CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

Demonstration of RJSeal™ Bridge Decks, Chang-Ji Highway, Jilin, Peoples Republic of China

September 2003

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

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APPENDICES

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B	RJSeal™ Descriptive Literature
C	Desco D200 Sprayer - Technical Data

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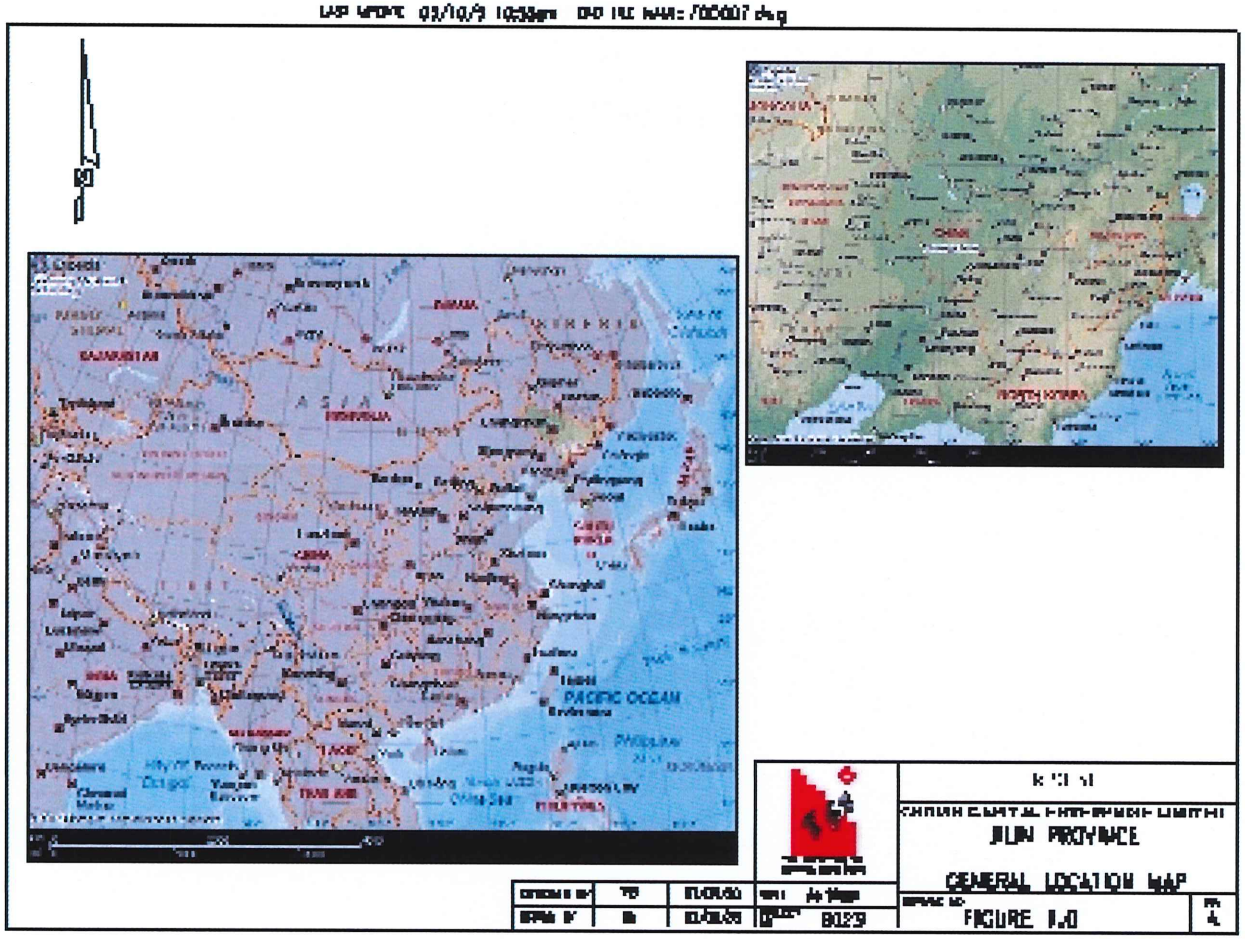
1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Highways Department, Communications Bureau of Jilin Province, China in September 2002. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on highways within Jilin Province.

Jilin Province is situated in northeastern China, and is bounded by North Korea and Mongolia as well as Heilongjiang Province to the north and Liaoning Province to the south. The capital city of Jilin Province is Changchun with a population of approximately 5 million. Changchun has a different architectural appearance when compared to cities in southern China, and this is attributable to the fact that Russia occupied this part of China for many years when it was called Mongolia. The Japanese also occupied the area from 1905 until 1945 and establish the deposed Chinese Emperor Puyi as a Puppet Emperor in 1915 in an attempt to solidify their control of the region.

In recent years, Jilin has seen a major growth in the highway system, due to a government drive to build national highways linking Changchun with major cities in the adjoining provinces. Oil was discovered in the Changchun area in the early 1960's, which led to modest petroleum developments in the area. The majority of the area lies at 150 metres in elevation, on an extensive plain. The regions' latitude (44 degrees north), mean that there are four seasons, with temperatures ranging from 45 Celsius in the long, hot summer to minus 35 Celsius in the short winter. There is no rainy season per-se, just thunderstorms and these occur primarily in June thru August, but can extend into September. See figure 1.0 for a map showing the location of Changchun and Jilin Province.

In the immediate Changchun area, a significant sedimentary sequence predominates covered by a veneer of glacial till. The predominant feature of the area is shallow lakes with closed drainage systems aligned along the direction of the retreating continental ice sheet that covered this area. There are very limited 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 Jilin Province, as well as washed gravels from the ancient glacial feed channels. The bitumen binder for the asphalt is probably imported from offshore refineries.



JILIN PROVINCE

GENERAL LOCATION MAP

FIGURE 1.0

2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with Jilin Province is to demonstrate RJSeal™ at different locations selected by the Highways Administration Bureau. The demonstration will subsequently allow analysis of the performance of RJSeal™ on a variety of asphalt surfaces. A demonstration was undertaken on September 13, 2003 on two Bridge Decks, respectively 17 and 27 kilometres, east of the city of Changchun. These two Bridge Decks are located on the Chang-Ji highway that connects ChangChun with Jilin. The bridge decks are comprised of pre-cast, pre-stressed concrete beams which abut each other with an asphalt pavement overlay, nominally 5 centimetres thick. The exact age of the asphalt pavement is not known, but is in excess of 6 years, as this highway opened in September 1997. Concern had been expressed about water percolating through the asphalt overlay and then corroding the steel rebar inside the concrete beams. Furthermore, this asphalt pavement overlay is approaching the end of its useful life and keen interest was expressed in having the life extended.

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 provided to participants at a presentation held in DaQing in early September 2002. This outlines the experience with RJSeal™ at various locations in 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 twenty six (26) locations in China and five (5) commercial-scale applications have taken place at various locations, including Shanghai and Kunming.

4.0 TEST PROGRAM

Since Jilin Province is located in a northern climate (Latitude: 42 to 45North) at a low altitude (150 to 250 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 35 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

Jilin has a significant concentration of highways in China, with some 4,000 kms of National and Provincial highway. In view of this extensive network of roads and the relatively short life of the asphalt surface, Jilin is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, Jilin has agreed to try RJSeal^{TM} on two Bridge Decks on the Chang-Ji Highway, just east of the city of Changchun. See Figure 4.0, showing the location of this highway with respect to Changchun and Jilin

On September 13, 2003, an inspection was made of the asphalt pavement on two Bridge Decks. It was decided to try an application of RJSeal^{TM} with the Desco D200 Sprayer at a rate of 3.5 square metres/kilogram on the bridge deck located at Km 17. A trial strip on the westbound, slow (outside) lane was initially undertaken adjacent to the inside (overtaking) lane. It was decided to try an application of RJSeal^{TM} with the Desco D200 Sprayer at a rate of 4.0 square metres/kilogram on the bridge deck at Kilometre marker 27. A trial strip on the westbound, slow (outside) lane was initially undertaken adjacent to the outside safety barrier. These trial strips were at the following geographic locations:

Table 4.1		**Geographic Location of Test Strip Site**	
Bridge Loc'n	**System**	**Northing**	**Easting**
Kilometre 17+274.5m	Geographic (deg, min)	43^0 57.296'	125^0 37.814'
	Universal Transverse Mercator Grid (metres) 51T	0711040	4870248
Kilometre 27+561m	Geographic (deg, min)	43^0 59.337'	125^0 44.927'
	Universal Transverse Mercator Grid (metres) 51T	0720428	4874336

Inspection of the trial strip on the asphalt pavement at the bridge located at Km 17, showed that the application rate of 3.5 m^2/kg was adequate and was used as a guide for the balance of the bridge deck on the two westbound lanes at this location. Subsequent inspection of the trial strip on the asphalt pavement at the initial bridge located at Km 27, showed that the application rate of 4 m^2/kg was adequate and was used as a guide for the balance of the bridge deck on the two westbound lanes at this location

See figure 4.0, which follows, for a location of the general locale. The location with respect to the road is graphically shown in figure 4.1, which follows.

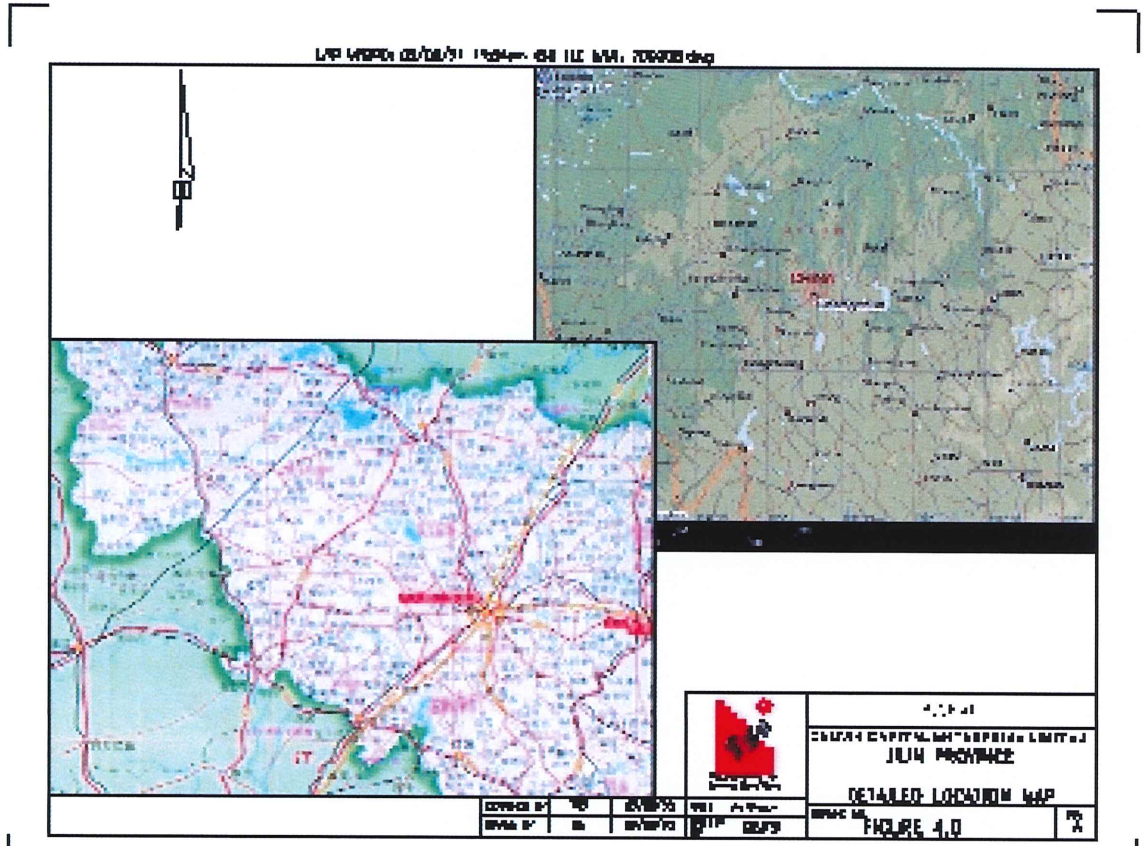

JUBA PROVINCE
DETAILED LOCATION MAP
FIGURE 4.0

Figure 4.1 Test Strip, Bridge Decks
Chang-Ji Highway, Jilin
Km 17 at Top, Km 27 at Bottom

The demonstration section, on the two Bridge Decks was selected by the Chang-Ji Highway Management Company and the east end of the two bridge decks respectively are as follows:

Table 4.2		Location of Demo Site	
Bridge Loc'n	**System**	**Northing**	**Easting**
Kilometre 17+274.5	Geographic (deg, min)	43^0 57.296'	125^0 37.814'
	Universal Transverse Mercator Grid (metres) 51T	0711040	4870248
Kilometre 27+561	Geographic (deg, min)	43^0 59.337'	125^0 44.927'
	Universal Transverse Mercator Grid (metres) 51T	0720428	4874336

Refer to Figure 4.0 for the location. Work commenced on the demonstration section at 10:00 am on September 13, on a warm, sunny day, where the mid-day temperature reached 25 Celsius. The two bridge decks are nominally 50 metres long, and have two lanes eastbound and two lanes westbound. The west bound portion of the bridge decks was treated with RJSeal™ with the eastbound lanes left untreated for comparison purposes. The width of the two driving lanes are 3.7 metres between the painted driving lines with a 0.8 metre wide shoulder, adjoining the outside traffic barrier and a 5 metre shoulder adjoining the center divider. The test section on the bridge at Kilometre 17 is located on an uphill grade of nominally 5%, whereas the test section on the bridge at Kilometre 27 is located on a level section. There is a slight camber to the road, which causes water to run off toward the shoulder, 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 rutting due to traffic wear. There where several recent patches on both bridge decks and there was aging and oxidation of the bitumen, which extended to a depth of several millimetres. There were some minor longitudinal cracks, and also some minor lateral cracks. The entire portion of the RJSeal™ demo section was applied, using a Desco D200 Sprayer. See Appendix C for technical information on this unit. This unit can uniformly apply the RJSeal™ over the entire area chosed for the application. Details of the application are summarized in the table that follows:

Table 4.3			Details on RJSeal™ Demo Section on Bridge Decks								
Bridge Deck	Work Schedule Sept 13	Work Time (hrs)	Length (m)	Width (m)	Area m^2	RJSeal™ Applied			Application Rate		
						US gals	litres	kgs	US Gal /yd2	m^2 /litre	m^2 /kg
Km 17+274.5	11:00-12:00	1.00	66	5.8	383	30	114	118	0.066	3.37	3.24
	15:30-15:50	0.33	66	4.8	317	25	94	98	0.066	3.36	3.23
	15:50-16:00	0.17	50	4.9	245	19	73	76	0.066	3.35	3.22
Km 27+561	10:00-11:00	1.0	50	5.8	290	20	76	79	0.058	3.82	3.67
	15:00-15:30	0.50	50	9.7	485	34	127	132	0.058	3.82	3.67
Miscellaneous		0.30				20	77	80			
Totals		3.30			1720	148	561	583	0.072	3.07	2.95

Ambient temperatures at the time of the application on September 13 were in the 22 to 26 degree Celsius range, with humidity in the 60% range. Photos showing the application of RJSeal™ follow in figures 4.2, 4.3 and 4.4. on the pages that follow.

The site was subsequently visited on September 14 around 10:00 am and a difference was readily perceived between the RJSeal™ treated section and the adjoining untreated lanes. A screwdriver was used to dig two small holes in the asphalt pavement on the bridge deck at Km 27, to a depth of 3 centimetres, some 4 metres west of the extreme east end of the demonstration section, to determine the penetration of the RJSeal™. At these two locations the newly rejuvenated surface was evident, by the black resilient surface layer, which was now approximately 2 millimetre thick. Below that depth, the grey, oxidized layer of asphalt was evident.

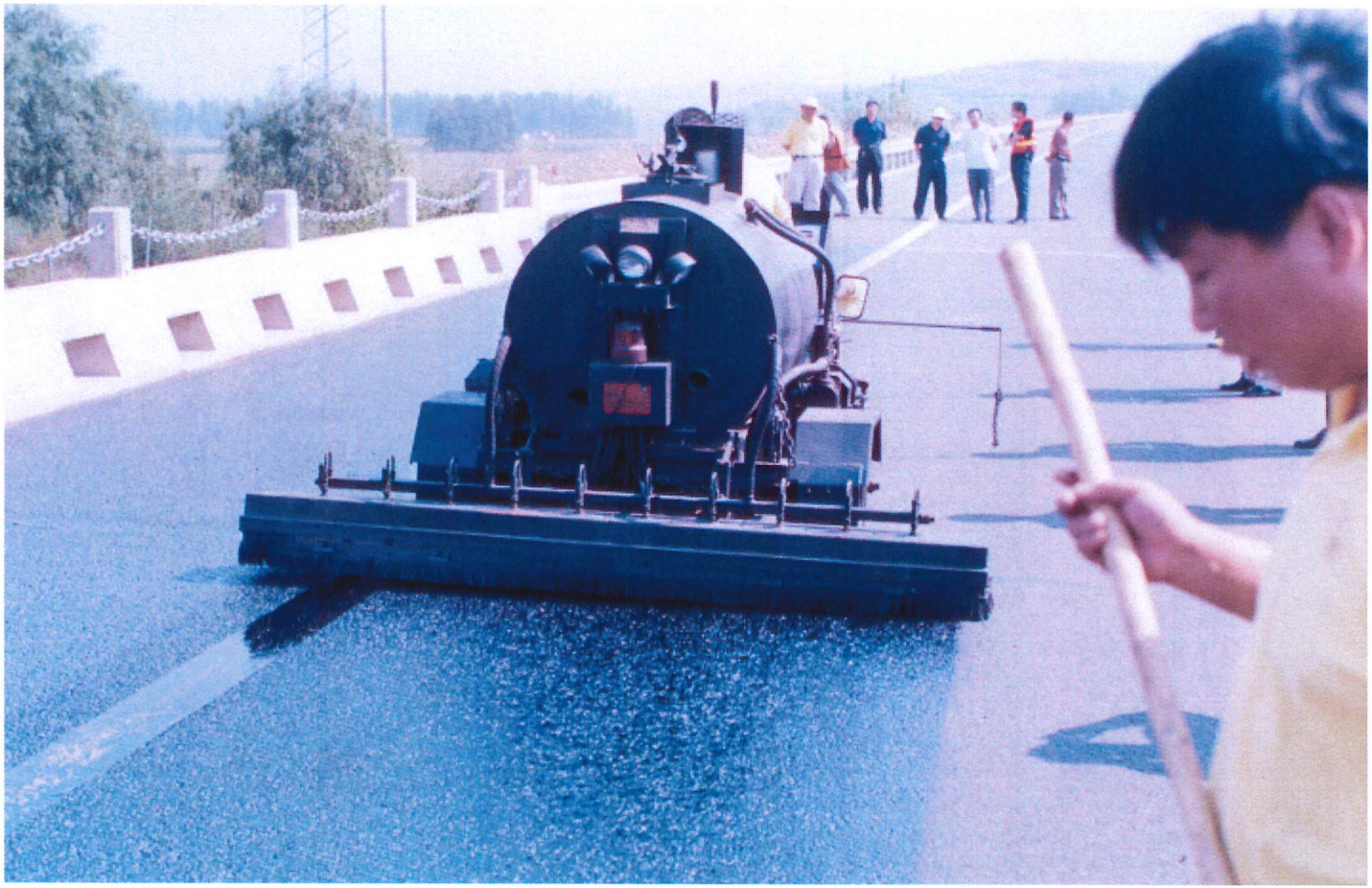


Figure 4.2 Typical Application Procedure.

Figure 4.3 Original Surface at Top
Finished Surface.at Bottom,
Bridge Deck - Km27

Figure 4.4 Bridge Deck - Km 17
Site Visit following application

4.1 RJSeal™ Testing

To date the comparison of the asphalt treated with RJSeal™ has been compared on a very short period at the test site on the Bridge Decks. The Chang-Ji Highway Management Company will bring additional testing equipment to the site, for comparison on a more disciplined, objective basis and to this end, the following tests will be undertaken.

- British Pendulum Test
- Water Infusion Test.

These will be reported separately in a report compiled by the Chang-Ji Highway Maintenance Company.

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 RJSeal™ 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.

Reading were taken with this aforesaid Outflow Meter at several locations on September 13 on the two bridge decks. Further readings were acquired on the follow-up visit on September 14. The results are shown in the table that follows:

Table 4.4				**Outflow Meter Readings**	
Loc'n of Bridge	Test Date	Location relative to center divider of Bridge Decks	Location relative to east end of test section	Before RJSeal™ (secs)	After RJSeal™ (secs)
Km 17	Sept 13	8.8 metres north	1.5 m east	n/a	4
	Sept 14	5.1 metres north	8 m east	n/a	4
Km 27	Sept 13	2.0 metres north	18 m east	8	n/a
	Sept 13	8.5 metres north	1 m east	n/a	3
	Sept 14	5.2 metres north	20 m east	n/a	4

- **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 RJSeal™ 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 RJSeal™ personnel and as such, external assistance has been sought from outside experts in the field of Asphalt Testing. This will be reported separately.

5.0 Test Completion Schedule

Technicians from the Chang-Ji Highway Maintenance Company will be dispatched to undertake further testing on the trial. The projected completion of this testing is scheduled as shown in the following chart.

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Appendix A

RJSeal™ – Technical Seminar,
DaQing,
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Appendix B

RJSeal™ Descriptive Literature

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Appendix C

Desco D200 Sprayer - Technical Data

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