South Carolina DOT
Data Driven
Intersection Safety Improvements
Intersection Safety Data

Nationwide:
- 21% of all fatalities occur at or near intersections, as well as...
- 52% of all injuries
- 45% of all property damage

South Carolina:
- 44% of all intersection crashes occurred at 1.3% of intersections
- FHWA provides guidance to make data driven decisions
- generating crash data analysis will identify problems
MAP-21 Legislation – Data Driven Improvements

• “(A) maintaining highway signage and pavement markings, or… maintain minimum levels of retroreflectivity…
  • with a focus on both engineering and economic analysis based upon quality information…
  • over the lifecycle of the assets at minimum practicable cost…
• “(ii) to collect safety data, including data identified as part of the model inventory for roadway elements
• “(iii) to store and maintain safety data in an electronic manner
South Carolina Named a Safety Focus State by the Federal Highway Administration
2002 – 2006:

- Traffic fatality rates in SC were among the highest in the nation
- Economic impact to the state was $13 billion
- Primary goal established to reduce fatalities to fewer than 784 by 2010
  - 25% reduction from 2004
- Secondary goal to lower the number of traffic related injuries by 3%
- 5 year analysis of traffic crash data identified intersections as one of 9 target areas within the Serious Crash Type emphasis area
South Carolina DOT Example: Streamlined Delivery Method

Cost and Efficiency

- **Systematic** approach across 7 Districts
  - Applied to Rural and Urban areas Statewide
- **Involves Low-Cost Countermeasures**
  - *Low-Cost* = countermeasures ranging from $1,000 to $50,000
TYPES of TREATMENTS – All Intersections

- **Signing**
  - Doubled Up (left & right) Signing
  - Oversized Signing with **Fluorescent**
  - Advance Street Name Sign on Intersection Warning Signs
  - Retroreflective sign post panel
  - Solar-powered, sign mounted beacons
  - Replacement of additional Safety related signs within 500 feet
    - Do Not Enter, One-Way, etc…
TYPES of TREATMENTS – All Intersections

- **Pavement Markings:**
  - Properly placed STOP bars (4’-8’ offset and perpendicular to the mainline)
  - Dashed Edge lines to delineate the mainline and Turn bays and establish points of Conflicting traffic
  - Lane Arrows and word messages
  - Addition of Crosswalks
### TYPES of TREATMENTS – Signalized Intersections

- **Signing and Pavement Markings**
  - One signal head per lane
  - Backplates with retroreflective borders
  - 12” LED signal indications
  - Pedestrian treatments, such as push button indicators and pedestrian countdown signals
South Carolina Case Study: Implementation

- SCDOT headquarters released Work Orders to the District traffic engineering offices, with 40 - 50 intersections per Work Order

- Challenges with managing statewide program
  - Utilized a **Website for project management** to show all work planned on a regular basis
  - Provide data about Work Order progress of work performed at each Intersection location
  - Provide 24/7 access to view Drawings, Inventories, Approvals, Work Checklist, Reconciliation/Punch List, Time lines and work completion

- Transfer to State DOT database after completion of work
### SCDOT Data Requirements for the Internet Website

<table>
<thead>
<tr>
<th>Pavement Markings</th>
<th>Traffic Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road name/Highway # (intersections)</td>
<td>Road name/Highway # (locations)</td>
</tr>
<tr>
<td>Work Order #</td>
<td>Work Order #</td>
</tr>
<tr>
<td>Quantities of material installed</td>
<td>GPS coordinates of each traffic sign location</td>
</tr>
<tr>
<td>Type of material used</td>
<td>Sign ID # (bar code of new signs)</td>
</tr>
<tr>
<td>Field Supervisor name</td>
<td>Sign ID # (bar code - removed signs/posts)</td>
</tr>
<tr>
<td>Status of work - planned or completed</td>
<td>Ex. Signs had ID # and posts have an Assembly #</td>
</tr>
<tr>
<td>Start Date</td>
<td>MUTCD code for each sign type</td>
</tr>
<tr>
<td>Finish Date</td>
<td>Sign dimensions (width and height)</td>
</tr>
<tr>
<td>Date Evaluated</td>
<td>Sign face substrate</td>
</tr>
<tr>
<td>Evaluation results - durability and reflectivity (PDF file download option)</td>
<td>Post type/style</td>
</tr>
<tr>
<td></td>
<td>Date of sign installation</td>
</tr>
<tr>
<td></td>
<td>Sheeting type</td>
</tr>
<tr>
<td></td>
<td>Sign face direction</td>
</tr>
<tr>
<td></td>
<td>Field Supervisor name</td>
</tr>
<tr>
<td></td>
<td>Status of work - planned or completed</td>
</tr>
<tr>
<td></td>
<td>Approval date - utility locates</td>
</tr>
<tr>
<td></td>
<td>Start Date of Work Order</td>
</tr>
<tr>
<td></td>
<td>Finish Date of Work Order</td>
</tr>
</tbody>
</table>
Results of Implementation
Social, Economic and Safety Benefits

• Before and After Statistical Analysis
  • Preliminary analysis done by DOT in-house on 458 completed locations
  • Simple B/A study
  • Results are only for ground mounted signs and pavement markings
  • Signal equipment upgrade dates are not included
  • Rigorous study utilizing Empirical Bayesian (EB) methods to predict the benefits of crash reductions at higher crash rates and traffic demands will be conducted by FHWA as part of the FHWA Evaluation of low cost safety improvements- Pooled Funds Study
# Results of Implementation

## Social, Economic and Safety Benefits

## Project Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 14, 2009</td>
<td>Project Let</td>
</tr>
<tr>
<td>October 1, 2009</td>
<td>First Work Order Submitted</td>
</tr>
<tr>
<td>December 31, 2010</td>
<td>12 Work Orders Completed – 530 Intersections</td>
</tr>
<tr>
<td>December 31, 2011</td>
<td>13 Work Orders Completed – 575 Intersections</td>
</tr>
<tr>
<td>December 31, 2012</td>
<td>16 Work Orders Completed – 688 Intersections</td>
</tr>
<tr>
<td>May 30, 2013</td>
<td>4 Work Orders Completed – 199 Intersections</td>
</tr>
<tr>
<td>May 30, 2013</td>
<td>All 45 Work Orders Complete – 1992 Intersections</td>
</tr>
</tbody>
</table>

- **Total expenditures**: $12.05 M
- **# of intersections treated**: 1,992
- **Cost/Intersection (avg.)**: $6,225
- **Number of signs installed**: 21,500

## Pavement Marking Quantities

<table>
<thead>
<tr>
<th>Marking Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” Solid Lines</td>
<td>2,254,200 LF</td>
</tr>
<tr>
<td>12” Solid Lines</td>
<td>30,767 LF</td>
</tr>
<tr>
<td>24” Stop Bars</td>
<td>219,945 LF</td>
</tr>
<tr>
<td>8” Crosswalks</td>
<td>449,251 LF</td>
</tr>
<tr>
<td>Turn Arrows</td>
<td>13,103</td>
</tr>
<tr>
<td>“ONLY” Messages</td>
<td>5,981</td>
</tr>
<tr>
<td>R/R Crossing Symbols</td>
<td>133</td>
</tr>
</tbody>
</table>
## Results of Implementation

Social, Economic and Safety Benefits

### Continued Before and After Analysis

**Crashes Per Location Per Year**

**458 Locations**

<table>
<thead>
<tr>
<th></th>
<th>Average Crashes per Year BEFORE</th>
<th>Average Crashes per Year AFTER</th>
<th>Total Crashes Percent Reduction</th>
<th>Nighttime Crashes Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Locations</td>
<td>11.75</td>
<td>9.16</td>
<td><strong>22.0</strong></td>
<td>25.2</td>
</tr>
<tr>
<td>Signalized Locations</td>
<td>16.48</td>
<td>13.49</td>
<td><strong>18.1</strong></td>
<td>19.3</td>
</tr>
<tr>
<td>Unsignalized Locations</td>
<td>6.11</td>
<td>4.00</td>
<td><strong>34.5</strong></td>
<td>43.1</td>
</tr>
</tbody>
</table>
Results of Implementation
Social, Economic and Safety Benefits

Benefits and Costs
458 Intersections

- Annual Cost: $2.9 million
- Annual Benefit: $59.0 million
- Net Benefit: $56.1 million

B/C Ratio = 20.7
Results of Implementation
Social, Economic and Safety Benefits

Construction Time Comparison

Time (Months)

Contract

Traditional (SCDOT forces)

204 Months Faster

36 months

240 months

Deployment Type
Results of Implementation
Social, Economic and Safety Benefits

Before and After Analysis
Total Crashes Per Year
458 Locations

- 22.0% Crash Reduction (25.2% Nighttime)

<table>
<thead>
<tr>
<th>Total Crashes</th>
<th>Before (Crashes/Year)</th>
<th>After (Crashes/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,379</td>
<td>1183 less (22.0%)</td>
<td>4,196</td>
</tr>
<tr>
<td>4,196</td>
<td>1,118</td>
<td>282 less (25.2%)</td>
</tr>
</tbody>
</table>

Night

- 836
Results of Implementation
Social, Economic and Safety Benefits

Before and After Analysis
Total Crashes Per Year
249 Signalized Locations

<table>
<thead>
<tr>
<th>Total Crashes</th>
<th>Before (Crashes/Year)</th>
<th>After (Crashes/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,103</td>
<td>3,360</td>
</tr>
<tr>
<td></td>
<td></td>
<td>743 less (18.1%)</td>
</tr>
</tbody>
</table>

18.1% Crash Reduction (19.3% Nighttime)

<table>
<thead>
<tr>
<th>Night</th>
<th>839</th>
<th>678</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>161 less (19.3%)</td>
<td></td>
</tr>
</tbody>
</table>
Results of Implementation
Social, Economic and Safety Benefits

Before and After Analysis
Total Crashes Per Year
209 Unsignalized Locations

34.5% Crash Reduction (42.8% Nighttime)

Before (Crashes/Year)
After (Crashes/Year)

441 less (34.5%)
119 less (42.8%)

1,277
836
278
159

0
200
400
600
800
1,000
1,200
1,400

Total Crashes
Night
Results of Implementation
Social, Economic and Safety Benefits

Before and After Analysis
Total Fatal Crashes Per Year

- Before (Crashes/Year): 21
- After (Crashes/Year): 12

42.9% Crash Reduction (9 Less/year)
Results of Implementation
Social, Economic and Safety Benefits

Before and After Analysis
Total Injuries Crashes Per Year

- Before (Crashes/Year): 1,492
- After (Crashes/Year): 976

34.6% Crash Reduction (516 Less/year)
Results of Implementation

Social, Economic and Safety Benefits

Before and After Analysis
Total PDO Crashes Per Year

17.0% Crash Reduction
(657 Less/year)
SC highway deaths at lowest rate for August since 1975

The final month of the typical “100 deadliest days of summer” in South Carolina were a lot less deadly than they have been in awhile.

Citing improved roads and crossings, driver awareness and law enforcement agency cooperation, the SC Department of Transportation said August saw the fewest number of highway deaths, 45, since 1975.

The number is 17 fewer than in August 2011 and 10 percent lower than the previous four-year average for August and a full 50 percent lower than the 10-year average for August, which was 84 deaths on average from 2002 to 2011.

August’s relatively low number of fatal wrecks also helped push the total number of deaths for the year, 526, below the total for the same time period in 2011, which was 543.

State Secretary of Transportation Robert St. Onge credited engineering and law enforcement.

“SCDOT engineers are maximizing the resources available to them to improve the safety of roads and intersections that need improvements,” he said. “We also commend the efforts of state and local law enforcement agencies that are stepping up their efforts to crack down on violators.”

Finally, drivers themselves can take some credit for wearing seat belts and driving defensively, St. Onge said.
Conclusion
Social, Economic and Safety Benefits

• Preliminary data indicates project goals will be met
• The safety improvements have resulted in reduced crashes
• The improvements are saving lives
• The accelerated delivery methods saved additional lives beyond the improvements themselves
• The improvements can be replicated in other states
• A shorter time frame for implementation results in greater value for improved statistical analysis
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