Smarter Work Zones Webinar Series

Webinar #14: Leveraging Traffic Management Center Resources for Work Zone Management

Todd Peterson, Gerald (Jerry) Ullman, Eric Rasband, and Brian Kary

June 16, 2016 1:00-2:30pm EDT

Efficiency through technology and collaboration

innovation ingenuity imagination invention
Every Day Counts

U.S. Department of Transportation
Federal Highway Administration

Smarter Work Zones

Introduction and Today's Speakers

Today's Speakers

Todd Peterson, P.E., PTOE
Transportation Specialist
FHWA Office of Operations

Gerald (Jerry) Ullman, Ph.D., P.E.
Senior Research Engineer
Texas A&M Transportation Institute

Eric Rasband
Traffic Operations Analysis and Reporting Manager
Utah DOT

Brian Kary, P.E.
Freeway Operations Engineer
Minnesota DOT

Smarter Work Zones (SWZ) Webinar Series

- This is the fourteenth in a series of monthly SWZ webinars
- Topics based on **what matters most to you!**
- Previous Webinar topics include:
  - Corridor-Based and Program-Based Project Coordination
  - Queue Warning Systems
  - Variable Speed Limits
  - Dynamic Lane Merge
  - Work Zone Project Coordination Guide and Examples
  - Integrating Project Coordination & Technology Applications: Iowa DOT
  - Lane Closure and Permitting Systems
  - Integrating Technology Applications: Massachusetts DOT
- Recordings and materials for previous webinars are available on The National Work Zone Safety Information Clearinghouse website: https://www.workzonesafety.org/swz/webinars
- Coming Up:
  - Webinar #15: Work Zone Impacts and Strategies Estimator (WISE) Tool Pilot States – Early September 2016

Purpose of Today's Webinar

Discuss strategies that agencies can use to utilize Traffic Management Center (TMC) resources during the four stages of a work zone as highlighted in "Guidance on Using Traffic Management Centers for Work Zone Management" (FHWA-HOP-15-032).

Topics include:

1. SWZ Technology Application Initiative
   - Show how the SWZ Technology Application initiative can be used by agencies to enhance their current work zone management practices
2. "Guidance on Using TMCs for Work Zone Management" Overview
   - Provide an overview of the Guidance on Using TMCs for Work Zone Management document
3. SWZ Real-World Examples
   - Provide real-world examples from two states of how their agencies utilized TMC data and tools to manage work zones

Smarter Work Zones

SWZ Overview & Technology Application Initiative

What are Smarter Work Zones (SWZ)?

Innovative strategies designed to optimize work zone safety and mobility

- Policies and practices used to incrementally and continuously improve WZ operations
- Tools to reduce WZ crashes and delays
- Tools to enhance WZ management strategies

Two Identified SWZ Initiatives:

Project Coordination

Coordination within a single project and/or among multiple projects within a corridor, network, or region, and possibly across agency jurisdictions

Technology Application

Deployment of Intelligent Transportation Systems (ITS) for dynamic management of work zone traffic impacts, such as queue and speed management

Today's Focus of Discussion

Technology Application – What is it?

Deployment of ITS for dynamic management of work zone traffic impacts, such as queue and speed management to **provide actionable information** to drivers and traffic managers.

Capabilities include:

- Improving driver awareness
- Providing dynamic and actionable guidance to drivers
- Enhancing tools for on-site traffic management

Source: FHWA

SWZ Technology Application Goals:

Goal 1A

By December 2016, 35 State DOTs have implemented business processes for work zone ITS technologies as identified in the Work Zone ITS Implementation Guide

- **What does this mean?**
  - Well-documented agency policies and processes to streamline consideration and use of work zone ITS technologies to minimize traffic impacts

SWZ Technology Application Goals:

Goal 1B

By December 2016, 35 State DOTs have utilized at least one work zone ITS technology application for dynamic management of work zone impacts

- **What does this mean?**
  - Consideration of the six step process explained in the WZ ITS implementation guide to plan and implement ITS strategies
  - Identify and use ITS strategies such as speed and/or queue management on at least one project for dynamic management of work zone impacts

Smarter Work Zones

Guidance on Using TMCs for Work Zone Management

Guidance on Using TMCs for Work Zone Management

- Published in October 2015
- Provides guidance for DOTs to consider how TMC resources (staff, data, and tools) can be used to support all stages of a work zone
- Available for download: http://www.ops.fhwa.dot.gov/publications/fhwahop15032/fhwahop15032.pdf

Work Zone Stage 1: Project Development – Planning and Design

Strategy #1: Use TMC Resources to Coordinate Road Work Projects

- Strategy 1A: Share access to TMC tools to record ongoing or upcoming projects.
- Strategy 1B: Involve TMC staff in planning of work projects to understand impacts for all areas served by TMC.
- Strategy 1C: Organize annual meetings with TMC staff from neighboring jurisdictions to discuss upcoming road work plans.

Strategy #2: Use TMC Resources to Support Preliminary WZ Impact Analyses

- Strategy 2A: Use TMC data along with TMC performance management tools to calculate demand-to-capacity ratios.
- Strategy 2B: Develop Traffic Operations Plans before the TMP is developed to define planned use of ITS to maximize input from the TMC.
- Strategy 2C: Use TMC resources to support innovative contracting or accelerated construction considerations.

Work Zone Stage 2: Project Development – Work Zone Management

Strategy #3: Use TMC Resources to Support the Development of the TMP WZ Impact Assessment Report

- Strategy 3A: Use TMC archive volume and speed data to estimate demand/delays/queue lengths and reliability metrics during upcoming WZ.
- Strategy 3B: Use TMC incident log as surrogate for crash data to estimate number of crashes likely to occur during WZ.
- Strategy 3C: Use Road Conditions Reporting Systems to understand planned events causing vehicle restrictions or capacity reductions on alternate routes during WZ.

Strategy #4: Use TMC Resources to Support the Development of the TMP WZ Impacts Management Strategies

- Strategy 4A: Use TMC resources to understand likely ITS device outages due to work zone and prepare mitigation strategies to maintain critical field device operations.
- Strategy 4B: Use TMC resources to improve safety and mobility in and around the WZ.

Work Zone Stage 3: Active Work Zone Operations (1 of 2)

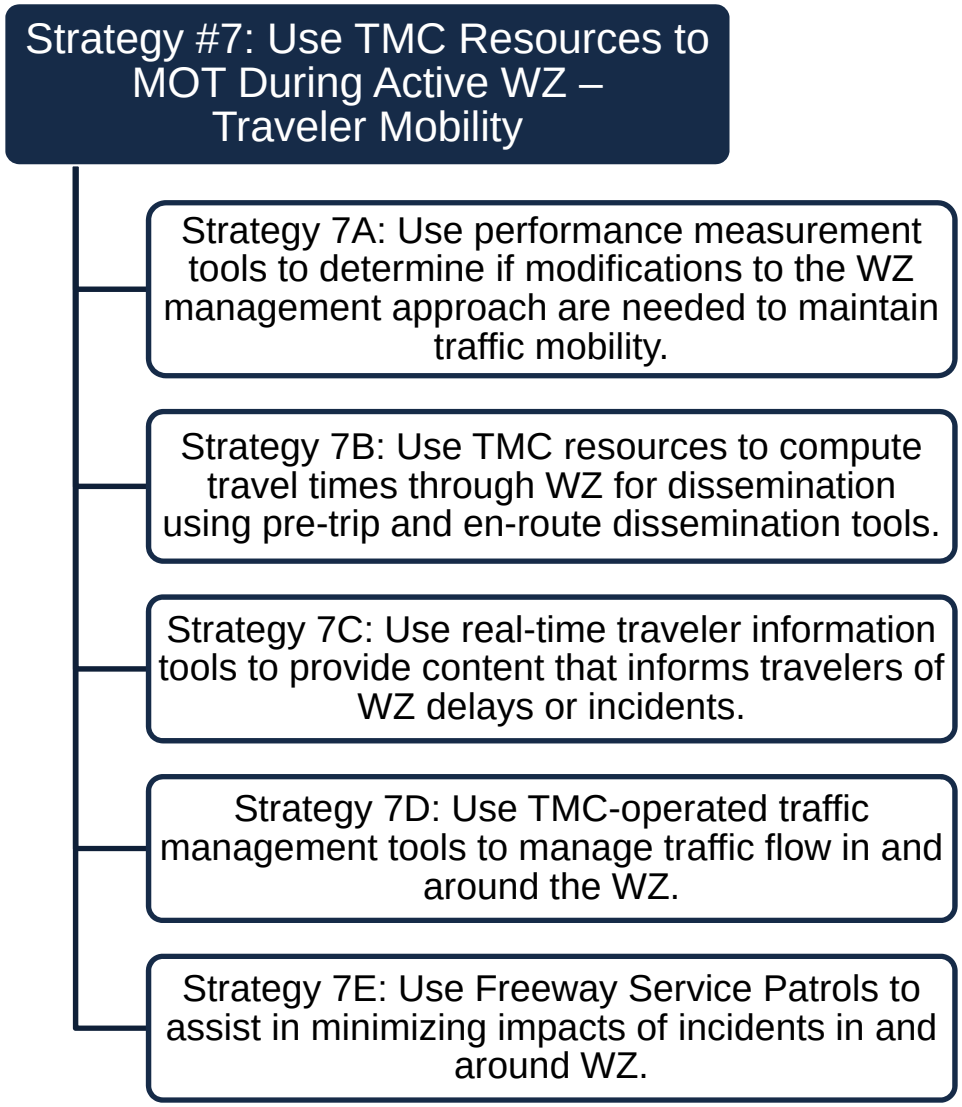
Strategy #5: Use TMC Resources to Support Pre-Work Zone Information Dissemination

- Strategy 5A: Use TMC-operated DMS in the vicinity to describe the upcoming work zone impacts to travelers prior to the start of the WZ.
- Strategy 5B: Use TMC-operated traveler information systems to describe upcoming WZ and anticipate impacts to travelers.

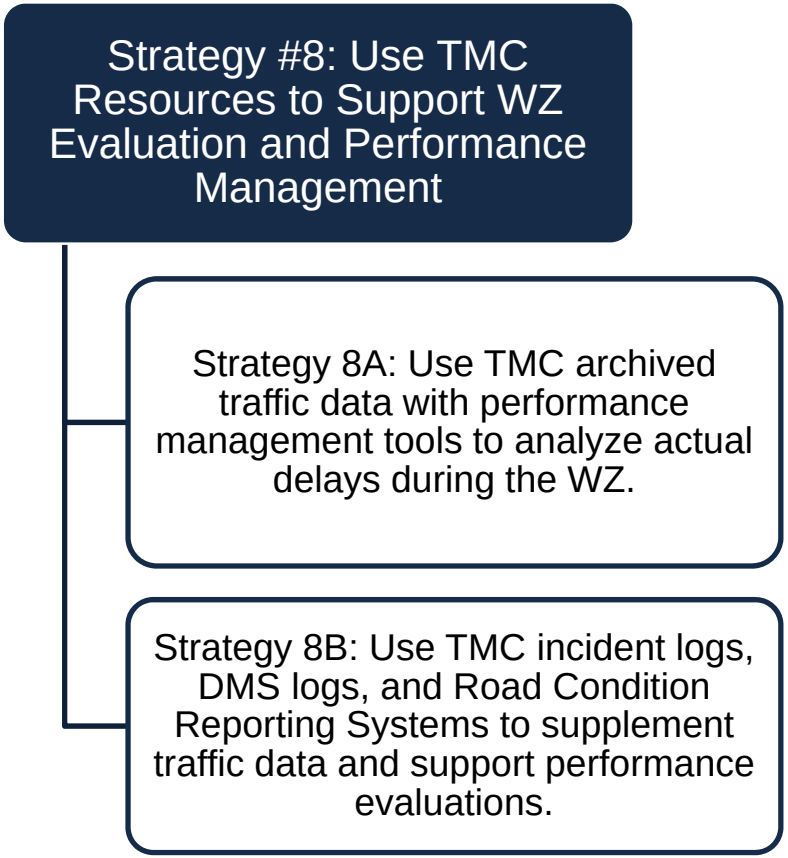
Strategy #6: Use TMC Resources to Support Maintenance of Traffic (MOT) During Active WZ– Traveler Safety

- Strategy 6A: Use TMC real-time traffic data and CCTV to detect stopped traffic and/or queues approaching WZ and inform travelers using TMC-controlled DMS.
- Strategy 6B: Use TMC-operated CCTV and traffic data to detect or verify incidents in and around WZ to support quicker incident clearance and to alert travelers upstream.

Work Zone Stage 3: Active Work Zone Operations (2 of 2)



Work Zone Stage 4: Post-Work Zone Evaluation and Performance Management



For More Information:

Gerald (Jerry) Ullman, Ph.D., P.E.
Senior Research Engineer
Texas A&M Transportation Institute
g-ullman@tti.tamu.edu

Dean Deeter, P.E.
Athey Creek Consultants
deeter@acconsultants.org

Tina Roelofs
Athey Creek Consultants
roelofs@acconsultants.org

Smarter Work Zones

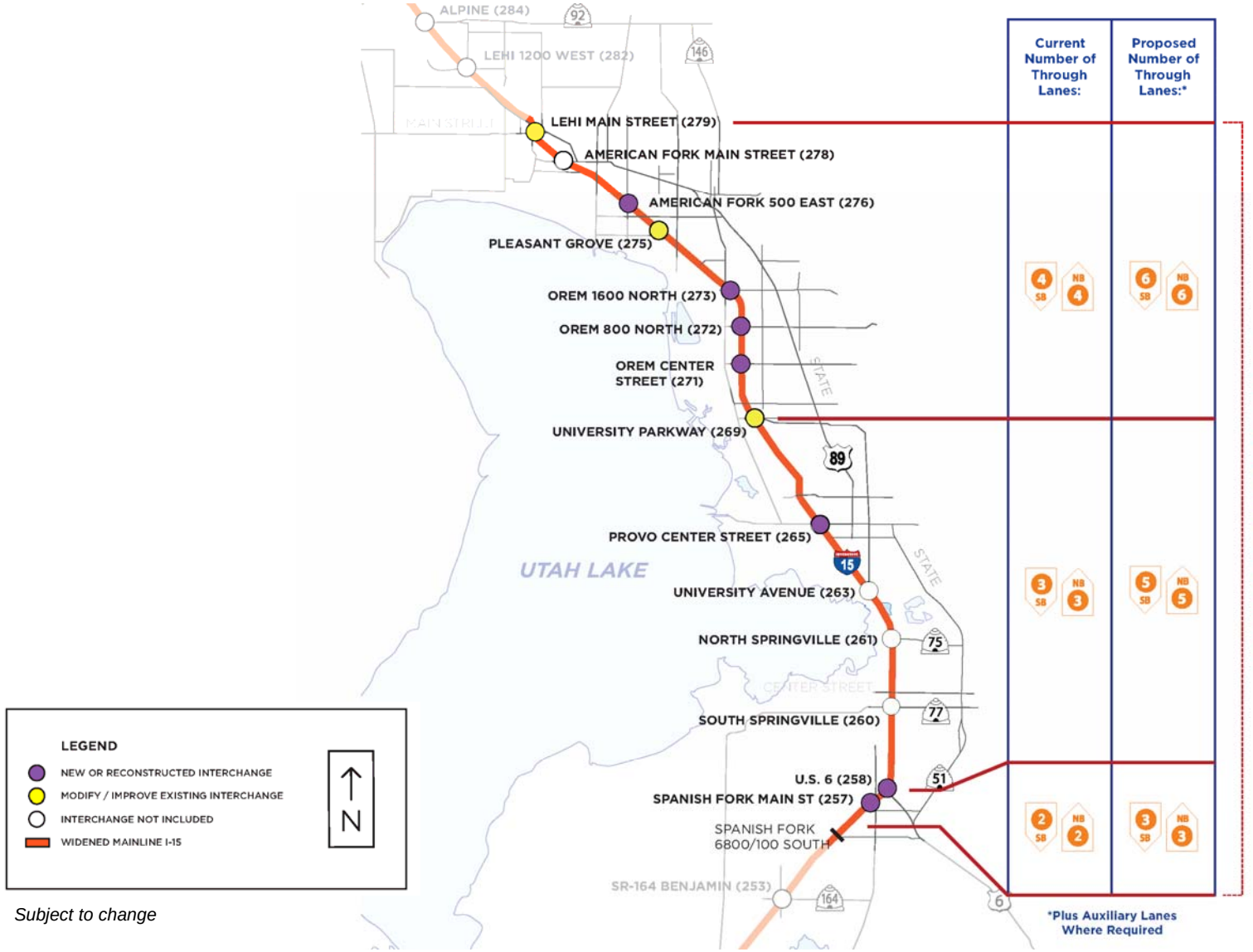
Utah DOT Maintenance of Traffic (MOT) Planning and Execution

I-15 CORE Project

MOT Overview

- Key to Success: Ownership
  - "Nobody has higher expectation or cares more about traffic than we do."
- Principled approach to MOT:
  - Minimize inconvenience to the public
  - Uphold the public trust
  - Maintain regional mobility
  - ***New goal: Strengthen the Economy***

Project Scope (1 of 2)



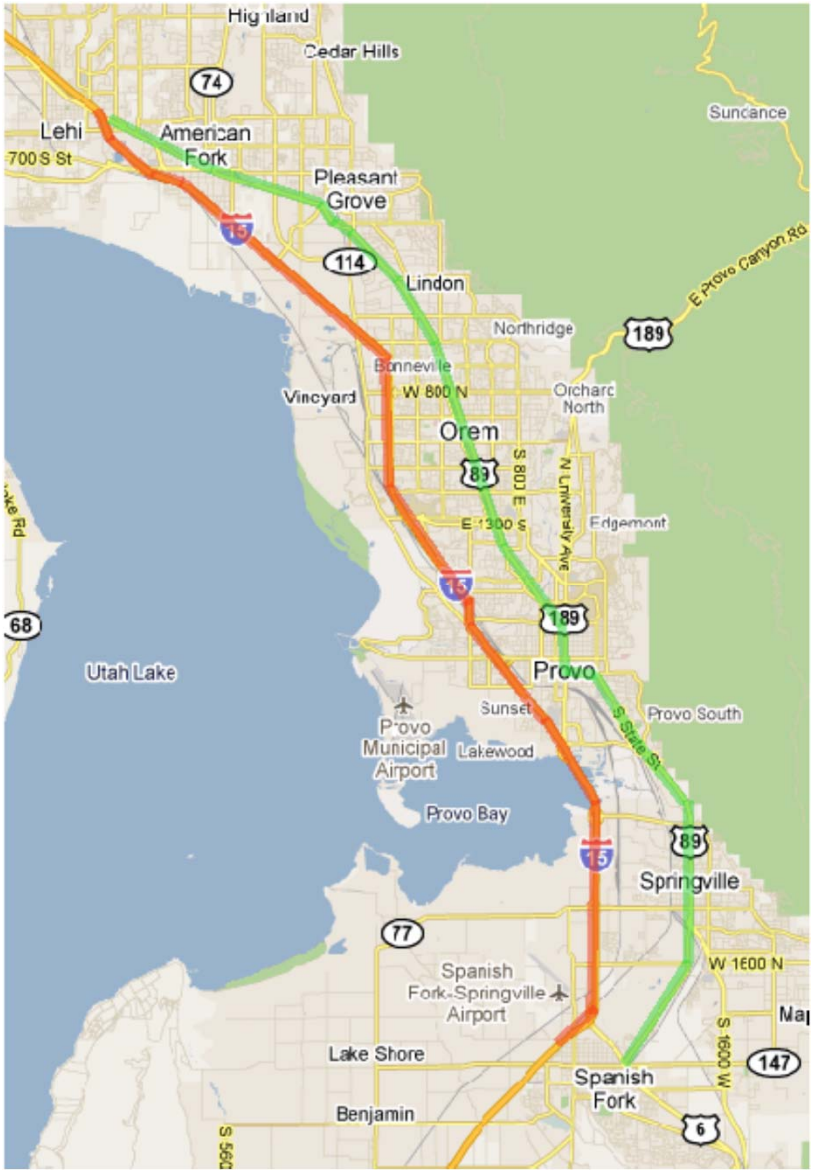
Subject to change

Source: UDOT

Project Scope (2 of 2)

- $1.725 billion budget
- 24 miles of freeway
- Two new lanes in each direction
- 10 interchanges
- 63 bridges
- 2.8 million square yards of concrete pavement
- 3.75 million square yards of asphalt
- 7.5 million tons of fill

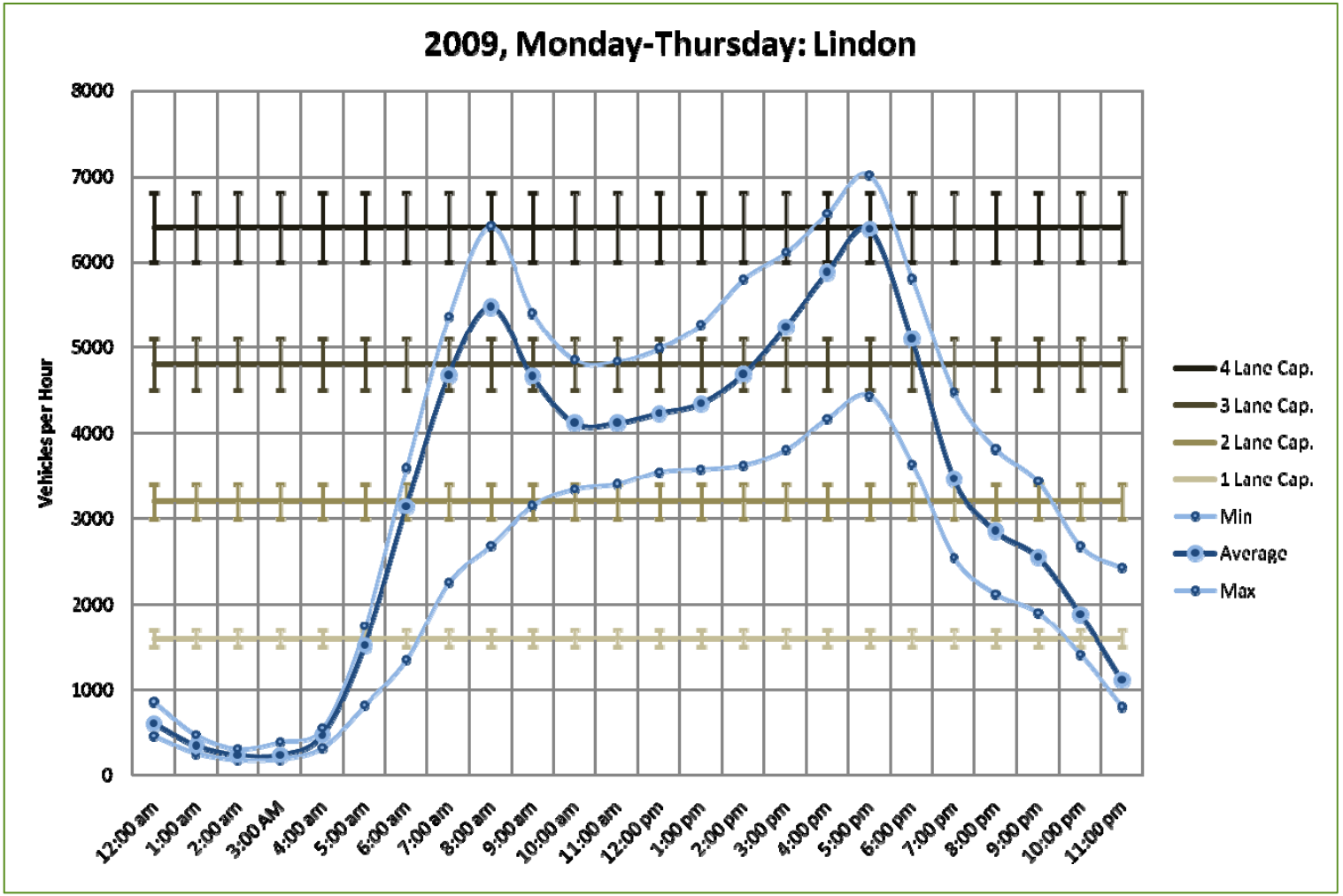
The Challenge



Source: Google

Strategy/Approach to Operations

Contract requirement – Definition of allowable closures



MOT Strategy

- Lane Closure Approval Process
  1. Design/Builder (D/B) Submits a Request
  2. I-15 CORE Approve/Disapprove Request
     - Collaborate with Public Information (PI) Team
     - Review request for contract compliance
     - Add additional requirements if needed (“A” approval)
  3. D/B Notifies the Department
     - 14 days in advance
  4. PI disseminates closure information to the public

Challenges to Operations

- Infrastructure – Do we have what we need?
  - Traffic signal control system
  - Vehicle Detection
  - Closed Circuit Television (CCTV) cameras
  - Variable Message Signs
  - Windshield survey
  - 511
  - UDOT Traffic Website

Preparations (1 of 3)

- Left turn phases
  - Provo, 820 North/Geneva Road
  - Orem, Center Street/Geneva Road
  - Lindon, 700 North/Geneva Road
    - Paid for by Traffic & Safety
    - Installed by Region 3 signal squad

Source: Google

Preparations (2 of 3)

- Right turn overlaps
  - Provo, University Parkway/University Avenue
  - Provo, Center Street/500 West
    - Both installed by Region 3 project
  - Orem, University Parkway/State St
  - Orem, Center Street/State St
  - Orem, 800 North/State St
  - Orem, 1600 North/State St
  - Lindon, 700 North/Geneva Road
    - All 5 installed by Region 3 signal squad

Preparations (3 of 3)

- CCTV Cameras – funded by Traffic Operations Center (TOC)
  - Orem, University Parkway/Geneva Road
  - Pleasant Grove (PG), State St/Geneva Road
  - PG, State St/PG Boulevard
  - PG, 2000 W/PG Boulevard
  - American Fork (AF), State St/500 East
  - AF, State St/Main St
  - Lehi, State St/Main St
- CCTV Cameras – funded by D/B
  - Lindon, 700 North/Geneva Road
  - PG/AF, State St/2000 West/1100 East
  - AF, State St/100 East

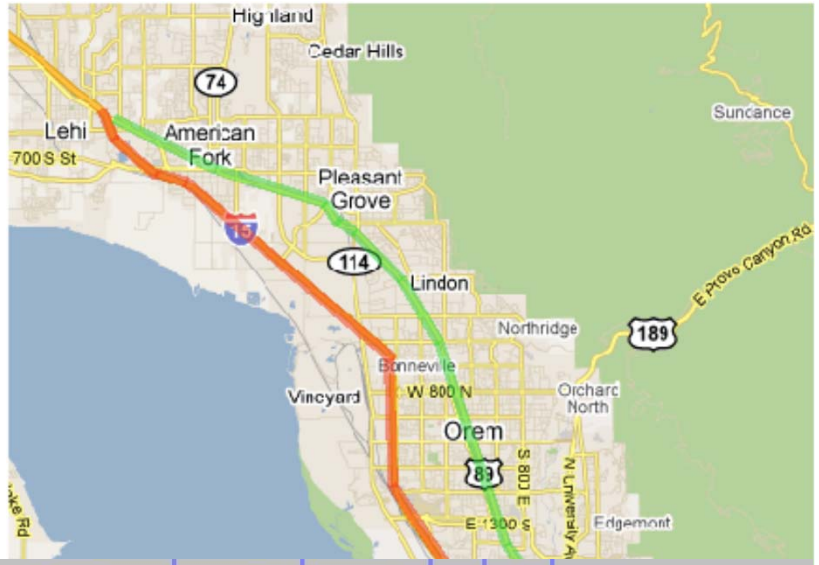
Source: Google

Travel Time Sign

Source: UDOT

Engineering

- Traffic Signal interconnect
  - Provo/Orem conversion
  - Pleasant Grove
    - D/B proposal
  - Lehi
    - TOC/Region Project



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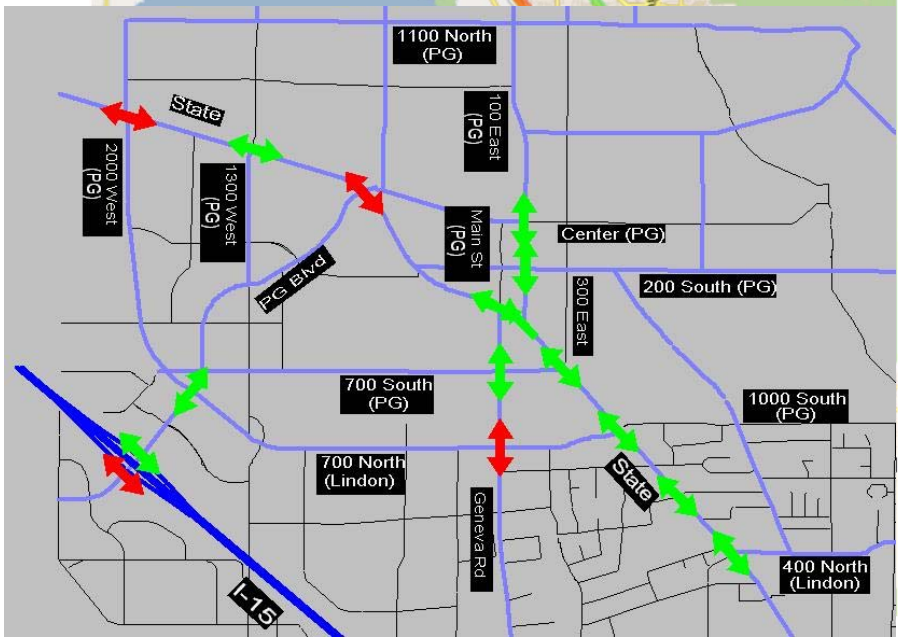


Ramp meters installed prior to construction

Source: UDOT

Strategy/Approach to Operations

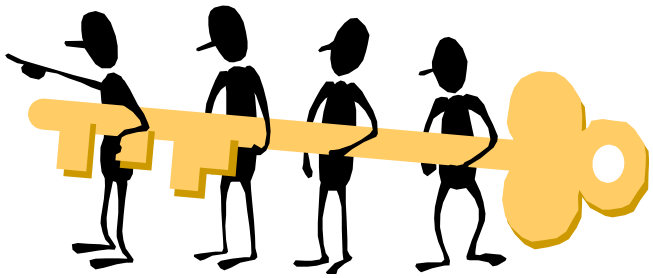
- UDOT is responsible for signal operations during construction
  - All state routes in Utah County
  - 24/7
  - New on a project of this size
    - I-15 Salt Lake County – D/B was responsible
  - Three separate traffic control system in Utah County – a unified system is ideal.

Provo/Orem conversion

- Necessary elements for unified signal control:
  - Agreements
    - Jurisdiction
    - Standard operating procedures
    - Partnership for future upgrades/expansion

Provo/Orem conversion

- Working Relationships
  - Keep your commitments
  - Compromise all around
  - Professional response/attitude
  - Working well together to manage special events and signal operations
  - Synergy

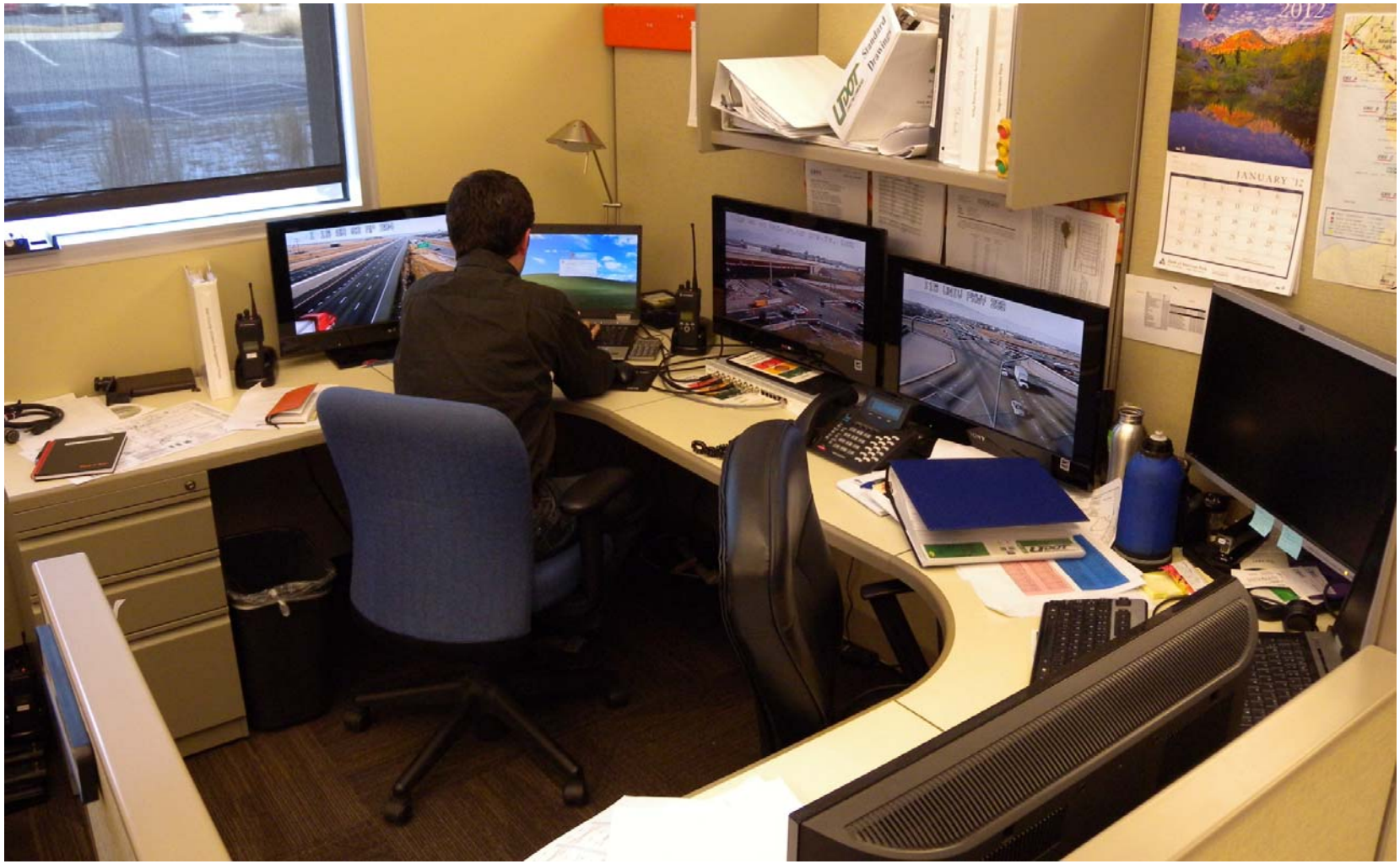


Source: Google

Challenges to Operations

- Benefits
  - Valued partnership with Provo/Orem
    - Makes the work fun
  - Extended coverage of signal operations
  - Working together towards a common goal
    - Benefit the traveling public
  - Multiple perspectives arrived at better outcome

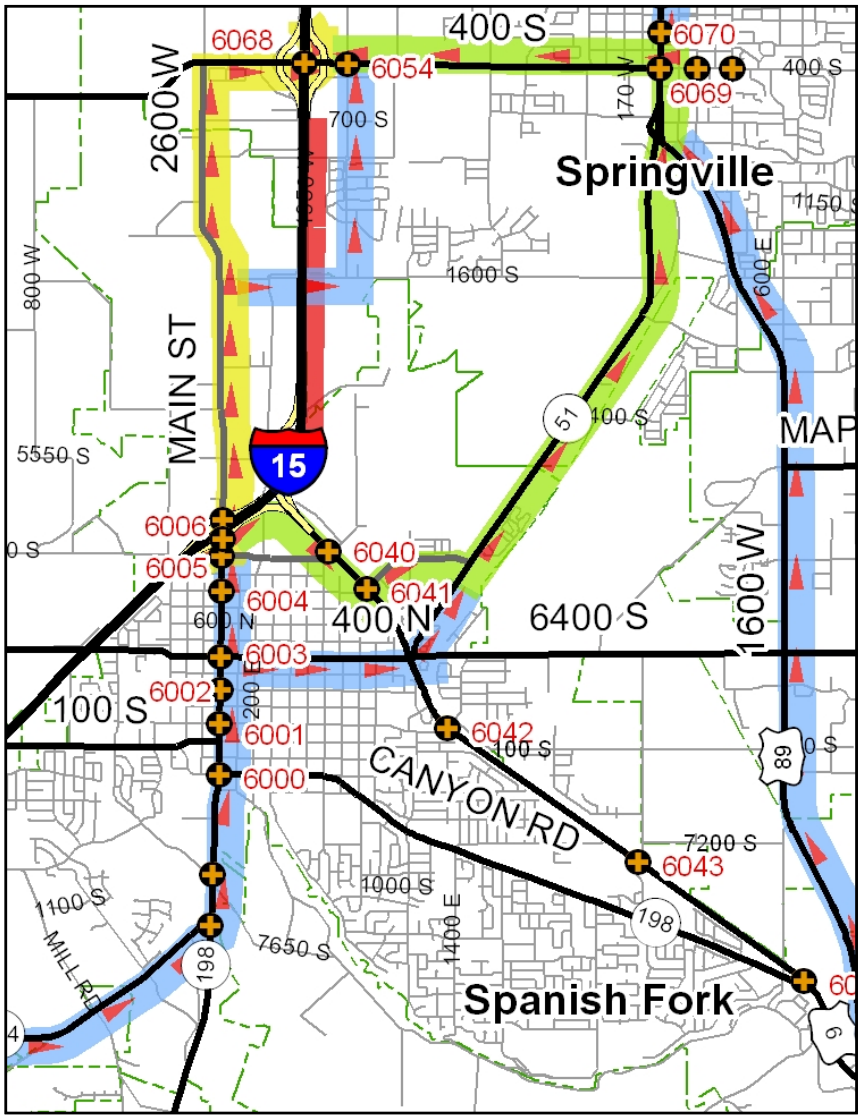
“Mini” TOC



Source: UDOT

Engineering

- Incident/Detour plans
- Detection maintenance/upgrades
- Background signal adjustments
- Monitoring existing Advanced Traffic Management System (ATMS) elements
  - Generate work orders for sites impacted by construction/ maintenance
- Central TOC signal desk expanded coverage



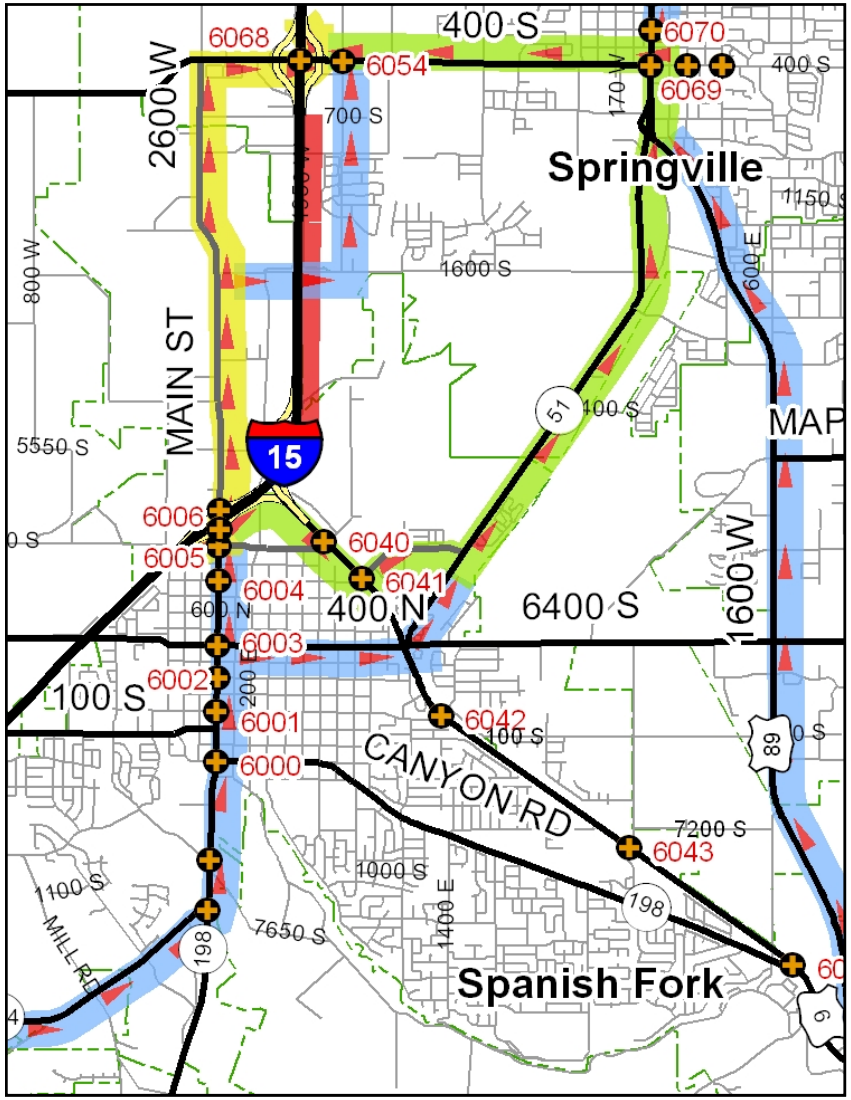
Source: UDOT

Closures

- Full freeway closures
  - 2010: 30 directional closures
  - 2011: 32 directional closures
- Partial closures (one lane)
  - 2010: 5 time periods of multiple days
    - 21 total days southbound
    - 19 total days northbound
  - 2011: 4 time periods of multiple days
    - 97 total days southbound
    - 77 total days northbound

Incident Management

- 24-hour D/B Supplied Courtesy Patrol
  - Value-added
  - Utah Highway Patrol (UHP) requested Patrol carry UHP radio
- Signal system used to manage incidents
  - 2010: 520 manual assignments
  - 2011: 1329 manual assignments



Source: UDOT

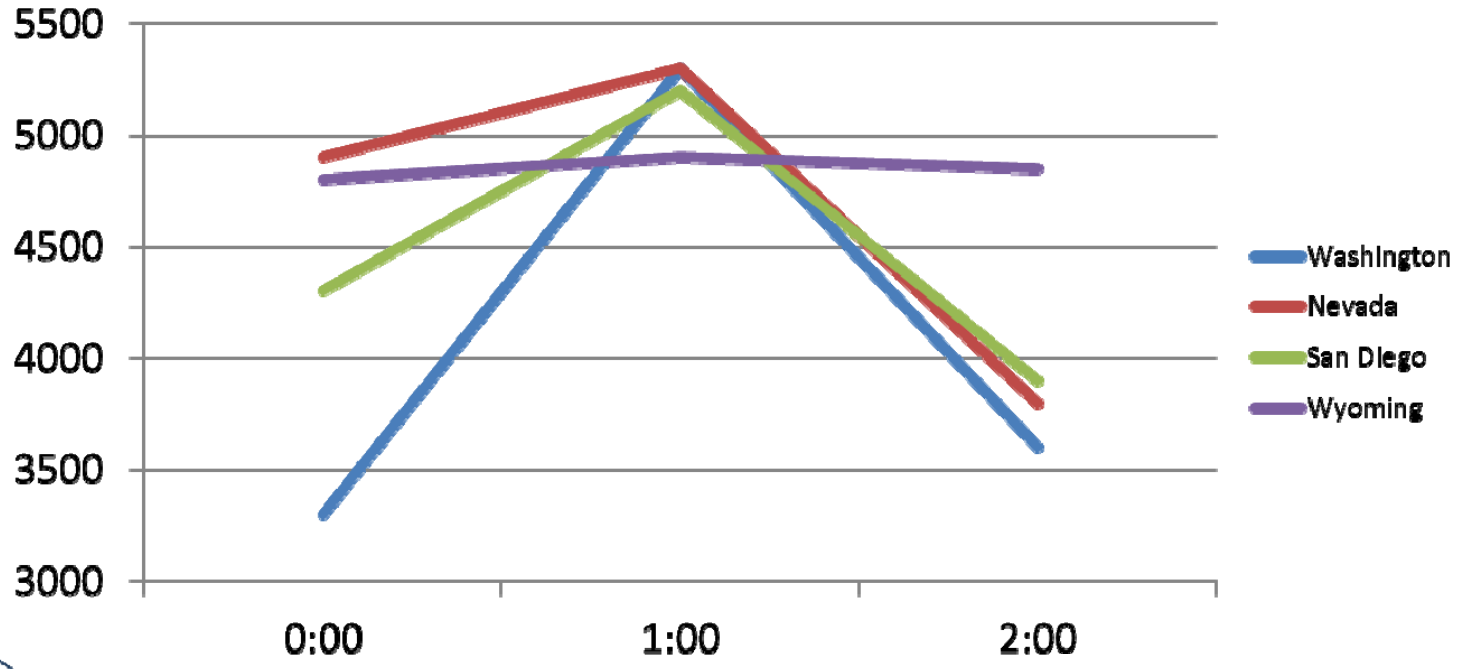
Major Events – Brigham Young University (BYU) Athletics

- BYU Football
  - 13 games
  - 50% reduction in event clearance times

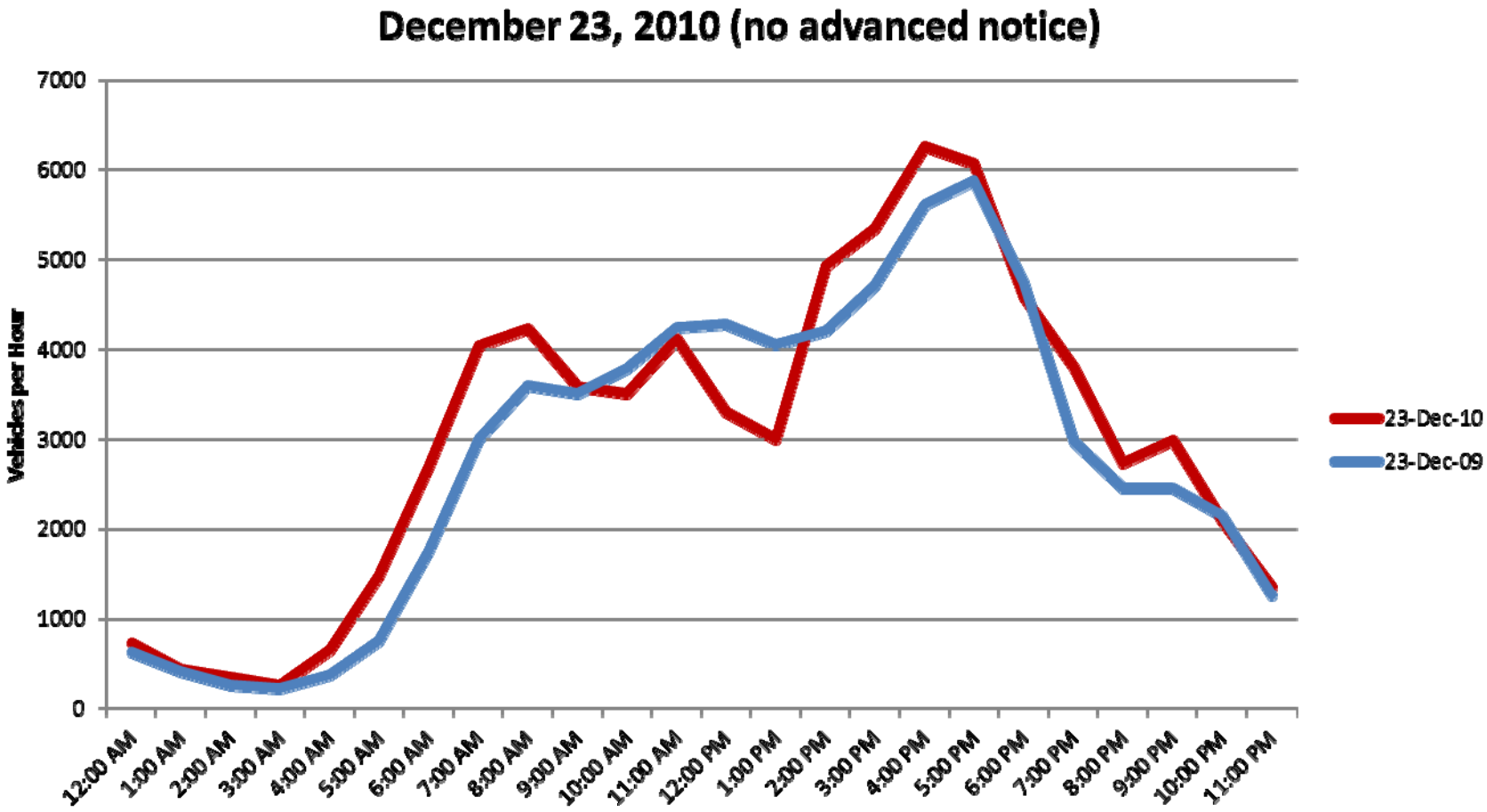
- BYU basketball
  - 35 games
  - 40% reduction in event clearance times

Major Events – BYU Football – PI Involvement

- 2010 Wyoming Game with Public Outreach
  - Paving operation BYU vs Wyoming
  - Fans encouraged to stay for dinner or shopping
  - 15% changed behavior



Emergency Work: I-15 Pothole Repair



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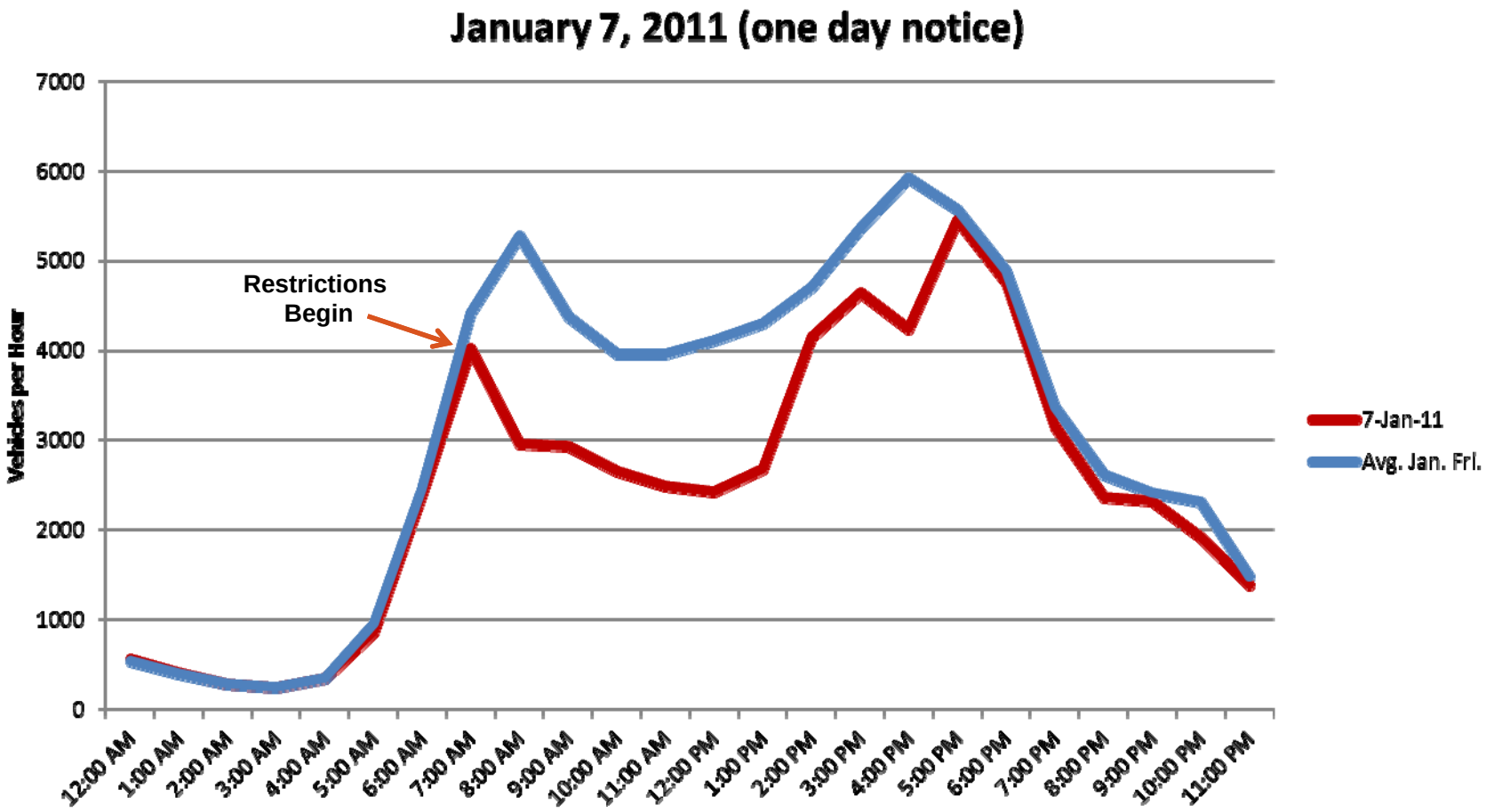


Summary

- Early project planning provided equipment in the field and contract documents to minimize inconvenience to the public.
- D/B understood the importance of ATMS
  - Interconnect, signs, signal updates, and CCTV included in the proposal
- Cooperation/respected with our local government partners ensured project success
- Public Involvement Team were key partners to success

For More Information:

Eric Rasband
Traffic Operations Analysis and Reporting Manager
Utah DOT
erasband@utah.gov

Smarter Work Zones

Use of TMC Tools in Work Zone Operations – Minnesota DOT

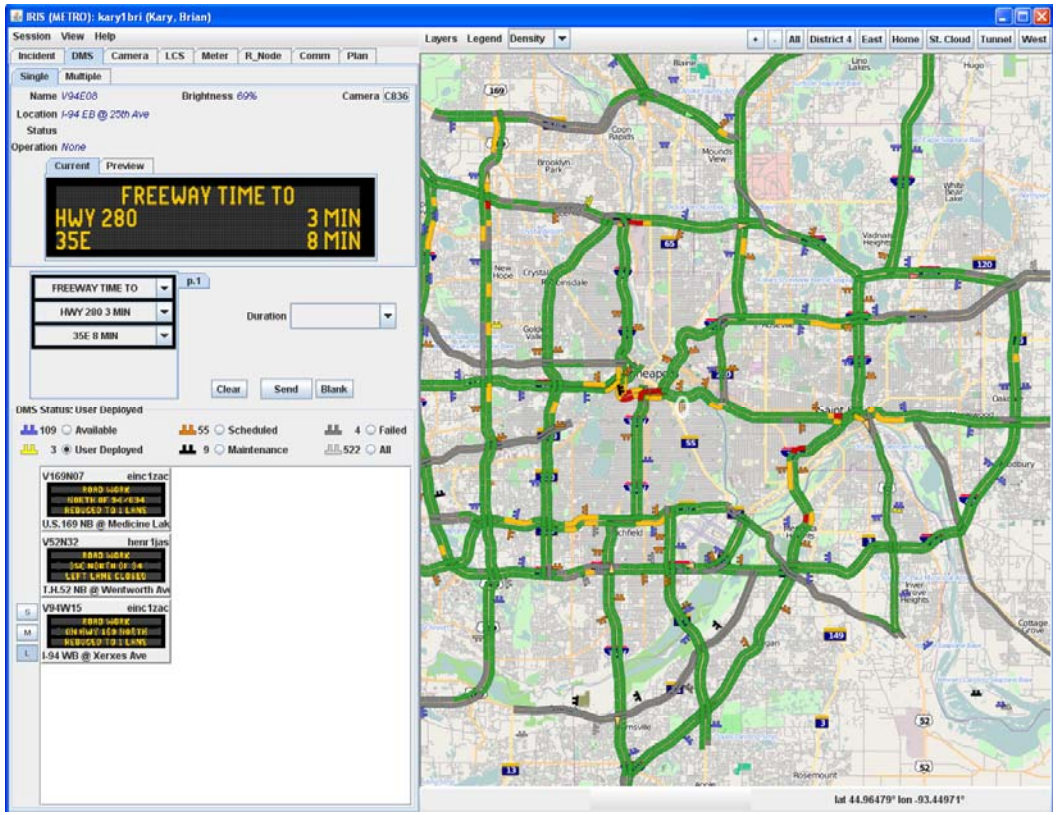
Minnesota DOT (MnDOT) Regional Transportation Management Center (RTMC)

- Shared Operations Center
  - MnDOT Traffic Operations
  - MnDOT Maintenance Dispatch
  - State Patrol Dispatch
- 400 miles of freeway management system
  - Cameras
  - Changeable Message Signs
  - Freeway Service Patrol

Source: MnDOT

Intelligent Roadway Information System (IRIS)

- Advanced Traffic Management System (ATMS) Software
- Control Field Devices
  - Dynamic Message Sign (DMS), Meters, etc.
  - Collect traffic data
- Developed in-house
- Open-source software



Source: MnDOT

Incident Management

- Cameras to detect and verify incidents
  - Existing cameras where available
  - Temporary wireless cameras when needed

Source: MnDOT

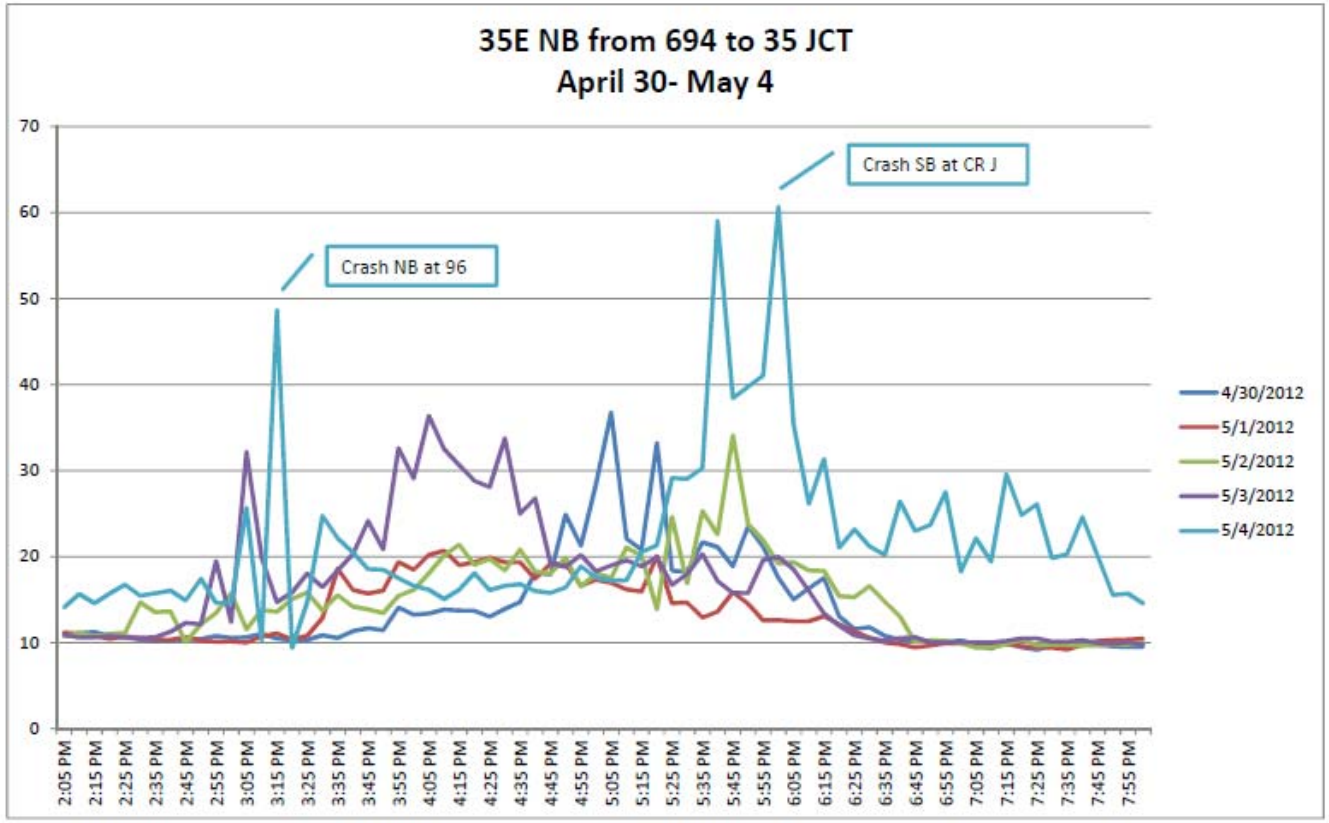
Freeway Service Patrol

- Freeway Incident Response Safety Team (FIRST)
  - ¾ ton pickup trucks
  - MnDOT vehicles and staff
- Tow Truck Service Patrol
  - Supplement FIRST in major work zones
  - Contractor provided flatbed tow

Source: MnDOT

I-35E Travel Time Reliability Example

- I-35E reduced to single lane in each direction for resurfacing work.



Temporary Detection and Travel Times in Work Zones

- Temporary Detection Trailer
  - Traffic Sensor
  - Camera
  - Wireless Modem
- Deployed for all construction projects expected to have major traffic impacts
  - Permanent Lane Closures
  - Very Restrictive WZ
  - Already Heavily Congested
- Types of Systems
  - Stand alone systems (outstate)
  - Integrated into existing RTMC systems (Twin Cities Metro)

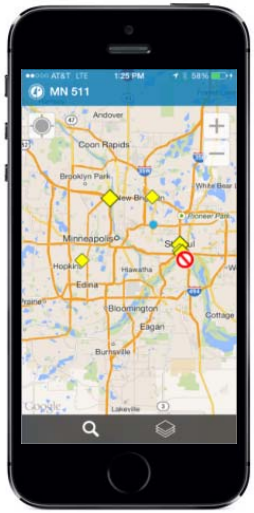
Source: MnDOT

Integration into existing RTMC System

- Temporary Sensors are tied into existing IRIS software
  - Calculation for travel times
  - Input into existing data tools

- Reduced Costs
  - Utilize existing 150+ DMS
  - Utilize detection outside of work zone

- Traveler Information
  - 511 Website, Smart Phone App, & Phone System
  - Radio Traffic Reports
  - Travel Times Signs



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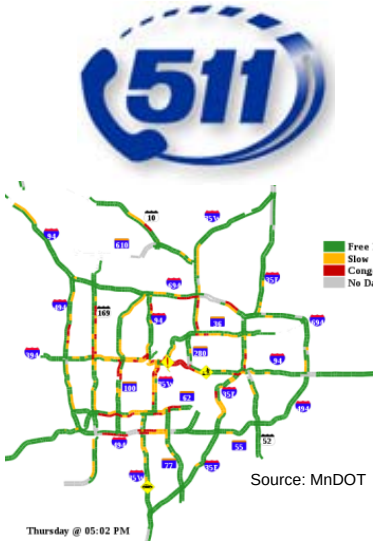


Source: MnDOT

Source: MnDOT

Traffic Data Responsibilities

- Who is responsible for the data?
  - Contractor monitors traffic sensors to ensure they are fully operational at all times.
  - Data is sent to MnDOT and integrated into IRIS software.
  - Data is stored within MnDOT system for post-analysis.

- How is data quality assessed?
  - Contractor ensures sensors are working and provides some high level data quality checks.
  - MnDOT performs travel time runs and comparisons to Google.

Contracting Methods

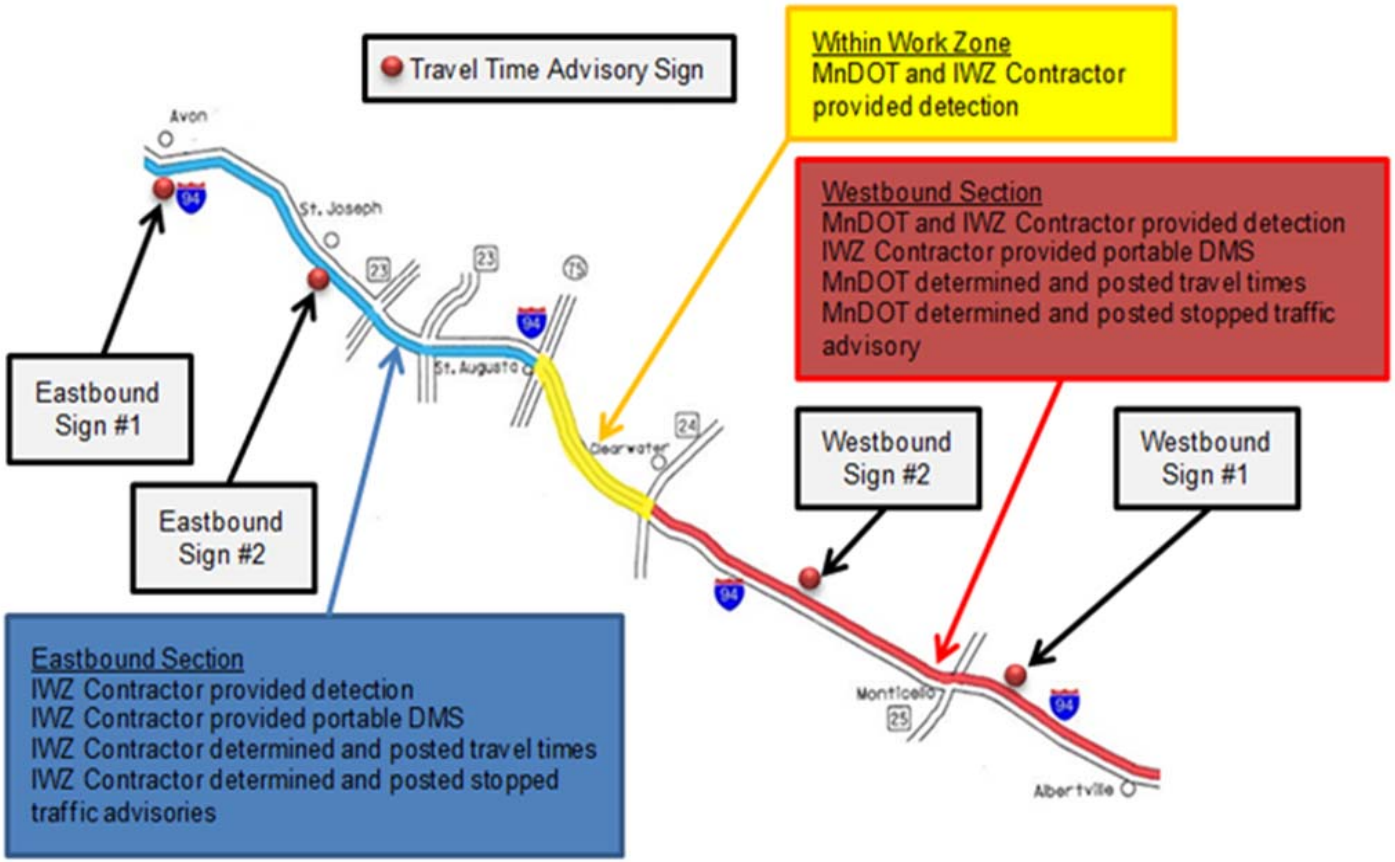
- Intelligent Work Zone (IWZ) provided by Sub-Contractor
  - Easiest contracting method
  - Difficulty in getting devices out in a timely manner
  - Devices not recalibrated after traffic switches

- Independent Contractor
  - Let as a separate project to hire IWZ vendor directly
  - Contractor provided IWZ for 4 major projects

- Future Projects
  - Long term projects – IWZ provided by sub-contractor but with specifications that IWZ must be deployed before lane restrictions being
  - Short term projects – independent contractor or utilize an on-call contractor.

I-94 St. Cloud Intelligent Work Zone Data Collection & Evaluation (1 of 2)

- Areas of Responsibility



Source: MnDOT

I-94 St. Cloud Intelligent Work Zone Data Collection & Evaluation (2 of 2)

- User Feedback of Travel Time and Stopped Traffic Advisories
  - 93% of respondents VALUED the travel time and alternate route information signage in construction work zones.
  - 79% of respondents thought the travel information posted in the construction work zone enhance roadway safety
  - 80% of the respondents highly rated the usefulness of STOPPED TRAFFIC AHEAD warning signs
  - Drivers reported less stress and delays

MnDOT Data Tools

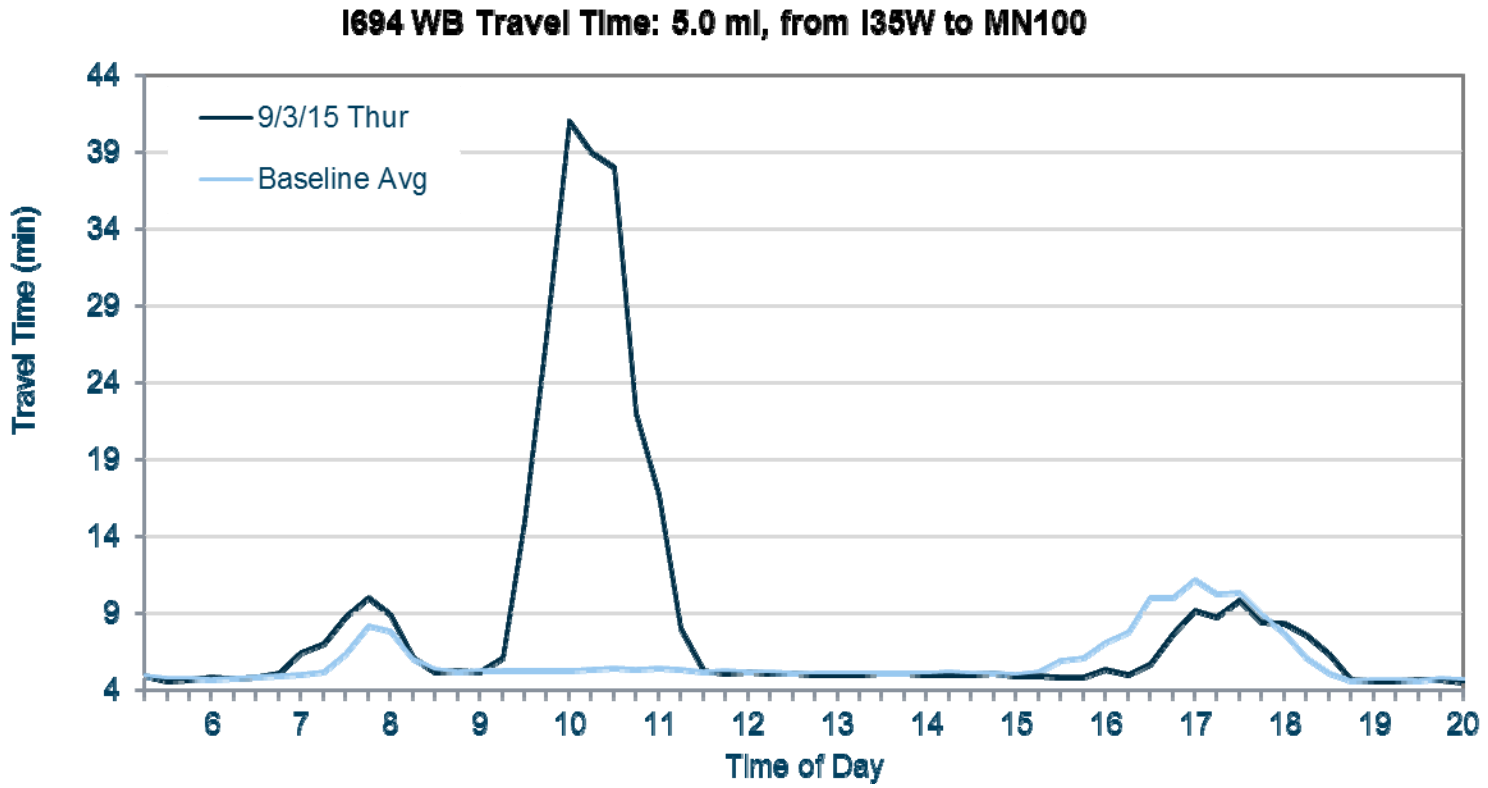
- Performance Measurement System (PeMS)
  - Web-based system provided by Iteris
  - Access to RTMC data and standard reports

- Traffic Information & Condition Analysis System (TICAS)
  - Developed with University of Minnesota – Duluth
  - Provides corridor performance measures including throughput, delay, and travel times

- Contractor provided reports
  - Contractor is monitoring detector health and accuracy of data.
  - Contractor provides performance reports showing travel times, traffic volumes, and summary of incidents

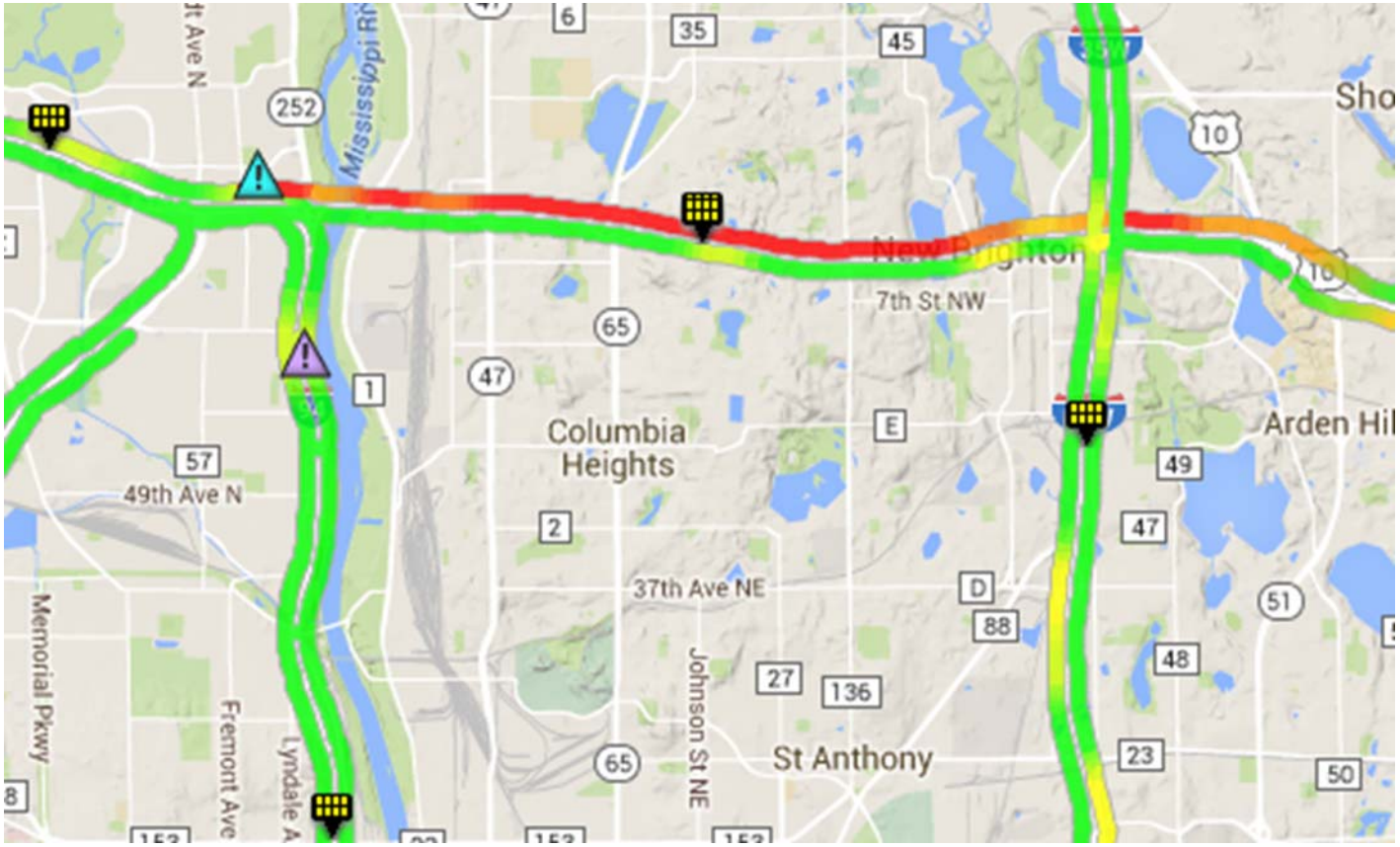
Sample Analysis (1 of 3)

- Lane closure on WB 694 for maintenance work



Sample Analysis (2 of 3)

- Lane closure on WB 694 for maintenance work

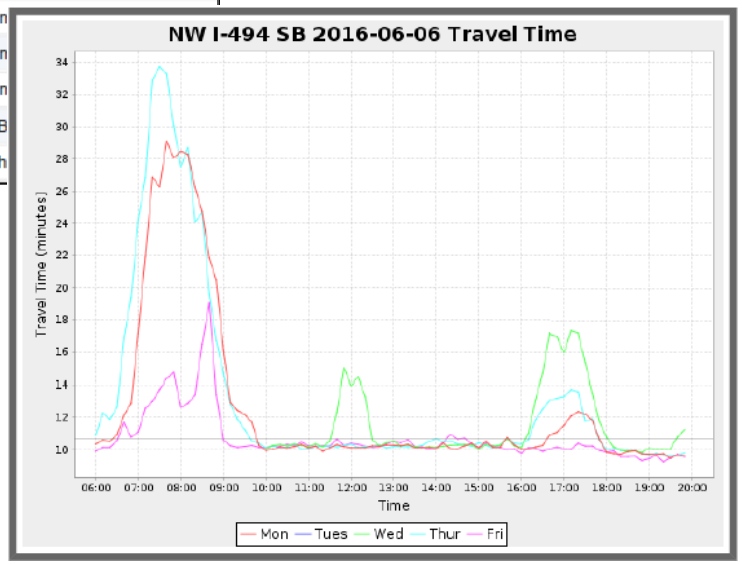


Source: MnDOT

Sample Analysis (3 of 3)

- Contractor provided reports for I-494 reconstruction
  - Average Travel Time, 95th Percentile, Buffer Time Index
  - Compiled incident reports

Title	Time	Location
Crash	Thu Jun 9, 2016 04:04 PM(183 min)	I-494 mile 13.76 at Crosstown Hwy in Minnetonka
Debris On Roadway	Fri Jun 10, 2016 04:54 PM(21 min)	MN 62 mile 100.00 at Crosstown Hwy in Eden Prairie
Crash	Sat Jun 11, 2016 05:08 PM(10 min)	I-494 n
Incident	Sat Jun 11, 2016 05:08 PM(9 min)	I-494 n
Incident	Sun Jun 12, 2016 05:59 PM(183 min)	I-494 n
Animal On Roadway	Sun Jun 12, 2016 11:09 AM(18 min)	I-494 EB
Stalled Vehicle	Tue Jun 7, 2016 08:20 AM(56 min)	I-494 mile 24.43 at Sch



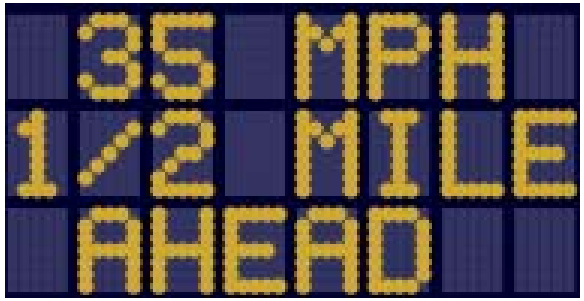
Source: MnDOT

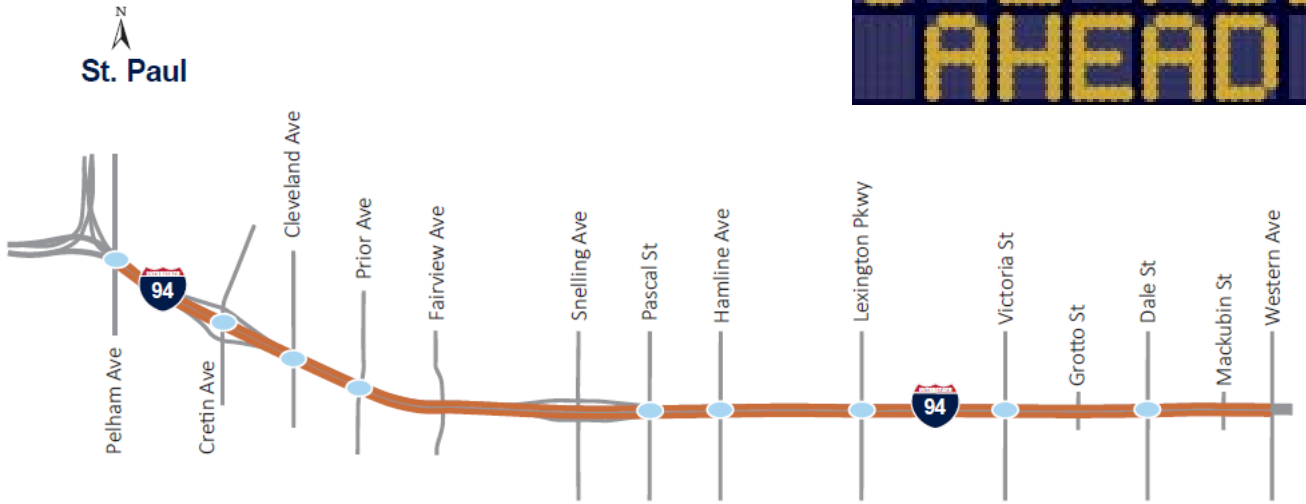
University Research Project

- Development of Guidelines for Work Zone Diversion Rate and Capacity Reduction
  - University of Minnesota – Duluth
  - Principal Investigator – Eil Kwon
  - Developing tool design engineers can use to determine the expected diversion rates and delay due to a work zone
  - Tool still under development
    - Only for 2 lane roadways
    - Phase 2 to make tool more user friendly
  - http://www.cts.umn.edu/Research/ProjectDetail.html?id=2014004

I-94 Speed Warning System

- Resurfacing project on I-94 east of St. Paul in 2016 & 2017
- IRIS software will detect queues using temporary detection within the work zone
- IRIS will deploy warning messages on PCMS spaced every mile within the work zone
  - Advisory Message Only
  - Speeds <45MPH = Speed Warning
  - Speeds <14MPH = Stopped Traffic Warning





Source: MnDOT

For More Information:

Brian Kary
Freeway Operations Engineer
Regional Transportation Management Center
Minnesota DOT
brian.kary@state.mn.us

Smarter Work Zones

FHWA Resources

SWZ Interactive Toolkit Available!

https://www.workzonesafety.org/SWZ/

Source: FHWA

Other Resources – Technology Application

FHWA	• Guidance on Using TMC for Work Zone Management http://www.ops.fhwa.dot.gov/publications/fhwahop15032/fhwahop15032.pdf • FHWA Work Zone Management Program – ITS and Technology http://www.ops.fhwa.dot.gov/wz/its/index.htm • FHWA Work Zone Management Program – Peer-to-Peer Program http://www.ops.fhwa.dot.gov/wz/p2p/index.htm • Work Zone ITS Implementation Guide http://www.ops.fhwa.dot.gov/publications/fhwahop14008/fhwahop14008.pdf • Work Zone ITS Case Studies http://www.ops.fhwa.dot.gov/publications/fhwahop14007/ • Work Zone ITS Overview Webinar http://www.ops.fhwa.dot.gov/wz/webinars/itsoverview013014/ullman/index.htm

Thanks for joining us!

- **Upcoming Events**
  - Webinar #15: Work Zone Impacts and Strategies Estimator (WISE) Tool Pilot States
    - Early September 2016
- Registration: Look for an invitation in mid-August
  - Check The National Work Zone Safety Information Clearinghouse website for updates https://www.workzonesafety.org/SWZ/

- **Questions or Comments?**
  - Jawad Paracha (FHWA Operations, WZ Management Team) jawad.paracha@dot.gov