Development and Validation of Methodology and Tool to Estimate Retroreflectivity of Pavement Markings Using LiDAR

CTIPS-010 – UTC Project Information

Recipient/Grant Number:	North Dakota State University, University of Utah Grant No. 69A3552348308
Center Name:	Center for Transformative Infrastructure Preservation and Sustainability
Research Priority:	Preserving the Existing Transportation System
Principal Investigator(s):	Juan Medina, Ph.D.
Project Partners:	USDOT, Office of the Assistant Secretary for Research and Technology – $50,000
	Utah Department of Transportation – $55,000
Total Project Cost:	$105,000
Project Start and End Date:	5/6/2024 to 5/5/2026

Project Description

Pavement marking retroreflectivity plays a significant role in communicating drivers their location with respect to roadway lanes, particularly during low light and low visibility conditions. As such, retroreflectivity plays important role in traffic operations and safety. Moreover, a recent ruling from FHWA introduced a mandate for transportation agencies to maintain minimum levels of retroreflectivity on public roads, resulting in the need for agencies to measure and monitor pavement markings in order to maintain compliance with such requirements. Typically, retroreflectivity of pavement markings is measured using retroreflectometers operated manually or mounted on mobile devices. However, even though mobile setups allow for the collection of measurements at driving speeds, they require special equipment and represent significant costs. Therefore, improvements leading to retroreflectivity estimates without extensive data collection needs could represent a significant reduction in related costs and data processing. The proposed project targets an opportunity to achieve such benefits, by repurposing LiDAR datasets the agency already collects periodically, and postprocessing them to extract retroreflectivity estimates intended to supplement and eventually replace field measurements using reflectometers.

USDOT Priorities

The objectives proposed in this project are directed and strongly linked towards improvements in safety, as the primary USDOT strategic goal. Likewise, the project directly impacts practices leading to effective utilization of resources, enhancing an agency's ability to preserve the existing transportation system.

Outputs

Outcomes form this project are expected to have multiple avenues for technology transfer activities, including a seminar and presentations to researchers and practitioners, as well as serving as a significant step towards further development into policies related to estimating retroreflectivity of pavement markings. Such policies, in turn, are expected to lead to a sustainable program for maintenance of such pavement treatments, and ultimately to improve safety.

In addition, enhancements to the tool as part of the proposed project will allow the team to disseminate the computer tool through avenues discussed in coordination with UDOT. Thus, the outcomes of the project will have further potential to reach practitioners and researchers through a source code and/or the executable application tool directly available through a website maintained by the PI or through a site provide by UDOT. A document accompanying the computer tool will be developed to illustrate the uses of the tool and sample reports of retroreflectivity assessments that could be used to support federal reporting.

Lastly, the findings from this research are expected to serve as the basis for further development of a comprehensive plan to maintain and report retroreflectivity pavement markings at the state level. Such maintenance plan is needed not only to meet new federal requirements, but also to improve efficiencies and ultimately safety.

Outcomes/Impacts

This research is expected to provide 1) a new methodology to assess levels of pavement marking retroreflectivity using LiDAR datasets; 2) a determination of the retroreflectivity levels assessed through the methodology, regarding their compliance with the minimum values specified by the new FHWA ruling and a confidence level on this determination; and 3) a computer tool to be used by the Utah Department of Transportation (and possibly others) to input LiDAR data, process the data through the proposed methodology, and to determine the estimated retroreflectivity compliance with FHWA ruling.

Altogether, this research is expected to produce a significant stepping stone conducive to establishing a long-term plan to assess and report levels of retroreflectivity pavement markings in light of the new FHWA ruling on minimum levels to be maintained on certain public roads.

Final Report

Upon completion, the final report link will be added to the [project page on the CTIPS website](#).