Best Practices for Collecting, Processing & Managing Roadway Asset Inventory Data

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Topics

• Research Objectives
• Summary of Practice
• Introduction to the Guide
  – Materials Included
  – Highlights
• Future Directions
Research Objective

• To develop practical guidelines that can be used by practitioners to collect, process and manage roadway asset inventory data
Summary of Practice

• Advantages & Disadvantages of Common Data Collection Techniques
  – Manual methods are best for assets that can’t be seen from the travel lanes. Traditionally, this method is labor intensive.
  – Automated (mobile) techniques allow collection of multiple assets at traffic speeds – but they must be visible from the traffic lane
Summary of Practice (Synthesis 470)

• Manual methods are most common for building asset inventories
• Manual methods may use handheld computers and GPS units
• After pavements & bridges, the most common asset inventories include (>20 of 28 states):
  – Culverts, overhead sign structures, signs, signals, variable message boards, impact attenuators, pavement markings, guardrail end treatments, & rest areas
Summary of Practice - Trends

• Interest in performance-based decision making is increasing, so inventories will become more important
• Limited resources are available to collect data
• Agency staff need to develop new skills to take advantage of new technology
  ― GIS training, database skills, communication expertise, working knowledge of computers
• Data must be highly reliable to be used to monitor contractor performance
Introduction to the Guide

• Included as the Appendix to the final report
• Can be printed as a stand-alone document
• Focused on three forms of technology:
  – Manual
  – Photogrammetry
  – LiDAR
Introduction to the Guide

• Organization
  – Chapter 1 – Introduction
  – Chapter 2 – Data Collection Methods
  – Chapter 3 – Guidelines
  – Chapter 4 – Future Directions
  – Appendix A – Sample Data Dictionary
  – Appendix B – Sample RFP Content
4-Step Process

1. Getting ready to select a methodology

2. Selecting a methodology

3. Collecting the data

4. Processing and managing the data
1. Getting Ready to Select a Methodology

- Select assets to include in the inventory
- Determine constraints on budget, available personnel, etc.
- Identify users and encourage higher participation
- Develop data dictionary and document attributes
4-Step Process

1. Getting ready to select a methodology
2. Selecting a methodology
3. Collecting the data
4. Processing and managing the data
2. Selecting a Methodology

- Determine asset visibility from the roadway surface
- Identify accuracy requirements
- Determine agency maturity to fully utilize the data provided
- Consider safety standards
- Evaluate resources to collect & maintain data
- Identify other data collection efforts
## Do We Have A Clear Winner?

<table>
<thead>
<tr>
<th></th>
<th>Manual</th>
<th>Photogrammetry</th>
<th>Mobile LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td>No specialized equipment</td>
<td>ROW cameras</td>
<td>Dedicated equipment, software and training</td>
</tr>
<tr>
<td><strong>Type of assets inventoried</strong></td>
<td>All, including drainage structures</td>
<td>Only assets visible from roadway</td>
<td>Only assets visible from roadway, within range</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>± 5-10 ft.</td>
<td>± 1-3 ft.</td>
<td>± 3-5 in.</td>
</tr>
<tr>
<td><strong>QA and adding new elements</strong></td>
<td>Requires resurvey</td>
<td>Images can be reused</td>
<td>Spatial data can be reused</td>
</tr>
<tr>
<td><strong>Collection speed</strong></td>
<td>Slow</td>
<td>Traffic speeds</td>
<td>Traffic speeds</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>High exposure</td>
<td>Low exposure</td>
<td>Low exposure</td>
</tr>
<tr>
<td><strong>File size</strong></td>
<td>Manageable</td>
<td></td>
<td>Large files</td>
</tr>
</tbody>
</table>
4-Step Process

1. Getting ready to select a methodology

2. Selecting a methodology

3. Collecting the data

4. Processing and managing the data
3. Collecting the Data

- Secure equipment or vendor
- Develop data collection protocols for resolution, accuracy, repeatability, acceptance testing, etc.
- Conduct training and calibration for better quality control
- Conduct acceptance testing to help identify malfunctioning equipment, anomalies, completeness, and reasonableness of data
Guidelines for Developing or Updating a Roadway Asset Inventory

1. Getting ready to select a methodology
2. Selecting a methodology
3. Collecting the data
4. Processing and managing the data
4. Processing and Managing Data

- Develop in-house expertise to understand capabilities and limitations of technology
- Formulate processing procedure and limit time at workstations to 2-hour slots
- Provide users access to data in an easily useable format
- Address organizational issues to promote the greatest use of the data
- Implement data governance standards
- Plan for inventory updates
• Includes tips from practitioners

While the Utah DOT uses LiDAR for collecting most of its roadway asset data, its inventory of drainage assets and underground utilities was established by part-time interns using manual data collection techniques.

Agencies using automated data collection vendors have found it helpful to establish a contract period that covers at least two data collection cycles to help ensure consistency. For instance, an agency may establish a contract for one data collection cycle with an option to renew the contract for another cycle if the agency is satisfied with the vendor’s performance.
# Introduction to the Guide - Highlights

- Summarizes considerations for each of the three methodologies.
- Includes tips to “accelerate the learning curve”.

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Manual Survey</th>
<th>Photogrammetry</th>
<th>Mobile LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair degree of accuracy</td>
<td>(± a few ft.)</td>
<td>Good accuracy (± 1 ft.)</td>
<td>High degree of accuracy (± 3 in.)</td>
</tr>
<tr>
<td>Labor intensive</td>
<td></td>
<td>Not labor intensive</td>
<td>Not labor intensive</td>
</tr>
<tr>
<td>Safety issues with personnel in the field</td>
<td>Requires specialized equipment</td>
<td>Requires specialized equipment</td>
<td></td>
</tr>
<tr>
<td>Quality control activities require additional personnel in field</td>
<td>Operates at traffic speeds</td>
<td>Operates at traffic speeds</td>
<td></td>
</tr>
<tr>
<td>Best option for inventorying assets not visible from the road</td>
<td>Can only be used to inventory assets visible from the road</td>
<td>Can only be used to inventory assets visible from the road</td>
<td></td>
</tr>
<tr>
<td>Does not require specialized technical expertise or equipment</td>
<td>Easily used in conjunction with automated pavement condition surveys</td>
<td>Provides features for estimating asset dimensions</td>
<td></td>
</tr>
<tr>
<td>Most applicable when collecting a limited amount of data</td>
<td>Data can be used by multiple Divisions within an agency</td>
<td>Easily used in conjunction with automated pavement condition surveys</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality control activities can be done at a workstation</td>
<td>Data can be used by multiple Divisions within an agency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requires some technical expertise</td>
<td>Quality control activities can be done at a workstation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires some technical expertise</td>
<td>Generates large data files that must be managed</td>
</tr>
</tbody>
</table>
Future Directions

• Data collection activities will serve multiple purposes
• Automated inventories are becoming more common
• Mobile LiDAR is most beneficial when an agency can use it in conjunction with other agency needs
• Emerging technologies are under development that may influence future data collection efforts
For a Copy of the Guide

Go to the AASHTO Subcommittee on Maintenance Website

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Go to Completed Tasks

Select Task 357
Questions?

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