Interactive Highway Safety Design Model (IHSDM) 2014 Release

Web Conference
October 2, 2014
Agenda

- Welcome and Introductions
- Integrating Safety Analysis in Design
- IHSDM 2014 – Overview
- IHSDM 2014 – Demonstration
- Why use IHSDM to implement HSM Part C?
- Questions / Discussion
What is the **intent** of the safety analysis for a transportation improvement project?

*To help make more informed project design decisions*
The safety analysis should help guide design decisions in effort to:

• Mitigate existing risk features that potentially contribute to increased number and severity of crashes

• Reduce future safety risks by making effective and efficient design choices
Good design is more than just looking up values “in the book”

It’s applying engineering knowledge of the relationship between design factors and the “safety performance” of the facility.
IHSDM: A Quantitative Approach to Evaluating Highway Safety
What is IHSDM?

• A suite of software tools that support project-level geometric design decisions by providing quantitative information on the expected safety and operational performance
What Benefits does IHSDM Provide?

• 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.
Potential IHSDM Applications

• As a tool to identify facilities where the “safety performance” is worse than expected

• Assists in making decisions where to invest limited resources in ways that will clearly improve safety performance

“… evolution in safety analysis from descriptive methods to quantitative, predictive analysis”

AASHTO Highway Safety Manual – Chapter 1 Introduction and Overview
• As a tool to assess the safety “benefit” when conducting a B/C analysis
  – Predict crashes before and after reconstructing or improving a facility
Potential IHSDM Applications

- As a tool to assess design options:
  - Evaluate alternatives
  - Evaluate proposed design exceptions
  - Evaluate and refine preliminary geometry
IHSDM: A Quantitative Approach

• Enables more informed decision-making
• Helps explain decisions to stakeholders
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What Highway Types can the 2014 Release Evaluate?

• Facility types:
  – Two-lane rural highways (All Modules)
  – Multilane rural highways (Crash Prediction)
  – Urban & suburban arterials (Crash Prediction)
  – Freeway segments (Crash Prediction)
  – Freeway ramps/interchanges (Crash Prediction)

• Existing and proposed alternative highway geometric designs
Data Needs

- Vary by IHSDM evaluation module (and by highway type in CPM)
- Highway Segment Data (all modules)
- Intersection Data (CPM, IRM)
- Interchange Data (CPM)
- Crash Data (CPM – optional)
New / Updated for 2014

- **Enhancement of Crash Prediction Module for Freeway Ramps / Interchanges**
  - Site Set capabilities added
  - Calibration Utility fully implemented

- **Help/Documentation**
  - Updated to reflect new features
Crash Prediction Module (CPM)

Typical Uses

✓ Predicts crash frequency for highway segments, intersections and interchanges
✓ Evaluates the safety impact of highway improvements/treatments
✓ Compares relative safety performance of design alternatives
✓ Assesses safety cost effectiveness of design decisions
Relationship between IHSDM CPM and the HSM

A. Introduction and Fundamentals
B. Roadway Safety Management Process
C. Predictive Method (IHSDM CPM)
   - Chapter 10: Rural, Two–Lane Roads
   - Chapter 11: Rural, Multilane Highways
   - Chapter 12: Urban & Suburban Arterials
   - Chapter 18: Freeways
   - Chapter 19: Ramps
D. Crash Modification Factors
Predictive Method for:
- Freeways
- Ramps
CPM for Freeway Segments and Ramps/Interchanges

- Implements methods described in HSM 2014 Supplement, including the Calibration procedure
CPM for Freeways / Ramps
Capabilities

• Evaluation of freeway segments, including segments with speed change lanes

• Evaluation of freeway ramps / interchanges, including:
  – Ramps
  – Collector–Distributor (C–D) Roads
  – Ramp Terminals
• CPM automatically segments highways for evaluation (including freeway segments, ramps and C–D roads), following HSM Chapters 18/19

• Application of the Empirical–Bayes (EB) process to factor in historical crash data – for freeway segments, ramps and C–D roads
CPM (Lesson 4)

- Freeways
  - Exercises 4.6.1 to 4.6.6 (Implementing HSM Chapter 18 Sample Problems 1–5)

- Ramps / Interchanges
  - Exercises 4.8.1 to 4.8.6 (Implementing HSM Chapter 19 Sample Problems 1–6)
  - Exercise 4.8.7 (“Example Freeway” project; evaluate components of two interchanges)
CPM for Freeways / Ramps
Help/Documentation

• “CPM Engineer’s Manual for Freeway Segments and Speed Change Lanes”
• “CPM Engineer’s Manual for Freeway Ramps, C–D Roads and Ramp Terminals”
CPM Calibration Utility

• Assists agencies in implementing the calibration procedures described in the Appendix to HSM Part C
  – Organizes Required and Desired Data
  – Calculates Calibration Factors

• Allows agencies to enter their own SPFs and to modify default crash distributions
IHSDM Workflow

1. Create a project
2. Establish highways, intersections, interchanges/ input data
3. Run evaluation module(s)
4. View results (output)

Establish project goals

Synthesize IHSDM Output
IHSDM Freeway/Ramps Data Structure

- Freeway 1 with Interchanges 1 & 2
  - Crossroad A (Imported v1)
  - Crossroad B (Imported v1)
  - Freeway 1 (Imported v1)
  - Interchange 1
    - C-D Road A (v1)
    - Ramp Exit 1 (v1)
      - [v1] Evaluation 1 (Crash Prediction)
      - Ramp Entrance 1 (v1)
      - Ramp Exit 2 (v1)
      - Ramp Entrance 2 (v1)
    - Crossroad A Terminal D4 (v1)
      - [v1] Evaluation 1 (Crash Prediction)
  - Interchange 2
IHSDM Freeway/Ramps
Data Structure

Project

- Freeway 1 with Interchanges 1 & 2
  - Crossroad A (Imported v1)
  - Crossroad B (Imported v1)
  - Freeway 1 (Imported v1)
  - Interchange 1
    - C-D Road A (v1)
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      - Ramp Entrance 2 (v1)
    - Crossroad A Terminal D4 (v1)
      - [v1] Evaluation 1 (Crash Prediction)
  - Interchange 2
IHSDM Freeway/Ramps Data Structure

- Crossroad (Highway)
- Freeway (Highway)
- C-D Road (Highway)
- Ramp (Highway)
IHSDM Freeway/Ramps Data Structure

- Freeway 1 with Interchanges 1 & 2
  - Crossroad A (Imported v1)
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- Interchange
- Ramp Terminal
IHSDM Demonstration

- IHSDM 2014 Release (version 10.0.0; September 9, 2014)
Data Input Options

Add data via the IHSDM Highway Editor, Intersection Editor or Ramp Terminal Editor; or via the IHSDM Site Set Editor.

Export data from design software into LandXML format and then import into IHSDM.

Copy and paste data from a spreadsheet.
For all HSM Part C chapters:

“The definitions of roadway segments and intersections...are the same as those used in the FHWA IHSDM.”
Site–based Data Input and Analysis

- Provides an alternative to "station–based" data / analysis
- Provides flexibility in how data are entered for CPM evaluations.
- Applies to:
  - Rural 2–lane highways
  - Rural multilane highways
  - Urban / suburban arterials
  - Freeway Segments
  - Freeway Ramps, C–D Roads and Ramp Terminals
The Site Set Data Editor is used to add/edit site set data.

An IHSDM Site Set contains a set of geometric, traffic and ancillary data – or highway elements – that describes the highway and associated intersections/interchanges.

Highways and Intersections / Interchanges can be entered using site data; users may find this capability particularly useful for intersections.
Site Sets

```
SiteSetData 1 (v1)
  [v1] Evaluation 1 (Site Set Crash Prediction)
  [v1] Alt. 1 (Site Set Crash Prediction)

Project 4
```
IHSDM Demonstration 2

Site Sets

- IHSDM 2014 Release (version 10.0.0; September 9, 2014)
Why use IHSDM to implement HSM Part C Methods?

- Can evaluate many highway segments, intersections and interchanges over a number of years
- “Station-Based” Data Input automatically segments the highway into homogeneous segments as per HSM Part C
- “Site-Based” Data Input – especially useful for projects where detailed, station-based geometry not available
Why use IHSDM to implement HSM Part C Methods?

- Can handle complex (and simple) alignments
- Seamlessly evaluates a highway that changes facility type (e.g., rural 2-lane to rural multilane)
- Implements the Empirical-Bayes procedure
Why use IHSDM to implement HSM Part C Methods?

- IHSDM “Navigation tree” helps users to organize projects, highways, evaluations, etc.
- Evaluation Reports and Graphs provide extensive documentation of results / output
- Highway Viewer provides graphical representation of design
Why use IHSDM to implement HSM Part C Methods?

- Extensive documentation in “Help Browser”
- Tutorial provides step-by-step “soup to nuts” guidance
- IHSDM Administration Tool includes a Calibration Utility to help agencies implement HSM Calibration Procedures
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Typical IHSDM Applications

- Evaluate relative safety impacts of alternative designs for EIS (CPM+)
- Evaluate expected safety impacts of recently completed improvements (CPM+)
- Safety analysis of preliminary construction plans (CPM+)
- Evaluate operational impacts of passing/climbing lanes (TAM)
- In conjunction with Road Safety Audits (CPM, DCM, IRM, PRM)
Typical IHSDM Applications

- Quantify relative safety/operational performance of alternatives and compare against other (e.g., environmental, cost) impacts (CPM, TAM+)
- Refine alternatives to optimize safety and operational performance (All)
- Evaluate / prioritize 3R safety improvements (All)
- Verify design exception areas (PRM, CPM)
• Download: http://www.ihsdm.org

• Technical support:
  – IHSDM.Support@dot.gov
  – (202)-493-3407

• Training:
  – On–Site: FHWA–NHI–380071
  – See NHI catalog at http:// nhi.fhwa.dot.gov
Upcoming Training Session

- Web-based IHSDM Training Course (FHWA–NHI–380100)
  - 4 “live” Web Conference Training (WCT) sessions on Oct. 28 & 30, and Nov. 4 & 6; 1:00 to 3:00 pm EST
  - Self-paced activities in-between WCTs
  - Gives participants the opportunity to use the IHSDM software tools to evaluate and analyze highway designs
  - To register: visit NHI catalog at http://nhi.fhwa.dot.gov; enter keyword “IHSDM” in the “Search for a Course” field
  - Cost: $200 per participant
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