

Draft

TERMINAL BLEND ASPHALT RUBBER CHIP SEAL

PG70-22TR

&

PG76-22PM



TECHNICAL REPORT

A COST EFFECTIVE ALTERNATIVE FOR HOT
APPLIED CHIP SEAL SYSTEMS

Prepared by:



**PARAMOUNT
ASPHALT**

a subsidiary of **ALON** USA

Terminal Blend Asphalt Rubber Chip Seal PG70-22TR

A COST EFFECTIVE ALTERNATIVE FOR HOT APPLIED CHIP SEAL SYSTEMS

THE PROCESS

In the effort to demonstrate the effectiveness of, and encourage agencies to use recycled tires in a variety of applications, Kern County in Bakersfield, CA agreed to use PG70-22TR as a trial section for hot applied chip seal. The project covered 107,000 sq.yds. and was divided into two sections. 25 liquid Tons of PG70-22TR and 135 liquid Tons of PG76-22PM were used (initially the PG76-22 modified binder Kern county spec was specified and replaced by Caltrans PG76-22PM to eliminate proliferation of binders in the State of California). PG70-22TR is a terminal blend asphalt rubber binder that is fully PG graded and needs no special equipment such as an on site blending unit for the job. The TR binder is handled like any other Terminal blend hot asphalt binder, and the manufactured material shows no visual signs of the digested tire rubber residue.

On Tuesday August 7 2007, the truck of PG70-22TR showed up on the job at a temperature of 285°F due to the traveling distance from the refinery. The product is also available at many of Paramount locations. The asphalt distributor truck was used to heat up the binder to 317°F. The section of PG70-22TR chip seal was placed on the number one northbound lane just north of the Kern River Bridge, on Manor Street and extended to China Grade Loop in Bakersfield, California. It then was applied in the #1 southbound lane of Manor from China Grade to the Norris Rd Intersection. The aggregate used was 3/8 x #4 and pre-coated with 0.25% of PG64-10 for the TR section and 0.5% to 0.7% for the PM section. The PG70-22TR application started at 8:40 am and finished about noon. The ambient air temperature at the start of the test was about 68°F and the

surface temperature was 82°F. The application rate of the asphalt binder was 0.32 – 0.35 gal/sy and the aggregate spread rate was 17 lb/sy – 19 lb/sy.

The sequence of the application was the usual hot asphalt chipping scenario, spraying the oil closely followed by the chip spreader and then immediately followed by the rubber tire rollers. The crew waited a couple of hours before sweeping. The TR performed exceptionally with minimal rock loss and no reported vehicle claims.

The PG76-22PM was placed that afternoon and over the next two days using the same aggregate at the same application rates. The two binders were indistinguishable and were handled exactly in the same manner and the results reported were similar.

The following Tuesday the whole project was fog sealed with Topein®C, which is standard practice by Kern County on all chip seal jobs. The temperature on the ground Tuesday for the fog seal treatment was 85°F in the morning and 125°F at 2:00PM. The fog seal was applied at 0.07 gals per square yard. Time from application to release to traffic was roughly 30 minutes.

The PG70-22 TR, PG76-22PM and Topein®C were supplied by Paramount Petroleum; the pre-coated aggregate source was Vulcan Material Bakersfield, spreading was done by Burtch Construction and trucking was by Pan Pacific Transportation. The construction crew was from the Kern County maintenance division. Standard spreading equipment was used as the means to apply the Terminal Blend Asphalt Rubber and visible VOC's were minimal.

Equipment used:

Chip Spreader—W.H. Manufacturing Model 8803

Asphalt Distributors—BearCat 501/CRC Super Spreader (Standard Equipment)

Three 9 wheel pneumatic rubber roller

Sweepers

The benefits of AC 15-5TR (PG70-22TR) include improved driving comfort, protection from oxidation, prolonged pavement lifespan, fast application with quick return to traffic, cost effectiveness and extended treatment service life.

This product can and is being used as a viable surface treatment for agencies in California, Arizona and Texas. This type of product will enhance agency and taxpayer savings as Kern County showed that they, as an agency, could do the work successfully themselves and agencies can also have the option of using private contractors and equipment for placement which are readily available.

As can be seen from the pictures and a site visit, the Hot Asphalt products filled voids and cracks exceptionally well to bring the road surface to a more uniform appearance while rejuvenating the structural and surface capabilities of the pavement.

In conclusion the AC 15-5TR (PG70-22TR) is a cost effective alternative to similar products and meets or exceeds the performance characteristics for other hot applied chip seals. The Terminal Blend Binder (TR) is a proven product that can and should be in the forefront of agency's minds as a viable way to improve their road system for taxpayers, doing so in a cost effective manner and offering the added benefit of grants in aid from the State Waste Resources Department.

Process of applying Chip Seal using Terminal blend Product



Fig. 1 spraying the asphalt binder



Fig. 2 followed by the chipper



Fig. 3 laying the chip



Fig. 4 behind the chipper



Fig. 5 followed immediately by the rollers



Fig. 6 product after rolling

Distresses of the Pavement before Chip Seal



Finished Job



TOPEIN®C Fog Seal



TOPEIN®C Specification

<u>Tests on Concentrated Dispersion:</u>		Limits	
<u>Test Description</u>	<u>Test Method</u>	<u>Min</u>	<u>Max</u>
Viscosity at 25 C (77 F), SSF	AASHTO T-59	16	80
Sieve, %	AASHTO T-59		0.01
5 Day Settlement, %	AASHTO T-59		5.0
Particle charge	AASHTO T-59	Positive	
pH (used if particle charge test is inconclusive)	AASHTO T-59	2.0	7.0
Residue, %	AASHTO T-59	51	
<u>Tests on Recovered Residue:</u>			
Viscosity at 135 C (275 F), cSt	ASTM D4402	475	1500
Flash point, COC, C	AASHTO T-48	232	
Solubility in TCE	AASHTO T-44	97.5	
Specific Gravity (1- Water)	AASHTO T-228	0.98	
Asphaltenes, %	ASTM D2007 mod	20	40
Polar Compounds, %	ASTM D2007 mod	30	
Aromatics, %	ASTM D2007 mod	15	
Saturates, %	ASTM D2007 mod		10
<u>Tests on TOPEIN®C ready to shoot, dilute:</u>			
Residue, %	AASHTO T-59	29	
Pumping Stability	Note 1	pass	

Note 1: Pumping stability is tested by pumping 475 ml of dilute emulsion, at 25 C (77 F), through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes without significant coagulation or separation of bitumen and water.

Paramount Petroleum of Arizona

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CERTIFICATE OF ANALYSIS

Material: AC-15-5TR (PG70-22TR) Date Tested: 8/5/2007
Tank: 22

PROPERTIES

RESULTS

SPECS

ORIGINAL TESTS

Minimum Ground Tire Rubber, %	5	5%
Penetration @ 25°C, 100g, 5sec	77	50-75
Viscosity @ 60°C, Poise	35420	REPORT
Viscosity @ 135°C, centipoise	915	2000 MAX
Elastic Recovery @ 25°C <i>20 cm elongation, 5cm/min, % recovery after 1 hour</i>	83	55 MIN.
Softening Point, °C	68.8	60 MIN.
COC Flash Point, °C	260+	260MIN.
Solubility in Trichloroethylene, %	98	97.5
Dynamic Shear @ 70°C, kPa	1.38	1.0 Min.
Phase angle	66.8	75 Max.
RTFO RESIDUE TESTS		
Retained Penetration Ratio <i>25°C, 100g, 5sec, /Orig., %</i>	63.2	55 MIN
Dynamic Shear @ 70°C, kPa	2.71	2.20Min
PAV RESIDUE 110°C		
Dynamic Shear @ 28°C, kPa	2544	5000 Max
Stiffness @ -22°C mPa	151	300 Max
"m" @ -22°C	0.315	0.300 Min
BKF Viscosity #27 spd<20 RPM @ 135	915	
BKF Viscosity #27 spd<20 RPM @ 149	530	
BKF Viscosity #27 spd<20 RPM @ 163	310	
BKF Viscosity #27 spd<20 RPM @ 176	195	

We Certify that this material meets the requirements of AC15-5TR, Hot Climate Specifications



Product: **PG76-22PM Asphalt Cement**
Code: #1
Date: 8/8/2007
Tank: #8

Purchaser: _____
Destination: Bakersfield
Transporter: _____
Truck No: _____
Bill of Lading No: _____
Contract No: _____
Purchase Order No: _____

MEETS SPECIFICATIONS: California Dept. of Transportation, ASTM D6373; AASHTO M320

CERTIFICATE OF COMPLIANCE

TESTS	ASTM#	AASHTO #	SPEC	RESULT
<i>Test on Original Asphalt:</i>				
DSR, G*/sinδ, 76°C @ 10 rad/s, kPa		T315	1.00 min	<u>1.36</u>
Viscosity, 135°C, Pa.s		T316	3.0 max	<u>1.1</u>
Solubility, %		T44	99 min.	<u>99.9</u>
Flash Point, C.O.C., °F	D92	T48	450 min	<u>550+</u>
Density, 60°F, Lb/Gallon	D70	T228	~~	<u>8.5616</u>
Specific Gravity, 77/77°F	D70	T228	----	<u>1.0215</u>
Specific Gravity, 60/60°F	D70	T228	----	<u>1.0278</u>
API Gravity, 60°F	D70	T228	----	<u>6.2</u>
<i>Test on Residue from Rolling Thin Film Oven:</i>				
		T240	----	
DSR, G*/sinδ, 76°C @ 10 rad/s, kPa		T315	2.20 min	<u>3.18</u>
Phase Angle δ, 76°C @ 10 rad/s, delta		T315	80 max	<u>53</u>
Elastic Recovery, 25°C (77°F), 5cm/min, cm		T301	65 min	<u>93</u>
Loss on Heating, wt. %	D2872	T240	1.0 max	<u>0.450</u>
<i>Tests on Residue from Pressure Aging Vessel @110°C</i>				
DSR, G*/sinδ, 31°C @ 10 rad/s, kPa		T315	5000 max	<u>727</u>
Creep Stiffness, S, -12°C @ 60s, Mpa	D6648	T313	300 max	<u>96</u>
Creep Stiffness, m-value, -12°C @ 60s, Mpa	D6648	T313	0.300 min	<u>0.314</u>

We hereby certify that the above material was sampled and tested according to the applicable ASTM and AASHTO standards and that it complies with all specifications.

This certification is valid for 30 days from the day of issued

Screening Grading Requirements

3/8" Maximum	
Sieve Size	Percentage Passing
1/2"	100
3/8"	70-85
No. 4	0-15
No. 8	0-5
No. 200	0-1

Screening Quality Requirements

Test Parameters	California Test	Requirements
Los Angeles Rattler (100 Revolutions)	211	10 Max.
Los Angeles Rattler (500 Revolutions)	211	40 Max.
Film Stripping	302	25 Max.
Cleanness Value	227	80 Min.
Durability	229	52 Min.

Comparison between Caltrans and Kern County Spec.

Performance Graded Modified Asphalt Binder ^a

Property	AASHTO Test Method	Specification		
		Grade		
		PG76-22 Modified binder (Kern County Spec)	PG 76-22TR	PG 76-22PM
Original Binder				
Flash Point, Minimum °C	T48	230	230	230
Solubility, Minimum % ^b	T44	N/A	97.5	99
SBS Polymer content, %		4%	N/A	N/A
Ground Tire Rubber, %		N/A	10 min.	N/A
Viscosity at 135°C, ^c Maximum, Pa's	T316	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T315	76 1.00	76 1.00	76 1.00
RTFO Test ^e , Mass Loss, Maximum, %	T240	1.00	1.00	1.00
RTFO Test Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T315	76 2.20	76 2.20	76 2.20
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum (delta), %	T315	75	Note d 80	Note d 80
Softening Pt, F		175 Min.	N/A	N/A
Elastic Recovery, Test Temp. Minimum recovery, %	T301	ASTM D6084 25 70	25 65	25 65
PAV ^e Aging, Temperature, °C	R28	?	110	110
RTFO Test and PAV Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T315	31 5000	31 5000	31 5000
Creep Stiffness, Test Temperature, °C Maximum S-value, MPa Minimum M-value	T313	-12 300 0.300	-12 300 0.300	-12 300 0.300