Wisconsin Statewide Crash Mapping Automation Enhancements

Steven T. Parker
Traffic Operations and Safety (TOPS) Laboratory
Dept. of Civil and Environmental Engineering
University of Wisconsin-Madison

April 20, 2015 – Des Moines, Iowa
Presentation Outline

- Wisconsin Crash Mapping Overview and Status
- Crash Mapping Methodology
  - Wisconsin GIS Systems
  - Highway Crash Mapping
  - Local Road Crash Mapping
- Highway Crash Mapping Automation
Wisconsin Crash Mapping: Objectives

- Locate both highway and local road crashes on a single map
- Have the ability to display multiple years of crash data
- Perform GIS enabled safety analysis query functions Statewide
- Apply strategies that are reproducible, minimize disruption to existing systems, and can be generalized to other linear referenced business data.
Wisconsin Crash Mapping: Timeline

- **Phase I (2008-2010):** Prototyping, methodology, and base map selection.
- **Phase II (2010-2012):** Initial statewide crash map for 2005-2009 crashes.
- **Phase III (2012-2014):** Online map rollout, process improvements, and outreach.
**Wisconsin Crash Mapping: Project Team**

- **Wisconsin Department of Transportation**
  - Susie Forde / Kelly Schieldt, Bureau of State Highway Programs
  - Rebecca Szymkowski, Bureau of Traffic Operations
  - Jonathan DuChateau, Bureau of Information Technology

- **University Research Partners**
  - Steven Parker, University of Wisconsin-Madison, Traffic Operations and Safety (TOPS) Lab
  - Xiao Qin, University of Wisconsin-Milwaukee / South Dakota State University
  - Andrew Graettinger, University of Alabama

- **FHWA Wisconsin Division**
  - Dave Jolicoeur
  - William Bremer
WisTransPortal Online Crash Data Facility

WisTransPortal Online Crash Data Facility

WISLR Statewide Crash Map added 2012.
WisTransPortal Crash Data
2014 Annual Snapshot by User Type

Distinct Users By Type
- TOPS: 13%
- WISDOT: 35%
- OTHER GOVT: 37%
- UNIVERSITY: 7%
- CONSULTANT: 8%

366 Total Users

Daily Page Hits By User Type
- TOPS: 13%
- WISDOT: 58%
- OTHER GOVT: 14%
- UNIVERSITY: 5%
- CONSULTANT: 6%

540 Average Hits Per Day
WISLR Crash Mapping Process

- Two WisDOT GIS Networks
  - State Trunk Network (STN) – 12K Miles
  - Local Road Network (WISLR) – 100K Miles

- Highway Crashes
  - Move hand coded “RP” crashes from STN to WISLR
  - LINK-LINK cross walk table developed

- Local Road Crashes
  - Map crashes directly from crash report location fields
  - CMAT automation tool developed
STN (red) and WISLR (gray) roadway networks for Dane County.
WISLR Crash Mapping Process

2012 Dane County Highway “RP” Crashes
WISLR Crash Mapping Process

2012 Dane County Combined Highway and Local Road Crashes
**Crash Mapping Process: LINK_LINK**

STN part = STN full * (WILSR part / WISLR full)

\[(100 - 60) \times (158 / (158 + 53)) = 30\]

<table>
<thead>
<tr>
<th>STNid</th>
<th>STN start</th>
<th>STN end</th>
<th>WISLRid</th>
<th>WISLR start</th>
<th>WISLR end</th>
<th>Flag Columns</th>
<th>Coder</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>60</td>
<td>i</td>
<td>0</td>
<td>317</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>60</td>
<td>90</td>
<td>ii</td>
<td>0</td>
<td>158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>90</td>
<td>100</td>
<td>iii</td>
<td>0</td>
<td>53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Crash Mapping Process: CMAT

Parsing
• Validation
• Standardization

Matching
• Spelling check
• Adj. muni. check

Crash occurred on Main St. E. 200 ft. from Badger Ave.
Highway Crash Mapping Considerations

- WisDOT highway safety analysis still performed against STN network.
- Highway “RP” crash coding a manual process to assign 55K crashes per year to STN.
- Enhancements to address highway safety analysis requirements:
  - WisDOT Incident Location Tool (ILT)
  - CMAT highway coding enhancements
  - LINK-LINK / ARNOLD enhancements
Highway Crash Mapping: ILT

- Incident Location Tool (ILT) included with TraCS 10 rollout.
- Crashes mapped directly by police officer with electronic crash report.
- Incorporates WISLR as the base map.
- In 2014, approximately 30% of highway crashes were reported with ILT locations.
Highway Crash Mapping: CMAT

**Objective:**

- Reduce manual RP effort with CMAT processed highway crash locations.
- Complements ILT process.

**CMAT Enhancements:**

- Highway crash report locations do not always correspond to WISLR ON/AT intersection locations.
- Use LINK-LINK and algorithm improvements to handle special cases.
Highway Crash Mapping: CMAT

- **Milepost (MP) Mapping**
  - Before: Few MP referenced crashes were mapped
  - After: 90% MP crashes have been mapped with higher accuracy using the MP table created from the state trunk network (STN).

- **Bridge Mapping**
  - Before: No crashes were mapped at Bridge locations
  - After: large number of crashes have been mapped using the Bridge table created from STN

- **Ramp Mapping**
  - Before: No crashes were mapped at ramp locations
  - After: Some crashes have been mapped by preprocessing ramp crashes.
Highway Crash Mapping: LINK-LINK

- ILT and CMAT assign crash locations directly to WSLR.
- RP Coder Utility developed on top of LINK-LINK to reverse crosswalk WSLR crash locations back to STN “RP” values.
- Requires moving data from low resolution to high resolution GIS roadway network.
- Concurrent ARNOLD project enhancements (University of Alabama) will lead to a more bijective LINK-LINK capability.
Highway Crash Mapping Considerations

STN Representation

WISLR Representation
Conclusion

- WISLR Crash Mapping and ILT provides a comprehensive, multiyear, statewide crash map with respect to a single GIS roadway network.
- Initial development focused on moving highway crash data from STN to WISLR.
- Highway analysis and automation requires movement of crash data back from WISLR to STN.
- WISLR ARNOLD updates are fundamental to this effort.
Questions?

Steven T. Parker
Traffic Operations and Safety (TOPS) Laboratory
University of Wisconsin-Madison
sparker@engr.wisc.edu

Kelly Schieldt
Bureau of State Highway Programs
Wisconsin Department of Transportation
Kelly.Schieldt@dot.wi.gov