MATERIALS & RESEARCH

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RESEARCH UPDATE U 2004-3

SNOWPLOWABLE RAISED PAVEMENT MARKERS
(Initial Report)

REFERENCES:

Work Plan No. 2001-R-6, Work Plan No. 2003-R-5A, Report No. 2002-5

INTRODUCTION:

Raised pavement markers (RPMs) have been widely used by state transportation departments for several years. Manufactured in different shapes and sizes, these devices are designed to accommodate areas with little or no snowfall as well as those in the snow-belt region. Snowplowable raised pavement markers (SRPMs) differ in design from conventional RPMs by incorporating a lower ramp angle to provide for better plowability and a minimal exposure above the road surface. This study will evaluate the performance of several different makes and models of SPRMs.

PROJECT DESCRIPTION:

The markers were installed to augment the center line of I-89 in the towns of Waterbury and Bolton. The markers were installed as part of the Waterbury/Bolton IM089-2(33) project which began at MM 62.5 (in the NB Lane) and extended northward to MM 71.470. The markers were installed in the southbound lane which was constructed in 2003 as part of Waterbury/Bolton IM089-2(32). This project began at MM 63.595 and extended northerly (in the southbound lanes) to MM 71.570. For this project 35 mm of bituminous material was cold planned and replaced with a similar thickness of Type IV Superpave Bituminous Concrete.

PRODUCT INFORMATION:

The first test site for the evaluation of raised pavement markers was located in the southbound lane of Interstate 89 in Waterbury between mile markers 66.55 and 64.75. In November, 2001, 126 Avery Dennison's model 101LPCR markers were installed between the center skip lines at intervals of 80 feet as part of the Middlesex-Bolton AC IM 089-2(26) project. After one-year, the markers had minimal damage with only one lens detaching from the casing. In the second

year, the markers continued to show little damage however in September, 2003 these markers were removed to make way for resurfacing in this location.

In 2004 SRPM markings were installed from MM 68.70 to MM 64.23 for a distance of 4.47 miles. The markers were placed according to the standards in the Manual for Uniform Traffic Control Devices, Section 3B.13, which states that the markers should be placed at 80 feet intervals augmenting the skip lines. The experimental markers were installed in the following sequence (in the direction of traffic):

1) Avery Dennison 101 LPCR	96 markers	SB MM 68.70 to 67.25
2) Hallen H1010	100 markers	SB MM 67.25 to 65.73
3) Ray-O-Lite SnowLite 150	50 markers	SB MM 65.73 to 64.98
4) Ray-O-Lite SnowLite 200	50 markers	SB MM 64.98 to 64.23

INSTALLATION:

The markers were installed on June 23, 2004. The weather was clear and the temperature ranged from 65 to 72°F during the application of the markers. Originally the experimental section was to start at MM 68.20 but the resident engineer decided that the markers should be moved farther north to ensure that they ended before the Exit 10 interchange. This resulted in the last marker being placed at MM 64.23.

Grooving to create the recess for the markers began at 8:40AM. The truck traveled at 5 MPH and stopped every 80 feet to install a groove for the markers. This process took only about a minute each with the grooving being completed at noon. The concrete saw is designed with a stack of 18" diameter concrete saw blades bordered by 20" diameter saw blades on each side. With a single plunge, the groove created is in the same configuration as the marker, allowing for a close match for the inset. (This blade pattern will vary depending on marker size and shape).

Figure 1 – Grooving

Figure 2 – Close up of Grooving

Behind the grooving truck two employees used a pneumatic hose to clean out the groove with compressed air. Immediately after this process, epoxy sealant was poured into the grooves. Without delay, the markers were positioned and tamped into place. This part of the installation process took considerably more time to accomplish than the grooving because of the number of

steps which took about one minute at each groove for the installation process. This had to be repeated every 80 feet for a distance of 4.47 miles, the length of the experimental site. This part of the installation began at 8:50 AM and was completed close to 7 hours later, at 3:45 PM. The epoxy adhesive system used consisted of two independent pressurized tanks that feed through two independent lines to a disposable plastic application tip. The two components, discernible by color, met at the nozzle and mixed within the spiraled chamber of the application tip producing a gray adhesive material. There were no difficulties or setbacks during the installation.

Figure 3 – Applying epoxy

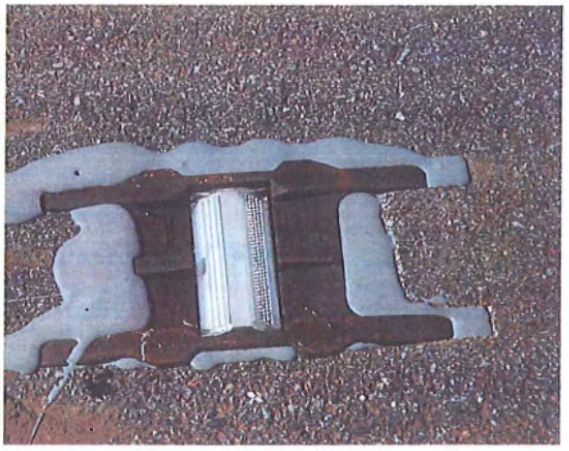

Figure 4- Finished marker

COSTS:

The 2004 cost for installing the markers was bid at $60.00 each as part of the contract with the overall cost for installation of $17,760. This cost did not include the removal of the old markers.

RELATED INFORMATION

Both the Avery Dennison Model 101 and the Hallen H1010 were installed on a test deck as part of a National Transportation Product Evaluation Program test in Ohio in 2000. Located on Interstate 270, near Columbus, Ohio, this evaluation reported on the field performance of four SRPMs. In addition to a field review, the Georgia Department of Transportation provided some laboratory test results on each of the markers. The criteria for the test site required a pavement structure in good condition, an average annual daily traffic greater than 20,000, a minimum snowfall of 25 inches per year controlled with plowing, salt, and grits, and a speed limit of 50 to 75 miles per hour (Ohio, 5). During the two-year period, this site met these criteria with the first winter being harsher then the second.

This study indicated that after one-year, the condition of the housing and lens of the Stimsonite LPCR101 SRPMs are good, but the overall visibility is fair. In the second year, the housing continued to remain in good condition with both the lens and visibility performance declining to a rating of fair to poor condition. Comparing the results of this NTPEP study's first year data and the field performance of the SRPMs on I-89 we can conclude the performance is similar.

Between 1983 and 1986, Vermont evaluated the performance of two different types of SRPMs. Placed as a supplement to traffic markings, these devices were installed along the center skip line of Interstate I-89 in Waterbury and within the gore areas of the northbound and southbound exit ramps at the Exit 10, Waterbury interchange. The results of this study concluded that these devices provided excellent reflectivity in wet and dry nighttime conditions initially, but declined rapidly after exposure to traffic and typical winter maintenance practices. Since the 1983 installation, the design and installation techniques of SRPMs have been improved upon, warranting another evaluation of their performance.

SRPMs installed on Vermont's interstate in 1983 experienced significantly more damage than those tested in the NTPEP study with 93% of the markers exhibiting some type of damage after its first winter season (Houston, 14). One of the two SRPM markers evaluated in this study was a Stimsonite model, but with a higher profile. Hence, it is probable that the redesigned lower-profile units contributed to a more successful performance of the device.

SUMMARY:

The markers installed in 2001 performed well for the two years that they were in service. Only one of the lenses debonded from the marker and none of the housings were detached from the pavement. Since these new markers were installed in June 2004, no problems or concerns have been reported.

FOLLOW UP:

Monitoring by Research staff scheduled to begin in 2005, will help determine overall effectiveness of these experimental devices.

REFERENCES

Houston, E.C., "*Experimental Use of Raised Pavement Markers on I-89*," Initial Report 85-11. State of Vermont, Agency of Transportation, Montpelier, VT. December 1985.

Ohio Department of Transportation et al, "*Second Year and Final Field Evaluation of Plowable Raised Pavement Markers (SRPMs),*" Report 00 NTPEP 208. AASHTO's National Transportation Product Evaluation Program, Washington, D.C. January 2001.

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