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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

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Research Notes

ADA Ramp Compliance Assessment Automation Using Point Cloud Data

Automated tools for evaluating curb ramp compliance using Light Detection and Ranging (LiDAR) data.

Construction

November 2025

Project Title: ADA Ramp Compliance Assessment Automation Using Point Cloud Data

Task Number: 4568

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WHAT IS THE NEED?

A method is needed for automatic curb ramp measurement that is reliable and fast. Mobile Terrestrial Lidar Systems (MTLS) or Terrestrial Lidar Systems (TLS) provides an ideal solution for this need. The resulting point cloud data would support extraction of curb ramp features such as slope, cross slope, and counter slope. While such extraction can be done manually using existing point cloud software, this is still a time-consuming and labor-intensive manual process. It would be extremely useful and cost-effective to automate all or a significant portion of this process. Automation is vital to reduce cost and time for Americans with Disabilities Act (ADA) curb ramp feature extraction combined with quantitative measurements to ensure ADA compliance. Traditionally, ramp measurements are conducted manually in the field by trained personnel. This method is highly labor-intensive, prone to errors and limited by the subjective interpretation of the field personnel. To mitigate these challenges, there is a need for automated tools and techniques to ensure consistent and efficient measurements of ADA-compliant ramps.

WHAT ARE WE DOING?

The research project will begin by developing or identifying a software application to support processing large-scale point cloud datasets and ADA curb ramp coordinate metadata, extracting individual curb ramp point cloud segments, and providing an intuitive visualization and annotation interface for labeling ramp type and boundary keypoints. The tool will generate structured annotation outputs to be used for training AI systems for automated ramp type classification and keypoint detection. Next comes the collection and annotation of ADA curb ramp data from Caltrans-provided MTLS point cloud datasets. A minimum dataset size of 1000 ramps is expected to be utilized for each ramp type. The

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research team will then develop, train, and evaluate improved machine learning models using the annotated ADA curb ramp datasets. The machine learning models will be capable of automatically identifying curb ramp types and extracting key point locations, supporting scalable and efficient ADA compliance assessment. The automated measurement methods will build on techniques from phase 1 (Task 4189) to cover all ramp types. The techniques will be used to obtain curb ramp dimensions and angles from detected keypoints and assess compliance with ADA standards based on ramp type-specific criteria. Finally, the automated compliance assessment point cloud measurements will be validated and benchmarked against field measurements provided by Caltrans on collected ramp types.

WHAT IS OUR GOAL?

The goal of this research study is to develop a comprehensive framework for automating geometric measurements and compliance assessments for ADA curb ramps using point cloud data. Specifically, the study aims to expand the Phase 1 research (Task 4189) to improve the efficiency, accuracy, and scalability of infrastructure assessments by integrating different processing techniques for the remaining six ramp types.

WHAT IS THE BENEFIT?

The automated system developed in this study will improve ADA accessibility by ensuring that infrastructure such as curb ramps, meet the required standards for individuals with disabilities, enhancing mobility and independence. By automating the assessment of ADA compliance, the method ensures that these assessments are more accurate, consistent, timely, and ultimately safer urban environments throughout California. It streamlines the surveying process, significantly reducing the labor and time traditionally required for manual inspections. The integration of point cloud data with deep learning techniques allows for more scalable and efficient assessments.

WHAT IS THE PROGRESS TO DATE?

The contract package is being reviewed by the Division of Procurement and Contracts (DPAC). The anticipated contract execution is in the spring of 2026.

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