CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Demonstration of RJSeal™
Airport Expressway, Guangzhou, GuangDong Province, Peoples Republic of China

July 2004

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

Demonstration of RJSeal
Airport Expressway, Guangzhou, GuangDong Province,
Peoples Republic of China

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FIGURES

TABLES

Crown Capital Enterprise Limited.
RJSeal Demonstration
Airport Expwy, Guangzhou

Demo Date	26-Jul-04
Prepared by	Ekman Tang
Updated by	A.G. Speed
Updated	19-Sep-04

Weather Conditions

Temperature	**36 Celsius**
Humidity	60%
	Sunny
Rd surface Temp	**60 Celsius**

Assumptions

Panel Length	77.0	Metres
Panel Width	3.60	Metres
Panel Area	277.2	Sq Metres

Conversion Factors

US Gallon=	3.78	Litres
Sq Metre=	10.76	Sq Feet
Sq Metre=	1.20	Sq Yds
One Litre	1.04	kgs

Crew Consist	No
Labourers	4
Supervisor	1
Total	5

Work Schedule	Work Time	No. of Panels	Test Length	Total Area m^2	Total Area	RejuvaSeal Applied			Application Rate				5 Man Crew	
am/pm	(hrs)		(m)		yd^2	US gals	litres	kilograms	USGal /yd^2	Litres/m^2	m^2 /Litre	m^2/Kg	m^2 /man hr	yd^2 /man hr
13.30-15.30	2.00	1	77.0	277	331	21	78	80	**0.062**	0.28	3.55	3.47	27.7	33.1
Totals	2.00	1	77.0	277	331	21	78	80	**0.062**	0.28	3.55	3.47	27.7	33.1

Demo Location K12, to GZ direction, main lane next to emergency lane

Road Testing - Water permeability test

Location	(Before RJSeal) Sample No.	Inflow ml/min	(After RJSeal) Sample No.	Inflow ml/min
Left wheel track	1	0	4	0
middle	2	27	5	0
Right wheel track	3	50	6	0
	Approximately 5 metres north of start of test strip		**Approximately 6.5 metres south of start of test strip**	

Road Testing - Sand Patch Test

Location	Sample No.	(Before RJSeal) July 26 Diameter of Sand Patch D1 (mm)	D2 (mm)	Diameter Average (mm)	Texture depth (mm)
Left wheel track	1	190	220	205	0.76
middle	2	165	170	167.5	1.14
Right wheel track	3	165	190	177.5	1.01

Location	Sample No.	(After RJSeal) Sept 17 Diameter of Sand Patch D1 (mm)	D2 (mm)	Diameter Average (mm)	Texture depth (mm)
Left wheel track	4	180	190	185	0.93
middle	5	170	175	172.5	1.07
Right wheel track	6	220	205	212.5	0.71

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1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Guangzhou Airport Expressway Operating Management CO. LTD., of Guangzhou, Guangdong Province, China in July 2004. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on roads within the jurisdiction of the Guangzhou Airport Expressway Operating Management CO. LTD.

The Guangzhou Airport Expressway Operating Management CO. LTD. is located in the northeast sector of the City of Guangzhou in Guangdong Province, which is bordered by Fujian, JiangXi, Hunan, and GuangXi Provinces. Guangzhou is the capital city of GuangDong province and is a major service center for the area and in recent years has seen a major growth in population, along with significant construction due to the transfer of manufacturing from Hong Kong to Guangzhou and special economic development zones like the neighbouring cities of Shenzhen and Zhuhai. Guangzhou lies in the Pearl River Delta and hosts HuangPu port, which is accessible to river going vessels of intra-coastal (10,000 tonnes) size, which has a major container terminal for the export trade. The present population of Guangzhou and its suburbs and surrounding area is estimated at approximately 10 million. See figure 1.0 for a map showing the location of Guangzhou in Guangdong Province. The majority of the area lies at 10 to 15 metres in elevation, although mountains to the north and east hold some peaks that exceed 1,000 metres. The regions' latitude (23 degrees north), mean that there are four seasons, with temperatures ranging from 45 Celsius in the long, hot summer to 5 Celsius in the short winter. The rainy season is primarily May thru August, but can extend into September.

In the immediate Guangzhou area, a sequence of sedimentary rocks predominates, although some metamorphic rocks also occur. Due to the rock cuts along the highways, numerous rock outcrop exposures are available. The asphalt in the area is manufactured from local materials, which is comprised of crushed and screened sandstone, diorite, phylites and granite, as well as washed gravels from the various rivers. The bitumen binder for the asphalt is sourced from various locations. Since Guangzhou is near HuangPu Port on the Pearl River, which is navigable by intra-coastal size vessels, the possibility of bitumen being sourced from offshore is a distinct possibility so refineries in Singapore and the like should not be forgotten.

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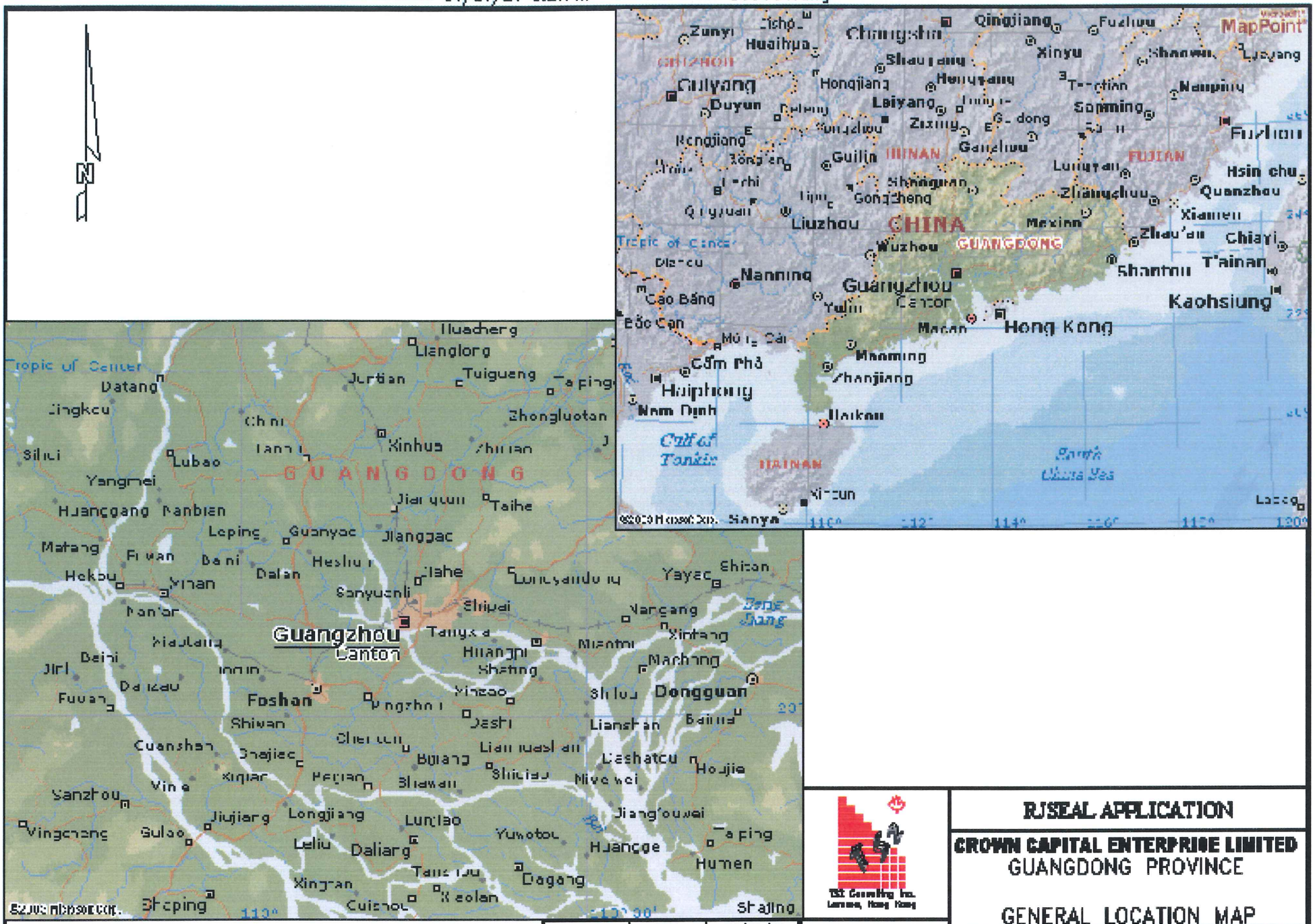


DESIGNED BY	TS2	04/01/06	SCALE: As Shown	
DRAWN BY	TS	04/01/06	PROJECT NO. B023H	

TSE Consulting Inc.
Lantau, Hong Kong

RJSEAL APPLICATION

CROWN CAPITAL ENTERPRISE LIMITED
GUANGDONG PROVINCE

GENERAL LOCATION MAP

DRAWING NO. FIGURE 1.0

REV. A

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with the Guangzhou Airport Expressway Operating Management CO. LTD. is to demonstrate RJSeal™ at a location selected by the road maintenance division, which will subsequently allow analysis of the performance of RJSeal™. A demonstration was undertaken on the expressway linking the new BaiYun Airport to the city of Guangzhou on July 26, 2004 near kilometre marker 12.5. The BaiYun Airport Expressway is an eight-lane, divided highway. The demonstration strip was on the outside lane on the Guangzhou (south) bound lane. The portion of the expressway treated was a Stone Matrix Asphalt (SMA) pavement that was placed in 2002. No details are known about the subgrade, but inspection of the shoulder show a sandy-silty material. Knowing construction techniques in Highways in China in general, minimal gravel would be used for an immediate coarse base, beneath the pavement. At the demonstration site, inspection of the asphalt pavement generally showed that there was a significant amount of exposed aggregate and the bitumen was quite oxidized. Some longitudinal cracks existed, but were typically in the 1.0 to 2.5 mm width range. These appear to be attributable to the cold joint between adjoining mats or reflective cracks from cold joints in the underlying asphalt pavement lifts. Some spots had been patched, which were probably attributable to replacement of sub-standard asphalt or possibly asphalt that was damaged due to softening of the sub-grade attributable to water penetration.

3.0 RJSEAL™

RJSeal™ is a proprietary product that is supplied by Crown Capital Enterprise Limited of Wanchai, Hong Kong. RJSeal™ has been proven in numerous applications in North and South America to rejuvenate asphalt pavement at various stages of its life and economically extend the life of the pavement. RJSeal™ is a three component, asphalt sealer rejuvenator that is comprised of Refined Coal Tar, Coal Tar Oils and Petroleum Solvents.

3.1 PRIOR EXPERIENCE

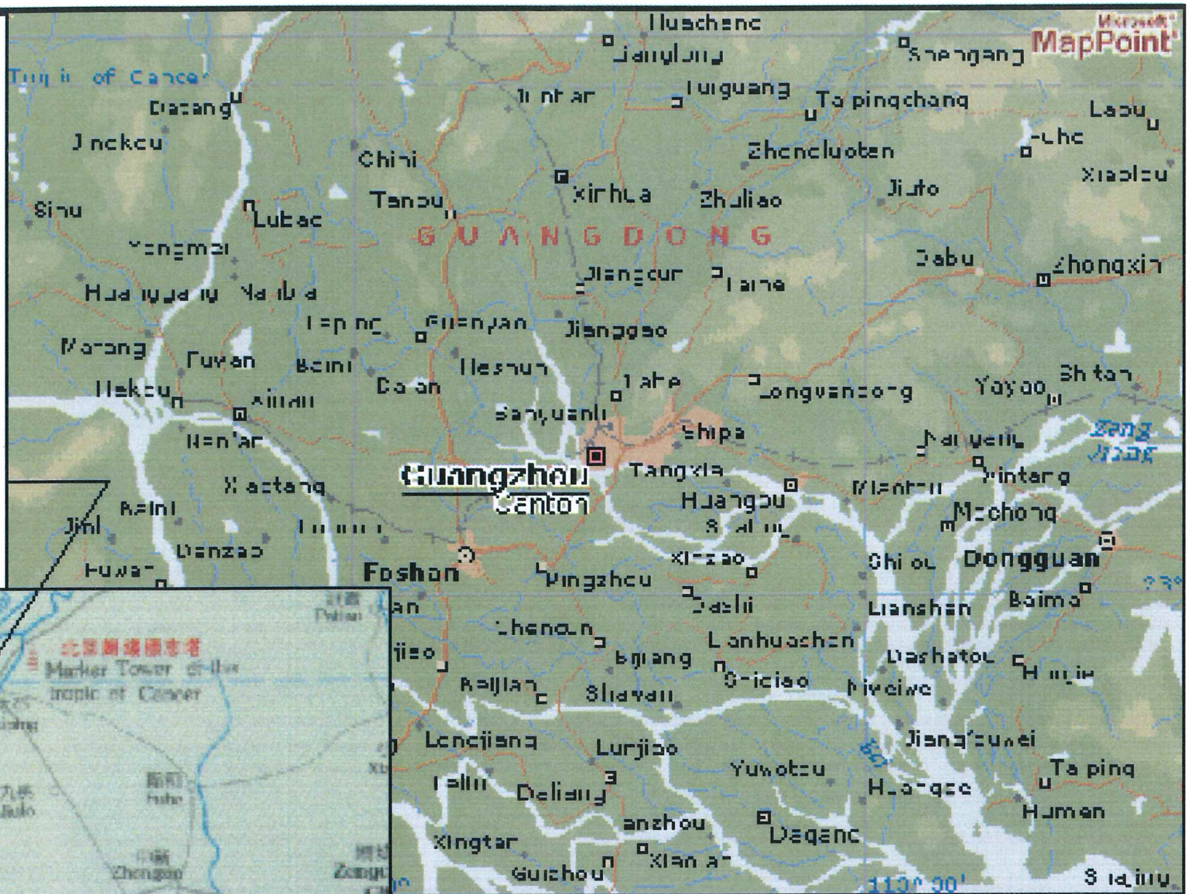
Refer to Appendix A for a copy of the brochure prepared by Crown Capital Enterprise Limited. This outlines the experience with RJSeal™ at various locations in China, North America and South America. Further information is available from Crown Capital Enterprise Limited on their website (www.crowncapital.com.hk) and also shown in the brochure in Appendix A. RJSeal™ has been used at numerous airports in North and South America, as well as highways in Alberta, Canada; Cearo State, Brazil and North Dakota and Texas, as well as other locations in the U.S.A. Since 2000, RJSeal™ has been demonstrated successfully at over forty (40) locations in China and fourteen (22) commercial-scale applications have taken place at various locations, including Shanghai, DaQing, QinHuangDao and Kunming.

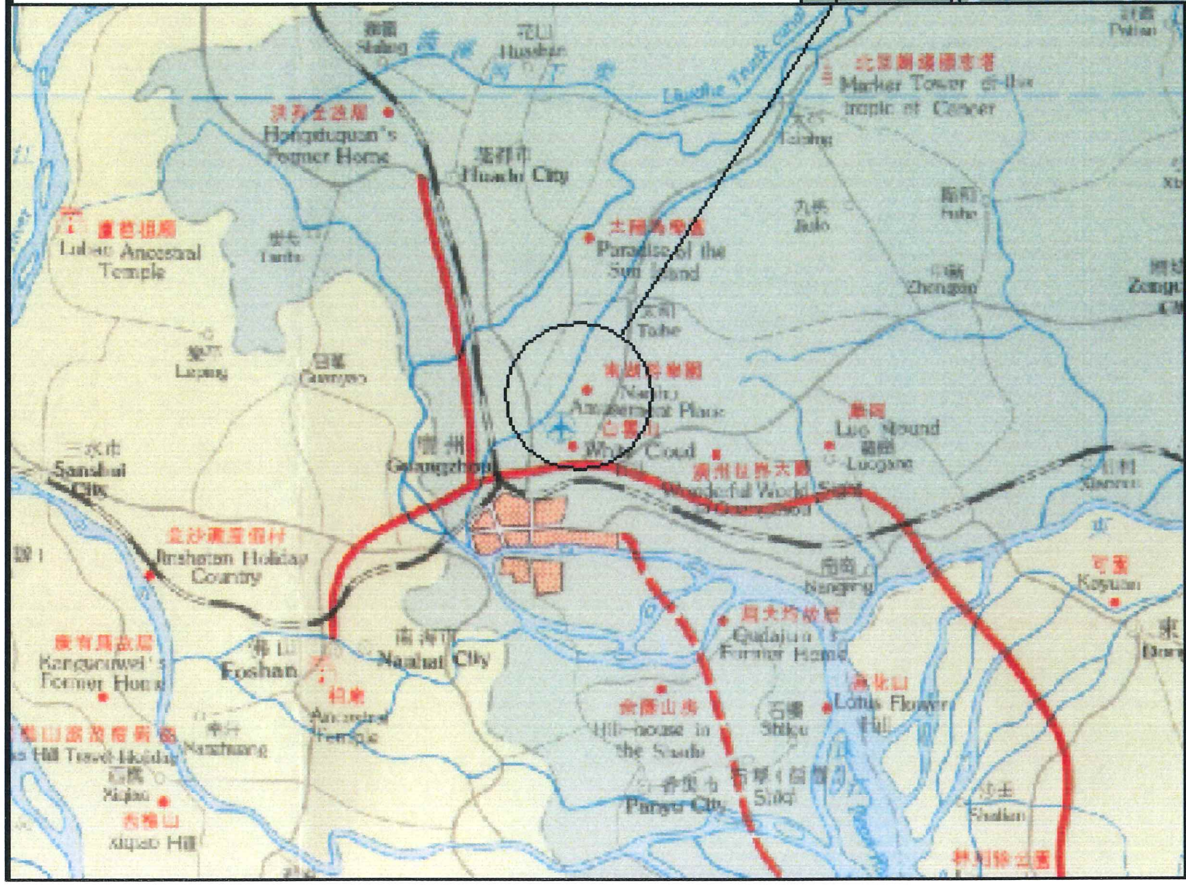
4.0 TEST PROGRAM

Since GuangDong Province is located in a tropical climate (Latitude: 23 degrees North) at a low altitude (10 to15 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 46 Celsius in summer and 5 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

The new BaiYun Airport is located north east of Guangzhou and the maintenance personnel are definitely interested in determining how to economically extend the life of the asphalt road surface and inhibit water penetration. To this end, the Guangzhou Airport Expressway Operating Management CO. LTD., which is responsible for road maintenance has agreed to try RJSeal™ on the Airport Expressway. The arrangement led to selection of an appropriate location for the testing of RJSeal™. The demonstration section is located at Km 12.5 on the Airport Expressway, northeast of the City of Guangzhou. See figure 4.0, which follows, for a location of the general locale.

Demo Loc'n





	RISEAL APPLICATION
	CROWN CAPITAL ENTERPRISE LIMITED
	DETAILED LOCATION MAP
SCALE: NTS	DRAWING NO. FIGURE 4.0
PROJECT NO. B023E	REV. A

The demonstration section on Airport Expressway was selected by the Guangzhou Airport Expressway Operating Management CO. LTD., who is responsible for highway maintenance on the Airport Expressway. The section chosen for the demonstration is geographically located as follows:

Table 4.1		**Location of Demo Site**	
Location	**System**	**Northing**	**Easting**
West End	Geographic (deg, min)		
	Universal Transverse Mercator Grid (49Q)(metres)		
East End	Geographic (deg, min)		
	Universal Transverse Mercator Grid (49Q)(metres)		

Work commenced on the demonstration section at 13:30 on July 26, on a hot afternoon, where the temperature reached 36 Celsius. A test strip, 77 metres long, was undertaken on the Guangzhou bound, outside lane of the BaiYun Airport Expressway. The test section is located on a straight section with a no appreciable gradient. 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 the section treated, was reputedly 2 years old (2002 vintage). No significant oil spills were observed, just the occasional drop of transmission oil, crankcase oil or hydraulic fluid. The surface was not appreciably worn, with minimal rutting due to traffic wear. There were some longitudinal cracks, usually in the 0.5 to 1.5 mm width, which appear to be the cold joint at adjoining mats from the initial asphalt paving. The oxidation of the bitumen extended to a depth of several millimetres. The entire portion of the treated highway is on a compacted silty-clay, sub-grade

On July 26, one segments (panel) was marked off, some 77 metres in length. The width of this southbound (outside) lane is 3.60 metres between the painted, dividing line and the paved shoulder lane. The RJSeal™ was applied, using paint rollers and plastic pails.

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

Figure 4.2			**Details on RJSeal™ Demonstration Section on Airport Expressway**						
Work Schedule	Work Time (Hrs)	Test Length (m)	Total Area m^2	RJSeal™ Applied			Application Rate		
				US gals	Litres	Kgs	US Gal /yd^2	m^2 /Litre	m^2 /Kg
13:30-15:30	2.0	77	277	21	78	80	0.062	3.55	3.47

Ambient temperatures at the time of the application were in the 36 degree Celsius range, with humidity in the 60% range. The application ceased at 15:30 am and the lane remained closed until 7:00 pm on July 26, when it was

re-opened for traffic. Photos showing the test application of RJSeal™ follow in figures 4.1, and 4.2 and on the following pages.

The site was visited on September 17, 2004 around 11:30 am and a difference was readily perceived between the RJSeal™ treated section and the adjoining untreated portion. A screwdriver was used to dig two small holes in the asphalt pavement, to a depth of 3 centimetres, some 10 metres south of the start point (north end) of the demonstration (test) section, to determine the penetration of the RJSeal™. This was two months after the application of RJSeal™ and at this location the newly rejuvenated surface was evident, by the black resilient surface layer, which was now approximately 4 millimetres thick. Below that depth, the grey, oxidized layer of asphalt was evident. See figure 4.3 for details on the road on the inspection.

Figure 4.1 Typical Application Procedure for RJSeal.

Figure 4.2 Finished RJSeal Surface.

Figure 4.3 Inspection of demo, two months after RJSeal application

4.1 RJSeal™ Testing

To date the comparison of the asphalt treated with RJSeal™ has been compared on a subjective basis over a very short period. The technicians from the Hong Kong office of Crown Capital Enterprise conducted some preliminary testing on the initial demo section in July 2004 and again in September. Their findings are documented in the following tables in the report.

Testing equipment was brought to the site for comparison on a disciplined, objective basis, to ascertain the following properties, which is document in the following sections:

- Macrotexture Depth
- Water Penetration

Testing equipment will be brought to the site for comparison on a disciplined, objective basis, to ascertain the following properties:

- Hydroplaning Potential
- Viscosity/Ductility Testing

4.2 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™ treated section.

Table 4.3			**Water Penetration Meter Readings**		
Test No.	Test Date	Location relative to the shoulder line	Location relative to start of demo section	Before RJSeal™ (ml/min)	After RJSeal™ (ml/min)
1	July 26	2.0 m east	5 m north	0*	n/a
2	July 26	1.5 m east	6.5 m north	27	n/a
3	July 26	0.5 m east	5 m north	50	n/a
4	Sept 17	2.0 m east	6.5 m south	n/a	0
5	Sept 17	1.5 m east	7.5 m south	n/a	0
6	Sept 17	0.5 m east	8.5 m south	n/a	0

The readings taken before the application of RJSeal™ indicated that this pavement has a problem with water penetration. See Figure 4.4 that follows for a pictorial presentation of the Water Penetration Tests.

Figure 4.4 Water Penetration Meter

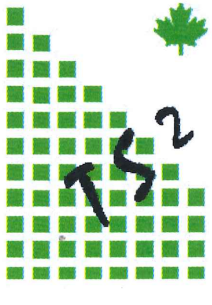
4.3 Macrotexture Depth

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) will be used to ascertain the Pavement Macrotexture Depth. Comparison was undertaken at several locations on both the untreated and RJSeal™ treated sections.

Table 4.4			**Sand Patch Readings (Macrotexture Depth)**		
Test No.	Test Date	Location relative to the shoulder line	Location relative to start of demo section	Untreated (mm)	RJSeal™ Treated segment (mm)
1	July 26	2.0 m east	5 m north	0.76	n/a
2	July 26	1.5 m east	5 m north	1.13	n/a
3	July 26	0.5 m east	5 m north	1.01	n/a
4	Sept 17	2.0 m east	6.5 m south	n/a	0.93
5	Sept 17	1.5 m east	7.5 m south	n/a	1.07
6	Sept 17	0.5 m east	8.5 m south	n/a	0.71

The readings taken before the application of RJSeal™ indicate that the road surface is sufficiently rough, to minimize problems with skidding, especially when raining and hydroplaning.

Figure 4.5
Humble Equipment Co. Outflow Meter



5.0 Conclusion

The application of RJSeal™ on the test strip has shown that the loss of fine material from the asphalt pavement can be minimized due to the rejuvenation of the bitumen binder with increase in ductility of the bitumen. Furthermore, water penetration along the linear cold joints between adjoining mats of the asphalt pavement has been appreciably reduced due to the sealing effect of RJSeal™. This will minimize future damage due to water penetration and softening of underlying material.