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HIGHWAY RESEARCH REPORT

EXPERIMENT TION

67-58

September, 1967

STATE OF CALIFORNIA

TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

NO. M & R 643229

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STATE OF CALIFORNIA—TRANSPORTATION AGENCY

RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

September 1967

Interim Report
M&R No. 643229

Mr. J. A. Legarra
State Highway Engineer

Dear Sir:

Submitted herewith is a research report titled:

EXPERIMENTAL ASPHALT TEST SECTION

ROAD 04-CC-4-4.4/9.8

Ernest Zube
Principal Investigator

John B. Skog and Glenn R. Kemp
Co-Investigators

Assisted By

Gene S. Stucky

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

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REFERENCE: Zube, E.; Skog, J. B., and Kemp, G. R., "Experimental Asphalt Test Section Road 04-CC-4-4.4/9.8", State of California, Department of Public Works, Division of Highways, Materials and Research Department, Research Report 643229, September 1967.

ABSTRACT: The primary purpose of this research project is to determine the durability of the 1965 Tentative Specification paving asphalt in terms of service life. It will take a period of time to draw any positive conclusions concerning the asphalt.

We have observed from preliminary tests involving both the new and control asphalts, that the new product should prove more durable. There were no difficulties encountered during either the placement of the asphalt mixture or during the preliminary tests.

KEY WORDS: Testing, asphalts, asphalt pavements, durability, laboratory studies, field performance, field tests, test sections, construction methods, pavements, asphalt tests.

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INTRODUCTION

The purpose of this project was to incorporate approximately 150 tons of the new 1965 Tentative Specification paving asphalt into the paving mixture used on Contract 04-120224, Road 04-CC-4-4.4/9.8. The Chevron Asphalt Company produced the 150 tons of material. This quantity permitted the paving of approximately 9,300' of the surface course in the westbound travel and passing lanes between Stations 284+25 and 377+25. A control section for comparison of rolling and "setting" properties and for future coring was established in the westbound travel and passing lanes between Stations 377+25 and 405+75. The control section contained the contract asphalt which was Standard Specification 85-100 grade produced by Douglas Oil Company.

Both asphalt test sections were laid by Standard Specification procedures except for some low mix temperatures causing some rolling difficulties. The "setting" quality of paving mixtures prepared from both asphalts was satisfactory.

The test sections as placed should provide valuable future information on the weathering rates of the two asphalts since the durability test indicates wide differences for this property.

The purpose of this report is to present observations and field test results during construction of the test sections together with laboratory studies on the original asphalts, field mix samples, and cores removed from the pavement shortly after construction.

CONCLUSIONS

The 1965 Tentative Specification experimental asphalt provided a paving mixture on this project which was satisfactory in every respect and had good "setting" and rolling characteristics. Evaluation of the durability aspects of this asphalt in relation to field performance will, of course, follow at a later date.

CONSTRUCTION OF TEST SECTIONS

Asphalt concrete paving on this project consisted of 0.33' Type "A" AC surface over 0.25' Type "A" AC base. The experimental asphalt was used in the 0.17'

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Type "A" AC surface course of the westbound travel and passing lanes between Stations 284+25 and 377+25. The intended asphalt content of the mix was 5.0%, the same as used for the contract.

In order to compare the rolling and "setting" properties of the experimental asphalt, a control section was established in the westbound travel and passing lanes between Stations 377+25 and 405+75. The control section contains the contract asphalt which is Standard Specification 85-100 grade from Douglas Oil Company.

Paving operations using the experimental and control asphalts were performed on September 6 and 7, 1966. Weather conditions were not the best with cool days and a strong breeze.

The paving mixture was produced in a Standard paving plant with a 6000# mixer. Arrangements were made at the plant to use a spare paving asphalt storage tank with special feed lines for handling the experimental asphalt. This arrangement prevented possible contamination, and caused no delays in the contractor's paving operations.

The mixture was placed on the roadbed with bottom-dump trucks and spread with a Cedarapids Paver. The rolling on the project was accomplished with a 12-ton steel wheel roller for breakdown, a pneumatic with tire pressure of 90 psi for intermediate rolling, and an 8-ton steel wheel roller for finish operations. Average rolling temperatures were as follows:

Asphalt Test Section	Breakdown	Pneumatic
Experimental Asphalt	188°F	124°F
Control 85-100 Grade Asphalt	206°F	158°F

The breakdown roller followed directly behind the paver. The pneumatic and final rolling was being performed by one operator for a time which caused quite a lag in the pneumatic and final rolling. There were no "setting" problems with either asphalt; however, rolling temperatures were generally on the low side. This fact may have contributed toward the high permeabilities encountered on the project.

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FIELD AND LABORATORY TEST RESULTS

Water permeability tests were performed on both test sections 24 hours after completion of paving. The average results are shown below:

Asphalt Test Section	Permeability Results 24 Hours after Paving, Mls/Min
Experimental Asphalt	444 and 603
Douglas 85-100 Control	551

The permeability results for both test sections are well above the 150 ml./min. tentative maximum requirement for measurements after 24 hours.

Asphalt concrete mix samples were obtained at the plant and the normal routine tests performed. Abson Recoveries were also performed and various tests on the asphalt were made. The average results are shown in the tables below:

Average Paving Mixture Test Results

Asphalt Tested	Stab.	Cohesion	Asphalt Content	Grading 3/4"	3/8"	#4	#8	#30	#200
Experimental	42	277	5.5%	100	73	48	33	21	4
Douglas Control	43	228	5.3%	100	68	49	33	22	5

Average Recovered Asphalt Properties

Asphalt Tested	Plant Mix Temp.	Pen. 77°F	S.P. °F	Duct 77°F 5cm/min	Viscosity 140°F Poises	275°F Centistoke
Experimental	290°F	53	126°F	100+cm	4184	470
Douglas Control	307°F	54	122°F	100+cm	2462	363

Four inch diameter cores were removed from each test section shortly after construction and laboratory tests were performed. The average laboratory test results on these cores are shown below:

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Average Laboratory Test Results on 4" Cores

Asphalt Tested	Air Permeability, mls/min		Percentage of air voids	
	Complete Core	Top 2" Surface Course	Complete Core	Top 2" Surface Course
Experimental	71	927	6.1%	10.3%
Douglas Control	126	463	7.1%	8.7%

There is some difference in the percentage of air voids and in the air permeability of the sections. In each case the experimental section is more open than the control section and should therefore be exposed to more severe conditions. The experimental asphalt was actually used only in the surface course and that is where the greatest difference arises in these tested properties. Because of this difference, an excellent comparison of future weathering should be possible.

The test properties of the experimental and control asphalts are compared with the 1965 Tentative Specifications below. The Douglas 85-100 grade control asphalt was manufactured to comply with the 1964 Standard Specifications.

Asphalt Test	Specification Requirements	Experimental Asphalt	Douglas Control Asphalt
Flash Point, P.M.C.T. °F min.	450	440*	445
Penetration of Original Sample at 77°F	---	85	85
Stain Number of Original Sample. Max. After 120 Hrs. -140°F-50#/sq.in.	10	4.5	4.0
Rolling Thin Film Test 325°F -75 min.:			
Viscosity, Residue-140°F, Poises	4000-6000	3878*	2257.4
Viscosity, Residue-275°F, Centistokes	425-800	465	330
Duct., Residue, 77°F, Minimum	75	100+	100+

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Durability Test - Viscosity of Residue After Durability Test, Megapoises at 77°F:			
Shear Rate 0.05 $sec.^{-1}$ Max.	25	29*	40.5
Shear Rate 0.001 sec^{-1} Max.	60	54	98.0
Micro-duct. of Residue 1/2cm/min. Min., mm	10	12	2
Solubility, $CC/_4$, Orig. Sample % Min.	99	99.9	99.9

*Did not meet specification requirements.

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