

RAISED MARKERS PLACED IN PAVEMENT GROOVES

by

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(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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ABSTRACT

Previous research has noted the feasibility of placing raised pavement markers in grooves cut into the pavement to prevent them from being damaged by snowplows. Because of the potential economic benefit of using this procedure in place of the one presently in use to install a durable, effective marking system for night-wet roadway delineations, a demonstration project was set up.

It was concluded that placing the markers in grooves is a feasible means of protecting them from snowplow damage and that while markers so placed provide an acceptable level of retro-reflectivity. The method offers an economic advantage over the marking procedures presently used by the Department.

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INTRODUCTION

Raised pavement markers are being used around the state for roadway delineation, and in most cases they are protected from snowplow damage by using steel castings that allow the plow blade to pass over the markers without contact. The steel castings commonly used are effective but expensive. A 1979 study by the Council evaluated the feasibility of using an alternative method of protecting the marker by placing it in a groove cut into the pavement surface.* From that evaluation, it was concluded that placing the markers in grooves was a feasible means of protecting them and that markers so placed provided effective night visibility. However, the method used to groove the pavement was time-consuming and expensive, and it was recommended that this method of centerline delineation not be used until a more efficient method of cutting the groove and securing the marker was found.

Since the 1979 study, and through a concerted effort by governmental and private agencies, viable procedures for pavement grooving and marker placement have been devised. Based on the potential of the procedure for use in constructing an economical and effective marking system, a demonstration project was set up.

S. & C. Concrete Cutting, Inc., of Kirkersville, Ohio, was contracted to install 169 markers on a 4-lane, divided section of Route 33 at the top of the mountain at Swift Run Gap. This location is noted for frequent dense fogs and ice and snow conditions.

PURPOSE AND SCOPE

In the demonstration, emphasis was placed on (1) the initial cost of grooving the pavement and placing the markers, (2) the durability of the markers and grooves, and (3) the delineation provided by the markers. Only the Stimsonite Model 947 marker was used.

*Shepard, F. D., Evaluation of Recessed, Snowplowable Markers for Centerline Delineation; Virginia Highway & Transportation Research Council, July 1979.

Installation

The markers were placed in longitudinal grooves cut between each centerline skip (40 ft. o.c.) on a 4-lane.

Figure 1 is a schematic of the groove, which is 44 in. long, 4-1/8 in. wide, and tapers to a depth of 1/2 in. where the marker is placed. (The marker is 1/2 in. high.) Figures 2 and 3 show the groove being cut into the bituminous pavement and dried with an air hose, while Figures 4 and 5 show the epoxy adhesive being applied by hand and the marker being placed in the groove.

EVALUATION

The evaluation consisted of estimating the installation cost and subjectively rating the durability of the grooves and markers and the visibility characteristics of the markers. Also, the build-up of debris in the groove was observed.

RESULTS

Cost

The markers cost \$1.25 each, and the combined cost of cutting the grooves and installing the markers was approximately \$6.25 per unit, which included the price of the epoxy adhesive. This total cost was \$12.00 below the \$19.50 per unit cost for markers installed on recent projects. It is noted that these are contractor costs and may vary depending upon the availability of contractors, size of project, etc. However, it is believed that these figures are indicative of the relative costs of the two methods of placement.

Durability

Markers

After 18 months and several ice and snow storms, no markers had been lost and less than 2% of them had been damaged (less than 10% of face damaged). Most of the markers exhibited small surface abrasions caused by traffic, but these had not significantly affected their performance.

Grooves

There was no evidence of the groove being damaged by either the weather, snowplows, or traffic. Also, no pavement damage was observed as a result of the grooves being cut.

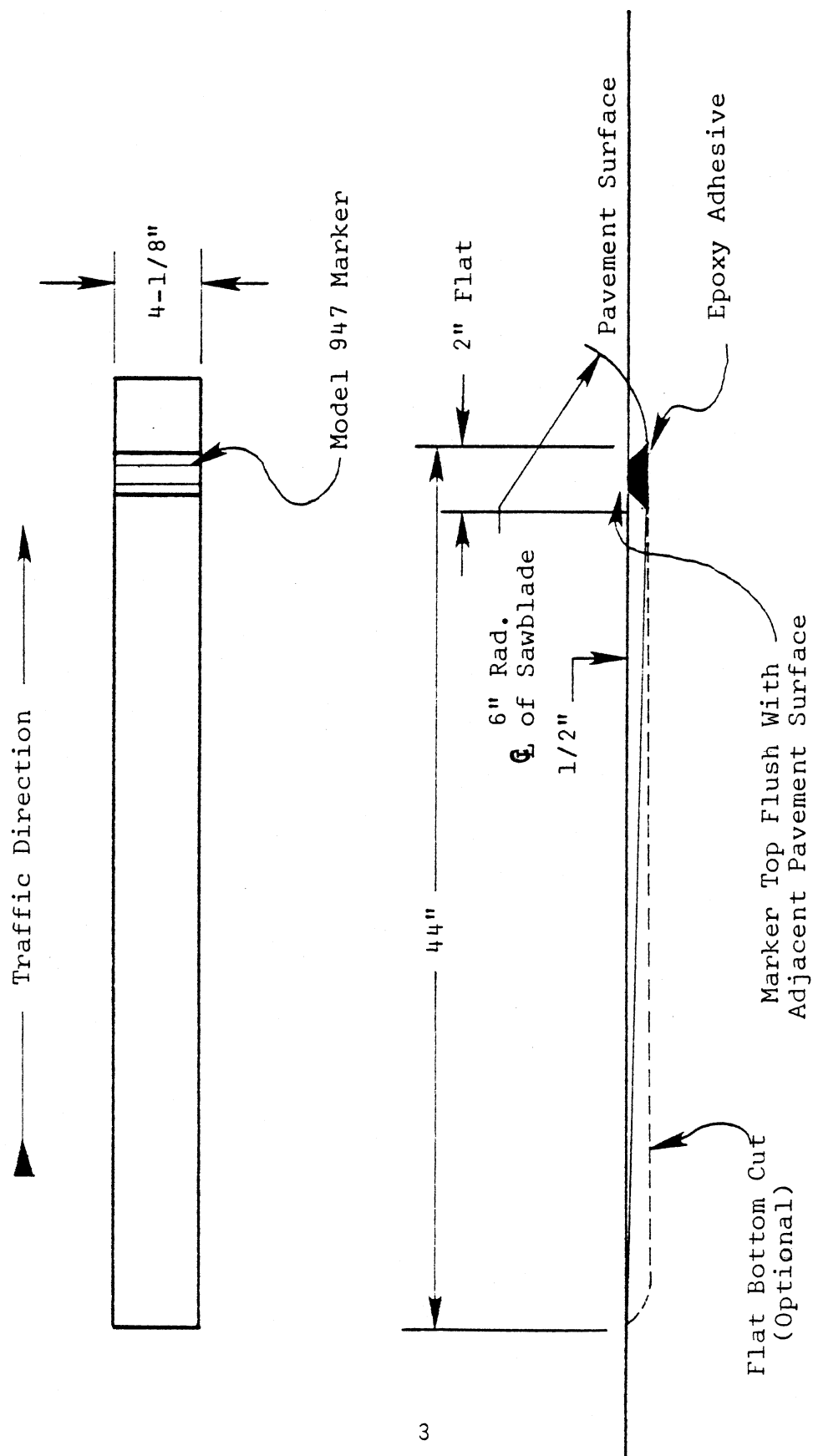


Figure 1. Schematic of groove.

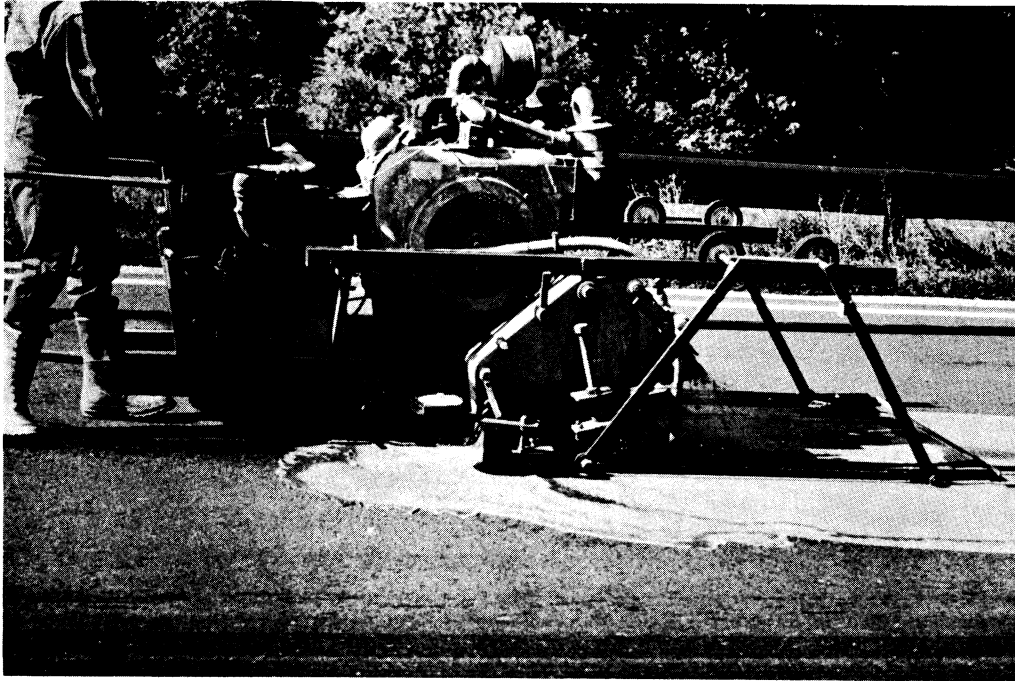


Figure 2. Groove being cut into the pavement.

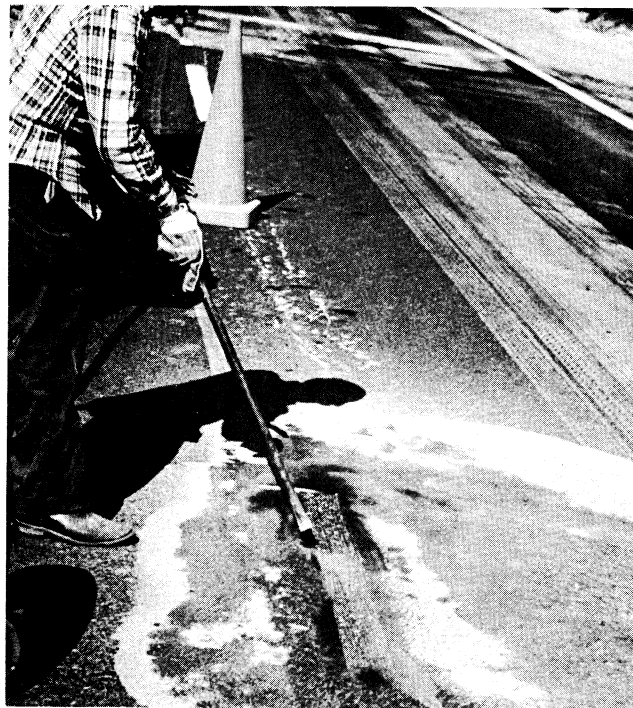


Figure 3. Groove being dried with an air hose.



Figure 4. Epoxy adhesive being applied.



Figure 5. Placement of marker.

This method of installing raised markers will not present problems when new pavement surfaces are applied. Steel castings, on the other hand, have to be removed or they cause popouts.

Visibility Characteristics

The initial visibility characteristics were good for all markers. Figures 6 and 7 show, respectively, markers installed on a curve and a straight section of highway. The night visibility remained good throughout the 18 months observation period; however, as a result of the epoxy adhesive not hardening properly, several markers twisted into a direction not parallel with the drivers' line of sight. This loss of alignment decreased the retroreflectance of the marker and, in some cases, rendered them barely visible. Also, in front of several markers there was a buildup of the flexible adhesive that obscured part of the face. Table 1 shows the percentages of markers adversely affected by the soft adhesive. These problems notwithstanding, it is believed that the overall visibility of the markers was adequate for nighttime delineation. Also, the problem with the epoxy adhesive not hardening is uncommon and should not be of concern.

The author had an opportunity to observe the markers during a dense nighttime fog and concluded that it would have been extremely difficult to traverse the mountain top safely without the guidance provided by the markers.

Debris Buildup

There were instances when the grooves were partially filled with sand, small gravel, or both, that were placed for snow and ice control. Although this obstructed the visibility of some markers (less than 10%), there was still a portion of the reflecting unit available for delineation. A small number of markers (less than 5%) were totally obstructed by the debris. It is noted that this problem was limited to periods directly after application of the sand and gravel and before the grooves could be cleaned 1 to 2 days afterwards.

Observations during the spring, summer, and fall revealed some sand or dirt in the grooves; however, it did not affect the night visibility.

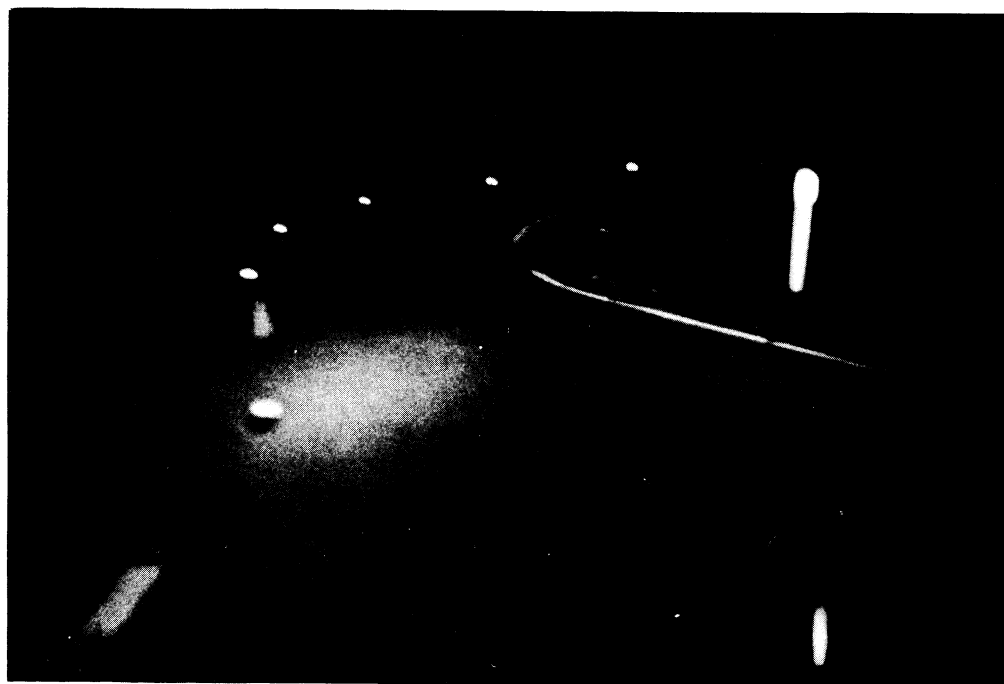


Figure 6. Newly installed marker on a curve.

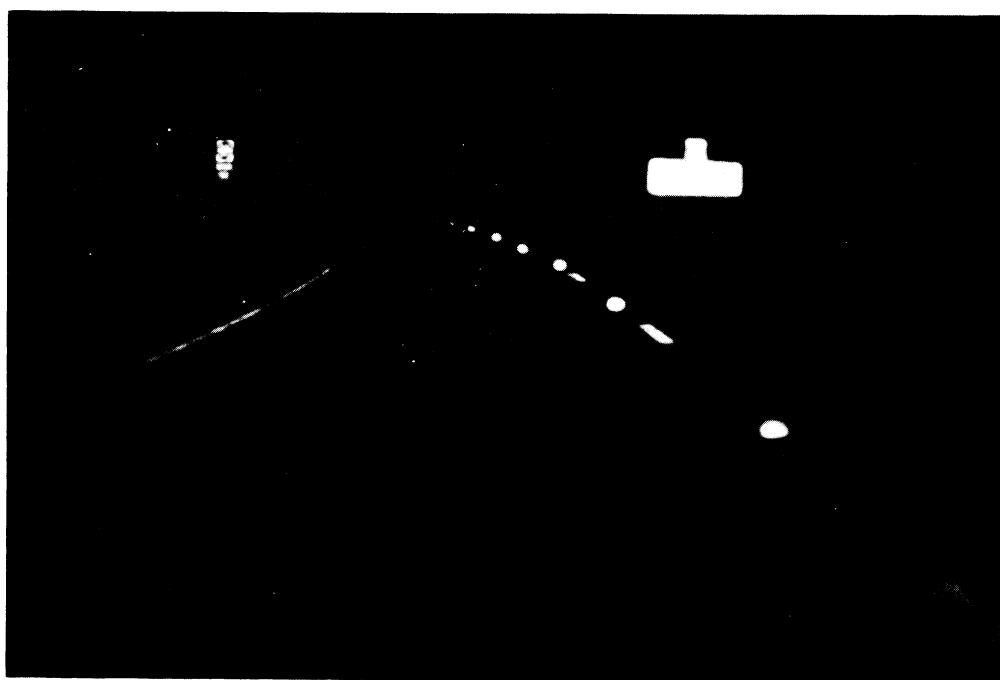


Figure 7. Newly installed marker on a straight section.

Table 1

Markers Adversely Affected by Adhesive

| | <u>Percent</u> |
|-------------------------------------|----------------|
| Epoxy adhesive soft | 13.6 |
| Markers slightly twisted | 6.5 |
| Markers severely twisted | 1.8 |
| Adhesive buildup in front of marker | |
| 5%-10% of face obscured | 5.9 |
| 10%-25% of face obscured | 1.2 |
| 20%-50% of face obscured | 1.2 |
| 50%-75% of face obscured | 1.8 |

CONCLUSIONS AND RECOMMENDATIONS

Based on observations over approximately 18 months, placing raised markers in grooves cut into the pavement is a feasible means of protecting them from snowplow damage. All of the markers were still intact and provided an acceptable level of retroreflectivity.

The cost of placing the markers in grooves is less than half that for utilizing steel castings.

Based on this demonstration project, it is recommended that consideration be given to using this method of placing the raised markers.