Asset Management Data Collection for Supporting Decision Processes

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6th National Conference on Transportation Asset Management
Overview

- Introduction
- Literature Review
- Web-based Survey
- Proposed Data Collection Framework
- Findings, Conclusions & Recommendations
Introduction

- Data collection is a key part of Asset Management
- Transportation agencies collect data for their assets in order to support decision making
- Data collection activities do not always specifically support decision processes
Research Objective

1. Investigate how data collection is linked with decision processes – especially at the Project Selection level

2. Propose a framework for effective and efficient data collection to support Project Selection decision
Literature Review

1. Asset Management

- Most transportation agencies around the world have begun moving towards Asset Management
- Primarily by considering the integration of individual management systems
- Some organizations are trying to develop comprehensive Asset Management Systems
Literature Review

2. Decision Levels

- The levels of decision making are:
  - Strategic Level
  - Network Level
    - Programming
    - Project Selection
  - Project Level

- Different focus/impact on the system
- Relate to different decision processes
Literature Review
3. Decision Processes & Data Needs

Increase in Detail and Quantity of Data

Higher Decision Making Level

Strategic Level

Network Level

Programming Level

Project Selection Level

Project Level
TAM Survey - Part 1

- General Agency Information on Asset Management
  - Endorsement and implementation
  - Existing/planned individual management systems
  - Existing levels of decision making
  - Identification/ rating of decision processes
  - Identification/ rating of Project Selection criteria
TAM Survey - Part 2

- Roadway Asset Management
  - Data management, collection methods and integration
  - Rationale behind existing/planned data collection
  - Evaluation of roadway asset data for Project Selection
  - Identification of links between Project Selection and data collection activities.
TAM Survey - Development

- Web page developed using Macromedia Dreamweaver and PHP
- Web page uploaded @ www.am.vtti.vt.edu
- Database created using MySQL
- Access to the survey was granted through recipients’ email addresses
- Sent to 103 transportation officials in all 50 US DOTs and Puerto Rico
- Open for responses for 3 weeks
48 responses were received from 40 states

Response rates:
- 78% in terms of individual states
- 47% in terms of individual respondents

Statistically analyzed
TAM Survey - Results

Part 1

- **Implementation of Asset Management system**
  - 24 states are in still in the planning phase
  - 11 states have already implemented one

- **Individual management systems**
  - Pavements (39)
  - Bridges (39)
  - Maintenance (32)
TAM Survey - Results
Part 1

- Integration of individual systems
  - Most States are still in the planning phase
  - Most integration efforts have taken place for Pavement and Bridge management systems (20 states)
Defined Decision Making Levels

### Number of responses

<table>
<thead>
<tr>
<th>No explicit definition</th>
<th>Strategic Level</th>
<th>Programming and Budgeting Level</th>
<th>Project Selection Level</th>
<th>Project Level</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>5</td>
<td>23</td>
<td>27</td>
<td>27</td>
<td>23</td>
</tr>
</tbody>
</table>
Please rate the following Asset Management decision processes in terms of their relative importance within your agency/organization.
### Ranking of Asset Management Decision Processes

<table>
<thead>
<tr>
<th>Asset Management Decision Processes</th>
<th>Average Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance evaluation and monitoring</td>
<td>3.54</td>
</tr>
<tr>
<td>Fiscal planning</td>
<td>3.48</td>
</tr>
<tr>
<td>Project selection</td>
<td>3.33</td>
</tr>
<tr>
<td>Resource allocations</td>
<td>3.31</td>
</tr>
<tr>
<td>Policy formulation</td>
<td>3.13</td>
</tr>
<tr>
<td>Program optimization and trade-offs</td>
<td>3.10</td>
</tr>
<tr>
<td>Program delivery/ project implementation</td>
<td>3.02</td>
</tr>
<tr>
<td>Performance-based budgeting</td>
<td>2.96</td>
</tr>
<tr>
<td>Audit, reporting and communication</td>
<td>2.81</td>
</tr>
<tr>
<td>Development of alternatives</td>
<td>2.77</td>
</tr>
<tr>
<td>Impact analysis</td>
<td>2.65</td>
</tr>
</tbody>
</table>

Key: 4 = Very Important, 3 = Somewhat Important, 2 = Not Very Important, 1 = Not Important at All
Please rate the following criteria according to their level of importance for selecting projects that are candidates for funding and implementation within your agency/organization.
## Ranking of Project Selection Criteria

<table>
<thead>
<tr>
<th>Project Selection Criteria</th>
<th>Average Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available budgets/ earmarked funds</td>
<td>3.75</td>
</tr>
<tr>
<td>Engineering parameters</td>
<td>3.44</td>
</tr>
<tr>
<td>Public demands/ user opinion</td>
<td>3.27</td>
</tr>
<tr>
<td>Project significance</td>
<td>3.27</td>
</tr>
<tr>
<td>Agency costs/ benefits</td>
<td>3.19</td>
</tr>
<tr>
<td>Usage of project</td>
<td>3.08</td>
</tr>
<tr>
<td>Environmental considerations</td>
<td>3.06</td>
</tr>
<tr>
<td>Geographic distribution of projects/ funds</td>
<td>2.83</td>
</tr>
<tr>
<td>User costs/ benefits</td>
<td>2.77</td>
</tr>
<tr>
<td>Community costs/ benefits</td>
<td>2.65</td>
</tr>
<tr>
<td>Distribution among asset types</td>
<td>2.46</td>
</tr>
<tr>
<td>Ease/ difficulty of implementation</td>
<td>2.38</td>
</tr>
<tr>
<td>Proximity of project to major urban areas</td>
<td>2.25</td>
</tr>
</tbody>
</table>

Key: 4 = Very Important, 3 = Somewhat Important, 2 = Not Very Important, 1 = Not Important at All
TAM Survey Results
Part 2

- **Asset Management roadway database**
  - 75% have already developed one (30)
  - Majority of remaining states (5) are in planning phase

- **All agencies collect data for pavements and bridges**
Agency Data Collection Rationale

<table>
<thead>
<tr>
<th></th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical practice and staff experience</td>
<td>30</td>
</tr>
<tr>
<td>Data collection standards</td>
<td>22</td>
</tr>
<tr>
<td>Needs of systems/processes</td>
<td>21</td>
</tr>
<tr>
<td>Don't know</td>
<td>2</td>
</tr>
</tbody>
</table>
Which roadway asset data are most important in your agency’s view for the selection between two projects, e.g. between different pavement projects or between a pavement project and a bridge project?
# Ranking of Roadway Asset Data for Project Selection

<table>
<thead>
<tr>
<th>Roadway Asset Data</th>
<th>Average Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural condition</td>
<td>3.77</td>
</tr>
<tr>
<td>Functional condition</td>
<td>3.67</td>
</tr>
<tr>
<td>Usage</td>
<td>3.29</td>
</tr>
<tr>
<td>Initial agency costs</td>
<td>3.23</td>
</tr>
<tr>
<td>Life Cycle Costs</td>
<td>2.96</td>
</tr>
<tr>
<td>Attributes/ characteristics</td>
<td>2.90</td>
</tr>
<tr>
<td>Customer/ user feedback and complaints</td>
<td>2.83</td>
</tr>
<tr>
<td>Location</td>
<td>2.67</td>
</tr>
</tbody>
</table>

Key: 4 = Very Important, 3 = Somewhat Important, 2 = Not Very Important, 1 = Not Important at All
Link Between Data Collection & Project Selection

- 52.5% of Agencies Only identified
- 32.5% of Agencies Identified and documented

<table>
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</thead>
<tbody>
<tr>
<td>Only identified</td>
<td>13</td>
</tr>
<tr>
<td>Identified and documented</td>
<td>21</td>
</tr>
</tbody>
</table>
Identification of candidate projects and corresponding treatments for all assets under consideration

Identification of project evaluation/assessment tools and their requirements

Identification and/or definition of data needs for the analyses/evaluations to be performed

Identification of existing databases and data quality assessment

Identification of missing data elements

Selection of the appropriate data collection methodology and implementation

FEEDBACK LOOP: Evaluation of assessment tools/data inputs/data collection and overall results
Proposed Data Collection Framework

- Framework can function as a starting point for systematic data collection and Project Selection decision making
- Framework leads to partial optimization of data collection for Project Selection
Findings

- US transportation agencies still collect data predominantly based on past practices and staff experience.
  - There is a trend towards following data collection standards and input needs
- Most important criteria for Project Selection
  - Available Budgets/ Earmarked Funds
  - Engineering Parameters
  - Public Demands/ User Opinions
Findings

- Most important data for supporting Project Selection:
  - Structural condition of asset
  - Functional condition of asset
  - Usage of asset
Conclusion

- US Transportation agencies have explicitly defined decision levels and are moving towards rationalization of data collection activities.
  - Past practices and staff experience → collection standards and input needs
  - Agencies have identified links between data collection and decision making at the project selection level but not all of them have explicitly documented these links
Further Research

- Investigate champions in the field
  - Identify “Best Practices”
  - Enhance data collection framework
  - Develop standards
Many Thanks to...

- All survey respondents
- AASHTO Task Force on Protocols, Procedures, and Technology for Asset Management Condition Data Collection
- VT Statistics and Survey Department
- Federal Highway Administration
Questions

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