Fundamental Objectives

1. Preserve our assets and minimize their whole life costs.
2. Operate in a financially sustainable manner.
3. Provides a framework to improve performance on a long-term basis
The Law: (23 U.S.C. 101(a)(2), MAP-21 § 1103)

Asset management is a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost.
Where does ITS Infrastructure Fit In?

Signal Heads
Loop Detectors
Video Cameras
Controllers

Hardware
Software
Firmware
Communications
Operational
DataBase

Operators
Maintainers
Managers
Elected Officials

Physical
Systems
Personnel

Operations Asset Components
Beyond Pavement and Bridges

Related to Operations Asset Management

- People
- Data
- Processes

Traffic Signal Asset Management applies those objectives to traffic signal systems
Valuation of Traffic Signals

Field hardware
Timing plan development
Communication cost
Central management system
### Playing with numbers…

<table>
<thead>
<tr>
<th>Agency</th>
<th># Signals</th>
<th>Hardware Investment</th>
<th>Timing Investment</th>
<th>Comm Network</th>
<th>Other stuff</th>
<th>Central</th>
<th>Total per agency</th>
<th>M&amp;O/Agency</th>
<th>M&amp;O/Agency</th>
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</thead>
<tbody>
<tr>
<td>VDOT</td>
<td>212</td>
<td>$ 50,880,000</td>
<td>$ 1,060,000</td>
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<td>$ 800,000</td>
<td>$ 52,740,000</td>
<td>$ 527,400</td>
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<tr>
<td>Norfolk</td>
<td>306</td>
<td>$ 73,440,000</td>
<td>$ 1,530,000</td>
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<td>$ 800,000</td>
<td>$ 75,770,000</td>
<td>$ 757,700</td>
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<tr>
<td>Hampton</td>
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<td>$ 56,400,000</td>
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<td>$ 800,000</td>
<td>$ 58,375,000</td>
<td>$ 583,750</td>
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<tr>
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<td>$ 1,870,000</td>
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<td>$ 800,000</td>
<td>$ 92,430,000</td>
<td>$ 924,300</td>
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<tr>
<td>Suffolk</td>
<td>90</td>
<td>$ 21,600,000</td>
<td>$ 450,000</td>
<td></td>
<td>$ 800,000</td>
<td>$ 22,850,000</td>
<td>$ 228,500</td>
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<tr>
<td>Newport News</td>
<td>257</td>
<td>$ 61,680,000</td>
<td>$ 1,285,000</td>
<td></td>
<td>$ 800,000</td>
<td>$ 63,765,000</td>
<td>$ 637,650</td>
<td></td>
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<tr>
<td>Portsmouth</td>
<td>118</td>
<td>$ 28,320,000</td>
<td>$ 590,000</td>
<td></td>
<td>$ 800,000</td>
<td>$ 29,710,000</td>
<td>$ 297,100</td>
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<tr>
<td>Chesapeake</td>
<td>170</td>
<td>$ 40,800,000</td>
<td>$ 850,000</td>
<td></td>
<td>$ 800,000</td>
<td>$ 42,450,000</td>
<td>$ 424,500</td>
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<td><strong>Totals</strong></td>
<td><strong>1762</strong></td>
<td><strong>$ 422,880,000</strong></td>
<td><strong>$ 8,810,000</strong></td>
<td></td>
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<td>$ 4,380,900</td>
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<tr>
<td>M&amp;O @ 1%</td>
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<td>$ 4,228,800</td>
<td>$ 88,100</td>
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<td>$ 64,000</td>
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<tr>
<td>M&amp;O @ 10%</td>
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<td>$ 42,288,000</td>
<td>$ 881,000</td>
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<td>$ 640,000</td>
<td>$ 43,809,000</td>
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</table>
Portland Example

- 1070 signalized intersection
- 10,500 streetlights
- Utilized risk of failure to prioritize budget
- Risk = Likelihood x Consequence
  - Likelihood: probable time to failure
  - Consequence: severity of a failure
### Portland: Risk Matrix Definition

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Very low</td>
</tr>
<tr>
<td>Very low (1)</td>
<td>VL</td>
</tr>
<tr>
<td>Low (2)</td>
<td>VL</td>
</tr>
<tr>
<td>Moderate (3)</td>
<td>L</td>
</tr>
<tr>
<td>High (4)</td>
<td>L</td>
</tr>
<tr>
<td>Very high (5)</td>
<td>L</td>
</tr>
</tbody>
</table>

**Likelihood Rating**  
- Very High (5) < 4 years  
- High (4) 5-10 years  
- Moderate (3) 11-14 years  
- Low (2) 15-19 years  
- Very Low (1) > 20 years

**Consequences:**  
- Safety  
- Legal/regulatory  
- Economic  
- Service level  
- Environmental
# Portland: Signal Risk Examples

<table>
<thead>
<tr>
<th>Asset</th>
<th>failure mode</th>
<th>Condition</th>
<th>Age interval</th>
<th>% of system</th>
<th>risk score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signal Controller - School zones</td>
<td>Reached end of useful life (age based)</td>
<td>Very Good</td>
<td>0-5 years</td>
<td>51%</td>
<td>H</td>
</tr>
<tr>
<td>High Crash Intersections (211)</td>
<td></td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fair</td>
<td>6-10 years</td>
<td>12%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>11-15 years</td>
<td>7%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Very Poor</td>
<td>&gt; 16 years</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Traffic Signal Controller - Transit/Freight (164)</td>
<td>Reached end of useful life (age based)</td>
<td>Very Good</td>
<td>0-5 years</td>
<td>34%</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fair</td>
<td>6-10 years</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>11-15 years</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very Poor</td>
<td>&gt; 16 years</td>
<td>43%</td>
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</tr>
<tr>
<td>Traffic Signal Controller - Transit/Freight (164)</td>
<td>Reached end of useful life (age based)</td>
<td>Very Good</td>
<td>0-5 years</td>
<td>52%</td>
<td>M</td>
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<tr>
<td></td>
<td></td>
<td>Good</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Fair</td>
<td>6-10 years</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>11-15 years</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very Poor</td>
<td>&gt; 16 years</td>
<td>33%</td>
<td></td>
</tr>
</tbody>
</table>
Utah Example

- 1883 Traffic Signals
- Objective (est. 2011)
  - Realtime monitoring of health and quality
  - Track equipment failures and facilitate proactive maintenance
  - Long term maintenance planning
  - Inventory of equipment and configuration
- Software tool: Customized TransSuite AIMS
Virginia Example

- 1300 ITS Devices (CCTV, DMS, RWIS, HAR)
- 5 Traffic Operations Center
- 3000 Signalized Intersections
- Signal Needs Based Budgeting
- Intersection Sufficiency Rating
- Asset Management software: IBM Maximo
Virginia Signal Needs Based Budgeting (NBB)

Utilized Maintenance and Operations needs based on asset inventory and conditions

- Signal Preventive Maintenance Needs
- Signal Repair Needs
- Signal Replacement Needs
- Signal Operating Needs

Allocate budget as percentage of needs
Virginia Intersection Sufficiency Rating (ISR)

Used to programming & prioritizing resources

Factors

- Safety
- Congestion
- Corridor Operations
- Maintenance/conditions levels
- Design standards
- Technology Obsolescence
- Roadway functional class volumes
- Others…
More than counting boxes…

• Digital information is an asset
  • Manage the total cost of ownership
  • Replacement vs maintenance vs update?
  • Buy and maintain vs Lease
• Measuring Return On Investment
  • Monitor the performance being delivered
  • Monitor the cost to maintain performance
MAP-21 National Goals

1. SAFETY
2. INFRASTRUCTURE CONDITION
3. CONGESTION REDUCTION
4. SYSTEM RELIABILITY
5. FREIGHT MOVEMENT AND ECONOMIC VITALITY
6. ENVIRONMENTAL SUSTAINABILITY
7. REDUCED PROJECT DELIVERY DELAYS
The Law: (23 U.S.C. 119(e)(1), MAP-21 § 1106)

Each State is required to develop a risk-based asset management plan for the National Highway System (NHS) to improve or preserve the condition of the assets and the performance of the system.
What are the scope and content of a risk-based asset management plan?

1. States must address pavements and bridges but are **ENCOURAGED** to include all infrastructure assets within the highway right-of-way in their risk-based asset management plan. (Also can include roads other than on the NHS.)

2. Includes strategies that lead to a program of projects that would make progress toward achievement of the State targets for asset condition and performance of the NHS.
Risk-Based Asset Management Plan

1. Pavement and bridge inventory and conditions on the NHS
2. Objectives and measures,
3. Performance gap identification,
4. Lifecycle cost (management for the whole-life) and risk management analysis,
5. A financial plan, and
6. Investment strategies
Resources Are Available

• FHWA MAP-21 website
  • http://www.fhwa.dot.gov/map21/
• FHWA Office of Asset Management:
  • http://www.fhwa.dot.gov/asset/index.cfm
• AASHTO Asset Management Guide – A Focus on Implementation
  • http://www.fhwa.dot.gov/asset/pubs/hif13047.pdf
• NHI Transportation Asset Management Training Courses
  • http://www.nhi.fhwa.gov
  • Evaluating Performance of Traffic Signal Systems (133123)
  • Successful Traffic Signal Management
• AASHTO Asset Management Subcommittee
• TRB Asset Management Committee