Design Exceptions and Design Variations

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Puzzle Pieces for Success!

Design Exceptions & Variations

- Definitions and Criteria

What are Design Exceptions?

A documented decision to design a highway element or a segment of highway to design criteria that do not meet minimum values or ranges established for that highway or project.

FHWA Mitigation Strategies for Design Exceptions
July 2007

Exceptions

Design Exceptions are required when proposed design elements are below both FDOT and AASHTO criteria for FHWA's 13 "Controlling" Criteria.

- Design Speed
- Lane Width
- Shoulder Width
- Bridge Width
- Structural Capacity
- Vertical Clearance
- Grade
- Cross Slope
- Superelevation
- Horizontal Alignment
- Vertical Alignment
- Stopping Sight Distance
- Horizontal Clearance (lateral offset to obstruction)

FHWA Direction (MAP-21)

NHS Design Standards and Design Exceptions

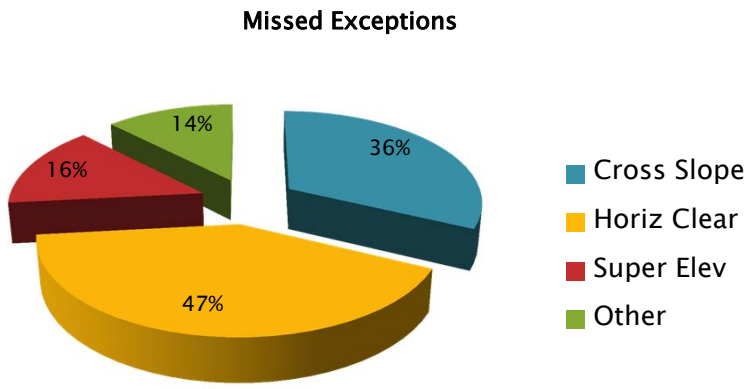
"We encourage State DOTs and local agencies to consider using design exceptions as a useful tool to achieve a design that balances project and user needs, performance, cost, environmental implications, and community values. State DOTs or local authorities must evaluate, approve, and document design exceptions."

Effective Oct 1, 2012, All NHS projects under MAP-21 must meet FHWA approved standards or receive approved Design Exceptions.

Most Common Design Exceptions

1. Shoulder Width
2. Cross Slope
3. Horizontal Clearance
4. Bridge Width
5. Stopping Sight Distance
6. Vertical Alignment
7. Structural Capacity

QAR Findings (2009-2012)



QARs: Horizontal Clearance

QARs Cross Slope

QARs: Superelevation

Design Variations

Required when proposed design elements are below the Department's criteria and where a Design Exception is not required. Some examples include:

- Border Width
- Sidewalk
- Bike Lanes
- Hand Rails
- Front Slope

- Note: See Roadway Design Bulletin 13-08 for PPM Changes.

Why do we consider Design Exceptions and Variations?

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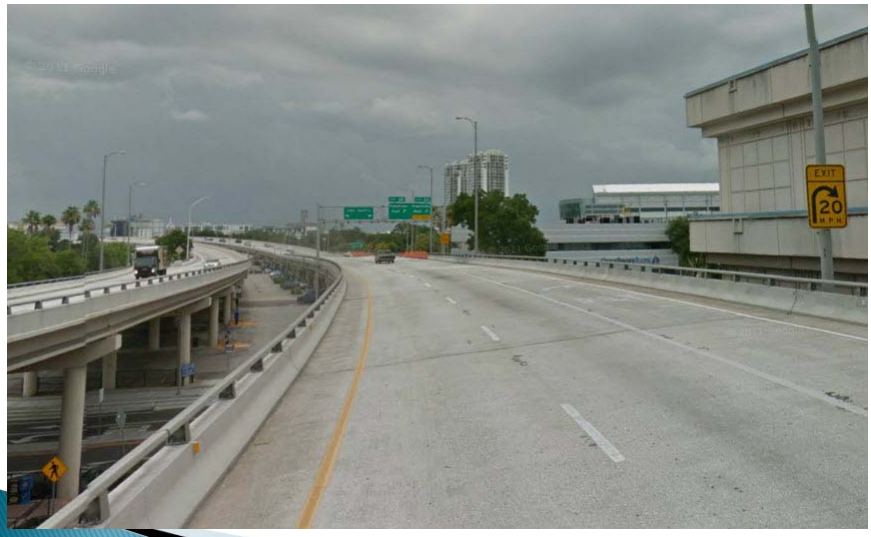

Why do we consider Design Exceptions and Variations?

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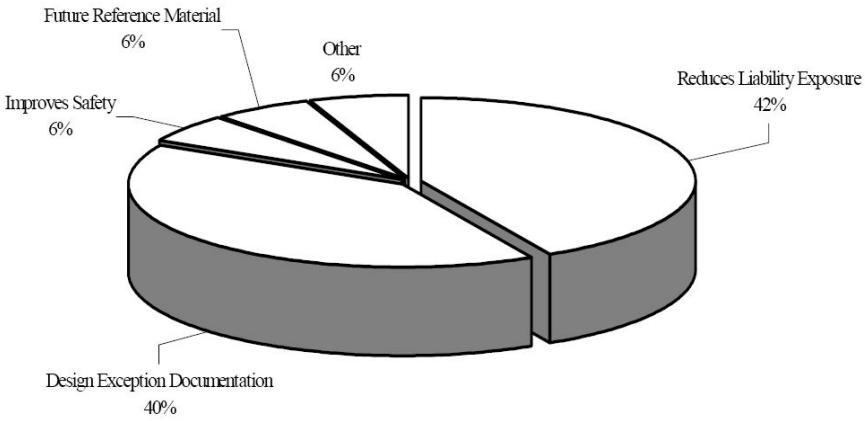
Why document?



- Source: FHWA "Developing Stronger Justification for Design Exceptions", 2009.

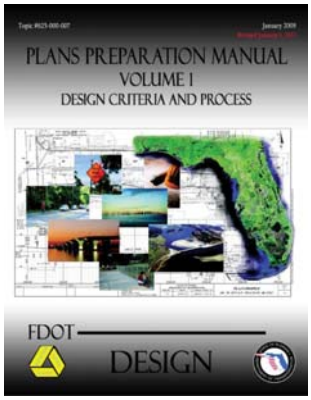
Design Project Scopes

- Set design criteria according to your scope.
  - New Construction (Design/Bid/Build)
  - RRR (D/B/B)
  - Local/LAP
  - Design/Build
  - Design/Build/Operate/Maintain/Finance
  - Drainage, Safety, and Traffic Ops Projects (Exceptions may not be required)
  - Maintenance resurfacing (Some Exclusions)

Criteria Resources:

FDOT	AASHTO
Plans Preparation Manual (PPM)	AASHTO Greenbook
Design Standards	AASHTO Interstate Standards
Structures Manual	AASHTO Roadside Design Guide

Plans Preparation Manual (PPM) 2013

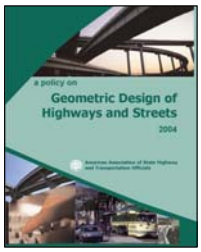


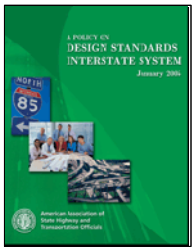
Chapter 2, 4, 23, 25

- Ch 2 and 25 New/RRR Criteria
- Ch. 4 Roadside Safety
- Ch 23 Approval processes:
  - Design Exceptions
  - Design Variations

AASHTO Criteria

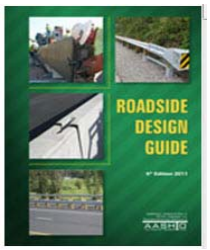
A Policy on Geometric Design of Highways and Streets (Greenbook)



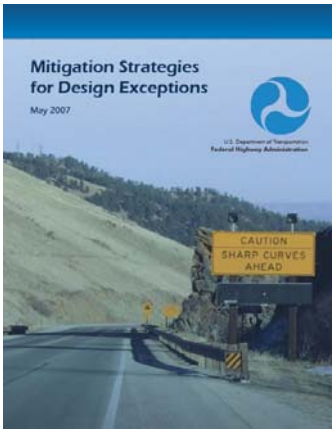


A Policy on Design Standards Interstate System

Roadside Design Guide



FHWA Mitigation Strategies for Design Exceptions



1. Basic Information
2. Design Exception Process
3. Clarifies Criteria
4. Potential Mitigation Strategies
5. Case Studies

Website: http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/index.htm/

Design Exceptions & Variations

- Safety Analysis

Defining Safety for Road Design

- NOMINAL SAFETY

examined in reference to compliance with standards, warrants, guidelines and sanctioned design procedures

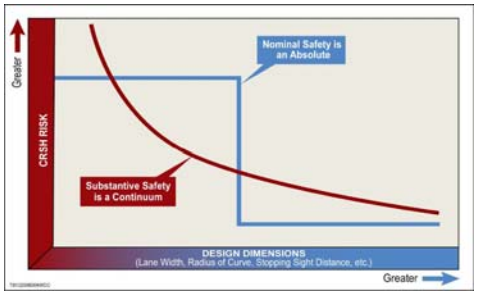
- SUBSTANTIVE SAFETY

actual or expected crash frequency and severity for a highway or roadway segment or intersection

Source: FHWA Resource Center
Developing Strong Justifications for Design Exceptions

Nominal vs. Substantive:

- Nominal safety changes abruptly along with criteria change



- Substantive safety continuously changes with changes in historical or predicted crashes.

CRFs

- CRFs (Crash Reduction Factors): Measure the percent reduction in the number of crashes as a result of the implementation of one or more countermeasures.
  - Generally used with Historical Crash Analyses
  - Apply to crashes attributable to the deficient condition. Used for the benefit portion of the B/C equation.

CMFs

- CMFs (Crash Modification Factors/AMF): measure the percentage of change in the number of crashes as a result of implementing one or more countermeasures.
  - Generally used in HSM and Predictive Analyses
  - Apply this factor to the total amount of crashes for each alternative.
  - CMF= 1- (CRF/100)

Analytical Methods and Tools

- Historical
  - Historical crash method
  - 5 Year Analysis
  - Uses Historical Crashes
  - Use CRFs.
- Predictive
  - HSM
  - RSAP
  - Design Life Analysis
  - Uses future crashes
  - Uses CMFs.

Historical Crash Method

- Compares annualized observed crashes over 5 years attributable to a deficient condition to the costs for construction to meet criteria. Uses CRFs.
  - Would like an alternative Benefit/Cost (B/C) comparison, when possible.
  - Use crash analysis detailed later with CRFs to generate annual reductions in attributable crashes.

Highway Safety Manual

- 1st Edition 2010
- FDOT Implementation under development
- "Resource that provides safety knowledge and tools in a useful form to facilitate improved decision making based on safety performance." Excerpt from 2010 HSM
- Design Exception Safety Analysis Tool

Highway Safety Manual

Safety Analysis Combinations:

- Apply Part C SPFs (Safety Performance Functions) with Part C CMFs.
- Apply Part C SPFs with Part D CMFs.
- Apply Part C SPFs with FHWA Clearinghouse CMFs.
- Apply Part D CMFs to Historical Crash rates.

- Design Exception Training with an HSM component is coming soon statewide.

Design Exception Tools

SAFETY ANALYSIS TOOLS FOR DESIGN EXCEPTIONS AND VARIATIONS (MAY 2013)

13 Controlling Design Elements	2-lane Undivided: Highway Safety Manual Part C	2-lane Undivided: Highway Safety Manual Part D	2-lane Undivided: FHWA Clearinghouse CMFs	4-lane Undivided: Highway Safety Manual Part C	4-lane Undivided: Highway Safety Manual Part D	4-lane Undivided: FHWA Clearinghouse CMFs	4-lane Divided: Highway Safety Manual Part C	4-lane Divided: Highway Safety Manual Part D	4-lane Divided: FHWA Clearinghouse CMFs	Urban & Suburban Arterials: Highway Safety Manual Part C	Urban & Suburban Arterials: Highway Safety Manual Part D	Urban & Suburban Arterials: FHWA Clearinghouse CMFs	Freeways: Highway Safety Manual Part C	Freeways: Highway Safety Manual Part D	Freeways: FHWA Clearinghouse CMFs	Speed-Change Lanes: Highway Safety Manual Part C	Speed-Change Lanes: Highway Safety Manual Part D	Speed-Change Lanes: FHWA Clearinghouse CMFs	Ramps: Highway Safety Manual Part C	Ramps: Highway Safety Manual Part D	Ramps: FHWA Clearinghouse CMFs	All Facilities: Roadside Safety Analysis Program (RSAP)	All Facilities: Historical Crash Method (HCM)	Reference ID for State Safety Office CRFs or CRF Recommended Range
Design Speed			5-Star (5)			5-Star (5)			5-Star (5)		✓	3-Star (8) 4-Star (1) 5-Star (8)			5-Star (5)								✓	45, 116
Lane Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (12) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓	✓	3-Star (4) 4-Star (6) 5-Star (8) Unrated (5)	✓	✓	3-Star (3) 4-Star (8) 5-Star (17) Unrated (5)	✓	✓	3-Star (5) 4-Star (1) 5-Star (1)	✓	✓		✓	✓			✓	18-22, 30-34, 43, 90, 95, 106, 118, 120-122, 126
Shoulder Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (15) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓	✓	3-Star (4) 4-Star (6) 5-Star (8) Unrated (5)		✓	3-Star (3) 4-Star (8) 5-Star (20) Unrated (5)	✓	✓	3-Star (5) 4-Star (1) 5-Star (1)	✓	✓		✓			✓	✓	18-22, 30-34, 43, 91, 92, 95, 106, 117, 118, 120-123, 126
Bridge Width																							✓	94
Horizontal Alignment	✓	✓										5-Star (3)	✓			✓			✓				✓	84, 96
Superelevation	✓	✓																					✓	85, 95, 96
Vertical Alignment		✓	3-Star (1) Unrated (1)																				✓	
Grade	✓	✓	3-Star (1) Unrated (1)																				✓	95
Stopping Sight Distance																							✓	104
Cross Slope																							✓	Recommended CRF Range 0.30 - 0.33
Vertical Clearance																							✓	
Horizontal Clearance (lateral offset to obstruction)	✓	✓	3-Star (4) 4-Star (2) 5-Star (7) Unrated (32)		✓	3-Star (3) 4-Star (2) 5-Star (3)		✓	3-Star (3) 4-Star (6) 5-Star (4)		✓	3-Star (3) 4-Star (2) 5-Star (1)		✓	3-Star (3) 4-Star (2) 5-Star (1)		✓		✓	✓		✓	✓	23-29, 35-38, 78-83, 101, 107, 114, 125, 127
Structural Capacity	Provide Load Rating Calculations and Maintenance Office Recommendation for Inventory Ratings less than 1.0. See FDOT Structures Design Guide Sections 1.7, 3.15.14, 4.6.10, & 7.1.1 and FDOT Bridge Load Rating Manual (http://www.dot.state.fl.us/statemaintenanceoffice/LRManual2012.pdf)																							105

NOTES:
1. The interactive version of this spreadsheet will be coming soon.
2. 1-Star (#) - Numbers in parenthesis indicate number of available FHWA Clearinghouse CMFs with its corresponding Star Rating as of May 2013. This table will be updated on an as-needed basis using the latest FHWA Clearinghouse CMFs which are updated quarterly.
3. CMF - measures the percentage of change in number of crashes as a result of implementing one or more countermeasures; typically are applied in HSM Predictive Analyses.
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5. CMF & CRF - multiplicative factors that can help identify the safety impacts of implementing one or more countermeasures. Mathematically related: CMF = 1 - (CRF / 100).
6. FDOT State Safety Office CRFs with less than 3 Projects are not recommended for use. In any analysis, no more than 3 Cumulative CMFs/CRFs should be used. Non cumulative CRFs or CRFs shall not be used together. (e.g. a stop sign and a traffic signal)
7. FHWA CRFs can be used with the Historical Crash Method.
8. References used to produce this table include:

Reference	Website
Highway Safety Manual	www.highwaysafetymanual.org
FHWA Clearinghouse	www.cmfclearinghouse.org
FDOT State Safety Office CRFs	www.dot.state.fl.us/rddesign/CSI/Tools/CRF.pdf
FDOT Roadway Design Office	www.dot.state.fl.us/rddesign/default.shtm
FHWA Desktop Reference for Crash Reduction Factors	safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011

Design Exception Tools

SAFETY ANALYSIS TOOLS FOR DESIGN EXCEPTIONS AND VARIATIONS (MAY 2013)

(Same table, notes and reference list as above, repeated with the 2-lane Undivided and 4-lane Undivided columns for Design Speed, Lane Width, Shoulder Width and Bridge Width highlighted.)

Design Exception Tools

13 Controlling Design Elements	2-lane Undivided			4-lane Undivided			High
	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	
	Part C	Part D		Part C	Part D		Part
Design Speed			5-Star (5)			5-Star (5)	
Lane Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (12) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓
Shoulder Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (15) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓
Bridge Width							
Horizontal Alignment	✓	✓					

Design Exception Tools

SAFETY ANALYSIS TOOLS FOR DESIGN EXCEPTIONS AND VARIATIONS (MAY 2013)

13 Controlling Design Elements	2-lane Undivided			4-lane Undivided			4-lane Divided			Urban & Suburban Arterials			Freeways			Speed-Change Lanes			Ramps		All Facilities			Reference ID for State Safety Office CMFs or CRF Recommended Range
	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Roadside Safety Analysis Program (RSAP)	Historical Crash Method (HCM)	
	Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D				
Design Speed			5-Star (5)			5-Star (5)			5-Star (5)		✓	3-Star (4) 4-Star (1) 5-Star (3) 5-Star (4)			5-Star (5)								✓	43, 116
Lane Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (12) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓	✓	3-Star (4) 4-Star (6) 5-Star (8) Unrated (5)	✓	✓	3-Star (4) 4-Star (6) 5-Star (17) Unrated (3)	✓	✓	5-Star (5) 6-Star (1) 5-Star (1)	✓	✓		✓	✓			✓	10-12, 30-34, 41, 91, 95, 106, 118, 120-122, 126
Shoulder Width	✓	✓	3-Star (4) 4-Star (6) 5-Star (15) Unrated (7)	✓	✓	3-Star (4) 4-Star (6) 5-Star (10) Unrated (5)	✓	✓	3-Star (4) 4-Star (6) 5-Star (8) Unrated (5)		✓	3-Star (3) 4-Star (8) 5-Star (10) Unrated (3)	✓	✓	3-Star (3) 4-Star (1) 5-Star (1) 5-Star (1)	✓	✓		✓			✓	✓	10-12, 30-34, 41, 91, 92, 95, 106, 117, 118, 120-122, 126
Bridge Width																							✓	94
Horizontal Alignment	✓	✓										5-Star (1)	✓			✓			✓				✓	94, 96
Superelevation	✓	✓																					✓	93, 95, 96
Vertical Alignment		✓	3-Star (1) Unrated (1)																				✓	
Grade	✓	✓	3-Star (1) Unrated (1)																				✓	95
Stopping Sight Distance																							✓	104
Cross Slope																							✓	Recommended CRF Range 0.40 - 0.50
Vertical Clearance																							✓	
Horizontal Clearance (lateral offset to obstruction)	✓	✓	3-Star (4) 4-Star (1) 5-Star (7) Unrated (10)		✓	3-Star (3) 4-Star (1) 5-Star (1)		✓	3-Star (3) 4-Star (6) 5-Star (4)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓		✓	✓		✓	✓	13-24, 45-48, 78-83, 101, 107, 114, 125, 127
Structural Capacity	Provide Load Rating Calculations and Maintenance Office Recommendation for Inventory Ratings less than 1.0. See FDOT Structures Design Guide Sections 1.7, 3.15.14, 4.8.10, & 7.1.1 and FDOT Bridge Load Rating Manual (http://www.dot.state.fl.us/statematerialsoffice/LRManual82012.pdf)																							115

NOTES:
1. The interactive version of this spreadsheet will be coming soon.
2. 3-Star (#) - Numbers in parenthesis indicate number of available FHWA Clearinghouse CMFs with its corresponding Star Rating as of May 2013. This table will be updated on an as-needed basis using the latest FHWA Clearinghouse CMFs which are updated quarterly.
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Highway Safety Manual	www.highwaysafetymanual.org
FHWA Clearinghouse	www.cmfclearinghouse.com
FDOT State Safety Office CMFs	www.dot.state.fl.us/safetyoffice/CMFs/CMFRP.pdf
FDOT Roadway Design Office	www.dot.state.fl.us/roadwaydesignofficebulletins
FHWA Desktop Reference for Crash Reduction Factors	www.fhwa.dot.gov/publications/research/safety/desktop/08021

Design Exception Tools

	Ramps			All Facilities		
	Highway Safety Manual		FHWA Clearinghouse CMFs	Roadside Safety Analysis Program (RSAP)	Historical Crash Method (HCM)	State Safety Office CRFs (Countermeasure IDs) or CRF Recommended Range
	Part C	Part D				
					✓	45, 116
	✓	✓			✓	18-22, 30-34, 43, 90, 95, 106, 118, 120-122, 126
	✓			✓	✓	18-22, 30-34, 43, 91, 92, 95, 106, 117, 118, 120-123, 126
					✓	94

Design Exception Tools

SAFETY ANALYSIS TOOLS FOR DESIGN EXCEPTIONS AND VARIATIONS (MAY 2013)

13 Controlling Design Elements	2-lane Undivided			4-lane Undivided			4-lane Divided			Urban & Suburban Arterials			Freeways			Speed-Change Lanes			Ramps			All Facilities		Reference ID for State Safety Office CRFs or CRF Recommended Range
	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Roadside Safety Analysis Program (RSAP)	Historical Crash Method (HCM)	
	Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D				
Design Speed			5-Star (5)			5-Star (5)			5-Star (5)		✓	3-Star (3) 4-Star (1) 5-Star (6)			5-Star (5)								✓	45, 116
Lane Width	✓	✓	3-Star (4) 4-Star (8) 5-Star (12) Unrated (7)	✓	✓	3-Star (4) 4-Star (8) 5-Star (10) Unrated (5)	✓	✓	3-Star (4) 4-Star (8) 5-Star (8) Unrated (5)	✓	✓	3-Star (4) 4-Star (8) 5-Star (172) Unrated (5)	✓	✓	4-Star (6) 5-Star (1) 5-Star (1)	✓	✓		✓	✓			✓	18-22, 30-34, 43, 90, 95, 106, 118, 120-122, 126
Shoulder Width	✓	✓	3-Star (4) 4-Star (8) 5-Star (10) Unrated (7)	✓	✓	3-Star (4) 4-Star (8) 5-Star (10) Unrated (7)	✓	✓	3-Star (4) 4-Star (8) 5-Star (8) Unrated (7)		✓	3-Star (4) 4-Star (8) 5-Star (19) Unrated (5)	✓	✓	3-Star (1) 4-Star (1) 5-Star (1)	✓	✓		✓			✓	✓	18-22, 30-34, 43, 91, 92, 95, 106, 117, 118, 120-123, 126
Bridge Width																							✓	94
Horizontal Alignment	✓	✓										5-Star (1)	✓			✓			✓				✓	94, 96
Superelevation	✓	✓																					✓	95, 95, 96
Vertical Alignment		✓	3-Star (1) Unrated (1)																				✓	
Grade	✓	✓	3-Star (1) Unrated (1)																				✓	95
Stopping Sight Distance																							✓	104
Cross Slope																							✓	Recommended CRF Range 0.40 – 0.60
Vertical Clearance																							✓	
Horizontal Clearance (lateral offset to obstruction)	✓	✓	3-Star (4) 4-Star (1) 5-Star (7) Unrated (10)		✓	3-Star (1) 4-Star (1) 5-Star (8)		✓	3-Star (1) 4-Star (6) 5-Star (8)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓		✓	✓		✓	✓	19-24, 35-40, 70-91, 115, 127, 154, 155, 157
Structural Capacity	Provide Load Rating Calculations and Maintenance Office Recommendation for Inventory Ratings less than 1.0. See ROUT Structures Design Guide Sections 1.7, 3.10.14, 6.6.10, & 7.5.1 and ROUT Bridge Load Rating Manual (http://www.dot.state.fl.us/statematerialsoffice/SMManual8/0351.pdf)																							105

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1. The interactive version of this spreadsheet will be coming soon.
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6. ROUT State Safety Office CRFs with less than 10 records are not recommended for use. In any analysis, no more than 3 Cumulative CMFs/CRFs should be used. Non-cumulative CRFs or CMFs shall not be used together. (e.g. a stop sign and a traffic signal).
7. FHWA CRFs can be used with the Historical Crash Method.
8. References used to produce this table include:

Reference	Website
Highway Safety Manual	www.highwaysafetymanual.org
FHWA Clearinghouse	www.cmfclearinghouse.org
ROUT State Safety Office CRFs	www.dot.state.fl.us/design/DR/tools/CRF.pdf
ROUT Roadway Design Office	www.dot.state.fl.us/roadwaydesignoffice/
FHWA Desktop Reference for Crash Reduction Factors	safety.fhwa.dot.gov/tools/crf-resources/Propose%20Revisions/

Design Exception Tools

		✓	104
		✓	Recommended CRF Range 0.30 - 0.33
		✓	
	✓	✓	23-29, 35-38, 78-83, 101, 107,

Design Exception Tools

SAFETY ANALYSIS TOOLS FOR DESIGN EXCEPTIONS AND VARIATIONS (MAY 2013)

13 Controlling Design Elements	2-lane Undivided			4-lane Undivided			4-lane Divided			Urban & Suburban Arterials			Freeways			Speed Change Lanes			Ramps			All Facilities		Reference ID for State Safety Office CRFs or CRF Recommended Range
	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Highway Safety Manual		FHWA Clearinghouse CMFs	Available Safety Analysis Programs (ASAP)	Historical Crash Method (HCM)	
	Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D		Part C	Part D				
Design Speed			5-Star (3)			5-Star (3)			5-Star (3)		✓	3-Star (6) 4-Star (1) 5-Star (8)			5-Star (3)								✓	45, 116
Lane Width	✓	✓	2-Star (4) 4-Star (3) 5-Star (12) Unrated (1)	✓	✓	2-Star (4) 4-Star (3) 5-Star (14) Unrated (1)	✓	✓	2-Star (4) 4-Star (3) 5-Star (8) Unrated (1)	✓	✓	2-Star (3) 4-Star (3) 5-Star (17) Unrated (3)	✓	✓	3-Star (3) 4-Star (1) 5-Star (1)	✓	✓		✓	✓				✓	10-12, 30-34, 41, 90, 95, 106, 108, 110-112, 126
Shoulder Width	✓	✓	2-Star (4) 4-Star (3) 5-Star (15) Unrated (1)	✓	✓	3-Star (4) 4-Star (3) 5-Star (13) Unrated (1)	✓	✓	3-Star (4) 4-Star (3) 5-Star (8) Unrated (1)		✓	2-Star (3) 4-Star (3) 5-Star (19) Unrated (3)	✓	✓	2-Star (1) 4-Star (1) 5-Star (1)	✓	✓		✓			✓	✓	10-12, 30-34, 41, 91, 92, 95, 106, 117, 118, 120-122, 126
Bridge Width																							✓	94
Horizontal Alignment	✓	✓										5-Star (3)	✓			✓			✓				✓	94, 96
Superelevation	✓	✓																					✓	95, 95, 96
Vertical Alignment		✓	3-Star (1) Unrated (1)																				✓	
Grade	✓	✓	3-Star (1) Unrated (1)																				✓	95
Stopping Sight Distance																							✓	104
Cross Slope																							✓	Recommended CRF Range 0.30 - 0.33
Vertical Clearance																							✓	
Horizontal Clearance (lateral offset to obstruction)	✓	✓	2-Star (4) 4-Star (1) 5-Star (7) Unrated (1)		✓	3-Star (1) 4-Star (1) 5-Star (3)		✓	3-Star (1) 4-Star (1) 5-Star (3)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓	3-Star (1) 4-Star (1) 5-Star (1)		✓		✓	✓		✓	✓	23-29, 35-38, 78-83, 101, 102, 114, 125, 127
Structural Capacity	Provide Load Rating Calculations and Maintenance Office Recommendation for Inventory Ratings less than 1.0. See KDOT Structures Design Guide Sections 1.7, 5.13.14, 6.8.10, & 7.1.1 and KDOT Bridge Load Rating Manual (http://www.dot.state.ks.us/bureaus/maintenance/files/LRMManual82012.pdf)																							105

NOTES:
1. The interactive version of this spreadsheet will be coming soon.
2. 5-Star (8) - Numbers in parenthesis indicate number of available FHWA Clearinghouse CMFs with its corresponding Star Rating as of May 2013. This table will be updated on an as needed basis using the latest FHWA Clearinghouse CMFs which are updated quarterly.
3. CMF - measures the percentage of change in number of crashes as a result of implementing one or more countermeasures. Typically are applied in HSM Predictive Analyses.
4. CRF - measures the percent reduction in number of crashes as a result of implementing one or more countermeasures. Typically are applied in Historical Crash Method Analyses.
5. CMF & CRF - multiplicative factors that can help identify the safety impacts of implementing one or more countermeasures. Mathematically related: CRF = 1 - (CMF / 100).
6. KDOT State Safety Office CRFs with less than 3 Projects are not recommended for use. In any analysis, no more than 1 Cumulative CMF/CRF should be used. Non-cumulative CMFs or CRFs shall not be used together. (e.g. a stop sign and a traffic signal).
7. FHWA CMFs can be used with the Historical Crash Method.
8. References used to produce this table include:

Reference	Website
Highway Safety Manual	www.highwaysafetymanual.org
FHWA Clearinghouse CMFs	www.cmfclearinghouse.org
KDOT State Safety Office CRFs	www.dot.state.ks.us/bureaus/traffic/safety/crf.pdf
KDOT Roadway Design Office	www.dot.state.ks.us/bureaus/design/roadway
FHWA Desktop Reference for Crash Reduction Factors	safety.fhwa.dot.gov/tools/crf/resources/fhwa99064/

Design Exception Tools: Notes

- References
- Website Links
- Special Notes for CMFs/CRFs
- Legend for acronyms in spreadsheet

NOTES:

1. The interactive version of this spreadsheet can be found on-line at the following website: www.dot.state.fl.us/rddesign/QA/Tools.shtm
2. 1-Star (#) - Numbers in parenthesis indicate number of available FHWA Clearinghouse CMFs with its corresponding Star Rating as of May 2013. This table will be updated on an as-
3. CMF - measures the percentage of change in number of crashes as a result of implementing one or more countermeasures; typically are applied in HSM Predictive Analyses
4. CRF - measures the percent reduction in number of crashes as a result of implementing one or more countermeasures; typically are applied in Historical Crash Method Analyses.
5. CMF & CRF - multiplicative factors that can help identify the safety impacts of implementing one or more countermeasures. Mathematically related: CMF = 1 - (CRF / 100).
6. FDOT State Safety Office CRFs with less than 3 Projects are not recommended for use.
7. References used to produce this table include:

Reference	Website
Highway Safety Manual	www.highwaysafetymanual.org
FHWA Clearinghouse	www.clearinghouse.org
FDOT State Safety Office CRFs	www.dot.state.fl.us/rddesign/QA/Tools/CRF.pdf
FDOT Roadway Design Office	www.dot.state.fl.us/rddesign/default.shtm
FHWA Desktop Reference for Crash Reduction Factors	safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011

Design Exceptions & Variations

- Historical Crash Analysis

Historical Crash Reports Provide Clues

Historical Crash Analysis: Bridge Width Highlights

Identify the location(s)

↓

Gather Data

↓

Analyze Crashes

District Three: SR 97 Escambia County

Historical Crash Analysis
Highlights

Establishing Limits

- Project
  - MP 0.615 – 20.070
- Bridge
  - MP 16.087 – 16.101

Historical Crash Analysis
Highlights

- Analysis Period
  - 5 Complete Years of crash data
- What Years?
  - 2007 – 2011 Minimum

Historical Crash Analysis
Highlights

- Crash Analysis Reporting (C.A.R.) System
  - Detail or Summary Reports
  - Law Enforcement Crash Reports (Long Forms)
  - **Order CARS crash records through your Project Manager.**

Detail Output (5 Year Minimum)

```
REPORT...CARPJ13-01                    FLORIDA - DEPARTMENT OF TRANSPORTATION                          PAGE NO:       2
  DATE...06/05/2013                      C A R - CRASH ANALYSIS REPORTING SYSTEM                       USERID:  RD960JF
  TIME...10:21:24                 CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS           I/O....  CARO213

COMMENT:                                  1 - SORT BY ROADWAY, MILE POINT
  FROM: 01/01/2007 TO 12/31/2011                                  RAMPS INCL
  FROM CO/SEC/SUB: 48 004 000             MP: 008.334              INFL INCL
  TO   CO/SEC/SUB: 48 004 000             MP: 010.043             CR/OS INCL

  C      ROADWYID   M     N    S   ADT   Y  M  D  H  CRCC  A H  L W R T  R  SL R A V  V  VM V PI CC D  V  V  V  V PI CC D  # # N
  R N    C S   S    I     EN   TR  VAR   E  O  A  O  RALA  L AE I E D RC OC IO O C ET EU EO E OM OA RA ET EU EM E OM OA RA    UI
  A U    O E   E    L     AO   AO  EIA   A  N  Y  U  ATAT  C RV G A   AO AO TC A C HY HS HV H IP NU IG HY HS HO H IP NU IG V K MN
  S M    U C   SC   E     RD   TA  RLF   R  T     R  SSSE    ME H T S FN DN EA D   IP IE IM   NA TS VE IP IE IV   NA TS VE E I BJ
  H B    N T   UT   P     EE   ED  AYF      H        H SG  I FN T H U FT  D  T   L CE C  CN D TC RE /  CE C  C  D TC RE /  H L EU
    E    T I   BI   O     S        G I                 O  N UT I E R IR  T  I S N L  L1 LT I  T I  P1 L  L2 L2 I  T I  P2 C L RR
    R    Y O   O    S     T        E C                 R  V L  N R F CO  N  O D   E1 E  E  R O  B1 E  E2 E  E  R O  B2 E  L E  E
                N  N    T                              Y     1 G     L  S  N  #          1 1 F1     D                2 F2     D S D  D
*****************************************************************************************************************************
828406930Y48040000 01.920 1729   95 012300 11 12 07 16 U-4DP 0 09 1 1 1 01 01 03 R 1 02 01 01 N 03 02 21 01 01 02 N 10 00 56 2 0 00
828313680Y48040000 01.930 1729   95 012300 11 11 15 16 U-4DP 0 01 2 2 1 01 01 01 R 2 01 01 01 N 01 02 65 03 01 02 N 08 00 44 3 0 02
768417400Y48040000 01.939 1729   95 016800 07 09 14 15 U-4DP 0 01 1 2 1 03 01 01 R 2 03 01 01 N 01 02 00 01 01 02 N 08 00 61 2 0 00
768432310Y48040000 01.941 1729   95 016800 07 09 18 13 U-4DP 0 01 1 1 1 05 01 03 R 2 01 01 01 N 01 02 25 01 01 02 N 08 00 38 2 0 01
768483110 48040000 01.949 1729   95 020300 08 05 20 15 U-4DP 0 01 1 1 1 03 01 02 L 1 01 01 02 S 01 02 00 01 01 02 S 08 00 18 2 0 00
768376760 48040000 01.958 1729   95 016800 07 02 10 03 U-4DP 1 03 4 2 1 05 01 02 L 2 01 01 01 S 01 77 25 01 01 01 W 04 21 21 2 0 03
768400520 48040000 01.958 1729   95 016800 07 03 28 12 U-4DP 0 01 1 1 1 03 01 01 T 1 03 01 01 W 01 77 21 01 01 02 W 08 00 46 4 0 00
768369460 48040000 01.958 1729   95 016800 07 03 31 21 U-4DP 0 01 5 3 2 05 01 03 S 2 01 01 01 W 01 02 00 01 01 02 W 08 00 31 3 0 00
768413750 48040000 01.958 1729   95 016800 07 05 30 13 U-4DP 0 06 1 3 2 05 01 02 L 1 00 00 03 N 02 03 00 01 01 01 W 13 00 26 2 0 02
768413780 48040000 01.958 1729   95 016800 07 05 31 13 U-4DP 0 01 1 2 1 05 01 02 L 2 01 01 01 W 01 02 21 01 01 02 W 08 00 32 2 0 00
768454160 48040000 01.958 1729   95 016800 07 11 03 23 U-4DP 1 00 4 1 1 05 01 02 R 2 03 01 01 N 01 00 34 01 01 01 E 03 00 56 2 0 01
768473940 48040000 01.958 1729   95 020300 08 01 18 07 U-4DP 0 01 1 1 1 03 01 02 R 2 01 01 01 E 01 02 36 01 01 02 E 08 00 63 2 0 02
770769700 48040000 01.958 1729   95 020300 08 07 16 13 U-4DP 0 03 1 1 1 05 01 02 L 1 01 01 01 W 03 03 44 03 01 01 S 01 00 28 2 0 02
770792380 48040000 01.958 1729   95 020300 08 10 22 12 U-4DP 0 03 1 2 1 05 01 02 T 1 01 01 01 W 03 20 26 01 01 01 S 02 00 42 2 0 02
770844820 48040000 01.958 1729   95 013300 09 05 23 22 U-4DP 0 03 4 2 1 05 01 02 L 2 01 01 01 N 01 11 21 01 01 01 W 01 00 19 2 0 02
770835130 48040000 01.958 1729   95 013300 09 05 24 12 U-4DP 0 03 5 2 2 05 01 02 R 1 02 01 01 W 14 11 32 01 01 01 N 06 00 17 3 0 01
770947520 48040000 01.958 1729   95 011500 10 06 13 20 U-4DP 0 03 5 1 1 05 01 02 R 1 01 01 03 E 05 06 22 01 01 01 N 02 00 33 2 0 00
770950270 48040000 01.958 1729   95 011500 10 08 08 07 U-4DP 0 01 1 2 2 03 01 03 L U 01 01 01 S 00 02 00 01 01 02 S 08 00 29 2 0 00
770963570 48040000 01.958 1729   95 011500 10 08 22 17 U-4DP 0 03 1 3 2 05 01 02 L 1 01 01 01 E 01 11 39 01 01 01 S 04 00 70 2 0 03
770990060 48040000 01.958 1729   95 011500 10 11 29 19 U-4DP 0 03 5 3 2 05 01 02 R 2 01 01 01 N 01 11 58 01 01 01 E 04 00 46 3 0 02
820337500 48040000 01.958 1729   95 012300 11 01 10 19 U-4DP 0 03 4 1 1 05 01 02 L 1 01 01 01 S 01 11 21 03 01 01 W 05 00 49 4 0 02
820721060 48040000 01.958 1729   95 012300 11 04 02 21 U-4DP 0 03 5 1 1 05 01 02 I M 01 01 03 S 02 03 31 03 01 01 N 02 00 32 2 0 10
819477390 48040000 01.958 1729   95 012300 11 11 08 10 U-4DP 0 01 1 1 1 05 01 02 I M 03 01 03 N 14 02 54 01 01 03 N 08 00 31 2 0 00
768369860 48040000 01.961 1729   95 017700 07 01 04 05 U-4DP 0 01 4 2 1 05 01 02 L 2 01 01 01 S 01 02 00 03 01 01 S 09 00 46 2 0 00
768427460 48040000 01.961 1729   95 017700 07 08 29 11 U-4DP 0 01 1 1 1 05 01 02 L L 03 01 01 S 01 02 26 01 01 02 S 08 00 77 2 0 02
770800200Y48040000 01.967 1729   95 013500 09 01 23 24 U-4DP 0 01 1 1 1 03 01 03 L 1 01 01 01 S 00 02 54 01 01 02 S 08 00 61 2 0 03
770919550Y48040000 01.967 1729   95 012000 10 03 05 19 U-4DP 0 01 5 1 1 05 01 03 L 1 03 01 01 S 01 02 53 03 01 02 S 08 00 45 2 0 01
768378220Y48040000 01.977 1729   95 017700 07 01 25 16 U-4DP 0 05 1 1 1 03 01 04 L 2 01 01 05 E 14 03 00 01 01 02 S 02 00 19 2 0 00
- - - -
```

Detail Output Legend

REPORT...CARPJ13-01
DATE...06/05/2013
TIME...10:21:24

FLORIDA - DEPARTMENT OF TRANSPORTATION
C A R - CRASH ANALYSIS REPORTING SYSTEM
CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS
CODE SHEET

PAGE NO: 1
USERID: RD960JP
I/O.... CARO113

CRASH NUMBER: THE 9 DIGIT CRASH REPORT NUMBER
ROADWAY ID: THE 8 DIGIT NUMBER THAT IDENTIFIES THE PART OF THE STATE ROAD SYSTEM ON WHICH THE CRASH HAS OCCURRED
COUNTY: THE FIRST TWO DIGITS OF THE ROADWAY ID ARE THE NUMERIC D.O.T. CODE FOR COUNTY
SECTION: THE THIRD, FOURTH AND FIFTH DIGITS OF THE ROADWAY ID ARE THE SECTION OF THE STATE ROAD SYSTEM, WITHIN COUNTY, ON WHICH THE CRASH OCCURRED
SUBSECTION: THE SIXTH, SEVENTH AND EIGHTH DIGITS OF THE ROADWAY ID IDENTIFY THE SUBDIVISION OF THE PRIMARY SECTION ON WHICH THE CRASH OCCURRED
MILEPOST: THE MILEPOST IDENTIFIES THE EXACT POINT ON THE ROADWAY ID WHERE THE CRASH HAS OCCURRED
NEAREST NODE: THE NEAREST NODE IS THE CLOSEST NODE (A DEFINED POINT ON THE STATE ROAD SYSTEM) TO THE LOCATION OF THE CRASH
STATE ROAD: THE STATE ROAD IS THE ROUTE NUMBER ASSIGNED TO THE ROADWAY ID
AVERAGE DAILY TRAFFIC: THE AVERAGE NUMBER OF VECHICLES PER DAY PASSING THE MILE POINT WHERE CRASHES OCCURRED
YEAR: THE YEAR IN WHICH THE CRASH OCCURRED (FINAL TWO DIGITS)
MONTH: THE MONTH OF THE CRASH
DAY: THE DAY OF THE MONTH ON WHICH THE CRASH OCCURRED
HOUR: THE TIME AT WHICH THE CRASH OCCURRED, MILITARY TIME
CRASH RATE CLASS CATEGORY: THIS FIVE-LETTER/NUMBER CODE IS A COMBINATION OF RURAL/URBAN/ SUBURBAN CLASSIFICATION, NUMBER OF LANES, DIVIDED/UNDIVIDED CODE, TYPE OF MEDIAN AND SUBSECTION TYPE. FOR THOSE NOT OTHERWISE DEFINED BELOW:
- A FIRST LETTER "U" MEANS "URBAN" (CURB & GUTTER), "S" MEANS "SUBURBAN", (OPEN DRAINAGE INSIDE CITY OR URBAN AREA), "R" MEANS RURAL (OPEN DRAINAGE OUTSIDE CITY OR URBAN AREA).
- AFTER THE HYPHEN (-) THE NUMBER GIVES THE NUMBER OF THRU LANES: "2" MEANS 2-3, "4" MEANS 4-5, "6" MEANS 6 OR MORE.
- THE LETTER IN THE 4TH POSITION DISTINGUISHES DIVIDED ("D") FROM UNDIVIDED ("UN")
- THE LETTER IN THE FINAL POSITION INDICATES THE TYPE OF MEDIAN: "R" FOR RAISED, "P" FOR PAINTED AND "UN" FOR NOT DIVIDED.
- "INT" MEANS INTERSTATE
- "TOL" MEANS TOLL ROAD
- "OLA" MEANS OTHER LIMITED ACCESS
- "RAMP" MEANS RAMP
- "1WAY" MEANS ONE WAY
- "UNKN" MEANS UNKNOWN

ALC INV: ALCOHOL INVOLVED CODE, COMBINED CRASH-LEVEL CODE FOR ALL OF DRIVERS AND PEDESTRIANS INVOLVED IN CRASH
0 - NONE
1 - ALCOHOL INVOLVED
2 - DRUGS INVOLVED
3 - ALCOHOL AND DRUGS
4 - UNDETERMINED

HARMFUL EVENT 1: FIRST HARMFUL EVENT FOR FAULT/1ST VEHICLE AS REPORTED BY OFFICER
00 - UNKNOWN/NOT CODED
01 - REAR-END
02 - HEAD-ON
03 - ANGLE
04 - LEFT-TURN
05 - RIGHT-TURN
06 - SIDESWIPE
07 - BACKED INTO
08 - COLL. W/ PARKED CAR
09 - COLL. W/ MV ON ROADWAY
10 - COLL. W/ PEDESTRIAN
11 - COLL. W/ BICYCLE
12 - COLL. W/ BICYCLE (BIKE LANE)
13 - COLLISION WITH MOPED
14 - COLLISION WITH TRAIN
15 - COLLISION WITH ANIMAL
16 - HIT SIGN/SIGN POST
17 - UTILITY/LIGHT POLE
18 - HIT GUARDRAIL
19 - HIT FENCE
20 - HIT CONC. BARRIER WALL
21 - HIT BRIDGE/PIER/ ABUTMENT/RAIL
22 - HIT TREE/SHRUBBERY
23 - COLL. W/CONSTRUCTION BARRICADE/SIGN
24 - COLL. W/TRAFFIC GATE
25 - COLL. W/CRASH ATTENUATORS
26 - COLL. W/FIXED OBJECT ABOVE ROAD
27 - HIT OTHER FIXED OBJECT
28 - COLL. W/MOVEABLE OBJECT ON ROAD
29 - RAN IN DITCH/CULVERT
30 - RAN OFF RD INTO WATER
31 - OVERTURNED
32 - OCCUPANT FELL FROM VEH
33 - JACKKNIFED
34 - FIRE
35 - EXPLOSION
36 - DOWNHILL RUNAWAY
37 - CARGO LOSS OR SHIFT
38 - SEPARATION OF UNITS
39 - MEDIAN CROSSOVER
77 - ALL OTHER (EXPLAIN)

LIGHTING: LIGHTING CONDITIONS AT TIME OF CRASH, AS REPORTED BY OFFICER
01 - DAYLIGHT 02 - DUSK
03 - DAWN
04 - DARK (STREET LIGHT)
05 - DARK (NO STREET LIGHT)
88 - UNKNOWN

WEATHER: WEATHER CONDITIONS AT TIME OF CRASH, AS REPORTED BY OFFICER
01 - CLEAR 02 - CLOUDY
03 - RAIN 04 - FOG
77 - ALL OTHER 88 - UNKNOWN

RD SURF: ROAD SURFACE CONDITIONS AT TIME OF CRASH, AS REPORTED BY OFFICER
01 - DRY 02 - WET
03 - SLIPPERY 04 - ICY
77 - ALL OTHER 88 - UNKNOWN

TRAFFIC CONTROL: TRAFFIC CONTROL AT SITE OF CRASH, AS REPORTED BY OFFICER
00 - UNKNOWN/NOT CODED
01 - NO CONTROL
02 - SPECIAL SPEED ZONE
03 - SPEED CONTROL SIGN
04 - SCHOOL ZONE
05 - TRAFFIC SIGNAL
06 - STOP SIGN
07 - YIELD SIGN
08 - FLASHING LIGHT
09 - RAILROAD SIGNAL
10 - OFFICER/GUARD/FLAGMAN
11 - POSTED NO U-TURN
12 - NO PASSING ZONE
77 - ALL OTHER

ROAD CONDTNS: ROAD CONDITIONS AT TIME AND LOCATION OF CRASH, AS REPORTED BY OFFICER
00 - UNKNOWN/NOT CODED
01 - NO DEFECTS
02 - OBSTRUCTION W/ WARNING
03 - OBSTRUCTION WO WARNING
04 - ROAD UNDER REPAIR/ CONSTRUCTION
05 - LOOSE SURFACE MATERIAL
06 - SHLDR - SOFT/LOW/HIGH
07 - HOLES/RUTS/UNSAFE PAVED EDGES
08 - STANDING WATER
09 - WORN/POLISHED RD SURF
77 - ALL OTHER (EXPLAIN)

SITE LOCATION: D.O.T. SITE LOCATION AS CODED BY SAFETY OFFICE
01 - NOT AT INTERSECTION/ RRXING/BRIDGE
02 - AT INTERSECTION
03 - INFLUENCED BY INTERSECTION
04 - DRIVEWAY ACCESS
05 - RAILROAD CROSSING
06 - BRIDGE
07 - ENTRANCE RAMP
08 - EXIT RAMP
09 - PARKING LOT (PUBLIC)
10 - PARKING LOT (PRIVT)
11 - PRIVATE PROPERTY
12 - TOLL BOOTH
13 - PUBLIC BUS STOP ZONE
77 ALL OTHER

Detail Output Legend

REPORT...CARPJ13-01
DATE...06/05/2013
TIME...10:21:24

FLORIDA - DEPARTMENT OF TRANSPORTATION
C A R - CRASH ANALYSIS REPORTING SYSTEM
CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS
CODE SHEET

PAGE NO: 2
USERID: RD960JF
I/O.... CARO113

ROAD SD: SIDE OF ROAD, AS REPORTED BY FLORIDA DEPT OF TRANSPORTATION SAFETY OFFICE FOR FIRST POINT OF IMPACT IN CRASH
E - END OF STATE ROAD
I - INTERSECTION
L - LEFT
M - MEDIAN
R - RIGHT
S - SIDE ROAD RIGHT
T - SIDE ROAD LEFT
U - UNKNOWN

ACC LN #: ACCIDENT LANE LOCATION, AS REPORTED BY FLORIDA DEPT OF TRANSPORTATION SAFETY OFFICE FOR FIRST POINT OF IMPACT IN CRASH
A - ACCEL/MERGE LANE
B - TOLL PLAZAS
C - CROSSWALK
E - END OF STATE ROAD
H - ISLAND AREA
K - SERVICE/ACCESS ROAD
L - LEFT TURN LANE
M - MEDIAN
P - PARKING LANE
R - RIGHT TURN LANE
S - SIDE OF THE ROAD
T - CONTINUOUS TURN LANE (CENTER)
U - UNKNOWN
V - BICYCLE LANE
X - RAMP
1 - 9 THROUGH-LANE (NUMBERED FROM CENTER)

VEHICLE TYPE 1 OR 2: VEHICLE TYPE FOR FIRST OR SECOND VEHICLE, AS REPORTED BY THE OFFICER
00 - UNKNOWN/NOT CODED
01 - AUTOMOBILE
02 - PASSENGER VAN
03 - PICKUP/LIGHT TRUCK (2 REAR TIRES)
04 - MEDIUM TRUCK (4 REAR TIRES)
05 - HEAVY TRUCK (2 OR MORE REAR AXLES)
06 - TRUCK TRACTOR (CAB)
07 - MOTOR HOME (RV)
08 - BUS (DRIVR + 9-15 PASS)
09 - BUS (DRIVR + > 15 PASS)
10 - BICYCLE
11 - MOTORCYCLE
12 - MOPED
13 - ALL TERRAIN VEHICLE
14 - TRAIN
15 - LOW SPEED VEHICLE
77 - OTHER

VEHICLE USE 1 OR 2: VEHICLE USE FOR FIRST OR SECOND VEHICLE, AS REPORTED BY THE OFFCER
00 - N/A
01 - PRIVATE TRANSPORTATION
02 - COMMERCIAL PASSENGERS
03 - COMMERCIAL CARGO
04 - PUBLIC TRANSPORTATION
05 - PUBLIC SCHOOL BUS
06 - PRIVATE SCHOOL BUS
07 - AMBULANCE
08 - LAW ENFORCEMENT
09 - FIRE/RESCUE
10 - MILITARY
11 - OTHER GOVERNMENT
12 - DUMP
13 - CONCRETE MIXER
14 - GARBAGE OR REFUSE
15 - CARGO VAN
77 - OTHER
88 - UNKNOWN/DUMMY RECORD

VEHICLE MOVMNT 1 OR 2: VEHICLE MOVEMENT FOR FIRST OR SECOND VEHICLE, AS REPORTED BY THE OFFICER
01 - STRAIGHT AHEAD
02 - SLOWING/STOPPED/STALLED
03 - MAKING LEFT TURN
04 - BACKING
05 - MAKING RIGHT TURN
06 - CHANGING LANES
07 - ENTRNG/LVNG PRKING SPCE
08 - PROPERLY PARKED
09 - IMPROPERLY PARKED
10 - MAKING U-TURN
11 - PASSING
12 - DRIVERLESS/RUNAWAY VEH
77 - ALL OTHERS
88 - UNKNOWN

VEH DIR1 OR DIR 2: VEHICLE DIRECTION FOR FIRST OR SECOND VEHICLE, AS REPORTED BY THE OFFICER
E - EAST N - NORTH
S - SOUTH U - UNKNOWN
W - WEST

POINT OF IMPACT 1 OR 2: POINT OF IMPACT FOR FIRST OR SECOND VEHICLE, AS REPORTED BY THE OFFICER
00 - NOT APPLICABLE
01 - FRONT END
02 - RIGHT FRONT CORNER
03 - RIGHT FRONT QUTR PANEL
04 - RIGHT FRONT DOOR
05 - RIGHT REAR DOOR
06 - RIGHT REAR QUTR PANEL
07 - RIGHT REAR CORNER
08 - REAR END
09 - LEFT REAR CORNER
10 - LEFT REAR QUTR PANEL
11 - LEFT REAR DOOR
12 - LEFT FRONT DOOR
13 - LEFT FRONT QUTR PANEL
14 - LEFT FRONT CORNER
15 - HOOD
16 - ROOF
17 - TRUNK
18 - UNDERCARRIAGE
19 - OVERTURN
20 - WINDSHIELD
21 - TRAILER
88 - UNKNOWN

CONTRIB CAUSE 1 OR 2: DRIVER CONTRIBUTING CAUSE FOR FIRST OR SECOND VEHICLE DRIVER, AS REPORTED BY THE OFFICER
00 - UNKNOWN/NOT CODED
01 - NO IMPROPER DRVNG/ACT
02 - CARELESS DRIVING
03 - FAILED TO YIELD
04 - IMPROPER BACKING
05 - IMPROPER LANE CHANGE
06 - IMPROPER TURN
07 - ALCHOL-UNDER INFL
08 - DRUGS-UNDER INFLUENCE
09 - ALC & DRUGS-UNDER INFL
10 - FOLLOWED TOO CLOSELY
11 - DISREGARDED TRAFF SGNL
12 - EXCEEDED SAFE SPD LMT
13 - DISREGARDED STOP SIGN
14 - FAILED TO MAINTAIN EQUIPMENT/VEHICLE
15 - IMPROPER PASSING
16 - DROVE LEFT OF CENTER
17 - EXCEED STATED SPD LMT
18 - OBSTRUCTING TRAFFIC
19 - IMPROPER LOAD
20 - DISREGARDED OTHER TRAFFIC CONTROL
21 - DRIVING WRONG SIDE/WAY
22 - FLEEING POLICE
23 - VEHICLE MODIFIED
24 - DRIVER DISTRACTION
77 - ALL OTHER (EXPLAIN)

DRIVER/PED AGE 1 OR 2: DRIVER OR PEDESTRIAN AGE FOR FORM SECTION 1 OR 2, AS REPORTED BY THE OFFICER
VEHCLS: TOTAL NUMBER OF VEHICLES INVOLVED IN THE CRASH. IF THE NUMBER IS HIGHER THAN 9 THEN THIS FIELD WILL DISPLAY AN ASTERISK (*).
KILLED: TOTAL NUMBER OF FATALITIES AS A RESULT OF THE CRASH. IF THE NUMBER IS HIGHER THAN 9 THEN THIS FIELD WILL DISPLAY AN ASTERISK (*).
NUMBER INJURED: TOTAL NUMBER OF INJURIES AS A RESULT OF THE CRASH. IF THE NUMBER IS HIGHER THAN 99 THEN THIS FIELD WILL DISPLAY ASTERISKS(**).

Y: THE "Y" THAT SOMETIMES APPEARS BETWEEN THE COLUMNS FOR CRASH NUMBER AND ROADWAY ID, IS A FLAG THAT IDENTIFIES CRASHES THAT ARE ON OTHER SR'S OR ON NON-MAINTAINED SIDE ROADS. THESE CRASHES ARE OCCURRING WITHIN 250 FEET OF THE QUERIED SR AND ARE CLASSIFIED AS INFLUENCED CRASHES. CRASHES ON OTHER ROADWAYS WHICH ARE AT THE INTERSECTION WITH THE QUERIED SR WILL ALWAYS BE REPORTED AND WILL NOT SHOW THIS FLAG.

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REPORT...CARPJ13-01                    FLORIDA - DEPARTMENT OF TRANSPORTATION                    PAGE NO:      2
  DATE...06/05/2013                      C A R - CRASH ANALYSIS REPORTING SYSTEM                 USERID:  RD960JF
  TIME...10:21:24                CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS      I/O....  CAR0213

COMMENT:                                1 - SORT BY ROADWAY, MILE POINT
  FROM: 01/01/2007 TO 12/31/2011                                  RAMPS INCL
  FROM CO/SEC/SUB: 48 004 000            MP: 008.334               INFL INCL
  TO   CO/SEC/SUB: 48 004 000            MP: 010.043              CR/OS INCL

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R N    C S   S   I    EN   TR   VAR   E O  A  O  RALA L AE I E D RC OC IO O C ET EU EO E OM OA RA ET EU EM E OM OA RA    UI
A U    O E   E   L    AO   AO   EIA   A N  Y  U  ATAT C RV G A   AO AO TC A C HY HS HV H IP NU IG HY HS HO H IP NU IG V K MN
S M    U C   SC  E    RD   TA   RLF   R T     R  SESE   ME H T S FN DN EA D   IP IE IM   NA TS VE IP IE IV   NA TS VE E I BJ
H B    N T   UT  P    EE   ED   AYF       H        H SG I FN T H U FT D T  L CE C CN D TC RE / CE C  C  D TC RE /  H L EU
E      T I   BI  O    S        G I                  O N UT I E R IR T I S N L L1 LT I T I P1 L L2 L2 I T I P2 C L RR
R      Y O   O   S    T        E C                  R V L N R F CO N O D  E1 E E RO B1 E E2 E E RO B2 E L E E
       N     N   T                                  Y   1 G     L S N  #       1 1 F1   D       2 F2     D S D D
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819477390Y48040000 01.958 1729   95 012300 11 11 08 10 U-4DP 0 01 1 1 1 05 01 02 I M 03 01 03 N 14 02 54 01 01 03 N 08 00 31 2 0 00
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REPORT...CARPJ13-01                       FLORIDA - DEPARTMENT OF TRANSPORTATION                    PAGE NO:        2
  DATE...06/05/2013                       C A R - CRASH ANALYSIS REPORTING SYSTEM                   USERID:   RD960JF
  TIME...10:21:24                CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS           I/O....   CARO213

COMMENT:                                   1 - SORT BY ROADWAY, MILE POINT
  FROM: 01/01/2007 TO 12/31/2011                             RAMPS INCL
  FROM CO/SEC/SUB: 48 004 000              MP: 008.334        INFL INCL
  TO   CO/SEC/SUB: 48 004 000              MP: 010.043       CR/OS INCL

 C        ROADWYID   M      N    S    ADT   Y  M  D  H  CRCC  A H  L W R T  R  SL R A V  V  VM V PI CC D  V  V  V  V PI CC D  # # N
 R N      C S   S    I      EN   TR   VAR   E  O  A  O  RALA  L AE I E D RC OC IO O C ET EU BO E OM OA RA ET EU EM E OM OA RA     UI
 A U      O E   E    L      AO   AO   EIA   A  N  Y  U  ATAT  C RV G A   AO AO TC A C HY HS HV H IP NU IG HY HS HO H IP NU IG V K MN
 S M      U C  SC    E      RD   TA   RLF   R  T     R  SESE    ME H T S FN DN EA D   IP IE IM   NA TS VE IP IE IV   NA TS VE E I BJ
 H B      N T  UT    P      EE   ED   AYF      H        H SG  I FN T H U FT D  T   L CE C  CN D TC RE /  CE C  C  D TC RE /  H L EU
   E      T I  BI    O      S         G I                  O  N UT I E R IR T  I S N L  L1 LT I  T I  P1 L  L2 L2 I  T I  P2 C L RR
   R      Y O   O    S      T         E C                  R  V L  N R F CO N  O D   E1 E  E  R O  B1 E  E2 E  E  R O  B2 E  L E  E
            N   N    T                                     Y     1 G     L S  N  #      1 1 F1    D           2 F2    D  S D  D
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828313680Y48040000 01.930 1729   95 012300 11 11 15 16 U-4DP 0 01 2 2 1 01 01 01 R 2 01 01 01 N 01 02 65 03 01 02 N 08 00 44 3 0 02
768417400Y48040000 01.939 1729   95 016800 07 09 14 15 U-4DP 0 01 1 2 1 03 01 01 R 2 03 01 01 N 01 02 00 01 01 02 N 08 00 61 2 0 00
768432310Y48040000 01.941 1729   95 016800 07 09 18 13 U-4DP 0 01 1 1 1 05 01 03 R 2 01 01 01 N 01 02 25 01 01 02 N 08 00 38 2 0 01
768483110 48040000 01.949 1729   95 020300 08 05 20 15 U-4DP 0 01 1 1 1 03 01 02 L 1 01 01 02 C 01 02 00 01 01 02 C 08 00 18 2 0 00
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768400520 48040000 01.958 1729   95 016800 07 03 20 12 U-4DP 0 01 1 1 1 03 01 01 T 1 03 01 01 W 01 77 21 01 01 02 W 00 00 46 4 0 00
768369460 48040000 01.958 1729   95 016800 07 03 31 21 U-4DP 0 01 5 3 2 05 01 03 S 2 01 01 01 W 01 02 00 01 01 02 W 08 00 31 3 0 00
768413750 48040000 01.958 1729   95 016800 07 05 30 13 U-4DP 0 06 1 3 2 05 01 02 L 1 00 00 03 N 02 03 00 01 01 01 W 13 00 26 2 0 02
768413780 48040000 01.958 1729   95 016800 07 05 31 13 U-4DP 0 01 1 2 1 05 01 02 L 2 01 01 01 W 01 02 21 01 01 02 W 08 00 32 2 0 00
768454160 48040000 01.958 1729   95 016800 07 11 03 23 U-4DP 1 00 4 1 1 05 01 02 R 2 03 01 01 N 01 00 34 01 01 01 E 03 00 56 2 0 01
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768378220Y48040000 01.977 1729   95 017700 07 01 25 16 U-4DP 0 05 1 1 1 03 01 04 L 2 01 01 05 E 14 03 00 01 01 02 S 02 00 19 2 0 00
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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711602780 48070000 02.686 0245  291 020100 07 03 04 21 S-4DP 0 77 4 1 1 05 01 02 R 2 03 01 01 N 01 02 42 01 01 02 N 08 00 51 2 0 03
809429570 48070000 02.686 0245  291 020100 07 06 19 07 S-4DP 0 02 1 2 1 05 01 02 I M 01 01 03 E 01 03 47 01 01 01 W 14 00 47 2 0 01
801563050 48070000 02.686 0245  291 020100 07 11 17 22 C-4DP 0 04 4 1 1 05 01 02 L 2 03 01 03 N 14 01 41 01 01 01 C 01 00 46 2 0 02
801521620 48070000 02.686 0245  291 005700 08 03 23 06 C-4DP 0 04 4 1 1 05 01 03 L 1 01 01 03 W 02 03 18 01 01 01 C 14 00 59 2 0 00
801544950 48070000 02.686 0245  291 005700 08 03 14 11 S-4DP 0 03 1 2 1 05 01 02 R L 01 01 03 N 02 03 27 01 01 01 S 14 00 44 2 0 00
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Caution should be used with eliminating crash reports to review!


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REPORT...CARPJ13-01                       FLORIDA - DEPARTMENT OF TRANSPORTATION                    PAGE NO:        2
  DATE...06/05/2013                       C A R - CRASH ANALYSIS REPORTING SYSTEM                   USERID:   RD960JF
  TIME...10:21:24                CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS           I/O....   CARO213

COMMENT:                                   1 - SORT BY ROADWAY, MILE POINT
  FROM: 01/01/2007 TO 12/31/2011                             RAMPS INCL
  FROM CO/SEC/SUB: 48 004 000              MP: 008.334        INFL INCL
  TO   CO/SEC/SUB: 48 004 000              MP: 010.043       CR/OS INCL

 C        ROADWYID   M      N    S    ADT   Y  M  D  H  CRCC  A H  L W R T  R  SL R A V  V  VM V PI CC D  V  V  V  V PI CC D  # # N
 R N      C S   S    I      EN   TR   VAR   E  O  A  O  RALA  L AE I E D RC OC IO O C ET EU BO E OM OA RA ET EU EM E OM OA RA     UI
 A U      O E   E    L      AO   AO   EIA   A  N  Y  U  ATAT  C RV G A   AO AO TC A C HY HS HV H IP NU IG HY HS HO H IP NU IG V K MN
 S M      U C  SC    E      RD   TA   RLF   R  T     R  SESE    ME H T S FN DN EA D   IP IE IM   NA TS VE IP IE IV   NA TS VE E I BJ
 H B      N T  UT    P      EE   ED   AYF      H        H SG  I FN T H U FT D  T   L CE C  CN D TC RE /  CE C  C  D TC RE /  H L EU
   E      T I  BI    O      S         G I                  O  N UT I E R IR T  I S N L  L1 LT I  T I  P1 L  L2 L2 I  T I  P2 C L RR
   R      Y O   O    S      T         E C                  R  V L  N R F CO N  O D   E1 E  E  R O  B1 E  E2 E  E  R O  B2 E  L E  E
            N   N    T                                     Y     1 G     L S  N  #      1 1 F1    D           2 F2    D  S D  D
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768432310Y48040000 01.941 1729   95 016800 07 09 18 13 U-4DP 0 01 1 1 1 05 01 03 R 2 01 01 01 N 01 02 25 01 01 02 N 08 00 38 2 0 01
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820337500 48040000 01.958 1729   95 012300 11 01 10 19 U-4DP 0 03 4 1 1 05 01 02 L 1 01 01 01 S 01 11 21 03 01 01 W 05 00 49 4 0 02
820721060 48040000 01.958 1729   95 012300 11 04 02 21 U-4DP 0 03 5 1 1 05 01 02 I M 01 01 03 S 02 03 31 03 01 01 N 02 00 32 2 0 10
819477390 48040000 01.958 1729   95 012300 11 11 08 10 U-4DP 0 01 1 1 1 05 01 02 I M 03 01 03 N 14 02 54 01 01 03 N 08 00 31 2 0 00
768369860 48040000 01.961 1729   95 017700 07 01 04 05 U-4DP 0 01 4 2 1 05 01 02 L 2 01 01 01 S 01 02 00 03 01 01 S 09 00 46 2 0 00
768427460 48040000 01.961 1729   95 017700 07 08 29 11 U-4DP 0 01 1 1 1 05 01 02 L L 03 01 01 S 01 02 26 01 01 02 S 08 00 77 2 0 02
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770919550Y48040000 01.967 1729   95 012000 10 03 05 19 U-4DP 0 01 5 1 1 05 01 03 L 1 03 01 01 S 01 02 53 03 01 02 S 08 00 45 2 0 01
768378220Y48040000 01.977 1729   95 017700 07 01 25 16 U-4DP 0 05 1 1 1 03 01 04 L 2 01 01 05 E 14 03 00 01 01 02 S 02 00 19 2 0 00
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822047330Y48003000 02.679 1369  289 017000 11 04 12 18 U-4DP 0    1 1 1 05 01 03 R 1                00 01 01 01 N 09    30 2 0 00
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
735524640 48070000 02.686 0245  291 020100 07 01 02 11 S-4DP 0 77 1 1 1 05 01 02 R 1 00 00 05    00 03 00 03 01 01 N 08 00 00 3 0 00
711602780 48070000 02.686 0245  291 020100 07 03 04 21 S-4DP 0 77 4 1 1 05 01 02 R 2 03 01 01 N 01 02 42 01 01 02 N 08 00 51 2 0 03
809429570 48070000 02.686 0245  291 020100 07 06 19 07 S-4DP 0 02 1 2 1 05 01 02 I M 01 01 03 E 01 03 47 01 01 01 W 14 00 47 2 0 01
801563050 48070000 02.686 0245  291 020100 07 11 17 22 C-4DP 0 04 4 1 1 05 01 02 L 2 03 01 03 N 14 01 41 01 01 01 C 01 00 46 2 0 02
801521620 48070000 02.686 0245  291 005700 08 03 23 06 C-4DP 0 04 4 1 1 05 01 03 L 1 01 01 03 W 02 03 18 01 01 01 C 14 00 59 2 0 00
801544950 48070000 02.686 0245  291 005700 08 03 14 11 S-4DP 0 03 1 2 1 05 01 02 R L 01 01 03 N 02 03 27 01 01 01 S 14 00 44 2 0 00
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REPORT...CARPJ13-01                FLORIDA - DEPARTMENT OF TRANSPORTATION                     PAGE NO:       2
  DATE...06/05/2013                C A R - CRASH ANALYSIS REPORTING SYSTEM                    USERID:  RD960JF
  TIME...10:21:24           CRASH DATA DETAIL AND EXTRACT FOR STATE-MAINTAINED ROADS         I/O....  CARO213

COMMENT:                              1 - SORT BY ROADWAY, MILE POINT
  FROM: 01/01/2007 TO 12/31/2011                              RAMPS INCL
  FROM CO/SEC/SUB: 48 004 000        MP: 008.334                INFL INCL
  TO   CO/SEC/SUB: 48 004 000        MP: 010.043              CR/OS INCL

   C     ROADWYID   M      N    S    ADT   Y  M  D  H  CRCC  A H  L W R T  R  SL R A V  V  VM V PI CC D  V  V  V  V PI CC D  # # N
  R N    C S   S    I      EN   TR   VAR   E  O  A  O  RALA  L AE I E D RC OC IO O C ET EU EO E OM OA RA ET EU EM E OM OA RA     UI
  A U    O E   E    L      AO   AO   EIA   A  N  Y  U  ATAT  C RV G A   AO AO TC A C HY HS HV H IP NU IG HY HS HO H IP NU IG V K MN
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  H B    N T  UT    P      EE   ED   AYF      H        H SG  I FN T H U FT  D  T   L CE C  CN D TC RE /  CE C  C  D TC RE /  H L EU
    E    T I  BI    O      S         G I                  O  N UT I E R IR  T  I S N L  L1 LT I  T I  P1 L  L2 L2 I  T I  P2 C L RR
    R    Y O   O    S      T         E C                  R  V L  N R F CO  N  O D   E1 E  E  R O  B1 E  E2 E  E  R O  B2 E  L E  E
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770919550 48040000 01.967 1729   95 012000 10 03 05 19 U-4DP 0 01 5 1 1 05 01 03 L 1 03 01 01 S 01 02 53 03 01 02 S 08 00 45 2 0 01
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822047330 48003000 02.679 1369  289 017000 11 04 12 18 U-4DP 0    1 1 1 05 01 03 R 1                00 01 01 01 N 09    38 2 0 00
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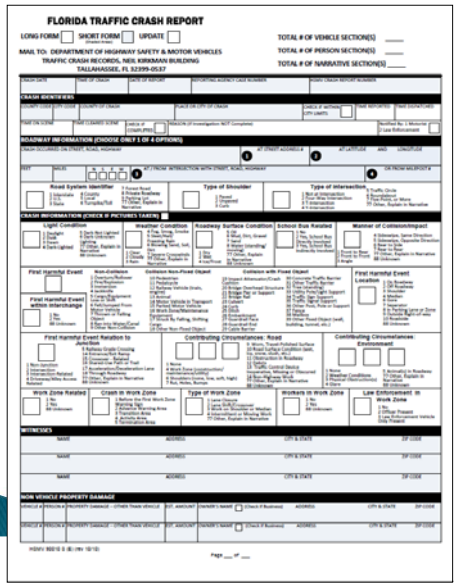
801521620 48070000 02.686 0245  291 005700 08 02 23 06 S-4DP 0 04 4 1 1 05 01 02 L 1 01 01 03 W 02 03 18 01 01 01 C 14 00 59 2 0 00
801544950 48070000 02.686 0245  291 005700 08 03 14 11 S-4DP 0 03 1 2 1 05 01 02 R L 01 01 03 N 02 03 27 01 01 01 S 14 00 44 2 0 00
```

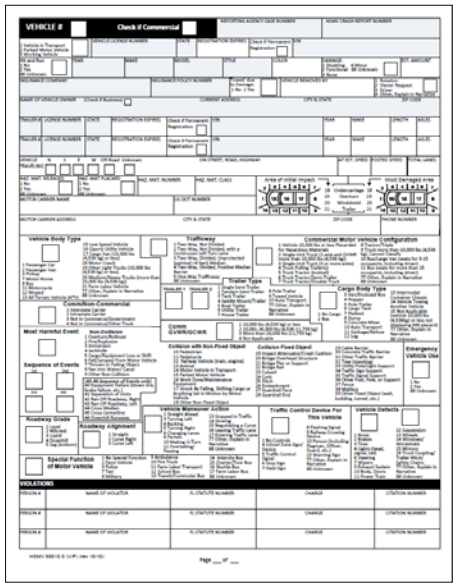
Historical Crash Analysis
Highlights

Identify the location(s) → **Gather Data** → Analyze Crashes

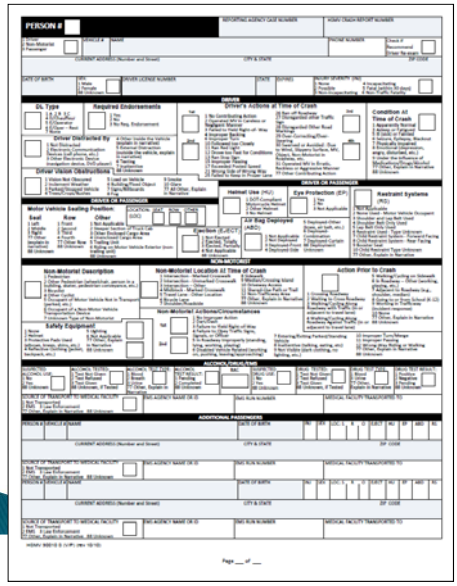
- Crash Analysis Reporting (C.A.R.) System
  - Detail or Summary Reports
  - Law Enforcement Crash Reports (Long Forms)

HSMV 90010 S – New Crash Report





HSMV 90010 S – New Crash Report



ONLY the Crash Reports Tells the Story

Historical Crash Analysis
Highlights

Identify the location(s)

↓

Gather Data

↓

Analyze Crashes

- Contributing Factors
  - Road Condition (Road design)**
  - Human (Driver behavior)
  - Vehicle (Vehicle design and maintenance)
  - Environmental (Weather)

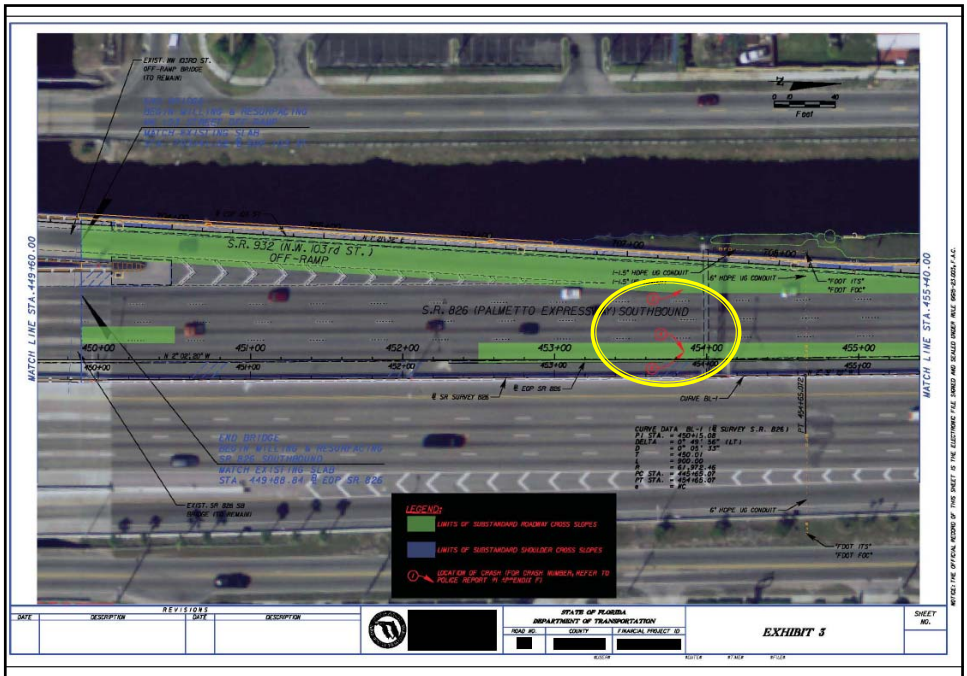
Historical Crash Analysis
Highlights

- Crash Patterns
  - Identify Crash Patterns and Significant Trends.

Cross Slope Example: Crash Analysis

A Design Exception Request for Substandard (flat) Cross Slope on a RRR Project:

- 5 years of crash data reveals 434 crashes within the design exception limits.
- 61 occurred under wet pavement conditions.
- Further evaluation of the police reports indicate 8 out of 61 crashes which occurred under wet pavement conditions may have been attributed to substandard cross slope.
- A crash diagram was used for further evaluation.



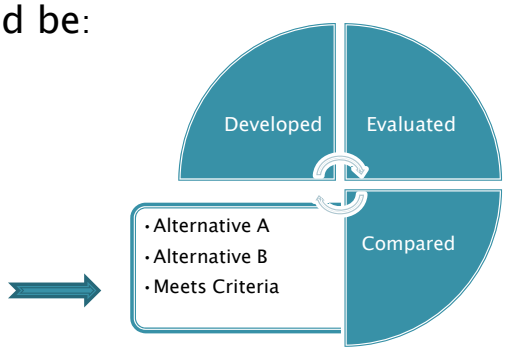
Crash Numbers: 4, 5 & 11

Design Exceptions & Variations

- Economic Analysis

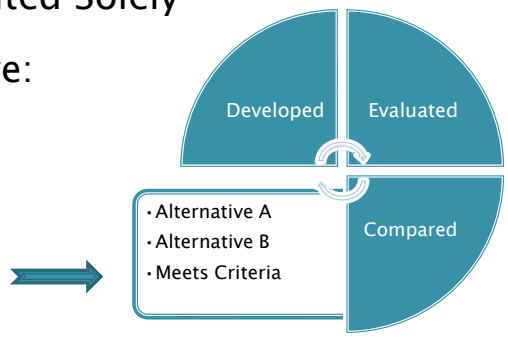
Identify Alternatives

- If it appears that meeting criteria may not be feasible at a particular location, alternatives should be:



Benefit/Cost Analysis for Alternatives

- The Analysis Should Only Include the Benefits and Costs Attributed Solely to Each Alternative:

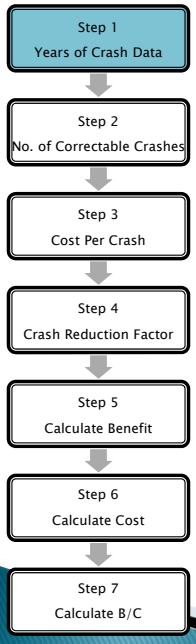


Economic Analysis

- Historical Tools
  - Historical Crash Method
- Predictive Tools
  - HSM
  - RSAP
  - Safety Analyst
  - IHSDM

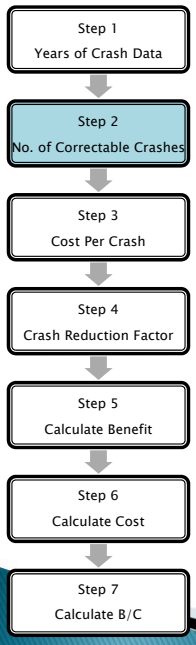
7 Steps to B/C Analysis

Note: When using the Historical Crash Method, if there isn't a history of attributable crashes, a B/C Analysis is not necessary.



Crash Data

1. Minimum of 5 most recent years of crash data.



Number of Correctable Crashes

2. Number of correctable crashes that were directly related to the deficient roadway element.

Step 1
Years of Crash Data

Step 2
No. of Correctable Crashes

Step 3
Cost Per Crash

Step 4
Crash Reduction Factor

Step 5
Calculate Benefit

Step 6
Calculate Cost

Step 7
Calculate B/C

Societal Cost
(Cost Per Crash)

3. Societal Cost provided by the SSO found in the PPM by facility type

HSIPG COST/CRASH BY FACILITY TYPE						
FACILITY TYPE	DIVIDED			UNDIVIDED		
	URBAN	SUBURBAN	RURAL	URBAN	SUBURBAN	RURAL
2-3 Lanes	$98,837	$150,613	$262,821	$114,040	$222,040	$416,658
4-5 Lanes	$110,115	$183,372	$369,954	$87,390	$158,476	$93,628
6+ Lanes	$109,638	$130,645	$545,271	n/a	n/a	n/a
Interstate	$138,873	n/a	$274,449	n/a	n/a	n/a
Turnpike	$127,584	n/a	$218,394	n/a	n/a	n/a

All State Roads Average Cost/Crash: **$141,085**

Step 1
Years of Crash Data

Step 2
No. of Correctable Crashes

Step 3
Cost Per Crash

Step 4
Crash Reduction Factor

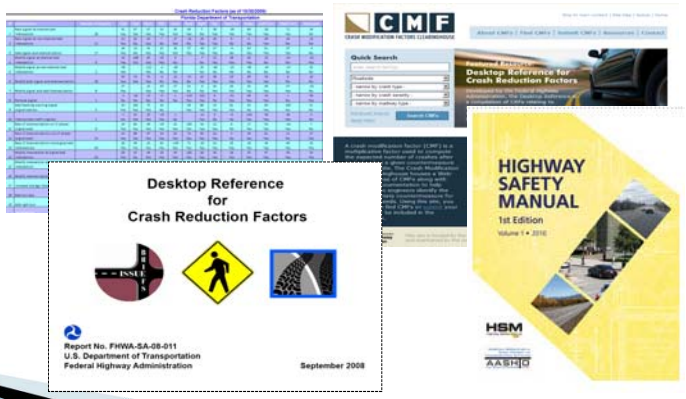
Step 5
Calculate Benefit

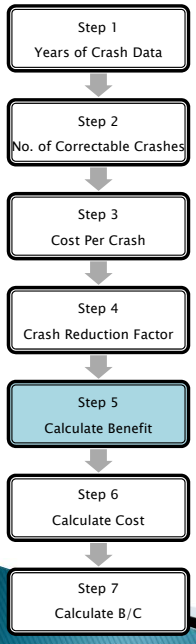
Step 6
Calculate Cost

Step 7
Calculate B/C

Crash Reduction Factor

4. Select a CRF (FDOT Table)
References
- AASHTO Highway Safety Manual
- FDOT State Safety Office
- FHWA CMF Clearinghouse
- FHWA Desktop Reference

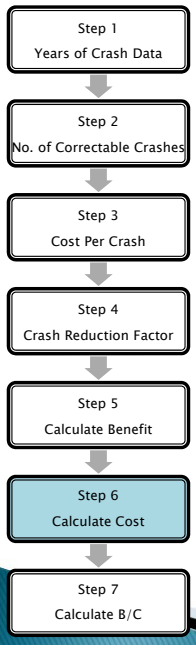




Calculate the Benefit

5. The Benefit is the anticipated total annual crash cost saving.

$$\text{Annual Benefit} = \frac{\text{No. Correctable Crashes X Cost per Crash X CRF}}{\text{No. Years of Crash Data}}$$



Calculate Cost

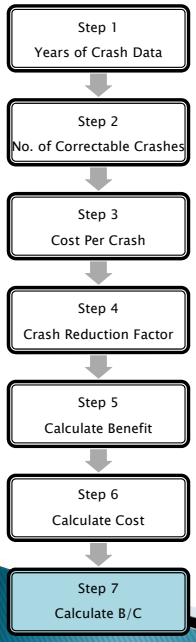
6. Cost from the Historical Trends or Long Range Estimate (LRE). See FDOT Estimates Website.

   Use Capital Recovery Factor (Std. Financial Tables)

   Service Life (FDOT Tables)

   Discount Rate (4%)

$$\text{Annual Cost} = \Sigma \text{ Construction Cost per Feature X (Capital Recovery Factor)}$$



Calculate B/C

7. The B/C is the Annual Benefit divided by the Annual Cost

$$\frac{B}{C} = \frac{\text{Annual Crash Reduction Benefit}}{\text{Annual Cost to Fix Condition}}$$

Design Exceptions & Variations

- Mitigation Strategies

Mitigation Strategies

Mitigation is a through process. Every Exception is unique.

Mitigation Strategies for Design Exceptions (July 2007) is a resource for evaluating and implementing.

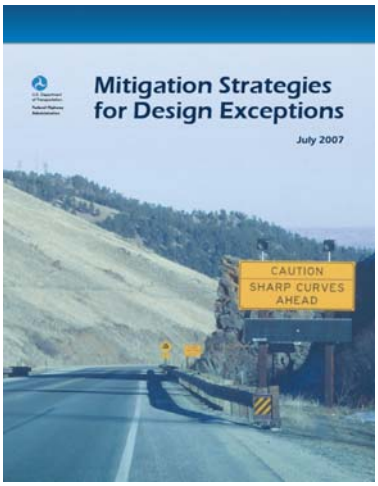
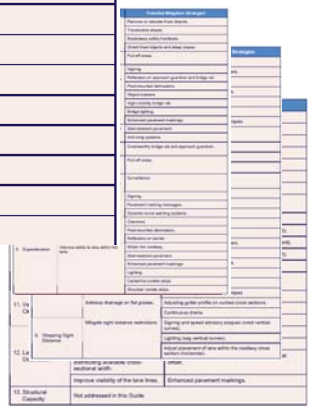


TABLE 22
Potential Mitigation Strategies

Mitigation Strategies

Design Element	Objective	Potential Mitigation Strategies
1. Design Speed	Reduce operating speeds to the design speed.	Cross-sectional elements to manage speed.
2. Lane Width & 3. Shoulder Width	Optimize safety and operations by distributing available cross-sectional width.	Select optimal combination of lane and shoulder width based on site characteristics.
	Provide advance warning of lane width reduction.	Signing.
	Improve ability to stay within the lane.	Wide pavement markings.
		Recessed pavement markings.
		Raised pavement markings.
		Delineators.
		Lighting.
		Centerline rumble strips.
		Shoulder rumble strips.
		Painted edgeline rumble strips.
	Improve ability to recover if driver leaves the lane.	Paved or partially-paved shoulders.
		Safety edge.



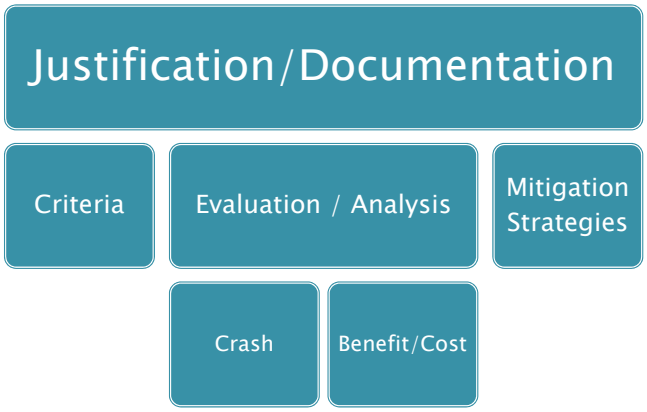
Mitigation Strategies

- Include a Section In Your Report that Discusses all Mitigation Strategies:
  - Existing
  - Considered
  - Proposed

Design Exceptions & Variations

- Justification and Documentation

Most Common Reasons for Denial



Justification

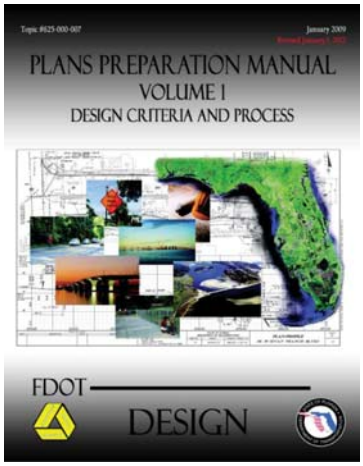
- A Strong Case for an Exception Can Be Made If:
  - The Required Criteria Are Not Applicable to the Site Specific Conditions.
  - The Project Can be as Safe by Not Following the Criteria
  - The Environmental or Community Needs Prohibit Meeting Criteria

Justification

- A Case Should Not Be Made Based Solely On the Basis That:
  - The Department can save money.
  - The Department can save time.
  - The proposed design is similar to other designs.

Documentation

- Plans Preparation Manual <u>Chapter 23</u>
  - Working to streamline documentation required.
  - See Section 23.5 for other requirements.



Documentation

- Use engineering judgment
- Length of documentation is not important.
- The key is to provide clarity and completeness to someone not familiar with the project or the design.

Note: Provide Enough Time for Central Office and for FHWA Review

Design Exceptions & Variations

» Approvals

Submittal and Approval Process

- Submit Design Exceptions early for improved flexibility.
- Check to ensure that you have the adequate appendices. (TSP, Crash Summary, Project Traffic, Plans, Schedule, etc.)
- Submit through your project manager.
- A denial does not necessarily imply a disagreement with the decision, but usually just inadequacies or errors in the documentation.
- <u>Reminder…Most Design Exceptions are ultimately approved.</u>

Approval Process (PPM Exhibit 23-B)

**Exhibit 23-B Central Office Approvals-
Design Exceptions and Design Variations**

Design Element	State Roadway Design Engineer	State Structures Design Engineer	State Transportation Planner	Chief Engineer	FHWA Division Admin.*
	Approval	Approval	Review	Approval	
Design Speed Exception	X				
-FIHS/SIS	X		X	X	
Design Speed Variation -FIHS/SIS			X	X	
Lane Width Exception	X				
Shoulder Width Exception	X				
Bridge Width Exception	X	X			
Bridge Width Variation (Category 2 Structures)		X			
Structural Capacity of Bridge Exception		X			
Structural Capacity of Bridge Variation					
-Category 2 Structures		X			
-Deficient Load Ratings (Category 1 and 2 Structures)		X			
-Traffic Railing (Category 1 and 2 Structures)		X			
Vertical Clearance Exception	X				
-16' for rural Interstate routes or single urban Interstate route	X				X
-All Category 1 and 2 Structures	X	X			
Vertical Clearance Variation (Category 2 Structures)		X			
Grades Exception	X				
Cross Slope Exception	X				
Superelevation Exception	X				

**Exhibit 23-B Central Office Approvals-
Design Exceptions and Design Variations (continued)**

Design Element	State Roadway Design Engineer	State Structures Design Engineer	State Transportation Planner	Chief Engineer	FHWA Division Admin.*
	Approval	Approval	Review	Approval	
Horizontal Alignment Exception	X				
Vertical Alignment Exception	X				
Stopping Sight Distance Exception	X				
Horizontal Clearance Exception	X				
-RR-South Fla Rail Corridor	X				
-Category 1 and 2 Structures	X	X			
Horizontal Clearance Variation (Category 2 Structure)		X			
Design Variation: Rumble strip requirements	X				
Design Variation: Crossovers on Limited Access Facilities	X				X
Design Variation: Patterned Pavement Technical Special Provisions	X				
Roundabout Designs-All	X				
Colored Bike Lane Assessments (The first 3 years after installation)	X				
Design Variation: Community Structures Non-Interstate	X				
Design Variation: Community Structures Interstate	X				X
Lump Sum Contracts (Non-Typical)	X				

*Design Exceptions on full FHWA oversight projects

Helpful Hints…

1. For Cross slope, include a station table of cross slopes for the deficient areas.
2. For Superelevation, include the 6% and 12% superelevation values from the AASHTO tables.
3. Generally, most crest vertical alignment exceptions are stopping sight distance exceptions as well, so include a table of Existing vs. FDOT vs. AASHTO values for K and SSD.
4. For lane width and shoulder width exceptions, include the limits of the deficiencies and strategies for addressing stalled vehicles.

Helpful Hints…

5. Check your vertical clearances on RRR projects. For Railroad related Vertical Clearances, please include a letter of concurrence from the owner of the Rail facility for all associated vertical or horizontal clearances.
6. Consider design alternatives (e.g. Existing To Remain, Meets FDOT Criteria, and possibly Partial Correction Meeting AASHTO Criteria or Practical Design.)
7. Include a copy of the Typical Section Package in your submittal. Criteria, Traffic, Design Exceptions, and Typicals are valuable when reviewing Design Exceptions.

Helpful Hints…

8. For Crash Analyses, always include at least the last 5 years. More than 5 years is allowed, but outdated data will likely be sent back as a denial. (See PPM Ch. 23 for latest years certified)
9. Include a section in your report called Mitigation Strategies. It is important to document that strategies for mitigating deficient elements have been evaluated and included as applicable for your site specific conditions. (See FHWA Mitigation Strategies for Design Exceptions)
10. Verify that your seal is visible in the pdf file (e.g. Pencil shade over crimp seals prior to scanning). Prepare 2 files, one for the report and one for the approval document. Sign and date the letter. Only sign and seal the report.

Who has the first question??

Central Office Contacts

Quality Assurance: Exceptions and Variations

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John Fowler, P.E.,
Quality Assurance Engineer
(850) 414-4373
john.fowler@dot.state.fl.us

FDOT Quality Assurance Website

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