Research Summary

A Pavement Marking Inventory and Retroreflectivity Condition Assessment Method Using Mobile LiDAR

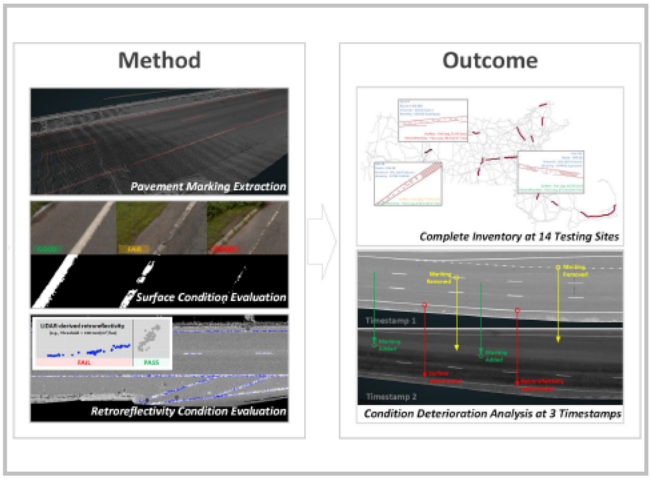
Research Need

To improve pavement marking performance at a national level, FHWA is proposing regulations to guide minimum pavement marking retroreflectivity levels. Regulatory compliance poses a challenge, as conventional methods of visual inspection are labor-intensive, and the results can be subjective. There is a pressing need for MassDOT to develop and implement an effective, efficient inventory and reliable retroreflectivity condition assessment method.

Goals/Objectives

This study is aimed at utilizing mobile light detection and ranging (LiDAR) and video log imagery data and developing an automated method for the extraction, localization, and retroreflectivity condition assessment of in-service pavement markings. The research team selected 14 representative testing sections with various road characteristics, pavement marking materials, and installation times, for analysis in this study. The detailed objectives include:

- Develop and validate an automated method for the inventory and retroreflectivity condition assessment for pavement markings as a proof of concept by leveraging the mobile LiDAR and video log images.
- Investigate the feasibility of identifying deterioration trends of retroreflectivity conditions using the developed LiDAR-based method for better defining the benefit-to-cost ratio of different pavement marking materials in the future and eventually leading toward the MassDOT's pavement marking standards.



Methodology

In this study, a complete data processing methodology for guardrail inventory from raw LiDAR and video log image data acquisition to GIS integration. The methodology consists of five key steps, including data acquisition, guardrail location identification, guardrail property extraction, guardrail condition evaluation, and the final guardrail inventory and GIS integration.

A suite of automated algorithms has been developed, including a LiDAR-based guardrail inventory algorithm using the Difference of Normal feature, a LiDAR and image-based guardrail terminal identification algorithm using OM sign identification and terminal curvature feature, a guardrail geometry measurement algorithm using ground and road boundary extraction, and several LiDAR-based guardrail defect identification algorithms using local guardrail defect feature

Key Findings

The research team has developed a complete methodology for automatically inventorying pavement markings and evaluating the corresponding retroreflectivity condition and binding material loss, using mobile LiDAR and video log images. This study demonstrated that the mobile LiDAR-based method is a feasible and reliable option for state transportation agencies to implement in their pavement marking inventory and retroreflectivity condition evaluation program.

Use of Findings

The deliverables of this study include a complete, georeferenced pavement marking inventory with retroreflectivity condition measurements for selected road sections. The georeferenced inventory database includes the detailed retroreflectivity deterioration trends covering three observation timestamps (i.e., 6-month intervals) within the duration of this study.

This study, as a proof of concept, has built a technical foundation for establishing an automated LiDAR-based methodology or program for comprehensively building the pavement marking management program that will meet the forthcoming MUTCD requirement. The findings of this study will guide MassDOT's selection of marking materials and repair frequency.

In addition, with the complete pavement marking inventory and condition information, the outcome of this study will also establish an essential data layer to support MassDOT's decisions on connected and autonomous vehicles (CAV) testing, implementation, and operation.

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Project Information

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