2014-22TS
Published October 2014

RESEARCH SERVICES & LIBRARY

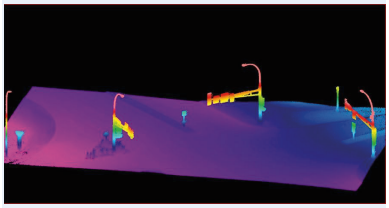
OFFICE OF TRANSPORTATION SYSTEM MANAGEMENT

TECHNICAL SUMMARY

Principal Investigator:
Trisha Stefanski, MnDOT
Trisha.Stefanski@state.mn.us

Project Coordinator:
Bruce Holdhusen, MnDOT
Bruce.Holdhusen@state.mn.us

PROJECT COST:
$245,358



Microstation .tin files generated from LiDAR data will be used to design sidewalks and pedestrian ramps on U.S. 61.

Putting Research into Practice: Using Mobile Mapping to Inventory Barriers

MnDOT used mobile imagery and LiDAR to create an inventory of concrete barriers and plate beam guardrails in the Metro District. Many MnDOT staff will use this inventory in a variety of planning, design and maintenance applications.

What Was the Need?

MnDOT needs to have an accurate inventory of its transportation infrastructure to properly maintain it. Before this project, however, the Metro District didn't have an inventory of its plate beam guardrails and concrete barriers.

Mobile mapping is an emerging technology that safely and quickly collects high-quality geospatial data needed for an inventory of roadway physical assets. Specific mobile mapping technology options include mobile imagery (Audio Video Interleave-format photos taken at regular intervals from a vehicle driving at highway speeds) and LiDAR (using a laser range finder and reflected laser light to measure distances).

After mobile imaging data are collected, they must be compiled and processed to create files that are compatible with the extraction software. The extraction process can be expensive when outsourced, so MnDOT wanted to determine if extracting data in-house was cost-effective.

What Was Our Goal?

The goals of this project were to create an inventory of roadway barriers, evaluate the viability of in-house data extraction of mobile imaging data and demonstrate the use of LiDAR data collection technology.

What Did We Implement?

This project implemented mobile imagery and LiDAR technology. These technologies are relatively new to MnDOT, and its staff has only limited experience with them.

How Did We Do It?

A consultant collected mobile imagery on 1,100 miles of roadway operated by the MnDOT Metro District, including images of all ramps, overpasses, interchanges, weigh stations, rest areas and historical sites. The consultant also collected LiDAR data at selected sites. While potentially very accurate, LiDAR data are significantly more expensive to collect than mobile imagery, which is why data collection was limited to three sites.

Metro District staff reviewed the mobile images and extracted a variety of specific data, including route name; location (mainline, ramp or local road); travel direction; roadway position (right, median or left); barrier type; end treatment types; delineator type and whether it is mounted to specification; attachments; maximum and minimum barrier height; average barrier height; and barrier condition.

What Was the Impact?

Collecting barrier data using mobile imagery provided significant time and cost savings, and was much safer than collecting the information manually. All data collected in this project are being published on MnDOT's Georilla internal map server, where it will be accessible to staff. The barrier inventory will be a valuable asset for a variety of projects and regular tasks performed by many MnDOT divisions. Examples of its applications include:

continued

"Mobile mapping technology has gained momentum recently. It's really beneficial for collecting a lot of data in a safe and efficient manner."

—Trisha Stefanski,
Principal Engineer,
MnDOT Metro District

"While there is not one tool that serves every situation, MnDOT is looking at mobile LiDAR as a safe, fast and accurate alternative to collecting road surface data."

—Peter Jenkins,
Photogrammetrics Supervisor, MnDOT Office of Land Management

The extraction process from mobile imaging triangulates the location of barriers and other assets by comparing the items in consecutive images. These images also show attributes such as attached items, materials, barrier height and barrier condition.

- **Design.** Mobile imagery data is accurate to within 1 foot, which is sufficient for designers to use in a preliminary design plan without surveying in the field. LiDAR data was survey-grade and accurate to within 0.1 foot.
- **Planning.** The geodatabase includes a map that shows all barrier locations. This lets planners see what guardrails will be affected by a project and determine the cost of moving or replacing them.
- **Maintenance.** When a vehicle hits a barrier, maintenance staff members can check the database to see the type of barrier and end treatment involved to ensure they bring the right equipment to make repairs.

MnDOT found quality control of mobile data to be critical. Some mobile images were missing or had excessive sun glare, although quality control checks allowed these issues to be discovered and rectified. Timing of data collection was also important since images needed to be taken after vegetation had been mowed.

MnDOT tracked the time it took to extract data in-house, but found no significant cost savings over having a consultant perform the extraction.

What's Next?

MnDOT will maintain the database for future use. This will not require further collection of mobile imagery. Instead, data will be updated when barriers are installed or maintained.

While this project focused on collecting barrier data, the imagery contains other assets that could be extracted as needed. MnDOT has already used the imagery to extract some noise wall and sign data.

In general, mobile imaging will be used for asset attribution and location, while LiDAR will be used for design. Both technologies will be used to check bridge, utility and overhead sign clearances. MnDOT plans to conduct mobile imagery and LiDAR data collection projects on Interstate 35W and U.S. Highway 10 in preparation of design projects on those highways. Other mobile LiDAR projects underway include a stringless paving project on Minnesota State Highway 23 near Granite Falls and a concrete rehabilitation project on MN 5 and Trunk Highway 8 in the Metro District.

Produced by CTC & Associates for:
Minnesota Department
of Transportation
Research Services & Library
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
651-366-3780
www.mndot.gov/research

This Technical Summary pertains to Report 2014-22, "Minnesota Department of Transportation Metro Barrier Extraction and LiDAR Project," published June 2014. The full report can be accessed at http://www.lrrb.org/PDF/201422.pdf.