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

EXPERIMENTAL ASPHALT TEST SECTION

ROAD 03-Sac, ED-50

AUGUST 1966

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

August 24, 1966

Lab. Auth. No. 643229

Mr. J. C. Womack
State Highway Engineer
Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is:

A

PROGRESS REPORT

ON

CONSTRUCTION OF THE EXPERIMENTAL

ASPHALT TEST SECTION NEAR EL

DORADO HILLS ON HIGHWAY 50

EAST OF SACRAMENTO, CALIFORNIA

TOGETHER WITH RELATED FIELD

AND LABORATORY STUDIES.

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

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SYNOPSIS

Approximately 50 tons of our new 1965 Tentative Specification paving asphalt was used in the paving mixture on Contract 65-3T13C074024, Road 03-Sac,ED-50.

There were no problems during mixing or paving operations and the "setting" of the paving mixture was good during warm weather conditions.

Special studies were performed to determine the effectiveness of high-temperature pneumatic rolling following steel wheel breakdown in reducing water permeability and increasing density. Trials were performed on two different test sections containing the experimental asphalt and a Standard Specification 85-100 grade paving asphalt. Different temperatures and coverages were used, holding the steel wheel breakdown and finish rolling patterns constant. The results indicate that, for the paving mixture used on this project, high-temperature intermediate pneumatic rolling will decrease the permeability, but will not increase the density beyond that found using Standard Specification rolling requirements.

High-temperature pneumatic rolling requires a good release agent for aiding in preventing tire pickup and excellent spraying and wiping equipment for the tires.

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INTRODUCTION

The primary purpose of this project was to incorporate approximately 50 tons of the new 1965 Tentative Specification paving asphalt into the paving mixture used on Contract 65-3T13C074024, Road 03-Sac,ED-50. The Chevron Asphalt Co. produced the 50 tons of material. This quantity permitted the paving of approximately 1700' of surface and level course in the W.B. travel and passing lanes between Stations 61 and 78.

The Chevron Research Company has recently developed a release agent for preventing sticking of asphalt concrete to cold pneumatic compactor tires at high pavement temperatures (250°-275°F.). In a report on high-temperature pneumatic compaction(1), R. J. Schmidt and Associates showed a definite increase in density when pneumatic rolling, following steel wheel breakdown rolling, was performed at high temperatures (195-220°F.). Pneumatic rolling was possible at these temperatures because the tires were lubricated with water containing three percent of the release agent. On the basis of these studies, it was decided to perform rolling trials on this project using the special asphalt and the Standard Specification asphalt control test sections.

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.

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CONCLUSIONS

A paving grade asphalt conforming to the 1965 Tentative Specification produced a uniformly coated paving mixture. The mixture was laid without encountering any "setting" problems during warm weather.

On this project, high-temperature pneumatic rolling following steel wheel breakdown rolling, provided lower water permeability results than the Specification rolling procedure, but did not increase the density of the pavement. High-temperature pneumatic rolling requires good equipment for wiping the tires, and excellent spray nozzles that will insure complete coverage of the tire with a water-release agent blend.

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CONSTRUCTION OF TEST SECTIONS

Asphalt concrete paving on this project consisted of 0.25' AC base, 0.33' AC surfacing, and 0.05' open graded AC. The experimental asphalt was used in the two 2" surface courses of the W.B. travel and passing lanes between Stations 61 and 78. The paving mixture was a Type B - 3/4" maximum mixture specified for the project. The asphalt content was 5.1%, the same as used for the level and surface courses on the project.

In order to compare the rolling and "setting" properties of the experimental asphalt, a control section was established in the W.B. travel and passing lanes between Stations 181 and 202. The project asphalt was a Standard Specification 85-100 grade produced by Shell Oil Co.

Paving operations using the experimental asphalt were performed on August 2, 1965. The control section was paved on August 16-17, 1965. Weather conditions were excellent on the three paving dates with warm, dry weather.

The paving mixture was produced in a modern commercial batch plant of Pacific Coast Aggregates at Fair Oaks. Arrangements were made at the plant to use the individual truckloads of the experimental asphalt as storage units. 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 Hyster of 25-ton capacity for pneumatic rolling, and a 12-ton steel wheel roller for finish operations. During normal operations, the tires of the pneumatic were warmed up by repeated rolling over approximately 500-800 feet of the initial paving in the morning. There was considerable sticking during this operation and the surface was quite spotted with material wiped from the tires. However, after finish rolling, the surface appeared normal. After this heating period, there was little or no sticking during the balance of the day's operations.

In order to study the effect of high-temperature pneumatic rolling together with the use of a release agent, the following rolling patterns were followed in the experimental and control test sections. Breakdown and finish rolling was the same throughout the test sections. The variation was in the amount of coverages and temperature during pneumatic rolling. The release agent was used at the rate of 3 gallons per 100 gallons of water. The following patterns were performed on both the level and surface courses:

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EXPERIMENTAL ASPHALT			
Location		Pneumatic Rolling	
Station	Lane	Number of Coverages	Temperature Range, °F.
71+50 - 78	W.B. Travel	None	--
66+50 - 71+50	W.B. Travel	3	L=145-150 S=175-180
61+00 - 64+00	W.B. Travel	9	L=165-210 S=190-200

The control (Shell asphalt) section was rolled in the same manner except that three coverages were made in one section at high temperature. The temperature ranges for all sections were approximately the same as the equivalent experimental asphalt sections. The test section locations are shown in Figure 1.

At the start of these trials, problems were encountered from failure of the spray system to cover the tire surface with the release agent. Serious sticking at elevated temperatures was found whenever the tire was not properly wetted. Following adjustment of the coco mats and installation of new nozzles, the sticking problem was virtually eliminated. It should be stressed that future use of high temperature intermediate pneumatic rolling using a release agent must be performed with rollers having well adjusted mats and an excellent spray system for wetting the tire surface.

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FIELD AND LABORATORY TEST RESULTS

In order to determine the effectiveness of high temperature pneumatic rolling, water permeability measurements were performed and cores were removed from the sections for density determinations. The average water permeability results are shown below. The measurments were made on the surface course 24 hours after completion of paving.

Asphalt	Pneumatic Rolling		Average Water Permeability Ml./Min.
	Number of Coverages	Temperature °F	
Experimental	None	--	141
Shell Control	None		239
Experimental	3	Normal 160±	127
Shell Control	3		256
Shell Control	3	High 190±	169
Experimental	9	High 190±	65
Shell Control	9		120

The results indicate that high temperature pneumatic rolling will decrease the water permeability. However, the asphalt source appears to be an important parameter. Further field trials will be required.

A series of 4" cores was removed from each section and density determinations were performed. The average results for the surface and level courses are shown below.

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Asphalt	Pneumatic Rolling		Density lb./cu.ft.
	Number of Coverages	Temperature °F.	
Experimental	None	--	149.6
Shell Control	None		148.0
Experimental	3	Normal 160±	149.5
Shell Control	3		148.2
Shell Control	3	High 190±	148.2
Experimental	9	High 190±	150.2
Shell Control	9		150.0

The results indicate no significant change in density by any form of pneumatic rolling in either test section. Nuclear density measurements also confirmed the results. These findings are contrary to those reported by Schmidt[1] on a Contra Costa County project where definite increases in density were attained by high-temperature pneumatic rolling. There is a possibility that the breakdown rolling operation was more efficient on this project than on the Contra Costa County trials.

Asphalt concrete mix samples were obtained at the plant and the normal 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	Stab.	Cohesion	Asphalt Content	Grading					
				3/4"	3/8"	#4	#8	#30	#200
Experimental	41	309	5.1	98	61	47	34	19	7
Shell Control	40	254	5.1	99	66	49	37	20	6

Average Recovered Asphalt Properties

Asphalt	Mix Temp. Plant	Pen. 77°F.	S.P. °F.	Ductility 77°F. 5 cm./min.	Viscosity	
					140°F. Poises	275°F. Centistokes
Experimental	302	54	126	100+	4319	496
Shell Control	311	54	124	100+	4568	510

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The average recovered asphalt properties indicate that both asphalts should have good "setting" properties and this was confirmed during paving operations under warm weather conditions. The paving mix containing both asphalts did not present any problems during rolling and appeared to have good "set" after 24 hours.

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

Test	Spec. Requirements	Experimental Asphalt	Shell Control Asphalt
Flash Point, P.M.C.T. °F.Min	475	500	455
Penetration of Orig. Sample at 77°F.	--	75	93
Stain Number of Original Sample. Max. After 120 Hrs.-140°F.-50#/sq.in.	10	6	6
Rolling Thin Film Test 325°F., 75 Min.			
Viscosity, Residue 140°F., Poises	4000-6000	4060	3829
275°F., Centistokes	425-800	467	466
Duct., Residue, 77°F., Min.	75	100+	100+
Durability Test			
Viscosity of Residue after Durability Test, Megapoises at 77°F			
Shear Rate 0.05 Sec-1 Max.	25	26	45
Shear Rate 0.001 Sec -1 Max	60	45	160
Micro Ductility of Residue 1/2 cm./min. Minimum, mm	10	21	4
Solubility, CC/4, Original Sample, % Min.	99	99.9	99.9

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The experimental asphalt was slightly high in durability residue viscosity at 0.05 Sec^{-1} shear rate. However, the material complied with all other requirements. The Shell control material should furnish an important comparison material for future evaluation of durability properties of the 1965 tentative specifications for paving asphalts.

REFERENCE

(1) R. J. Schmidt, L. E. Santucci, and W. A. Garrison, "High Temperature Pneumatic Compaction," Highway Research Board Meeting, January, 1966.

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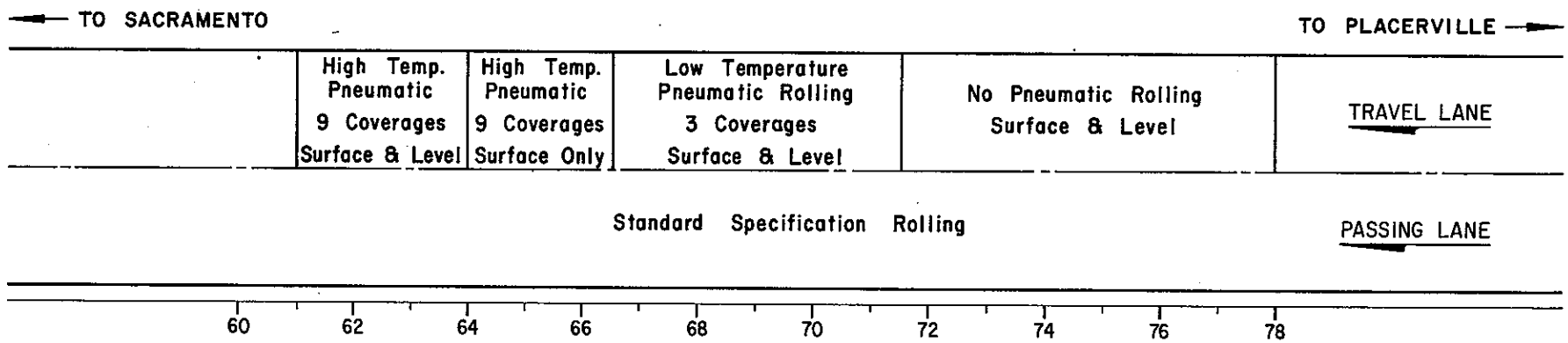
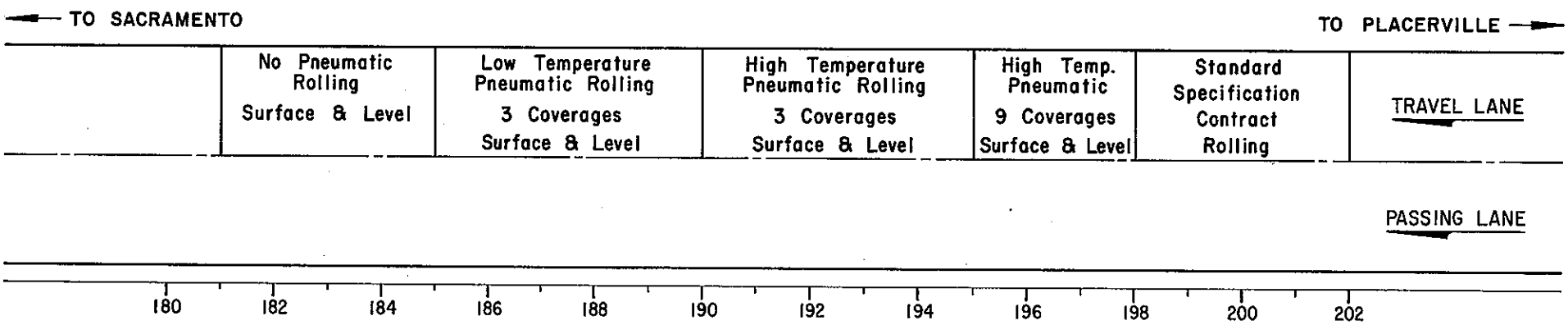
PNEUMATIC ROLLING TEST SECTIONS

CONTRACT 03-074034
ROAD 03-Sac, ED-50



EXPERIMENTAL ASPHALT TEST SECTION

FIGURE 1



CONTRACT STANDARD SPECIFICATIONS ASPHALT
85-100 GRADE

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