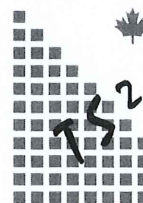


**REJUVASEAL (YUNNAN) INC**

**KUNMING, YUNNAN, CHINA**

**Demonstration of Rejuvaseal™  
Kun-Yu Expressway, Yunnan Province  
Peoples Republic of China**

**April 2003**



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

# **REJUVASEAL (YUNNAN) INC**

## **Demonstration of RejuvaSeal KunYu Expressway, Yunnan Province Peoples Republic of China**

**April 2003**

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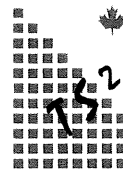
# **REJUVASEAL (YUNNAN) INC**

**Demonstration of RejuvaSeal  
KunYu Expressway, Yunnan Province  
Peoples Republic of China**

**April 2003**

## **APPENDICES**

<b>No.</b>	<b>Description</b>
A	Rejuvaseal™ – Technical Seminar, Kunming, Yunnan, China, 8 May, 2001
B	Rejuvaseal Descriptive Literature
C	Field Testing.



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

# RejuvaSeal (Yunnan) Inc.

## RejuvaSeal Demo

Kun-Yu Highway - Km 67-Km68

Demo Date 22-Apr-03

Prepared by A.G. Speed

Updated by A.G. Speed

## Assumptions

Slow Lane Width 3.75 Metres

Travelling Lane Width 3.75 Metres

Passing Lane Width 3.50 Metres

Total Width 11.00 Metres

## Conversion Factors

US Gallon= 3.78 Litres

Sq Metre= 10.76 Sq Feet

Sq Metre= 1.20 Sq Yds

SG 1.04

## Crew

Desco Op 1

Desco helper 1

Truck Driver 2

Crane Op 1

Labourers 4

Sweeper Op 1

Supervisor 2

12

Updated 4-May-03

Work Schedule	Work Time (hrs)	Test Length (m)	Total Area m <sup>2</sup>	Total Area ft <sup>2</sup> approx	RejuvaSeal Applied			Application Rate					11 Man Crew	
					US gals	litres	kgs	USGal /ft <sup>2</sup>	USGal /yd <sup>2</sup>	Litres /m <sup>2</sup>	m <sup>2</sup> /Litre	m <sup>2</sup> /Litre	m <sup>2</sup> /man hr	yd <sup>2</sup> /man hr
10:30-12:45	2.25	1,000	5,500	59,171	247	935	973	0.004	0.038	0.18	5.66	5.66	203.7	243.5
15:30-18:00	2.50	1,000	5,500	59,171	247	935	973	0.004	0.038	0.18	5.66	5.66	183.3	219.2
Totals	4.75	2,000	11,000	118,342	495	1,870	1,945	0.004	0.038	0.18	5.66	5.66	193.0	230.7

21-Apr-03

Patch Width (m)	Patch Length (m)	Total Area m <sup>2</sup>	Total Area ft <sup>2</sup> approx	RejuvaSeal Applied			Application Rate				
				US gals	litres	kilogram	USGal /ft <sup>2</sup>	USGal /yd <sup>2</sup>	Litres	m <sup>2</sup>	m <sup>2</sup> /Ka
1.02	1.02	1.04	11	0.07	0.25	0.26	0.006	0.053	0.24	4.16	4.00
1.14	1.14	1.30	14	0.07	0.25	0.26	0.005	0.043	0.19	5.20	5.00
1.25	1.25	1.56	17	0.07	0.25	0.26	0.004	0.035	0.16	6.25	6.01



RejuvaSeal (Yunnan) Inc

Testing Requirements of Contract

Kun-Yu Highway

Prepared9-Sep-03

PreparedA.G. Speed

Updated11-Sep-03

Testing Procedure						
Test	Penetration	Ductility	Elasticity	Softening	Infusion	Pendulum.
ASTM	D5	D 113	D 2171	D 36		
CHINA	T 0604	T 0605	T 0620	T 0606	T 0730	T 0964
Contract	yes	yes	yes	yes	yes	yes
Todate	yes	yes	no	yes	no	yes

# **REJUVASEAL (YUNNAN) INC**

## **Demonstration of RejuvaSeal™ KunYu Expressway, Yunnan Province Peoples Republic of China**

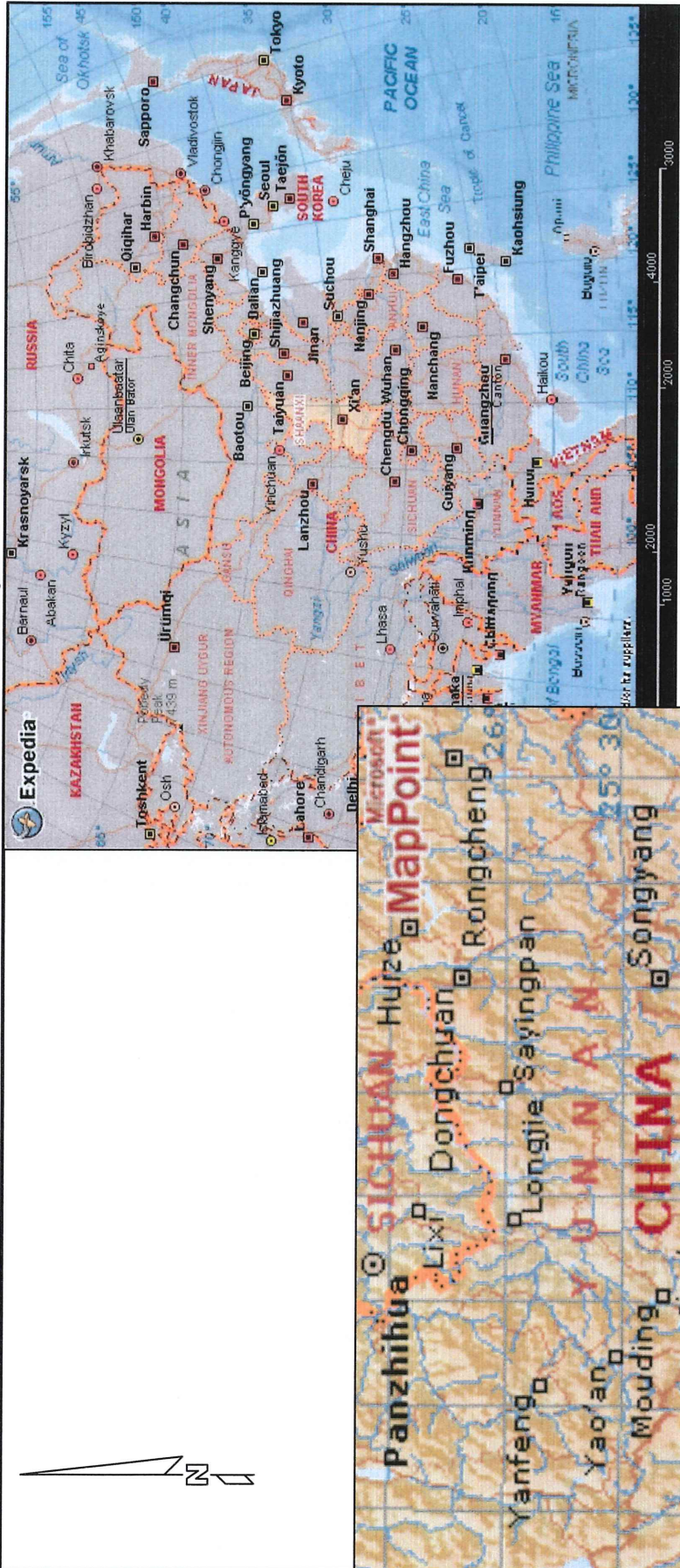
**April 2003**

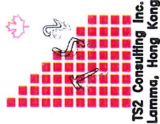
### **1.0 INTRODUCTION**

RejuvaSeal (Yunnan) Inc. of Kunming, Yunnan Province entered into an agreement with the KunYu Expressway Management Company, based in Kunming, Yunnan Province, China on April 21, 2003. The agreement calls for the analysis of the performance of RejuvaSeal™, a sealer/rejuvenator for asphalt pavement on highways within the jurisdiction of the KunYu Management's area.

Kunming is located in Yunnan province, in the southwestern sector of the Peoples Republic of China and is bordered by Vietnam, Laos and Myanmar (Burma). See figure 1.0 for a map showing the location of this province. Kunming is the Capital City and the majority of the area lies in the Yunnan-Guizhou Plateau which averages 2000 metres in the area of interest. The altitude, combined with the regions' latitude, mean that the climate is quite pleasant in China, warm and mild, and is known as "spring at all seasons."

The asphalt in the area is manufactured from local materials, which is comprised almost exclusively of crushed and screened limestone. In the immediate Kunming area, a karst topography predominates and has formed numerous scenic vista's. Alternate road surfacing material does not exist, aside from slag from local steel mills and boiler slag (bottom ash) from coal fired, power plants. The bitumen binder for the asphalt is sourced from various locations, and in discussions with members of the Highways Department; Singapore and Dalian in Liaoning province were two sources mentioned. No doubt other suppliers have been tried in the past, as no readily accessible petroleum refinery distillates exist in Yunnan province, nor the neighbouring provinces of Guangxi, Guizhou or Sichuan. A coal char/coking plant exists in Anning, near Kunming, but the availability of appropriate coal tar distillates for use as an asphalt binder is not known.





TSZ Consulting Inc.  
Lamhe, Hong Kong

REJUASEAL DEMO

**REJUASEAL (YUNNAN) INC.**  
YUNNAN PROVINCE

DESIGNED BY	TS2	03/02/1	SCALE: As Shown	DRAWING NO.	REV.
DRAWN BY	TS	03/02/2	PROJECT NO.	B025G	A

GENERAL LOCATION MAP

**FIGURE 1.0**

## **2.0 CO-OPERATIVE PROGRAM**

The intent of the Agreement is to demonstrate RejuvaSeal™ at different locations, which will subsequently allow analysis of the performance of Rejuvaseal™ on a variety of asphalt surfaces. A demonstration was undertaken at milestone Km 67-68 on April 22, on the primary highway that leads from Kunming, some 92 km south to Yuxi and known as the KunYu Expressway. The section of highway at milestone Km 68 was built in 1999 and the asphalt pavement is approximately 120 mm thick. No details are known about the subgrade, but inspection of the shoulders in the fill sections of the highway, show a sandy silty material. Knowing construction techniques in highways in China in general, minimal gravel would be used in the immediate coarse base, beneath the asphalt pavement.

### **3.0 REJUVASEAL™**

RejuvaSeal is a proprietary product that is supplied by RejuvaSeal (Yunnan) Inc of Kunming, Yunnan, China. Rejuvaseal™ has been proven in numerous applications in China as well as North and South America to rejuvenate asphalt pavement at various stages of it's 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 Kunming on May 8, 2001. This outlines the experience with Rejuvaseal™ at various locations in North America and South America. Further information is available from RejuvaSeal (Yunnan) Inc. 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 Yunnan Province is located in a semi-tropical climate (Latitude: 25 North) at a high altitude (2000 metres), it's a demanding setting for asphalt, given the year round warm climate (average of 25 Celsius, with extremes of 30 Celsius) and intense exposure to ultraviolet radiation, all which contribute to the oxidation and breakdown of the asphalt binder. Furthermore, the soft limestone mosaic of the asphalt quickly wears under the traffic. Discussions with the Kunming-based Highway Management Department indicate that on primary highways the life cycle of the asphalt requires that the traveling surface be planed and a new overlay of fresh asphalt be applied every five or six years.

The KunYu Highway Management is definitely interested in determining how to economically extend the life of the asphalt road surface. To this end, they have agreed to try RejuvaSeal™ on one section of the KunYu highway. The agreement of April 21 led to the selection of a location for the testing of RejuvaSeal™. On April 22, a 1,000 metre section of the Kunming-Yuxi (KunYu) Expressway was treated with RejuvaSeal™.

#### 4.1 Test Section – KunYu Expressway

On April 21, three test patches were implemented on the centre lane and similar three test patches were also implemented on the outside lane (adjacent to the shoulder) of KunYu Highway and were treated with RejuvaSeal™. The test patches were at the following geographic location:

Table 4.1	Geographic Location of Test Patch Site	
System	Northing	Easting
Geographic (deg, min)	24° 32.631 '	102° 34.398'
Universal Transverse Mercator Grid (48R) (metres)	2716613	0254176

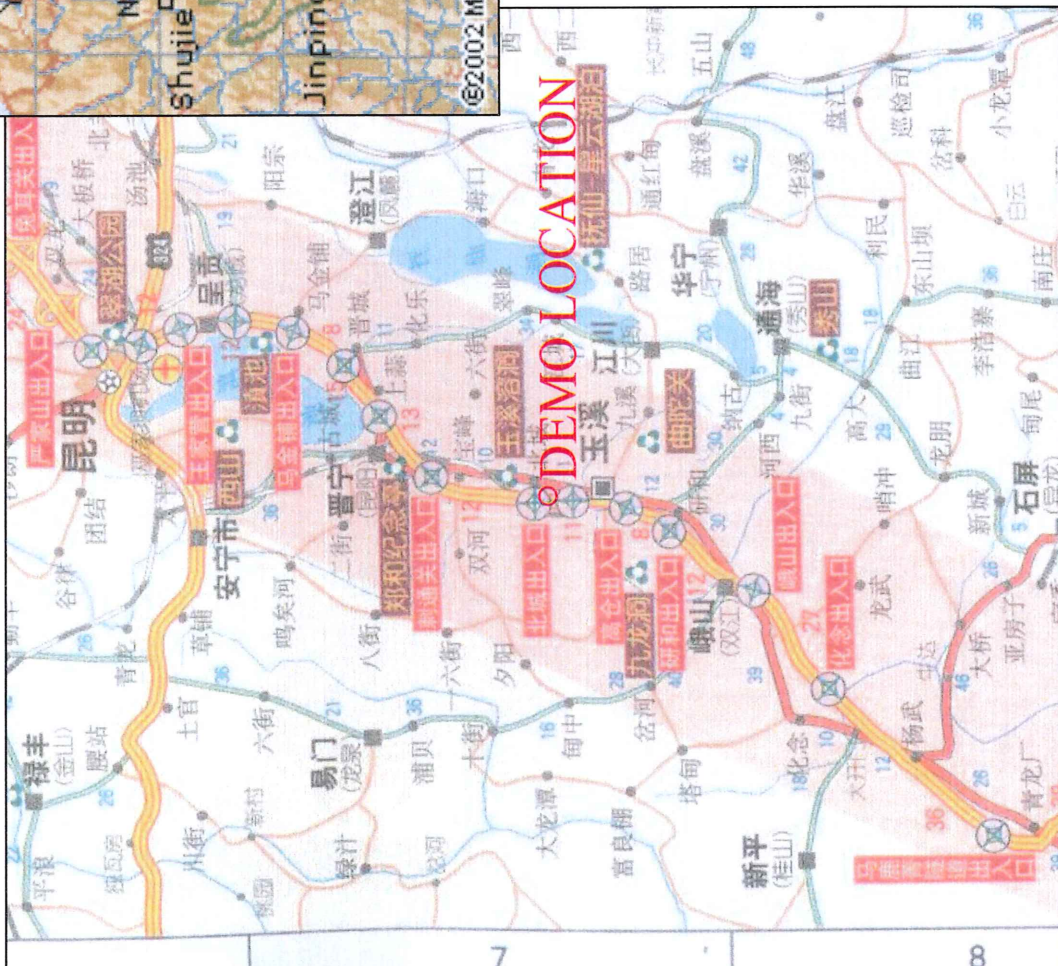
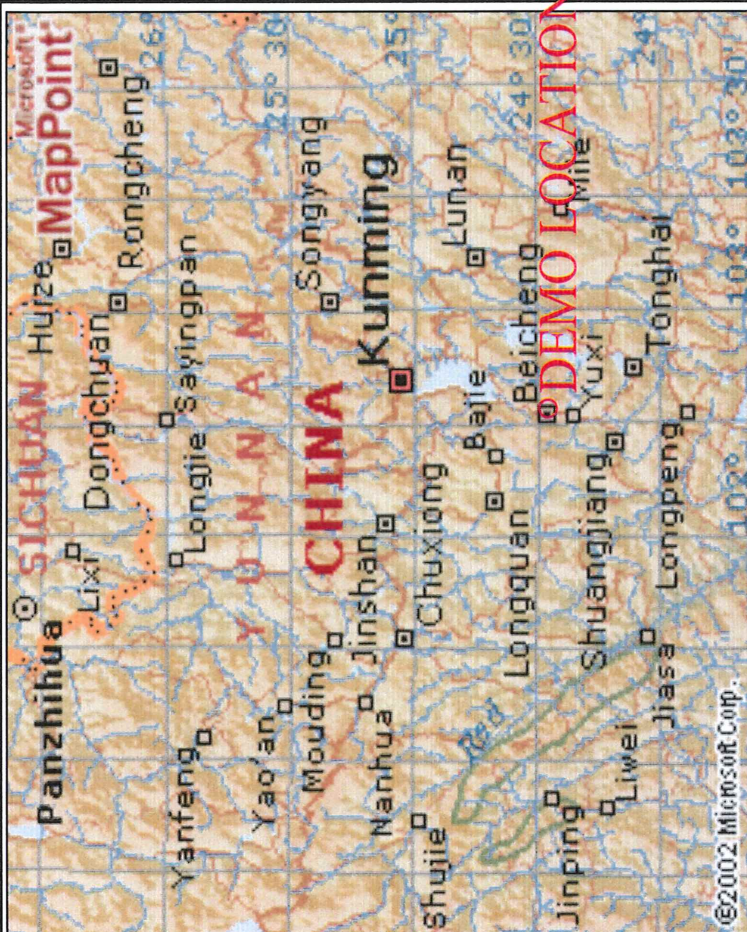
See Figure No 4.1 for a photo showing the test patches as implemented. Particulars of the test patches are as follows:

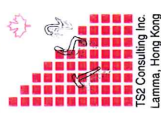
Table 4.2				Particulars of the test patch						
Test Patch Number	Patch Width (m)	Patch Length (m)	Total Area m <sup>2</sup>	Total Area ft <sup>2</sup> approx	RejuvaSeal™ Applied		Application Rate			
					litres	Kgs	US Gal /yd <sup>2</sup>	Litres /m <sup>2</sup>	m <sup>2</sup> /Litre	m <sup>2</sup> /Kg
One	1.02	1.02	1.04	11	0.25	0.26	0.053	0.24	4.16	4.00
Two	1.14	1.14	1.30	14	0.25	0.26	0.043	0.19	5.20	5.00
Three	1.25	1.25	1.56	17	0.25	0.26	0.035	0.16	6.25	6.00



Subsequent inspection of the test patches on April 22, showed that the application rate of 5.0 m<sup>2</sup>/kg (test patch two) was appropriate for the asphalt pavement on the middle lane and the inside lane (passing lane), whereas the outside lane would be adequately treated with 5.5 m<sup>2</sup>/kg.

The south end of the 1,000 metre long demonstration strip on the KunYu Expressway is located at Kilometre marker 68 and the north end of the test strip is located at Kilometre marker 67 on the north bound lanes. See figure 4.0, which follows, for a location of the general locale. The test patch were located approximately 150 metres north of the south end of the demonstration strip and are shown in figure 4.0



	REJUVASEAL DEMO		REV. A
	REJUVASEAL (YUNNAN) INC		
	DETAILED LOCATION MAP		
SCALE: NTS	DRAWING NO.	FIGURE 4.0	
PROJECT NO.	B023E		



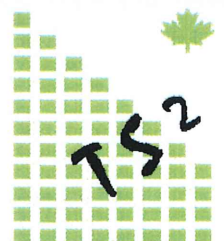
The 1,000 metre test section is located the KunYu Expressway, 12 km north of the city of Yuxi at the following geographic location:

<b>Table 4.3</b>		<b>Geographic Location of Demo Site</b>	
<b>System</b>		<b>Northing</b>	<b>Easting</b>
North End	Geographic (deg, min)	24 <sup>0</sup> 32.531 ‘	102 <sup>0</sup> 34.344’
	Universal Transverse Mercator (metres)	2717349	0254401
South End	Geographic (deg, min)	24 <sup>0</sup> 33.031 ‘	102 <sup>0</sup> 34.523’
	Universal Transverse Mercator (metres)	2716430	0254083

See figure 4.1 which follows, for a graphic presentation of the location.



Figure 4.1  
Test Patches at Demonstration Site.





*Work commenced on the demonstration section at 10:30 am on April 22, on a hot, sunny day, where the mid-day temperature reached 28 Celsius. A strip, 1,000 metres long on the north bound side of the six lane,* divided portion of this primary highway was treated. The test section is located on a straight section with a uphill grade of approximately 6%. There is a slight camber to the road which causes water to run off, rather than puddle on the road. The asphalt surface on the section treated, was reputedly four years old (1999 vintage). No significant oil spills were observed, just the occasional drop of transmission oil, crankcase oil or hydraulic fluid. The highway surface was not noticeably worn and had about 35-40% of the surface composed of exposed aggregate, with a few minor lineal cracks and no rutting due to traffic wear. There was appreciable aging and oxidation of the bitumen, which extended to a depth of one to two millimetres. The initial 100 metres of the treated highway section was on fill, the remainder in cut. Several dry creeks crossed the right of way and were contained in concrete box culverts.

On April 22, between 10:30 am and 12:45 pm, the inside lane and a portion of the center lane were treated with RejuvaSeal using a Desco D200 Spraying Machine. This machine has 10 spray tips and covers a path some 2.2 metres wide. Several passes were made with this machine to cover the area, with a 10 centimetre overlap between passes. The width of the passing (inside) lane is 3.5 metres between the painted divider line and the shoulder marker line,, whereas the center lane was 3.75 metres wide. The white lines were covered with adhesive tape prior to the RejuvaSeal application and this tape consequently prevented the white lines from being coated. This adhesive tape was stripped off, following the RejuvaSeal application. A lunch break was taken at 12:45. After the RejuvaSeal was dry around 15:00, the traffic was diverted onto the treated section and following taping of the white lines, the balance of the center lane and the outside (slow) lane were treated using the Desco D200 Spraying Machine. Details of the application are summarized below:

<b>Table 4.4</b>		<b>Details on RejuvaSeal Demonstration Strip on KunYu Expressway</b>						
Time Start-finish	Work Time (hrs)	Total Area m <sup>2</sup>	Total Area ft <sup>2</sup>	RejuvaSeal™ Applied			Application Rate	
				US gals	litres	Kilo Gram	USGal /yd <sup>2</sup>	m <sup>2</sup> /Litres
10.30 12.45	2.25	5,500	59,171	247	935	973	0.038	5.66
15:00 18:00	2.50	5,500	59,171	247	935	973	0.038	5.66
Totals	4.75	11,000	118,342	495	1870	1945	0.038	5.66

The test strip application was completed by 18:00 and the outside lane remained closed until 7:20 pm on April 22, when it was re-opened for traffic. Photos showing the test application of RejuvaSeal™ follow in figures 4.2 and 4.3. on the following pages.



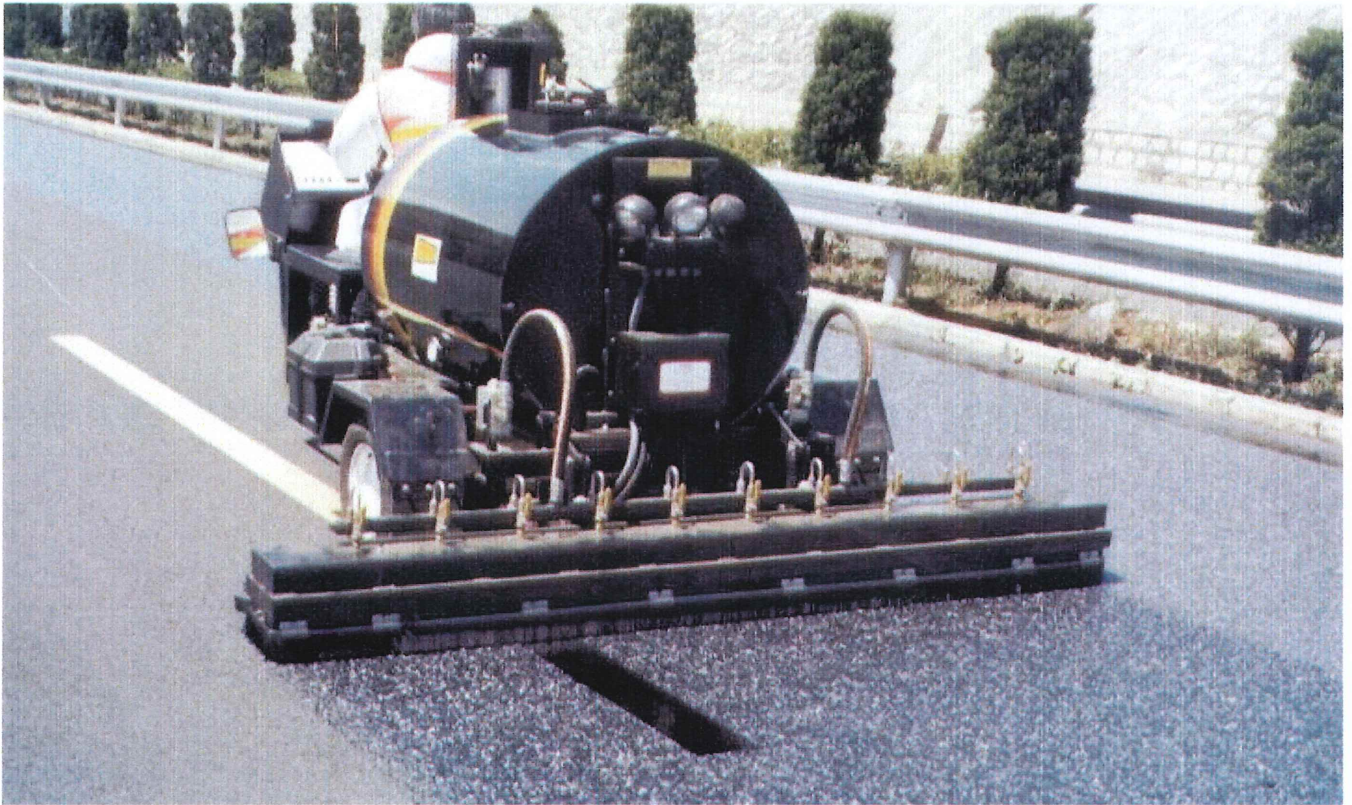


Figure 4.2 Typical Application Procedure.





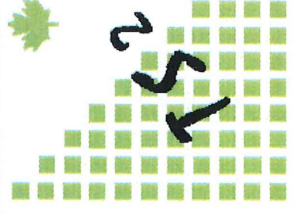
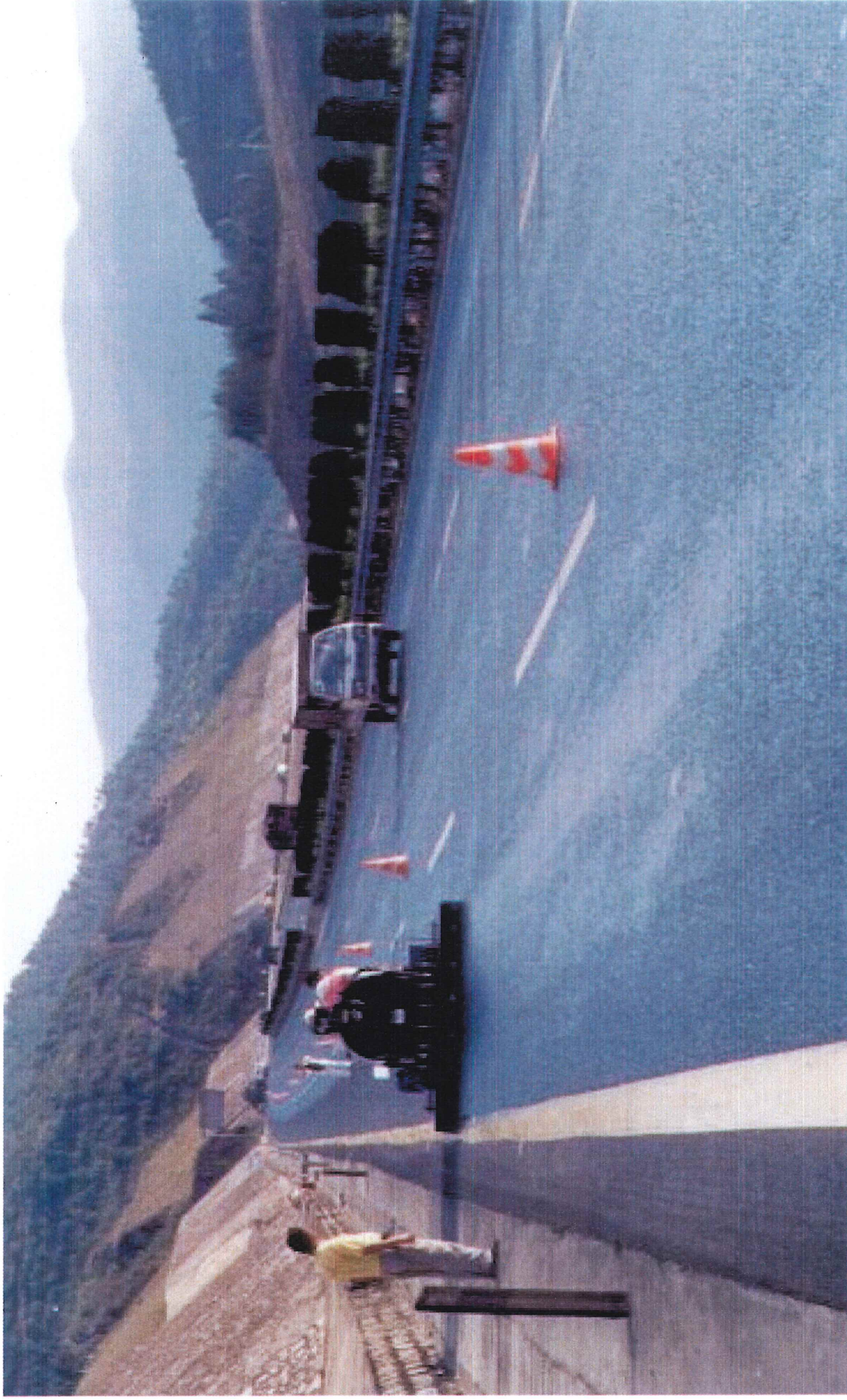


Figure 4.3 Finished Surface.

## **4.2 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 the Kun-Yu highway. Appropriate testing equipment was brought to the site and a comparison on a more disciplined, objective basis will be undertaken. To this end, the following tests will be undertaken.

- Water Dissipation (Hydroplaning Comparison)
- Fuel Resistance Comparison
- Elasticity/Ductility Testing

## **4.3 Water Dissipation**

An “Outflow Meter” manufactured in the U.S.A. by Humble Equipment Co. and under the trademark “Outflow Meter” (see figure 4.4) can be used to measure the asphalt pavement’s capability to dissipate water during rainfall, 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 8 seconds are satisfactory results for an asphalt surface, if hydroplaning is to be minimized.

Readings are scheduled to be taken with this aforesaid Outflow Meter on both untreated sections of the highway and RejuvaSeal™ Treated sections, in close proximity to each other, once the section has had a little longer time to react to the RejuvaSeal treatment and a little more traffic has passed over the test section. This will be reported separately !

## **4.4 Fuel Resistance Comparison**

Fuel Resistance Comparison was undertaken on several sections of the untreated and RejuvaSeal™ treated sections in close proximity to the Outflow meter tests. This comparison consisted 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. In all instances the diesel fuel readily penetrated the asphalt pavement of the untreated section and in all instances the diesel fuel pooled to some extent on the RejuvaSeal™ treated sections.

#### **4.5 Skid Resistance**

British pendulum Test (See figure 4.5)

#### **4.6 Water Penetration**

Water infusion Test (See figure 4.5)

#### **4.7 Elasticity/Ductility Testing**

This aspect of the testing was beyond the capabilities of the field equipment available to both RejuvaSeal (Yunnan) Inc and RejuvaSeal personnel. And as such, external assistance has been sought from outside experts in the field of Asphalt Testing. To this end, core samples of the asphalt pavement from the RejuvaSeal™ treated section will be acquired on May 29 and submitted for independent testing.





Figure 4.4  
Humble Equipment Co. Outflow Meter



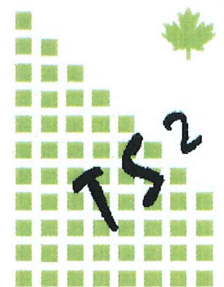


Figure 4.5 British pendulum Test (top)  
Water Infusion Test (lower left)

## **5.0 Test Completion Schedule**

The team of technicians from the Kunming office of RejuvaSeal (Yunnan) Inc will be dispatched in late May to undertake initial testing on the trial section. Further testing with the Outflow Meter will take place in the near future. Also testing with the British Pendulum and a Water Infusion testing device

The completion of this initial testing is scheduled as shown in the following chart.

Figure 5.0 Project Completion Schedule

## **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 visit in April 2003 to Kunming and participation in the test work described in this report

Dated at Hong Kong, this \_\_\_\_\_ day of June, 2003



---

Anthony G. Speed, P.Eng.

**REJUVASEAL (YUNNAN) INC.**

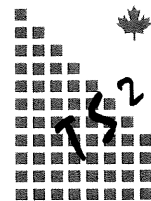
**KUNMING, YUNNAN, CHINA**

**Demonstration of Rejuvaseal™  
KunYu Expressway, Yunnan Province  
Peoples Republic of China**

**April 2003**

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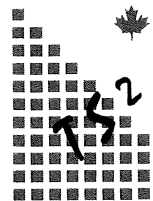
**KUNMING, YUNNAN, CHINA**

**Demonstration of Rejuvaseal™  
KunYu Expressway, Yunnan Province  
Peoples Republic of China**

**April 2003**

**Appendix A**

**Rejuvaseal™ – Technical Seminar,  
Kunming, Yunnan,  
China,  
8 May, 2001**



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**REJUVASEAL (YUNNAN) INC.**

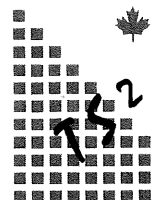
**KUNMING, YUNNAN, CHINA**

**Demonstration of Rejuvaseal™  
KunYu Expressway, Yunnan Province  
Peoples Republic of China**

**April 2003**

**Appendix B**

**Rejuvaseal™ Descriptive Literature**



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**REJUVASEAL (YUNNAN) INC.**

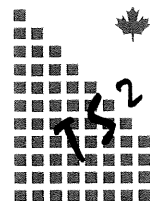
**KUNMING, YUNNAN, CHINA**

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**April 2003**

**Appendix C**

**Field Testing.**



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