



**Developing Consistency in ITS Safety Solutions – Intersection Warning Systems  
Workshop #2 Summary  
September 15-16, 2011  
Best Western – Bloomington, Minnesota**

**Purpose – Project and Workshop #2**

Bringing together organizations that have developed and deployed intersection warning systems, the purpose of this project is to develop a consistent approach for accelerated, uniform deployment and further evaluation of intersection warning systems, and to recommend preliminary guidance for MUTCD consideration. This work will be initiated through a webinar and two in-person workshops. Participants will include ENTERPRISE pooled fund states, other states that have deployed systems, FHWA, NCUTCD, AASHTO and NACE.

The focus of Workshop #2 is to **review the preliminary guidance** proposed for MUTCD consideration, **develop an evaluation framework** that may be used in future deployments for experimentation, and **discuss plans for future experimentation and coordination**.

**Preliminary Design Guidance**

At the July 28-29 workshop, participants discussed function, placement, sign size and messages as basic elements of standardization for intersection warning systems. It was agreed that a standard in the MUTCD would eventually be best for these systems but efforts to produce near-term, preliminary standards should be developed and viewed more as recommended practice and guidance. This will still support greater consistency in future deployments and it will also serve to illustrate the need for further evaluation.

The resulting guidance document is intended to offer technical insight and recommended practice for designing and evaluating intersection conflict warning systems. It does not mandate the deployment of such systems, nor does it limit the engineering or policy discretion of the transportation agencies who may consider deploying these systems. The guidance is expected to evolve as more systems are deployed and further evaluation is conducted. It is also expected to serve as preliminary guidance for what may eventually be included in the MUTCD.

A draft of the suggested design guidance was distributed one week before the September 15-16 workshop and included:

- **Introduction.** A definition of the problem, acknowledgement of traditional vs. ITS safety solutions, recognition of deployments throughout the country, and a statement of function that these systems provide substantial vs. nominal warning for drivers.
- **Purpose.** Emphasis on the guidance orientation of the document, reference to key information sources, and recognition that information will evolve as more evaluation is completed.
- **Typical System Components.** References to the various technologies used to detect vehicle presence, calculate and deliver warnings, communicate between components, manage data and monitor system performance.
- **Glossary of Terms.** Contains a list of terms commonly referenced with MUTCD definitions used when applicable and available.
- **Recommended Layouts.** Four categories of systems were identified and typical layouts provided to offer technical insight and recommended practice. Layouts include conditions under which a system might be used, intended driver use, physical layout, options for sign placement, sign combinations and message sets, and a section on relevant notes and references.

During the workshop, numerous comments and suggestion were made regarding the form, function and content of the design guidance. In general, participants were comfortable with how the document was introduced and presented as recommended practice and guidance. It was suggested that an abbreviated reference to the actual systems deployed in each state be included as an appendix to the guidance. It was also agreed that adding the term “conflict” to the generic name of these systems – intersection conflict warning systems – would be appropriate. There was considerable discussion about how much detail to include in the individual layouts regarding ADT, costs, benefits, etc. Because limited information is available on these attributes, it was agreed that they should be removed as specific references with the layouts and instead added as general references in the document introduction. These and other suggestions will be incorporated into a second draft of the guidance document.

### **Evaluation Framework**

The second draft of the guidance document will also include a section on evaluation. This was the focus for the next portion of the workshop. It was acknowledged that not all systems currently deployed have been formally evaluated for their effectiveness. The evaluation guidance is intended to establish the basis of a common framework that may be used to evaluate existing and future deployments of intersection conflict warning systems. Using this common evaluation framework will allow the agencies to pool and compare data from individual deployments to better understand the collective effectiveness of such systems and the potential for broader national deployment and crash reduction.

Evaluation that has been completed ranges in approach across traditional crash analysis, benefit-cost analysis, traffic conflict technique, market research and human factors research. To illustrate the use of these approaches, three states were asked to share their evaluation experience during the workshop. North Carolina shared their use of crash analysis, which will begin in earnest this fall, to assess over 70 deployments in four different categories. Pennsylvania presented their benefit-cost analysis conducted on the two systems deployed in their state. Minnesota then summarized their use of the traffic conflict technique, market research and human factors research in several of their deployment projects. Rather than focusing on results from these evaluations, participants listened for measures of effectiveness, performance targets, sample size, duration and type of data collected, etc. This was intended to serve as reference for discussing a common evaluation framework that may be applied to all systems.

Using the [ITS Evaluation Guidelines](#)<sup>1</sup> published by FHWA, the framework discussion was focused around establishing an evaluation goal, strategy, hypotheses and high-level test plan parameters. The group also emphasized that evaluation framework must be tightly focused to ensure that agencies can execute their own evaluation or at least provide data efficiently and easily for a prospective national evaluation effort.

- **Goal.** To determine the effectiveness of individual ICWS configurations and their effectiveness in relation to various intersection geometries (i.e., 2-lane, 2-lane intersections). There are a number of subtleties that will affect this goal including the impacts of sign placement, message set, dynamic elements, etc. These will be acknowledged in the test parameters as details that must be identified, understood, controlled for and potentially further evaluated in separate studies.
- **Strategy.** Safety was identified as the most critical goal area to establish measures of effectiveness around. Several measures of effectiveness were discussed and three were identified as being the most critical and relevant to all systems deployed at present and in the future.
  1. Reduction in total crashes
  2. Reduction in target (right angle) crashes
  3. Reduction in severity of crash related injuries

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<sup>1</sup> [http://www.its.dot.gov/evaluation/eguide\\_resource.htm](http://www.its.dot.gov/evaluation/eguide_resource.htm)

- **Hypotheses.** Specific hypotheses were not articulated during the workshop. Additional suggestions will be made in the second draft of the guidance document. An example hypothesis may state, “If both major and minor road alerts are provided, crashes will be further reduced than a minor road only or major road only alert.”
- **Test Plan Parameters.** Numerous test plan parameters were identified by the group and should be accounted for during evaluation. Parameters included study duration (three years recommended), crash history (total crashes, target crashes and injury severity), ICWS configuration, sign placement and legend, dynamic element (i.e., flashing beacon), intersection geometry, traffic control, other safety improvements, traffic volume (minor/major/entering), posted speeds, land use around intersection, and jurisdiction. A taxonomy of these parameters must be developed so they can be fully understood and controlled for, as necessary, during evaluation.

Also discussed were the [Highway Safety Manual](#)<sup>2</sup> published by AASHTO and the [Crash Mitigation Factor Clearinghouse](#)<sup>3</sup> initiated by FHWA. The Highway Safety Manual provides tools to conduct quantitative safety analyses, allowing for safety to be quantitatively evaluated alongside other transportation performance measures such as traffic operations, environmental impacts and construction costs. A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure – ICWS, for example – at a specific site. It is important to note that a CMF represents the long-term expected reduction in crashes and this estimate is based on the crash experience at a limited number of study sites; the actual reduction may vary. The clearinghouse offers transportation professionals a central, web-based repository of CMFs and related information and resources. These recently developed tools were suggested as core references for further development of an evaluation framework for ICWS.

### Future Deployments and Coordination

Based on information gathered through these workshops, there are already over a dozen different systems that have been deployed at over 120 intersections throughout the country. The agencies that participated in the workshop shared their prospective plans for further deployment and evaluation on intersection conflict warning systems. This was done to make key standards, engineering and industry groups aware of where the market for these systems may develop in the next 1-3 years.

Most of the states will move forward with applying the evaluation parameters developed through the workshop to their existing deployments. North Carolina currently has over 80 sites that have had intersection conflict warning systems installed for several years. They are in the process of completing in-depth crash analysis on the effectiveness of the systems they have deployed. Because of the statistical significance of analysis at this number of locations, many of the states are eagerly awaiting North Carolina’s results so that they may leverage them for further deployments.

Minnesota is developing a project that will deploy intersection conflict warning systems at up to 150 locations throughout the state. Some of the states are considering participation in a project being developed by the University of Minnesota to deploy up to 40 systems throughout the country. Other states, like Missouri, will continue deploying systems on an individual basis or as a tool in corridor-wide improvements when needed.

In addition to the states sharing their prospective plans, those participants agreeing to represent or coordinate with other associations or organizations were asked to comment on prospective responses from each.

*Federal Highway Administration – Jim McCarthy and Will Stein, FHWA-Minnesota Division*

It will be important to update the FHWA MUTCD team (include Eric Ferron, Kevin Sylvester and Hari Kalla) and Office of Safety (include Rosemarie Anderson and Ed Rice), preferably via a webinar. The

<sup>2</sup> <http://www.highwaysafetymanual.org/Pages/default.aspx>

<sup>3</sup> <http://www.cmfclearinghouse.org/index.cfm>

webinar should summarize webinar/workshop proceedings and the resulting document, “Design and Evaluation Guidance for Intersection Conflict Warning Systems.” There should also be suggestions and discussion of potential next steps for future deployments, moving toward national evaluation, formally engaging the MUTCD process, etc. FHWA division staff in each of the states should also be updated again. They were initially contacted in April regarding this project and their states’ participation. An update on the results of the work and potential next steps would be appropriate and welcome.

*National Association of County Engineers – Joe Gustafson, Washington County, Minnesota*  
Counties will likely advocate for ICWS at state/local road intersections, particularly when geometric changes or traffic signals aren’t viable. Because volumes are much lower at local/local road intersections, engineers will likely lean toward other safety improvements, such as an all-way STOP. It will be very important for industry to eventually design systems that are user friendly operationally, particularly since some counties don’t even have traffic signals or maintenance staff. As evaluation is completed and designs guidance is refined to better explain the conditions for deploying ICWS, it will be just as important to explain when ICWS should NOT be considered. This will help ensure systems aren’t overly deployed and minimize the risk of drivers becoming desensitized. The next annual meeting for NACE is scheduled for April 1-5, 2012 in Lexington, KY. It would be good to continue working with Minnesota’s county engineers who are active at the national level – Wayne Sandberg, Washington County and Sue Miller, Freeborn County were suggested – to see if there could be a presentation or committee meeting discussion on ICWS.

*National Committee on Uniform Traffic Control Devices – Matt Rauch, Wisconsin*  
There are two potential NCUTCD technical committees that could address ICWS – Guide/Motorist Information Signs or Regulatory/Warning Signs. These and other technical committees will be meeting during the afternoon and evenings of January 18-19, 2012 at the TRB Annual Meeting in Washington, DC. Tom Heydel, Wisconsin, is a member of the Regulatory/Warning Signs technical committee and would be willing to share the Design and Evaluation Guidance for Intersection Conflict Warning Systems document with the committee. He would recommend that a task force be formed to consider next steps related to the MUTCD. Typically, language in the MUTCD is going to relate to the signs specifically and would reference other documents, such as the Traffic Control Devices Handbook and Highway Safety Manual, for recommended conditions of use, deployment considerations, etc. It would also be useful to share the guidance with the Regulatory/Warning Sign Committee chair, Bruce Ibarguen, Maine. Maine is one of the states that has deployed an ICWS and they have participated in this project. The webinar with FHWA noted above will further support an ICWS introduction to the technical committee.

*AASHTO Subcommittee on Traffic Engineering – Gary Sanderson, Idaho*  
SCOTE will also meet in January during the TRB Annual Meeting. Each state was encouraged to share information about the ICWS, particularly the design and evaluation guidance, with their SCOTE representative in advance of the January meeting.

*Traffic Control Devices TPF-5(065) – Julie Stotlemeyer, Missouri*  
The Traffic Control Devices (TCD) Consortium focuses on systematic evaluation of novel TCDs, employing a consistent process that addresses human factors and operations issues for each TCD idea. This could be an avenue for further human factors research into sign placement and legend. The group has their next annual meeting in April 2012 in Kansas. Missouri, North Carolina, Pennsylvania, Kansas and Iowa are members of this pooled fund and could propose this research. More information about the pooled fund is available online through the [Transportation Pooled Fund Program](http://www.pooledfund.org)<sup>4</sup>; search for the TPF number 5(065).

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<sup>4</sup> <http://www.pooledfund.org>

*Evaluation of Low Cost Safety Improvements TPF-5(099) – Shawn Troy, North Carolina*

The goal of this pooled fund is to develop reliable estimates of the effectiveness of the safety improvements that are identified as strategies in the National Cooperative Highway Research Program (NCHRP) Report 500 Guides. This group may be an option for coordinating a national evaluation of ICWS. Several states participating in the workshop are also members of the pooled fund – Iowa, Kansas, Minnesota, Missouri, North Carolina, Pennsylvania and Wisconsin. They are scheduled to hold their next annual meeting in March or April 2012. More information about the pooled fund is available online through the Transportation Pooled Fund Program; search for the TPF number 5(099).

*ENTERPRISE TPF-5(231) – Jon Jackels, Minnesota*

ENTERPRISE is currently considering another ICWS related project in its 2012 work plan. The scope of the project has evolved from deployment among member states to national evaluation. If other pooled funds are better suited to coordinating a national evaluation, it may be suggested that ENTERPRISE 1. Co-sponsor a national evaluation or 2. Rescope its next project to have more of a coordination and marketing focus to further support ICWS evaluation and standardization. More information about the pooled fund is available online through the Transportation Pooled Fund Program; search for the TPF number 5(231). You can also visit ENTERPRISE online at [www.enterpriseprog.org](http://www.enterpriseprog.org).

All of these opportunities will be added to the roadmap that was started during Workshop 1. Jon Jackels and Athey Creek will also continue coordinating with workshop participants to support these next steps.

### **Vendor Community Insight**

As state and local agencies continue planning for future deployment of intersection conflict warning systems, several questions arise for industry in relation to product availability, standardization, costs and so forth. Because ATSSA was unable to participate directly in the September 15-16 workshop, they agreed to a written exchange of information about future ICWS deployments and answers to industry related questions from the transportation agencies. Following is a list of questions (numbered for reference only) posed by the agencies who participated in the ENTERPRISE workshops.

1. What components, as described in the attached excerpt of the draft Design and Evaluation Guidance for Intersection Conflict Warning Systems, are available commercially off the shelf today?
2. What trends does industry believe will impact the cost of intersection conflict warning systems?
3. What number of systems deployed (present and future) would entice a company to develop a product line for intersection conflict warning systems?
4. What kind of maintenance could be expected for an intersection conflict warning system?
5. Would industry be interested in offering operation and maintenance related plans to transportation agencies?
6. Would industry be interested in design-build-operate-maintain arrangements with transportation agencies?
7. What failsafe options does industry see for these types of systems?
8. How might industry see itself participating in developing system requirements, specifications or standards for intersection conflict warning systems?

These questions will be sent by Jon Jackels, as the ENTERPRISE project champion, to Roger Wentz, ATSSA president and CEO, following the workshop. Their response and any further coordination will be shared with workshop participants.

### **Attendees\***

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\* Those attendees shaded above participated in Workshop 1 but were unable to attend Workshop 2. Information will still be shared and feedback will still be sought from them.