The Ohio Department of Transportation
Office of Research & Development
Executive Summary Report

Airborne LiDAR Reflective Linear Feature Extraction for Strip Adjustment and Horizontal Accuracy Determination

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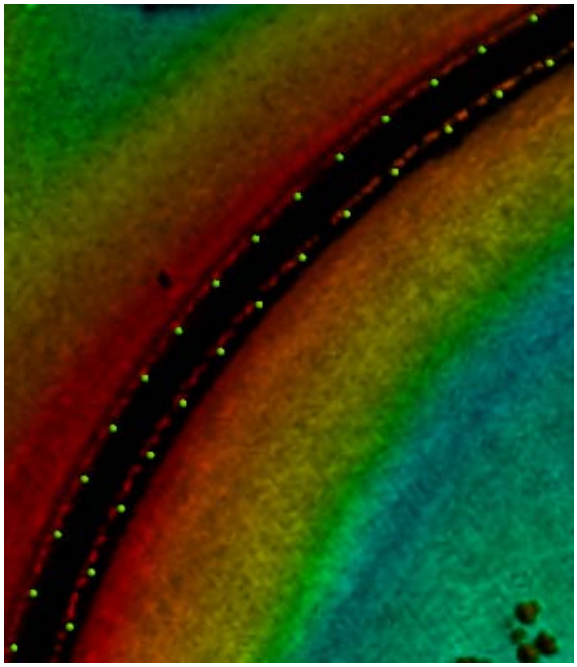
Problem

The Office of Aerial Engineering (OAE) has been using an Optech 30/70 ALTM airborne LiDAR system for about four years. The introduction of LiDAR technology was a major development towards improving the mapping operations, and the overall experiences are excellent, as evidenced by numerous projects, where highly accurate surface data were produced in an unprecedentedly short time. Similar to the pattern of other users, during the learning period of the new technology, OAE has identified areas for improvements in terms of achieving better accuracy and increasing data processing efficiency. In particular, the horizontal accuracy of the LiDAR product required further attention.



Objectives

- To introduce ground control to LiDAR by using road pavement markings that can be precisely surveyed by the ODOT GPS VRS system.
- To perform a strip adjustment for seamless integration of strips into the final product. Due to navigation solution and sensor calibration anomalies, the surface points in the strip overlap area may differ more than the vertical accuracy range would allow for.
- To improve the horizontal accuracy in order to better characterize the final product; i.e., to provide a measure for the horizontal accuracy similar to the vertical parameters.
- To improve accuracy (both horizontal and vertical), use ground control that is less labor-intense, requires no or limited surveying and imposes less restrictions in normal field operations.

Description

The ultimate objective of this research project was to advance the earlier developed LiDAR-specific ground control-based LiDAR data accuracy improvement technique by including existing natural and man-made objects as targets, in particular using pavement markings, and extending the methodology for handling both types of targets in a highly automated way. Obviously, the total elimination of the deployable targets was the desirable long-term research objective.

Conclusions & Recommendations

The developed technique in this research project, which is based on using road pavement markings, has shown good automation potential and attractive performance as a tool to validate the horizontal accuracy and/or to provide for strip corrections, if needed. Except for the automated pavement markings extraction component, all the other processing steps exhibit a rather robust performance. Ongoing tests are expected to further increase the performance level of this process.

In summary, based on our test results, the horizontal accuracy terms can be obtained around 5 cm precision for typical transportation corridor projects, at engineering scale, flown by the ODOT OAE LiDAR system. This performance level should satisfy the accuracy requirements of most OAE products.

Implementation Potential

The OSU staff worked in close collaboration with ODOT OAE personnel to ensure that all functional aspects of the horizontal accuracy requirements were met in the project. The OSU-developed code in Matlab, wrapped in C++ has been passed to GeoCue Corporation for integration and is under extensive product testing. We expect to further collaborate on the integration, so the developed technique can be used as a standard production tool in GeoCue in the ODOT OAE production environment.