MICHIGAN INTERSECTIONS

A Safety Success Story

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March 13, 2008
Michigan Success Story

- FATALITIES:
  - 1,367 (1998)
  - 1,084* (2007)
  - 21% decrease

- INTERSECTIONS:
  - 403 (1998)
  - 286* (2007)
  - 29% decrease

* = Preliminary
Indirect Left Turn

Michigan DOT - Left Turn from Main Road

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
4-Lane to 3-Lane Conversions

20-30 Corridors Converted & More Coming…

PED CRASHES 45%

8 MI Corridors
↓
Injury Crash Reduction

M-43 E Lansing

26 % All Ages

37 % Drivers Over 65
4-Lane to 3-Lane Conversions

US-23
Tawas City

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
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/sec^2)
- \( G \) = 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
Michigan MUTCD Now Requires 12” for New Signals

Recent Conversions:
- Lansing
- Detroit (On-Going)
- Grand Rapids
- Port Huron
- MDOT (On-Going)

- 46% Reduction Angle Crashes
- 10% Total Crashes - FHWA
5 LED Signals

Michigan Users:
Oakland County
MDOT
Detroit
Grand Rapids

Brighter Than Incandescent Bulbs
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
Wyoming converts 2 intersections per year.

Big Users
- Washtenaw County
- Ann Arbor
- Wyoming
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%
Kalamazoo - Citywide
2002-2005

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

TOTAL CRASHES 37%

12 to 101 Signals
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
Roundabouts

Eliminate Left-Turn Head on Crashes
Michigan Roundabouts

Circa 2001

- Under Design / Seeking Funding
- Constructed
Michigan Roundabouts

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

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

Before

High School, ½ Mile

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.

- 15% chance of death at 20 MPH
- 45% chance of death at 30 MPH
- 85% chance of death at 40 MPH

Speed Range of Most Roundabouts
Speed Range of Many Conventional Intersections
“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%
Advance Street Name Signs

- Troy
- Suburban
- Rural - MDOT
- Statewide

Recognized Elderly Mobility Benefit
Advance Street Name
Supplemental Plaques

Ingham County (All Roads) 1980+