A Summary of Maintenance Quality Assurance (MQA) Field Inspection Practices

Results From NCHRP Synthesis Project 45-13
Published as NCHRP Synthesis 470

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Synthesis Objectives

• To document the use of MQA field inspection practices to support maintenance investments
  – Types of data collected
  – Methodology used to assess condition
  – Processes used to ensure data quality
  – Use of data for budgeting and reporting
  – Rationale and motivation behind the adoption of the MQA program
Data Sources

- Literature review
- Survey of state practice
- Interviews with representatives from:
  - Alaska DOT
  - Florida DOT
  - Kentucky Transportation Cabinet
  - Montana DOT
  - North Carolina DOT
  - Utah DOT
  - Washington DOT
  - Wisconsin DOT
Findings – MQA Program Status

- 28 of 40 states have a program in place
Findings – Program Status

- Most programs have undergone substantial changes since originally implemented.

How long since substantial changes were made?

- More than 10 years
- 5 to 10 years
- 2 to 5 years
- 0 to 2 years

Number of agencies:
## Findings – Data Collection

### Drainage Assets

<table>
<thead>
<tr>
<th>Component</th>
<th>Complete</th>
<th>Partially Complete</th>
<th>No inventory/Did not respond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culvert</td>
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<tr>
<td>Curb &amp; Gutter</td>
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<tr>
<td>Drop Inlet</td>
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<tr>
<td>Ditch or Slope</td>
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<tr>
<td>Sidewalk</td>
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<tr>
<td>Underdrain &amp; Edgedrain</td>
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<tr>
<td>Flume</td>
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</tr>
</tbody>
</table>
Most Common Condition Attributes - Drainage

- **Culverts:** Channel condition (22), culvert condition (18), erosion (13)
- **Flume:** Channel & flume condition (7 each)
- **Curb & Gutter:** Flowline interrupted (12), structural damage/spalling (10)
- **Sidewalk:** Displacement/heaving (5)
- **Ditch:** Inadequate drainage (21), erosion (16)
- **Slope:** Erosion (16)
- **Drop Inlet:** Blockage (20), grate broken/missing (16), structural deficiency (13)
- **Underdrain and Edgedrain:** Pipe blocked (8), end protection damage (7), pipe crushed (6)
Findings – Data Collection

• Roadside Assets

- Sound Barrier
- Fence
- Landscaping
- Plant Beds
Most Common Condition Attributes – Roadside Assets

- **Fence**: Length of damaged or missing (13)
- **Grass Mowing**: Grass height (17)
- **Brush**: Vision obstructions (10)
- **Litter**: Volume within a certain length (18)
- **Weed Control**: Amount within a certain area (13)
- **Landscaping**: Appearance (7)
- **Plant Beds**: Appearance or Presence of undesirable vegetation (3 each)
- **Sound Barrier**: No measure used by more than 1 agency
Findings – Data Collection

• Pavements
Most Common Condition Attributes - Pavements

- **Paved Shoulders**: Drop-off (14), structural distress (12), functional distress (10)
- **Unpaved Shoulders**: Drop-off (17)
- **Paved Roadway**: Cracking (16), rutting (15), structural distress (14), roughness (12), use PMS results (12)
Findings – Data Collection

• Bridges
  – 27 of the 28 agencies reported having a complete bridge inventory
Most Common Condition Attributes - Bridges

- Bridge Management Inspections (14), deck condition rating (13), joint condition rating (11), bearing condition rating (10), structural adequacy (10)
Findings – Data Collection

- Traffic Assets

<table>
<thead>
<tr>
<th>Traffic Asset</th>
<th>Complete</th>
<th>Partially Complete</th>
<th>No Inventory/Did Not Respond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead Sign Structure</td>
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<tr>
<td>Sign</td>
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<tr>
<td>Signal</td>
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<td>Variable Message Board</td>
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<td>Impact Attenuator</td>
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<tr>
<td>Pavement Marking</td>
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<td>Guardrail End Treatment</td>
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<td>Highway Lighting</td>
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<tr>
<td>Protective Barriers</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pavement Marker</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Green bar: Complete
- White bar: Partially Complete
- Purple bar: No inventory/Did not respond
Most Common Condition Attributes – Traffic Assets

- **Signal**: No metric used by more than 1 agency
- **Signs**: Panels damaged (22), legibility (20), post damage (17), sign orientation (15), obstructions (14), visibility (13)
- **Pavement Marking**: Missing/damaged (18), day visibility (16), night retroreflectivity (10)
- **Pavement Marker**: Number missing, damaged, or obstructed (15)
- **Guardrail End Treatment**: End treatment damage (18), post damage (15), functionality (11), end treatment alignment (10)
- **Overhead Sign Structure**: Structural integrity (9)
- **Impact Attenuator**: Structurally damaged (16), functionality (15)
- **Protective Barriers**: Structurally damaged (18), functionality (14), misaligned (11)
- **Variable Message Board**: No metric used by more than 1 agency
- **Highway Lighting**: % Operational (7)
Findings – Data Collection

- Special Facilities

![Bar chart showing data collection for Rest Areas, Weigh Stations, Tunnels, and Traffic Monitoring Systems. The chart indicates the percentage of facilities that are complete, partially complete, or have no inventory/Did not respond.]
Most Common Condition Attributes – Special Facilities

- **Rest Areas**: Working properly, appearance, landscaping, & cleanliness (10 each)
- **Tunnels**: Lighting, debris, & drainage (4 each)
- **Weigh Stations**: Functionality (2)
- **Traffic Monitoring Systems**: No metrics reported
Findings – Survey Methods

- MQA programs are generally classified as a pass/fail approach, a graded approach, or a combination of the two.
Findings - MQA Survey Approaches

• The majority of state DOTs rely on district or regional personnel to conduct surveys
• Annual surveys are most common
Findings - Type of Equipment Use

- Most states conduct manual surveys using low-tech tools for collecting MQA data

![Bar chart showing types of equipment used by agencies](chart)
Findings - Sampling

- 23 of the 28 states use sampling
- Most states use 0.10-mile samples
Findings – Resource Requirements

• The total number of samples inspected varies from 100 to 22,000 samples

<table>
<thead>
<tr>
<th>Resource Requirement</th>
<th>Agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 6 person-months</td>
<td>14</td>
</tr>
<tr>
<td>5 to 6 person-months</td>
<td>2</td>
</tr>
<tr>
<td>4 to 5 person-months</td>
<td>4</td>
</tr>
<tr>
<td>3 to 4 person-months</td>
<td>1</td>
</tr>
<tr>
<td>2 to 3 person-months</td>
<td>1</td>
</tr>
<tr>
<td>1 to 2 person-months</td>
<td>2</td>
</tr>
<tr>
<td>Less than 1 person-month</td>
<td>0</td>
</tr>
</tbody>
</table>
Findings – Methods Used to Ensure Quality

• Most states have procedures in place to ensure data quality
Findings – Availability of a MMS

- Most states with an MQA program have a computerized MMS in place.
Findings – Use of MQA Data for Budgeting

• States are interested in using MQA data for budgeting activities

Performance information used for budgeting?

- Yes: 11
- No: 9
- Not yet, but this is under development: 8
Findings – Keys to Success

- Upper management support is a key success factor

![Bar chart showing agencies for different factors]

- Upper management support
- Training
- Simplicity of the MQA program
- Degree of confidence in data
- Buy-in from field personnel
- Ease of use
- Field personnel involved in development
- Having a project champion
- Staffing levels
- Other
Findings – Initiatives and New Technology

• Many states are considering these new initiatives or technologies

![Bar chart showing agencies using various technologies]
- Handheld data collection devices
- New computer software
- GPS
- Automated surveys
- Other
- LIDAR

Agencies
To Obtain a Copy of the Report

- Google NCHRP Synthesis 470 to get a copy OR use this link: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_470.pdf