Innovative Safety Analysis Resources from the United States

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"Road safety management is in transition. The transition is from action based on experience, intuition, judgment, tradition, and outdated methods to action based on empirical evidence, science, and technology…"

- Ezra Hauer

What is Safety?

- Principle evidence of lack of safety are crashes and the harm they cause
- Definition – number of crashes, or crash consequences, by kind & severity, **expected** to occur at a location during specified period of time

2-3

Measuring Safety

- Important distinction between directly observable & not observable
  - Directly observable = crash counts
  - Not observable = long-term averages

2-4

Crash Counts

- Count of crashes changes from one period to another even when there has been no change in any observable casual factor

- Useful definition of safety – Is in terms of the elusive mean (or average in the long run) that is behind the randomly fluctuating counts

Measure Safety

- The number of crashes by kind and severity, **expected to occur,** at a location during a specified period.

- Statistical methods used to estimate the expected number of crashes which increase the precision of estimates beyond what is possible when one is limited to the use of two-three year history of crashes, and correct for regression-to-the-mean bias.

2-6

Drawbacks of Older Safety Prediction Methods

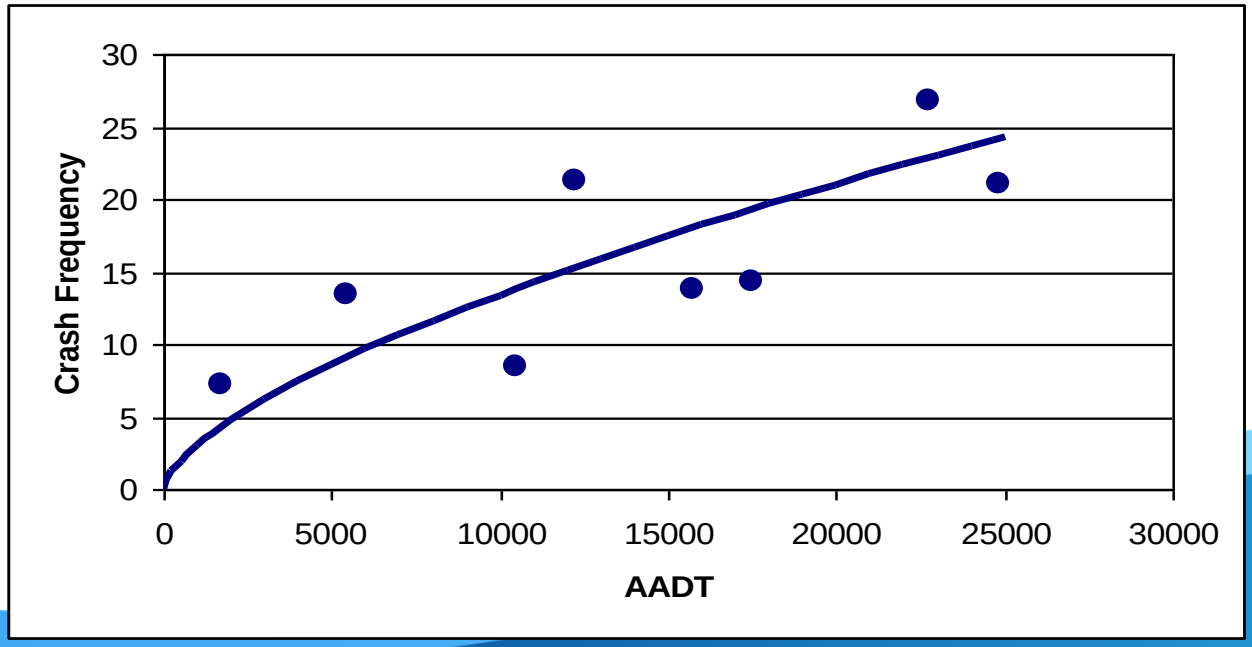
- Traditional regression modeling often used crash rate measures like crashes per million veh-mi of travel as the dependent variable
- This approach presumes a linear relationship between crash frequencies and exposure/traffic volume; what if the relationship is nonlinear?

BEST AVAILABLE APPROACH:

- Use crash frequency as the dependent variable and explicitly model exposure/traffic volume effects

Safety Performance Functions

SPF = Mathematical relationship between crash frequency per unit of time (and road length) and traffic volumes



Drawbacks of Older Safety Prediction Methods

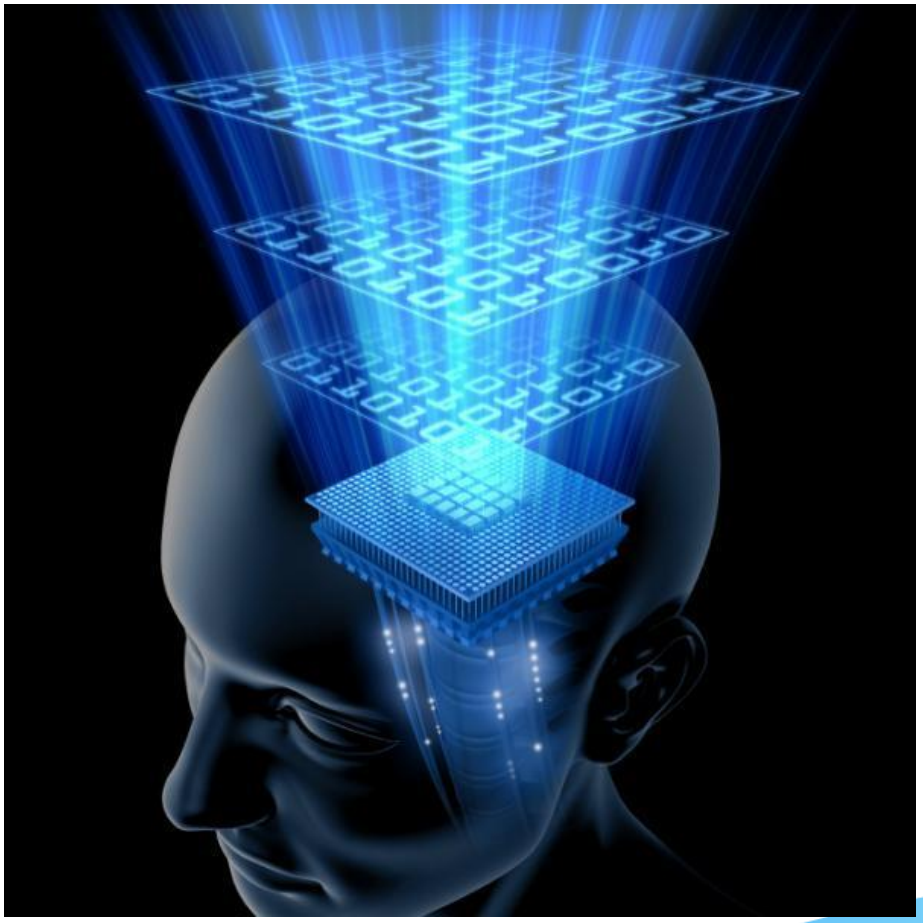
- Traditional methods treat observed crash history data as if they were exact safety measures
- Observed crash frequencies are random observations from a population whose true mean (and variance) are unknown
- Crash frequencies are highly variable from year to year
- As a result, crash frequencies are strongly subject to regression to the mean

BEST AVAILABLE APPROACH

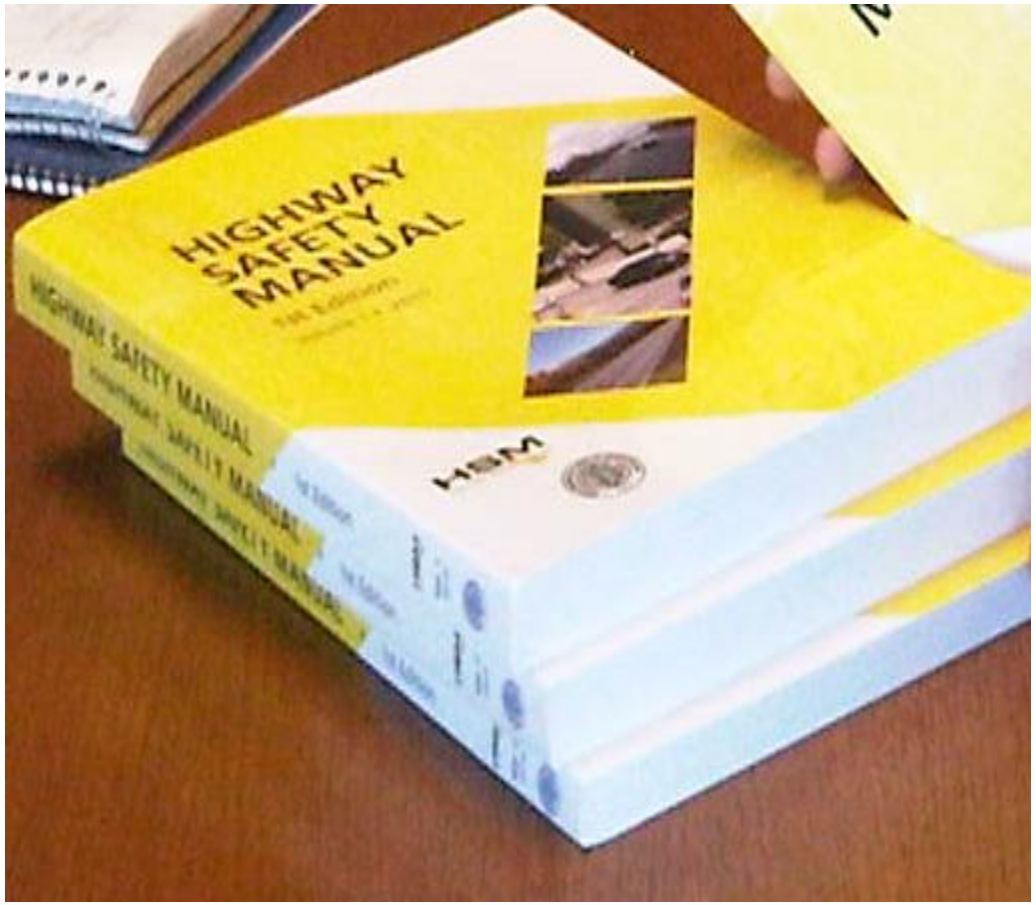
- The Empirical Bayes (EB) method combines the information available in both predictive models and observed data

- The EB method compensates for regression-to-the-mean

New Approach



Highway Safety Manual (HSM)



Part A - Introduction, Human Factors, and Fundamentals

Chapter 1 – Introduction and Overview
Chapter 2 – Human Factors
Chapter 3 - Fundamentals

Part B - Roadway Safety Management Process

Chapter 4 – Network Screening
Chapter 5 – Diagnosis
Chapter 6 – Select Countermeasures
Chapter 7 – Economic Appraisal
Chapter 8 – Prioritize Projects
Chapter 9 – Safety Effectiveness Evaluation

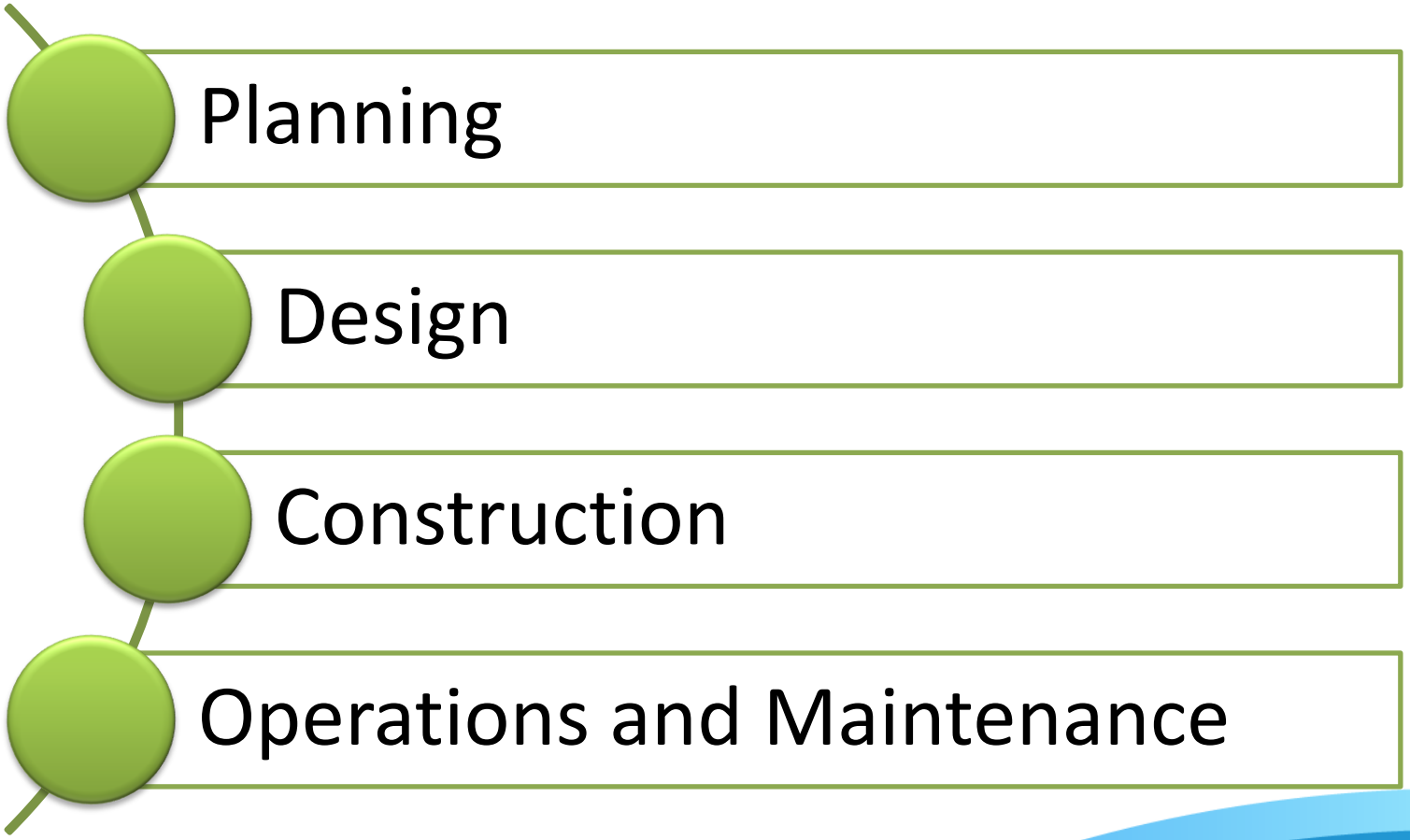
Part C - Predictive Method

Chapter 10 – Rural Two-Lane Roads
Chapter 11 – Rural Multilane Highways
Chapter 12 – Urban and Suburban Arterials

Part D - Crash Modification Factors

Chapter 13 – Roadway Segments
Chapter 14 – Intersections
Chapter 15 – Interchanges
Chapter 16 – Special Facilities
Chapter 17 – Road Networks

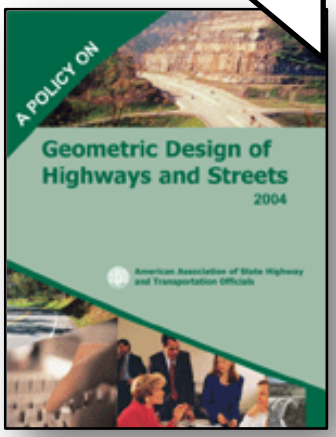
Incorporating safety in the project development decision-making process at all levels in an quantitative manner



Safety Trade-Offs?

What Do You Do?

Nominal Safety



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

Substantive Safety

HSM
Highway Safety Manual
AASHTO

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

Part A: Introduction, Human Factors and Fundamentals

Part A

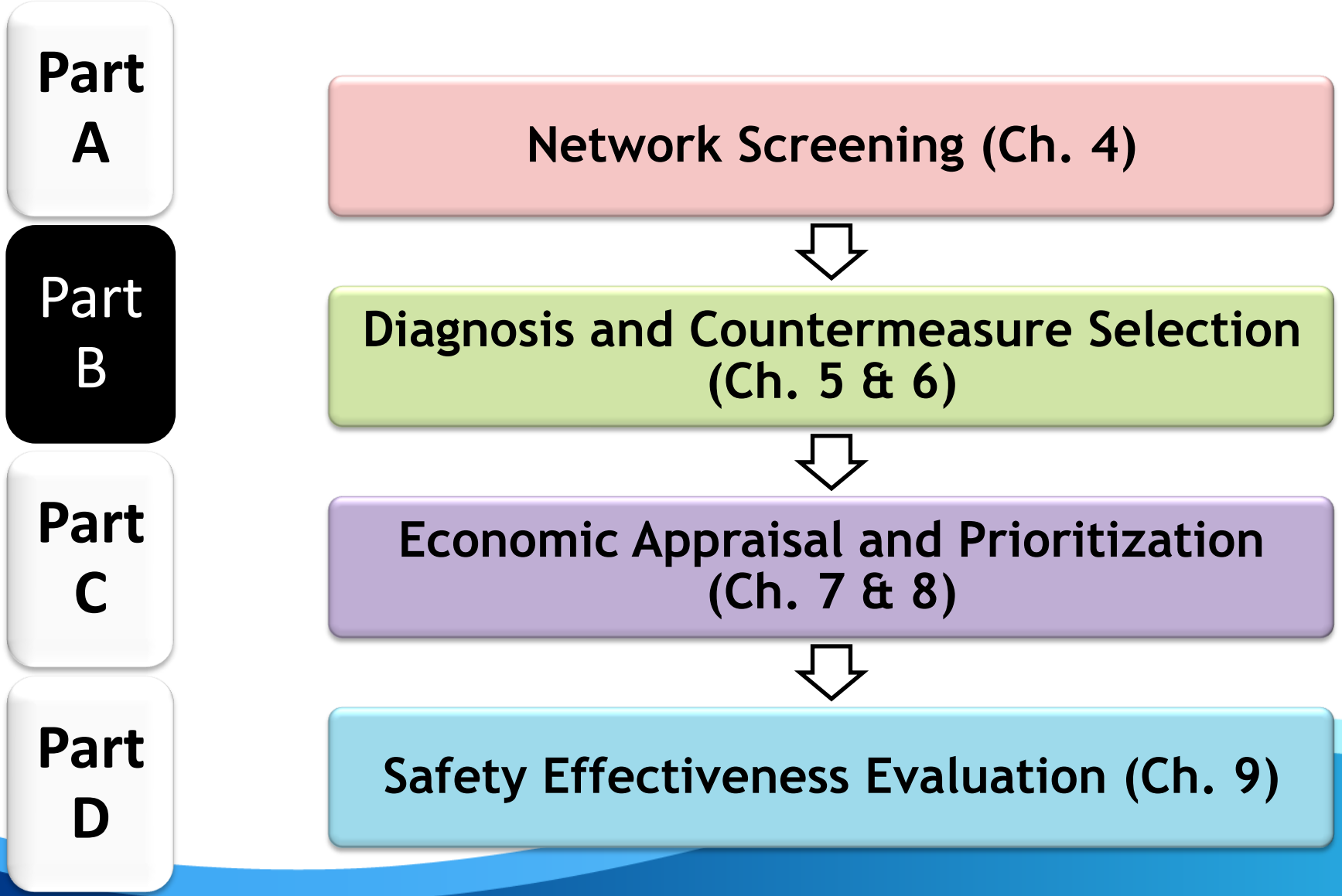
Part B

Part C

Part D

- **Part A:**
- **Introduction and Overview (Ch. 1)**
- **Human Factors (Ch. 2)**
- **Fundamentals (Ch. 3)**

Part B: Road Safety Management Process



Part C: Predictive Methods

Part A

Part B

Part C

Part D

- **Crash Prediction Methodology**
  - **Safety Performance Functions**
  - **Crash Modification Factors**
  - **Calibration**
- **Applications**
- **Example problems**
- **References**

Part D: Crash Modification Factors

Part A

Part B

Part C

Part D

- Roadway segments (Ch. 13)
- Intersections (Ch. 14)
- Interchanges (Ch. 15)
- Special facilities and geometric situations (Ch. 16)
- Road Networks (Ch. 17)

CMFs

What kinds of HSM tools are available?

- Part B - SafetyAnalyst
- Part C - Interactive Highway Safety Design Model (IHSDM)
- Part D - CMF Clearinghouse

SafetyAnalyst

- Software tool to support safety management decision making by State and local highway agencies
- State-of-the-art analytical methods for:
  - Module 1 Network Screening
  - Module 2 Diagnosis and Countermeasure Selection
  - Module 3 Economic Appraisal and Priority Ranking
  - Module 4 Evaluation of Implemented Countermeasures

Objectives of *SafetyAnalyst*

- Effectiveness of decision making:

  Automating state-of-the art analytical methods yields better information upon which to make better decisions in the programming of site-specific highway safety improvements

- Efficiency of decision support:

  Integrating all parts of the safety management process in a single, modular software package streamlines work flow

Interactive Highway Safety Design Model (IHSDM)

A suite of software tools that support **project-level** geometric design decisions by providing **quantitative** information on the expected safety and operational performance

IHSDM Benefits

- IHSDM results help project developers make design decisions that improve the expected safety performance of designs

- IHSDM helps project planners, designers, and reviewers justify and defend geometric design decisions

Crash Modification Factor (CMF) Clearinghouse (www.cmfclearinghouse.org)

Resources

- Highway Safety Manual Website
  www.highwaysafetymanual.org
- TRB Committee on Highway Safety Performance
  www.safetyperformance.org
- Interactive Highway Safety Design Model
  www.ihsdm.org
  - Technical Support, E-mail: IHSDM.Support@dot.gov
- *SafetyAnalyst*
  www.safetyanalyst.org
- CMF Clearinghouse
  www.cmfclearinghouse.org