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
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

<table>
<thead>
<tr>
<th>TASK</th>
<th>STATUS</th>
</tr>
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<tbody>
<tr>
<td>WisDOT Traffic Operations Data Inventory</td>
<td>Complete</td>
</tr>
<tr>
<td>Regional and National Webinars</td>
<td>Complete</td>
</tr>
<tr>
<td>“State of the Art” Investigation/“State of the Practice” Evaluation</td>
<td>Complete</td>
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<tr>
<td>Organizational Mapping</td>
<td>95%</td>
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<tr>
<td></td>
<td>Final report pending</td>
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<tr>
<td>Strawman User Interface &amp; Visualization Development</td>
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<tr>
<td>Mobility Performance Measures</td>
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<tr>
<td>Investigative Prototype Design &amp; Deployment</td>
<td>Madison (30 of 40)</td>
</tr>
<tr>
<td></td>
<td>Milwaukee (Spring)</td>
</tr>
<tr>
<td></td>
<td>Complete</td>
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<tr>
<td></td>
<td>40%</td>
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</table>
WisDOT Traffic Ops Web Resources

- TOPMS Project Site - [www.topslab.wisc.edu/its/topms](http://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
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 traffic operations, safety, and intelligent transportation systems (ITS) data, archiving, and real-time for Wisconsin highways. Because of its prominent role in this performance management process, 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 in 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.
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
• 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)
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 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

<table>
<thead>
<tr>
<th>Objectives (in gray) and Actions (in white)</th>
<th>Measures of Effectiveness</th>
<th>Existing Data Source</th>
<th>New Data Source</th>
<th>Feedback Opportunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Consistently Utilize Traffic Management Tools to Reduce Delay and Promote Safety in Work Zones</td>
<td>Documentation of tools listed</td>
<td>Delay:</td>
<td>Bluetooth data on both work zone routes and alternate routes</td>
<td>Utilize user delay data to refine work zone and lane closure guidelines</td>
</tr>
<tr>
<td>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)</td>
<td></td>
<td>• FHWA HERE probe data</td>
<td>• Bluetooth data on both work zone routes and alternate routes</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• TranSuite detector data</td>
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<td></td>
<td></td>
<td>• V-SPOC</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Work zone detector data</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Volume:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• TRADAS</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• V-SPOC</td>
<td></td>
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<tr>
<td></td>
<td>Travel times:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• FHWA HERE probe data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Wis511XML feed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lane Closure System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Management Action</td>
<td>Primary Function Involved</td>
<td>Other BTO Function(s) Involved</td>
<td>Other DOT Functions</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
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<td></td>
</tr>
<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>
<td></td>
</tr>
<tr>
<td>• Feedback findings to traffic management plan development and general planning of construction activity</td>
<td></td>
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</tr>
</tbody>
</table>

Summary Table of Feedback Opportunities – Work Zone Review Function
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
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
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
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
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

#### Wisconsin Department of Transportation
**Workzones**

**Map**

- **Workzones**
  - **Attributes**
    - **Temporal**
      - Start Date: 01/1/2012
      - End Date: 03/30/2012
      - Daily Period: AM Peak
    - **Alignment**
      - Route: RI 53
    - **Locality**
      - County: Portage
      - Urban/Rural: Rural
    - **Upstream Taper**
      - Length: 850
    - **Closed Lanes**: 1
  - **Comments**
    - Resurfacing of outside lane

#### Workzones Table

<table>
<thead>
<tr>
<th>Workzone 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>123</td>
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</table>
Visualization Strawman Options – Work Zone Tool
Visualization Strawman Options – Work Zone Tool
Mobility Performance Measures Development

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

### Performance Measures

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Pilot Area</th>
<th>Phase 2 Area</th>
<th>Phase 3 Area</th>
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</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>Performance Goal Setting</td>
<td>2016</td>
<td>2016</td>
<td>2016</td>
</tr>
</tbody>
</table>

### Reliability Measures

- Planning time = 227 minutes
- Planning time index = $227 / 115 = 1.97$
- Buffer index = $(227-150) / 150 = 5.13$

- State Route 536 Eastbound, weekdays from 4 to 7 pm
## Mobility Performance Measures Development

<table>
<thead>
<tr>
<th></th>
<th>NPMRDS-Based Travel Time Source Information</th>
<th>Dynaflow-Based Travel Time Source Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2013 Delay Mobility Measure</strong></td>
<td>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</td>
<td></td>
</tr>
<tr>
<td><strong>2013 Reliability Mobility Measure</strong></td>
<td>Planning Time Index ($\text{PTI}_{95}$) – The ratio of the 95th percentile travel time to the agency-determined threshold travel time (travel time at posted speed limit)</td>
<td></td>
</tr>
<tr>
<td><strong>Volume Source</strong></td>
<td>TRADAS (Fixed ATR Locations)</td>
<td>VSPOC</td>
</tr>
<tr>
<td><strong>Limits</strong></td>
<td>All 9 Major Backbone Corridors</td>
<td>Capitol Corridor (Badger to Zoo I/C)</td>
</tr>
<tr>
<td><strong>Delay Methodology</strong></td>
<td>Calculated for each TMC segment in 5 minute intervals: Hours of Vehicle Delay = (NPMRDS – travel time at posted speed limit) x ATR volume</td>
<td>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</td>
</tr>
<tr>
<td><strong>Reliability Methodology</strong></td>
<td>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)</td>
<td></td>
</tr>
</tbody>
</table>
Mobility Performance Measures Development

Vehicle Delay - Connections 2030 Interstate Corridors - 2013 Quarters

Travel Time Reliability
South Central Connector (I-39/90)
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.

<table>
<thead>
<tr>
<th>DataPoint</th>
<th>route_id</th>
<th>tmc</th>
<th>timeofday</th>
<th>dayofyear</th>
<th>month</th>
<th>dayofweek</th>
<th>speed</th>
<th>traveltime</th>
<th>speedlimit</th>
<th>delta</th>
<th>volume</th>
<th>delayInSecond</th>
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<tbody>
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<td>1</td>
<td>3107P04748</td>
<td>0</td>
<td>273</td>
<td>9</td>
<td>2</td>
<td>65</td>
<td>48</td>
<td>65</td>
<td>48</td>
<td>0</td>
<td>29</td>
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<td>273</td>
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<td>65</td>
<td>9</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

Seconds of delay = 313,570,732
Minutes of delay = 5,226,179
Hours of delay = 87,103
### Capitol Corridor Total Hours of Vehicle Delay

<table>
<thead>
<tr>
<th>Route</th>
<th>Quarter 1</th>
<th>Quarter 2</th>
<th>Quarter 3</th>
<th>Quarter 4</th>
<th>Annual</th>
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</thead>
<tbody>
<tr>
<td>WB - Milwaukee to Madison</td>
<td>133,013</td>
<td>100,340</td>
<td>101,126</td>
<td><strong>87,104</strong></td>
<td>421,583</td>
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<tr>
<td>EB - Madison to Milwaukee</td>
<td>137,874</td>
<td>158,164</td>
<td>192,075</td>
<td>154,832</td>
<td>642,945</td>
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<tr>
<td>EB &amp; WB (Cumulative)</td>
<td>270,887</td>
<td>258,504</td>
<td>293,201</td>
<td>241,936</td>
<td><strong>1,064,528</strong></td>
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</tbody>
</table>

### Capitol Corridor Planning Time Index (PTI_{95})

<table>
<thead>
<tr>
<th>Route</th>
<th>Quarter 1</th>
<th>Quarter 2</th>
<th>Quarter 3</th>
<th>Quarter 4</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB - Milwaukee to Madison</td>
<td>1.08</td>
<td>1.03</td>
<td>1.03</td>
<td>1.03</td>
<td>1.04</td>
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<td>EB - Madison to Milwaukee</td>
<td>1.08</td>
<td>1.06</td>
<td>1.08</td>
<td>1.08</td>
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<tr>
<td>EB &amp; WB (Averaged)</td>
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<td><strong>1.05</strong></td>
<td><strong>1.06</strong></td>
<td><strong>1.06</strong></td>
<td><strong>1.06</strong></td>
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</tbody>
</table>

Note: These results are for the Capitol Corridor ranging from the Badger Interchange in Madison to the Zoo Interchange in Milwaukee.
Performance Measure Dashboard Development Status
Performance Measure Dashboard Development Status

- Map of the area
- Delay chart for Milwaukee and Madison
- Delay by time of day chart
- Delay by day of week chart

Graphs show traffic delay data for the Capitol Corridor Quarter 1.

- Hours of vehicle delay by TMC
- Hours of vehicle delay by time of day
- Hours of vehicle delay by day of week

Charts display detailed traffic analysis for performance measures.
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