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

Advisory Group Meeting-November 10, 2014
Project Approach

• **3-Phase, 3-Year Project to Design and Build TOPMS**
  - Phase 1 – Planning/Design, Conceptual and Investigative Prototype
  - Phase 2 – Prototype Refinement, Geographic Expansion and Interim Evaluation
  - Phase 3 – Statewide TOPMS and Evaluation

• **Phase 1 Providers**
  - Cambridge Systematics - National and International TOPMS Expertise
  - TranSmart with partner TrafficCast - Wisconsin based Technology Companies with products to support project
  - TOPS Laboratory - Traffic Data Assessment, Peer Exchange Coordination, Project Team Coordination
WisDOT Traffic Ops Web Resources

- TOPMS Project Site – www.topslab.wisc.edu/its/topms
Wisconsin DOT Traffic Operations Performance Management System (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 traffic operations, safety, and intelligent transportation systems (ITS) data, archiving, and real-time services for Wisconsin highways. Because of its prominent role in this performance management project, unfamiliar readers are encouraged to first familiarize themselves with some basics about the WisTransPortal by starting here: About WisTransPortal.

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

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

Data Source Inventory and Information – www.topslab.wisc.edu/its/topms/data
WisDOT Traffic Ops Web Resources

• Online Mapping Resources -
  www.topslab.wisc.edu/its/topms/map
BEST PRACTICES REVIEW
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

MDOT
Illinois Tollway
Department of Transportation
FDOT
FAST
BUREAU OF TRAFFIC OPERATIONS
Best Practices

• Las Vegas RTC FAST System
  – Partnership of Regional Transportation Commission and Nevada DOT
  – NDOT owns facilities and RTC operates under joint funding agreement
  – Operates Freeway and Arterial systems in coordinated fashion
  – Member communities serve on policy and operating committees
• Performance measures are being used for performance management and operational improvements
  – Michigan DOT Data Use and Processing (DUAP) Project
    • Provides real time mobile data on weather, pavement conditions, speeds
    • Potential to replace legacy data collection programs at lower cost
  – Florida DOT
    • Breakdown of incident response components (detection, clearance)
    • Comparisons allow areas for improvement to be identified
  – Utah DOT
    • Use reliability measures to develop targeted, targeted traveler information messages during adverse weather
• Some are waiting on MAP-21 rule making outcomes
Florida DOT

- Incident Management Component Breakdown
  - Compare District performance and identify areas for improvement
• Some Opportunities Identified
  – Improve efficiency of data collection and processing by exchanging data between bureaus
  – Groups working together to provide data in multiple formats
  – Exchange of data with other agencies for system operations
    • Variety of DOT internal functions (traffic data, asset management, construction)
    • Traffic management (real-time speed control, peak shoulder running, managing diversion routes, weather-related management, parking management)
    • Deployment of maintenance resources and contracting strategies
    • Commercial vehicle permit routing
ORGANIZATIONAL MAPPING
Based on Objectives and Actions Identified in BTO Strategic Plan (STOPP Report)

- Goals, objectives and strategies from STOPP Report were documented
- Interviews used to identify needs
- Measures identified for evaluating progress of meeting plan objectives
- Identified where performance measures can be used as feedback to meet needs and improve process/performance
- Barriers identified in both SWOT analysis and organizational mapping
5 Priority Opportunities

• MAP-21 Report Generation
• *Work Zone Analysis Tool*
• Measurement of Incident Response Time Components
• Measurement of Diversion Route Impacts
• Life Cycle Cost Analysis for Field Equipment
## Feedback Opportunities

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

- Key objectives
  - Reduce work zone delay
  - Reduce impact on overall system
  - Enhance safety of both workers and traveling public
  - Optimize allowable work hours

- Functions that can be enhanced through feedback
  - Work zone review
  - Construction
  - Traffic management/detours
  - Incident management resource deployment
MOBILITY PERFORMANCE MEASURES
Intended performance measures

<table>
<thead>
<tr>
<th>Performance Measures</th>
<th>Pilot Area</th>
<th>Phase 2 Area</th>
<th>Phase 3 Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate User Delay Hours</td>
<td>2013</td>
<td>2014</td>
<td>2014</td>
</tr>
<tr>
<td>Aggregate User Delay Costs</td>
<td>2014</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>Cause Specific User Delay Costs</td>
<td>2014</td>
<td>2015</td>
<td>2016</td>
</tr>
<tr>
<td>Event Specific Delay Costs</td>
<td>2015</td>
<td>2016</td>
<td>2016</td>
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<tr>
<td>Performance Goal Setting</td>
<td>2016</td>
<td>2016</td>
<td>2016</td>
</tr>
</tbody>
</table>

Bluetooth for alternate route travel behavior
Mobility Performance Measures

• MAP-21 Requirements
  – Rule making this year

• Reliability
  – Many ways to measure
  – Widespread travel time data (i.e., probe data)
  – See graphic on next slide

• Delay
  – Vehicle delay, user delay, user delay cost
  – Travel time data plus volume data (i.e., TRADAS)
Mobility Performance Measures

- Measuring Reliability...

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>CALCULATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Time Index* (PTI)</td>
<td>$\frac{95\text{th Percentile of } TT}{\text{Free Flow } TT}$</td>
<td>The extra time required to arrive at a destination “on time” 95 percent of the time. Can be calculated for trips, corridors, or segments. <strong>The PTI is the recommended measure because it gives intuitive and consistent results.</strong></td>
</tr>
</tbody>
</table>
• National Performance Management Research Data Set (NPMRDS)
  – Made freely available to states as of October 2013
  – Probe data for complete National Highway System
  – By short segments (TMC), in 5-minute bins
Mobility Performance Measures

- MAPSS Mobility Measures – Process
Mobility Performance Measures

- MAPSS Mobility Measures – Reporting

http://www.dot.wi.gov/about/performance/goalmobility.htm
VISUALIZATION STRAWMAN
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
Work Zone Tool Data Flow

Road Segment Characteristics
- Lanes
- Time period
- Posted speed
- Location
- Environment (urban or rural)

Calculate Base Delay & Base Travel Time Index

Calculate Additional Delay from Work Zone
- Impacted Route
- Diversion Routes

Test assumptions about work zone characteristics and delay

V-SPOC TRADAS NPMRDS
Travel Characteristics
- Speed
- Volumes
- Travel Time

Contract Docs TMP LCS

Work Zone Characteristics
- Lanes Closed
- Closure Hours (daily)
- Length of Closure

Radius Diversion Route Model

Evaluate delay thresholds and implement changes

Compare delay with other work zones

Measured Delay
- Main Route
- Diversion Routes

Meta Manager

Bluetooth

Work Zone Database
<table>
<thead>
<tr>
<th>Project ID</th>
<th>Name</th>
<th>Start Date</th>
<th>End Date</th>
<th>Route ID</th>
<th>Fr Measure</th>
<th>To Measure</th>
<th>Estimated Delay</th>
<th>Actual Delay</th>
<th>Estimated Index</th>
<th>Actual Index</th>
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<tbody>
<tr>
<td>1206-07-78</td>
<td>US 18 I/C Modification</td>
<td>5/1/2013</td>
<td>10/31/2013</td>
<td>US 18</td>
<td>10.3</td>
<td>10.8</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
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<tr>
<td>1206-04-51</td>
<td>US 12 Yahara River Bridge</td>
<td>6/1/2013</td>
<td>6/30/2013</td>
<td>US 12</td>
<td>15.3</td>
<td>15.8</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
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<tr>
<td>1206-01-54</td>
<td>US 21 / Fish Hatchery Rd I/C</td>
<td>7/1/2013</td>
<td>7/9/2014</td>
<td>US 12</td>
<td>7.2</td>
<td>7.6</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
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<tr>
<td>1066-33-77</td>
<td>I 894 / S 59th St I/C</td>
<td>3/27/2013</td>
<td>12/1/2014</td>
<td>I 894</td>
<td>17.1</td>
<td>17.4</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>
DASHBOARD DEVELOPMENT
Interactive Location Maps; Live Maps (Bluetooth and Dynaflow)

Customizable Bins tied to interactive links on location map
• 52 total devices deployed in Madison, Milwaukee, and on the Capitol Corridor

• Key contribution in Rapid Response for Data Coverage of 54 hour closure of I-94 at Zoo Interchange weekend of July 18, 2014
Dashboard Development (Rapid Redeployment of Devices)

- 11 Units relocated (8/28) and reporting within 24 hour period
- Key contribution to performance measure documentation along Wis 50
• Real time traffic data via GPS probe data sources

• Micro and Macro view of areas.
Capitol Corridor Performance Measures with Dynaflow:

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

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)
Dashboard Development – Arterial Analysis (WIS 50)

Travel Time & Performance Measures Evaluation with BlueTOAD/BlueARGUS

AWIS 50 Travel Time and Performance Measure Evaluation Results

Kenosha County Between I-94 and 43rd Avenue

Summary Excerpts from report

Total Hours of Vehicle Delay and User Delay Cost, 9/30/14 to 10/6/14

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Total Hours of Vehicle Delay</th>
<th>Passenger Delay Cost</th>
<th>Freight Delay Cost</th>
<th>Total User Delay Cost</th>
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<tbody>
<tr>
<td>7-Day Data Collection Period</td>
<td>5438</td>
<td>$162,611</td>
<td>$11,384</td>
<td>$173,995</td>
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<tr>
<td>Weekday AM Peak (6am - 9am)</td>
<td>295</td>
<td>$8,818</td>
<td>$611</td>
<td>$9,429</td>
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<tr>
<td>Weekday PM Peak (3pm - 6pm)</td>
<td>1193</td>
<td>$35,704</td>
<td>$2,479</td>
<td>$38,182</td>
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</tbody>
</table>

Travel Reliability Results, 9/30/14 to 10/6/14

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Reliability Index</th>
<th>95th Percentile Travel Time</th>
<th>Travel Time during 'light' or low flow traffic conditions (min)</th>
<th>Speed at 95th Percentile Travel Time (mph)</th>
<th>Average Speed during 'light' or low flow traffic conditions (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EB</td>
<td>WB</td>
<td>EB</td>
<td>WB</td>
<td>EB</td>
</tr>
<tr>
<td>7-Day Data Collection Period</td>
<td>1.18</td>
<td>1.38</td>
<td>10.02</td>
<td>9.53</td>
<td>8.46</td>
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<tr>
<td>Weekday AM Peak (6am - 9am)</td>
<td>1.09</td>
<td>1.16</td>
<td>9.18</td>
<td>7.99</td>
<td>8.46</td>
</tr>
<tr>
<td>Weekday PM Peak (3pm - 6pm)</td>
<td>1.26</td>
<td>1.39</td>
<td>10.70</td>
<td>9.60</td>
<td>8.46</td>
</tr>
</tbody>
</table>
Menu can be expanded and customized to allow a user to focus on their data and analysis needs.
Dashboard Development – Current Menu Choices

Prototype Menu Choices:

- Dashboard with Bluetooth or Dynaflow speed map
- Work Zone Tool
- 54-hr Zoo Interchange Freeway Closure
- Link to WI 511 website
- Link to Madison traffic camera website

<table>
<thead>
<tr>
<th>Dashboard</th>
<th>Work Zone Tool</th>
<th>54-Hour Closure</th>
<th>511 WI</th>
<th>Madison Traffic Cam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live Traffic Map</td>
<td>Dynaflow Madison</td>
<td>Dynaflow Milwaukee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dashboard Development – Work Zone Module

Work zone tool module with schematic and analysis bins
Work zone tool module with additional analysis bins

- Example of swapping out data elements for graphical content and camera images in Work Zone Module
• 54 hour Zoo Interchange full freeway closure tab (7/18 – 7/20)

• Units/Closure tab operational within less then 72 hours
Outside public sources provide powerful plug-and-play solutions and possible future partnership/resource sharing opportunities:

- Madison Traffic Cameras: [https://cameras.cityofmadison.com](https://cameras.cityofmadison.com)
- WisDOT MAPSS Performance Improvement Program: [http://www.dot.state.wi.us/about/performance/](http://www.dot.state.wi.us/about/performance/)
- WisTransportal: [http://transportal.cee.wisc.edu/](http://transportal.cee.wisc.edu/)
Dashboard Development - Interactive Map & Links

Interacting with links will populate bins with relevant data and analysis

Live Demo
Bins allow information to be displayed in an easy to view form.

Types of data to display:
* Real-Time
* Historical
* Internal
Supplement mobility performance measures and provide operations tools

- Traveler information
- Support federal work zone safety and mobility rule
- Work zone safety
- Work zone management program area objectives to monitor work zones and create partnerships with regional & statewide bureau functions
- Contribute to consistent project mitigation efforts
Develop a tool specific to WisDOT stakeholder needs that measures and reports work zone conditions in terms of delay and/or reliability. The recommended direction is towards real time performance of work zones as they are impacted by weather, incidents, special events and recurrent congestion.

CONCLUDING REMARKS, QUESTIONS, AND NEXT STEPS
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