# WANCHAI, HONG KONG

Demonstration of RJSeal™ Federal Highway Route No. 2, Shah Alam, Selangor, Malaysia

May 8, 2006



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# May 8, 2006

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Consciputes 3 Conscipus 2 Suparvisor 1	6 Man Crew	m² yd²	╀	45.6 54.5		1	20.3 24.2
G,	g	Lbs		*	0.5	,	0.5
	Slag Applied	Kg Roters /es		*	0.3		0.3
		m² /Kg		897	,	•	4.68
	Rate	m² /Litre	,	969	4		4.96
Lifres Sq Feet Sq Yds S.G. Feet Kgs Lbs	Application Rate	Litres /m² m² /Litre		0.00			0.20
3.78 10.76 11.06 3.28 3.28 2.22		USGal Md <sup>2</sup>	,	0.045	,		0.045
Conversion Factors US Galton US Galton Sq Metre Sq Metre RejuvaSeal PepuvaSeal One Can	pejid	kilograms		100 Sept. 100 Se			39
	RejuvaSeal Applied	Iltres	ŀ	37	,		37
Metres Metres Sq Metres kgs Ros Ros Ros Ros	ijeH	US gals	ı	101	,	•	10
50.0 3.65 182.5 50.00 20.00 12.00 15.00	Total Area	yd²	ŀ	218	ı	-	218
Assumptions Slow (shoulder) Lane Driving Lane width Area - Slow lane Slag Applied Ribell Certei	Total Area	~E		183	ı	•••	183
	Work Time   Comments		Preparation	Rolling RJS	Slag Applic	Clean-Up	
#2 - Kuala Lun	Work Time	(hrs)	0.17	0.67	0.33	0.33	1.50
nprise 08 Anthor Anthor 15.	75%	am/pm	21:30 - 21:40	21:40 - 22:20	22:20 - 22:40	22:40 - 23:00	Totals
Crown Capital Ente RJSeat Application Batu Tiga - Federal Near Shah Aiam Appl. Date Propared by Updated by Updated by Updated by Pavement Temp - C Air Temporature - C	Relative Humidity Work Schedute	Date of	08-May	İ			

Batu Tiga on Federal Highway Route 2, along The North South Expressway Central Link near Shah Alam, traverse southwards towards the Kusla Lumpur Intaernational Airport

9:00 PM Arrive at jobsite. Carrying out preparation works including, taping white lines, mixing barrels of RJSeal 9:20 PM Traffic Diverted from Slow Lane with Cones, Apply tape to White Line 9:40 PM Start rolling RJSeal onto the shoulder lane 10:20 PM Finish rolling RJSeal onto the shoulder lane 10:20 PM Finish rolling RJSeal onto the above section, commence Copper Stag Application 10:40 PM Finish applying Copper Stag 11:00 PM Complete removing tape & testing & clean-up 11:26 PM Return and Conduct Testing on completed test strip 5:00 AM Road Open to Traffic Area 187.5 Shoulder n/a Driving Lane 3.75 Length 50 Finish KLTES2 Chronology of Events 08-May Start KLTES1 Re-Stating Calculations
Test Section
Slow Lane

Nstance x Distance		2405					
Distance		2404.9216				-	
Diff E		-49			Comments	Before RJSeal	After RJSeal
Z #		۰۶ 	British	Pendulum	# 60	n/a	n/a
FM 50Q No UTM East	786107	786156		Depth of Structure		0.504	0.571
UTM 500 No	341055	341057		Area	SG mm	49,554	43,814
	KLTES1	KLTES2		Avg dla	s,mm	251.3	236.3
r		1	Sand Patch Test	D¢	re/a	240	240
Longitude	101 34.440'	101 34.466'	Sand Pa	D3	e/u	255	230
47 N Grid Latitude	03" 04.948	03° 04.949 ·		D2	s,ww	260	230
#S45	KLTES1	KLTES2		ŀΟ	S,UU	250	245
Km Marker			Outflow	Meter	seconds	ς.	ro.
Description	1 Start of RJSeal Strip	2 Finish of RJSeal Strip		Water Penetration Me	ml/mln	0	0
Item			Testing Location	KM Marker	KLTES1	-0.6 metres	+0.6 metres

Volume of Sand (cc's) 25000

Demonstration of RJSeal<sup>™</sup> Federal Highway Route No. 2, Shah Alam, Selangor, Malaysia

May 8, 2006

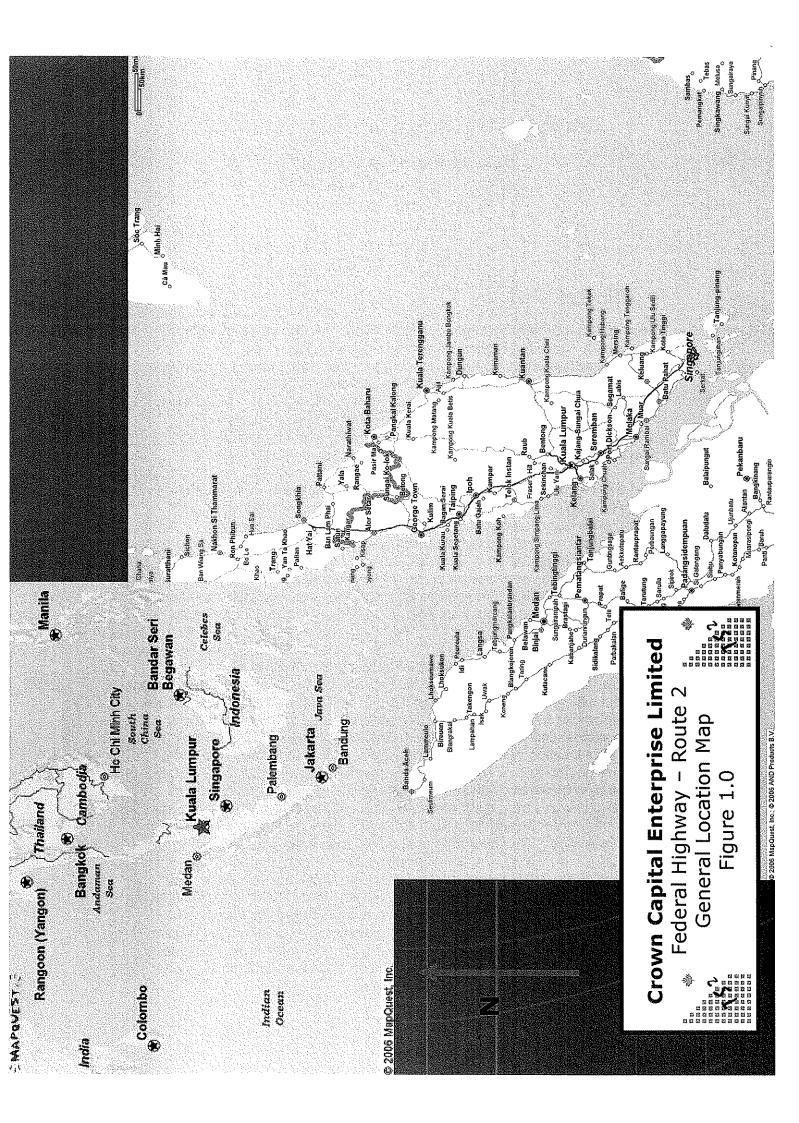
#### 1.0 INTRODUCTION

"Crown Capital Enterprise Limited of Hong Kong through its agent Kalvani International Limited of Singapore and its exclusive agent Viva Anggun Sendirian Berhad in Malaysia entered into arrangement with Projek Lebuhraya Utara Selatan (PLUS) and Projek Penyelenggaraan Lebuhraya Berhad (PROPEL) Kuala Lumpur, it's highway / expressway maintenance company on 8 May 2006". This arrangement calls for the analysis of the performance of RJSeal<sup>TM</sup>, a sealer/rejuvenator for asphalt pavement on Federal Highway Route No. 2 near Shah Alam, Selangor, Malaysia.

Malaysia is located in the tropics, comprising the southern portion of the Malaysian Peninsular, immediately south of Thailand, plus Sarawak and Sabbah on the north coast of Borneo. The majority of the country is positioned just north of the equator. Malaysia is separated from Singapore by the Straits of Johor and from Sumatra, the largest island of Indonesian Archipelago, by the Straits of Malacca. Malaysia has an extensive history, relating to the fact it's located on the Straits of Malacca, a significant maritime trading route between South East Asia, the Middle East and East African States.

Malaysia has a major north-south highway system on the Malaysian Peninsula, linking the major cities of Kuala Lumpur, with Georgetown (Penang) and eventually Hat Yai in the north and south with Jahor Bhatu that is linked to Singapore via two causeways. Furthermore there is a major east-west highway connecting Kuala Lumpur with Port Kelang. See figure 1.0 for a map showing the location of Malaysia with respect to its Indonesian, Thai and Singapore neighbours. The capital city is Kuala Lumpur, which lies at 20 to 100 metres in elevation, with suburbs now sprawling out for a distance of some 20 kilometres from the city centre. Malaysia enjoys a tropical climate with temperatures ranging from 40 Celsius to a more moderate 25 Celsius in the late evenings. Thunderstorms occur almost on a daily basis.

In the immediate Kuala Lumpur area, there are minimal exposures of the sedimentary rock sequence. Drainage channels afford limited opportunities to see the bedrock. The asphalt in the area is manufactured from imported materials, which is comprised of crushed and screened granites and diorites hauled in from quarries, as well as washed sand and gravel from the various rivers. The bitumen binder for the asphalt is sourced from various locations offshore and refineries, principally Singapore.



#### 2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with PROPEL of Kuala Lumpur is to demonstrate RJSeal<sup>T</sup> and subsequently allow analysis of the performance of RJSeal<sup>TM</sup> on a variety of asphalt surfaces. A demonstration was undertaken on May 8, on Federal Highway Route No. 2, near Shah Alam, Selangor, some 20 kilometres south west of the city centre of Kuala Lumpur, Malaysia. This highway leads to Port Kelang. The portion of the road that was treated was composed of asphalt pavement of mid-1993 vintage that had been milled and an overlay applied in 2003. The thickness of the overlay and base are not known. No details are known about the subgrade, but inspection of the shoulders show a sandy-silty material. Knowing construction techniques in roads in general, minimal gravel would be used for an immediate coarse base, beneath the asphalt pavement. The surface of the asphalt has a fairly coarse texture and no concern had been expressed about hydroplaning during heavy rains. Keen interest was expressed in having the life of the asphalt pavement extended.

# 3.0 RJSeal<sup>™</sup>

RJSeal<sup>TM</sup> is a proprietary product that is supplied by Crown Capital Enterprise Limited of Wanchai, Hong Kong. RJSeal<sup>TM</sup> has been proven in numerous applications in North and South America and recently in China to rejuvenate asphalt pavement at various stages of its life and economically extend the life of the pavement. RJSeal<sup>TM</sup> is a three component, asphalt sealer rejuvenator that is comprised of Refined Bitument (RT12), rejuvenator oils and Petroleum Solvents.

### 3.1 PRIOR EXPERIENCE

Refer to Appendix A for a copy of the brochure that outlines the experience with RJSeal<sup>TM</sup> at various locations in North America and South America as well as China. Further information is available from Crown Capital Enterprise Limited. RJSeal<sup>TM</sup> has been used at numerous airports in North and South America, as well as highways in Alberta, Canada; Cearo State, Brazil and other locations in the U.S.A. Since 2000, RJSeal<sup>TM</sup> has been demonstrated successfully at over fifty (50) locations in China and fifty eight (58) commercial-scale applications have taken place at various locations, such as Beijing, Shanghai, ShenYang, ChangChun, Harbin and Xi'an. Within the last 6 months, demonstrations have also been undertaken in Singapore at Changi Airport and also on several streets.

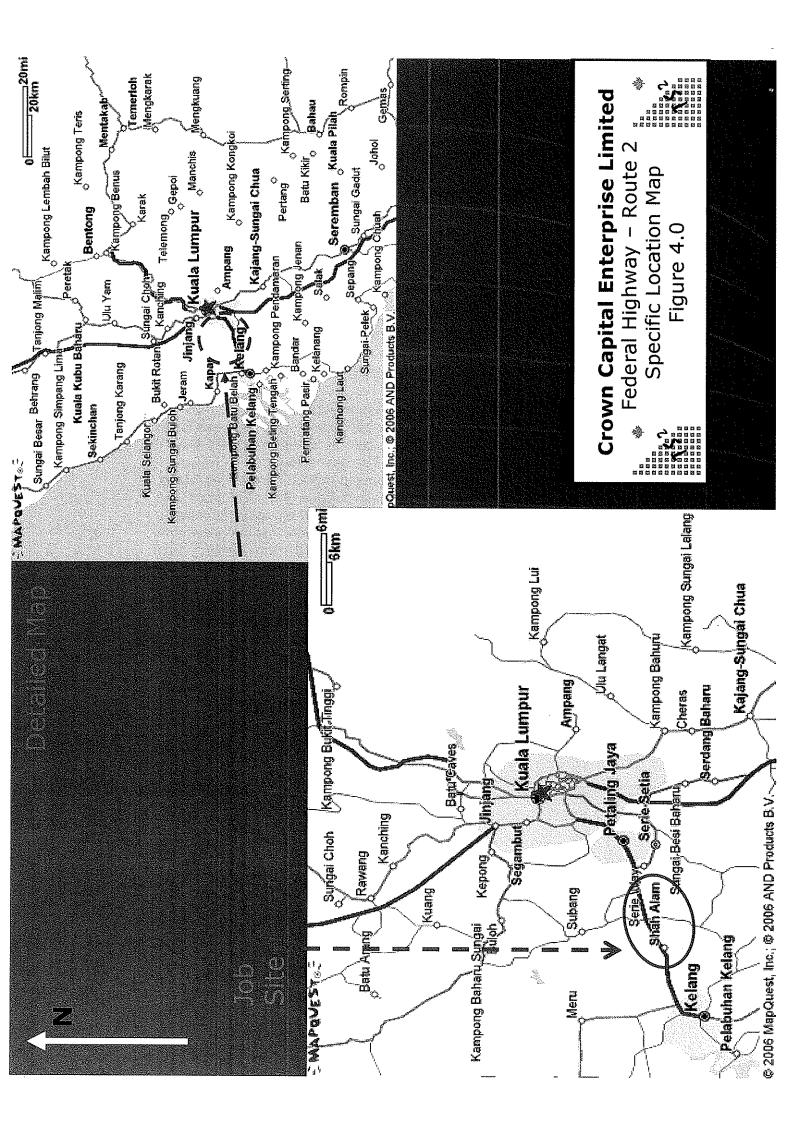
#### 4.0 TEST PROGRAM

Since Malaysia is located in a tropical climate (Latitude: 1 degree North to 7 degrees north) at a low altitude, it's a demanding setting for asphalt, given the year round warm climate (extremes of 40 Celsius and overnight lows in the 25 Celsius range) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

PROPEL, is responsible for operating approximately 200 kms of Toll Highway and Expressway. PROPEL is a subsidiary of United Engineers Malaysia, a publicly listed company, which is partially owned (37.1%) by Renong Bhd, a publicly listed conglomerate. PROPEL has agreed to try RJSeal<sup>TM</sup> at Km. 848 Federal Highway Route No. 2, Shah Alam, Selangor, which is owned by PLUS, a wholly owned subsidiary of Renong Bhd. See Figure 4.0, showing the location of this Toll Highway with respect to Kuala Lumpur.

Work commenced on the demonstration section at 9:30 pm on May 8, on a warm evening, where the temperature was approximately 27 degrees Celsius. There is a slight camber to the road, which causes water to run off toward the shoulder, rather than puddle on the road. The asphalt surface on Federal Highway Route No. 2, was reputedly 3 years old (mid-2003 vintage), being an asphalt overlay following milling of the original surface. No information was available as to the thickness of the overlay, however the original pavement was laid in 1993. No significant oil spills were observed, just the occasional drop of transmission oil, crankcase oil or hydraulic fluid. The asphalt pavement surface was not appreciably worn with no rutting due to traffic wear. There was aging and oxidation of the bitumen, which extended to a depth of several millimetres. The entire portion of the treated road was composed of asphalt pavement that was purportedly 15 centimetres thick and underlain by a gravel base, which was on a compacted silty-clay, sub-grade. The 50 metre long portion of Federal Highway Route No. 2 that had RJSeal<sup>TM</sup> applied was at the following geographic location:

Table 4.1	Geographic Location	Geographic Location of Test Strip					
Loc'n	System	Northing	Easting				
West End	Geographic (deg, min)	03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'				
	Universal Transverse Mercator Grid (47N) metres	341055	786107				
East End	Geographic (deg, min)	03° 04.949 '	101 <sup>0</sup> 34.466'				
	Universal Transverse Mercator Grid (47N) metres	341057	786156				



Details of the application are summarized in the table that follows:

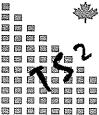
Table 4.2				Applicati Route N								
Work Schedule (am/pm)	į.		1	Total Area m <sup>2</sup>	Total Area yd <sup>2</sup>	RJ	Seal App	olied	P	Application	on Rate	
(annpin)	(1118)	111	yu	US gals	litres	Kgs	USGal /yd²	Litres /m <sup>2</sup>	m <sup>2</sup> /Litre	m²/Kg		
21:30 - 21:40	0.17	Prepa	ration	-	-	-		-	-	-		
21:40 - 22:20	0.67	183	218	10	37	39	0.045	0.20	4.96	4.68		
22:20 - 22:40	0.33		Slag Application		-	-	-	-	-	-		
22:40 - 23:00	0.33	Clea	ın-Up			-	-	-	-			
Totals	1.50	183	218	10	37	39	0.045	0.20	4.96	4.68		

Ambient temperatures were 27 degrees Celsius at the commencement of work at 9:30 pm pm, with humidity in the 80% range. The application of RJSeal<sup>TM</sup> was undertaken on the eastbound shoulder (slow) lane. The work area was treated with copper slag at an application rate of 0.3 kgs/square metre, immediately after the application of RJSeal<sup>TM</sup>. The intent was to see if the copper slag improved the skid resistance of the eastbound lane. Photos showing the application of RJSeal<sup>TM</sup> follow in figures 4.1 and 4.2 on the following pages.

The site was visited on May 9 around 10:30 am and a difference was readily perceived between the RJSeal<sup>TM</sup> treated section and the adjoining untreated portions. See figure 4.3



Figure 4.1 Typical Application Procedure



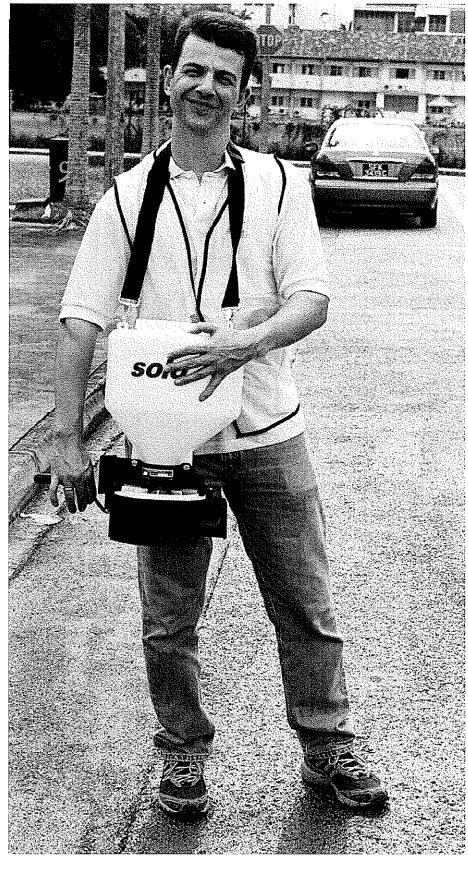
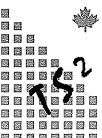


Figure 4.2 Copper Slag Application



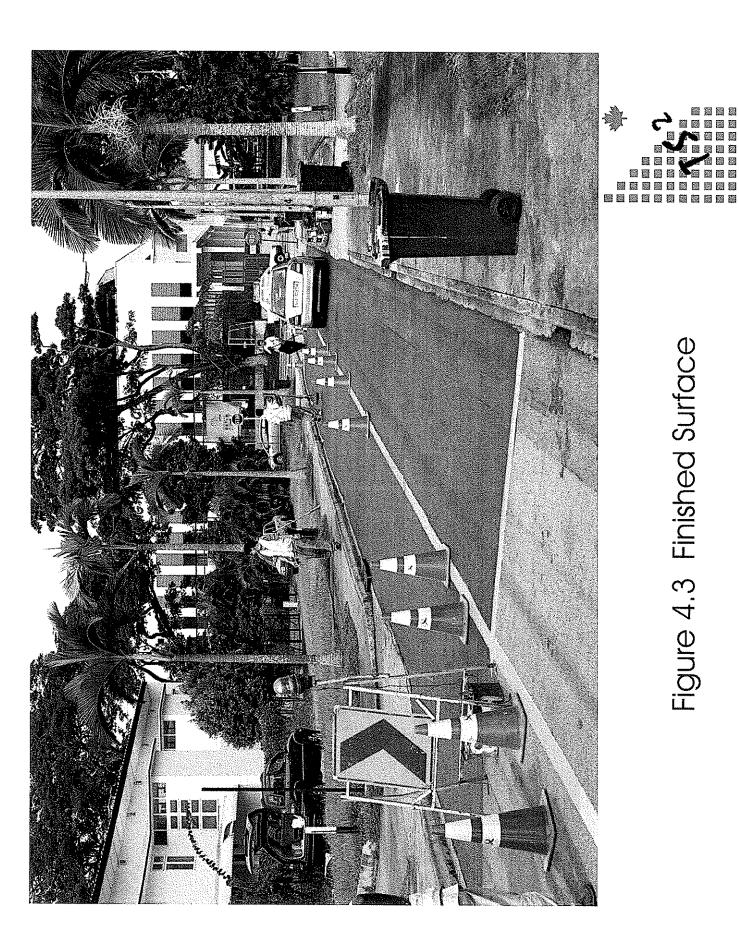


Figure 4.3 Finished Surface

## 4.1 RJSeal<sup>TM</sup> Testing

To date the comparison of the asphalt treated with RJSeal<sup>™</sup> has been compared on a subjective basis over a very short period on Federal Highway Route No. 2, Shah Alam, Selangor, Malaysia. Testing equipment was brought to the site for comparison on a more disciplined, objective basis included the following tests.

- Skid Resistance
- Water Penetration
- Macrotexture (Depth of Texture)

At a later date, cores will be acquired from the asphalt pavement for laboratory testing and the following properties of the asphalt pavement will be determined:

- Viscosity
- Ductility
- Penetration
- Softening Point

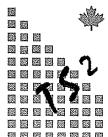
### 4.2 HydroPlaning Potential

An "Outflow Meter" manufactured in the U.S.A. by Humble Equipment Company of Ruston, Louisiana and sold under the trademark "Outflow Meter" was used to measure the asphalt pavement's macrotexture, to ascertain the hydroplaning potential on the RJSeal<sup>TM</sup> treated surface, versus the untreated surface. The procedure is documented in the ASTM Testing Standard E2380. The Outflow Meter gives readings in seconds for the dissipation of a known quantity of water. It is suggested that any readings between 3 and 10 seconds are satisfactory results for an asphalt pavement surface, if hydroplaning is to be minimized. Results of the testing are shown in the table below:

Table 4.3 Outflow Meter Testing						
Testing Locat	tion	Particul	Outflow Reading			
Latitude	Longitude Distance from west end of test strip		Lane	Location (wheelpath)	Before seconds	After seconds
03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'	-0.6 metres	Eastbound	Left	5	n/a
03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'	+0.6 metres	Eastbound	Left	n/a	5



Figure 4.4 Outflow Meter



#### 4.3 Water Penetration

Water Penetration Tests (China Testing Standard T 0730-2000) were undertaken at several locations on the untreated portion of the road, in close proximity to the test strip and later on the RJSeal<sup>TM</sup> treated section. Particulars of the tests are shown in the table that follows

Tab	le 4.4	Water Penetration Testing				
Testing Local	tion (Lat/Long)	Particulars of Testing Location Wat				
Latitude	Longitude	Distance from west end of test strip	Lane	Location (wheelpath)	Before ml/min	After ml/min
03 <sup>0</sup> 04.948 '	101° 34.440'	-0.6 metres	Eastbound	Left	0	n/a
03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'	+0.6 metres	Eastbound	Left	n/a	0

See Figure 4.5 that follows for a pictorial presentation of the Water Penetration Meter.

### **4.4 Macrotexture (Depth of Texture)**

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) was used to ascertain the Pavement Macrotexture Depth. Comparison was undertaken at several locations on both the untreated and RJSeal<sup>TM</sup> treated sections. The results of the testing are documented in the table that follows:

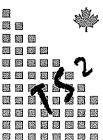
Tab	le 4.5	Sand Patch Testing				
Testing Locat	ion	Particulars of Testing Location Depth of Texts			Texture	
Latitude	Longitude	Distance from west end of test strip	west end of Lane (wheelnath)			After mm
03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'	-0.6 metres	Eastbound	Left	0.504	n/a
03 <sup>0</sup> 04.948 '	101 <sup>0</sup> 34.440'	+0.6 metres	Eastbound	Left	n/a	0.571

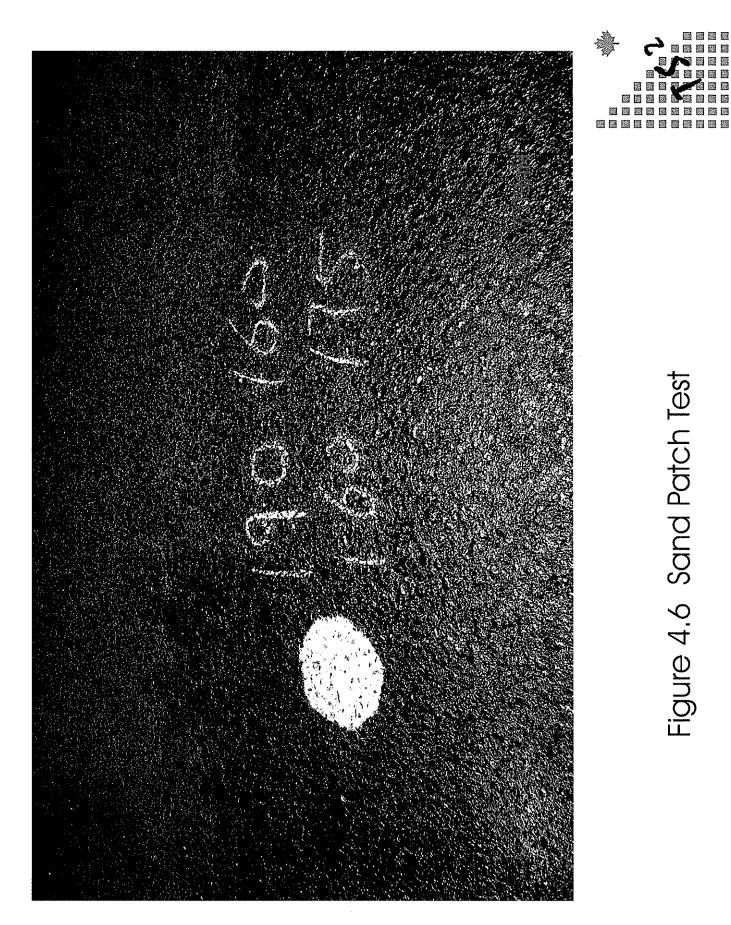
The results from the sand patch testing indicate that the depth of texture of road surface is adequate. The application of copper slag on the eastbound lane to improve the skid resistance was not essential, but undertaken for demonstration purposes. .

See Figure 4.6 which follows, showing the sand patch testing procedure.



Figure 4.5 Water Penetration Meter







### 4.5 Skid Resistance Tests

This aspect of the testing was conducted by IKRAM Engineering Services Sdn. Bhd (Pavement Research Section) for Soil Centralab Sdn Bhd. (wholly owned subsidiary of PROPEL on June 30, 2006. This is some 7 weeks after the actual application of the RJSeal<sup>TM</sup> (May 8, 2006)

The Skid Resistance testing was undertaken with a British Pendulum as prescribed in ASTM testing Procedure E303 and the results are as follows:

	Table 4.6		British Pendulum Tests				
Sample ID	Temp of Test Surface			Corrected SRV at 35 deg C			
		1	2	3	4	5	MEAN
point 1	33.0	57	60	65	62	63	60
point 2	33.0	55	56	57	57	58	56
point 3	32.0	56	58	59	58	57	56
point 4	33.0	60	61	62	63	63	61
				Average			58

These results are acceptable to PROPEL, who require a minimum of 55 for highways.

#### 4.6 <u>Ductility/Softening Point/Penetration Testing</u>

This aspect of the testing is beyond the capabilities Crown Capital Enterprise Limited and Kalvani International personnel and its exclusive agent Viva Anggun Sendirian Berhad in Malaysia has been sought from outside experts in the field of Asphalt Testing. To this end, PROPEL have retained IKRAM Engineering Services Sdn. Bhd. of Selangor (pavement material & QA/QC), which has appropriate testing facilities for asphalt cement to conduct tests on core samples from the RJSeal<sup>TM</sup> treated section. This is reported separately in Appendix C to this report.

# 5.0 Test Completion Schedule

Technicians from IKRAM Engineering Services Sdn. Bhd, will undertake testing on the trial section. The projected completion of this testing is scheduled as shown in the following chart.

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WANCHAI, HONG KONG

Demonstration of RJSeal™ Federal Highway Route No. 2, Shah Alam, Selangor, Malaysia

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Appendix A

**RJSeal<sup>™</sup> Descriptive Literature** 



WANCHAI, HONG KONG

Demonstration of RJSeal™ Federal Highway Route No. 2, Shah Alam, Selangor, Malaysia

May 8, 2006

Appendix B

**Copper Slag – Technical Specifications** 



WANCHAI, HONG KONG

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May 8, 2006

**Appendix C** 

Lab Tests on Core Samples from RJSeal<sup>TM</sup> Test Strip prepared by IKRAM Engineering Service Sdn. Bhd Kuala Lumpur



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