CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Demonstration of Rejuvaseal™
TangJin Expressway, TangShan, Hebei,
Peoples Republic of China

August 2002

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

Demonstration of RejuvaSeal
TangJin Expressway, TangShan, Hebei,
Peoples Republic of China

August 2002

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CROWN CAPITAL ENTERPRISE LIMITED

Demonstration of RejuvaSeal
TangJin Expressway, TangShan, Hebei,
Peoples Republic of China

August 2002

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B	Rejuvaseal Descriptive Literature

TS² Consulting Inc.
Lamma, Hong Kong

TS² CONSULTING INC. <

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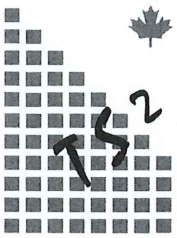

September 28th, 2002

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™ on TangJin Expressway, TangShan, Hebei.

This is the final report on the demonstration of RejuvaSeal™ on TangJin Expressway, near TangShan, Hebei province.. This demonstration was undertaken August 20, 2002 on this six lane expressway. An initial strip, 69 metres long, on the eastbound overtaking lane and the adjoining travel lane of this six-lane, divided highway was treated at the Kilometre 112 km + 700 marker. A second strip some 75 metres long and covering the center (travelling) east bound lane at Kilometre 114 + 480 was also treated on the same day. The asphalt surface on the sections treated, was reputedly 5 years old (1997 vintage).

The principal interest of the highway maintenance authority was extension of the asphalt pavement's life and improvement of the resistance to water penetration. Reports from the local agent, indicate that these objectives have been met.

Yours Sincerely

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

Crown Capital Enterprise Limited.
RejuvaSeal Demo
TangJin Expressway, Hebei

Demo Date	20-Aug-02
Prepared by	A.G. Speed
Updated by	A.G. Speed
Updated	29-Aug-02

Assumptions

Loc'n - Km 112+700

Panel Length	69.0	Metres
Panel Width	7.20	Metres
Panel Area	496.8	Sq Metres

Loc'n Km 114 +480

Panel Length	75.0	Metres
Panel Width	3.60	Metres
Panel Area	270.0	Sq Metres

Conversion Factors

US Gallon=	3.78	Litres
Sq Metre=	10.76	Sq Feet
Sq Metre=	1.20	Sq Yds
One Litre	1.10	kgs

Crew Consist	No
Labourers	10
Truck Driver	1
Supervisor	1
Total	12

Work Schedule	Work Time	No. of Panels	Test Length	Total Area	Total Area	RejuvaSeal Applied			Application Rate				12 Man Crew	
am/pm	(hrs)		(m)	m^2	yd^2	US gals	litres	kilograms	USGal /yd^2	Litres/m^2	m^2 /Litre	m2/Kgs	m^2 /man hr	yd^2 /man hr
08:30-09:30	1.00	1	69.0	497	594	34	127	140	**0.057**	**0.26**	**3.90**	**3.55**	41.4	49.5
10:00-10:25	0.42	1	75.0	270	323	16	62	68	**0.051**	**0.23**	**4.37**	**3.97**	54.0	64.6
Totals	1.42	2	144.0	767	917	50	189	208	**0.055**	**0.25**	**4.06**	**3.69**	45.1	53.9

Test Patches
TangJin Expressway, Hebei
Shanghai

Test Patch Date
30-Jul-02

Test Patch Number	Patch Width (m)	Patch Length (m)	Total Area m^2	Total Area ft^2 approx	RejuvaSeal Applied			Application Rate			
					US gals	litres	kilograms	USGal /yd^2	Litres/m^2	m^2 /Litre	m2/Kgs
One	0.50	0.90	0.45	5	0.07	0.25	0.275	**0.014**	**0.56**	**1.80**	**1.64**

FlowMeter Readings — **Time (sec)**

August 20, 2002	Time	Location	Location
Untreated	**9**	north shoulder	km 112+700
Untreated	**11**	Centre	km 112+700
Untreated	**6**	Centre	km 112+700
Untreated	**7**	south shoulder	km 112+700

CROWN CAPITAL ENTERPRISE LIMITED

Demonstration of RejuvaSeal™
TangJin Expressway, TangShan, Hebei
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1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Highway Administration Department of Hebei Province, China in May 2002. This arrangement calls for the analysis of the performance of RejuvaSeal™, a sealer/rejuvenator for asphalt pavement on highways within Hebei Province.

Hebei Province is situated to the north of the Yellow River (HuangHe) at it's confluence with the Sea of Bohai. Hebei is bordered by Henan, Shanxi, Shandong and Liaoning Provinces as well as Mongolia. Furthermore, Beijing and TianJin and their independently administered Municipalities are hosted by Hebei Province Hebei has seen a major growth in the highway system, in recent years, due to a government drive to build national highways linking Beijing and TianJin with major cities in the adjoining provinces and the massive increase in the world export trade. TangShan, lies some 65 kms southwest of TianJin and some 200 kilometres south of Beijing. The capital city of Hebei Province is Shijiazhuang with a population of approximately 3 million. See figure 1.0 for a map showing the location of TangShan and Hebei Province. The majority of the area lies at 10 to 20 metres in elevation, on the extensive plain that borders the Sea of Bohai. The regions' latitude (38 degrees north), mean that there are four seasons, with temperatures ranging from 45 Celsius in the long, hot summer to minus 5 Celsius in the short winter. Their is no rainy season per-se, just thunderstorms and these occur primarily in June thru August, but can extend into September.

In the immediate TangShan area, a significant unconsolidated sedimentary sequence predominates and this is due to the site adjoining the delta of the Yellow River. The silt from the flooding that has occurred over several millennium and now obscures all outcrops. Drainage channels feeding into the Yellow River also afford no opportunities to see the bedrock. The asphalt in the area is manufactured from imported materials, which is comprised of crushed and screened sandstone and diorites hauled in from quarries elsewhere in Hebei Province, as well as washed gravels from the various rivers. The bitumen binder for the asphalt is sourced from various locations. Since Hebei Province 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.

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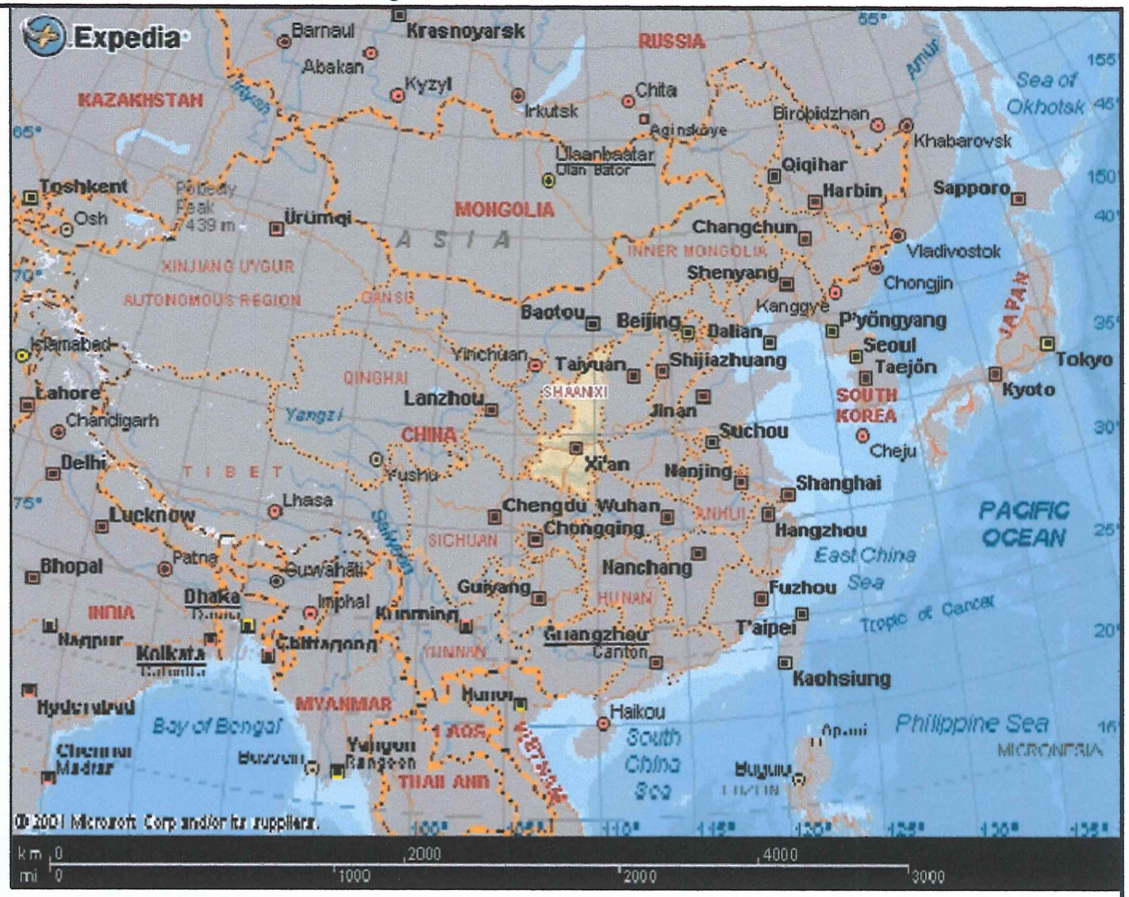

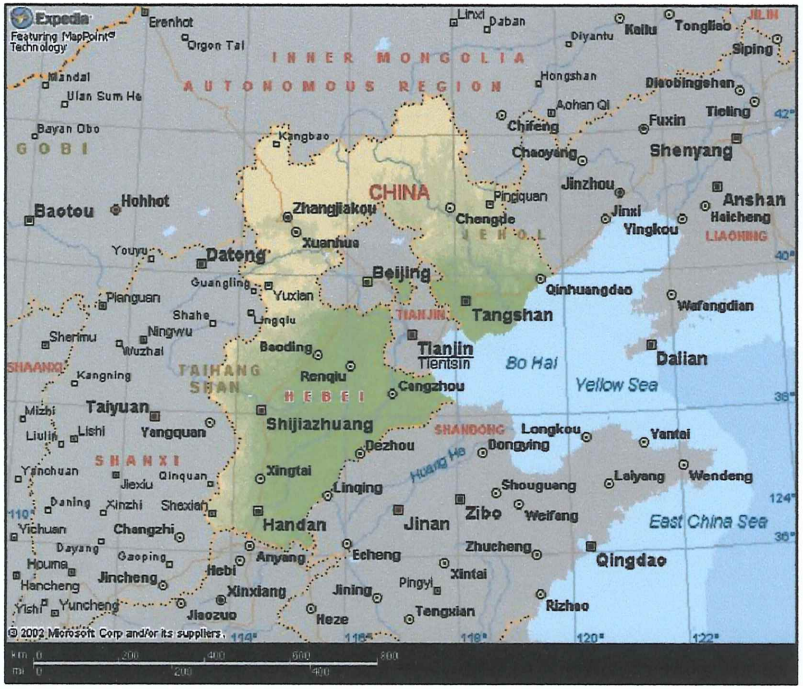

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DRAWN BY	Bb	02/08/20	PROJECT NO. B023G	

REJUVASEAL DEMO

CROWN CAPITAL ENTERPRISE LIMITED

HEBEI PROVINCE

GENERAL LOCATION MAP

DRAWING NO. FIGURE 1.0

REV. A

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with Hebei Province is to demonstrate RejuvaSeal™ at different locations selected by the Highways Administration Bureau. The demonstration will subsequently allow analysis of the performance of Rejuvaseal™ on a variety of asphalt surfaces. A demonstration was undertaken on TangJin Expressway, some 25 kilometres southwest of the city of TangShan, on August 20, 2002. The portion of the highway that was treated was composed of asphalt pavement of Mid-1997 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 pavement. 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™ is a proprietary product that is supplied by Crown Capital Enterprise Limited of Wanchai, Hong Kong. Rejuvaseal™ 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™ 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™ at various locations in North America and South America. Further information is available from Crown Capital Enterprise Limited. Rejuvaseal™ 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 Hebei Province is located in a semi-tropical climate (Latitude: 38 North) at a low altitude (10 to 20 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.

Hebei has the second greatest concentration of highways in China (after ShangDong), with some 10,000 kms of National and Provincial highway. TangShan is responsible for 1000 kilometres of National Highway, and 800 kilometres of Provincial Highway, within it's jurisdiction (distances as of year-end 2000) and approximately 100 kms of streets in TangShan and other neighbouring communities

In view of this extensive network of roads and the relatively short life of the asphalt surface, Hebei is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, Hebei has agreed to try RejuvaSeal™ on the TangJin Expressway, some 46 kilometres south west of the city of TangShan. The arrangement led to a committee being struck to suggest appropriate locations for the testing of RejuvaSeal™. See Figure 4.0, showing the location of this street with respect to TangShan and Hebei

On July 31, one test patch in the eastbound slow lane of the TangJin Expressway (six lane highway with paved shoulders, was treated with RejuvaSeal™. The test patch was at the following geographic location:

Table 4.1	**Geographic Location of Test Patch Site**	
System	**Northing**	**Easting**
Geographic (deg, min)	39^0 27' 30"	117^0 46' 00"

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

Table 4.2				**Particulars of the test patch**						
Test Patch Number	**Patch Width (m)**	**Patch Length (m)**	**Total Area m^2**	**Total Area ft^2 approx**	**RejuvaSeal™ Applied**		**Application Rate**			
					Litres	**Kgs**	**US Gal /yd^2**	**Litres /m^2**	**m^2/Litre**	**m^2/Kg**
One	0.50	0.90	0.45	5	0.25	0.275	0.014	0.56	1.80	1.64

Subsequent inspection of the test patch on August 19, showed that the application rate of 1.6 m^2/kilogram was appropriate for the asphalt pavement at this location and could be used as a guide for other locations with similar physical characteristics.

The west end of the 465 metre long demonstration section on TangJin Expressway is located 46 kilometres southwest of the City of TangShan. This 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 highway is graphically shown in figure 4.1, which follows.

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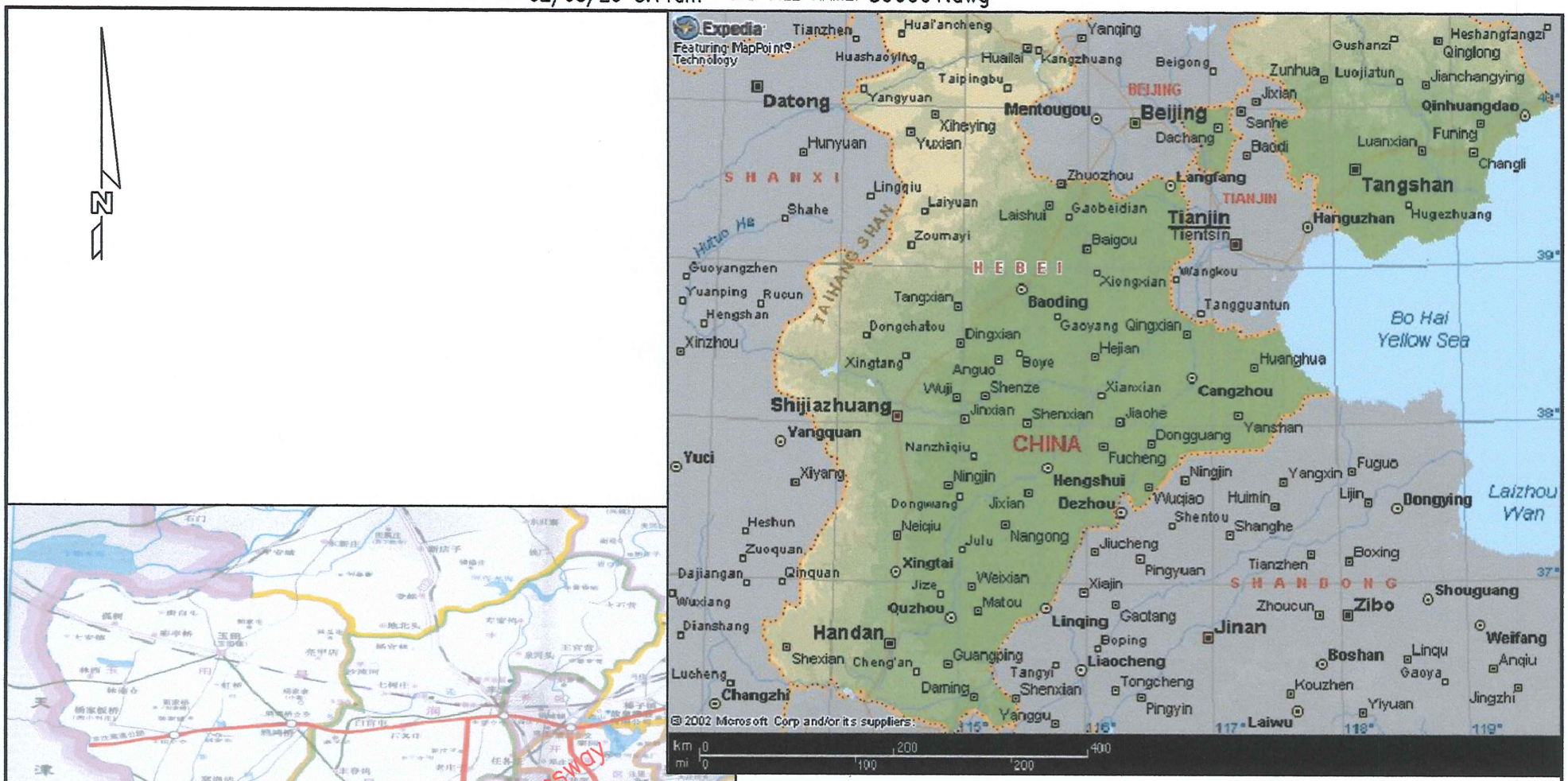

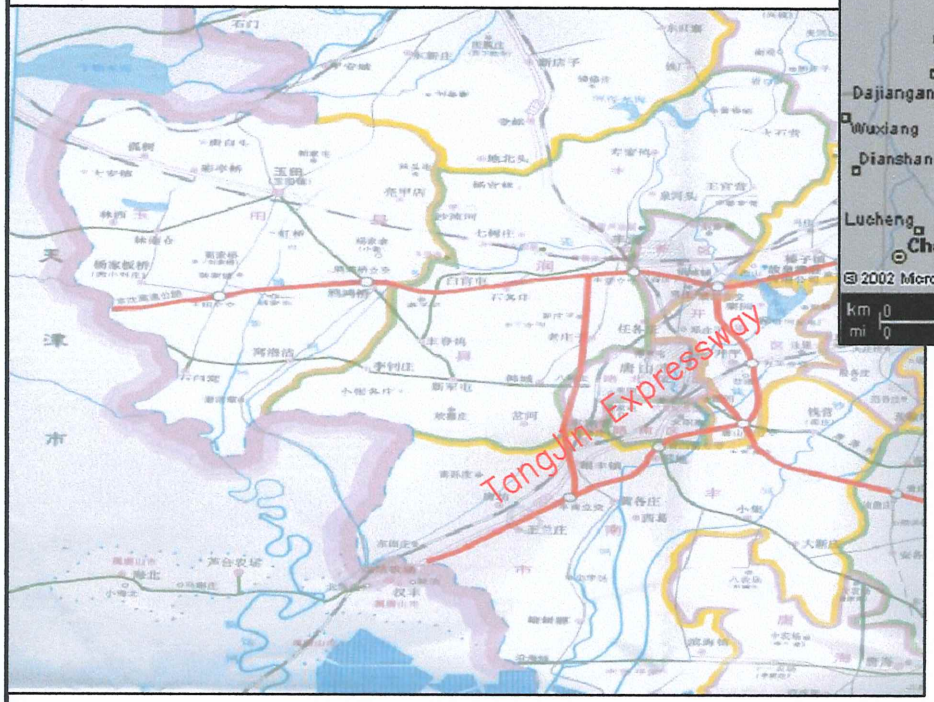

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REJUVASEAL DEMO

CROWN CAPITAL ENTERPRISE LIMITED

HEBEI PROVINCE

DETAILED LOCATION MAP

DRAWING NO. FIGURE 4.0

REV. A

Figure 4.1 Test Patch at Demonstration Site.

the demonstration section, on TangJin Expressway was selected by the Hebei Highway Administration Department and is geographically located as follows:

Table 4.3	Location of Demo Site	
System	Northing	Easting
Geographic (deg, min)	39^0 27' 30"	117^0 46' 00"

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 8:30 am on August 20, on a sunny day, where the mid-day temperature reached 27 Celsius. An initial strip, 69 metres long, on the eastbound overtaking lane and adjoining travel lane of this six-lane, divided highway was treated at the Kilometre 112 km + 700 marker. The test section is located on a straight section. 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 5 years old (1997 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 these were outnumbered by lateral cracks. The entire portion of the treated highway section 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.

A second strip some 75 metres long and covering the center (travelling) east bound lane at Kilometre 114 + 480 was also treated. The same specifics, as to asphalt pavement and application for the initial section are also applicable. RejuvaSeal™ was applied to each of the panels, excluding the paved shoulder, using paint rollers to ensure uniformity in the application.

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

Table 4.4				Details on RejuvaSeal™ Demonstration Section on TangJin Expressway						
Work Schedule	Work Time	Test Length	Total Area m^2	RejuvaSeal Applied			Application Rate			
am/pm	(hrs)	(m)		US gals	litres	Kilo grams	US Gal /yd^2	Litres /m^2	m^2 /Litre	Kgs/m^2
08:30-09:30	1.00	69.0	497	34	127	140	**0.057**	**0.26**	**3.90**	**3.55**
10:00-10:25	0.42	75.0	270	16	62	68	**0.051**	**0.23**	**4.37**	**3.97**
Totals	1.42	144.0	767	50	189	208	**0.055**	**0.25**	**4.06**	**3.69**

Ambient temperatures at the time of the application were in the 24 to 27 degree Celsius range, with humidity in the 65% range. The application ceased at 10:55 pm and this southbound lane remained closed until 8 pm on August 20, when it was re-opened for traffic. Photos showing the test application of RejuvaSeal™ follow in figures 4.2, 4.3 and 4.4. on the following pages.

The site was visited on August 21 around 9:15 am and a difference was readily perceived between the RejuvaSeal™ 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 south of the extreme north end of the demonstration section, to determine the penetration of the RejuvaSeal™. This was one day after the application of RejuvaSeal™ 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. Little carryover of the RejuvaSeal™ was observed from vehicle tires at the west end of the treated segments on the eastbound side of the expressway, so it can be presumed that the surface was dry before the site was vacated at 8 pm on August 20.

Figure 4.2
Typical Application Procedure.

Figure 4.3 Finished Surface - Km112+700.

Figure 4.4 Finished Surface - Km114+480.

4.1 RejuvaSeal™ Testing

To date the comparison of the asphalt treated with Rejuvaseal™ has been compared on a subjective basis over a very short period at the test site on TangJin Expressway. 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™ 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. Initially readings were taken with this aforesaid Outflow Meter at four locations on the portion of the highway selected for the test, in proximity to the test patches. These initial readings were taken at 8:00 am on August 20.
The results are shown in the table that follows:

Table 4.5		**Outflow Meter Readings**		
Test Date	Location relative to highway centerline	Location relative to highway marker	Before RejuvaSeal™ (secs)	After RejuvaSea™ (secs)
Aug 20	north shoulder	km 112+700	**9**	n/a
Aug 20	Centre	km 112+700	**11**	n/a
Aug 20	Centre	km 112+700	**6**	n/a
Aug 20	south shoulder	km 112+700	**7**	n/a

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™ 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™ personnel and as such, external assistance has been sought from outside experts in the field of Asphalt Testing. To this end, the TangJin Expressway company has contacted an independent laboratory for advise on asphalt pavement testing.

5.0 Test Completion Schedule

Technicians from the independent testing agency will be dispatched to undertake further testing on the trial sections in the near future. The projected completion of this testing is scheduled as shown in the following chart.

Figure 5.0 Project Completion Schedule

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Appendix A

Rejuvaseal™ – Technical Seminar,
Beijing,
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August 2001

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Appendix B

Rejuvaseal™ Descriptive Literature

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