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Supplementary Notes				
Abstract A demonstration project was set up to test a marking system by Stimsonite designed to provide daytime and nighttime delineation for work zones. The temporary markers were placed on five-foot centers along the centerline and edgelines. This study presents an evaluation of the marking system by a task force formed to observe its installation and removal and to assess its durability and day/night delineation capabilities.				

AN EVALUATION OF THE MODEL 66 RAISED PAVEMENT
MARKER SYSTEM BY STIMSONITE

by

Frank D. Shepard
Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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INTRODUCTION

Inadequate safety in work zones is a serious problem. Statistics show that 29 people died and 167 were seriously injured in work zones in Virginia in 1985. One way of increasing work zone safety consists of providing clear guidance for motorists approaching and traversing a work zone. Motorists are typically required to deviate from their expected travel path when traversing work zones. It is important that every effort be made to clearly indicate the direction of road alignment. Raised pavement markers are sometimes used to enhance work zone delineation. One system utilizing raised pavement markers that is being used in several states is a construction zone marking system by Stimsonite, which is designed to provide daytime and nighttime delineation. Because of its potential for providing improved guidance and safety in work zones, a demonstration project was set up to test this system.

INSTALLATION SITE

A site was chosen on Interstate 85 at the toll booths in Dinwiddie County. Figure 1 shows the northbound approach to the toll booth after the markers were installed. Since the toll booths were being removed, it was necessary to move traffic to the southbound lanes (2 way) while the northbound booths were being dismantled and to the northbound lanes while the southbound booths were being dismantled. This required traffic to be directed around the work area, which provided a good site for testing the effectiveness and durability of the Stimsonite system.

MARKING SYSTEM

A construction zone marking system by Stimsonite, designated as "Model 66," was installed. The markers, shown in Figure 2, are made of a plastic material and provide reflectivity by using corner-cube reflectors.

The markers were placed on five-foot centers along the centerlines and edgelines using a bituminous adhesive. Solid pieces of the bituminous adhesive were placed in an applicator for melting. After reaching melting temperature, the adhesive was applied at predetermined spots along the road. Figures 3 and 4 show the adhesive being applied and the positioning of the markers. The system is applied without stripping since the close spacing and marker color is supposed to simulate pavement stripping.

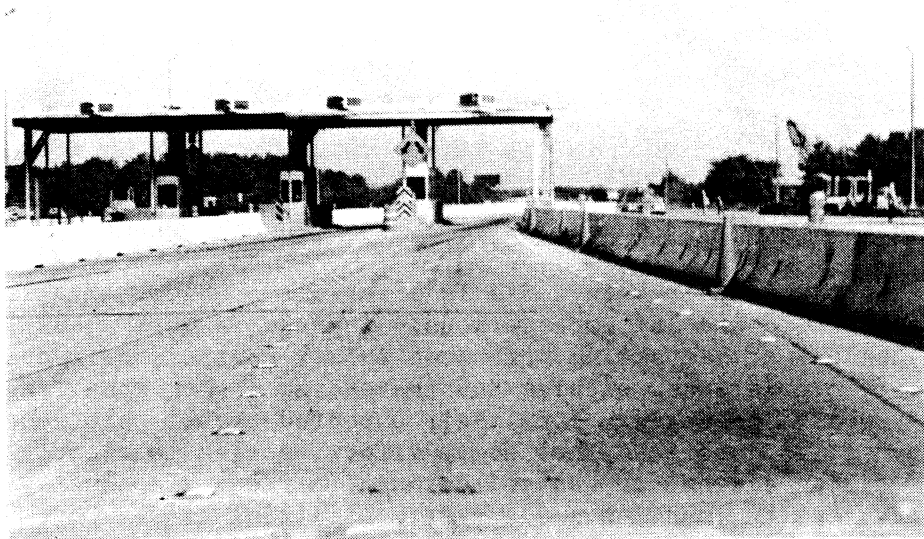


Figure 1. Study site at I-85 toll booth.



Figure 2. Raised markers used for delineation.

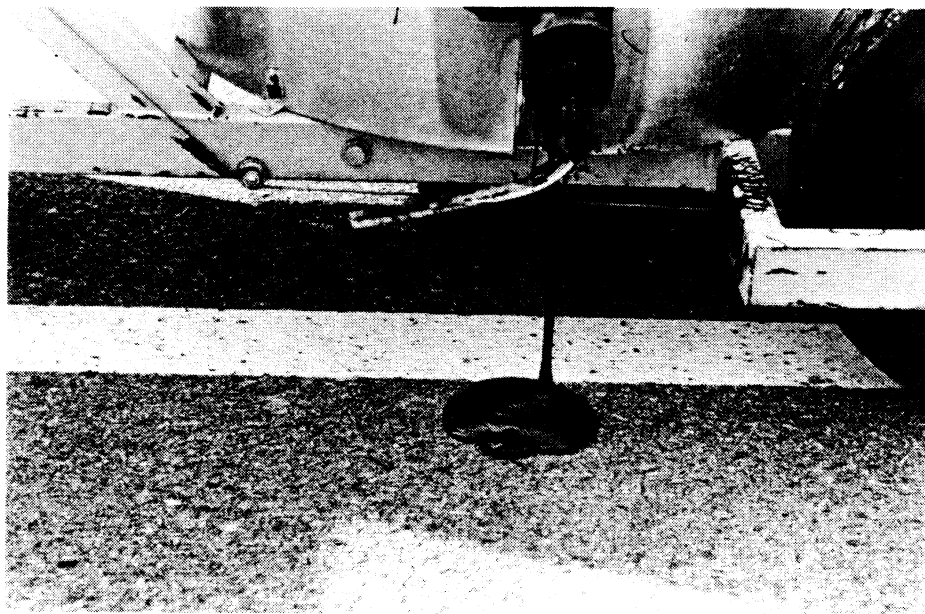


Figure 3. Application of adhesive for securing raised markers.



Figure 4. Placement of raised markers on adhesive.

In the first phase, 1,500 temporary markers were placed along the southbound lanes and remained for 21 days. In the second phase, 1,306 markers were placed in the northbound lanes and remained for 17 days.

After the demonstration, the remaining markers were removed using a loader bucket as shown in Figure 5.



Figure 5. Removal of raised markers.

EVALUATION

The marking system was evaluated by forming a task force to observe its installation and removal and assess its durability and day/night delineation capabilities.

Marker Installation

Installation of the markers was delayed until the bituminous adhesive could be broken into pieces and melted in the applicator. The lane was closed while the markers were being applied.

Durability

Marker durability was evaluated by noting the number of markers lost and the extent of their discoloration. Five markers were lost during Phase I, which lasted 21 days, whereas 132 markers were lost during Phase II, which lasted 17 days. The loss rate was low for Phase I; however, during Phase II, twenty-one markers were lost in one night. It was theorized that a temperature drop below freezing was the primary cause since this was the only variable that changed. Also, 86 markers were lost as a result of an accident. During the last five days of the project, five markers were lost per day. The rate of loss was higher for concrete pavement than for bituminous.

Discoloration was evident in areas where traffic encroached on the markers. Figure 6 shows an example of "tire black" on the markers. The movement of some markers from their original position on the concrete pavement was observed.

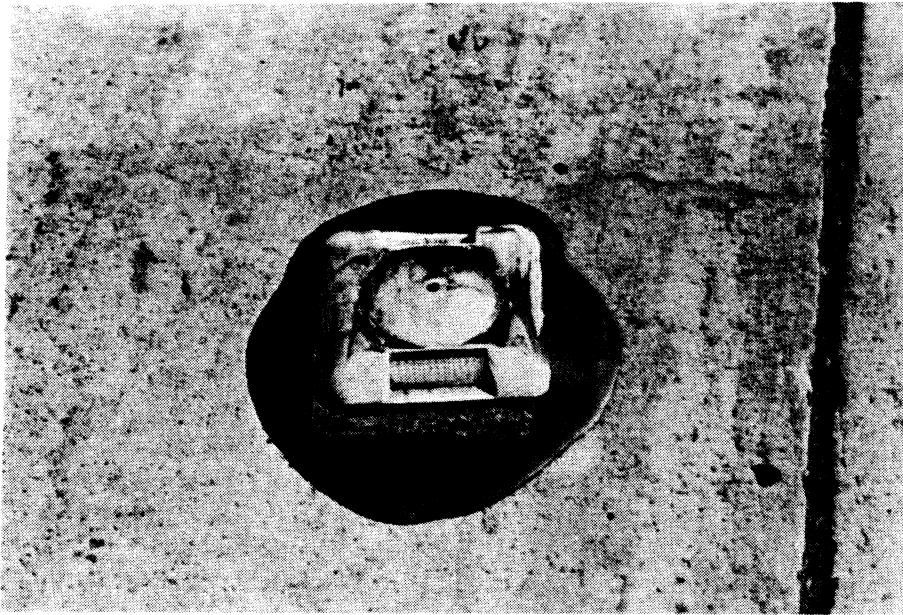


Figure 6. An example of discoloration.

The difficulties with lane delineation are compounded whenever markers are lost or become dirty since they are the only source of delineation.

Visibility

It was felt that during daylight the marking system did not adequately provide the required pavement marking for lane delineation. Effective marking of the desired paths of travel was not provided since the raised markers, which were the only source of guidance, did not significantly contrast with the pavement. This problem was aggravated by differences in pavement texture and pavement color, old pavement markings, and the fact that pavement joints were not parallel to the travel lanes. Figures 7, 8, and 9 show some of the markers in the vicinity of the toll booth.

The lane delineation was better during darkness because of the good retroreflectivity and brightness provided by the closely spaced markers. Figure 10 shows the markers at night.

Marker Removal

Markers were removed using a tractor loader blade, which easily dislodged them from the pavement. In most cases, part of the adhesive remained on the roadway (see Figure 11). Also, there were instances in which part of the bituminous pavement was dislodged along with the markers (see Figure 12).



Figure 7. Marker placement on the approach to the toll booths.

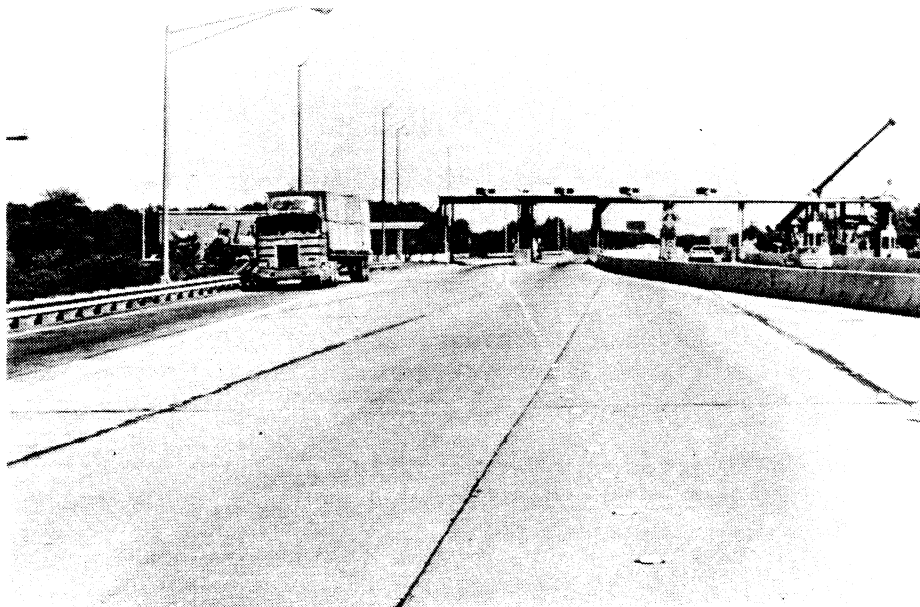


Figure 8. Marker placement on the lanes existing the toll booths.



Figure 9. Marker placement beyond toll booths.



Figure 10. Visibility of marker system at night.

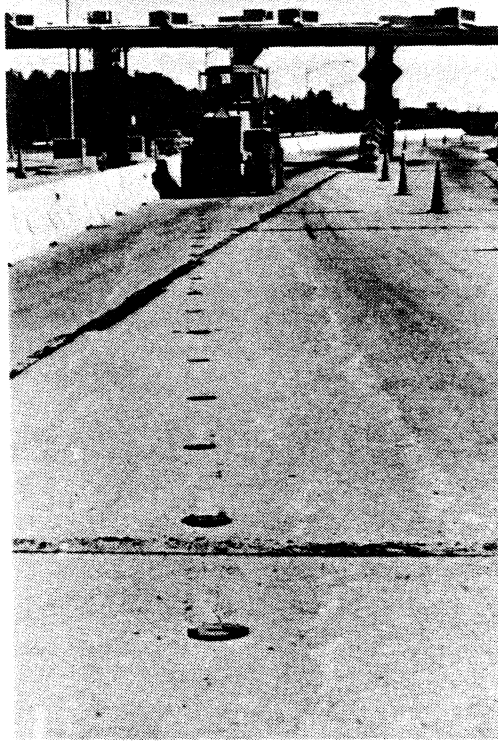


Figure 11. Concrete pavement after marker removal.

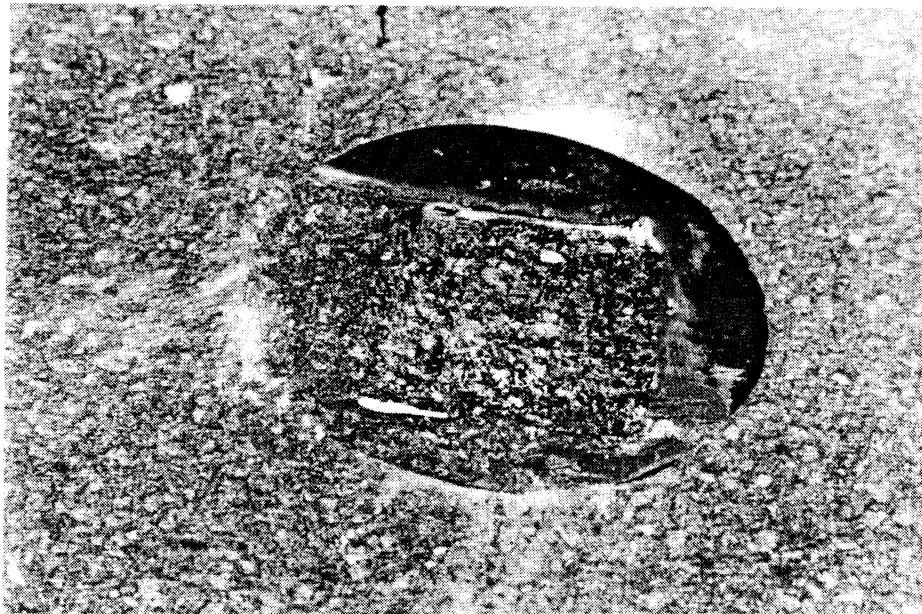


Figure 12. Bituminous pavement after marker removal.

CONCLUSIONS

Based on periodic observations made by the task force, the following conclusions are offered:

- The markers could not be used in winter because snowplows would dislodge them.
- The markers are subject to discoloration by tire scuffs, thus decreasing visibility.
- The markers provide good delineation at night, especially during wet conditions.
- The loss of markers causes gaps in the lane delineation leading to discontinuous and confusing delineation.

The unanimous opinion of the task force was that these markers are unacceptable for the purpose of guiding motorists. It was felt that effective guidance through work zones is critical, and it is thus necessary to provide continuous stripping supplemented with raised pavement markers when necessary.

