# WANCHAI, HONG KONG

Demonstration of Rejuvaseal™ Guang'anmen Beibinhei Lu, Beijing, Peoples Republic of China

**July 2002** 



### Demonstration of RejuvaSeal Gaung'anmen Beibinhei Lu, Beijing, Peoples Republic of China

### **July 2002**

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## Demonstration of RejuvaSeal Gaung'anmen Beibinhei Lu, Beijing, Peoples Republic of China

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No.	Description
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В	Rejuvaseal Descriptive Literature
С	Kunming Copper Slag – Technical Data
D	Independent Testing Report on RejuvaSeal <sup>TM</sup> treated, asphalt pavement



## Demonstration of RejuvaSeal<sup>™</sup> Guang'anmen Beibinhei Lu, Beijing Peoples Republic of China

**July 2002** 

#### 1.0 INTRODUCTION

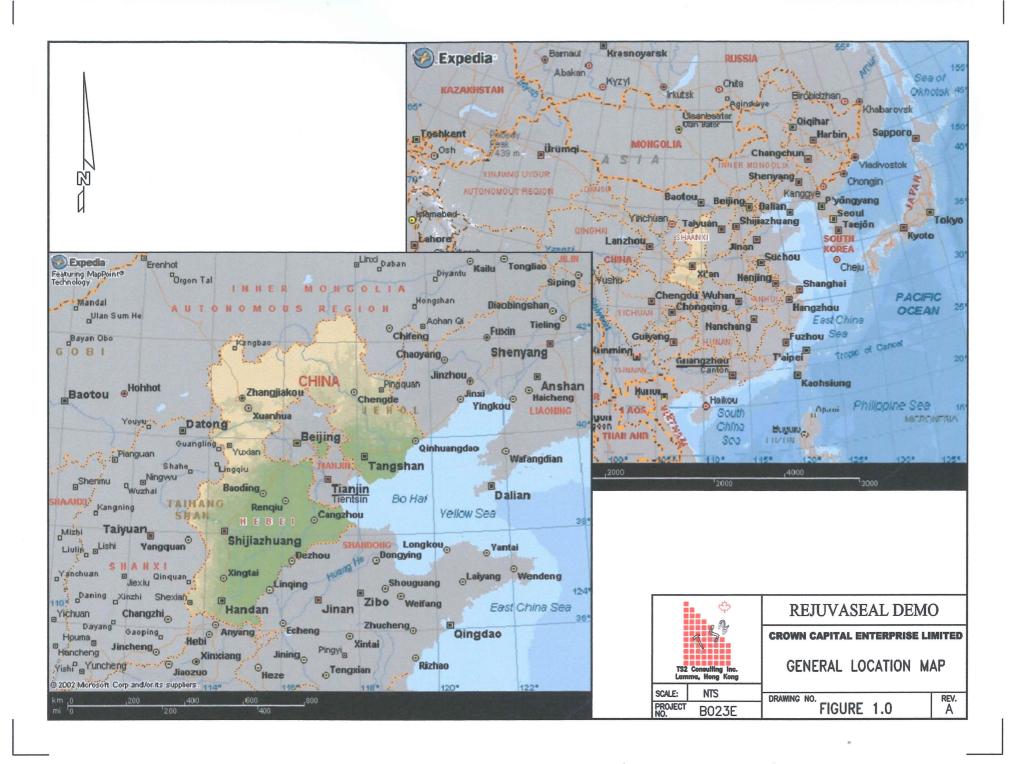
Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Road Maintenance Department of Beijing, China in July 2002. This arrangement calls for the analysis of the performance of RejuvaSeal<sup>TM</sup>, a sealer/rejuvenator for asphalt pavement on roads within Beijing.

The City of Beijing is a self-administered municipality that is bordered by Hebei Province. See figure 1.0 for a map showing the location of Beijing. The area lies in the lowlands adjacent to the Gulf of BoHai and averages 50 metres in elevation. The regions' latitude (40 degrees north), mean that there are four distinct seasons, with temperatures ranging from 35 Celsius in the long, hot humid summer to –10 Celsius in the short, but frigid winter.

The present population of Beijing is estimated at approximately 15 million. There are no rainy season per-se, just afternoon thunderstorms with accompanying rain and these occur primarily in July thru August, but can extend into September.

In the immediate Beijing area, a significant unconsolidated sedimentary sequence predominates as it lies immediately to the north of the plains that adjoin the Yellow River Delta. There are no outcrop exposures available within the immediate area, although 30 kilometres to the north are hills, which are primarily composed of sedimentary rocks, such as sandstones, siltstones and conglomerates. The asphalt in the area is manufactured from imported materials, which is comprised of crushed and screened sandstone and diorites hauled in from quarries in surrounding Hebei Province, as well as washed gravels from the various rivers.

The bitumen binder for the asphalt is sourced from various locations. Since adjoining Hebei and Shandong Province have their own indigenous oil fields and petroleum refining capacity, there is some domestic asphalt production. Since Beijing is very close to TianJin, which borders the Sea of BoHai, the possibility of bitumen being sourced from offshore is a distinct possibility so refineries in Singapore and the like should not be forgotten.





#### 2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with Beijing is to demonstrate RejuvaSeal<sup>TM</sup> at different locations selected by the Road Maintenance Bureau. The demonstration will subsequently allow analysis of the performance of Rejuvaseal<sup>TM</sup> on a variety of asphalt surfaces. A demonstration was undertaken on the interchange ramp, where Guang'anmen Beibinhei Lu, passes beneath Guang'anmen Waidajie, within the southwest sector of Beijing, on July 11-12, 2002. The portion of the road that was treated was composed of asphalt pavement of 1996 vintage. No details are known about the subgrade, but inspection of the shoulders 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 asphalt payement. The surface of the asphalt is quite smooth and concern had been expressed about hydroplaning during heavy rains and also water percolating through cracks in the asphalt pavement and softening the sub-grade. Furthermore, this asphalt pavement is approaching the end of its useful life and keen interest was expressed in having the life extended.

### 3.0 REJUVASEAL™

RejuvaSeal<sup>TM</sup> is a proprietary product that is supplied by Crown Capital Enterprise Limited of Wanchai, Hong Kong. Rejuvaseal<sup>TM</sup> 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. Rejuvaseal<sup>TM</sup> 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 provided to participants at a seminar held in Ping-Gu (Beijing Municipality) in August 2001. This outlines the experience with Rejuvaseal<sup>TM</sup> at various locations in North America and South America. Further information is available from Crown Capital Enterprise Limited. Rejuvaseal<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 North Dakota and Texas, as well as other locations in the U.S.A.

#### 4.0 TEST PROGRAM

Since Beijing is located in a semi-tropical climate (Latitude: 40 North) at a low altitude (50 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 5 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

Beijing has a significant concentration of roads. Beijing is responsible for 2,000 kilometres of National Highway; within it's jurisdiction (distances as of year-end 2000) and approximately 3000 kms of City Streets.

In view of this extensive network of roads and the relatively short life of the asphalt surface, Beijing is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, Beijing agreed to try RejuvaSeal<sup>TM</sup> on the one segment of the interchange at the juncture of Guang'anmen Beibinhei Lu and Guang'anmen Waidajie, within the city of Beijing. See Figure 4.0, showing the location of this street with respect to Beijing

On July 11, a test patch on the on-ramp leading to Guang'anmen Beibinhei Lu was treated with RejuvaSeal<sup>TM</sup>. The test patch was at the following geographic location:

Table 4.1	Geographic Location of Test Patch Site				
System	Northing	Easting			
Geographic (deg, min)	39 <sup>0</sup> 54.712'	116 <sup>0</sup> 22.754'			
Universal Transverse Mercator Grid	4418176	0446942			
(50S) (metres)					

See Figure No 4.1 for a photo showing the test patch as implemented. Particulars of the test patch are as follows:

Table 4.	.2		Particulars of the test patch								
Test Patch Number	Patch Width	Patch Length	Total Area m <sup>2</sup>	Total Area ft <sup>2</sup>	Rejuva App		Application Rate				
Number	(m)	(m)	""	approx	US gals	litres	US Gal /ft²	US Gal /yd²	Litres /m²	m² /Litre	
One	1.00	1.00	1.00	11	0.07	0.25	0.006	0.055	0.25	4.0	

Subsequent inspection of the test patch on July 11 showed that the application rate of 4.0 m<sup>2</sup>/litre was appropriate for the asphalt pavement at this location and could be used as a guide for other locations with similar physical characteristics.

The demonstration section is located immediately south of the Second Ring road, in the southeastern sector of Beijing at the interchange, where

Guang'anmen Beibinhei Lu passes beneath Guang'anmen Wadijie. . The northwest sector of this interchange was the demonstration section. The strip is entirely asphalt pavement. See figure 4.0, which follows, for a location of the general locale. The location of the test patch with respect to the demonstration portion of the street is graphically shown in figure 4.1, which follows.

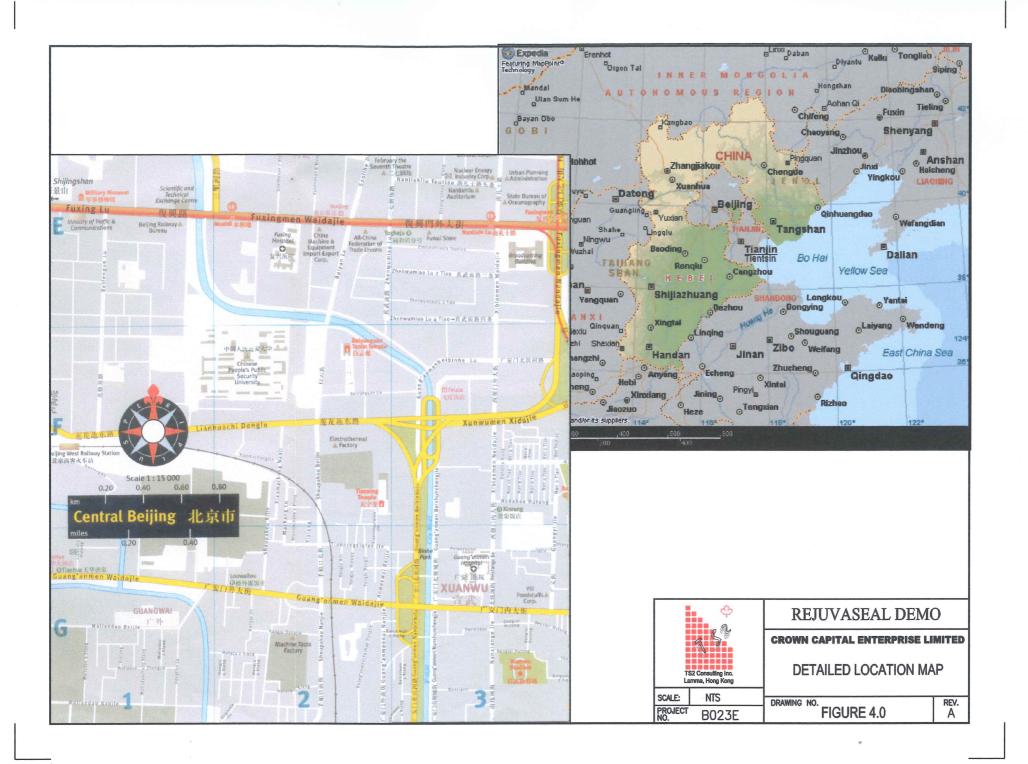






Figure 4.1 Test Patches at Demonstration Site.



The demonstration section, at the interchange where Guang'anmen Beibinhei Lu passes beneath Guang'anmen Wadijie, was selected by the Beijing Road Maintenance Department, and is geographically located as follows:

Table 4.3	Location of Demo Site				
System	Northing	Easting			
Geographic (deg, min)	39 <sup>0</sup> 54.712'	116° 22.754'			
Universal Transverse Mercator Grid	4418176	0446942			
(metres) 50S					

This is at the same location as the test patch. Refer to Figure 4.0 for the location. Work commenced on the demonstration section at 10:30 pm on July 11, on a warm, evening, where the overnight temperature hovered around 30 degrees. Celsius. The test section is located on the northwest portion of the interchange. The segment serves as both the southbound off-ramp from Guang'anmen Beibinhei Lu onto westbound Guang'anman Wadijie. It also permits access from westbound Guang'anman Wadijie onto southbound Guang'anmen Beibinhei Lu. 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 6 years old (1996 vintage). 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. There were some longitudinal cracks, although lateral cracks were more predominant. The entire portion of the treated road section was on a compacted silty-clay, sub-grade.

On the southbound off-ramp lane, an initial five segments (panels) were marked off in 15 metre increments. The width of the lane is 5.1 metres between the painted lane dividing line and the outside lane (adjacent to the shoulder) marker line. A five U.S. gallon (17.9 litres) pail of RejuvaSeal<sup>TM</sup> was assigned to each panel. The RejuvaSeal<sup>TM</sup> was applied to each of the panels, using paint rollers and paint roller pans, to ensure uniformity in the application. A further 5 segments (panels) were subsequently marked off, with the length retained at 15 metres and RejuvaSeal<sup>TM</sup> effectively covered the surface.

On the northbound, on-ramp lane, 8 panels were marked off, with each one some 20 metres in length by 7.5 metres wide. A five U.S. gallon (17.9 litres) pail of RejuvaSeal<sup>TM</sup> was assigned to each panel. At the point where this onram merges into Guang'anmen Beibinhe Lu, the lane widened to 9.5 metres and the panels were shortened to 15 metres. The RejuvaSeal<sup>TM</sup> was applied to each of the panels, using paint rollers and paint roller pans. The last panel was completed at 3:00 am. Following application of the RejuvaSeal, copper slag was applied at a rate of approximately 0.46 kilograms per square metre. The slag was distributed by hand and a 15 tonne, rubber tired roller was subsequently used to press the slag into the road surface.

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

Table 4.4	Details on RejuvaSeal <sup>™</sup> Demonstration Section on Guang'anmen Beibinhei Lu											
Work Schedule	Work Time	No. of Panels	<u>Test</u> <u>Length</u>	Total Area m²	Total Area yd <sup>2</sup>	RejuvaSeal <sup>TM</sup> Applied		Total RejuvaSeal <sup>TM</sup>				Rate
	(hrs)		<u>(m)</u>			<u>litres</u>	<u>kgs</u>	<u>Litres</u> /m2	<u>m²</u> /Litre	m² /kg		
22:30-24:00	1.50	10	150	765	914	189	208	0.25	4.05	3.68		
00:00-03:30	3.50	4	80	600	717	76	83	0.13	7.94	7.22		
00:00-0330	3.50	4	60	570	681	76	83	0.13	7.54	6.85		
Totals	5.00	18	290	1,935	2,313	340	374	0.18	5.69	5.17		

In view of concern expressed by the Beijing Road Maintenance Department that the RejuvaSeal<sup>TM</sup> treated road gave the appearance of a slippery surface, Copper Slag from a smelter in Kunming was applied to the road surface immediately following the application of RejuvaSeal<sup>TM</sup>. The application rate was approximately 0.46kgs/sq metre (1.0 lbs/sq yard). Further information on this copper slag is contained in technical data sheets in Appendix C. The approximate size consist for copper slag is as follows: >98% passing #8 mesh (2.5 mm) and <5% passing #30 mesh (0.5mm). A 15 tonne, pneumatic-tired roller was used following the slag application to roll the slag into the softened asphalt pavement surface

Ambient temperatures at the time of the application were in the 30 to 31 degree Celsius range, with humidity in the 95% range. The application ceased at 3:30 pm and the lane remained closed until 6 am on July 12, when it was re-opened for traffic. Photos showing the test application of RejuvaSeal<sup>TM</sup> follow in figures 4.2, 4.3 and 4.4. on the following pages.

The site was visited on July 12 around 4:30 pm and again on July 13 around 10 am. A difference was readily perceived between the RejuvaSeal<sup>TM</sup> treated section and the adjoining untreated lanes. A screwdriver was used to dig two small holes in the asphalt pavement, to a depth of 3 centimetres, some 45 metres west of the extreme north end of the demonstration section, to determine the penetration of the RejuvaSeal<sup>TM</sup>. This was one day after the application of RejuvaSeal<sup>TM</sup> and at these two locations the newly rejuvenated surface was evident, by the black resilient surface layer, which was now approximately 1 millimetre thick. Below that depth, the grey, oxidized layer of asphalt was evident. The copper slag remained embedded in surface of the road, and most had cemented to the RejuvaSeal<sup>TM</sup>. Little carryover of the RejuvaSeal<sup>TM</sup> was observed from vehicle tires at either end of the demonstration strip, so it can be presumed that the surface was dry shortly after the site was vacated at 6 am on July 12.



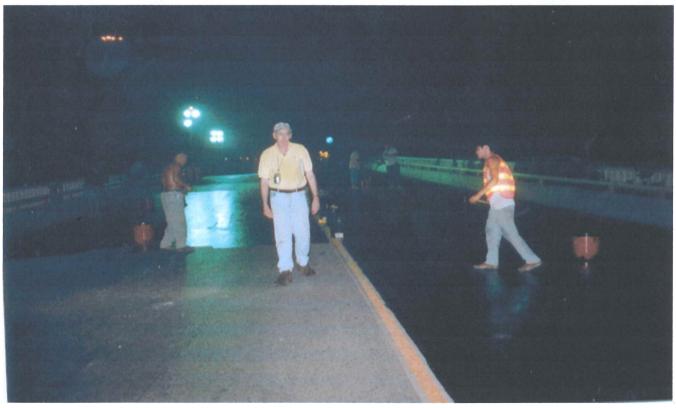


Figure 4.2 Typical Application Procedure.





Figure 4.3 Application of Kunming Copper Slag to RejuvaSeal Surface.





Figure 4.4 Finished Surface.



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

To date the comparison of the asphalt treated with Rejuvaseal<sup>TM</sup> has been compared on a subjective basis over a very short period at the test site on Guang'anmen Beibinhei Lu . Testing equipment brought to the site for comparison on a more disciplined, objective basis solely consisted of an Outflow meter manufactured by Humble Equipment Co. of Reston, Louisiana, U.S.A. This was to establish the Water Dissipation (Hydroplaning Comparison).

Testing equipment will be 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.

- Fuel Resistance Comparison
- Elasticity/Ductility Testing

#### . 4.2 Water Dissipation

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 capability to dissipate water, as concern has been expressed about hydroplaning on the RejuvaSeal<sup>TM</sup> treated surface, versus the untreated surface. 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 surface, if hydroplaning is to be minimized.

Readings were taken with this aforesaid Outflow Meter at five locations on the portion of the street, where the RejuvaSeal<sup>TM</sup> demonstration was conducted. The initial two were on the segment treated with copper slag. These readings were taken at 9:30 am on July 12. The results are shown in the table that follows:

Table 4.	5	Outflow Meter Readings					
Test	Location relative	Location	Before	After			
	to Guang'anmen	relative to	RejuvaSeal <sup>TM</sup>	RejuvaSea <sup>lTM</sup>			
	Beibinhe Lu	traffic island	(secs)	(secs)			
		curb					
July 12	20.0 metres west	2 metres south	15	n/a			
July 12	20.2 metres west	3 metres south	7	n/a			
July 12	20.4 metres west	4 metres south	7	n/a			
July 12	22.0 metres west	9 metres south	17	n/a			

 Readings in the 3 to 10 second range are quite acceptable from a skid resistance viewpoint.

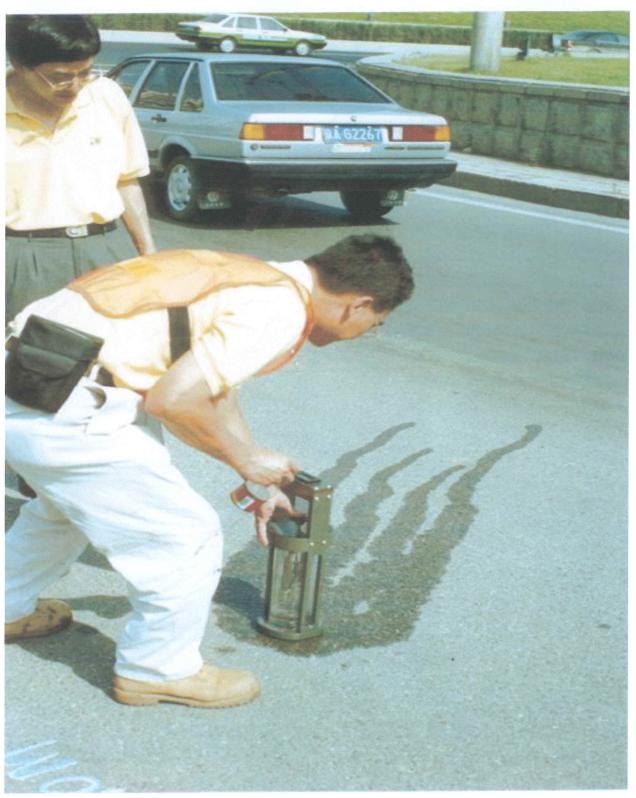


Figure 4.5 Humble Equipment Co. Outflow Meter



#### 4.3 Fuel Resistance Comparison

Fuel Resistance Comparison will be undertaken on several sections of the untreated and RejuvaSeal<sup>TM</sup> treated sections in close proximity to the Outflow meter tests in the near future. This comparison will consist of pouring about a cupful of diesel fuel onto the road surface and then later checking the penetration of the fuel. If the fuel readily penetrated the asphalt pavement surface, then resistance to this form of chemical attack was presumed to be lower than if the fuel pooled on the surface of the asphalt pavement and slowly evaporated.

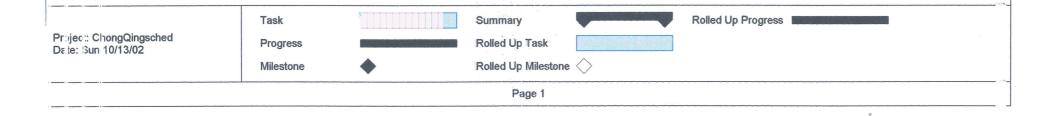
#### 4.4 Elasticity/Ductility Testing

This aspect of the testing is beyond the capabilities of the field equipment available to both Crown Capital Enterprise Limited and RejuvaSeal<sup>TM</sup> personnel and as such, external assistance has been sought from outside experts in the field of Asphalt Testing. To this end, Crown Capital Enterprise Limited committed the China Communication Department, Road Research Office for an independent assessment of the demonstration section and their report is contained in Appendix D.

#### 5.0 Test Completion Schedule

The technicians from the China Communication Department, Road Research Office were dispatched to undertake independent testing on the trial section. The projected submittal of the final report for this testing is scheduled as shown in the following chart.

		July					August				
D	Task Name	Duration	7/7	7/14	7/21	7/28	8/4	8/11	8/18	8/25	
1	Travel to Beijing	1d									
2	Demonstration Section - Street	1d									
3	Visit to site to record status of demo	1d		7							
1	Frepare draft report on RejuvaSeal Demo and Testi	10d									
5	Hiatus	10d									
3	Il-dependent Testing Report	10d									
7	É'repare final report	5d									
3	Submit final report	1d									



# WANCHAI, HONG KONG

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**July 2002** 

# **APPENDICES**

No.	Description
	Rejuvaseal <sup>TM</sup> – Technical Seminar, Ping-Gu (Beijing) China, August, 2001
В	Rejuvaseal <sup>TM</sup> Descriptive Literature
С	Kunming Copper Slag - Technical Data
D	Independent Testing Report on RejuvaSeal <sup>TM</sup> treated, asphalt pavement



WANCHAI, HONG KONG

Demonstration of Rejuvaseal™ Guang'anmen Beibinhei Lu, Beijing, Peoples Republic of China

**July 2002** 

Appendix A

Rejuvaseal<sup>tm</sup> – Technical Seminar, Beijing, Peoples Republic of China, August 2001



WANCHAI, HONG KONG

Demonstration of Rejuvaseal™ Guang'anmen Beibinhei Lu, Beijing, Peoples Republic of China

**July 2002** 

**Appendix B** 

Rejuvaseal<sup>TM</sup> Descriptive Literature



WANCHAI, HONG KONG

Demonstration of Rejuvaseal™ Guang'anmen Beibinhei Lu, Beijing, Peoples Republic of China

**July 2002** 

**Appendix C** 

**Kunming Copper Slag** 

**Technical Data** 



WANCHAI, HONG KONG

Demonstration of Rejuvaseal™ Guang'anmen Beibinhei Lu, Beijing, Peoples Republic of China

**July 2002** 

**Appendix D** 

**Independent Testing Report** 

RejuvaSeal<sup>TM</sup> Treated Asphalt Pavement

China Communication Department Road Research Office



# TS $^2$ CONSULTING INC. <

(British Virgin Islands Incorporated) website: http://ts2.stormloader.com

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Aug 28th, 2002

中国云南昆明市人民中路丰园大厦2607室



Crown Capital Enterprise Limited B5, Centre Point Building 181 – 185 Gloucestor Road, Wanchai, Hong Kong.

Attn: Charence Chiang

General Manager

**Dear Charence** 

Re: Demonstration of RejuvaSeal<sup>TM</sup> on Guang'anmen Interchange, Beijingi.

This is the final report on the demonstration of RejuvaSeal<sup>TM</sup> on the northwest sector of the interchange at the junction of Gaung'anmen Beibinhei Lu and Guang'anmen Wadijie in Beijing, just south of the second Ring Road. This demonstration was undertaken during the night of July 11-12, 2002 and encompassed a portion of the southbound (off-ramp) lane (150 metres) and northbound (on-ramp) lane (140 metres). A very smooth asphalt surface was encountered on this street and the initial results of the RejuvaSeal<sup>TM</sup> application appear quite satisfactory. Several major cracks were encountered and these were treated by Crafco with their hotmix, following routing to a width of one centimetre. Minor portions of these cracks were treated by Crown Capital, with a cold pour crack filler. Copper Slag from Kunming was also applied to the entire 290 metres of this demonstration strip on an experimental basis, at an application rate of approximately 0.45 kgs/square metre. The hot weather and the subsequent traffic on the road, the following morning, embedded most of the slag in the immediate vehicle path into the rejuvenated surface,

Yøurs Sincerely

Anthony G. Speed, P.Eng. (Ontario, Canada)

Crown Capital	Enterprise Limited.	<b>Assumptions</b>		Conversion Factors				
ReiuvaSeal De		Panel 1-10 Lengt	15.0	Metres	US Gallon=	3.78	Litres	
Beijing - Secon		Panel Width	5.10	Metres	Sq Metre=	10.76	Sq Feet	
Guang'anmen Nanbinhelu Access Ramp		Panel Area	76.5	Sq Metres	Sq Metre=	1.20	Sq Yds	
Demo Date	11-Jul-02	Panel 11-14 Lenç	20.0	Metres	RejuvaSeal	1.10	S.G.	
Prepared by	A.G. Speed	Panel Width	7.50	Metres	Crev	v Consis		
Updated by	A.G. Speed	Panel Area	150.0	Sq Metres		_abourers		
Updated	16-Jul-02	Panel 15-18 Leng	15.0	Metres	L	ight Crev		
Opuated		Panel Width 9.50 Metres			Equipment Op 3			
		Panel Area	142.5	Sq Metres	S	Superviso		
						Γotal	22	

Work Schedule	Work Time	No. of Panels	Test Length	Total	Total Area	Rejuv	/aSeal Ap	plied	Application Rate			22 Man Crew		
	(hrs)		(m)	Area m²	yd²	US gals	litres	kilogram	USGal	Litres /m <sup>2</sup>	m <sup>2</sup>	m² /Kg	m <sup>2</sup>	yd²
am/pm								S	/yd <sup>2</sup>		/Litre		/man hr	/man hr
22:30 - 24:00	1.50	10	150.0	765	914	50	189	207.9	0.055	0.25	4.05	3.68	23.2	27.7
00:00 - 03:30	3.50	4	80.0	600	717	20	76	83.2	0.028	0.13	7.94	7.22	7.8	9.3
00:00 - 03:30	3.50	4	60.0	570	681	20	76	83.2	0.029	0.13	7.54	6.85	7.4	8.8
Totals	5.00	18	290.0	1,935	2,313	90	340	374.2	0.039	0.18	5.69	5.17	17.6	21.0

Test Patches Second Ring road BeiJing Test Patch Date

11-Jul-02

	11 001 02											
Test Patch	Patch Width	Patch	Total	Total Area ft <sup>2</sup>	Reju	RejuvaSeal Applied Application Rate						
Number	(m)	Length	Area m <sup>2</sup>									
	()	(m)	7 11 00 111	approx	US gals	litres	kilogram	USGal	USGal	Litres	$m^2$	m <sup>2</sup> /Kg
		(,					s	/ft <sup>2</sup>	/yd <sup>2</sup>	/m <sup>2</sup>	/Litre	<u> </u>
One	1.00	1.00	1.00	11	0.07	0.25	0.28	0.006	0.055	0.25	4.00	3.64

FlowMeter Readings	Time (sec)	Location	
July 11, 2002	Time	Location with respect to Guang'anmen Nanbinhelu	Location with respect to Traffic Island Curb
Untreated	15	20 metres west	2 metres south of Curb
Untreated	7	20.2 metres west	3 metres south of Curb
Untreated	7	20.4 metres west	4 metres south of Curb
Untreated	17	22 metres west	9 metres south of Curb

## Demonstration of RejuvaSeal Gaung'anmen Beibinhei Lu, Beijing, Peoples Republic of China

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#### 6.0 Qualifications

#### STATEMENT OF QUALIFICATIONS

- I, Anthony G. Speed of Hong Kong in the Special Administrative Region of China, DO HEREBY CERTIFY.
- THAT I am a Consulting Engineer, with offices at 2/F, 81 Po Wah Yuen, ١. Lamma Island, Hong Kong
- THAT I am a 1968 graduate of the University of Saskatchewan, 11. Canada with a Bachelor of Science Degree in Mining Engineering.
- THAT I am currently registered and in good standing as a Professional III. Engineer with the Association of Professional Engineers of Ontario, and New Brunswick, Canada
- THAT my 30 years of continuous experience in mining, major civil IV. engineering works (earth moving, highway and mining construction) has exposed me to a broad knowledge of mining and heavy civil engineering construction and allowed considerable familiarization with road construction and asphalt pavement.
- THAT this report is based on my visit on July 11-13, 2002 to Beijing, V. China to view the test section, described in this report

Dated at Hong Kong, this

day of August. 2002

thony G. Speed,

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P.Eng. (Ontario and New Brunswick, Canada)