RUBBER MODIFIED AND PBA-6 ASPHALT BINDER PAVEMENTS

SR-5, Lewis County Line to SR-12

WA-RD 347.1

Post-Construction Report
April 1994

Washington State Department of Transportation

Washington State Transportation Commission
Transit, Research, and Intermodal Planning (TRIP) Division
in cooperation with the U.S. Department of Transportation
Federal Highway Administration

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This study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. ABSTRACT

This report documents the construction of two experimental test sections of asphalt concrete pavement containing polymer and ground rubber additives. The two sections are located on I-5 south of Olympia, Washington and were constructed in the summer of 1992.

The test sections were paved with an open-graded mix using PBA-6 and PBA-6GR asphalt cement binders. PBA-6 is a performance based asphalt cement with a polymer additive. PBA-6GR is also a performance based asphalt cement but with ground rubber tires as the additive. The PBA-6GR is a new product developed by the U.S. Oil and Refining Company of Tacoma, Washington.

The completed test sections are performing well, although the PBA-6GR section is flushing due to too high of an initial asphalt content. The sections will be monitored for a minimum of 10 years to determine long-term performance.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
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Post-Construction Report
WA93-03

RUBBER MODIFIED AND PBA-6 ASPHALT BINDER PAVEMENTS

SR-5, Contract 4036

Lewis County Line to SR-12

by

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Washington State Transportation Commission
Department of Transportation
and in cooperation with
U.S. Department of Transportation
Federal Highway Administration

April 1994

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Transportation Commission, Department of Transportation, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

TABLE OF CONTENTS

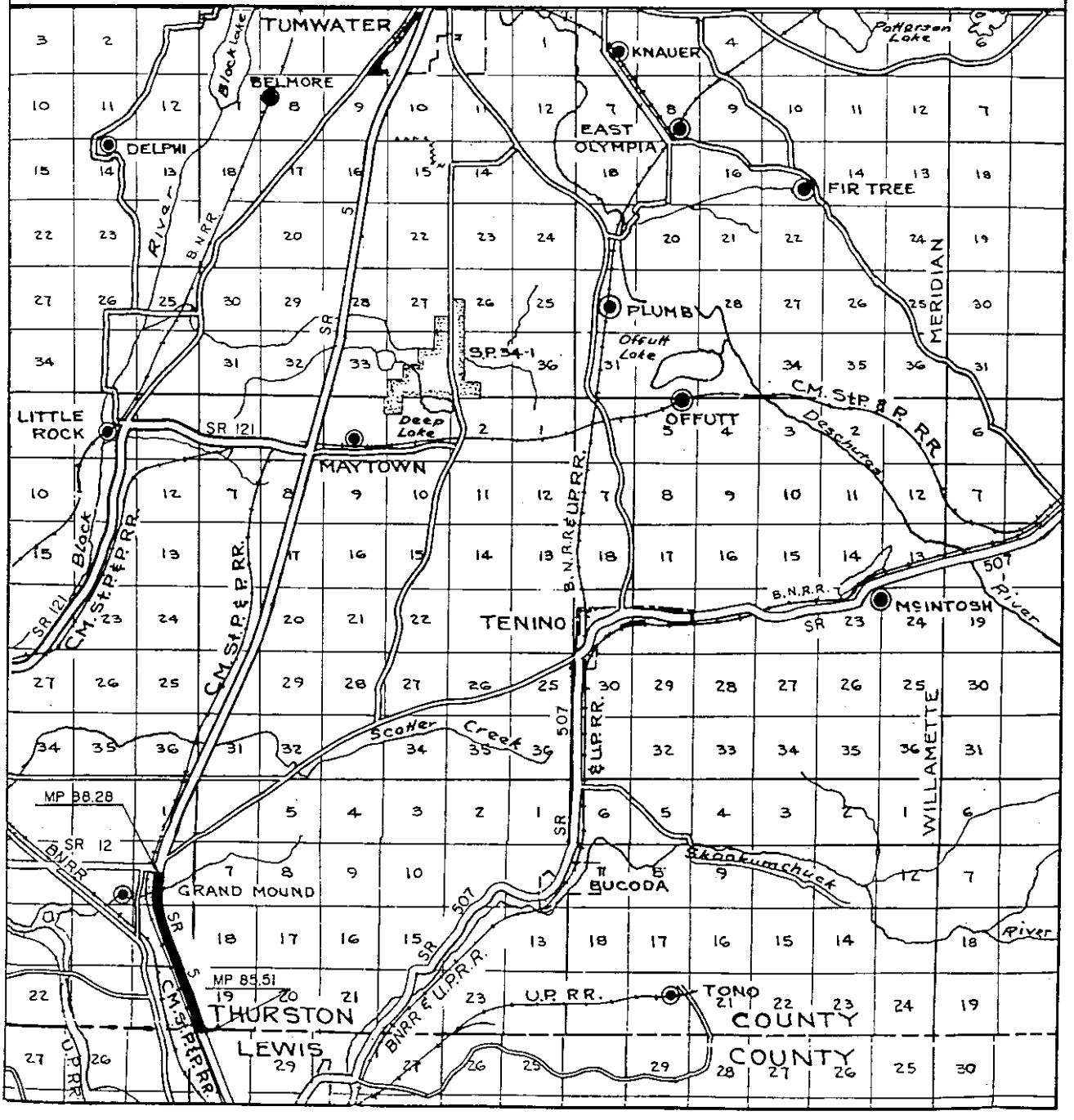
Section	Page
Vicinity Map	1
Introduction	2
Study Site	3
Construction Summary	4
Discussion	5
Cost	6
Conclusions	6
Appendix A (Material Specifications)	8
Appendix B (Roadway Sections)	16
Appendix C (Test Reports)	18

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

OLYMPIA, WASHINGTON

MAP OF STATE HIGHWAYS

THURSTON COUNTY



INTRODUCTION

This experimental feature is designed to evaluate the performance of two different types of asphalt binders against the performance of our standard AR4000W binder. The two types of asphalt binders to be evaluated are PBA-6 and PBA-6GR.

PBA-6 is a performance based asphalt binder with specifications developed by the West Coast User/Producers Group. Performance based binder specifications have evolved out of research such as the SHRP program and the efforts of various user/producer groups throughout the country. A performance based binder is designed to fit the needs of a specific set of parameters two of which would be climate and traffic.

PBA-6GR is a performance based binder which uses ground crumb rubber as the additive which gives it its polymer like characteristics. The crumb rubber binder was produced with a new wet process which combines very fine (80 to 200 mesh) crumb rubber with the liquid asphalt cement at the suppliers plant. The PBA-6GR meets all of the requirements of PBA-6 except for ductility. The product is delivered to the contractor by tanker and put through the asphalt plant using the same procedures as a conventional non-modified asphalt cement binder.

The two binders were used in the production of a modified Class D asphalt. Modified Class D is an open-graded mix with a maximum aggregate size of 1 inch (the maximum size for conventional Class D aggregate is 1/2 inch). The change to a larger rock size was prompted by the desire for a pavement with greater resistance to rutting. The PBA-6 and PBA-6GR specifications were chosen because of the ability of these binders to increase the thickness of the asphalt film on the aggregate. This should increase the resistance of the pavement to ravelling.

STUDY SITE

The section of roadway that was overlaid is located on I-5 approximately 16 miles south of Olympia as shown on the vicinity map. The roadway consists of two 12 foot lanes with 4 and 10 foot shoulders in each direction separated by a 40 foot sod median (see Appendix B for roadway sections). The contract called for preleveling and a 0.15 ft. overlay on both the northbound and southbound lanes between mileposts 85.51 ant 88.03. The test section of PBA-6 (MP 85.51 to 87.14) and PBA-6GR (MP 87.14 to 88.03) were placed on the northbound lanes. The southbound lanes were overlaid with a conventional Class A asphalt mix using AR4000W liquid asphalt cement.

A control section of conventional Class D mix was not included in the contract due to the existing complexity faced by the contractor of placing three different mixes on one project.

The existing roadway section, prior to the overlay, consists of the following components:

0.35 ft. ACP with fabric

0.75 ft. PCCP

0.84 ft. Untreated base

Pavement surveys performed prior to the overlay indicated scattered areas of longitudinal and transverse cracking over 1/4 inch in width, wheel path rutting of 1/4 to 1/2 inch in depth, patching, and low severity alligator cracking. The majority of the longitudinal and transverse cracking seems to be related reflection of the joints and cracks in the underlying PCCP rather than structural failure of the ACP layer. Traffic data for this section is as follows:

Traffic Index	8.2
1990 ADT	40,035
1991 ADT	42,651
Truck Volume	21%

(5.5% single axle and 15.5% combinations)
(ESAL's approximately 25,000,000 over 10 years)

CONSTRUCTION SUMMARY

Lakeside Industries of Centralia was awarded the contract on January 17, 1992, with work commencing on May 15 to provide for the best possible weather conditions for paving. The project has originally been set up to compare the modified Class D and the normal Class A, however at the suggestion of the asphalt supplier (U.S. Oil), the Class D with ground rubber was added. Lakeside Industries agreed to this as a no cost change order since there was difference in the cost of the material or required changes to their paving operations.

Two mix designs were developed using the two different liquid asphalts. The first mix used PBA-6 supplied by Chevron Oil. U.S. Oil supplied the second liquid asphalt, PBA-6GR, which used an ultra-fine powdered rubber blended into the asphalt cement. This special blend was developed in to meet the ISTEA requirements for the use of recycled tires in asphalt pavements (see Appendix C for detailed information on the mix properties). The mix designs for the open graded mixes are simple drain down tests which determine the maximum asphalt content that the aggregate can hold without excessive draining. The optimum asphalt contents determined were 5.5% for the PBA-6 and 6.6% for the PBA-6GR. The following table lists some of the statistical data on the placement of the two special mixes.

Table 1. Statistics on the placement of the two open-graded D modified mixes.

	PBA-6	PBA-6GR
Tons Placed	4100	1460
Asphalt Content *	5.4%	6.6%
Mixing Temperature	240-285	280-290
Laydown Temperature	240-280	260-290
Ambient Temperature	55-90	50-70

* Asphalt content is based on tank stickings and plant production records.

Paving occurred at night due to traffic constrictions. Paving operations were August 10 - 17 for the PBA-6 and August 24-26 for the PBA-6GR. Since paving was at night, ambient air temperatures became a factor in the operation. The ambient air temperature restriction was left to the discretion of the Engineer. Compaction was accomplished by using a 10 ton vibratory roller. Several methods were tried but the best results were with the roller in vibratory mode. There were no other problems with the laydown or compaction of the mixes.

DISCUSSION

The finished pavements have distinct differences in appearance. The PBA-6 looks like a normal open graded pavement. The PBA-6GR, in contrast, looks flushed. It is apparent that the asphalt content for the PBA-6GR was too high. It is difficult to analyze why the asphalt content proved to be too high. The PBA-6GR meets most of the specification requirements for PBA-6, therefore, one would conclude that the mix designs would be similar for the two materials, provided the same aggregate sources and gradations were used, which was true in this project, and yet the drain down test called for a full percent more binder for the PBA-6GR mix. The supplier of the PBA-6GR, U.S. Oil, agreed that the asphalt content was two high, but also thought the use of vibratory rollers was a contributing factor to the problem. There theory is that the vibrations caused a migration of the binder to the surface of the pavement similar in nature to the movement of water to the surface of a sand beach when the sand is vibrated. This seriousness of this migration would be compounded by a mix which contained excessive asphalt binder.

It is too early to make any determination as to which mix is the most desirable. From a materials testing standpoint, both the polymer and crumb rubber additives create problems.

on either of these two mixes with the quick wash test due to the clogging of the filter with the polymer or crumb rubber particles. For example, the asphalt content of two samples of the PBA-6GR which were determined in the lab with the extraction test averaged 4.7 percent, well below the 6.6 determined from the plant production records and tank stickings. The extraction test results, which do not measure the fine rubber particles as a part of the total binder content of the sample, are not representative of the true asphalt content of the mix. Therefore, the most accurate record of asphalt content appears to be the plant production records. In subsequent projects the nuclear asphalt content guage will be used and gradations will be determined before the aggregate is mixed with the binder. No problems were noted in the paving operation of the three different mixes, although the contractor preferred PBA-6 OVER the PBA-6GR, because of differences in handling the mix. The PBA-6GR binder was also somewhat harder to pump, but did not differ from any other asphalt binder as far as storage is concerned.

COST

The unit contract bid price for the Class A asphalt mix was $34.75 per ton and the unit cost both types of Class D asphalt mix was $51.25 per ton.

CONCLUSIONS

The following preliminary conclusions can be drawn from the early information and observations of in place test sections:

1. The PBA-6GR section is flushing due to a mix design which called for 1.1% more binder than the PBA-6 section.

2. The PBA-6GR asphalt binder was used successfully in the an asphalt plant without an of the modifications of the pumping or storage facilities usually deemed mandatory with rubber-asphalt binders and as such is more user friendly than these other wet processes.
3. The PBA-6GR binder is similar to other rubber-asphalt and polymer binders with regard to the difficulties experienced in running extractions tests and getting a true asphalt content.
4. The PBA-6GR is one of the less expensive products which qualify as rubber-asphalt binder meeting the ISTEA requirements for the use of recycled tires in pavements.

APPENDIX A

Materials Specifications

MODIFIED ASPHALT CONCRETE PAVEMENT CLASS D

General
Modified asphalt concrete pavement Class D shall meet the requirements of section 5-04 for asphalt concrete pavement Class D except as modified herein.

Materials
Section 5-04.2 is supplemented with the following:

The grade of paving asphalt to be used for modified asphalt concrete Class D shall be PBA-6 and shall conform to the following:

Characteristics	AASHTO TEST Method	Specification
Penetration @ 39.2 F, 200g, 60s, dmm RTFO Aged Residue (Note 1)	T-49	30+
Absolute Viscosity @ 140 F, P (Note 2)		
Original Asphalt	T-202	2000+
RTFO Aged Residue (Note 1)	T-202	5000+
Kinematic Viscosity @ 275 F, cSt		
Original Asphalt	T-201	2000-
RTFO Aged Residue (Note 1)	T-201	275+
Absolute Viscosity Ratio @ 140 F RTFO Viscosity/Original Viscosity		4.0-
Flash Point, Cleveland Open Cup, F		
Original Asphalt	T-48	450+
Ductility @ 77 F, 5 cm/min, cm	T-51	60+

Note 1. "RTFO Aged Residue" means the asphaltic residue obtained using the Rolling Thin-Film Oven Test ("RTFO Test"), AASHTO T-240 or ASTM D-2872.

Note 2. The Absolute Viscosity (60C) of PBA-6 will be determined at 1 sec^{-1} using ASTM P-159 (Vol. 4.03, 1985) with Asphalt Institute Vacuum Capillary Viscometers.

Section 9-03.8(2) is supplemented with the following:

The fracture requirements for modified asphalt concrete Class D are at least two fractured faces on 90 percent of

the material retained on each sieve 1/4 inch square and above and at least one fractured face on 75 percent of the material retained on the U.S. No. 10 sieve. These fracture specifications apply to those sieves which retain more than 5 percent of the total sample.

Section 9-03.8(6) is supplemented with the following:

The grading and asphalt requirements for modified asphalt concrete Class D are as follows:

	Percent Passing
1" square	99-100
3/4" square	85-96
1/2" square	60-71
1/4" square	17-31
U.S. No. 10	7-19
U.S. No. 200	1-6
Asphalt % of total mixture	4-8

Construction Requirements
The third paragraph of Section 5-04.3(8) is supplemented with the following:

When discharged, the temperature of the modified asphalt concrete Class D mix shall not exceed 260 F unless otherwise directed by the Engineer.

Section 5-04.3(8) is supplemented with the following:

Acceptance testing of the modified asphalt concrete Class D for compliance of gradation will use the Quick Wash Procedure, WSDOT Test Method 711, part A.

Asphalt content will be determined from the plant's asphalt meter or weighing system, and confirmed by invoices and tank stickings.

Payment
The unit contract price per ton for "Modified Asphalt Conc. Pavement Cl. D" shall be full pay for performing the work specified.

Excerpt from Change Order No. 3, Contract 4036, August 24, 1992.

All work, materials, and measurements to be in accordance with the provisions of the Standard Specifications and Special Provisions for the type of construction involved.

This contract is revised as follows:

DESCRIPTION OF WORK

You are ordered to perform the following described work upon receipt of an approved copy of this change order:

Overlay SR 5 with Powdered Rubber Modified Asphalt Concrete Class D from SR 5 86+00 to SR 5 133+00 northbound on the 4 foot inside shoulder and both 12 foot lanes as detailed in this change order.

Technical data for the Powdered Rubber Modified Asphalt Concrete Class D shall be as follows:

General
Powdered rubber modified asphalt concrete Class D shall meet the requirements of Section 5-04 for asphalt concrete pavement Class D except as modified herein.

Materials
The product shall consist of a homogeneous mixture of asphalt cement; powdered, reclaimed, vulcanized rubber; and if required by the mix design, a liquid anti-stripping agent. The asphalt cement, powdered rubber, and anti-strip shall be blended at the asphalt supplier's refinery or terminal.

Section 5-04.2 is supplemented with the following:

Powdered rubber paving asphalt to be used for powdered rubber modified asphalt concrete Class D shall conform to the following:

Characteristics	AASHTO TEST Method	Specification
Penetration @ 39.2 F, 200g, 60s, dmm		
Original	T-49	Report
RTFO Aged Residue (Note 1)	T-49	Report

Penetration @ 77 F, 100g, 5s, dmm	T-49	Report
Retained 39.2 F Penetration, % min.		75
Absolute Viscosity @ 140 F, P (Note 2)		
Original Asphalt	T-202	2000+
RTFO Aged Residue (Note 1)	T-202	5000+
Kinematic Viscosity @ 275 F, cSt		
Original Asphalt	T-201	3000-
RTFO Aged Residue (Note 1)	T-201	275+
Flash Point, Cleveland Open Cup, F		
Original Asphalt	T-48	450+
Ductility @ 77 F, 5 cm/min, cm		
RTFO Aged Residue (Note 1)	T-51	60+

Note 1. "RTFO Aged Residue" means the asphaltic residue obtained using the Rolling Thin-Film Oven Test ("RTFO Test"), AASHTO T-240 or ASTM D-2872.

Note 2. The Absolute Viscosity (60C) of PBA-6 will be determined at 1 sec^{-1} using ASTM P-159 (Vol. 4.03, 1985) with Asphalt Institute Vacuum Capillary Viscometers.

Section 9-03.8(2) is supplemented with the following:

The fracture requirements for modified asphalt concrete Class D are at least two fractured faces on 90 percent of the material retained on each sieve 1/4 inch square and above and at least one fractured face on 75 percent of the material retained on the U.S. No. 10 sieve. These fracture specifications apply to those sieves which retain more than 5 percent of the total sample.

Section 9-03.8(6) is supplemented with the following:

The grading and asphalt requirements for modified asphalt concrete Class D are as follows:

	Percent Passing
1" square	99-100
3/4" square	85-96
1/2" square	60-71
1/4" square	17-31
U.S. No. 10	7-19
U.S. No. 200	1-6

Powdered rubber asphalt percentage

The estimated powdered rubber asphalt binder content is 6.5%

Powdered Rubber

The powdered rubber shall conform to the following specification requirements:

Chemical Properties

Acetone Extract (ASTM D-297) % max.	23
Ash (ASTM D-297B) % max.	7
Carbon Black (ASTM D-297B) % max.	34
Rubber Hydro carbon (be difference) % max.	42
Specific Gravity (ASTM D-297)	1.15±0.02
Moisture Content % max.	1.0

Sieve Analysis (U.S. Standard Screens):

Sieve Size	% Passing
#60	99 - 100
#80	89 - 100
#100	74 - 90
#200	24 - 90

Construction Requirements

The third paragraph of Section 5-04.3(8) is supplemented with the following:

The mixing temperature and the laydown temperature will be determined by the mix design procedure or as directed by the Engineer.

Section 5-05.3(8) is supplemented with the following:

Acceptance testing of the powdered rubber modified asphalt concrete Class D for compliance of gradation will use the Quick Wash Procedure, WSDOT Test Method 711, Part A.

Asphalt content will be determined from the plant's asphalt meter or weighing system and confirmed by invoices and tank stickings.

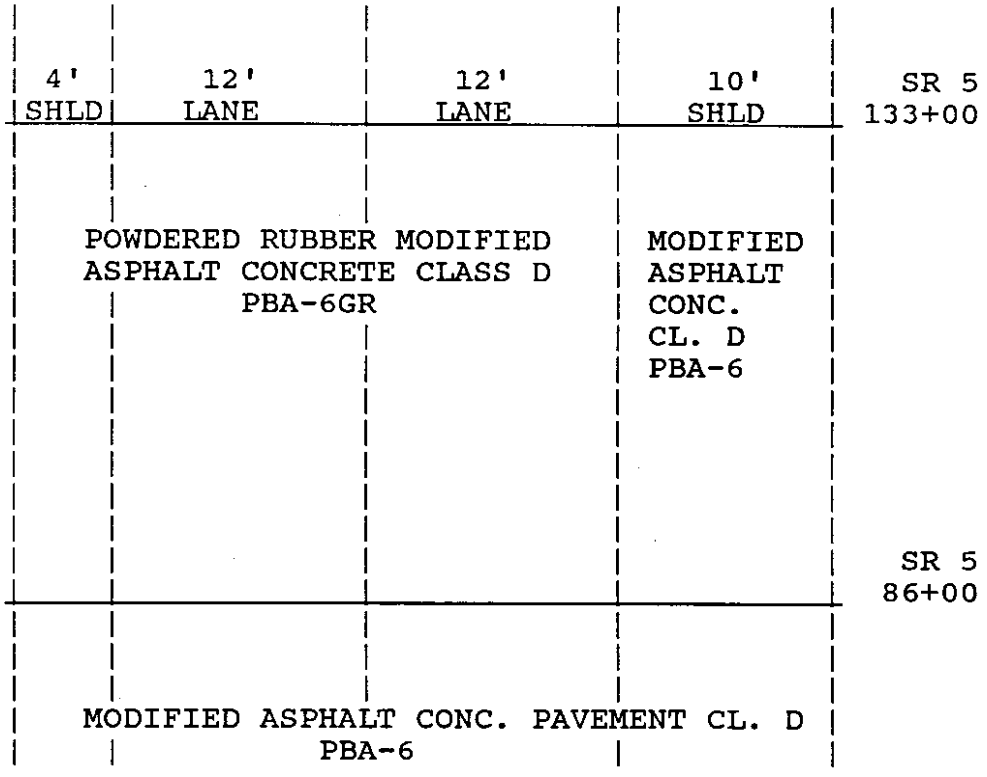
Powdered rubber content as a component of the Powdered Rubber Asphalt Cement and conformance to the gradation and composition requirements shall be affirmed by a manufacturer's certificate of compliance.

Powdered Rubber Modified Asphalt Concrete Class D will be measured as Modified Asphalt Conc. Pavement Cl. D.

The unit contract price per ton for "Modified Asphalt Conc. Pavement Cl. D" shall be full pay for performing the work specified including furnishing and placing "Powdered Rubber Modified Asphalt Concrete Pavement Class D".

Contract time will be addressed when the impact of the actual work has been completed.

PLACE POWDERED RUBBER MODIFIED ASPHALT CONCRETE CLASS D ON 4 FT. SHOULDER AND BOTH 12 FT. LANES.

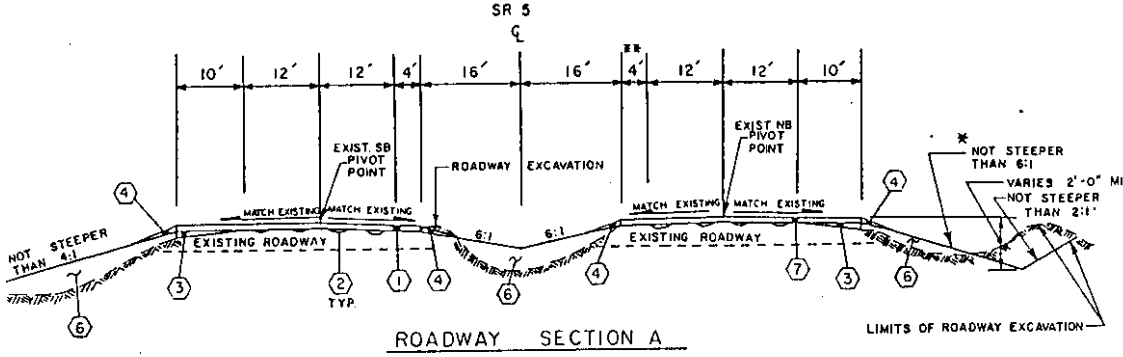


Excerpt from Product Certification, Rouse Rubber Industries, Inc., August 14, 1992

CUSTOMER:	U.S. OIL & REFINING CO./WA.
ORDER NUMBER:	#4506
DATE SHIPPED:	8/12/92
WEIGHT SHEET NO:	#11244
STOCK:	#GF80
LOT#:	#223
ACETONE EXTRACT:	15.7
ASH:	4.4
CARBON BLACK	29.7
RHC:	50.2
MOISTURE:	0.1
SPECIFIC GRAVITY	1.145
SIEVE ANALYSIS SCREEN	% RETAINED
14m	
16m	
20m	0
30m	0
35m	
40m	0
60m	T
80m	11
100m	14
Pan	75
	15

APPENDIX B

Roadway Sections



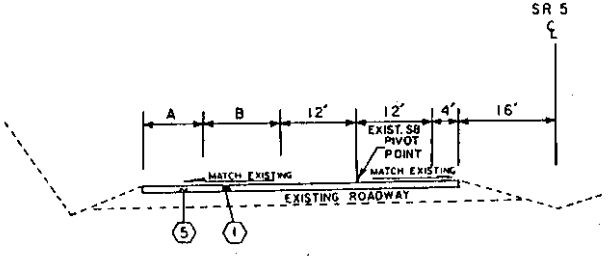
ROADWAY SECTION A

SOUTHBOUND		NORTHBOUND	
SR 5	STA. 0+00 TO 128+78	SR 5	STA. 0+00 TO 129+02
SR 5	STA. 129+38 TO 133+00	SR 5	STA. 129+62 TO 133+00

* CUTS & FILLS OCCUR ON BOTH SIDES OF ROADWAY. THE SLOPE VARIES. SEE SLOPE TABLE SHEET 16.

** SEE ALTERNATE SHOULDER DETAIL.

SEE PLANING DETAILS "A" AND "C", SHEET 17.



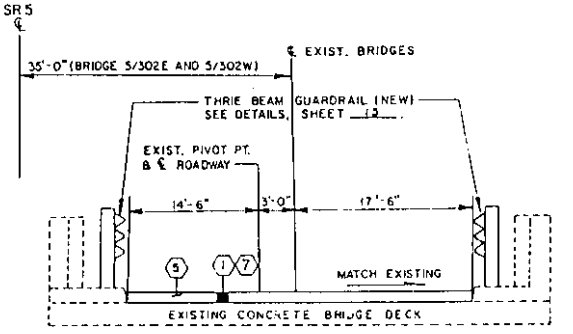
ROADWAY SECTION B

(Southbound Lanes Only)

SR5 STATION	A	B
133+00 TO 141+50	10'	0'
141+50 TO 144+00	10'-8'	0'-12'
144+00 TO 146+00	8'	12'

SEE PLANING DETAIL "B", SHEET 17.

THE CUTS AND FILLS OCCUR ON BOTH SIDES OF THE ROADWAY.



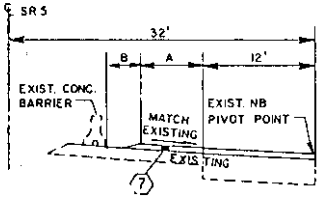
ROADWAY SECTION C (TYPICAL)

PRAIRIE CREEK BRIDGES

(7) BRIDGE 5/302E SR5 STA. 129+02 TO 129+62 (32' RT.)

(1) BRIDGE 5/302W SR5 STA. 128+78 TO 129+38 (32' LT.)

SEE PLANING DETAIL "D", SHEET 17.



ALTERNATE SHOULDER DETAIL

		A	B
SR5	STA. 113+11 TO 115+40 (RT)	6.5'	13.75'-0'
SR5	STA. 115+40 TO 128+08 (RT)	6.5'	0'
SR5	STA. 128+08 TO 128+03 (RT)	6.5'-2.5'	0'

SURFACING LEGEND

(1)	ASPHALT CONC. PAVEMENT CL. A	0.15' COMP. DEPTH
(2)	ASPHALT CONC. FOR PRELEVELING CL. G	VARIABLE COMP. DEPTH
(3)	ASPHALT CONC. FOR PRELEVELING CL. A	VARIABLE COMP. DEPTH
(4)	CRUSHED SURFACING TOP COURSE	VARIABLE COMP. DEPTH
(5)	PLANING EXISTING ASPHALT CONC. PAVEMENT	0.15' DEPTH
(6)	EMBANKMENT CONSTRUCTION	METHOD 'A' COMPACTION
(7)	MODIFIED ASPHALT CONC. PAVEMENT CL.D 0.15' COMP. DEPTH	

APPENDIX C

Test Reports

JOB MIX DESIGN CLASS D-MOD

SR-5, LEWIS COUNTY LINE TO SR-12

PBA-6

Material:	Min. Agg.	Blend Sand	Combined	Specifications
Source:	L-114	L-114		
Ratio:	80.0 %	20 %	100 %	
	100.0	100.0	100	
	100.0	100.0	100	
	100.0	100.0	100	
	100.0	100.0	100	
1	100.0	100.0	100	99-100
3/4	95.0	100.0	96	85-96
1/2	59.0	89.0	65	60-71
1/4	28.0	22.0	27	17-31
#10	14.0	3.0	12	7-19
#200	3.10	1.50	2.8	1-6

LABORATORY ANALYSIS

Asph % by Wt of Total Mix:	4.3	4.8	5.2	5.7	6.1	6.5
Stabilometer "S" Value:						
Cohesiometer "C" Value:						
Density (lbs/cf):						
% Voids - Volume in Mix:						
% Voids in Mineral Agg:						
Max Density from Rice:						

LOTTMAN STRIPPING EVALUATION

		0%	1/4%	1/2%	3/4%	1%
U.S. OIL	Visual Appearance:	NONE	NONE	NONE	NONE	NONE
	% Retained Strength:	52	70	74	81	89

RECOMMENDATIONS

Supplier	CHEVRON PORTLAND
% Asphalt (by total mix)	5.5
Grade of Asphalt	PBA-6
% Anti Strip (by wt asph)	1.00
Type of Anti Strip	PAVE BOND SPECIAL
Rice Density lbs/cf (est)	--
Mixing Temperature	282

JOB MIX DESIGN CLASS D-MOD

SR-5, LEWIS COUNTY LINE TO SR-12

PBA-6GR

Material:	Min. Agg.	Blend Sand	Combined	Specifications
Source:	L-114	L-114		
Ratio:	80.0 %	20 %	100 %	
	100.0	100.0	100	
	100.0	100.0	100	
	100.0	100.0	100	
	100.0	100.0	100	
1	100.0	100.0	100	99-100
3/4	95.0	100.0	96	85-96
1/2	59.0	89.0	65	60-71
1/4	28.0	22.0	27	17-31
#10	14.0	3.0	12	7-19
#200	3.10	1.50	2.8	1-6

LABORATORY ANALYSIS

Asph % by Wt of Total Mix:	6.2	6.6	7.0
Stabilometer "S" Value:			
Cohesiometer "C" Value:			
Density (lbs/cf):			
% Voids - Volume in Mix:			
% Voids in Mineral Agg:			
Max Density from Rice:	152.7	151.7	150.2

LOTTMAN STRIPPING EVALUATION

		0%	1/4%	1/2%	3/4%	1%
U.S. OIL	Visual Appearance:	NONE	NONE	NONE	NONE	NONE
	% Retained Strength:	82	97	99	86	118

RECOMMENDATIONS

Supplier	U.S. OIL
% Asphalt (by total mix	6.6
Grade of Asphalt	PBA-6GR
% Anti Strip (by wt asph)	0.25
Type of Anti Strip	PAVE BOND SPECIAL
Rice Density lbs/cf (est)	151.7
Mixing Temperature	270 F *

* The mixing temperature was raised to 300 F in a later reference design.

VISCOSITIES

MIX DESIGN SAMPLES

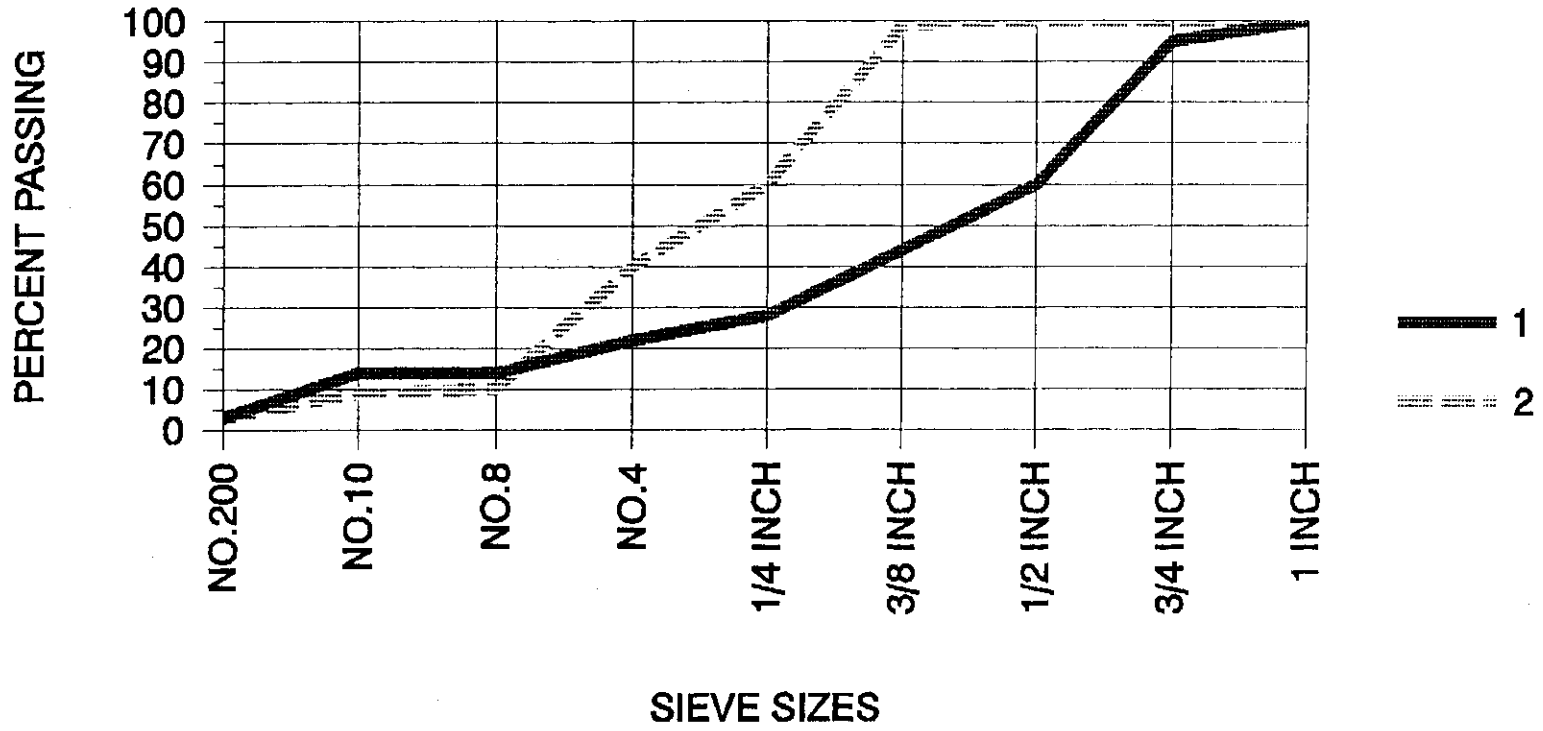
Asphalt	Original 140 F poise	Original 275 F cts	RTFC 140 F poise	RTFC 275 F cts	Recommended Mixing Temperature
PBA-6 Chevron	2495	950	7077		282 F
PRPA U.S. Oil Lab Sample	3123	687	8114	2562	270 F
PRPA ** U.S. Oil Production Sample	2727	1786	6934	3270	300 F

CONTROL SAMPLES

PBA-6	1914	596	5212	952
	2008	494	7742	998
PRPA	3763	1406	6644	1705
	4139	1372	7786	1699
	3254		8404	
	3608		7290	
	2451		5294	
	2377		5458	
AR4000W	1713	361	4197	535
U.S. Oil	1642	350	4250	509
17 Control Samples of AR4000W from U.S. Oil		High	4483	
		Low	3077	
		Average	3564	

** This data supplied by U.S. Oil

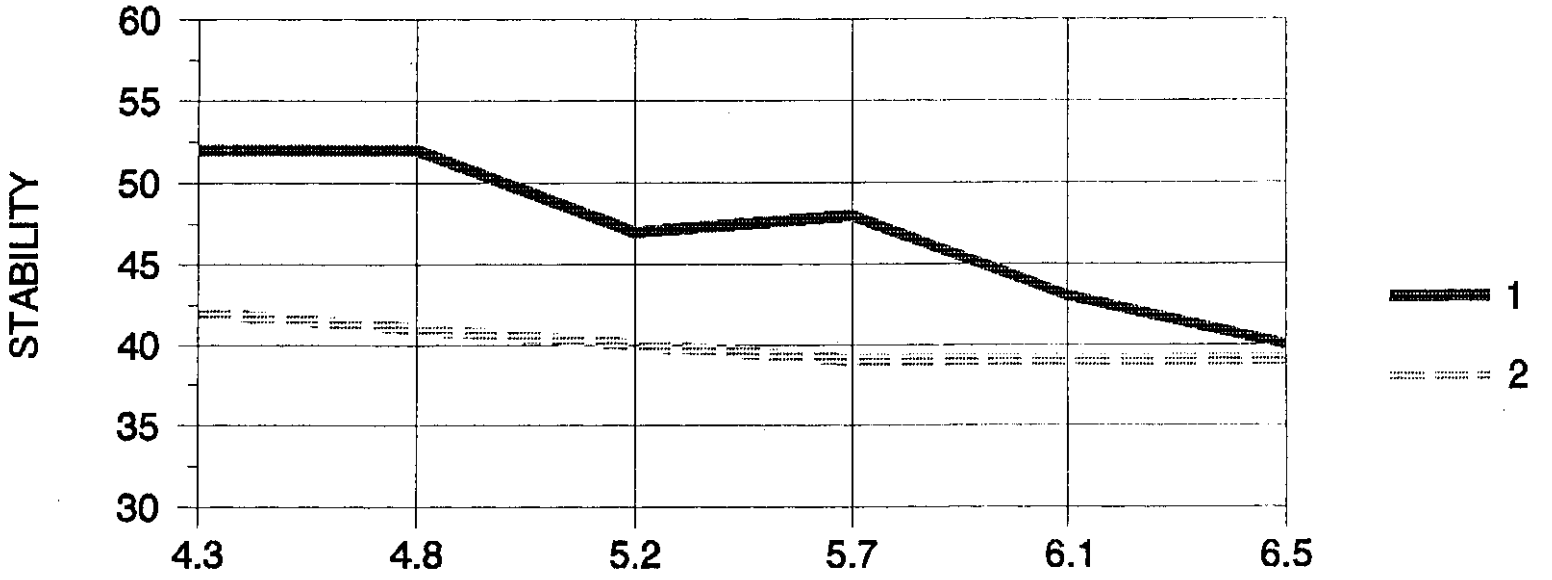
CLASS D GRADATION



1. MODIFIED CLASS D GRADATION
2. MIDLINE STANDARD CLASS D GRADATION

STABILITIES

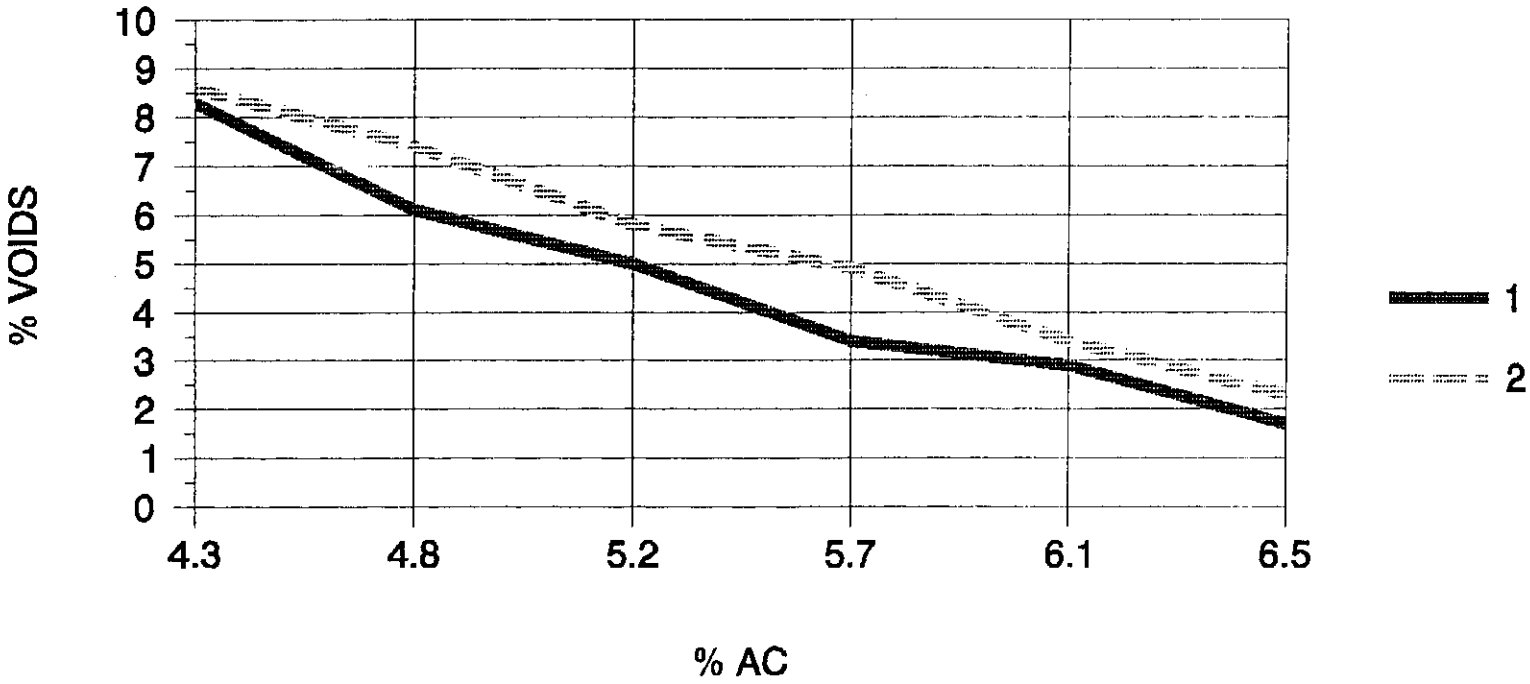
FOR CLASS A ASPHALT CONCRETE MIX



1. AR4000W
2. POWDERED RUBBER PAVING ASPHALT

% VOIDS

FOR CLASS A ASPHALT CONCRETE MIX



1. AR4000W
2. POWDERED RUBBER PAVING ASPHALT