# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™
## HangZhou Ring Road, Hangzhou, ZheJiang, Peoples Republic of China

## March 2004

TS$^2$ Consulting Inc.
Lamma, Hong Kong

# TS² CONSULTING INC. <

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May 29, 2004

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 RJSeal™ on the Hangzhou Ring Road, Zhejiang.

This is the final report on the demonstration of RJSeal™ on the Ring Road that encircles the city of Hangzhou, Zhejiang Province. This demonstration was undertaken on March 14 and encompassed a 1.6 kilometre long section on the western portion of the Ring Road (two northbound lanes and shoulder) as well as a 0.9 km long bridge deck (three westbound lanes) on the northern portion of the Ring Road The principal interest of the RaoChen City Expressway Company was restoration of the asphalt pavement's ductility plus sealing of transverse and longitudinal cracks to minimize water penetration. Initial indications are that these requirements have been readily met.

Conflict between the Highway Police and the Technical/Maintenance Group led to cancellation of an additional 800 metre test strip, planned for an adjoining southbound portion of the Western Ring Road. This may be completed using hand rollers at a later date.

Yours Sincerely

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

# CROWN CAPITAL ENTERPRISE LIMITED

## Demonstration of RJSeal™
## HangZhou Ring Road, Hangzhou, ZheJiang, Peoples Republic of China

## March 2004

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# CROWN CAPITAL ENTERPRISE LIMITED

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# CROWN CAPITAL ENTERPRISE LIMITED

## Demonstration of RJSeal™
## HangZhou Ring Road, Hangzhou, Zhejiang
## Peoples Republic of China

## March 2004

### 1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the RaoChen City Expressway Company of Zhejiang Province, China in March 2004. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on highways within the RaoChen City Expressway Company administrative district.

Zhejiang Province is situated immediately south of the municipality of Shanghai, which straddles the Yangtze (Chiang Jiang) River at it's mouth that enters the East China Sea. Zhejiang has a lengthy history related to the sea, with fishing villages and ports along the coastline that have supported trade with foreign countries since recorded time. Zhejiang province is bordered by Anhui, JiangXi and Fujian Provinces as well as Shanghai Municipality. The province is generally quite mountainous and the principal city is Hangzhou, which has a population of approximately 3 million and is also the capital city. Hangzhou was already a city of note in the Song Dynasty and Marco Polo languished there and wrote of the beauty of the West Lake and the surrounding area. The principal seaport is NingBo, which has grown to be a major container terminal along the southeastern coast of China and competes with Shanghai and Shenzhen for business. Zhejiang has seen a major growth in the highway system, in recent years, due to a government drive to build national highways linking Shanghai with major cities in the adjoining provinces and the massive increase in the world export trade. Hangzhou, lies some 200 kilometres south of Shanghai. See figure 1.0 for a map showing the location of Hangzhou and Zhejiang Province. The majority of the area lies at 60 to 70 metres in elevation. The regions' latitude (30 degrees north), mean that there are four seasons, with temperatures ranging from 45 Celsius in the long, hot summer to minus 2 Celsius in the short winter. There is a rainy season per-se, that occurs primarily in May thru August, but can extend into September and throughout the winter there are numerous showers and thunderstorms

In the immediate Hangzhou area, a significant consolidated sedimentary sequence predominates. Due to mountain building a significant number of hills and small mountains prevail, that have been gradually eroded and . afford excellent opportunities to see the bedrock. The asphalt in the area is manufactured from local materials, which is comprised of crushed and screened sandstone hauled in from local quarries, as well as washed gravels from the various rivers. The bitumen binder for the asphalt is sourced from

various locations. Since Zhejiang 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.

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| | | | | |
|---|---|---|---|---|
| DESIGNED BY | TS2 | 04/05/29 | SCALE: As Shown | RJSEAL APPLICATION |
| DRAWN BY | TS | 04/06/05 | PROJECT NO. B023H | CROWN CAPITAL ENTERPRISE LIMITED<br>ZHEJIANG PROVINCE<br>GENERAL LOCATION MAP |
| | | | | DRAWING NO. FIGURE 1.0 REV. A |

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## 2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with RaoChen City Expressway Company of Zhejiang Province is to demonstrate RJSeal™ at different locations selected by the RaoChen City Expressway Company. The demonstration will subsequently allow analysis of the performance of RJSeal™ on a variety of asphalt surfaces. A demonstration was undertaken at two different locations on the HangZhou Ring Road, near the city of Hangzhou, on March 14, 2004.

The initial portion of the Ring Road at Kilometre marker 65+500 that was treated, was of mid-1998 vintage and was on an elevated portion for the initial part, whereas the final part was at grade. Knowing construction techniques in highways in China , the portion on grade would have minimal gravel in the immediate coarse base, beneath the asphalt pavement. The surface of the asphalt were quite smooth with some lateral and longitudinal cracks and concern had been expressed about water percolating through the asphalt pavement and softening the sub-grade.

The final portion of the Ring Road at Kilometre 108+00 that was treated, was of mid-2000 vintage and was for the most part on an elevated portion, comprising the three westbound lanes on a six lane, rail-line grade separation with a final part at grade. Knowing construction techniques in highways in China , the portion on grade would have minimal gravel in the immediate coarse base, beneath the asphalt pavement. The surface of the asphalt was fairly smooth, with some lateral and longitudinal cracks and concern had been expressed about water percolating through the asphalt pavement and softening the sub-grade.

## 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 two (32) locations in China and fourteen (14) commercial-scale applications have taken place at various locations, including Shanghai and Kunming.

## 4.0 TEST PROGRAM

Since Zhejiang Province is located in a semi-tropical climate (Latitude: 30 degrees North) at a low altitude (50 to 70 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 2 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

Zhejiang has the significant concentration of highways in China with some 4,000 kms of national and provincial highway. RaoChen City Expressway Company is responsible for over 150 kilometres of Provincial Highway, within it's jurisdiction (distances as of year-end 2003).

In view of this network of roads and the relatively short life of the asphalt surface RaoChen City Expressway Company is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, RaoChen City Expressway Company has agreed to try RJSeal™ on the HangZhou Ring Road. See Figure 4.0, showing the location of this highway with respect to Hangzhou and Zhejiang

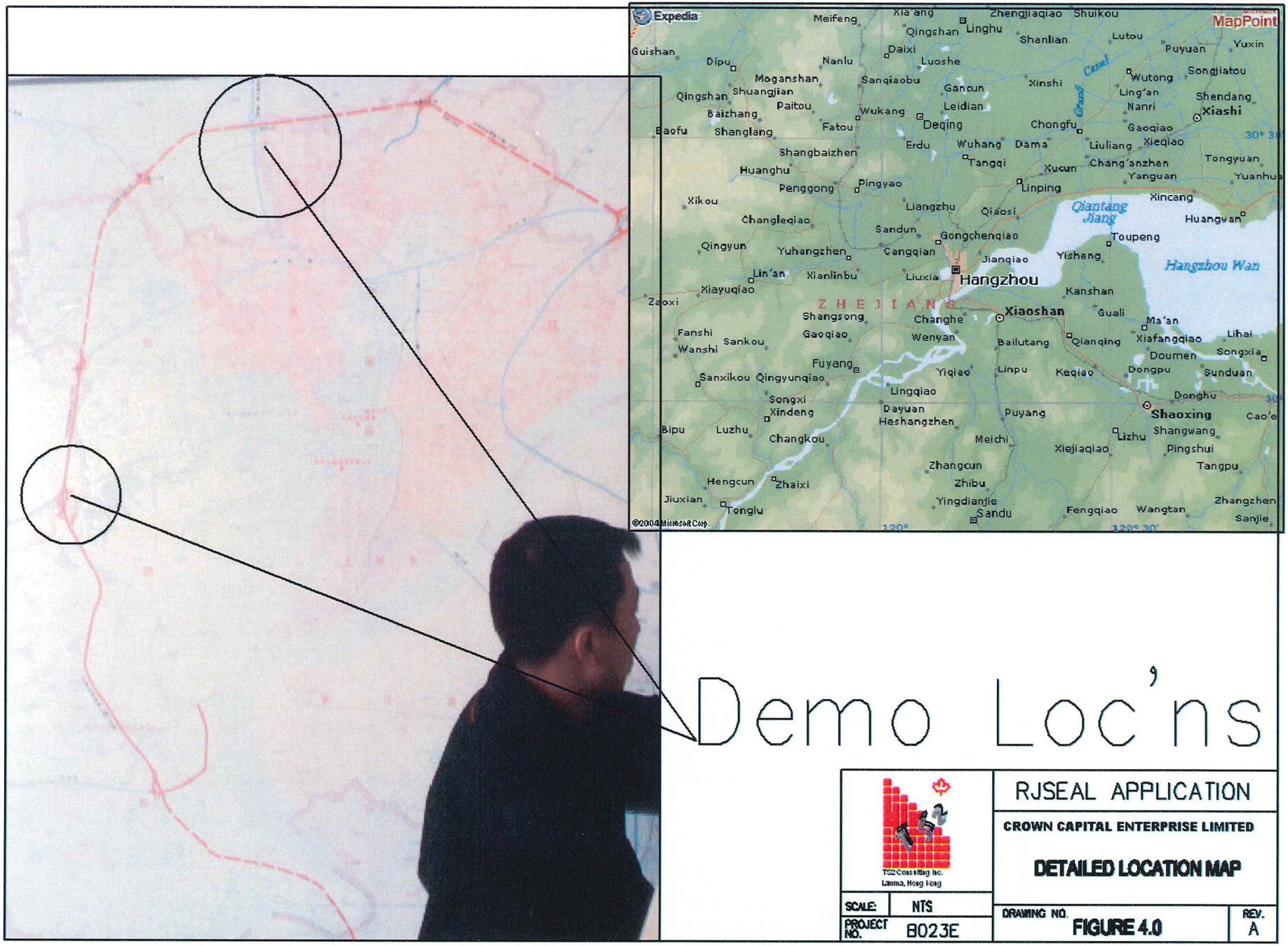
On March 22, a test patch at kilometre marker 65, on the shoulder of the southbound segment of this four lane, divided highway was treated with RJSeal™. This test patch was at the following geographic location:

| **Table 4.1 Kilometre 65 - Test Patch** | | **Geographic Location of Test Patch Site** | |
|---|---|---|---|
| **Loc'n** | **System** | **Northing** | **Easting** |
| | Geographic (deg, min) | $29^0$ 20.734' | $120^0$ 52.383' |
| | Universal Transverse Mercator Grid (51R) (metres) | 3339933 | 0218917 |

This test patch showed that an application rate of 5.0 $m^2$/kg would be appropriate for the road surface at this location. See figure 4.1, which follows, for a depiction of the general locale for the test patch.

Particulars of this 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 $ft^2$** | **RejuvaSeal™ Applied** | | **Application Rate** | | | |
| | | | | **Approx** | **litres** | **Kgs** | **US Gal /$yd^2$** | **Litres /$m^2$** | **$m^2$ /Litre** | **$m^2$ /Kg** |
| One | 1.14 | 1.14 | 1.30 | 14 | 0.25 | 0.26 | 0.043 | 0.19 | 5.20 | 5.00 |




# Demo Loc'ns

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RJSEAL APPLICATION

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**DETAILED LOCATION MAP**

| SCALE: | NTS | DRAWING NO. | REV. |
|---|---|---|---|
| PROJECT NO. | B023E | FIGURE 4.0 | A |


Figure 4.1 Test Patch for RJSeal

Two Test Strips were undertaken on March 14, 2004. The first test strip was 1,660 metres long and was located on the west sector of the Hangzhou Ring Road at the location shown in Table 4.3 which follows:

| **Table 4.3 Kilometre 65+500 - Test Strip West Ring Road – 1660 metres** | | **Geographic Location of Test Strip Site** | |
|---|---|---|---|
| **Loc'n** | **System** | **Northing** | **Easting** |
| South End | Geographic (deg, min) | $30^0$ 09.615' | $120^0$ 04.859' |
| | Universal Transverse Mercator Grid (51R) (metres) | 3340155 | 0218860 |
| North End | Geographic (deg, min) | $30^0$ 10.266' | $120^0$ 04.145' |
| | Universal Transverse Mercator Grid (51R) (metres) | 3341387 | 0217743 |

The second test strip was 890 metres long and was located on the northern sector of the Hangzhou Ring Road at the location shown in Table 4.4 which follows:

| **Table 4.4 Kilometre 108+850 – Test Strip North Ring Road – 890 metres** | | **Geographic Location of Test Patch Site** | |
|---|---|---|---|
| **Loc'n** | **System** | **Northing** | **Easting** |
| East End | Geographic (deg, min) | $30^0$ 21.524' | $120^0$ 14.818' |
| | Universal Transverse Mercator Grid (51R) (metres) | 3361764 | 0235385 |
| West End | Geographic (deg, min) | $30^0$ 21.689' | $120^0$ 14.305' |
| | Universal Transverse Mercator Grid (51R) (metres) | 3362088 | 0234572 |

Work commenced on the initial demonstration section at 9:30 am on March 14, on an overcast morning with a mid-morning temperature of 18 Celsius. The road section selected for the demonstration was on two of the northbound lanes of this four lane divided highway. The initial 1000 metres of this 1,660 metre long demonstration section were on an elevated portion for the initial 1000 metres as one proceeds north from marker 65+500 and then descended back to grade. This elevated portion had a lazy s curve, which had some super-elevation, which caused water to run-off, rather than puddle on the road. The at grade portion had a slight camber that also ensured that water would not 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 was some aging and oxidation of the bitumen, which extended to a depth of several millimetres. The entire portion of the at grade segment of the highway had an asphalt underlay that was purportedly 15 centimetres thick and underlain by a gravel base, which was on a compacted silty-clay, sub-grade. No particulars were known about the asphalt pavement on the elevated portion in terms of thickness. The asphalt pavement on the section treated was reputedly 2 years old.

On the final demonstration section, work commenced after lunch and this was on a overpass for several rail-lines in a common corridor. The overpass was

six lanes wide with a central divider. The three westbound lanes with shoulders on either side were treated. The RJSeal™ was applied using a Desco D200 Sprayer and technical specifications for this unit are contained in Appendix B. This demonstration section dried in approximately 2 hours.

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

| **Table 4.5** | | | **Details of RJSeal™ Demonstration Section on HangZhou Ring Road** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Work Schedule | Work Time (hrs) | Test Length (m) | Total Area $m^2$ | RJSeal Applied | | | Application Rate | | | |
| | | | | US gals | litres | Kilo grams | USGal /$yd^2$ | Litres /$m^2$ | $m^2$ /Litre | $m^2$/Kg |
| 09:30-13:30 | 4.00 | 1,660 | 16,600 | 867 | 3,278 | 3409 | **0.044** | **0.20** | **5.06** | **4.87** |
| 13:30-16:30 | 3.00 | 890 | 9,879 | 508 | 1,922 | 1,999 | **0.043** | **0.19** | **5.14** | **4.94** |
| Totals | 7.00 | 2,550 | 26,479 | 1,375 | 5,200 | 5,408 | **0.043** | **0.20** | **5.09** | **4.90** |

Photos showing the test application of RJSeal™ follow in figures 4.2 and 4.3 on the following pages. Copper slag was applied to demonstrate an improvement in skid resistance once this material is applied and becomes embedded in the asphalt surface, see figure 4.4 showing the application of the copper slag.

The site was visited on March 15, 2004 around 10:00 am and a difference was readily perceived between the RJSeal™ treated sections and the untreated lane, just north of the test section.


Figure 4.2 Typical Application Procedure for RJSeal

Figure 4.3 Finished Surface -Northbound Lanes

Figure 4.4 Slag Application - Km 65+500


Figure 4.5 Finished Surface - Eastbound Lanes.


Figure 4.6 Slag Application - Km 108+850

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## 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 HangZhou Ring Road. Testing equipment that 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.

- Hydroplaning Susceptibility
- Water Penetration
- Macrotexture Depth
- Ductility/Penetration/Viscosity 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 4.7) will be 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 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.

## 4.3 Water Penetration

Water penetration into the asphalt pavement is minimized by the application of RJSeal™. Water Pentration meter tests (China Testing Standard T 0730-2000) will be undertaken on a section of the RJSeal™ treated section in close proximity to the Outflow meter test.

## 4.4 Macrotexture Depth Comparison

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) 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.

## 4.5 Ductility/Penetration/Viscosity Testing

This aspect of the testing requires specialized laboratory equipment and is beyond the capabilities of 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, an independent laboratory has been contacted to undertake asphalt pavement testing.

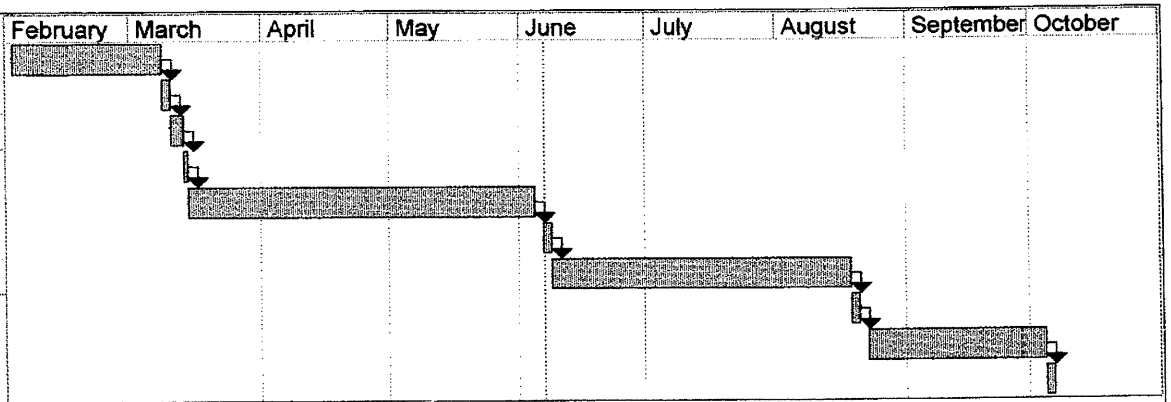

Figure 4.7 Outflow Meter

Figure 4.8 Water Penetration Meter

## 5.0 Test Completion Schedule

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

| ID | Task Name | Duration |
|---|---|---|
| 1 | Negotiations | 25 days |
| 2 | Mobilize | 2 days |
| 3 | Standby in Hangzhou | 3 days |
| 4 | Demo on Ring Road | 1 day? |
| 5 | Report Compilation | 60 days |
| 6 | Report Submittal | 2 days |
| 7 | Hiatus | 51 days |
| 8 | Roller Brush Application | 2 days |
| 9 | Hiatus | 31 days |
| 10 | Testing | 2 days |




Project: Hangzhou Ring Road Demo
Date: Mon 6/7/04

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline

## 6.0 Qualifications

### STATEMENT OF QUALIFICATIONS

I, Anthony G. Speed of Hong Kong in the Special Administrative Region of China, DO HEREBY CERTIFY.

I. THAT I am a Consulting Engineer, with offices at 2/F, 81 Po Wah Yuen, Lamma Island, Hong Kong

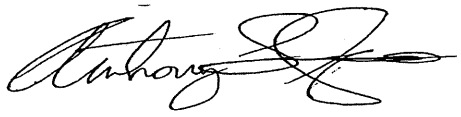
II. THAT I am a 1968 graduate of the University of Saskatchewan, Canada with a Bachelor of Science Degree in Mining Engineering.

III. THAT I am currently registered and in good standing as a Professional Engineer with the Association of Professional Engineers of Ontario, and New Brunswick, Canada

IV. THAT my 30 years of continuous experience in mining, major civil 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.

V. THAT this report is based on my collation of data and a visit on March 7 thru 15 to Zhejiang Province to view the HangZhou Ring Road as described in this report.

Dated at Hong Kong, this _____day of May 30, 2004



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Anthony G. Speed, P.Eng. (Ontario and New Brunswick, Canada)

# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™ HangZhou Ring Road, Hangzhou, ZheJiang, Peoples Republic of China

## March 2004

## APPENDICES

| No. | Description |
|---|---|
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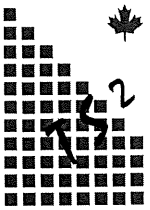
| B | Desco D200 Technical Specifications |
| C | Kunming Copper Slag – Technical Specifications |



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

# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™ HangZhou Ring Road, Hangzhou, ZheJiang, Peoples Republic of China

## March 2004

## Appendix A

## RJSeal™ – Descriptive Literature

TS$^2$ Consulting Inc.
Lamma, Hong Kong

# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™
## HangZhou Ring Road,
## Hangzhou, ZheJiang,
## Peoples Republic of China

## March 2004

## Appendix B

## Desco D200 Sprayer
## Technical Specifications

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# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™ HangZhou Ring Road, Hangzhou, ZheJiang, Peoples Republic of China

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## Appendix C

## Kunming Copper Slag Technical Specifications

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