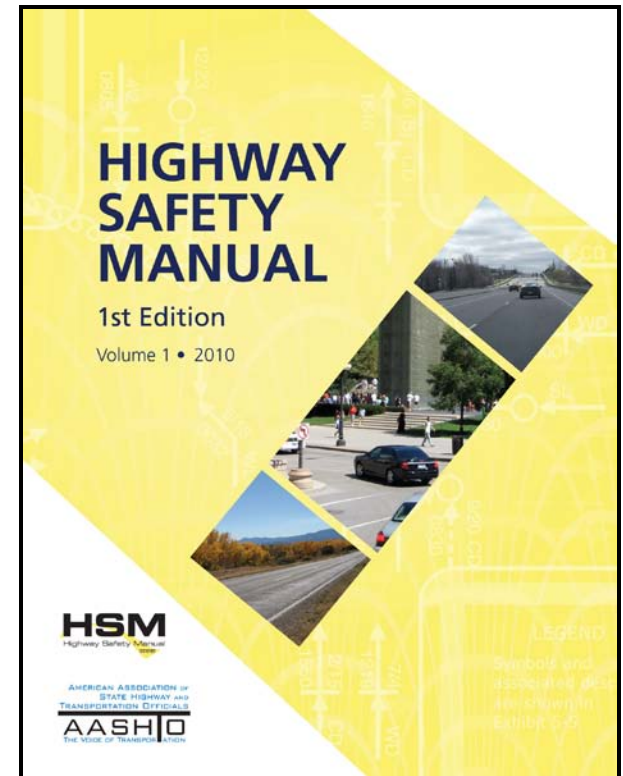


Highway Safety Manual Webinar



HSM Practitioners Guide for Multilane Rural Highways and Urban Suburban Streets



HSM Applications to Multilane Rural Highways and Urban Suburban Streets

Introduction and Background

- Session #1



HSM Applications to Multilane Rural Highways and Urban Suburban Streets

Learning Outcomes:

- ▶ Review Crash Frequency (Safety) Performance of Rural Multilane Intersections
- ▶ Define Substantive Safety beyond Nominal Safety

Multilane Highways - Expressways:

- ▶ Constructed since the early 1950's
- ▶ Expressways are less expensive to build
- ▶ no grade separation Intersections (less \$\$)
- ▶ not full access control (less \$\$)

Multilane Highways (Rural&Urban):

3,995,644 miles – US Public Roads

976,477 miles - US Federal Aid Mileage

165,783 miles - Multilane Highways 17%

44,673 miles – Multilane Undivided 27%

121,100 miles – Multilane Divided 73%

65,357 miles - Multilane rural highways

Rural Expressway Mileage:

Sorted by 2005 Total Miles		
2005 MILES RANK	STATE	* 2005 TOTAL MILES
1	Texas	2071
2	Virginia	1097
3	New Mexico	830
4	Mississippi	813
5	Ohio	751
6	Missouri	733
7	Alabama	694
8	Minnesota	679
9	Florida	672
10	Georgia	598
11	California	587
12	North Carolina	580
13	Indiana	575
14	Oklahoma	538
15	Tennessee	527
16	Iowa	493

*NCHRP 650

Safety Performance of Rural Multilane Highways:

- ▶ Crash rate on rural expressways (0.9 crashes per mvm) less than for rural 2-lane Highways (1.0 crashes per mvm)
- ▶ Severities on rural expressways (1.2 deaths per 100 mvm) less than for rural 2-lane Highways (1.5 deaths per 100 mvm)
- ▶ When access density is low, crash rate is similar to rural freeway (0.52 per mvm)

* Minn DOT, NCHRP 650

Table 2. Nebraska crash experience: 2-lane highways versus 4-lane expressways (8).

CRASH TYPE	CRASH RATES (crashes/million vehicle miles)		PERCENT DIFF.
	324 MI OF RURAL 2-LANE HWYS PLANNED FOR EXPRWY CONVERSION	111 MI OF RURAL 4-LANE DIVIDED EXPRWYS (ADT < 8,000 vpd)	
All Crashes	0.942	0.991	+ 5.2
Fatal	0.022	0.015	-31.8
Injury	0.324	0.309	-4.6
Property-Damage-Only	0.596	0.668	+ 12.1
Single-Vehicle Crashes	0.556	0.661	+ 18.9
Run-Off-Road	0.213	0.247	+ 16.0
Animal	0.309	0.381	+ 23.3
Multiple-Vehicle Crashes	0.386	0.330	-14.5
Sideswipe (Opposite)	0.067	0.005	-92.5
Head-On	0.012	0.004	-66.7
Rear-End	0.131	0.093	-29.0
Sideswipe (Same)	0.064	0.051	-20.3
Left-Turn	0.026	0.025	-3.8
Right-Angle	0.087	0.149	+ 71.3
Intersection-Related	0.231	0.236	+2.2

Key Safety Principles and Design

Knowledge is imprecise, judgment is essential

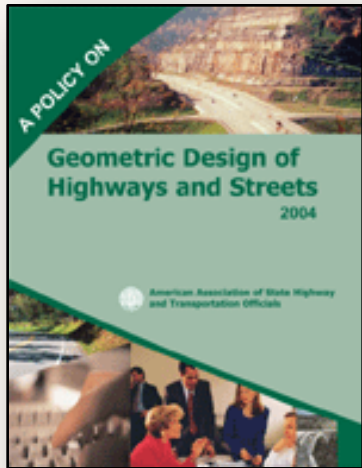
- ▶ Meeting standards does not necessarily make a highway safe
- ▶ Some Important features of highways are not determined by standards
 - Alignment of left turn lanes (angled or parallel)
 - Spiral transitions to Horizontal curves
 - Center Two-Way Left Turn Lanes



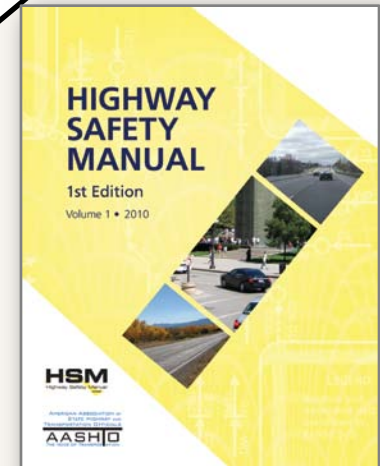
Approaches for Considering Safety

*Nominal
Safety*

*Substantive
Safety*



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



The expected or actual crash frequency and severity for a highway or roadway

Nominal Safety

Nominal Safety

1st Step



Complies ?

Yes

No

- ▶ **Based on research and operational experience**
- ▶ **Provides consistent level of quality**
- ▶ **Reflective of general cost-effectiveness**
- ▶ **Protection from claims of legal liability - ???**

Nominal and Substantive Safety

Example:

1st Step



Nominal Safety:

Rural Multilane
intersection design has
median opening
(CMF = 1.00)

2nd Step



Substantive Safety

Use Positive Offset alignment
Left Turning Lanes
CMF = 0.52 which is 48%
fewer total crashes

Nominal and Substantive Safety

Example: At 20,000 ADT
1st Step



26.3 crashes/mile

2nd Step



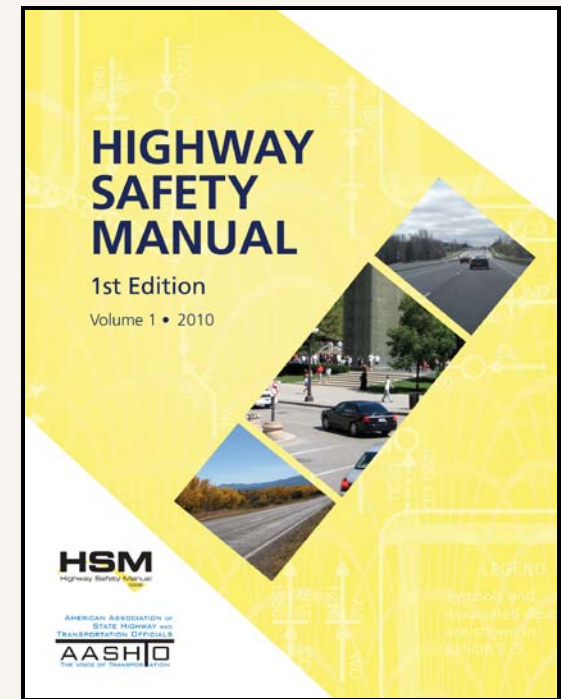
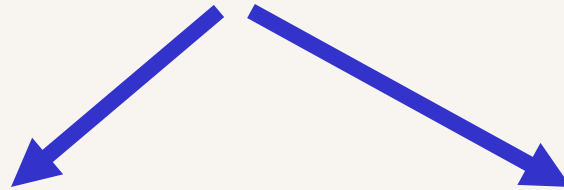
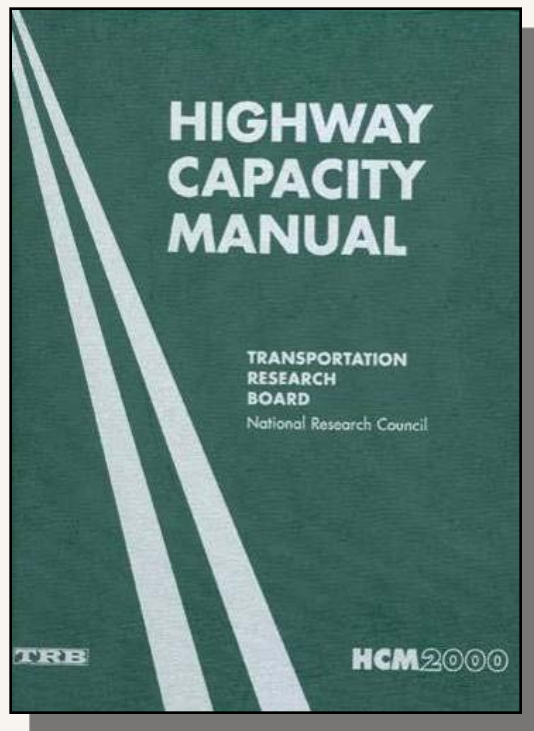
4.2 crashes/mile

Nominal Safety – Two 12' wide lanes in each direction

+Add median
= **Substantive Safety**

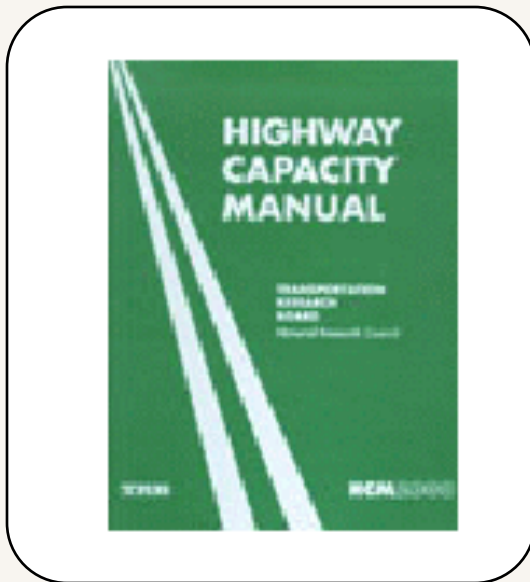
The New Highway Safety Manual of 2010

- ▶ Methodology is like that for assessing and assuring the adequacy of Capacity
- ▶ HSM allows the transportation professional to understand and quantify highway safety performance for informed and balanced decision making

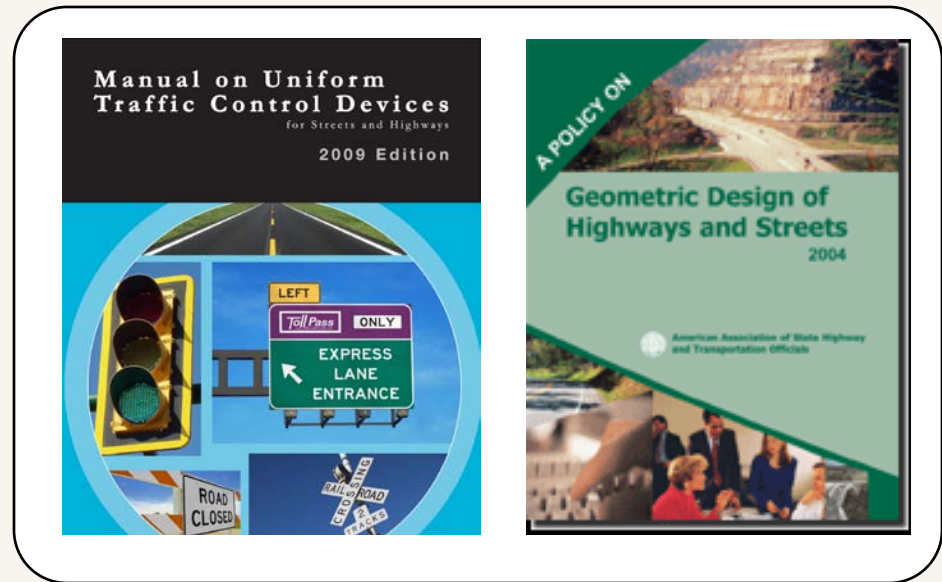


WHAT THE HSM IS.....

...Like the HCM



...NOT Like the MUTCD & Green Book



The HSM **describes** the mathematical relationships for safety performance based upon exposure and roadway conditions

The HSM is an **analysis tool only**; just like the HCM

The HSM does **not** have “Standards” nor “Best Practice” guidance

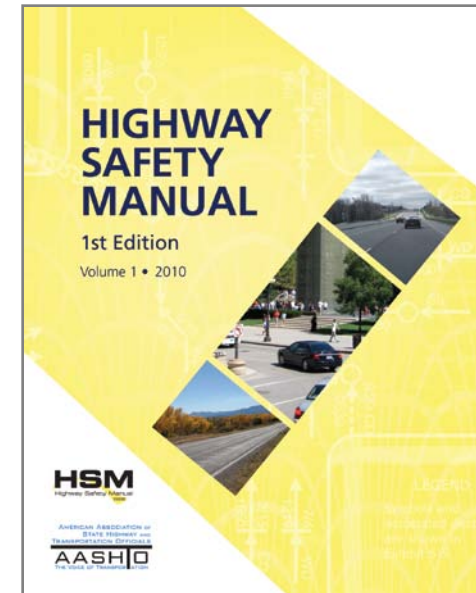
The HSM does **not** supersede other publications that do.

What is the HSM?

- ▶ A set of tools for Prediction of Crash Frequency and for Analysis of safety
- ▶ Facilitates explicit consideration of safety throughout the project development process
- ▶ Provides a synthesis of validated highway safety research
- ▶ Provides analytical tools for predicting the impact of decisions on road safety

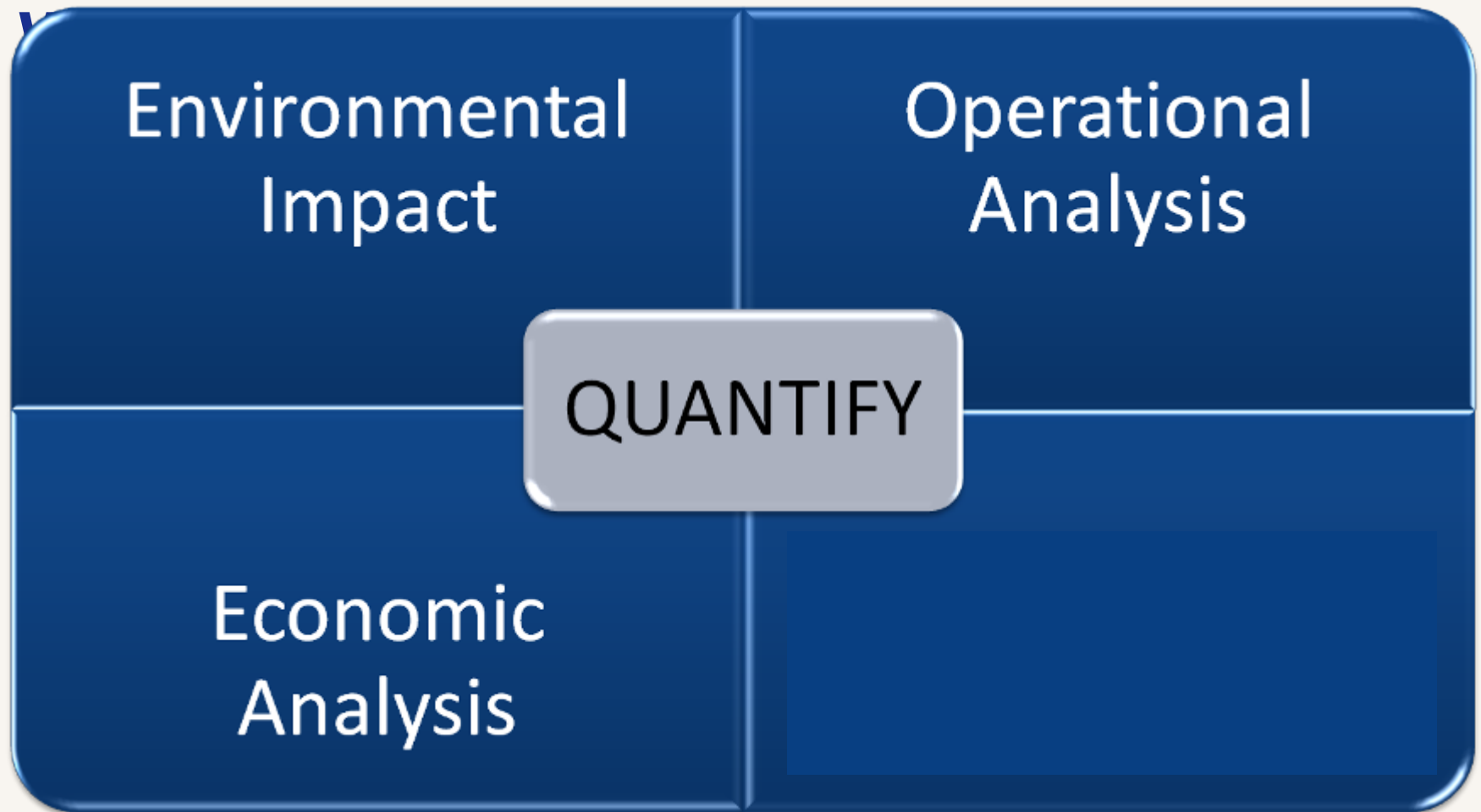
The New Highway Safety Manual of 2010

Contains Best Science & Research



- Synthesis of previous research
 - New research commissioned by AASHTO and FHWA

What Can the HSM Do?



How can a crash prediction be used?

Program level - Prioritize segments or locations for selection of projects

Project Level –

- Assess the relative needs for a project
- Communicate the relative needs to public
- Prioritize work to keep project within budget
- Supporting documentation for design exceptions

Tort Defense – if used properly

- This tool can help quantify the relative safety of a facility and demonstrate that an agency is addressing safety needs appropriately.

Consideration of Safety in the Design Process – Jan 7, 2005

It is the policy of FHWA that Safety must be fully considered in every aspect of:

Planning

Programming

Environmental Analysis

Project Design

Construction

Maintenance

Operations

Balancing **safety** with many other factors is critical to good design decision-making in the planning and preliminary design phases ...and it is a Requirement



Introduction and Background

Role of Road Design in Crash Prevention

Design can reduce:

- Incidence of human error
- Chance of human error resulting in crash
- Severity of the consequences of crashes

How a particular section of a highway/street or an intersection is built (Engineering) and how it is operated effects both the number and severity of crashes

What Can the HSM Do for ME?

- ▶ Predict Safety Performance of Geometric Design Features? **YES**
- ▶ Quantitatively calculate Safety Effects? **YES**
- ▶ Predict Safety Performance of Intersections? **YES**
- ▶ Better Decisions for Safety? **YES**

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Learning Outcomes:

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Introduction and Background

Questions and Discussion:

