

EXPERIMENTAL USE OF RESIN MODIFIED
ASPHALT PAVEMENT ON
MONTPELIER STATE HIGHWAY

INITIAL REPORT 83-5

JUNE 1983

REPORTING ON WORK PLAN 82-R-19

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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Date: July 12, 1983

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TABLE OF CONTENTS

	Page
Abstract	1
Introduction.	2
Product Information Provided by Supplier.	3
Project Description & Roadway Condition	4
Location Map.	5
Mix Production & Testing.	6
Paving Operation.	8
Post Construction Observations	10
Summary.	11
Appendix A	
Original Pavement Condition.A1-A8
Appendix B	
Mays Ride Meter Information. B1
Appendix C	
Mix Design & Testing DataC1-C11
Appendix D	
Work Plan 82-R-19D1-D3

ABSTRACT

Approximately 365 tons of bituminous concrete mix modified with Solar Laglugel, a natural and synthetic resin, was produced and placed as a wearing course on Montpelier State Highway in Montpelier, Vermont in October of 1982.

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 production or placement of the modified mix. Lab tests conducted on the core samples for recovered penetration values averaged 55 for the standard mix and 61 for the modified mix.

Mays Ride Meter readings taken on the project averaged 49.8"/mile on the regular mix with readings of 36.4"/mile on the modified mix.

Field inspections through the first six (6) months of service revealed less than 1 percent cracking in both the standard and modified mixes. Rutting readings ranged from 1/16" to 3/16" in the standard mix and 1/16" to 2/16" in the modified mix. Both mixes averaged 1/16" overall

INTRODUCTION

Solar Laglugel (S.L.) is a resin and nylon base modifier designed to increase the performance of bituminous concrete paving surfaces. Suppliers propose that the use of S.L. with its greater resiliency allows for the placement of thinner overlays resulting in significant cost savings.

In August, 1982, the Vermont Agency of Transportation was offered 550 pounds of the S.L. at no charge for a field evaluation. With the cooperation of the local bituminous concrete producer, Cooley Asphalt Paving Corporation, an experimental bituminous concrete mix was batched and placed in October of 1982.

This report describes the production and placement of the modified mix and field performance results through the first six months of service.

PRODUCT INFORMATION PROVIDED BY SUPPLIER

Solar Laglugel is a nylon based modifier consisting of fourteen (14) natural and synthetic resins recommended for use in bituminous concrete mixes. The material donated for experimental use on Vermont highways was Solar Laglugel, distributed by Additives of New England, Inc., 104 Woodland Road, Ashland, Massachusetts, 01721 (phone, 617-881-1684).

The product data indicates that S.L. treated material has a higher Tensile Splitting Strength than untreated mix. Stripping resistance tests of a S.L. sample treated for 24 hours at 60°C showed that 50% of the asphalt was retained. After boiling for 10 minutes in water, both treated and untreated samples retained less than 5% asphalt (these strip test results do not meet State of Vermont Standard Specifications for Highway and Bridge Construction).

The S.L. modifier can be added to the asphalt cement in the storage tank at the batch plant or to the transport tanker. Mixing is achieved by circulating the mixture for 60 minutes at temperatures between 280°F and 320°F.

Placement and compaction of the modified mix is achieved with conventional pavers and rollers.

When S.L. is added at a rate of 1.33 percent by weight of the asphalt cement, the modified mix could be expected to cost \$10.00/ton extra (1.68 lbs/ton). The material is sold in 110 pound bags for \$5.60/lb., F.O.B. Additives of New England, Ashland, Massachusetts for 1982/1983.

Price includes labor for adding the S.L. to the mix. The supplier claims that adding the modifier to the mix is cost effective because the performance is sufficient to extend pavement life and allow for a significant reduction in pavement thickness (3/4" min., 1" overlay is usually sufficient).

PROJECT DESCRIPTION & ROADWAY CONDITION

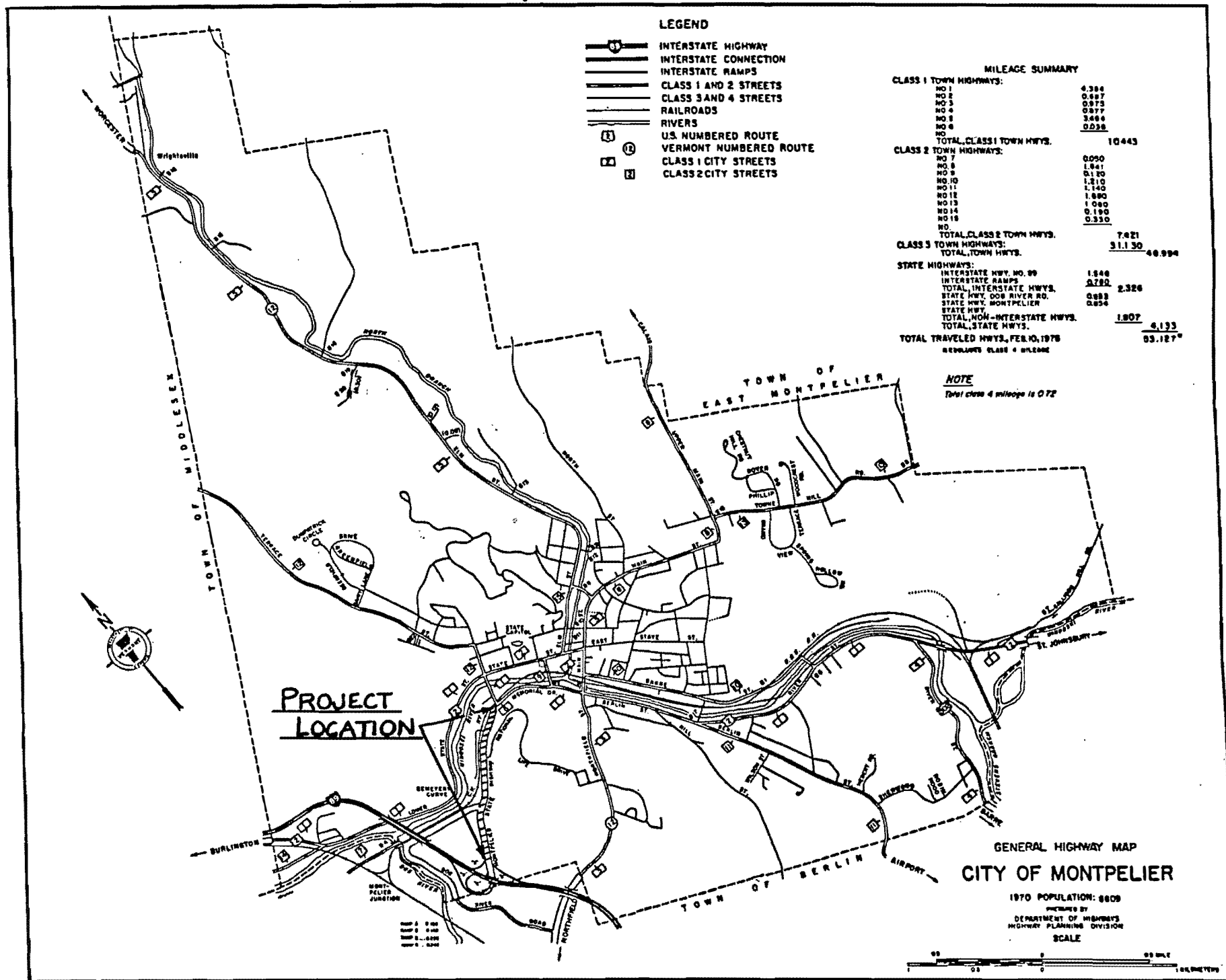
The project, Montpelier F 028-2(6)S, was located in the City of Montpelier, on the Montpelier State Highway, beginning at the intersection of the Montpelier State Highway and Ramp A of Interstate 89 and extending easterly 3981 feet, ending 200 feet west of the intersection with Bailey Avenue Extension. See location map on page 5.

The existing roadway was constructed during the period 1958-1960 using a 20" Gravel and 6" Macadam Sub-base, with 3" of Bituminous Concrete Pavement. An additional 3/4" of bituminous concrete mix was placed in 1969.

From the centerline of the intersection at Bailey Avenue Extension proceeding westerly, the roadway is undivided for 1096' beginning at that point, there is a median varying in width from 4' - 16' dividing the highway (with the exception of the National Life drive and Montpelier Junction turn) to its termination at the I89 interchange.

Detailed pavement condition surveys were made at six locations approximately 1 month prior to cold planing the roadway. The test section surveys included a detailed crack count and rutting measurements at 3 locations per test

-5-



DIST. NO. 6

LOCATION MAP

section. The crack counts revealed an average of 366 lf. of cracks per 100 lf. of 24' wide roadway. Approximately 59% of the cracks were longitudinal, 36% were transverse, and the remaining 5% were miscellaneous. Rutting ranged from 1/16" to 12/16" with an overall average of 5/16". The pavement's original condition can be seen on pavement survey sheets, Appendix A1 - 8.

The entire length of the project was cold planed at a depth of 1" and the test sections were resurveyed prior to paving. The crack counts showed that 84% of the cracks were still visible. There were 2092 lf. of cracks in the surface prior to cold planing compared to 1747 lf. after cold planing.

The average daily traffic for this section of Montpelier State Highway in 1980 was 7965.

MIX PRODUCTION AND TESTING

The 550 pounds of S.L. arrived at the Cooley Asphalt Paving Corp. in Berlin, Vermont on October 7, 1982. The modifier was added to 41,000 pounds of asphalt in storage tank #3 at a rate of 1.34% by weight of the asphalt cement. While adding the modifier to the tank, the workers noted that several of the S.L. bags had arrived in a semi-solid state. The supplier indicated this was due to warm storage for several months. To remedy the problem, the plant employees found it necessary to use a steel bar to break up the bags of caked material. The remaining bags crumbled with handling and were easily poured into

the tank. Once all the material was in the tank, the asphalt was circulated overnight at a temperature of 300⁰ to 320⁰.

Due to rain, paving was cancelled for October 8, 1982. When visually inspected through the top port of the asphalt tank on October 9, 1982, it appeared that the S.L. modifier was floating on the surface of the asphalt cement. A sampling device was designed so the asphalt could be sampled directly from the top of the tank. Several samples were taken but there was no visual evidence of any undissolved S.L. modifier floating on the surface of the asphalt cement sample.

A Type III bituminous concrete mix was produced for the project on October 11, 1982, at the Cooley Asphalt Paving Corporation batch plant. The asphalt was an 85/100 penetration grade supplied by British Petroleum, Montreal, Quebec, Canada. The coarse aggregate consisted of crushed granite. The fine aggregate included natural sand and stone screenings from crushed granite.

The modified and standard mixes were tested on October 11, 1982, for asphalt content, gradation, air void content, stability and flow.

The following chart shows the results of these tests:

TESTS	MODIFIED MIX	STANDARD MIX
Extraction (Asphalt content)	6.22%	6.27%
Air Void Content	3.7%	3.9%
Stabililty	2424 lb.	2525 lb.
Marshall Flow Value	10	12

Details of the mix design and laboratory test results can be seen in Appendix C1 - 11.

PAVING OPERATION

Paving began about 10:00 AM on October 11, 1982 under overcast skies with the ambient temperature at 40°F and rising. Approximately 228 tons of standard mix was produced prior to switching over to the modified mix. A plan view of the installation can be seen on page 9.

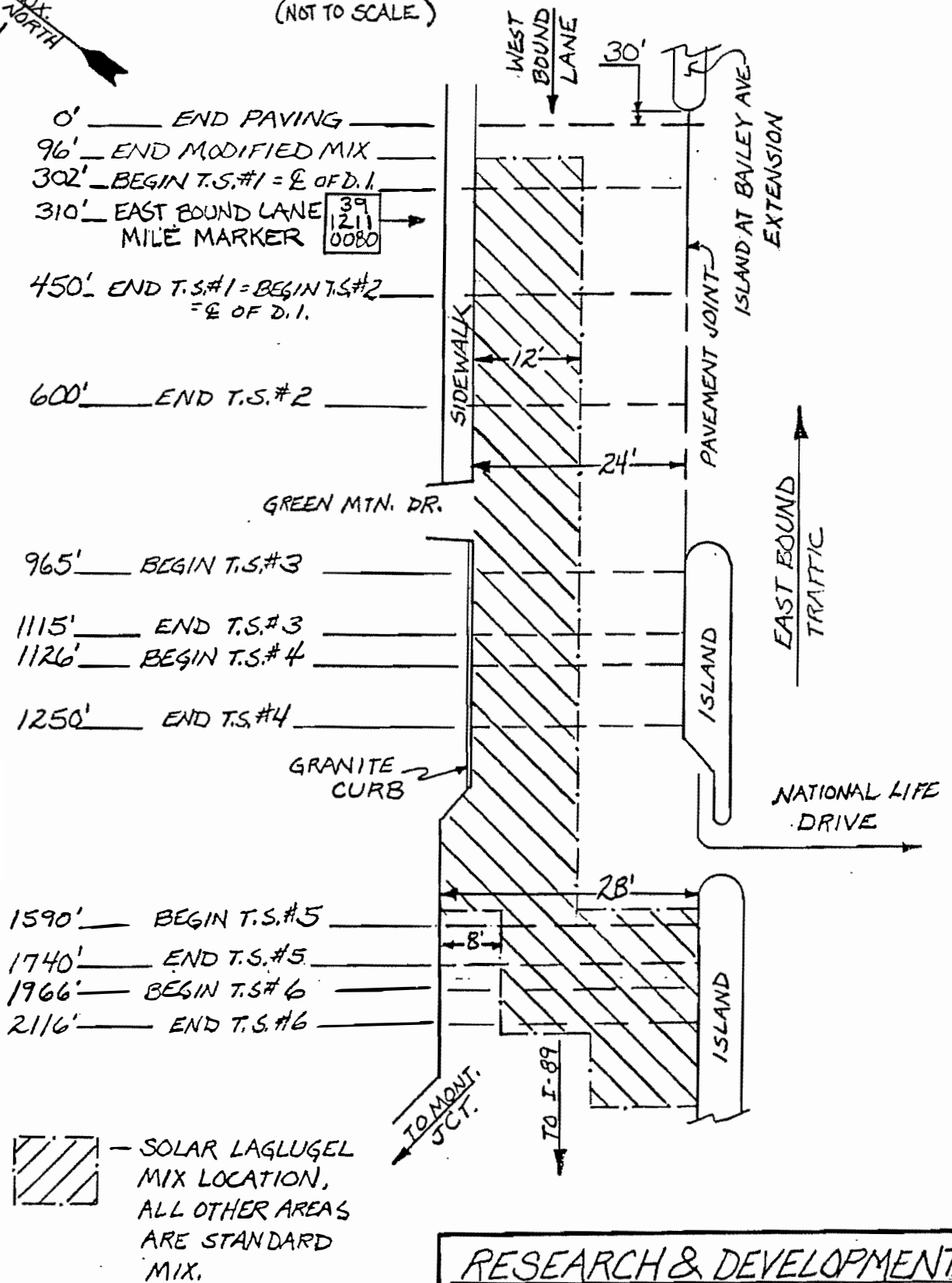
The paving sequence proceeded from west to east in the west bound lane. Type III mix was used until the paver neared the test sections, at which time the tanks at Cooley's were switched to the modified asphalt. The modified mix covered half of all the test sections.

Thickness of the overlay was 1 1/4" throughout the project. Mix temperatures sampled from trucks on the project ranged from 295°F to 305°F. Workers on the project commented that the modified mix was stickier than the standard mix but did not present any problems with placement. It appeared somewhat blacker and had more of a shine but the color variation was not evident after the pavement had been compacted. The S.L. modifier mix gave off a very strong odor.

Modified mix was placed in test sections 1-4 between 3:00 PM and 3:25 PM. The breakdown rolling phase left edge and stopping marks in the pavement surface in these areas. Traffic was placed on the roadway in these areas prior to final rolling. The final rolling took place after 5:00 PM when the surface temperature was less than 90°F.

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

POST CONSTRUCTION OBSERVATIONS

Core samples taken November 22, 1982 showed that compaction was within job specifications when tested in the lab. The test results averaged 97.7 for percent compaction (see Core Analysis - Column I, Appendix C-10). Percent air voids ran on the high side with an average of 6.3 (the standard ranges from 2 - 8%).

The cores were also tested for gradation, asphalt content, and recovered penetration of the asphalt cement. Both mix types passed the job requirements for gradation and percent asphalt cement. Penetration values for the recovered asphalt from the cores taken in the modified mix were 63 and 58 for an average of 60.5. The standard mix had somewhat lower values of 58 and 51 with an average of 54.5.

On November 30, 1982, a May Ride Meter Surface Tolerance Run was made over the project area. The weather was cloudy with light rain and a temperature of 45⁰F. Vehicle speed was 45± mph.

Readings were as follows:

<u>Type Mix</u>	<u>Lane</u>	<u>Initial Readings (Inches/Mile)</u>
Standard	West Bound, Left	49.8"
Modified	West Bound, Right	36.4"

Test sections 1-4 were surveyed for cracks and rutting on March 23, 1983. (Test sections 5 and 6 were not resurveyed due to the placement of both standard and modified mix within both test sections). Rutting ranged from 1/16" to 3/16". The following chart shows a comparison of crack count data taken after cold planing and after the first six months of service.

CRACK SUMMARY CHART*

Pre Construction After Cold Planing			Post Construction	
	Standard Mix	Modified Mix	Standard Mix	Modified Mix
Total LF.	594	652	2	5
Avg/100' Rdwy.	104	113	0	1

*Total lineal footage of cracks does not include cracks along the longitudinal pavement joint or test sections 5 and 6.

There were some areas of small transverse parallel cracks located primarily in the area of test sections 1-4. These areas corresponded with the areas which had traffic on them prior to final rolling (as noted on page 8).

These finely cracked areas appear to have the potential of developing into larger cracks which allow the intrusion of water. One such area had already developed in test section #4. A crack of about 10" in length appears to be wider than others and has water accumulated in it.

SUMMARY

No significant problems were encountered in the production or placement of approximately 365 tons of bituminous concrete mix modified with SOLAR LAGLUGEL.

With the exception of mixing the additive with the asphalt in the storage tank, the mix procedure is basically the same. The bituminous mix producer felt that the mixing process would not significantly alter the normal plant procedures.

Lab tests conducted on the core samples for recovered penetration of the asphalt cement averaged 55 for the standard mix and 61 for the modified mix.

Mays Ride Meter readings taken on the project averaged 49.8"/mile on the regular mix with readings of 36.4"/mile on the modified mix.

After six months of service, crack reflection totalled less than 1% on both the standard and modified mixes. Rutting readings taken prior to cold planing ranged from 1/16" to 12/16". Readings taken after 6 months of service revealed readings ranging from 1/16" to 3/16" in the standard mix and 1/16" to 2/16" in the modified mix. Both mixes averaged 1/16" overall.

FOLLOW UP

The long term performance of the modified pavement will continue to be monitored with emphasis on the following areas:

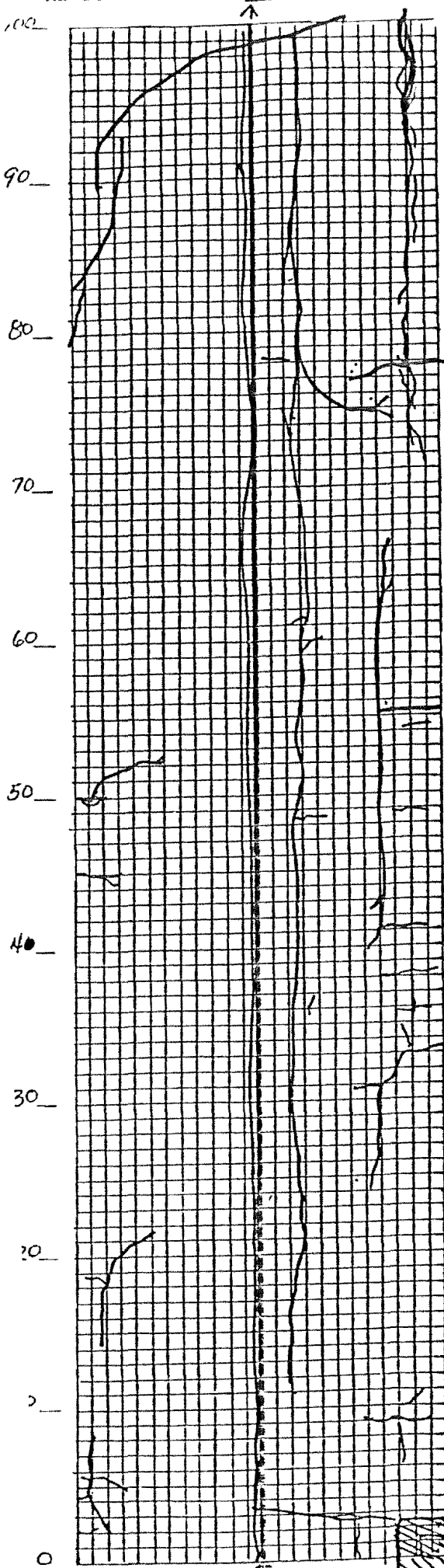
Reduction of reflective cracking.

Retention of ride values.

Recovered penetration values.

ORIG. SURVEY BY K. ORT DATE 9/8/82
RE-SURVEYED BY _____ DATE _____

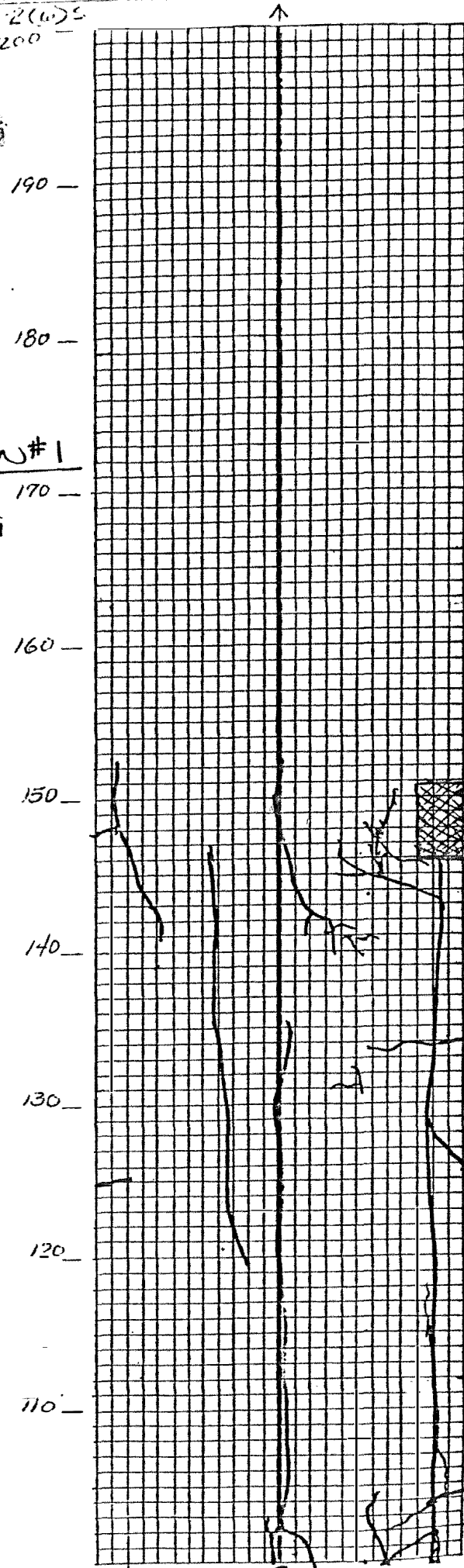
PAVEMENT CONDITION SURVEY
PROJECT MONTELEONE STATE HIGHWAY
F 028-2(6)S



ORIGINAL
BEFORE PLANING

TEST SECTION #1
~~150~~ LONG
148

↑
TRAFFIC



☐
D.I.
END
THIS
SECTION

DI A1

ORIG. SURVLY BY P. GORT DATE 9/5/67
RE-SURVEYED BY _____ DATE _____

PAVEMENT CONDITION SURVLY SHEET 1 OF 1
PROJECT MONTELEONE STATE HIGHWAY

F. 028 2(02)
200

ORIGINAL

BEFORE PLANING

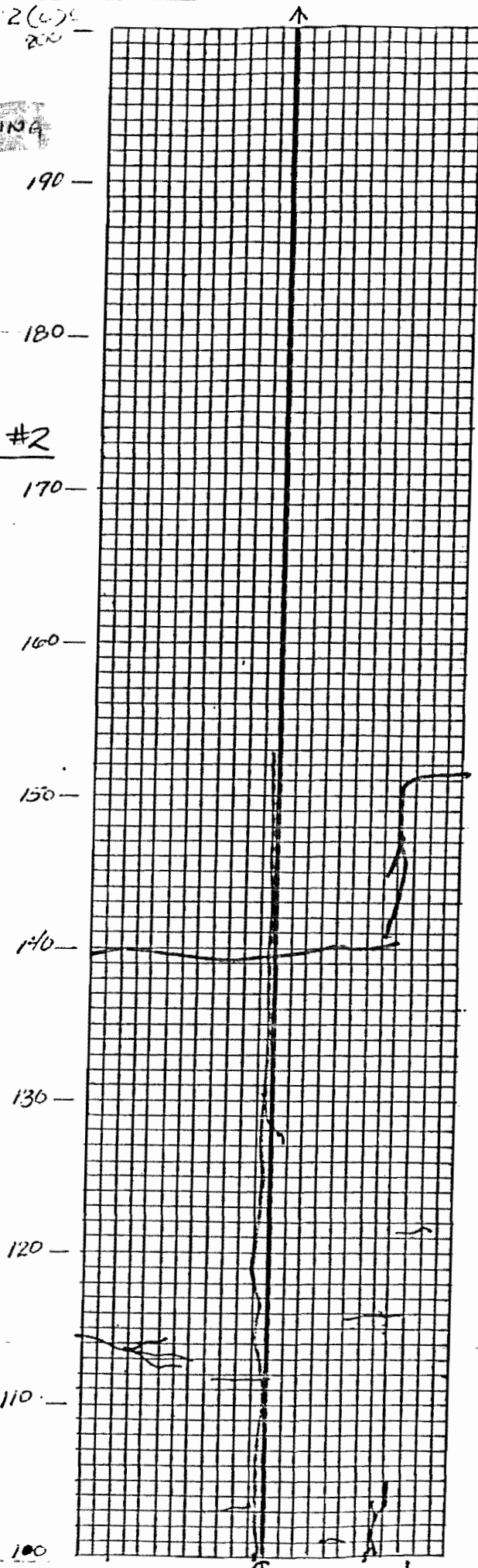
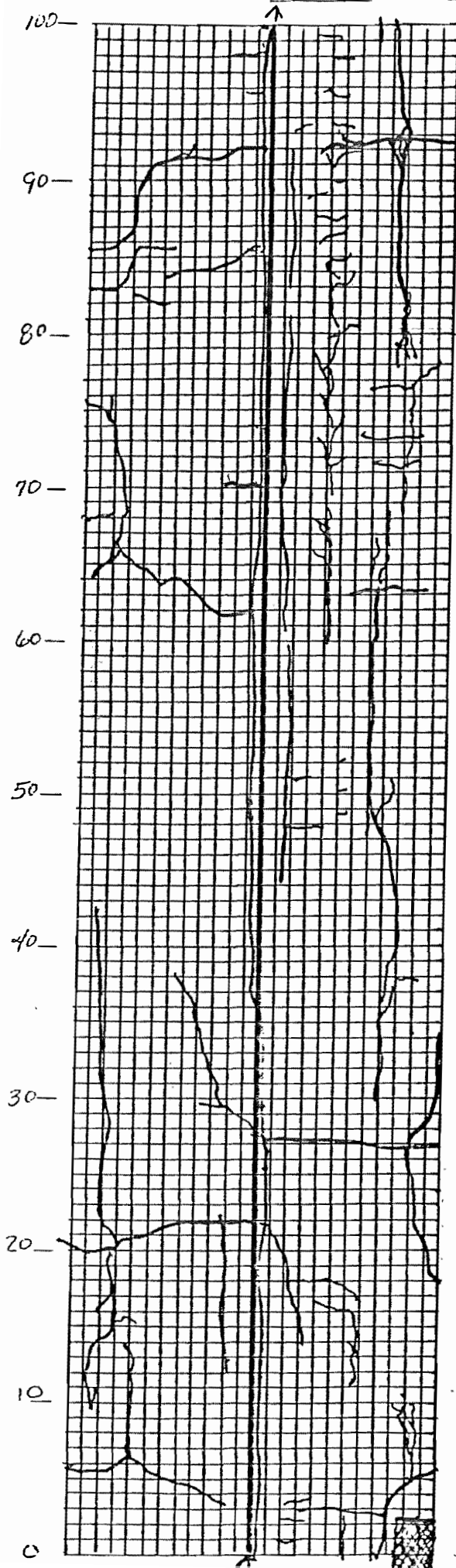
TEST SECTION #2

150' LONG

↑
TRAFFIC

0 POLE #6

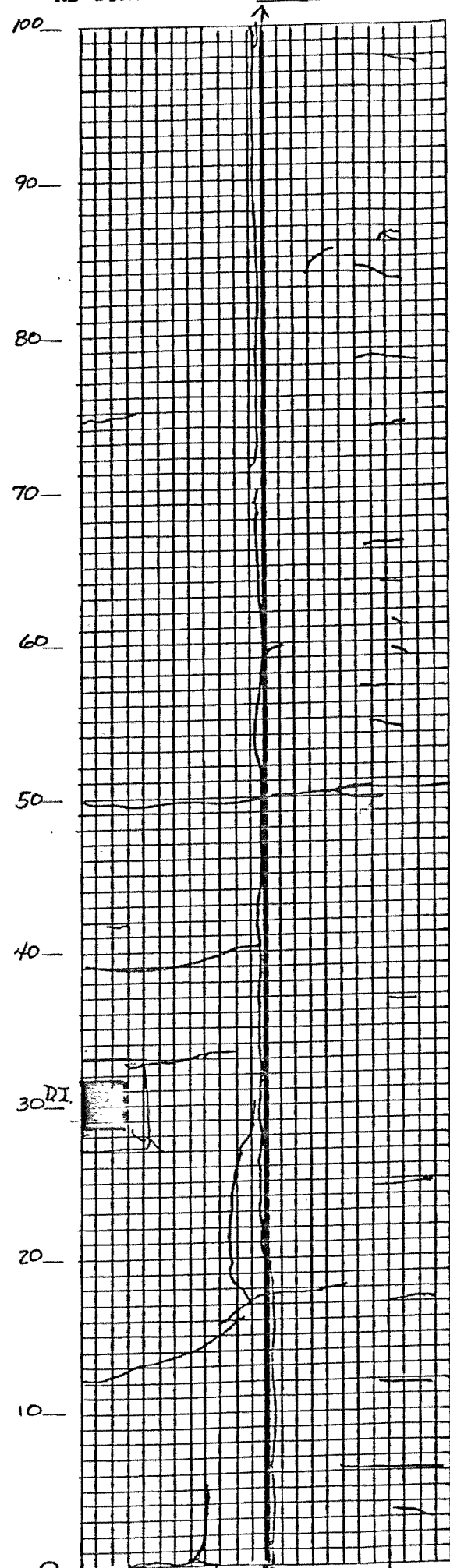
A.D.I. A2



ORIG. SURVEY BY P. Corti DATE 9/8/60
RE-SURVEYED BY _____ DATE _____

PAVEMENT CONDITION SURVEY
PROJECT MONTPELIER STATE HIGHWAY
F 028-2 (6)5

SHEET _____ OF _____

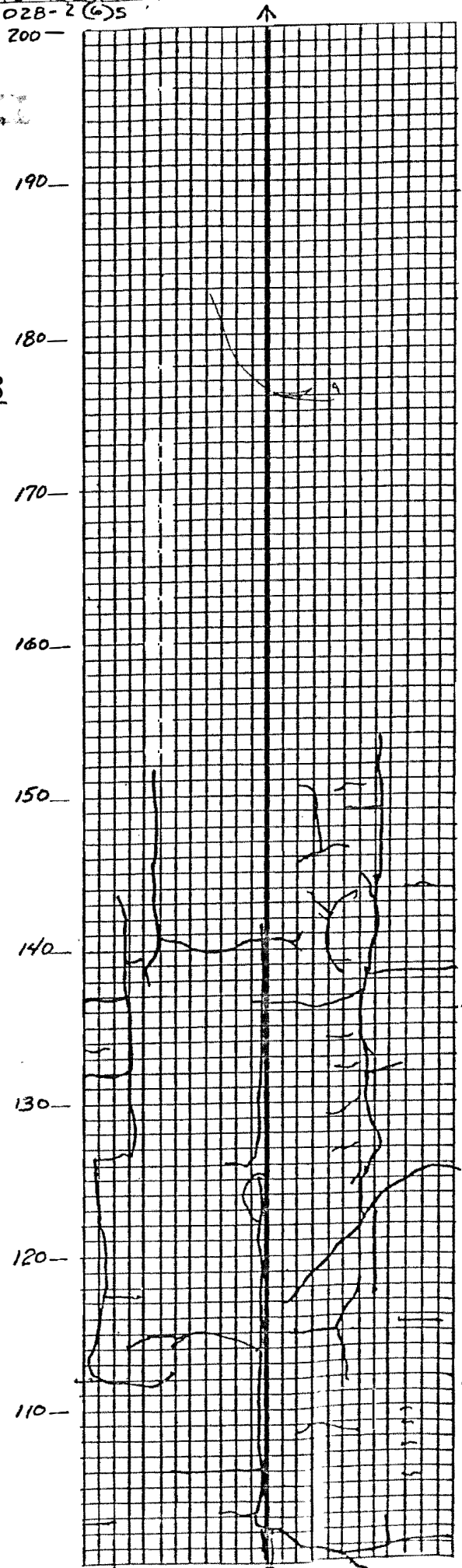


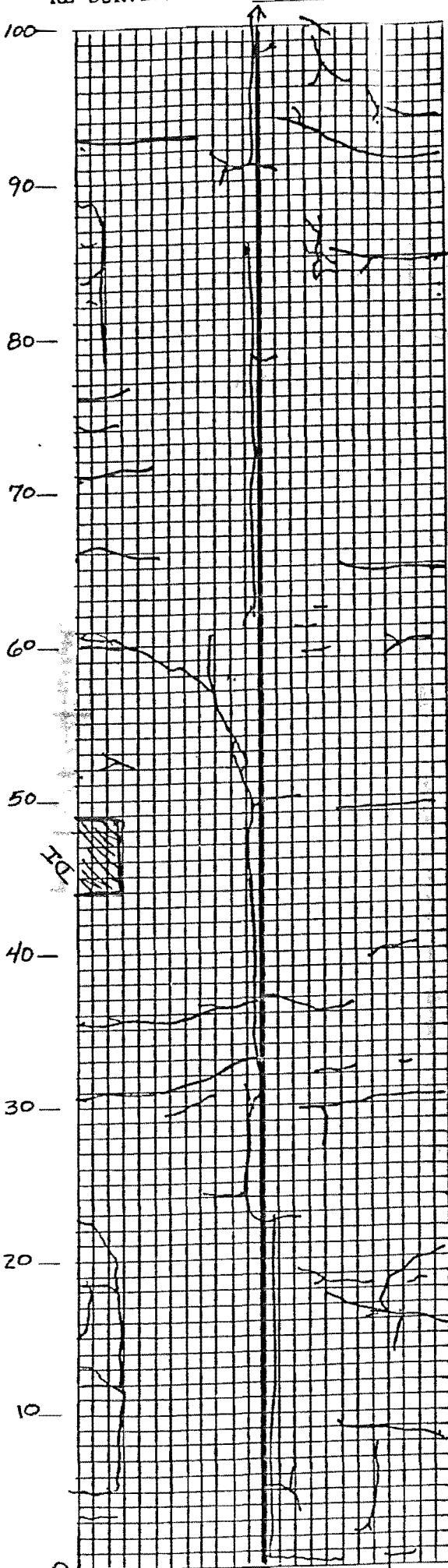
ORIGINAL
BEFORE PLANING

TEST SECTION #3

150' LONG

↑
TRAFFIC

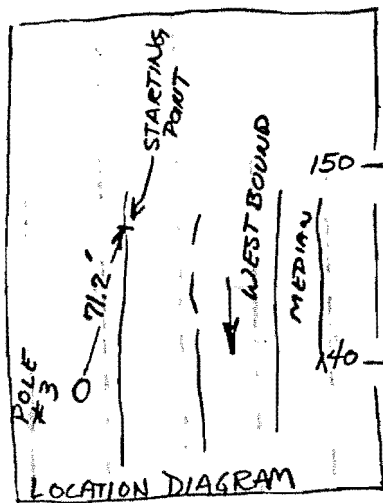




ORIGINAL
BEFORE PLANING

↑
TRAFFIC

TEST SECTION #4
125' LONG



190—

180—

170—

160—

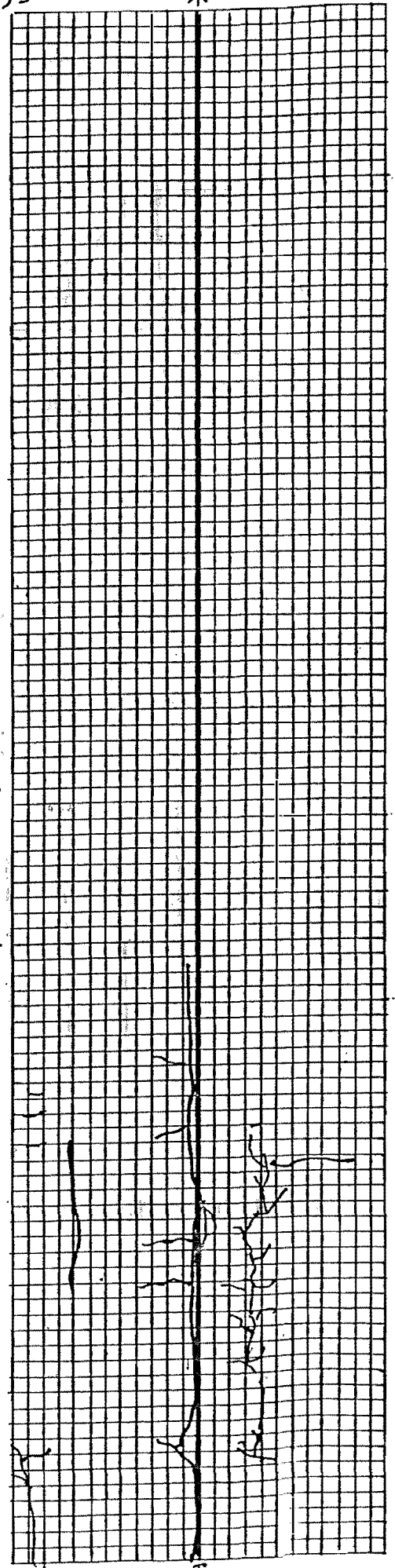
150—

140—

130—

120—

110—



ORIG. SURVEY BY PCRU DATE 9/8/82
RE-SURVEYED BY _____ DATE _____

PAVEMENT CONDITION SURVEY
PROJECT MONTEREY STATE HIGHWAY
F 02822(6)S

ORIGINAL
AFTER PLAN

CRACKS AFTER
COLD PLANING
P.E.C. 10/5/82

TEST SECTION ①

~~150'~~ LONG
148'

SUM A

= 7'

END
THIS
SECTION

DI

A5

ORIG. SURVEY BY K. COEN DATE 9/8/87
RE-SURVEYED BY _____ DATE _____

PAVEMENT CONDITION SURVEY
PROJECT MONTICELLO STATE HIGHWAY
FOR 200

ORIGINAL

CRACKS AFTER
COLD PLANING
REC 10/5/82

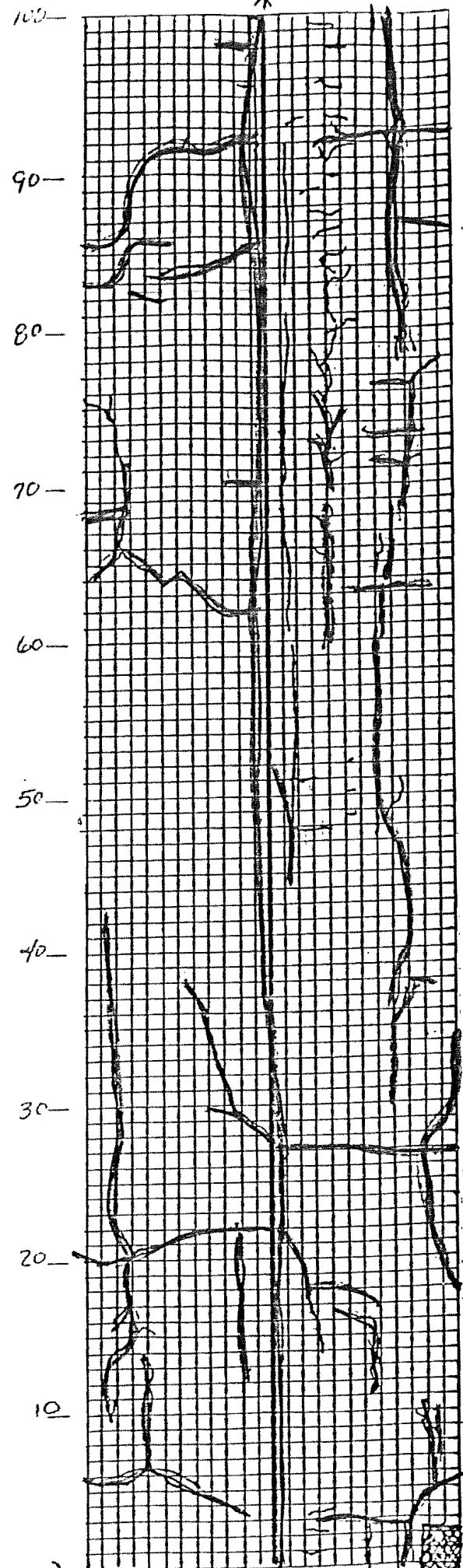
T.S. #2

SURVEY
22/83

OPOLE #6

= 1/1

C.D.I. A6



180-

170-

160-

150-

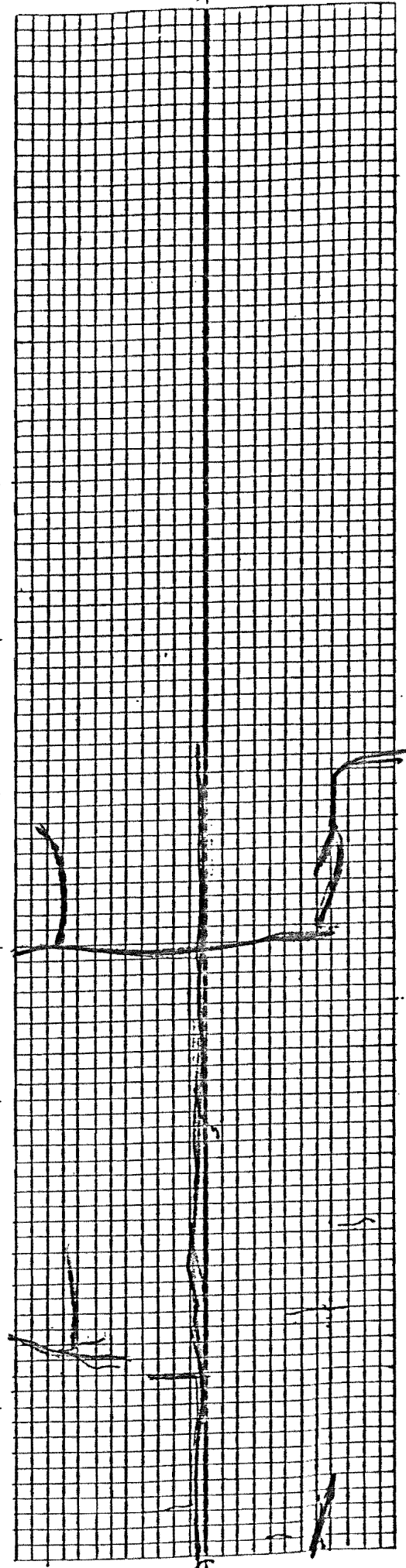
140-

130-

120-

110-

100-

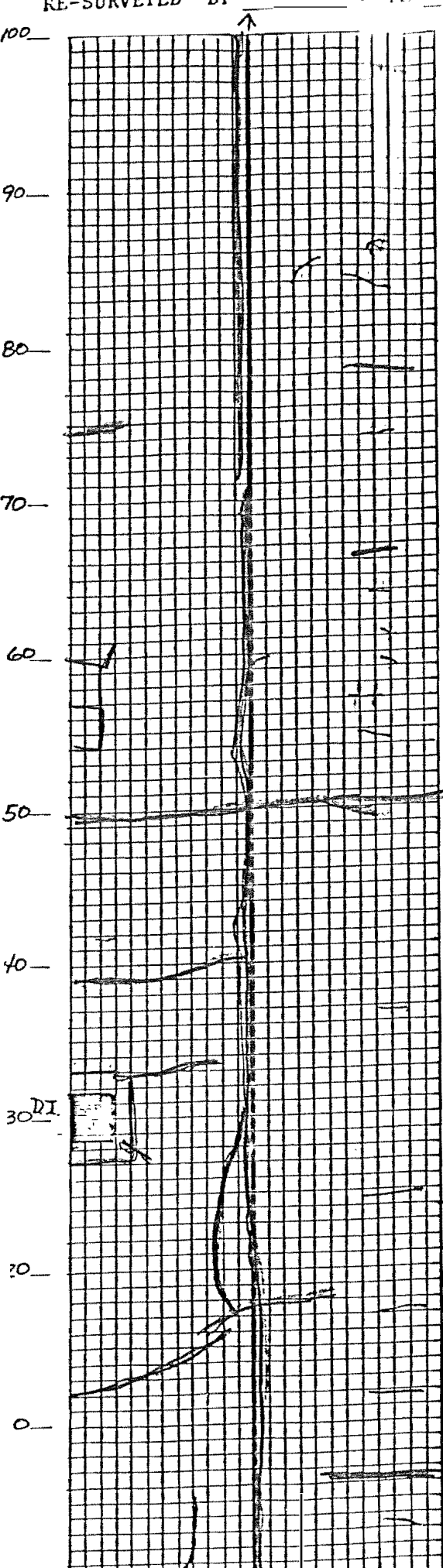


ORIG. SURVLY BY P. Corti
RE-SURVEYED BY _____

DATE 9/8/62
DATE _____

PAVEMENT CONDITION SURVLY
PROJECT MONTPELIER STATE HIGHWAY
F 02B-2 (6)S

SHEET _____ OF _____



ORIGINAL

CRACKS AFTER COLD
PLANING DEC 10/5/62
190—

T.S.#3

3/11/62

200—

180—

170—

160—

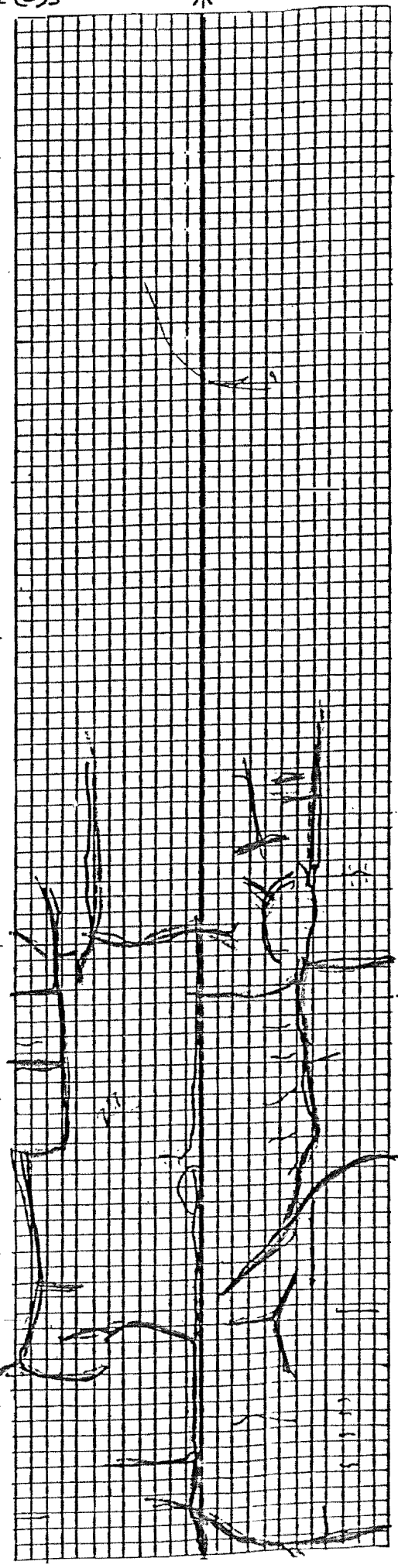
150—

140—

130—

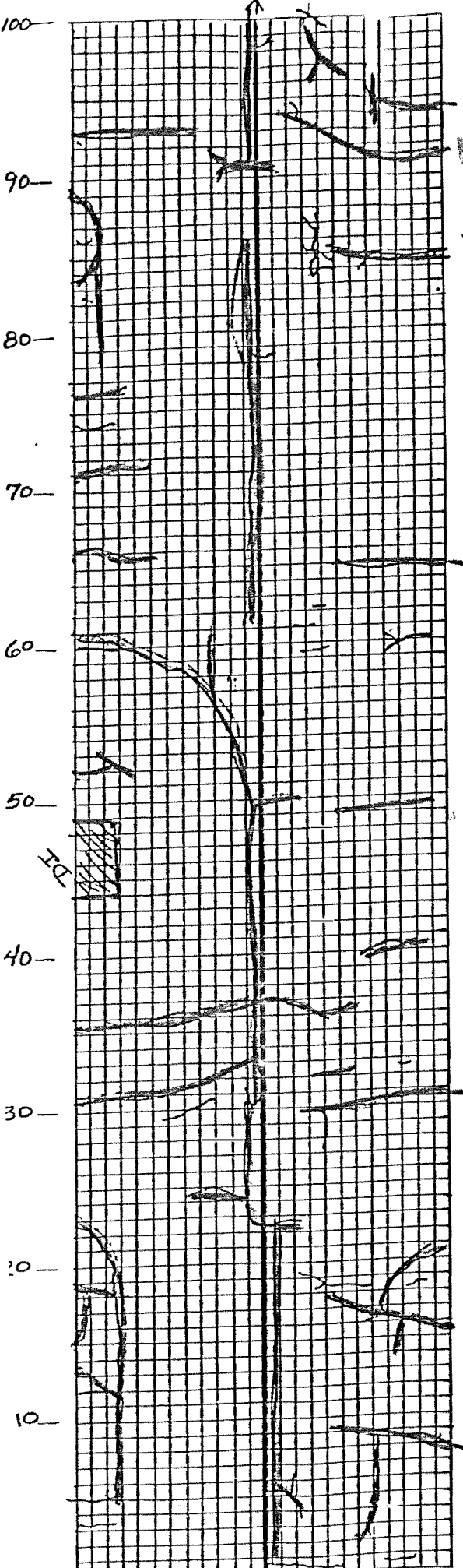
120—

110—



ORIG. SURVEY BY P. COLE DATE 1/6/82
RE-SURVEYED BY _____ DATE _____

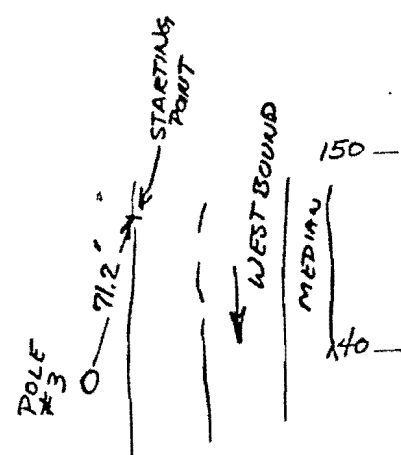
PAVEMENT CONDITION SURVEY
PROJECT MONTPELIER STATE HIGHWAY
F02B-2(6)S



ORIGINAL

CRACKS AFTER COLD
PLANING 10/5/82 REF.
190

TEST SECTION (4)
125' LONG



180—
170—
160—
150—
140—
130—
120—
110—

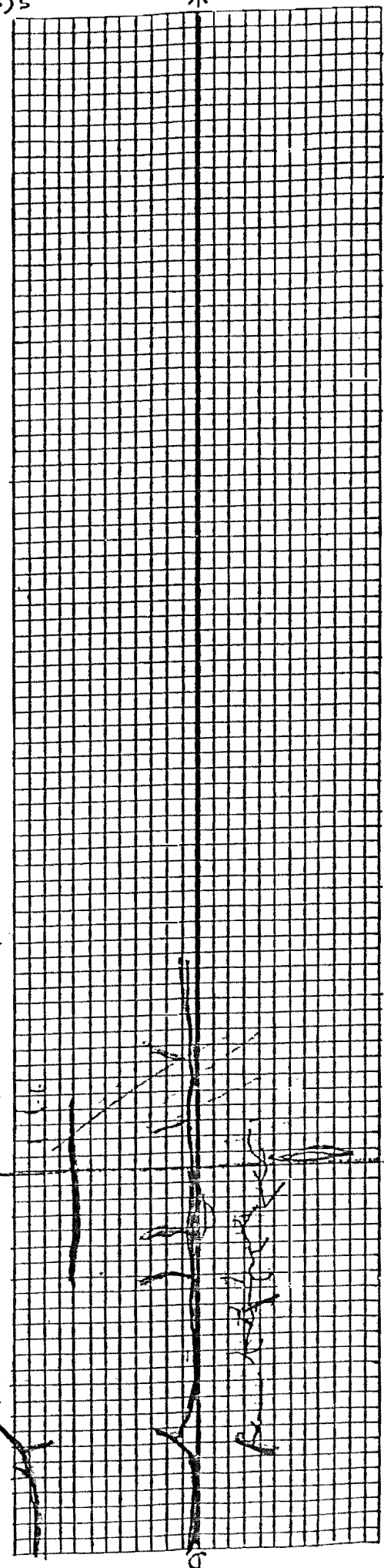


TABLE 7

MONTPELIER. F-028-2(6)5 (MONT. ST. HIGHWAY) 1982

MAYS RIDE METER SURFACE TOLERANCE RUN MADE 11/30/83 BY W. HURON
P. COLETT

WEATHER: CLOUDY- SLIGHT RAIN- 45°; SPEED VEHICLE- 45 MPH ±

1" COLD PLATE - $\frac{1}{2}$ " LEVEL COURSE
1" COLD PLATE - $1\frac{1}{2}$ " WEARING COURSE

	Length	Inches of Paper						Factor	Inches	
Day Run	(Miles)	Run 1	Run 2	Run 3	Run 4	Avg.	16.4	Per Mile		
									LANE AVG.	
		MONTPELIER								
		"WEST BOUND"								
	0.754	5.9	6.0	5.7		5.87		49.80"	49.80"	
		"EAST BOUND"								
	0.754	4.9	5.2	4.8		4.97		42.19"	42.19"	
		SOLAR LASLUCEL MIX AREA								
		WEST BOUND								
	0.475	2.6	2.8	2.7		2.70		36.38"	36.38"	

B1

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION - BITUMINOUS CONCRETE SUBDIVISION No 2260
Design of Bituminous Concrete Mixtures

Town Montpelier Project No. F-028-2(6)S
Gentlemen:

In accordance with the specification requirements for the above project I submit the following job mix formula:
Pavement Type III Produced By: Cooley Asphalt Paving Plant Location Benlin
Stockpile Gradations — % Passing

Size	% Used	1%	1½	1	%	½	%	4	8	16	30	50	200
Wet Sand	27.5						100	95	90	78	60	34	6
Gr Sand	27.5						100	100	81	55	34	18	2
3/8"	17						100	34	6				
1/2"	28				100	99	33	4					
Resultant	100				100	99	23	60	48	36	21	14	2

Hot Bin Gradation — % Passing

Bin	% Used	1%	1½	1	%	½	%	4	8	16	30	50	200
S	55							100	82	64	45	26	7
2	22						100	28	3				
3	23				100	99	30	3					
4													
5													
Resultant	100				100	99	84	62	47	36	25	15	3

Batch Weights	Bin S	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	AC	Total
	3557	1642	1368			441	7,000

	1%	1½	1	%	½	%	4	8	16	30	50	200	AC
Job Mix Formula				100	99	84	62	47	36	25	15	3.5	6.3
Job Aim				100	95	78	56	43	31	20	11	2	6.0
Specification Limits				100	95	78	54	39	24	14	6	5	6.8

Source of Materials

Aggregates	Asphalt
Coarse: <u>Cooley Asphalt Paving - Websterville</u>	AC-5:
Fine: <u>Granite Sand - Cooley - Websterville</u>	AC-10:
<u>Wet Sand - Thunder Road Pit</u>	
<u>Buzzards Town</u>	Other: <u>85-100 BP Canada, Montreal</u>

Mixing Times — Dry: 5 Wet: 35 Total: 40 Temperature: 280°F ± 20°F
Submitted by: Wilfred A. Laguarda (signature) Date: 9-2-82
Company Cooley Asphalt Paving Corp. Title Treasurer

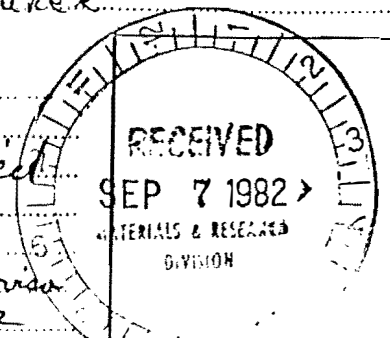
FOR STATE OF VERMONT USE ONLY

Approved ☒

Rejected ☐

Comments: Mix satisfactorily produced on a previous project.

Signature Charles E. Jerd Title Bituminous Concrete Supervisor
Date Sept. 14, 1982



STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION - BITUMINOUS CONCRETE SUBDIVISION No 2261
Design of Bituminous Concrete Mixtures

Town Montpelier

Project No. F 028-2(6)S

Gentlemen:

In accordance with the specification requirements for the above project I submit the following job mix formula:

Pavement Type IV Produced By: Cooley Asphalt Paving Plant Location Bealin
Stockpile Gradations — % Passing

Size	% Used	1%	1½	1	%	½	%	4	8	16	30	50	200
Not Sand	27						100	92	80	67	46	23	4
Gr. Sand	27						100	96	76	53	34	18	3
3/8"	46						100	34	6				
Resultant	100						100	67	46	32	22	11	2

Hot Bin Gradation — % Passing

Bin	% Used	1%	1½	1	%	½	%	4	8	16	30	50	200
S	56							100	83	64	45	26	7
2	44						100	28	2				
3													
4													
5													
Resultant	100						100	68	47	35	25	14	2.9

Batch Weights	Bin S	Bin No. 2	Bin No. 3	Bin No. 4	Bin No. 5	AC	Total
	3430	3115				455	7000

	1%	1½	1	%	½	%	4	8	16	30	50	200	AC
Job Mix Formula					100	98	68	46	34	24	13	3.5	6.5
Job Aim					100	95	62	42	30	20	9	2	6.1
Specification Limits					100	95	62	39	24	14	6	0	6

Source of Materials

Aggregates	Asphalt
Coarse: <u>Cooley Asphalt Paving - Websterville</u>	AC-5:
Fine: <u>Granite Sand - Cooley - Websterville</u>	AC-10:
<u>Not Sand - Thunder Reed Pit</u>	
<u>Beane Town</u>	Other: <u>85-100 BP Canada - Montpelier</u>

Mixing Times — Dry: 5 Wet: 35 Total: 40 Temperature: 280°F ± 20°

Submitted by: Wilfred A. Layerade (signature) Date: 9-2-82

Company Cooley Asphalt Paving Corp. Title Treasurer

FOR STATE OF VERMONT USE ONLY

Approved ☒

Rejected ☐

Comments:

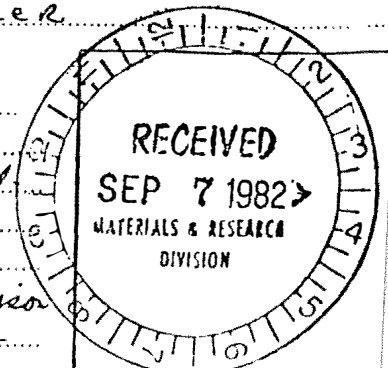
Mix satisfactorily produced on a previous project

Signature Charles E. Jers Title Bituminous Concrete Supervisor

TA 556

C2

Date Sept. 14, 1982



Bituminous Concrete System
FILE MAINTENANCE
Control No. H616

Vermont Transportation Agency
Materials & Research Division
ASPHALT MIXTURE PROPERTIES
- Field Test Data -
(Items P401 or 406)

Sheet 1 of

Project

Code No.

820920

Mix

Design No.

22600

Project Name MONTPELIER

Project No. F 028-2(6) S

Source of Mix 21 COOLEY BERLIN

Ring No. 9389

Year 82

Item No. 40625 Type of Mix 03

Sp. Gr. AC 1020

(Note- Begin a new page if any of the prior fields change)

Line	Formula	Description	1	2	3	4	5	
A		Lab No.	D 82	19.18	19.19	19.20	19.21	19.22
B		Field Spec. No.	M	1.T	2.T	3.T	4.T	5.T
C		Test Date (mo.:day)	10/07	10/11	10/11	10/12	10/12	10/12
D3		% Passing 1"						
D4	100	" 3/4"	100.0	100.0	100.0	100.0	100.0	100.0
D5	95-100	" 1/2"	99.1	98.0	98.4	99.7	99.0	99.0
D6	78-90	" 3/8"	84.1	82.4	81.5	79.7	82.3	82.3
D7	56-68	" #4	61.8	60.1	60.5	56.4	61.3	61.3
D8	43-51	" #8	48.2	46.5	50.3	44.5	47.1	47.1
D9	31-39	" #16	35.8	34.6	39.5	33.8	35.2	35.2
D10	20-28	" #30	24.7	23.9	28.5	23.4	24.3	24.3
D11	11-19	" #50	13.7	13.1	16.5	12.6	13.2	13.2
D12	2-5	" #200	2.7	2.4	3.6	2.1	2.4	2.4
E	6.0-6.7	Bitumen % (AC)	6.29	6.27	6.22	6.29	6.29	6.29
F	100(R-P)/R	% Voids - Mix	3.9	3.9	3.7	4.3	4.9	4.9
G	100S/(S+F)	" - Filled	78.6	78.6	79.7	76.9	74.3	74.3
H	P x 62.4	Unit Wgt., lb/ft ³	145.3	145.1	145.7	144.5	143.2	143.2
I		Stab.-Conv., lb.	242.4	252.5	242.4	193.9	257.6	257.6
J		Marshall Flow Value	1.1	1.2	1.0	1.3	1.5	1.5
K		Sample Thick., in.	2.500	2.500	2.500	2.563	2.500	2.500
L		Wgt. in Air, gm.	119.4	120.5	120.5	122.3	122.3	122.3
M		Wgt. in Water, gm.	68.1	68.7	68.9	69.5	69.1	69.1
N		Wgt. surf. dry, gm.	119.4	120.5	120.5	122.3	122.4	122.4
P	L/(N-M)	Sp. Gr. - Bulk	2.328	2.326	2.335	2.316	2.295	2.295
R		Sp. Gr. - Max.	2.423	2.420	2.424	2.419	2.414	2.414
S	PxE/SpGrAc	AC by Volume %	14.36	14.29	14.52	14.28	14.15	14.15
T		Stab.-Measured, lb.	240	250	240	200	255	255
U		Accept, Reject or N	A	A	A	A	A	A

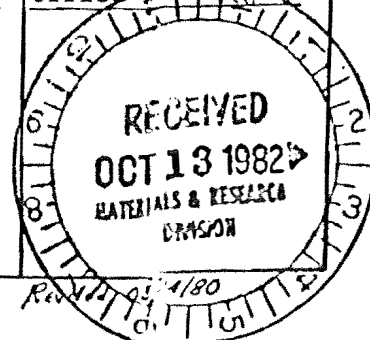
Field Notes:

TEST # 3T HAS SOLAR Laglugel Additive

Inspector(s):

G. Du Bois
P. Prantiss

Office Time Stamp:



STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

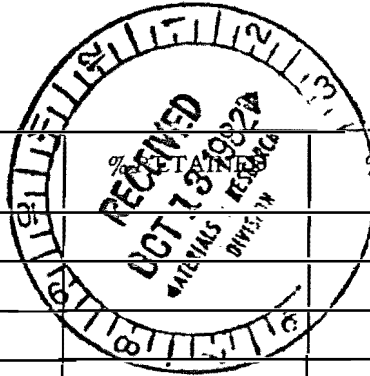
BITUMINOUS CONCRETE EXTRACTION WORK SHEET

PROJECT MONTPELIER LAB NO. D82 1515 DATE 10-11-82
SOURCE COOLEY BERLIN F028 -2(6) 5 MIX TYPE III
SAMPLE NO. M-2T

BOWL & MIX 2474 PAN & AGG. 1496 SLIP NO. 6088
BOWL 1231 PAN 334 TIME 9:57
MIX 1243 AGG. 1162 MIX TEMP. 285°
%AC = MIX - AGG = 6.52 % - - = 6.52 %

% Slip Ac = 6.27 %

% STONE (+8) 53
% SAND (-8) 47
% AIR VOIDS 3.9



RETAINED ON	WEIGHT	% RETAINED	% PASSING	JOB AIM	REPORTED
1 3/4					
1 1/2					
1					
3/4			100	100	100
1/2	22	2.0	98.0	95-100	98
3/8	181	15.6	82.4	78-90	82
4	259	22.3	60.1	56-68	60
8	158	13.6	46.5	43-51	47
16	138	11.9	34.6	31-39	35
30	124	10.7	23.9	20-28	24
50	125	10.8	13.1	11-19	13
200	124	10.7	2.4	2-5	2
Pass 200	28	2.4			
Totals	1159				
% Slip AC				6.0-6.7	6.3

	BIN S	BIN NO. 2	BIN NO. 3	BIN NO. 4	BIN NO. 5	AC	TOTAL
BATCH WEIGHTS	3857	1642	1360			441	7000
Wt. ADJUSTMENT							

CORRECTIVE ACTION

COMMENTS:

O.K.

P. Prentiss

Inspector

1M 6/82

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION
BITUMINOUS CONCRETE SUBDIVISIONMAXIMUM SPECIFIC GRAVITY WORKSHEET
AASHTO T209-78
ASTM D2041-78

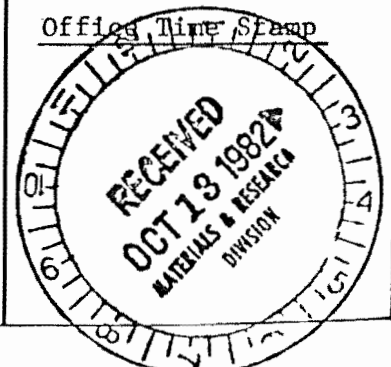
Project MONTPELIER No. F 028-2(b)S Date 10-11-92
Source Mix COOLEY - BERLIN Type III Test No. M-2T
Design No. 2260 Bulk Sp. Gr. 2,326
Flask No. 1

1. Wt. of Flask + Sample	<u>2393</u>
2. Wt. of Flask	<u>1045</u>
3. Wt. of Sample (1-2) (A)	<u>1348</u>
4. Wt. of Flask filled with H ₂ O (D)	<u>3237</u>
5. Wt. of Flask + Water + Sample (E)	<u>4028</u>

CALCULATION:

Max. Sp. Gr. = $A / (A + D - E)$
= $\frac{1348}{1348 + 3237 - 4028}$ = 2.420

% Voids Mix = $100 \times \frac{\text{Max. Sp. Gr.} - \text{Bulk Sp. Gr.}}{\text{Max. Sp. Gr.}}$
 $\frac{2.420 - 2.326}{2.420} = \underline{3.884}$

Comments:Inspector(s)P. PrentissOffice Time Stamp

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

BITUMINOUS CONCRETE EXTRACTION WORK SHEET

PROJECT Montpelier LAB NO. 1082 15.20 DATE 10-11-82
SOURCE COLEBY BERLIN FO 28-2(6)5 MIX TYPE III
SAMPLE NO. M-3T

BOWL & MIX 2358 PAN & AGG. 1573 SLIP NO. 6106
BOWL 1231 PAN 334 TIME 12:25
MIX 1327 AGG. 1239 MIX TEMP. 300°
%AC = MIX - AGG = 6.63 % - - = 6.63 %

% Slip Ac = 6.22 %

% STONE (+8) 50
% SAND (-8) 50
% AIR VOIDS 3.672

RETAINED ON	WEIGHT	% RETAINED	% PASSING	JOB AIM	REPORTED
1 3/4					
1 1/2					
1					
3/4			100	100	100
1/2	14	1.6	98.4	95-100	98
3/8	209	16.9	81.5	78-90	82
4	261	21.0	60.5	56-68	61
8	126	10.2	50.3	43-51	50
16	134	10.8	39.5	31-39	39
30	136	11.0	28.5	20-28	28
50	149	12.0	16.5	11-19	17
200	160	12.9	3.6	2-5	4
Pass 200	45	3.6			
Totals	1234				
% Slip AC				6.0-6.7	6.2

	BIN 5	BIN NO. 2	BIN NO. 3	BIN NO. 4	BIN NO. 5	AC	TOTAL
BATCH WEIGHTS	3557	1642	1360			441	7000
Wt. ADJUSTMENT							

CORRECTIVE ACTION

COMMENTS:

O.K. NOTE: SOLAR LAG LUGEL
ADDED TO AC

P. Prentiss

Inspector

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION
BITUMINOUS CONCRETE SUBDIVISION

MAXIMUM SPECIFIC GRAVITY WORKSHEET
AASHTO T209-78
ASTM D2041-78

Project MONTPELIER No. F028-2(6)5 Date 10-11-82
Source Mix COOLEY BERLIN Type III Test No. M-3T
Design No. 2260 Bulk Sp. Gr. 2.335
Flask No. 1

1. Wt. of Flask + Sample	<u>2.395</u>
2. Wt. of Flask	<u>1045</u>
3. Wt. of Sample (1-2) (A)	<u>1350</u>
4. Wt. of Flask filled with H ₂ O (D)	<u>3237</u>
5. Wt. of Flask + Water + Sample (E)	<u>4030</u>

CALCULATION:

$$\text{Max. Sp. Gr.} = \frac{A}{(A + D - E)}$$

$$= \frac{1350}{1350 + 3237 - 4030} = 2.424$$

$$\% \text{ Voids Mix} = 100 \times \frac{\text{Max. Sp. Gr.} - \text{Bulk Sp. Gr.}}{\text{Max. Sp. Gr.}}$$

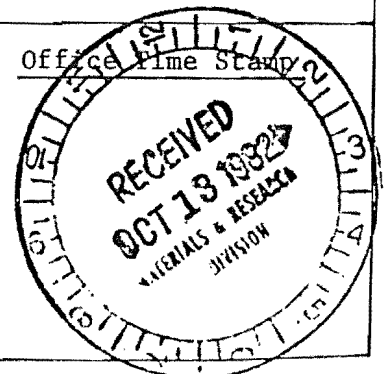
$$\frac{2.424 - 2.335}{2.424} = 3.672$$

Comments:

Inspector(s)

P. Prentiss

Office Time Stamp



STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION
BITUMINOUS CONCRETE SUBDIVISION
Plant Daily Report

Project & No. MONTPELIER F028-2(6)S

Produced By COOLEY BERLIN

Aggregate Source:

Course COOLEY - WEBSTERVILLE

Fine " " " + T. ROAD P.T.

AC Source R.P. MONTREAL AC Type BS-100

Weather FOGGY

Air Temp 25 AM PM

AC Sp. Gr. 1.020

Page 5
Sheet 1 of
Date 10-11-82

III EXTRACTION RESULTS										AGGREGATES			
Sieve	Aim	M2T	M3T					Aim		Coarse Aggregate			
1-3/4	/							/					
1-1/2	/							/		1-3/4			
1	/							/		1-1/2			
3/4	100	100	100					/		1			
1/2	95 100	98.0	98.4					/		3/4			
3/8	78 90	82.4	81.5					/		1/2			
#4	56 68	60.1	60.5					/		3/8			
#8	43 51	46.5	50.3					/		#4			
#16	31 39	34.6	39.5					/		#8			
#30	20 28	23.9	28.5					/		T & E			
#50	11 19	13.1	16.5					/		FRAC			
#200	2 5	2.4	3.6					/		Fine Aggregate			
AC	6.0 6.7	6.5	6.6					/					
Slip AC		6.3	6.2							1			
% Air Voids		3.9	3.7							3/4			
Slip No.		6088	6106							1/2			
Time		9:57	12:25							3/8			
PROJECT TONNAGE BY MIX TYPE										#4			
	303	Type II	Type III	Type IV	OTHER					#8			
PRIOR			103	657						#16			
TODAY			674	0						#30			
TOTAL			777	657						#50			
										#200			

MIX Type	MIX TIME		SP. GR.		BATCH WEIGHTS					A C	Total	FOR OFFICE USE
	Dry	Wet	+ 8	- 8	Bin 1	Bin 2	Bin 3	Bin 4				
III	5	35	-	-	3557	1642	1360			441	7000	

TA 424 Rev. 500 3/82
1M 6/82

Patricia J. Prentiss
INSPECTOR

Cores Taken by:

ITEM: 406

Remarks By Reed-Leroy - CAC

[illegible]

Date Prepared: 11-29-82

Core Analysis

Prepared By: W. Royce

Type of Mix: III

C10

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, P.E.
Materials & Research Engineer

Date: Sept. 3, 1982

Materials & Research Division
Agency of Transportation
August 31, 1982