



Florida Department of
TRANSPORTATION

Use of Highway Safety Manual in PD&E Studies

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In this presentation...

- How do we analyze safety now?
- What are we missing?—compare with operational
- What is Highway Safety Manual (HSM)?
- HSM in PD&E Studies
- Purpose and Need Statements
- Alternatives Analysis
- How do we scope safety analysis
- What resources and references do we have?

Safety objectives for projects

Should always be considered

- What are opportunities to improve safety for projects

May come from Purpose and Need

- Identify the location and magnitude of the problem
- Provide means of developing effective crash countermeasure strategies



Examples of analysis objectives

To improve safety and mobility of road users

- ✗ What data can we use to measure?

To reduce number of rear-end crashes at cross point intersection and improve motorists travel time along the corridor

- ✓ Clear, specific, measurable and realistic
- ✓ Require existing crash data and travel time

How do we analyze safety now?

Historically, safety has been analyzed by review of crash records

Part of existing conditions analysis—Crash Data Analysis

One of the criteria in Comparative Alternatives Evaluation—Qualitative/narrative evaluation

Existing safety analysis

Seeks to answer the following

- What are the contributing factors to fatal and serious injury crashes reported?
- What are behavioral contributing factors contribute to the crashes
- Are there any common road environment characteristics for the reported crashes?

Tip for Analysts... review crash reports, not just the data

Existing safety analysis

Seeks to answer the following

- Are there any particular crash types that are more common?
- Are there any particular times of day
- Where are these crashes are more prevalent?

Are we missing anything?

Objective: To reduce number of rear-end crashes and improve motorists travel time along the corridor

Required data: traffic crashes and travel time



FHWA, Public Roads

Can you measure travelers delay?

Can you measure safety?

... Existing Conditions?

... Future Conditions?

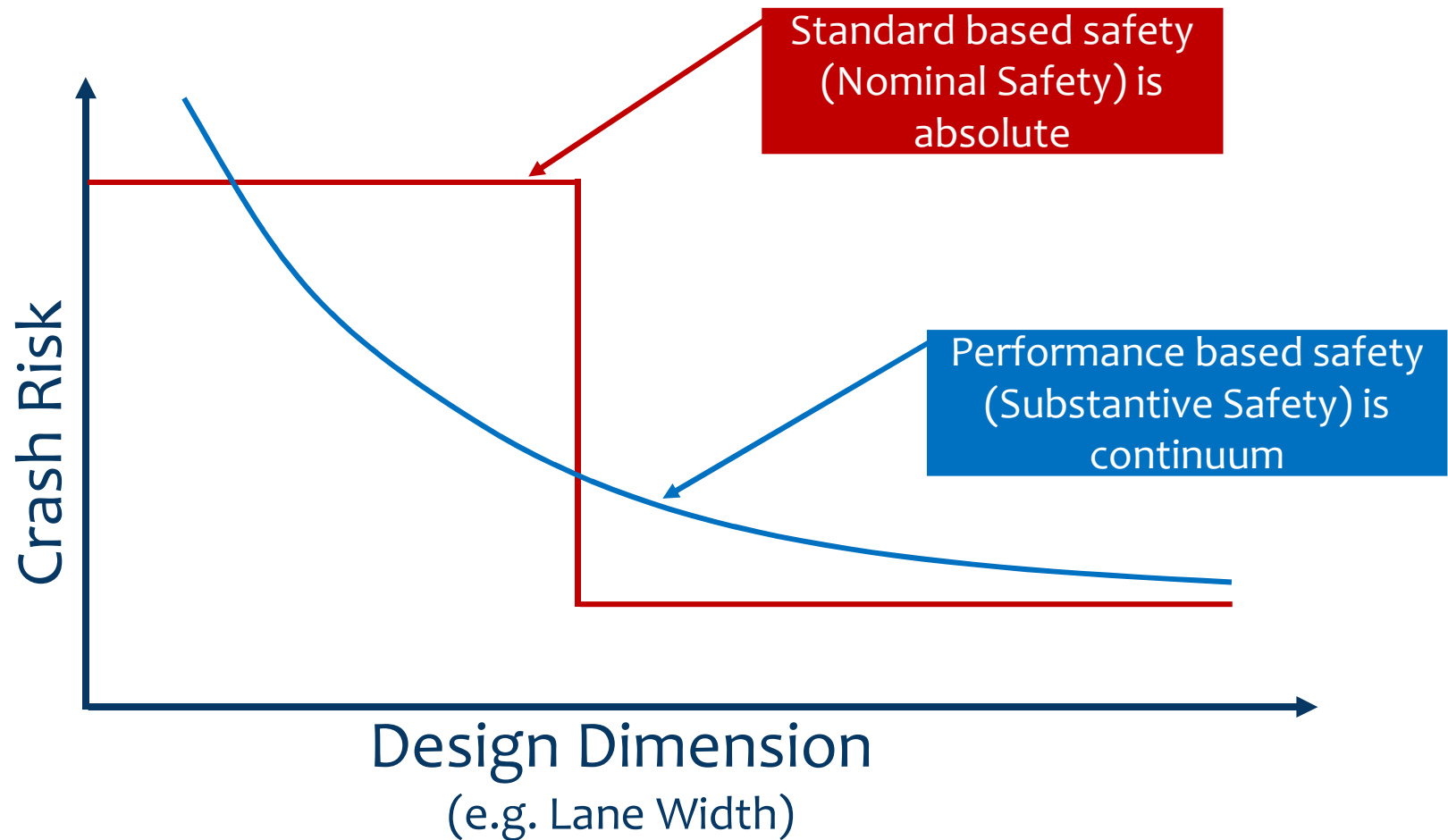
Are we missing anything?

Future safety analysis of a corridor

- Qualitative, simplistic and cursory
- If a design meets guidelines and standards it is assumed to be safe

Addressing safety requires considering more than *Design Standards and Policies*

Standard vs performance based safety



Performance based (substantive) safety

Understanding substantive safety requires knowledge of the factors that can affect crashes

- Relationships between actions,
- Environment,
- Modes of travel, and
- Other characteristics

HSM contains info that can help such understanding

Highway Safety Manual

First Edition published 2010

- Documents science-based procedures/methods that removes guess work
- Provides a set of tools to conduct quantitative safety analyses
- Allows safety to be quantitatively evaluated alongside other performance measures

Second Edition in the making (NCHRP 17-72)

Highway Safety Manual

Is organized into four parts:

- Part A— Introduction, Human Factors, and Fundamentals of Safety
- Part B—Roadway Safety Management Process
- Part C—Predictive Methods
- Part D—Crash Modification Factors

Quantitative safety analysis

Paradigm shift to incorporate proactive approaches in the project development cycle

Use of proactive approaches rather than reactive

Use of scientific based methods which are quantitative

Performance based/data driven analysis

What you need to understand...

- Relationship between crash frequency, and exposure variables (traffic volume, time)
- Crash contributing factors
- Analytical methods, models and procedures
 - Safety performance functions (SPF)

Safety Performance Function

- SPF is an equation to **predict** the average number of crashes per year at a location as a function of exposure
- Thru SPFs one can perform
 - Network screening
 - Countermeasure comparison
 - Project evaluation

$$\text{Predicted Crashes} = \exp[a + \beta * \ln(\text{AADT}) + \ln(\text{Length})]$$

Use of HSM in PD&E Studies

- HSM procedures can estimate predicted crashes and expected crashes for future conditions
- Articulate goals and objectives in performance-based terms



Can you measure travelers delay?

Can you measure safety?

... Existing Conditions

... Future Conditions?

Use of HSM in PD&E Studies

- Estimating future crashes with and without improvements
- HSM's human factors fundamentals can help project analysts identify safety-specific needs for the projects and estimate the potential for safety improvements.
- Relative comparisons of magnitude of potential safety impacts based on change in crash frequency from CMFs

Use of HSM in PD&E Studies

The following project development activities can benefit from the use of HSM:

- Assess and refine purpose and need for a project
- Develop project alternatives
- Analyze and evaluate project alternatives
- Communicate safety results to the public

Purpose and Need

Defining the safety problem

- Safety is linked to standards of design features
- HSM provides a detailed analysis procedure to quantitatively define safety problem
- Data: existing crash rate and expected crash rates

If safety is not part of the Need

- P&N should not include safety
- Part 2, Chapter 4 of the PD&E Manual

Alternatives evaluation

If safety is a primary purpose and need:

- Develop alternatives based on safety objectives
- Eliminate alternatives that do not meet purpose and need
- Evaluate the extent to which alternatives meet the desired safety objectives
- Consider both operational and engineering countermeasures

Alternatives evaluation

- HSM estimates relative safety benefits
 - How much an alternative reduces number of crashes, fatalities, or serious injuries
 - HSM crash prediction methods
 - HSM Crash Modification Factors
- Develop preliminary designs based on safety performance
- Compare alternatives based on safety performance

Alternatives evaluation

Compare alternatives with and without treatments

Treatment	Setting (Road Type)	Traffic Volume	Accident Type (Severity)	CMF	Std. Error
Provide a median	Urban (Arterial Multilane)	Unspecified	All types (Injury)	0.78	0.02
			All types (Non-injury)	1.09	0.02
	Rural (Multilane)		All types (Injury)	0.88	0.03
			All types (Non-injury)	0.82	0.03

Base Condition: Absence of raised median

Safety analysis guidance

- Highway Safety Manual Implementation Policy
- PD&E Manual (Part 2, Chapter 5)
- PPM (Part1, Chapter 23)
- Standard Scope of Services for PD&E Studies

Safety analysis procedure

- Analyze crash history to assess the existing safety performance and evaluate the potential safety implications of a project
- Assess future safety performance using predictive methods such as *HSM* methodologies and tools
- Exercise engineering judgment when analyzing, interpreting and presenting safety performance of a project in conjunction with other criteria
- Meaningfully present safety performance of a project to both technical and nontechnical audiences

Scoping HSM safety analysis

- Safety is part of Purpose and Need for the project
- Projects that claim a safety benefit
- Projects where there could be a substantial difference in safety for the alternatives analyzed
- Projects with existing safety issues

In each project... Ask yourself

- Will the project have any implications for safety?
- Were existing safety conditions examined?
- Even if no potential safety impacts are identified, is it still possible to improve safety, taking each type of user into consideration?
- Does the concept design incorporate best practices for safety?

... Tips for reviewers

Limitations of HSM

Not all projects can benefit from HSM methods

The HSM is not a standard

The HSM is neither intended to be, nor does it establish, a legal standard of care for users or professionals as to the information it contains

The documentation for HSM analysis may be protected under federal law (23 USC 409)

Safety resources and references

- Safety Analyst: for network screening
- Interchange Safety Analysis Tool enhanced (ISATe): for interchange evaluation
- Highway Safety Manual Spreadsheets
- Crash Modification Factors clearinghouse
- Highway Safety Manual
- “Upcoming 2017” – Florida HSM Webinars and Workshops on all project phases

HSM Websites

- AASHTO HSM, <http://www.highwaysafetymanual.org/>
 - About, Getting Started, Tools, Training, Resources
- FHWA HSM, <http://safety.fhwa.dot.gov/rsdp/hsm.aspx>
 - Outreach materials, Guidance, Case Studies
- FDOT HSM, <http://www.dot.state.fl.us/safety/11A-SafetyEngineering/TransSafEng/HighwaySafetyManual.shtm>
 - Crash Distribution, Calibration Factors, Organizational Chart, Implementation Summary, Implementation Plan Timeline, Presentations
- TRB, NCHRP 17-45, Freeways and Interchanges <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2512>

HSM Websites – AASHTO HSM

The screenshot shows the AASHTO HSM website homepage. At the top left is the AASHTO logo with the tagline "THE VOICE OF TRANSPORTATION". To the right, under "FOLLOW US ON:", are icons for Twitter, Facebook, and YouTube. A navigation bar below contains links for "About AASHTO", "Bookstore", "Software", "Meetings", "Committees", "Programs", "Newsroom", and "Resources". The main content area features the "HSM Highway Safety Manual" logo on the left and three image boxes on the right: a road with a cyclist, a highway interchange, and a traffic jam. Below this is a secondary navigation bar with links: "Home", "About", "Getting Started", "Implementation", "Tools", "Research Resources", "Training", "Related Resources", "FAQs", and "Contact".

Welcome to the Highway Safety Manual (HSM) web site – the source for information on quantifying and evaluating highway safety performance using the Highway Safety Manual. This web site includes information on:

- What the HSM is [about](#);
- How to [get started](#) using the HSM;
- The best approach to [implementing the HSM](#);
- What [tools](#), [training](#), and [resources](#) are available; and
- How to [purchase](#) the HSM.

While this web site is hosted by AASHTO, the Association works closely with the Federal Highway Administration (FHWA) Office of Safety ([click here](#) to visit the FHWA HSM web page) and the Transportation Research Board (TRB) [Highway Safety Performance Committee](#) on issues related to the HSM.

Click on the boxes below to find out what's new, view an informational video on the HSM, reach out to HSM users through our Discussion Forum, or find out the technical changes to the document.

Check Out
What's New

Learn More About
HSM
Highway Safety Manual

Visit updated
HSM Errata

Visit the
Discussion
Forum

HSM Websites – FHWA HSM

Highway Safety Manual

A new generation of highway safety analysis tools is being deployed to the transportation community through several innovative research efforts. The Highway Safety Manual (HSM) is published by the American Association of State Highway Transportation Officials (AASHTO). FHWA has developed supporting implementation tools including the Interactive Highway Safety Design Model (IHSDM) and the Crash Modification Factors (CMF) Clearinghouse. These tools will greatly advance state and local highway agencies' ability to incorporate explicit, quantitative consideration of safety into their planning and project development decision making.

The first edition of the HSM provides the best factual information and tools in a useful form to facilitate roadway planning, design, operations, and maintenance decisions based on precise consideration of their safety consequences. The primary focus of the HSM is the introduction and development of analytical tools for predicting the impact of transportation project and program decisions on road safety.

AASHTO's Highway Safety Manual Webpage

AASHTO's Highway Safety Manual webpage, highwaysafetymanual.org, serves as the official HSM website where you can find the most up to date information and new developments on the HSM.

[HSM Outreach Materials](#)
[HSM Technical Support](#)
[Guidance](#)
[HSM Training](#)
[Case Studies](#)
[HSM Data Support](#)
[HSM Tools](#)
[Additional Resources](#)

HSM Outreach Materials

- [HSM Overview Brochure](#)



HSM Websites – FDOT HSM

State Safety Office

State Safety Office / Safety Engineering / Highway Safety Manual

Highway Safety Manual



Welcome to the Florida Department of Transportation Highway Safety Manual (HSM) webpage on HSM statewide implementation efforts. This page will be focused on providing information on what implementation efforts have been done and are planned to do. Key information will include implementation plan timeline, management presentations, district projects, and training schedules. Also included on the site will be links to national implementation efforts of the HSM. We welcome you to visit the site often as this page will be frequently updated as the department moves forward with HSM implementation efforts.

Please feel free to contact Joe Santos, FDOT, Safety Engineer, joseph.santos@dot.state.fl.us, 850.414.4097 should you have any questions.

[FDOT HSM User Guide 2015](#)

[FDOT Crash Distribution 2008-2012](#)

[FDOT Calibration Factors 2012](#)

[FDOT HSM Organizational Chart](#)

[FDOT HSM Implementation Summary](#)

[FDOT HSM Implementation Plan Timeline](#)

National Training Activities

<http://www.highwaysafetymanual.org/Pages/Training.aspx>

Training

AASHTO > Highway Safety Manual > Training



Training is an important first step before using the HSM. Following is a brief description of the various training programs currently available to help state DOTs maximize the effectiveness of the HSM.

HSM Online Overview Course – (FHWA-NHI 380106) is now available free of charge through the National Highway Institute (NHI) web site.

HSM Training Guide – This guide focuses on identifying HSM training currently available to state and local agencies who are considering implementation of the HSM.

NHI HSM Training Courses – FHWA has developed training courses on specific parts of the HSM that are offered through the National Highway Institute (NHI).

Webinar Series – The FHWA HSM webinar series, which began in June 2010, was recorded.

Training Webinars – These webinars are available from the FHWA Resource Center.

US Roadway Safety.org – This web site has a searchable database for safety training courses.

HSM Training

- National Highway Institute (NHI),
- <http://www.nhi.fhwa.dot.gov/training>
 - FHWA-NHI-380106, Highway Safety Manual Online Overview
 - Free Web Based Training (WBT) course includes an introduction of terminology, examples of the Roadway Safety Management Process (Part B) and Predictive Methods (Part C), explains the relationship of Crash Modification Factors (CMFs) to decision making and quantitative safety analysis, and human factors
 - Length: 12 Hours

Thank you

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Arrive Alive

