

## ATSIP 2013 Traffic Records Project of the Year

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### *Blank Best Practices Recognition Form*

#### *Part I - Project Summary*

**Project Title:** Wisconsin Statewide Crash Mapping and Analysis

**Project Description (three sentences or less):**

*The Wisconsin Department of Transportation (WisDOT) has recently implemented a statewide crash map through coordination of the Bureau of State Highway Programs (BSHP) and the Bureau of Traffic Operations (BTO). This map combines multiple years of police reported highway and local road crashes onto a single GIS network. The map has been integrated into an online crash data information system at the University of Wisconsin-Madison and is used to support safety data integration and analysis across all levels of state and local government in Wisconsin.*

Nominating Person Contact Information:

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**Lead Agency for Project:** *Wisconsin Department of Transportation*

**Participating/Cooperating Agencies (if any):**

(Additional members of project team and their contact information may be provided as desired.)

- *Steven T. Parker, Ph.D., University of Wisconsin-Madison, Traffic Operations and Safety (TOPS) Laboratory*
- *Andrew Graettinger, Ph.D., University of Alabama*

- *Xiao Qin, Ph.D., P.E., South Dakota State University*
- *David M. Jolicouer, P.E., Federal Highway Administration, Wisconsin Division*

**Which National Agenda goals apply?** (May be numbered 1-6 corresponding to the order given in the original document)

*All six National Agenda goals apply, with particular application to 1-4:*

1. *Involves leader who promotes the importance of highway safety information systems, used for safety policy and program decision-making.*
2. *Involves the coordination of the collection, management, and use of highway safety information among various organizations responsible for highway transportation policy.*
3. *Represents an example of integrating the planning of highway safety programs with highway safety information systems.*
4. *Represents an example where managers and users of highway safety information have utilized or were provided the necessary resources to select the appropriate technology to meet their information needs?*

**Reference the priority in your traffic records strategic plan to which this project applies:**

*The Wisconsin Strategic Highway Safety Plan (SHSP), currently in its 2011-2013 revision, examines various issue areas that are affecting highway safety in Wisconsin and assembles the 10 highest priority issue areas along with associated tasks. The Statewide Crash Mapping and Analysis project is listed as a specific performance measure output and is further enumerated under the SHSP Action Plan Task #4 to improve the geo-coding of crash locations.*

*The Wisconsin Information System for Local Roads (WISLR), which serves as the base network for the statewide crash map, was implemented to provide an online GIS database/ network to facilitate state and local decision-making. The Statewide Crash Mapping and Analysis project satisfies an original design goal of the WISLR system to support safety planning and analysis as a third development phase.*

**Project Cost:** planned \$: 360,260                      actual \$: 384,686

**Extent of Project Implementation:** (Sample Response: As of December 2012, the project created software that has been installed in 10 of the 15 cities in this pilot project. Five of those cities have provided performance information used in the “benefits” sections of this application.)

*The statewide crash map was officially made available in July 2012 based on crash data for 2005-2011. As of July 2013:*

- *The statewide crash map has been updated on a regular basis and includes the most recently available police reported crash data (currently through June 2013).*
- *During the period July 2012 - June 2013, the online crash map was accessed on average 813 time per day by 160 distinct users from across the State of Wisconsin including*

*WisDOT, public safety organizations, local governments, regional planning commissions, universities, engineering firms, and others.*

- *The statewide crash map has been leveraged to support two years of WisDOT HSIP programming for High Risk Rural Roads (HRRR) and the Five Percent Report.*
- *The statewide crash map has been integrated into ongoing WisDOT traffic safety engineering practice through coordination of the Traffic Safety Engineering Workgroup that is comprised of members from WisDOT, FHWA, and UW-Madison.*
- *WisDOT has started implementation of focused enhancements to the highway roadway network in the underlying WISLR linear referencing system to improve crash mapping and data integration capabilities.*

**Summary of Project Benefits: What was improved, who benefited, and how?** Benefits may be measurable or anecdotal, direct or indirect. If you can demonstrate the benefits of a traffic records project all the way to the bottom line (saving lives, reducing injuries and damage due to motor vehicle crashes), please do so!

It may be easiest to fill out the benefits section under Project Detail first, and then write a one- to three-sentence summary of that material here.

1. *The statewide crash map provides the first complete map of highway and local road crashes in Wisconsin.*
2. *The crash map is available to all public agencies statewide through an online crash data information system hosted at the UW-Madison TOPS Lab.*
3. *The online crash map provides a feedback mechanism between WisDOT and local agencies to improve the quality and timeliness of crash data.*
4. *Mapping crashes to the agency's linear referencing system has enabled automated GIS network analysis of crash locations, such as the statewide ranking of high risk rural roads for HSIP project development.*
5. *The GIS "crosswalk" mechanism (described below) that was developed for highway crash locations was designed and serves as a generalized tool to move business data between the two main WisDOT linear referencing systems.*

### ***Part Two: Project Detail***

**Guidance to completing this section—you may delete this italicized guidance section from your final document before returning it.**

#### **Project Description:**

*The Wisconsin Statewide Crash Mapping and Analysis project was initiated through coordination of the Wisconsin Department of Transportation (WisDOT) Bureau of State Highway Programs (BHSP) and Bureau of Traffic Operations (BTO) to develop a geo-coded database of police reported highway and local road crashes throughout Wisconsin. Specific objectives of the projects were:*

- *Locate both state and local crashes onto a single network. WisDOT's Wisconsin Information System for Local Roads (WISLR) linear referencing system was chosen as the base network.*
- *Have the ability to display multiple years of crash data. The initial map included crashes for 2005-2009. It has subsequently been updated on a regular basis to include the latest available reported crash data (currently through June 2013).*
- *Perform GIS enabled safety analysis functions statewide. Rather than generating a simple point location map, crashes are located to the WISLR linear referencing system link-network, which allows for integration with other WisDOT business data, such as traffic volumes and roadway inventory data, and supports corridor and network wide analysis.*

*An important design consideration was to map crashes to one of the Department's linear referencing systems. This was critical to support network based analysis and integration with other WisDOT business data. Since WisDOT maintains two distinct linear referencing systems (one for the highway network and a second for local roads), separate mapping processes were implemented to merge the two sources of crash locations onto the WISLR network. Details of this process are described below under the "Process Steps" section.*

*A second consideration was to conduct a formal QA/QC process to determine overall quality and completeness of the combined crash map. This process involved a combination of automated database checks and hand verification steps. For the hand verification process, over 6,000 crash locations were selected for manual inspection, i.e., approximately 1% of all crashes for the 2005-2009 period. It was found that 93% of all crashes statewide were assigned to a network location in WISLR. For highway crashes, 5% could not be mapped and 2% were mapped incorrectly. For local road crashes, 12% could not be mapped and 5% were mapped incorrectly. The primary sources of errors related to data quality in the police crash reports and limitations in the WISLR network.*

*The final statewide crash map was incorporated into an existing online crash data information system (WisTransPortal) maintained by the University of Wisconsin TOPS Lab that is used extensively by all levels of state and local government, public safety organizations, universities, and others. The new crash map interface represented a significant enhancement to the WisTransPortal system by providing map based query and retrieval capabilities along with the ability to view crash reports and database attribute information directly from the online map. The facility also provides the ability to download crash location geo-coordinates for use in third party modeling and analysis applications and local mapping systems.*

*The WISLR crash map implementation project took 18 months and followed several prior project phases that investigated potential methodologies and algorithms for the mapping process. The current project phase is oriented towards post-rollout maintenance and business process enhancements.*

**Describe the major process steps for your project, including any unique aspects that enhanced success:**

*1. Map Merge Process*

*WisDOT maintains two separate linear referencing systems (LRS). The State Trunk Network (STN) contains a complete GIS network of the Wisconsin state trunk highway system. The WISLR system contains a complete GIS network of all publically maintained roadways in Wisconsin with specific detail given to local roads. Although the STN and WISLR share similar LRS design features, they have generally been developed and maintained as distinct systems with limited capabilities for sharing data.*

*Since 1998, WisDOT has maintained a program to manually assign all highway crashes to STN reference points. There is no equivalent process for mapping local road crashes. In order to produce a combined map of statewide traffic crashes, two separate processes were developed. The University of Alabama (UA) developed a link-network "crosswalk" capability that enabled the transfer of mapped highway crashes from STN to WISLR. South Dakota State University (SDSU) developed an automated process to map local road crashes directly to WISLR by processing location description fields from the Wisconsin police crash report. The two sources were merged into a combined geo-coded database by the University of Wisconsin TOPS Lab.*

## *2. Maintenance Procedures*

*The statewide crash map was designed to support continual updates to the underlying crash data and GIS network as new information becomes available. This capability was considered critical to support ongoing safety analysis requirements in the future. The ability to maintain the crash mapping system over time was accomplished fundamentally in the design of the mapping process that leveraged the underlying linear referencing system to transfer and locate crash data to the GIS network, rather than performing a onetime spatial merge of crash point data onto WISLR.*

*Since rollout, maintenance procedures have been implemented to update the online crash map on a regular (i.e., monthly) basis as additional reported crash data becomes available from WisDOT Division of Motor Vehicles. Annual maintenance procedures are also being developed to update the underlying WISLR GIS network and database on the TOPS Lab WisTransPortal system to align with WisDOT's annual certification cycle.*

## *3. WISLR State Trunk Highway Roadway Network Enhancements*

*Deficiencies in the representation of divided highways and complex interchanges in WISLR has been identified as an important factor affecting data quality in the final crash map. To address this area, UA has begun working with WisDOT to apply focused edits to the WISLR highway linework. Due to the design philosophy described above, these edits will have direct bearing on the quality of the underlying crash map. They will also benefit concurrent crash data enhancements projects in the Department (discussed below).*

## *4. Coordination with Other Crash Data Enhancements Initiatives*

*There are several important crash data enhancement projects that are being executed concurrently in the Department. In addition to the WISLR statewide crash map, WisDOT is in the process of rolling out a new version of its electronic crash and citation software (Badger TraCS) that will include crash mapping capabilities directly in the patrol car. WisDOT is also in the process of updating the Wisconsin "MV4000" police crash report and*

*underlying database management system to address advances in the MMUCC data standard and modern data management capabilities. Leveraging WISLR as a common GIS location system across all efforts has been identified as an important enterprise goal to maximize efficiency and data integration capabilities. Effective coordination between the respective project teams is a critical component of this process.*

**Provide the evidence and reasoning used to determine the success of the project:**

- *The formal QA/QC effort provides quantitative results about the quality of the crash map. No automated system is perfect, but the statewide crash map has been shown to exceed expectations and data quality standards needed for safety analysis and decision making.*
- *System usage statistics for the online crash map provide indirect evidence of the value this resource brings to all levels of government, public safety organizations, researchers, engineers, and others.*
- *WisDOT has successfully developed a statewide ranking of High Risk Rural Roads based on the WISLR crash map. This project demonstrated the ability to use the crash map for data integration and to automate the process of generating corridor based crash rates for safety analysis and problem identification.*
- *The project team has worked with a range of stakeholders including the WisDOT regional traffic safety engineers, county and municipal governments, and regional planning commissions to elicit feedback on the crash map.*

**Why should this project be recognized as a best practice in traffic records?**

1. *This project represents a successful effort to develop a combined map of highway and local road crashes with respect to a single GIS network.*
2. *The emphasis on leveraging the Department's linear referencing system for crash mapping and analysis has led to an automated, reproducible process that enables integration with other business data at the network level.*
3. *This project was not simply a technology advancement but incorporated maintenance and business process development to establish the crash mapping process for future safety analysis requirements. In particular, the crash mapping project is part of a larger, coordinated effort to enhance safety data reporting in Wisconsin.*

**I would like to have this project considered for presentation during one of the forum sessions**

**Yes, oral presentation**       **Yes, poster presentation**       **No**

*Results of an initial pilot implementation of the Wisconsin statewide crash mapping project were presented at TRF in 2011. The project team has also submitted three abstracts for presentation this year related to specific aspects of the final project.*