

MICHIGAN INTERSECTIONS

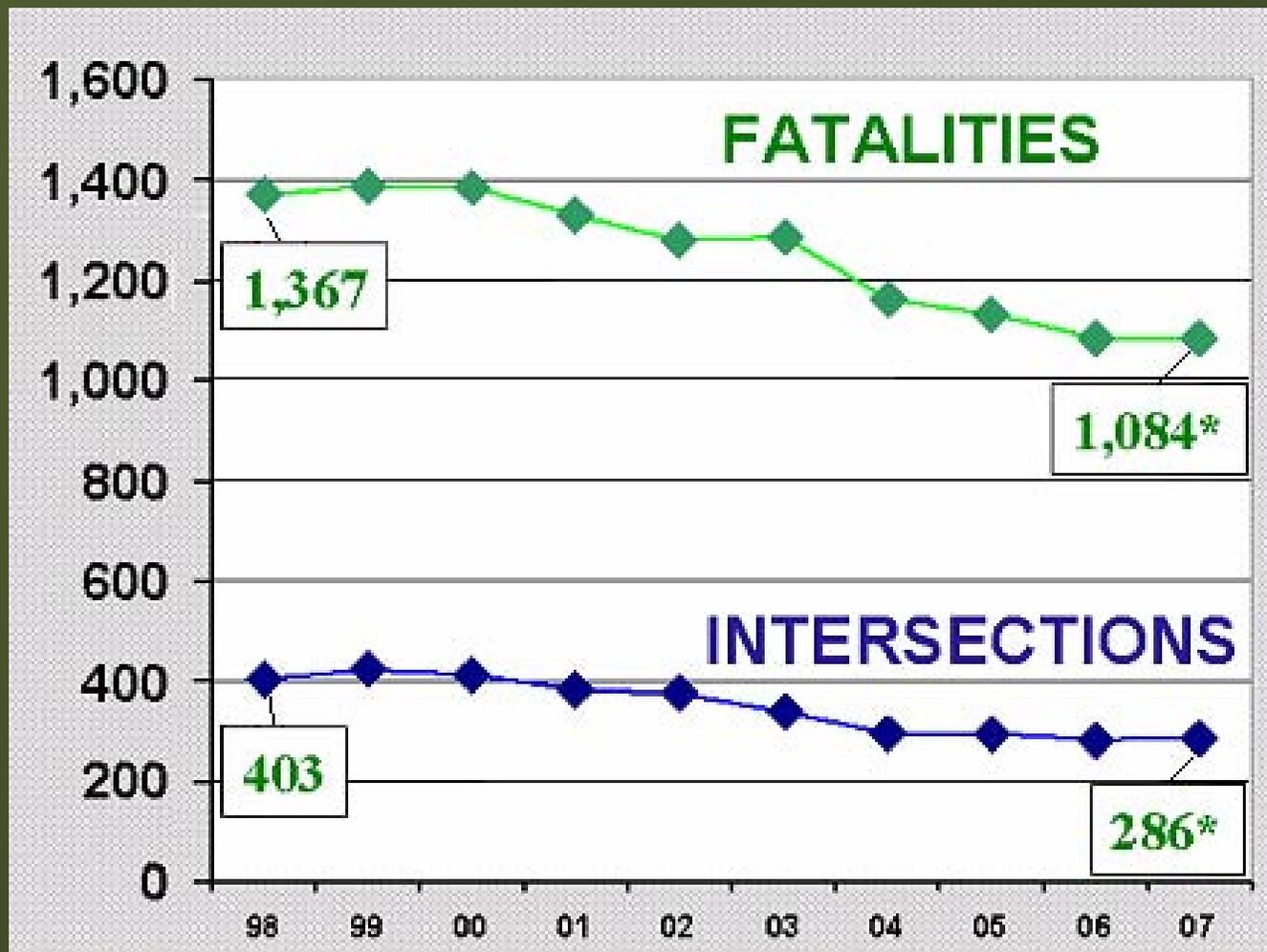
A Safety Success Story

Mark Bott

MDOT Traffic & Safety Division

March 13, 2008

Michigan Success Story



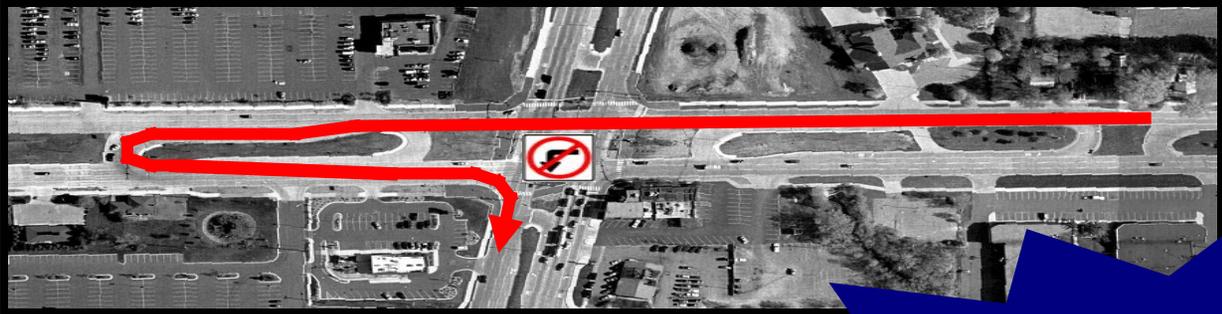
21%

29%

* = Preliminary

1

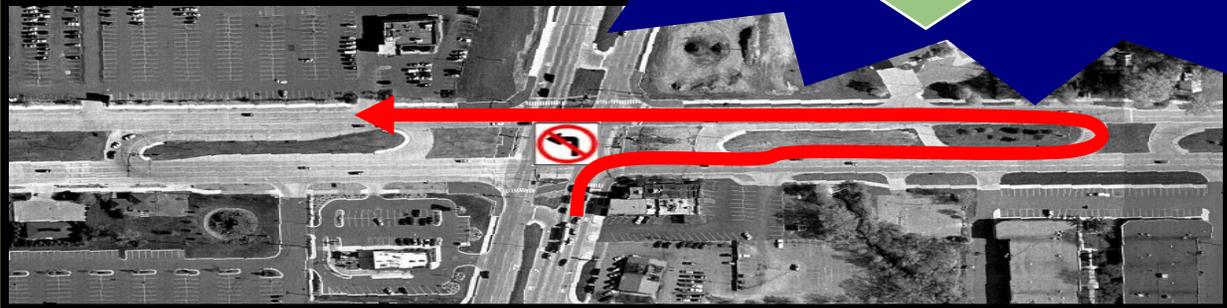
Indirect Left Turn



Michigan DOT - Left Turn

INJURY CRASHES

45%



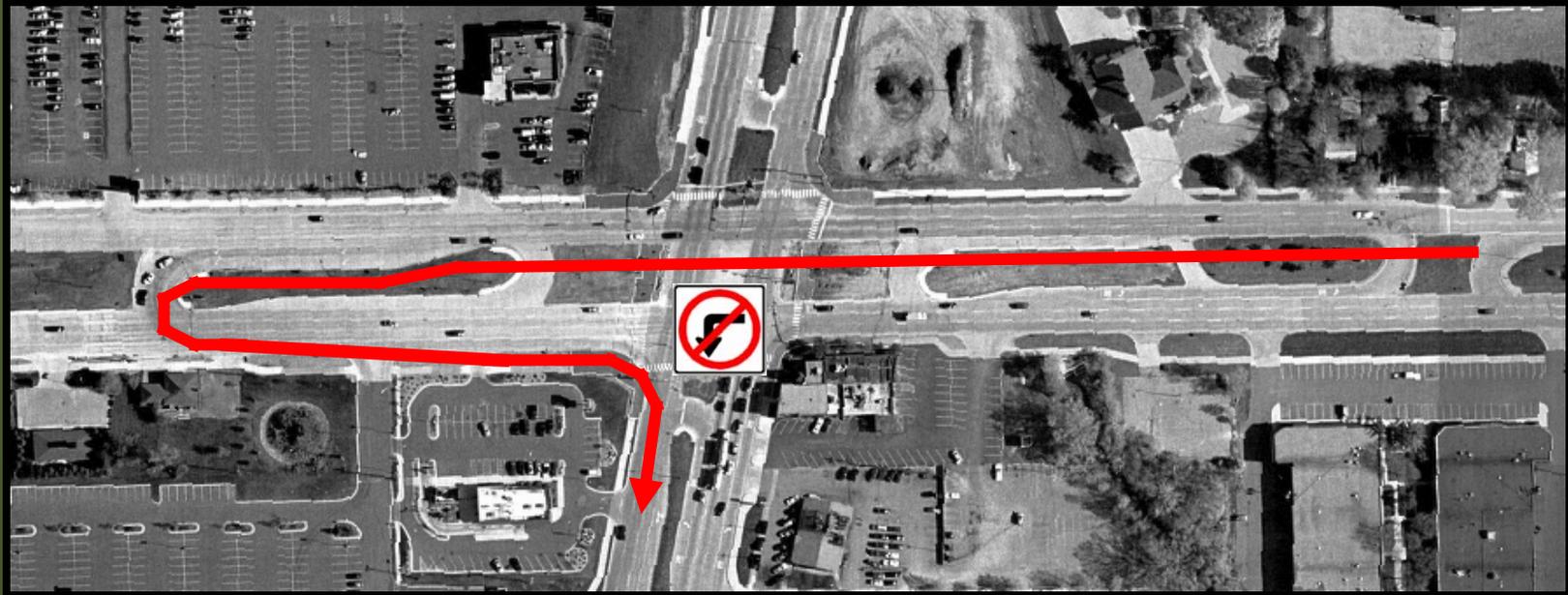
Michigan DOT - Left Turn from Side Road

Indirect Left Turn Narrow Median



Oakland County, Grand Rapids / Kent County

Effect on Capacity

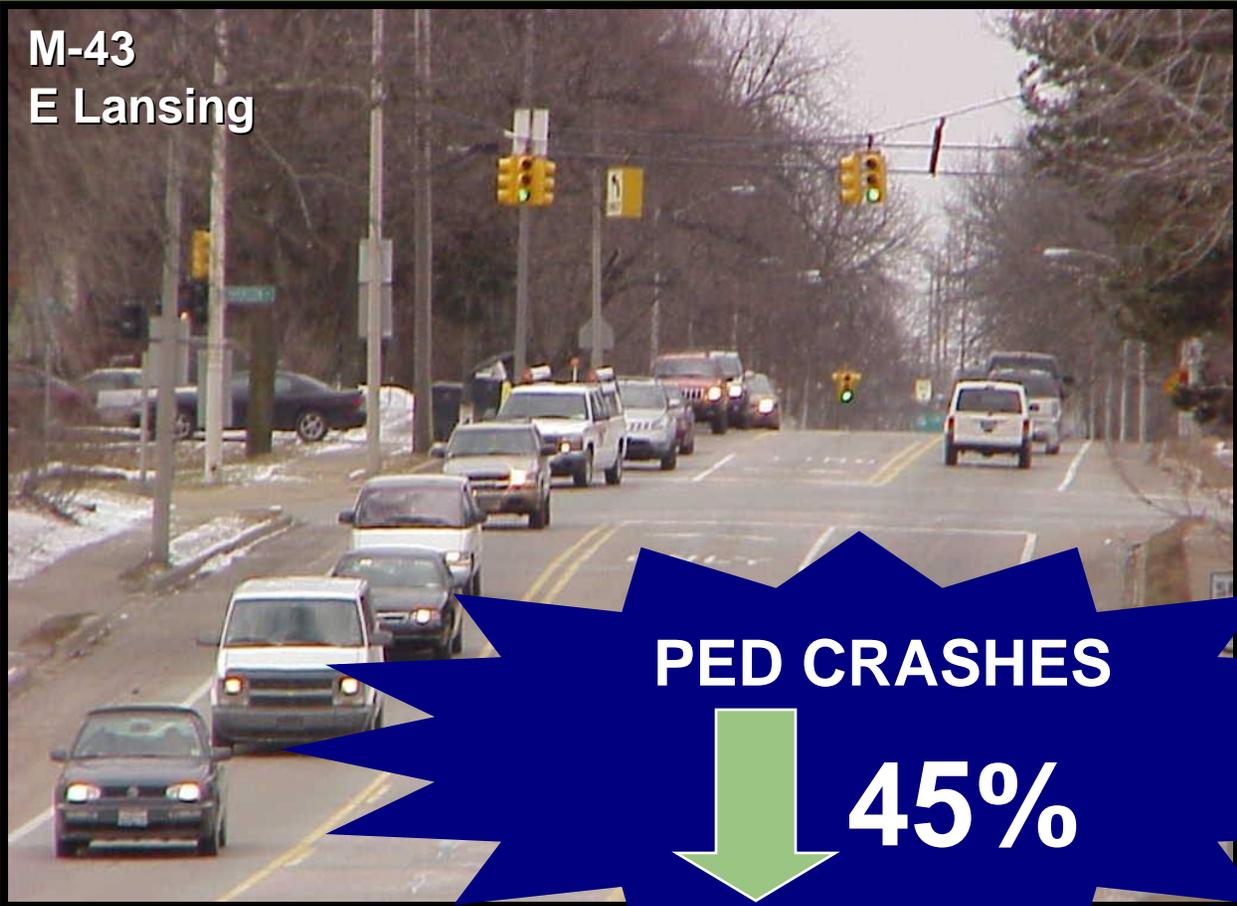


- Signal Phasing Reduces to 2-Phase
- Progression with Other Signals is Easier
- General Upgrade – One Level of Service

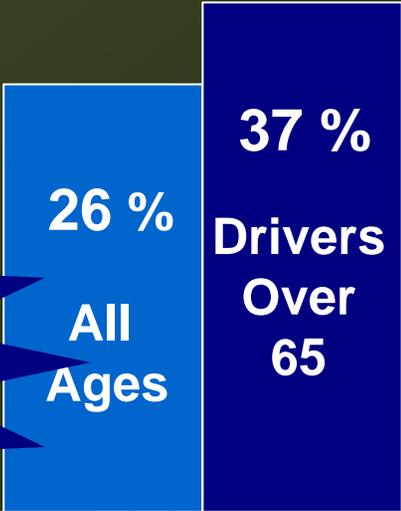
2

4-Lane to 3-Lane Conversions

M-43
E Lansing

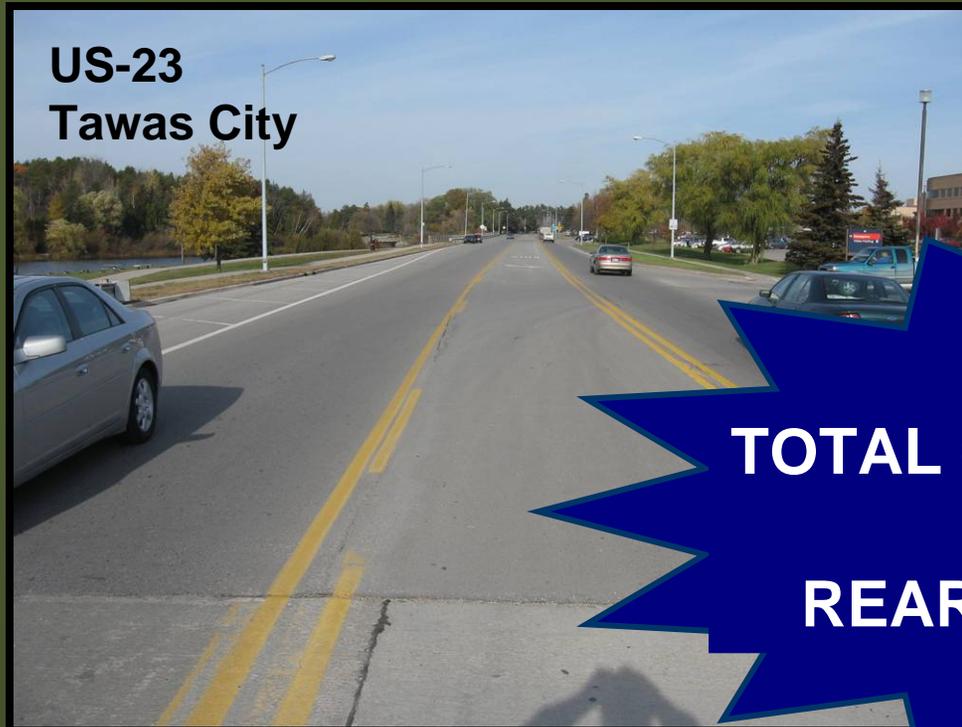


8 MI Corridors
↓
Injury Crash
Reduction



20-30 Corridors Converted & More Coming...

4-Lane to 3-Lane Conversions



0.27 Miles in Front of Alpena
Regional Medical Center

TOTAL CRASHES

55%

REAR-ENDS

100%

Corridors Converted:

MDOT (21 – 20 Miles)
East Lansing

Grand Rapids
Lansing

Benefits Are at the Intersections

Sioux City, IA



All Left Turns Cross One Lane Only

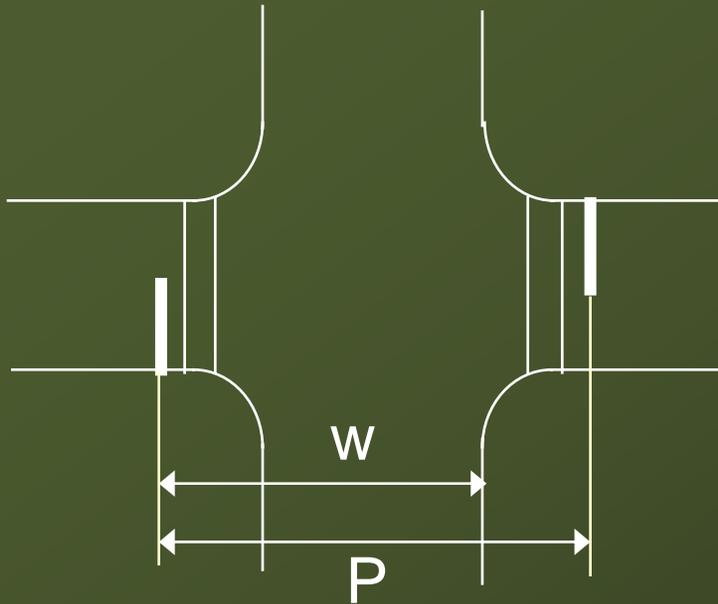
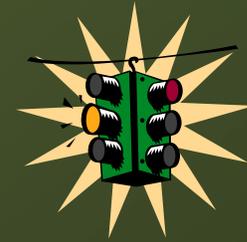
3

ITE Clearance Interval



**MDOT & Many of the Larger Michigan Agencies
Have Adopted the ITE Clearance Interval**

ITE Clearance Interval



$$Y = t + \frac{v}{2(a \pm Gg)}$$

$$R = \frac{W + L}{v} \quad \text{or} \quad \frac{P}{v} \quad \text{or} \quad \frac{P + L}{v}$$

t = Reaction Time

v = Approach Speed (ft/sec)

A = Deceleration Rate (ft/sec²)

G = Acceleration Due to Gravity

g = Grade in %

L = 20'

ITE Clearance Interval

Troy, MI

Citywide in 2003/2004

2 Year Before/After Crashes:

ALL CRASHES

15%

65+ CRASHES

30%

MDOT – Initiated Switch to All Red, Spring 2006

- 3000 + Signals
- Revise Total Clearance Interval as Part of Retiming Efforts

4

12" Lens



Recent Conversions:

Lansing

Detroit (On-Going)

Grand Rapids

Port Huron

MDOT (On-Going)

- 46% Reduction Angle Crashes
- 10% Total Crashes - FHWA

Michigan MUTCD Now Requires 12" for New Signals

5 LED Signals

Michigan Users:
Oakland County
MDOT
Detroit
Grand Rapids

Brighter Than
Incandescent
Bulbs



6

Far-Side Signals

Diagonal Span



Aged Diminished Capabilities

Reduction in Visual Field / Attention



Seeing and Reacting to Information
Outside the Limited Field of View

Far-Side Signal

Box Span



Grand Rapids

Far-Side Signals – Box Span

Moving to Box Span:

- Port Huron
- Oakland
- Grand Rapids
- Lansing
- Holland
- Ingham County
- Kent County
- MDOT



Far-Side Signals – Mast Arm



Big Users

- Washtenaw County
- Ann Arbor
- Wyoming

Wyoming

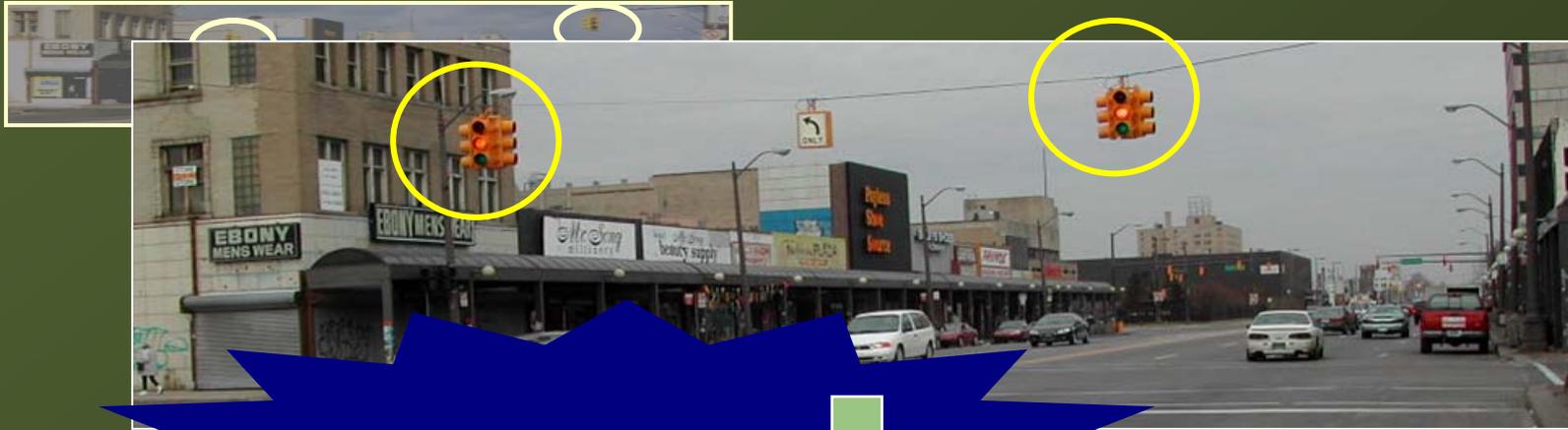


Converts 2
Intersections per Year



**Sometimes
Crash Reduction is
Reported
for a Basket of
Intersection
Improvements**

Detroit - Woodward Avenue



INJURY CRASHES

46%



**33
Locations**

- Reposition Signal Heads
- 12" Signal Heads
- Supplemental Signals
- All Red Interval



Port Huron - Citywide

22
Locations

- Box Span
- 12" Lenses
- Signal Re-Timing
- ITE Yellow + All Red



TOTAL CRASHES ↓ **47%**

URS

Kalamazoo - Citywide

2002-2005

- Audible Pedestrian Countdown (44)
- ITE Clearance Interval (101)
- Permissive Phase First (40)
- 12" Lenses (80)
- Box Span (12)

**12 to 101
Signals**

TOTAL CRASHES ↓ **37%**



Kalamazoo – Portage St. Corridor

15
Signals

- Audible Pedestrian Countdown
 - ITE Clearance Interval
 - Permissive Phase First
 - 12" Lenses
 - Box Span

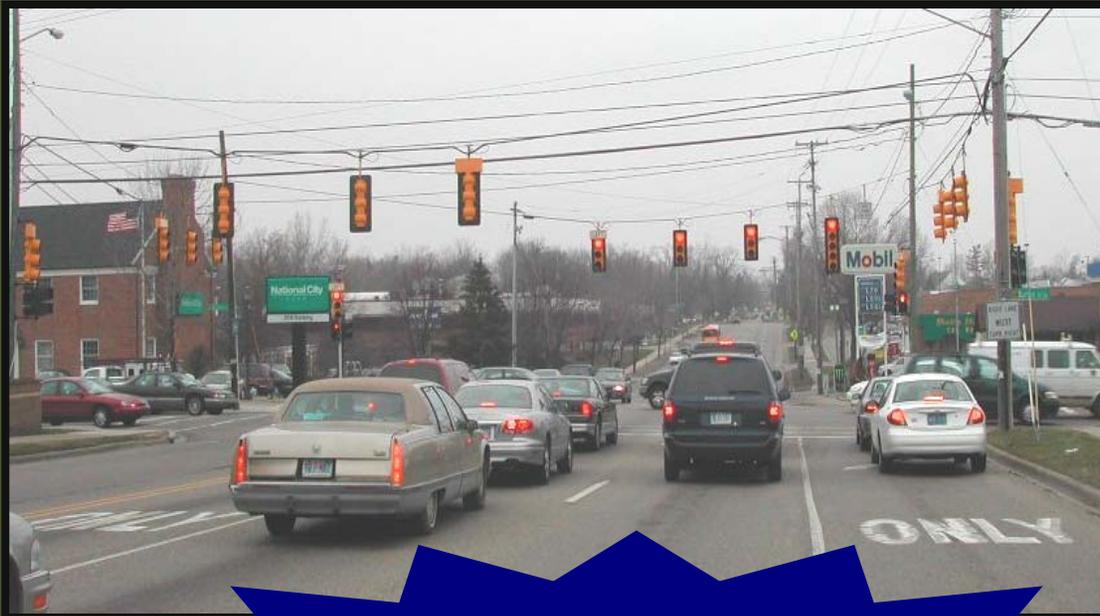


PED CRASHES



72%

Grand Rapids – Burton & Division Corridors



- Box Span
- ITE Yellow & All Red
- Signal Re-Timing
- 12" Signal Heads
- Supplemental Signals
- Back Plates

INJURY CRASHES ↓ **41%**

17
Locations



7

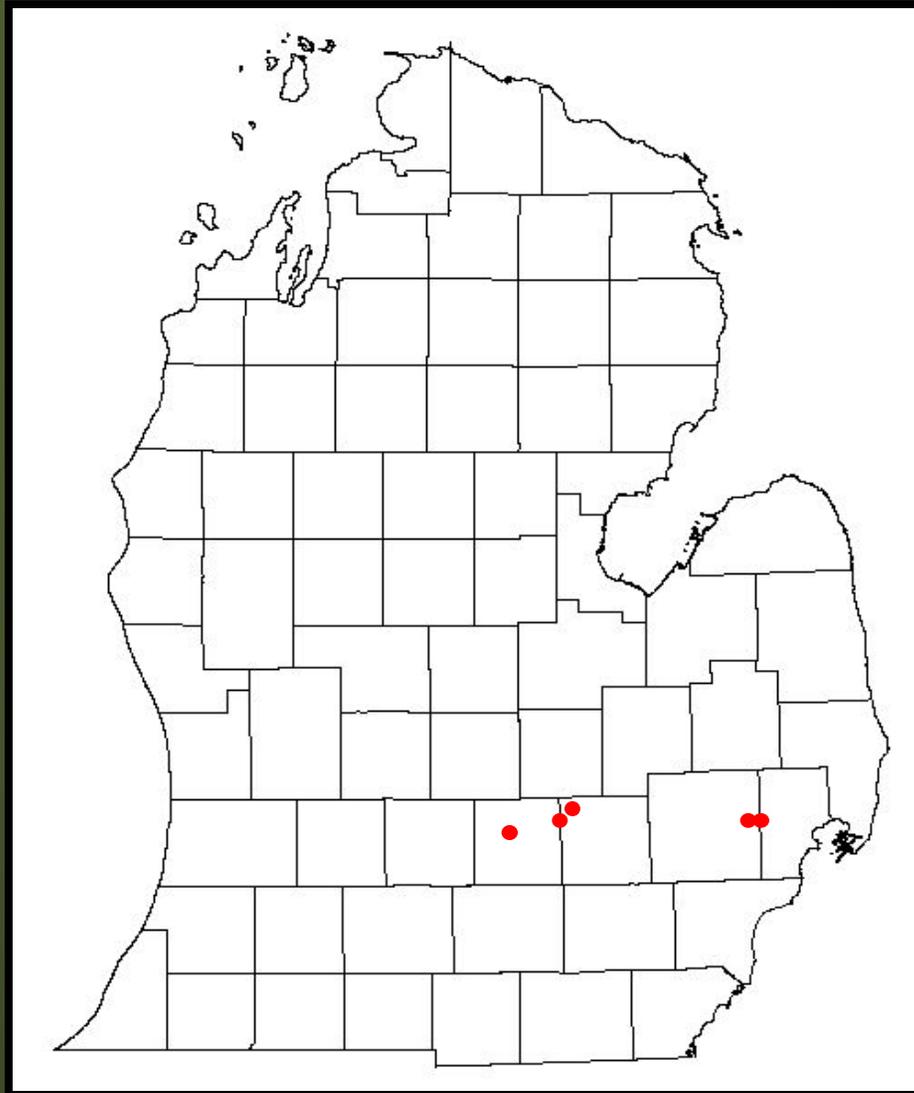
Roundabouts



Gaylord
High
School

Eliminate Left-Turn Head on Crashes

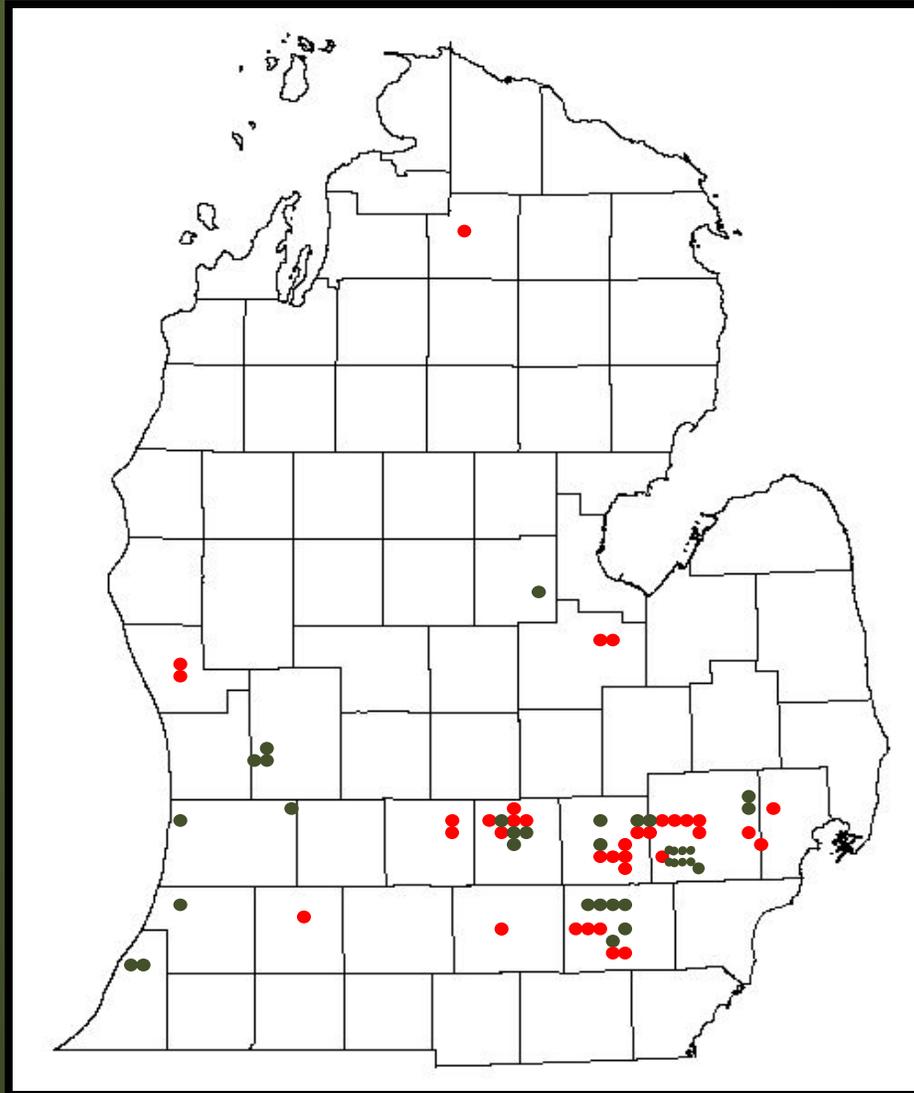
Michigan Roundabouts



**Circa
2001**

- Under Design / Seeking Funding**
- Constructed**

Michigan Roundabouts



May
2007

- Under Design / Seeking Funding
- Constructed

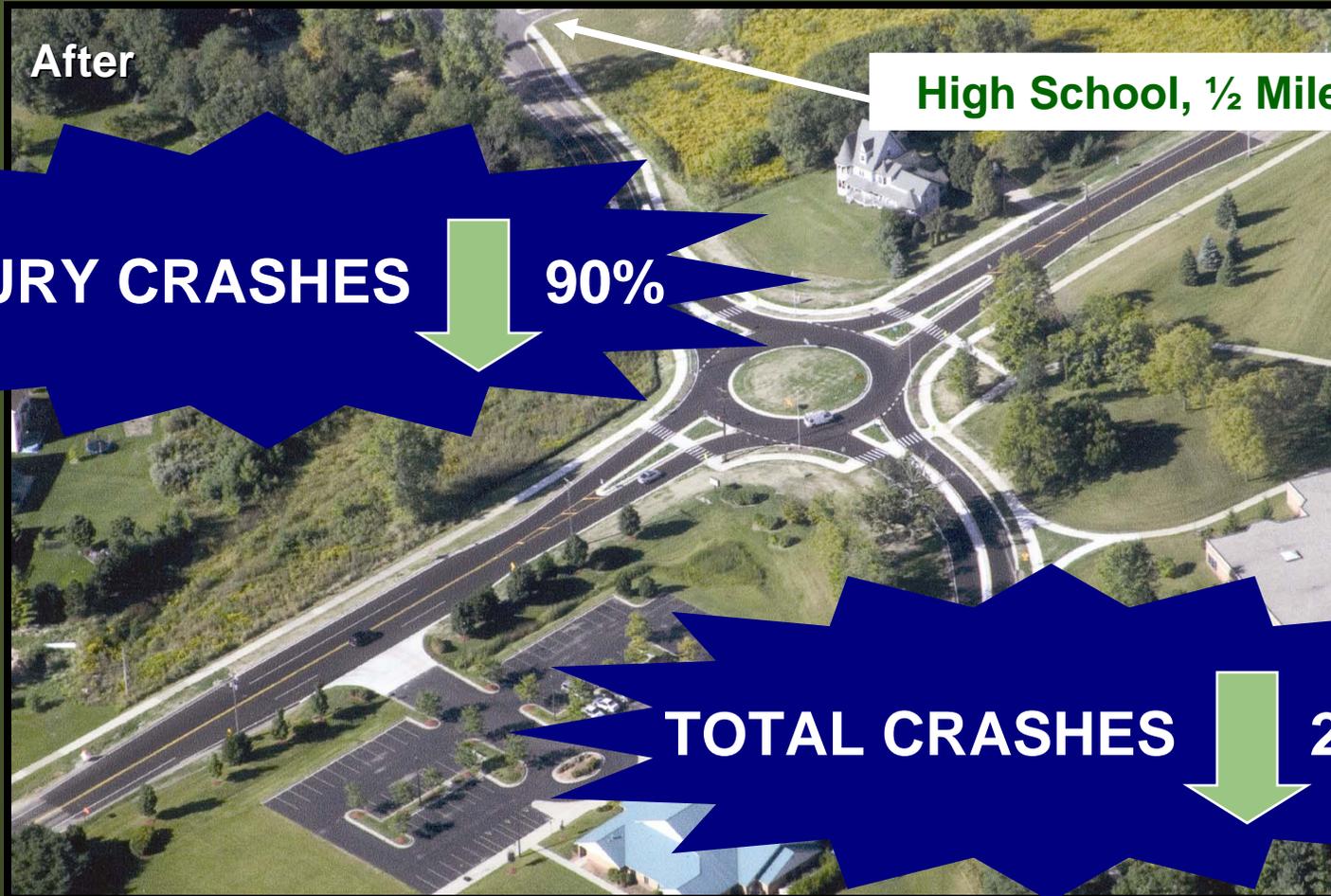
Map Does Not Include the Scores of Roundabouts in Earlier Planning Stages

Okemos – Hulett Rd at Bennett Rd



11 Crashes (6 Injury) 2002-2003

Okemos – Hulett Rd at Bennett Rd



8 Crashes (1 Injury) 2005-2006

I-75 at M-81 Interchange



INJURY CRASHES ↓ 100%

TOTAL CRASHES ↓ 43%

Safety Statistics

National Study, Persaud et. al. (IIHS), 2000:

- 23 U.S. Intersections Converted Stop/Signal to Roundabout:

- 40% Reduction in Total Crashes
- 80% Reduction in Injury Crashes
- 90% Reduction in Severe Injury Crashes

Maryland DOT, 2004 – 15 Single Lane Roundabouts

- 68 % Reduction in Total Crashes
- 86 % Reduction in Injury Crashes
- 100% Reduction in Fatal Crashes

Multi-Lane Roundabouts: Crash Rates Closer to Signals, but Severity is Lower

Behavior at Roundabouts

Vehicles Entering

- 5-20 Mph
- Enter on Angle
- Drivers Alert

Vehicles in Circulating Road

- 15-25 Mph



Behavior at Roundabouts

Pedestrians

- Looking: One Direction Traffic at a Time
- More Alert
- Refuge Island

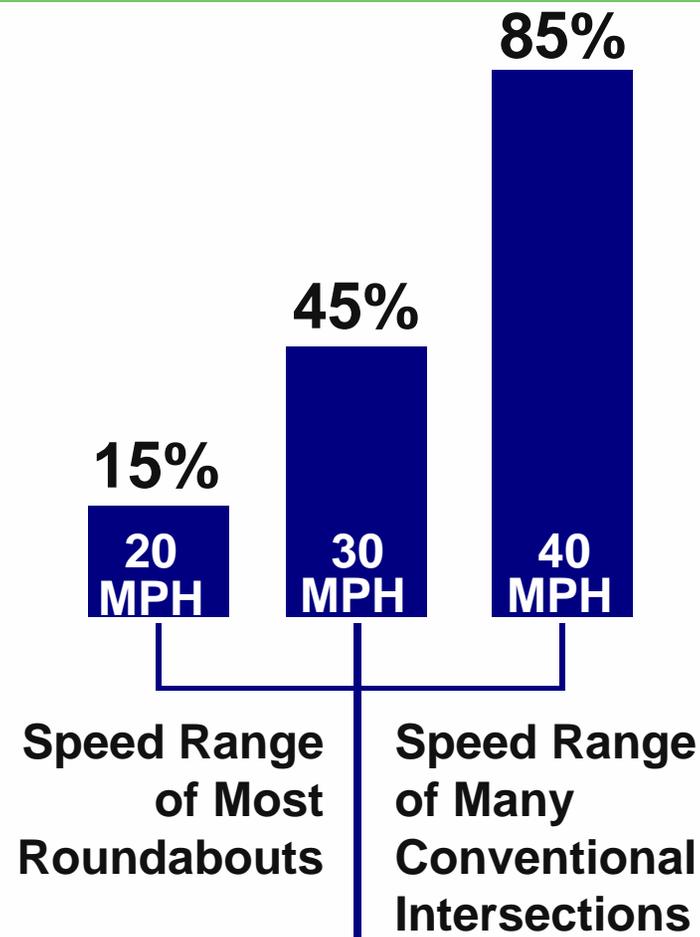
Drivers

- Low Speeds
- Pedestrians First, then Merge



Speed and Pedestrian Safety

**Chance of Death
When a
Pedestrian
is Hit by a
Vehicle.**



School Children

“It definitely has improved the flow of traffic and has not proved to be the safety concern that several parents feared.”

- Jeri Mifflin, Principal, Bennett Woods Elementary School



Pedestrian Safety Statistics

US - Minimal Information – Anecdotal

Tumber, 1997 (Australia)

- Severity of Pedestrian Crashes Lower than Other Intersection Types

Lalani, 1975 (U.K.)

- 38 Intersections Converted to Roundabouts
- Ped Crash Frequency Dropped 46% After Conversion to Roundabouts
- Fatal & Serious Pedestrian Crash Frequency Down 70%

8

Advance Street Name Signs

Troy



Recognized Elderly
Mobility Benefit

Suburban

Rural - MDOT
Statewide



M-43

Advance Street Name Supplemental Plaques



Ingham County (All Roads) 1980+