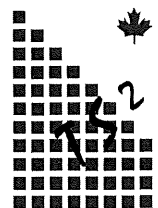


**CROWN CAPITAL ENTERPRISE  
LIMITED**

**WANCHAI, HONG KONG**

**Demonstration of RJSeal™  
Ji-Liao Expressway, LiaoChen,  
ShanDong Province,  
Peoples Republic of China**

**July 2003**



**TS<sup>2</sup> Consulting Inc.  
Lamma, Hong Kong**

# **CROWN CAPITAL ENTERPRISE LIMITED**

## **Demonstration of RJSeal Ji-Liao Expressway, LiaoChen, ShanDong Province, Peoples Republic of China**

**July 2003**

### **TABLE OF CONTENTS**

| <b>Section</b> | <b>Description</b>           | <b>Page</b> |
|----------------|------------------------------|-------------|
| 1.0            | Introduction                 | 1           |
| 2.0            | Co-operative Program         | 3           |
| 3.0            | RJSeal™                      | 4           |
| 3.1            | Prior Experience             | 4           |
| 4.0            | Test Program                 | 5           |
| 4.1            | RJSeal™ Testing              | 13          |
| 4.2            | Water Dissipation            | 13          |
| 4.3            | Fuel Resistance Testing      | 15          |
| 4.4            | Elasticity/Ductility Testing | 15          |
| 5.0            | Project Completion Schedule  | 16          |

### **FIGURES**

| <b>No.</b> | <b>Description</b>                                     | <b>Page</b> |
|------------|--------------------------------------------------------|-------------|
| 1.0        | General Location Map                                   | 2           |
| 4.0        | Specific Location Map                                  | 6           |
| 4.1        | Test Patches At Demonstration Site                     | 7           |
| 4.2        | Typical Application Procedure using Desco D200 Sprayer | 10          |
| 4.3        | Finished Surface                                       | 11          |
| 4.4        | Site Visit, following Application                      | 12          |
| 4.5        | Humble Equipment Co. Outflow Meter                     | 14          |
| 5.0        | Project Completion Schedule                            | 17          |

### **TABLES**

| <b>No.</b> | <b>Description</b>                                                                          | <b>Page</b> |
|------------|---------------------------------------------------------------------------------------------|-------------|
| 4.1        | Geographic Location of Test Patch                                                           | 5           |
| 4.2        | Geographic Location of Demo Site                                                            | 8           |
| 4.3        | Details of RJSeal™ Demonstration Section on Ji-Liao Expressway, LiaoChen, ShanDong Province | 8           |
| 4.4        | Outflow Meter readings at Demo Site                                                         | 13          |

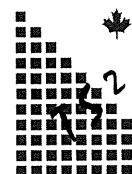
# **CROWN CAPITAL ENTERPRISE LIMITED**

**Demonstration of RJSeal  
Ji-Liao Expressway, LiaoChen, ShanDong Province,  
Peoples Republic of China**

**July 2003**

## **APPENDICES**

| <b>No.</b> | <b>Description</b>                                                             |
|------------|--------------------------------------------------------------------------------|
| A          | RJSeal <sup>TM</sup> – Technical Seminar, Ping-Gu (Beijing) China, August 2001 |
| B          | RJSeal Descriptive Literature                                                  |
| C          | Desco D200 Sprayer – Technical Data                                            |



**TS<sup>2</sup> Consulting Inc.  
Lamma, Hong Kong**

# **CROWN CAPITAL ENTERPRISE LIMITED**

## **Demonstration of RJSeal™ Ji-Liao Expressway, LiaoChen, ShanDong Province Peoples Republic of China**

**July 2003**

### **1.0 INTRODUCTION**

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the Traffic Administration Bureau of QingDao, ShanDong Province, China in July 2003. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on highways within ShanDong Province.

ShanDong Province straddles the Yellow River (HuangHe) at its confluence with the Bohai Sea. ShanDong Province is bordered by Henan, Hebei and JiangSu Provinces. ShanDong Province has seen a major growth in the highway system, due to a government drive to build national highways linking ShanDong Province with major cities in the adjoining provinces. LiaoChen, lies approximately 85 kilometres west of Jinan, the capital city of ShanDong Province and lies immediately north of the Yellow River. The population of LiaoChen is estimated at approximately 1 million. See figure 1.0 for a map showing the location of ShanDong Province. The majority of the area lies at 20 to 30 metres in elevation, on the extensive plain that borders the Sea of Bohai and the East China Sea. The regions' latitude (34 to 37 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. There is no rainy season per-se, just thunderstorms and these occur primarily in June thru August, but can extend into September.

In the immediate LiaoChen area, a significant unconsolidated sedimentary sequence predominates and this is due to the site adjoining the delta of the Yellow River. There are no outcrop exposures available. 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 in ShanDong Province, as well as washed gravels from the various rivers. The bitumen binder for the asphalt is sourced from various locations. Since ShanDong Province has its own indigenous oil fields and petroleum refining capacity, there is some domestic bitumen production. ShanDong Province borders the East 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.

## **2.0 CO-OPERATIVE PROGRAM**

The intent of the arrangement with Traffic Administration Bureau of QingDao, ShanDong Province is to demonstrate RJSeal™ at different locations selected by the Traffic Administration Bureau of QingDao. The demonstration will subsequently allow analysis of the performance of RJSeal™ on a variety of asphalt surfaces. A demonstration was undertaken on Ji-Liao Expressway, immediately north of the city of LiaoChen on July 30, 2003. The portion of the highway that was treated was composed of an asphalt overlay of 2000 vintage which lies atop an asphalt pavement of 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 in the slow lane, but is moderately rough in the overtaking lane. Concern had been expressed about 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 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 seminar held in Ping-Gu (Beijing Municipality) in August 2001. 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 ShanDong Province is located in a semi-tropical climate (Latitude: 34 to 37 degrees North) at a low altitude (10 to 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. ShanDong Province has the greatest concentration of highways in China, with some 26,000 kms of National and Provincial Highways. The ShanDong Infrastructure Company is responsible for administering the Ji-Liao Expressway which stretches 8 kilometres from LiaoChen to interconnect with the Interprovincial Expressway that connects Jinan in Shandong Province with GuanTou in Hebei Province to the west . The owner of the Highway is the ShanDong Provincial Expressway.

In view of this extensive network of roads and the relatively short life of the asphalt surface, ShanDong is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, the ShanDong Infrastructure Company Limited has agreed to try RJSeal™ on the Ji-Liao Expressway, nearby the city of LiaoChen. See Figure 4.0, showing the location of this highway with respect to LiaoChen and ShanDong Province

On July 30, an inspection was made of the asphalt pavement on this highway and it was decided to try an application of RJSeal™ with the Desco D200 Sprayer at a rate of 6.5 square metres/kilogram. A trial strip on the northbound lane (adjacent to the center divider ) on the Ji-Liao Expressway (National Highway G309) was undertaken with RJSeal™. The test strip was at the following geographic location:

| <b>Table 4.1</b>                                  | <b>Geographic Location of Test Patch Site</b> |                |
|---------------------------------------------------|-----------------------------------------------|----------------|
|                                                   | <b>Northing</b>                               | <b>Easting</b> |
| <b>System</b>                                     |                                               |                |
| Geographic (deg, min)                             | 36° 43.676'                                   | 116° 43.408'   |
| Universal Transverse Mercator Grid (50S) (metres) | 4080547                                       | 0568478        |

See Figure No 4.1 for a photo showing the test strip as implemented. Inspection of this test strip showed that the application rate of 6.5 m<sup>2</sup>/kg was appropriate for the asphalt pavement at this location. Accordingly the balance of the demonstration section was treated at the same rate, except for a strip at the shoulder which was exceedingly dirty and rollers were used to apply additional RJSeal™ to combat this problem

The 600 metre long demonstration section on the Ji-Liao Expressway is located approximately 6 kilometres north of the City of LiaoChen. This strip is entirely asphalt pavement. See figure 4.0, which follows, for a location of the general locale.

The demonstration section, on the Ji-Liao Expressway was selected by the Traffic Administration Bureau of QingDao, and is geographically located as follows:

| <b>Table 4.2</b>        |                                                 | <b>Location of Demo Site</b> |                          |
|-------------------------|-------------------------------------------------|------------------------------|--------------------------|
| <b>Location</b>         | <b>System</b>                                   | <b>Northing</b>              | <b>Easting</b>           |
| South End of Test Strip | Geographic (deg, min)                           | 36 <sup>0</sup> 43.676'      | 116 <sup>0</sup> 43.408' |
|                         | Universal Transverse Mercator Grid (metres) 50S | 4064742                      | 0475308                  |
| West End of Test Strip  | Geographic (deg, min)                           | 36 <sup>0</sup> 43.773'      | 116 <sup>0</sup> 43.808' |
|                         | Universal Transverse Mercator Grid (metres) 50S | 4064920                      | 0475903                  |

Refer to Figure 4.0 for the location. Work commenced on the demonstration section at 4:00 pm on July 30, on a hot, sunny afternoon, where the mid-afternoon temperature reached 34 Celsius. A strip, 600 metres long, on the three northbound lanes on this six-lane, divided highway was treated. 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 3 years old (2000 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 detectable rutting due to traffic wear. There was aging and oxidation of the bitumen, which extended to a depth of several millimetres. There were longitudinal cracks and some lateral cracks that had been filled with road tar, but close inspection showed that the asphalt pavement immediately beneath this road tar had negligible bitumen binder. The entire portion of the treated highway section was on a compacted silty-clay, sub-grade

RJSeal™ was applied, using a Desco D200 Sprayer. See Appendix C for technical information on this unit. This unit can uniformly apply the RJSeal™ in the application.

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

| <b>Table 4.3</b>     |                  |                        | <b>Details on RJSeal™ Demonstration Section on Ji-Liao Expressway</b> |                                  |                        |               |            |                         |                  |               |
|----------------------|------------------|------------------------|-----------------------------------------------------------------------|----------------------------------|------------------------|---------------|------------|-------------------------|------------------|---------------|
| <u>Work Schedule</u> | <u>Work Time</u> | <u>Test Length (m)</u> | <u>Total Area m<sup>2</sup></u>                                       | <u>Total Area yd<sup>2</sup></u> | <u>RJSeal™ Applied</u> |               |            | <u>Application Rate</u> |                  |               |
|                      | (hrs)            |                        |                                                                       |                                  | <u>US gals</u>         | <u>litres</u> | <u>kgs</u> | <u>US Gal /yd2</u>      | <u>m2 /Litre</u> | <u>m2 /kg</u> |
| 4:00-7:00            | 3.00             | 600                    | 5,790                                                                 | 7,029                            | 229                    | 865           | 900        | 0.033                   | 6.69             | 6.43          |
| 7:00-8:45            | 1.75             | 600                    | 210                                                                   | 143                              | 15                     | 58            | 60         | 0.061                   | 3.64             | 3.50          |
| Totals               | 4.75             | 600                    | 6,000                                                                 | 7,172                            | 244                    | 923           | 960        | 0.034                   | 6.50             | 6.25          |



Ambient temperatures at the time of the application were in the 31 to 34 degree Celsius range, with humidity in the 85% range. The application ceased at 7:00 pm. The highway remained closed until 11 am on July 31, when it was re-opened for traffic. Photos showing the test application of RJSeal™ follow in figures 4.2, 4.3 and 4.4. on the following pages.

The site was visited on July 31 around 10:00 pm 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, to a depth of 3 centimetres, some 20 metres north of the extreme south end of the demonstration section, to determine the penetration of the RJSeal™. This was one day 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 1 millimetre thick. Below that depth, the grey, oxidized layer of asphalt was evident.

#### **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 Ji-Liao 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 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.

A reading was taken with this aforesaid Outflow Meter at one location on July 31 on the demonstration portion treated with Desco D200 Sprayer. Further readings were precluded by a heavy downpour that commenced immediately after this initial reading. This sole readings was taken at 10:00 am. The result is shown in the table that follows:

| <b>Table 4.4</b> |                                          | <b>Outflow Meter Readings</b>                  |                       |                      |
|------------------|------------------------------------------|------------------------------------------------|-----------------------|----------------------|
| Test Date        | Location relative to shoulder of highway | Location relative to south end of test section | Before RJSeal™ (secs) | After RJSeal™ (secs) |
| July 31          | 2.5 metres east                          | 20 m north                                     | n/a                   | 4                    |

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

#### **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. To this end, independent consultants have been contacted for advise on testing.

## **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.

## **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.

# **CROWN CAPITAL ENTERPRISE LIMITED**

**WANCHAI, HONG KONG**

**Demonstration of RJSeal™  
Ji-Liao Expressway, LiaoChen,  
ShanDong Province,  
Peoples Republic of China**

**July 2003**

## **APPENDICES**

| <b>No.</b> | <b>Description</b>                                                 |
|------------|--------------------------------------------------------------------|
| A          | RJSeal™ – Technical Seminar, Ping-Gu (Beijing) China, August, 2001 |
| B          | RJSeal™ Descriptive Literature                                     |
| C          | Desco D200 Sprayer - Technical Data                                |



**TS² Consulting Inc.  
Lamma, Hong Kong**

**CROWN CAPITAL ENTERPRISE  
LIMITED**

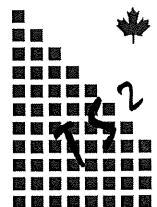
**WANCHAI, HONG KONG**

**Demonstration of RJSeal™  
Ji-Liao Expressway, LiaoChen,  
ShanDong Province,  
Peoples Republic of China**

**July 2003**

**Appendix A**

**RJSeal™ – Technical Seminar,  
Beijing,  
Peoples Republic of China,  
August 2001**



**TS<sup>2</sup> Consulting Inc.  
Lamma, Hong Kong**

**CROWN CAPITAL ENTERPRISE  
LIMITED**

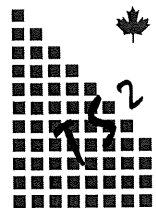
**WANCHAI, HONG KONG**

**Demonstration of RJSeal™  
Ji-Liao Expressway, LiaoChen,  
ShanDong Province,  
Peoples Republic of China**

**July 2003**

**Appendix B**

**RJSeal™ Descriptive Literature**



**TS² Consulting Inc.  
Lamma, Hong Kong**



**CROWN CAPITAL ENTERPRISE  
LIMITED**

**WANCHAI, HONG KONG**

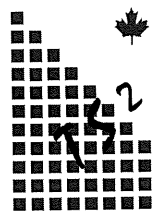
**Demonstration of RJSeal™  
Ji-Liao Expressway, LiaoChen,  
ShanDong Province,  
Peoples Republic of China**

**July 2003**

**Appendix C**

**Desco D200 Sprayer**

**Technical Data**



**TS² Consulting Inc.  
Lamma, Hong Kong**