Asset Management Decision Support Tools

Omar Smadi
CTRE, Iowa State University
November 14th, 2000
Asset Management System (Roads and Bridges)
Asset Management System
(Rolling Stock, Facilities and Human Resources)

- Fleet Management System
  - Maintenance Records
  - Mileage
  - Condition
  - Depreciation

- Facilities Management System
  - Inventory
  - Plans
  - Condition

- Human Resources
  - Job History
  - Training
  - Turnover Rate

Valuation Model
Asset Management Flow Chart

Individual Management System (Pavement, Bridge, etc...)

Condition Forecast

Value (Valuation Model)

Combine Assets

Resource Allocation

New Asset Value

Performance Parameters

Cost Utility Earning Potential

Mathematical Programming Economic Analysis Prioritization
Condition Forecasting

Forecast asset condition in the future. Use is based on age, traffic, mileage, etc...
Valuation Models

Determine the value of the asset based on the condition
The value can be cost, utility (benefits), or earning potential.
Resource Allocation
Decision Support Tools

Inputs
Mathematical Models
Results
Decision Support Tools

Inputs:

- Condition data
- Performance parameters
- Policy goals
- Funding
Decision Support Tools

Techniques:

• Optimization:
  – Linear Programming
  – Dynamic Programming
  – Goal Programming

• Multi-year Prioritization
  – Incremental Benefit Cost
  – Marginal Cost Effectiveness

• Prioritization
Decision Support Tools

Results:

- Resource allocation across assets
- Network level performance
- Funding impacts/trade-off
- Input to the individual management systems:
  - Project selection
  - Rehabilitation and maintenance projects
Essential Questions For AM

What Assets Do We Have?

What is Their Condition and/or Status?

What is Their Value and How Do We Determine it?
Asset Management
Implementation

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Outline

Why Implement AM?
Asset Management Survey (FHWA and AASHTO)
State DOT’s Experiences
Canadian Experience
Lessons Learned
Why?

The Bottom Line:

- $1 Trillion investment
- Aging Infrastructure
- Change from construction to preservation
- Change in government role/function
- Performance based management
- Increased accountability

Asset Management
Asset Management Survey

AASHTO and FHWA
(Sue McNeil, Mary Lynn Tischer, Alan DeBlasio)

Organize an Asset Management Workshop
State DOTs
July 1999
30 Responses Received
AM Survey - Summary of Results

States are not Overtly Practicing Asset Management
Many States are Undertaking Activities that form the Building Blocks for Asset Management
Many State DOTs are Utilizing their Building Blocks
Asset Management Building Blocks

Inventory

Individual Management Systems:
  • Pavement
  • Bridges
  • Signs
  • etc…

Asset Valuation

Decision Support Tools
Survey Results - The Numbers

Inventory:
30 States with an Inventory system
Average #  9

Management Systems:
30 States
Average #  7
Survey Results - The Numbers

Valuation:
Yes 12 States attempted
No 18 States
Survey Results - The Numbers

Decision Support Tools:
29 States

- 7 states applied across modes
- 10 states with analysis to allocate for capital vs. maintenance
- 11 states with benefit cost analysis of major maintenance expenditures
- 11 states with benefit cost analysis for operational improvements
## Survey Results - Inventory

<table>
<thead>
<tr>
<th>Asset</th>
<th>Inventory %</th>
<th>Condition %</th>
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</thead>
<tbody>
<tr>
<td>Pavements</td>
<td>93%</td>
<td>93%</td>
</tr>
<tr>
<td>Bridges</td>
<td>97%</td>
<td>93%</td>
</tr>
<tr>
<td>Signals</td>
<td>80%</td>
<td>47%</td>
</tr>
<tr>
<td>Lighting &amp; Signs</td>
<td>57%</td>
<td>33%</td>
</tr>
<tr>
<td>Asset</td>
<td>Using %</td>
<td>Performance %</td>
</tr>
<tr>
<td>-------------</td>
<td>---------</td>
<td>---------------</td>
</tr>
<tr>
<td>Pavements</td>
<td>97%</td>
<td>90%</td>
</tr>
<tr>
<td>Bridges</td>
<td>97%</td>
<td>90%</td>
</tr>
<tr>
<td>Safety</td>
<td>70%</td>
<td>53%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>70%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Survey Results - Analysis Tools for Investment Decision

- Life Cycle Cost: 80%
- Trade-Off Analysis: 27%
- Benefit Cost Analysis: 83%
- Quantitative Analysis: 13%
- Other: 23%

29 out of 30 use Analysis Tools
State DOTs Experiences

AASHTO
Maryland
Minnesota
Virginia
New York
Montana
AASHTO

Task Force on Asset Management (1997)

Mission:
Champion concepts and practices that integrate transportation investment decisions regarding operation, preservation, and improvement of transportation systems for member agencies

Vision:
Supports AASHTO’s vision through the incorporation of asset management as an accepted way of managing the transportation system
AASHTO AM Task Force

Strategic Plan
AASHTO Asset Management Guide
Conferences and Workshops
Develop and Utilize Lead State Models

1998 to 2003 - Budget of $3 Million
State of Maryland

Asset Management Team

- Charged with Development of AM Strategic Plan
- Evaluated how Assets are Currently Managed
- Provided Recommendations on how each can be better Managed
- Recommendations on how to Manage Statewide and Across Assets
State of Maryland

Evaluation Process:

- Asset description
- Asset inventory
- Asset value:
  - Depreciated replacement cost
  - Condition bases
- Expenditures (to maintain the assets)
- Performance indicators
- Improvement repair process

Completed evaluation of 12 out of 19 Assets
State of Maryland

Lessons Learned:

- Include technical staff on evaluation team
- Dedicated staff to complete effort
- Keep an open mind and keep it simple
- Develop long term implementation with **MANY** small successes along the way
State of Maryland

Contributors:
- Support from senior management
- Adequate resources
- Willingness to change from asset managers

Impediments:
- Lack of dedicated staff
- Resistance from asset managers
- Time
State of Minnesota

Asset Management Approach:

- Customer input
- System management
- Policy and goals
- Performance monitoring
State of Minnesota

Common Elements:
• Consistent process framework
• Decision making models
• Data reliant
• Technology dependent
State of Minnesota

Lessons Learned:

- Focused leadership
- Demonstrated benefit
- It takes time and resources (expensive)
- Organizational Readiness
- System managers cooperation
State of Minnesota

Challenges:

- No clear understanding of benefits
- Linking asset management with performance based planning
- Integration across modes and jurisdictions
- Technical and data issues
State of Virginia

System Integration vs. silos and stovepipe systems
Financial Data
Customer Input
Policy, Expectations, and Outcomes

From an acorn, grows and oak.... (Andrew Bailey)
State of New York

A Blueprint for Developing and Implementing Asset Management Organizational Placement

Focus Areas:

- Benchmarking AM
- Asset identification and categorization
- Asset valuation
- New technologies
State of New York

Asset Valuation:

• Determine the value of the transportation assets covered by the AM system
• Traditional accounting practices vs. GASB34
• New York DOT process:
  – Calculate replacement value
  – Depreciation to date
  – Loss of asset value
  – Preventive maintenance
  – Capital improvements
### State of New York

<table>
<thead>
<tr>
<th></th>
<th>Pavements</th>
<th>Bridges</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Replacement Values</td>
<td>$36,000</td>
<td>$19,400</td>
<td>$55,400</td>
</tr>
<tr>
<td>Depreciation to date</td>
<td>$8,200</td>
<td>$8,800</td>
<td>$17,000</td>
</tr>
<tr>
<td>Net Value</td>
<td><strong>$27,800</strong></td>
<td><strong>$10,600</strong></td>
<td><strong>$38,400</strong></td>
</tr>
<tr>
<td>Preventive Maintenance</td>
<td>$127</td>
<td>$95</td>
<td>$222</td>
</tr>
<tr>
<td>Capital Improvements</td>
<td>$520</td>
<td>$540</td>
<td>$1,060</td>
</tr>
<tr>
<td>Program as % of Asset Value</td>
<td><strong>0.5%</strong></td>
<td><strong>0.9%</strong></td>
<td><strong>0.6%</strong></td>
</tr>
<tr>
<td></td>
<td><strong>1.9%</strong></td>
<td><strong>5.1%</strong></td>
<td><strong>2.8%</strong></td>
</tr>
</tbody>
</table>
State of New York

Lessons Learned:

- Asset management improves the decision making process
- Asset management is not a black box
- Develop your own plan to meet your needs
- Asset management implementation is incremental and requires management discipline
- Modify plan along the way
State of New York

Challenges:

- Data issues
- Need for integrated goals
- Lack of technical tools
- Accountability
State of Montana

Definition:
AM is used to assess how successful the DOT’s investments are in moving toward overall policy goals as measured by system performance

Performance Programming
Focus on Investment Analysis
Annual Incremental Changes
Respect for Engineering Judgement - a Glass Box not a Black Box
State of Montana

Three Modules:

– Policy
  • Policy directions from statewide plan
– Investment analysis (funding plan)
  • Performance objectives
  • Resource allocation
– Program development
  • Project nomination
  • Project selection
State of Montana

Lessons Learned:

- Internal organization
- Accept incremental change
- Use the best, don’t wait for the perfect
- Ensure underlying policy basis
- Be opportunistic
Canadian Experience

Driving Forces:

- Privatization (B.C., Alberta 1990s)
- Re-Organization
- Federal and provincial deficit and dept reduction
- Private sector thinking
- Performance measures
- Accountability

Move to integration and full scale Asset Management
Canadian Experience

Growing Awareness:

- Primer on asset management
- Development of capitalization procedures and accounting principles
- Network performance indicators and executive information systems
- AM training
- Economic analysis training and guidance
Canadian Experience

Issues and Questions:
  • Deterioration = Depreciation?
  • What valuation method to use for each asset?
    – Book Value
    – Written down replacement cost
    – Market value
    – Equivalent present worth
  • How to account for assets that improve?
  • How to deal with complex assets?
Summary

VALUATION
DATA
INTEGRATION
RESOURCES (Time and Money)
Top Management Support
Web Resources

CTRE’s Website
http://www.ctre.iastate.edu/GASB34

GASB Website
http://www.gasb.org