Wisconsin Traffic Operations Performance Management System (TOPMS)-Phase 1

Advisory Group Meeting
January 23, 2014
10:00 – 11:00 AM
Hill Farms State Transportation Building
Room 419
888-557-8511 Access #6969016

Agenda

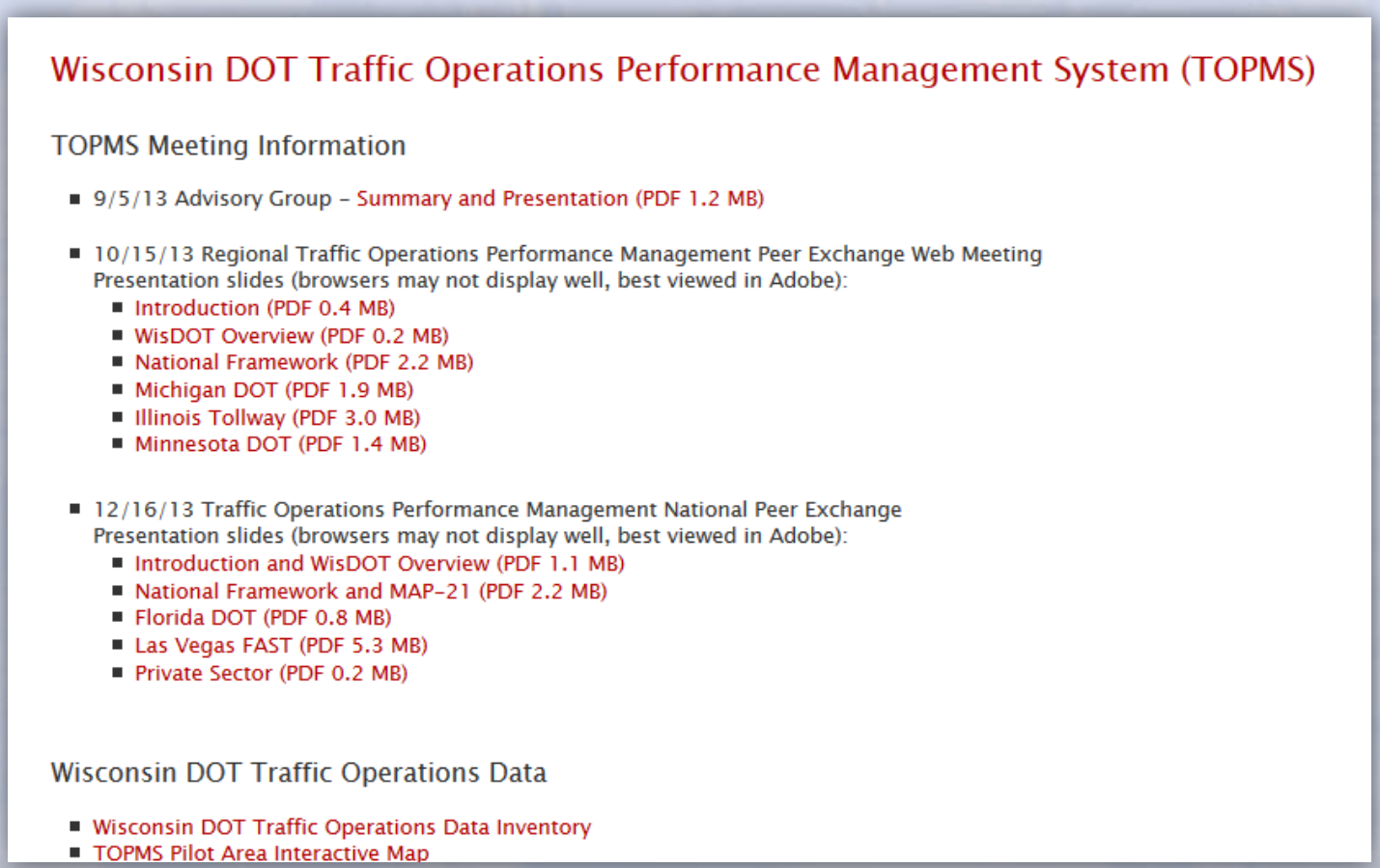
1. Welcome/Intros (5 min)
2. WisDOT Traffic Operations Data Inventory (5 min.)
3. Regional and National Webinars (5 min)
4. “State of the Art” Investigation/“State of the Practice” Evaluation (10 min)
5. Organizational Mapping (5 min)
6. Strawman User Interface & Visualization Development (5 min)
7. Mobility Performance Measures (10 min)
8. Investigative Prototype Design & Deployment (10 min)
9. Questions / Next Steps (5 min)

High Level Project Status

TASK	STATUS
WisDOT Traffic Operations Data Inventory	Complete
Regional and National Webinars	Complete
"State of the Art" Investigation/"State of the Practice" Evaluation	Complete
Organizational Mapping	95% Final report pending
Strawman User Interface & Visualization Development	70%
Mobility Performance Measures	90%
Investigative Prototype Design & Deployment - Bluetooth Detectors - Dynaflow - TrafficCaster	 Madison (30 of 40) Milwaukee (Spring) Complete 40%

WisDOT Traffic Ops Web Resources

- TOPMS Project Site - www.topslab.wisc.edu/its/topms
- Traffic Ops Data Inventory complete and available online
  - WisDOT Operations Data Sources, online map



Wisconsin DOT Traffic Operations Performance Management System (TOPMS)

TOPMS Meeting Information

- 9/5/13 Advisory Group – Summary and Presentation (PDF 1.2 MB)
- 10/15/13 Regional Traffic Operations Performance Management Peer Exchange Web Meeting
  Presentation slides (browsers may not display well, best viewed in Adobe):
  - Introduction (PDF 0.4 MB)
  - WisDOT Overview (PDF 0.2 MB)
  - National Framework (PDF 2.2 MB)
  - Michigan DOT (PDF 1.9 MB)
  - Illinois Tollway (PDF 3.0 MB)
  - Minnesota DOT (PDF 1.4 MB)
- 12/16/13 Traffic Operations Performance Management National Peer Exchange
  Presentation slides (browsers may not display well, best viewed in Adobe):
  - Introduction and WisDOT Overview (PDF 1.1 MB)
  - National Framework and MAP-21 (PDF 2.2 MB)
  - Florida DOT (PDF 0.8 MB)
  - Las Vegas FAST (PDF 5.3 MB)
  - Private Sector (PDF 0.2 MB)

Wisconsin DOT Traffic Operations Data

- Wisconsin DOT Traffic Operations Data Inventory
- TOPMS Pilot Area Interactive Map

WisDOT Traffic Ops Web Resources

UNIVERSITY OF WISCONSIN-MADISON COLLEGE OF ENGINEERING

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Wisconsin Traffic Operations and Safety Laboratory

TOPS | ITS HOME

Wisconsin DOT Traffic Operations Performance Management System (TOPMS)

Back to TOPMS

Wisconsin Traffic Data Inventory Summary

1. Introduction

An early task in the Wisconsin Department of Transportation (WisDOT) TOPMS project was to compile a summary scan of internal data sources that have at least some potential bearing on traffic operations performance management. The scope of this task does not include detail on the many and varied sources of data from other providers, although some are mentioned below for completeness. This data sources inventory is intended to be a living online resource not only for the TOPMS project but for use by others.

The organization of this begins with a summary table, followed by brief descriptions of each source within data type categories. Use the table of contents at right to skip down to a section of interest.

Chief among the resources available to obtain traffic operations data is the WisTransPortal transportation data hub. Hosted by the Wisconsin TOPS Lab, this is the central source for t operations, safety, and intelligent transportation systems (ITS) data, archiving, and real-tin for Wisconsin highways. Because of its prominent role in this performance management pr unfamiliar readers are encouraged to first familiarize themselves with some basics about t WisTransPortal by starting here: About WisTransPortal.

Those interested in learning more about where ITS devices and communications are locate state should start at Wisconsin ITS Inventory.

All questions, corrections, and suggestions related to this page should be directed to inventory@topslab.wisc.edu.

WisDOT Traffic Ops Peer Exchanges

Regional Peer Exchange

- **October 15, 2013**
- Web meeting
- Presenters
  - National Framework
  - Michigan DOT
  - Illinois Tollway
  - Minnesota DOT
- 25-30 participants

National Peer Exchange

- **December 16, 2013**
- Web meeting
- Presenters
  - National Framework
  - Florida DOT
  - Las Vegas
  - Private Sector
- 55-60 participants

MAP-21

Moving Ahead for Progress in the 21st Century

State of the Art Investigation/State of the Practice Update

- Identify examples where performance measures are being used for operational improvements
  - 5 State DOTs
  - 3 National transportation studies (FHWA and NCHRP)
  - 4 Private sector examples
  - 3 European Union projects
- Findings emphasize importance of matching measures to specific objectives
- Research orientation (Michigan DUAP) vs. very specific issue (United Airlines weather information)

State of the Art Investigation/State of the Practice Update

- Some opportunities identified
  - Efficiency of data collection for a variety of functions (traffic data, asset management, construction impacts)
  - Traffic management (real-time speed control, peak shoulder running, managing diversion routes, weather-related management, parking management)
  - Incident management resource deployment
  - Deployment of maintenance resources and contracting strategies
  - Commercial vehicle permit routing

- Characteristics of success stories
  - Tie measures closely to objectives and make sure they remain linked
  - Use measures that are meaningful, easily understood and few in number
  - Keep improvement efforts focused on specific functions
  - Encourage employees at all levels to have a stake in the process and bring forward ideas for continuous improvement
  - Recognize that when one bottleneck is solved the next one will show itself – keep looking
  - Build and maintain knowledge database over time

Organizational Mapping

- Organizational Mapping Task
  - Based on objectives and actions identified in BTO Strategic Plan (STOPP Report)
  - Interviews completed with BTO and DTIM staff
  - General observations
    - Staff has high level of interest in performance-based management
    - Much of the data required currently exists but not always easily accessible or in usable format
      - Mapping system compatibility a key issue
    - Large number of opportunities but can't do at once
    - Look for early winners
      - Bluetooth provides good opportunities to support performance management in a number of areas

Organizational Mapping

- Key Interview Findings
  - Functions
  - Performance measures currently in use
  - Primary data and systems used to perform functions
  - Current gaps in data and systems
    - New data sources
    - Existing data sources that could be modified to better address needs
  - Needs related to data and performance management

Organizational Mapping

First Level Screening for Feedback Opportunity – Work Zone Review

Objectives (in gray) and Actions (in white)	Measures of Effectiveness	Existing Data Source	New Data Source	Feedback Opportunity
(1) Consistently Utilize Traffic Management Tools to Reduce Delay and Promote Safety in Work Zones				
With Local Agencies, Conduct Work Zone Safety and Mobility Analyses, Identify and Coordinate Enforcement Needs, Incorporate Lane Closure Guidelines into Work Zone Plans, Identify Potential Routing Alternatives, and Use Signage to Communicate Relevant Information Such as Expected Time Delays (2030)	▪ Documentation of tools listed	Delay: ▪ FHWA HERE probe data ▪ TranSuite detector data ▪ V-SPOC ▪ Work zone detector data Volume: ▪ TRADAS ▪ V-SPOC Travel times: ▪ FHWA HERE probe data ▪ Wis511XML feed Lane Closure System	▪ Bluetooth data on both work zone routes and alternate routes	▪ Utilize user delay data to refine work zone and lane closure guidelines

Organizational Mapping

Performance Management Action	Primary Function Involved	Other BTO Function(s) Involved	Other DOT Functions
Measurement of Work Zone delay • **Feedback findings to traffic management plan development and general planning of construction activity**	Work Zone Management and Operations	ITS Planning and Design STOC Control Room and IT Systems Traffic Engineering and Operational Analysis Traffic Engineering and Speed Management Traveler Information	Bureau of Project Development Regions DTIM Planning WSP

Summary Table of Feedback Opportunities – Work Zone Review Function

Visualization Strawman Options

1. MAP-21 Report Generation
   - Feedback Opportunities
     - Match delay with event manager database and LCS to estimate impacts of:
       - Work zones
       - Incidents
       - Special events
       - Include alternate routes
     - Feedback to identify specific improvement opportunities

Visualization Strawman Options

2. Measurement of Work Zone Delay
   - Key Data Sources
     - FHWA HERE Database
     - V-SPOC
     - BlueToad installations where available
     - TRADAS for volume and classification data
   - Feedback to identify specific improvement opportunities
     - Allowable lane closure times
     - Number of lanes closed
     - Length of work zones
     - Impact of shoulder/ramp closures
     - Diversion impacts
     - Deployment of Freeway Service Teams

Visualization Strawman Options

3. Measure Components of Incident Response Time
   - Feedback to identify specific improvement opportunities
     - Identify components of incident response time
       - Detection
       - Verification
       - Response
       - Clearance
     - Review variation in components over different corridors and facility types
     - Develop relationship between incident response times and user delay by capturing the average speed and volume during the time of the incident, from notification to clearance
     - Identify actions to reduce components of response time

Visualization Strawman Options

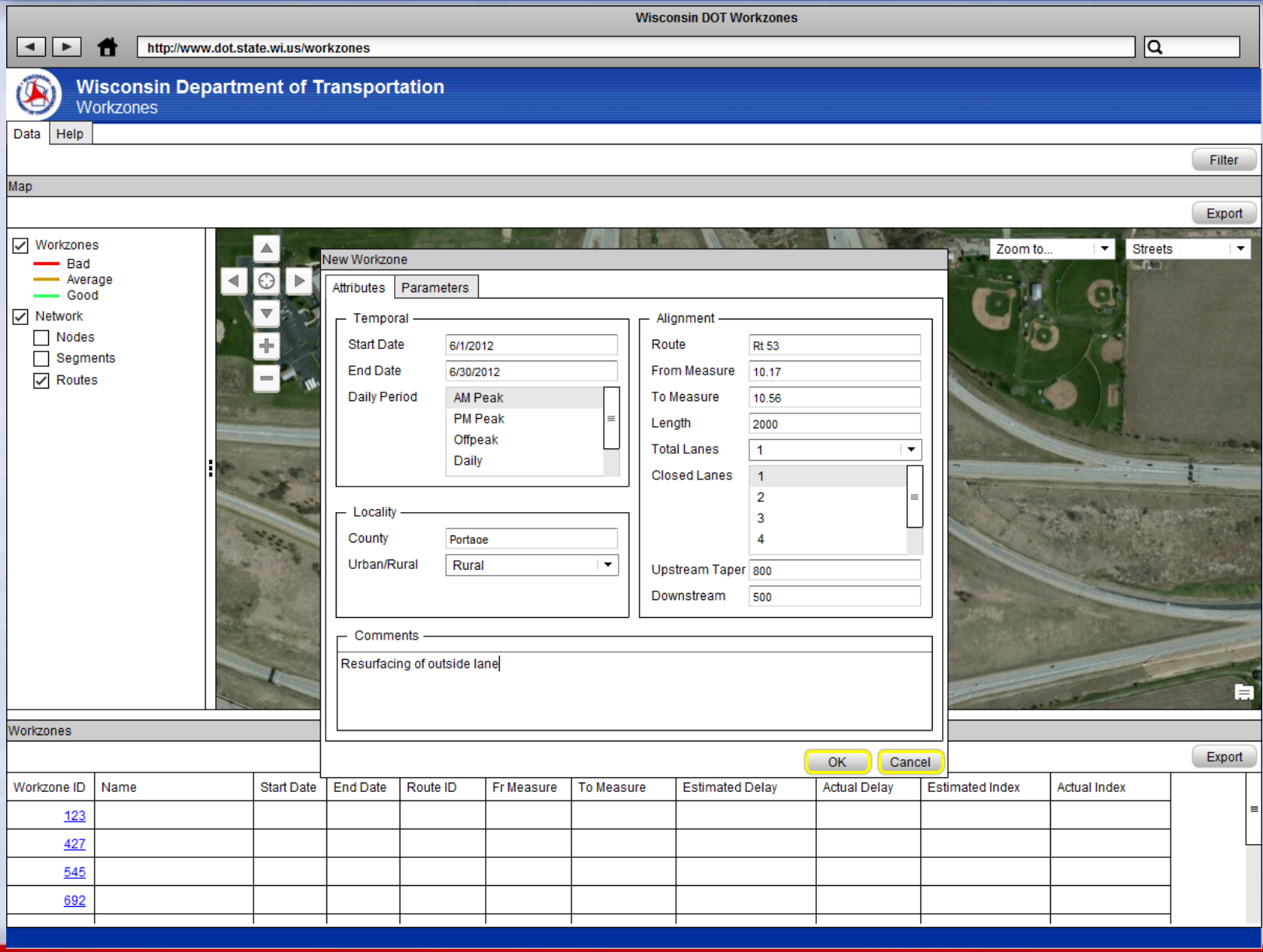
4. Measure Diversion Route Impacts

- Feedback opportunities
  - Identify feasible diversion routes
    - Can operate satisfactorily during diversion
    - Investment required to assure satisfactory operation
    - Conditions under which to encourage diversion
    - Recommended actions
      - » Measure diversion route speeds through bluetooth readers, purchased probe data or temporary detectors
      - » DMS/511 messages
      - » Trailblazer signs
      - » Signal timing plans

Visualization Strawman Options

5. Life Cycle Cost Analysis for Field Equipment
   - Key Data Sources
     - ITS Maintenance Database
     - Cartograph asset management
     - Contract/bid documents
     - Centrax signal control system (in progress)
   - Feedback to identify improvement opportunities
     - Calculate life cycle costs to support replacement program
     - Identify operations/maintenance costs of specific equipment types for future procurement
     - Evaluate overall performance and cost for equipment approvals and adoption of new technology
       - Select specific deployment or technology for limited test to develop process

Visualization Strawman Options – Work Zone Tool



Visualization Strawman Options – Work Zone Tool

Wisconsin DOT Workzones

http://www.dot.state.wi.us/workzones

Wisconsin Department of Transportation
Workzones

Data | Workzone 427 | Help

Comment | Edit | Clone | Delete

Details

Export

Workzone ID	427
Name	Fast Lane Resurface
Start Date	2012-06-01
End Date	2012-06-30
Period(s)	AM Peak
Comments	

Analysis

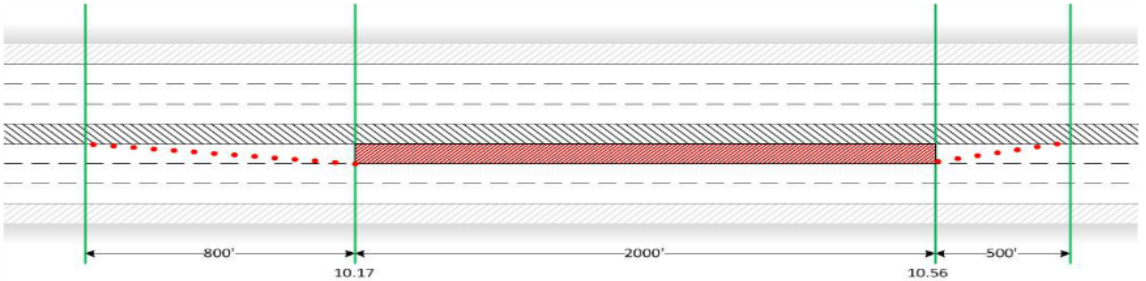
Export

Name	Base Speed	Estimated Speed	Actual Speed	Base Volume	Estimated Volume	Actual Volume	Estimated Delay	Actual Delay	Estimated Index	Actual Index
Workzone	65	45	37	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Diversion A	55	40	39	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Diversion B	55	32	48	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Diversion C	45	27	31	XXX	XXX	XXX	XXX	XXX	XXX	XXX
All Facilities	57	38	39	XXX	XXX	XXX	XXX	XXX	XXX	XXX

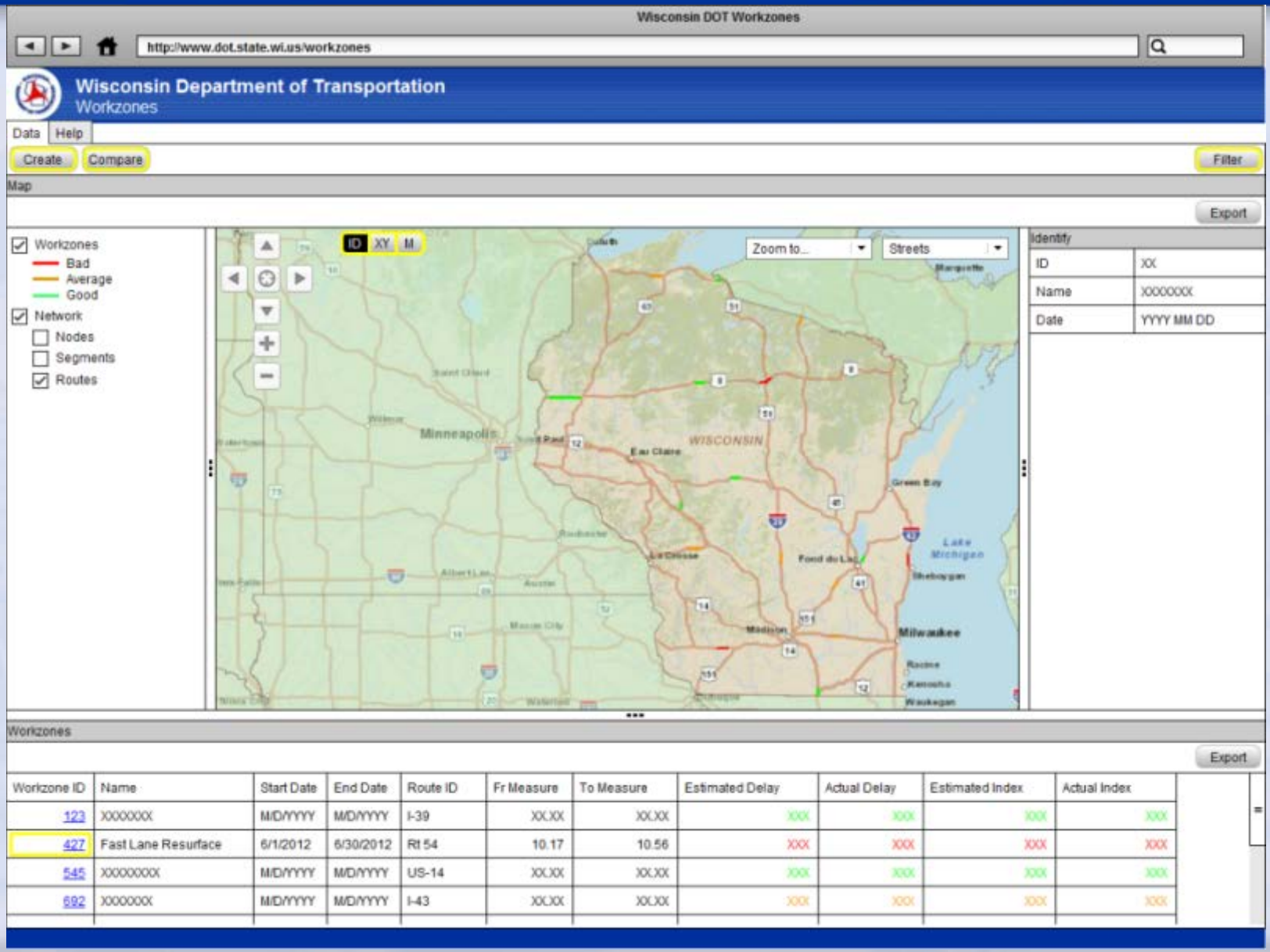
Map

Schematic

Export

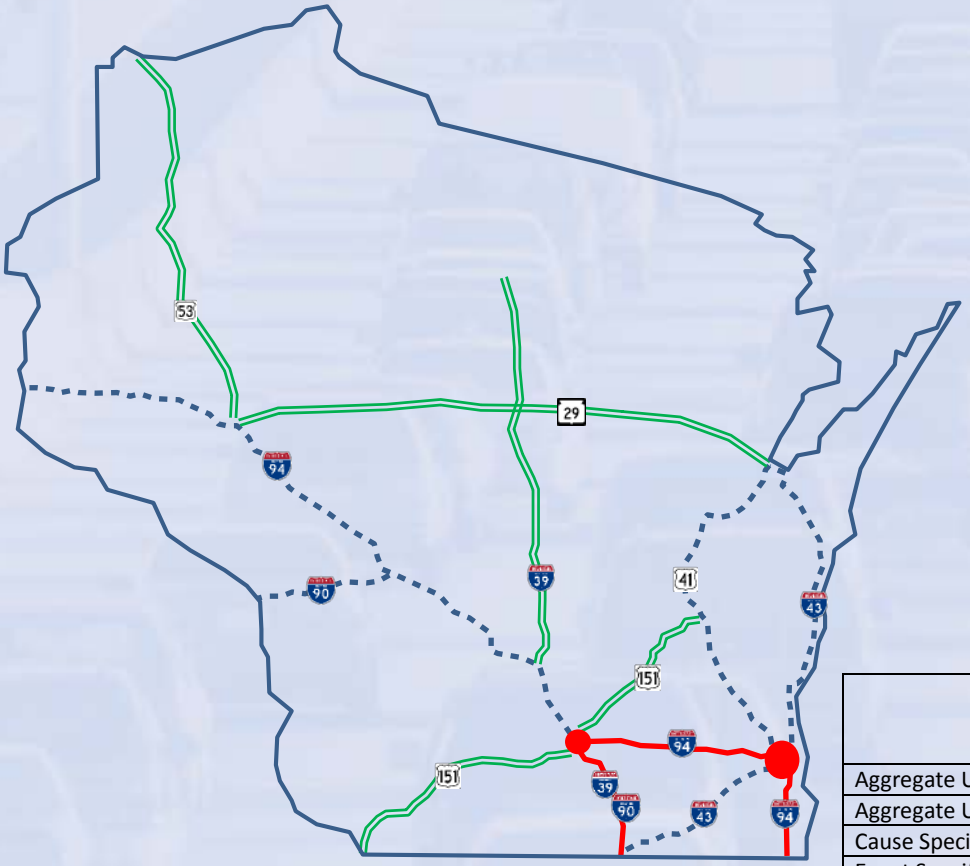


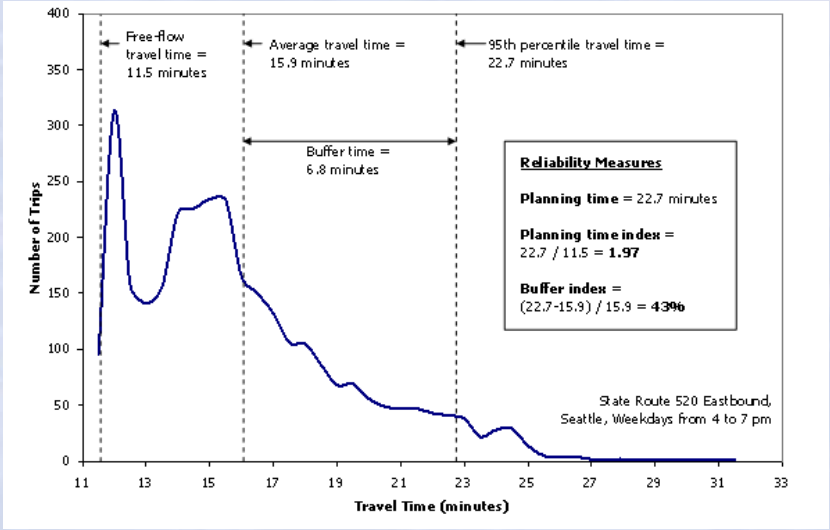
Visualization Strawman Options – Work Zone Tool



Mobility Performance Measures Development

DRAFT - Traffic Operations Performance Management System (TOPMS) Implementation Plan



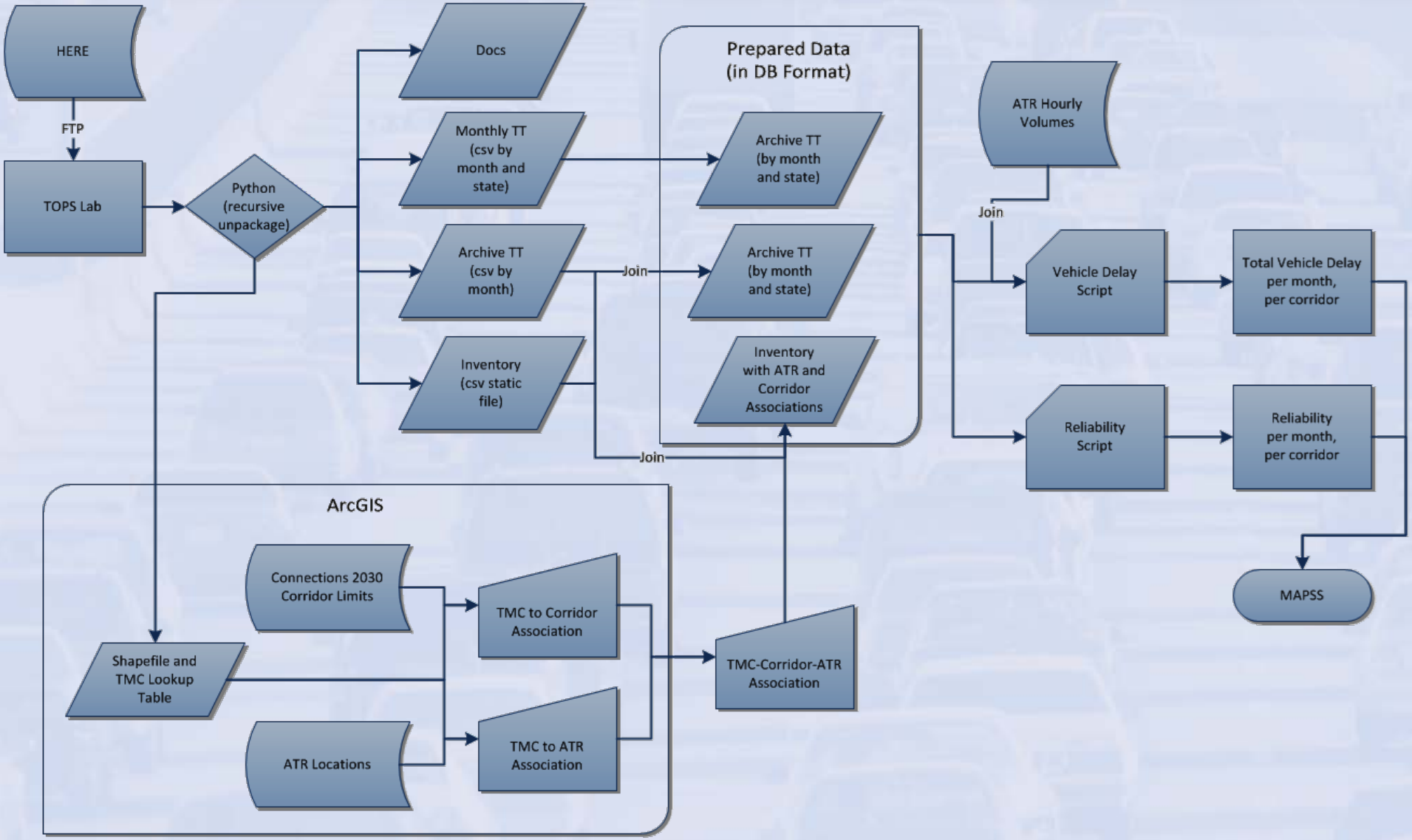


Performance Measure	Pilot Area	Phase 2 Area	Phase 3 Area
Aggregate User Delay Hours	2013	2014	2014
Aggregate User Delay Costs	2014	2014	2015
Cause Specific User Delay Costs	2014	2015	2016
Event Specific User Delay Costs	2015	2016	2016
Performance Goal Setting	2016	2016	2016

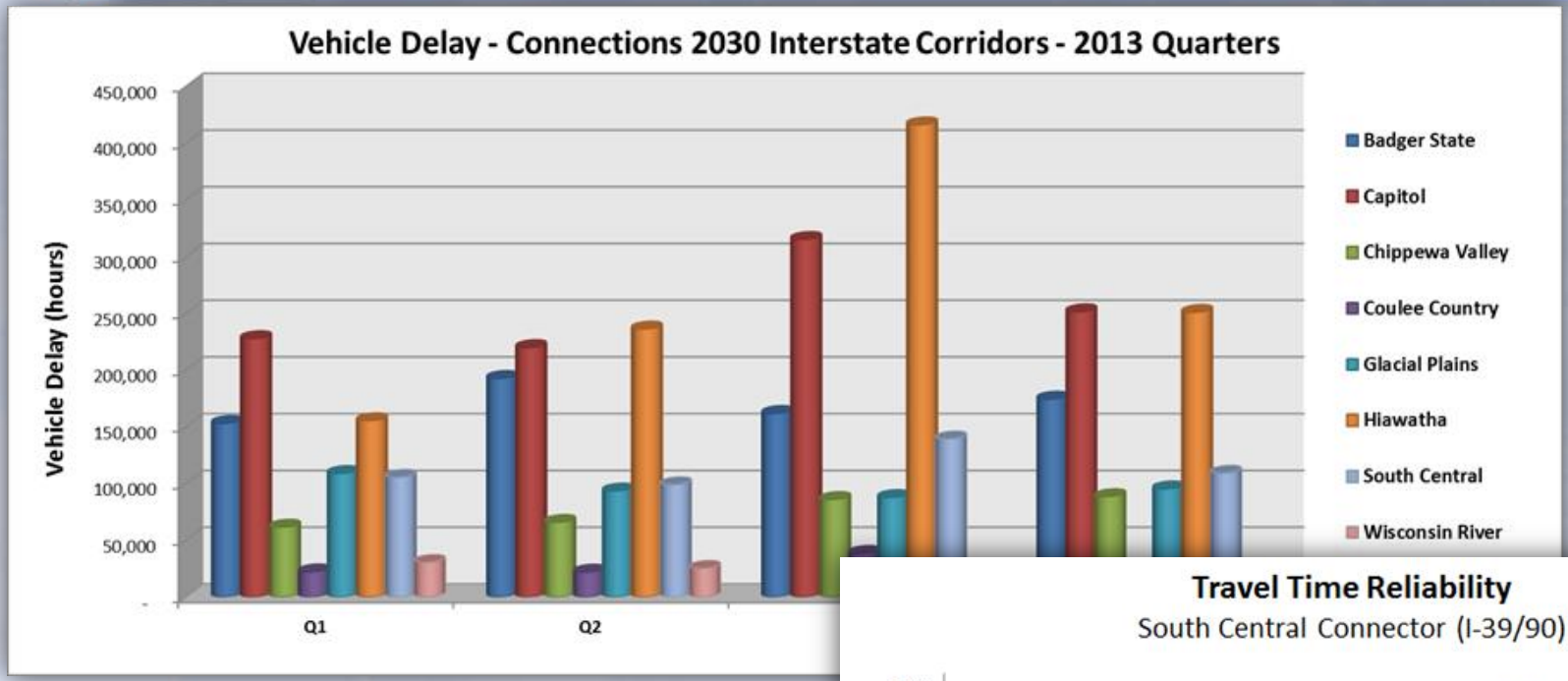
Mobility Performance Measures Development

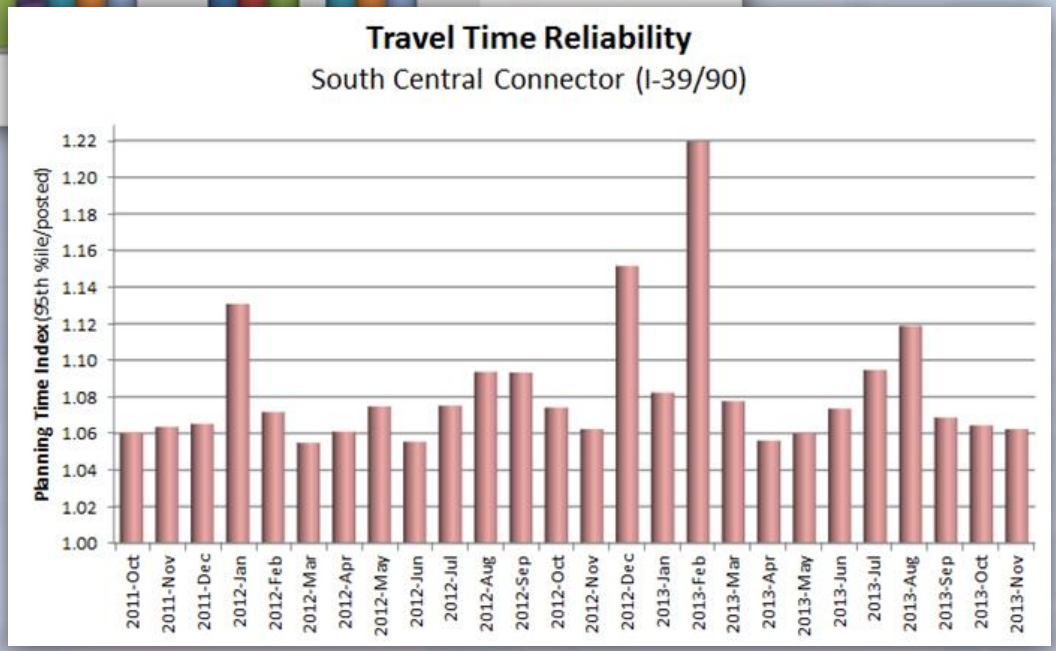
	NPMRDS-Based Travel Time Source Information	Dynaflow-Based Travel Time Source Information
2013 Delay Mobility Measure	Annual Hours of Delay (AHD) - Travel time above a congestion threshold (defined as speed limit) in units of vehicle-hours of delay on a corridor	
2013 Reliability Mobility Measure	Planning Time Index (PTI_{95}) – The ratio of the 95th percentile travel time to the agency-determined threshold travel time (travel time at posted speed limit)	
Volume Source	TRADAS (Fixed ATR Locations)	VSPOC
Limits	All 9 Major Backbone Corridors	Capitol Corridor (Badger to Zoo I/C)
Delay Methodology	Calculated for each TMC segment in 5 minute intervals: Hours of Vehicle Delay = (NPMRDS – travel time at posted speed limit) x ATR volume	Calculated for each TMC (traffic message channel) segment in 5 minute intervals: Hours of Vehicle Delay = (Dynaflow travel time – travel time at posted speed limit) x V-SPOC volume
Reliability Methodology	Calculated by taking each 5-minute interval route travel time and choosing the 95th percentile: Planning Time Index = (95th percentile travel time) / (corridor travel time at posted speed limit)	

Mobility Performance Measures Development



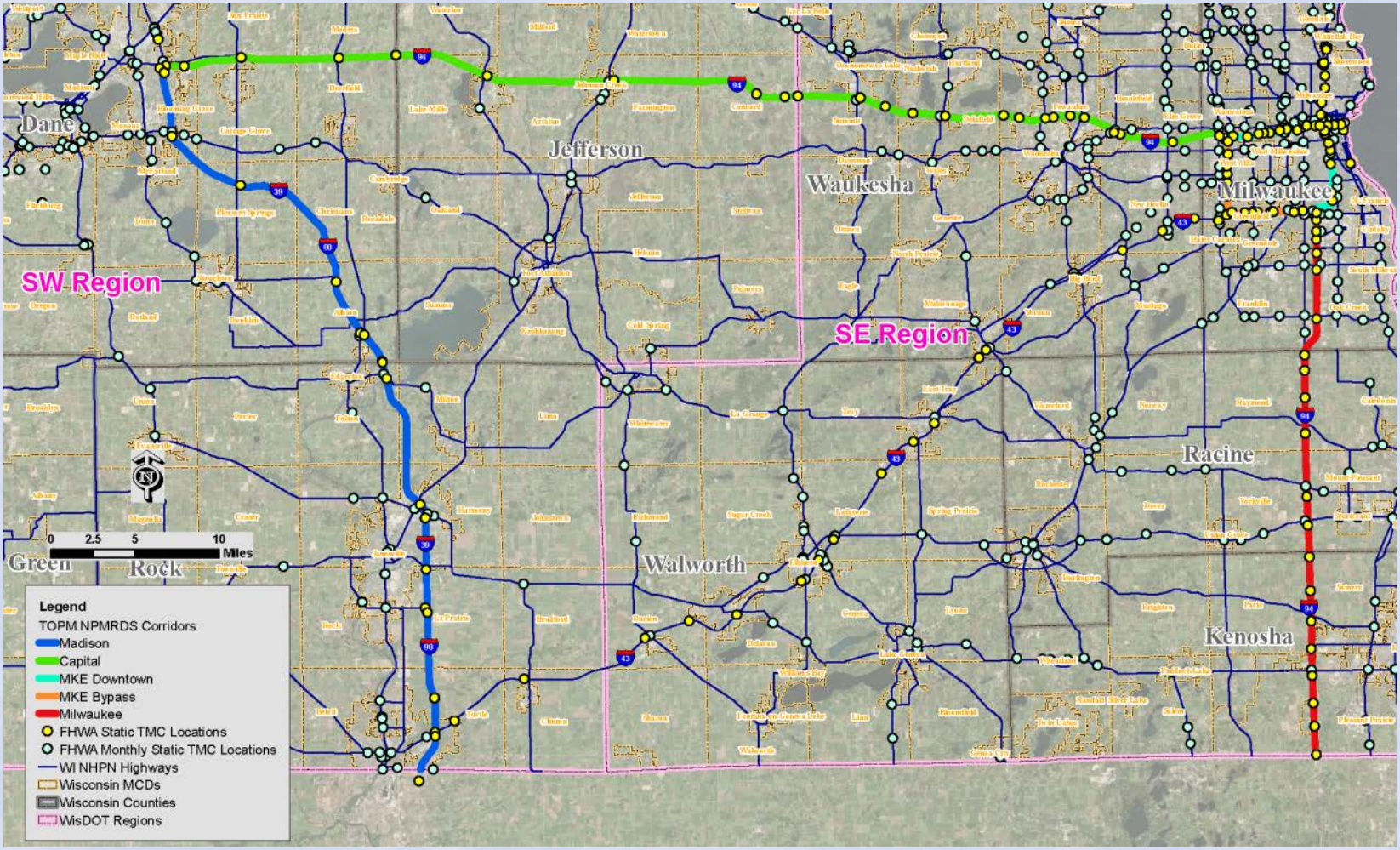
Mobility Performance Measures Development





Performance Measure Development

Pilot Area Corridor & TMC Map



Travel time Delay – Detail Background

- Performance Measures Summary is the Quarterly aggregate of travel time/volume calculation every five minutes as explained below: 662,400 total measurements
- This framework enables calculation of Average Delays for user-defined time periods, such as “last month,” “last storm event,” etc.

Ref ID of Data Calc in Sequence	ID # of Route. In this case = MKE > MSN (East > West)	Map link identifier in TMC protocol. Total of 51 TMC links on route.	Number from 0-287 = 5 minute intervals for 24 hours (60/5 x 24)	Number from 0-364: one number fo each day of year	Number from 0-11: for each month of year	Number from 0-6: for each day of week	Dynaflow Speed for time interval, in MPH	Travel time @ DF speed calculated for known length of TMC link	Posted Speed Limit in MPH (assumed to be "free flow" speed)	Travel time @ Speed Limit calculated for known length of TMC link	Difference between Actual Travel time vs. Free Flow Travel Time, in Seconds	Vehicle count for 5 minute interval from V-SPOC TRADAS	interval/TMC Link, in seconds, calcualated by multiplying Delta travel time by Volume. (Negative numbers indicate speeds > speed limit)
DataPoint	**route_id**	**tmc**	**timeofday**	**dayofyear**	**month**	**dayofweek**	**speed**	**traveltime**	**speed_limit**	**speedlimit_traveltime**	**delta**	**volume**	**delayInSecond**
1	3	107P04748	0	273	9	2	65	48	65	48	0	29	0
2	3	107P04747	0	273	9	2	64	51	65	51	0	29	0
3	3	107P04746	0	273	9	2	65	104	65	104	0	27	0
4	3	107P04745	0	273	9	2	65	44	65	44	0	27	0
662397	3	107P04675	287	364	11	2	66	324	65	329	-5	4	-20
662398	3	107P05404	287	364	11	2	66	44	65	45	-1	14	-14
662399	3	107P04676	287	364	11	2	64	205	65	202	3	3	9
662400	3	107P05403	287	364	11	2	67	9	65	9	0	14	0

Seconds of delay =	**313,570,732**
Minutes of delay =	**5,226,179**
Hours of delay =	**87,103**

2013 Dynaflow-Based Performance Measure Results

Capitol Corridor Total Hours of Vehicle Delay

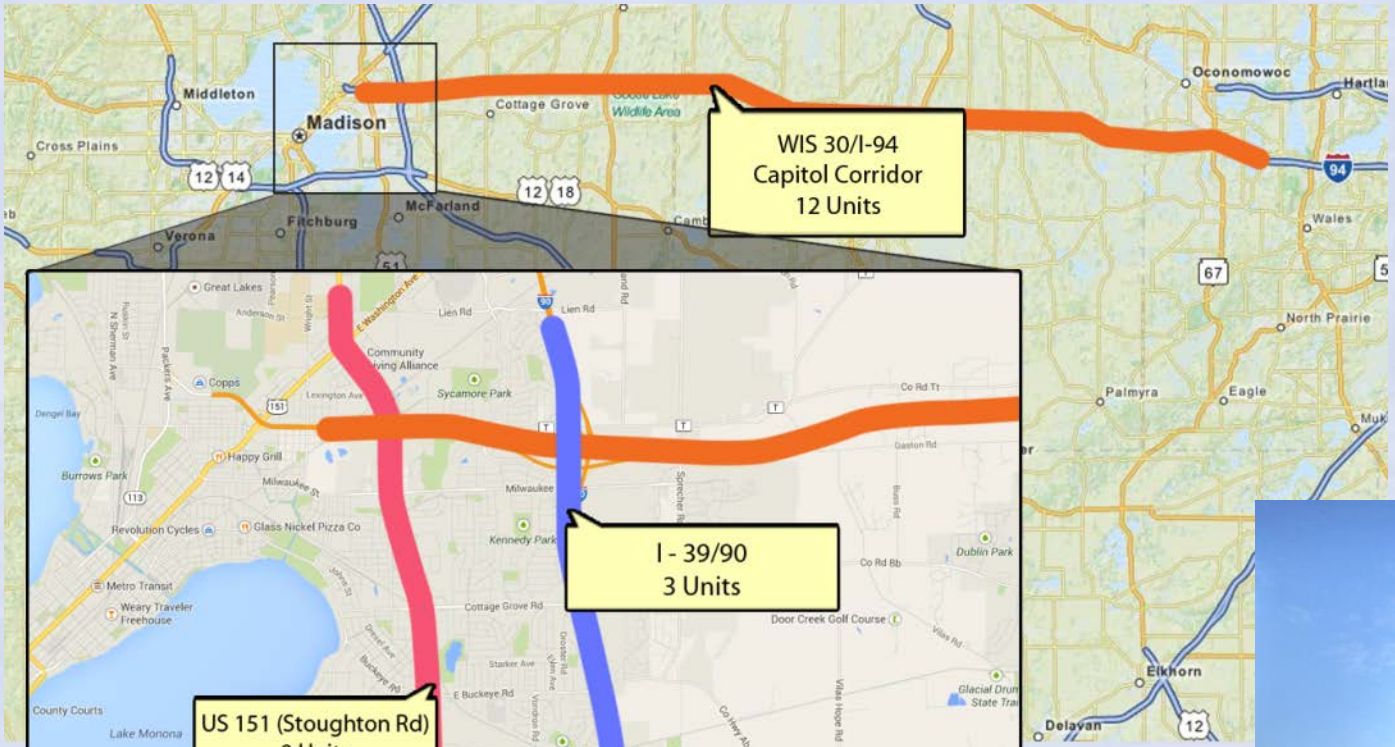
Route	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
WB - Milwaukee to Madison	133,013	100,340	101,126	**87,104**	421,583
EB - Madison to Milwaukee	137,874	158,164	192,075	154,832	642,945
EB & WB (Cumulative)	**270,887**	**258,504**	**293,201**	**241,936**	**1,064,528**

Capitol Corridor Planning Time Index (PTI_{95})

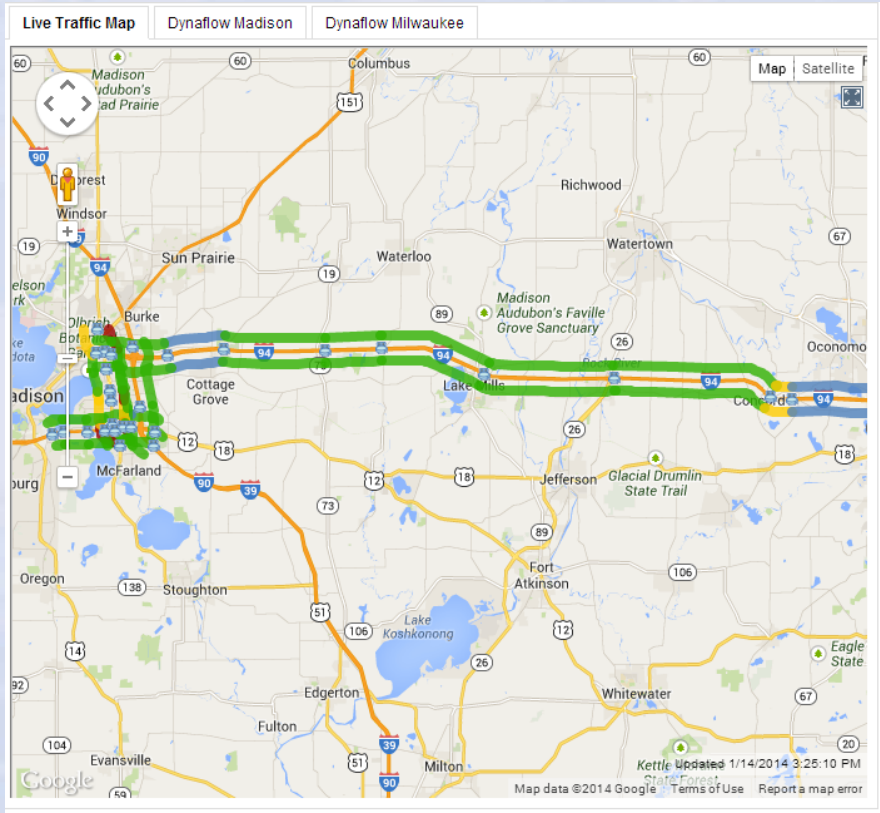
Route	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
WB - Milwaukee to Madison	1.08	1.03	1.03	1.03	1.04
EB - Madison to Milwaukee	1.08	1.06	1.08	1.08	1.08
EB & WB (Averaged)	**1.08**	**1.05**	**1.06**	**1.06**	**1.06**

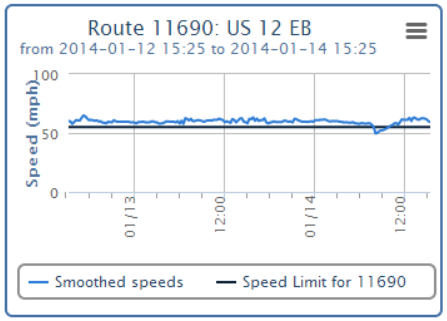
Note: These results are for the Capitol Corridor ranging from the Badger Interchange in Madison to the Zoo Interchange in Milwaukee

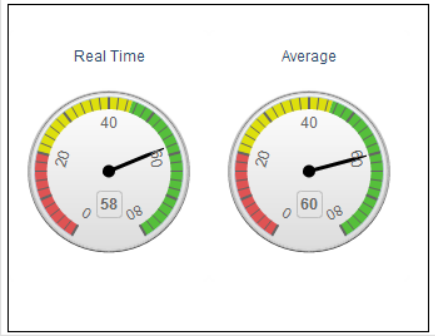
Bluetooth Implementation Status

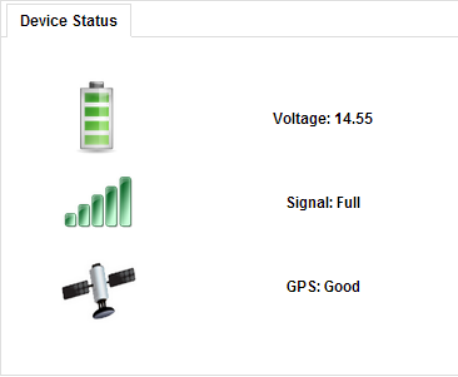


Performance Measure Dashboard Development Status

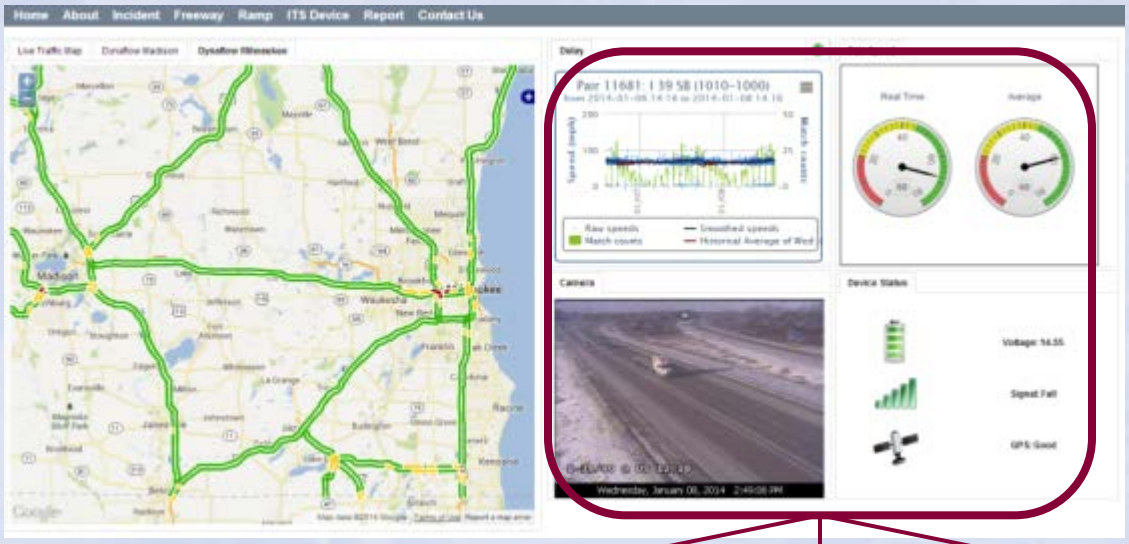


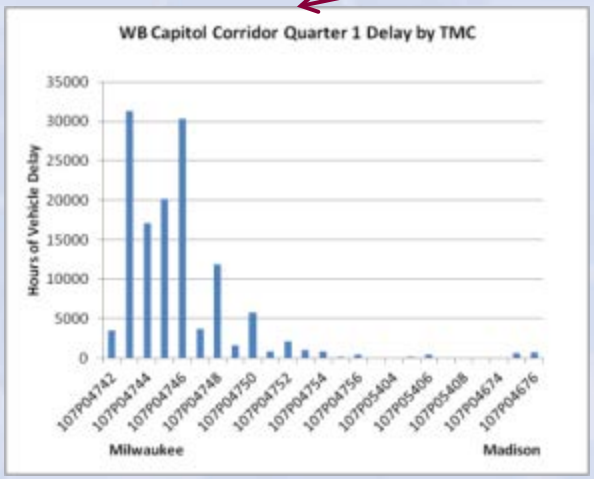






Performance Measure Dashboard Development Status





Questions/Next Steps

1. Refine Mobility Performance Measures / Support WisDOT Institutionalization
2. Complete Bluetooth Detector Installations
3. Integrate Strawman User Interface/ Visualization Requirements in TrafficCaster for:
   - Mobility Performance Measures
   - Work Zones
4. Next Advisory Group Meeting – July/August