CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Demonstration of RJSeal™
Estrada de Pac On,
Taipa, Macao,
Peoples Republic of China

March 2004

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

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March 2004

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Peoples Republic of China

March 2004

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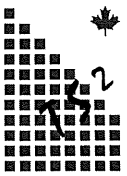

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1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Instituto Para Os Assuntos Civios E Municipals of Macao in March 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 Instituto Para Os Assuntos Civios E Municipals in Macao.

Macao is a major gambling destination as well as service center for the area and in recent years has seen a major growth, along with significant construction due to the transfer of manufacturing from Hong Kong to special economic development zones established in the neighbouring cities of Shenzhen and Zhuhai. Macao lies at the mouth of Pearl River Estuary and hosts a port, which is accessible to oceangoing vessels of Panamax (40,000 tonnes) size, and has a container terminal for the export trade. The present population of Macao and its suburbs is estimated at approximately 400,000. See figure 1.0 for a map showing the location of Macao. The majority of the area lies at 10 to 15 metres in elevation, although mountains to the north and west hold some peaks that exceed 1,000 metres. The regions' latitude (23 degrees north), mean that there are four seasons, with temperatures ranging from 42 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 area, a sequence of sedimentary rocks predominates, although some metamorphic rocks also occur. Due to the rock cuts along the various city streets, 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 Macao is located on the South China Sea, the possibility of bitumen being sourced from offshore is a distinct possibility so refineries in Singapore and the like should not be forgotten.


Guangzhou
Huizhou
Foshan
Dongguan
GUANGDONG
Shenzhen
Pearl
River
Delta
Jiangmen
HONG KONG
Zhuhai
MACAU
0
30 km


Expedia
Microsoft MapPoint
Tangxia
Rongqi
Wanqingsha
Heping
Shiyan
Niudipu
Duruan
Buxu
Minzhong
Longhua
Henggang
Beijie
Gangkou
Buji
Jiangmen
Nantou
Shenzhen
Lap Wo
Tsuen
Daze
Xinhui
Zhongshan
Qishan
Pun Uk Tsuen
Shaxi
Nanlang
22° 30'
Tesha
Shekou
Ng Uk
Tsuen
Muzhou
Dayong
Shuen Wan
Chenchong
GUANGDONG
Cuihengcun
Zhujiang Kou
Hau Hoi Wan
Shuangshui
Tan Jiang
Yuen Long
Tai Po
Miaojiao
Lingding
Yang
Min Fong
Dasha
Lung Tsai
Dongbei
Xiazha
Shenwan
Tsuen Wan
Gujing
Tangjia
Tsing Yi Town
Fui Yiu
Sanxiang
Sham Wan Tsuen
Huangchong
Shenwan
Kowloon
Sancun
Nim Shue Wan
Zhuhai
Dachikan
Sunset Peak
Qianshan
Hong Kong
Nanping
Gongbei
TAI YUE SHAN
Meige
Doumen
Yi O San Tsuen
HONG KONG SAR
(CHINA)
Gudou
Shan
Wanzai
Macao
Siu A Chau Tsuen
Mashan
Qianwu
TAIPA
Sheung Tsuen
Pingsha
Xiaolin
HENGQIN
DAO
COLOANE
Duhu
SANZAO DAO
Chixi
Huangmao Hai
22°
Tiantou
Wanshan
DAWANSHAN
DAO
GAOLAN DAO
BEIJIAN DAO
Tonggu
HEBAO DAO
South
China Sea
©2004 Microsoft Corp.
113° 30'
114°


Microsoft MapPoint
Zunyi
Jishou
Changsha
Qingjiang
Fuzhou
Huaihua
Xinyu
Shaowu
Luoyang
GUIZHOU
Shaoyang
Guiyang
Hengyang
Hongjiang
Tengtian
Nanping
Duyun
Defeng
Leiyang
Longhai
Sanming
Zixing
Guidong
26°
Yongzhou
Rongjiang
Ruijin
Fuzhou
Ganzhou
Guilin
HUNAN
FUJIAN
Rong'an
Luokun
Longyan
Hsin-chu
Hechi
Shaoguan
Zhangzhou
Quanzhou
Lipu
Gongcheng
Qingyuan
Xiamen
Liuzhou
CHINA
Mexian
24°
Tropic of Cancer
Zhao'an
Chiayi
Wuzhou
GUANGDONG
Dizhou
T'ainan
Nanning
Shantou
Guangzhou
Canton
Cao Bằng
Kaohsiung
Yulin
Bắc Cạn
22°
Macao
Hong Kong
Móng Cái
Maoming
Cẩm Phả
Zhanjiang
Red
Haiphong
Nam Định
20°
Haikou
Gulf of Tonkin
HAINAN
South China Sea
Xincun
Laoag
©2003 Microsoft Corp.
Sanya
110°
112°
114°
116°
118°
120°

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with the Instituto Para Os Assuntos Civios E Municipals is to demonstrate RJSeal™ at different locations they select, which will subsequently allow analysis of the performance of RJSeal™ on a variety of asphalt surfaces. A demonstration was undertaken in the northern portion of Macao in the Taipa Suburb adjacent to the International Airport on March 19, 2004 on Estrada de Pac On, a four-lane divided street. The demonstration strip was on the outside (curb) eastbound lane. The portion of the Street treated was an asphalt pavement that was placed in 1996. No details are known about the subgrade, but inspection of the shoulder show a sandy-silty material. Knowing construction techniques in Streets in this area 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 linear and longitudinal cracks existed, but were typically in the 0.5 to 1.5 mm width range. Some potholes had been patched, which were probably attributable to softening of the sub-grade due to water penetration or possibly underground utility repairs. One or two locations had alligator cracks

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 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. 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 thirty four (34) locations in China and fourteen (14) commercial-scale applications have taken place at various locations, including Shanghai and Kunming in mainland China

4.0 TEST PROGRAM

Since Macao 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 42 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 Instituto Para Os Assuntos Civios E Municipals is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, they agreed to try RJSeal™ on Estrada de Pac On. The arrangement led to selection of an appropriate location for the testing of RJSeal™. The demonstration section on the Estrada de Pac On is located in the north-east sector of the City of Macao in the Taipa Suburb. See figure 4.0, which follows, for a location of the general locale.

The demonstration section on Estrada de Pac On was selected by the Instituto Para Os Assuntos Civios E Municipals, who are responsible for road and highway maintenance in Macao. The section chosen for the demonstration is geographically located as follows:

Table 4.1		**Location of Demo Site**	
Location	**System**	**Northing**	**Easting**
East End	Geographic (deg, min)	22^0 11.75'	113^0 33.5'
	Universal Transverse Mercator Grid (49Q)(metres)		

Work commenced on the demonstration section at 10:30 am on March 19, on a cool morning, where the temperature reached 17 Celsius. A test strip, 100 metres long, was undertaken on the outside (curb) eastbound lane of Estrada de Pac On. The test section is located on a straight section with 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 7 years old (1996) 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 no noticeable rutting due to traffic wear. There were some longitudinal and linear cracks, usually in the 0.5 to 1.5 mm width. Several depressions with alligator cracks were also present in the same area. The oxidation of the bitumen extended to a depth of several millimetres. The entire portion of the treated street on a compacted silty-clay, sub-grade

On March 19, a test strip, some 100 metres in length was marked off in the eastbound, curb (outside) lane. The width of this eastbound lane is 3.2 metres between the painted shoulder lane and the center center dividing line, which had a small shoulder portion. The RJSeal™ was applied to each of the panels, using paint rollers and plastic pails.

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

Table 4.2				**Details on RJSeal™ Demonstration Section on Estrada de Pac On**						
Work Schedule	Work Time (hrs)	No. of Panels	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
10:45-12:30	1.75	5	100	320	17	63	66	0.047	4.69	4.51

Ambient temperatures at the time of the application were in the 23 degree Celsius range, with humidity in the 50% range. The application ceased at 12:30 am and the lane remained closed until 4:00 pm on March 19, 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 May 10, 2004 around 2:00 pm 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 east of the start point (west end) of the demonstration (test) section, to determine the penetration of the RJSeal™. This was two months after the application of RJSeal™ and at these two locations the newly rejuvenated surface was evident, by the black resilient surface layer, which was now approximately 4 millimetre 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 Road - Two Months After

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 at the test site on the Estrada de Pac On. Testing equipment was brought to the site for comparison on a more disciplined, objective basis in the future, and to this end, the following tests will be undertaken.

- Hydroplaning Potential
- Water Penetration
- Macrotexture Depth
- Viscosity/Ductility Testing

. 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" (see figure 4.4) 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.

Readings were taken with this aforesaid Outflow Meter at six locations, when the site was revisited on May 10, 2004. The results are shown in the table that follows:

Table 4.3		**Outflow Meter Readings**		
Test	Location relative to the curb on north side of road	Location relative to west end of demo sect'n	Untreated Pavement (secs)	RejuvSeal™ Treated segment (secs)
One	2.9 m south	2 m west	7*	n/a
Two	0.7 m south	2 m west	8*	n/a
Three	1.4 m south	3 m east	n/a	30
Four	0.5 m south	4 m east	n/a	4*
Five	1.9 m south	99.5 m east	n/a	37
Six	1.9 m south	100.5 m west	25	n/a

*** These readings are acceptable from a skid resistance viewpoint.**

Figure 4.4 Humble Equipment Co.
Outflow Meter

4.3 Water Penetration Comparison

Water Penetration Tests (China Testing Standard T 0730-2000) were undertaken at several locations on the RJSeal™ treated section and the adjoining untreated portion of the road, in close proximity to the Outflow meter tests on May 10, 2004. The results are show in the following table.

Table 4.4		**Water Penetration Meter Readings**		
Test May 10/04	Location relative to the curb	Location relative to west end of demo sect'n	Untreated (ml/min)	RejuvSeal™ Treated segment (ml/min)
One	2.9 m south	1.5 m east	n/a	0
Two	2.9 m south	1 m west	3	n/a
Three	1.5 m south	2 m west	100	n/a
Four	2.2 m south	1 m east	n/a	40(1)
Five	6.1 m south	99.7 m east	n/a	0
Six	2.1 m south	101 m east	0	n/a
Test May 14/04	1.5 m south	3 m east	300	n/a
	1.5 m south	3 m east	n/a	0

Note: (1) Located on a "new" (i.e. since original RJS application on March 19, 2004) crack in pavement. Crack filler subsequently applied on May 14 and test (refer latter two tests) re-done with resulting "zero" inflow

4.4 Macrotexture Depth

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™ treated sections in close proximity to the Outflow meter tests. The results are as follows:

Table 4.5		**Sand Patch Readings (Macrotexture Depth)**		
Test	Location relative to the curb	Location relative to west end of demo sect'n	Untreated (mm)	RejuvSeal™ Treated segment (mm)
One	2.9 m south	2 m west	0.45	n/a
Two	2.9 m south	3 m east	n/a	0.31
Three	2.0 m south	3 m west	0.33	n/a
Four	0.9 m south	5 m east	n/a	0.33
Five	2.9 m south	50 m east	n/a	0.49
Six	2.9 m south	102 m east	0.40	n/a
Seven	2.9 m south	93 m east	n/a	0.48
Eight	2.0 m south	88 m east	n/a	0.30

4.5 Viscosity/Ductility Testing

This aspect of the testing is beyond the capabilities of the field equipment available to both Crown Capital Enterprise Limited and RJSeal™ personnel

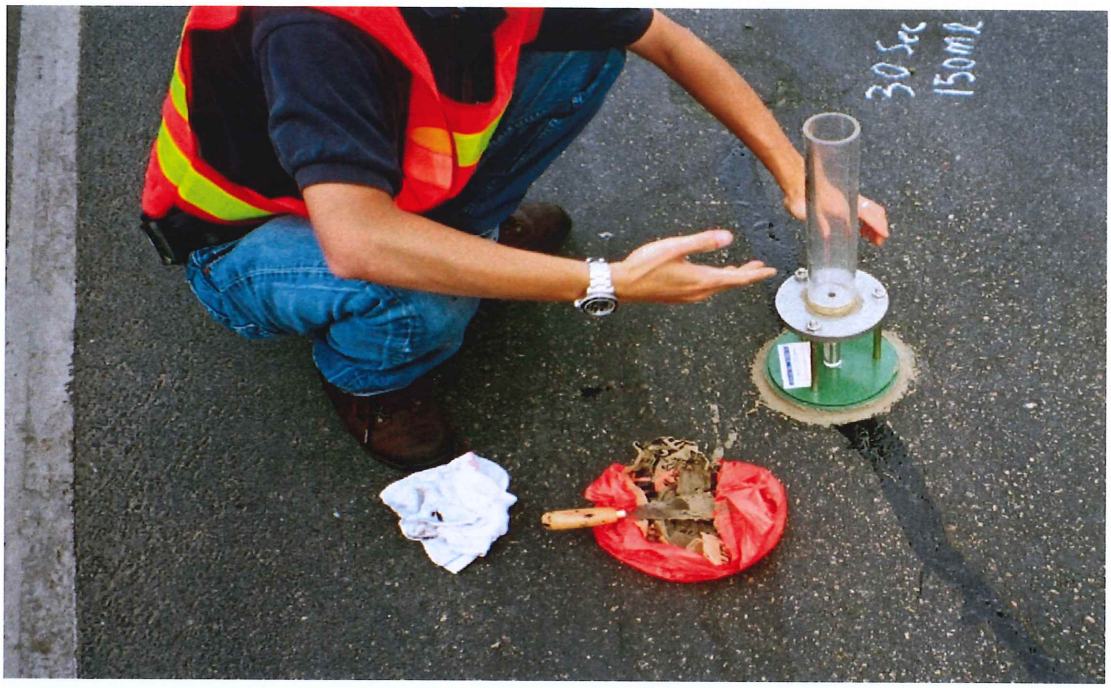


Figure 4.5 Water Penetration
& Sand Patch Test

5.0 Test Completion Schedule

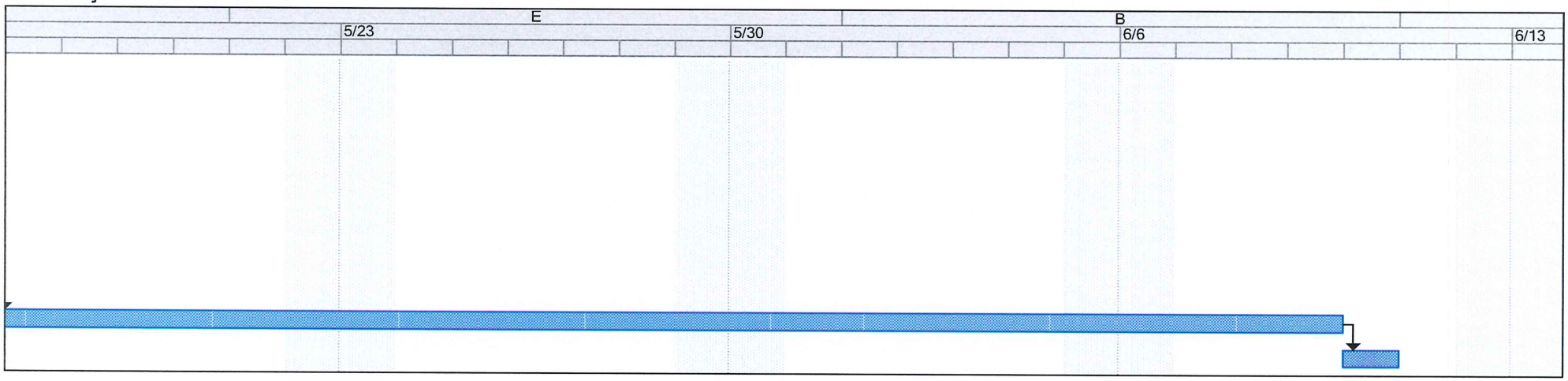
The team of technicians from the Hong Kong office will be dispatched to undertake further testing on the trial section in the near future. The projected completion of this testing is scheduled as shown in the following chart.

LiveProject - Macao Demo

ID	Task Name	% Complete	Duration	Start	Finish	Predecessors	Successors	Resource Names
1	Preliminary site inspection	0	1 day?	22/1/2004	22/1/2004		2	
2	Negotiations	0	40 days	23/1/2004	18/3/2004	1	3	
3	Demo on Estrada de pac On	0	1 day?	19/3/2004	19/3/2004	2	4	
4	Hiatus	0	35 days	22/3/2004	7/5/2004	3	5	
5	Site Inspection and Testing	0	1 day?	10/5/2004	10/5/2004	4	6	
6	Hiatus	0	3 days	11/5/2004	13/5/2004	5	7	
7	Crack Filler Application and Testing	0	1 day?	14/5/2004	14/5/2004	6	8	
8	Report Compilation	0	18 days	17/5/2004	9/6/2004	7	9	
9	Report Submittal	0	1 day?	10/6/2004	10/6/2004	8		

Task is on time	A pending suggestion exists	A suggestion was rejected
Task is delayed	Pending suggestion has a conflict	There was an error while updating Project file
Task is complete	A suggestion was accepted	

LiveProject - Macao Demo



Normal task:
% complete:
Milestone:
Split task:
Summary task:
External task:
Critical task:
Rolled up Summary task:
Deadline:

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Appendix A

RJSeal™ Descriptive Literature

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