

Highway Safety Manual Updates

An overview of resources, updates, and plans for the next edition



Agenda

- HSM Overview
- Content Comparison
- New Chapters
- New Predictive Models
- New Research Resources
- HSM Application Tools
- Looking Forward



HSM Overview

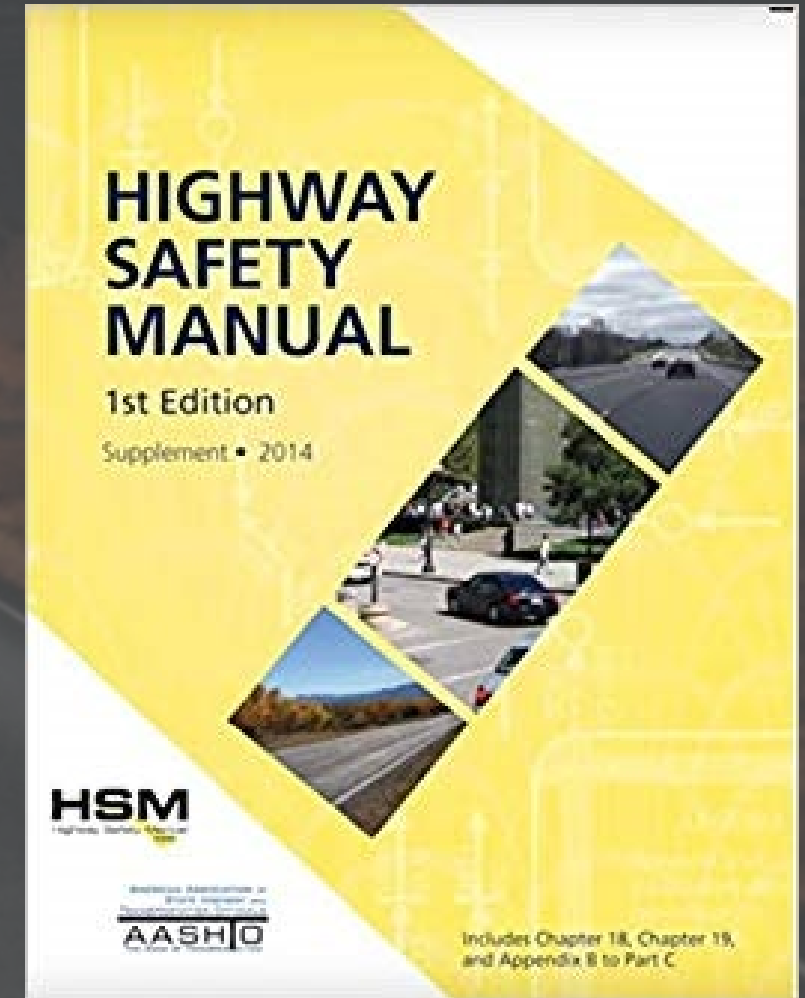
An overview of the new document being developed by AASHTO

HSM Background

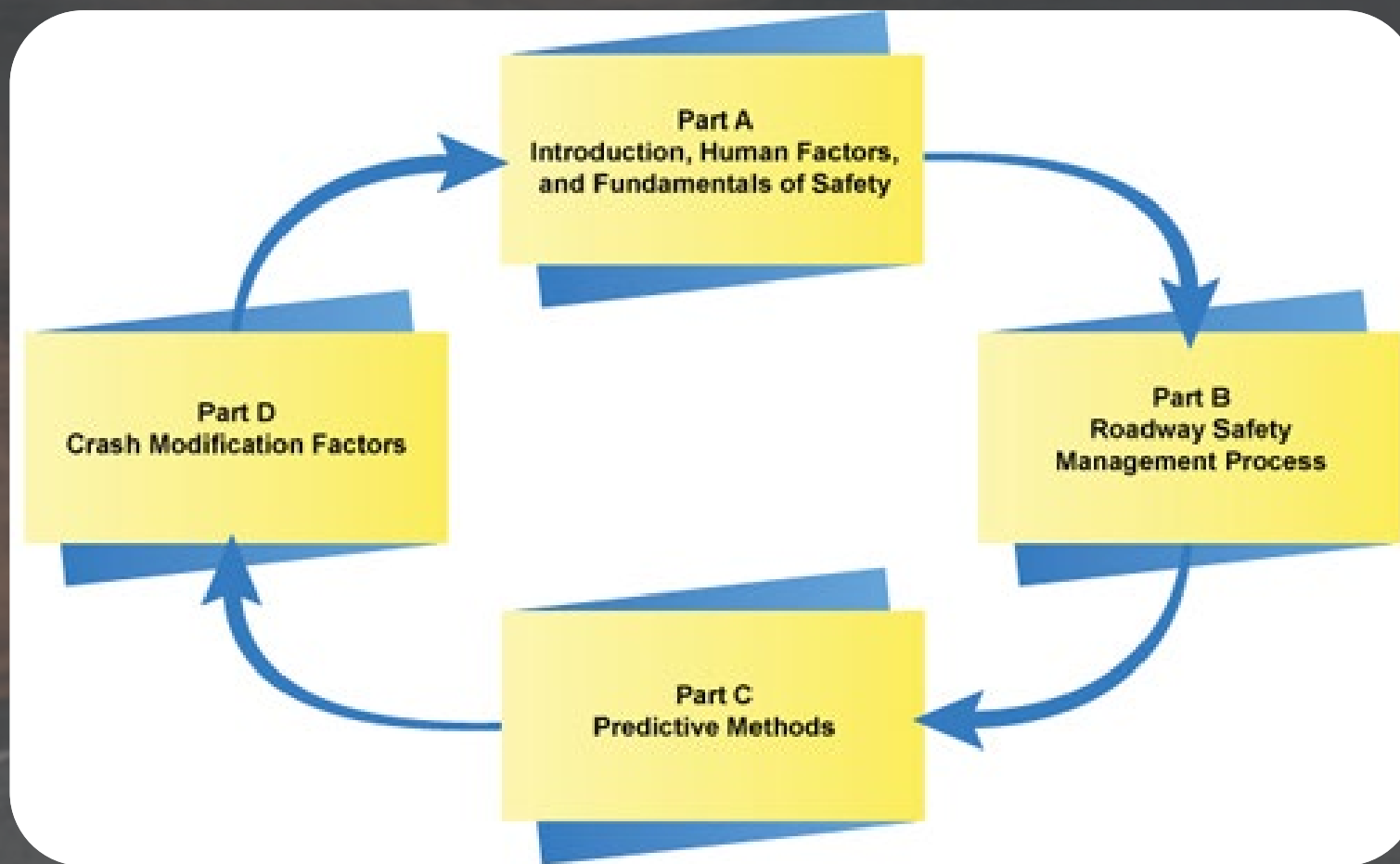
“The Highway Safety Manual (HSM) is the premier guidance document for incorporating quantitative safety analysis in the highway transportation project development process.”

HSM Background

- First Edition Published in 2010 by AASHTO
- Provides guidance on
 - Human Factors and safety fundamentals
 - Roadway Safety Management Process
 - Predictive methods for safety improvement project development
- All these elements will be enhanced in HSM2



HSM Background



The HSM2 Will...

- ❖ **Expand** upon the methodologies in HSM1
- ❖ **Incorporate** new models and research completed since HSM1
- ❖ **Modify** practices and guidance based on user experiences and needs

Content Comparison

Differences in the HSM1 and the HSM2

HSM 2 Chapters: Preface and Intro.

Part	Chapter Subject	Chapter Number (HSM1)	Chapter Number (HSM2)
Preface & Other	Preface	-	-
	Introduction & Overview to the HSM	1	1
	Glossary	-	-

HSM 2 Chapters: Part A

Part	Chapter Subject	Chapter Number (HSM1)	Chapter Number (HSM2)
A	Part A Intro	-	-
	Road Safety Principles (Fundamentals)	3	2
	Human Factors	2	3
	Pedestrians & Bicyclists	(new)	4

HSM 2 Chapters: Part B

Part	Chapter Subject	Chapter Number (HSM1)	Chapter Number (HSM2)
B	Part B Intro	-	-
	Areawide Planning	(new)	5
	Network Screening	4	6
	Diagnosis	5	7
	Countermeasure Selection	6	8
	Economic Appraisal	7	9
	Project Prioritization	8	10
	Safety Effectiveness Evaluation	9	11
	Systemic Safety Management	(new)	12

HSM 2 Chapters: Part C

Part	Chapter Subject	Chapter Number (HSM1)	Chapter Number (HSM2)
C	Part C Intro	-	-
	Developing, Calibrating, and Using SPFs and CPMs	(new)	13
	Rural Two-Lane Roads	10	14
	Rural Multilane Highways	11	15
	Urban & Suburban Arterials	12	16
	Freeways	18	17
	Ramps	19	18

HSM 2 Chapters: Part D

Part	Chapter Subject	Chapter Number (HSM1)	Chapter Number (HSM2)
D	<i>Roadway Segment CMFs</i>	13	<i>(removed)*</i>
	<i>Intersection CMFs</i>	14	<i>(removed)*</i>
	<i>Interchange CMFs</i>	15	<i>(removed)*</i>
	<i>Special Facility CMFs</i>	16	<i>(removed)*</i>
	<i>Road Network CMFs</i>	17	<i>(removed)*</i>
	Part D Intro	-	-
	Selecting CMFs	(new)	19
	Applying CMFs	(new)	20

* Superseded by CMF Clearinghouse

New Chapters

What to expect in the HSM2

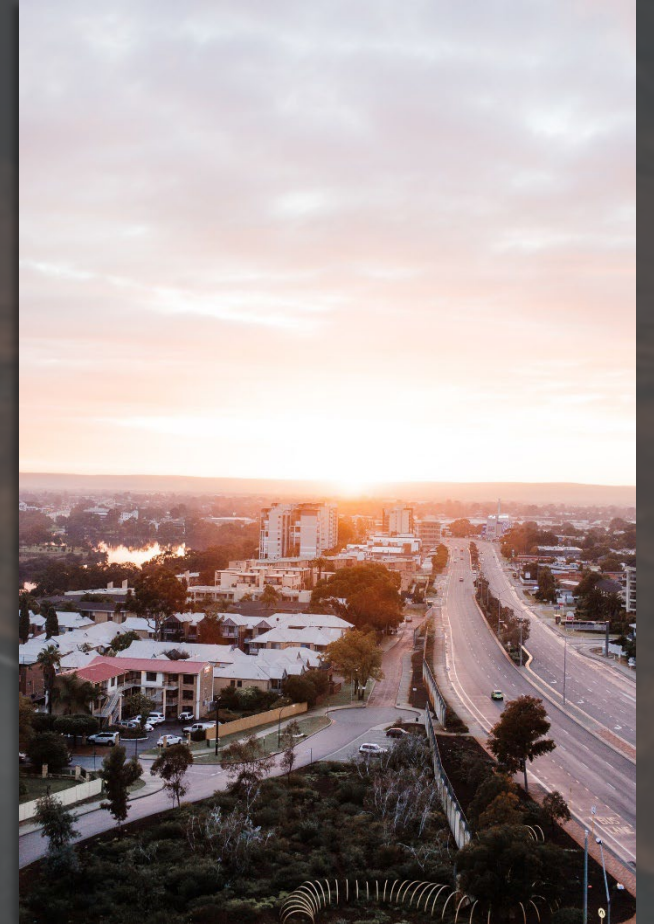
Bike & Pedestrian Safety

- Chapter 4
- Provide an overview of methods for incorporating bike & pedestrian considerations in safety management
- Bike & pedestrian predictive models will be in Part C



Areawide Planning

- Chapter 5
- Overview of macro-level quantitative safety planning
- Considers demographics, geography, land use, and more
- Based on NCHRP 17-81



Systemic Safety

- Chapter 12
- Provides an introduction to the systemic safety method
- How to incorporate systemic safety in your roadway safety management program
- Includes systemic methods for pedestrian and bicycle application



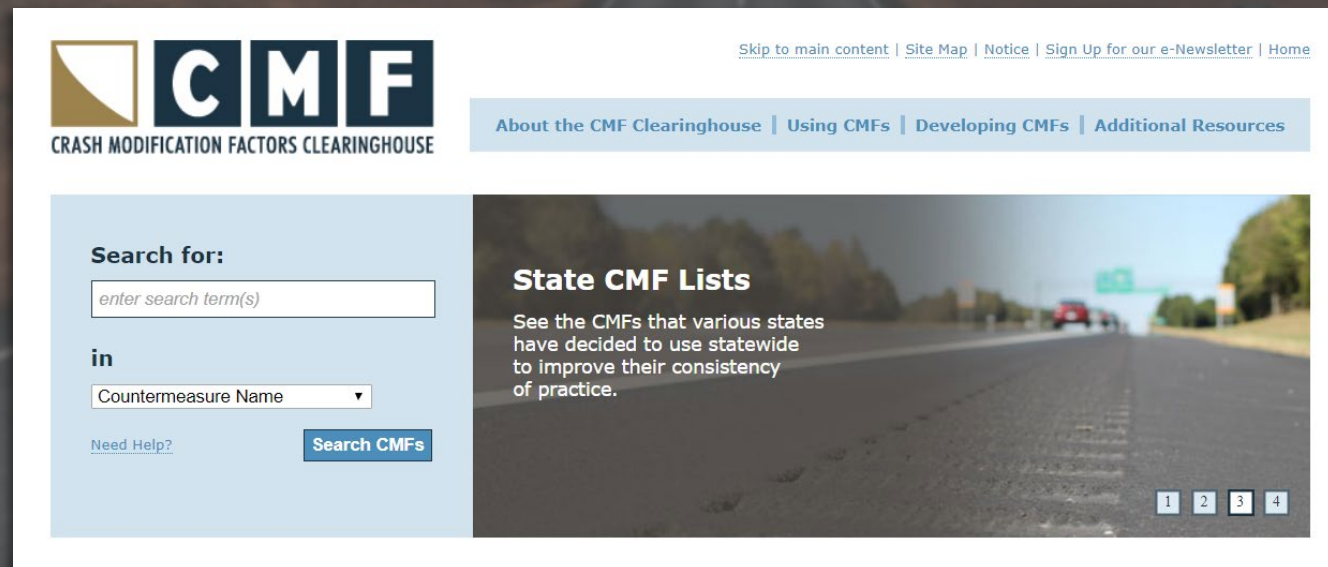
SPF Calibration

- Chapter 13
- Methods for calibrating safety performance functions with state/regional data
- The importance of calibration and when it is needed



Restructured Part D

- New chapters on selecting, creating, and using CMFs
- All CMFs will be housed on the CMF Clearinghouse website (www.cmfclearinghouse.org)



New Predictive Models

What to expect in the HSM2

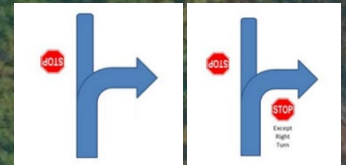
Ch 14. Predictive Method for Rural Two-Lane, Two-Way Roads (Facility Types)

Roadway Segments

- 2-lane undivided (2U) ^

Intersections

- 3-leg minor-road stop control (3ST) ^
- 3-leg turning (3STT) *
- 3-leg signal control (3SG) *^
- 3-leg single-lane roundabout (31R) *
- 3-leg two-lane roundabout (32R) *
- 4-leg minor-road stop control (4ST) ^
- 4-leg all-way stop control (4aST) *
- 4-leg signal control (4SG) ^
- 4-leg single-lane roundabout (41R) *
- 4-leg two-lane roundabout (42R) *



3-leg turning configuration (3STT)

* New facility types planned for HSM2 ^ Expanded facility types planned for HSM2

Ch 15. Predictive Method for Rural Multilane Highways (Facility Types)

Roadway Segments

- 4-lane undivided (4U) ^
- 4-lane divided (4D) ^

Intersections

- 3-leg minor-road stop control (3ST) ^
- 3-leg signal control (3SG) *^
- 3-leg single-lane roundabout (31R) *
- 3-leg two-lane roundabout (32R) *
- 4-leg minor-road stop control (4ST) ^
- 4-leg signal control (4SG) ^
- 4-leg single-lane roundabout (41R) *
- 4-leg two-lane roundabout (42R) *

* New facility types planned for HSM2 ^ Expanded facility types planned for HSM2

Ch 16. Predictive Method for Urban and Suburban Arterials (Facility Types – Roadway Segments)

Roadway Segments

- 2-lane undivided (2U)
- 3-lane with center TWLTL (3T)
- 4-lane undivided (4U)
- 4-lane divided (4D)
- 5-lane with center TWLTL (5T)
- 6-lane undivided (6U) *
- 6-lane divided (6D) *
- 7-lane with center TWLTL (7T) *
- 8-lane divided (8D) *
- 2-lane one-way (2O) *
- 3-lane one-way (3O) *
- 4-lane one-way (4O) *

* New facility types planned for HSM2 ^ Expanded facility types planned for HSM2

Ch 16. Predictive Method for Urban and Suburban Arterials (Facility Types – Intersections)

Intersections (3-leg)

- Minor-road stop control (3ST) ^
- Minor-road stop control, high speed (3ST-HS) *
- All-way stop control (3aST) *
- Turning (3STT) *
- Signal control (3SG) ^
- Signal control, high speed (3SG-HS) *
- Single-lane roundabout (31R) *
- Two-lane roundabout (32R) *

Intersections (4-leg, 5-leg)

- Minor-road stop control (4ST) ^
- Minor-road stop control, high speed (4ST-HS) *
- All-way stop control (4aST) *
- Signal control (4SG) ^
- Signal control, high speed (4SG-HS) *
- Single-lane roundabout (41R) *
- Two-lane roundabout (42R) *
- Signal control (5SG) *

* New facility types planned for HSM2 ^ Expanded facility types planned for HSM2

Ch 17. Predictive Method for Freeways (Facility Types)

Rural Freeways

- 4-lane
- 6-lane
- 8-lane

Urban Freeways

- 4-lane (PTSU, HOV, HOT) ^
- 6-lane (PTSU, HOV, HOT) ^
- 8-lane (PTSU, HOV, HOT) ^
- 10-lane (PTSU, HOV, HOT) ^

Note: Part-time shoulder use (PTSU); High occupancy vehicle lane (HOV); High occupancy toll lane (HOT)

** New facility types planned for HSM2 ^ Expanded facility types planned for HSM2*

Ch 18. Predictive Method for Ramps (Facility Types)

Ramp Segments

Rural

- 1-lane entrance (1EN)
- 1-lane exit (1EX)

Urban

- 1-lane entrance (1EN)
- 1-lane exit (1EX)
- 2-lane entrance (2EN)
- 2-lane exit (2EX)

Ramp Terminals

- 3-leg terminals with diagonal entrance ramp (D3en)
- 3-leg terminals with diagonal exit ramp (D3ex)
- 4-leg terminals with diagonal ramps (D4)
- 4-leg terminals at four-quadrant partial cloverleaf A (A4)
- 4-leg terminals at four-quadrant partial cloverleaf B (B4)
- 3-leg terminals at two-quadrant partial cloverleaf A (A2)
- 3-leg terminals at two-quadrant partial cloverleaf B (B2)
- Single-point diamond interchanges (SP) *
- Tight diamond interchanges (TD) *

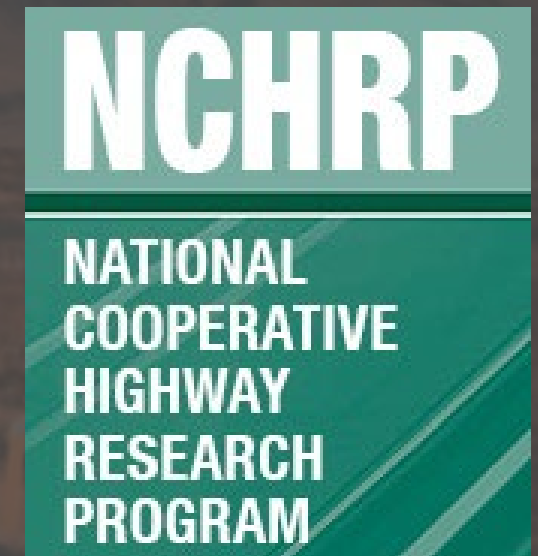
* New facility types planned for HSM2 ^ Expanded facility types planned for HSM2

New Research Resources

How to access and implement new research going into the HSM2

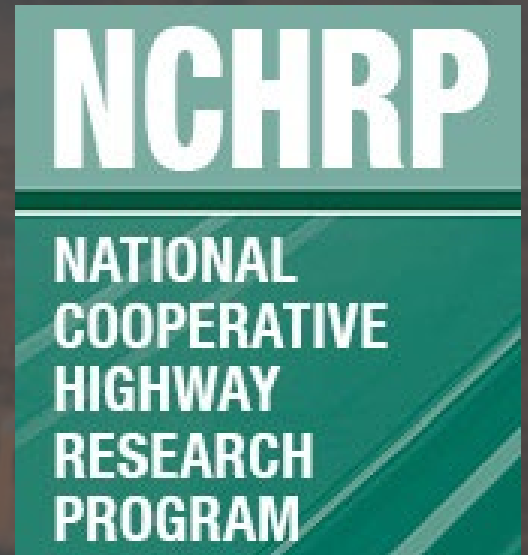
New NCHRP Research

- 17-50: Lead States Initiative for Implementing the HSM
- 17-58: CPMs for Six-Lane and One-Way Urban and Suburban Arterials
- 17-62: Improved Prediction Models for Crash Types & Severities
- 17-63: Guidance for the Development and Application of CMFs
- 17-68: Intersection Crash Prediction Methods for the HSM
- 17-70: Development of Roundabout CPMs and Methods
- 17-71: Proposed AASHTO Highway Safety Manual, 2nd Edition
- 17-72: Update of Crash Modification Factors
- 17-73: Systemic Pedestrian Safety Analyses
- 17-77: Guide for Quantitative Approaches to Systemic Safety Analysis



New NCHRP Research (cont.)

- 17-78: Understanding and Communicating Reliability of CPMs
- 17-81: Proposed Macro-Level Safety Planning Analysis Chapter for HSM
- 17-83: Briefings and Training Materials for Implementation
- 17-84: Pedestrian and Bicycle Safety Performance Functions for the HSM
- 17-89: Safety Performance of Part-Time Shoulder Use on Freeways
- 17-89A: HOV/HOT Freeway CPMs for HSM



New Available Research Summary

- HSM2 Research Resources web page
 - Contains an index of research projects related to the Highway Safety Manual from NCHRP and FHWA
 - Research results may be included in HSM2 or future versions
 - highwaysafetymanual.org/Pages/ResearchResources.aspx



Application Tools & Resources

Software, tools, and case studies for applying HSM methods

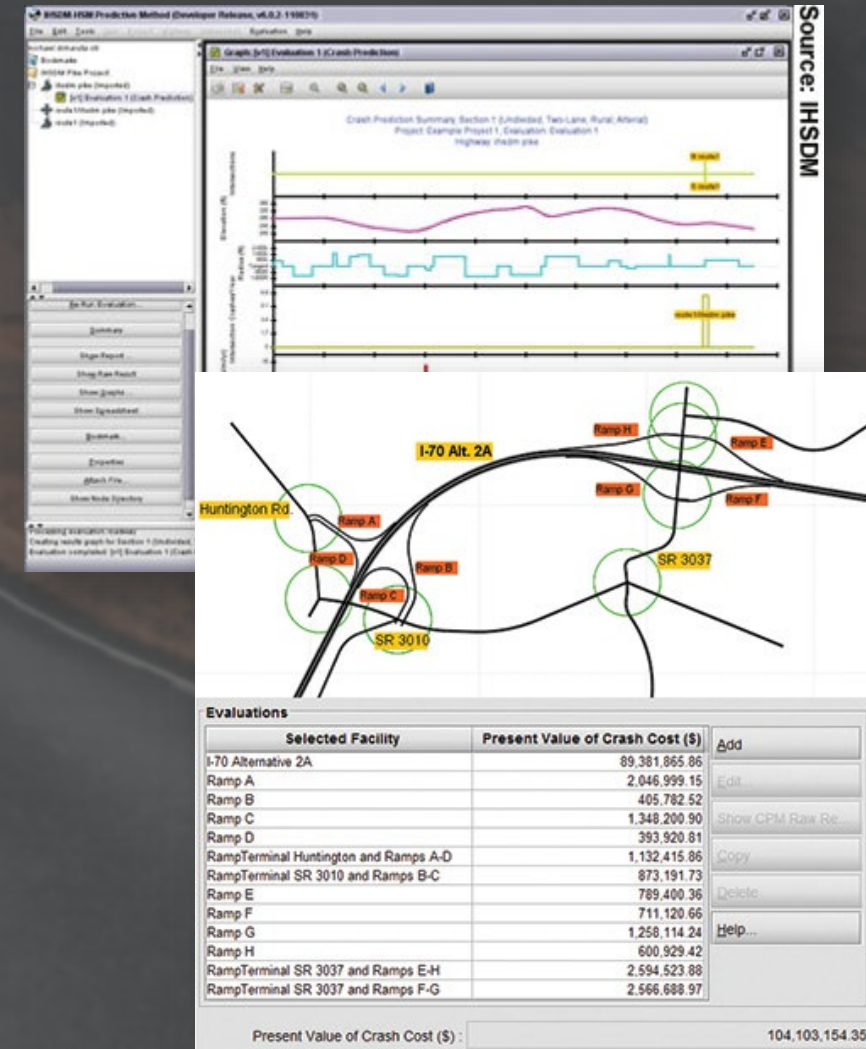
Crash Prediction Spreadsheets

- Simple spreadsheet tools for running Part C predictive crash analyses
- Available for all roadway and intersection facility types included in HSM1 and the supplement
 - Rural two-lane
 - Rural multilane
 - Urban/suburban arterials
 - Freeways and ramps
- Access the latest tools:
 - <http://www.highwaysafetymanual.org/Pages/Tools.aspx>

Worksheet 1A -- General Information and Input Data for Rural Two-Lane Two-Way Roadway Segments															
General Information					Location Information										
Analyst	(enter name)				Roadway				(enter roadway name)						
Agency or Company	(enter agency)				Roadway Section				(enter roadway section)						
Date Performed	(enter date)				Jurisdiction				(enter jurisdiction)						
					Analysis Year		2019								
					Analysis Year		2019								
					Input Data				Base Conditions			Site Conditions			
					Length of segment, L (mi)				--			1			
					AADT (veh/day)				AADT _{BASE} = 17,800 (veh/day)			0			
					Lane width (ft)				12			12			
					Shoulder width (ft)				6			6			
					Shoulder type				Paved			Paved			
					Length of horizontal curve (mi)				0			0.0			
					Radius of curvature (ft)				0			0			
					Spiral transition curve (present/not present)				Not Present			Not Present			
					Superelevation variance (ft/ft)				< 0.01			0			
					Grade (%)				0			0			
					Driveway density (driveways/mile)				5			5.00			
					Centerline rumble strips (present/not present)				Not Present			Not Present			
					Passing lanes (present (1 lane) / present (2 lane) / not present)				Not Present			Not Present			
					Two-way left-turn lane (present/not present)				Not Present			Not Present			
					Roadside hazard rating (1-7 scale)				3			3			
					Segment lighting (present/not present)				Not Present			Not Present			
					Auto speed enforcement (present/not present)				Not Present			Not Present			
					Calibration Factor, Cr				1			1.00			
Worksheet 1B -- Crash Modification Factors for Rural Two-Lane Two-Way Roadway Segments															
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)			
CMF for Lane Width	CMF for Shoulder Width and Type	CMF for Horizontal Curves	CMF for Super-elevation	CMF for Grades	CMF for Driveway Density	CMF for Centerline Rumble Strips	CMF for Passing Lanes	CMF for Two-Way Left-Turn Lane	CMF for Roadside Design	CMF for Lighting	CMF for Automated Speed Enforcement	Combined CMF			
CMF 1r	CMF 2r	CMF 3r	CMF 4r	CMF 5r	CMF 6r	CMF 7r	CMF 8r	CMF 9r	CMF 10r	CMF 11r	CMF 12r	CMF combined			
from Equation 10-11	from Equation 10-12	from Equation 10-13	from Equations 10-14, 10-15, or 10-16	from Table 10-11	from Equation 10-17	from Section 10-7.1	from Section 10-7.1	from Equation 10-18 & 10-19	from Equation 10-20	from Equation 10-21	from Section 10-7.1	(1)(2)(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)(13)			
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.000			
Worksheet 1C -- Roadway Segment Crashes for Rural Two-Lane Two-Way Roadway Segments															
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)								
Crash Severity Level	N spt rs	Overdispersion Parameter,	Crash Severity	N spt rs by Severity	Combined	Calibration	Predicted average								

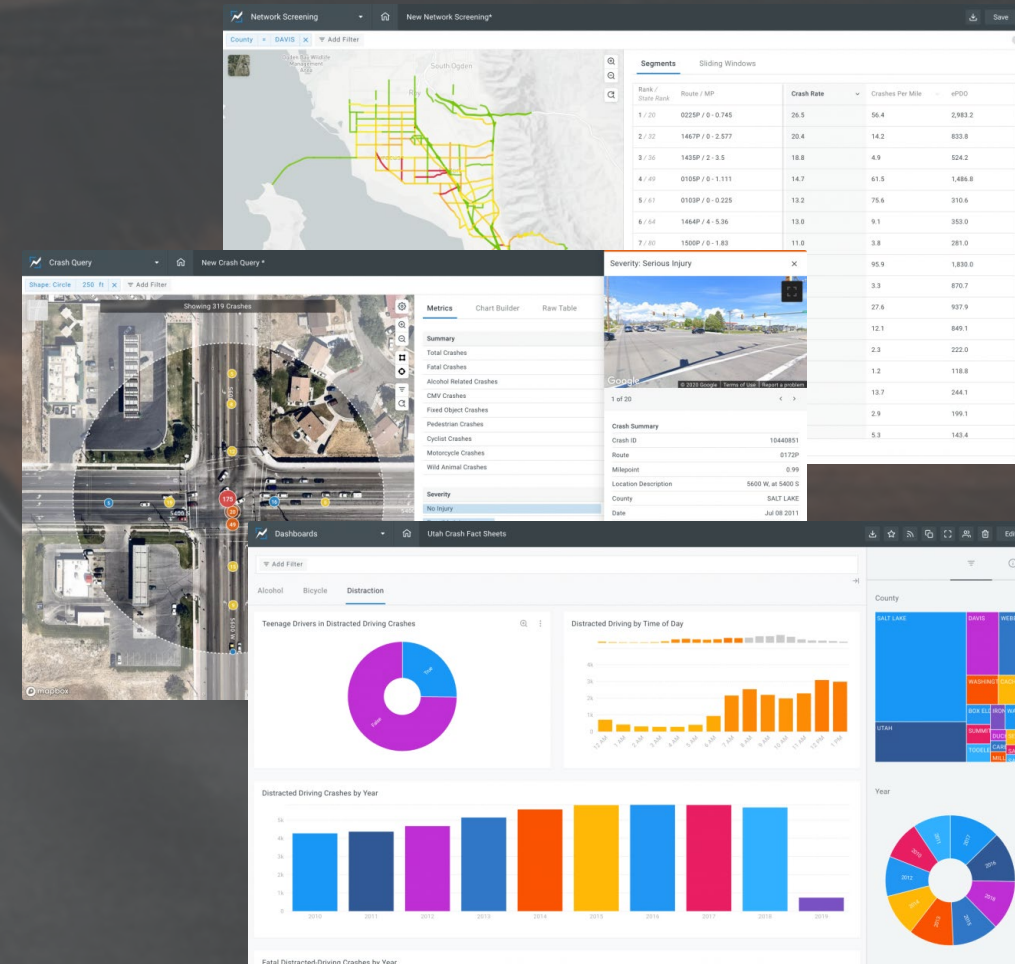
Interactive Highway Safety Design Model (IHSDM)

- FHWA standalone software tool for predictive crash analysis and visualization
- Includes all predictive models in HSM1 and the supplement, with additional facilities including:
 - Rural and urban all-way stop controlled intersections
 - Rural three-leg signalized intersections
 - Urban/suburban high-speed intersections
 - Urban five-leg signalized intersections
 - Single-point and tight diamond interchange terminals
 - And more...
- Sunsetting in 2024 but will still be available
 - Access the latest version [here](#)



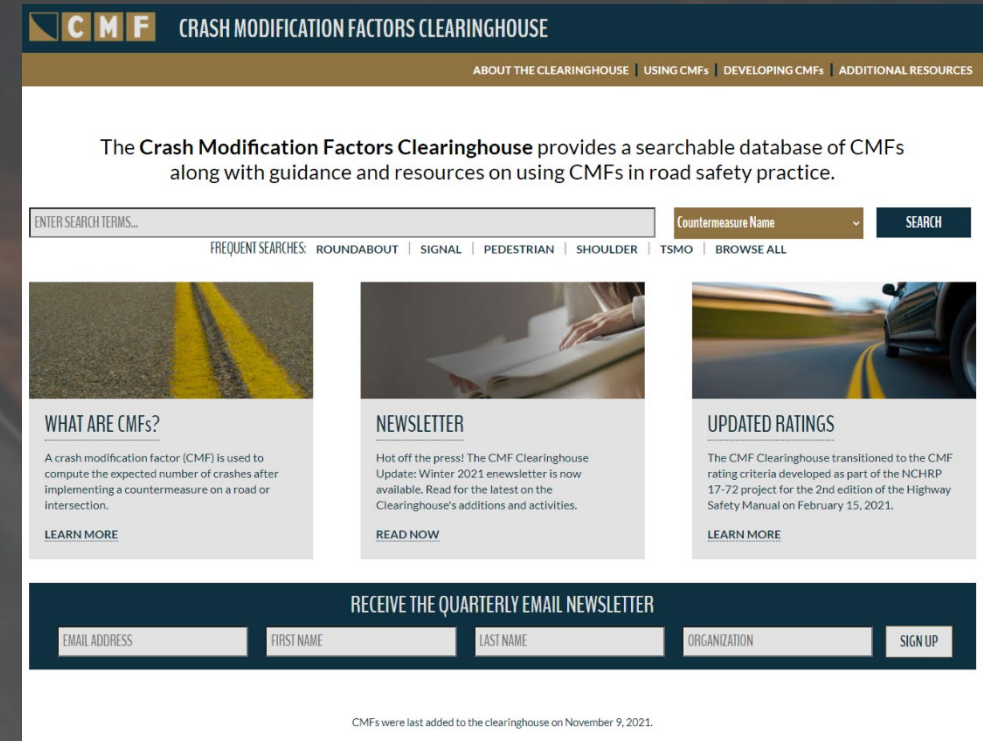
AASHTOWare Safety

- Web-based safety analysis suite powered by Numetric
 - Supersedes SafetyAnalyst
 - Annual cost is context-dependent
- Includes modules for segment, intersection, and trend analysis
- Features for network screening, crash querying, SPF development, visualization, and more
- Learn more at <https://numetric.com/>



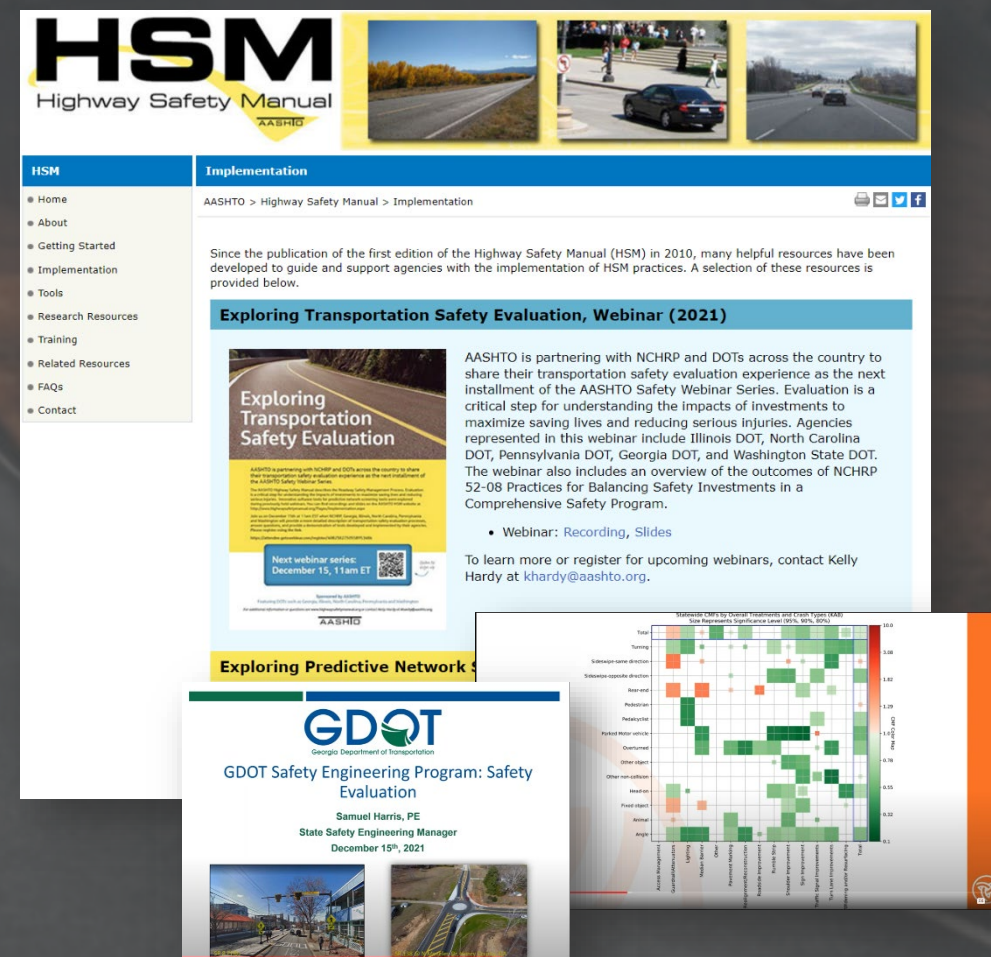
Crash Modification Factor (CMF) Clearinghouse

- Searchable database of research-driven crash modification factors
- Provides guidance and resources for using CMFs in practices
- CMFs are rated based on quality to help users find the most appropriate values
- Quarterly email newsletter for updates
- Visit <http://cmfclearinghouse.org/>



HSM Application Webinars

- AASHTO sponsors periodic webinars on HSM methods and research
- Recent and upcoming webinars include:
 - Transportation Safety Evaluation
 - Predictive Network Screening Tools
 - Applications of recently completed research
- Video recordings and slides are available on the HSM website's [implementation page](#)



HSM
Highway Safety Manual
AASHTO

Implementation

AASHTO > Highway Safety Manual > Implementation

Since the publication of the first edition of the Highway Safety Manual (HSM) in 2010, many helpful resources have been developed to guide and support agencies with the implementation of HSM practices. A selection of these resources is provided below.

Exploring Transportation Safety Evaluation, Webinar (2021)

AASHTO is partnering with NCHRP and DOTs across the country to share their transportation safety evaluation experience as the next installment of the AASHTO Safety Webinar Series. Evaluation is a critical step for understanding the impacts of investments to maximize saving lives and reducing serious injuries. Agencies represented in this webinar include Illinois DOT, North Carolina DOT, Pennsylvania DOT, Georgia DOT, and Washington State DOT. The webinar also includes an overview of the outcomes of NCHRP 52-08 Practices for Balancing Safety Investments in a Comprehensive Safety Program.

• Webinar: [Recording](#), [Slides](#)

To learn more or register for upcoming webinars, contact Kelly Hardy at khardy@aahto.org.

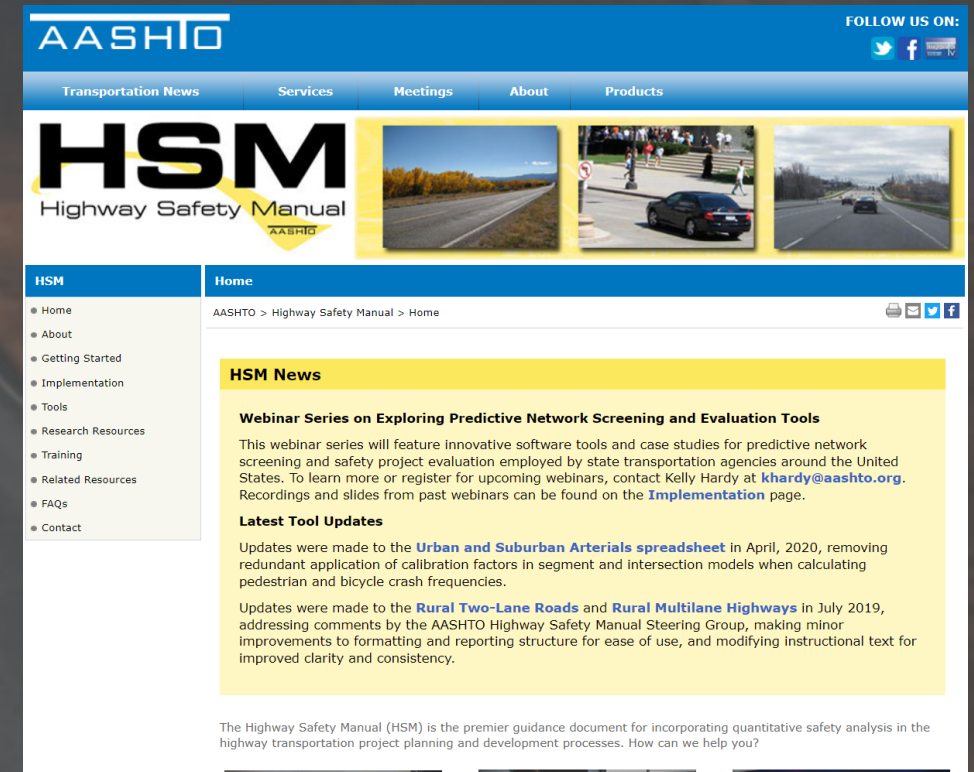
Exploring Predictive Network

GDOT
Georgia Department of Transportation
GDOT Safety Engineering Program: Safety Evaluation
Samuel Harris, PE
State Safety Engineering Manager
December 15th, 2021

Heatmap showing Safety Significance Level (SSL) for various road types and locations. The color scale ranges from 0.1 (blue) to 10.0 (red). The heatmap is titled 'Heatmap for Safety Significance Level (SSL) by Road Type and Location'.

Highway Safety Manual Website

- All these resources and more can be found on the highway safety manual website
- highwaysafetymanual.org



Looking Forward

When and where the HSM2 will be available

Publication Timeline

- Estimated HSM2 publication in 2024
- Website for updates and additional information
 - www.highwaysafetymanual.org
- Questions? Contact Kelly Hardy
 - info@highwaysafetymanual.org

Questions?

Thank you for your attention.

For more information, please contact
Kelly Hardy at info@highwaysafetymanual.org