Queue Warning System Pilot Projects – Stevens Point and Edgerton

Erin Schoon - WisDOT Bureau of Traffic Operations

July 22, 2016

Overview

- Wisconsin Background
- Federal Aid Grant
- Design and Implementation
- Edgerton/Rock River and Stevens Point Deployment
- Lessons Learned

Background

- Wisconsin has been looking for a way to increase safety and decrease end-of-queue crashes in work zones
- Other states saw a safety benefit and reduced crashes with the QWS
- Wisconsin has implemented a QWS in the Milwaukee and Madison area several years ago that was linked with the STOC.

3

Federal Aid Grant

- WisDOT applied for a grant in December 2015 to fund two pilot QWS in the following locations:
  - I-39 near Stevens Point
  - I-39 Rock River Bridge near Edgerton (mega project)
- Grant was approved in May 2016.
- Systems were implemented in April and May prior to grant approval, if grant not approved WisDOT was going to fund projects
- As part of the grant, WisDOT will be submitting a final report to FHWA.

4

Included in Federal AID Grant Submittal

- Application
- Letters of Support for each project
- Accelerated Innovation Deployment (AID) Demonstration Project Narrative
- Cost Estimate
- Project Plans and Special Provisions

5

Report

- Crash Analysis with and without QWS (if available)
- Speed Study – extra sensors deployed to collect
- Capacity Study
- Driver Survey
- Different types of messaging
- Lessons Learned

6

Public Outreach

- WisDOT Radio News Line
- News Release
- WisDOT Internal State Notice on Weekly Bulletin

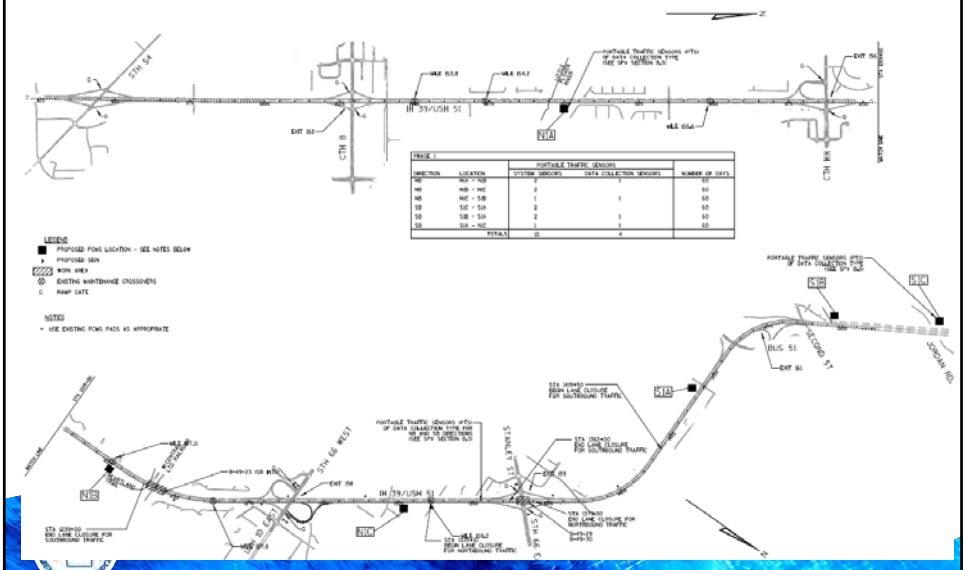
7

Implementation and Design

- WZ ITS Implementation Guide and QWS Research
- Reached out to the Regions to help determine projects that would be good candidates for a QWS
  - Stevens Point in NC Region
  - Edgerton in SW Region
- Reviewed TMP Plans
- Iowa EDC3 Peer Exchange and Smart WZ Vendors
- Developed Plan Sheets for Projects – in house consultant
- Developed Cost Estimate
- Proposed Plan was reviewed by Project teams

8

Sample Plan Sheet



9

Implementation and Design

- Queue Warning System was BID separately from the two LET projects
- RFB was sent out and Street Smart Rentals was selected as vendor along with VerMac and Mega Rentals traffic control contractor as subs.
- Meetings were held with each project team and Street Smart to go over QWS and placement, some changes were made based on these meetings

10

Cost

Project ID: 1005-10-88			
1. Rock River Bridge Project	**Project Duration**	**Street Smart Per day**	**Total**
1 System, 8 PCMS, and 22 sensors	280	$575.00	$161,000.00
3 additional data collection sensors	14	$60.00	$840.00
Change order of 8 additional PCMS	280	$150.00	$42,000.00
		Bid Price	$161,840.00
		Bid Price + Change Order	$203,840.00

Project ID: 1166-06-92			
2. Stevens Point Bridge Project	**Project Duration**	**Street Smart Per day**	**Total**
1 System, 6 PCMS, and 14 sensors	120	$826.00	$99,120.00
3 additional data collection sensors	14	$120.00	$1,680.00
		Bid Price	$100,800.00
		Bid Price Total Cost	$262,640.00
		Bid Price Total Cost + Change Order	$304,640.00
		Decision Support System	$170,416.00
		Evaluation and Coordination	$49,990.20

11

Why were these projects selected?

- Stevens Point
  - Previous crash history along roadway
  - Area traffic volumes, recreational/tourist traffic during summer months
  - Queue and Delay
  - Roadway geometry – horizontal and vertical curves
  - History of delay and queuing in the area
  - Only one work zone
- Edgerton
  - Area traffic volumes, recreational/tourist traffic during summer months
  - Initially only one work zone, other projects were advanced after QWS selection
  - Night time work with lane closures
  - Queuing not expected based on analysis

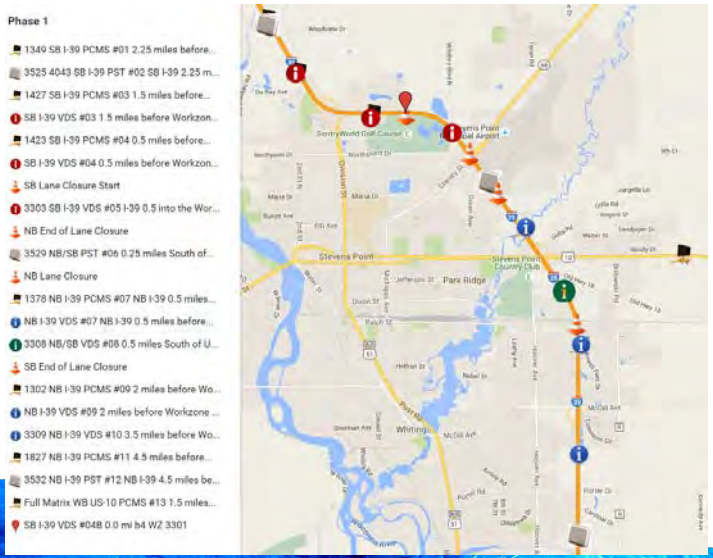
12

Layout of QWS

- Stevens Point (Phase 1/Phase 2)
  - 3 PCMS in each direction - Phase 1
  - 4 PCMS in the NB direction - Phase 2
  - 1 PCMS on USH 10 - Phase 1
  - 1-2 mile spacing
  - Doppler Sensors
  - Wavetronix Sensors for data collection
  - 1 camera for verification in Phase 1
- Edgerton
  - 8 PCMS in each direction
  - 1 mile spacing
  - Doppler Sensors
  - Wavetronix Sensors for data collection

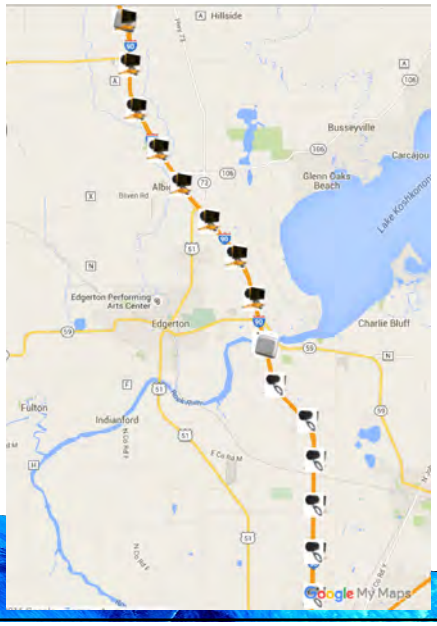
13

Stevens Point QWS Layout



Edgerton QWS Layout

RRB
- SB Sensor #8 (Volume)
- SB PCMS #8
- SB Sensor #7
- SB PCMS #7
- SB Sensor #6
- SB PCMS #6
- SB Sensor #5
- SB PCMS #5
- Sensor SB #4
- SB PCMS #4
- SB Sensor #3
- SB PCMS #3
- SB Sensor #2
- SB PCMS #2
- SB Sensor #1
- SB PCMS #1
- Construction Area
- SB-NB Sensor #0 (Volume)
- NB PCMS #1
- NB Sensor #1
- NB PCMS #2



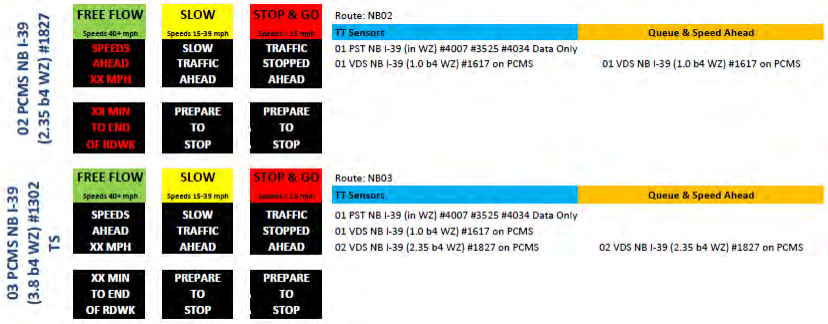
15

PCMS Messages

- Stevens Point
  - Free flow speeds in 5 mph increments not to exceed work zone speed limit (55 mph)
  - Phase 1 - minutes to end of road work, speeds ahead
  - Phase 2 – minutes and distance to end of road work and XX mile to road work, speeds ahead
  - Threshold for slow or stopped traffic (39 mph)
- Edgerton
  - Free flow speeds in 5 mph increments up to 59 mph.
  - Anything above 60 mph is in ‘free flow’ or four corners flashing
  - Threshold for slow or stopped traffic (39 mph)

Sample Messaging/Logic

Stevens Point Project – Phase 2



Sample Messaging/Logic

Edgerton

Notes:

1 SLOW: XX MPH = Even 5 MPH Increments Rounded Down for Only the NEXT sensor downstream
2 SLOWER & STOP-GO Conditions: Use Next 2 Sensors Downstream
3 Comm Loss = PCMS with Four Corners Flashing
4 Quick In/Slow Out Logic. 1 sample period to move to more congested condition and 2 periods to move to less congested condition.
5 One minute periods with < 8 vehicles or 7% occupancy (microwave) will be ignored by logic.

System Logic

- Stevens Point
  - 1 minute period, 3 minute period – latency to trigger system
  - Any sensor downstream dictates what is on PCMS upstream – worst case speed

Quick In/Slow Out Logic. 1 sample period to move to more congested condition and 3 periods to move to less congested condition.

- Edgerton
  - 1 minute period, 3 minute period – latency to trigger system
  - 8 vehicles/min and 7% occupancy for Edgerton Project – construction vehicles
  - Two sensors downstream dictates what is on PCMS – worst case speed

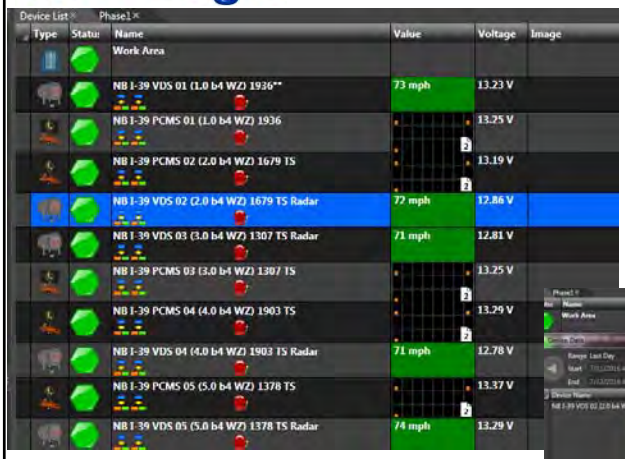
19

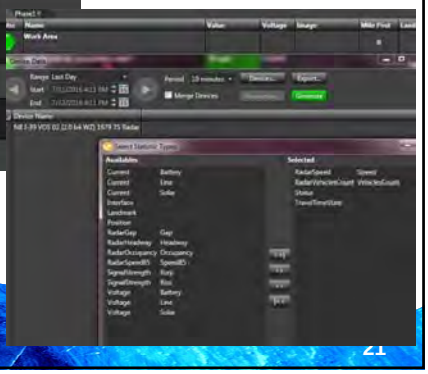
Jam Logic

- Information to be used from Jam Logic
  - Occupancy
  - Speed
  - Device malfunction
  - Duration of messages
  - Vehicle Counts
  - Vehicle Classification

20

Jam Logic





Alert/Notification Options

- Text Alerts
- Email Alerts
- Queue Thresholds
- Speed Thresholds

Sample Weekly Report

Lessons Learned Roundtable

- Construction vehicle activity triggering the system
- Type of detection – Doppler vs microwave
- Field staff availability to assist in placement of devices
- Working within multiple construction zones
- Mega projects
- Spacing of PCMS and Sensors
- Truck percentages
- Verifying/reviewing vendor input and logic
- Field adjustments built into contract
- Latency of system
- Don't move the PCMS boards to quickly near start of project
- Latency concerns

Future of QWS

- If projects are successful, WisDOT would like to implement QWS on more projects throughout the state.
- Working on a Decision Support tool to help identify future projects.

QWS Decision Support System

Brian Sippel – BTO Work Zones

7/22/2016

Overview of presentation

- Background
- System logic and overview
- Future Strategy

27

Background

- Challenges identifying pilot projects
  - Heavy reliance on regional resources
- Lessons learned from Iowa's Traffic Critical Projects program
- Working with the University of Wisconsin Traffic Operations and Safety Laboratory (UW-TOPS LAB)

28

Decision Support System - Overview

- Leveraging existing resources
  - Online WisTMP
  - SSA Crash Map tool (under development)
  - Meta Manager data
- Possible criteria used to flag potential projects
  - AADT
  - Delay and Queuing
  - Roadway Geometry

29

WisTMP User Inputs

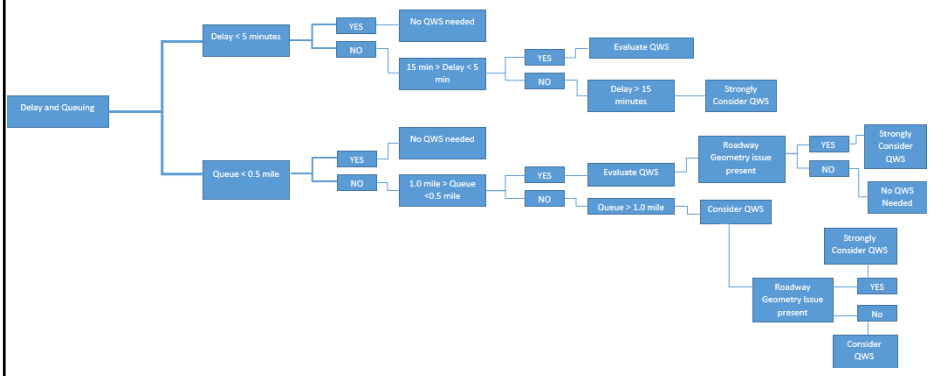
- Specific Project AADT
- Queue Analysis
- Delay Analysis

System Inputs

- Meta Manager AADT for State Trunk Network
- Geometric Deficiencies – Horizontal and Vertical

30

Decision Support System - Logic



Decision Support System – Outputs

- Query of Potential Projects by:
  - AADT (high level map overview)
  - Geometric Issues (map overview)
  - Queue and Delay – if available at time of query
  - Project Information such as year, type, region, etc.
- Online WisTMP output
  - Mitigation Strategy

Decision Support System - Status

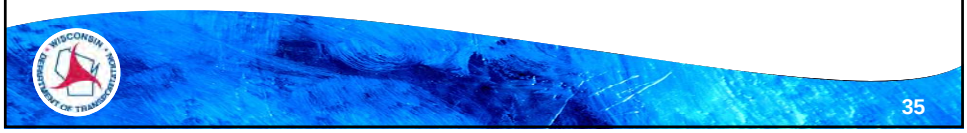
- Estimated cost - $170,000
- Concept plan vetted
- Scoping with UWTOPS Lab

Future Strategy

- Identify projects early in the scoping phase so funding is available
- Supports potential for larger scale deployment

Questions?

- Contact Information
  - Erin Schoon
  Erin.schoon@dot.wi.gov
  414-220-6803
  - Brian Sippel
  Brian.Sippel@dot.wi.gov
  414-531-9279



35