Highway Safety Evaluation

What Is Out There
## Workshop Series

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Wed. Nov. 6</td>
<td>Highway Safety Manual</td>
</tr>
<tr>
<td>Wed. Nov. 13</td>
<td>Application and Science of Crash Reduction Factors</td>
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<tr>
<td>Wed. Nov. 20</td>
<td>Requirements for HSIP Applications</td>
</tr>
<tr>
<td>Wed. Dec. 4</td>
<td>Safety Funding Categories/Requirements/Conditions</td>
</tr>
<tr>
<td>Wed. Dec. 11</td>
<td>Is Your Project Feasible? What’s Next and How Do We Move Forward?</td>
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<tr>
<td>Wed. Dec. 18</td>
<td>B/C Calculations plus NPV Calculations – New WP Guidelines</td>
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<tr>
<td>2014</td>
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<tr>
<td>Wed. Jan. 8</td>
<td>Safety Projects &amp; The Local Agency Program (LAP)</td>
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<tr>
<td>Wed. Jan. 15</td>
<td>Development of the Safety/LAP Project Schedule for Funding</td>
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<td>Purposes</td>
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<tr>
<td>Wed. Jan. 22</td>
<td>Safety/LAP Project Development</td>
</tr>
<tr>
<td>Wed. Jan. 29</td>
<td>Key to Successful Safety Programs</td>
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"Driving Down Fatalities Through Knowledge Sharing"
Highway Safety Evaluation

- Crash Analysis
  - Methods
  - Software
- Road Safety Audits
- Road Safety Assessments
  - Reports
- Tracking Safety Recommendations
- Case studies
- 5% Report

“Driving Down Fatalities Through Knowledge Sharing”
Crash Analysis Focus

- Reduce fatal and serious injuries
  - Intersection crashes
  - Lane departures
  - Vulnerable users
    - Pedestrians
    - Bicyclists
    - Motorcyclists
  - Older users
Analysis Methods

- Frequency method
  - Quantity of crashes
  - Trend line analysis
- Rate based method
  - Quantity and exposure
  - Comparisons to the Statewide Average
Segment vs. Intersection Analysis

- Segment – typically identified from mile post to mile post
- Intersection (Spot) - 250 feet of approaches
Crash Trend Over Time

- Excel function, =SLOPE

<table>
<thead>
<tr>
<th>Segment Crash Rate Analysis</th>
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<tbody>
<tr>
<td>Total Crashes</td>
</tr>
<tr>
<td>ADT</td>
</tr>
<tr>
<td>Analysis period (yrs)</td>
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<td>Segment Length (miles)</td>
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<td>Crash Rate</td>
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<table>
<thead>
<tr>
<th>Trend Line Analysis</th>
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<tbody>
<tr>
<td>Year</td>
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<tr>
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</tr>
<tr>
<td>2007</td>
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<td>2008</td>
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<tr>
<td>2010</td>
</tr>
<tr>
<td>2011</td>
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</table>

Slope = \frac{(C3*1000000)}{(C5*365*C4*C6)}

\[ f_{\text{SLOPE}} = \text{SLOPE(E4:E8,F4:F8)} \]
Approach To Implementing Safety Enhancements

- Data driven approach
  - Recommendations requiring a financial investment are supported by crash history
- Holistic approach
  - Recommendations will enhance future safety
Crash Analysis Tools

- Crash Analysis Reporting System (CARS)
- Crash Data Management System (CDMS)
- Signal Four Analytics
## CARS

- Rate based
- Statewide average comparison
- Summary
- Detail
- Crash reports

<table>
<thead>
<tr>
<th>LENGTH</th>
<th>CATG</th>
<th>CRASHES</th>
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<td>9555</td>
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"Driving Down Fatalities Through Knowledge Sharing"
CDMS

- Created by TOA; proprietary
- Frequency based
- Good graphics
- Rolling out a web based version

“Driving Down Fatalities Through Knowledge Sharing”
Signal Four Analytics

- Newest of the crash analysis software
- GeoPlan Center of UF
- Currently working to summarize crashes by direction
- Web based

“Driving Down Fatalities Through Knowledge Sharing”
Comparisons to the Statewide Average

- NOTE: If you’re going to do a rate based analysis and compare it to the statewide average, your analysis should be limited to those years that went into defining the statewide average.
A Road Safety Audit (RSA) is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.
Road Safety Assessment

- Developed for 3R projects
- Not formal
- Does not include and multi-disciplined team
- Cost effective alternative to a Road Safety Audit
- Conducted prior to the 3R scoping process
- Safety tool for project management
Field Review, Be Equipped

- Camera
- Tape measure
- Measuring wheel
- Smart level
- I-Pad
- Signal timings
Safety Assessment Report

- Executive Summary
- Introduction
- Segment Summary
- Intersection(s) Summary

Road Safety Assessment Report

US 41/SR 45
from Winkler Avenue (MP 21.033) to
Johnson Street (MP 23.421)

3R FRID: 431313-1-52-01
Section Number: 12010000
Mile Post: 21.033 – 23.421
Lee County

Task Work Order No. 02
District-wide Traffic Safety Study and Minor Design
FPN No.: 430852-2-32-01
FDOT Contract No.: 0945

prepared for:

Florida Department of Transportation – District One
801 N. Broadway Avenue
Bartow, FL 33830-3800

prepared by:

Carino
12481 Telecom Dr.
Tampa, FL 33637

September 2013

“Driving Down Fatalities Through Knowledge Sharing”
Safety Assessment Report

- Introduction
  - Purpose
  - Analysis method (rate and/or frequency based)
  - Crash software used
  - Years of analysis
  - Date of field review
  - Location map
Safety Assessment Report

- Segment / Intersection(s) Summary
  - Crash analysis
  - Qualitative assessment
  - Recommendations
Safety Assessment Report

- Segment / Intersection(s) Summary
  - Crash analysis
    - Define the limits and length (segment only)
    - Define the ADT
    - Define the facility Category type(s)
    - Quantify the yearly crashes
    - Identify the crash rate and statewide average crash
Segment / Intersection(s) Summary

Qualitative Assessment

Discuss the physical and operational characteristics and any observed deficiencies

Qualitative Assessment
Our field review identified recent improvements to this intersection. The improvements included adding an additional westbound left-turn lane requiring the permitted left-turn phase to be changed to protected only. This change eliminates the opportunity for future crashes of the type under which the fatality occurred. In addition to the recent improvements, Manatee County plans to widen 45th Street E. to a four-lane divided facility to include dual left-turn lanes on the north side of SR 70. Construction is anticipated to begin in 2015.
Safety Assessment Report

- Segment / Intersection(s) Summary
  - Recommendations
    - Discuss your recommendations
    - Costs to implement/construct
    - Expected crash reductions (don’t double count)
    - May include B/C and NPV calculations
Safety Assessment Report

Executive Summary

- Summary of the report highlights
- Targeted to PM staff

The crash analysis showed two crashes with pedestrians and five crashes with bicyclists. Of the crash reports reviewed, four of the crashes involved a right turning vehicle and the pedestrian or bicyclist crossing the intersection in the crosswalk on a green indication. None of the crashes were determined to be susceptible to correction by geometric or operational improvements. One fatality occurred at the intersection of SR 70 and Lockwood Ridge Road/45th Street E. due to a left turning vehicle failing to yield to the through vehicle during the permitted portion of the through phase. Recent improvements to the intersection removed the permitted phase for the westbound left-turn movement, eliminating the opportunity for future crashes of the type under which the fatality occurred.

SR 70 from Lockwood Ridge Road (MP 2.465) to Tara Boulevard (MP 4.807)

Executive Summary

The limits of this assessment for SR 70 are from MP 2.465 to MP 4.807 for a total of 2.342 miles and is defined as a 4-lane divided arterial. There are four signalized intersections within the study area. Lockwood Ridge Road/45th Street E., Natalie Way, Canoa Road/45th Street E., and Tara Boulevard/Creekwood Boulevard. The corridor has street lighting on the north side from Lockwood Ridge Road to 45th Street E. on Canoa Road and sidewalks on both the north and south sides throughout its limits. It also includes designated bicycle lanes throughout the corridor. The speed limit through the corridor is 50 MPH. An emergency signal is located east of 45th Street for access to the Division of Forestry complex. During the field review, no geometric or operational safety deficiencies were observed.

There were a total of 323 crashes within the 5-year period from 2007 to 2011. The rate-weighted rate based crash analysis companion indicates the segment of SR 70 has a lower crash rate, 1,081 than the statewide average of 3,581 for the same facility type area.

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Based on the crash analysis and qualitative field review, no safety deficiencies were identified requiring any safety improvements in addition to those already anticipated to be undertaken to bring the intersections up to current state standards during the 361 project.
Crash Modification Factors

- Use factors with high confidence (Quality/stars)
- Avoid double counting
- [www.cmfclearinghouse.org](http://www.cmfclearinghouse.org)

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Countermeasure: Protected/permisive to protected-only left turn phasing

<table>
<thead>
<tr>
<th>CMF</th>
<th>CRF (%)</th>
<th>Quality</th>
<th>Crash Type</th>
<th>Crash Severity</th>
<th>Area Type</th>
<th>Reference</th>
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<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>★★★★☆☆</td>
<td>Angle</td>
<td>All</td>
<td></td>
<td>Srinivasan et al., 2008</td>
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</tbody>
</table>

Countermeasure: Add 3-inch yellow retroreflective sheeting to signal backplates

<table>
<thead>
<tr>
<th>CMF</th>
<th>CRF (%)</th>
<th>Quality</th>
<th>Crash Type</th>
<th>Crash Severity</th>
<th>Area Type</th>
<th>Reference</th>
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<tbody>
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<td>All</td>
<td>Urban</td>
<td>Sayed et al., 2005</td>
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</table>
Tracking Implementation of Safety Measures

- Short term – maintenance?
- Mid term - 3R projects?
- Long Term - major reconstruction?
- Before and after review
Road Safety Audit
Alligator Alley Case Study

- HSIP Focus Area
  - Lane departures crashes
- Audit Team
  - FDOT Central Office and D-1 staff
  - Cardno TBE staff
  - Enforcement Engineering
  - DBi Services
Road Safety Audit
Alligator Alley Case Study

- Crash analysis
  - 20 crashes resulting in 27 fatalities
  - 12 fatal crashes by lane departure
  - 3 crashes resulting in 7 fatalities by entering canal
Road Safety Audit
Alligator Alley Case Study

- Safety Recommendations
  - Enhanced use of Travel Advisory Radio
  - Upgrade of the roadside barriers to prevent canal entry
  - Widening the inside paved shoulder to 10’
  - Enhanced signing to discourage stopping at toll plaza
  - Enhance side slope stabilization for better recovery
  - Add audible/vibratory lane markings to supplement rumble strips

“Driving Down Fatalities Through Knowledge Sharing”
Pedestrian Safety Audit
Countryside HS Case Study

- HSIP Focus Area
  - Vulnerable user, pedestrian crashes
- Audit Team
  - FDOT D-7 staff
  - Pinellas County staff
  - School board staff
  - Law Enforcement
  - Cardno TBE & TOA staff

“Driving Down Fatalities Through Knowledge Sharing”
Pedestrian Safety Audit
Countryside HS Case Study

- Crash analysis
  - Study predicated on student fatality

“Driving Down Fatalities Through Knowledge Sharing”
Pedestrian Safety Audit
Countryside HS Case Study

- Safety Recommendations
  - Create barrier to discourage mid-block crossing
  - Enhance roadway lighting for morning arrival hours
  - Enhanced signalized intersection signing
Road Safety Assessment
SR 70 Case Study

- HSIP Focus Area
  - All with emphasis on intersection crashes
- Assessment Team
  - Cardno TBE
Road Safety Assessment
SR 70 Case Study

- Crash analysis
  - Segment crash rate less than statewide average
  - Intersection crash rate higher
  - Single left-turn fatality

<table>
<thead>
<tr>
<th>SR 70 Segment Analysis</th>
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<tr>
<td>Beg MP</td>
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<td>3.635</td>
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<table>
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<th>SR 70 at Lockwood Ridge / 45th St. Spot Analysis</th>
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<tr>
<td>MP</td>
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<td>2.538</td>
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Road Safety Assessment
SR 70 Case Study

- Safety Recommendations
  - None required other than those anticipated to be undertaken to bring the corridor/intersections up to current standards

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SR 70 and Lockwood Ridge Road/45th Street E:
Crash Analysis

The rate based crash analysis comparison indicates this signalized intersection has a higher crash rate than the statewide average for the same intersection type. A review of the crashes for the five year period indicates an increasing frequency trend. The one crash resulting in a fatality occurred on April 27, 2011 at 10:26 AM under dry and clear conditions where a westbound left turning vehicle failed to yield to the opposing through movement during the permitted left-turn phase.

<table>
<thead>
<tr>
<th>SR 70 at Lockwood Ridge / 45th St. Spot Analysis</th>
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<tr>
<td>MP</td>
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<td>2.538</td>
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**Qualitative Assessment**

Our field review identified recent improvements to this intersection. The improvements included adding an additional westbound left-turn lane requiring the permitted left-turn phase to be changed to protected only. This change eliminates the opportunity for future crashes of the type under which the fatality occurred. In addition to the recent improvements, Manatee County plans to widen 45th Street E. to a four-lane divided facility to include dual left-turn lanes on the north side of SR 70. Construction is anticipated to begin in 2015.

“Driving Down Fatalities Through Knowledge Sharing”
The Florida Highway Safety Implementation Program (HSIP) Transparency (5%) Report list is compiled by evaluating each one of FDOT's eight Districts separately as opposed to using a global statewide perspective. The number of locations per District represents the largest of 5% of the combined high crash intersection/segment list. The locations were sorted by the highest number of crashes and then sorted by fatalities plus injuries and the appropriate number of locations was selected from each District.
The 5% Report

- Screen to eliminate duplicates
- Crash analysis
  - Are crashes trending down?
  - Is there a spike in crashes
  - Is there a propensity of a particular crash type?
The 5% Report

- Qualitative assessment
  - Any deficiencies?
  - Changes in geometry?
  - Changes in operation?
  - Change to local traffic generators?
The 5% Report

- Implementation
  - Can it be done under maintenance?
  - How about the upcoming work program?
  - Possible LAP execution?
  - D/B Push Button execution?
Recommenda
tions  
And  
Repercussions

- Changing permissive to protected
  - Impacts to queue storage
- Adding signal heads or backplates
  - Impact on signal structure loading
- Adding raised medians
  - Operational constraints
Questions?