Report No. CDH-DTP-R-82-9

PREFORMED PAVEMENT MARKING MATERIAL FOR CONSTRUCTION ZONE PROJECT I 76-1(58)

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Final Report
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Prepared in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

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16. Abstract

This is a final report covering the installation, performance, and removal of a pre-formed plastic pavement marking material used for highway striping in a construction zone. The material used was 3M "Stamark", a self adhering tape. The evaluation of the material shows that other than a higher initial cost, the material was fast and easy to install, performed better than paint in most areas, and was fast and easy to remove after completion of the project.

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TABLE OF CONTENTS

INTRODUCTION

Motorists approaching and traversing construction zone work areas should be guided in a clear and positive manner. Proper pavement markings that are effective under varying conditions of light and weather can provide the motorist with positive guidance in advance of and through the work area. The use of pavement marking paint for construction zone marking is impractical and expensive due to the need for mobilization of equipment to place markings and the need to remove paint when inappropriate markings must be obliterated. There is a need to experiment with materials and application of temporary markings that allow removal without the use of heat, solvents, grinding or sand/water blasting.

The purpose of this study was to evaluate the use of pre-formed plastic pavement marking material for use in construction zones.

The project involved was I 76-1(58) which was the construction of eastbound lanes of I 76 from SH 7 to the Hudson interchange. The westbound I 76 traffic was detoured over a newly constructed frontage road, and the eastbound traffic was detoured over the I 76 westbound lanes. This involved several crossover detour sections.

The experimental marking material was placed where the traffic was routed across the newly constructed detour sections to mark the traffic lane crossovers. Partial plan sheets showing the detour areas are shown in Appendix A.

The material used for lane marking was 3M "Stamark" pre-formed pavement striping tape. This is a pressure sensitive adhesive backed retro-reflective tape designed for temporary highway striping uses.

The striping material was applied on September 1, 1981 and was removed in August 1982. In addition to normal traffic, the striping material was subject to snow removal and sanding operations during the 1981-1982 winter months.

INSTALLATION

The area where the tape is to be applied must be free of loose material and debris. This can be done by sweeping or air blowing.

The tape is applied using a hand operated rolling push-type applicator, (photos page 3). The roll of tape is mounted on the applicator, and the tape is fed continuously under a heavy roller which applies adequate pressure to bond the tape to the surface. A mechanical tape cut off allows the operator to cut the tape to proper length when necessary. The tape used was 4-inch white and yellow edge line color and 6-inch white centerline color. Where a double-wide white traffic channelizing marking was required, two 6-inch strips were laid side by side.

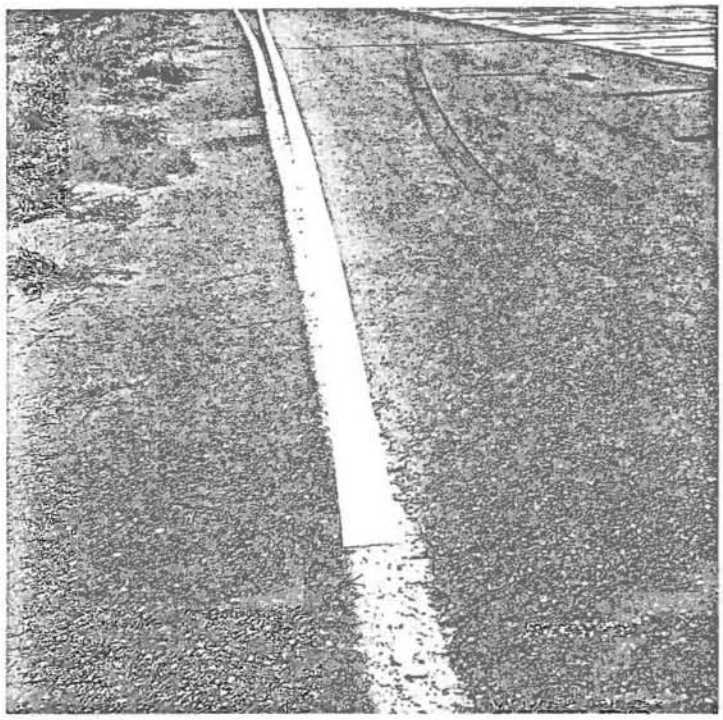
The striping consisted of 8080 linear feet of 4-inch yellow edge lines, 8080 linear feet of 4-inch white edge lines, and 2020 linear feet of 6-inch center lines. If the surface is new asphalt cement mat, the tape can be applied as soon as roller compacting is completed. The application can usually be completed while traffic control signs and traffic control flagmen are still in place from the paving operations. If an error is made in applying the tape, it can be corrected by lifting the tape and repositioning correctly.

The application of the temporary striping on this project was accomplished in approximately two hours.

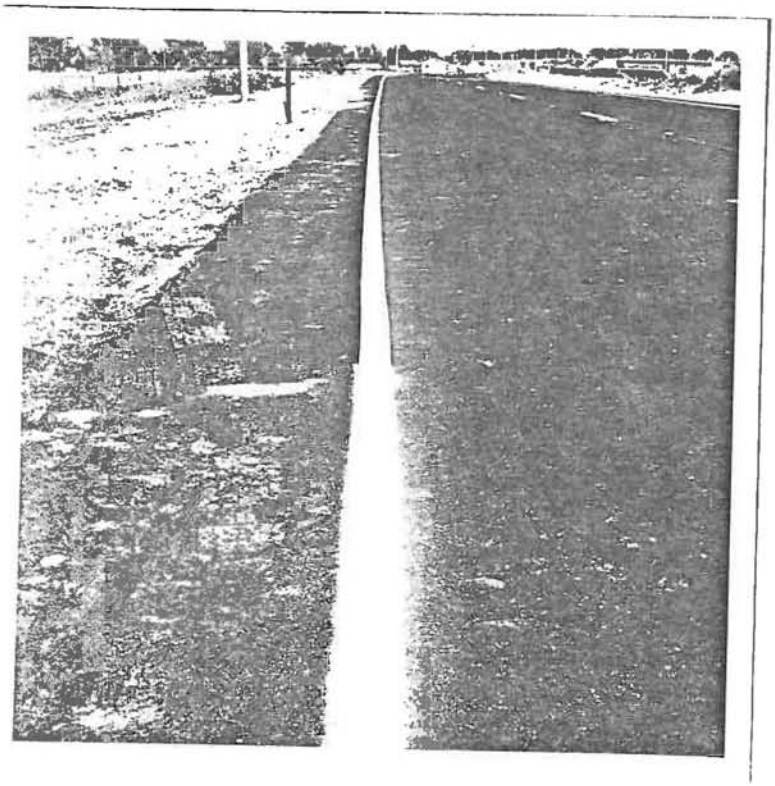
The photography on pages 4 through 8 show the striping just after application.

Marking Tape applicator

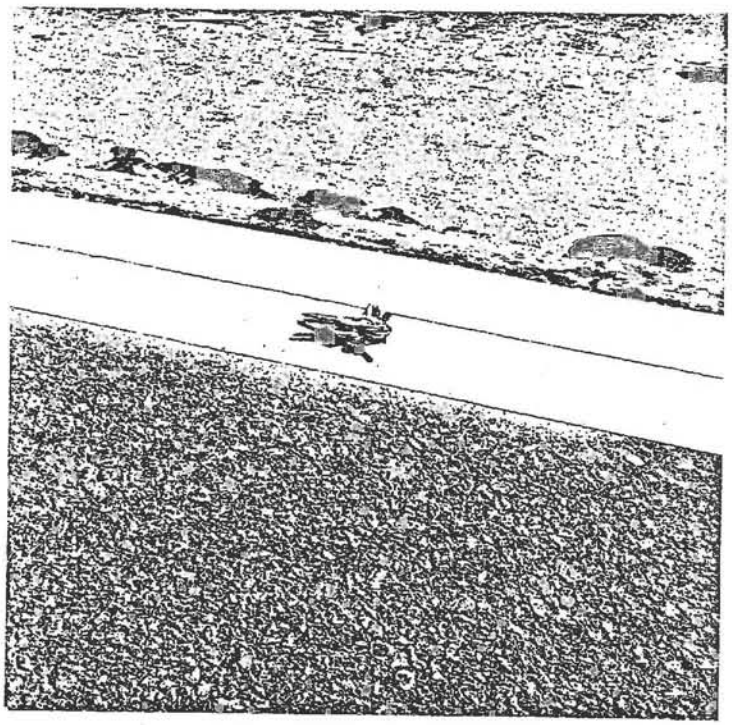
Close up view of
Marking tape applicator



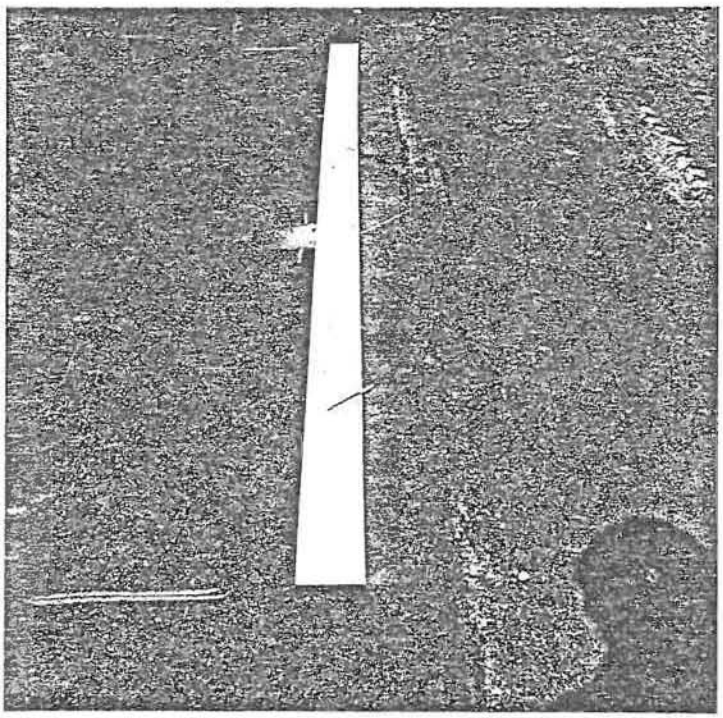
Striping applied at beginning of turnout.



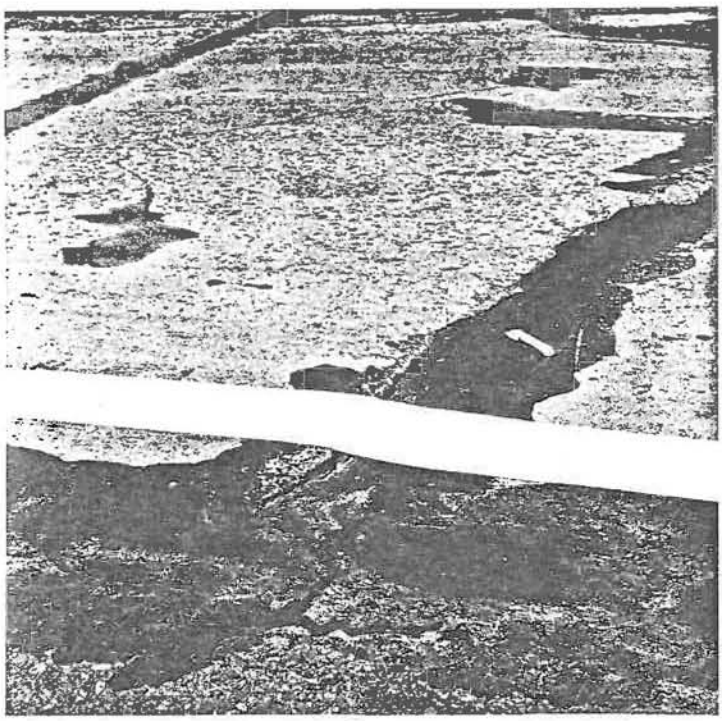
Right edge lane striping joining painted stripe. Sharp edge of plastic striping gives better contrast for higher visibility.



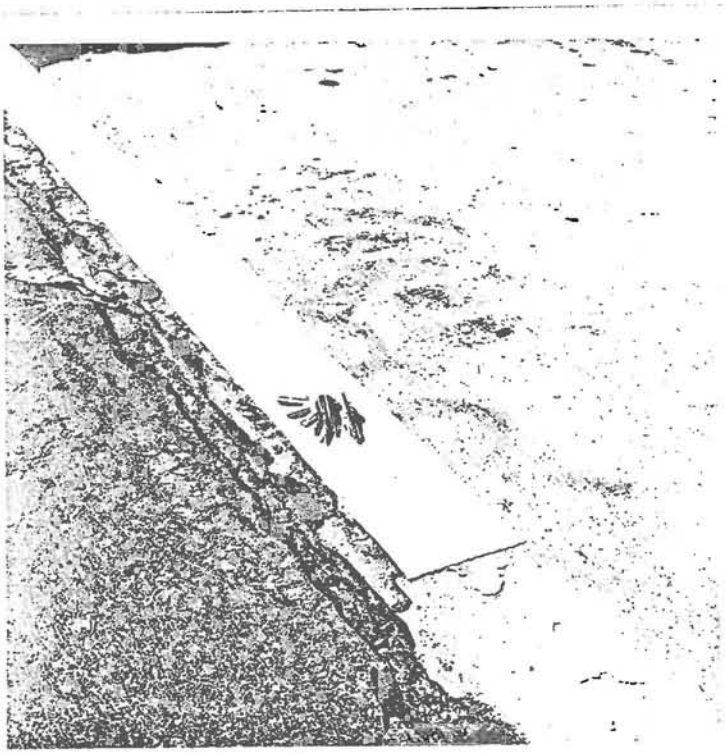
Double width striping applied where required.



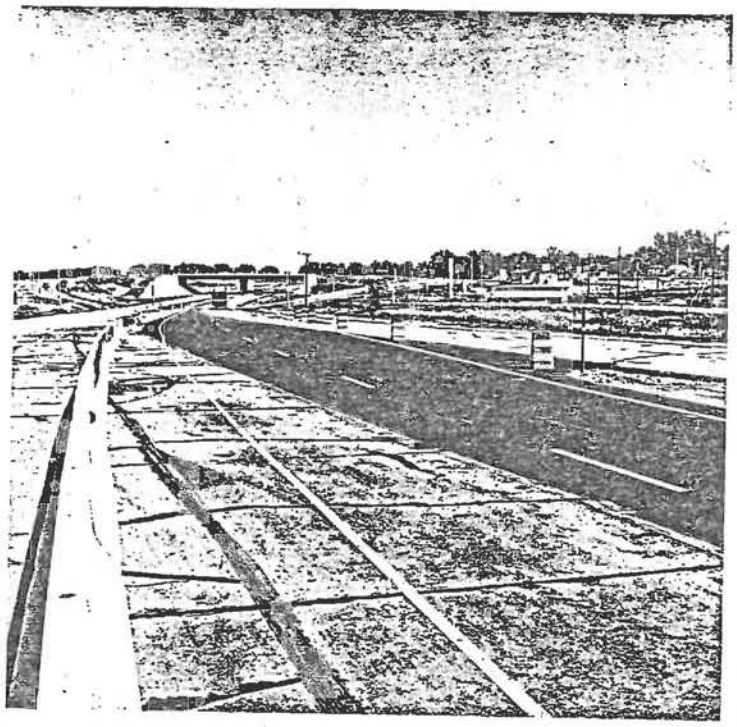
Centerline stripe.



Marking applied over a high spot. This area will probably suffer damage from plowing operations.



End of plastic striping where it joins regular paint striping.



Eastbound I 76 at Hudson interchange.

Westbound I 76 from Hudson interchange.

Yellow edge line which had recieved damage and discoloration shortly after being applied.

Yellow edge line which was applied over a rough section of pavement. Damage occurred shortly after application.

PERFORMANCE

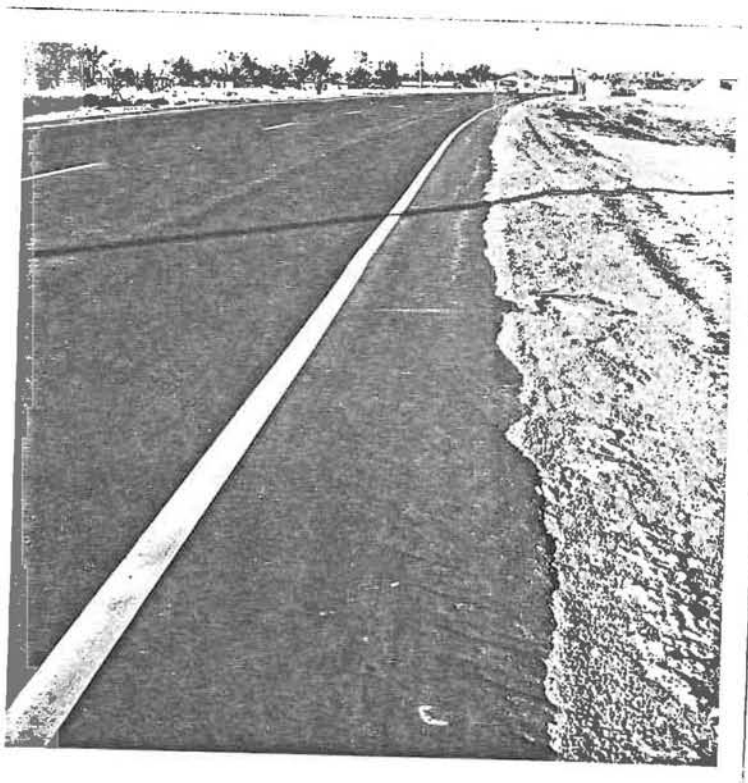
The installed material was inspected several times during the period from the time of application in September, 1981 until July, 1982, when the tape was removed for reopening of the highway to normal traffic. A final inspection was made on August 31, 1982, to evaluate the removal effectiveness and any possible problems with residues. Photographs on pages through show the conditions of the tape during the observation period.

The striping material had excellent adherance qualities. There were small patches where the material was bladed off by snowplowing operations. These small matches were in areas of rough pavement and the high spots on the pavement were subject to wear by the snowplow blade. These areas were not significant and did not reduce the effectiveness of the striping. The striping was very resistant to abrasive wearing due to sand application for ice and snow removal.

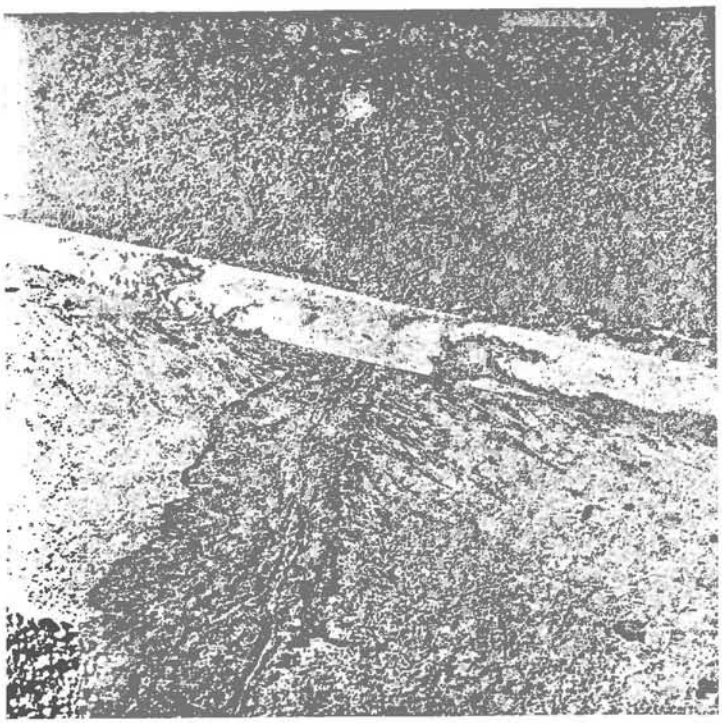
The retro-reflective quality of the striping material produced a high contrast with the pavement and had very good visibility. The temporary striping material gave better visibility response than the painted striping in the near vicinity. Nighttime visibility was superior to painted striping.

The highway striping over these detours was a continuation of the normal two lane divided highway markings. There was no interference to the traffic flow and during periods when there was no construction machinery in these areas, the traffic continued at the normal 55 mph speed limit.

Area where plastic has bubbled probably due to water under the plastic which had frozen.



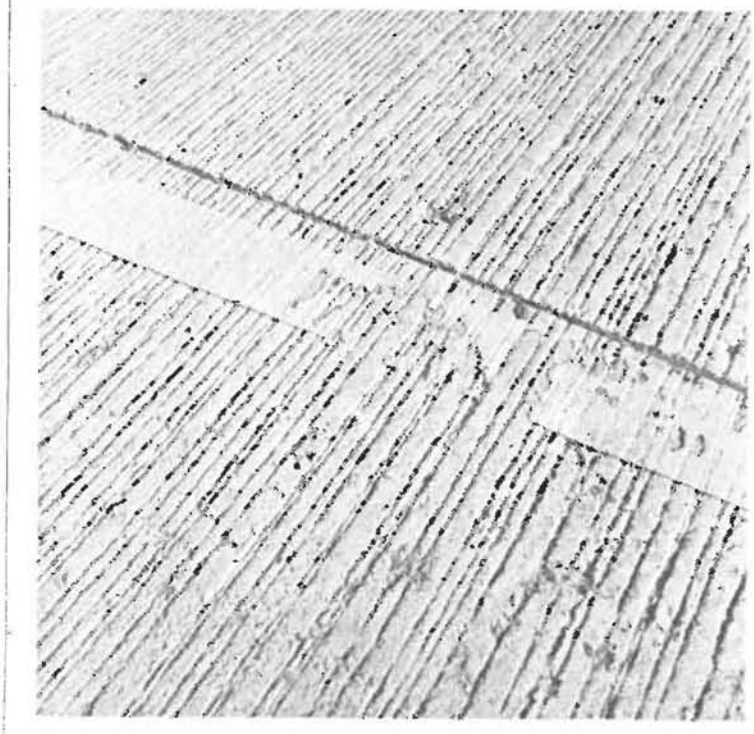
Inside lane yellow stripe on asphalt pavement. In good shape and not showing any evidence of wear or deterioration.



Marking worn off at a high spot.

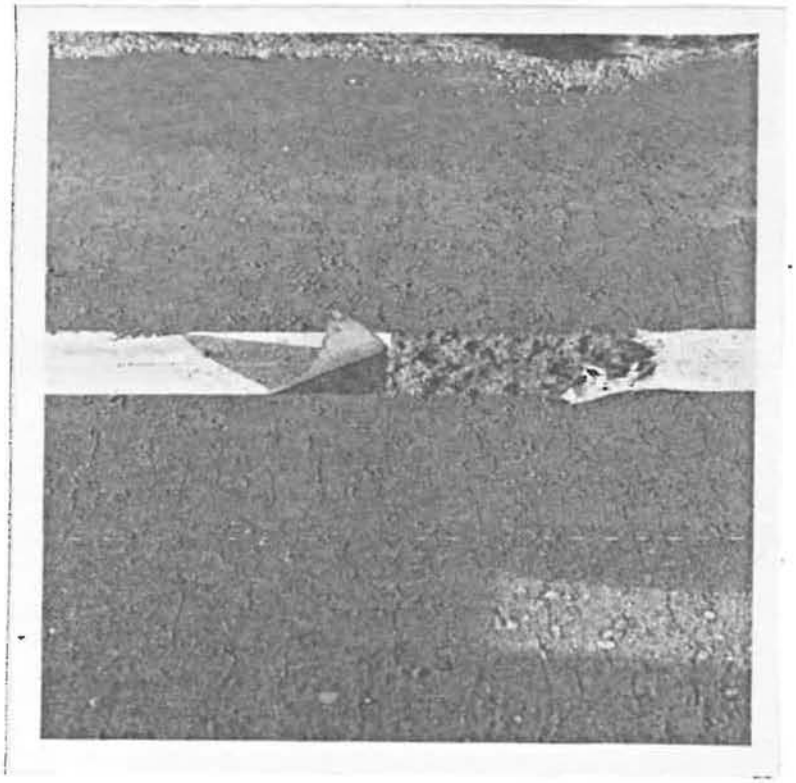
Marking bladed off of rough spot in pavement. Some pavement pulled off with marking material.

Area where the snowplow blade has peeled back the striping.



High spots in the concrete pavement allow the snowplow blade to wear off the striping material.

Centerline striping where the snowplow blade picked the edge of the striping and peeled it off.



This shows a place where two strips of material were joined. The piece on the right was picked up by the snow plow blade and removed some pavement which adhered to the striping. The piece on the left was intentionally pulled up from the pavement to test its adherance.

REMOVAL

Removal of the tape is easily accomplished by hand. One end edge of the tape is lifted from the surface, using a knife blade. The tape is then stripped from the pavement intact or in large pieces. The tape comes off clean or with very little residue remaining. The following photographs show the condition of the pavement after removal of the marking material.

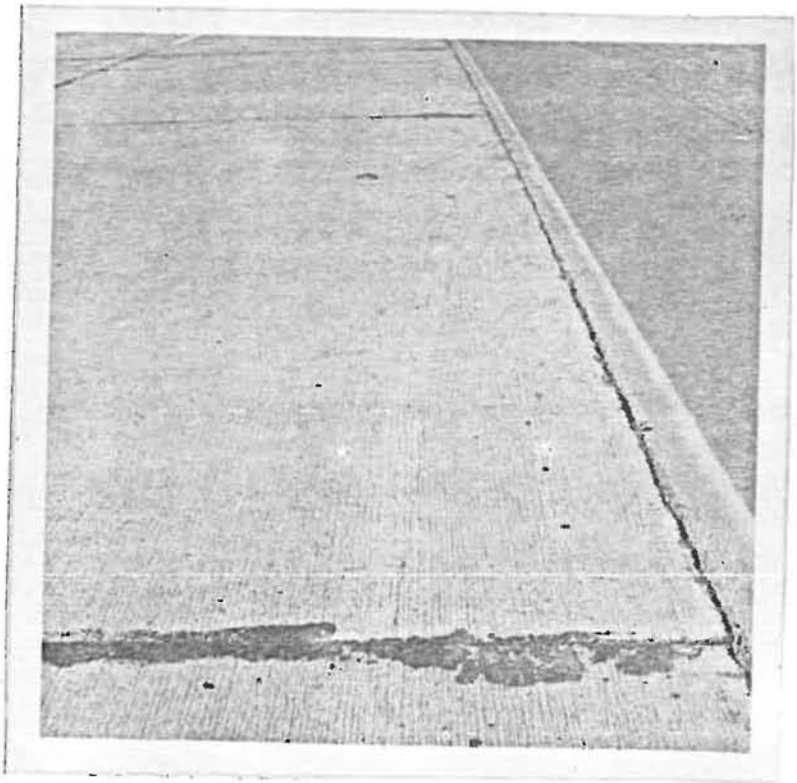
In some areas, removal of the tape left visible residue which resembled tire scuff marks. This visible residue was soon obliterated by normal traffic and did not interfere with normal lane striping.

Photographs on pages 15 through 16 were taken shortly after removal of the marking material.

Area where some residue remains after removal of marking material.

Area where centerline striping has been removed. No residue remains.

Area showing where center-line striping has been removed from concrete pavement.



Area showing where striping has been removed from concrete pavement.

COSTS

Cost of Preformed Pavement Marking:

Materials + 15%	$20,582.00
Labor + 35%	$ 4,090.00
TOTAL	$24,672.00

Cost for Paint Striping:

Cost of Paint + Labor	$ 696.00
Cost of Paint Removal	$ 2,600.00
TOTAL	$ 3,296.00

Net Cost for Preformed Pavement Marking $21,376

A saving not shown in the above figures is the cost involved in traffic control when striping using normal paint equipment. Another saving is the cost of Amortizing of paint striping equipment.

Appendix B is a project work order giving the station designations for the areas striped, and gives the estimated net costs for applying the pre-formed pavement marking material in place of paint striping for the detours.

The cost of the project detour striping for approximately 1-1/2 miles is $21,376. This high cost can be justified only if the environmental factors are overriding in selection of this type of temporary marking.

Lower traffic control costs during application and removal of the tape is an advantage of its use. Traffic control personnel and coning of traffic lanes was not required.

If a paint striped detour is in place for a longer period of time, repainting may be required and this would be a further economy of using the pre-formed pavement marking material.

CONCLUSIONS

From the observation and evaluation of the use of the Pre-formed Plastic Pavement Marking material on this project the following conclusions are made:

1. The application of the marking materials is easy and fast. The temporary detour is open to traffic immediately.
2. The visibility and reflectability of the marking material is excellent and better than painted striping, especially during precipitation when standing water would obscure painted striping. This is very important on a detour because normal shoulders and joints are not present as a reference when striping is observed.
3. The durability of the material is excellent when exposed to normal vehicular traffic.
4. During winter months when sanding and snow plowing operations are performed on the marking materials, the snow plow blade may scrape off the material on high spots and roughened areas.
5. This evaluation was for a period of nine months. There were no areas of the striping that required renewing the material.
6. Removing the material presented no difficulty. It was fast, and there was no problem with remaining residue requiring additional work for removal.
7. The cost figures do not show many of the positive aspects of using the Preformed Pavement Marking materials. These positive aspects are:
   a. The ease of application with very little traffic control needed.
   b. The ease of removal with no environmental impact of grinding, sand blasting, nor use of a propane burner.

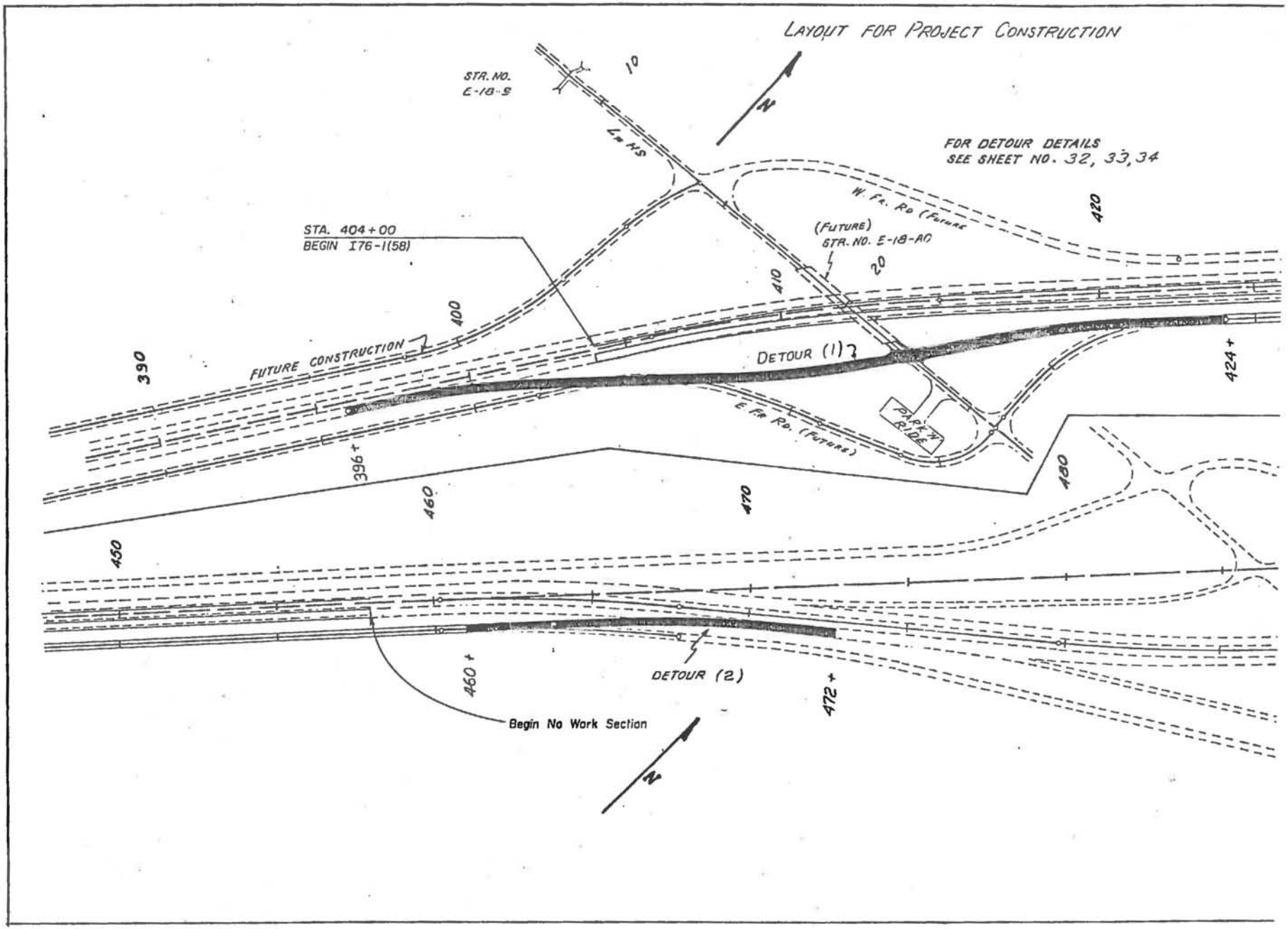
8. The use of the Pre-formed pavement marking material gave the motorist highly visible edge lines and center line marking over the detour sections, and permitted a normal flow of traffic through the construction zone.

RECOMMENDATIONS

The use of plastic pre-formed pavement marking for construction zones is recommended when the need for low maintenance and environmental considerations during removal are the primary factors considered.
The ease of application and removal are advantages to using the material but the high initial cost does not justify its use except in special circumstances.

Appendix A

Detour Areas Project I76-1(58)


LAYOUT FOR PROJECT CONSTRUCTION
STR. NO. E-18-S
10
Ln NS
N
FOR DETOUR DETAILS SEE SHEET NO. 32, 33, 34
W. Fr. Rd (Future
420
(FUTURE) STR. NO. E-18-AO
20
STA. 404+00 BEGIN I76-1(58)
410
400
390
FUTURE CONSTRUCTION
DETOUR (1)
424+
PARK N RIDE
E Fr Rd. (FUTURE)
396+
460
470
480
450
460+
DETOUR (2)
472+
Begin No Work Section
N

End Na Work Section
530
522 +
522 +
520
DETOUR (3)
510
DETOUR (3)
DETOUR (6)
505 +
504 +
500
490
Str. No. D-18-K
ON RR
NO. E-18-AM
STR. NO. E-18-AN

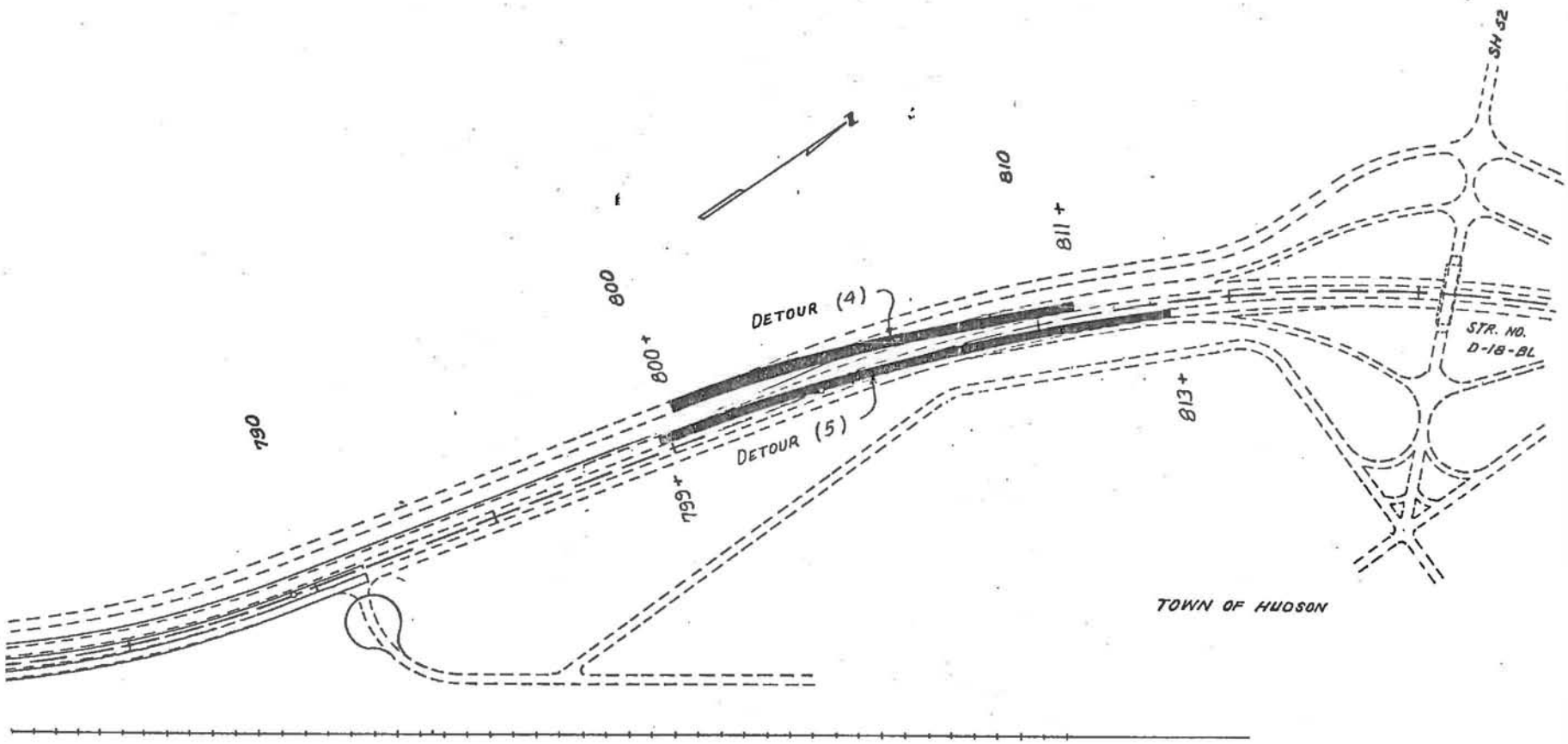
LAYOUT FOR PROJECT CONSTRUCTION

FEDERAL ROAD REGION NO.	DIVISION	PROJ. NO.	SHEET NO.	TOTAL SHEETS
VIII	COLORADO	176-1(58)	37	

AS CONSTRUCTED

NO REVISIONS ☐ REVISED ☐ VOID ☐

ORIGINAL SCALE: 1" = 200'



A-3

PROJECT I 76-1(58)
WORK ORDER

This work consists of placing experimental removable pavement markings in the detour and crossover sections as shown in the tabulation and deleting the appropriate quantities of Pavement Marking Paint and Removal of Pavement Markings.

ADD:

STATION	LOCATION	4" SOLID WHITE	4" SOLID YELLOW	5" BROKEN WHITE
396+00 To 404+00	Detour E.B.	800	800	800
460+00 To 471+25	Detour E.B.	1125	1125	1125
503+00 To 520+25	Crossover W.B.	1725	1725	1725
503+00 To 522+30	Crossover E.B.	1930	1930	1930
800+00 To 811+20	Crossover W.B.	1120	1120	1120
799+60 To 813+40	Crossover E.B.	1380	1380	1380
TOTAL (Linear Feet)		8080	8080	8080
TOTAL (Square Feet)		2694	2694	842

PROJECT TOTAL: 6230 Square Feet

DELETE:

1. Pavement Marking Paint (As shown in tabulation above)

   PROJECT TOTAL: 60 Gallons

2. REMOVAL OF PAVEMENT MARKINGS

   PROJECT TOTAL: 2000 Square Feet

Work Order Cost

Material:	8080 Ln ft 4" Yellow @0.96		$ 7,756.80
	8080 Ln ft 4" White @0.96		7,756.80
	2020 Ln ft 5" White @1.18		2,383.60
			$ 17,897.20
		plus 15%	2,684.80
			$ 20,582.00
Estimated Labor Including 35%:			
	Installation 20¢/ft		$ 3,636.00
	Removal 25% - 10¢/ft		454.00
			$ 4,090.00
Savings:	60 gallons paint @ $11.60		696.00
	2000 sq ft grinding @ 1.30		2,600.00
			3,296.00
		net cost	$ 21,376.00

File: 52.00
Preformed Pavement Marking

Striping applied at beginning of turnout.

Right edge lane striping adjoining painted stripe. Sharp edge of plastic striping gives better contrast for higher visibility.

File: 52.00
Preformed Pavement Marking

Double width striping applied where required.

Centerline stripe.

File: 52.00
Preformed Pavement Marking

Marking applied over a high spot. This area will probably suffer damage from plowing operations.

End of plastic striping where it joins regular paint striping.

File: 52.00
Preformed Pavement Marking

Yellow edge line which had recieved damage and discoloration shortly after being applied.

Yellow edge line which was applied oved a rough section of pavement. Damage occurred shortly after application.

File: 52.00
Preformed Pavement Marking.

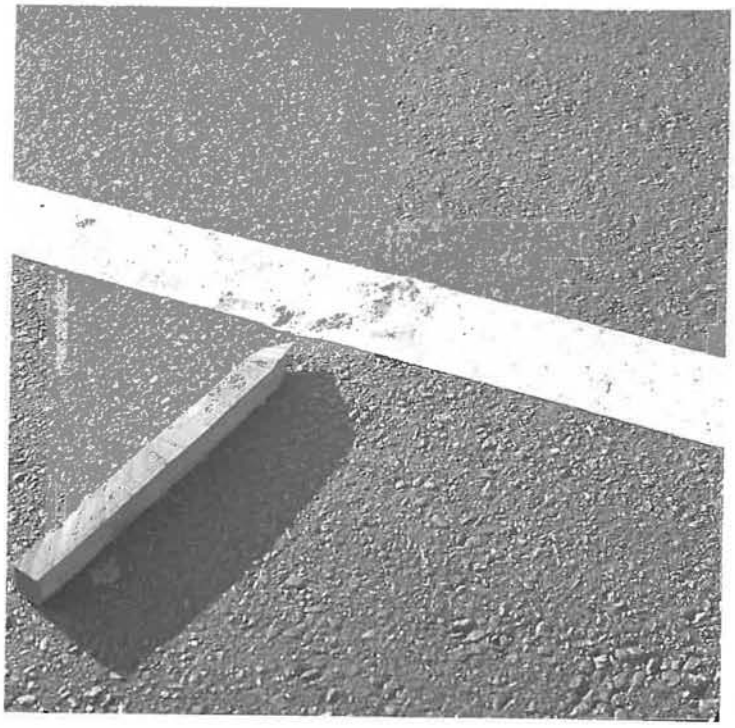
Eastbound I 76 at Hudson interchange.

Westbound I 76 from Hudson interchange.

File: 52.00
Preformed Pavement Marking

The piece of marking tape on the left was intentionally pulled up from pavement to test its adherance. The piece on the right was scraped off by plowing operations. Some pavement was also displaced where the tape adhered to the pavement.

File: 52.00
Preformed Pavement Marking



Area where plastic has bubbled probably due to water under the plastic which had frozen.

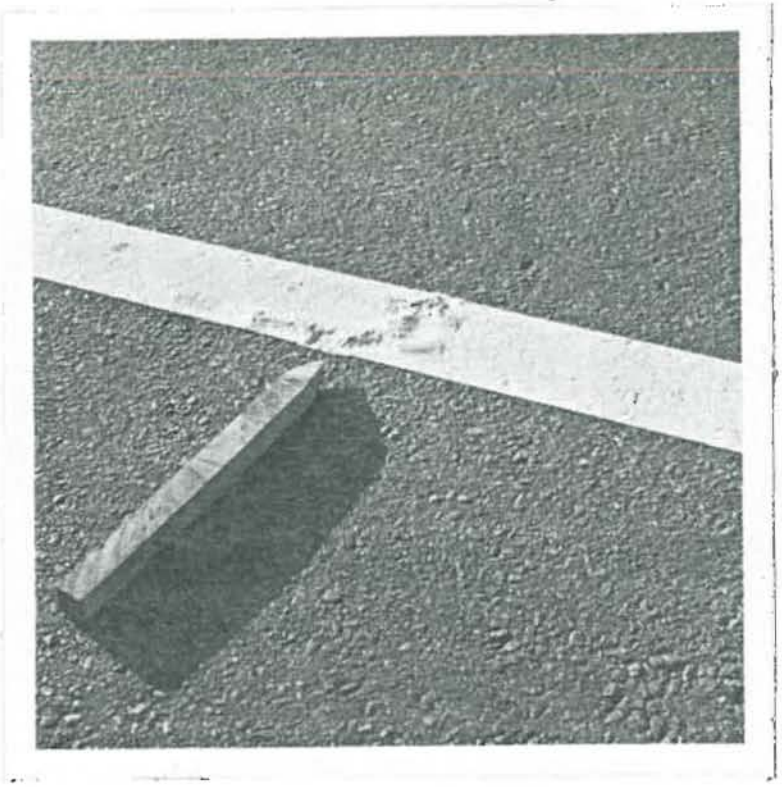
Inside lane yellow stripe on asphalt pavement. In good shape and not showing any evidence of wear or deterioration.

Area where snow plow blade has peeled back the plastic pavement marking.

High spots in the concrete pacement allow the snow plow blade to wear off the pavement markings.

Area of scoured concrete pavement where the snow plow blade has scuffed off the plastic pavement marking strips.

Same conditions as above.



File: 52.00
Preformed pavement marking.

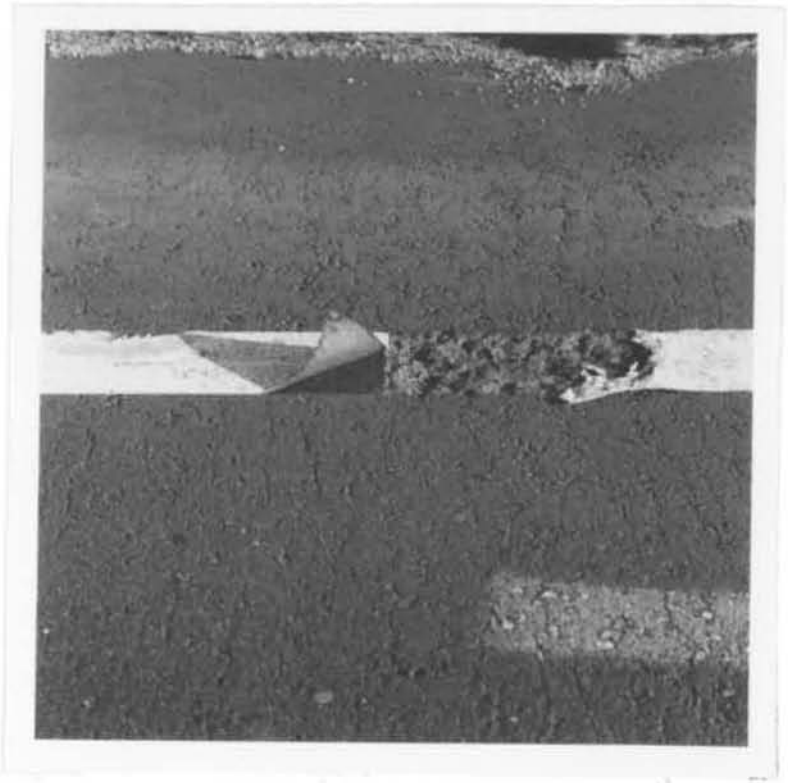
Marking worn off at a high spot.

Marking bladed off of rough spot in pavement. Some pavement pulled off with marking material.

Striping worn off by snowplow blade at high spot on pavement.

Striping bladed off at rough spot on pavement. Some asphalt pavement was pulled off with the striping material.

Centerline striping where the snowplow blade picked the edge of the striping and peeled it off.



This shows a place where two strips of material were joined. The piece on the right was picked up by the snow plow blade and removed some pavement which adhered to the striping. The piece on the left was intentionally pulled up from the pavement to test its adherance.

Area where the snowplow blade has peeled back the striping.

High spots in the concrete pavement allow the snowplow blade to wear off the striping material.