J-Turn
An Intersection Safety Improvement
Purdue Road School 2016
Tuesday, March 8, 2016
Brian Malone, INDOT & Josh Cook, HNTB
US 231 and SR 62 and SR 68
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

<table>
<thead>
<tr>
<th>SEVERITY</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Damage</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Non-Incapacitating Injury</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Incapacitating Injury</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fatal</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>10</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>

### Crash Analysis for US 231 and SR 68

<table>
<thead>
<tr>
<th>SEVERITY</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Damage</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Non-Incapacitating Injury</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Incapacitating Injury</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fatal</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>25</td>
</tr>
</tbody>
</table>
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**

![Before Image]

**After**

![After Image]
Improvements Prior to J-turn

- Removed slotted left turns to reduce median footprint.

**Before**

**After**

172’

50’
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

US 231 Northbound
How does a J-turn work?

US 231 Southbound
How does a J-turn work?

From SR 62/SR68
Eastbound/Northbound
J-Turn Intersection

How does a J-turn work?

From SR 62/SR68
Westbound/Southbound
RCUT/ Superstreet

- Signalized RCUT/Superstreet in Troy, MI
Michigan Left

- No left turns allowed from the major minor.
J-Turn Intersection

J-Turn
- 4 Crossing
- 10 Merge
- 10 Diverge

Conventional
- 24 Crossing
- 10 Merge
- 8 Diverge
J-Turn Intersection

- J-turns reduce a significant number of crashes.

### Case Studies Collision Summary by Type

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>%Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>13</td>
<td>8</td>
<td>-38%</td>
</tr>
<tr>
<td>Angle</td>
<td>47</td>
<td>0</td>
<td>-100%</td>
</tr>
<tr>
<td>Turning</td>
<td>32</td>
<td>10</td>
<td>-69%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>8</td>
<td>3</td>
<td>-63%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>100</td>
<td>21</td>
<td>-79%</td>
</tr>
</tbody>
</table>

### Case Studies Collision Summary by Severity

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>%Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury</td>
<td>56</td>
<td>10</td>
<td>-82%</td>
</tr>
<tr>
<td>Fatality</td>
<td>2</td>
<td>1</td>
<td>-50%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Design Vehicle</th>
<th>Median Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40’</td>
</tr>
<tr>
<td>Bus (40’)</td>
<td>Shoulder Only</td>
</tr>
<tr>
<td>WB-40 (40’)</td>
<td>Loon Required</td>
</tr>
<tr>
<td>WB-50 (50’)</td>
<td>Loon Required</td>
</tr>
<tr>
<td>WB-62 (62’)</td>
<td>Loon Required</td>
</tr>
<tr>
<td>WB-67 (67’)</td>
<td>Loon Required</td>
</tr>
</tbody>
</table>
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