2008 Ohio Transportation Engineering Conference

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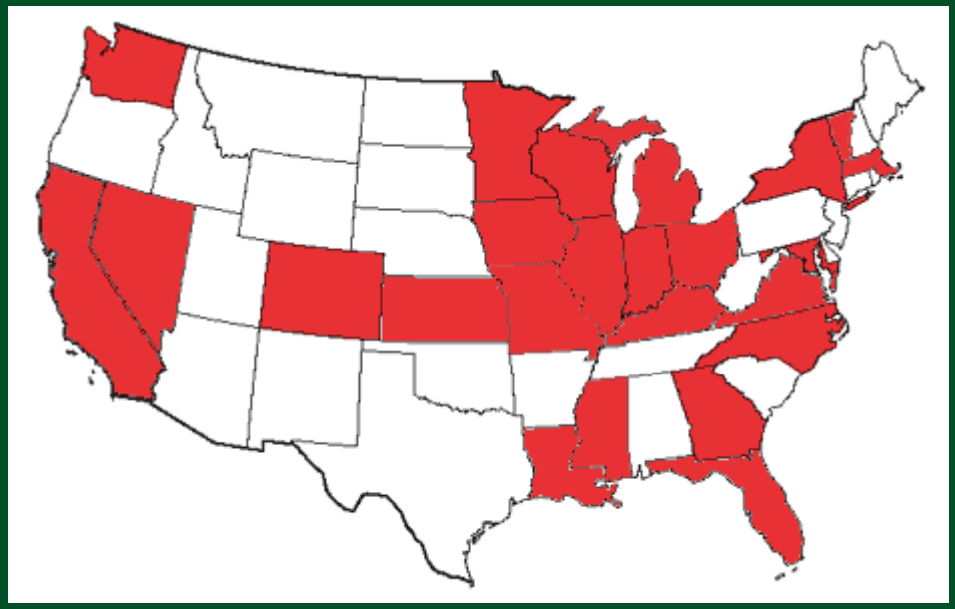
ODOT Office of Systems Planning & Program Management


SafetyAnalyst

Agencies Participating in SafetyAnalyst Development

California Department of Transportation
Colorado Department of Transportation
Florida Department of Transportation
Georgia Department of Transportation
Illinois Department of Transportation
Indiana Department of Transportation
Iowa Department of Transportation
Kansas Department of Transportation
Kentucky Transportation Cabinet
Louisiana Department of Transportation
Maryland State Highway Administration
Massachusetts Highway Department
Michigan Department of Transportation
Minnesota Department of Transportation
Mississippi Department of Transportation
Missouri Department of Transportation
Nevada Department of Transportation
New York State Department of Transportation
North Carolina Department of Transportation
Ohio Department of Transportation
Vermont Agency of Transportation
Virginia Department of Transportation
Washington State Department of Transportation
Wisconsin Department of Transportation



Additional participants include:
Delaware Valley Regional Planning Commission
North Jersey Transportation Planning Authority
Traffic Improvement Association, Oakland County, Michigan

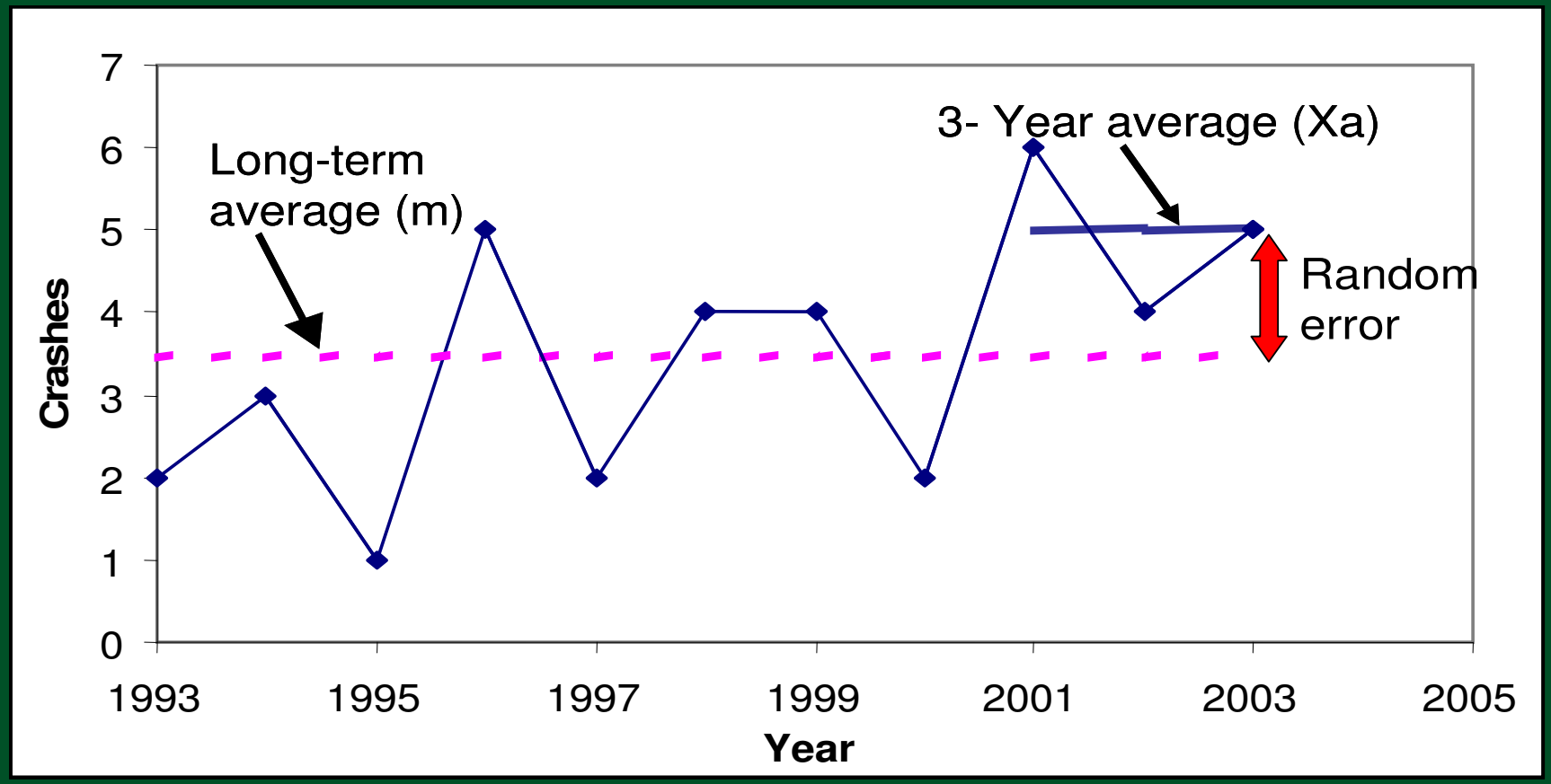
Overview

- **Safety management software for state and local highway agencies:**
  - Supports data-driven safety improvement decisions
  - Improves identification and programming of site-specific highway safety improvements
  - Incorporates state-of-the-art safety management approaches with computerized analytical tools
- **Web Sites:**
  - Public web site: http://www.safetyanalyst.org

State-of-the-Art Safety Methodology

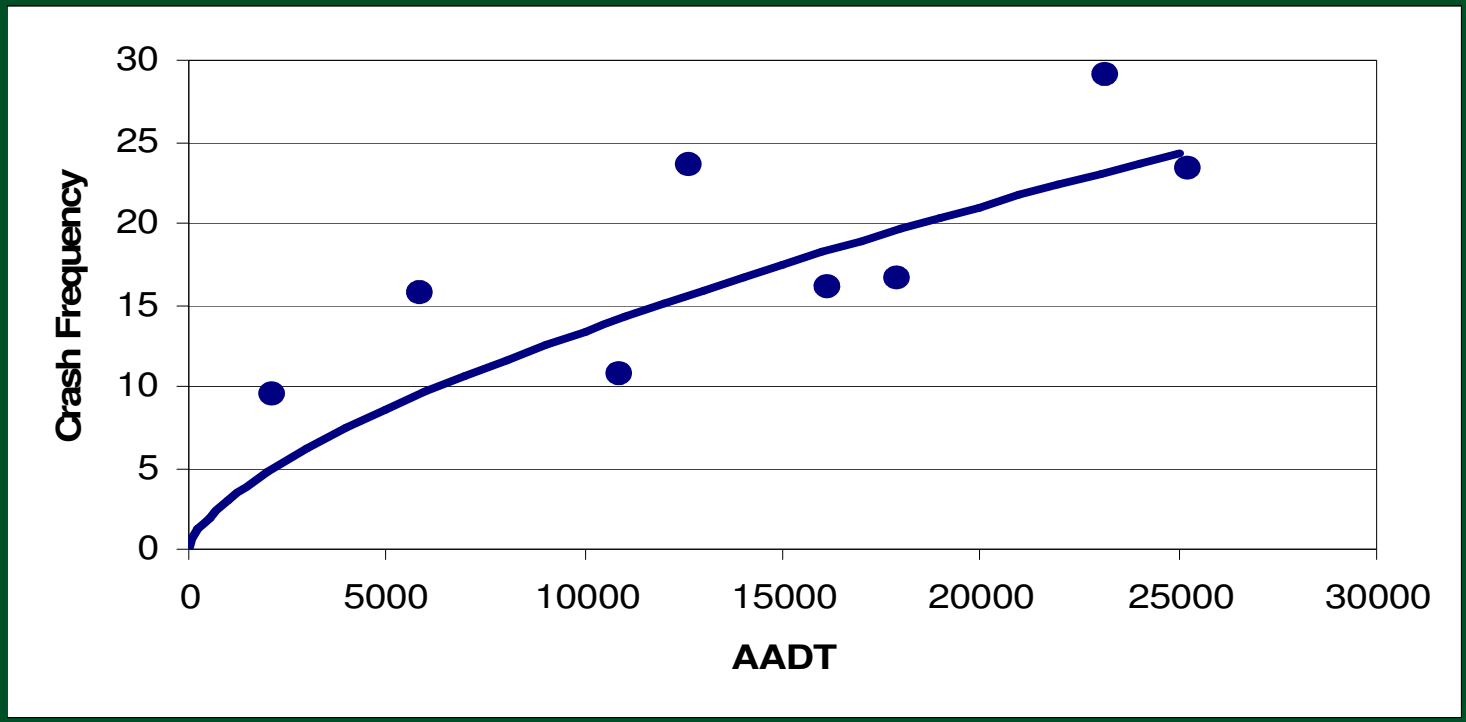
- **Number of crashes in any given time is unpredictable due to Regression-to-the-Mean**
- **Average expected number of crashes can be predicted (More reliable than short-term observed crash counts)**
- **Safety is measured by statistical methods**
  - Crash counts used to estimate long-term averages along with Regression analysis of similar sites (Safety Performance Functions – SPFs)

RTM Example with Average Observed Crashes



What Are Safety Performance Functions (SPFs)?

- Relationship between traffic volumes (AADT) and crash frequency per unit of time (and road length)



Where Do SPFs Come From?

- **SPFs are developed from multivariate regression techniques**
  - Negative binomial regression
- **SPFs are specific for a given road or intersection type**
  - Different road types = Different SPFs
- **Different SPFs for different severity levels**
- **Default SPFs are provided in *SafetyAnalyst***

Data Needed for SPF Development

- Historic crash data
- Annual traffic volumes
- Roadway inventory data

Example: SPF for Rural Two-Lane Highway

$$\kappa = e^{-3.63} \times \mathrm{ADT}^{0.53} \times \mathrm{SL}$$

Where:

ADT = Average daily traffic (veh/day)

SL = Segment length (mi)

κ = Predicted crash frequency per mile per year

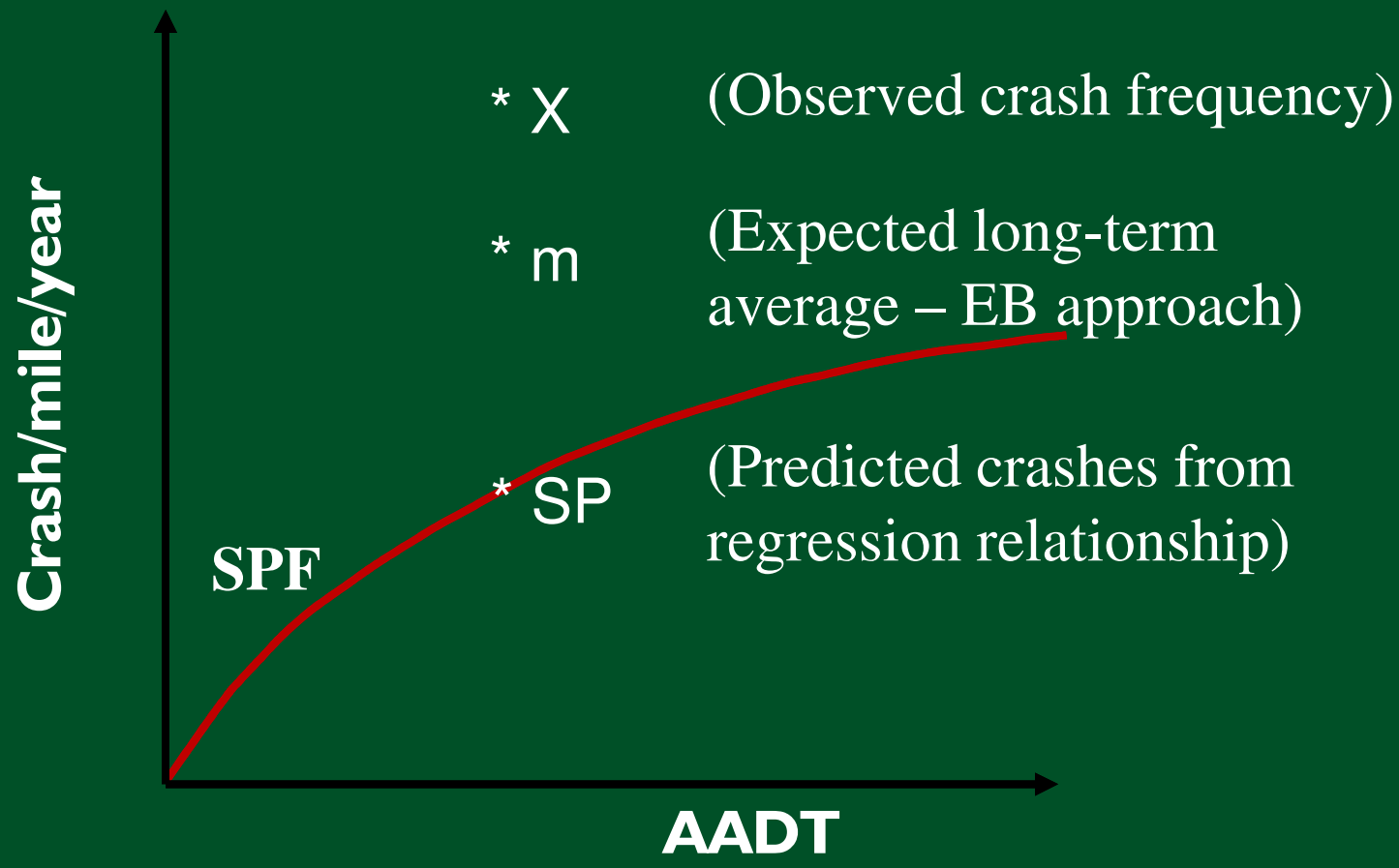
Given:

ADT = 10,000 vpd

SL = 2 mi

κ = 6.99 crashes/yr over 2 mi segment

Observed vs. Long-term Average vs. Predicted



It is noted that:

- **Predicted frequency (SP) and observed frequency (X) on their own are NOT good estimates of safety of a specific site**
  - (SP) does not consider the unique attributes
  - (X) is biased (randomness and regression to the mean phenomena)
- **Expected value (m) results from combining (SP) with (X) by applying a weight (w)**

Unique Site Attributes

SafetyAnalyst

Modules

Module 1 – Network Screening

Module 2 – Diagnosis and Countermeasure Selection

Module 3 – Economic Appraisal and Priority Ranking

Module 4 – Countermeasure Evaluation

Module 1 – Network Screening

- Review highway network (or any portion of the network) to identify sites with potential for safety improvement
- Identify sites that are candidates for further investigation

Module 1 – Network Screening

- Sites with higher-than-expected crash frequencies that may indicate the existence of safety problems correctable in a cost-effective manner.
- Sites where crash frequencies are not higher than expected but that experience enough crashes to warrant cost-effective measures.
- Screening for corridors with promise

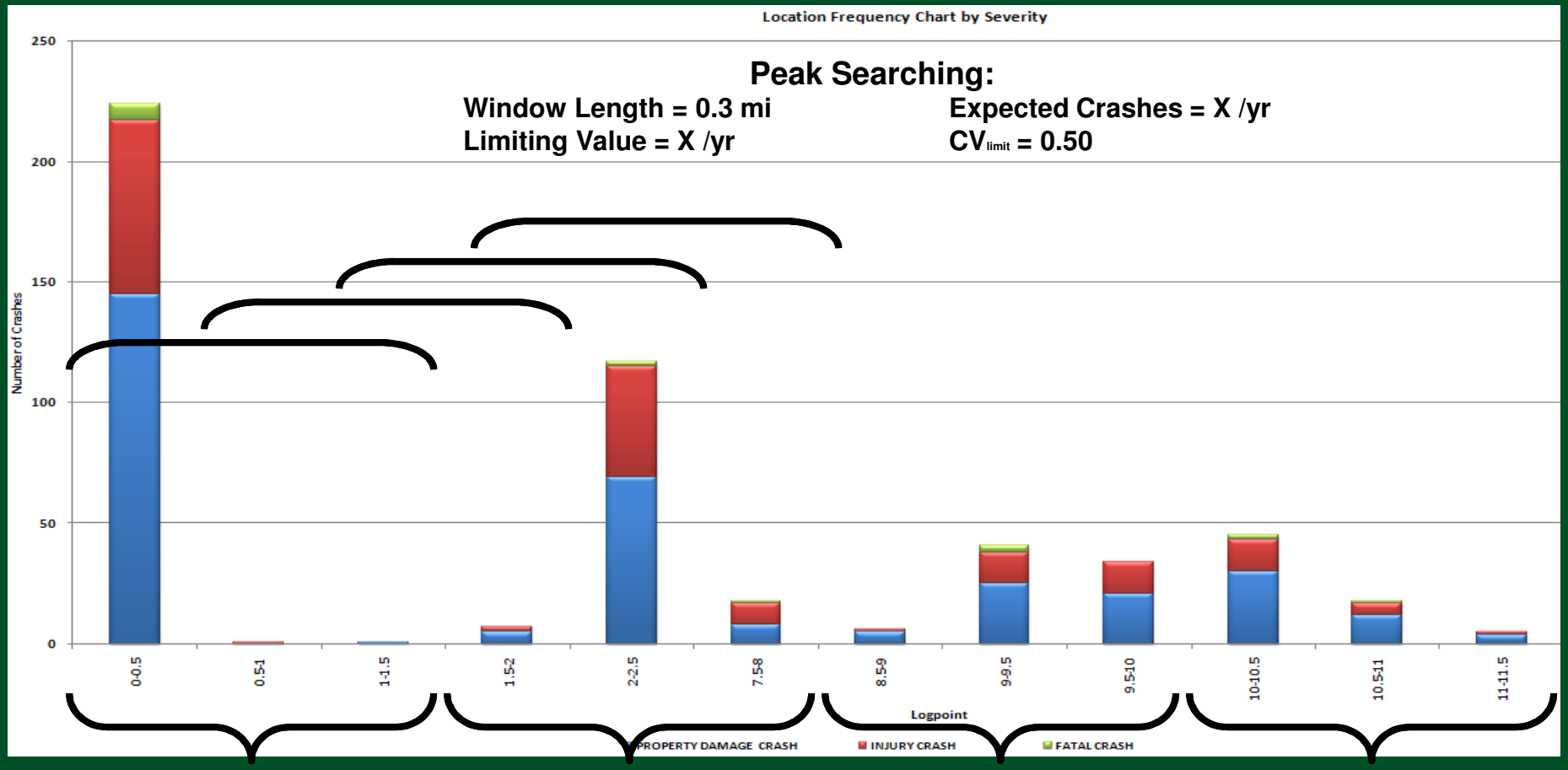
Network Screening Data Requirements

- Geometric design features
- Traffic control features
- Traffic volumes
- Crash history
- Crash characteristics
- Safety performance functions

Types of Network Screening

- **Basic network screening**
  - with Peak Searching on roadway segments
  - with Sliding Window on roadway segments
- **High proportion of specific crash type**
- **Increases in mean crash frequencies**
- **Corridor screening**

Sliding Window vs Peak Searching



Sliding Window:

Window Length = 0.3 mi
Increment Length = 0.3 mi
Expected Crashes = X /yr
Limiting Value = X /yr

Module 2 – Diagnosis and Countermeasure Selection

- Display collision diagram
- Identify crash patterns
- Conduct diagnostic investigations
- Suggest countermeasures that address identified crash patterns
- Select appropriate countermeasures

Conduct Diagnostic Investigation

- **For a number of crash patterns and site types, *SafetyAnalyst* asks a series of diagnostic questions about the site to which the user responds**
  - rural two-lane highways and urban signalized intersections
  - approximately 60 scenarios for different combinations of crash patterns and possible diagnoses
- **Yes/No answers yield potential list of recommended countermeasures**
- **Unknown answers yield office or field procedures**
- **Contraindications for specific countermeasures are provided**

Select Recommended Countermeasures

- **Selected countermeasures may include:**
  - countermeasures suggested by the software
  - countermeasures selected by the user from the master list of countermeasures, whether they were suggested by the software or not
- **The software suggests countermeasures, but does not make final selections**
- **Countermeasures are selected by the user for further consideration**
  - if diagnostic scenarios do not exist for crash pattern of interest and site subtype, user may directly select countermeasures for further consideration

Output Report

- **Summarizes list of recommended countermeasures**
- **Provides detailed list of diagnostic scenarios completed/reviewed during the investigation**
  - all questions and associated answers provided by the user are shown
- **Lists diagnostic scenarios not reviewed**
- **Provides descriptions of recommended office or field procedures for unknown answers**

Module 3 – Economic Appraisal and Priority Ranking

- **Perform economic analysis of:**
  - Alternative countermeasures for a specific site
  - Countermeasures across selected sites
- **Select an optimal mix of sites and countermeasures**
- **Develop priority ranking of alternative improvements**

Add Proposed Countermeasure Information to Sites

- **Software can consider one countermeasure per site or multiple countermeasures per site**
- **Countermeasures selected in Module 2 or added in Module 3 by the user**
- **Countermeasure information:**
  - effectiveness (AMFs)
  - service life
  - cost

Module 4 – Countermeasure Evaluation

- **Determine safety effectiveness (percent reduction in crashes) for specific implemented countermeasures**
  - Conduct before-after evaluation of crash frequencies using the Empirical Bayes (EB) approach
  - Conduct before-after evaluation of shifts in crash severity or crash type proportions

Create a List of Sites to be Evaluated

- Site list should only include those locations where a specific countermeasure or combination of countermeasures have been implemented
- All sites on the list should be of the same site type (i.e., all roadway segments, all intersections, or all ramps)
- Site list should include as many sites as possible

Status

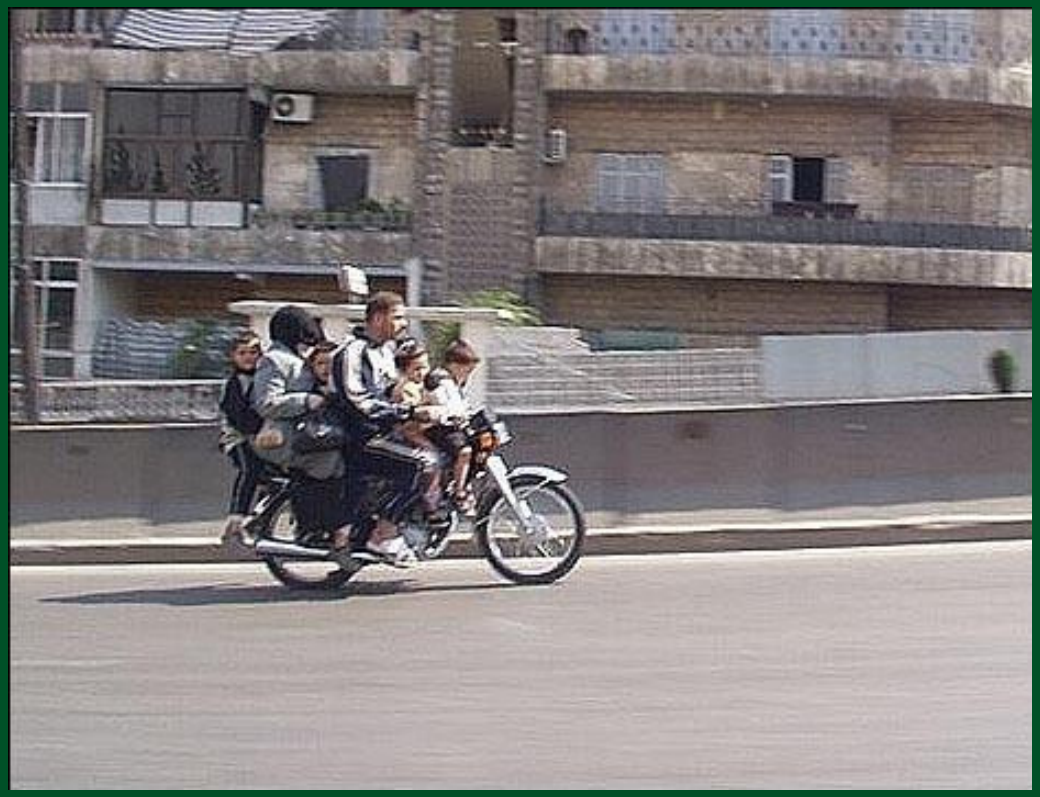
- 1st Phase: (Currently Available)

  Interim version with substantial, but intentionally limited, functionality and data management capabilities (prototype for testing & evaluation by TWG members)

- 2nd Phase: (July 2009)

  "Final" version with "full" set of functionality and capabilities (public release)

But Engineering is only one of the “E’s” in Highway Safety…



Questions?

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