# CROWN CAPITAL ENTERPRISE LIMITED

# WANCHAI, HONG KONG

## Demonstration of RJSeal™
## ZhongChuan Airport Expressway, Lanzhou, Gansu,
## Peoples Republic of China

## November 2005

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

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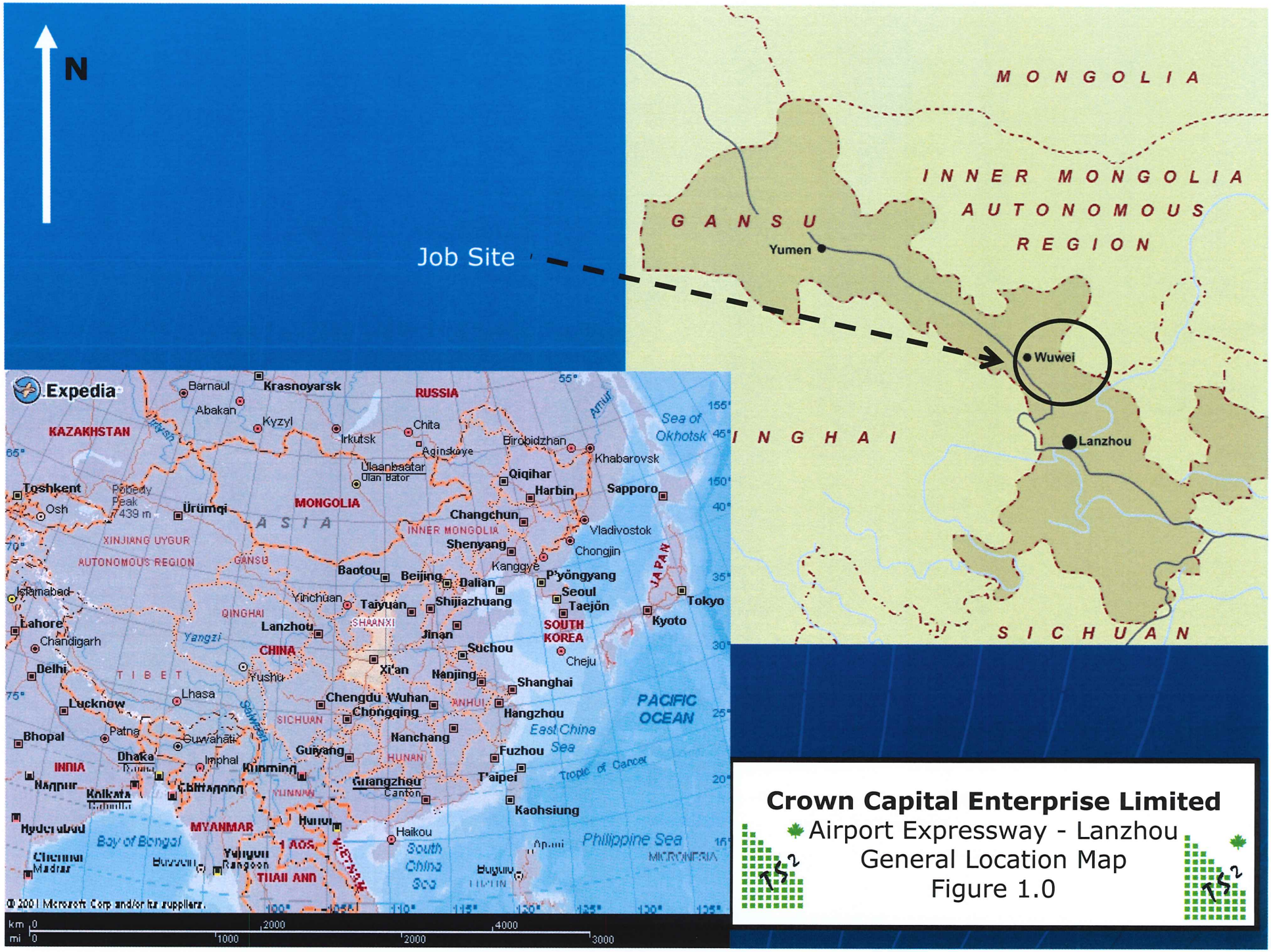
### 1.0 INTRODUCTION

Crown Capital Enterprise Limited of Hong Kong entered into an arrangement with the ZhongChuan Airport Expressway Maintenance Company in Lanzhou, Gansu Province, China in November 2005. This arrangement calls for the analysis of the performance of RJSeal™, a sealer/rejuvenator for asphalt pavement on the ZhongChuan Airport Expressway in Lanzhou, Gansu Province.

Gansu Province is located in north-central China and is adjoined by Sichuan Province to the south, Shaanxi Province to the east, NingXia Autonomous Region as well as Inner Mongolia to the north and XinJiang Province to the West. Lanzhou is the capital city and is located in southeast Gansu Province and is located approximately at Latitude 36 degrees north and longitude 104 degrees east. Lanzhou is located on the upper reaches of the Yellow River and was a former staging post on the famous Silk Road that connected China with the West and led to Xi'an, which is considered the terminus.

Gansu has seen a major growth in the highway system, in recent years, due to the central government drive to build national highways linking Lanzhou with major cities in the adjoining provinces and the massive increase in the world export trade. See figure 1.0 for a map showing the location of Lanzhou and Gansu Province. The area lies at 1500 to 2000 metres in elevation, with most settlements on the plain that straddles the Yellow River. The regions' latitude (36 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. The area is quite arid, with less than 50 mm of precipitation annually.

In the immediate Lanzhou area, a significant sedimentary sequence predominates. The rainfall that washed the loess and weakly cemented sedimentary bedrock toward the yellow river over several millennium now exposes many outcrops. Drainage channels feeding into the Yellow River also afford 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 Gansu Province, as well as washed gravels from the various rivers. Despite Gansu having indigenous oilfields, the bitumen binder for the asphalt is sourced from various locations offshore with refineries in Singapore and the like, not to be forgotten.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Job Site
MONGOLIA
INNER MONGOLIA AUTONOMOUS REGION
GANSU
Yumen
Wuwei
Lanzhou
QINGHAI
SICHUAN
Expedia
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Sea of Okhotsk
Barnaul
Krasnoyarsk
Abakan
Kyzyl
Irkutsk
Chita
Birobidzhan
Khabarovsk
Ulaanbaatar
Ulan Bator
Qiqihar
Harbin
Sapporo
Toshkent
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Ürümqi
Changchun
Vladivostok
Shenyang
Chongjin
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Lahore
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Delhi
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Nanjing
Shanghai
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Chengdu
Wuhan
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Fuzhou
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Bangkok
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Manila
Yangtze
Mekong
Tropic of Cancer
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km 0 2000 4000
mi 0 1000 2000 3000
Crown Capital Enterprise Limited
Airport Expressway - Lanzhou
General Location Map
Figure 1.0

## 2.0 CO-OPERATIVE PROGRAM

The intent of the arrangement with ZhongChuan Airport Expressway Maintenance Company is to demonstrate RJSeal$^{T}$ and subsequently allow analysis of the performance of RJSeal$^{TM}$ on a variety of asphalt surfaces. A demonstration was undertaken on ZhongChuan Airport Expressway, some 65 kilometres north of the city of Lanzhou, on November 4, 2005. The portion of the expressway that was treated was composed of asphalt pavement of Mid-2002 vintage. No details are known about the subgrade, but inspection of the shoulders show a sandy-silty material. Knowing construction techniques in roads in China in general, minimal gravel would be used for an immediate coarse base, beneath the asphalt pavement. The surface of the asphalt has a fairly coarse texture and no concern had been expressed about hydroplaning during heavy rains although water percolating through cracks in the asphalt pavement and softening the sub-grade was of concern. Furthermore, keen interest was expressed in having the life of the asphalt pavement 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 and recently in China 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 that outlines the experience with RJSeal™ at various locations in North America and South America as well as China. 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 other locations in the U.S.A. Since 2000, RJSeal™ has been demonstrated successfully at over fifty (50) locations in China and fifty eight (58) commercial-scale applications have taken place at various locations, such as Beijing, Shanghai, ShenYang in Liaoning Province, ChangChun in Jilin Province, Harbin in HeilongJiang Province and Xi'an in Shaanxi Province

## 4.0 TEST PROGRAM

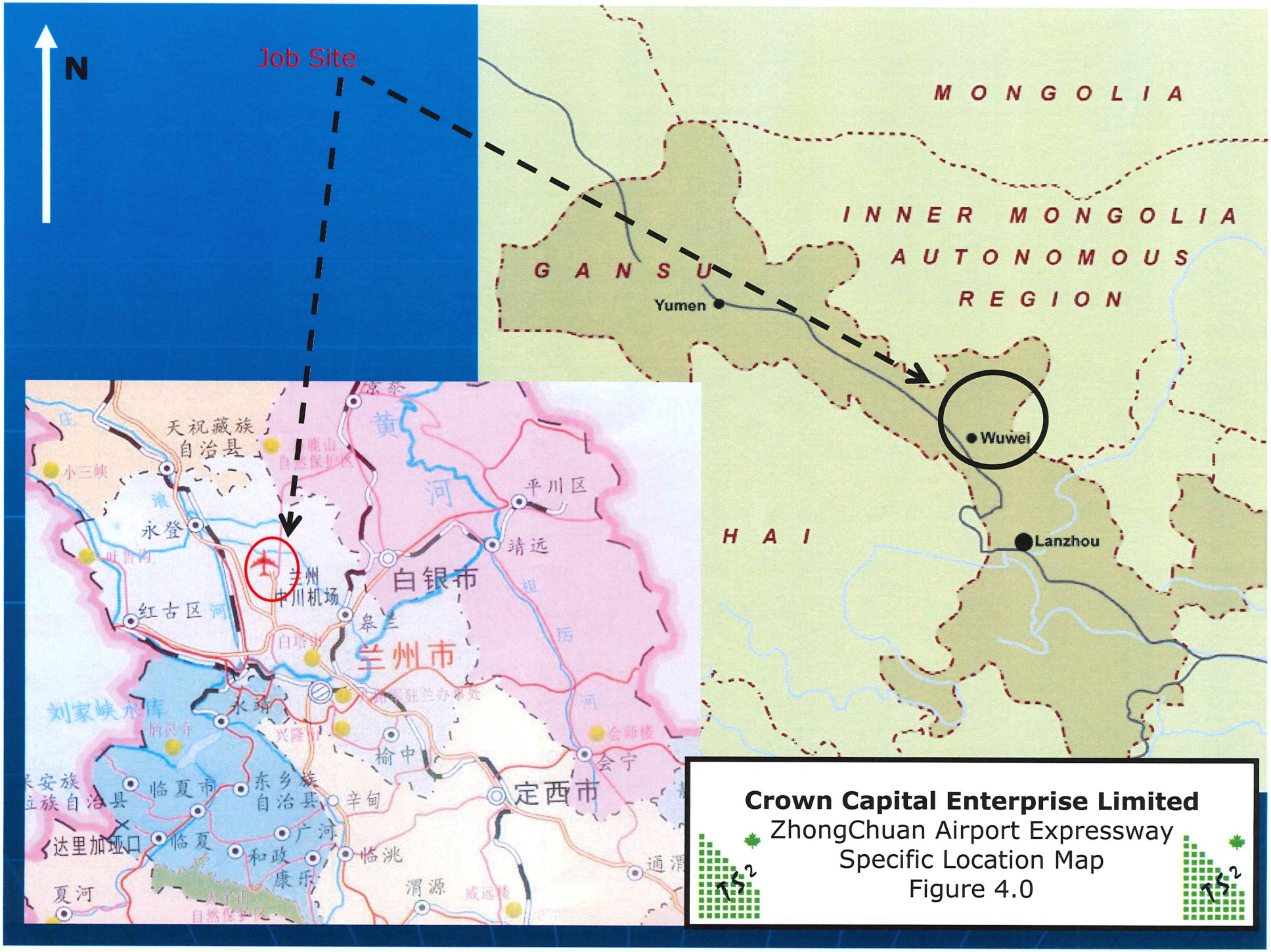
Since Gansu Province is located in an arid climate (Latitude: 36 degrees North) at a high altitude (1500 to 2000 metres), it's a demanding setting for asphalt, given the year round warm climate (extremes of 45 Celsius in summer and minus 5 Celsius in the winter) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder.

ZhongChuan Airport Expressway Company is responsible for approximately 100 kms the Expressway that joins the ZhongChuan Airport with Lanzhou and other neighbouring communities. The ZhongChuan Airport Expressway Company is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, the ZhongChuan Airport Expressway Maintenance Company has agreed to try RJSeal™ on the Expressway connecting the ZhongChuan Airport to Lanzhou. The arrangement led to a committee being struck to suggest appropriate locations for the testing of RJSeal™. See Figure 4.0, showing the location of this expressway with respect to Lanzhou and Gansu

On November 4, a test strip in the southbound, slow lane of the ZhongChuan Airport Expressway (four lane highway, with a median), was treated with RJSeal™. The test strip with respect to the demonstration portion of the street is graphically shown in figure 4.1, which follows.

Subsequent inspection of the test strip, showed that the trial application rate of 4.0 $m^2$/kilogram was adequate. The portion of ZhongChuan Airport Expressway that had RJSeal applied was at the following geographic location:

| **Table 4.1** | | **Geographic Location of Site** | |
|---|---|---|---|
| **System** | | **Northing** | **Easting** |
| North End 14+800 | Geographic (deg, min) | $36^0$ 26.023 ' | $103^0$ 36.044' |
| | Universal Transverse Mercator Grid (48S) (metres) | 4032979 | 0374578 |
| South End 15+000 | Geographic (deg, min) | $36^0$ 25.924 ' | $103^0$ 36.022' |
| | Universal Transverse Mercator Grid (48S) (metres) | 4032797 | 0374542 |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兰州中川机场
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平川区
靖远
兰州市
永靖
刘家峡水库
榆中
会宁
定西市
临夏市
东乡族自治县
辛甸
达里加垭口
临夏
和政
广河
康乐
临洮
渭源
夏河
通渭
Crown Capital Enterprise Limited
ZhongChuan Airport Expressway
Specific Location Map
Figure 4.0

Figure 4.1 Test Strip at Application Site

Work commenced on the demonstration section at 9:00 am on November 4, on a sunny day, where the mid-day temperature reached 15 degrees Celsius. 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 ZhongChuan Airport Expressway, was reputedly 4 years old (2002 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 lateral cracks, which had been patched with hot tar. The entire portion of the treated expressway 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.

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

| **Table 4.2** | **Details on RJSeal™ Application on ZhongChuan Airport Expressway** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Work Schedule | Work Time | Test Length | Total Area $m^2$ | RJSeal Applied | | | Application Rate | | | |
| am/pm | (hrs) | (m) | | US gals | litres | Kgs | USGal /$yd^2$ | Litres /$m^2$ | $m^2$ /Litre | $m^2$/Kg |
| 09:00-11:00 | 2 | 200 | 1,080 | 67 | 255 | 270 | **0.052** | **0.24** | **4.24** | **4.00** |
| 14:30-15:30 | 1 | 200 | 360 | 22 | 85 | 90 | **0.051** | **0.24** | **4.24** | **4.00** |
| Totals | 3 | n/a | 1,440 | 90 | 340 | 360 | **0.052** | **0.24** | **4.24** | **4.00** |

Ambient temperatures were 2 degrees Celsius at the commencement of work at 9 am and rose to 12 degree Celsius by mid-afternoon, with humidity in the 30% range. The application of RJSeal™ commenced on the southbound driving (slow) lane at 9 am thru until 11 am. When the RJSeal™ had dried, then RJSeal™ was applied on the overtaking (inside) lane and work ceased at 3:30 pm. The entire work area was treated with copper slag at an application rate of 0.17 kgs/square metre, immediately after the application of RJSeal™. Photos showing the application of RJSeal™ follow in figures 4.2 and 4.3 on the following pages.

The site was visited on September 5 around 7:15 am and a difference was readily perceived on the two southbound lanes, 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 5 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.


Figure 4.2 Typical Application Procedure

Figure 4.3 Copper Slag Application

Figure 4.4 Finished Surface

## 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 on ZhongChuan Airport Expressway in Lanzhou. Testing equipment was brought to the site for comparison on a more disciplined, objective basis included the following tests.

- Skid Resistance
- Water Penetration
- Macrotexture (Depth of Texture)

At a later date, cores will be acquired from the asphalt pavement for laboratory testing and the following properties of the asphalt pavement will be determined:

- Viscosity
- Ductility
- Penetration
- Softening Point

## 4.2 Skid Resistance

A British Pendulum ASTM Standard E303-93 OR China Standard T 0964-95) was employed to determine the skid resistance of the road surface prior to the application of RJSeal and also after the application.

A BPN of 40 or higher is indicative of an acceptable road surface from a skid resistance point of view. Whereas a BPN of 30 or less infers that the road surface is unacceptable. The test results from the British Pendulum, are not directly correlate-able with the sand patch test.

Results of the testing are shown in the table below:

| Table 4.3 British Pendulum Testing | Particulars of Testing Location | | | BP # (Fb20) | |
|---|---|---|---|---|---|
| Testing Location | Distance from start of job | Lane | Wheel Path | Before BP # | After BP# |
| Km Marker 15+000 | 0 metres | Overtaking | Left wheel path | 50 | 52 |
| Km Marker 15+000 | 0 metres | Overtaking | right wheel path | 45 | 48 |

See Figure 4.5 that follows for a pictorial presentation of the British Pendulum during testing.

Figure 4.5 British Pendulum

## 4.3 Water Penetration

Water Penetration Tests (China Testing Standard T 0730-2000) were undertaken at several locations on the untreated portion of the road, in close proximity to the test strip and later on the RJSeal™ treated section, in close proximity to the British Pendulum tests.

| Table 4.4 Water Penetration Testing | Particulars of Testing Location | | | Water penetration | |
|---|---|---|---|---|---|
| | Distance from start of job | Lane | Wheel Path | Before | After |
| Testing Location | | | | ml/min | ml/min |
| Km Marker 15+000 | 0 metres | Overtaking | Left wheel path | 23 | 17 |
| Km Marker 15+000 | 0 metres | Overtaking | right wheel path | 17 | 10 |

See Figure 4.6 that follows for a pictorial presentation of the Water Penetration Meter.

## 4.4 Macrotexture (Depth of Texture)

The sand patch test (ASTM Standard E965-96 OR China Standard T 0961-95) were used to ascertain the Pavement Macrotexture Depth. Comparison was undertaken at several locations on both the untreated and RJSeal™ treated sections. The results of the testing are documented in the table that follows:

| Table 4.5 Sand Patch Testing | Particulars of Testing Location | | | Depth of Texture | |
|---|---|---|---|---|---|
| | Distance from start of job | Lane | Wheel Path | Before | After |
| Testing Location | | | | mm | mm |
| Km Marker 15+000 | 0 metres | Overtaking | Left wheel path | 1.07 | 1.04 |
| Km Marker 15+000 | 0 metres | Overtaking | right wheel path | 1.01 | 1.03 |

See Figure 4.7 which follows, showing the sand patch testing procedure.


Figure 4.6 Water Penetration Test

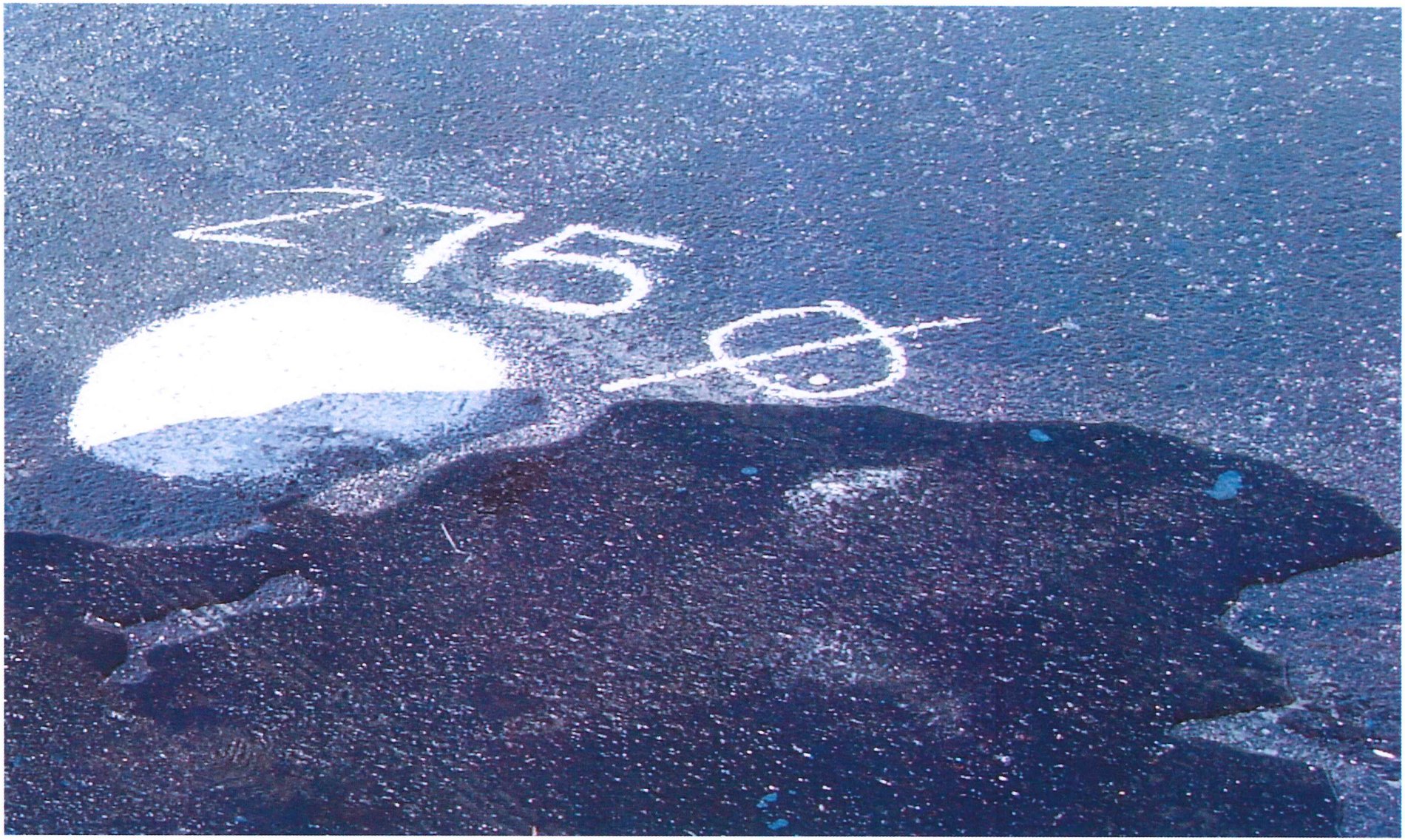


Figure 4.7 Sand Patch Test

## 4.5 Ductility/Viscosity/Penetration Testing

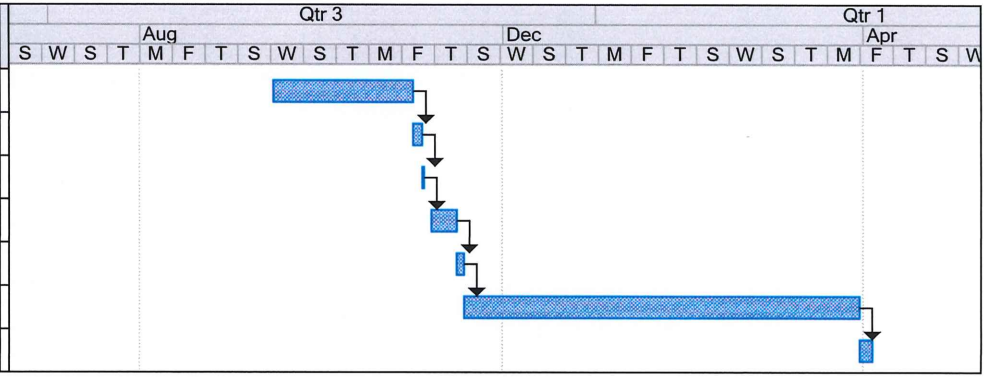
This aspect of the testing is beyond the capabilities Crown Capital Enterprise Limited personnel and external assistance has been sought from outside experts in the field of Asphalt Testing. To this end, the Lanzhou's ZhongChuan Airport Expressway Maintenance Company will retain an independent testing company to conduct tests on the treated section. This will be reported separately.

## 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.

LiveProject - Lanzhou Airport Expressway

| ID | Task Name | Duration | Start | Finish | Predecessor | Successors |
|---|---|---|---|---|---|---|
| 1 | Negotiate Contract for De | 37 days | 15/9/2005 | 31/10/2005 | | 2 |
| 2 | Mobilization | 3 days | 1/11/2005 | 3/11/2005 | 1 | 3 |
| 3 | Application | 1 day | 4/11/2005 | 4/11/2005 | 2 | 4 |
| 4 | Hiatus | 7 days | 7/11/2005 | 15/11/2005 | 3 | 5 |
| 5 | Report Preparation | 2 days | 16/11/2005 | 17/11/2005 | 4 | 6 |
| 6 | Hiatus | 95 days | 18/11/2005 | 30/3/2006 | 5 | 7 |
| 7 | Field Testing | 2 days | 31/3/2006 | 3/4/2006 | 6 | |




Normal task:
% complete:
Milestone:
Split task:
Summary task:
External task:
Critical task:
Rolled up Summary task:
Deadline: