CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Demonstration of RJSeal™
Zhonghuan Xi Road, Wuhan, Hubei, Peoples Republic of China

September 2004

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

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Zhonghuan Xi Road, Wuhan, Hubei,
Peoples Republic of China

September 2004

APPENDICES

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B	Desco D200 Technical Specifications
C	Copper Slag - Specifications

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1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Wuhan Zhonghuan Road (West Section) Management Office, Hubei Province, China in September 2004. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on roads within the Wuhan Zhonghuan Road (West Section) Management administrative district.

Hubei Province is situated immediately astraddle of the Yangtze (Chiang Jiang) River and is bordered by Henan, Anhui, JiangXi and Hunan and Shanxi Provinces as well as ChongQing Municipality. The province is generally quite mountainous and the capital city is Wuhan, which has a population of approximately 6 million. Wuhan is a port on the Chiang Jiang (Yangtze) River and has a container terminal as well. The city was originally comprised of three towns, which merged to become known as Wuhan during the 19th Century. The primary transportation route to Wuhan was originally via boats, which could travel upstream from Shanghai with Sampans and Junks initially powered by oar and sail being the traditional conveyance. Later these were replaced by ships initially powered with steam engines and finally combustion engines. However significant commercial transport activity really commenced when the rail-line was completed from Beijing to Wuhan in the 1890's. The subsequent the rail-line north from Guangzhou reached Wuhan in 1906. At that time, there was no direct connection between the two rail-lines and railcars and passengers had to be ferried across the Yangtze River. The completion in1957 of a high-level, rail/vehicular bridge across the Yangtze River meant that trains could travel uninterrupted without the aid of ferries. Recently, two more vehicular bridges have been completed across the Yangtze River in Wuhan. The original rail/vehicular bridge was of lattice girder construction whereas the more recent vehicular traffic bridges have been either suspension bridges or cable-stayed bridges. Hubei has seen a major growth in the highway system, in recent years, due to a government drive to build national highways linking Wuhan with major cities in the adjoining provinces. One of the principal industries in Wuhan is the Dong Feng-Citroen Joint Venture which manufactures several models of cars, principally four door, sedans and of note is the brewery which produces Budweiser Beer under license from the Anheuser Busch Brewery in the USA.

See figure 1.0 for a map showing the location of Wuhan and Hubei Province. The majority of the area lies at 80 to 90 metres in elevation. The regions'

latitude (30 degrees north), mean that there are four seasons, with temperatures ranging from 45 Celsius in the long, hot summer to minus 10 Celsius in the short winter. There is a rainy season per-se, with rainfall occurring primarily in May thru August, but can extend into September.

In the immediate Wuhan area, a significant consolidated sedimentary sequence predominates. Due to mountain building a significant number of hills and small mountains prevail, that have been gradually eroded and afford excellent opportunities to see the bedrock. The asphalt in the area is manufactured from local materials, which is comprised of crushed and screened sandstone hauled in from local quarries, as well as washed gravels from the various rivers. The bitumen binder for the asphalt is sourced from various locations. Since Hubei Province straddles the Yangtze River and has sufficient depth for river vessels and barges to transport material from Shanghai and other coastal ports, 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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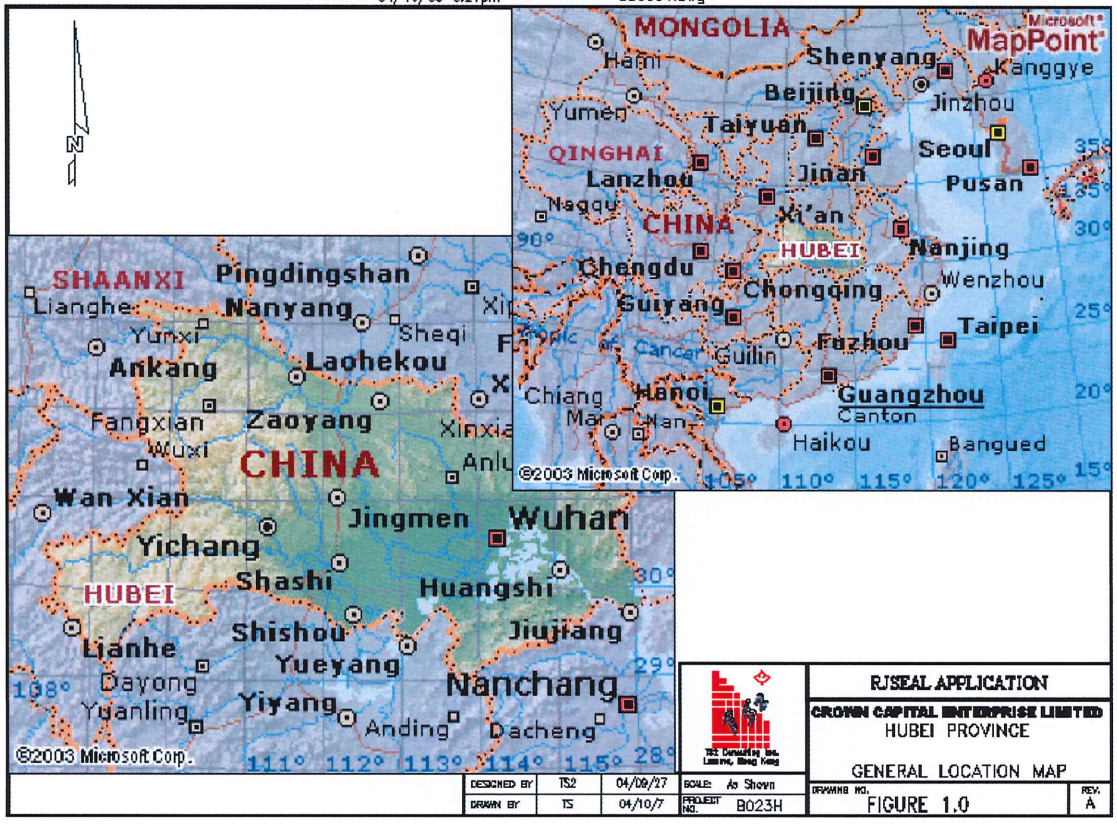

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RJSEAL APPLICATION

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HUBEI PROVINCE

GENERAL LOCATION MAP

DRAWING NO. FIGURE 1.0 REV. A

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with Wuhan Zhonghuan Road (West Section) Management of Hubei Province is to demonstrate RJSeal™ at location(s) selected by the Wuhan Zhonghuan Road (West Section) Management. The demonstration will subsequently allow analysis of the performance of RJSeal™ on a variety of asphalt pavement surfaces. A demonstration was undertaken on the Zhonghuan Xi Road that is the southern approach to the bridge across the Second Bridge over the Han Jiang River that joins the Chiang Jiang River within the city of Wuhan. The demonstration section was on a one kilometre section of this four lane divided highway. The asphalt pavement was suspected to be of mid-1990's vintage. The surface of the asphalt was quite rough with numerous lateral and longitudinal cracks, that had recently been patched with hot tar. Furthermore, there were extensive patches to the road surface, that were completed just prior to the application of RJSeal™. The primary concern expressed has been about extending the life of the road surface, thru rejuvenation of the bitumen binder and elimination of water percolating through cracks in the asphalt pavement and softening the underlying road subgrade.

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 at their website www.crowncapital.com.hk. 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 fourty two (42) locations in China and twenty five (25) commercial-scale applications have taken place at various locations in China, including Shanghai, Kunming, DaQing, QinHuangDao and Shenzhen.

4.0 TEST PROGRAM

Since Hubei Province is located in a semi-tropical climate (Latitude: 30 North) at a low altitude (80 to 90 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 2 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

Hubei has the significant concentration of highways in China with some 4,000 kms of National and Provincial highway. Wuhan Road and Bridge Toll Management Centre is the manager for two (2) bridges that cross the Chiang Jiang (Yangtze) River and three (3) bridges that cross the Han Jiang River in Wuhan along with 50 kilometres of ring road (National Highway and Provincial Highway) connecting these bridges. Wuhan Zhonghuan Road (West Section) Management is responsible for the maintenance of these bridges and roads.

In view of the aging of the asphalt pavement with attendant loss of fines and also the loss of ductility and water seepage thru cracks in the aging asphalt pavement, the Wuhan Zhonghuan Road (West Section) Management Office is definitely interested in determining how to economically reduce the permeability of the asphalt road surface and restore the ductility. To this end, Wuhan Zhonghuan Road (West Section) Management agreed to try RJSeal™ on the Zhonghuan Xi Road, near Wuhan. See Figure 4.0, showing the location with respect to Wuhan and Hubei

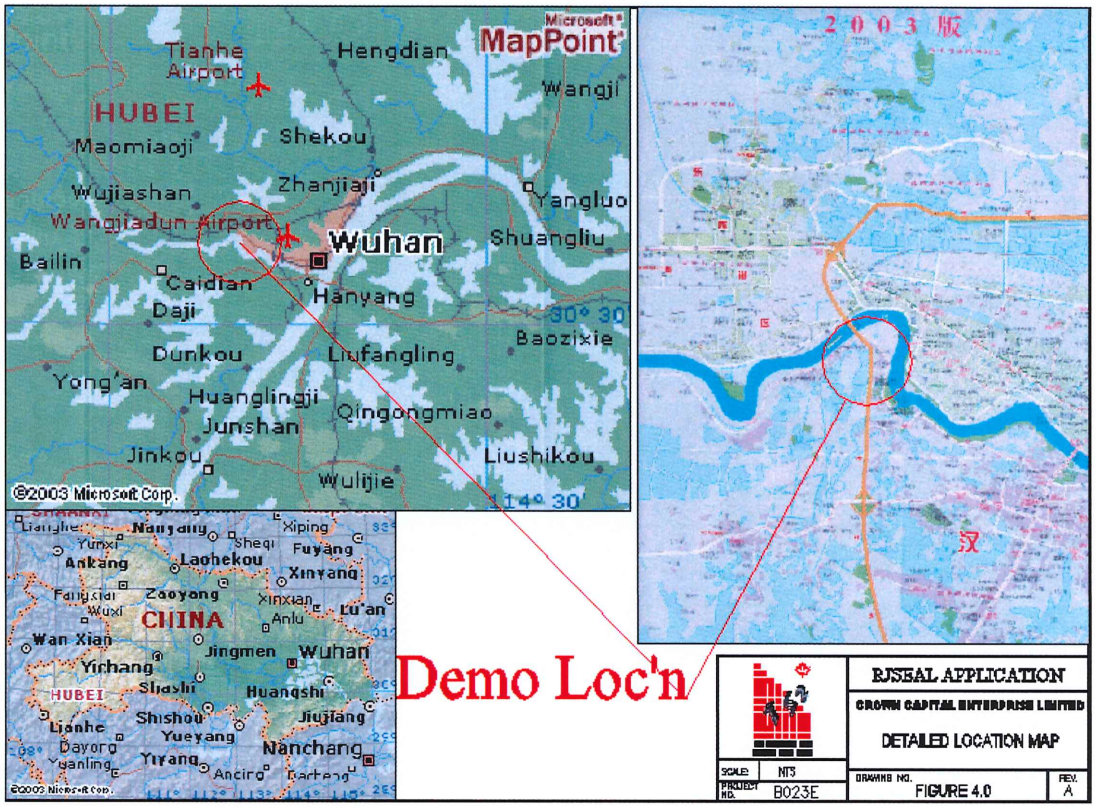
The demonstration segment was at the following geographic location:

Table 4.1 Zhonghuan Xi Road	**Geographic Location of Demonstration Site**	
System	**Northing**	**Easting**
Geographic (deg, min)	30^0 00.000'	114^0 00.000'
Universal Transverse Mercator Grid (50R) (metres)	0224822	3364004

The section selected for the demonstration is a portion of the ring road, immediately south of the Fifth Bridge over the Jiang Han River. There is a slight camber to the road, which causes water to run-off toward the outside, rather than puddle on the road. 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 apparant rutting due to traffic wear. There was some aging and oxidation of the bitumen, which extended to a depth of several millimetres. The fines in the asphalt pavement had been lot, so the coarser aggregate stood out quite prominently The asphalt pavement on the section treated was reputedly 8 years old.

On September 22, the three northbound lanes of the Zhonghuan Xi Road (six lane, divided bridge Road with nominal shoulders) were treated with RJSeal™ that was applied using a Desco D200 Sprayer (see Appendix B for technical specifications). Copper slag was subsequently applied, using a Sno-Way PT-

8, sand spreader and this was then rolled with a twelve-tonne, pneumatic tired roller. Specifications of the copper slag are contained in Appendix C. On September 23, the three adjoining southbound lanes were treated with RJSeal™ and followed with Copper Slag.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Hengdian
Wangji
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Shuangliu
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CHINA
HUBEI
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Demo Loc'n
RJSEAL APPLICATION
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DETAILED LOCATION MAP
SCALE: NTS
PROJECT NO. B023E
DRAWING NO. FIGURE 4.0
REV. A

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

Table 4.2					Details of RJSeal™ Application - Zhonghuan Xi Road					
Date Sept	Work Schedule am/pm	Work Time (hrs)	Test Length (m)	Total Area m^2	RJSeal™ Applied			Application Rate		
					US gals	Litres	Kilo grams	USGal /yd^2	m^2 /Litre	m^2/Kg
22	09:00-17:00	8.0	1,000	10,000	550	2070	2150	0.046	4.84	4.65
23	08:00-17:00	9.0	1,000	13,200	720	2740	2850	0.046	4.82	4. 63
	Total	17	n/a	20,000	1270	4820	5000	0.046	4.83	4. 64

This demonstration was primarily intended to show that the asphalt pavement ductility could be restored and water penetration could be appreciably stopped. See figure 4.1, which follows, showing the application of RJSeal™.

Figure 4.1 Typical Application Procedure

Figure 4.2 Completed Job

Copper slag was applied to the treated surface shortly after the RJSeal™ was applied. Some 2 tonnes of copper slag was applied to the entire 20,000 square metre demonstration area. Refer to Appendix C for specifications of this copper slag. See figure 4.3 showing the application of the copper slag with a Sno-Way PT-9 Sand Spreader.

Figure 4.3 Slag Application

4.1 RJSeal™ Testing

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

- Macrotexture Depth
- Water Penetration
- Hydroplaning Potential

Preliminary testing was conducted on the application section on September 22, 2004, prior to the application of RJSeal™. The findings are documented in the following tables.

4.2 Water Penetration

Water Penetration Tests (China Testing Standard T 0730-2000) were undertaken at several locations on the Firth Bridge Road, just south of the obsolescent toll booths, in close proximity to the demonstration strip.

Table 4.3			**Water Penetration Meter Readings**		
Test No.	Test Date	Location relative to the median	Location relative to start of demo section	Before RJSeal™ (ml/min)	After RJSeal™ (ml/min)
1	Sept 22	5.0 m east	0.3 m south	0	n/a

The readings taken before the application of RJSeal™ indicated that the asphalt pavement does not have a problem with water penetration, except presumeably at cracks and cold joints of adjoining mats . See Figure 4.4 that follows for a pictorial presentation of the Water Penetration Tests.

Figure 4.4 Water Penetration Meter
& Sand Patch Test

4.3 Macrotexture Depth

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) was used to ascertain the Pavement Macrotexture Depth. A reading was undertaken on the untreated section in close proximity to the Water Penetration Meter test.

Table 4.4			**Sand Patch Readings (Macrotexture Depth)**		
Test No.	Test Date	Location relative to the median	Location relative to start of demo section	Untreated (mm)	RJSeal™ Treated segment (mm)
1	Sept 22	5.0 m east	0.3 m south	0.37	n/a

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

4.4 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" (see figure 4.5) was used to measure the asphalt pavement's macrotexture, as concern has been expressed about hydroplaning on the RJSeal™ treated surface, versus the untreated surface. The procedure is documented in the ASTM working paper, WK-364. 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. The following reading was obtained at the north end of the demonstration section, prior to application of RJSeal™:

Table 4.5			**Outflow Meter Readings**		
Test No.	Test Date	Location relative to the median	Location relative to start of demo section	Untreated Segment (seconds)	RJSeal™ Treated Segment (seconds)
1	Sept 22	5.0 m east	0.3 m south	3	n/a

These readings suggest that hydroplaning is not a significant problem.

Figure 4.5 Outflow Meter Test

5.0 Test Completion Schedule

Technicians from the Hong Kong office will be dispatched to undertake further testing on the RJSeal™ application section in the near future. The projected completion of this testing is scheduled as shown in the following chart.

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Appendix A

RJSeal™ – Descriptive Literature

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Appendix B

Desco D200 Sprayer
Technical Specifications

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Appendix C

Copper Slag – Specifications

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