IHSDM 2019 – New Enhancements Support DDSA

DDSA Webinar
November 7, 2019
Agenda

- DDSA Overview
- IHSDM Overview
- What’s New in IHSDM 2019?
  - User-defined CMFs
  - Roundabout crash prediction method
- IHSDM 2019 Demonstration
- Crash Prediction Method Disclaimer
- IHSDM User Group & Training Opportunities
- Q & A
Data-Driven Safety Analysis

Using evidence-based tools to evaluate the current and future safety performance of roadways, allowing agencies to target investments with more confidence and reduce severe crashes on their system.
• These tools help agencies **quantify** the safety impacts of transportation decisions, similar to the way agencies quantify:
  – traffic growth
  – environmental impacts
  – traffic operations
  – pavement life
  – construction costs
DDSA can be applied throughout the Project Development Process


Planning  Alternatives Analysis  Design  Construction, Operations & Maintenance
DDSA in Alternatives Analysis

- DDSA tools can predict the number and severity of crashes for each project alternative, allowing safety performance to be considered along with other project criteria.
Integrating Safety into NEPA Analysis

Safety Planning Process (Pre-NEPA)

- Scoping: Solicit input from safety stakeholders
- Purpose-and-Need: Include safety; link to safety planning processes
- Alternatives Analysis: Evaluate safety performance
- Affected Environment: Define the context
- Environmental Consequences: Evaluate safety impacts
- Mitigation: Propose mitigation to address safety impacts

Policy/Stakeholder Involvement

- Include safety stakeholders
- Provide safety analysis to the public

Source: FHWA

http://safety.fhwa.dot.gov/tsp/fhwasa1136/fhwasa1136.pdf
DDSA in the Design Process

• DDSA can be used to determine *optimal* design criteria, considering both safety and cost.

• DDSA helps justify flexibility in design
  – design exceptions
  – performance–based practical design
Performance-Based Practical Design

• An approach to decision-making that encourages *engineered solutions* rather than reliance on maximum values or limits found in design specifications

• Characteristics
  - grounded in performance management
  - exercises engineering judgment to address purpose and need
  - uses appropriate performance-analysis tools
  - considers both short- and long-term project and system goals
Version 15.0.0 (November 2019)
# IHSDM Development Team

<table>
<thead>
<tr>
<th>FHWA Geometric Design Lab (GDL) Manager</th>
<th>IHSDM Software Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton Chen</td>
<td>Peter Holm (Peraton)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GDL Staff</th>
<th>IHSDM Software Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Dimaiuta</td>
<td></td>
</tr>
<tr>
<td>Mohamad Banihashemi</td>
<td></td>
</tr>
<tr>
<td>Ehsan Dadvar (NRC Postdoc Fellow)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FHWA Resource Center</th>
<th>FHWA Office of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Petrucci</td>
<td>Jerry Roche</td>
</tr>
</tbody>
</table>
IHSDM Evaluation Modules / Tools

**Crash Prediction Module**

**Diagnostic Tools**
- Traffic Analysis Module
- Intersection Review Module
- Design Consistency Module
- Driver/Vehicle Module

**Economic Analyses Tool**

**Policy Review Module**
Vol. 1

Part A: Introduction, Human Factors, & Fundamentals

Part B: Roadway Safety Management Process

Vol. 2

Part C: Predictive Methods

Vol. 3

Part D: Crash Modification Factors (CMFs)

Supporting tools
DDSA using IHSDM

Crash Prediction Module

CPM output (crash frequencies / rates and severities) are used in DDSA
<table>
<thead>
<tr>
<th>Release</th>
<th>Enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2019</strong> (15.0.0) Nov. 2019</td>
<td>Capability to add user-defined CMFs (external to HSM Part C) to CPM evaluation (Phase 1)</td>
</tr>
<tr>
<td></td>
<td>Predictive methods for Roundabouts (based on NCHRP 17–70)</td>
</tr>
<tr>
<td><strong>2018 Update</strong> (14.1.0) March 2019</td>
<td>CPM: Enhanced reporting capabilities for Site Sets (to match location-based reports)</td>
</tr>
<tr>
<td></td>
<td>Extended Economic Analyses Tool to Site Sets</td>
</tr>
<tr>
<td></td>
<td>CPM Eval. Reports (location-based): Ramp Terminals now included in evals. of crossroads</td>
</tr>
<tr>
<td></td>
<td>CPM: capability to evaluate a ramp without establishing ramp connections</td>
</tr>
</tbody>
</table>
Adding User-Defined (External) CMFs to IHSDM CPM

- Some project scenarios do not fit neatly within the HSM Part C methods (e.g., urban freeway > 10 lanes; DDIs; pedestrian treatments; etc.)

- HSM Part C lists 4 methods for estimating safety effectiveness of a proposed project
  - **Method 2:** Apply Part C method to estimate crashes for existing condition, then apply appropriate project CMF from Part D / CMF Clearinghouse to estimate safety performance of proposed condition.
Adding User–Defined (External) CMFs to IHSDM CPM

• There was no mechanism within IHSDM to apply user–defined CMFs (i.e., beyond the CMFs in HSM Part C) to the CPM results.

• Providing such a capability in IHSDM supports HSM “Method 2” for estimating the safety effectiveness of a proposed project.
Adding User-Defined (External) CMFs to IHSDM CPM

• Initial implementation in IHSDM 2019:
  – Add CMF data elements in the Highway and Intersection Editors to allow users to define CMFs and what they apply to (e.g., facility types, crash severities)
Crash Prediction Method for Roundabouts

- Completed in 2018 under NCHRP Project 17–70 and published in NCHRP Research Report 888 (Development of Roundabout Crash Prediction Models and Methods)
Crash Prediction Method for Roundabouts

- New models include...
  - Intersection-level models for rural 2-lane and multilane highways, and urban arterials. Roundabouts at freeway ramp terminals can also be evaluated.
  - Leg-level models (not incorporated into IHSDM)
Crash Prediction Method for Roundabouts

• Site Types
  – 3–leg, single circulating lane (31R)
  – 4–leg, single circulating lane (41R)
  – 3–leg, 2 circulating lanes (32R)
  – 4–leg, 2 circulating lane (42R)

• Intersection–level SPFs
  – FI crashes
  – PDO crashes
Crash Prediction Method for Roundabouts

- CMFs (Adjustment Factors):
  - Intersection-level:
    - Inscribed circle diameter
    - Outbound-only leg
  - Calculated for each leg, then aggregated:
    - Right-turn bypass lane
    - Access point frequency
    - Entry width
    - Circulating width
• User-Defined CMFs
• Roundabouts
Disclaimer Regarding Crash Prediction Method

Disclaimer Regarding Crash Prediction Method

• Since the HSM was published, new research has been conducted to develop predictive models/methods for facility types not covered in HSM1
• The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO’s approval for incorporation into a future edition of the HSM:
  
  – Roundabouts: completed in 2018 under NCHRP Project 17–70 and published in NCHRP Research Report 888
  – 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17–58
Disclaimer Regarding Crash Prediction Method

• “...in the absence of local calibration factors, it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17–58 and 17–70) to results from HSM–1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results.

• If local calibration factors are available and applied to both new models and HSM–1 models, then it may be appropriate to directly compare the results.”
Disclaimer Regarding Crash Prediction Method

- Work being performed under NCHRP Project 17–72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM–1) and new (e.g., NCHRP 17–70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.
Disclaimer Regarding Crash Prediction Method

- The models produced for NCHRP Project 17–70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.
The HSM–1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.
IHSDM User Group

• Foster communication between IHSDM users.
• Provide FHWA with a formal mechanism for obtaining input from IHSDM users. Input will help FHWA establish priorities for future IHSDM software development.
• Provide a forum for discussions/presentations on specific IHSDM–related topics.

Send an e–mail to IHSDM.support@dot.gov to be added to the User Group mailing list
2019 Release

• Download: http://www.ihsdm.org

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

Through FHWA Resource Center and NHI – contact Dave Petrucci at david.Petrucci@dot.gov or 202–823–2260:

• Visit (NHI)
• “IHSDM“ (2–day on–site)
• “Safety Analysis of Freeways and Interchanges” (2–day on–site)
For more information on DDSA…

• Fact Sheets and Case Studies
• Infographics
• Videos
• Webinars
• Informational Guides
• Training Workshops
• Technical Assistance