RESEARCH
PROJECT CAPSULE [23-1GT]
March 2023
TECHNOLOGY TRANSFER PROGRAM

LiDAR for Geotechnical Applications

JUST THE FACTS:

Start Date:
March 1, 2023

Duration:
30 months

End Date:
August 31, 2025

Funding:
TT-Fed/TT-Reg-6

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Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University

POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

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PROBLEM

Light detection and ranging (LiDAR) is a method for measuring distances by emitting thousands of laser beams and measuring their reflections from surrounding surfaces. The technology calculates distances based on reflection times and vectors from/to the laser to create a point cloud of spatially related points. Some projections are so dense they can appear like a photo or image.

Initially very expensive, LiDAR is becoming more common and affordable, is utilized for mapping, measuring, and creating digital twins. LiDAR data collection occurs from land, vehicles, drones, and/or fixed wing airplanes. The Louisiana Department of Transportation and Development (DOTD) has begun collecting LiDAR on state highways, but access to the data has not been linked to geotechnical applications.

LiDAR data can be utilized for many purposes, and though the primary reasons are likely not geotechnical related, the data can be of benefit to DOTD and its geotechnical groups.

OBJECTIVE

The research intends to focus on four objectives regarding LiDAR for geotechnical applications.

- **Site investigation and reconnaissance for drilling operations.** LiDAR scans identifying slopes and feasible areas for drilling access could save time and efforts, possibly reducing site visits.
- **Geotechnical asset management inventory data collection.** LiDAR scans may prove to be an effective way to inventory and characterize slopes, embankments, and culverts.
- **Change detection for use in forensic evaluations and monitoring.** LiDAR scans can be utilized to determine volumes, and when compared to previous scans can detect changes. This would help identify slope failures and the extent of remediation efforts. The Vicksburg bridge over the Mississippi River, which is experiencing movements, would likely benefit from this technology.
- **Cross-section data collection for stability analyses.** LiDAR scans could help create fast and efficient cross-sections for use in emergency scenarios where computer analyses and modeling are required for remedial actions regarding slope failures.

METHODOLOGY

To achieve the aforementioned objectives, the research team will complete several tasks:

1. Research existing local, state, and federal efforts regarding LiDAR.
2. Determine the applicability and implementation potential of LiDAR for geotechnical applications within Louisiana.
3. Conduct slope performance monitoring using remote sensing via drone and LiDAR.
4. Connect information with the Geotechnical Database for geotechnical user access.
5. Recommend and implement strategies.
6. Document the research effort.
7. Process through editing.

IMPLEMENTATION POTENTIAL

This research will follow up on research with geotechnical assets, the future conduct of geotechnical borings regarding access, and assist in the evaluation of slope stability problems by utilizing LiDAR scans and technology for change detection, monitoring, and slope stability analyses. The proposed research will utilize existing data sets and intends to provide a user interface for the DOTD Geotechnical section to utilize this data for management of slopes and other geotechnical assets.

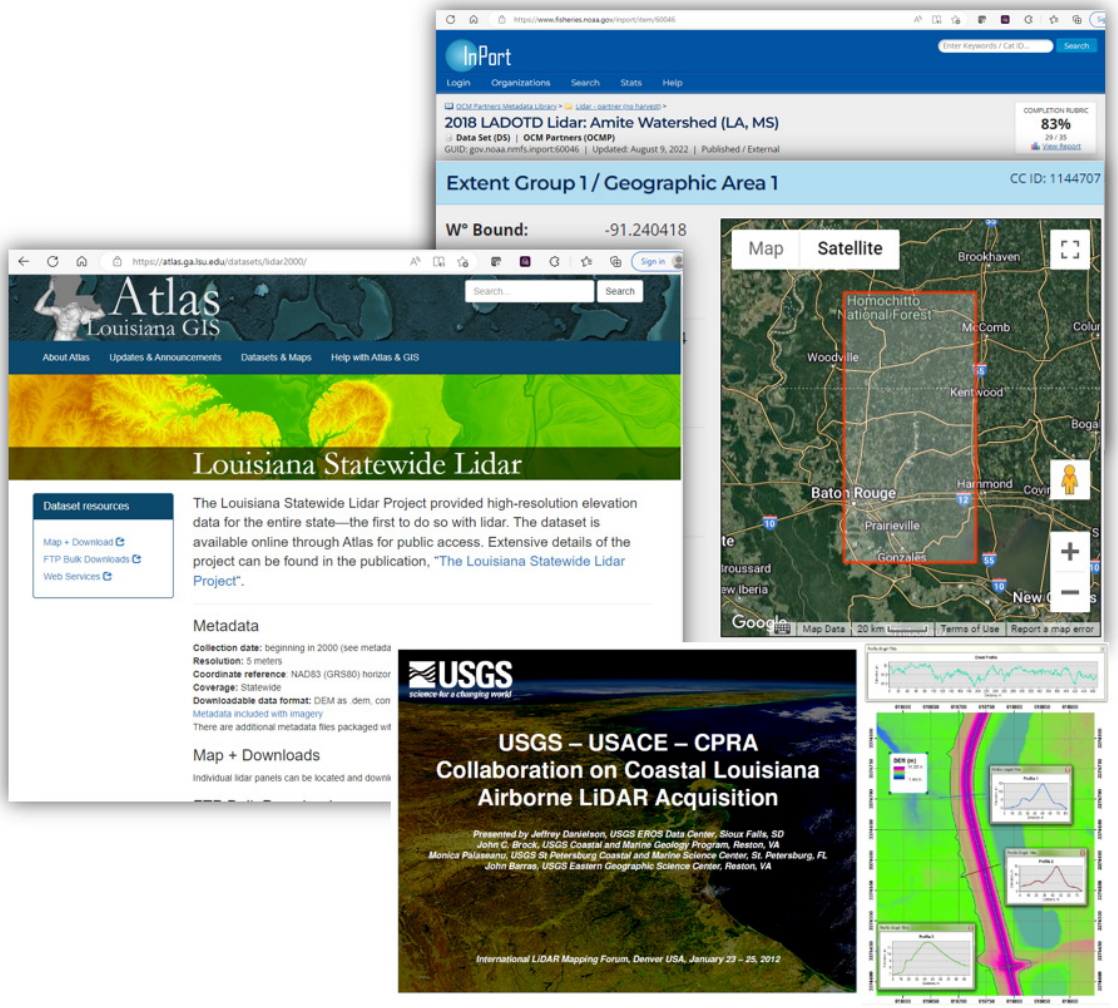

Figure 1. Examples of LiDAR source data