Utilizing ITS for Rural Road Safety

Jon Jackels, SRF Consulting Group

ITS for Rural Road Safety

- Iowa DOT Intelligent Work Zone Systems
- Overview of Iowa DOT Truck Parking Project
- Introduction to Intersection Conflict Warning Systems
- Minnesota Local Road Research Board LED vs. ICWS
- Animal Warning System in MN & ID

Iowa DOT Intelligent Work Zone Systems

Rural Intelligent Transportation Systems (ITS) Toolkit

Work Zone Safety Systems

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Photo: Courtesy of Neil Hetherington, WTI

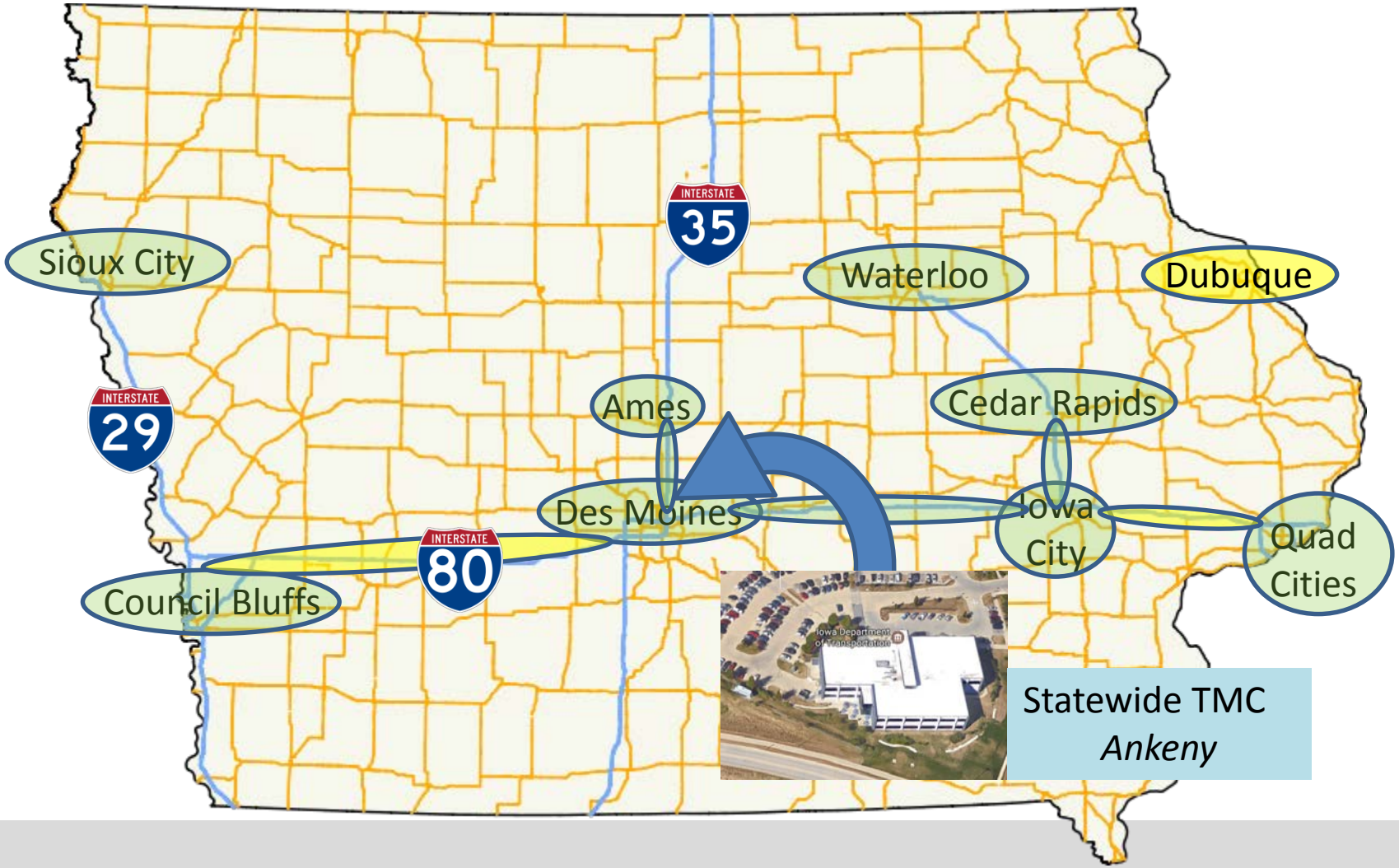
Description: Work zone safety systems deploy intelligent transportation system (ITS) devices to increase safety and implement traffic management both in and around a work zone. Examples of work zone safety systems include cameras, dynamic late lane merge systems, Bluetooth detectors to monitor traffic, queue detection systems, and speed compliance systems. Work zone safety systems are typically portable or temporary. Integrated traveler information systems (see #TTI4) and dynamic message signs (see #TTI3) can be used in conjunction with these applications to notify drivers of a change in speed limit, changes in lane configuration, upstream events that may have caused traffic back-ups, delays or alternative routes. Vehicle detection devices (see #TM5) can be used as a warning system to alert construction workers if a driver gets too close to where they are working.

https://ruralsafetycenter.org/wp-content/uploads/2018/03/CC12.pdf

Iowa DOT's Traffic Critical Projects Program

- Started in 2014
- Initial focus
  - Intelligent Work Zones (IWZ)
  - Traffic Incident Management (TIM) planning

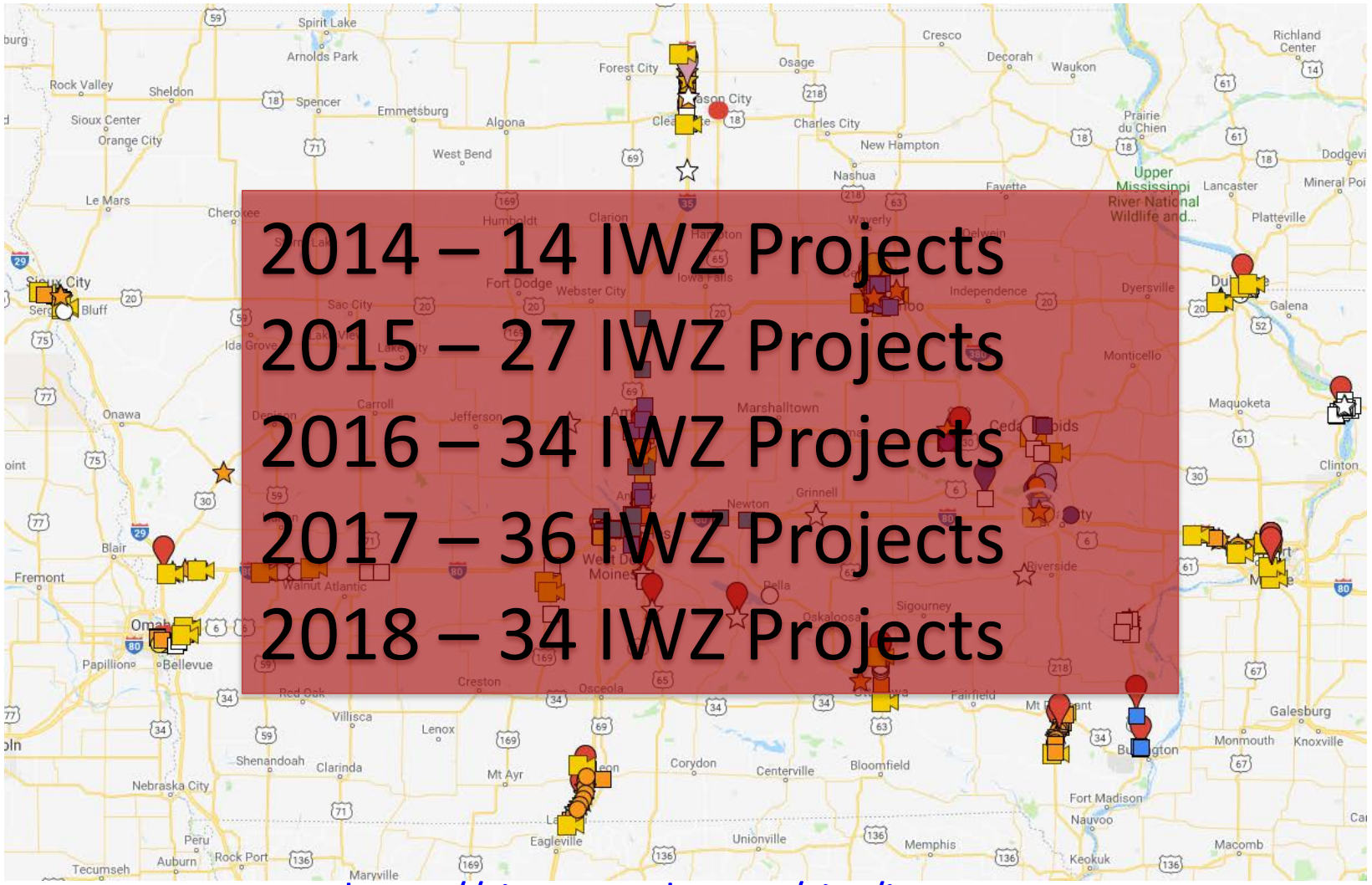
Iowa Snapshot - 9 “Metro” Areas (over 50,000)



Statewide Traffic Management Center

- 24 hours, 365 days
- Monitor Highways, Notify Enforcement, Dispatch Highway Helper, Enter Incident Information
- Control over 200 DMS (permanent, portable, contractor)
- TransSuite Software

IWZ Projects

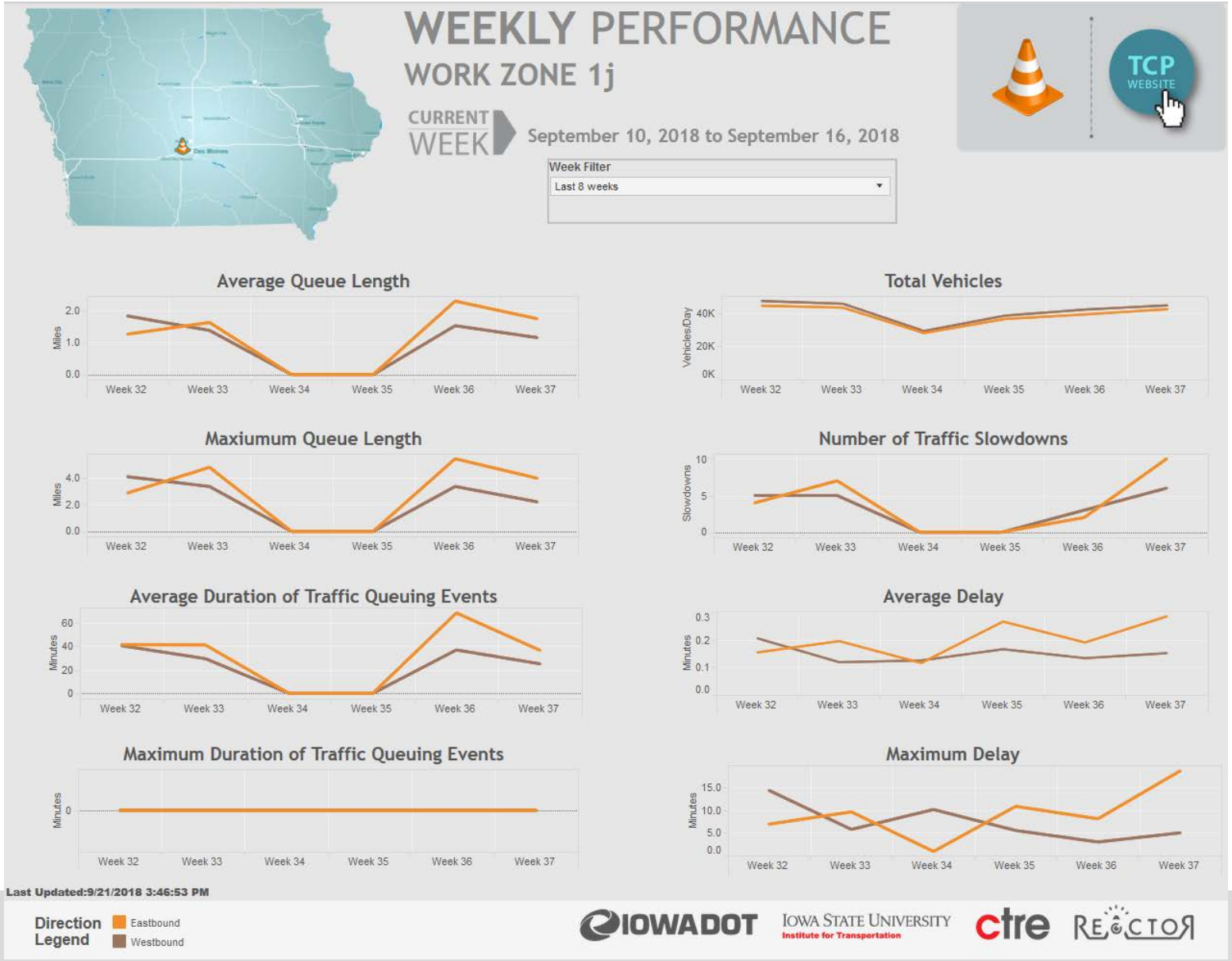


https://sites.google.com/site/iowatcp

Intelligent WZ Team

- SRF Consulting: Writing contract and managing program
- Street Smart Rental: Statewide IWZ Vendor Contract
- TransCore: ATMS Integration
- Digital Traffic Systems: ITS Maintenance
- Kapsch: Traffic Management Center
- CTRE (Iowa State Univ.): Evaluation & Analysis

ISU Data Analysis Tools



What are Iowa's benefits?

- Increased monitoring and awareness
- Automated queue detection and warning systems
- Flexibility to add new devices, new projects and new technologies
- More accurate driver information via portable DMS and 511 services

Additional Information (working site):
https://sites.google.com/site/iowatcp

Overview of Iowa DOT Truck Parking Project

Rural Intelligent Transportation Systems (ITS) Toolkit

Smart Trucks

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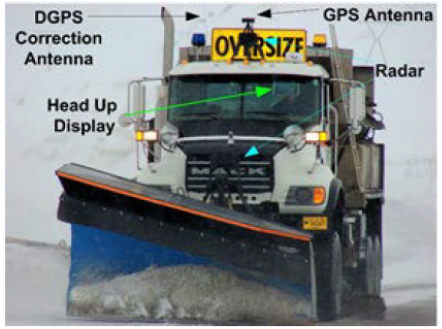


Photo: Courtesy of Craig Shankwitz, WTI

Description: A smart truck is a commercial truck that uses connected vehicle technology to communicate with other vehicles or infrastructure. These communications work to reduce collisions, improve safety, and provide real-time information. Commercial vehicles equipped with this technology are also able to travel in a platoon, or a group of vehicles that are driven using communications technology between the vehicles. Platooning allows following vehicles to react immediately to the lead vehicle. Platooning works to improve traffic safety and reduce fuel consumption. Smart trucks may also have cameras and sensors installed that help with blind spot warnings, drowsy driving warnings, and lane assistance. Furthermore, a smart truck may be equipped with automatic vehicle location (AVL) for fleet management, which can allow for tracking the safe transportation of hazardous materials (HAZMAT).

https://ruralsafetycenter.org/wp-content/uploads/2018/03/CC10.pdf

The Problem

Lack of Adequate Parking for Truck Drivers

Issues for Drivers

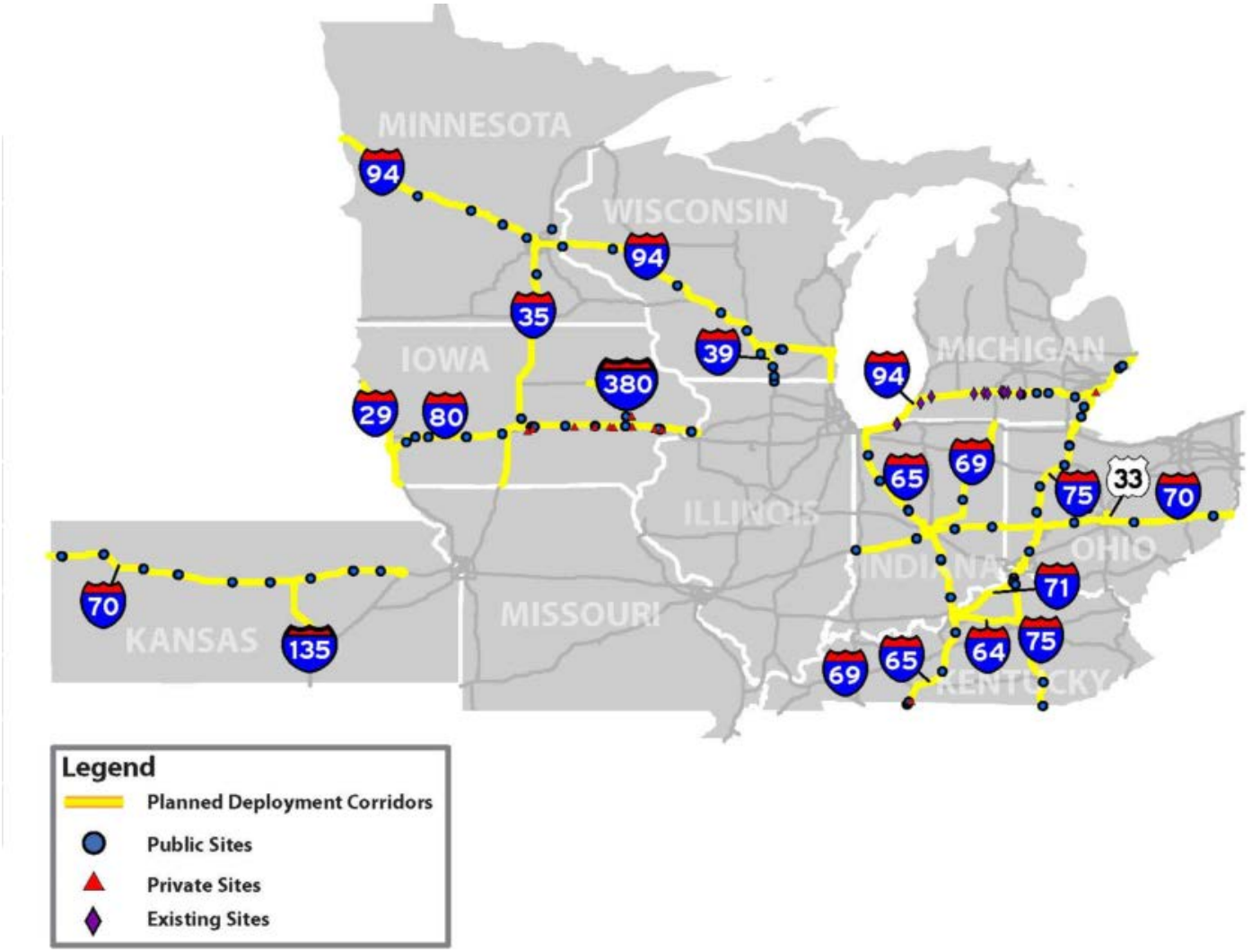
- Driver Hours of Service Limitations - FMCSA
- If rest areas and truck stops are full and a driver's hours are almost up that becomes problematic. Less than desirable options are:
  - Continue to drive past your hours
  - Choose a less than desirable place to park
- Recent survey revealed that 83% of drivers spend greater than 30 minutes searching for parking!!

TIGER Grant

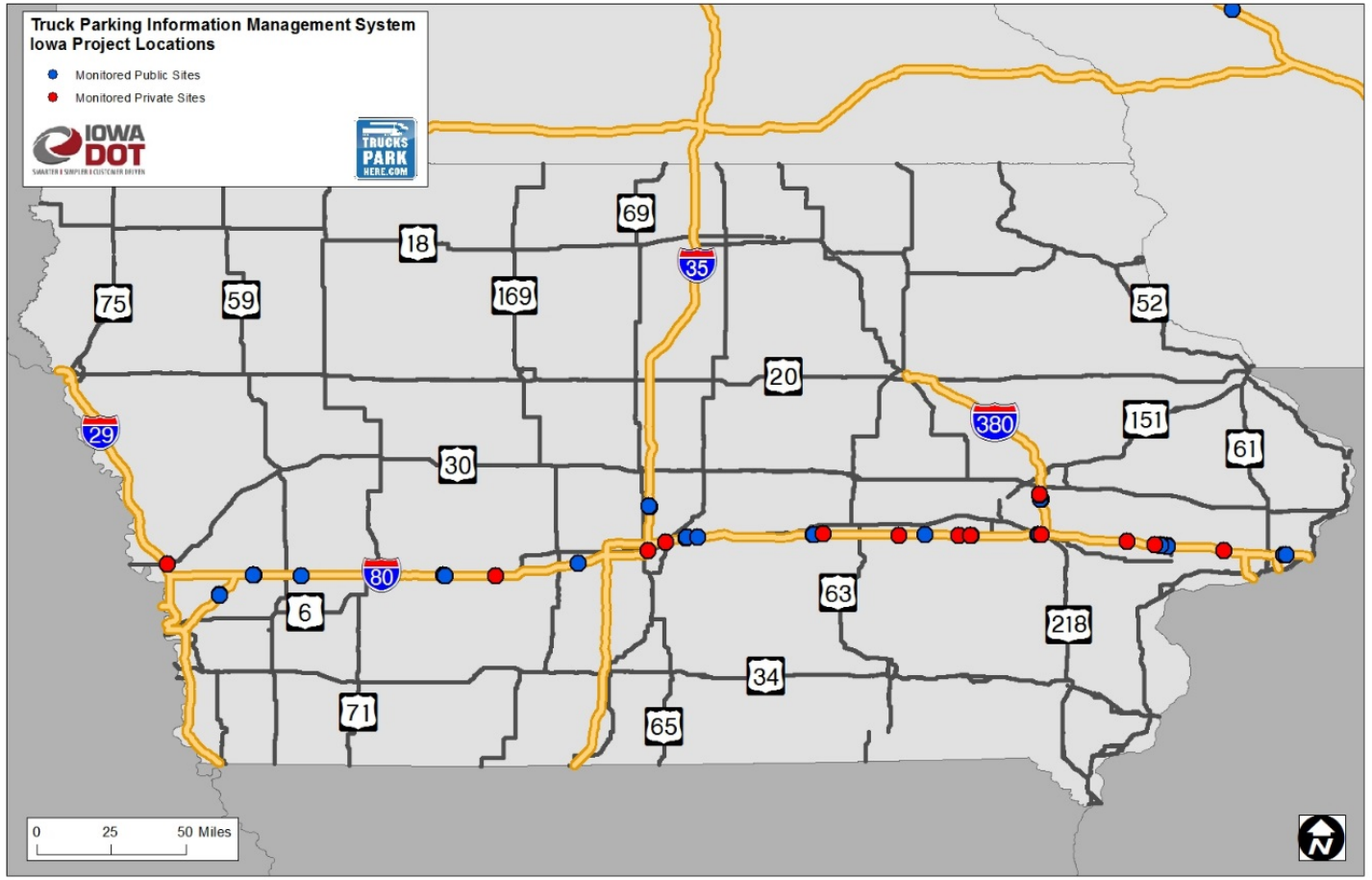
- MAASTO Consortium (8 of 10 States) 139 public & private sites
  - Missouri and Illinois Opted out
- MAASTO TIGER Grand Award for $25 million
  - $31.2 million in federal funding
  - Iowa Federal Share = $4,362,807
  - Iowa State Contribution = $498,086

- Collect, aggregate & communicate real-time parking availability
- Measure impact on truck parking and safety
- System launch: January 2019

Project Extent



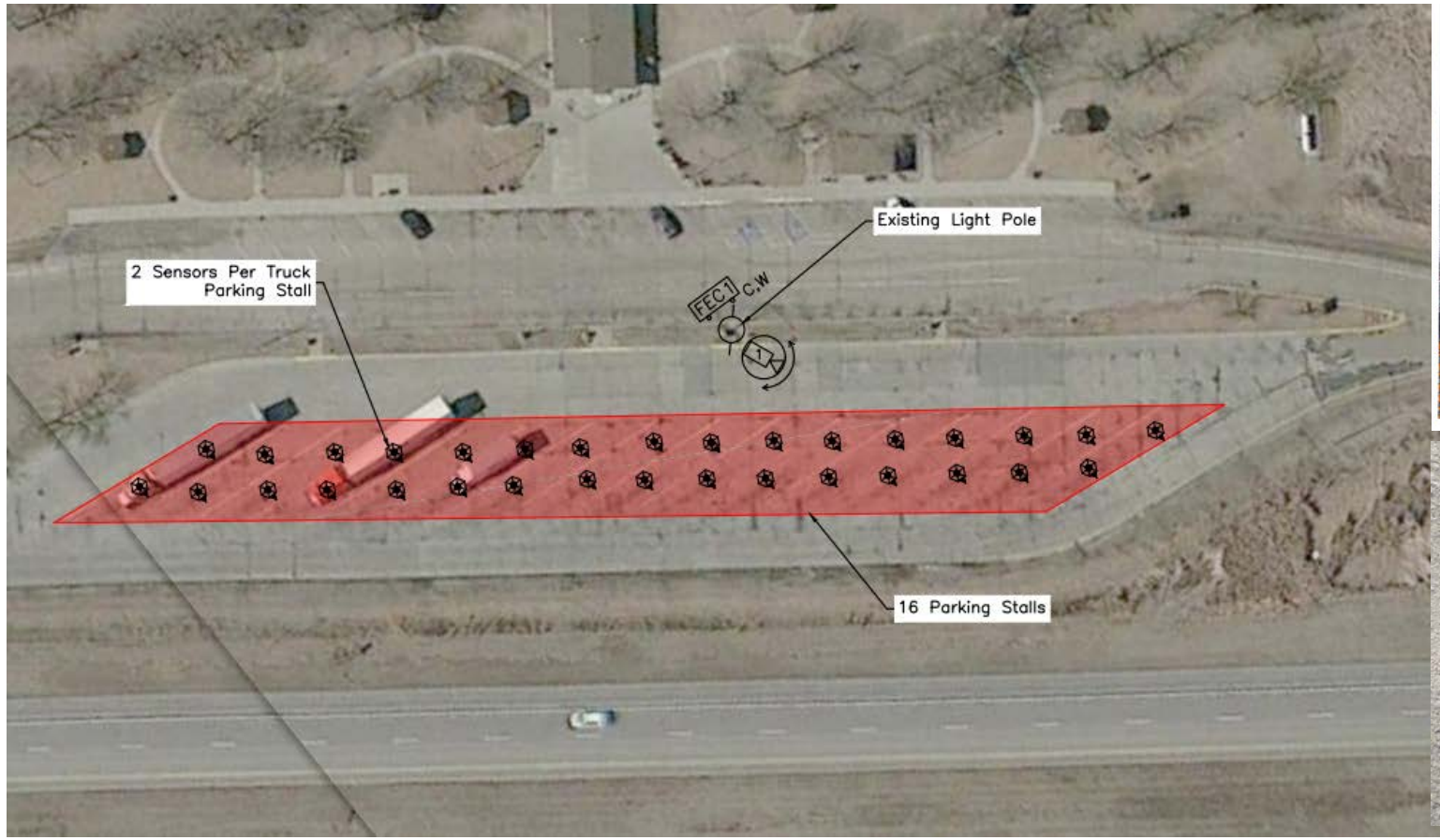
Iowa Deployment



Iowa TPIMS Sites			
Corridor	DOT	Private	Total
I-80	23	11	34
I-29		1	1
I-35	2 (+2)		
I-235		1	1
I-380	2	2	4
Total	27 (+2)	15	42 (+2)

Iowa Technology Solution

In-ground Magnetometer Puck



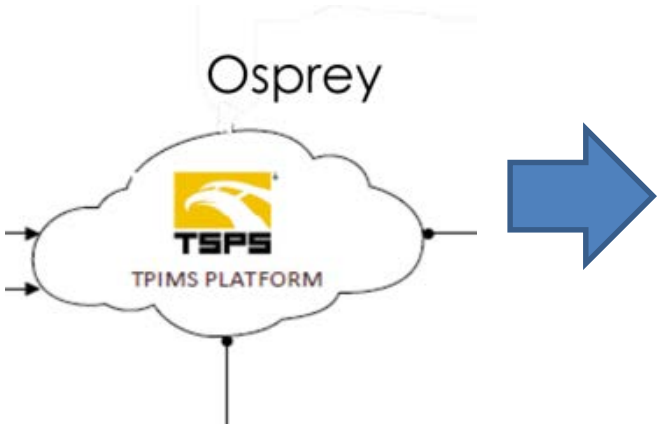
Iowa Technology Solution

- Entrance/Exit Counting
- Camera with Built In Video Analytics

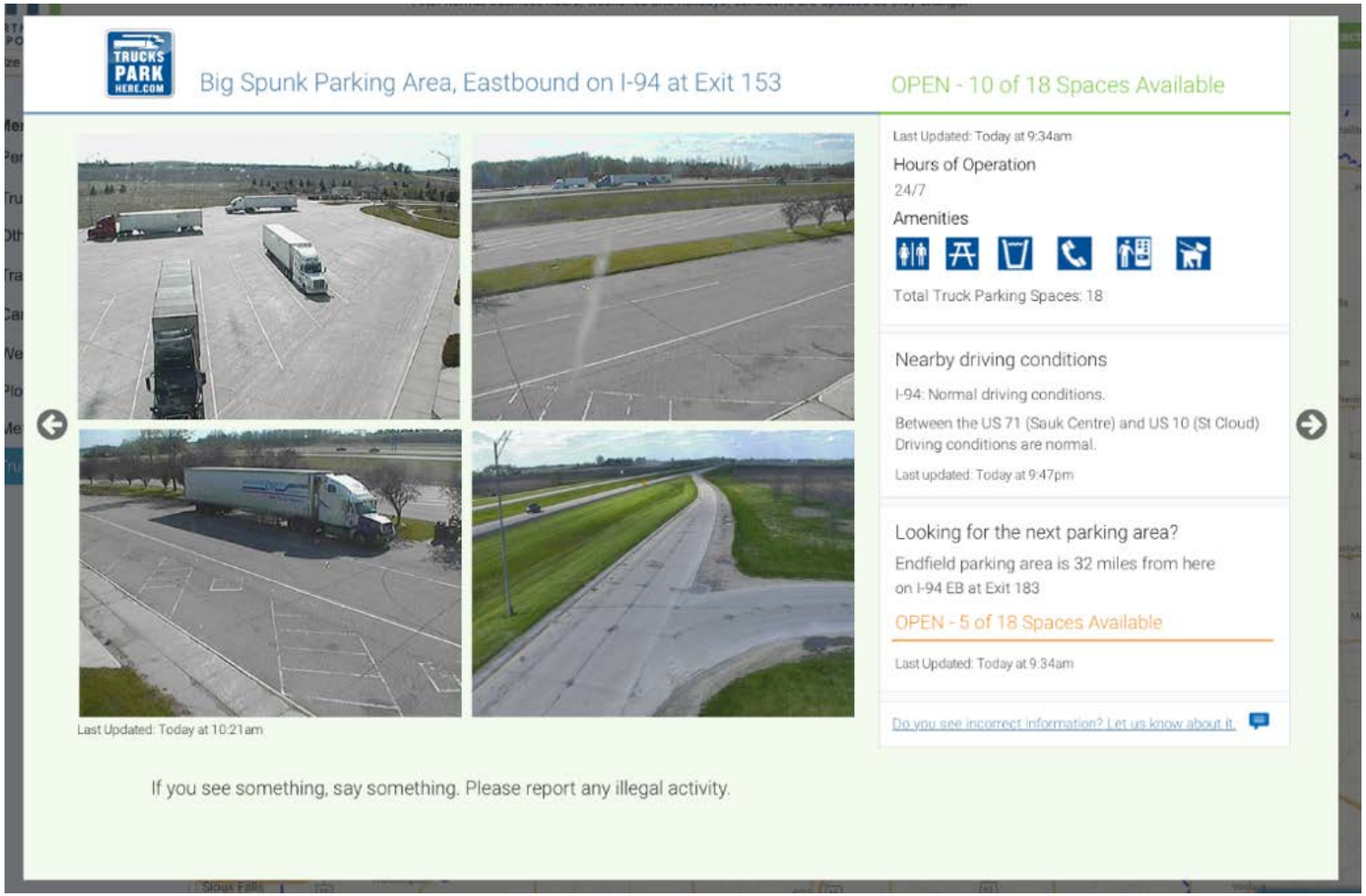
Iowa Technology Solution

System Validation with Fish Eye and Pan/Tilt/Zoom Cameras

511 Traveler Website

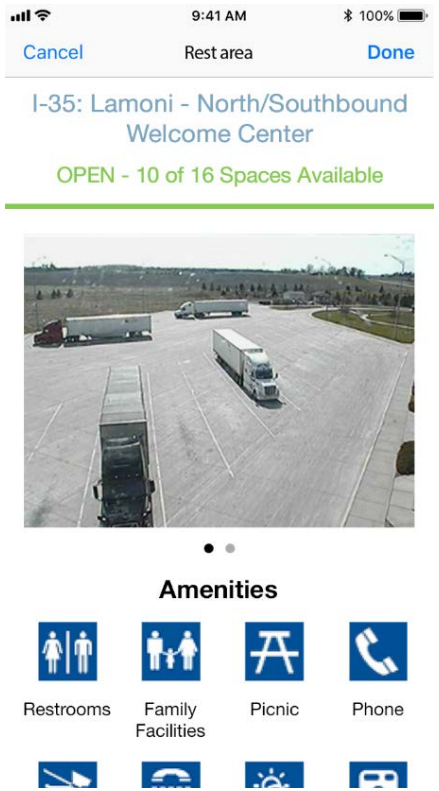


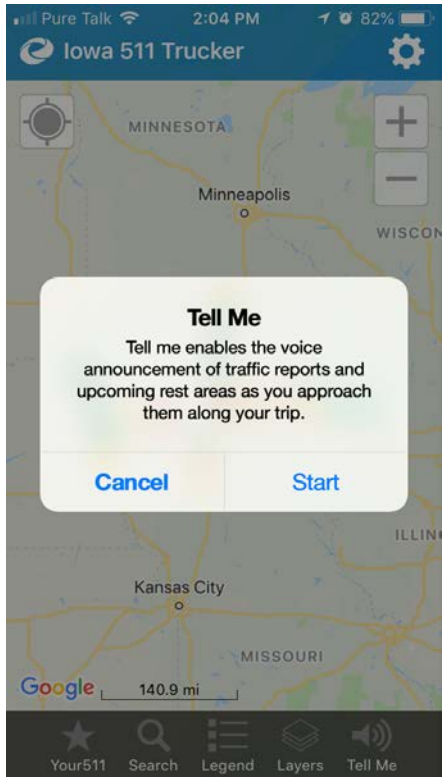
511 integration

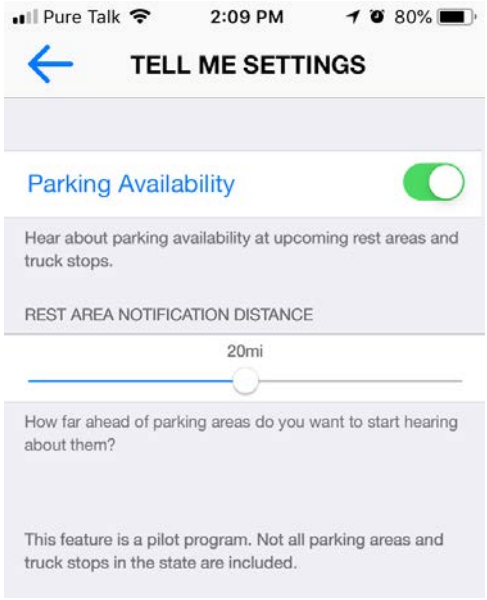


Pictures available for Public Rest Areas Only (DRAFT)

511 Mobile app prototype







Next Steps for Deployment

- Finalize Construction (Oct 2018)
- System Testing (December 2018)
- User Outreach and Communications (Fall/Winter)
- Go-live (January 2019)
- Operations, maintenance and performance measures (2019 – 2021)

Project Website:
TrucksParkHere.com

Introduction to Intersection Conflict Warning Systems

Rural Intelligent Transportation Systems (ITS) Toolkit

Intersection Collision Warning System (ICWS)

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Photo: Courtesy of SRF Consulting Group

Description: Intersection Collision Warning Systems (ICWS) help to inform the crossing or entering vehicle regarding whether there is an approaching vehicle(s). The selection of insufficient gaps has been shown to be a contributing factor at intersections where one direction is stop-controlled while the other is uncontrolled. Intersections of this type in rural areas can be particularly challenging due to the high-speed nature of the through traffic. An ICWS can be defined as a "traffic control device placed on major, minor or both roads of an intersection to provide drivers with a real-time dynamic warning of vehicles approaching or waiting to enter the intersection." Therefore, ICWS are NOT intended to assist a driver in selecting appropriate gaps; rather, their intent is to assist a driver with *rejecting* unsafe gaps.

https://ruralsafetycenter.org/wp-content/uploads/2018/03/CC7.pdf

Intersection Conflict Warning Systems (ICWS)

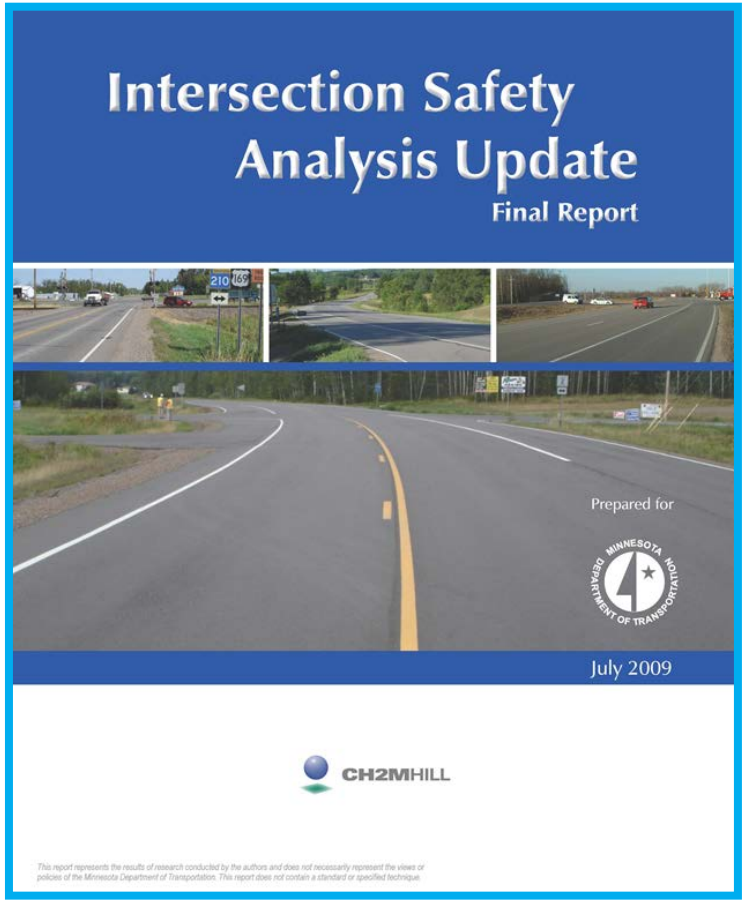
Intersection Conflict Warning System Considerations

- Define the Safety Problem
- Investigate ITS Solutions
- Identify At-Risk Intersections
- Deploy ICWS

Intersection Safety Analysis Update Project

How do you select “Bad” Intersections in Rural Areas?

- Absence of crashes does NOT equate to no risk
- Risk based on crashes AND other surrogate measures
- Best for low crash frequencies in rural areas
- Leads to development and use of surrogates



Surrogate Measures for Risk

- Skewed intersection
- Intersection on or near a horizontal curve
- Commercial development in one or more of the quadrants
- Railroad crossing on minor approach
- ADT ratio between 0.4 and 0.8
- More than 5 miles from previous stop sign
- Crash in the last 5 years

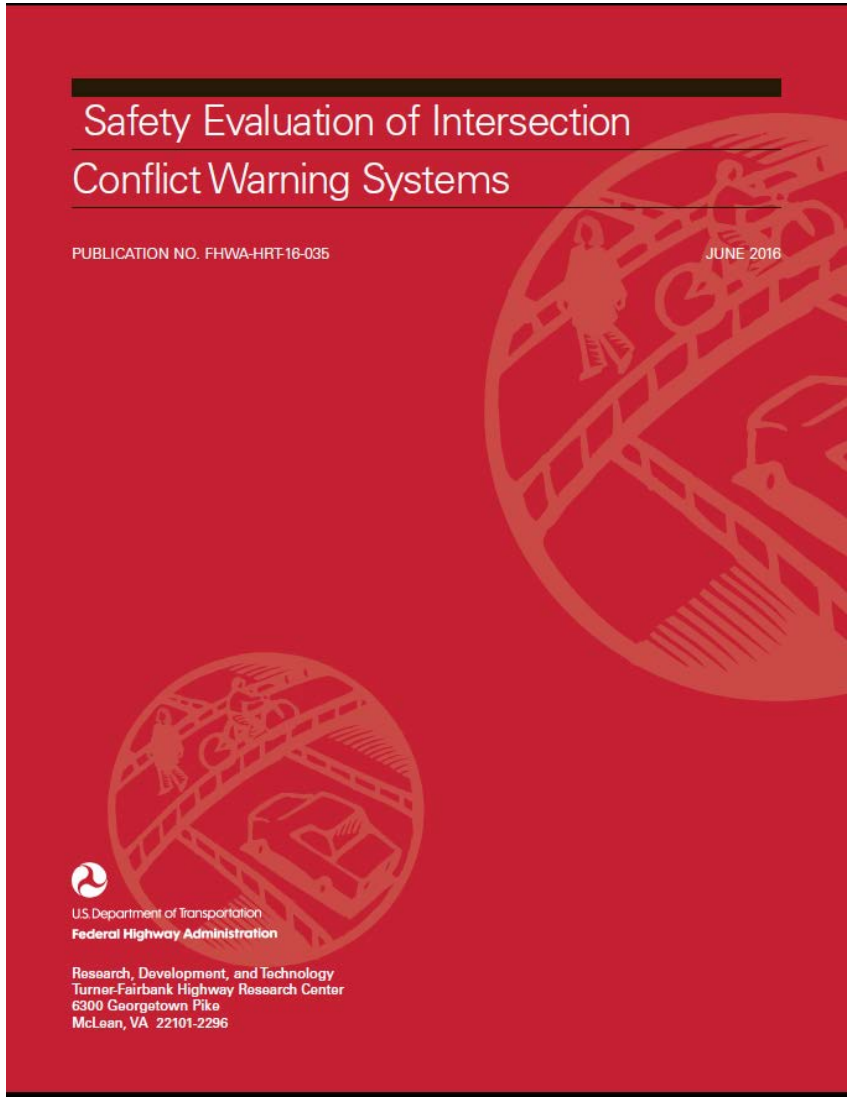
Identifying and Prioritizing Locations

- Minnesota looked at 13,000 rural un-signalized STOP-controlled intersections
  - Only 14 had more than 1 serious crash (major injury or fatality) in a five year period.

- Selected over 150 intersections with higher-than-expected crash and severity rates.

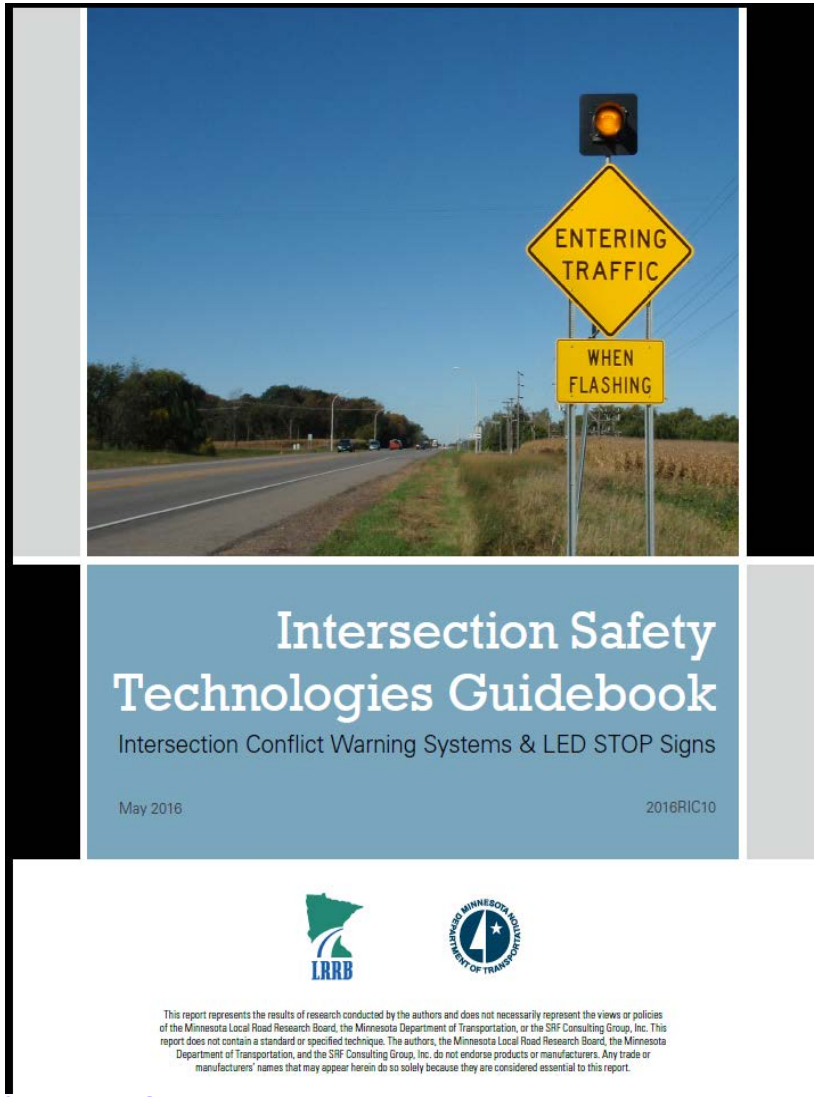
Effectiveness of ICWS

Crash Type	Total	Fatal and Injury	Right Angle	Rear-end	Night time
Two-Lane at Two-Lane					
CMF	**0.73**	**0.70**	**0.80**	**0.43**	0.90
Standard error	0.04	0.05	0.05	0.07	0.10
Four-Lane at Two-Lane					
CMF	**0.83**	**0.80**	**0.85**	0.97	**0.61**
Standard error	0.06	0.07	0.08	0.22	0.11



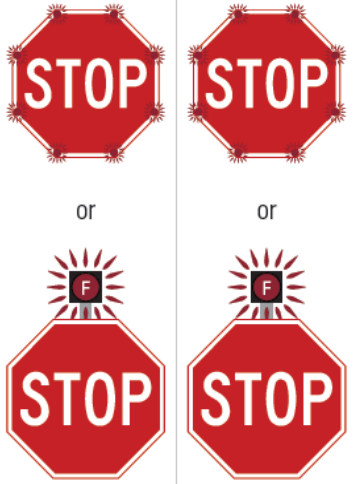
Minnesota Local Road Research Board LED vs. ICWS

- History of the evolution of intersection safety technologies in Minnesota
- Usage and research related to each technology
- Design considerations and costs associated with each technology
- Case studies that highlight experiences and lessons learned for eight agencies in Minnesota that have installed an LED Stop Sign or ICWS systems on their roadways
- Example design plans

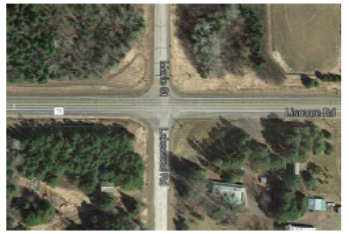


http://dotapp7.dot.state.mn.us/projectPages/pages/lrrbProjectDetails.jsf?id=5954&type=PROJECT

LED STOP Signs and ICWS

	Passive LED STOP Sign	Active LED STOP Sign	Major Road Only System	Minor Road Only System	Major & Minor Road Warning
Controller	None	Controlled by Detector	Controlled by Detector	Controlled by Detector	Signal Controller
Signs			 on mainline	 on major road	 on mainline  on minor road
Detection	No	Yes	Detect Minor Road Vehicles	Detect Major Road Vehicles	Detect all approaches
Malfunction Detection	No	No	Yes	Yes	Yes
Event Logging	No	No	Yes	Yes	Yes
System Cost	$2,000	$20,000	$50,000	$50,000	$100,000–$150,000

St. Louis County ALERT ICWS



Lakewood Rd and Lismore Rd

ALERT System Signs

System

The ALERT System is an ICWS that provides dynamic warning for both the mainline and minor road vehicles. The system uses commercial off the shelf parts including solar power, wireless communication, and non-intrusive vehicle detection. The CROSS TRAFFIC Warning signs flash when there is an approaching vehicle on the minor road.

The main goals of the system are to be low cost, have high reliability, be easy to maintain, and have no underground components.

Public Perception

The system has been favorably received.

The public found the warning system easy to understand (94 percent) and felt the system improved the safety of the intersection (92 percent). About 98 percent felt that the system attracted their attention and 91 percent felt that the system should be expanded to other intersections.

Lessons Learned

A few problems were encountered in the project. In the first phase of research (ALERT System 1), the batteries would drain during the winter because of the limited solar charging periods.

To correct these issues, the following considerations have been made for future systems. These systems will have a higher level of reliability for the batteries, vehicle detectors and wireless communication. Also, the system should be modularized so that devices could be replaced independently. Finally, the system should have a simplified controller that is as easy to use as a Christmas tree light controller.

Contact

Victor Lund
St. Louis County Traffic Engineer
218-625-3873
lundv@stlouiscountymn.gov

Animal Warning System in MN & ID

Rural Intelligent Transportation Systems (ITS) Toolkit

Animal Warning Systems

CC 1

Photos: Courtesy of Marcel Huijser, WTI

Description: Animal Warning Systems are intended to warn motorists about the potential or actual presence of animals on the road. Animal Warning Systems utilize electronic sensors to detect animals. Once an animal is detected, signs are activated to warn drivers of the presence of an animal. These systems are different than:

1) Standard wildlife warning signs,
2) Enhanced wildlife warning signs, and
3) Temporal wildlife warning signs.

Animal Warning Systems are best used to *mitigate* large mammal/vehicle collisions; they are not intended to eliminate them.

https://ruralsafetycenter.org/wp-content/uploads/2018/03/CC1.pdf

Minnesota Deer Warning

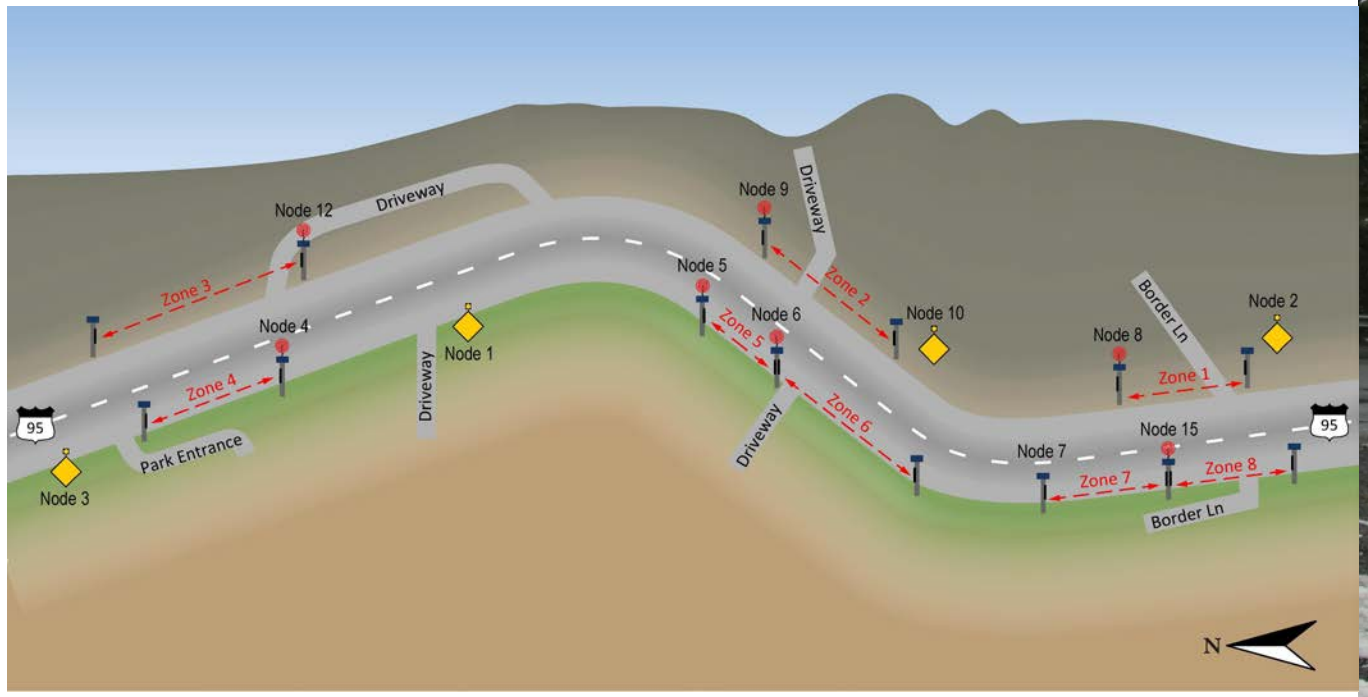
- Site Conditions
- Deer – Vehicle Collison History

Site Maintenance Considerations

Site Conditions and Considerations

Idaho Site Considerations

- Site Conditions
- Crash History



Jon Jackels, SRF Consulting Group

Thank you!

jjackels@srfconsulting.com | (763) 249-6722