

EXPERIMENTAL USE OF
DURABLE PAVEMENT MARKING MATERIALS
ON U. S. ROUTE 302
BERLIN, VERMONT

FINAL REPORT 85-10
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Reporting On Work Plan 82-R-14

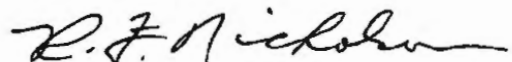
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MATERIALS & RESEARCH DIVISION

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ABSTRACT

This final report discusses the performance of preformed and thermoplastic pavement markings. Products evaluated included 3M Stamark Tape, series 5730 and 5750 and thermoplastic material meeting Rhode Island and Massachusetts specifications.

The 3M tapes were placed as part of the Berlin PMS 0197 (2) project on 1.9 miles of U. S. Route 302 in conjunction with the Berlin RS 0197 (1) overlay project. Application was carried out in October of 1982 using the preferred inlaid technique. The tape performed well in terms of durability but not in terms of night reflectivity.

Both 3M tapes, thermoplastic and standard traffic paint were placed as experimental test decks. The 3M 5730 tape provided the greatest durability followed by the thermoplastic material. The durability of the 3M 5750 tape was not satisfactory. The thermoplastic material provided the best reflectivity, but all three materials were considered less than desirable under wet nighttime pavement conditions.

INTRODUCTION

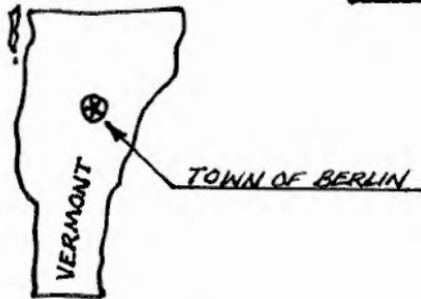
This report discusses the performances of the three experimental pavement marking materials with more than two years of service. The information regarding application was reported out in Product Evaluation P82-9 Initial Report. The 3M materials were applied on October 29 and 30 of 1982 as part of the pavement marking project Berlin PMS 0197 (2) and Berlin RS 0197 (1) overlay project located on U. S. Route 302 in the Town of Berlin (See Location Map). The 3M tapes and thermoplastic materials were also applied during this time as experimental test decks. The average daily traffic for the roadway in 1983 was 13,690 vehicles with 7% consisting of trucks.

The 3M tapes applied throughout the project for delineation (except for edge lines) were installed using the preferred inlay method. The test decks were applied using both the inlay and overlay technique (hot and cold).

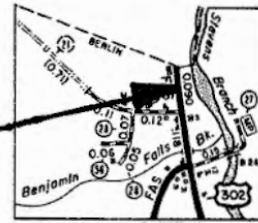
The thermoplastic material was applied using a kettle/extrusion device which heated the material. The 125 mil lines were applied 18 days after the paving had been completed.

The experimental materials were monitored on a bi-monthly schedule for a period of approximately 30 months which included photographic documentation of the test decks.

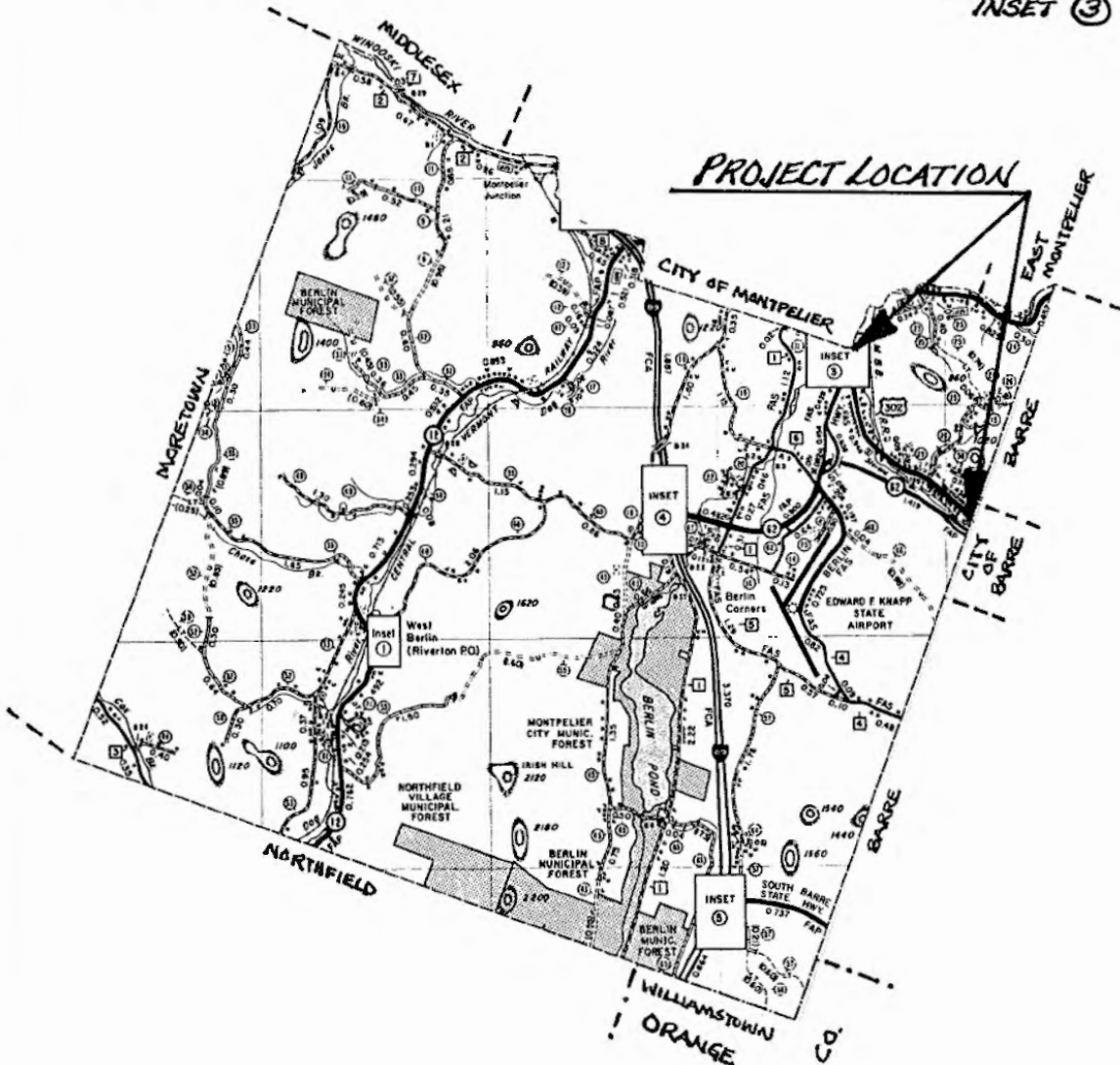
LOCATION MAP



EXPERIMENTAL
TEST DECK
LOCATION



INSET ③



PROJECT:

BERLIN PMS 0197 (2)

BERLIN RS 0197 (1)

STATE OF VERMONT

TOWN OF BERLIN

WASHINGTON COUNTY

— NOT TO SCALE —

DISCUSSION OF PERFORMANCE

For purposes of this report, performance of the materials was evaluated in two categories: durability and reflectivity, with bond failure, snowplow shear and abrasion resistance falling into the durability category.

Durability:

Overall, the experimental markings have performed well with respect to durability. The best performance was from the 3M series 5730 tape followed by the thermoplastic. Durability was unsatisfactory with 3M series 5750 tape which has a metallic layer that became visible after approximately five and one-half months of exposure to traffic. The wear combined with bond failure was significant enough to warrant replacement with the heavy duty 5730 tape on July 1, 1983. All of the 5750 tape used on the project was replaced except for the test decks. The new 5730 tape has held up well since its application as a replacement for the 5750.

The 5750 tape has maintained good line integrity in areas where vehicle passes were minimal. Wear became evident after approximately six to seven months in wheel path areas such as stop bars. Resistance to snowplow wear has been very good. We believe this is due to the excellent installation which carefully followed the hot inlay procedure.

The thermoplastic test deck performed well overall, but not in terms of durability. Wheel path wear became evident after only

four months and was considered significant after six to eight months of exposure. Complete wear through on the transverse lines was recorded after 16 months of exposure. All of the lines developed transverse cracks at one to three inch intervals, but this condition did not cause any additional problems.

The control standard paint test deck applied at eight mils wet thickness had significant signs of wear after only two months of service and had worn completely through after only seven months. The edge lines throughout the project did not wear as rapidly but did require painting once every year.

See appendix for photographs showing each test deck in various stages of wear.

Reflectivity:

The 3M tapes failed to provide adequate night reflectivity. When driving through the project at night, two to three dash lines or the equivalent distance (50' - 90'±) was the maximum visible. This condition worsened with wet night conditions. Because of the excellent durability characteristics of the 5730 tape, day visibility has been very good. The 5750 tape did not perform as well for the reasons stated in the durability discussion.

The thermoplastic had good night reflectivity initially, but after approximately eight months, bead loss was substantial enough to decrease performance in this area. The thermoplastic

material demonstrated good day visibility until wear became significant.

The standard paint had good reflectivity initially, but after approximately two months, began losing most of its reflective qualities.

TRAFFIC SAFETY

Information concerning accidents in the project area were reviewed using data from 1979 through 1983 (1984 unavailable). Figures show a decrease in total number of accidents by approximately 25% (August 1979-1982 = 44 total accidents, 1983 = 33).

Prior to the new overlay, this section of roadway consisted of yellow colored bituminous pavement as a storage lane for turning movements. The configuration used for the new project was modified to conform with the newer universal standards. The storage lane was delineated with four inch lines on each side, leaving the lane free of colored bituminous pavement. Directional arrows and signing were also included. This design has proven to be better understood by motorists utilizing the roadway and as a result should decrease the accident rate. Incorporating the use of 3M durable markings contributes to the safety by providing delineation during late winter and spring months when standard paint would otherwise be less effective.

With these two factors of change it is not feasible to determine how much effect the experimental pavement markings have had on the apparent reduction in the accident rate.

SUMMARY

Overall, the 3M series 5730 tape has outperformed thermoplastic and standard paint. None of the three materials provided fully adequate night reflectivity. In terms of durability, the 3M series 5730 tape and thermoplastic performed the best. The high cost of these materials make their use limited, but justified, in certain "hard to stripe" areas.

The following list applies to 3M series 5730 tape which performed the best of all materials evaluated. The hot inlay technique is recommended in order to obtain the best durability:

Advantages

Very good durability
Good resistance to snowplow abrasion
Can be done with inexperienced crew
Very good daytime visibility

Disadvantages

High cost - \$1.25/lf
Material subject to wheel path wear
Fair nighttime reflectivity

The following list applies to thermoplastic pavement marking material:

Advantages

Moderate to good durability
Moderate resistance to snowplow abrasion
Very good daytime visibility
Moderate nighttime reflectivity
Moderate cost - \$0.32/lf

Disadvantages

Requires experienced crew and considerable equipment
Safety a concern due to hot temperatures of materials during application
Material subject to wheel path wear

The following list applies to standard paint pavement marking material:

Advantages

Low initial cost - \$0.04/lf
Good initial reflectivity
Relative safe handling

Disadvantages

Poor durability, particularly in high ADT areas
Delineation often poor prior to reapplication

RECOMMENDATION

1) The 3M series 5730 tape and the thermoplastic material evaluated in this report should be allowed for inclusion as Durable Pavement Marking Materials.

2) When the 3M series 5730 tape is used, the hot inlay technique

is recommended.

3) The 3M series 5750 tape is only recommended for use in areas with minimal vehicle crossings, such as edge lines.

APPENDIX PHOTOGRAPHIC DOCUMENTATION

The following pages contain photographs of each test deck evaluated in this report. The photographs used in the report were selected on the basis of how they represent performance throughout the evaluation.

Page

11 & 12	Test decks #1 through #6 in "New Condition". Photos taken on October 27, 1982.
13 & 14	Test decks #2 through 6 after approximately one year, eight months of service. Test deck #1 is shown at ten months old.
15	Test deck #2, 3M 5730 tape shown at six months, 18 months and two years of service.
16	Test deck #6, thermoplastic shown at six months, 18 months and two years of service.
17	Test deck #4, 3M 5750 tape shown at six months, 18 months and two years of service.
18	Test deck #1, standard paint shown at 22 days, two months and seven months of service.

Test Deck # Description Of Material Applied

1	Standard Paint
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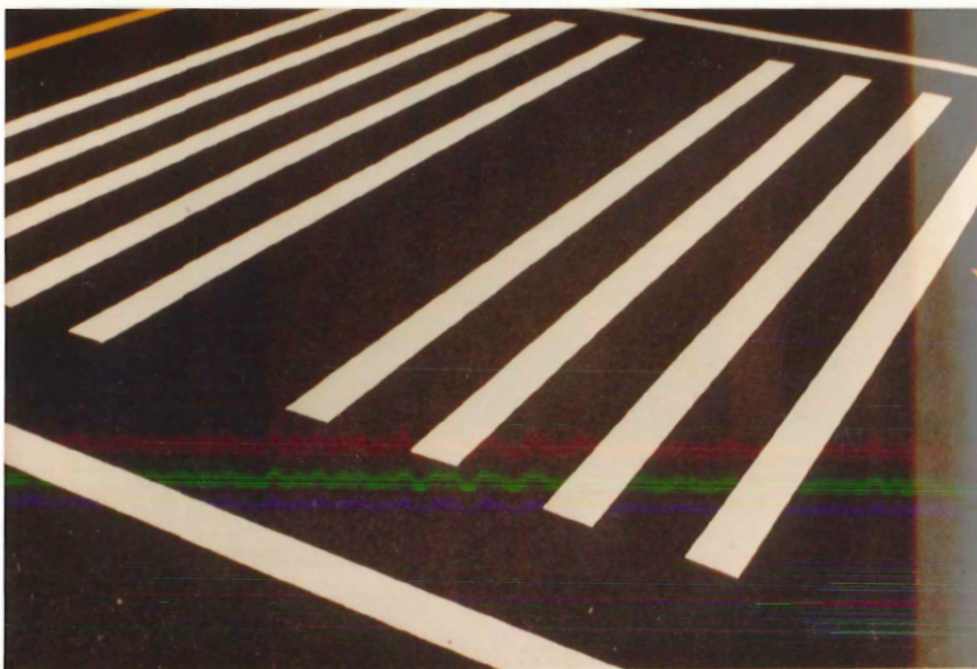
- 2 3M Series 5730 Tape (Hot Application)
- 3 3M Series 5730 Tape (Cold Application)
- 4 3M Series 5750 Tape (Hot Application)
- 5 3M Series 5750 Tape (Cold Application)
- 6 Thermoplastic Material



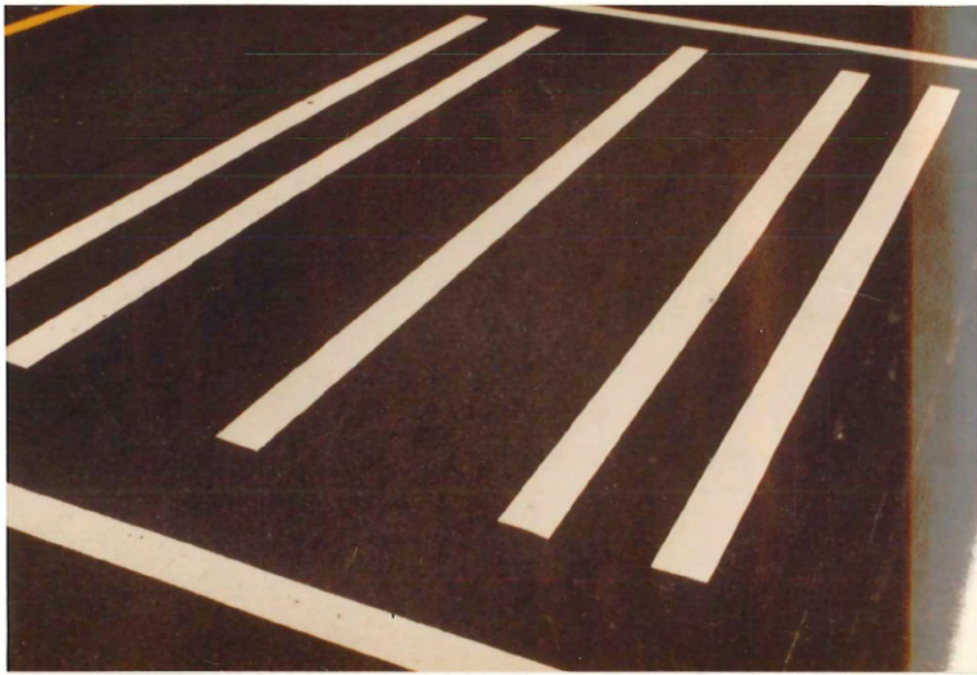
TD #1
Paint



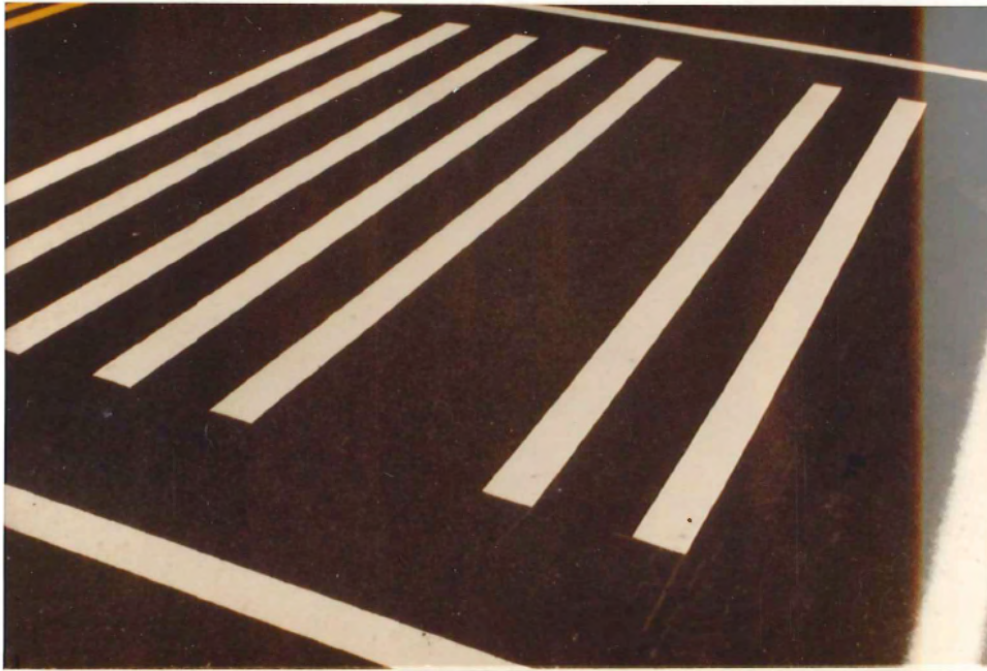
TD #2
3M, 5730
Hot Appl.



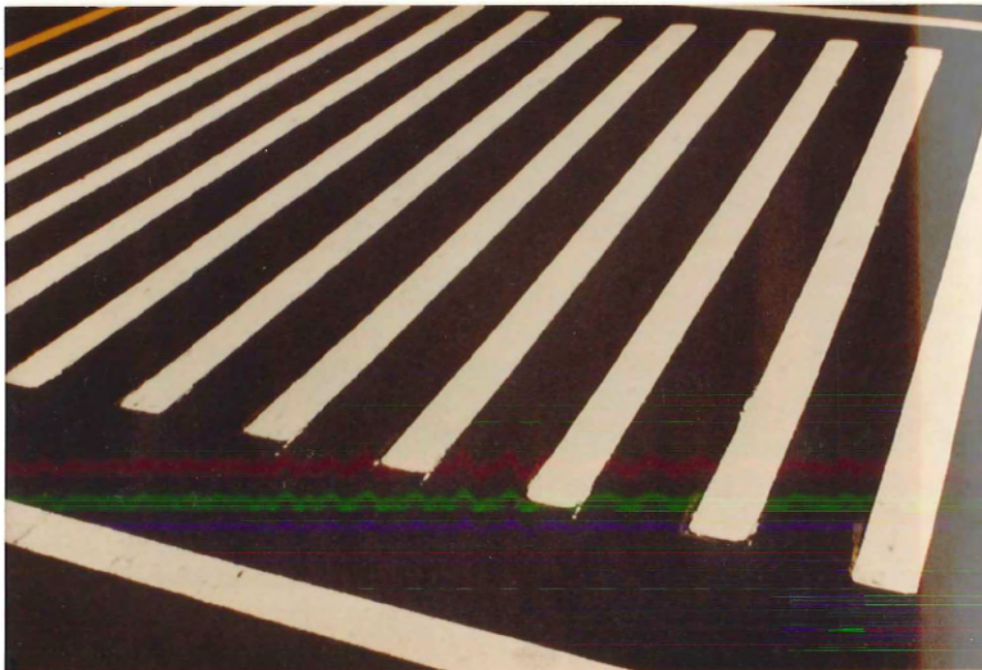
TD #3
3M, 5730



TD #4
3M, 5750
Hot Appl.



TD #5
3M, 5750



TD #6
Thermoplastic



TD #1
Paint



TD #2
3M, 5730
@ 1yr, 8mos



TD #3
3M, 5730
@ 1yr, 8mos



TD #4
3M, 5750
@ 1yr, 8mos.



TD #5
3M, 5750
@ 1yr, 8mos.



TD #6
Thermoplastic
@ 1yr, 8mos.



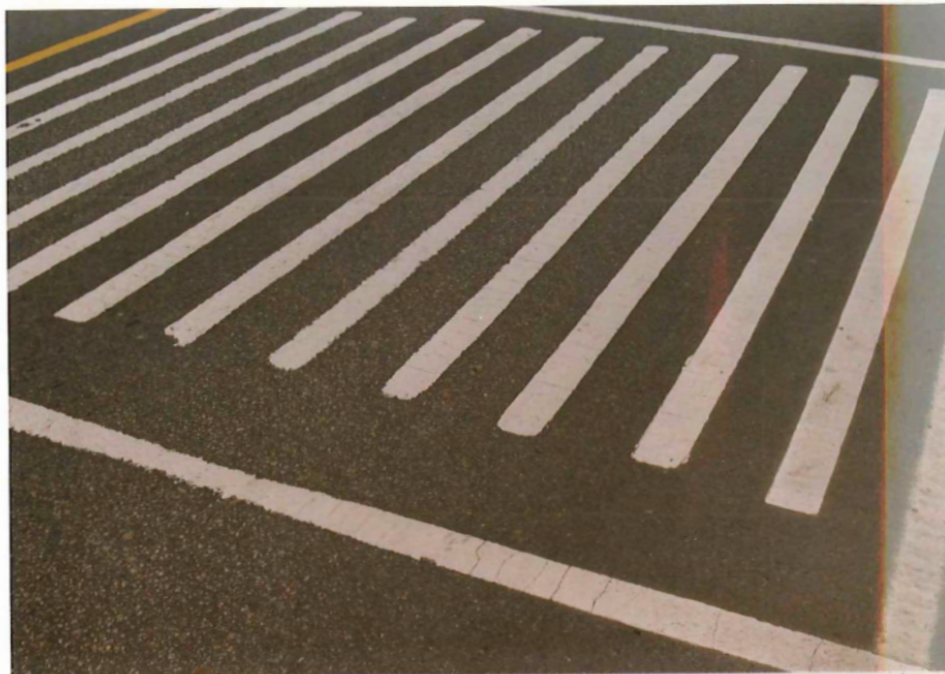
TD #2
3M, 5730
Hot Appl.
@ 6 mos.



TD #2
@ 18 mos.



TD #2
@ 2 yrs.



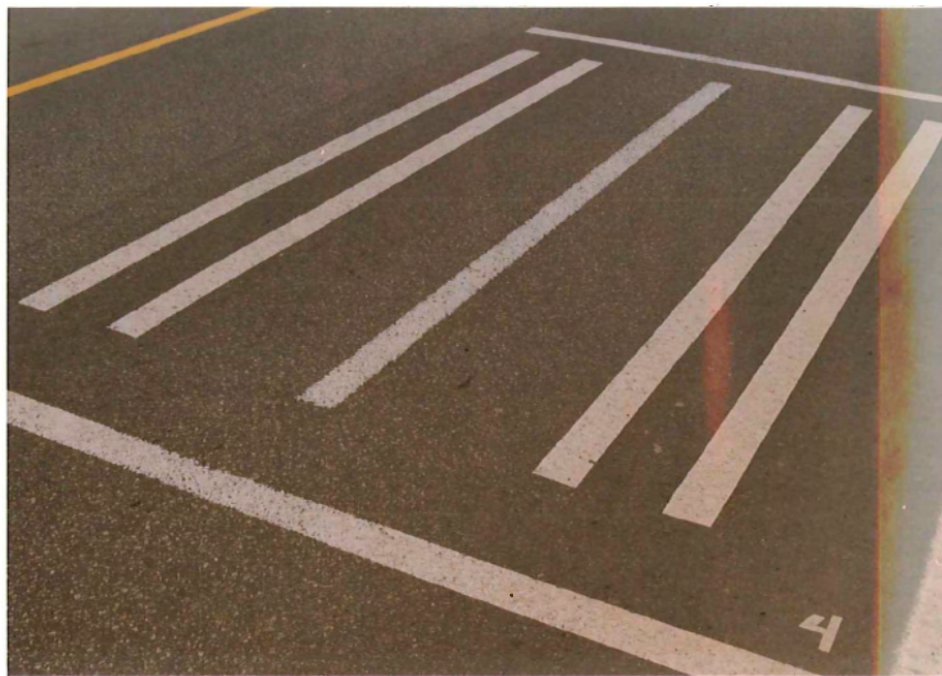
TD #6
Thermoplastic
@ 6 mos.



TD #6
@ 18 mos.



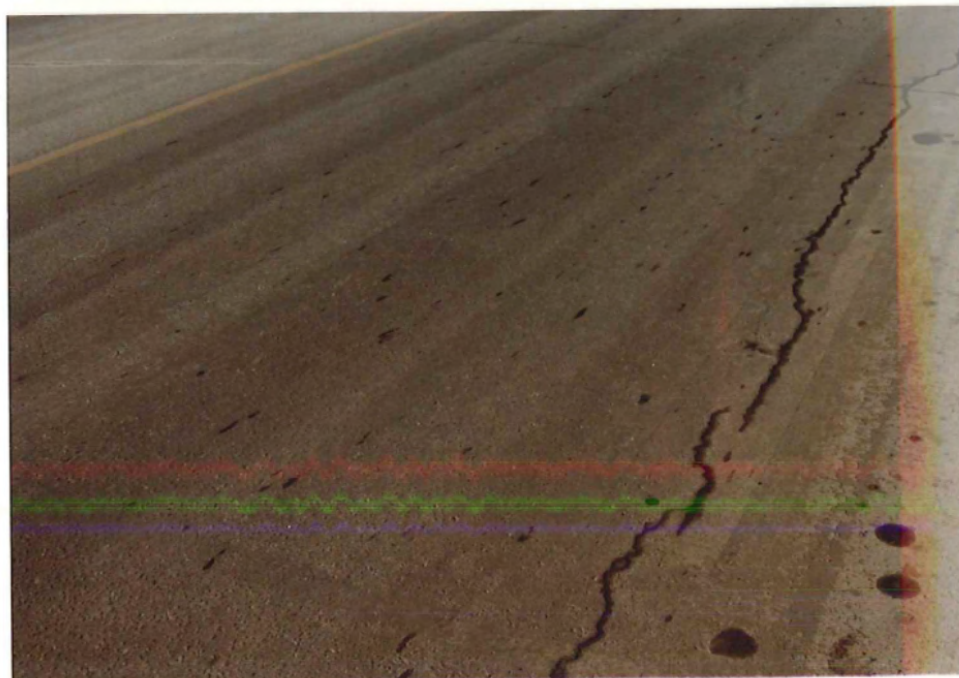
TD #6
@ 2 yrs.



TD #4
3M, 5750
Hot.Appl.
@ 6 mos.



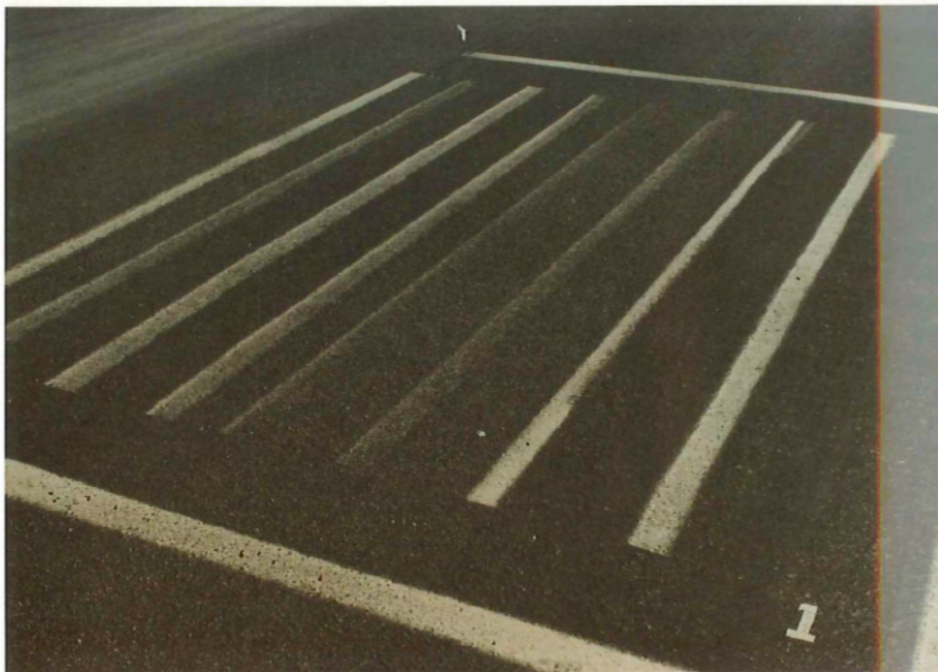
TD #4
@ 18 mos.



TD #4
@ 2yrs, 2mos.



TD #1
Paint
@ 22 days



TD #1
@ 2 mos.



TD #1
@ 7 mos.

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

WORK PLAN FOR
CATEGORY II EXPERIMENTAL PROJECT
PERMANENT PAVEMENT MARKING MATERIALS

WORK PLAN 82-R-14

OBJECTIVE OF EXPERIMENT

To compare the performance and cost effectiveness of permanent pavement marking materials with that of standard painted lines.

PROJECT

Berlin PMS 0197(2)

PROJECT LOCATION

In the Town of Berlin, beginning at the Montpelier City - Berlin Town Line and extending southeasterly 1.895 miles on U.S. Route 302 to the Barre City Line.

EXPERIMENTAL WORK LOCATION

Throughout the project length with the permanent pavement marking materials used to delineate divisional islands, barrier lines, symbols, special markings, skip lines and lane lines.

MATERIALS TO BE USED

"Stamark" Brand Pavement Marking Tape, series 5730 and 5750, manufactured by the 3M Company, Traffic Control Materials Division, 3M Center, Bldg. 223-3N St. Paul, Minnesota. The series 5750 material shall be used for diagonal crosshatch lines within the channelization islands. The series 5730 material shall be used for all other markings except for the edge lines which shall be painted.

APPLICATION PROCEDURE

Application of the permanent marking materials shall be as recommended by the manufacturer.

CONTROL SECTION AND TREATMENT

The Agency's standard paint shall be applied as edge lines (shoulder lines) for comparison purposes. In addition, both the experimental and control materials plus other promising pavement marking materials shall be applied in test decks for the purpose of determining material durability and visual performance characteristics.

COST

The estimated cost per lineal foot for marking materials is as follows:

Series 5730 tape	= \$0.82
Series 5750 tape	= \$0.48
Tape application machine	= \$0.05
Truck time and labor for tape application	= \$0.05
Painted lines including equipment and labor	= \$0.04

DATE OF INSTALLATION

Prior to October 1, 1982

DURATION OF STUDY

The project will be evaluated for the length of time required to obtain valid conclusions on the performance and cost effectiveness of the materials.

SURVEILLANCE

The experimental materials placed throughout the project and at the test deck locations shall be monitored during application and visually inspected on a bimonthly schedule for the duration of the study. The surveillance shall include photographic documentation for the life of both experimental and control treatments. The durability of the marking materials shall be evaluated with respect to bond failure, snowplow shear failure, and abrasion resistance. The materials will also be rated for daytime appearance and nighttime reflectivity. A before and after accident study shall be conducted to determine if the pavement markings improve traffic safety within the project area.

REPORTS

An initial report covering the installation and initial observations and a final report drawing conclusions on the effectiveness of the experimental materials shall be submitted to the Federal Highway Administration.

Materials Division
Agency of Transportation
July 1, 1982

Reviewed By:


R.F. Nicholson, P.E., Materials Engineer

Date: July 6, 1982