Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6647: Developing Luminance-Based Mobile Highway Delineation Equipment and Level of Service Guidelines for Safe Nighttime High-Speed Travel

Background

No matter how well a roadway system is designed for the intended traffic, that system is only as effective as the traffic control devices (TCDs) are at clearly delineating the drive path as it was intended in the original design. Once these devices are in place on a new or reconstructed roadway, transportation agencies must assess when TCDs are no longer visible to drivers and no longer providing adequate guidance for drivers to safely navigate the roadway network. Transportation agencies routinely travel their extensive roadway networks conducting subjective roadway assessments of TCDs both day and night.

A federal requirement, retroreflectivity is a good tool for product testing but can provide false positives for TCDs based on the approach geometry, such as when a sign becomes twisted. This research project developed an objective nighttime assessment method for TCDs using TCD presence and luminance that could be tied back to a form of level of service.

What the Researchers Did

The researchers reviewed the pertinent literature with an emphasis on research and factors study (see Figure 1) to gather real-world driver assessment of in-service TCDs and their correlated luminance. These data were used to predict driver assessment values of in-service TCDs that would be used to assess their level of service under nighttime conditions along high-speed rural roadways.

What They Found

The level of service of existing TCDs can be tied to a measurable metric, such as presence and TCD luminance. The researchers considered the retroreflectivity, luminance, and contrast ratios of these properties. Considering the capabilities of the prototype mobile luminance measurement system and models developed from the human factors study, the researchers developed a framework for conducting nighttime inspections to assess the level of service of existing TCDs along rural two-lane roadways. The researchers considered two approaches to the nighttime inspections: precise measurement and approximate measurement.

Using the precise measurement method, each district could drive its roadways and record images continuously. While this method is time consuming and labor intensive, the data from this method could be used for planning purposes.

The approximate measurement method uses on-screen, real-time processing by the data collection staff. This method would be used in a simple pass/fail criteria level of service model and could be tied to retroreflectivity, which could be beneficial in light of Federal Highway Administration minimum retroreflectivity requirements stated in the *Manual on Uniform Traffic Control Devices*.

At this time, the researchers recommend only using these methods to supplement existing nighttime inspections until either method can be validated.

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Texas A&M Transportation Institute

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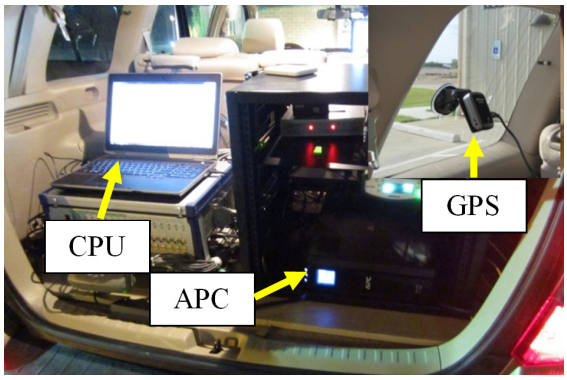
What This Means

Researchers recommend the following:

- Evaluate the precise and approximate measurement methods in conjunction with nighttime inspections and retroreflectivity measurements to assess the accuracy and repeatability versus time required to collect data.
- When using the precise method, compare the prescribed treatment along roadway segments based on curve and tangent assessments versus tangent segments only because it is more cost-effective with respect to time and money, and more likely to match current requirements and practices with respect to TCD maintenance. For instance, it is not likely that districts would add delineators in a curve that did not already have them because delineators should be installed based on the severity of the curve.
- Consider the integration of three-dimensional scanning light detection and ranging (LIDAR). Significant advances have occurred to measure distance from an object using LIDAR, and it will soon be possible to measure distance to roadside TCD hardware more efficiently in a manner that would help generate more accurate inventories and potentially improve the likelihood of full automation in post-processing.
- Consider the integration of a motorized varifocal lens with a motorized iris to better accommodate on-the-fly in-field system adjustments that are traceable and minimize error.

(a) Lighting and Luminance Camera Setup

(b) Headlight Controller



(c) Computer, Power, and GPS

(d) Data Collector Station

Figure 1. Human Factors Data Collection Setup.

For More Information

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