Use of TMC Data for Performance Measurement and Improving Operations

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Presentation Outline

• Motivations
• Performance Measures
  – TMC Operations
  – Incident Management
  – System Mobility
• Data and Trends
• Guiding Principles
Motivations

• Legislative mandates
• Agency wide performance initiatives
• Formal business linkage – particularly for operations
  – Use performance reporting to improve agency cooperation, or employee actions
  – Plan future investments / resource allocation
• Quantification of benefits
  – To assist in defense of program funding
  – To assist in competition for additional funding with infrastructure projects
Practitioner Survey Results

• Initial reporting activities
  – Description of activities being performed
    • Number of incidents responded to by size of incident
    • Number of DMS messages posted
  – Size and operational condition of equipment/staff
    • Number of devices / staff
    • Number of operating devices / staff on duty
Practitioner Survey Results

• Second level TMC reporting activities
  – Detailed quantification of activities being performed, e.g.,
    • Detailed incident descriptives for trend reporting
      – Log of incident types, timestamps, actions taken
      – Number of incidents lasting more than 90 minutes
      – Time required to post DMS messages
    • Size and operational condition of equipment/staff
      – Time required to repair equipment
Practitioner Survey Results

• Second Level Reporting - Mobility Data
  – Volumes, delays, reliability
    • Reported as travel times, congestion by location, revenue (HOT lanes), severe weather response
  – Most TMCs are reporting current conditions
  – Not all TMCs are actively summarizing roadway performance data for analysis
  – Increasing use of private sector probe data
  – Still need agency collected volume data
Practitioner Survey Results

• Third Level Reporting: advanced TMCs are actively working on improved reporting of
  – Cause and effect of disruptions
  – Responses to those disruptions
  – The effect / effectiveness of those responses

• Activities
  – “After action” reports and summaries for improving agency response and interaction
  – Before and after reports on conditions after new activities are undertaken
  – Benefits analyses for programs
Practitioner Survey Results

• Performance reporting growth
  – What we are doing?
  – How well are we doing those activities?
  – What is happening on the roadway?
  – How what we are doing effects what is happening on the roadway?
TMC Operations

• Focus on statistics regarding TMC operations activities and assets
• Basic performance measures are divided into three categories:
  – ITS Infrastructure and Traveler Information Services
  – TMC Operational Activities and Responsibilities
  – TMC Staff Performance
TMC Operations: ITS Infrastructure / Traveler Info Services

- Number of Devices
  
<table>
<thead>
<tr>
<th>FIELD EQUIPMENT</th>
<th>CAMERAS</th>
<th>DETECTORS</th>
<th>DMS</th>
<th>PCMS</th>
<th>HAR</th>
<th>RAMP METERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices as of Dec. 31, 2011</td>
<td>210</td>
<td>247</td>
<td>62</td>
<td>195</td>
<td>13</td>
<td>141</td>
</tr>
<tr>
<td>Percent Expansion</td>
<td>11%</td>
<td>7%</td>
<td>17%</td>
<td>10%</td>
<td>0%</td>
<td>2%</td>
</tr>
</tbody>
</table>

- Coverage
  - Miles covered
  - AADT exposed to DMS

TMC Operations: ITS Infrastructure / Traveler Info Services (Contd.)

• Usage
  – Number of times equipment was used by TMC staff
  – Number of times traveler information services were used/viewed by the public

Phone/web traffic information
***Calendar year-to-date 2012

Number of 511 calls and 511 web hits

896,913***
Increase the use of the 511 travel information system annually

For the first half of 2012, the Department logged 99,632 calls and 797,281 web hits.

Source: RIDOT Traffic Management Center Incident Statistics (4/1/12 to 6/30/12)
Source: WisDOT July 2012 MAPSS Performance Dashboard Report
TMC Operations: ITS Infrastructure / Traveler Info Services (Contd.)

• Device Availability/Maintenance Activities
  – Average Device Availability
  – Number of repairs/trouble tickets by device type

Average Device Availability

<table>
<thead>
<tr>
<th>Device Type</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTV</td>
<td>93%</td>
<td>89%</td>
</tr>
<tr>
<td>DMS</td>
<td>83%</td>
<td>81%</td>
</tr>
<tr>
<td>GATES</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>HAR</td>
<td>88%</td>
<td>99%</td>
</tr>
</tbody>
</table>

Source: VDOT Hampton Roads Transportation Operations Center 2011 Annual Report
TMC Operations: TMC Activities / Responsibilities

- Number of Calls Received
- Number of Incidents Managed/Responded To
- Detection Source/How Notified

Source: Houston TranStar 2010 Annual Report
TMC Operations: TMC Staff Performance

- Staff Performance Targets
- Staff Retention and Turnover Rates

<table>
<thead>
<tr>
<th>Performance Measures</th>
<th>FY 09-10 Average</th>
<th>FY 10-11 Average</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMS Efficiency</td>
<td>99.72%</td>
<td>99.82%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>TMC Operator Error Rate</td>
<td>0.43%</td>
<td>0.32%</td>
<td>&lt;0.69%</td>
</tr>
<tr>
<td>Time to Dispatch Road Rangers</td>
<td>00:01:05</td>
<td>00:00:56</td>
<td>&lt;00:02:00</td>
</tr>
<tr>
<td>Time to Confirm an Event*</td>
<td>00:00:23</td>
<td>00:01:31</td>
<td>&lt;00:02:00</td>
</tr>
<tr>
<td>Time to Post DMS</td>
<td>00:03:17</td>
<td>00:02:47</td>
<td>&lt;00:05:00</td>
</tr>
<tr>
<td>Time to Notify Other Agencies</td>
<td>00:01:19</td>
<td>00:01:15</td>
<td>&lt;00:07:00</td>
</tr>
</tbody>
</table>

*Does not include events detected by Road Ranger

Source: FDOT District Six ITS Annual Report (Fiscal Year 2010-2011)
TMC Operations: Data Sources

- ATMS/TMC Equipment
- ATMS/TMC System Logs (i.e. TMC Operator Event Logs)
- DMS Operating Status and Message Log
- ITS Maintenance Logs
- Asset Management Systems
- 511/Web Site Travel Information System Usage Reports
Traffic Incident Management

• Basic performance measures are divided into three categories:
  – Traffic Incident Statistics
  – Incident Timeline
  – Safety Service Patrol Activities
Incident Management: Traffic Incident Statistics

• Number of Incidents, by:
  – Type or Severity
  – Location
  – Time of Day or Day of Week
  – Duration

• Many agencies have identified and are tracking specific incident characteristics based on agency priorities, such as number of incidents involving:
  – Tractor trailers/semis
  – Lane blockages
  – Rollovers
  – Secondary crashes
Incident Management: Incident Time
Incident Management: Incident Time (Contd.)

Statewide IR responses and average fatality collision clearance time
April 1, 2008 to June 30, 2011
Number of responses, clearance time in minutes

Data source: Washington Incident Tracking System (MITS), WSDOT Traffic Office

Source: MoDOT Tracker - Measures of Departmental Performance, July 2012
Incident Management: Full Function Service Patrol (FFSP)

- Number of assists/services provided, by:
  - Type
  - Location
  - Time of Day

- Response and clearance times

Source: VDOT Hampton Roads Transportation Operations Center 2011 Annual Report
Incident Management: Full Function Service Patrol (Contd.)

- Motorists feedback, typically obtained through comment cards, provides a qualitative review of performance.
Incident Management: Full Function Service Patrol Good Practices

• The HRTOC Safety Service Patrol (SSP) program utilizes quarterly incident data to reconfigure SSP routes for the most effective use of resources
• Many agencies have calculated Benefit to Cost Ratios for their FFSP programs (Baird, 2008)
  – Range - from 4.6:1 to 42:1
  – Median - 9.45:1
  – Average - 12.4:1

Source: VDOT Hampton Roads Transportation Operations Center 2011 Annual Report
Traffic Incident Management: Data Sources

• TMC
• Input of response partners
• Incident response data come from:
  – Law enforcement
  – Fire
  – EMS
  – Emergency management
  – Towing and recovery providers
  – Media
  – Traveling public
System Mobility

- Key Measures
  - Speed / Travel Time
  - Volume
  - Lane Occupancy / Density
System Mobility: Roadway Performance

• Where is congestion?
  • How often does it occur?
  • When does it occur?
  • How long does it last?
    – Described at the location and corridor level
      • Speed or frequency of congestion, versus
      • Travel time

• How many people/vehicles/trucks are using the system?
Where is Congestion?
When does it occur? How long does it last?

Using Travel Time

Using Speed, or Frequency of Congestion At a Location Also Shows Volume
System Mobility: Reporting Methods

• Answer these basic questions in a combination of graphic and tabular forms
  – Use indices when comparing routes
  – Otherwise use terms that your audience understands

• Tailor the reporting statistics and presentation format to your audience
System Mobility: Summary Tables for Comparisons / Trends

<table>
<thead>
<tr>
<th>AM peak period trips</th>
<th>Peak Period Travel Time</th>
<th>Peak Period Travel Time</th>
<th>Peak Period Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2FW-FederalWay-Seattle-2010</td>
<td>42</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>1-SR526-Seattle-2010</td>
<td>41</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>3EV-SR526-Bellevue-2010</td>
<td>42</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>4-Tukwila-Bellevue-2010</td>
<td>35</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>5-Auburn-Renton-2010</td>
<td>17</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>8B-Bellevue-Seattle-I90-2010</td>
<td>14</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>8A-Bellevue-Seattle-SR520-2010</td>
<td>14</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>8B-Seattle-Bellevue-I90-2010</td>
<td>14</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>8A-Seattle-Bellevue-SR520-2010</td>
<td>16</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Peak Period (6 – 9 AM)</th>
<th>AADT</th>
</tr>
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<tbody>
<tr>
<td>S. Pearl St.</td>
<td>20,500</td>
<td>7,500</td>
</tr>
<tr>
<td>University St.</td>
<td>18,200</td>
<td>6,600</td>
</tr>
<tr>
<td>NE 63rd St.</td>
<td>13,300</td>
<td>5,800</td>
</tr>
<tr>
<td>NE 137th</td>
<td>11,600</td>
<td>4,500</td>
</tr>
</tbody>
</table>
## System Mobility: Travel Time Index Comparison

<table>
<thead>
<tr>
<th>Corridor ATLANTA</th>
<th>Travel Time Index</th>
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<tbody>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>I-75A, NB (I-285 to I-20 7.72 miles)</td>
<td>1.09</td>
</tr>
<tr>
<td>I-75A, SB (I-20 to I-285 7.36 mi)</td>
<td>1.05</td>
</tr>
<tr>
<td>I-75B, NB (I-20 to I-85 Split 3.73 mi)</td>
<td>1.21</td>
</tr>
<tr>
<td>I-75B, SB (I-85 Split to I-20 4.04 mi)</td>
<td>1.38</td>
</tr>
<tr>
<td>I-75C, NB (I-85 Split to I-285 8.95 mi)</td>
<td>1.11</td>
</tr>
<tr>
<td>I-75C, SB (I-285 to I-85 Split 9.63 mi)</td>
<td>1.05</td>
</tr>
<tr>
<td>I-85A, NB (Camp Creek Parkway to I-75 4.18 mi)</td>
<td>1.02</td>
</tr>
<tr>
<td>I-85A, SB (I-75 to Camp Creek Parkway 4.05 mi)</td>
<td>1.02</td>
</tr>
<tr>
<td>I-85B, NB (I-75 to Jimmy Carter Boulevard 14 mi)</td>
<td>1.07</td>
</tr>
<tr>
<td>I-85B, SB (Jimmy Carter Boulevard to I-75 13.6 mi)</td>
<td>1.10</td>
</tr>
</tbody>
</table>
System Mobility: Summary Statistics

• Basic speed and volume data can also be summarized as
  – Vehicle hours of delay
  – Vehicle miles of delay
  – Centerline miles of congestion (by time period)
• As data/experience grows, more sophisticated reporting can be undertaken
  – Person delay versus vehicle delay
  – Reporting trucking use and delay separate from people or vehicles
  – Lost highway productivity
  – HOV versus GP lane performance
System Mobility: Information Delivery

- Traditional paper reports
- Web based information delivery
System Mobility: Data Sources

- Fixed Sensors
  - Volume
  - Spot speed
  - Lane occupancy
- Vehicle Probes
  - Speed data on roadway segments
- Manual Collection
  - Vehicle occupancy counts
Additional Measures

- Customer (Public) Satisfaction
- Incident Delay
- Recovery Time
- Other Measures to Consider
Public Satisfaction

• Determine value of TMC activities in terms of improved roadway performance
  – What benefits does the public experience as a result of TMC activities?

• Also examines the public’s perception of the value of those activities
Incident Delay

• Measuring changes in outcomes
  – Congestion, Throughput and Travel time

• As a result of activities of TMC
  – Incident response
  – Traffic management plans/controls
  – Disruption response (e.g., snow plow operations)

• Primarily uses data collected for
  – Mobility reporting (for outcomes as experienced by users)
  – TIM (to describe TMC management activities)
  – Incident response (to describe incident response activities)
Recovery Time

• TMCs may need to define specific traffic outcomes
  – When has a road “recovered” from an event?
  – Different time for different corridors/geographic areas
    • Snow fall stops in the north but not the south

• “Recovery” may be different on different roads
  – Rural roads
  – High volume urban freeways
  – Roads experiencing snow / ice conditions
Before / After Studies

- Report outcome of new traffic control activities
- Requires “before” data

**Volume and Congestion on Eastbound SR-520 on the Viaduct**

- **170 veh / hr / ln improvement**
- **LOS F occurs 1 day per week less often**
Guiding Principles

• Take Stock of Your Existing Data
• Identify Near-Term Monitoring Needs
• Start with What You Can Report
• Don’t Let the Perfect be the Enemy of the Good
• Collect and Archive Data that Describe TMC’s Activities
• Increase Reporting as More Data Become Available
Guiding Principles (Contd.)

• Track and Report Trends
• Use Reporting Language that Meets Audience Needs
• Collect Data to Understand Cause-and-Effect Relationships
• Set Goals and Monitor Results
• Use Monitoring and Reporting Outcomes to Actively Manage Staff and Resources
Additional Resources

• Transportation Management Center Data Capture for Performance and Mobility Measures

• TMC Performance Monitoring, Evaluation and Reporting Handbook