4-Lane to 3-Lane Conversions

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The Iowa 4 Lane to 3 Lane Experience

Optimization of Pavement to Improve Safety and Enhance Quality of Life
Traditional Improvement to 2-Lane Urban Street

4-Lane Undivided Roadway
# US-61 Ft. Madison, Iowa
## Two-Lane to Four-Lane Widening

<table>
<thead>
<tr>
<th>Corridor Element</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Traffic volume</td>
<td>Increased 4 percent</td>
</tr>
<tr>
<td>+ Corridor travel delay</td>
<td>Increased 4 percent</td>
</tr>
<tr>
<td>+ Mid-block 85(^{th}) %tile speed</td>
<td>Increased 2.5 percent</td>
</tr>
<tr>
<td>+ Traffic traveling more than 5 mph over the posted speed limit</td>
<td>Increased from 0.5 percent to 4.2 percent</td>
</tr>
<tr>
<td>+ Crash rate</td>
<td>Increased 14 percent</td>
</tr>
<tr>
<td>+ Injury rate</td>
<td>Increased 88 percent</td>
</tr>
<tr>
<td>+ Total value loss</td>
<td>Increased 280 percent</td>
</tr>
</tbody>
</table>
Urban Minnesota DOT
Crash Rates

Facility Types

Crash Rate

(Crashes / Million Vehicle Miles Traveled)

After converting several high crash 4-Lane corridors
Cross-Traffic Conflict Points

- 4 Lane
  - Conflict Points

- 3 Lane
Intersection Site Distance

4 Lane

3 Lane
Four-Lane Undivided Roadway/Intersection Operating as “Defacto” Three-Lane Cross Section
Mid-Block Conflict Points

4 Lane

Conflict Points

3 Lane
Pedestrian Crossing
4 Lane Undivided Roadway
Pedestrian Crossing
3 Lane Undivided
Responding to Older Driver / Pedestrian Concerns in Sioux Center, Iowa
July 1999

Sioux Center Population 6,000
US-75 Sioux Center
Before
## Iowa’s First Case Study
### US-75 Sioux Center

<table>
<thead>
<tr>
<th>1998 ADT</th>
<th>8 -14,000 VPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Trucks</td>
<td>9%</td>
</tr>
<tr>
<td>Land Use</td>
<td>Residential / CBD w/parking</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>Three</td>
</tr>
<tr>
<td>Speed Limit</td>
<td>25 MPH</td>
</tr>
</tbody>
</table>

**Before Concerns:**
- Excessive speeding
- Difficulty entering and crossing US-75
- Fatal and major injury older person pedestrian crashes
Sioux Center After
## Before / After Analysis
### US-75 Sioux Center

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After (2)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak Hour Travel Time</strong></td>
<td>50 sec</td>
<td>68 sec</td>
<td>+ 36 %</td>
</tr>
<tr>
<td><strong>Average Travel Speed</strong></td>
<td>28 mph</td>
<td>21 mph</td>
<td>- 25%</td>
</tr>
<tr>
<td><strong>Average Free Flow Speed</strong></td>
<td>35 mph</td>
<td>32 mph</td>
<td>- 10%</td>
</tr>
<tr>
<td><strong>Vehicles Traveling more than 5mph above speed limit</strong></td>
<td>43 %</td>
<td>13 %</td>
<td>- 70 %</td>
</tr>
<tr>
<td><strong>Crashes</strong></td>
<td>30</td>
<td>13</td>
<td>- 57 %</td>
</tr>
<tr>
<td><strong>Personal Injury Crashes</strong></td>
<td>10</td>
<td>0</td>
<td>- 100 %</td>
</tr>
</tbody>
</table>

1. Posted Speed Limit – 25MPH
2. 7 months before and after
### Before / After Public Opinion Survey (1)
#### US-75 Sioux Center

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Conversion</td>
<td>18 %</td>
<td>45%</td>
</tr>
<tr>
<td>Neutral</td>
<td>37 %</td>
<td>15%</td>
</tr>
<tr>
<td>Oppose Conversion</td>
<td>45 %</td>
<td>40%</td>
</tr>
</tbody>
</table>

(1) 930 Responses - City Population 6,002
Ardith Lein, Executive Director
Sioux Center Chamber of Commerce

Mrs. Lein stated that:

- The Chamber of Commerce Executive Board, as well as almost all business owners, prefer the three-lane highway to the previous four-lane highway.
It has slowed traffic down through the central business district, which has improved the shopping environment.

Pedestrian crossing of US-75 are much safer; there have been fewer accidents and the emergency vehicles like having the center lane available to drive in.

“Safety has to be the priority over a little extra delay.”
Harold Schiebout, City Manager

- ‘But we can not have it both ways so we have to decide which is best overall.’

- “Currently, the city council supports keeping the conversion permanent.”
Rod DeKruyt, had called Mr. Schiebout and stated:

- “I thought all of you were plumb nuts when you proposed changing US 75 from 4 lanes to 3 lanes."
- “But now I take my hat off to you for being persistent.”
- “It is not perfect, but it is much better.”
Paul Adkins, Chief of Police

- Chief Adkins admitted he was opposed to the four lane to three lane conversion when it was proposed.

- He said it was initially confusing for many elderly drivers, but now he is the biggest advocate.

- He suggested that any city that is considering a conversion to call him at

  (---) --- ----
Blue Grass - US 61 (9,000 ADT)
- Speeds regulated much better
- Accidents have decreased significantly
- Reduction in capacity is not an issue.

Sanford Remly, Public Works Director

Osceola - US 34 (11,000ADT)
- “I was skeptical but have since changed my mind.”
- Initial reactions are positive
- Capacity has not been adversely affected
- Overall a success

Brad Wright, City Administrator
### IOWA 4-LANE TO 3-LANE CONVERSION STUDY

#### SUMMARY OF STUDY RESULTS

BEFORE AND AFTER CONVERSION

<table>
<thead>
<tr>
<th>CITY</th>
<th>AADT(range)</th>
<th>BEFORE</th>
<th>AFTER</th>
<th>%CHANGE</th>
<th>BEFORE</th>
<th>AFTER</th>
<th>%CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Lake</td>
<td>5100 - 9100</td>
<td>64</td>
<td>34</td>
<td>-47</td>
<td>13.40</td>
<td>8.18</td>
<td>-39</td>
</tr>
<tr>
<td>Clear Lake</td>
<td>11900 - 12000</td>
<td>34</td>
<td></td>
<td></td>
<td>5.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mason City</td>
<td>7100</td>
<td>9</td>
<td>4</td>
<td>-56</td>
<td>1.67</td>
<td>0.87</td>
<td>-48</td>
</tr>
<tr>
<td>Osceola</td>
<td>6100 - 9900</td>
<td>47</td>
<td>22</td>
<td>-53</td>
<td>7.70</td>
<td>3.50</td>
<td>-55</td>
</tr>
<tr>
<td>Manchester</td>
<td>11200</td>
<td>15</td>
<td>11</td>
<td>-27</td>
<td>12.26</td>
<td>7.60</td>
<td>-38</td>
</tr>
<tr>
<td>Iowa Falls</td>
<td>9400 - 11700</td>
<td>21</td>
<td>8</td>
<td>-62</td>
<td>4.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock Rapids</td>
<td>3910 - 5100</td>
<td>6</td>
<td>2</td>
<td>-67</td>
<td>10.23</td>
<td>3.31</td>
<td>-68</td>
</tr>
<tr>
<td>Glenwood</td>
<td>2950 - 7100</td>
<td>30</td>
<td>15</td>
<td>-50</td>
<td>12.60</td>
<td>6.28</td>
<td>-50</td>
</tr>
</tbody>
</table>

"Before" cases based on 5 years of data (except Storm Lake); "after" cases based on 1 to 5 years of data. Year of conversion is not included in the data analysis. Storm Lake "before" data 1991 and 1992 only; conversion in 1993. Clear Lake conversion completed in 2003, after data not available. AADT reported for year of conversion where available. Storm Lake AADT not available for 1993; value shown represents first available year (1996). Council Bluffs AADT not available for 2000; value shown represents 1996.
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<th>AFTER</th>
<th>%CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Des Moines</td>
<td>12300 - 17400</td>
<td>67</td>
<td>39</td>
<td>-42</td>
<td>11.13</td>
<td>6.57</td>
<td>-41</td>
</tr>
<tr>
<td>Council Bluffs</td>
<td>9600</td>
<td>8</td>
<td>2</td>
<td>-75</td>
<td>10.36</td>
<td>2.70</td>
<td>-74</td>
</tr>
<tr>
<td>Blue Grass</td>
<td>9400 - 10000</td>
<td>12</td>
<td>3</td>
<td>-75</td>
<td>6.23</td>
<td>2.86</td>
<td>-54</td>
</tr>
<tr>
<td>Sioux Center</td>
<td>7200 - 10500</td>
<td>65</td>
<td>23</td>
<td>-65</td>
<td>11.13</td>
<td>4.45</td>
<td>-60</td>
</tr>
<tr>
<td>Indianola</td>
<td>7500 - 12800</td>
<td>29</td>
<td>24</td>
<td>-17</td>
<td>4.85</td>
<td>3.18</td>
<td>-34</td>
</tr>
<tr>
<td>Lawton</td>
<td>8400 - 9800</td>
<td>6</td>
<td>2</td>
<td>-67</td>
<td>2.97</td>
<td>0.80</td>
<td>-73</td>
</tr>
<tr>
<td>Sioux City</td>
<td>9300 - 11100</td>
<td>5</td>
<td>3</td>
<td>-40</td>
<td>1.94</td>
<td>1.34</td>
<td>-31</td>
</tr>
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Model

1st Level

\[ y_{it} \sim \text{Poi} \left( \frac{\lambda_{it} v_{it}}{1000} \right) \]

2nd Level

\[
\log(\lambda_{it}) = \beta_1 + \beta_2 X_{1it} + \beta_3 t + \beta_4 (t - t_{0i}) I_{(t > t_{0i})} + \beta_5 X_{1rt} + \beta_6 X_{1t}(t - t_{0i}) I_{(t > t_{0i})} + \beta_7 X_{2it} + \beta_8 X_{3it} + \beta_9 X_{4it} + \text{id}_i
\]

where:

\[
\text{id}_i \sim N\left(0, (\tau_{bw}^2)^{-1}\right)
\]

\[
I_{(t > t_{0i})} = \begin{cases} 
1, & \text{if } t > t_{0i} \\
0, & \text{if } t \leq t_{0i}
\end{cases}
\]

Priors:

\[
\beta_j \sim N(0,1000), \text{ for } j \text{ from 1 to 9}
\]

and

\[
\tau_{bw}^2 \sim \text{gamma}(0.01,0.01)
\]

\[ \tau_{bw}^2 \text{ is the between-site precision} \]
Results/Discussion

- 25.2% (23.2% - 27.8%) ↓ in crashes/mile

- 18.8% (17.9% - 20.0%) ↓ in crash rate
Potential Benefits

- Improved Vehicle Safety
- Improved Pedestrian Safety
- Traffic Calming
- Improved Emergency Response Time
- Potential Bike Accommodation
Emergency Vehicle Access

Four - Lane Emergency Vehicle Access

Three - Lane Emergency Vehicle Access
Three-Lane Cross Section with Bike Lanes
Potential Disadvantages

1. Increased delay at un-signalized access points.

2. Loss of passing opportunities
   - Aggressive Drivers
   - Slow Moving Vehicles

3. Increased Travel Delay
Supplementary Right Turn Lanes
Access Control Considerations

Eliminate, consolidate and relocate driveways
Cautions

- ADT greater than 15,000 ADT
- At grade rail crossings
- School bus stops
- Curbside mailboxes
- 90 degree turns along corridor
- High volume of slow-moving agricultural vehicles
- Offset side streets or major access points
- High volume turning trucks
Which is the Priority?

- Improving traffic and pedestrian safety while maintaining acceptable traffic flow

  Or

- Moving traffic with a minimum amount of delay and accepting higher safety risks

?????
4-Lane to 3-Lane Conversions

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