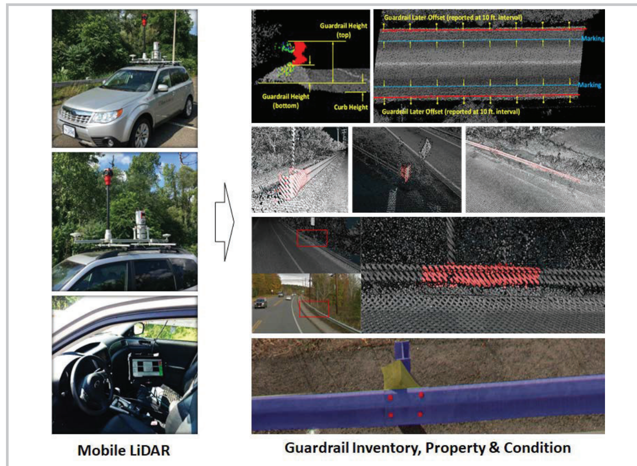
Research Summary

Automated Guardrail Inventory and Condition Evaluation

Research Need

Guardrail is an important infrastructure that provides effective prevention for vehicles running out of the road and protects critical roadside properties from consequential collisions. MassDOT actively works with FHWA on the Manual for Assessing Safety Hardware (MASH) implementation. It is critical to plan and manage MASH upgrades and integrate the guardrail asset within its asset management plan with a complete guardrail inventory.



Goals/Objectives

This study aims at developing and validating new processes using automated LiDAR and video-log imagery to inventory in-service guardrails and evaluate their condition using representative testing road sections, which consist of various types, lengths, and conditions. Detailed objectives include:

• Develop an automated methodology for determining the presence of guardrails along the roadway and for extracting inventory information, including georeferenced starting and ending points, terminal types, curb presence, lateral offset (from the edge of the nearest travel lane to the guardrail), and elevation (from the pavement surface to the tip of the guardrail).

• Develop an automated methodology for identifying typical conditional defects for guardrails, including face dentation, end terminal damage (or missing), and guardrail support deficiency. The research team investigated the feasibility of identifying missing bolts or connection failure of guardrails using image processing.

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 and validated a comprehensive methodology for automatically inventorying the guardrail and extracting the corresponding properties and conditions of the guardrails.

The results have shown that mobile LiDAR is an effective and efficient technology for network-level guardrail inventory with detailed property and condition information.

Use of Findings

Besides the validation, a case study covering 15 miles of the network (including State Route 9, State Route 12, and State Route 122) near Worcester, MA, was developed to demonstrate the feasibility of the developed methodology for network-level analysis. The resulting inventory geodatabase with all the properties and conditions can be readily used for supporting asset management and safety improvement tasks for MassDOT.

The next step of this study is to implement the developed methodology in a large network so that a comprehensive guardrail inventory can be established for MassDOT. In addition, for meeting the MASH compliance and facilitating streamlined guardrail management, the developed methodology for property extraction and condition evaluation can be further validated for detailed classification of different terminal types and the defected support of the guardrails respectively.

The developed algorithms are also ready to be customized for other critical assets, e.g., sound barriers, light poles, signal posts, etc.

Project Information

This project was completed as part of the Massachusetts Department of Transportation (MassDOT) Research Program with funding from Federal Highway Administration (FHWA) State Planning and Research (SPR) funds.

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Project Start Date:

Jan 2021

Project Completion Date:

May 2022

MassDOT Research Project Number:

Key Words:

Guardrail, Safety, Asset Management, LiDAR

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