EXPERIMENTAL USE OF RESIN MODIFIED ASPHALT PAVEMENT ON MONTPELIER STATE HIGHWAY

FINAL REPORT 87-2

JANUARY 1987

REPORTING ON WORK PLAN 82-R-19

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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16. Abstract

This Final Report discusses the performance of a bituminous concrete mix modified with Solar Laglugel, a combination of natural and synthetic resins. The resins were added to the asphalt in the plant storage tank at a rate of 1.34 percent by weight of the asphalt cement. No significant problems were encountered with the productions or placement of 365 tons of the modified mix. Detailed information related to initial construction and observations can be found in Report 83-5, dated June, 1983.

The project was monitored for bituminous mix properties, reflective cracking, wheel path rutting, riding quality, friction values and maintenance requirements over a four year period of service.

In general, there was very little difference in performance between the Solar Laglugel modified and standard mixes placed in the field trial. Although the modifier may enhance the performance of a marginal bituminous concrete mix, its addition to Vermont's standard mix at a cost of $10.00 to $12.00 per ton would not be cost effective based upon the results obtained in this study.

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Performance Bituminous Concrete Mix Solar Laglugel Cost Effective	No Restrictions

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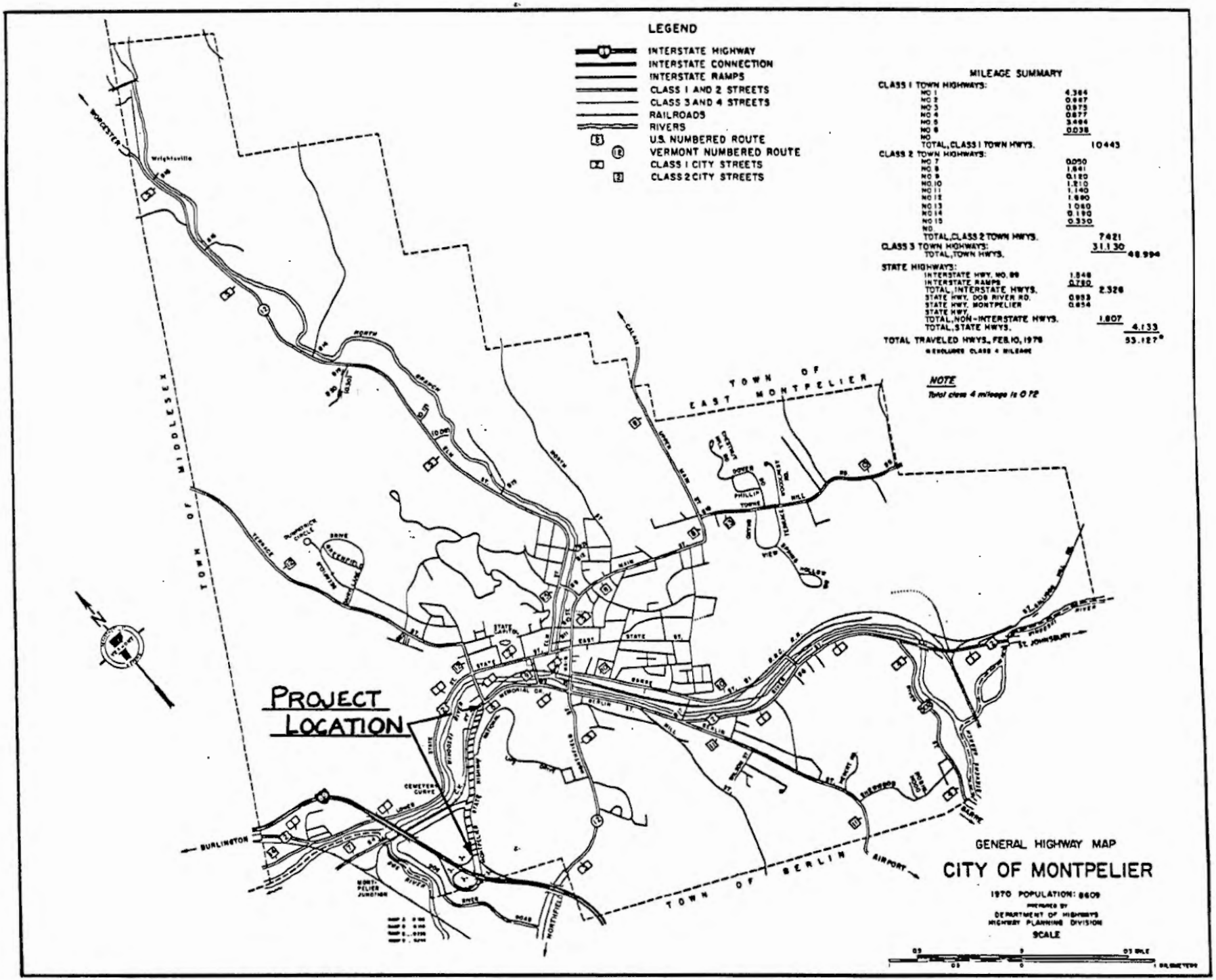
INTRODUCTION

Solar Laglugel is a resin and nylon base modifier designed to increase the performance of bituminous concrete pavements. Suppliers of the product propose that when combined with asphalt, Solar Laglugel significantly increases tensile strength, acts as an anti-stripping agent, enhances adhesive bonding qualities and retains friction values. Greater resiliency of the modified pavement allows the placement of thinner overlays (3/4 inch minimum) resulting in significant cost savings. The modifier is available from Additives of New England, Inc., 104 Woodland Road, Ashland, MA 01721 (Phone No. 617-881-1684).

In August of 1982, the Vermont Agency of Transportation was offered 550 pounds of Solar Laglugel at no charge for a field evaluation. With the cooperation of the local bituminous concrete producer Cooley Asphalt Paving Corporation, approximately 365 tons of the experimental mix was produced and placed in Montpelier, Vermont on the Montpelier State Highway in October, 1982. There were no significant problems encountered with the production of the modified mix or with its placement in a 1¼ inch thick overlay.

Detailed information on the production, placement, and initial field performance of the modified and standard mixes can be found in Report 83-5, dated June, 1983. This Final Report discusses the performance of the pavements through four years of service.



DIST. NO. 6

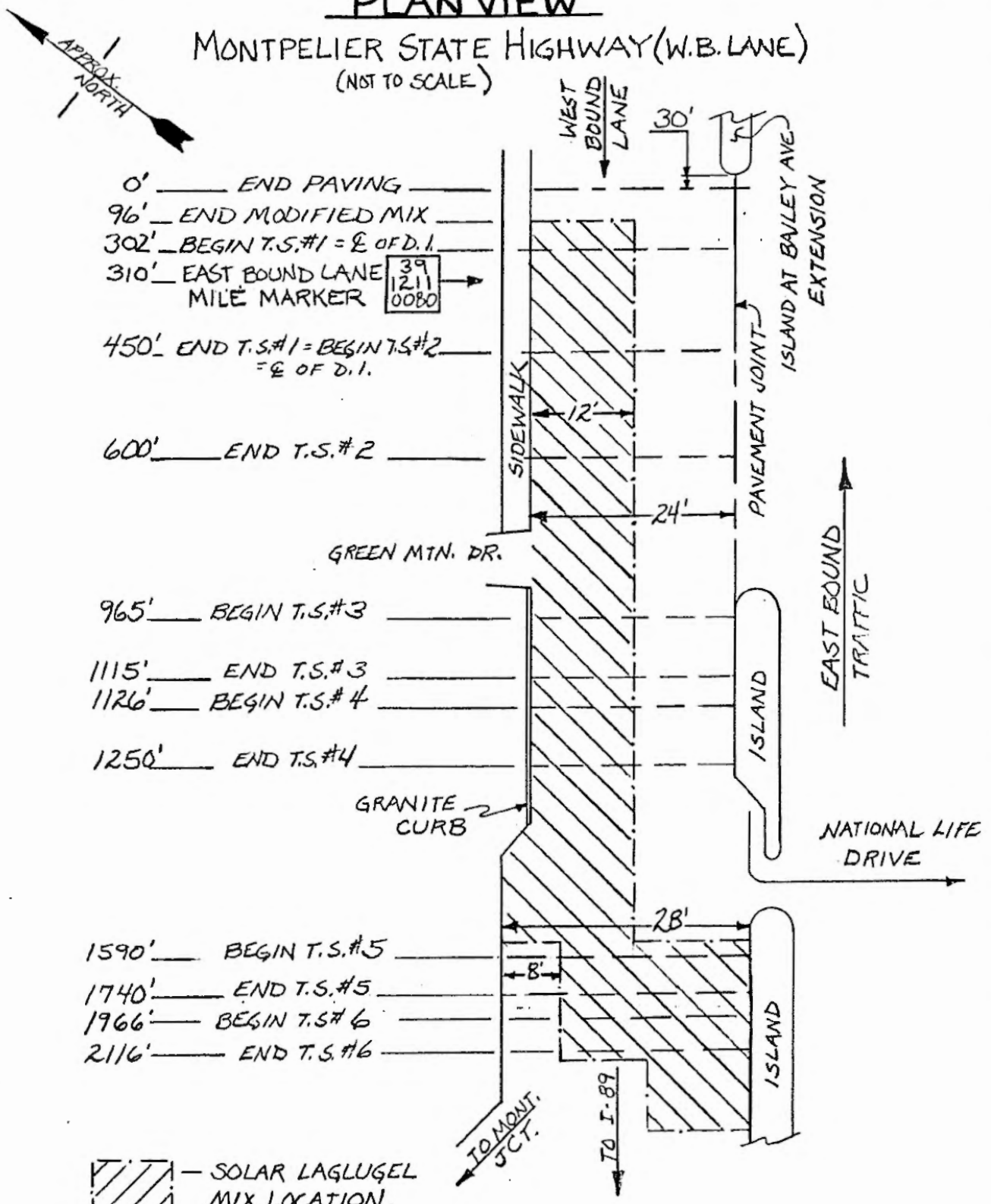
WASHINGTON COUNTY

LOCATION MAP

PLAN VIEW

MONTPELIER STATE HIGHWAY (W.B. LANE)

(NOT TO SCALE)



RESEARCH & DEVELOPMENT

PROJECT: MONTPELIER STATE HIGHWAY
F 028-2(6)S

PRODUCT: SOLAR LAGLUGEL

BY: E.C. HOUSTON DATE: 5/83

FIELD EXPOSURE CONDITIONS

Weather conditions through the 48 month evaluation period have generally fallen within the norm for the geographical area. The averages would include a freezing index of 1,250, 75 freeze-thaw cycles and 75 inches of snow. Frost penetration within the roadway cross section is believed to have reached the 50 to 60 inch depth. Air temperatures over 90 degrees were recorded on several occasions while pavement surface temperatures would have been expected to peak at less than 130°F.

The average daily traffic on the test site which includes two westbound lanes ranged from 4,170 in 1982 to 4,280 in 1986. However, it should be noted that approximately 70 percent of the traffic uses the left-hand lane which has the standard mix, while the remaining 30 percent of the vehicles travel over the modified mix in the test sections under evaluation. Truck traffic is estimated at six percent of the total.

PROJECT CONDITION AND PERFORMANCE

Mix Properties

The initial project testing revealed that both the standard mix and the mix modified with the addition of 1.34 percent Solar Laglugel by weight of asphalt cement were within job specifications. The Marshall stability of the resin modified mix was 2,424 pounds or 101 pounds less than the standard mix. The Marshall flow value was 10 or 2 less than the standard mix. Penetration values for the recovered asphalt from pavement cores taken in November, 1982 were recorded at an average of 61 in the modified mix and 55 in

the standard mix. Cores taken in 1985 revealed a 16 point drop to 45 for the modified mix and a 12 point drop to 43 for The standard mix.

Reflective Cracking

Test sections 1-4 were surveyed four times to determine the rate of reflective cracking. Through 1985, reflective cracking occurred at a slightly higher rate in the modified mix. The condition may have been due in part to the lower traffic volume since the traffic volume is known to effect the development of cold weather transverse cracks. The last survey in June, 1986 revealed 51 percent reflection of transverse cracks in the modified mix and 48 percent in the standard mix. The reoccurrence of longitudinal and miscellaneous cracks was much lower in the modified mix at 30 percent as compared to 51 percent in the standard mix. The overall rate of reflection can be seen in the following table.

Type Mix	Original Lf. Of Cracks	% Reflective Cracking 2/23/86	6/5/84	8/9/85	6/2/86
Modified	653	17	21	26	39
Standard	594	16	20	24	44

There was no significant difference in the width of the pavement cracks in the two mixes nor was there visual evidence of raveling along the edges of cracks. The level of cracking resulted in a maintenance application of hot rubberized asphalt crack filler in July, 1986.

Pavement Rutting

Pavement wheel path rutting has been insignificant on both mixes to date. Measurements taken on June 2, 1986 averaged 2/16 inch on the modified mix and 3/16 inch on the standard mix. It could

be assumed the difference in values is due to the additional traffic volume on the standard mix.

Riding Quality

The riding quality of the pavement was monitored with a Mays Meter in November, 1982 shortly after placement and again in October, 1986. The initial surface tolerance in inches of roughness per mile was 36 for the modified mix and 50 for the standard mix. After four years, the roughness of the experimental section had increased by 48 inches to 84 inches per mile while the standard mix had increased 40 inches to 90 inches per mile.

Friction Values

Pavement friction values were obtained in 1983 and again in 1985 using a locked wheel friction trailer. The measurements were taken in the left wheel path at a speed of 40 miles per hour. The first tests on the modified mix averaged 51.6. Values obtained two years later had dropped 2.6 to 49.0. Initial values on the standard mix averaged 46.1 and dropped 0.8 to 45.3 in 1985. All values obtained are considered satisfactory.

Maintenance Requirements

There has been no bleeding, raveling, development of pot holes or other distress noted on the project. Maintenance requirements have been limited to the crack filling operation conducted in July, 1986 and reapplication of traffic markings.

SUMMARY

There were no significant problems encountered with the production of 365 tons of bituminous concrete mix modified with Solar Laglugel at a rate of 1.34 percent by weight of asphalt cement. With the

exception of mixing the additive with the asphalt in the storage tank, the mix procedure was unchanged.

The modified mix gave off a strong odor and was stickier than the standard mix but did not present any problems with placement.

The Marshall stability and flow values on the modified mix were slightly lower than those recorded on the standard mix.

Penetration values for the recovered asphalt from pavement cores taken after three years of service revealed a 16 point drop to 45 for the modified mix and a 12 point drop to 43 for the standard mix.

Transverse cracks reflected up through both mixes at approximately the same rate while fewer longitudinal and miscellaneous cracks occurred in the modified mix. The overall rate of reflection was 39 percent for the modified mix and 44 percent for the standard mix through 44 months of service.

Pavement wheel path rutting has been insignificant and approximately equal on both mixes.

Through four years of service, pavement roughness has increased by 48 inches to 84 inches per mile for the modified pavement as compared to a 40 inch increase to 90 inches per mile for the standard pavement.

Satisfactory initial pavement friction values have been retained with little difference noted between the two mixes.

With the exception of pavement crack filling and reapplication

of traffic markings, there were no maintenance requirements on the test site and none are anticipated in the near future.

CONCLUSION AND RECOMMENDATION

In general, there was very little difference in performance between the Solar Laglugel modified and standard mixes placed in the field trial. Although the modifier may enhance the performance of a marginal bituminous concrete mix, its addition to Vermont's standard mix at a cost of $10.00 to $12.00 per ton would not be cost effective based upon results obtained in this study.

Further trial use of Solar Laglugel is not recommended.

FOLLOWUP

Periodic observations will continue on the project. If significant changes are noted prior to rehabilitation, a followup report will be prepared and distributed.

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

WORK PLAN FOR CATEGORY II EXPERIMENTAL PROJECT

RESIN MODIFIED ASPHALT PAVEMENT

WORK PLAN 82-R-19

OBJECTIVE OF EXPERIMENT

To produce and place a bituminous concrete mix modified with a natural and synthetic resin admixture and to compare the properties and performance of the modified material with a standard bituminous concrete mix.

PROJECT

Montpelier F 028-2(6)S

PROJECT LOCATION

In the City of Montpelier, on the Montpelier State Highway, beginning at the intersection of the Montpelier State Highway and Ramp A and extending easterly 3981 feet, ending 100 feet west of the intersection with Bailey Avenue Extension.

EXPERIMENTAL WORK LOCATION

On 2900 ± lineal feet of 12 foot wide roadway beginning near the intersection with Bailey Avenue and continuing westerly. The work location is subject to change, depending on mix production and field conditions.

MATERIALS TO BE USED

The experimental mix shall be modified with SOLAR LAGLUGEL, a compound consisting of a nylon gel and 14 natural and synthetic resins. The material is available from Solar Asphalt of America, Inc., 1361 St. Georges Avenue, Rahway, N.J. 07065. Phone (201) 381-5522.

PRODUCTION PROCEDURE

The SOLAR LAGLUGEL Modifier shall be added to the asphalt cement in the delivery tanker or in a storage tank at the batch plant at the rate of 1.33 percent by weight of the asphalt cement. Mixing shall be achieved by circulating the mixture for 60 minutes at temperatures between 280°F and 320°F. Approximately 325 tons of the modified mix shall be produced.

CONTROL SECTION AND TREATMENT

The control section shall consist of adjacent areas of bituminous concrete pavement constructed with the same bituminous mix without the admixture. Sufficient data will be gathered on the control section to make the desired comparisons with the modified pavement section.

COST

The in-place cost of the standard bituminous concrete pavement shall be $26.50 per ton. There will be no increase in cost for the modified mix, due to the cooperation of the material supplier and paving contractor.

DATE OF CONSTRUCTION

The experimental treatment shall be completed prior to October 15, 1982.

EVALUATION PROCEDURE

The initial evaluation will include the following steps:

1) Obtain initial design, construction and maintenance records on the section of highway which is to be overlaid.

2) Visually inspect and document the condition of the existing pavement.

3) Observe the production and paving process and document pertinent information on the equipment required, method of production, mix temperatures, compaction effort required and achieved, weather conditions, and other related information.

4) Document laboratory and field tests taken during the construction of the project and obtain core samples of the standard and modified pavement for lab analysis.

5) Obtain Mays Meter ride values and friction tests on the experimental and control sections.

DURATION OF STUDY

The experimental project will be evaluated for a minimum of five years following completion of construction.

SURVEILLANCE

The experimental and control pavements shall be monitored during construction and at least once each winter and spring for the duration of the study. Evaluations shall include documentation of the condition of both experimental and control pavements. The long term performance of the modified pavement will be compared with that of the standard pavement with emphasis on the following areas:

1) Reductions in reflective cracking.

2) Retention of initial ride values.

3) Retention of initial friction values.

REPORTS

An initial report covering the production, placement, and initial observations and a final report showing conclusions on the effectiveness of the experimental material shall be submitted to the Federal Highway Administration.

Reviewed By:

R. F. Nicholson

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

Date: Sept. 3, 1982

Materials & Research Division
Agency of Transportation
August 31, 1982

* Federally Approved 9/23/82