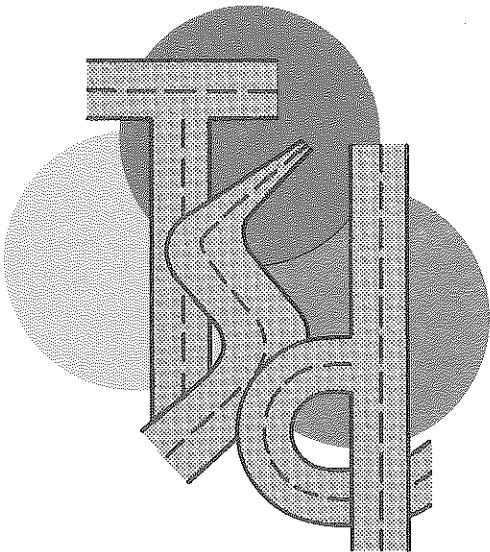


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A STUDY OF COLD PLASTIC
PAVEMENT MARKING MATERIALS

TSD-0-118 (I)-69



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A STUDY OF COLD PLASTIC
PAVEMENT MARKING MATERIALS

TSD-0-118 (I)-69

Interim Report

By

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Contributor to the Report

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Reflective Devices Unit
Operations Section
Traffic and Safety Division

in cooperation with

Material Research Unit
Testing and Research Division

SYNOPSIS

The following is an interim report on cold plastic pavement marking materials. Our experience to date has been only with cold plastic pavement marking arrows which have been installed at four locations in the Lansing, Grand Rapids, and Ionia areas. The findings in this report are based only upon observations of cold plastic pavement marking arrows after they were subjected to winter maintenance activity. Future testing will be initiated to determine the feasibility of using cold plastic materials for highway striping.

In our judgement, the cold plastic pavement marking arrows have proven to be very durable when installed on new bituminous or smooth portland cement concrete surfaces and will provide year-round service when installed on high volume urban trunk-lines. From a break-even cost study it appears that a cold plastic arrow would have to maintain operational quality for 0.67 years in order to be as economical as the conventionally painted arrow. Some of our test arrows have maintained excellent operational quality for one and one-half years. Due to the poor reflectivity of the cold plastic materials, it is recommended that the cold plastic arrows be installed only in well-lighted areas.

INTRODUCTION

Our present method of using conventional paints to mark guide arrows on pavements has several limitations. The painted arrows do not provide year-round service and, in many instances, lose their operational effectiveness in a few months. Heavy traffic volumes, de-icing chemicals and snow plow activity have had an adverse effect on the operational life of painted arrows.

A study was recently conducted to determine the feasibility of using cold plastic pavement marking arrows in an effort to provide the motorist with a more effective operational device. According to manufacturer's laboratory tests and claims, the cold plastic pavement marking materials are impervious to water, oil and salt, and its resiliency and toughness provide outstanding wear. The service life varies to some extent with the nature and condition of the surface to which it is bonded.

Prior to this study, very little was known about the life expectancy of cold plastic pavement marking materials in Michigan. The plastic arrows used for this study were furnished by Holland-Suco Color Company of Holland, Michigan (Presslab Arrows) and Prismo Safety Corporation of Huntington, Pennsylvania (Prismo Arrows). The arrows were installed in accordance with each manufacturer's specifications. Subsequent field inspections were made to determine the durability and performance of the arrows. These field inspections are the

basis for recommendations or conclusions contained in this interim report.

PROCEDURE

Three Holland-Suco Presslab Arrows were installed on September 20, 1967 at the following locations:

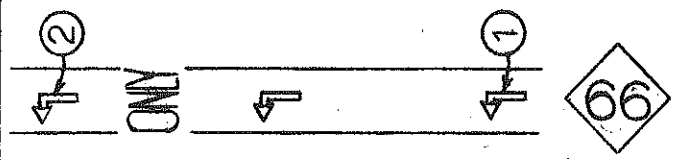
Holland-Suco Presslab Arrows

| <u>Project Area</u> | <u>Surface</u> | <u>Type of Arrow</u> | <u>Gauge</u> |
|---|----------------|----------------------|--------------|
| First Advance Centerlane Arrow on WB Saginaw (M-43) @ Waverly Rd. Ingham Co. | New Bituminous | Left Turn | 095 |
| Second Advance Centerlane Arrow on WB Saginaw (M-43) @ Waverly Rd. Ingham Co. | New Bituminous | Left Turn | 095 |
| Advance Centerlane Arrow on EB Saginaw (M-43) @ Waverly Rd. Eaton Co. | New Bituminous | Left Turn | 095 |

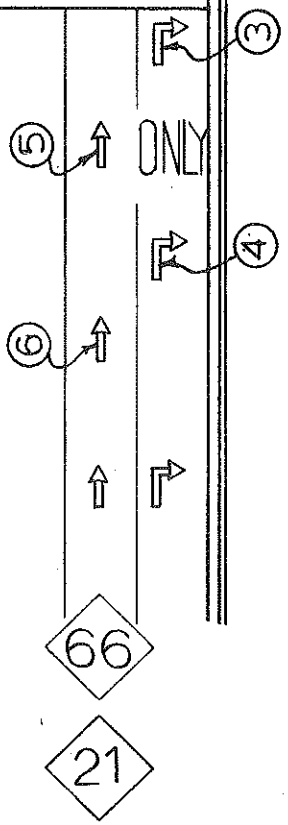
These three Presslab arrows were installed according to the manufacturer's specifications approximately two months after placement of the bituminous surface.

Ten Holland-Suco Presslab arrows were installed on October 14, 1968. Six arrows were placed at the intersection of the west junction of M-66 and M-21 in the City of Ionia, and four arrows were installed at the southbound US-131 off-ramp to M-11 in the City of Wyoming. Figure #1 depicts these locations and provides an identifying number for each arrow. The characteristics of the arrows are as listed in the following table:

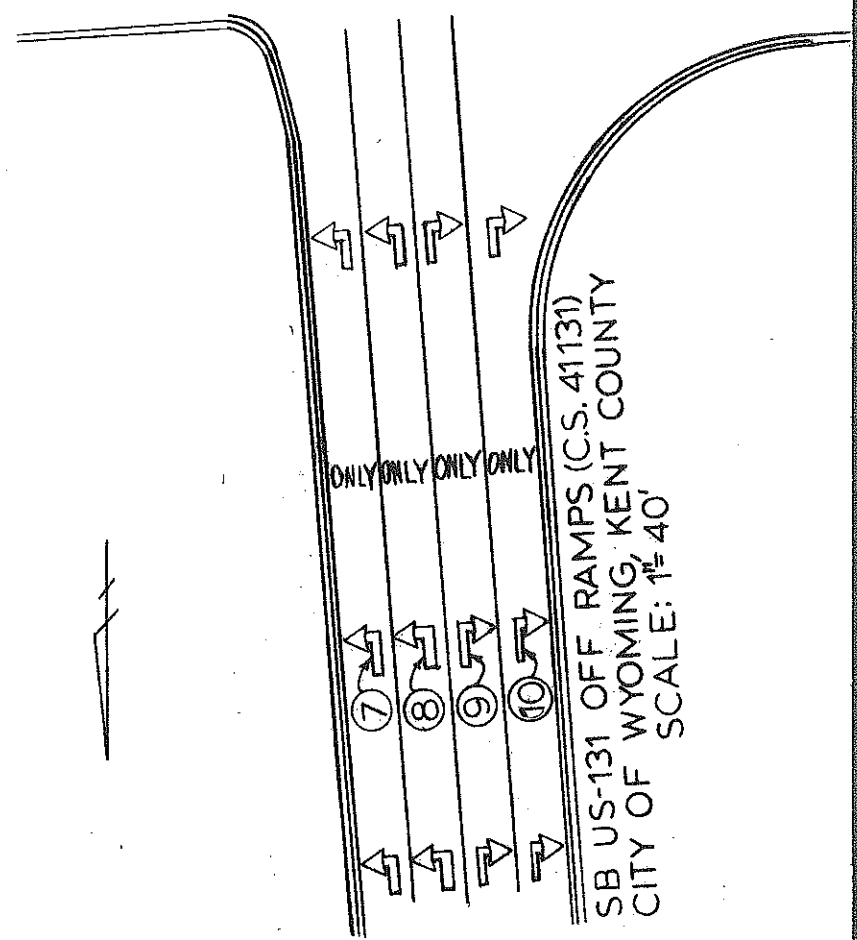
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WEST INTERSECTION M-66 & M-21
 IN CITY OF IONIA (C.S. 34033)
 IONIA COUNTY
 SCALE: 1"=30'



11 - 28th St



SB US-131 OFF RAMP (C.S. 41131)
 CITY OF WYOMING, KENT COUNTY
 SCALE: 1"=40'

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| | |
|--------------|-------------------|
| AUTH. NO. | DRAWN TMW |
| CONT. SEC. | DATE 5-19-69 |
| REP. | SCALE As Shown |
| SHEET 1 OF 1 | PLAN |

Figure #1

Holland-Suco Presslab Arrows

| <u>Arrow Configuration</u> No. | <u>Surface</u> | <u>Gauge</u> |
|-----------------------------------|-----------------|--------------|
| 1. Left Turn | Bituminous 1959 | 070 |
| 2. Left Turn | Bituminous 1959 | 070 |
| 3. Right Turn | Bituminous 1952 | 095 |
| 4. Right Turn | Bituminous 1952 | 095 |
| 5. Straight | Bituminous 1952 | 040 |
| 6. Straight | Bituminous 1952 | 040 |
| 7. Left Turn | Concrete 1962 | 070 |
| 8. Left Turn | Concrete 1962 | 070 |
| 9. Right Turn | Concrete 1962 | 095 |
| 10. Right Turn | Concrete 1962 | 095 |

Installation of the ten arrows was accomplished by a crew of three men. Arrows #1 through #6 were installed on rough bituminous surfaces. Arrows #7 through #10 were installed on a smooth portland cement concrete surface. The first group of six arrows took approximately one and one-half hours to install. The second group of four took twenty minutes to install. The difference in time was attributable to increased familiarity with the arrow application method and the ease of stripping the backing paper.

Protection of the work area was accomplished by closing a lane by use of traffic cones and parking a station wagon equipped with a rotating red beacon in the closed lane between the traffic cones and the arrow placement area. Pavement primer was rolled on to the pavement with a roller, pavement cleaner was used when necessary, and the arrows were pressed firmly against the pavement with a rubber roller.

Two Prismo cold plastic arrows were installed on October 16, 1968 at the following locations:

| <u>Project Area</u> | <u>Surface</u> | <u>Type of Arrow</u> | <u>Gauge</u> |
|---|----------------|----------------------|--------------|
| NB US-27 @ State Rd. Clinton County | New Bituminous | Right Turn | 095 |
| SB US-27 @ Sheridan Rd. Clinton County | New Bituminous | Right Turn | 095 |

The Prismo arrows were installed according to the manufacturer's specifications shortly after the placement of the bituminous surface.

RESULTS

A survey was made of the Holland-Suco Presslab Arrows at the M-43 - Waverly Road intersection on March 18, 1969. After one and one-half years (two seasons of winter maintenance activity), these Presslab arrows showed very little loss of material. Tire marks were visible on each arrow, however (Figure #2).

The Presslab arrows in the cities of Ionia and Wyoming were inspected on December 30, 1968. At the time of this inspection, arrows #1 through #10 had been subjected to winter maintenance activity resulting from snow and ice storms. The arrows in the City of Ionia (arrows #1 through #6) had lost large amounts of the plastic material and, in some instances, it was difficult to determine the original form of the pavement markings (Figure #3). The four arrows placed on the freeway off-ramp (City of Wyoming) fared better with only the leading edges of the Presslab material being removed. However, some tire marks were visible on the arrows (Figure #4).

The two Prismo right-turn arrows on US-27 north of Lansing were inspected on March 18, 1969. The Prismo arrows were not tire-marked, but large amounts of the plastic material had been lost from the arrow at State Road. Except for a tar splatter, the arrow at Sheridan Road was not damaged (Figure #5).

DISCUSSION

Our experience to date with cold plastic pavement marking materials has been rather limited. It is apparent, from analyzing the test arrows, that the plastic material is breaking away, rather than wearing away. The critical parameter in the service life of the cold plastic arrow seems to be its bonding strength to the pavement, and the bonding strength is dependent upon the nature and condition of the surface to which it is bonded. Snow plow activity and high traffic volumes appear to be the worst enemies to the pressure-sensitive bond.

A reflectivity comparison between the cold plastic pavement marking arrow and the conventionally painted arrow has been accomplished at this date. The conventionally painted arrows have much better reflectivity than cold plastic arrows.

Our experience to date justifies further testing of cold plastic pavement marking materials. Some of the test arrows have provided a year-round operational device. To make a comparative cost study between a cold plastic arrow and a painted arrow would require that the painted arrow be

maintained at the same level of quality as the plastic arrow. The more frequent maintenance required on the painted arrow creates additional traffic delay and increases accident potential.

Tire marks visible on many of the cold plastic test arrows indicates that occasional cleaning might be desirable. However, the fact that the arrows do not become completely tire marked indicates that they may be self-cleaning to some extent. The short life of the conventionally painted arrow, if not properly maintained, results in an ineffective traffic control device and thereby increases accident potential and reduces highway capacity. It is recommended that consideration be given to further testing of cold plastic pavement marking materials to determine the conditions (surface type, surface age, traffic volumes, climate, etc.) for which the use of cold plastic pavement marking materials could be justified from a standpoint of economy and safety.

BREAK-EVEN COST ESTIMATE

The following is a cost comparison to determine the number of years that a cold plastic pavement marking arrow would have to remain in an effective operational condition in order to be as economical as a conventionally painted pavement marking arrow. The assumption is made that the conventionally painted arrow would require painting three times annually to ensure operational quality.

Plastic Arrow

Painted Arrow

I. Initial Cost

A. Material = \$22.00
B. Labor = 8.00
Total = \$30.00

I. Initial Cost

A. Material = \$ 2.00
B. Labor = 13.00
Total = \$15.00

a = Number of applications required annually to maintain operational quality for the painted arrow = 3

b = Cost of one application of paint = \$15.00

c = Cost of one plastic arrow installation = \$30.00

Y = Service life (in years) for the plastic arrow to meet the break-even cost of the painted arrow.

$$Y = \frac{c}{ab} = \frac{\$30.00}{3(\$15.00)} = 0.67 \text{ year}$$

This cost comparison does not include costs incurred by the motorist due to traffic delay and potential accidents resulting from the frequent maintenance requirements of the painted arrow.

SUMMARY AND CONCLUSIONS

Our tests to date have revealed that cold plastic arrows applied to new bituminous surfaces or to smooth portland cement surfaces have performed rather well and seem to be quite durable. Those arrows installed on an older, rough bituminous surface have had a shorter life than a conventionally painted arrow on the same surface.

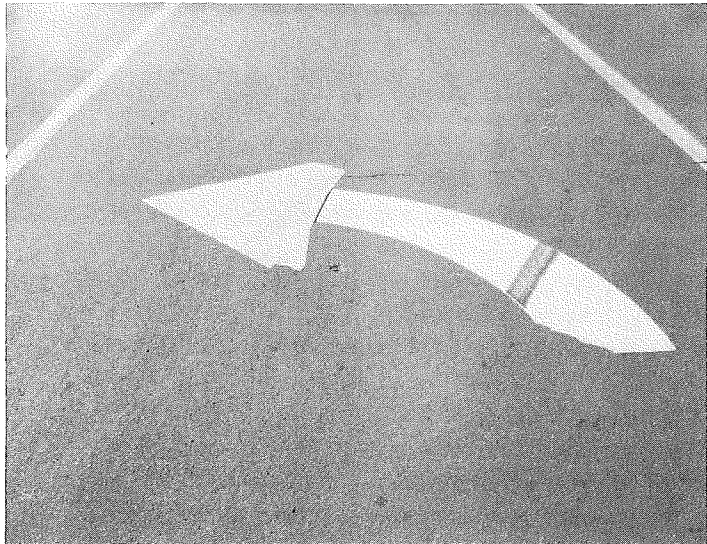
Further testing of cold plastic pavement marking materials has been scheduled. Three Prismo arrows and three Presslab arrows are being installed in September, 1969 on a new bituminous surface at the intersection of M-44 and M-45 in the City of Grand Rapids. Prismo and Presslab arrows and lane lines are scheduled to be installed in August, 1969, on a new bituminous surface at the intersection of BL-94 and

M-139 in the City of Benton Harbor. Lastly, 3500 feet of Prismo lane markings are to be installed in August, 1969 on northbound BS-696 at the Davison Freeway in Detroit on a new bituminous surface. It is anticipated that all the test materials will be installed on a hot bituminous surface prior to final rolling. These locations will be kept under surveillance for observance of performance and durability, as will all of the cold plastic test materials.

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Figure #2

HOLLAND-SUCO PRESSLAB
LEFT TURN ARROWS
INSTALLED SEPT. 20, 1967



FIRST ADVANCE CENTERLANE
ARROW ON WB. SAGINAW (M-43)
@ WAVERLY RD. (3-18-69)



SECOND ADVANCE CENTERLANE
ARROW ON WB. SAGINAW (M-43)
@ WAVERLY RD. (3-18-69)



ADVANCE CENTERLANE ARROW
ON EB. SAGINAW (M-43)
@ WAVERLY RD. (3-18-69)

Figure #3
HOLLAND-SUCO PRESSLAB ARROWS
INSTALLED OCTOBER 14, 1968
W. JCT. M-66 & M-21, CITY OF IONIA

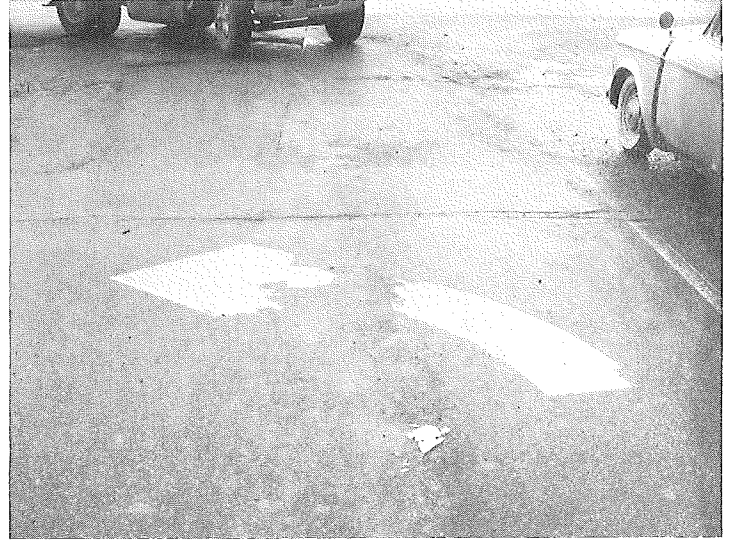
Arrow #1

12-30-68



Arrow #2

12-30-68



Arrow #3

12-30-68



Arrow #4

12-30-68



Arrow #5

12-30-68



Arrow #6

12-30-68

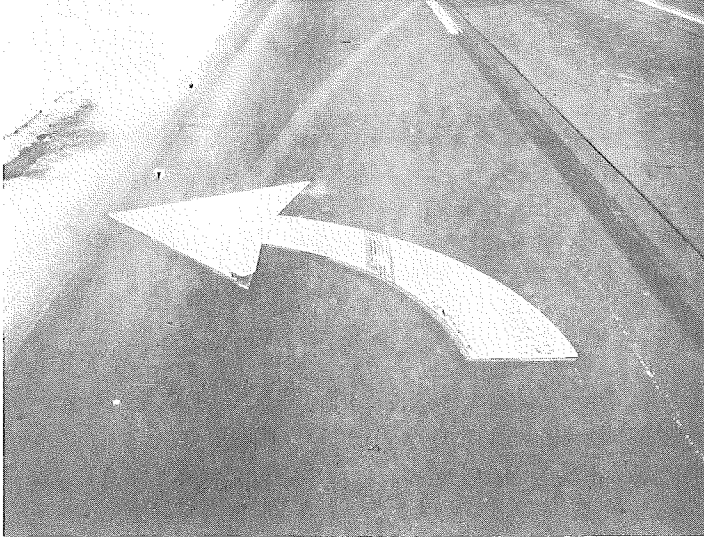


Figure #4

HOLLAND-SUCO PRESSLAB ARROWS
INSTALLED OCTOBER 14, 1968
S.B. US-131 OFF RAMP TO 28th ST.
CITY OF WYOMING

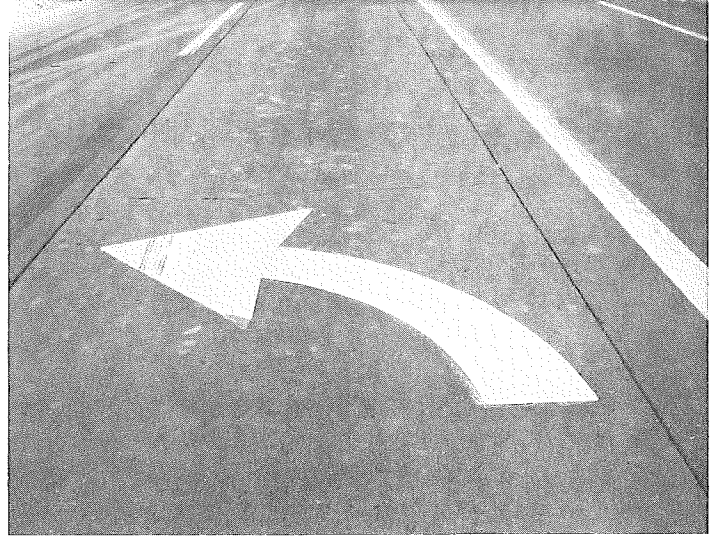
Arrow #7

12-30-68



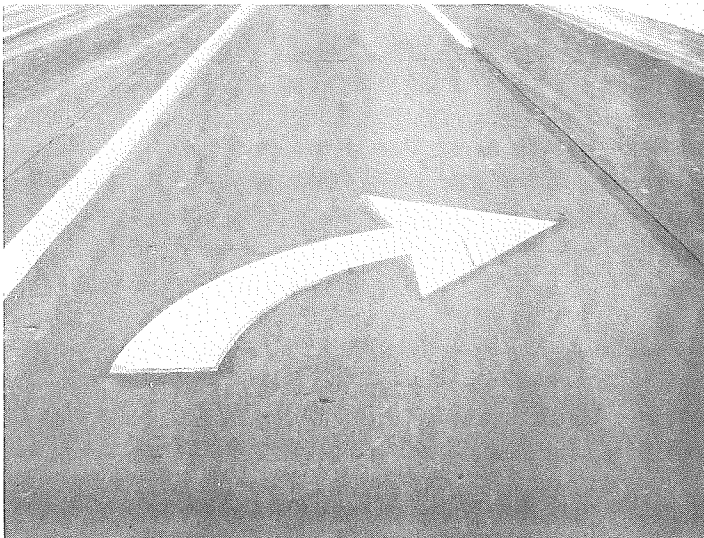
Arrow #8

12-30-68



Arrow #9

12-30-68



Arrow #10

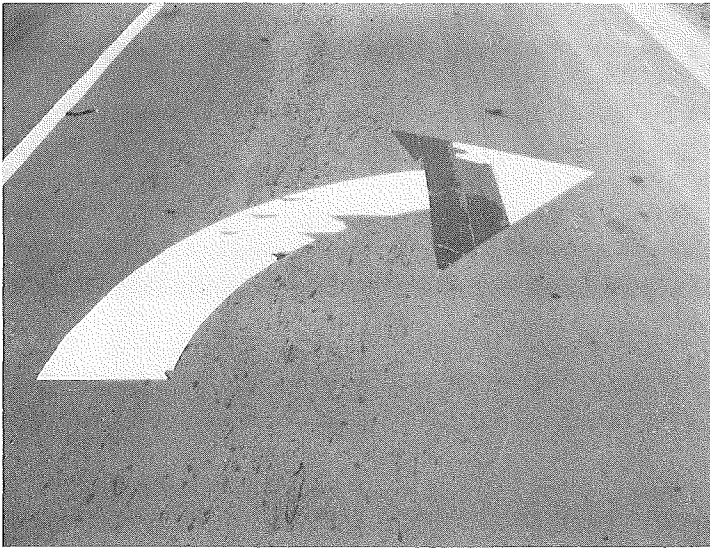
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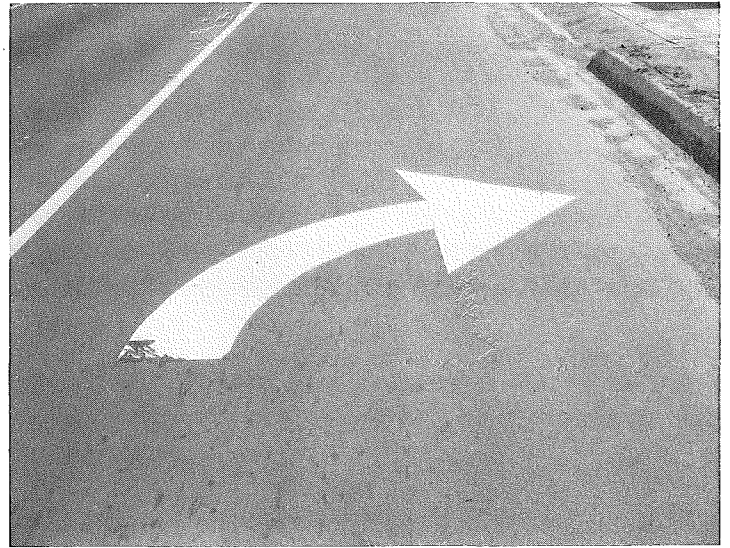
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Figure #5

PRISMO COLD PLASTIC
RIGHT TURN ARROWS
INSTALLED OCT. 16, 1968



RIGHT TURN LANE ON
N.B. US-27 @ STATE RD.
(3-18-69)



RIGHT TURN LANE ON
N.B US-27 @ SHERIDAN RD.
(3-18-69)