Florida Department of Transportation

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ROADWAY DESIGN BULLETIN 14-12
STATE SAFETY OFFICE BULLETIN 14-01

DATE: June 6, 2014

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Construction Engineers, District Geotechnical Engineers, District Structures Design Engineers, District Safety Engineers, District Traffic Operations Engineers, District Program Management Administrators

FROM: Michael Shepard, P.E., State Roadway Design Engineer
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COPIES: Brian Blanchard, Tom Byron, Duane Brautigam, David Sadler, Tim Lattner, Mark Wilson, Bruce Dana, John Krause, Nick Finch (FHWA)

SUBJECT: Design Safety Analysis Updates: Benefit/Cost Analysis and Highway Safety Manual Use

REQUIREMENTS

Replace item "y" in the ***Plans Preparation Manual, Volume 1, Section 23.5*** of the Design Exception documentation with the following:

y) For areas with crash histories or when a benefit to cost analysis is required, provide a time value analysis between the benefit to society (quantified in dollars) and the costs to society (quantified in dollars) over the life of the Design Exception. In general practice, the benefit to society is quantified by the reduction in crash cost foreseeable because of the proposed design and the cost due to the implementation of that change, such as the construction and maintenance costs over the life of the project. The Discount (interest) rate to be utilized in a benefit/cost analysis is 4%.

Both Historical (HCM) and Predictive (RSAP, HSM) methods are acceptable for performance of a benefit/cost analysis. These three methods are outlined below:

1. Historical Crash Method (HCM)

This method can be used for sites with a crash history. It is basically the ratio (benefit/cost) of the estimated annual reduction in crash costs to the estimated annual increase in combined construction and maintenance costs. This annualized conversion will show whether the projected expenditure of funds for the crash benefit will exceed the direct cost for the improvement.

The HCM uses the ***Highway Safety Improvement Program Guideline (HSIPG)*** cost per crash by facility type in ***Table 23.5.1*** to estimate benefit to society, while the cost to society is estimated by the expected cost of right of way, construction, and maintenance.

Table 23.5.1 FDOT (HSIPG) Average Crash Costs by Facility Type

FACILITY TYPE	DIVIDED			UNDIVIDED		
	URBAN	SUBURBAN	RURAL	URBAN	SUBURBAN	RURAL
2-3 Lanes	$144,112	$215,885	$374,247	$155,444	$310,580	$589,421
4-5 Lanes	$152,103	$260,271	$519,109	$133,200	$255,081	$90,957
6+ Lanes	$151,384	$184,426	$815,085	n/a	n/a	n/a
Interstate	$193,477	n/a	$395,511	n/a	n/a	n/a
Turnpike	$180,836	n/a	$285,189	n/a	n/a	n/a

All State Roads Average Cost/Crash: **$195,791**

The above values were derived from 2008, 2009, 2010, 2011 and 2012 traffic crash and injury severity data for crashes on state roads in Florida using the formulation described in ***FHWA Technical Advisory "Motor Vehicle Accident Costs", T 7570.2, dated October 31, 1994*** and from a memorandum from USDOT, ***Revised Departmental Guidance: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses, dated February 5, 2008*** updating the value of life saved to $5.8 million, updated from $5.8 million to $6 million on March 18, 2009, to $6.2 million on July 29, 2011, and to $9.1 million on February 28, 2013.

http://www.dot.gov/sites/dot.dev/files/docs/VSL%20Guidance%202013.pdf

When utilizing predictive methods for analysis, the crash severity level costs should be revised as follows:

Table 23.5.2 FDOT KABCO Crash Costs

Crash Severity	Comprehensive Crash Cost
Fatal (K)	$10,100,000
Severe Injury (A)	$818,636
Moderate Injury (B)	$163,254
Minor Injury (C)	$99,645
Property Damage Only (O)	$6,500

Source: Florida Department of Transportation Crash Analysis Reporting (C.A.R.) System

2. Roadside Safety Analysis Program (RSAP)

This method complements the AASHTO Roadside Design Guide, dated 2011. When a hazard cannot be removed or relocated, designers need to determine if a safety device, such as a guardrail or a crash cushion, is warranted to protect motorists from the roadside obstacle. This method can be used to perform a benefit/cost analysis comparing a potential safety treatment with the existing or baseline conditions (i.e., the do-nothing option) and/or alternative safety treatments. Based on the input of information available to the user (offsets, traffic, slopes, crash history, traffic crash severity levels, etc.), the program will offer results which can be used in comparing design alternatives.

3. Highway Safety Manual (HSM)

The AAHSTO Highway Safety Manual provides analytical tools and techniques for quantifying the potential effects on crashes as a result of decisions made in planning, design, operations and maintenance. The new techniques and knowledge in the HSM reflect the evolution in safety analysis from descriptive (historical) methods to quantitative, predictive analyses. In the HSM, crash frequency is the fundamental basis for safety analysis and is used to reduce crashes and/or severities through the selection of alternative treatments.

The HSM includes Safety Performance Functions (SPFs) for many roadway segment and intersection applications. SPFs are equations used to estimate or predict the expected average crash frequency per year at a location as a function of traffic volume and roadway characteristics. The use of Highway Safety Manual (HSM) Safety Performance Functions (SPF) and Crash

Modification Factors (CMF), with an Empirical Bayes (EB) adjustment, provides research based solutions for use in Benefit/Cost comparisons. Crash distributions presented in ***Table 23.5.3*** and KABCO costs as specified in ***Table 23.5.2*** should be used in determining benefits from an HSM analysis.

Table 23.5.3 HSM Crash Distribution for Florida (2007-2011)

Facility Type		Rural Roadways			Urban & Suburban Arterials					Freeways			All
		2-lane (R2U)	4-lane Undivided (R4U)	4-lane Divided (R4D)	2-lane Undivided (U2U)	3-lane TWLTL (U32LT)	4-lane Undivided (U4U)	4-lane Divided (U4D)	5-lane TWLTL (U52LT)	Rural	Urban	Ramps	All Roadways & Ramps
Fatal	**K**	0.038	0.018	0.037	0.011	N/A	0.006	0.010	N/A	0.023	0.009	0.006	0.010
Incapacitating Injury	**A**	0.148	0.135	0.139	0.079	N/A	0.047	0.068	N/A	0.103	0.058	0.051	0.064
Non-incapacitating Injury	**B**	0.209	0.237	0.219	0.180	N/A	0.146	0.178	N/A	0.177	0.152	0.149	0.163
Possible (or minor) Injury	**C**	0.208	0.254	0.209	0.228	N/A	0.220	0.246	N/A	0.204	0.244	0.253	0.239
Property Damage Only	**O**	0.397	0.356	0.396	0.502	N/A	0.581	0.497	N/A	0.493	0.537	0.541	0.525

Tools and spreadsheets for use with these analytical methods have been developed and are available on the following websites:

http://www.dot.state.fl.us/safety/11A-SafetyEngineering/TransSafEng/HighwaySafetyManual.shtm

http://www.dot.state.fl.us/rddesign/QA/Tools.shtm

BACKGROUND

This bulletin is necessary to update crash costs and tools available for calculating a benefit/cost analysis. Updates to the HSIPG Crash Cost table and the KABCO Cost Severity table reflect the 2012 5-year Statewide Average Crash Rates for Segments from the CAR System, as of February 5, 2014. The latest guidance and tables needed to perform a Highway Safety Manual benefit/cost comparison will now be included in the PPM.

IMPLEMENTATION

These changes are effective on all applicable projects still in the design phase where implementation will not adversely impact production schedules.

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