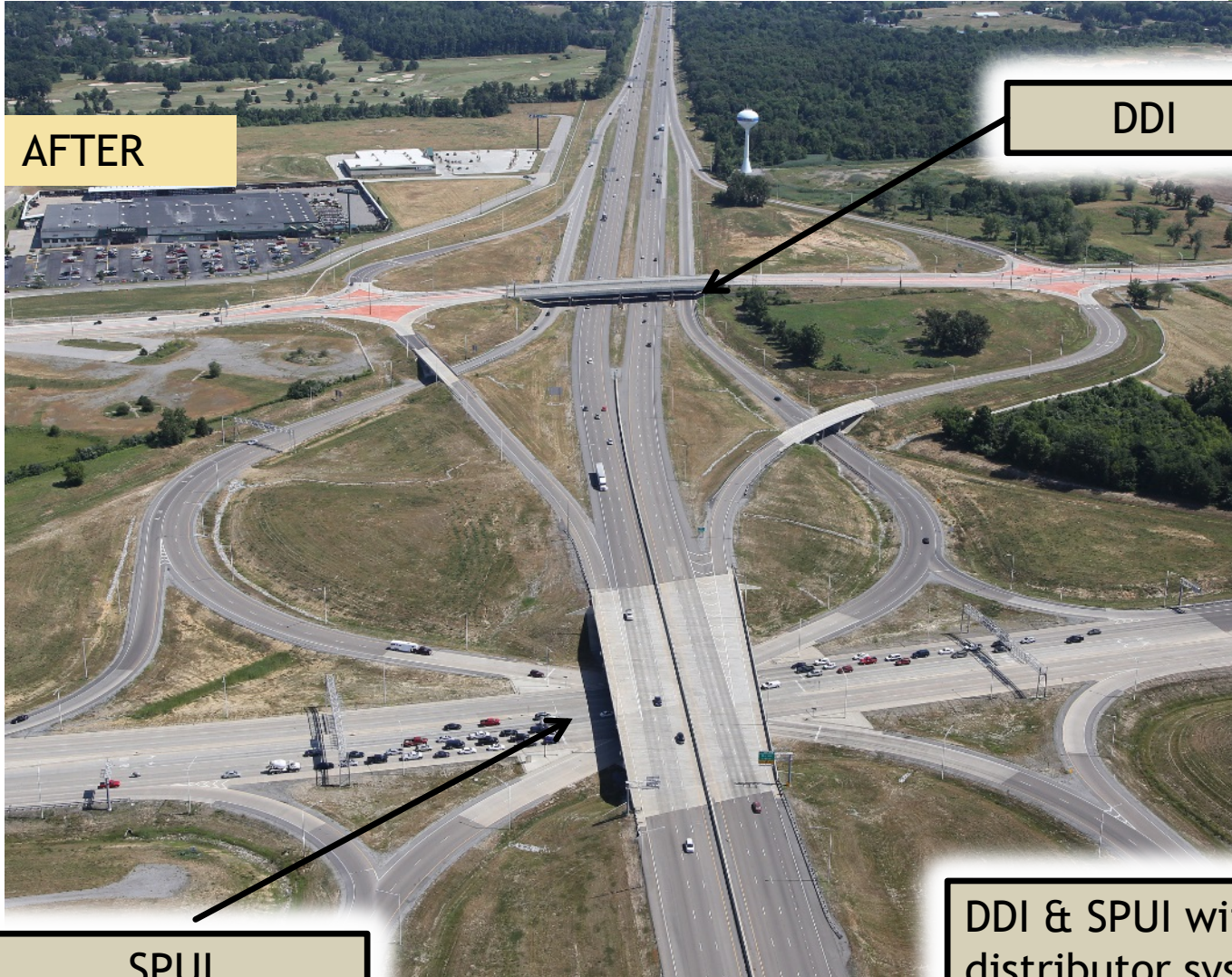
Existing:
Cloverleaf
Proposed: SPUI

Image USDA Farm Service Agency

Image © 2016 DigitalGlobe

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DDI and SPUI



AFTER

DDI

SPUI

DDI & SPUI with collector distributor system from I-57 to IL 13 and The Hill Ave

Crashes DDI

DIVERGING DIAMOND INTERCHANGE

	FIXED OBJECT	REAR END	SIDESWIPE SAME DIRECTION	TURNING	TOTALS
2010	0	1	0	1	2
2011	0	0	0	1	1
2012	0	3	0	1	4
2013	0	3	0	0	3
2014	3	2	0	1	6
Opened August 12, 2015					
2015	0	0	0	0	0
2016	0	1	1	1	3
2017	2	3	1	1	7
2018	0	3	1	1	5

I-57 & The Hill Ave

CRASHES 2010 TO 2013 (5-YRS)

16 CRASHES

3 INJURIES

0 FATALITIES

I-57 & The Hill DDI

CRASHES 08/2015 TO 2018 (~4-YRS)

15 CRASHES (6% reduction)

2 INJURIES (33% reduction)

0 FATALITIES

SPUI Crashes

CLOVERLEAF vs SPUI INTERCHANGE CRASHES

	FATAL	A - INJURY	B - INJURY	C - INJURY	PD ONLY	TOTALS
2006	0	1	2	0	11	14
2007	0	0	4	1	11	16
2008	0	1	2	1	18	22
2009	0	2	1	1	3	7
<u>2010</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>7</u>	<u>9</u>
TOTAL	0	5	10	3	50	68
PROJECT LET JANUARY 2012 - OPENED JULY 2014						
2014	0	1	1	3	18	23
2015	0	2	2	0	24	28
2016	1	1	3	5	26	36
2017	0	0	2	1	25	28
<u>2018</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>25</u>	<u>32</u>
TOTAL	1	5	10	13	118	147

I-57 & IL 13 Cloverleaf

CRASHES 2006 TO 2010 (5-YRS)

68 CRASHES

18 INJURIES

0 FATALITIES

I-57 & IL 13 SPUI

CRASHES 2014 TO 2018 (5-YRS)

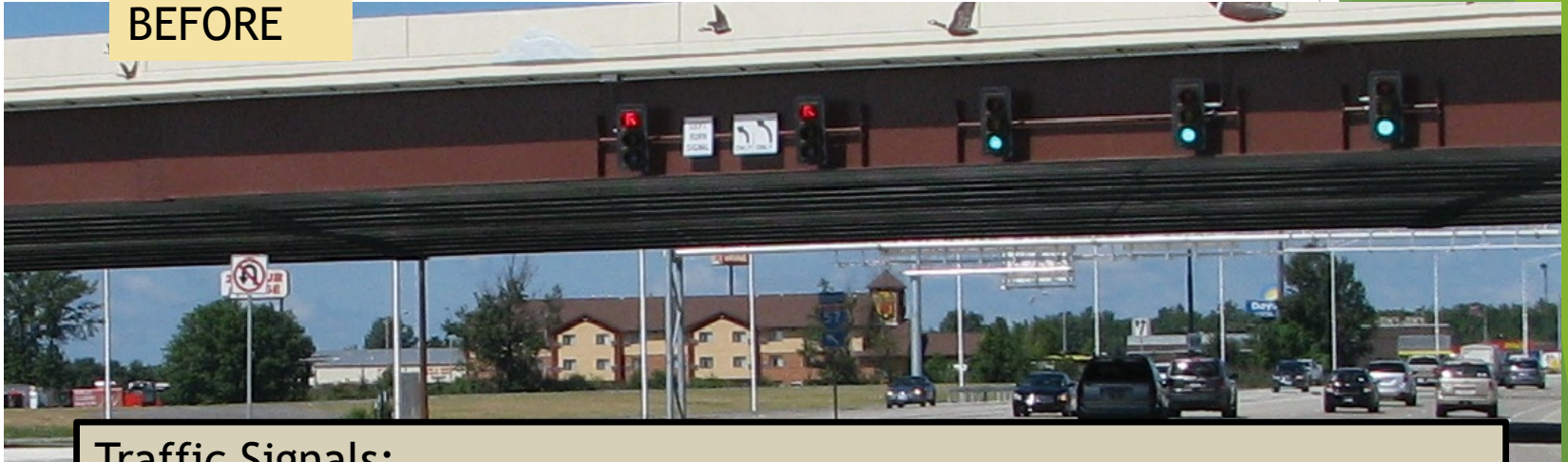
147 CRASHES (116 % increase)

28 INJURIES (55% increase)

1 FATALITIES

Lessons Learned SPUI

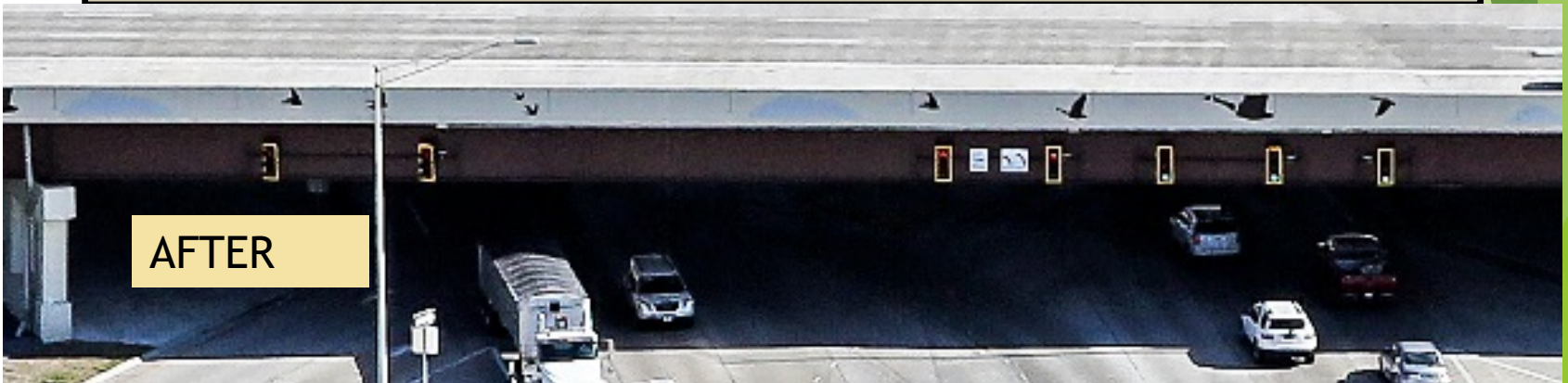
BEFORE



Traffic Signals:

- Added reflective yellow black plates to delineate traffic signals
- Rotated/Angled the left turn arrows to better direct traffic
- Long traffic signal cycle length

AFTER



Lessons Learned DDI

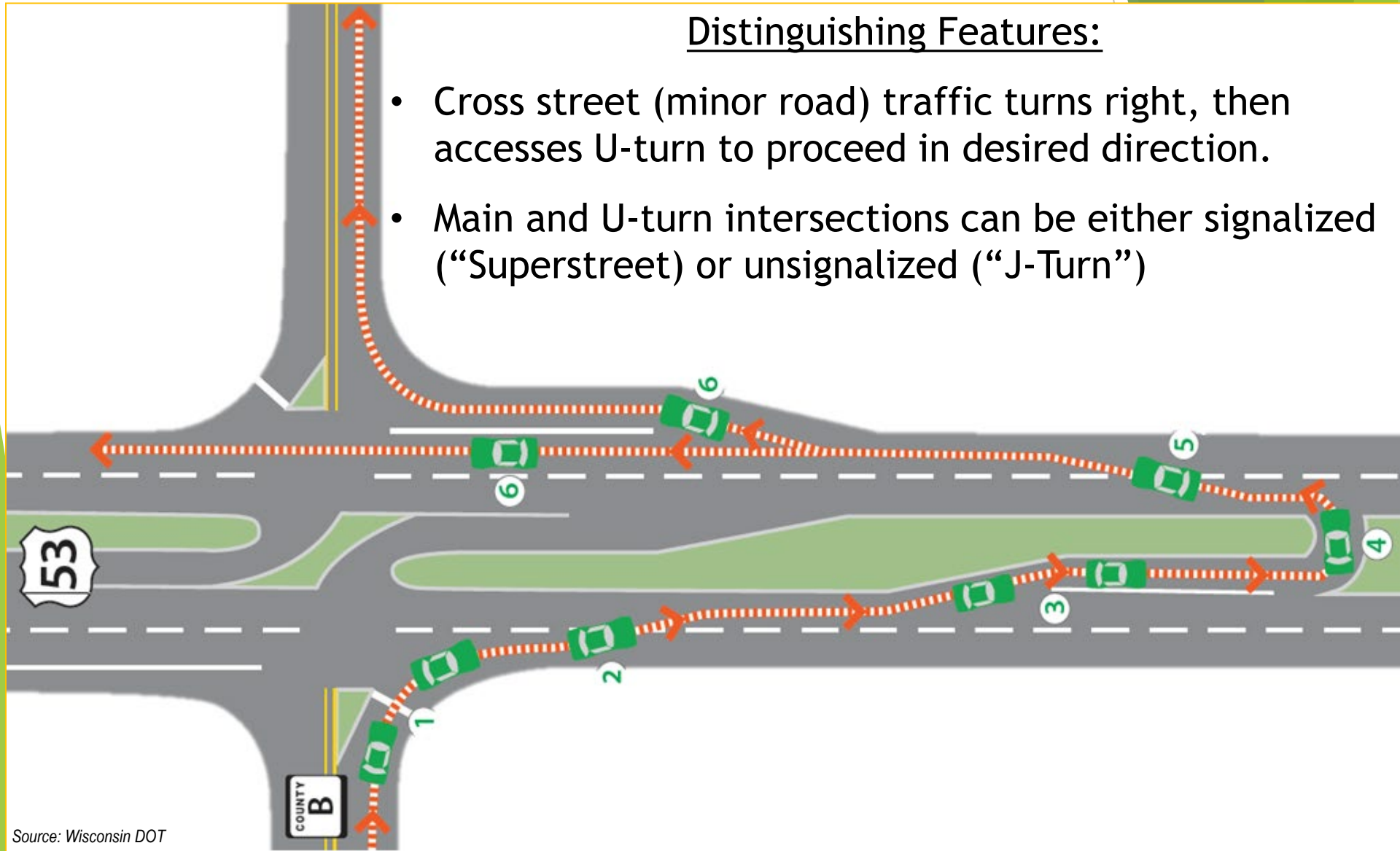


- Signage: required several truss mounted signs which are expensive and require maintenance
- DDI required fewer lanes = smaller/narrower bridge (no left turn lanes on bridge)
- Efficient/short 2-phase traffic signal (“free” lefts and rights turns from all directions)
- DDI complicated to convey message via signage
- DDI difficult to construct under traffic

Restricted Crossing U-Turn (RCUT)

Distinguishing Features:

- Cross street (minor road) traffic turns right, then accesses U-turn to proceed in desired direction.
- Main and U-turn intersections can be either signalized (“Superstreet”) or unsignalized (“J-Turn”)

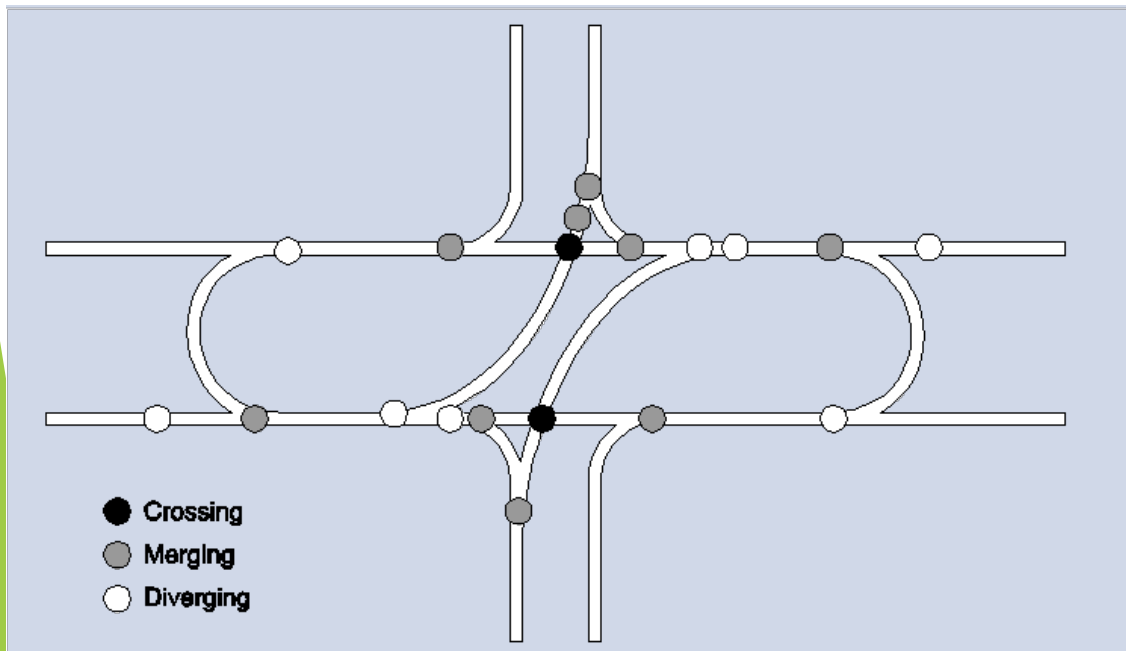


U-Turn Intersection Basics

Conflict Point Comparison for Basic Intersection

Conflict Type	Conventional	RCUT
Merging/Diverging	16	16
Crossing (left turn)	12	2
Crossing (angle)	4	0
Total	32	18

**Highest Severity
Crash Types**

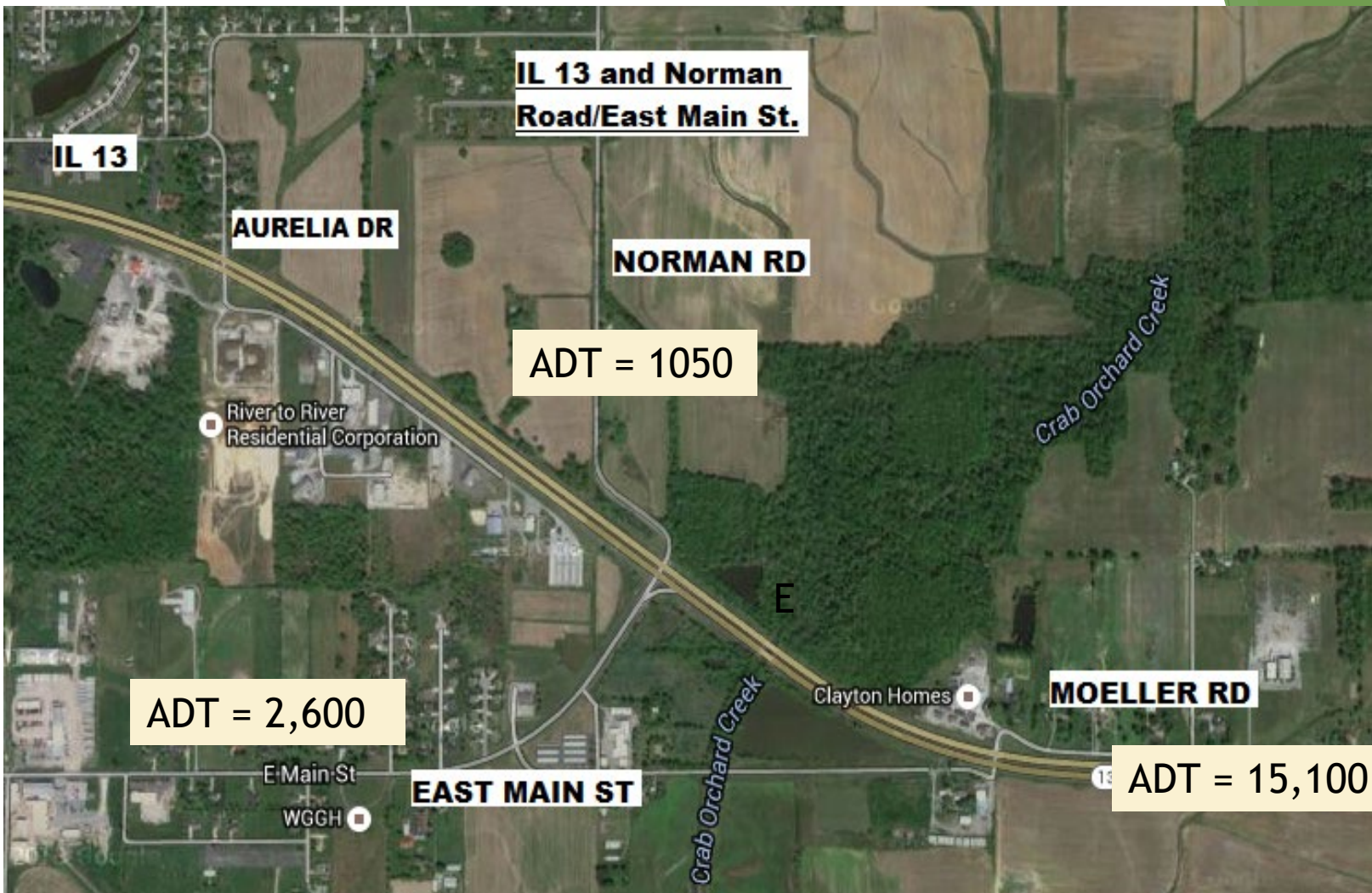


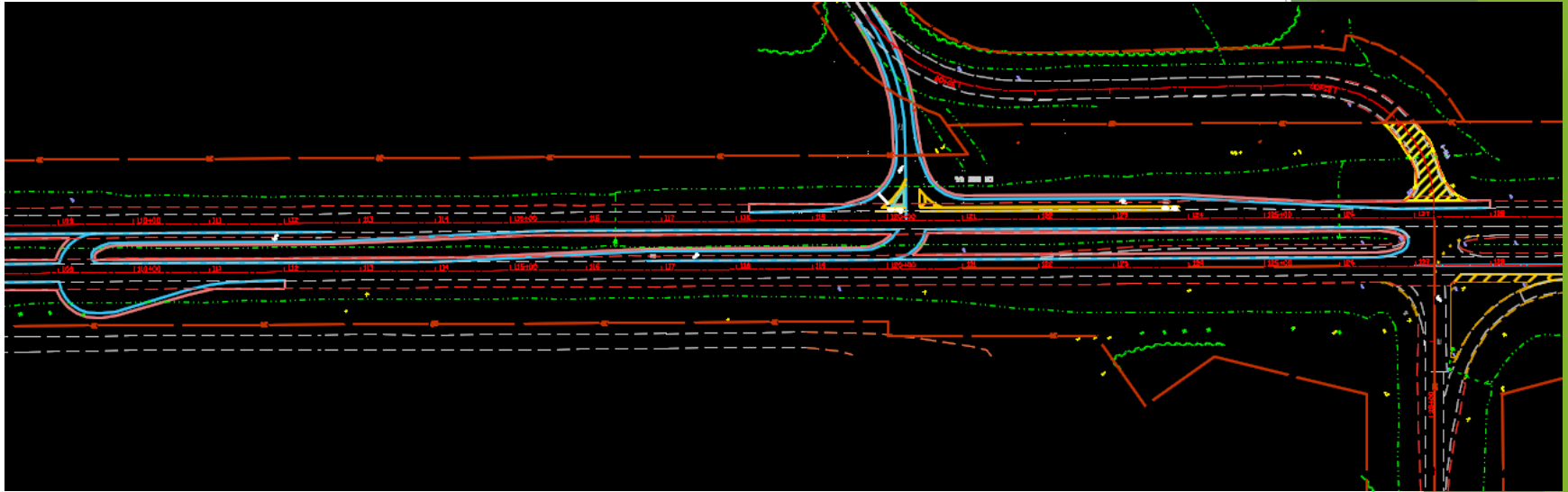
FHWA study at 27 RCUT locations:

- 34% (avg.) reduction in total crashes
- 48% (avg.) reduction in severe crashes

Key Features of J-Turns







► Benefits:

- ◆ Solves the IL 13 left turn blocking problem
- ◆ Less competition in the median for NB left turns
- ◆ No through movements from side roads eliminates possibility of angle crashes
- ◆ Left turn at East Main Street available for oversized design vehicles

RCUT: IL 13 and Norman Road/Main Street

IL 13/Norman Rd INTERSECTION

CRASHES 2012 TO 2016 (5-YRS)

25 CRASHES

6 INJURY

1 FATALITIES



Crashes per Year (2012-2016)

5 CRASHES/year

1.2 INJURY Crashes/year

0.2 FATAL Crashes/year



Opened in October, 2017

CRASHES AT RCUT

2018

1st Full Year Operable
5 CRASHES (0% REDUCTION)
1 INJURY (16% REDUCTION)
0 FATALITIES

2019

2nd Full Year Operable
2 CRASHES (60% REDUCTION)
0 INJURY (100% REDUCTION)
0 FATALITIES

Lessons Learned RCUT



Somewhat narrow median required a loon for large trucks to U-turn

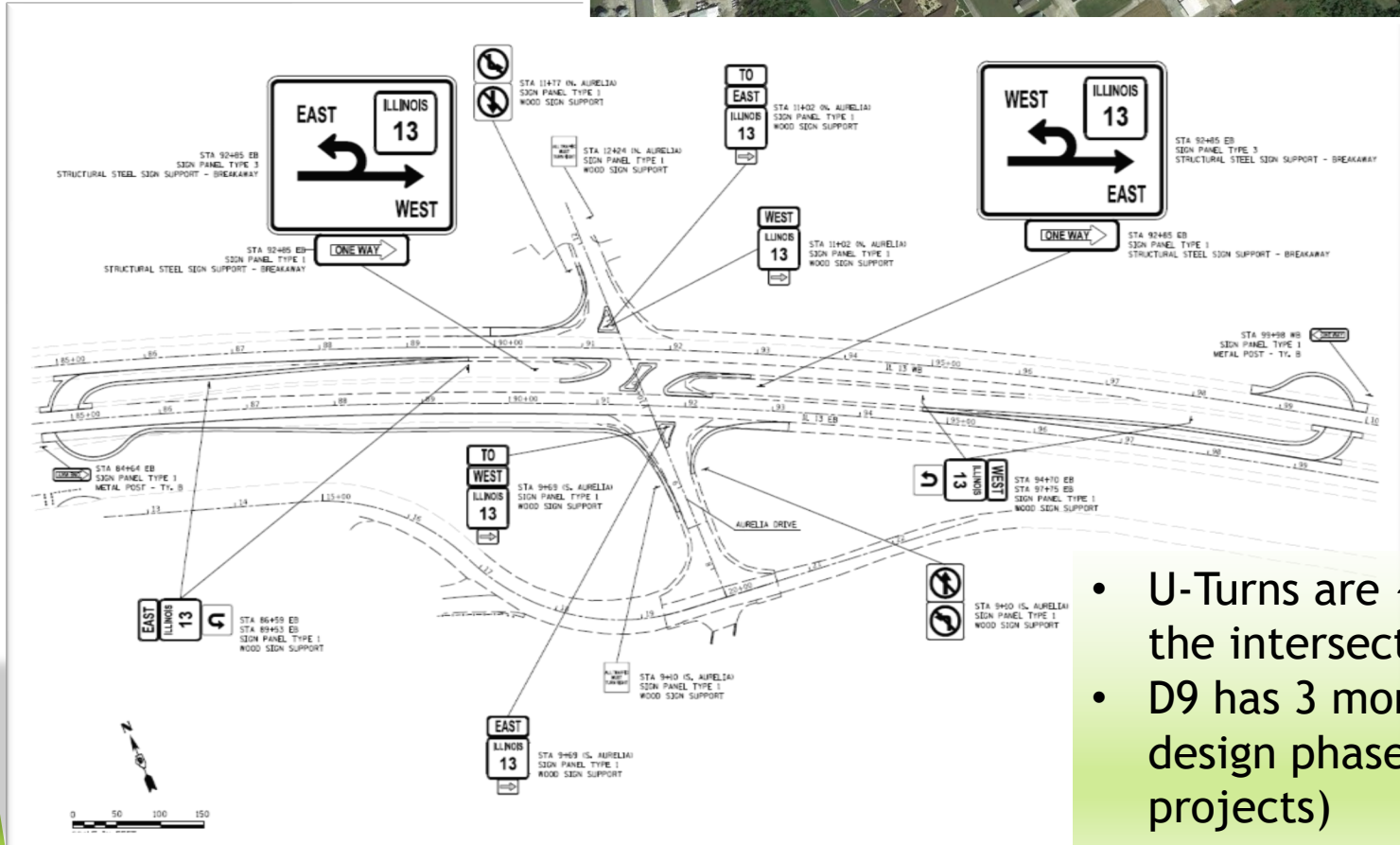
Added lighting

U-turn

Right Turn channelizing Island

- Public Involvement is difficult
- After the fact, Marion is very happy with the RCUT
- We've selected the Marion to Harrisburg corridor (4-lane rural expressway) to build more RCUTs

Full RCUT on the March 6, 2020 letting at IL 13 and Aurelia St



- U-Turns are ~600' from the intersection
- D9 has 3 more RCUTs in design phase (2 are HSIP projects)

So How is “*Life After Innovative Intersections?*”



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Questions?