



Project Summary

Texas Department of Transportation

0-5089: Raised Pavement Marker Improvements

Background

Retroreflective raised pavement markers (RRPMs) are routinely used in Texas to supplement highway pavement markings. In recent years, problems resulting from marker failure such as poor retention on pavements, physical damage, and loss of retroreflectivity have been common. Several recent installations experienced mass failures.

All marker models used in Texas meet the requirements set by the American Society for Testing Materials (ASTM) specifications. However, their performance varies significantly, and results from existing testing methods do not correlate with field performance. It is therefore critical to identify or develop new lab testing methods that can accurately predict marker performance in the field. In addition to marker product quality control, investigation of other factors affecting RRPM performance and development of countermeasures are important for the improvement of marker performance.

What the Researchers Did

Over a three-year period, researchers conducted the following tasks to identify the causes of RRPM problems and to evaluate marker performance on the field decks, in the lab, and through theoretical modeling, so as to develop new lab tests that can predict marker field performance:

- Researchers conducted a survey of Texas Department of Transportation (TxDOT) districts and RRPM manufacturers to gather information on existing testing procedures and marker field performance.
- Researchers performed field visits to observe RRPM failure modes and installation processes.
- Four field test decks were installed and monitored. Retroreflectivity and physical condition data were collected on six RRPM models on the four deck locations that were selected based on traffic condition, pavement surface type, geographic, and other environmental factors.
- Researchers conducted lab tests. The tests included currently recommended ASTM tests, modified ASTM tests, and other new tests.
- Researchers conducted finite element modeling of RRPMs under tire-marker impact and lab testing settings to gain insights into the correlation between lab test results and marker performance by comparing the stresses inside the RRPMs.
- Finally, the researchers conducted an analysis to correlate lab and field test performance to make lab test recommendations.

Research Performed by:

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What They Found

This research yielded several important findings with respect to RRPM performance and testing methods, some of which are:

- Performance of RRPM products has a wide range and depends on traffic volume, truck traffic, and pavement surface type.
- Retroreflectivity degrading is directly related to average daily traffic.
- High truck traffic significantly accelerates marker physical damage.
- Marker physical conditions deteriorate more rapidly on concrete surfaces but some models perform remarkably poorer on flexible surfaces due to cracking of the marker case.
- No marker models were found to withstand high traffic volumes beyond one year.
- Marker retention is directly related to installation quality.
- Existing lab testing methods do not produce results consistent with field performance.
- The results from the developed pendulum impact test (shown in the figure) had a sound correlation with that of field performance.



Developed Pendulum Impact Test

What This Means

Based on the findings from this project, the researchers conclude that there is a critical need to emphasize the quality of RRPM installation as it directly relates to retention and performance in the field. TxDOT's current RRPM replacement schedule is reasonable for the products currently available in the market. The researchers also recommend conducting pendulum impact tests for the purpose of marker qualification and quality control.

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