

Overview of the First Edition of the Highway Safety Manual

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The HSM is a guidebook providing:

- **Knowledge**
- **Predictive Tools**
- **Safety Management and Evaluation Process**



Overview

- **Why is the ‘Highway Safety Manual’ needed?**
- **What is the HSM?**
- **History on the Evolution of the HSM**
- **Organization and contents of the HSM**
- **What can you do now?**



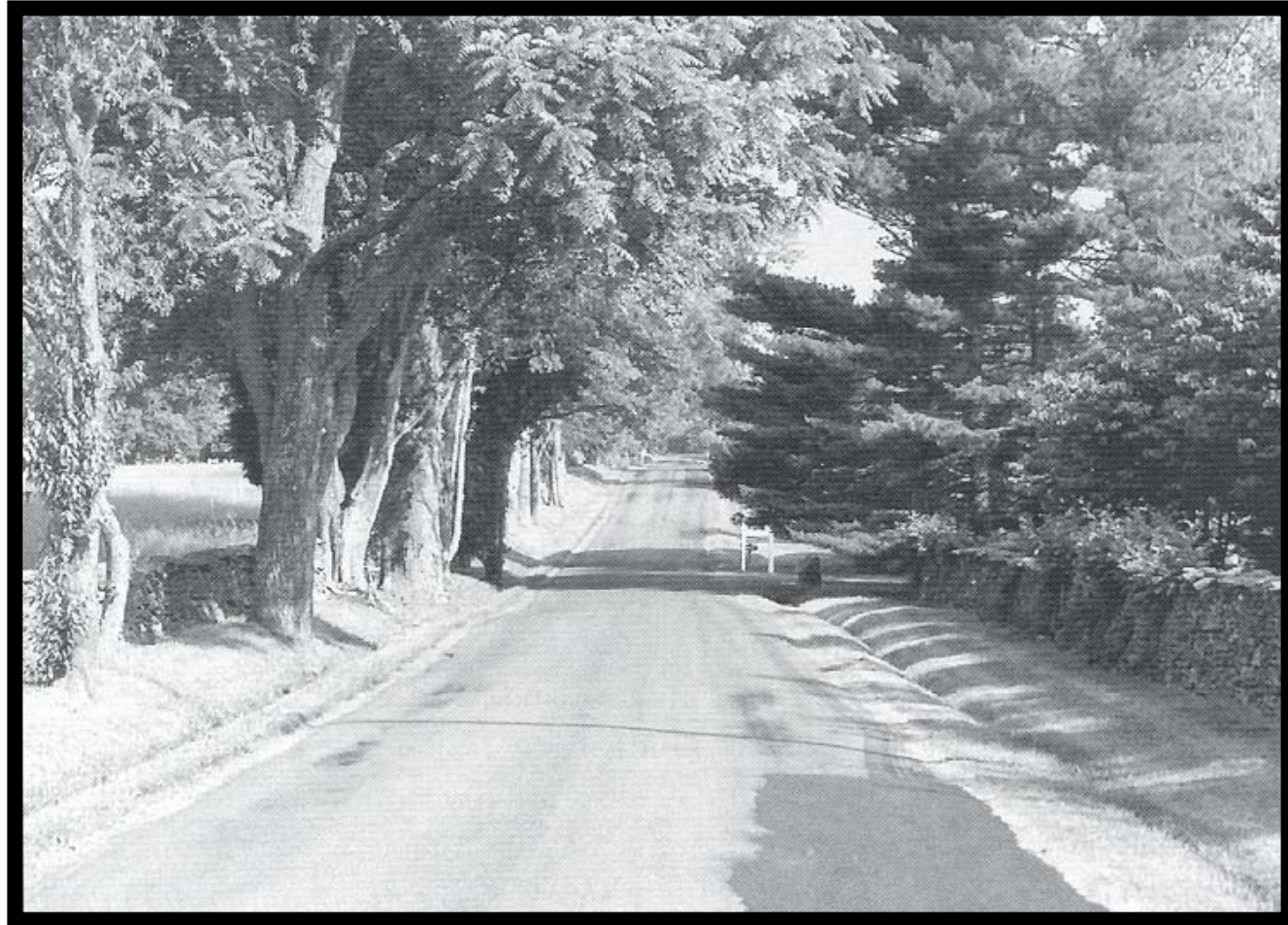
How do we make judgments about balancing 'safety' with other community values?



Source: HSM Task Force User Liaison Subcommittee



Is this road “safe” or “unsafe”?

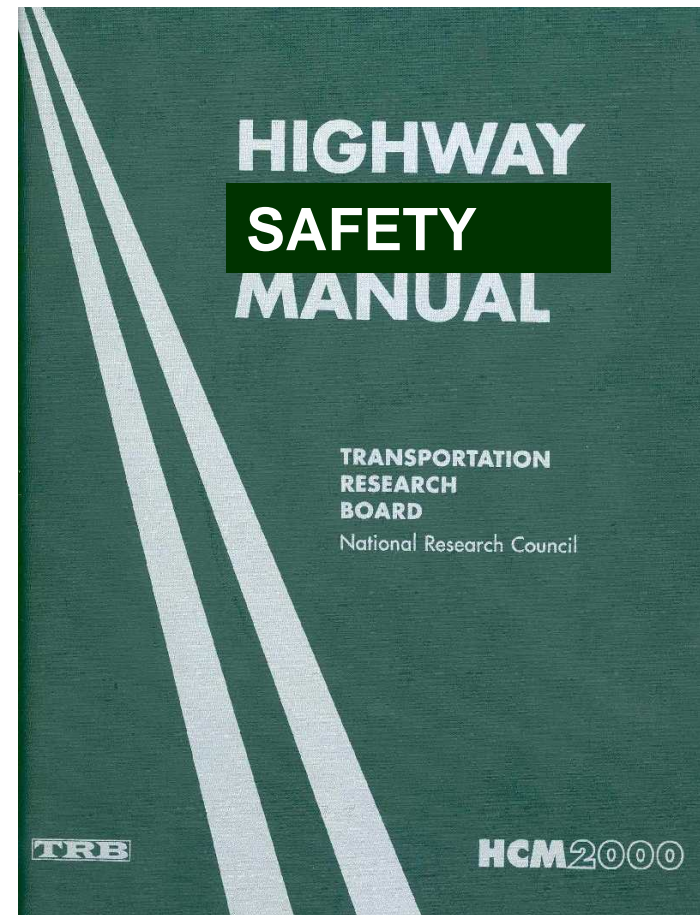


Source: HSM Task Force User Liaison Subcommittee



The 'vision' of the HSM

- **Definitive**
- **Widely accepted**
- **Science-based**



Provide the best factual information and tools

- **Useful form for explicit consideration**
- **Synthesis of validated highway research**
- **Adapted & integrated to practice**
- **Analytical tools for predicting impact on road safety**



Targeted Users of the HSM

- **Everyday engineers and planners**
 - **Analysts studying the effect of actions on road users**
 - **Planners, designers and those responsible for operations and maintenance**
- **Management**
- **Educational Institutions**



History (1)

- **Started with discussions within TRB about role of safety in Highway Capacity Manual**
- **Conference Session at TRB's January 1999 Annual Meeting concluded:**
 - The absence of, and the need for a single authoritative document to use for estimating safety impacts
- **December 1999 Workshop confirmed:**
 - The crucial need for a stand-alone document to be named the Highway Safety Manual



History (2)

- **Formation of a TRB Joint Subcommittee for the development of a HSM:**
 - **Members of sponsoring committees**
 - **AASHTO, FHWA, ITE**
- **Meetings since January 2000:**
 - **From 20 to 80 members and friends**
 - **Status 2003: Task Force**
- **First Edition expected in 2008**



Research & Development

- **Task Force key objective - provide direction and oversight to the research**
- **Relevant NCHRP efforts:**
 - Table of Contents; Work Plan, and Prototype Chapter (17-18(4))
 - Fundamentals and Knowledge (Parts I and II) (17-27)
 - Safety Performance Models for Urban and Suburban Arterials (17-26)
 - Safety Prediction Models for Rural Multilane Highways (17-29)
 - Roadway Safety Management and Estimating AMFs (17-34)
 - Production of the First Edition of the HSM (17-36)
 - On-going: IHSDM, SafetyAnalyst and Human Factors Guide



Outline for the First Edition of the HSM

Part I – Introduction and Fundamentals

Part II – Knowledge

Part III – Predictive Methods

Part IV – Safety Management of a Roadway System

Part V – Safety Evaluation

Glossary



Chapter 1 - Introduction and Overview

Chapter 2 – Fundamentals

- **Chapter 1 - Introduction and Overview**
 - Purpose and Background
 - Audience
 - Scope and Context
 - Intended Use
 - Summary
- **Chapter 2 - Fundamentals**
 - What is Safety
 - How is Safety Measured
 - Safety Performance Functions and Accident Modification Factors
 - Human Factors in Road Safety
 - Speed and Safety
 - Safety Evaluation



Part II – Knowledge

- **Chapter 3 - Roadway Segments**
- **Chapter 4 - Intersections**
- **Chapter 5 - Interchanges**
- **Chapter 6 - Special Facilities and Geometric Situations**
- **Chapter 7 - Road Networks**

Provides measured safety effects of design elements, traffic control and operational elements, other elements, and ped/bike safety

AMF = Factor used to adjust baseline accident frequency to account for feature or intervention. Includes standard error (measure of accuracy).



Sample AMFs Currently Included in Draft HSM

AMFs for Roadway Segment Design Elements

Cross-Section Elements

Modify lane width	Add lanes	“Road Diets”	Provide a median
Modify shoulder width	Improve shoulder type		

Roadside Elements

Flatten slideslopes	Increase distance to roadside features
Change roadside barrier	Install median barrier
Install crash cushions	Reduce Roadside Hazard Rating

Alignment Elements

Modify horizontal curve radius and length	
Correct superelevation deficiency	Change vertical grade



Example AMF from Chapter 3

Treatment: Remove through lanes or “road diets”

“Road diets” are generally conversions of four-lane undivided roads into three lanes (two through lanes plus a center two-way left-turn lane). The remaining roadway may be converted to bicycle lanes, sidewalks, or on-street parking. ⁽⁶⁾

Rural two-lane roads; Rural multi-lane highways; Freeways; Expressways

Not applicable.

Urban and suburban arterials

Reducing four-lane undivided roads to three lanes may reduce accidents of all types and severities, as shown in Exhibit 3-3. ⁽⁶⁾

Exhibit 3-3: Safety effects of removing through lanes or “road diets” ⁽⁶⁾

Treatment	Setting Road type	Traffic Volume	Accident type Severity	AMF	Std. Error
Four to three lane conversion	Urban arterials	Unspecified	All types All severities	0.94*	0.08

NOTE: * Observed variability suggests that this treatment could result in a benefit or a disbenefit. See Chapter 1.



Part III – Predictive Methods

- **Chapter 8 - Rural, Two-Lane Highways**
- **Chapter 9 - Rural Multi-Lane Highways**
- **Chapter 10 - Urban and Suburban Arterial Highways**

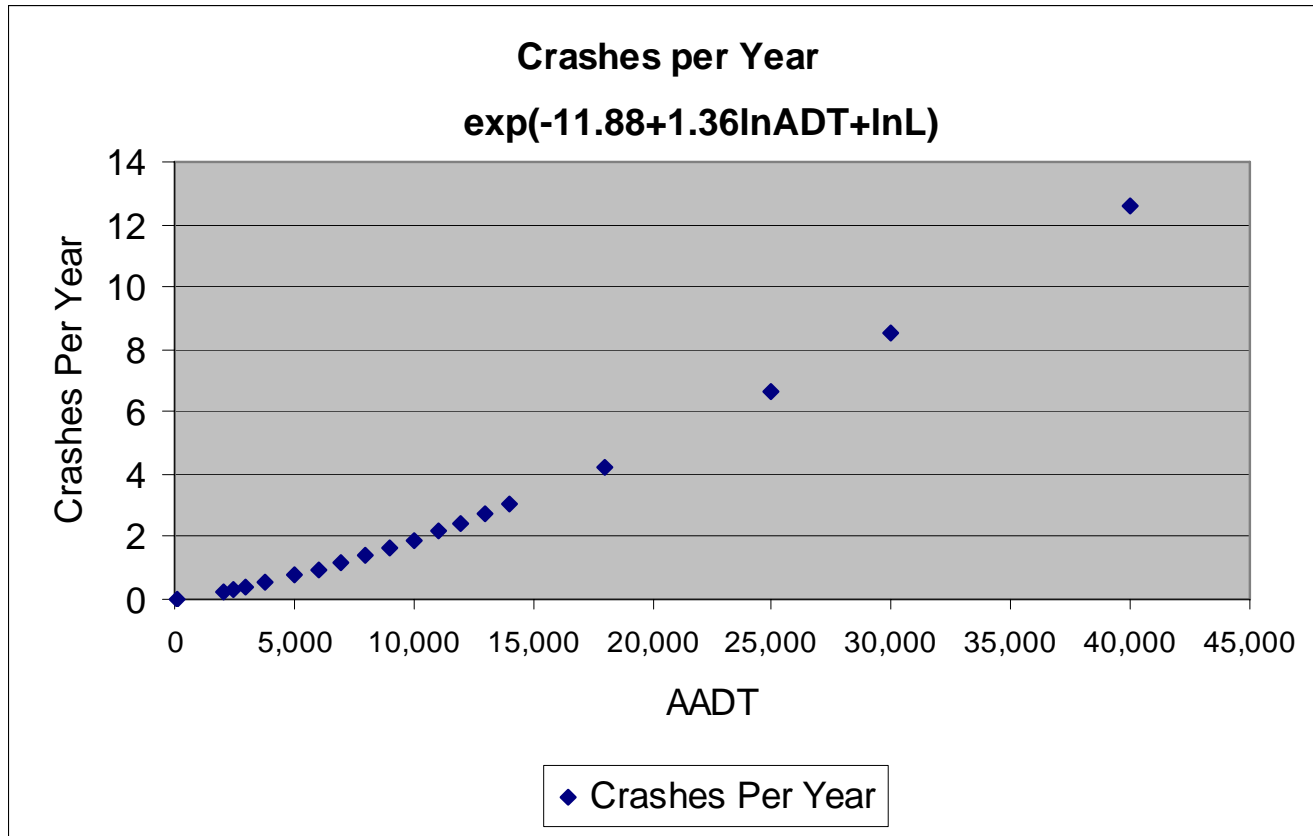
Each chapter provides safety prediction procedures – to predict the safety performance of specific facilities based on design and traffic control elements.

The contents of each chapter include an introduction, methodology, applications, and example problems.



Example Safety Performance Function

- Four Lane Divided Road Total Accidents Per Year



Crash Prediction Process

- **Select a segment or intersection**
- **Apply base models**
- **Apply calibration factors**
- **Apply AMFs for specific baseline conditions or average conditions**
- **Apply EB method if accident history is known**
- **Determine predicted crash frequency, or distribution by severity or type**
- **Calculate variance and confidence intervals**
- **Present final predicted value**



General Form of Prediction Methodology

$$N = N_{\text{base}} C (AMF_1 AMF_2 \dots AMF_n)$$

where:

- N = predicted number of accidents per year for roadway segment or intersection
- N_{base} = predicted number of accidents per year for nominal or base conditions
- C = calibration factor to convert predicted accident frequency to local conditions
- AMF_n = accident modification factor to convert nominal or base conditions to actual site conditions

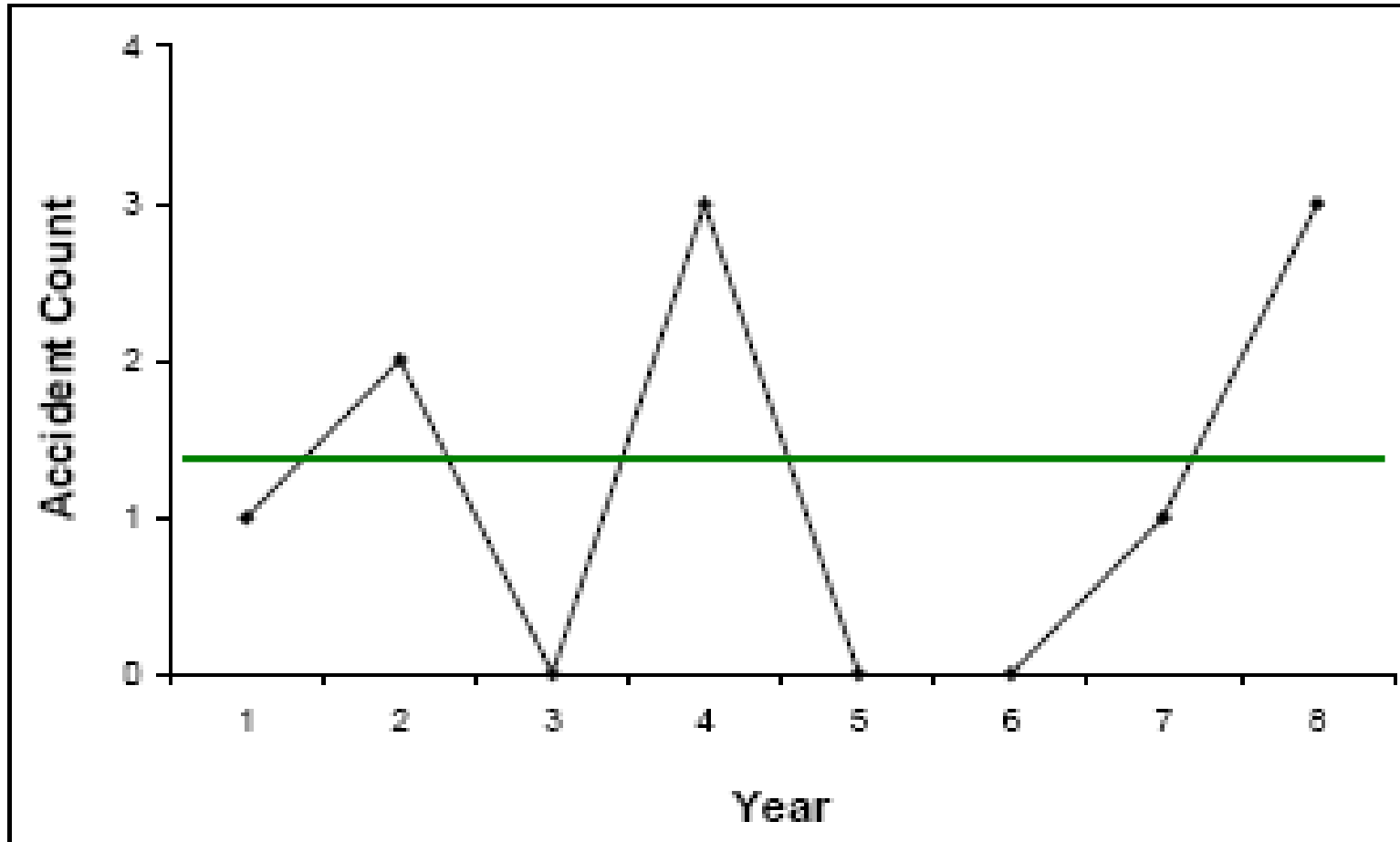


Empirical Bayes Methodology

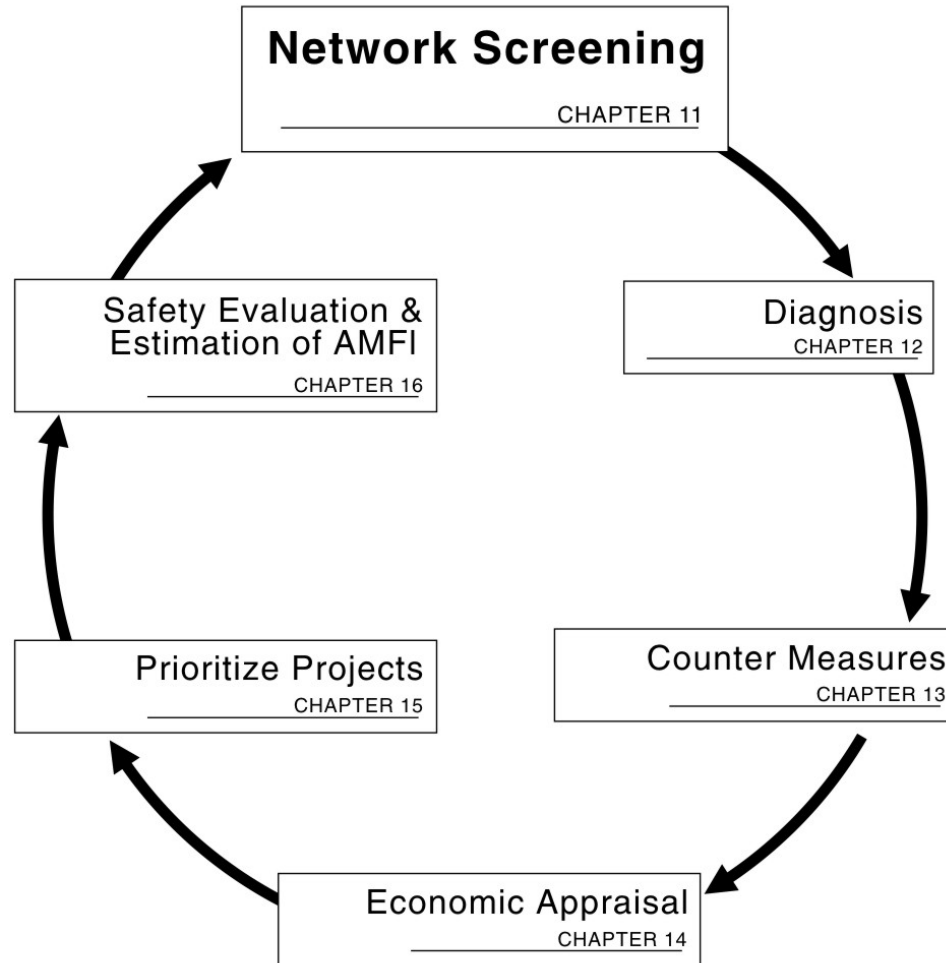
- **Combines predicted and observed crash frequency**
- **Predicted crashes – estimated with HSM methodology**
- **Observed crashes – site-specific crash history**
- **Compensates for Regression to the Mean**



Regression to the Mean



Part IV – Safety Management of a Roadway System



Example: Chapter 11 – Roadway Safety Network Screening

Network Screening – a process for reviewing a transportation network and identifying locations that may need and/or respond to safety improvements



Example: Chapter 11 – Roadway Safety Network Screening

Chapter 11 Outlines the Process, Data Needs and Methods for Screening

- Frequency
- Equivalent Property Damage Only
- Relative Severity Index
- Rate
- Rate Quality Control
- Level of Service of Safety
- High Proportion of Specific Crash Type
- Rank Based on Expected Crashes
- Rank Based on Excess Expected Crashes



Part V - Chapter 16

Safety Evaluation of Implemented Measures

- **Overview**
- **Process, data needs and methodologies**
 - **Comparison Group**
 - **Empirical Bayes**



Next Steps in the Research Project

- **Prepare Prototype Chapter**
- **Revise Annotated Outline**
- **Attend NCHRP Panel Meeting**
- **Conduct AASHTO Focus Group Meetings**
- **Update Chapter 8 Contents**
- **Meet with HSM Task Force and AASHTO Task Force**
- **Prepare Phase 2 Scope of Work**



The HSM is

- Knowledge
- Predictive Tools
- Safety Management and Evaluation Process

The image shows a whiteboard with handwritten notes titled "FATAL CRASHES". The notes are organized by year and list the date, location, and details of each incident. The incidents are as follows:

Year	Date	Location	Details
NOV 02 -	11-25	Petes Mtn Rd	1 - DUI
	12-11	Howards Mill Rd	1 - M/C-DUI
	12-24	122/Sonnyside-Roll	1 - DUI
2003	6-05	Advance Rd	2 - Speed - TE567
	6-20	Stafford/65th	1 - DUI
	8-30	Beau. Rd/Carvs	1 - 6yr old - Camper
	8-24	172nd new Sager	1 - Speed
	9-13	Eagle Ct Rd	1 - M/C - Speed
	12-3	Beau/Butte	1 - Auto/Red
2004	2-1	Canby-Marquam	1 - M/C
	3-8	Ladd Hill/Bell	1 - M/C
	4-9	Wildcat Mtn/Van Currin	1 - Car/Trk

Below the 2004 section, the word "Ride" is partially visible.

Source: Joe Marek, Clackamas County



What can you do now?

- **Explore the HSM website**
 - www.highwaysafetymanual.org
- **Check out SafetyAnalyst**
 - www.safetyanalyst.org
- **Check out IHSDM**
 - www.tfhrc.gov/safety/ihsdm
- **Provide Feedback and Concerns**
 - Don Vaughn
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