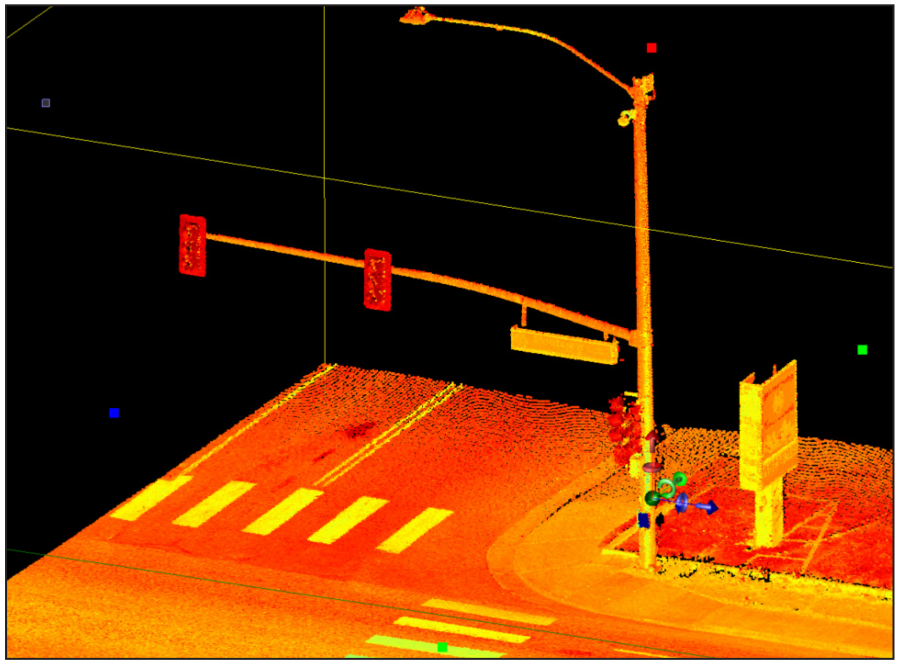
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 21-430 (project 615) | March 2021

A LiDAR-Based Approach to Quantitatively Assessing Streetscapes



the ISSUE

More than a century of research suggests that the size and spatial location of various streetscape features impacts walkability, livability, road safety, and other outcomes. However, current techniques for measuring/mapping streetscapes are limited to subjective audit-based methods, crude feature counts, or simple 2D Geographic Information System processing of roadside features.

the RESEARCH

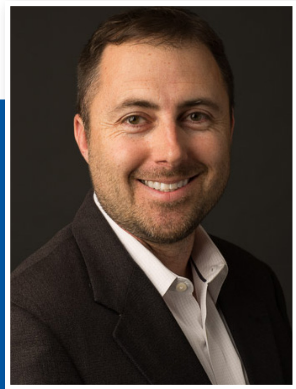
Researchers investigated objective methods to extract streetscape features with three different classes of light detection and ranging (LiDAR) processed with 3D volumetric pixels (voxels). LiDAR is a sophisticated aerial surveying and remote sensing technology that is becoming widely available for public use. The first part of the research investigated what streetscape features are detectable within the common USGS QL1 standards. Previous work looked at USGS QL2 LiDAR data, and the results were limited to buildings and street trees. Results from QL1 LiDAR data, being four times denser than QL2 data, suggest that many more streetscape features are detectable.

The second streetscape LiDAR dataset this report investigates is a mobile LiDAR dataset. Mobile LiDAR collects more than 2,000 points per square meter, which facilitated the measuring and quantifying of features such as small landscape furniture, traffic signage, and traffic signals that were not detectable with publicly available USGS LiDAR.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

Colorado State University
North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
University of Wyoming



Lead Investigator(s)

Wesley E. Marshall, PhD, PE
University of Colorado Denver
wesley.marshall@ucdenver.edu

Bruce Janson, PhD
University of Colorado Denver
bruce.janson@ucdenver.edxu

Research Assistant(s)

Yaneev Golombek, GRA

Project Title

A LiDAR-Based Approach to Quantitatively Assessing Streetscapes

Sponsors | Partners

Student support from the United States Geospatial Intelligence Foundation (USGIF)

In-kind support from CompassData,Inc.

University of Colorado Denver

USDOT, Research and Innovative Technology Administration

the FINDINGS

Several streetscape areas with QL1 coverage in Las Vegas, NV, were processed and analyzed. In addition to street trees and buildings, an analyst can also legitimately extract and statistically quantify walls, fences, landscape vegetation, light posts, traffic lights, power poles, power lines, street signs, and miscellaneous street furniture.

The results of the mobile LiDAR analysis suggest that mobile LiDAR's density allows for much smaller voxels and to thoroughly measure smaller streetscape features in 3D. This also includes street trees, light/lampposts, street furniture, traffic and commercial signage, building window proportions, awnings, and enclosed courtyard restaurants. Moreover, mobile LiDAR's density, tied to the ability to quantify features into smaller voxels, facilitated the ability to objectively measure and categorize these streetscape features in walkable, downtown-like streetscapes.

The LiDAR datasets studied can measure and quantify nearly all features found in a standard streetscape. The methods presented in this report for classifying and quantifying streetscape features into voxel height zones ultimately allow for comprehensive tabular descriptive statistics to be generated for any single or multiple features within a streetscape.

the IMPACT

With LiDAR's high precision and accuracy, this project suggests that the methods discussed provide the most objective 3D spatial location of streetscape feature data, which can ultimately be applied to better predict the impact of the streetscape environment on traffic safety, walkability, and other outcomes. LiDAR analytics have the potential to supplement and/or replace time-consuming and possibly subjective audit-based streetscape measures.

For more information on this project, download the entire report at https://www.ugpti.org/resources/reports/details.php?id=1029

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.