Safety and Operational Impact of Median Left Turns

Keystone, CO
June 2018
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First Arizona Application of the Indirect Left Concept

Major Contributions from:

Randall Overmyer, Former Transportation Planner, now with CivTech, Inc.

And

Dr. Robert E. Maki, PE, Former Transportation Director
“The Arizona Parkway”

- 40 years practice in seven states
- Marginal cost increase over conventional arterials
- Near-freeway volumes
- Context-sensitive
Boulevard, 60-ft Median, 200-ft Right-of-Way, up to 8-lanes

Arterial, 12-ft Median, 130-ft Right of Way, up to 6-lanes
Analysis and Studies

The Arizona Parkway
8 Mile Rd (M-102), west of Woodward Ave
124,600 vpd

Telegraph Rd (US-24), north of I-696
104,200 vpd

Hall Rd (M-59), east of M-53
102,300 vpd

Some intersections carry more than 130,000 entering vehicles per day

Bell Rd, over Agua Fria River
62,000 vpd
Results and Conclusions
AZ Pkwy versus Conventional Design

- 6-Lane MLT > 8-Lane Conventional parkway
- 4-Lane MLT = 6-Lane Conventional parkway
Conflict Points

32 Conflict Points in intersection
AZ Parkway intersections have 16 Conflict Points
Traditional intersection have 32 Conflict Points
MCDOT Design Guidelines

• Initiated in January 2008
• Included Field Visit in March 2008
• Reports
  – State of the Practice (April 2008)
  – Draft Design Guidelines (June 2008)
  – Final Report (July 2008)
Access Conceptual Schematic

INITIAL CONFIGURATION
WITH SIGNALS AT 1 MILE SPACING
AND LIMITED NUMBER OF CROSSESORS

FUTURE CONFIGURATION
WITH SIGNALS AT 1/2 MILE SPACING
AND MAXIMUM NUMBER OF CROSSESORS

NOTES:
1. Not to scale.
2. Crossover spacing from alpine to alpine should be 660 (+300)
3. Spacing between back to back crossovers is 600' minimum.
4. 330' spacing for high-volume driveways and 450' spacing for low-volume driveways.

DRAFT
Resources

• Enhanced Parkway Reports
  1. General Analysis
  2. Continuous Flow Intersections
  3. MLT Intersection Analysis

• MCDOT Design Guidelines
  1. State of the Practice
  2. Guideline Recommendations
Thank You!

Graphics Courtesy of:
Maricopa Association of Governments
Maricopa County (MCDOT)
Safety Evaluation of Median U-Turn (Michigan Left) Intersection Conversions in Michigan

June 2018
### Michigan Signalized MUT Conversions

<table>
<thead>
<tr>
<th>Name</th>
<th>County</th>
<th>Pre-Conversion Years</th>
<th>Post-Conversion Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rochester and Wattles</td>
<td>Oakland</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Crooks and South Boulevard</td>
<td>Oakland</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Crooks and Auburn</td>
<td>Oakland</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>M-24 and Silverbell</td>
<td>Oakland</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Highland and Grand River</td>
<td>Livingston</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Highland and Byron</td>
<td>Livingston</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

Six signalized intersections with protected left turns were converted to MUT (with left turn prohibition) between 2004 and 2017.
The same crash data collection limits were used pre/post conversion and extended just beyond the MUT boundary. Pre/post crash data was from 2004-2017.
## Pre/Post Crash Rate Results - Injury Severity

<table>
<thead>
<tr>
<th>Worst Injury Outcome</th>
<th>Pre-Conversion Annual Crash Frequency</th>
<th>Post-Conversion Annual Crash Frequency</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal (K) Crash Rate</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0%</td>
</tr>
<tr>
<td>Fatal (K) and Serious Injury (A) Crash Rate</td>
<td>0.0144</td>
<td>0.0119</td>
<td>-16.8%</td>
</tr>
<tr>
<td>Fatal and Injury (K+A+B+C) Crash Rate</td>
<td>0.2399</td>
<td>0.2355</td>
<td>-1.8%</td>
</tr>
<tr>
<td>Property Damage Only Crash Rate</td>
<td>1.2488</td>
<td>0.9129</td>
<td>-26.9%</td>
</tr>
<tr>
<td><strong>Total Crash Rate</strong></td>
<td><strong>1.4887</strong></td>
<td><strong>1.1484</strong></td>
<td><strong>-22.9%</strong></td>
</tr>
</tbody>
</table>

Notes: Crash rates presented in intersection crashes per one million entering vehicles. Major/minor volume data obtained from various sources, including MDOT, MPOs, and local agencies.
## Pre/Post Crash Rate Results - Crash Type as a Proportion of Total

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Pre-Conversion Crash Frequency</th>
<th>Pre-Conversion Percent of Total</th>
<th>Post-Conversion Crash Frequency</th>
<th>Post-Conversion Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vehicle</td>
<td>20</td>
<td>2.8%</td>
<td>39</td>
<td>5.8%</td>
</tr>
<tr>
<td>Head On</td>
<td>6</td>
<td>0.8%</td>
<td>2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Head On Left-Turn</td>
<td>20</td>
<td>2.8%</td>
<td>10</td>
<td>1.5%</td>
</tr>
<tr>
<td>Angle</td>
<td>125</td>
<td>17.2%</td>
<td>133</td>
<td>19.8%</td>
</tr>
<tr>
<td>Rear End</td>
<td>450</td>
<td>62.0%</td>
<td>399</td>
<td>59.3%</td>
</tr>
<tr>
<td>Sideswipe Same</td>
<td>67</td>
<td>9.2%</td>
<td>66</td>
<td>9.8%</td>
</tr>
<tr>
<td>Sideswipe Opposite</td>
<td>12</td>
<td>1.7%</td>
<td>2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Other</td>
<td>26</td>
<td>3.6%</td>
<td>22</td>
<td>3.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>726</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>673</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Summary of Michigan MUT Conversion Findings

• Six Michigan signalized intersections were evaluated pre/post MUT conversion:
  – 23% reduction in total crash rate post MUT
  – 17% reduction in fatal and serious injury crash rate post MUT
  – Reduced proportion of head-on left-turn crashes after conversion

• Results are based upon simple B&A rate comparisons methods and should be interpreted with caution
  – No comparison sites or EB analysis
  – Further work in this area will develop CMFs consistent with HSM methods