

ICWS 101: An Overview of the System



WEBINAR IS BEING RECORDED

ENTERPRISE

ENTERPRISE Webinar Series – Webinar 1
February 26, 2015

Agenda

WEBINAR IS BEING RECORDED

- Introduction
- ENTERPRISE Program
- Intersection Crashes
- Intersection Conflict Warning Systems
- Support Resources
- Questions



Ken Hansen, MnDOT
Featured Presenter



Ginny Crowson, Athey Creek
Moderator and ENTERPRISE Program Support



ENTER  PRISE

ENTERPRISE Program



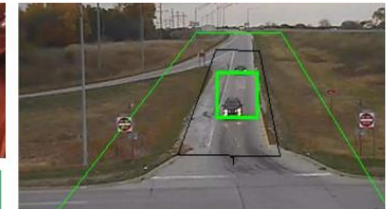
ENTERPRISE Program

ENTERPRISE Transportation Pooled Fund Study TPF-5 (231)



Use and Impacts of Camera
Images and Other Displays of
Traveler Information

ENTERPRISE Transportation Pooled Fund Study TPF-5 (231)



Next Generation Traffic Data and
Incident Detection from Video

FINAL REPORT

Evaluating **N**ew **T**Echnologies for **R**oad
PRogram **I**nitiatives in **S**afety and **E**fficiency



ENTERPRISE Program

Members

- Arizona DOT
- Georgia DOT
- Idaho Transportation Department
- Illinois DOT
- Iowa DOT
- Kansas DOT
- Maricopa County, Arizona
- **Michigan DOT**
- Minnesota DOT
- Oklahoma DOT
- Pennsylvania DOT
- Texas DOT
- **Washington State DOT**
- Ministry of Transport Ontario
- Transport Canada
- Dutch Ministry of Transport
- FHWA



ENTERPRISE Program

- Recent projects
 - Next Generation Traffic Data and Incident Detection from Video (Video Analytics Evaluation)
 - Synthesis of Intelligent Work Zone Practices
 - Assessment of Telematics Service Provider Data Feeds
 - HAR Best Practices and Future Direction
 - Crashworthiness and Protection of ITS Field Devices
 - ***Developing Consistency in ITS Safety Solutions – ICWS***
 - ***ICWS Coordination and Systems Engineering***



ENTER  PRIZE

Featured Presenter: Ken Hansen

Minnesota Department of Transportation



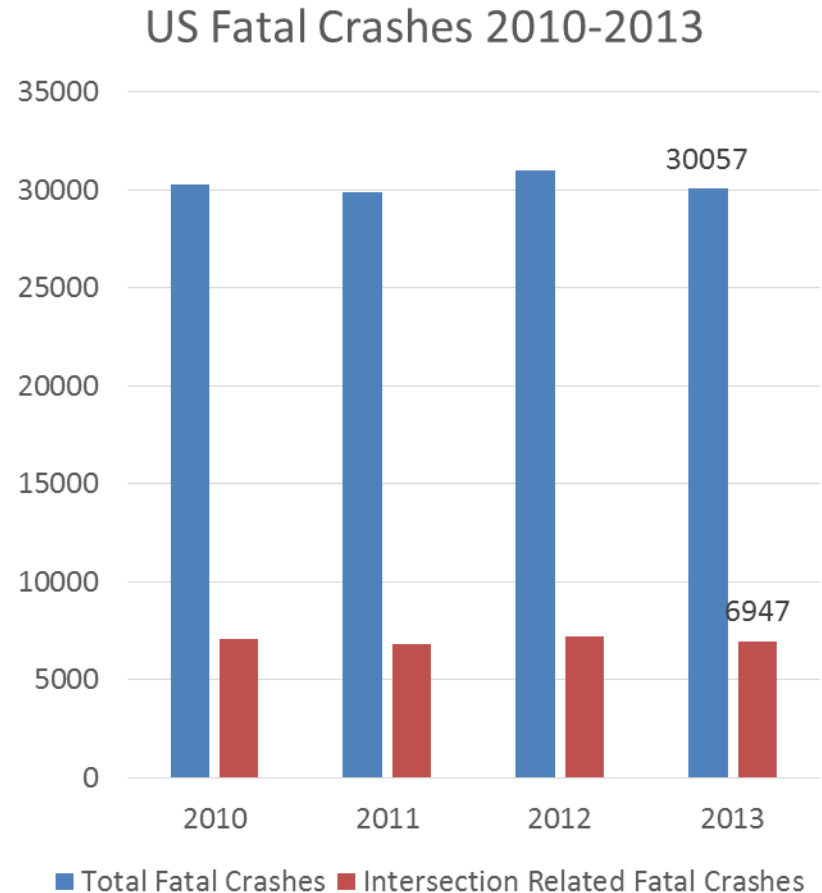
Intersection Crashes

Nature of the Problem



Intersection Crashes

- 6,947 fatal crashes associated with intersections in 2013 (FARS Data, US)
 - 23% of the 30,057 fatal crashes in 2013



Intersection Crashes

- Crash Factors in Intersection-Related Crashes: An On-Scene Perspective (NHTSA, 2010)
 - 96% of crashes attributed to drivers
 - 55.7% driver recognition errors
 - 29.2% driver decision errors



MnDOT Example

County Road Safety Plans



- All 87 Counties!
 - Identifies Safety Priorities
 - Easy Application for HSIP
- Reviewed 13,000+ intersections
 - Only 14 had more than 1 fatal crash



MnDOT Example

Risk Factors For Rural Intersections

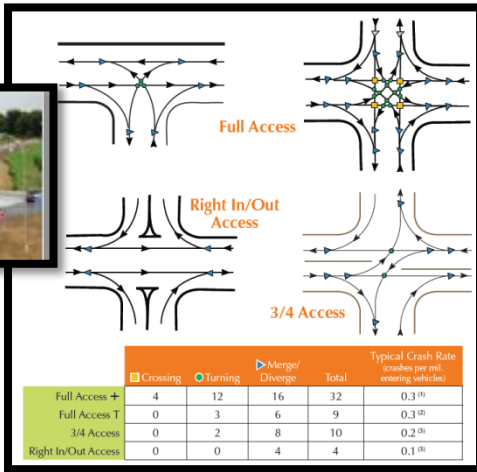
- ▶ Skew
- ▶ Curve
- ▶ Railroad Tracks
- ▶ Development
- ▶ Previous Stop
- ▶ Previous Crashes
- ▶ Minor/Major Volume



MnDOT Example



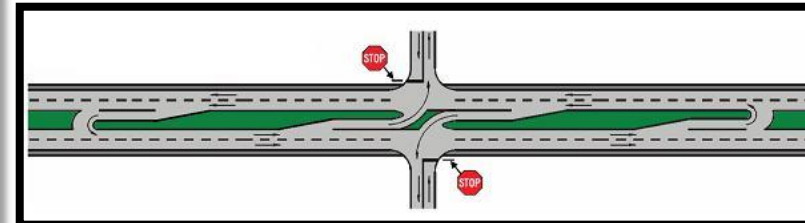
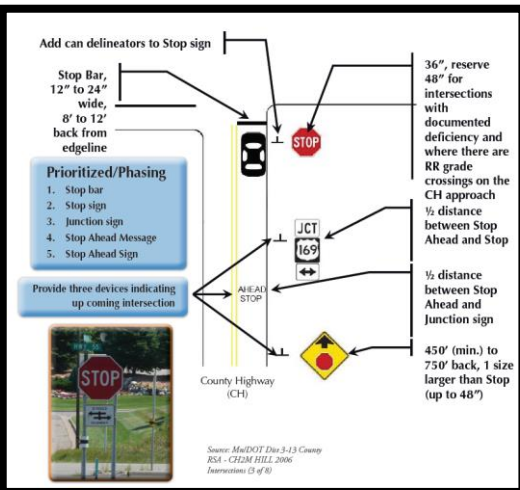
Change Intersection Type



Street Lighting



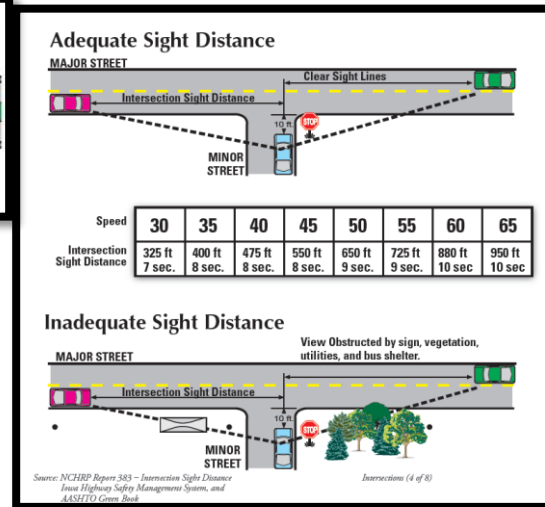
Dynamic Warning Signs



Indirect Turns

Enhanced Signing and Delineation

Improve Sight Distance



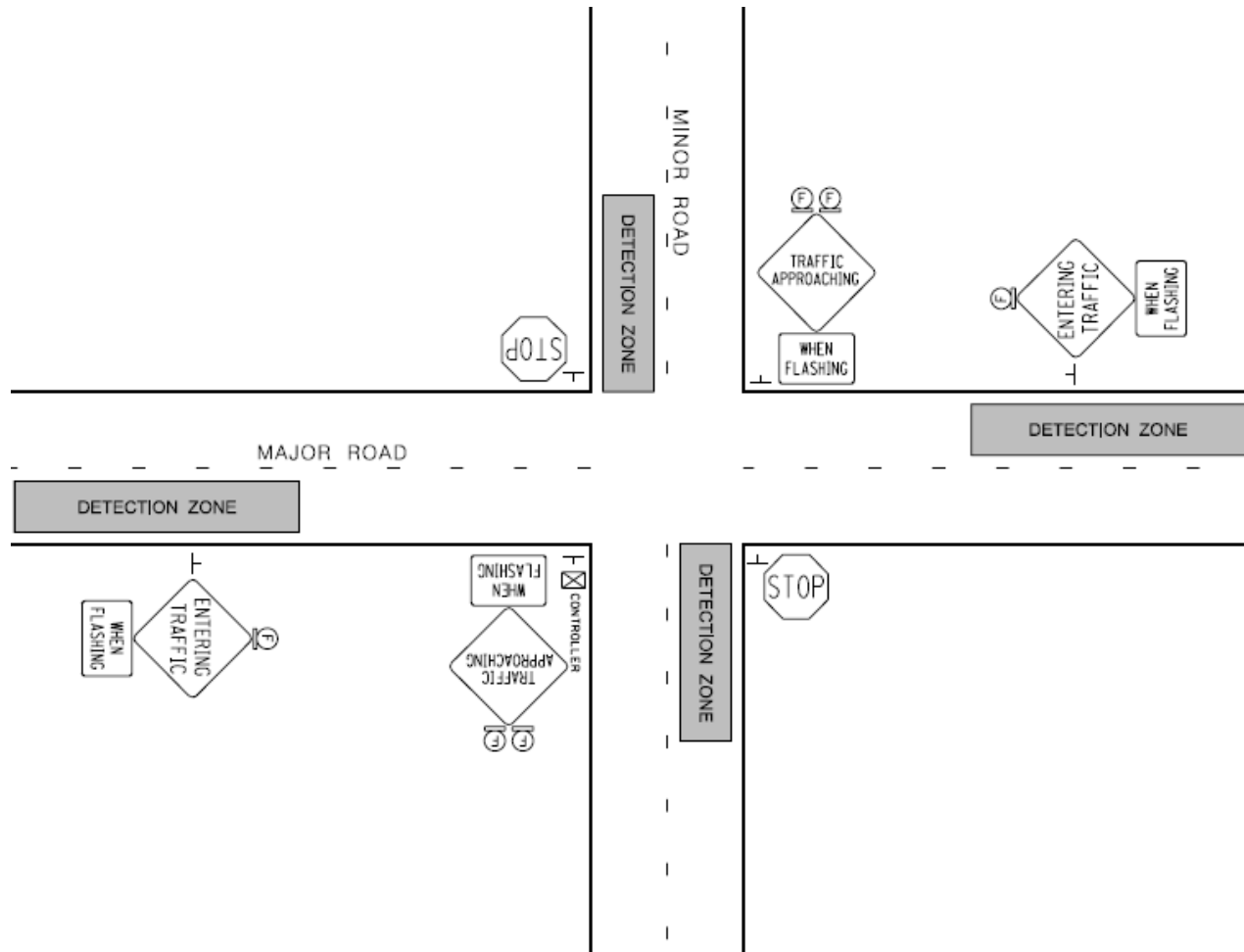
Example Intersection Strategies



Intersection Conflict Warning Systems



Intersection Conflict Warning Systems



MnDOT Example

Major Road Warning



MnDOT Example

Minor Road Warning



Intersection Conflict Warning Systems



Intersection Conflict Warning Systems

Safety Effectiveness of ICWS

- 25-30% Reduction in Total Crashes*
 - Major and minor road warning
 - Major road warning only



* Evaluation of the Safety Effectiveness of “Vehicle Entering When Flashing” Signs and Actuated Flashers at 74 Stop-Controlled Intersections in North Carolina (2012)

Support Resources

Further Consideration of ICWS



Support Resources

Planning Guidance/Warrants

ICWS Guideline - 1:

Intersections with High Crash Frequencies or Rates (Reactive Approach)

Purpose: To influence driver behavior at stop-controlled intersections (typically 45 mph or greater posted speed on the major road) where right-angle crashes are the predominant crash type.

ICWS Guideline- 2:

Intersection Characteristics (Proactive Approach)

Purpose: To influence driver behavior at stop-controlled intersections (typically 45 mph or greater posted speed on the major road) where conditions are such that the intersection could be susceptible to right-angle crashes.

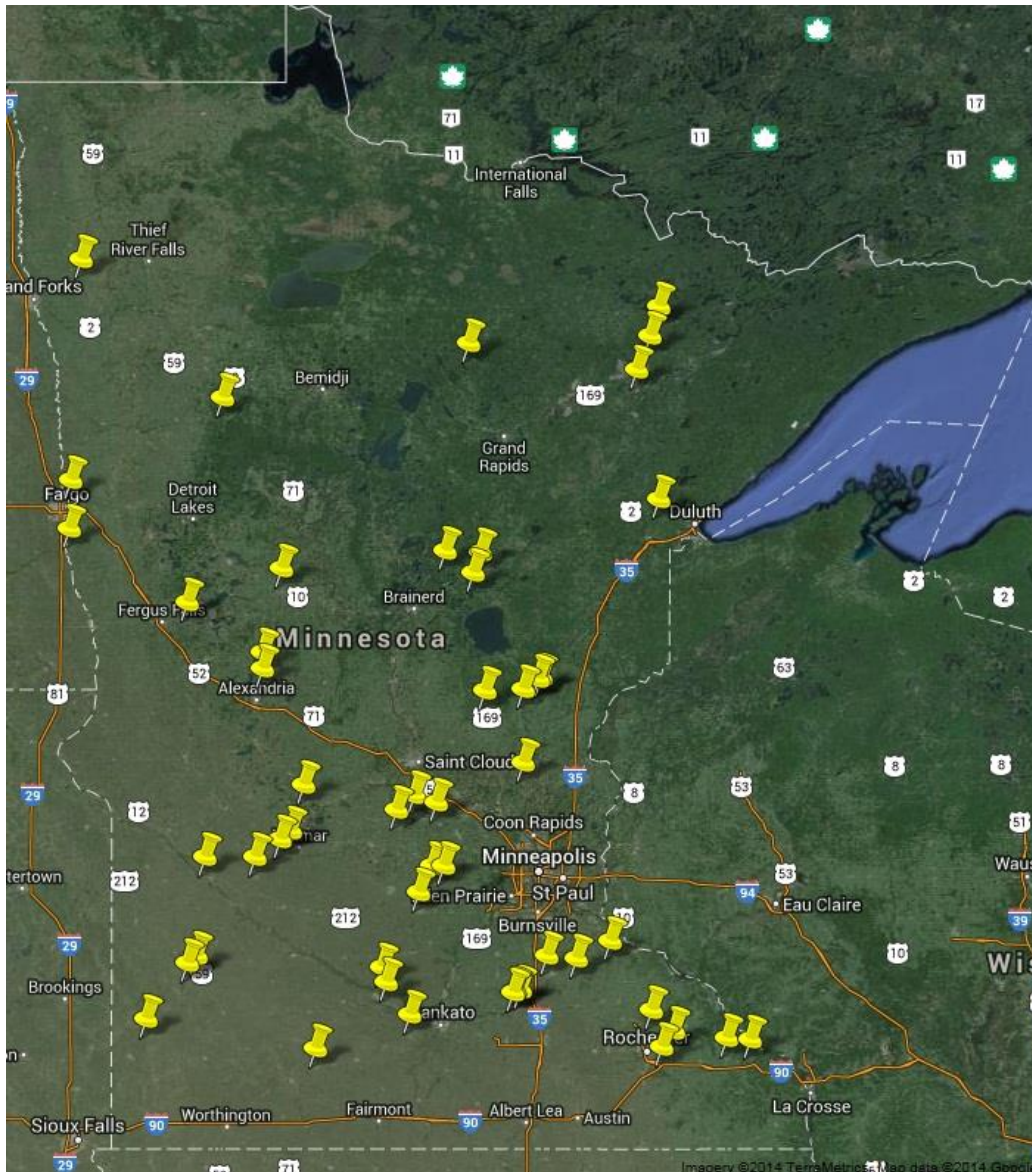


www.enterprise.prog.org/itswarrants/icws.html

MnDOT Example

RICWS Project

- Statewide Deployment
 - Phase I: 48 ICWS
 - Phase II: 5 ICWS



MnDOT Example

RICWS Site Selection

- 1st District/County Safety Plans
- 2nd 5-Year Total Crash Rate
- Local Support/Participation

Reference Number	Road Safety Plan Source	MnDOT District	County	City	Major Road	Minor Road	Star Rating	Total Crash Rate
10	District	8	Carver	New Germany	MNTH 7	CSAH 33/CARVER CO	5	0.8
11	District	6	Olmsted	Rochester	MNTH 63	CSAH 21/CR121	5	0.71
12	County	7	Nicollet	Klossner	MNTH 15	CSAH 5	5	0.63
13	District	8	Kandiyohi	Raymond	MNTH 23	CSAH 1/KANDIYOHI CO	5	0.45
14	District	3	Aitkin	Aitkin	MNTH 210	CSAH 12	5	0.43



Support Resources

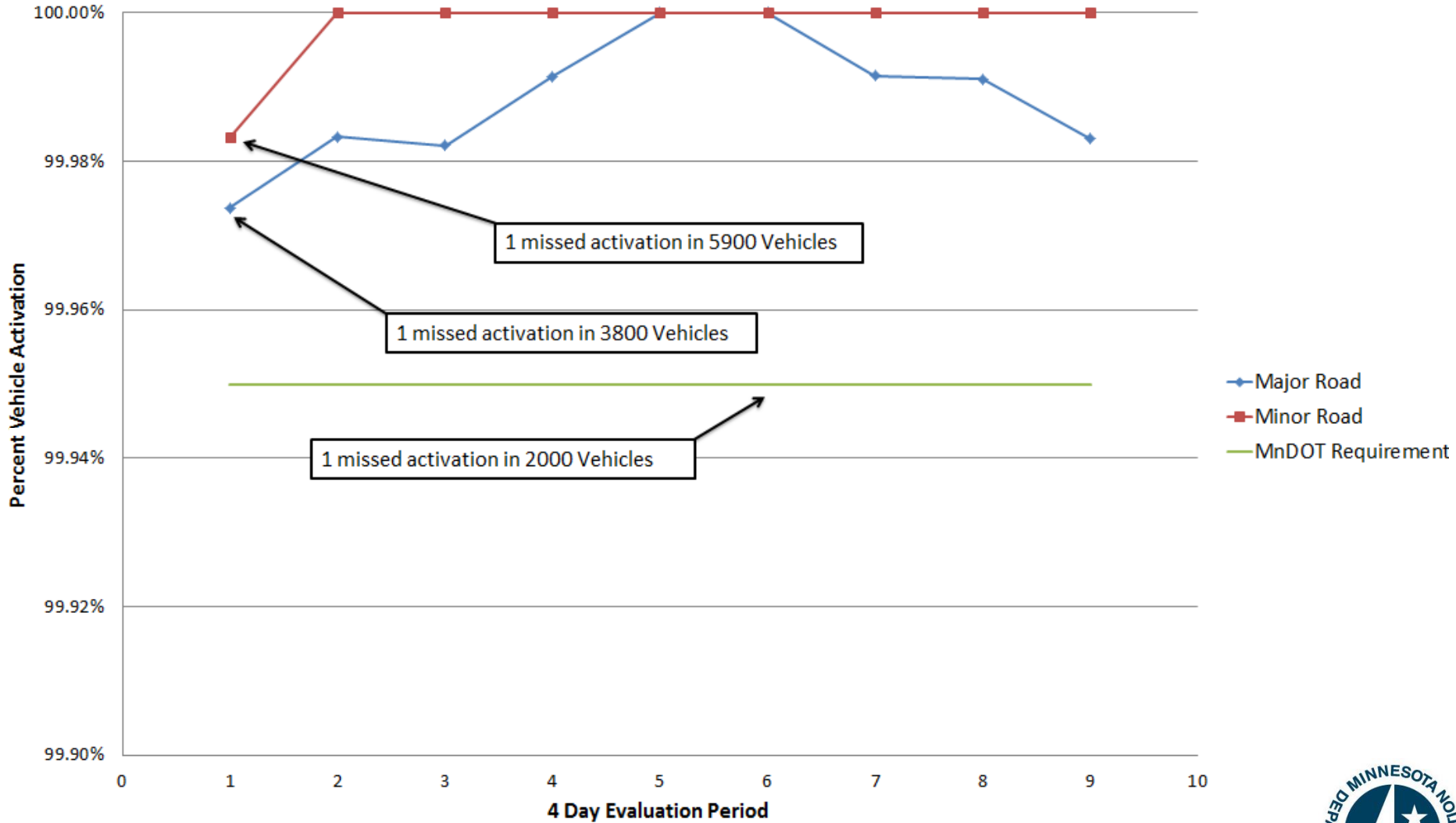
- Model Systems Engineering
 - Required for use of Federal Funds!
 - Starting point for agencies deploying ICWS
 - Concept of operations identifies stakeholders, needs, operational concept and system components
 - System requirements define what ICWS must do and set the basis for system design, procurement, installation and operation

MnDOT Example

- Driver Confidence Key to Effectiveness
 - UMD Research
 - Reliable – 99.95% = missing 1 veh/2000
 - Reliable – false warning included in 99.95%
 - Reliable – malfunctions look different to drivers
 - Reliable – 72hr malfunction response time



MnDOT Example



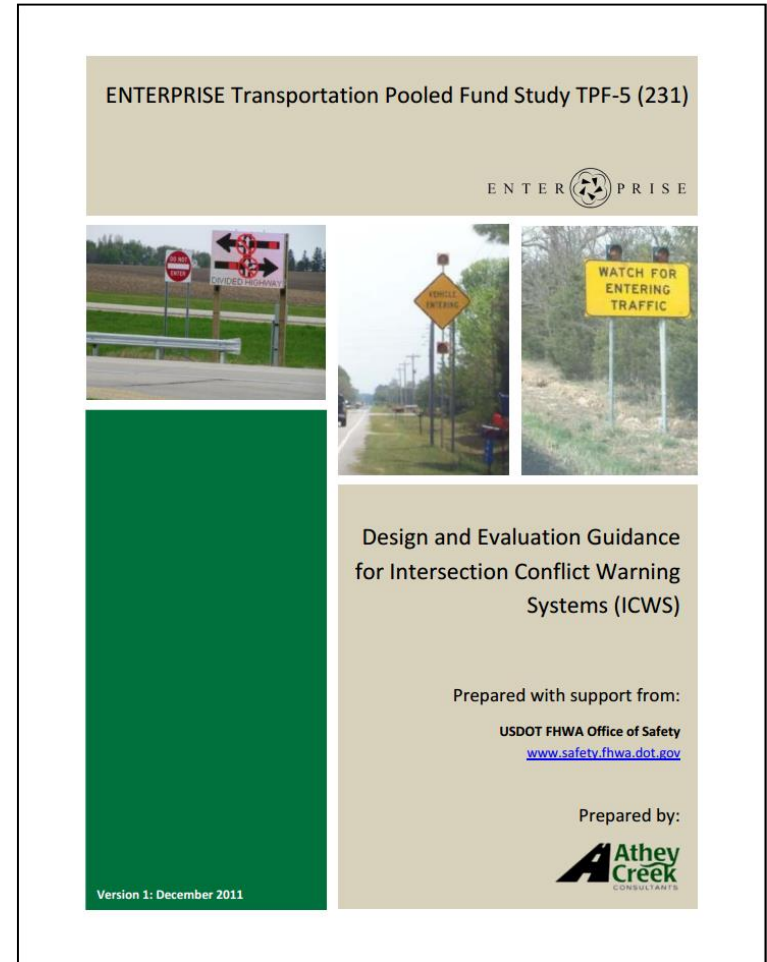
MnDOT Example

- Maintenance Minded
 - Commercial Off the Shelf Components
 - Nema TS2
 - Technician Familiarity
 - Data Logging
- Grid Power
 - 60-100kWhr per Month
 - Maintenance issues with batteries



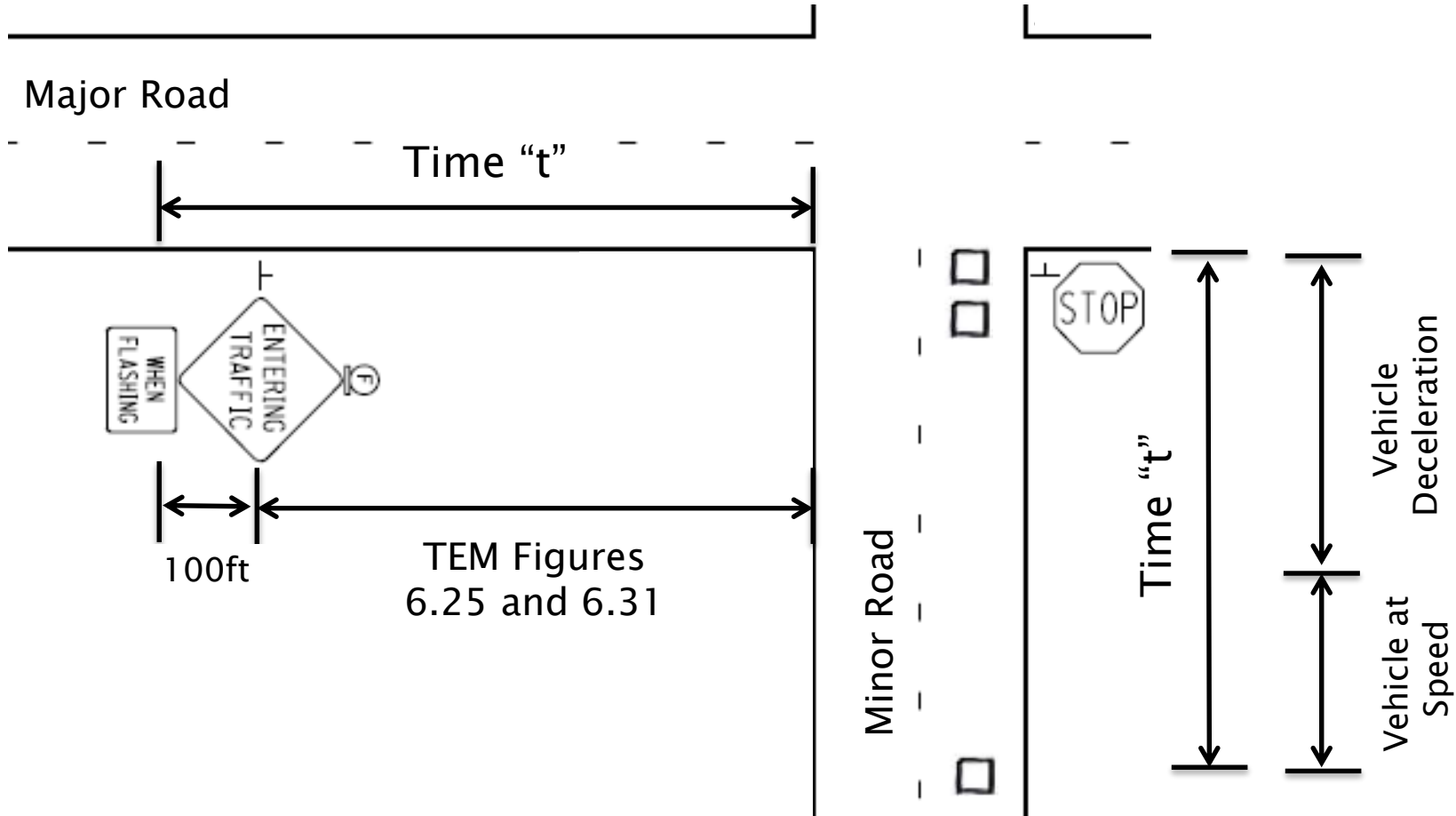
Support Resources

- ICWS Design and Evaluation Guidance
 - Four typical layouts based on warning direction and intersection configuration
 - Technical insight on current practice
 - Conditions, intended driver use, layout, options, notes and references
 - Evaluation framework



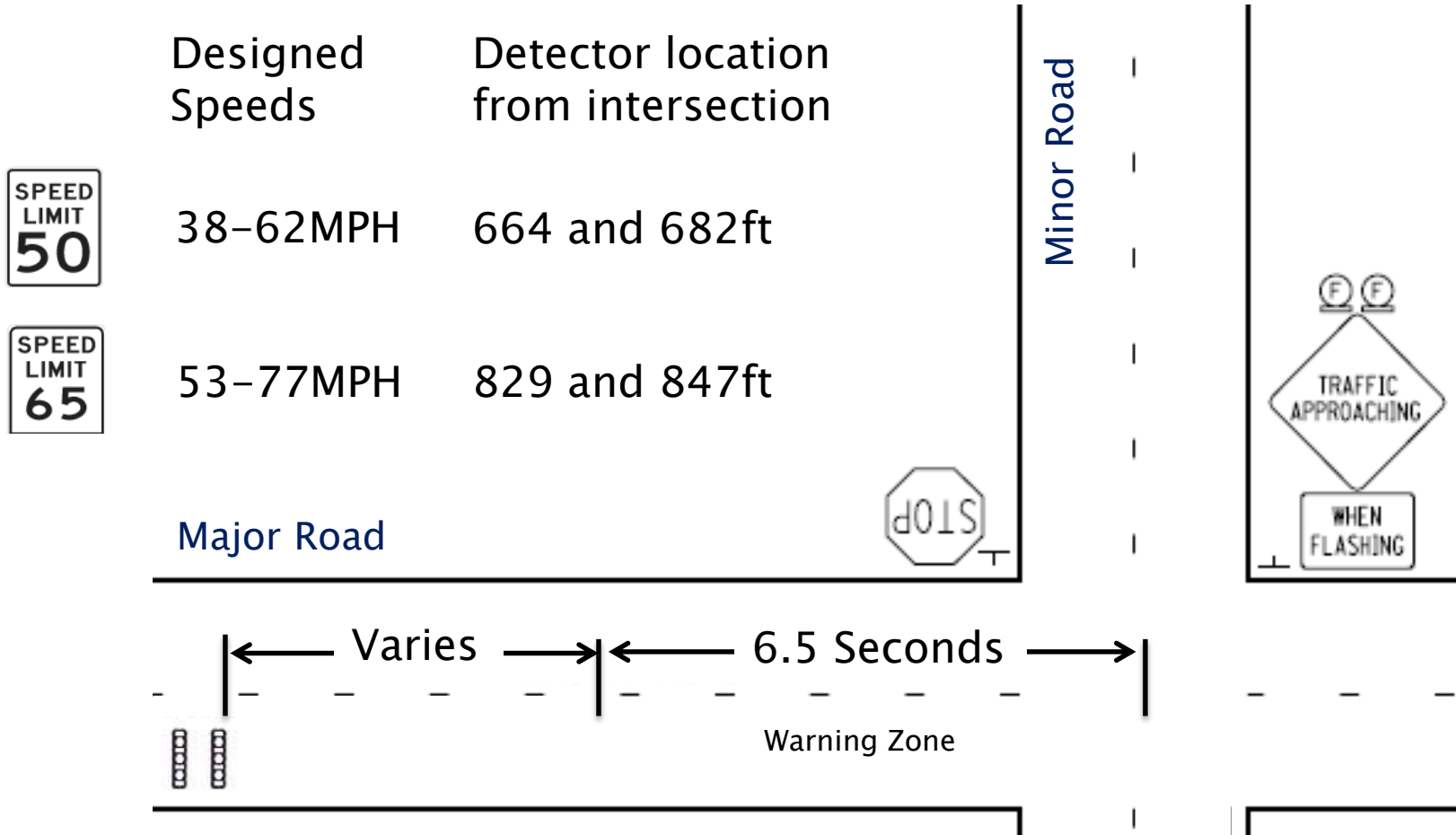
MnDOT Example

Major Road Warning/Minor Road Detection



MnDOT Example

Minor Road Warning/Major Road Detection



MnDOT Example

Sign Supports

- Blankout Signs
 - U-Channel is not crashworthy w/attached ITS devices
 - Square Tubes are not crashworthy with knee braces
 - Square Tubes with slip bases are only rated to 85MPH wind gusts



Support Resources

ENTERPRISE

Home Projects Members About Us Contact Us

enterprise.proj.org | Log In

Main Menu

- Home
- About Us
- Calendar
- Work Plans
- Management Plan
- Projects
- Members
- How to Join
- Benefits
- Progress Reports
- Contact Us
- Helpful Links

**Intersection Conflict Warning Systems (ICWS)
Related Documents/Links**

This page includes a listing of related documents and links to the ENTERPRISE projects, "Developing Consistency in ITS Safety Solutions - ICWS (Phase 1)", "ICWS Coordination and Systems Engineering (Phase 2)" and "ICWS Support and Outreach (Phase 3)". If you would like to contribute to this listing or have any questions, please contact Ginny Crowson at crowson@accidentsolutions.org.

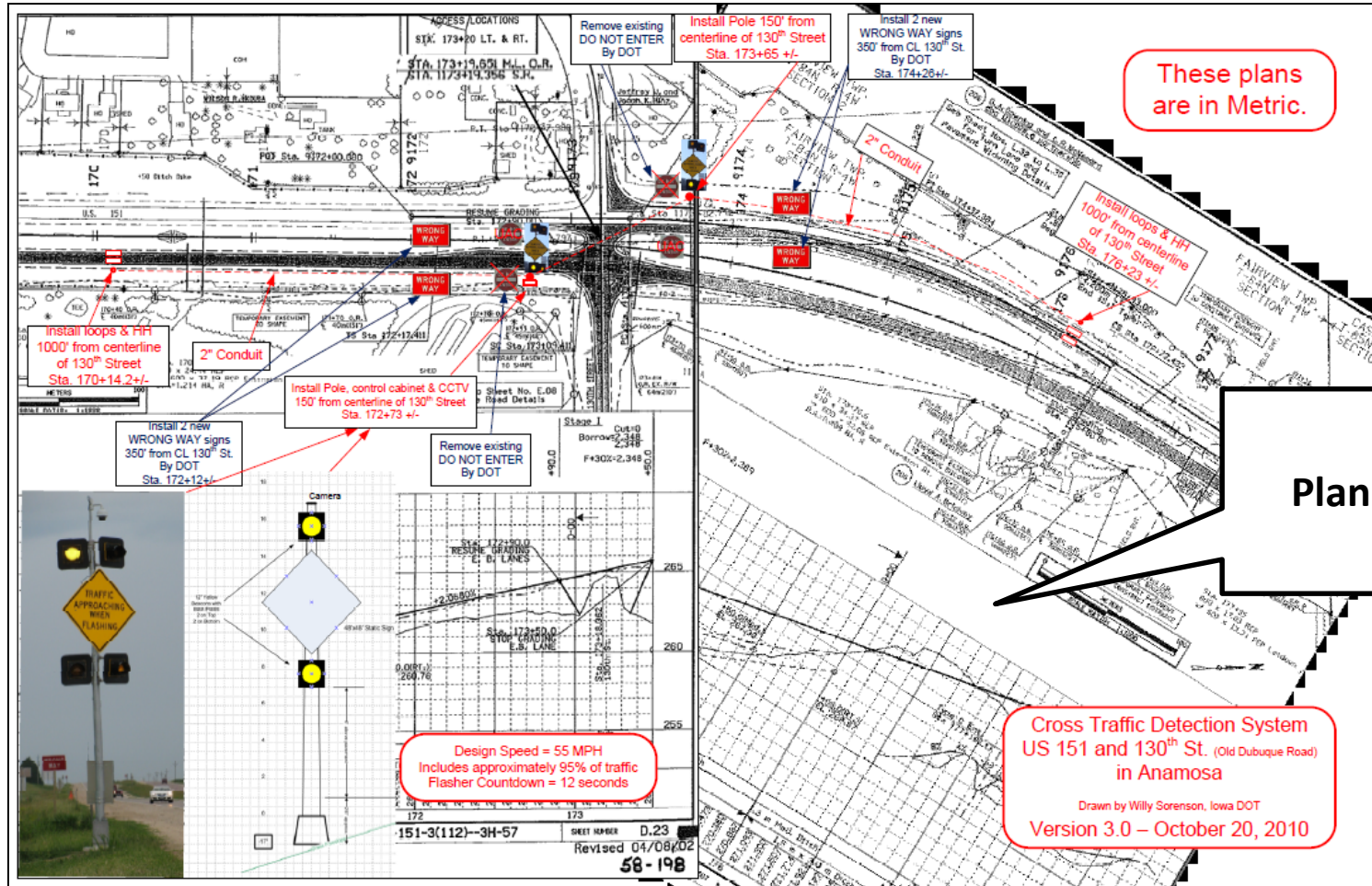
Source	Related Document/Link
ENTERPRISE	<ul style="list-style-type: none"> • Concept of Operations for Intersection Conflict Warning Systems (November 2012) • Systems Requirements for Intersection Conflict Warning Systems (May 2013) • Design and Evaluation Guidance for Intersection Conflict Warning Systems, Version 1 (December 2011) • Intersection Conflict Warning Systems-Characteristics Summary (December 2011) • Project Overview-Handout • Project Overview-Presentation
FHWA	<ul style="list-style-type: none"> • Stop-Controlled Intersection Safety: Through Route Activated Warning Systems
Florida	<ul style="list-style-type: none"> • Innovative Operational Safety Improvements at Unsignalized Intersections - Post-Mounted Flashing Beacons and Vehicle Actuated Variable Message Signs
Gwinnett County, Georgia	<ul style="list-style-type: none"> • Proposed Guidelines for Traffic Actuated Warning Signs at Intersections with Limited Sight Distance
InterSafe (Europe)	<ul style="list-style-type: none"> • Part of the Integrated Project PReVENT, InterSafe is a European effort exploring accident prevention and mitigation potential of an integrated preventive safety system for intersections
Iowa	<ul style="list-style-type: none"> • Plan Set for Anamosa Intersection • Plan Set for Dyersville Intersection • Traffic Approaching When Flashing Signs
Maine	<ul style="list-style-type: none"> • Final Technical Report #01-2 Evaluation of the Norridgewock Intersection Collision Avoidance Warning System on Route 201A, Norridgewock, Maine
Michigan	<ul style="list-style-type: none"> • Intersection Warning System Plans for US-31 and M-77 Sites • Special Provision for Intersection Warning System • Special Provision for Wireless Vehicle Detection

Project Information

- [Webinars/Workshops](#)
- [Related Documents/Links](#)
- [Phase 1: Developing Consistency in ITS Solutions - ICWS](#)
- [Phase 2: ICWS Coordination and Systems Engineering](#)
- [Phase 3: ICWS Support and Outreach](#)

**ENTERPRISE Project
Web Page**

Support Resources



Support Resources

03IT800(A215)

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
INTERSECTION WARNING SYSTEM (IWS)

LOG

1 of 12

ITS:APPR:CLC:DBP:12-15-09

Special Provisions

a. Description. This section describes wireless vehicle detection system (VDS), flashing beacons, and system controllers (SC) (including logic control software) which are to be provided as part of an IWS. The work consists of providing all labor, materials, equipment, and software necessary to furnish, install, test, integrate, configure, and provide a warranty for a fully functional and operational IWS. The work also includes all documentation and training necessary to operate and maintain the equipment and software.

The IWS is based on notification of vehicle occupancy at a two-way stop intersection. Wireless vehicle data will be processed by a SC that will determine occupancy and activate 2 flashing beacons based on real-time local conditions. The VDS, flashing beacons, SC, and IWS software are described in this special provision. The vehicle detectors and flashing beacons are required to complete the IWS and are described and paid for under separate special provisions.

This work must be done in accordance with the standard specifications, except as modified herein. The Plans indicate the quantity, location, sensor types and components required for each site, and the power available at these locations.

1. General. The IWS is comprised of the following components.
 - A. System Controller (SC). Provides remote (in-field) logic processing of all vehicle detector inputs and provides an output to the flashing beacon activation via the Input/Output (I/O) relay panel.
 - B. Vehicle Detection System (VDS). Detects the occupancy, and class of vehicles for each discrete travel lane and direction. See the Special Provision for Wireless Vehicle Detection System for requirements.
 - C. Optical Flashing Beacon. Flashing beacon units provide a visible means of alerting motorists as to the presence of an event.
 - D. Input/Output Relay Panel and Beacon Controller. Receives a contact closure input from the SC and serves as an on/off switch for the flashing beacon.
 - E. Power/Data Equipment. Provide power/data cabling between the field sensors/devices and the SC.
2. Summary.
 - A. Furnish, install, integrate, test, train, and provide a warranty for all equipment, software, components and communications necessary to provide complete functionality without additional expense to the Department which meets or exceeds all testing

Support Resources

What are the components of the RICAS?

1. Sensing - Sensors are used on the mainline to determine the position, speed, and lane of travel for vehicles approaching the intersection crossroads. Automotive radar is the sensor of choice for this application; automotive radar is accurate, durable, reliable, available, relatively inexpensive, and works in all weather



Monitoring Sensors at STH 77 and Highway 53



2 Monitoring Cameras

Additional information:

Project Website:

<http://www.topslab.wisc.edu/workgroups/rsip.html>

Project Contact:

Rebecca Szymkowski, P.E., PTOE
State Traffic Safety Engineer
Wisconsin Department of Transportation
rebecca.szymkowski@dot.wi.gov
608.266.9381

Project Participants:



Traffic Operations
and Safety (TOPS)
Laboratory at
University of
Wisconsin-Madison



U.S. Department
of Transportation
**Federal Highway
Administration**

UNIVERSITY OF MINNESOTA



Public Education Materials

computational system. A prototype of the sign is shown below.

4. Monitoring - Provides WisDOT and researchers the ability to monitor, troubleshoot and collect data remotely.



4 Electronic Message Signs

Rural Intersection Collision Avoidance System (RICAS)



US Highway 53 and State Highway 77 Minong, Wisconsin



Part of the USDOT Federal
Highway Administration Rural
Safety Innovation Program (RSIP)

Support Resources

www.enterprise.prog.org

Main Menu

- [Home](#)
- [About Us](#)
- [Calendar](#)
- [Work Plans](#)
- [Management Plan](#)
- [Projects](#)
- [Members](#)
- [How to Join](#)
- [Benefits](#)
- [Progress Reports](#)
- [Contact Us](#)
- [Helpful Links](#)

Welcome

Welcome to the ENTERPRISE Pooled Fund Study website. The ENTERPRISE Program is a [FHWA Pooled Fund Study](#) with member agencies from North America and Europe. Its main purpose is to use the pooled resources of its members, private sector partners and the United States federal government to develop, evaluate and deploy [Intelligent Transportation Systems \(ITS\)](#).

As part of its mission, ENTERPRISE seeks to facilitate the sharing of technological and institutional experiences gained from its ITS projects, and the projects for its individual members.

Project Highlight: Intersection Conflict Warning Systems (ICWS) Support and Outreach

A series of webinars will be scheduled in 2015 to feature various topics related to ICWS. They are designed to facilitate peer exchange on both introductory and advanced topics. A brief explanation of each webinar will be posted along with relevant presentation information as they are confirmed. For more information about the webinars contact Ginny Crowson at crowson@acconsultants.org.

Webinar 1 – ICWS 101: An Overview of the System

February 26, 2015, 2:00 – 3:30 p.m. (Central)

Ken Hansen from the Minnesota Department of Transportation (MnDOT) will introduce the concept of ICWS as an ITS safety solution and describe the current state of ICWS resources and use. Ken is a senior engineer with MnDOT and is the project manager for the department's Rural ICWS deployment project.

Projects completed in 2014 include:

- [Next Generation Traffic Data and Incident Detection from Video \(Video Analytics Evaluation\)](#)
- [Deployment Strategy for Rural Connected Vehicle Systems](#)
- [Synthesis of Intelligent Work Zone Practices](#)
- [Assessment of Telematics Service Provider Data Feeds](#)
- [Highway Advisory Radio - Best Practices and Future Direction](#)
- [Crashworthiness and Protection of ITS Field Devices](#)

Announcements and Resources

Mark Your Calendars - 2015 Conferences

April 27 - 29, 2015 - [ITS Heartland Annual Meeting](#) - Omaha, Nebraska

June 1 - 4, 2015 - [ITS American Annual Meeting and Expo](#) - Pittsburgh, Pennsylvania

August 9 - 12, 2015 - [National Rural ITS Conference](#) - Snowbird, Utah

Project Websites

[ENTERPRISE ITS Planning Guidance \(Warrants\)](#) - ENTERPRISE has developed planning guidance for 10 ITS devices to help make the initial decision of whether or not to deploy an ITS solution.



Support Resources

- Work beyond ENTERPRISE...
 - National safety effectiveness evaluation (CMF)
 - ELCSI Pooled Fund
 - Human factors on sign placement and legend
 - TCD Pooled Fund
 - Language for 2017 MUTCD
 - NCUTCD RWSTC Task Force



ENTER PRISE

Questions?

Open WebEx chat box using the pull-down menu at the top of your screen. Type your question and send to all participants.

Moderator will read questions aloud and panelists will respond verbally.



Next Webinar:

FHWA Development of Crash Modification Factors (DCMF) Safety Evaluation of ICWS

April 23, 2015

2:00 – 3:30PM (Central)

Co-hosted with

Evaluation of Low Cost Safety Improvements Pooled Fund Program

ENTERPRISE



- For more information...

- **Ken Hansen, MnDOT**

- MnDOT Rural ICWS Project Manager

- kenneth.hansen@state.mn.us, 651.234.7064

- **Cory Johnson, MnDOT**

- ENTERPRISE Project Champion

- coryj.johnson@state.mn.us, 651.234.7062

- **Ginny Crowson, Athey Creek**

- ENTERPRISE Program Support Consultant

- crowson@acconsultants.org, 651.600.3338



www.enterprise.prog.org