

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-479 (project 606) | August 2022

Image-Based 3D Reconstruction of Utah Roadway Assets



the ISSUE

Understanding the condition of roadway assets is important for transportation agencies to plan for future improvements and manage assets effectively. Because these assets are widely distributed across the transportation system, a manual data collection system is time consuming and expensive. Some departments of transportation are employing LiDAR technology for asset inventory data collection, but the technique is expensive and difficult to use for untrained staff.

the RESEARCH

This research focused on two technologies for 3D reconstruction for collecting asset data from roadways in mobile and stationary settings. Researchers studied the extent to which the proposed methods can accurately collect data on the following assets: traffic signs, bridges, pedestrian access ramps, and pavement.

Given the accuracy requirement for collecting different transportation assets, we tested two different data collection procedures: mobile and terrestrial data collection. The former helps collect data on assets distributed across the roadways such as overhead and roadside traffic signs, highway bridges, and pavement. The latter is suitable for cases such as pedestrian access ramps, which require very accurate 3D reconstruction because of inspection standards. The mobile data collection was conducted using a vehicular platform carrying the sensors (i.e., laser scanner and digital cameras). Laser scanners immediately produce the 3D point cloud models, requiring large data storage capacities. Digital images captured by cameras are stored and processed later to create 3D models using an advanced technique named Structure from Motion. Handheld digital cameras are used to take the necessary images in a circular pattern for terrestrial procedures.

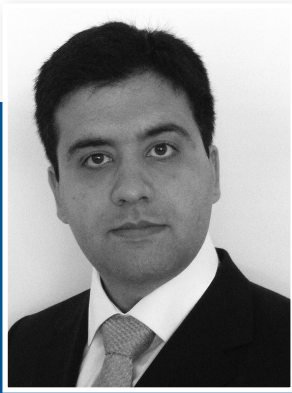


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Project Title

Image-Based 3D
Reconstruction of Utah
Roadway Assets

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Utah DOT, Asset Management
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the FINDINGS

The results showed that image-based 3D reconstruction is a cost-effective and accurate solution for remote inspection of pedestrian access ramps. According to the bridge case study, mobile LiDAR is the current superior technology for highway asset inventorying, but it is not detailed enough to be used for remote structural bridge inspections. Moreover, photogrammetry can only work well as a reliable alternative to LiDAR technology in favorable lighting conditions (e.g., no sudden change in illumination) for the highway asset inventory system. Additionally, mobile photogrammetry works well in cases where the camera platform can be moved at slower speeds (slower than approximately 50 mph), and when assets are not very far from the roadway (less than two lanes away). LiDAR may be the better technology for faster rates of travel and assets at farther distances.

the IMPACT

This research confirms that LiDAR technology is currently best suited for the in-motion collection of data on roadway assets but does not provide enough detail for remote structural bridge inspections. Image-based 3D reconstruction is an accurate solution for remote inspection of pedestrian access ramps. Mobile photogrammetry shows promise for assessing pavement condition. Consequently, this research will help agencies choose asset data collection technology that best meets their needs and will provide future direction for further refining automated roadway asset data collection technologies.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1099>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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