MATERIALS & RESEARCH

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RESEARCH UPDATE

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QUIK-GARD[®] GUARDRAIL DELINEATORS (Final Report)

REFERENCES

Work Plan 2001-R-5 (Product Evaluation)

INTRODUCTION

Numerous studies have been conducted nationwide to look at safety-related issues in respect to older drivers. As a result, an influx of safety-related devices for highways is emerging. In response to some of these studies, the state of Georgia commissioned Plastic Safety Systems, Inc., to devise a product to heighten driver awareness of guardrail locations. The result is the Quik-Gard[®] guardrail delineation system.

PRODUCT DESCRIPTION

Quik-Gard[®] guardrail delineators, manufactured by Plastic Safety Systems (PSS), Inc., of Cleveland, Ohio, is a system designed to provide increased and improved delineation of guardrails. The system is marketed to provide increased safety at work zones, dangerous curves and intersections, entrance and exit ramps, high speed areas, and areas with low visibility.

Constructed of black, 1/8" thick, high-density polyethylene with an ultraviolet protection package, the markers are manufactured in four configurations for varying application situations that provide reflective surface areas ranging from 12 to 52 square inches. The delineators, mounted directly behind the guardrail, can be attached to wood, plastic, or steel spacer blocks in the guard rail system. At the time of installation, the manufacturer's recommendation for installation included 3M-VHB tape, lag screws, epoxy, and nails, depending upon the material in the guardrail system.

COST

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At the time of installation the material cost for the Quik-Gard^{\oplus} guardrail delineators ranged from \$3 to \$6 per delineator depending on the size of the marker and the reflective sheeting grade. For the purposes of this study, the materials and installation was provided at no cost to the agency.

PROJECT DESCRIPTION

The site chosen for the evaluation of the Quik-Gard[®] guardrail delineation system was the northbound on-ramp of Interstate I-89 at Exit 7, in Berlin, Vermont. This location, with a horizontal curve and limited visibility, has guardrail on both the right and left side of the ramp as seen in Figure 1. In addition, the site is located in an open area and typically receives a considerable amount of snowfall, allowing to test the product's ability to withstand UV damage and damage caused by snowplowing.



Figure 1. Northbound Ramp at Exit 7, I-89 (before installation).

INSTALLATION

On May 31, 2001, Quik-Gard[®] guardrail delineators were installed on both the right-hand and lefthand side of the Exit 7, I-89 northbound on-ramp in Berlin, Vermont. On each side of the ramp (25) 4"x6 ½" and (10) 4"x13" markers were affixed to every third post with the larger markers evenly distributed between the smaller ones. In areas were the spacer block was damaged, the marker was placed on the next adjacent post. A total of 70 markers were placed along the entrance ramp, as shown in Figure 2.

The regional manufacturer's representative from PSS, Inc. was on-site to install the product in accordance to the manufacturer's recommendations. At the time of installation overcast skies prevailed with an ambient air temperature of 50°F. Each spacer block was wiped clean with a cloth prior to the delineator's attachment to the steel spacer blocks and was affixed with a 6"x2" piece of F-68, butyl adhesive tape manufactured by the Plymouth Rubber Company of Canton, Massachusetts.



Figure 2. Northbound Ramp at Exit 7, I-89 (after installation).



Figure 3. Detail of adhesive tape.

PERFORMANCE

After one month in place, one of the delineators on the right-hand side of the ramp had fallen off the steel spacer block. During an inspection in August 2001, it was discovered that two additional delineators had come off (one on each the right-hand and left-hand side), and in mid-December another became detached. The failure associated with these delineators is likely associated to the adhesive and method of attachment. Each of the delineators was recovered at the base of the guardrail post they were attached to with the adhesive primarily affixed to the delineator, as seen in Figure 4.



Figure 4. Detached delineator after three months.

On January 2002, an inspection revealed the loss of several more delineators on both the right and left side of the ramp. Some of these were found a few feet from the guardrail, some directly below the post, and some not at all due to the snow coverage. Similar to the ones lost in the summer and fall months, the failure of some of the markers was likely associated with the adhesive, but in these cases, the adhesive was either partially or fully attached to the steel guardrail spacer block as shown in Figure 5. Other delineators failed due to shear force, causing some to break completely or partially along the top edge of the spacer block as shown in Figures 6 - 8.

After 8 ½ months, only 40 markers remained affixed to the guardrail, 20 on both the right-hand and left-hand side of the ramp, resulting in a 57% loss. A final inspection in July 2002 revealed only 25 of the original 70 delineators were still attached to the steel guardrail spacer block.



Figure 5. Failure at adhesive.



Figure 6. Partial shear failure at top of spacer block.



Figure 7. Nearly complete shear failure at top of spacer block.



Figure 8. Shear failure above the spacer block.

SUMMARY

After 13 months of service, only 36% of the Quik-Gard[®] guardrail delineators remained intact along the northbound entrance ramp to Interstate I-89 at Exit 7 in Berlin, Vermont. A combination of failures, occurring under various climatic conditions was likely attributed to the large loss seen in Figure 9, as well as routine maintenance activities during the winter season.

The early failure during the summer and fall months was most likely associated with the adhesive's performance in warm climates. In the summer of 2001, Vermont experienced a warmer than average season, including several days with temperatures above 80°F. The adhesive's bond with the metal guardrail weakened causing the delineator to drop-off the spacer block.

The failures experienced during the winter and spring months were likely associated with several factors, such as the adhesive's performance in cold climates, its bond strength, and the brittleness of the PSS Quik-Gard[®] delineator. In some cases, the delineator became detached



Figure 9. Northbound Ramp at Exit 7, I-89 (13 months after installation).

leaving a majority of the adhesive on the metal spacer block. In others, the high-density polyethylene markers experienced a shear failure, likely associated with routine snow plowing activities such as contact between the plow equipment and the delineators or the force of the plowed snow against the markers. Vermont's 2001-2002 winter maintenance season experienced a less than normal snowfall and as a result, the snow banks did not require "winging" back as it would in a typical year.

Although the Quik-Gard[®] guardrail delineator provides high nighttime visibility, its designed placement location may be problematic in areas of heavy snowfall were normal snowplowing activities and maintenance routines require snow removal along the top of the guardrail. In cases where snow would need to be "winged", the placement of these markers above the guardrail would likely result in a loss of the delineators. In addition, the use of adhesive tape as the method of attachment resulted in the loss of several delineators in both warm and cold conditions.

In 2002, Plastic Safety Systems, Inc., modified their installation procedures recommending that on metal spacer blocks the delineators be attached by tapping a lag screw through the marker into the block and eliminated the sole use of butyl adhesive. According to the manufacturer, some states such as Georgia, Tennessee, New Mexico, and Illinois have approved the product for use in their state. Vermont's experience indicates a limited use for this product, although clearly visible, the product's design doesn't appear to withstand normal maintenance activities required in a snow belt region and may be suitable for only short-term applications.

DISCLAIMER

"The information contained in this report was complied for the use of the Vermont Agency of Transportation. Conclusions and recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Agency policy. This report does not constitute a standard, specification, or regulation. The Vermont Agency of Transportation assumes no liability for its contents of the use thereof."