Traffic Efficiency of a Non-Traditional Intersection Design: The Superstreet

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Typical Superstreet Intersection Design
Background

- First proposed by Richard Kramer in Alabama.
- Then studied by Hummer and Reid.
- Built in suburban MD as J-turn intersection with non-signalized u-turn channelization.
- Reduced crashes from 9 to less than 1 per year.
Comparisons of three case designs
Case 1
Case 2
Case 3
Travel Time Savings

Superstreet vs. Conventional (Case 1)
Average Travel Time Plot

Entering Volumes (Veh/hour)

Average Travel Time Saving (sec/veh)

% Savings in Travel Time

Average Travel Time Savings

% Travel Time Savings
Throughput increase

Superstreet vs. Conventional (Case 1)
Number of Serviced Vehicles Plot

Increase in the Number of Serviced Vehicles (veh/hour) vs. % Increase

- Increase in Number of Serviced Vehicles
- % Increase

Entering Volumes (veh/hour)
Near Saturation Flow Volumes for Case 1

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Southbound (1 lanes)</th>
<th>Northbound (1 lanes)</th>
<th>Eastbound (2 lanes)</th>
<th>Westbound (2 lanes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>TH</td>
<td>L</td>
<td>R</td>
</tr>
<tr>
<td>1</td>
<td>120</td>
<td>100</td>
<td>100</td>
<td>120</td>
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<tr>
<td>2</td>
<td>150</td>
<td>140</td>
<td>140</td>
<td>150</td>
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<tr>
<td>3</td>
<td>150</td>
<td>180</td>
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Case 2 results are comparable to case 1
## CASE 3 comparison

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Intersection</th>
<th>Delay (sec/veh)</th>
<th>Queue (ft)</th>
<th>No. of Stops</th>
<th>Serviced Vehicles</th>
<th>Average Travel Time (hours/veh)</th>
<th>Average Speed (mph)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Conventional</td>
<td>81.9</td>
<td>202.1</td>
<td>1.6</td>
<td>7419</td>
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<td>49.4</td>
<td>218.0</td>
<td>1.2</td>
<td>8121</td>
<td>0.029</td>
<td>19.77</td>
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<td>Improvement</td>
<td>40%</td>
<td>8%</td>
<td>26%</td>
<td></td>
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<td>9%</td>
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<tr>
<td>2</td>
<td>Conventional</td>
<td>90.4</td>
<td>229.1</td>
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<td>0.029</td>
<td>19.17</td>
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<td>12%</td>
<td>29%</td>
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<td>Conventional</td>
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<td>52%</td>
<td>44%</td>
<td>36%</td>
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</table>
## Surrogate Safety Assessment Model Results for 1 U-Turn Lane

<table>
<thead>
<tr>
<th></th>
<th>Crossing Conflicts</th>
<th>Rear End Conflicts</th>
<th>Lane Change Conflicts</th>
<th>Total Conflicts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.40</td>
<td>0.00</td>
<td>100.70</td>
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<td>Variance</td>
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<td>0.00</td>
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<td>t-test value (95%)</td>
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<td>Improvement</td>
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<td>100.00%</td>
<td>-9.76%</td>
<td>-</td>
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<tr>
<td>Result</td>
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<td>Significant</td>
<td>Not significant</td>
<td>Significant</td>
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## Surrogate Safety Assessment Model Results for 2 U-Turn Lane

<table>
<thead>
<tr>
<th></th>
<th>Crossing Conflicts</th>
<th>Rear End Conflicts</th>
<th>Lane Change Conflicts</th>
<th>Total Conflicts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.00</td>
<td>0.00</td>
<td>15.00</td>
<td>27.20</td>
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<tr>
<td>Variance</td>
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<td>0.00</td>
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<td>t-test value (95%)</td>
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<td>1.812</td>
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<tr>
<td>Improvement</td>
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<td>-81.33%</td>
<td>-77.74%</td>
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<td>Result</td>
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</tbody>
</table>
Conclusions

• The performance of the superstreet design is better than a conventional intersection primarily for one u-turn lane and at high volumes. Travel time was reduced by 30 to 40%, and throughput (serviced vehicles) increased by 22 to 40%.

• Highest throughput were obtained when the green time on the minor road is 20% of the major road green time for the one u-turn lane cases 1 and 2.

• For the two u-turn lanes case (case 3), smaller increase in throughput was obtained (ranging from 9 to 12%).

• SSAM results show a significant crash reduction for one u-turn lane design only.