INTERACTIVE HIGHWAY SAFETY DESIGN MODEL (IHSDM)

TSITE 2016 Winter Meeting · Nashville, TN · February 25, 2016
AGENDA

- Project History
- IHSDM: Background & Overview
- IHSDM: Interstate 24 Model
- IHSDM: Interstate 24 Results & Analysis
- Conclusion
PROJECT HISTORY
The proposed project is located in Nashville, Tennessee off Interstate 24. It serves as a connector between Illinois, Kentucky, Tennessee, and Georgia.
IAR – Regional Location

- For reference: approx. 15 miles away from our meeting today
- Serves as a connector between Nashville, Murfreesboro, and Chattanooga

WHERE WE ARE TODAY!

SITE LOCATION
IAR – Local Location

- Originally designed & built in 1980s
- Update designed in mid-1990s
- Redesign and approve for implementation in 2016
IAR – Site Location

- Current site: interchange only accesses the north
  Average AADT Interstate 128,000 veh/day
  Average AADT Ramps: 5,000 veh/day
Proposed site: 65,324 additional veh/day
2,552,500 s.f. of commercial and residential space
1 new roadway / 1 extended route
Project History

Timeline

- **Mid 1990s:**
  Interchange update first designed

- **Spring 2013:**
  The property adjacent to interchange was purchased for development

- **Fall 2014:**
  Initial meeting with state DOT
  Initial meeting with Metro Nashville Traffic

- **Summer 2015:**
  Traffic study finalized / First IAR submitted to FHWA

Consensus

- Required additional clarifications related to safety analysis
  - Specifically, the 2014 published Highway Safety Manual supplement
  - Interactive Highway Safety Design Model (IHSDM) v. 10.1 released October 1, 2015
IHSDM:
BACKGROUND & OVERVIEW
What is IHSDM?

- **IHSDM: Interactive Highway Safety Design Model**
  - “A suite of software tools that support project-level geometric design decisions by providing quantitative information on the expected safety and operational performance.”
  - Simply put, it helps planners, designers, and reviewers justify and defend geometric decisions.
The Modules

- Contains 6 separate evaluation “modules”; all based on Highway Safety Manual (HSM)
- New version contained updates to Crash Prediction module; specifically, interchange-level evaluation

<table>
<thead>
<tr>
<th>Module</th>
<th>Relationship to HSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash Prediction</td>
<td>Implementation of HSM, Part C (Predictive Method)</td>
</tr>
<tr>
<td>Policy Review</td>
<td>Evaluates nominal safety; use in conjunction with (not in place of) HSM, Part C methods</td>
</tr>
<tr>
<td>Design Consistency</td>
<td></td>
</tr>
<tr>
<td>Traffic Analysis</td>
<td>Diagnostic tools to that can further support HSM, Part C evaluations</td>
</tr>
<tr>
<td>Intersection Review</td>
<td></td>
</tr>
<tr>
<td>Driver/Vehicle</td>
<td></td>
</tr>
</tbody>
</table>
Software Capabilities

- Available Facility Types:
  - Two-lane rural highways
  - Multilane rural highways
  - Urban & suburban arterials
  - Freeway segments
  - Freeway ramps / interchanges
Input Requirements

- Requirements vary based on module.
Report types vary based on module.

For Crash Prediction Module:

- Highway Data
- Evaluation Report
  - Crash Frequency and Rates
  - Crash type distribution
- Graphs

Table 6. Expected Segment Crash Type Distribution (Freeway Ramp Sections)

<table>
<thead>
<tr>
<th>Element Type</th>
<th>Crash Type</th>
<th>Fatal and Injury</th>
<th>Property Damage Only</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Crashes</td>
<td></td>
<td>Crashes</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Collision with Animal</td>
<td>0.00</td>
<td>0.2</td>
<td>0.01</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Collision with Fixed Object</td>
<td>0.20</td>
<td>29.3</td>
<td>0.18</td>
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<tr>
<td>Highway Segment</td>
<td>Collision with Other Object</td>
<td>0.01</td>
<td>2.1</td>
<td>0.04</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Other Single-vehicle Collision</td>
<td>0.06</td>
<td>8.4</td>
<td>0.03</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Collision with Parked Vehicle</td>
<td>0.00</td>
<td>0.6</td>
<td>0.00</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Total Single Vehicle Crashes</td>
<td>0.28</td>
<td>40.6</td>
<td>0.26</td>
</tr>
<tr>
<td>Highway Segment</td>
<td>Right-Angle Collision</td>
<td>0.00</td>
<td>0.3</td>
<td>0.00</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.00</td>
<td>0.1</td>
<td>0.00</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.00</td>
<td>0.3</td>
<td>0.00</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.05</td>
<td>7.3</td>
<td>0.07</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.01</td>
<td>1.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.07</td>
<td>9.8</td>
<td>0.09</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.35</td>
<td>50.3</td>
<td>0.35</td>
</tr>
<tr>
<td>Highway Segment</td>
<td></td>
<td>0.35</td>
<td>50.3</td>
<td>0.35</td>
</tr>
</tbody>
</table>

IHSDM: Background & Overview
IHSDM: INTERSTATE 24 MODEL
Alternative #1: Existing Condition

- **No build scenario:**
  - Theoretical Alternative (null)
  - Assumes no modifications before 2020
  - Prop. development would not have direct access to either Interstate 24 or Hickory Hollow Parkway

IHSDM: Interstate 24 Model
Alternative #2: Proposed

- **Diverging Diamond Interchange (DDI):**
  - 3 thru lanes in each direction
  - 2 new signalized intersections
  - Exit ramps will diverge with thru lanes
  - Entrance ramps will merge with through lanes
Alternative #3: Proposed

- **Tight Urban Diamond Interchange (TUDI):**
  - Retains partial cloverleaf (parclo) in SE quadrant
  - Existing ramps modified to allow traffic in north & south direction
    - Also to improve existing sight distance issues on ramps
  - 2 new signalized intersections
  - Bridge widening
IHSDM:
INTERSTATE 24 ANALYSIS & RESULTS
### Projected Crashes for Network

<table>
<thead>
<tr>
<th>Total Crashes</th>
<th>2012-2015 Actual</th>
<th>2020 Alt. #1 (A)</th>
<th>2020 Alt. #2</th>
<th>2020 Alt. #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Eastbound at Exit 59</td>
<td>42.86/year</td>
<td>34.94/year</td>
<td>29.14/year</td>
<td>29.14/year</td>
</tr>
<tr>
<td>Total Eastbound at Exit 60</td>
<td>2.28/year</td>
<td>3.07/year</td>
<td>7.20/year</td>
<td>13.09/year</td>
</tr>
<tr>
<td>Total Eastbound at Exit 62</td>
<td>20.00/year</td>
<td>26.68/year</td>
<td>27.30/year</td>
<td>27.30/year</td>
</tr>
<tr>
<td>Total Westbound at Exit 62</td>
<td>29.14/year</td>
<td>24.34/year</td>
<td>24.70/year</td>
<td>24.70/year</td>
</tr>
<tr>
<td>Total Westbound at Exit 60</td>
<td>3.43/year</td>
<td>2.22/year</td>
<td>5.11/year</td>
<td>9.29/year</td>
</tr>
<tr>
<td>Total Westbound at Exit 59</td>
<td>19.43/year</td>
<td>27.10/year</td>
<td>23.96/year</td>
<td>23.96/year</td>
</tr>
<tr>
<td><strong>Total Segments and Ramps</strong></td>
<td><strong>117.14/year</strong></td>
<td><strong>118.35/year</strong></td>
<td><strong>117.41/year</strong></td>
<td><strong>127.48/year</strong></td>
</tr>
</tbody>
</table>

### Remaining Conflict Points Within Area of Influence

<table>
<thead>
<tr>
<th>Remaining</th>
<th>2012-2015 Actual</th>
<th>2020 Alt. #1 (A)</th>
<th>2020 Alt. #2</th>
<th>2020 Alt. #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining SR 254 Corridor</td>
<td>87.13/year</td>
<td>87.13/year</td>
<td>74.06/year</td>
<td>74.06/year</td>
</tr>
<tr>
<td>HH Pkwy at Crossings Blvd</td>
<td>8.29/year</td>
<td>8.29/year</td>
<td>12.13/year</td>
<td>12.13/year</td>
</tr>
<tr>
<td><strong>Total Remaining Areas</strong></td>
<td><strong>95.42/year</strong></td>
<td><strong>95.42/year</strong></td>
<td><strong>86.19/year</strong></td>
<td><strong>86.19/year</strong></td>
</tr>
<tr>
<td><strong>Total in Influence Area</strong></td>
<td><strong>212.56/year</strong></td>
<td><strong>213.77/year</strong></td>
<td><strong>203.06/year</strong></td>
<td><strong>213.67/year</strong></td>
</tr>
</tbody>
</table>

IHSDM: Interstate 24 Analysis & Results
Final Analysis

- **Alternative #2 (DDI):**
  - Will reduce the total crashes within the area of influence by 5% (almost 11 crashes per year).

- **Alternative #3 (TUDI):**
  - Can accommodate the 2020 site traffic, as well as the diverted traffic while keeping total crashes constant.

- In January of 2016, FHWA found design alternatives in the proposal to be both “engineering and operationally acceptable” and were both conceptually approved.
CONCLUSION

This is why safety is important...

QUESTIONS?
CONCLUSION

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