CROWN CAPITAL ENTERPRISE LIMITED

WANCHAI, HONG KONG

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

August 2003

TS^2 Consulting Inc.
Lamma, Hong Kong

CROWN CAPITAL ENTERPRISE LIMITED

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August 2003

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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 Chang-Ji Highway, some 28 kilometres east of the city of Changchun, on August 12, 2003. The portion of the highway that were treated was composed of asphalt pavement, nominally 10 centimetres thick, which overlays a silty-clay sub-grade . 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 cracks in the asphalt pavement, thus 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 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 the Chang-Ji Highway, adjacent to 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 this Bridge Decks and it was decided to try an application of RJSeal^{TM} with the Desco D200 Sprayer at a rate of 4.0 square metres/kilogram. A trial strip on the eastbound fast lane was initially undertaken, adjacent to the outside lane. This trial strip was at the following geographic location:

Table 4.1	**Geographic Location of Test Strip Site**	
System	**Northing**	**Easting**
Geographic (deg, min)	43^0 59.178'	125^0 43.930'
Universal Transverse Mercator Grid (51T) (metres)	0719104	4873997

Subsequent inspection of the trial strip, showed that the application rate of 4 m^2/kg was adequate for the asphalt pavement at this location and was used as a guide for the balance of eastbound fast (inner) lane at this location

The 180 metre long demonstration section on the Chang-Ji Highway on the Chang-Ji Highway is located some 28 kilometres east of the City of Changchun. See figure 4.0, which follows, for a location of the general locale. The locationof the test strip with respect to the road is graphically shown in figure 4.1, which follows.

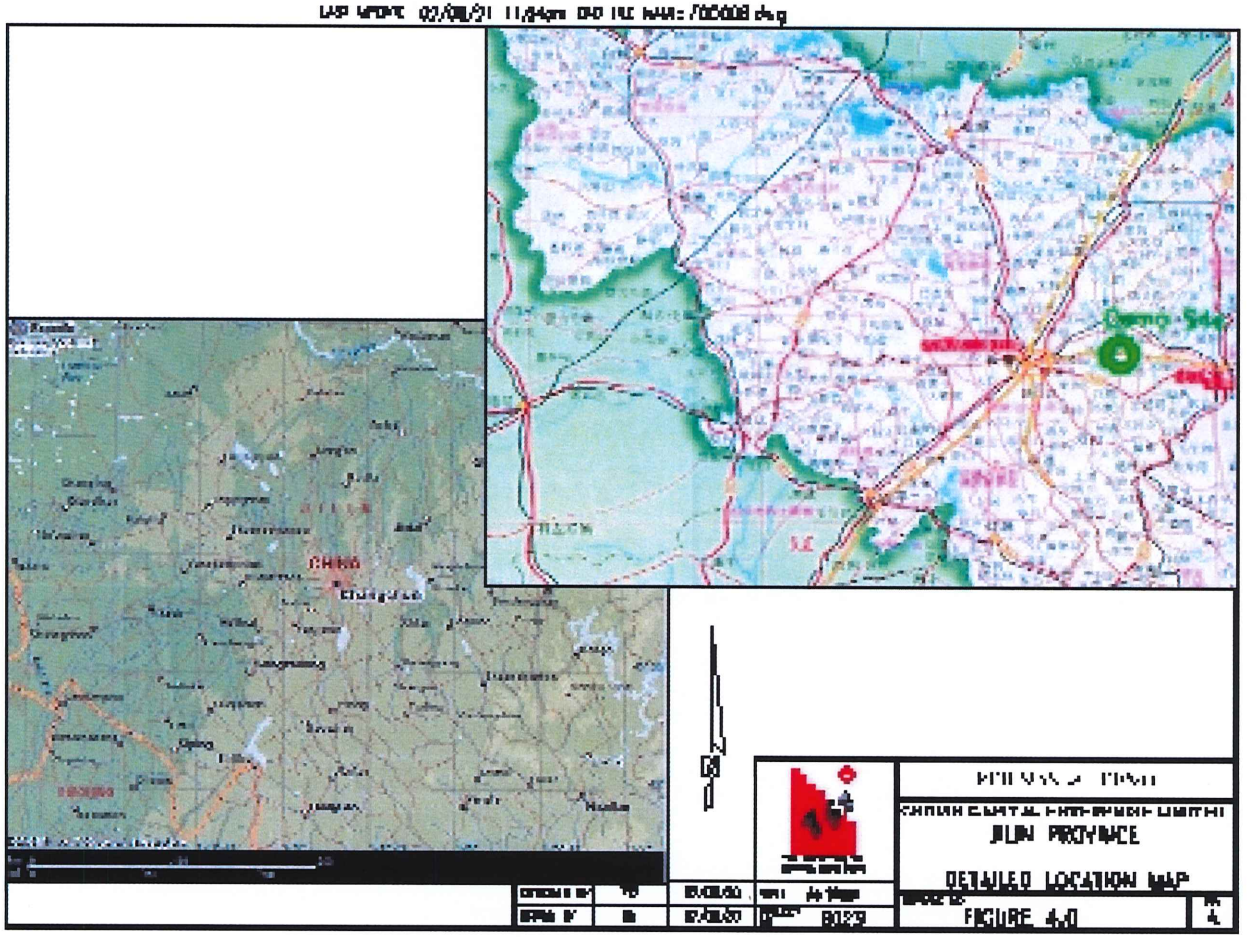
JILIN PROVINCE
DETAILED LOCATION MAP
FIGURE 4.0

Figure 4.1 Test Strip, Chang-Ji Highway.

The demonstration section, on the Chang-Ji Highway was selected by the Chang-Ji Highway Management Company and the west end of the demonstration strip is geographically located as follows:

Table 4.2	**Geographic Location of Test Strip Site**	
System	**Northing**	**Easting**
Geographic (deg, min)	43^0 59.178'	125^0 43.930'
Universal Transverse Mercator Grid (51T) (metres)	0719104	4873997

Refer to Figure 4.0 for the location. Work commenced on the demonstration section at 8:30 am on August 12, on a warm, sunny day, where the mid-day temperature reached 25 Celsius. A strip, 180 metres long, on the fast lane of the eastbound sector of this four-lane, divide highway was treated. The width of the lane is 3.7 metres between the painted driving lines, with a 0.8 metre wide shoulder, adjoining the center divider. The test section is located on a straight 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 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 treated asphalt pavement section overlies 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:

Table 4.3		**Details on RJSeal™ Demonstration Section on Chang-Ji Highway**								
Work Schedule Aug 12	Work Time (hrs)	Test Length (m)	Total Area m^2	Total Area yd^2	RJSeal™ Applied			Application Rate		
					US gals	litres	kgs	US Gal /yd2	m^2 /litre	m^2 /kg
8:30-9:30 am	1.0	180	810	968	53	200	208	0.055	4.05	3.89

Ambient temperatures at the time of the application on August 12 were in the 22 to 26 degree Celsius range, with humidity in the 60% range. Photos showing the test application of RJSeal™ follow in figures 4.2, 4.3 and 4.4. on the following pages.

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 lane. A screwdriver was used to dig two small holes in the asphalt pavement, to a depth of 3 centimetres, some 4 metres east of

the extreme west end of the demonstration section, to determine the penetration of the RJSeal™. This was one month 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 5 millimetre thick. Below that depth, the grey, oxidized layer of asphalt was evident.

Figure 4.2 Typical Application Procedure.

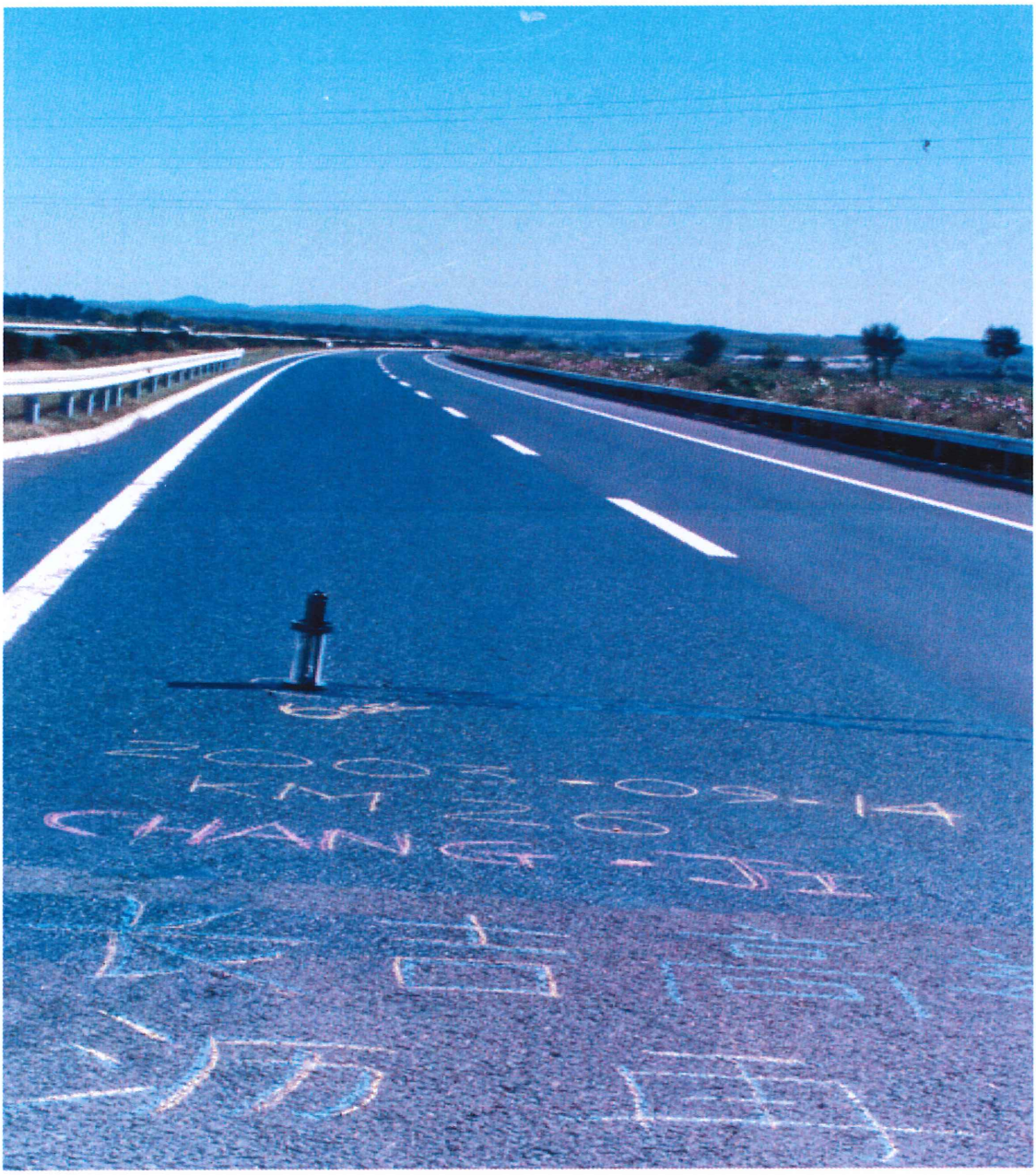

Figure 4.3 Finished Surface.

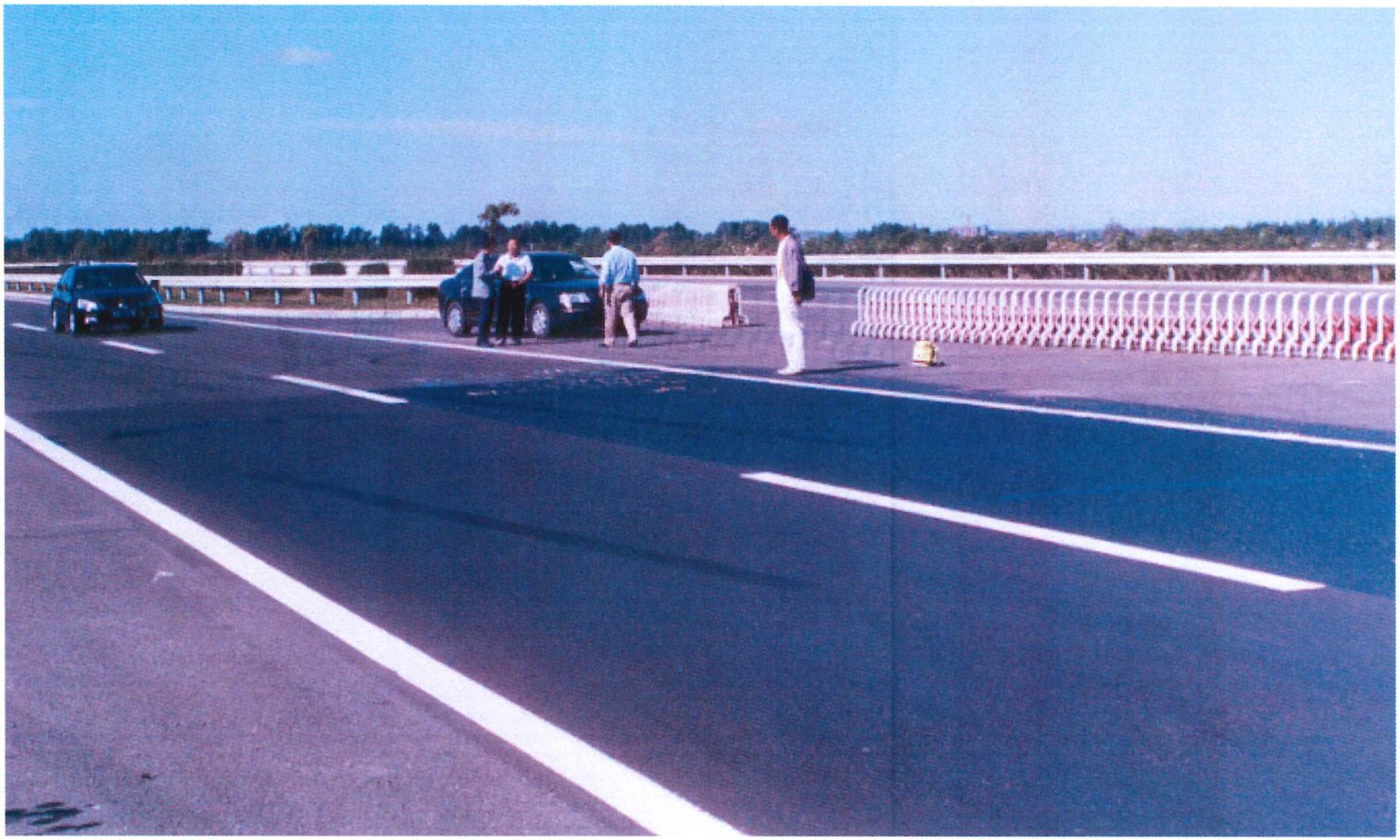

Figure 4.4 Site visit - following application

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 Chang-Ji Highway. 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.

A reading was taken with this aforesaid Outflow Meter at one location on September 14 on the demonstration portion treated with RJSeal™ that was applied with a Desco D200 Sprayer. This sole reading was taken at 10:00 am. The result is shown in the table that follows:

Table 4.4		**Outflow Meter Readings**		
Test Date	Location relative to center divider of highway	Location relative to west end of test section	Before RJSeal™ (secs)	After RJSeal™ (secs)
Sept 14	2.0 metres south	2 m east	n/a	6

- **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

Figure 4.5
Humble Equipment Co. Outflow Meter

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, Peoples Republic of China, September 2002

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Appendix B

RJSeal™ Descriptive Literature

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Appendix C

Desco D200 Sprayer - Technical Data

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