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STATE OF CALIFORNIA
HIGHWAY TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PROGRESS REPORT OF TEST RESULTS ON SAMPLES TAKEN FROM SEAL COAT TEST SECTIONS

ROAD II-Imp.-III

66-45

JULY 1966

MATERIALS & RESEARCH DEPARTMENT

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State of California
Department of Public Works
Division of Highways
Materials and Research Department

July 22, 1966

M&R Project
19301-762400-33290

Mr. J. Dekema
District Engineer
District 11
P.O. Box 390
San Diego, California

Dear Sir:

Submitted for your consideration is:

PROGRESS REPORT

OF

TEST RESULTS ON SAMPLES

TAKEN FROM SEAL COAT

TEST SECTIONS ON ROAD

11-IMP-111 P.M. 1.2-9.7

Study made by . . . . . Pavement Section
Under general direction of. . . . . E. Zube
Work supervised by. . . . . J. Skog & G. Kemp
Report prepared by. . . . . G. Kemp

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

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SYNOPSIS

District 11 Maintenance Department placed, during the month of May 1966, four seal coat experimental test sections at six locations on Road 11-Imp-III P.M. 1.2-9.7, where extensive raveling was occurring on a recently completed contract (11-039314). The test sections, as shown in the report, were placed in order to evaluate the relative merits of a "Reclamite" treatment when compared with an emulsion seal, and combination fuel oil-diesel oil treatment. At each location an untreated section of pavement was left as a control. In addition to sealing the pavement the "Reclamite" treatment and diesel-fuel oil combination may also be considered as asphalt softening agents.

The Materials and Research Department was asked to perform the laboratory testing of cores obtained prior to, and at intervals after treatment in order to evaluate the relative merits of the various applications. This report is prepared mainly for conveying the test results obtained on the cores taken from the pavement before treatment.

The test data shows there are differences in asphalt hardening, at the various test sections, and this hardening is more than expected for such a new pavement. Section 2 had the hardest and most viscous asphalt and Section 4 had the softest or least viscous asphalt before treatment. Differences in asphalt hardness appear to be caused by asphalt content, void content, and possibly the grade of asphalt used during construction. The two grades of asphalt used were 60-70 and 85-100 penetration paving asphalt.

The test section will not only be valuable for evaluating the effects of the treatment applied, but will serve in some degree for evaluating the rate of asphalt hardening with depth and void content.

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INTRODUCTION

In a teletype from Mr. P. E. Ruplinger to Mr. E. Zube, dated April 22, 1966, and in a memorandum dated May 12, 1966, from Mr. P. E. Ruplinger to Mr. J. C. Womack, District 11 requested the services of the Materials and Research Department to perform tests on cores obtained from their initiated seal coat experimental project.

The test sections involved are on road 11-Imp-III P.M. 1.2-9.7, from Calexico to 7 miles north. This newly constructed pavement was showing extensive "raveling" and "Reclamite" was advocated as a corrective treatment. The district set up six experimental test sections to evaluate the relative merits of three methods of treatment which are as follows:

1. "Reclamite" Seal (0.10 gal./sq.yd.) 2 parts "Reclamite" with 1 part water.

2. Emulsion Seal (0.10 gal./sq.yd.) Mixing Emulsion (SS-1) cut back with 50% water.

3. Combination fuel oil and diesel fuel (0.75 gal./sq.yd.) 2 parts A.P.I. 20° fuel oil plus 1 part diesel fuel S.G. 0.84 at 60°F.

Each treatment was applied to a 100' long area (Fig I), covering all the southbound travel lane. A 100' long control section was left for comparison. The six test locations were located at post miles 2, 3, 4, 5, 6, and 7. According to the district, the remaining portion of pavement received "Reclamite" treatment applied at the rate of 0.1 gal./sq.yd.

Initial cores from the test sections were obtained on April 26, 1966 before any treatment was applied. Coring after treatment will be made some time in the spring of 1967 for evaluating the effect of the treatments applied.

The purpose of this report is to present the test results on the cores obtained prior to treatment.

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CONCLUSIONS

Because this report was mainly prepared for reporting the test results of the cores taken before treatment, no conclusions can be made on the relative merits of the treatments applied. The test results obtained on the cores taken from the six test locations indicate that the asphalt varies in consistency between each location with Section 2 having the hardest asphalt with a penetration of 21, and Section 4 having the softest asphalt with a penetration of 45. "Raveling" should be more extensive at Sections 2 and 3 because of the hardness of the asphalt. Recoveries on the core slices showed that the asphalt was hardest at the surface and gradually softened toward the bottom of the core. Section 4 which had the softest asphalt and the least air voids and lowest air permeability, did not show this effect as much as the other two sections.

Air permeability test results follow the general trend of the air voids with the cores having the highest air voids showing the highest air permeability.

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TEST RESULTS AND DISCUSSION

This discussion of the test results involves test data obtained on cores taken before any treatment was applied. The tests performed were stability, cohesion, air permeability, specific gravity (for calculating air voids), % asphalt, and tests on the recovered asphalt both from the whole core and individual 1/2" slices from top to bottom. Results of the various tests are shown in Tables A and B.

Stability

The stabilities obtained on cores from each test location are low from a design standpoint. However, these are typical of stabilities obtained from field cores where the roadway has been under traffic for only a short period of time. Stabilities generally increase as the density of the pavement increases and approaches design density.

Cohesion

In general the cohesion results follow the pattern of the asphalt hardness with the highest cohesion obtained on the core from the section with the hardest asphalt and the lowest cohesion from the softest asphalt section.

Air Permeability and % Air Voids

The air permeability test results were quite variable ranging from 39-500 Mls/min., and fall generally in line with the percent of air voids. Asphalt hardening, which appears to be quite rapid,was aggrevated by the high void content and high permeability.

Extraction Results (%Asphalt)

There was a 1% difference between sections with the highest and lowest asphalt content. Section 4 had the highest asphalt content and the lowest % air voids with the lowest air permeability. Also the recovered asphalt was the softest from this section.

Recovered Asphalt Test Results

The recovered asphalt is considerably harder than normal for such a newly placed pavement, (approximately 4 months old). The recovered asphalt from Sections 2 and 3 is approaching a critical state with penetrations of 21 and 22 and relatively low ductilities. Section 4 has the highest penetration or the softest asphalt of all the sections tested and is more in line with expected asphalt consistency. Job records,

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(Contract 11-039314) show that two different grades were used on the project, 60-70 and 85-100 penetration paving asphalt. However, our records did not contain the job diaries, and it was, therefore, impossible to determine the exact location in the pavement where each grade was used. It is suspected that 85-100 grade was used at Section 4.

Asphalt hardness (viscosity in megapoise) in depth, as shown in Table B and Figure 2 for Sections 1 and 3, shows the hardest asphalt is near the surface with a gradual softening toward the bottom. Section 4 did not show this characteristic as much and had the softest asphalt of all the sections.

The other three sections (2, 5 and 6) were not tested for depth hardening because of high costs involved for this type of testing and the three sections tested were sufficient to show the general asphalt hardening trend.

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TABLE A

CORE SAMPLE TEST RESULTS

Road 11-Imp-III-1.2-9.6 Seal Coat Test Sections

Sample No	Station	Lane	Location in Lane	Treatment Planned	Core Ht.	Air Perm Mls/Min at 1" Vac	Wax Sp.Gr.	Theo. Max. Sp.Gr.	% Air Voids	Stab. 140°F	Cohes. 140°F	% Asph.	Recovered Asph Abson Method Pen.at 77°F	Recovered Asph Abson Method Duct.at 77°F cm
Section I P.M. 7.00														
31083	197' South	SB#2	OWT	Emulsion	0.27									
31062	297' South	SB#2	OWT	Control	0.29	500	2.15	2.44	11.9	20	130	4.7	27	100+
31071	397' South	SB#2	OWT	Fuel & Diesel Oil	0.27									
31077	497' South	SB#2	OWT	Reclamite	0.29									
Section II P.M. 6.00														
31132	197' South	SB#2	OWT	Emulsion	0.33									
31063	297' South	SB#2	OWT	Control	0.33	250	2.18	2.44	10.7	18	150	4.6	21	13
31078	397' South	SB#2	OWT	Fuel & Diesel Oil	0.33									
31084	497' South	SB#2	OWT	Reclamite	0.32									
Section III P.M. 5.00														
31082	197' South	SB#2	OWT	Emulsion	0.35									
31087	297' South	SB#2	OWT	Control	0.30	500	2.18	2.46	11.4	20	147	4.2	22	26
31070	397' South	SB#2	OWT	Fuel & Diesel Oil	0.31									
31074	497' South	SB#2	OWT	Reclamite	0.31									
Section IV P.M. 4.00														
31076	197' South	SB#2	OWT	Emulsion	0.32									
31085	297' South	SB#2	OWT	Control	0.29	39	2.26	2.43	7.0	21	85	5.2	45	100
31081	397' South	SB#2	OWT	Fuel & Diesel Oil	0.30									
31080	497' South	SB#2	OWT	Reclamite	0.30									
Section V P.M. 3.00														
31075	197' South	SB#2	OWT	Emulsion	0.29									
31088	297' South	SB#2	OWT	Control	0.31	59	2.20	2.45	10.2	20	110	4.6	28	75
31072	397' South	SB#2	OWT	Fuel & Diesel Oil	0.28									
31069	497' South	SB#2	OWT	Reclamite	0.30									
Section VI P.M. 2.00														
31079	197' South	SB#2	OWT	Emulsion	0.30									
31089	297' South	SB#2	OWT	Control	0.30	125	2.23	2.43	8.2	21	90	4.8	35	100+
31073	397' South	SB#2	OWT	Fuel & Diesel Oil	0.31									
31068	497' South	SB#2	OWT	Reclamite	0.29									

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TABLE B

CORE SAMPLE TEST RESULTS

Road 11-Imp-111-1.2-9.6 Seal Coat Test Sections
Test Results on Recovered Asphalt

Sample No	Station	Lane	Location in Lane	Treatment Planned	Top 0"- 1/2" Viscosity Megapoise .05	Top 0"- 1/2" Viscosity Megapoise .001	Top 0"- 1/2" Micro Duct MM	5/8" - 1-1/8" Viscosity Megapoise .05	5/8" - 1-1/8" Viscosity Megapoise .001	5/8" - 1-1/8" Micro Duct MM	1-1/4" - 1-3/4" Viscosity Megapoise .05	1-1/4" - 1-3/4" Viscosity Megapoise .001	1-1/4" - 1-3/4" Micro Duct MM	1-7/8" - 2-3/8" Viscosity Megapoise .05	1-7/8" - 2-3/8" Viscosity Megapoise .001	1-7/8" - 2-3/8" Micro Duct MM	2-1/2" - 3" Viscosity Megapoise .05	2-1/2" - 3" Viscosity Megapoise .001	2-1/2" - 3" Micro Duct MM
Section I P.M. 7.00																			
31083	197'South	SB#2	OWT	Emulsion	51.0	139.0	4	25.5	55.0	8	27.2	58.5	10	13.6	21.0	34	14.2	22.7	27
31062	297'South	SB#2	OWT	Control	47.0	138.0	2	34.7	65.5	6	30.5	63.0	10	23.4	58.0	10	14.2	20.9	27
31071	397'South	SB#2	OWT	Fuel & Diesel Oil	45.5	125.0	4	30.3	67.0	4	33.3	81.0	9	17.4	30.7	13	16.2	26.7	25
31077	497'South	SB#2	OWT	Reclamite	38.3	114.0	4	34.7	68.5	8	34.5	85.0	7	17.9	29.0	16	17.2	30.8	19
				Average	44.6	126.0	4	31.3	64.0	7	31.4	71.9	9	18.5	34.7	18	15.5	25.3	25
Section III P.M.5.00																			
31082	197'South	SB#2	OWT	Emulsion	60.5	195.0	3	47.0	128.0	1	38.3	108.0	7	33.9	102.0	6	21.7	48.0	13
31087	297'South	SB#2	OWT	Control	72.5	206.0	1	50.5	134.0	5	42.5	135.0	8	29.5	83.0	7	23.0	55.0	8
31070	397'South	SB#2	OWT	Fuel & Diesel Oil	74.5	262.0	2	51.0	165.0	4	34.8	90.0	5	29.0	67.5	10	23.4	52.0	10
31074	497'South	SB#2	OWT	Reclamite	69.0	226.0	1	49.5	165.0	5	44.5	104.0	4	34.0	94.0	3	22.0	37.3	11
				Average	69.1	222.3	2	49.5	148.0	4	40.0	109.2	6	31.6	86.6	7	22.5	48.1	11
Section IV P.M. 4.00																			
31076	197'South	SB#2	OWT	Emulsion	8.05	11.7	43	6.1	6.45	52	4.7	6.2	60	4.85	6.1	92	5.25	6.40	68
31085	297'South	SB#2	OWT	Control	7.1	7.9	47	5.7	7.25	45	5.0	6.2	59	5.2	5.6	80	6.1	7.5	88
31081	397'South	SB#2	OWT	Fuel & Diesel Oil	6.65	7.05	37	4.6	5.95	40	5.15	6.15	72	4.9	5.1	96	4.6	5.2	79
31080	497'South	SB#2	OWT	Reclamite	6.45	10.2	35	5.75	8.9	50	5.4	6.5	58	4.9	7.75	71	4.8	6.05	105
				Average	7.04	9.21	41	5.54	7.14	47	5.06	6.26	62	4.96	6.14	85	5.19	6.29	85

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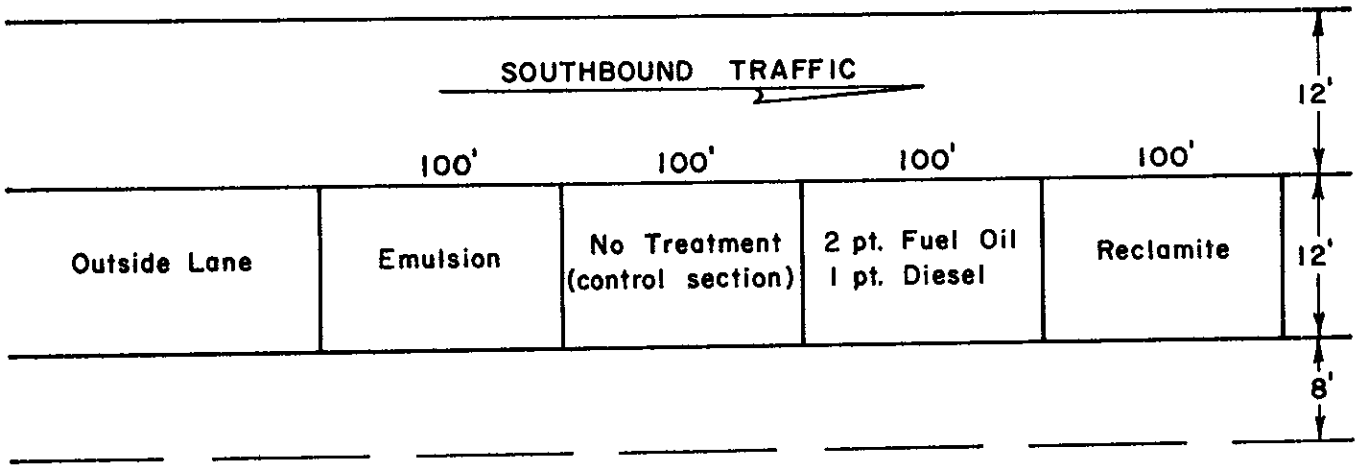

FIGURE 1

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ASPHALT VISCOSITY - CORE DEPTH RELATIONSHIP

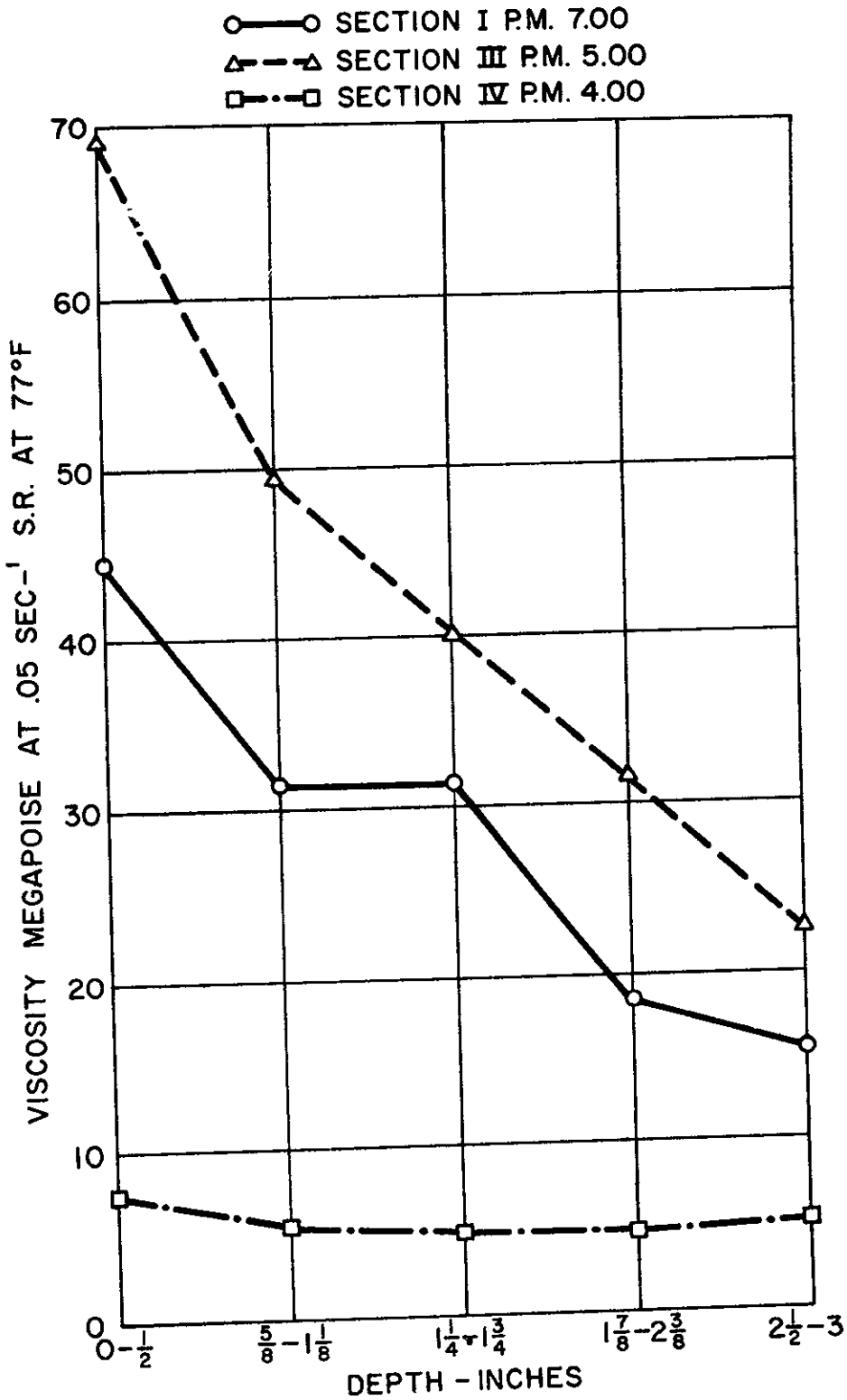

FIGURE 2

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