Release Notes for 2019 Public Release Update

Summary of Changes

Significant improvements/changes were made to the IHSDM software from the 2018 Release Update (Version 14.1.0; March 2019) to the 2019 Release (Version 15.0.0; September 2019) in the following areas:

- IHSDM Modules
- Data
- Output / Reporting
- Economic Analyses (EA) Tool
- Graphical User Interface (GUI)
- System Administration Tool (AdminTool)
- Help/Documentation
**IHSDM Modules**

**Crash Prediction Module**

Added a disclaimer titled **IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58**. The disclaimer appears each time the user begins a crash prediction Evaluation. The disclaimer is included in these Release Notes as well.

*Roundabout Crash Prediction Method*

A crash prediction method for roundabouts was developed under NCHRP Project 17-70 for inclusion in the future 2nd Edition Highway Safety Manual (HSM2). The methods are documented in NCHRP Research Report 888: Development of Roundabout Crash Prediction Models and Methods. The crash prediction models are organized into three basic types:

1. Planning-level crash prediction models,
2. Intersection-level crash prediction models, and
3. Leg-level crash prediction models.

The intersection-level crash prediction models developed for roundabouts are implemented in the IHSDM Crash Prediction Module (CPM) for all highway types (rural two-lane highways, rural multilane highways and urban arterials). Roundabouts connecting non-freeway highways to freeways through service ramps can also be evaluated by using this implementation.

The intersection-level crash prediction models available in this implementation are for the following roundabout types:

- **Three-leg single-lane roundabout (31R):** a roundabout with 3 legs and a single circulating lane conflicting with each leg.
- **Four-leg single-lane roundabout (41R):** a roundabout with 4 legs and a single circulating lane conflicting with each leg.
- **Three-leg two-lane roundabout (32R):** a roundabout with 3 legs and two circulating lanes conflicting with one or more legs.
- **Four-leg two-lane roundabout (42R):** a roundabout with 4 legs and two circulating lanes conflicting with one or more legs.

For Location-based data, Roundabouts can be evaluated in two ways:

- **Directly (i.e., by first selecting the Roundabout node in the Navigation Tree and then selecting New Evaluation from Roundabout Operations):**
Note: The Evaluation Roadway is assumed to be the Major roadway. In the future, the user will be able to select the Evaluation Roadway in addition to the Roadway with Crash Data. This also applies to Direct evaluation of Ramp Terminals.

- As part of a Highway Evaluation: as with other Intersections, any Roundabout associated with a Highway will also be evaluated when that Highway is evaluated. (In the figure below, a highway with 4 roundabouts was evaluated; results from the Evaluation Report for the Highway include the roundabouts.)
Results are documented in an Evaluation Report.

The models can be calibrated to reflect the safety conditions on roundabouts operated by a particular highway agency. The results of the calibration process can be incorporated in the crash prediction algorithm via the IHSDM System Administration Tool (Admintool).
IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual – First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. 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, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), 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. [Note: 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.]

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.
User-Defined CMFs

To allow the IHSDM users to use additional CMFs in their crash prediction evaluation (i.e., CMFs beyond those in the HSM Part C predictive methods), a new data element was added to the segment or intersection data. This data element carries the values of CMFs external to the predefined IHSDM CMFs (see Data for more details).

When a CPM Evaluation is run, all User-Defined CMF(s) related to the entity being evaluated (highway, intersection, roundabout, etc.) are applied to the crash prediction result, as appropriate.
Other

- Bug fix: for freeway segments, corrected a problem in calculating the distance from the edge of inside shoulder to the barrier face ($W_{icb}$).
- Bug fix: For ramp terminals, the CMF for presence of a Non-Ramp Public Street Leg (CMF 19) was not being calculated for location-based data when the intersection and ramp terminal have the same location on the cross-road. **Added a checkbox to allow the user to indicate the presence of a side street at the ramp terminal.**
- Added better warning messages for lane validation. For example, if lane Taper elements are defined without any corresponding full lane (Thru, Left-Turn, etc.), the software had been properly identifying them and provided a general message without specific locations. The location of the taper is now included in the message.
- Bug fix: For urban arterials, when a driveway is located at the point between two segments, the driveway-related crashes were being double-counted (i.e., the driveway was used to estimate driveway-related crashes for both segments).
Data

Roundabouts

- Roundabouts were added to the data structure, for both Location-based data and Site-based data.
- 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. This includes removal of a “Replaced with Roundabout” data item (check box) from the Intersection Editor (for Location-based data) and from all intersections in Urban/Suburban Arterial Site Data (for Site-based data).

Location-Based

A Roundabout Editor was added:
Site-Based

Site Sets were expanded to include Roundabouts. A Roundabout Site Data node was added to the Site Set Editor, with sub-nodes for 12 different roundabout types:
User-Defined CMFs

To allow the IHSDM users to use additional CMFs in their crash prediction evaluation (i.e., CMFs beyond those in the HSM Part C predictive methods), a new data element was added to the segment or intersection data. This data element carries the values of CMFs external to the predefined IHSDM CMFs. The user can add as many User Defined CMFs as needed. However, the recommendation is not to have more than three additional CMFs for the same site.

**Location-Based**

User-Defined CMF data elements have attributes for location range, year(s) for which the CMF is to be applied, crash severity (Total, Fatal and Injury, or Property Damage Only crashes), and the CMF Value.
**Site-Based**

User-Defined CMFs are associated with a particular Site, with attributes for year(s) for which the CMF is to be applied, crash severity (Total, Fatal and Injury, or Property Damage Only crashes), and the CMF Value.
Other

- Bug fix: When AADT data was incomplete with respect to the length of the highway, the editor was “hanging” on the AADT data and did not allow the user to move away from that table. The incomplete data could not be updated either. These issues were corrected.
- For freeway service ramps, Horizontal Alignment data: an error message is now produced if the user attempts to save the data with Average Curve Entering Speed not specified for one or more Curves.

NOTE: If the IHSDM 2019 Release is installed over an older version, existing projects will not be updated automatically. After opening a network, select Update or Save to save the changes "permanently."
Output / Reporting

Crash Prediction Module (CPM) Evaluation Reports

- Added a disclaimer to CPM Evaluation Reports titled **IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58.** The disclaimer appears after the Report Overview in every CPM Evaluation Report.

- Evaluation results for Roundabouts were added (see figure below for an example of Location-based evaluation results).

<table>
<thead>
<tr>
<th>Segment Number/Intersection Name/Cross Road</th>
<th>Location (Sta. ft)</th>
<th>Total Predicted Crashes for Evaluation Period</th>
<th>Predicted Total Crash Frequency (crashes/yr)</th>
<th>Predicted FI Crash Frequency (crashes/yr)</th>
<th>Predicted PDO Crash Frequency (crashes/yr)</th>
<th>Predicted Travel Crash Rate (crashes/million veh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundabout 1</td>
<td>0.000</td>
<td>3.710</td>
<td>0.6183</td>
<td>0.0707</td>
<td>0.5476</td>
<td>0.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sng. No.</th>
<th>Type</th>
<th>Fatal (K) Crashes (crashes)</th>
<th>Incapacitating Injury (A) Crashes (crashes)</th>
<th>Non-Incapacitating Injury (B) Crashes (crashes)</th>
<th>Possible Injury (C) Crashes (crashes)</th>
<th>No Injury (O) Crashes (crashes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roundabout</td>
<td>0.0063</td>
<td>0.0628</td>
<td>0.1952</td>
<td>0.1600</td>
<td>3.2854</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Crashes</th>
<th>FI Crashes</th>
<th>Percent FI (%)</th>
<th>PDO Crashes</th>
<th>Percent PDO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>0.55</td>
<td>0.06</td>
<td>11.689</td>
<td>0.48</td>
<td>88.311</td>
</tr>
<tr>
<td>2020</td>
<td>0.55</td>
<td>0.06</td>
<td>11.689</td>
<td>0.48</td>
<td>88.311</td>
</tr>
<tr>
<td>2021</td>
<td>0.55</td>
<td>0.06</td>
<td>11.489</td>
<td>0.48</td>
<td>88.311</td>
</tr>
<tr>
<td>2022</td>
<td>0.55</td>
<td>0.06</td>
<td>11.689</td>
<td>0.48</td>
<td>88.311</td>
</tr>
<tr>
<td>2023</td>
<td>0.76</td>
<td>0.08</td>
<td>11.077</td>
<td>0.67</td>
<td>88.923</td>
</tr>
<tr>
<td>2024</td>
<td>0.76</td>
<td>0.08</td>
<td>11.077</td>
<td>0.67</td>
<td>88.923</td>
</tr>
<tr>
<td>Total</td>
<td>3.71</td>
<td>0.42</td>
<td>11.439</td>
<td>3.29</td>
<td>88.561</td>
</tr>
<tr>
<td>Average</td>
<td>0.62</td>
<td>0.07</td>
<td>11.439</td>
<td>0.55</td>
<td>88.561</td>
</tr>
</tbody>
</table>

- A table showing User-Defined CMFs was added to the Evaluation Reports (see figure below for an example).

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Name</th>
<th>Start CMF Year</th>
<th>End CMF Year</th>
<th>Severity</th>
<th>Total</th>
<th>CMF Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UD CMF1</td>
<td>2019</td>
<td>2022</td>
<td>Total</td>
<td>0.9000</td>
<td>0.9000</td>
</tr>
<tr>
<td>1</td>
<td>UD CMF2</td>
<td>2019</td>
<td>2022</td>
<td>Fatal and Injury</td>
<td>0.8500</td>
<td>0.8500</td>
</tr>
<tr>
<td>1</td>
<td>UD CMF3</td>
<td>2019</td>
<td>2022</td>
<td>Property Damage Only</td>
<td>0.8000</td>
<td>0.8000</td>
</tr>
<tr>
<td>2</td>
<td>UD CMF1</td>
<td>2019</td>
<td>2022</td>
<td>Total</td>
<td>0.9000</td>
<td>0.9000</td>
</tr>
<tr>
<td>2</td>
<td>UD CMF2</td>
<td>2019</td>
<td>2022</td>
<td>Fatal and Injury</td>
<td>0.8500</td>
<td>0.8500</td>
</tr>
<tr>
<td>2</td>
<td>UD CMF3</td>
<td>2019</td>
<td>2022</td>
<td>Property Damage Only</td>
<td>0.8000</td>
<td>0.8000</td>
</tr>
<tr>
<td>3</td>
<td>UD CMF1</td>
<td>2019</td>
<td>2022</td>
<td>Total</td>
<td>0.9000</td>
<td>0.9000</td>
</tr>
<tr>
<td>3</td>
<td>UD CMF2</td>
<td>2019</td>
<td>2022</td>
<td>Fatal and Injury</td>
<td>0.8500</td>
<td>0.8500</td>
</tr>
<tr>
<td>3</td>
<td>UD CMF3</td>
<td>2019</td>
<td>2022</td>
<td>Property Damage Only</td>
<td>0.8000</td>
<td>0.8000</td>
</tr>
<tr>
<td>4</td>
<td>UD CMF1</td>
<td>2019</td>
<td>2022</td>
<td>Total</td>
<td>0.9000</td>
<td>0.9000</td>
</tr>
<tr>
<td>4</td>
<td>UD CMF2</td>
<td>2019</td>
<td>2022</td>
<td>Fatal and Injury</td>
<td>0.8500</td>
<td>0.8500</td>
</tr>
<tr>
<td>4</td>
<td>UD CMF3</td>
<td>2019</td>
<td>2022</td>
<td>Property Damage Only</td>
<td>0.8000</td>
<td>0.8000</td>
</tr>
</tbody>
</table>
• Fixed a problem that occurred when the effective length of a freeway segment is zero (i.e., when speed change lanes are on both sides of the freeway for the entire length of the segment). The effective length of a segment is equal to the length of the segment (L) minus 0.5 times the sum of lengths of speed change lanes in both directions combined. So, if speed change lanes are on both sides of the freeway for the entire length of a segment, then the effective segment length = \( L - \frac{L}{2} - \frac{L}{2} \) = 0.

This was a causing a problem with the Predicted (Expected) Crash Severity by Freeway Segment table in the Evaluation Report. Blank rows were shown for segments with zero effective length and the Total columns were blank for K, A, B and C severity crashes. This issue is now resolved.

• Additional details were added to the error message that occurs when AADT data of an entrance/exit ramp is missing (and, thus, the freeway segment downstream/upstream of the ramp cannot be evaluated).
Economic Analyses (EA) Tool

- Fixed a problem with missing EA cost estimation for freeway segments with an effective length equal to zero (i.e., when speed change lanes are on both sides of the freeway for the entire length of the segment). Due to issues with the crash prediction Evaluation (see Output/Reporting section), the EA Tool was unable to determine the predicted/expected crashes.

Graphical User Interface (GUI)

- The Message Area can be beneath the Desktop area or under both the Desktop and Project Tree/Operations areas. **Below the Desktop Area Only** is now the default behavior. It can be controlled by the User Preferences (under Edit > Preferences > Startup > Message Area Location). This capability allows the Project Tree to be larger.
Highway Viewer

- Enhancement: a view rotation capability was added to the Highway Viewer. This allows the view to be rotated via the mouse wheel with the Shift Key pressed or via the left (CCW) and right (CW) arrows with the Shift Key pressed. Also updated the on-line help to describe the new functionality.
- Bug fix: When zooming in and out in the Highway Viewer, the annotations moved around in unexpected ways. When given a background color, the background did not always resize in the same way as the text. Also, if an annotation was given a rotation angle, it might not be able to be selected for dragging or modification. These issues were corrected.

Other

- Enhancement: IHSDM no longer covers the Windows Task Bar when it is maximized.
- Many dialogs ask the user to open/import/export a file from a file location. The file chooser dialog was not setting the extension filter correctly for Project Import, Siteset Import/Export, and Unarchive operations (i.e., the All files (*.*) filter was always the default choice). This has been corrected.
System Administration Tool (AdminTool)

Crash Prediction > Calibration Data Sets

A Roundabout Site Data node was added, with sub-nodes for 12 different roundabout types:

![Roundabout Site Data Node]

Crash Prediction > Crash Distribution Data Sets

A Roundabout Crash Distribution Data node was added, with one sub-node (Roundabout Distributions):

![Roundabout Crash Distribution Data Node]
Crash Prediction > Model Data Sets

A Roundabout Model Data node was added, with 9 sub-nodes related to safety performance functions (SPF), crash modification factors (CMF), and severity distribution functions (SDF) for roundabouts:
Help/Documentation

Documentation was added / updated, including:

- Engineers Manuals > Crash Prediction on Roundabouts was added
- Engineers Manuals > Crash Prediction User Defined CMFs was added
- Data Requirements > Crash Prediction Module (CPM): a section was added for Roundabouts
- IHSDM Workflow > Managing Projects/Highways/Intersections/Evaluations > Via IHSDM Main Interface > Project Operations (updated to include New Roundabout option)
- IHSDM Workflow > Managing Highway/Intersection/Site Set Data > Edit Highway/Intersection/Site Set: a sub-section on the Roundabout Editor was added
- Engineers Manuals > IHSDM Highway Model > Data Definitions/Descriptions: a section was added for Roundabouts
- Engineers Manuals > Administration Tool > Crash Prediction Calibration Dataset and Crash Prediction Model Dataset: Added Roundabout datasets to each section
- Frequently Asked Questions (updated)
- Other sections were revised, as needed.

IHSDM Tutorial:
- Revised Lesson 4 (Crash Prediction Module) to add exercises related to the new user-defined CMFs capability and the roundabout crash prediction method.

Archived Projects and Sample Highways:
- Project archives were updated if necessary to reflect changes to the software.