

EXPERIMENTAL USE OF POLYESTER FIBER
MODIFIED BITUMINOUS PAVEMENT
ON U.S. ROUTE 2
BERLIN-BARRE-EAST MONTPELIER

INITIAL REPORT 87-3

JANUARY 1987

REPORTING ON WORK PLAN 84-R-4

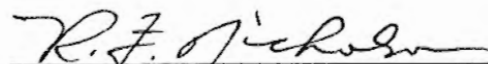
STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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16. Abstract <p>Approximately 1,000 tons of bituminous concrete mix, modified with BoniFibers B, a polyester fiber, was produced and placed as a 1½" wearing course on U.S. Route 2, as part of the Berlin-Barre-East Montpelier F 028-3 (23)S paving project.</p> <p>Test sites were selected which had very similar pavement condition and traffic counts. Two bituminous concrete pavement mixes were designed and produced with the same characteristics except for the addition of fibers at the rate of 5 lbs/ton and an additional 0.2% asphalt in the modified pavement. The two pavements were laid side by side on the same days using the same equipment and procedures and under the same weather conditions. During placement a tendency of the modified mix to cling to tools made hand-work (feathering) difficult. No other problems were noted in placement.</p> <p>Initial crack counts were taken prior to paving. After 30 months the survey shows a reflective crack rate of 32% overall for the standard mix with 10% overall for the modified mix. For transverse cracking, the difference in rates was closer with 45% for the standard mix and 33% for modified. Friction tests and pavement rutting measurements taken on this highway display no significant differences between the two pavements.</p>			
17. Key Words Bituminous Concrete Pavement Modified BoniFibers Polyester Fibers		18. Distribution Statement No Restrictions	
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"The information contained in this Report was compiled for the use of the Vermont Agency of Transportation. Conclusions and recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Agency policy. This Report does not constitute a standard, specification, or regulation. The Vermont Agency of Transportation assumes no liability for its contents or the use thereof."

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INTRODUCTION

In August of 1981 the Vermont Agency of Transportation began an investigation of the use of polyester fibers as a method of controlling reflective cracking in bituminous pavement overlays. Approximately 60 tons of a mix modified with BoniFibers B was placed on Vermont Route 12A in Northfield. The field trial was reported in Initial Product Evaluation Report 82-7 in August of 1982. Initial performance through the first 10 months appeared significantly better than the standard mix used as a control. Portions of the pavement were thin (3/8" to 1/4") and it was concluded that a better controlled experiment using a thicker course, more closely monitored would yield more reliable results.

As a result of the earlier positive indications, a second study was proposed on February 2, 1984. The project selected was a 3.1 mile section of U. S. Route 2 in portions of Berlin, Barre and East Montpelier, Vermont. Four 100' test sections were selected and detailed crack surveys were done in each prior to paving. An experimental mix was batched and placed by the contractor in late June and early July of 1984. Individual loads were selected as test loads and their location marked as they were placed.

The performance of this product through the initial 30 months of service is reported here.

PRODUCT INFORMATION PROVIDED BY THE SUPPLIER

The polyester fibers recommended for use in bituminous concrete mixes can be produced by most textile mills in a variety of weights and lengths using a continuous melt spinning process. The material used in this experiment is BoniFibers B, a registered trademark product supplied by KAPEJO, Inc., 115 Valley Road, Wilmington, Delaware 19802 (Phone No. 302-658-5494).

The material has a specific gravity of 1.38, melting point over 480°F, breaking strength of over 70,000 psi, high resistance to abrasion, low water absorbency and does not cake in storage. The material does not cause any dermatological or other health problems.

BoniFibers are available in two lengths, B (1/4"), and C (random averaging 1/50"). The B fibers are recommended for coarser mixes used for overlays and base courses. The C fibers are recommended for mixes used in curbs, bridge deck pavements, and thin overlays.

The fibers are added to the mix at a rate of 2.5 lbs. to 5 lbs. per ton of mix which is 0.125% to 0.25% by weight. BoniFibers are packaged in 2 mil. polyethylene bags which melt at approximately 200°F allowing the introduction of unopened bags directly into the pugmill with the aggregate. The fibers come in 5, 7½, or 10 lb. bags to accommodate various batch sizes. Uniform distribution is obtained through a 30 second dry mix cycle and an additional 0.2% asphalt is required to coat the fibers. Placement and compaction of the modified mix is achieved with conventional pavers and rollers.

COST INFORMATION

The modified mix was contracted as a part of the project. The in-place price for standard Type III mix was \$30.60 per ton and the modified mix price was \$41.80 per ton. Between \$6.00 and \$6.25 per ton of the \$11.20 increase was the purchase price of BoniFibers B. The remainder was shipping, labor, profit, etc. In order to be cost effective, a combination of reduced thickness and increased pavement life of over 36% would have to occur.

PROJECT DESCRIPTION AND ROADWAY CONDITION

The project is located in the Towns of Berlin, Barre, and East Montpelier beginning at the Montpelier-Berlin Town Line and extending 3.097 miles easterly passing through portions of Berlin, Barre, and East Montpelier, ending in East Montpelier at MM 1.630. The test area, including the 4 test sections, begins at the Berlin-Barre Town Line and extends 1.35 miles easterly passing through a portion of Barre and East Montpelier and ending at MM 01.34 in East Montpelier.

The roadway in the test area was relocated in 1961 from MM 0.700 in Berlin to MM 1.5 in East Montpelier with a 20" crushed rock subbase, a 4" macadam base, and a 3" bituminous concrete surface course. The project was paved in 1974 with 1½" of bituminous concrete.

Detailed crack counts were made at the four 100' test sections on June 21, 1984, 8 days prior to paving. The crack counts revealed an average of 880 lf. of cracks per 100 lf. of 24' roadway.

Approximately 49% of the cracks were longitudinal, 45% transverse and 6% miscellaneous. Pavement condition before paving and after 30 months can be seen on the crack count survey sheets, Appendix B pages 15 to 18.

Average Daily Traffic (ADT) for this project in 1984 was 5,170 over the westerly end and 5,430 over the easterly end.

Pavement rutting (wheel track depth) measurements were taken prior to paving with depths ranging from 2/16" to 10/16" being recorded. The table on page 11 shows the average depths for original and new pavements by test section. The rutting survey sheets with a more detailed breakdown are Appendix E, pages 27 to 30.

Berlin-Barre-East Montpelier
F 028-3(23)S

Project

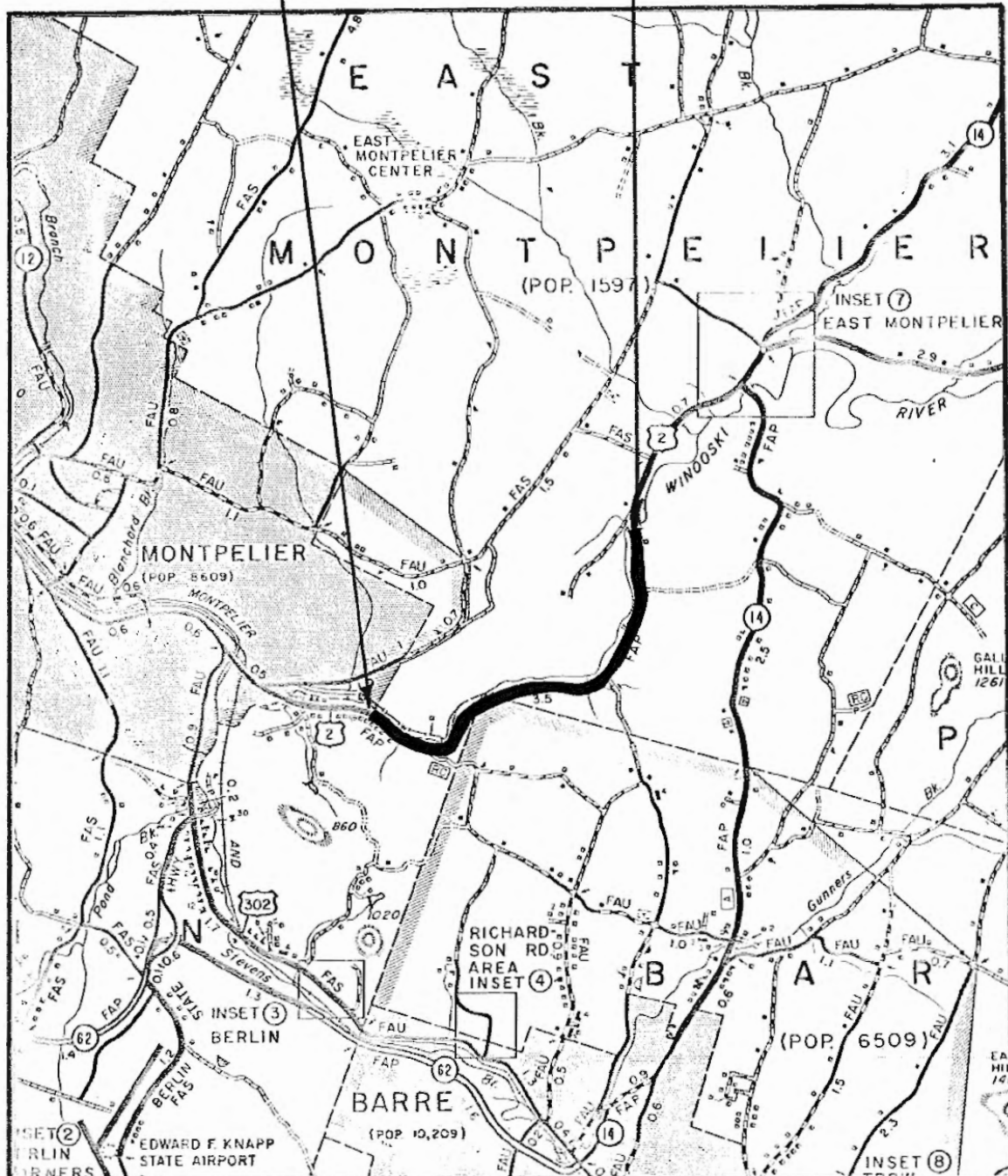
Beginning

Berlin MM 0.000

Project

End

East Montpelier MM 1.630



MIX PRODUCTION AND TESTING

Standard Type III and modified bituminous concrete mix were both produced for this project in late June and early July of 1984 at the Cooley Asphalt Paving Corporation batch plant in Berlin, Vermont. The modified mix was produced between June 27 and July 3, 1984. The asphalt cement was an 85/100 penetration grade supplied by British Petroleum of Montreal, Quebec in Canada. The coarse aggregate consisted of crushed granite with 95 to 100% passing the 3/8" sieve. The fine aggregate consisted of equal parts natural and crushed granite sands. Polyester fibers were added to the modified mix at a rate of 5 lbs. per ton or 0.25% by weight. The plants normal 5 second dry mix cycle was increased to 30 seconds as specified by the supplier to insure proper distribution of the fibers which were manually introduced at the pugmill. An additional 0.2% asphalt was added by direction of the manufacturer's representative.

Both mixes were tested for asphalt content, gradation, air void content, stability, flow and unit weight. Extraction tests revealed an average of 6.36% (+.03-.05) asphalt content in the standard mix and 6.92% (+.08-.13) in the modified mix due to the additional asphalt added. The standard mix had an average air void content of 4.7% compared to 3.78% for modified. The modified mix had a slightly lower stability of 1718.4 vs. 2372.0 for standard mix. Marshall flow values of 15.0 for modified and 13.5 for standard mix were produced. All test results showed that both mixes were within design specifications. Test results are shown in Appendix C, pages 19 to 25.

PAVING OPERATION

Paving began in the test area on June 27, 1984 and continued through July 3, 1984. All paving was done in an eastbound direction with east and westbound lanes being alternately paved to minimize applicational differences between modified and standard mixes. Except for test section 3 (the most easterly), standard mix was placed in the eastbound lane and modified mix in the westbound. The lanes were reversed on test section 3 so that any effect of directional ADT's could be determined.

The thickness of the surface course varied from 1 1/8" to 1 3/4". In test section 1, where there was no leveling course, the thickness was 1 5/8" to 1 3/4". In test section 3, where the surface course was scheduled to be reduced to 1", the core samples show that the thicknesses varied from 1 1/8" to 1 1/2". The varying thickness of the leveling course resulted in overall pavement thicknesses in the range of 1 3/4" to 2 1/2". Core analysis summary is Appendix D, page 26.

An observed difficulty with hand work, such as feathering construction joints, was due to the tendency of the BoniFibers to cling to rakes and resulted in a small load of standard mix being used to begin each days paving. This did not occur in a test section.

POST CONSTRUCTION OBSERVATIONS

Twelve core samples were taken and analyzed on August 6, 1984. When tested in the Lab these showed that compaction was within job specifications. Percent air voids ranged from 3.8 to 8.3 for all samples and averaged 6.0 overall. The modified mix ranged from a low of 3.8 to a high of 8.3 with an average of 6.1 while the regular mix ranged from 4.7 to 7.6 percent air voids with an average of 5.8.

Test Section #1 Standard Mix E.B.

<u>Type Of Crack</u>	<u>Pre-Const.</u>	<u>Percent Reflective Cracking</u>			
	<u>6/21/84</u>	<u>1/30/85</u>	<u>6/11/85</u>	<u>4/24/86</u>	<u>12/29/86</u>
Transverse	207 lf.	17	36	45	53
Longitudinal	243 lf.	0	0	12	25
Miscellaneous	40 lf.	0	0	18	18
Totals	490 lf.	7	16	26	36

Test Section #1 Modified Mix W.B.

Transverse	244 lf.	0	0	52	64
Longitudinal	278 lf.	0	0	0	1
Miscellaneous	10 lf.	0	0	50	50
Totals	532 lf.	0	0	25	31

Test Section #2 Standard Mix E.B.

Transverse	189 lf.	2	10	35	40
Longitudinal	221 lf.	0	0	0	16
Miscellaneous	24 lf.	0	0	13	13
Totals	434 lf.	1	4	17	26

Test Section #2 Modified Mix W.B.

Transverse	241 lf.	2	2	22	24
Longitudinal	158 lf.	0	0	0	0
Miscellaneous	18 lf.	0	0	33	33
Totals	417 lf.	1	1	14	18

Test Section #3 Standard Mix W.B.

Transverse	180 lf.	0	0	29	30
Longitudinal	168 lf.	0	0	13	19
Miscellandous	25 lf.	0	0	0	0
Totals	373 lf.	0	0	20	28

Test Section #3 Modified Mix E.B.

<u>Type Of Crack</u>	<u>Pre-Const.</u>	<u>Percent Reflective Cracking</u>			
	<u>6/21/84</u>	<u>1/30/85</u>	<u>6/11/85</u>	<u>4/24/86</u>	<u>12/29/86</u>
Transverse	224 lf.	0	0	17	17
Longitudinal	249 lf.	0	0	0	0
Miscellaneous	34 lf.	0	0	0	0
Totals	507 lf.	0	0	7	7

Test Section #4 Regular Mix E.B.

Transverse	133 lf.	0	5	55	56
Longitudinal	137 lf.	0	0	0	27
Miscellaneous	14 lf.	0	0	0	0
Totals	284 lf.	0	2	26	40

Test Section #4 Modified Mix W.B.

Transverse	191 lf.	3	3	43	47
Longitudinal	269 lf.	0	0	0	0
Miscellaneous	23 lf.	0	0	0	0
Totals	483 lf.	1	1	17	19

Standard Mix Overall - All Sections

Transverse	709 lf.	6	14	40	45
Longitudinal	769 lf.	0	0	7	24
Miscellaneous	103 lf.	0	3	10	10
Totals	1,581 lf.	3	6	22	32

Modified Mix Overall - All Sections

Transverse	900 lf.	1	2	33	38
Longitudinal	954 lf.	0	0	0	1
Miscellaneous	85 lf.	0	0	13	13
Totals	1,939 lf.	<1	<1	16	19

Friction testing of the new pavement surfaces was done approximately 1 month after paving. The modified pavement had an average friction value of 47.0 and the standard pavement had an average number of 46.2.

Rutting measurements (wheel track depths) were taken prior to paving. Rut depths ranged from 10/16" to 2/16". Measurements

taken on 12/29/86 on the new pavement ranged from 0" to 2/16". The following chart shows the average measurements arranged by test section. After 30 months, rutting is minimal and the difference between standard and modified pavement is insignificant.

Test Section	<u>Average Wheel Track Depths</u>			
	<u>Original W.B.</u>	<u>6/21/84 E.B.</u>	<u>BoniFiber Lane 12/29/86</u>	<u>Standard Lane 12/29/86</u>
1	3/16"	4/16"	0"	3/32"
2	6/16"	3/16"	1/16"	1/16"
3	5/16"	5/16"	1/16"	3/32"
4	6/16"	5/16"	1/16"	1/16"
Overall	5/16"	4/16"	1/16"	1/16"

Initial Mays road roughness meter readings were not taken due to equipment breakdowns. Readings are now scheduled to determine each pavements ability to maintain acceptable rideability.

SUMMARY

The design, production, and placement of the two mixes were within standards recommended by the manufacturer and/or specifications used by the Agency of Transportation.

Testing done at the mixing plant, at the job site, and from core analysis indicate that with the exception of the addition of fiber and additional asphalt to coat them, all mixes were standard.

The test sites within the test area were comparable in condition as shown by crack counts prior to construction.

Both types of mix performed well in application except that the fiber modified mix tended to cling to hand tools.

Core samples demonstrated that surface course thicknesses in the test sections varied from 1 1/8" to 1 3/4". Over the project the average was 1 1/2", the design depth.

Reflected cracks after 30 months total 32% overall in the standard mix and 19% in the modified mix. The rate for transverse cracks in standard mix is 45% while for modified mix it is 38%.

Pavement rutting measurements taken 12/29/86 show only slight differences between pavements as do friction tests taken on August 27, 1984.

FOLLOWUP

The test project will continue to be monitored until the evaluation is completed including:

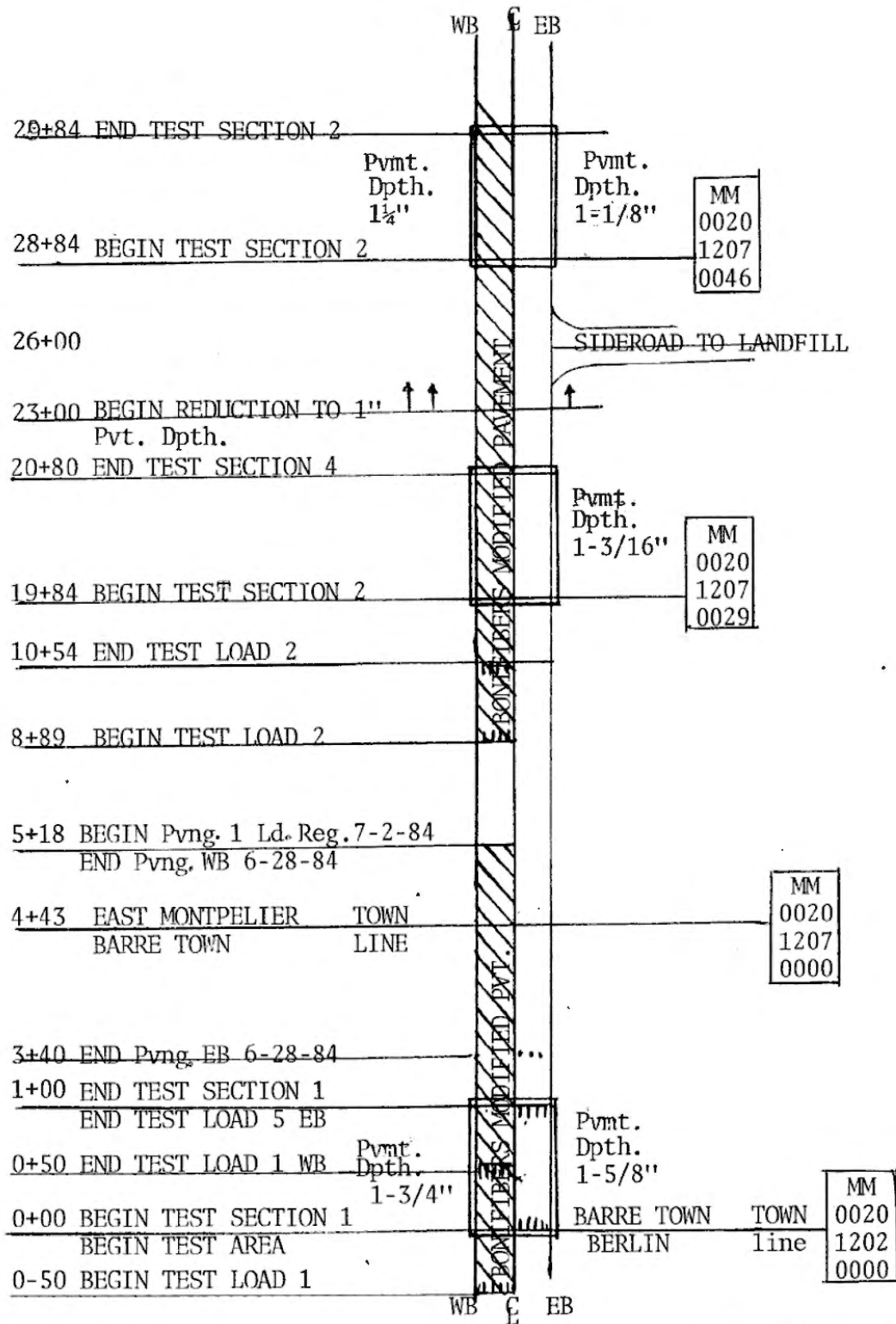
- Annual crack counts to determine whether BoniFibers reduce reflective cracking.

- Wheel track depth measurements to determine comparative surface wear.

- Mays roughness measurements to determine comparative retention of satisfactory ride values.

- Skid tests to determine retention of initial friction values.

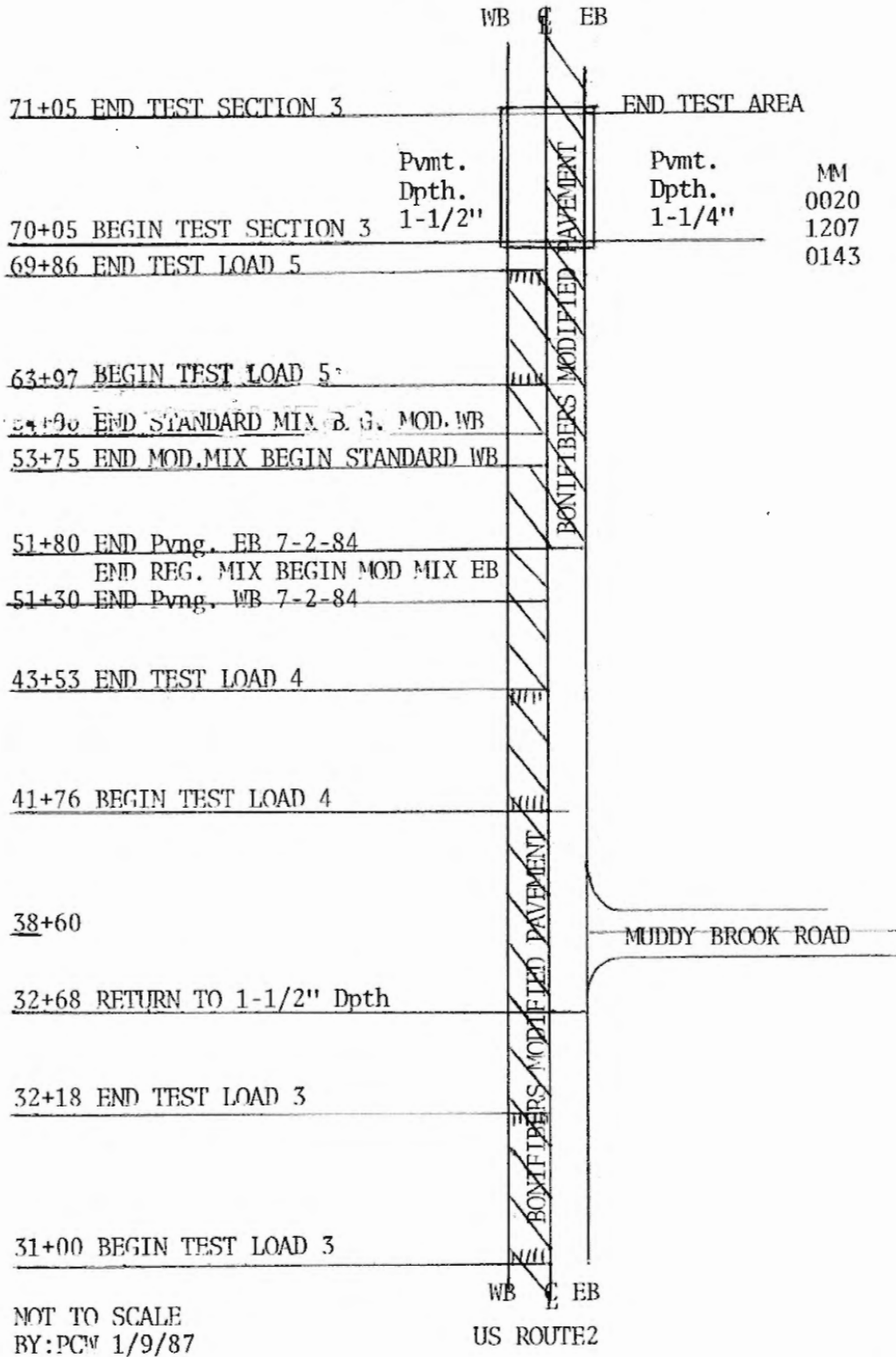
BONIFIBERS EVALUATION



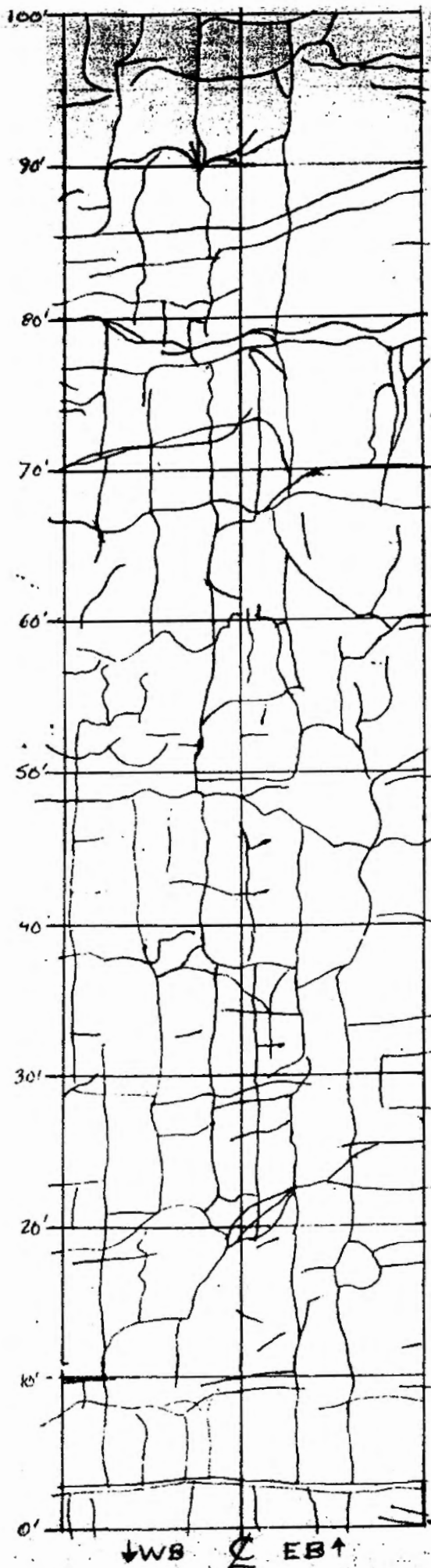
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TEST SECTION / LOAD
LOCATION SCHEMATIC

BONIFIBERS EVALUATION



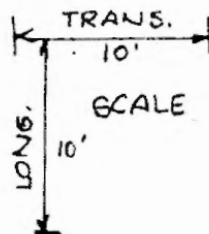
TEST SECTION / LOAD
LOCATION SCHEMATIC



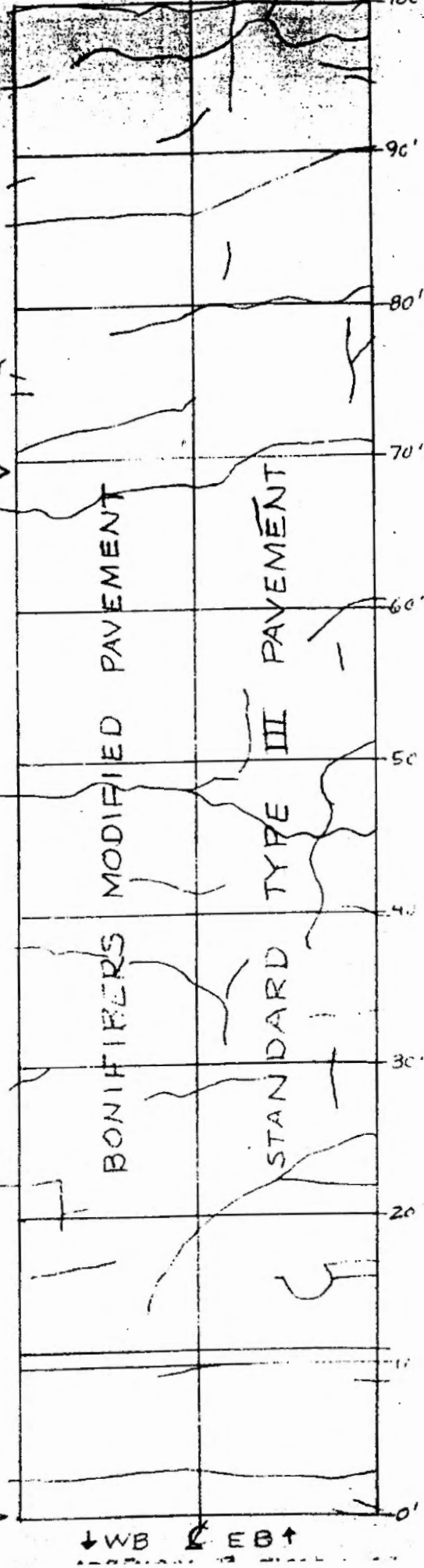
BERLIN - BARRE -
EAST MONTPELIER
FO28 22205
U.S. Rte 2
CRACK COUNT
TEST SECTION 1
300' LONG

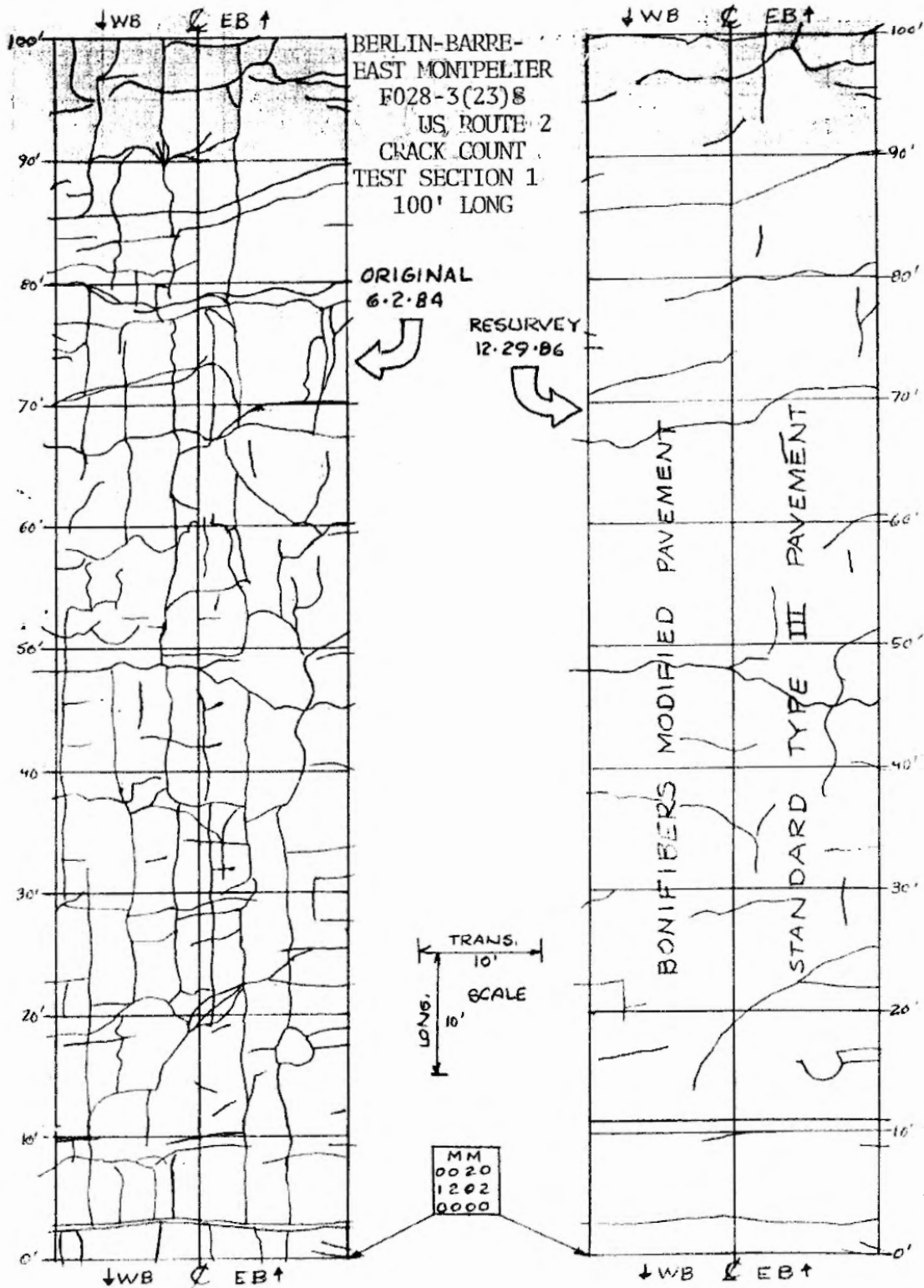
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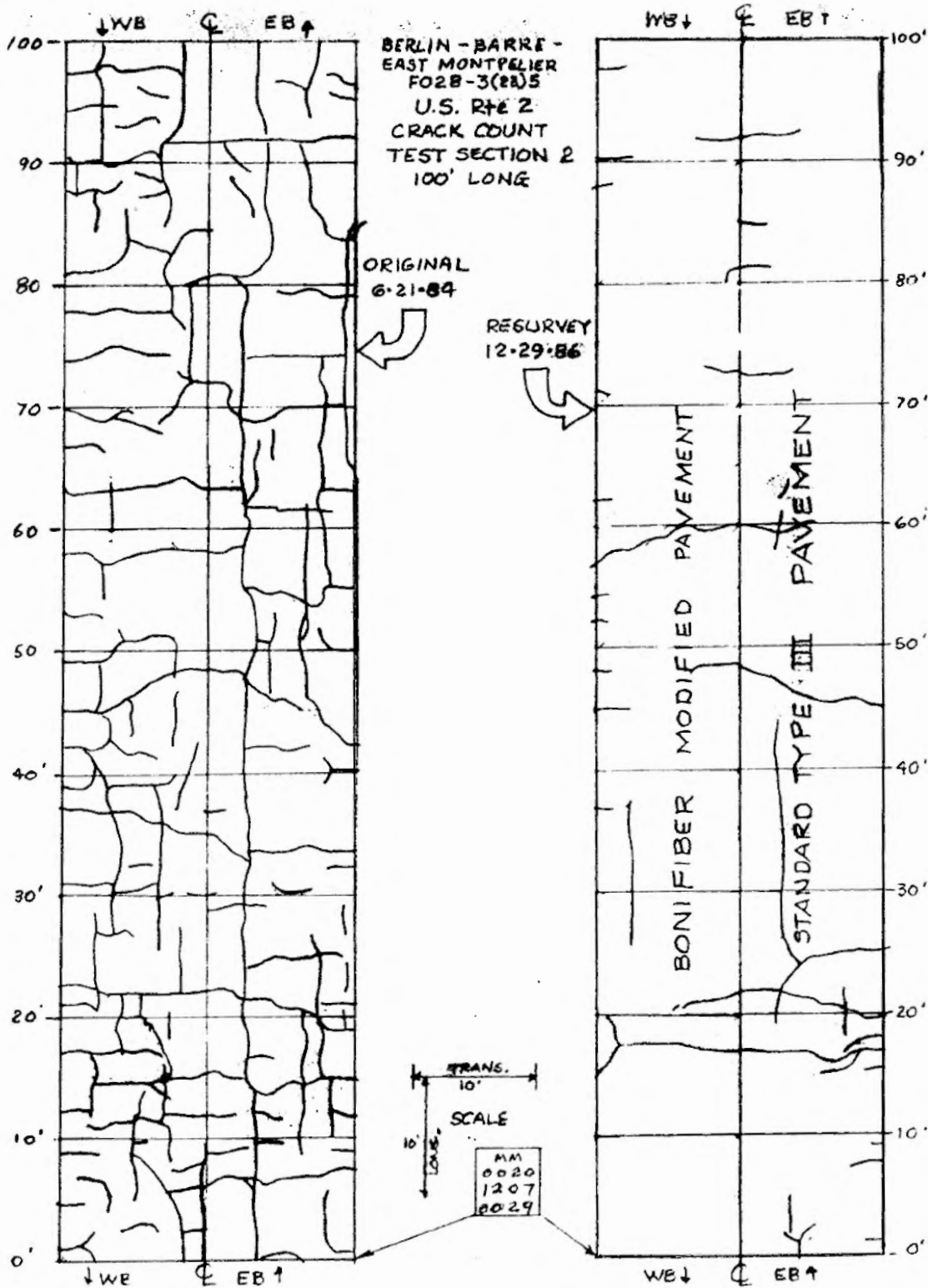
RESURVEY
12.29.86

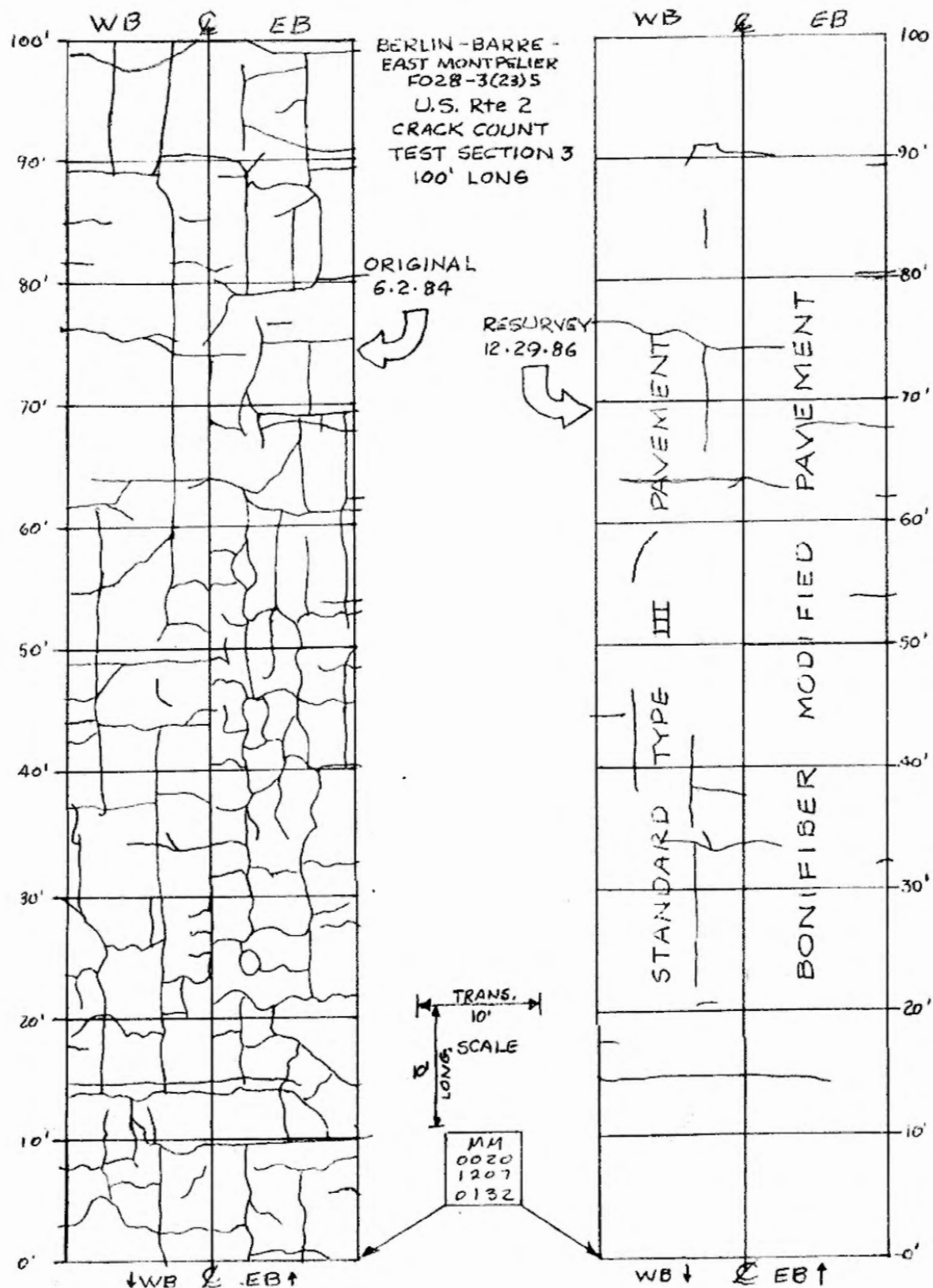


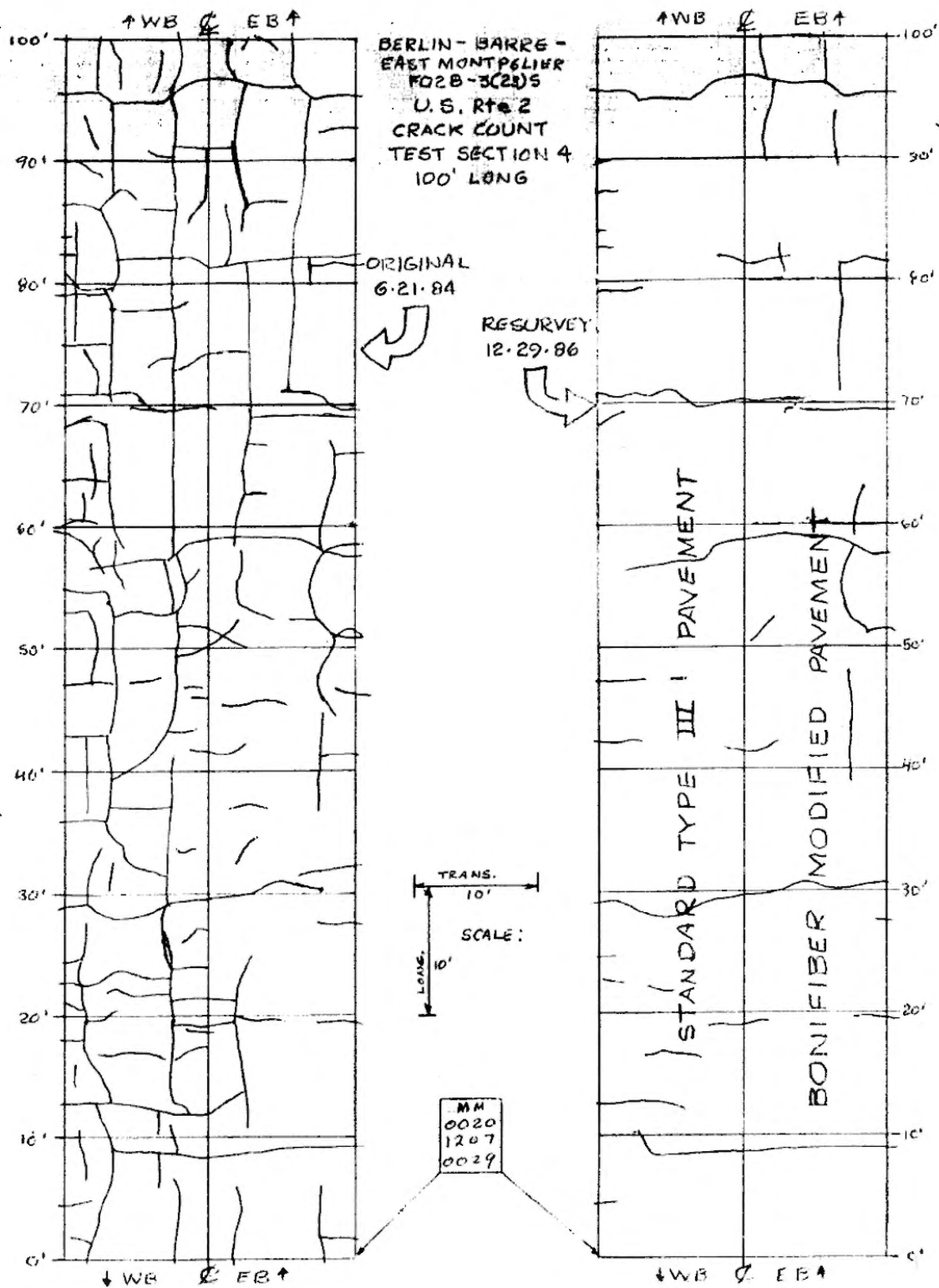
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RE = Jordan

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

Project & No. Berlin-Barre-E. Montpelier F02B-3(23)SProduced By Cooley-Berlin

Aggregate Source:

Coarse Cooley-WebstervilleFine " " 4 Thunder Road P.T.AC Source Petro-Canada AC Type BS/100
 Page 1
 Sheet of
 Date 06-26-84

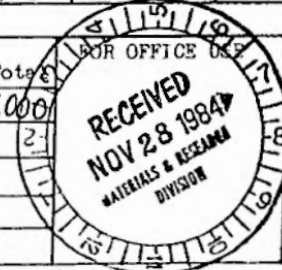
 Weather AM PM
 Air Temp AM PM
 AC Sp. Gr. 1.023

EXTRACTION RESULTS										AGGREGATES			
Sieve	Aim						Aim	BM-1L	BM-2L	Coarse Aggregate			
1-3/4										1/2"	3/8"		
1-1/2										1-3/4			
1										1-1/2			
3/4										1			
1/2	95	100					95	100	100	3/4	100		
3/8	78	90					62	99	99	1/2	96	100	
#4	54	66					41	64	62	3/8	34	97	
#8	29	50					29	49	46	#4	3	28	
#16	29	37					18	37	35	#8		10	
#30	20	28					9	26	25	T & E	0	0	
#50	10	18					1.4	17	13	FRAC	100	100	
#200	1.4	2.4					AC EXT	6.86	6.96	Fine Aggregate			
AC EXT							Slip	6.79	6.81	NA.SA.	ST. SC.		
Slip AC	6.4							3.5	3.3	1			
% Air Voids								18104	18126	3/4			
Slip No.								8.58 AM	1217 PM	1/2			
Time										3/8	100	100	

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			0	0	
TODAY			0	556	
TOTAL			0	556	

#4	94	97
#8	87	77
#16	74	52
#30	53	32
#50	25	17
#200	3	2

MIX Type	MIX TIME		SP. GR.		BATCH WEIGHTS					A C	Total
	Dry	Wet	+ 8	- 8	Bin 1	Bin 2	Bin 3	Bin 4			
IV	5	35			3300	3224				476	7,000


 TA 424 Rev. 500 2/88
 5C 5/83
 1M 4/84

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

Project & No. Berlin-Barre-E. Montpelier FD28-3(23)S Page 2
Produced By Codley-Berlin Sheet of
Aggregate Source: Codley-Websterville Date 06-27-84
Coarse 11 Weather Lightly clear PM
Fine 4 Thunder Road Pft. Air Temp 52° AM 80° PM
AC Source Petro-Canada AC Type BS/100 AC Sp. Gr. 1.023

EXTRACTION RESULTS										AGGREGATES									
Sieve	Aim	BA-1T	BA-2T	BA-3T		Aim	BA-1P	BA-2P		Coarse Aggregate									
1-3/4										1-3/4									
1-1/2										1-1/2									
1										1									
3/4	100	100	100	100		100	100	100		3/4									
1/2	95	99	99	99		95	99	98		1/2									
3/8	78	78	82	83		78	79	80		3/8									
#4	54	55	57	61		54	58	55		1/4									
#8	42	43	45	49		42	47	44		#4									
#16	29	32	34	37		29	36	34		#8									
#30	20	22	23	25		20	25	23		T & E									
#50	10	12	13	13		10	13	12		FRAC									
#200	1.4	2.7	2.5	1.8		1.4	2.1	1.9		Fine Aggregate									
AC EXT		6.60	6.64	6.61		AC EXT	6.54	6.73											
Slip AC	6.4	6.39	6.38	6.39		Slip AC	6.59	6.59											
% Air Voids		3.1	4.2	4.6			5.6	5.0											
Slip No.		18152	18192	18254			18174	18235											
Time		6:07 AM	9:54 AM	4:10 PM			8:23 AM	2:28 PM											

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			0	556	
TODAY			1720	0	
TOTAL			1720	556	

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			3426	1780	1352		448	7,000	15 lbs Bar Fiber B Added in Pug Mill
III	30	35			2914	1513	1177		396	6,000	
III	30	35			2814	1613	1177		396	6,000	
III	30	35			2808	1613	1177		402	6,000	

TA 424 Rev. 500 8/82
5C 5/83
1M 4/84

Mike W. Rogers
INSPECTOR

STATE OF VERMONT
 AGENCY OF TRANSPORTATION
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 BITUMINOUS CONCRETE SUBDIVISION
 Plant Daily Report

Project & No. Bark-Bark-Bark-Bark R228-2(23)S

Produced By Cooley - Bark

Aggregate Source Cooley - Litchfieldville

Fine Cooley - Websterville & Thunk Road Mt

AC Source Petro-Canada

AC Type 85/100 Pen

Page 4

Sheet 06-29-84

Date 06-29-84

Weather overcast AM 10:00 PM

Air Temp 65° AM 88° PM

AC Sp. Gr. 1.023

EXTRACTION RESULTS										AGGREGATES									
Sieve	Aim	80-100	100-150	150-250	250-425	425-600	600-850	850-1180	1180-1750	Aim	80-100	100-150	150-250	250-425	425-600	600-850	850-1180	1180-1750	1750-2500
1-3/4																			
1-1/2																			
1																			
3/4	100	100	100	100						100	100								
1/2	95	99	99	100						95	98								
3/8	78	81	78	82						78	79								
#4	54	63	59	58						54	59								
#8	42	(51)	46	46						42	48								
#16	29	(39)	34	34						29	36								
#30	20	26	22	24						20	24								
#50	10	13	12	12						10	13								
#200	1.4	2.0	1.9	2.0						1.4	2.2								
AC EXT		6.62	6.28	6.64						AC EXT	6.99								
Slip AC	6.4	6.38	6.39	6.39						Slip AC	6.69								
% Air Voids		5.7	4.9	4.6							5.0								
Slip No.		18024	18347	18396							18351								
Time		6:19 AM	8:11 AM	1:39 PM							8:45 AM								

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			2337	556	
TODAY			1241	0	
TOTAL			3778	556	

MIX Type	MIX TIME		SP. GR. + 8	- 8	BATCH WEIGHTS					A C	Total
	Dry	Wet			Bin 5	Bin 2	Bin 3	Bin 4			
III	5	35			3420	1780	1352			448	7000
III	30	35			2808	1613	1177			402	6000
III	5	35			3320	1880	1352			448	7000
III	30	35			2723	1698	1177			402	6000



TA 274 Rev. 500 8/83
 SC 5/83
 IM 4/84

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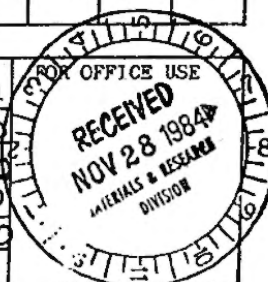
STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION
BITUMINOUS CONCRETE SUBDIVISION
Plant Daily Report

Project & No. Berlin-Banc-E-Montpelier F028-3(23)S Page 4
Produced By Cooley - Berlin Sheet of
Aggregate Source: Cooley - Websterville Date 06-29-84
Coarse Cooley - Websterville Weather overcast AM 10:40 PM
Fine Cooley - Websterville & Thunder Road Pit Air Temp 65° AM 88° PM
AC Source Petro-Canada AC Type 85/100 Pen AC Sp. Gr. 1.023

EXTRACTION RESULTS										Fiber Mix				AGGREGATES															
Sieve	Aim	BM-6T	BM-1T	BM-3L						Aim	BM-6T					Coarse Aggregate													
1-3/4																1-3/4													
1-1/2																1-1/2													
1																1													
3/4	100	100	100	100						100	100					3/4													
1/2	95	99	99	100						95	98					1/2													
3/8	78	81	78	82						78	79					3/8													
#4	54	63	59	58						54	59					#4													
#8	42	51	46	46						42	48					#8													
#16	29	37	34	34						29	36					#16													
#30	20	26	22	24						20	24					#30													
#50	10	13	12	12						10	13					T & E													
#200	1.4	2.0	1.9	2.0						1.4	2.2					FRAC													
AC EXT		6.62	6.28	6.64						AC EXT	6.99					Fine Aggregate													
Slip AC	6.4	6.38	6.39	6.39						Slip AC	6.69					1													
% Air Voids		5.7	4.9	4.6							5.0					3/4													
Slip No.		18324	18347	18396							18351					1/2													
Time		6:19 AM	8:11 AM	1:39 PM							8:45 AM					3/8													

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			2337	556	
TODAY			1241	0	
TOTAL			3778	556	

MIX Type	MIX TIME		SP. GR.		BATCH WEIGHTS					A C	Total
	Dry	Wet	+ 8	- 8	Bin 1	Bin 2	Bin 3	Bin 4			
III	5	35			3420	1780	1352			448	7,000
III	30	35			2808	1613	1177			402	5,000
III	5	35			3320	1880	1352			448	7,000
III Fiber Mix	30	35			2723	1698	1177			402	5,000



TA 424 Rev. 500 2/83
5C 5/83
1M 4/84

Mike Wilkerson

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

Project & No. Berlin-Patic-E. Montpelier FOZB-3(23)S
Produced By Cooley-Berlin
Aggregate Source:

Page 5
Sheet 06-30-84 of 06-30-84
Date

Coarse Cooley-Websterville
Fine Thunder Road Pit
AC Source Petro-Canada AC Type PS/100

Weather Partly cloudy overcast PM
Air Temp 65° AM 80° PM
AC Sp. Gr. 1.023

EXTRACTION RESULTS						AGGREGATES			
Slave	Aim	8M-4L	8M-5L			Aim			
1-3/4									
1-1/2									
1									
3/4	100	100	100						
1/2	95	99	99						
3/8	78	82	83						
#4	54	57	59						
#8	42	45	45						
#16	29	35	35						
#30	20	25	25						
#50	10	14	14						
#200	4	3.0	2.1						
ACEXT		6.51	6.46						
Slip AC	6.4	6.36	6.37						
% Air Voids		3.6	4.1						
Slip No.		18439	18465						
Time		7:11 AM	10:04 AM						

PROJECT TONNAGE BY MIX TYPE					OTHER
	NO3	Type II	Type III	Type IV	
PRIOR			3778	556	
TODAY			999	0	
TOTAL			4777	556	

Fine Aggregate			
	M.S.A.	ST. SC.	
1			
3/4			
1/2	100		
3/8	99	100	
#4	94	93	
#8	86	69	
#16	73	46	
#30	52	28	
#50	23	15	
#200	2	2	

MIX Type	MIX TIME		SP. GR.		BATCH WEIGHTS					Total
	Dry	Wet	+ 9	- 9	Bin 1	Bin 2	Bin 3	Bin 4	A C	
III	5	35			3320	1880	1352		448	7000



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5C 5/83
1M 4/84

John W. Kegan

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

Project & No. Berlin-Barre-Ft. Montpelier F02B-3(23)S Page 6
Produced By Cooley - Berlin Sheet of
Aggregate Source: Cooley - Websterville Date 07-02-84
Coarse Cooley - Websterville Weather clear AM clear PM
Fine Cooley - Websterville & Thunder Road P.t Air Temp 62° AM 85° PM
AC Source Petro-Canada AC Type 85/100 AC Sp. Gr. 1.023

Fiber Mix EXTRACTION RESULTS						Regular Mix			AGGREGATES			
Sieve	Aim	BM-9T	BM-10T	BM-11T		Aim	BM-12T	BM-13T	Coarse Aggregate			
1-3/4									1-3/4			
1-1/2									1-1/2			
1									1			
3/4	100	100	100	100		100	100	100	3/4			
1/2	95	98	99	98		95	99	99	1/2			
3/8	78	83	83	81		78	85	84	3/8			
#4	54	57	60	58		54	60	59	#4			
#8	42	45	49	47		42	46	45	#8			
#16	29	35	38	36		29	34	35	#16			
#30	20	24	25	24		20	24	24	#30			
#50	10	13	13	13		10	13	13	T & E			
#200	1.4	2.6	1.7	1.8		1.4	2.6	2.7	FRAC			
ACEXT		7.00	6.95	6.79		ACEXT	6.59	6.80	Fine Aggregate			
Slip AC	6.7	6.60	6.68	6.65		Slip	6.41	6.39	1			
% Air Voids	3.7	(5.5)	4.7				4.0	3.8	3/4			
Slip No.		18503	18539	18555			18585	18606	1/2			
Time		6:49 AM	10:03 AM	11:38 AM			2:51 PM	5:07 PM	3/8			

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			4777	556	
TODAY			1421	0	
TOTAL			6198	556	

MIX Type	MIX TIME		SP. GR.		BATCH WEIGHTS				A C	Total
	Dry	Wet	+ 8	- 8	Bin 1	Bin 2	Bin 3	Bin 4		
III	5	35			3320	1880	1352		448	7000
III	30	35			2723	1698	1177		4026	6000



TA 424 Rev. 500 2/88
5C 5/83
IM 4/84

Michael W. Rogers
INSPECTOR

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

Project & No. Berlin-Porte-E-Montpelier F028-3(23)S

Produced By Cooley - Bertha

Aggregate Source:

Coarse Cooley-Websterville

Fine " " & Thunder Road P.t

AC Source Rt 10 - Canada

AC Type BS/100

Page 7

Sheet

Date 07-03-04

Weather AM

Air Temp AM

AC Sp. Gr. 1.023

EXTRACTION RESULTS										AGGREGATES			
Sieve	Aim	RM-141						Aim	RM-151	Coarse Aggregate			
1-3/4										1-3/4			
1-1/2										1-1/2			
1										1			
3/4	100	100						100	100	3/4			
1/2	95	98						95	98	1/2			
3/8	70	82						70	81	3/8			
#4	59	57						54	57	#4			
#8	42	42						42	45	#8			
#16	29	37						29	35	T & E			
#30	20	27						20	24	FRAC			
#50	10	13						10	13	Fine Aggregate			
#200	1.4	3.3						1.4	1.9	1			
AC F.N.		6.60						AC F.N.	6.87	3/4			
Slip AC	6.4	6.34						Slip AC	6.65	1/2			
% Air Voids		3.0							4.8	3/8			
Slip No.		10623							18650	#1			
Time		5:51 AM							8:42 AM	#8			

PROJECT TONNAGE BY MIX TYPE					OTHER
	303	Type II	Type III	Type IV	
PRIOR			6198	556	
TODAY			875	0	
TOTAL			7073	556	

MIX Type	MIX TIME		SP. GR.	Bin 1	Bin 2	Bin 3	Bin 4	A C	Total
	Dry	Wet							
III	5	35		3370	1880	1352		448	7000
III	30	35		4723	1698	1177		402	6000



TA 124
NOV 28 1984
EX 1284

M. L. Ryan

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

Date Prepared: August 6, 1984Core AnalysisPrepared By: P. CortiProject: BERLIN-BARRE-EAST MONTEPELIER
F028-3(23)SType of Mix: III & III Modified

Lab Number	Core No.	Weight(grams)			Roadway Sp. Gr.	Plant Avg. Daily Bulk Sp. Gr.	Max. Sp.Gr.	Ratio %	% Voids in Place	In Place Unit Weight. (p.c.f.)	
		Air	Water	Surf dry							
A	B	C	D	E	F	G	H	I	J	K	
					$\frac{C}{E-D}$			$\frac{F}{G}$	$\frac{H-F}{H} (100)$	$62.4 \times F$	
8T	1-3/4"	TL 1	826.6	456.4	828.4	2.222	BM 8T 2.284	2.405	.973	7.6	138.65
9T	1-1/8"	TL 2	500.3	277.4	500.8	2.239	BM 9T 2.318	2.406	.966	6.9	139.71
10T	1-1/8"	TL 3	538.8	300.4	539.5	2.250	BM 10T 2.269	2.402	.992	6.3	140.40
11T	1-7/16"	TL 4	663.8	374.6	664.5	2.290	BM 11T 2.285	2.398	1.002	4.5	142.90
* 12T	1-5/8"	TL 5	723.0	405.8	723.5	2.276	BM 12T 2.295	2.411	.992	5.6	142.02
*	1-1/8"	EB TS 2	474.3	262.7	475.4	2.250	2.319	2.413	.962	7.6	139.5
	1-1/4"	WB TS 2	558.7	317.5	559.4	2.310	Same as TL3 2.269	2.402	1.018	3.8	144.14
* 14T	1-1/2"	WB TS 3	683.8	387.8	684.4	2.305	2.345	2.418	.983	4.7	143.83
	1-3/16"	TD 2	556.2	311.1	556.6	2.265	2.290	2.410	.989	6.0	141.54
*	1-3/16"	EB TS 4	543.3	3.064	543.9	2.287	2.319	2.417	.986	5.4	142.71
* = STANDARD TYPE III MIX											

RUTTING READINGS

TEST SECTION #1

[illegible]

COMMENT readings in
inches

WEAR (EO) IN STANDARD MIX

SLIGHTLY HIGHER THAN IN

MOD. 15 (WB) MIX.

Reserve 12-27-96 PCW

*Original Reading Before Construction

RUTTING READINGS

F 028-3(23)5

Test Section #2

COMMENT readings in
inches

← WEAR FAULTY EVEN BOTH SIDES

Recovery 12-29-86 PCW

[illegible]

*Original Reading Before Construction

$$6/16 = 3/8$$

$$\frac{3}{16}$$

RUTTING READINGS

- E. M. ...

Test Section #4

COMMENT Readings in
inches

- WEAR FAIRLY EVEN

BOTH SIDES

Resurvey 12-29-86 RW

*Original Reading Before Construction 5/6

6/16

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

WORK PLAN FOR
CATEGORY II EXPERIMENTAL PROJECT
POLYESTER FIBER MODIFIED BITUMINOUS PAVEMENT

WORK PLAN 84-R-4

OBJECTIVE OF EXPERIMENT

To produce and place a bituminous mix modified with polyester fibers and to compare the properties and performance of the modified material with a standard bituminous concrete mix.

PROJECT

Berlin - Barre - East Montpelier F 028-3(23)S

PROJECT LOCATION

On U.S. Route 2, beginning at the Montpelier - Berlin town line at MM 0.000 and extending easterly 3.097 miles to MM 1.630 in East Montpelier.

EXPERIMENTAL WORK LOCATION

The polyester fiber modified mix shall be placed on a single travel lane in order that its performance can be compared with the standard mix placed on the adjacent lane. The exact location shall be selected jointly by Construction Division and Materials & Research personnel.

MATERIALS TO BE USED

The polyester fibers shall be Boni Fibers B as supplied by KAPEJO, Inc, 3 Pierce Road, Wilmington, Delaware 19803. Phone (302) 453-8955

PRODUCTION AND PLACEMENT

The fibers shall be added to the mix at a rate of 5 pounds per ton (0.25% by weight of total mix). The pugmill dry mix cycle shall be increased to 30 seconds to ensure proper distribution of the fibers throughout the aggregate. The asphalt content of the mix shall be increased by 0.25% to ensure proper coating of the fibers. The placement shall include a 300± foot section plus tapers where the overlay thickness in both lanes shall be reduced to one inch (1") for evaluation purposes.

CONTROL SECTION AND TREATMENT

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

COST

The fiber modified mix is expected to cost between \$7.00 and \$10.00 more per ton than the standard mix.

DATE OF CONSTRUCTION

The experimental treatment shall be completed prior to October 15, 1984.

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 on the experimental and control sections both prior to and following the paving application.
- 6) Obtain friction values 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:

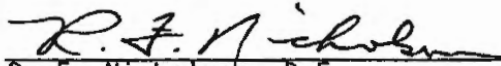
- 1) Reductions in reflective cracking.
- 2) Retention of initial ride values.
- 3) Retention of initial friction values.

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.

Materials & Research Division
Agency of Transportation
March 9, 1984

Reviewed By:



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

Date: 03-12-84