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This study is being conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration. This study is part of a project entitled "Binder Modifier Agents as Construction and Maintenance Seals".

16. ABSTRACT
This report contains a description of the installation and first year observations of a second construction seal Binder Modifier test section. It is located in a "desert climate" on Road 09-Ker-58-128.5/R135.5 in the Mojave desert near Edwards Junction, California. Included in this report are details of the placement, field testing, and laboratory testing a comparison of the Edwards Junction and Copperopolis test section test results. Testing included skid resistance tests, tests on the original products, and tests on four inch diameter cores removed from the treated areas.

The findings reveal that the effects of the binder modifiers upon the pavement surfaces are similar to those observed when these products were used on the Copperopolis test section. This includes a reduction of coefficient of friction values initially by all of the products and a sustained deleterious effect on skid resistance by the hardening agent type products. It was confirmed that the effect of the binder modifier products is limited to the top 1/4 inch of the pavement.

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Binders, surface treatments, penetration, field test, skid resistance testing, laboratory tests, core analysis

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DIVISION OF STRUCTURES AND ENGINEERING SERVICES

TRANSPORTATION LABORATORY

RESEARCH REPORT

EDWARD JUNCTION TEST SECTION, BINDER MODIFIERS AS CONSTRUCTION SEALS

INTERIM REPORT

CA-DOT-TL-3105-2-76-29

76-29

DECEMBER 1976

Prepared in Cooperation with the U.S. Department of Transportation, Federal Highway Administration

Caltrans

CALIFORNIA DEPARTMENT OF TRANSPORTATION

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16. ABSTRACT

This report contains a description of the installation and first year observations of a second construction seal Binder Modifier test section. It is located in a "desert climate" on Road 09-Ker-58-128.5/R135.5 in the Mojave desert near Edwards Junction, California. Included in this report are details of the placement, field testing, and laboratory testing and a comparison of the Edwards Junction and Copperopolis test section test results. Testing included skid resistance tests, tests on the original products, and tests on four inch diameter cores removed from the treated areas.

The findings reveal that the effects of the binder modifiers upon the pavement surfaces are similar to those observed when these products were used on the Copperopolis test section. This includes a reduction of coefficient of friction values initially by all of the products and a sustained deleterious effect on skid resistance by the hardening agent type products. It was confirmed that the effect of the binder modifier products is limited to the top 1/4 inch of the pavement.

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DEPARTMENT OF TRANSPORTATION
DIVISION OF STRUCTURES & ENGINEERING SERVICES
OFFICE OF TRANSPORTATION LABORATORY

December 1976

FHWA No. D-3-41
TL No. 633105

Mr. C. E. Forbes
Chief Engineer

Dear Sir:

I have approved and now submit for your information this interim research project report titled:

EDWARDS JUNCTION TEST SECTION-
BINDER MODIFIERS AS CONSTRUCTION SEALS

Study made by . . . . Roadbed and Concrete Branch

Under the Supervision of . . . . Donald L. Spellman, P. E.
and
John Skog, P. E.

Principal Investigator . . . . Robert N. Doty, P. E.

Co-Investigator . . . . Glenn R. Kemp, P. E.

Report Prepared by . . . . Nelson H. Predoehl

Very truly yours,

George A. Hill

GEORGE A. HILL
Chief, Office of Transportation Laboratory

Attachment

NHP:bjs

ACKNOWLEDGMENT

This work was done in cooperation with the U. S. Department of Transportation, Federal Highway Administration, and their cooperation is hereby acknowledged.

The contents of this report reflect the views of the Transportation Laboratory which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Acknowledgment is made of the work of James Henderson, who performed most of the laboratory testing; the coring and skid testing units under the general direction of Martin Bianco and Bobby Page, respectively, and David McLaughlin, Caltrans District 09 Resident Engineer for the Edwards Junction Contract.

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INTRODUCTION

Beginning with a test section near Copperopolis, California(1) in May 1972, a study of "Binder Modifier" products was undertaken. This report covers work performed on a second test section near Edwards Junction on State Route 58.

"Binder Modifier" is a term used to characterize various products manufactured to bind or modify an asphalt concrete surface to control raveling, pitting, cracking, etc. The products have been characterized into three main groups depending upon the effect they have upon the pavement surface. The groups are as follows:

1. Hardening Agents: These products contain a very hard base asphalt, (2 to 10 penetration normally) cutback with a highly volatile solvent. A California specification, designated RC-10H for Rapid Curing Liquid Asphalt, fits this product. The effect of this product is to seal the surface of the pavement with a very hard surface film.

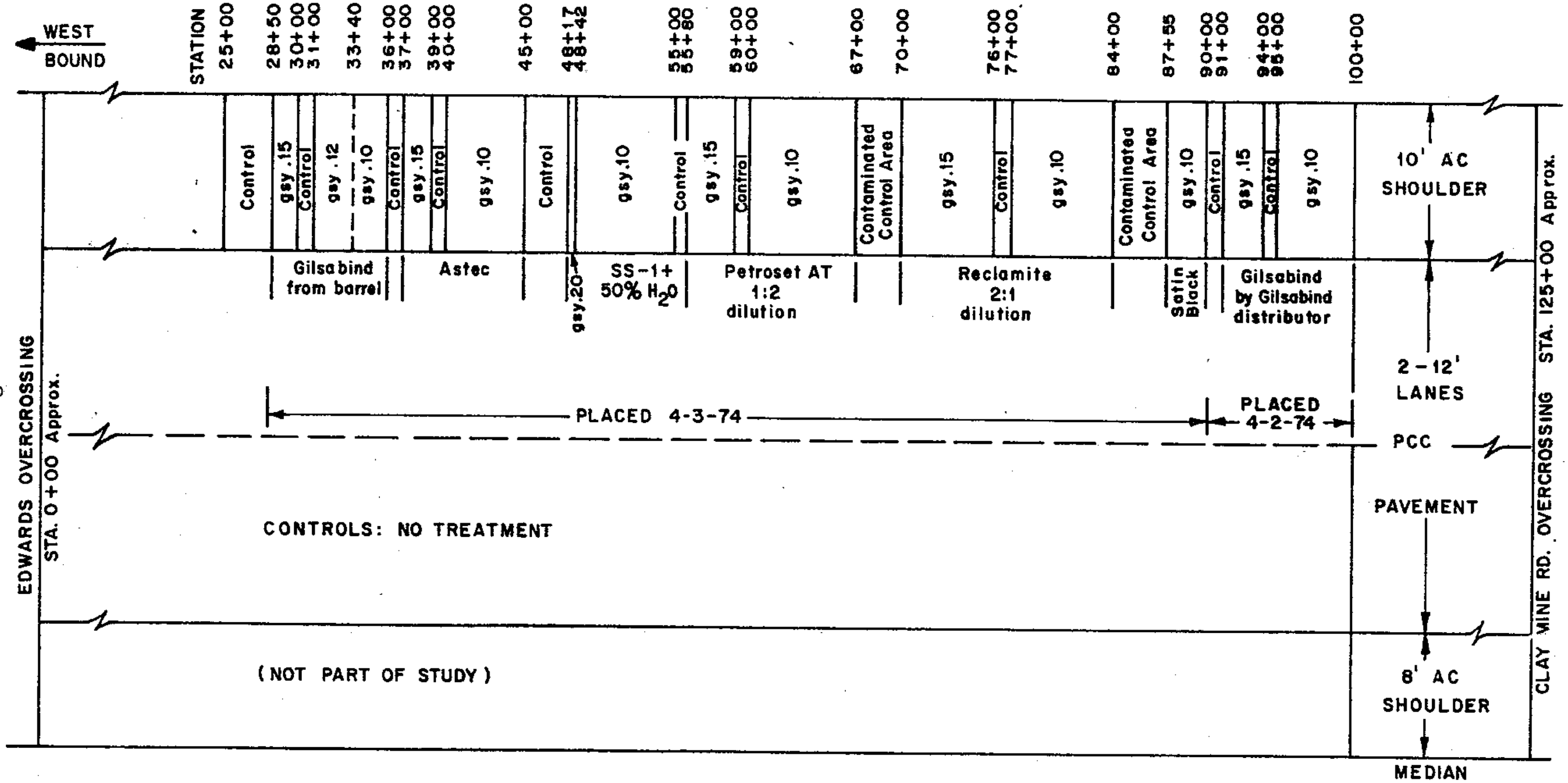
2. Softening Agents: This type of product normally is composed of resins and oils derived from the treatment of lubricating oils and is covered under the California specification for "Rejuvenating Agents". The effect of this product is to soften and, theoretically, combine with the surface portion of the asphalt to "liven" the asphalt, thereby contributing to crack healing when the pavement is subjected to the pneumatic compaction provided by the traffic.

3. Altering Agents: These are products in which rubber latex is dissolved in an oily emulsion system. These products supposedly rubberize the asphalt in a pavement on which they are applied, thereby altering the asphalt to improve its durability.

In accordance with the research proposal (D-3-41, 19301-762503-633105) to study the binder modifier products in field installations, this second construction seal test section using these products was placed during April 1974 on the westbound shoulder of Road 09-Ker-58-128.5/R135.5 under Contract 09-023324. This test site, (Figure 1), is approximately 17 miles east of Mojave, California, on State Route 58. It is located within the Mojave desert and is subjected to hot summers and mild, dry winters. The test sections will not be subject to traffic other than very infrequent parking since they are located on a shoulder.

This report describes the installation, initial field testing, laboratory testing of the original binder modifier products and of cores removed two weeks after the installation, and presents an analysis comparing the initial test results of the two construction seal test sections (Copperopolis and Edwards Junction). Evaluation of the effects of the various products will continue for several years.

BINDER MODIFIER RESEARCH PROJECT
EDWARDS JUNCTION TEST SECTION
RD. 09 - Ker - 58 - 128.5 / R 135.5 CONT. 09-023324



WEATHER CONDITIONS:

4-2-74, 10 AM	AIR 52°F SURF. AIR 62°F	GUSTY WINDS 25 - 35 MPH
4-3-74, 9:30 AM	AIR 65°F SURF. AIR 71°F	LIGHT BREEZE
12:15 PM	AIR 66°F SURF. AIR 85°F	LIGHT BREEZE

Figure 1

FINDINGS

1. There was an immediate reduction in the coefficient of friction values (as measured with a towed trailer according to test method ASTM E-274) after the application of all of the binder modifier products used in the Edwards Junction test section. The reduction was similar to the reduction which occurred after the application of the same products on the Copperopolis test section(1).

2. The reduced coefficient of friction values remained below the suggested minimum skid number for an extended period (from four weeks to 14 plus weeks) for several of the binder modifier treated areas, notably the areas treated by the hardening agents and the SS-1 emulsion fog seal. This sustained reduction of the coefficient of friction corresponded to the pattern exhibited in the Copperopolis test section.

3. The effects of the binder modifier products appear to be limited to the top 1/4 inch of the pavement as determined from the results of testing slices of the recovered cores. These effects are similar to the corresponding test results from the Copperopolis test section.

IMPLEMENTATION

As a result of the findings stated in the report of a similar test section at Copperopolis, California(1), a memorandum was issued urging caution when using the binder modifier products studied due to the possibility of wet weather skid hazards after their application. Since this report covers a similar installation of binder modifier products, the findings are similar, and this is primarily a report of the installation of the Edwards Junction test section. We will observe these installations during the next two years and report further on our findings.

INSTALLATION OF TEST SECTION

The binder modifier products were applied as construction seals on the westbound 10 foot outside shoulder of Road 09-Ker-58 between stations 100+00 and 25+00 (between the "Clay Mine Road and the "Edward" overcrossings) under contract 09-023324 on April 2 and 3, 1974. The 0.40± foot thick AC pavement that was treated was a California Type B, 3/4 inch maximum medium grading(2), with 6% AR4000 asphalt as the binder. The shoulder pavement, which was placed on 9-inch thick Class 2 Aggregate Base, was approximately one month old when treated. The products were applied at concentrations of 0.10 and 0.15 gallons per square yard in sections of various lengths depending upon the amount of product available. One hundred foot untreated control sections were left between each application. See Figure 1 for details of the installations. Two additional control sections of 250 to 300 feet in length were also left untreated for further study. All of the products were applied on April 3, 1974 using one distributor truck, except for a section of Gilsabind which was applied April 2 using a distributor truck owned by Gilsabind. The original date of application had been scheduled for April 2nd but application of the products had been postponed until the next day due to rain on the night of April 1st and a forecast of strong winds the next day. The weather April 2nd was clear with gusty southwesterly crosswinds estimated at 25 to 35 mph and an air temperature of approximately 50°F. Even though these conditions were less than ideal, the initial Gilsabind section was applied with no problems. During the application, there was some blowing dust across the newly treated surface. The Gilsabind penetrated immediately, as expected, as all of the binder modifier products were pretested on small random areas of the pavement with measured quantities. The weather conditions on April 3rd were much calmer with just a light breeze although it was fairly cool early in the morning.

Air temperatures taken during the morning were 65°F at 9:30 a.m. and 66°F at 12:15 p.m. Although these were acceptable air temperatures for application of the products, difficulty was encountered with the first product applied on April 3, Satin Black. Satin Black is a hard base, rapid curing liquid asphalt. Unfortunately, it was too viscous to atomize properly for spraying. Only about a 300 foot length of the shoulder was treated before determining that it would not be useful to continue as the section was very streaked. The remainder of this material was discarded and this section deleted from the formal evaluations. It was decided that it would be advantageous to wait until later in the day to apply the remainder of the hardening agents so that the sun could warm up the barrels since no heating facilities were provided by the distributor truck. Since the emulsified products were not as temperature sensitive, it was decided to apply them next. No difficulties were encountered in the application of the "Reclamite", "Petroset AT" and "SS-1 Emulsion Fog Seal". All of these products penetrated quickly - within approximately 5 minutes generally. The remaining products, i.e., Astec Pavement Sealer and Gilsabind, were applied at about noon with no problems regarding their ability to be sprayed. Minor streaking resulted with both products due to a malfunctioning nozzle - otherwise the coverage was uniform. All of the products applied April 3rd were pumped from their shipping barrels into the distributor truck tank and diluted, if required, in the distributor with the local water which had been tested previously for compatability. Thorough flushing and rinsing of the distributor was performed between each product change.

FIELD TESTING

The scope of the field testing for a project of this type consists primarily of evaluating both the immediate and long-range effects of the various treatments. The most important immediate concern is their effect on skid resistance.

Skid testing was initially performed two weeks after treatment and then two additional times during the first year. The results of these skid tests are presented in Table A. They are also graphically portrayed on Figure 2. The results indicate that after two weeks, a possible hazardous wet weather skid condition still existed due to all of the treatments except the Reclamite and Petroset products. After 14 weeks the conditions had improved to the point that only two of the test surfaces still exhibited possible unsafe wet weather skid conditions.

To test the sealing action of the binder modifier products, water permeability tests were performed on the different sections. These tests were performed two weeks after the application of the treatments at the same time the core samples were removed. The results of the water permeability tests as well as "whole" core tests on the 4" diameter cores are presented in Table B.

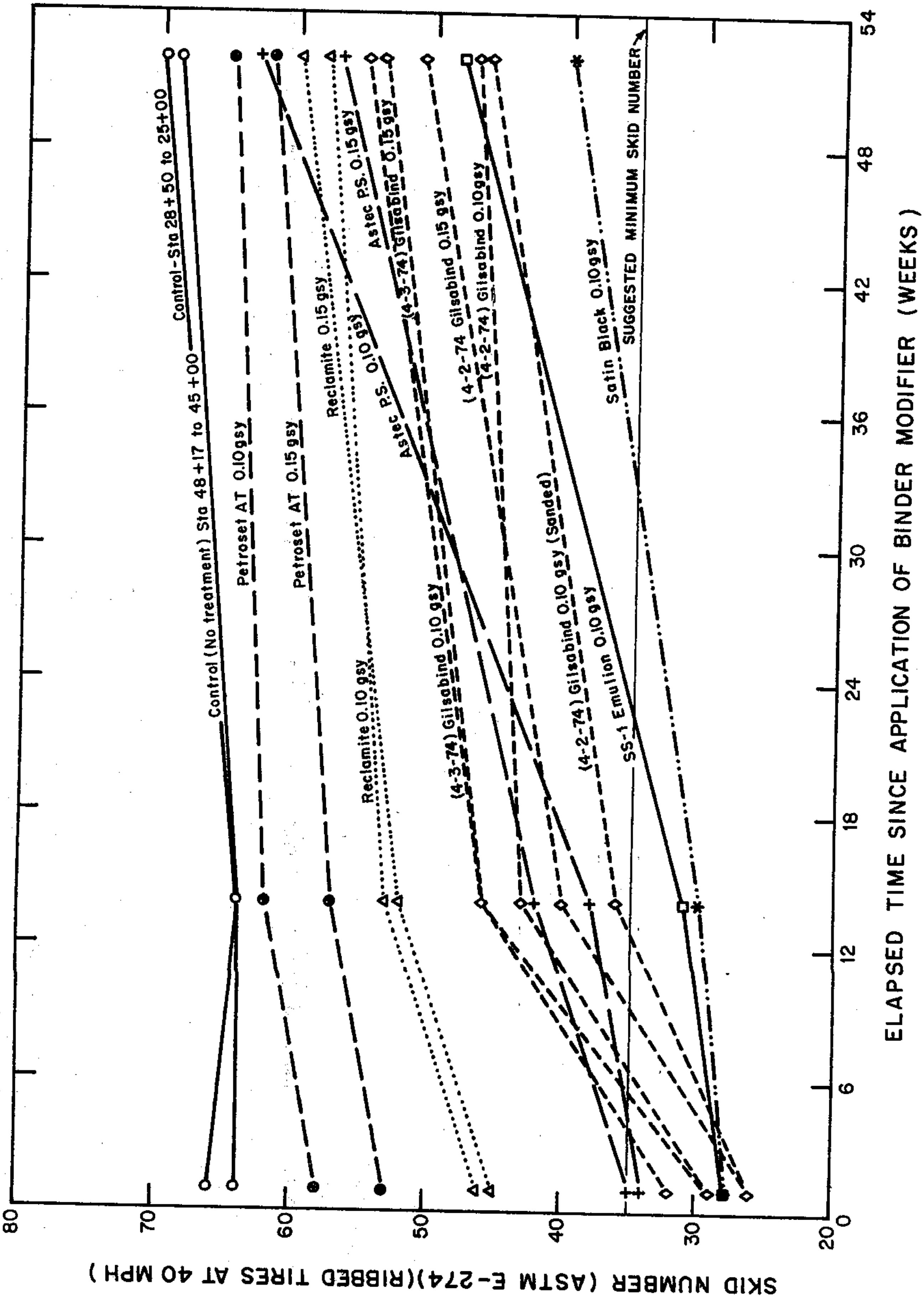
TABLE A

EDWARDS JUNCTION TEST SECTION (09-Ker-58)
SKID TEST RESULTS (Westbound Shoulder)
40 mph SKID NUMBER (ASTM E-274-65T) (Ribbed Tire)

Treatment applied
4-2,3-1974

Location Station	Product (Concentration)	4-15-74 after 2 weeks	7-8-74 after 14 weeks	4-6-75 after 52 weeks
100 ~to 97+50	Gilsabind (0.10 gal/yd^2)	29	43	47
97+50 to 95 ~	" " (sanded)	26	36	46
94 ~ to 91 ~	" (0.15 gal/yd^2)	26	40	51
90 ~ to 87+55	Satin Black (0.10 gal/yd^2)	28	30	40
84 ~ to 77 ~	Reclamite (0.10 gal/yd^2)	46	53	58
76 ~ to 70 ~	" (0.15 gal/yd^2)	45	52	60
67 ~ to 60 ~	Petroset AT (0.10 gal/yd^2)	58	62	65
59 ~ to 55+80	" (0.15 gal/yd^2)	53	57	62
55 ~ to 48+42	Emul.SS-1+H_2O(0.10 gal/yd^2)	28	31	48
48+17 to 45 ~	Control - (No Treatment)	64	64	69
45 ~ to 40 ~	Astec P.S. (0.10 gal/yd^2)	34	38	63
39 ~ to 37 ~	" (0.15 gal/yd^2)	35	42	57
36 ~ to 31 ~	Gilsabind (0.10 to 0.12 gal/yd^2)	32	46	55
30 ~ to 28+50	" (0.15 gal/yd^2)	29	46	54
28+50 to 25 ~	Control (No Treatment)	66	64	70

Figure 2



SKID TEST RESULTS–EDWARDS JUNCTION TEST SECTION
ROAD–09–Ker–58–128.5/R135.5

TABLE B

EDWARDS JUNCTION TEST SECTION (Rd 09-Ker-58)
PERMEABILITY AND DENSITY TEST RESULTS

(4" cores taken and water permeabilities performed April 15 and 16, 1974
Approximately 2 weeks after treatments were applied)

Section (Type treatment and application rate)	Water Permeabilities			Test Results on 4" Cores - Surface CR				
	Location			Location of core removal				
	Sta.	Feet from edge pave.	ml/min	Sta.	Feet from edge pave.	Waxed Specific Gravity	% Voids	Air Permeability ml/min/in^2/1" vac
Gilsabind at 0.10 g psy (4-2-74)	99+75	3'	10	99+47	5'	2.16		44.2
	99+50	5'	5	98+20	7'	2.13		54.9
	99+25	7'	10	96+70	2'	2.15		40.8
				95+71	9'	2.14		57.3
Average			8.3			2.15	10.8	49.3
Control (Sta 59 to 100)				94+37	6'	2.19		44.6
				90+62	3'	2.22		34.4
				76+94	1'	2.17		60.5
				59+14	8'	2.13		79.6
Average						2.18	9.6	54.8
Gilsabind at 0.15 g psy (4-2-74)				93+65	4'	2.17		47.8
				93+00	3'	2.14		58.9
				91+77	6'	2.13		57.3
				91+56	2'	2.13		54.1
Average						2.14	11.2	54.5
Reclamite at 0.10 g psy	83+75	3'	10	83+37	6'	2.17		43.0
	83+50	5'	20	82+31	4'	2.15		25.5
	83+25	7'	35	80+89	3'	2.16		27.8
				78+65	8'	2.13		15.1
Average			21.7			2.15	10.8	27.8
Reclamite at 0.15 g psy	75+75	3'	15	75+02	9'	2.16		39.0
	75+50	5'	10	73+79	2'	2.16		49.3
	75+25	7'	20	72+19	4'	2.13		58.9
				71+64	6'	2.21		39.2
Average			15.0			2.17	10.0	46.6

Continued

TABLE B

EDWARDS JUNCTION TEST SECTION (Rd 09-Ker-58)
PERMEABILITY AND DENSITY TEST RESULTS

(4" cores taken and water permeabilities performed April 15 and 16, 1974
Approximately 2 weeks after treatments were applied)

Section (Type treatment and application rate)	Water Permeabilities: Location Sta.	Water Permeabilities: Location Feet from edge pave	Water Permeabilities: ml/min	Test Results on 4" Cores - Surface CR: Location of core removal Sta.	Location of core removal Feet from edge pave	Waxed Specific Gravity	% Voids	Air Permeability ml/min/in²/1" vac
Petroset AT at 0.10 g psy	66+75	3'	30	66+37	6'	2.13		78.0
	66+50	5'	30	65+63	2'	2.22		35.3
	66+25	7'	20	64+62	1'	2.14		58.9
				62+92	7'	2.16		63.7
Average			26.7			2.16	10.4	59.0
Petroset AT at 0.15 g psy	58+75	3'	10	58+15	8'	2.16		14.3
	58+50	5'	10	57+23	1'	2.16		50.9
	58+25	7'	15	56+05	3'	2.14		54.1
				55+92	1'	2.11		90.7
Average			11.7			2.14	11.2	52.5
SS-1+50% H_2O at 0.10 g psy	54+75	3'	5	54+66	3'	2.15		11.5
	54+50	5'	5	53+47	8'	2.17		20.7
	54+25	7'	5	52+01	2'	2.18		35.8
				49+71	8'	2.15		108.6
Average			5.0			2.16	10.4	44.2
Control (Sta. 25 to 50)	48+00	3'	30	47+55	6'	2.18		35.8
	47+75	5'	30					
	47+50	7'	35	45+88	9'	2.10		113.8
	28+25	3'	60					
	28+00	5'	75	28+20	3'	2.16		85.3
	27+75	7'	25	27+63	2'	2.17		36.6
Average			42.5			2.15	10.8	67.9

Continued

TABLE B

EDWARDS JUNCTION TEST SECTION (Rd 09-Ker-58)
PERMEABILITY AND DENSITY TEST RESULTS

(4" cores taken and water permeabilities performed April 15 and 16, 1974
Approximately 2 weeks after treatments were applied)

Section (Type treatment and application rate)	Water Permeabilities: Location Sta.	Feet from edge pave	ml/min	Test Results on 4" Cores - Surface CR: Location of core removal Sta.	Feet from edge pave	Waxed Specific Gravity	% Voids	Air Permeability ml/min/in²/1" vac
Astec P.S. at 0.10 g psy	44+75	3'	15	44+92	1'	2.20		25.5
	44+50	5'	10	44+39	4'	2.14		43.8
	44+25	7'	10	42+93	9'	2.11		79.6
				41+32	2'	2.25		16.2
Average			11.7			2.17	10.0	41.3
Astec P.S. at 0.15 g psy				38+93	1'	2.20		9.6
				38+38	6'	2.17		27.1
				38+20	2'	2.20		19.9
				37+66	5'	2.17		59.7
Average						2.18	9.6	29.1
	(Gilsabind at 0.12 g psy)							
Gilsabind at 0.15 g psy (applied 4-3-74)	33+00	3'	25	29+34	7'	2.15		73.3
	32+75	5'	20	29+28	1'	2.14		73.3
	32+50	7'	25	28+70	6'	2.14		41.4
				28+65	1'	2.15		65.3
Average			23.3			2.14	11.2	63.3

end

LABORATORY TESTING

Laboratory testing was performed on samples of the original binder modifier products and on four-inch diameter cores removed from the various sections about two weeks after the application of the products.

Testing of the original products was performed in accordance with the specifications for the various products. The hardening agents were tested for compliance to the California specifications for RC-10H materials (Figure 3). The softening agents were tested according to the California "Asphalt Rejuvenating Agent" specification (Figure 4). Since it is water soluble, the Petroset AT, which is classified as an altering agent, was also tested according to the Rejuvenating Agent specification because there is no California specification for altering agent materials. Table C contains the results of the tests. The "Reclamite" product was inadvertently sampled after it had been diluted so the results represent a diluted product. Extrapolation of the results (indicated % residue of 66.7) shows that the percent residue would have met the Rejuvenating agent specification. It is also believed that the viscosity result would have met the specification although viscosity adjustment is not necessarily proportional.

The test results indicate that the different products generally complied with the applicable California specifications except for some tests on the "Hardening Agents".

Measuring the effects of the various treatments is being accomplished by testing four-inch diameter cores which have been removed from the test sections. Two four-inch diameter cores were cut at each of four randomly selected sites within each test area. One of the two cores was tested whole (top 2" surface course) and the top of the other

FIGURE 3

RAPID CURING LIQUID ASPHALT

Tentative Specification
RC-10H

Specification Designation	Test Method	Type RC-10H
Kinematic Viscosity at 140°F	AASHTO T201	10-20
Water % Maximum	AASHTO T55	0.2
Distillation	AASHTO T78	
Distillation (percent of total distillate to 680°F)		
To 374°F Minimum		50
To 437°F Minimum		85
To 500°F Minimum		90
To 600°F Minimum		95
Residue from distillation to 680°F. Volume percent of sample by difference, minimum.		30
Tests on Residue from Distillation		
Penetration at 77°F	AASHTO T47	2-10
Softening Point R&B °F Minimum	AASHTO T53	190
HCL Precipitation % Minimum	Calif. 357	20
Solubility in CCl_4 % Minimum	AASHTO T44	99.5

FIGURE 4

ASPHALT REJUVENATING AGENT SPECIFICATION

The asphalt rejuvenating agent shall be composed of a petroleum resin oil base uniformly emulsified with water and shall conform to the following requirements:

Test	Test Method	Requirements
Viscosity, 77°F.	AASHTO T59	15-40 SFS
Residue	No. Calif. 351	60% minimum
Tests on Residue		
Viscosity, 140°F	ASTM D 445	100-200 cSt
Asphaltenes	No. Calif. 352	0.75% maximum
Miscibility Test*	AASHTO T59	No coagulation
Sieve Test**	AASHTO T59	0.10% maximum
Particle Charge Test	No. Calif. 343A	Positive

*Test procedure: AASHTO T59 to be modified by using 0.02 normal calcium chloride solution in place of distilled water.

**Test procedure: AASHTO T59 to be modified by using distilled water in place of 2 percent sodium oleate solution.

EDWARDS JUNCTION TEST SECTION
ORIGINAL PROPERTIES OF BINDER MODIFIER AGENTS

Test	AASHTO Test Method	PRODUCTS: Gilsabind (H)	Astec PS (H)	Satin Black (H)	* Reclamite (A)	** Petroset (A)	SS-1	Calif. Spec. Require-ments
Hardening Agents(H)								
Kinematic Vis.@140F,CS	T201	22	16	26				10-20
Distillation to 680F	T78							
(% Volume of total @374F, %	"	72.7	90.3	43.2				+50
distillate to @437F, %	"	87.3	91.2	79.9				+85
680F.) @500F, %	"	93.4	95.2	89.6				+90
@600F, %	"	97.4	97.6	95.6				+95
Residue from Distillation by difference. %	"	25.0	38.0	33.0				+30
Tests on Distillation Residue								
Penetration at 77F °	T49	8	4	11				2-10
Solubility in CCl_4 %	T44	99.94	99.98	99.44				+99.5
Softening Point °F	T53	218	197	194				+190
HCl Precipitate %	Calif.357	35.9	23.3	19.8				+20
Softening Agents(S)								
SF Viscosity at 77F sec.	T59				11	28		15-40
% Residue %	Calif.351				42.4	60.6		+60
Sieve Test %	T59				0	0		-0.10
Particle Charge Elec.Chg.	T59				+	+		positive(+
Test on Recovered Residue								
Kinematic Vis.at 140F CS	T201				130	13.35 stokes		100-200
% Asphaltenes %	Calif.352				.97	—		-0.75
Emulsified Asphalt(SS-1)								
Residue by Distillation %	T59						57.3	+57
SF Viscosity at 77F sec.	T59						20	20-100
Cement Mixing %	T59						.47	-2.0
Sieve Test %	T59						.01	-0.10
Penetration of Residue from Distillation(at 77F) °	T49						147	100-200

*Reclamite sample was diluted: 2 parts Reclamite to 1 part water. Viscosity and Residue test would be within Spec. limits if undiluted.

**(A) altering agent - No Calif. specification - The Petroset was tested according to softening agent tests.

core was sliced into four 1/4 inch thick portions prior to recovery and testing of the asphalt (see Appendix A for recovery method). The results of tests of the whole cores are included in Table B while the results from testing the slices are found in Tables D and E. Table D presents only average results from each test section while Table E shows the individual results for each core slice.

Edwards Junction T.S.
Cored April 1974
Orig. Cores

TABLE D

ASPHALT CORE SLICE EVALUATION (CALIF. METHOD 365-A)
AVERAGE RESULTS OF RECOVERED ASPHALT TESTS
(on 1/4" thick core slices from surface)

Core Location		Treatment	0 to 1/4" depth				3/8 to 5/8" depth				3/4 to 1" depth				1-1/8 to 1-3/8" depth			
Station	ft. from Edge Shlrd. (4 sites)	& Amount	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS
(1) 95-100	Random	Gilsabind 0.10gsy	8.45	9.28	70	.02	4.49	4.64	63	.01	5.61	5.84	84	.01	4.5	4.5	68	.0
(2) 94-95 90-91 76-77 59-60	Random	East Control Area Sta 59-100	6.23	6.73	93	.02	4.4	4.68	74	.02	4.45	4.76	78	.02	4.41	4.69	72	.02
(3) 91-94	Random	Gilsabind 0.15gsy	11.3	12.6	52	.02	5.8	6.28	76	.02	5.18	5.43	68	.01	4.65	5.16	64	.03
(4) 77-84	Random	Reclamite 0.10gsy	1.51	1.8	48	.06	6.79	6.95	99	.01	7.0	7.45	84	.01	6.25	6.34	72	.0
(5) 70-76	Random	Reclamite 0.15gsy	0.79	0.98	51	.07	6.85	6.96	96	.0	7.28	7.43	92	.0	7.35	7.35	61	.0
(6) 60-67	Random	Petroset 0.10gsy	1.51	1.96	71	.04	7.11	7.8	120	.02	7.83	8.14	99	.01	7.25	7.25	91	.0
(7) 55+80-59	Random	Petroset 0.15gsy	1.55	1.97	55	.06	9.14	9.75	110	.01	10.4	12.1	101	.04	10.2	11.4	111	.03
(8) 48+52-55	Random	SS-1+H_2O 0.10gsy	10.7	10.8	130	.0	10.9	11.0	110	.0	12.5	13.4	100	.02	12.3	12.3	101	.0
(9) 45-48+17 25-28+50	Random	West Control Sta25-50	18.6	19.8	104	.01	13.2	14.9	112	.03	13.3	13.3	117	.0	13.8	16.5	104	.04
(10) 40-45	Random	Astec P.S. 0.10gsy	51.0	76.0	6	.10	11.4	11.5	75	.0	11.3	11.8	81	.01	11.2	11.2	76	.0
(11) 37-39	Random	Astec P.S. 0.15gsy	77.3	132.0	5	.12	14.1	14.2	73	.0	13.0	13.7	88	.01	13.0	13.2	73	.0
(12) 28+50-30	Random	Gilsabind 0.15gsy	59.8	101.0	2	.14	14.6	14.6	77	.0	13.4	14.1	68	.01	13.0	13.3	63	.01

* Microvis.=Microviscosity at 77F(results in megapoise);MD=Microductility at 77F;SS=Shear Susceptibility

** The results of this surface slice not included in the average result)

TABLE E

Edwards Junction Test Section
Original cores-April 1974
(westbound shoulder)

Asphalt Core Slice Evaluation(Calif. Method 365A)
Recovered Asphalt Test Results(on 1/4"thick core slices from surface)

Core Location		Treatment	0 to 1/4"depth				3/8to5/8" depth				3/4to1" depth				1-1/8to1-3/8"depth			
Station	ft.from Edge Shlrd.	& Sample No.	Microvis.* SR sec.$^{-1}$		MD	SS	Microvis.* SR sec.$^{-1}$		MD	SS	Microvis.* SR sec.$^{-1}$		MD	SS	Microvis.* SR sec.$^{-1}$		MD	SS
			.05	.001	mm		.05	.001	mm		.05	.001	mm		.05	.001	mm	
(1)		Gilsabind																
99+47	5'	A 742-67	1.13**	1.22	63	.02	4.15	4.35	51	.01	9.6	10.0	60	.01	5.6	5.6	85	.0
98+20	7'	B 742-68	7.95	7.95	96	.0	4.4	4.4	80	.0	4.25	4.25	73	.0	3.4	3.4	81	.0
96+70	2'	C 742-69	7.4	8.1	43	.02	4.8	4.9	62	.01	4.4	4.4	91	.0	4.4	4.4	57	.0
95+71	9'	D 742-70	10.0	11.8	70	.04	4.6	4.9	59	.02	4.2	4.7	105	.02	4.5	4.5	50	.0
	Gilsabind 0.10gsy	Average	8.45	9.28	70	.02	4.49	4.64	63	.01	5.61	5.84	84	.01	4.5	4.5	68	.0
(2)		Control (no treat.)																
94+37	6'	A 742-71	5.8	5.8	81	.0	4.2	4.2	77	.0	4.3	4.3	69	.0	4.9	5.0	78	.01
90+62	3'	B 742-72	6.9	8.8	86	.06	4.7	4.8	80	.01	4.8	4.8	73	.0	4.6	4.6	73	.0
76+94	1'	C 742-73	6.0	6.0	101	.0	4.4	4.5	85	.01	4.6	5.15	88	.03	4.05	4.55	76	.03
59+14	8'	D 742-74	6.2	6.3	103	.01	4.3	5.2	52	.05	4.1	4.8	82	.04	4.1	4.6	60	.03
	Control (no treatment)	Average	6.23	6.73	93	.02	4.4	4.68	74	.02	4.45	4.76	78	.02	4.41	4.69	72	.02
(3)		Gilsabind 0.15gsy																
93+65	4'	A 742-75	9.6	9.6	62	.0	5.3	5.3	77	.0	5.0	5.4	77	.02	5.1	5.1	84	.0
93+00	3'	B 742-76	9.5	9.5	78	.0	5.3	5.3	50	.0	5.0	5.05	75	.0	4.0	4.15	76	.01
91+77	6'	C 742-77	10.8	12.7	38	.04	5.8	6.6	92	.03	4.1	4.55	80	.03	3.35	4.5	61	.08
91+56	2'	D 742-78	15.2	18.6	31	.04	6.8	7.9	83	.04	6.6	6.7	39	.0	6.15	6.9	35	.03
	Gilsabind 0.15gsy	Average	11.3	12.6	52	.02	5.8	6.28	76	.02	5.18	5.43	68	.01	4.65	5.16	64	.03
(4)		Reclamite 0.10gsy																
83+37	6'	A 742-79	0.34	0.4	26	.04	6.4	6.7	109	.04	6.3	8.1	109	.06	5.0	5.0	114	.0
82+31	4'	B 742-80	4.95	5.8	88	.04	6.8	6.8	75	.0	8.1	8.1	100	.0	6.0	6.1	90	.0
80+89	3'	C 742-81	0.33	0.44	30	.07	6.95	7.3	107	.01	7.0	7.0	68	.0	6.8	7.05	43	.01
78+65	8'	D 742-82	0.41	0.55	46	.08	7.0	7.0	105	.0	6.6	6.6	58	.0	7.2	7.2	42	.0
	Reclamite 0.10gsy	Average	1.51	1.8	48	.06	6.79	6.95	99	.01	7.0	7.45	84	.01	6.25	6.34	72	.0

* Microvis.=Microviscosity at 77F(results in megapoise);MD=Microductility at 77F;SS=Shear Susceptibility

Edwards Junction Test Section
Original cores-April 1974
(westbound shoulder)

TABLE E(continued)

Asphalt Core Slice Evaluation(Calif. Method 365a)
Recovered Asphalt Test Results(on 1/4"thick core slices from surface)

Core Location		Treatment &	0 to 1/4"depth				3/8to5/8" depth				3/4to1" depth				1-1/8to1-3/8"depth			
Station	ft.from Edge Shlrd	Sample No.	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS	Microvis.* SR sec.$^{-1}$ .05	Microvis.* SR sec.$^{-1}$ .001	MD mm	SS
(5)		Reclamite 0.15gsy																
75+02	9'	A 742-83	0.19	0.34	29	.14	5.8	5.9	77	.01	6.8	7.4	106	.02	7.3	7.3	84	.0
73+79	2'	B 742-84	0.39	0.51	46	.07	6.6	6.95	94	.01	7.3	7.3	103	.0	6.7	6.7	42	.0
72+19	4'	C 742-85	0.74	0.74	58	.0	6.4	6.4	126	.0	6.7	6.7	68	.0	7.0	7.0	78	.0
71+64	6'	D 742-86	1.83	2.32	72	.06	8.6	8.6	86	.0	8.3	8.3	92	.0	8.4	8.4	42	.0
	Reclamite 0.15gsy	Average	0.79	0.98	51	.07	6.85	6.96	96	.0	7.3	7.43	92	.0	7.35	7.35	61	.0
(6)		Petroset 0.10gsy																
66+37	6'	A 742-87	1.6	2.18	97	.08	6.4	6.4	116	.0	7.3	7.95	73	.02	6.9	6.9	84	.0
65+63	2'	B 742-88	1.35	1.46	71	.02	7.2	7.2	131	.0	8.3	8.3	111	.0	7.4	7.4	87	.0
64+62	1'	C 742-89	1.8	2.6	51	.10	8.65	10.5	126	.05	8.5	9.1	94	.02	8.6	8.6	87	.0
62+92	7'	D 742-90	1.3	1.6	66	.06	6.2	7.1	109	.03	7.2	7.2	120	.0	6.1	6.1	106	.0
	Petroset AT 0.10gsy	Average	1.51	1.96	71	.04	7.11	7.8	120	.02	7.83	8.14	99	.01	7.25	7.25	91	.0
(7)		Petroset 0.15gsy																
58+15	8'	A 742-91	0.85	1.02	48	.04	5.1	5.3	112	.01	8.25	9.1	95	.02	8.3	8.3	112	.0
57+23	1'	B 742-92	1.6	2.33	70	.09	10.0	10.0	121	.0	8.7	8.7	127	.0	9.7	12.3	121	.06
56+05	3'	C 742-93	0.86	1.07	29	.05	9.45	11.7	121	.05	11.6	17.4	96	.11	11.3	13.7	98	.05
55+92	1'	D 742-94	2.9	3.45	71	.05	12.0	12.0	87	.0	13.0	13.0	87	.0	11.3	11.3	111	.0
	Petroset AT 0.15gsy	Average	1.55	1.97	55	.06	9.14	9.75	110	.01	10.4	12.1	101	.04	10.2	11.4	111	.03
(8)		SS-1+H20 0.10gsy																
54+66	3'	A 742-95	11.0	11.0	128	.0	12.4	12.4	96	.0	13.9	15.4	118	.03	11.3	11.3	104	.0
53+47	8'	B 742-96	11.8	11.8	128	.0	13.8	14.1	112	.01	12.6	13.8	120	.03	12.9	12.9	115	.0
52+01	2'	C 742-97	12.5	12.5	131	.0	10.9	10.9	108	.0	14.0	14.0	79	.0	14.0	14.0	93	.0
49+71	8'	D 742-98	7.6	7.8	134	.01	6.6	6.6	125	.0	9.4	10.2	85	.02	11.1	11.1	93	.0
	SS-1 + 50% H_2O 0.10gsy	Average	10.7	10.8	130	.0	10.9	11.0	110	.0	12.5	13.4	100	.02	12.3	12.3	101	.0

* Microvis.=Microviscosity at 77F(results in megapoise);MD=Microductility at 77F;SS=Shear Susceptibility

Edwards Junction Test Section
Original cores-April 1974
(westbound shoulder)

TABLE E (continued)

Asphalt Core Slice Evaluation (Calif. Method 365A)
Recovered Asphalt Test Results (On 1/4" thick core slices from surface)

Core Location: Station	ft. from Edge Shlrd.	Treatment & Sample No.	0 to 1/4" depth: Microvis.* SR sec.$^{-1}$ .05	0 to 1/4" depth: Microvis.* SR sec.$^{-1}$ .001	0 to 1/4" depth: MD mm	0 to 1/4" depth: SS	3/8 to 5/8" depth: Microvis.* SR sec.$^{-1}$ .05	3/8 to 5/8" depth: Microvis.* SR sec.$^{-1}$ .001	3/8 to 5/8" depth: MD mm	3/8 to 5/8" depth: SS	3/4 to 1" depth: Microvis.* SR sec.$^{-1}$ .05	3/4 to 1" depth: Microvis.* SR sec.$^{-1}$ .001	3/4 to 1" depth: MD mm	3/4 to 1" depth: SS	1-1/8 to 1-3/8" depth: Microvis.* SR sec.$^{-1}$ .05	1-1/8 to 1-3/8" depth: Microvis.* SR sec.$^{-1}$ .001	1-1/8 to 1-3/8" depth: MD mm	1-1/8 to 1-3/8" depth: SS
(9)		Control (no treat.)																
47+55	6'	A 742-104	22.2	22.2	89	.0	13.0	16.0	107	.05	12.8	12.8	117	.0	13.0	13.2	116	.01
45+88	9'	B 742-105	19.2	21.8	109	.03	11.9	15.0	108	.06	13.0	13.0	132	.0	13.5	13.5	131	.0
28+20	3'	C 742-106	18.9	21.2	126	.03	14.2	14.2	98	.0	13.0	13.0	112	.0	14.5	25.0	79	.14
27+63	2'	D 742-107	14.0	14.0	94	.0	13.7	14.5	135	.02	14.5	14.5	107	.0	14.2	14.2	89	.0
	Control (no treatment)	Average	18.6	19.8	104	.01	13.2	14.9	112	.03	13.3	13.3	117	.0	13.8	16.5	104	.04
(10)		Astec P.S. 0.10gsy																
44+92	1'	A 742-108	49.0	65.0	5	.07	14.0	14.0	39	.0	13.3	13.3	81	.0	12.7	12.7	85	.0
44+39	4'	B 742-109	63.0	105.0	3	.13	13.5	13.5	84	.0	12.5	12.5	58	.0	13.0	13.0	66	.0
42+93	9'	C 742-110	27.5	37.0	16	.08	5.95	6.3	112	.02	7.0	7.0	99	.0	6.0	6.0	99	.0
41+32	2'	D 742-111	64.5	97.0	0	.10	12.0	12.0	66	.0	12.5	14.3	85	.03	13.0	13.0	53	.0
	Astec P.S. 0.10gsy	Average	51.0	76.0	6	.10	11.4	11.5	75	.0	11.3	11.8	81	.01	11.2	11.2	76	.0
(11)		Astec P.S. 0.15gsy																
38+93	1'	A 742-112	112.0	231.0	0	.19	15.8	15.8	89	.0	12.6	12.6	79	.0	12.6	12.6	58	.0
38+38	6'	B 742-113	70.5	106.0	7	.11	13.2	13.2	38	.0	14.0	16.0	91	.03	13.9	14.0	83	.0
38+20	2'	C 742-114	51.5	73.0	8	.09	13.2	13.2	69	.0	12.4	13.0	107	.01	13.5	13.5	91	.0
37+66	5'	D 742-115	75.0	117.0	6	.11	14.3	14.8	95	.0	13.1	13.1	74	.0	12.0	12.5	59	.01
	Astec P.S. 0.15gsy	Average	77.3	132.0	5	.12	14.1	14.2	73	.0	13.0	13.7	88	.01	13.0	13.2	73	.0
(12)		Gilsabind 0.15gsy																
29+34	7'	A 742-116	69.0	113.0	3	.13	14.3	14.3	65	.0	12.3	14.5	65	.04	12.5	13.8	61	.03
29+28	1'	B 742-117	49.0	79.5	7	.13	15.1	15.1	118	.0	12.8	12.8	37	.0	14.0	14.0	66	.0
28+70	6'	C 742-118	57.0	98.0	0	.14	13.9	13.9	84	.0	13.9	14.5	90	.01	11.9	12.0	71	.0
28+65	1'	D 742-119	64.0	115.0	0	.15	15.3	15.3	25	.0	14.5	14.5	80	.0	13.5	13.5	53	.0
	Gilsabind 0.15gsy	Average	59.8	101.0	2	.14	14.6	14.6	77	.0	13.4	14.1	68	.01	13.0	13.3	63	.01

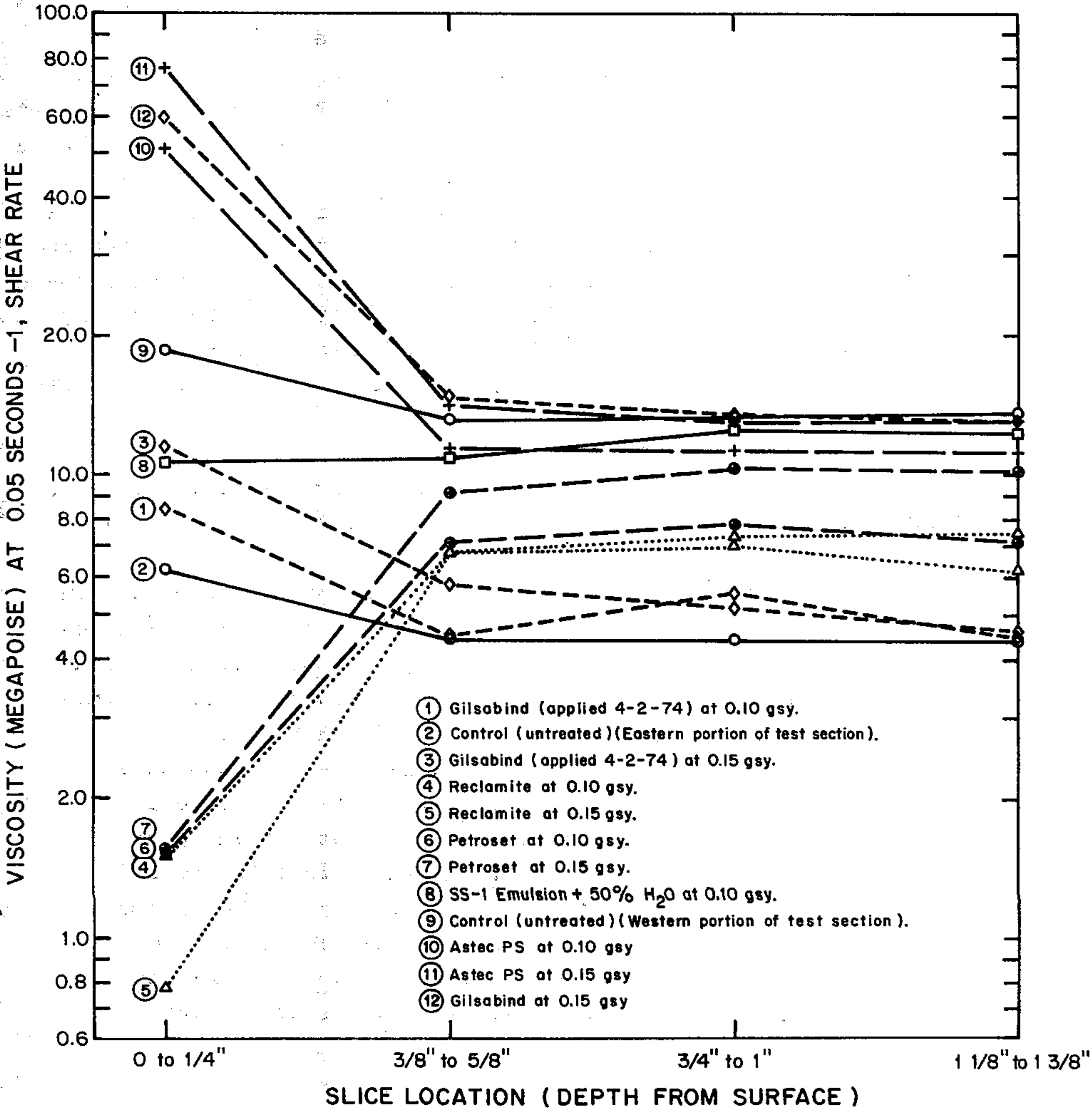
* Microvis.=Microviscosity at 77F (results in megapoise); MD=Microductility at 77F; SS=Shear Susceptibility

TEST DATA ANALYSIS

The test data from the Edwards Junction test section becomes more significant when compared to the data from the Copperopolis test section. An initial examination of the Edwards Junction test results from both the field and laboratory testing shows that although there are expected differences in the results from areas of different application rates of the same product, they still are quite similar and both follow the same trend. Figure 2 for the Skid Test Results and Figure 5 for the core slice results graphically illustrate these results. Test results from whole cores and from in-place testing of the two week old treated surfaces show a high degree of uniformity when comparing the air permeability and specific gravity results. The low water permeability results also indicate this general uniformity even though there are variations indicating that some of the products possibly seal the surface pores more effectively than others.

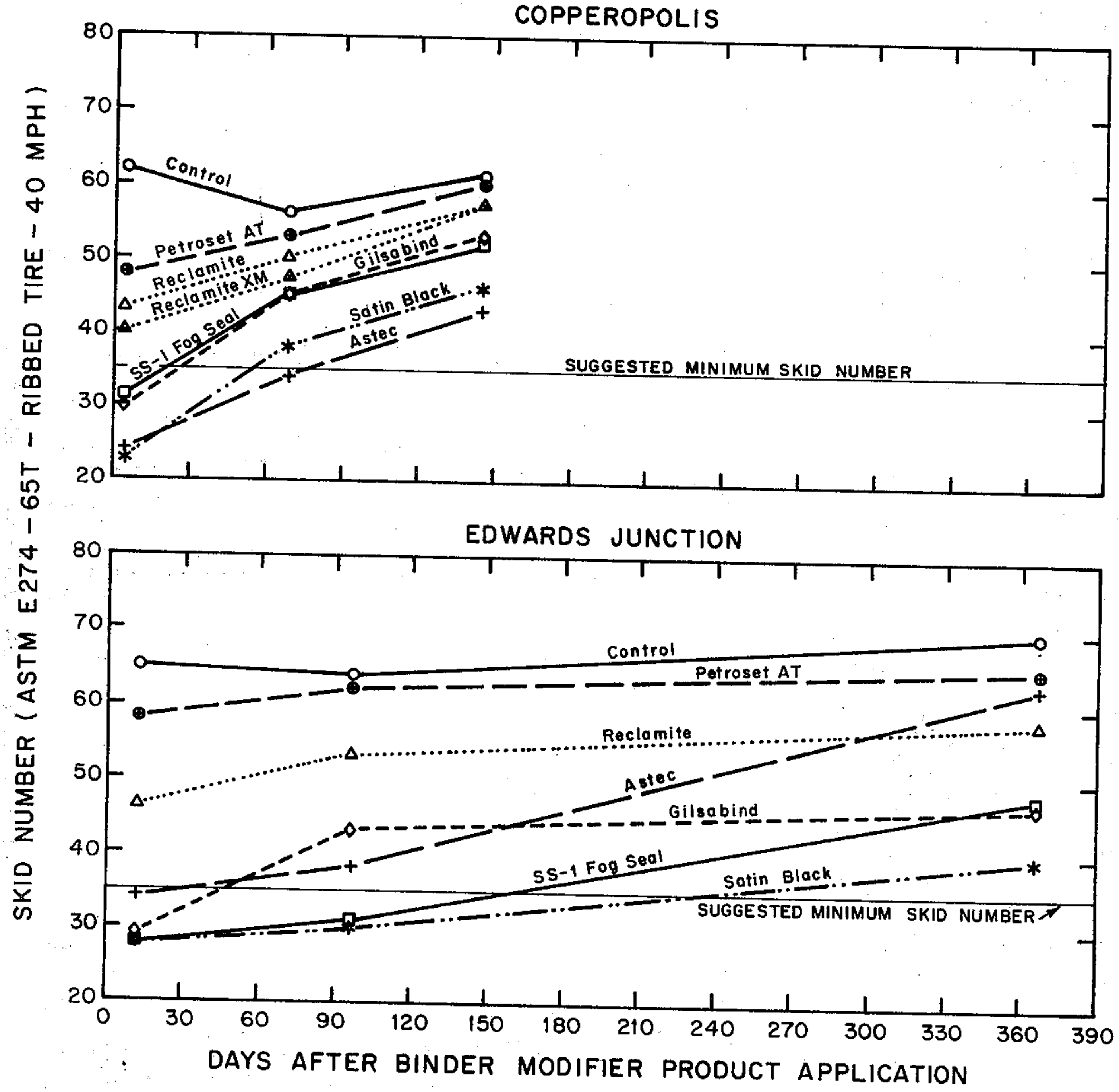
To compare the initial effects of the binder modifier products in the two test sections, combined test results are shown in Figures 6 and 7. For the sake of the comparison, the only results shown are those obtained for the same application rates. Tables F and G contain the numerical test results graphed on Figures 6 and 7. An examination of these graphs reveals that the products have produced similar effects upon the pavements of the two test sections regarding skid resistance and pavement hardening or softening with depth. The core slice results from the Edwards Junction test section indicate more variability of the pavement regarding uniformity and compaction. Indications of this are the variations in viscosity results from the control area in the east and west portions of the project. The Gilsabind sections also show this variation.

Figure 5



EDWARDS JUNCTION CORE SLICE RESULTS

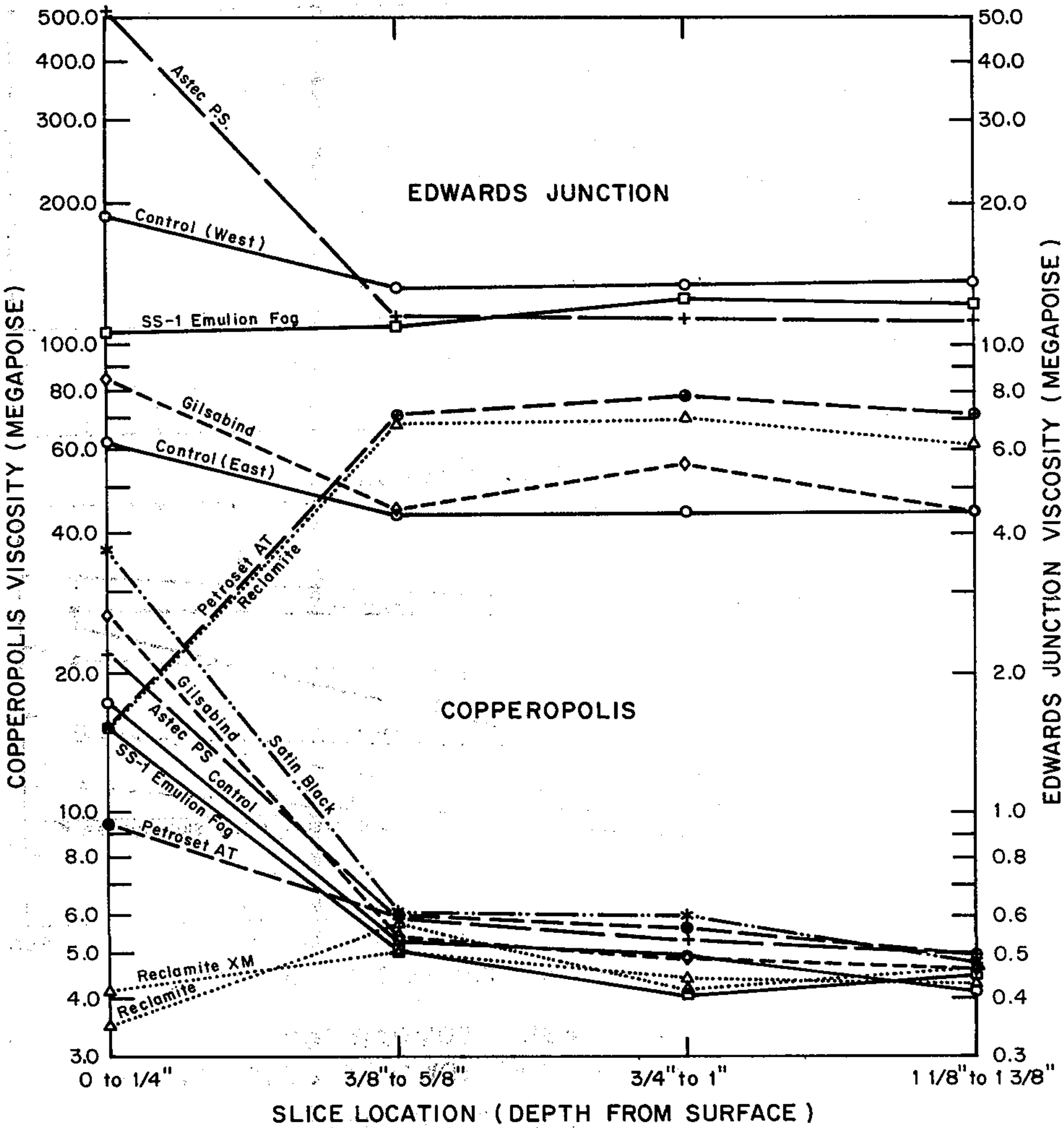
Figure 6



SKID NUMBER COMPARISON AT COPPEROPOLIS AND EDWARDS JUNCTION

(ALL PRODUCTS AT 0.10 GAL/YD²)

Figure 7



TEST RESULTS OF INITIAL CORING
(2 WEEKS AFTER APPLICATION)
(COMPARES PRODUCTS AT 0.10 gsy)

TABLE F

SKID TEST RESULTS FROM
THE COPPEROPOLIS AND EDWARDS JUNCTION
TEST SECTIONS
(used to prepare Figure 6)

Product (at 0.10 gal/yd^2)	(40 mph) Skid Numbers (ASTM E-274-65T)					
	Copperopolis*			Edwards Junction		
	after 4 days	after 69 days	after 146 days	after 12 days	after 96 days	after 366 days
Gilsabind	30	45	53	29	43	47
Astec P.S.	24	34	43	34	38	63
Satin Black	23	38	46	28	30	40
Petroset A.T.	48	53	60	58	62	65
Reclamite	43	50	57	46	53	58
Reclamite XM	40	47	57	--	--	--
SS-1 Fog Seal	31	45	52	28	31	48
Control (no treatment)	62	56	61	65	64	70

*Average of Eastbound and Westbound test results(1).

TABLE G

CORE SLICE TEST RESULTS FROM
THE COPPEROPOLIS AND EDWARDS JUNCTION
TEST SECTIONS
(Initial Coring - Results used to prepare report)

Test Section	Treatment (Quanity)	Micro-Viscosity at 0.05 sec^{-1} S.R. (megapoise)			
		0 to 1/4" depth	3/8 to 5/8" depth	3/4 to 1" depth	1 1/8 to 1 3/8" depth
Copperopolis	Gilsabind (0.10 gal/yd^2)	27.0	5.4	4.9	4.6
Edwards Junct (East Section)	"	8.5	4.5	5.6	4.5
Copperopolis	Astec P.S. (0.10 gal/yd^2)	22.5	5.8	5.3	4.9
Edwards Junct	"	51.0	11.4	11.3	11.2
Copperopolis	Petroset AT (0.10 gal/yd^2)	9.5	5.9	5.7	4.9
Edwards Junct	"	1.5	7.1	7.8	7.3
Copperopolis	Reclamite (0.10 gal/yd^2)	3.5	5.7	4.2	4.7
Edwards Junct	"	1.5	6.8	7.0	6.3
Copperopolis	SS-1 Fog Seal (0.10 gal/yd^2)	15.1	5.1	4.1	4.5
Edwards Junct	"	10.7	10.9	12.5	12.3
Copperopolis	Control (No treatment)	17.4	5.2	4.9	4.2
Edwards Junct	(East) "	6.2	4.4	4.5	4.4
"	(West) "	18.6	13.2	13.3	13.8

Another comparison which will be of interest is the effect of the binder modifier products upon pavements which are quite different as to their initial tightness or compaction. These variations are dramatized by difference in initial voids and usage of the pavement since the Edwards Junction section is part of the shoulder and the Copperopolis section is part of the traveled way.

The following table shows the difference in the original voids of the two sections.

TABLE H

COMPARISON OF ORIGINAL VOID CONTENT

	% Voids	
Product (0.10 gsy application)	Copperopolis	Edwards Junction
Gilsabind	5.8%	10.8%
Astec P.S.	6.2%	10.0%
Satin Black	7.0%	- - -
Petroset AT	7.8%	10.4%
Reclamite	7.8%	10.8%
SS-1 (Fog Seal)	5.8%	10.4%
Control	5.8%	10.2%

REFERENCES

1. Predoehl, N. H. and Kemp, G. R., Copperopolis Test Section, Binder Modifiers as Construction Seals, First Progress Report, CA-DOT-TL-3105-1-74-35, December 1974.

2. State of California, Department of Transportation Standard Specifications dated January, 1973.

TRANSPORTATION LABORATORY

State of California
Department of Transportation
Division of Highways

Test Method No. Calif. 365-A
October 7, 1974
(4 pages)

METHOD OF TEST FOR THE MICRO-RECOVERY OF ASPHALT FROM BITUMINOUS CORE SLICES AND SMALL SAMPLES OF LOOSE ASPHALT-AGGREGATE MIXTURES

SCOPE:

A rapid procedure using benzene to recover the asphalt from bituminous core slices and small samples of loose asphalt-aggregate mixtures is described in this test method.

Procedure:

A. Apparatus[1]

1. Glass Plates, of window glass 4 inches x 5 inches, free of scratches.

2. Flasks, Erlenmeyer design, 250 mls. capacity, of red low actinic glass.

3. Tube, pear shaped, 100 ml. capacity oil tubes.

4. Centrifuge, electric oil testing, International Model H, as designated in ASTM D-96 with 4 place head with Trunion rings and aluminum cups.

5. Evaporation Box, of metal with inlet tube entering on one end near bottom and outlet tube exiting near top on opposite end. It should be approximately 10 inches x 5 inches and 6 inches deep with a lid which is air tight when closed. It should contain a rack for holding the 4 inch x 5 inch glass plates in a vertical position baffling the flow of the nitrogen.

6. Flowmeter, capable of measuring a flow of 1500 ml. and 3000 ml. of nitrogen per minute.

7. Balance, at least 200 g. capacity accurate to 1 g.

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[1]Most of the apparatus is shown in Figures I and II.

8. Nitrogen bottle with pressure gauges.

9. Hammer or other battering instrument.

B. Materials

1. Razor blade, single edge type.

2. Solvent, Benzene.

3. Cork stoppers for 250 ml. Erlenmeyer flask and 100 ml. pear shaped tubes.

4. Hardwood applicators for spreading solution on evaporation plates.

C. Preparation of Sample

1. Prepare the bituminous core slices or loose asphalt-aggregate mix sample in the following manner before placing in 250 ml. (red low actinic glass) Erlenmeyer flasks.

a. If the sample is a bituminous core, saw or break the core into slices as desired to properly evaluate the core. (For a four inch core, the minimum thickness of a sawed slice should be approximately 1/4 inch to insure enough material. The saw will waste approximately 1/8 inch between slices.) Use a hammer to break the slices into small pieces. Weigh approximately 60 grams[2] of each slice into a 250 ml. (red low actinic glass) Erlenmeyer flask and stopper the flask.

b. If the sample is a loose asphalt-aggregate mixture, weigh approximately 60 grams[2] of the sample into a 250 ml. (red low actinic glass) Erlenmeyer flask and stopper the flask.

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[2] If the asphalt-aggregate mixtures have an asphalt content of approximately 5 to 6%, the 60 grams will provide a sufficient amount of recovered asphalt. Adjust the amount of sample used if the asphalt content varies substantially from the 5 to 6%.

2. Pour 30 ml. of benzene into the 250 ml. Erlenmeyer flask and let the contents soak for one hour. Agitate the flask approximately 6 times during the soaking period.

3. Decant the benzene-asphalt solution into a pear shaped 100 ml. tube and centrifuge for 20 minutes at about 400 g. The decanted solution will contain approximately 2.5 grams of asphalt. (There is some holdup of asphalt in the flask.)

4. Purge the evaporation box with 3000 ml. nitrogen per minute.

5. Pour a spot, about 2 inches in diameter, of the benzene-asphalt solution on a clean 4 inch x 5 inch glass evaporation plate. (See Figure III.) Spread the solution evenly on the plate with a hardwood applicator (See Figure IV); let set for 15 seconds, then place the plate immediately in the nitrogen evaporation box.

6. Continue with the nitrogen flow at 3000 ml./minute for 10 minutes after the evaporation box is loaded, then reduce the flow to 1500 ml./minute for an additional one hour and fifty minutes.

7. Remove the plates from the evaporation box as they are used and with a razor blade scrape all of the asphalt from all of the evaporation plates used for a sample (See Figure V). Divide the asphalt for testing (See Figure VI). (Three evaporation plates per sample will usually provide a sufficient amount of asphalt for micro-viscosity and micro-ductility testing.)

D. Testing and Reporting

1. Use the recovered asphalt to prepare test specimens within 30 minutes after removal from the evaporation plates.

2. Report the results of tests performed on the recovered asphalt as values representative of the asphalt in the parent asphalt-aggregate mix.

E. Precautions

1. Care should be taken that the solution be exposed to the air on the evaporation plates for exactly 15 seconds prior to placement in the evaporation box so that all plates will have the same film thickness and the effect of the drying in air will be the same.

2. All operations should be performed in subdued light as much as possible.

Hazards

Benzene used to dissolve the sample is a highly inflammable and explosive solvent. Also, the fumes and repeated body contact is dangerous since benzene is quite toxic; consequently, it should be used and kept under a well ventilated hood at all times.

REFERENCE

A California Method

ASTM D-96

End of Text on Calif. 365-A

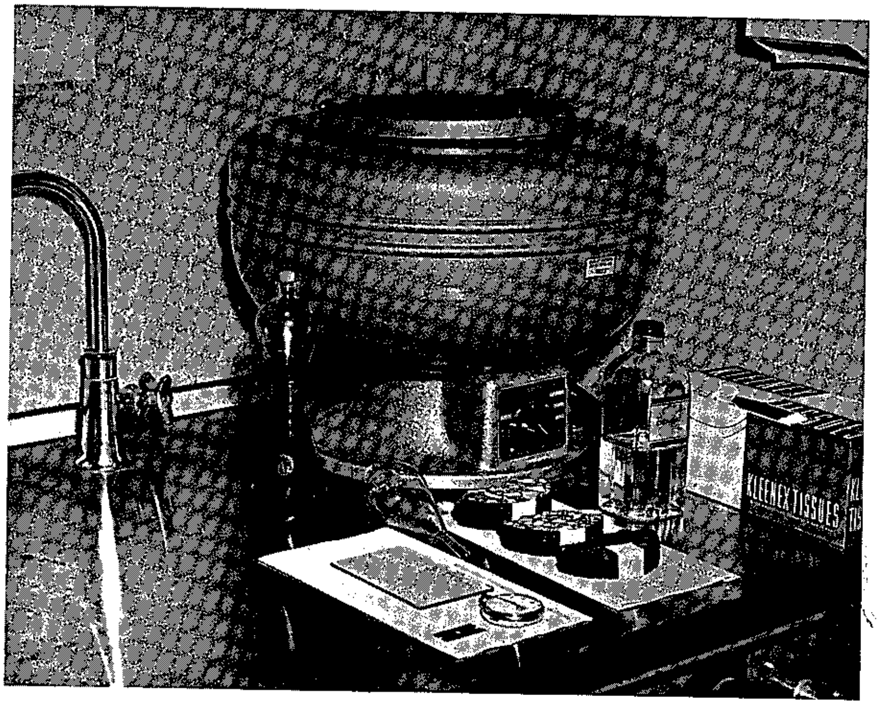

FIGURE I

APPARATUS FOR MICRORECOVERY OF ASPHALT MIXES

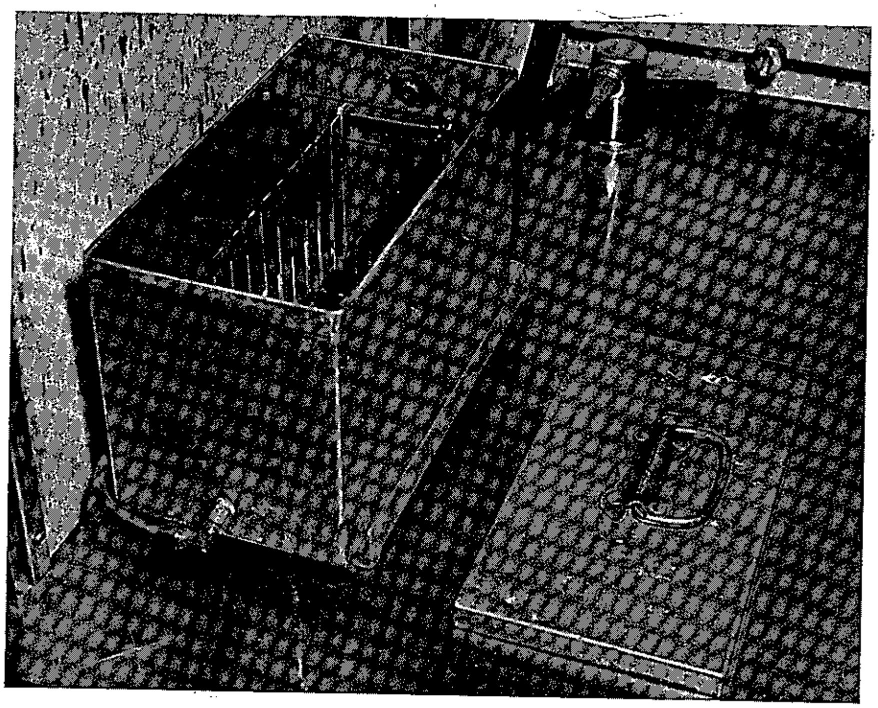

FIGURE II

EVAPORATION BOX WITH EVAPORATION PLATES

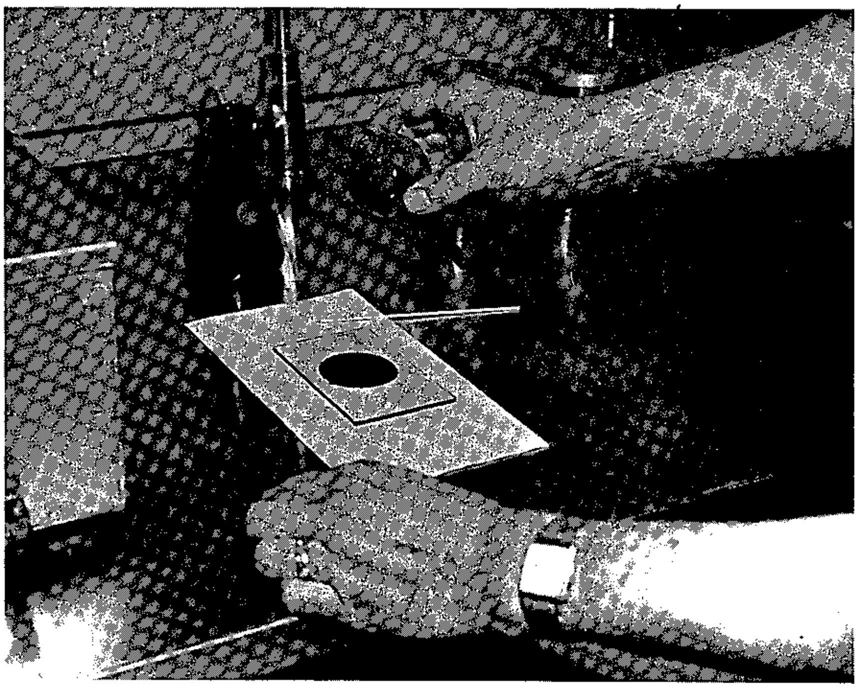

FIGURE III

TWO-INCH DROP OF ASPHALT-SOLVENT SOLUTION ON EVAPORATION PLATE

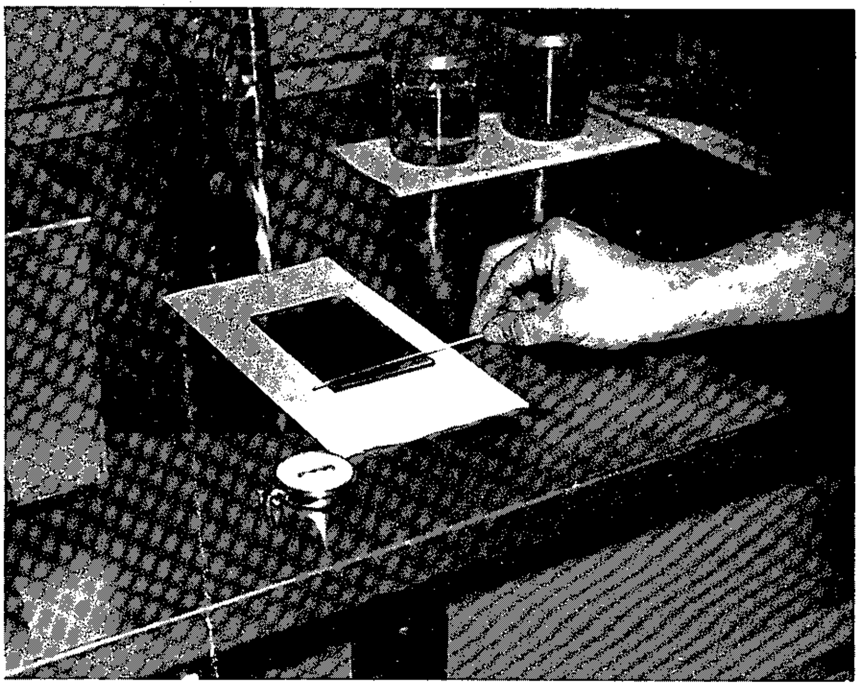

FIGURE IV

SPREADING SOLUTION ON EVAPORATION PLATE

FIGURE V

SCRAPING RECOVERED ASPHALT FROM EVAPORATION PLATE

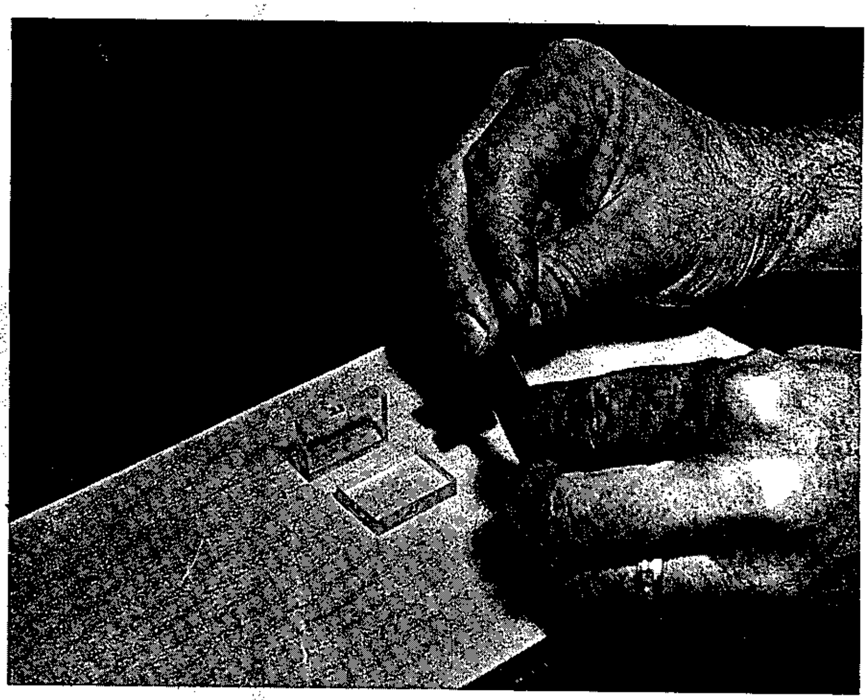

FIGURE VI

REMOVING RECCVERED ASPHALT FOR TESTING