transport
Department:
Transport
Province of KwaZulu-Natal

REHABILITATION OF P50-1

DETAILED DESIGN REPORT
From km 18+000 to km 26+000

February 2016

Prepared for:

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DETAILED DESIGN REPORT
P50-1
Between km 18+00 to km 26+00
Eshowe

Report No: **T01.PZB.000519**

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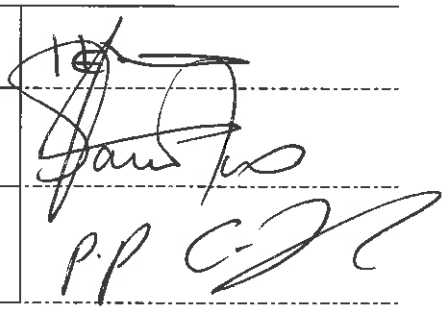
Signature:	Originator:	Hein Arnold	
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CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

1.1. TERMS OF REFERENCE

Royal HaskoningDHV were appointed by the Department of Transport KwaZulu-Natal to undertake a rehabilitation investigation on Road P50-1 (km 18+000 to 26+000)

Mr M Zondo and S Nene of Royal HaskoningDHV carried out a site inspection on 10 February 2015 and conducted a comprehensive visual assessment on the entire length of the road.

In the investigation carried out the following documents are applicable:

- TMH 1, Standard Methods of Testing Road Construction Materials;
- Draft TMH 9, 1990, Pavement Management Systems: Standard Visual Assessment Manual;
- Draft TRH4, 1996, Structural Design of Interurban and Rural Road Pavements;
- Draft TRH 12, 2003, Flexible Pavement Rehabilitation Investigation and Design; and,
- TRH 14, 1995, Guidelines for Road Construction Materials.

1.2. PURPOSE AND SCOPE OF THE REPORT

This report discusses the current condition of the existing pavement structure, results of the pavement investigation and proposes measures for the repair and surfacing of the pavement.

1.3. SUMMARY OF INVESTIGATION

Matrolab Group (Pty) Ltd conducted the material investigation and sampling during the period of 23rd March 2015 to 25th March 2015. Further investigations carried out included a detailed visual assessment.

2. PROJECT DESCRIPTION

2.1. LOCATION AND DESCRIPTION OF THE ROUTE

Main Road P50-1 is located north west of Eshowe in the Empangeni Region Kwa-Zulu Natal. The road is 26 km long road and starts at Km 0,00 at the intersection with P47-5 (R66) and proceeds in a northwest direction towards Nkandla and ends at km 26.

The section under investigation that forms part of this reports starts at km 18,00 and ends at km 26,00 towards Nkandla. (See below Appendix A for Locality Map). The road forms the main link between Eshowe and Nkandla, with many heavy vehicles making use of this road to transfer goods from Eshowe to Nkandla and Kranskop. The road also serves communities and social facilities (Schools and clinics).

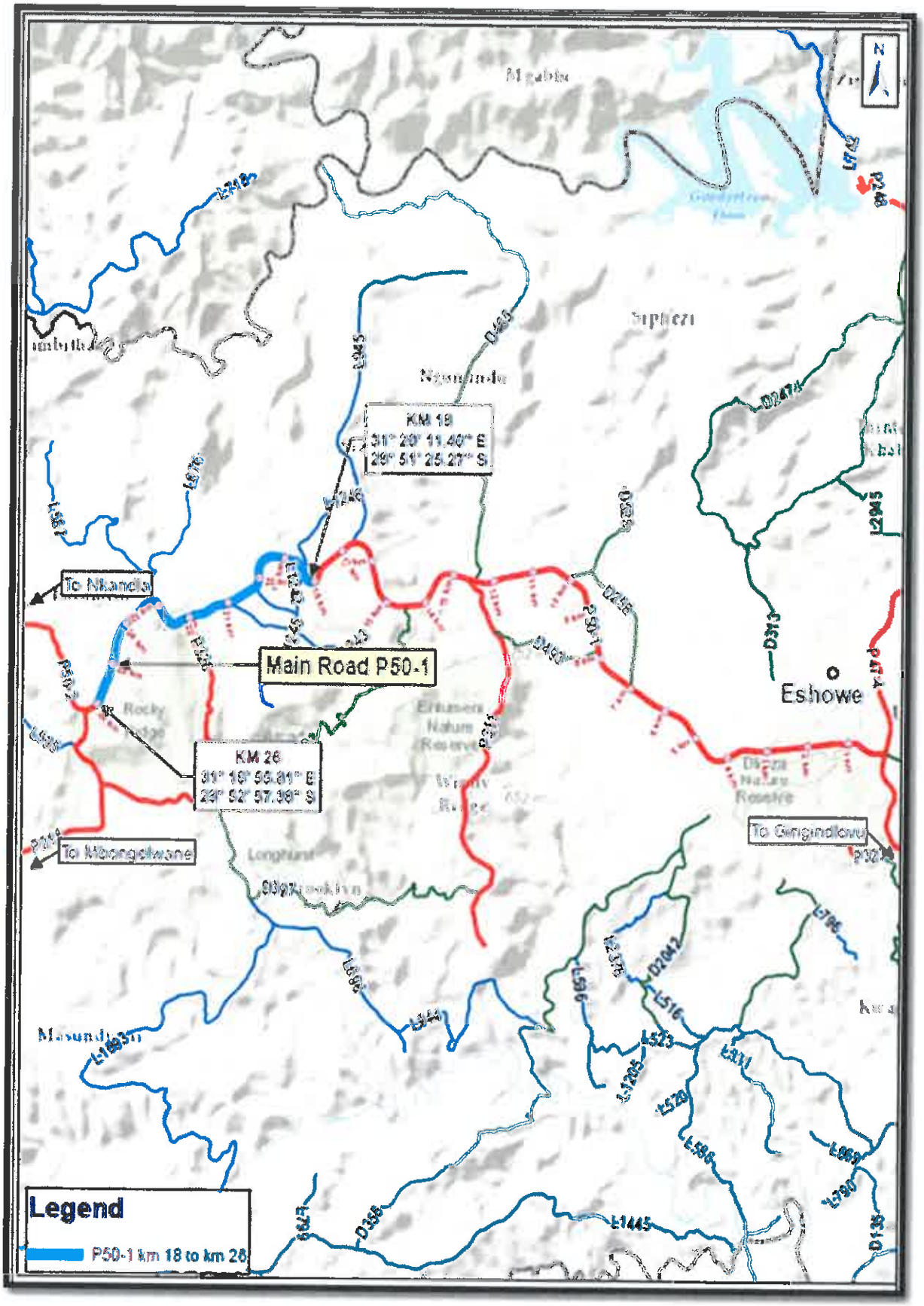


Figure 1: Locality Map of P50-1

2.2. PURPOSE OF THE ROUTE

The road forms part of the provincial road network of South Africa. This road severs as the main route that connects Eshowe and Nkandla. From an agricultural point of view the road is very important in transporting sugarcane from farms along the route to the nearby sugarcane mills. P50-1 can be classified as Category B major rural road, according to TRH4: (1996) with the respective design analysis 15-30 years.

3. PHYSIOGRAPHY

3.1. TOPOGRAPHY

The route passes through the rolling terrain with an average height above sea level of approximately 500 meters.

3.2. CLIMATE CONDITIONS

a) Climate classification of region

The table below shows the empirical relationship between potential evapotranspiration and mean air temperature. The area through which the road passes is situated in a wet area according to N-weinert value. The Thornthwaite's Moisture Index of greater than 20 (determined from Figure 15 of the Chapter 10, South African Pavement Engineering Manual) can be used as a basis for the adjustments of criteria for the applicable parameters of pavement design. The moisture condition affects the weathering of rock, the durability of weathered material and in combination with drainage condition and the surface layer integrity.

This criteria indicates that chemical weathering will occur for the section under investigation due to the wet climate

Table 3-1: Empirical relationship between potential evapotranspiration and mean air temperature

Description	Weinert N value	Thornthwaite Moisture Index, I_m	Typical Mean Annual Rainfall
Arid	>5	<40	<250mm
Semi-arid	4 to 5	20 to 40	250 to 500mm
Semi-arid to sub-tropical	2 to 4	0 to 20	500 to 1000mm
Humid tropical	< 2	20 to +100	>1000mm

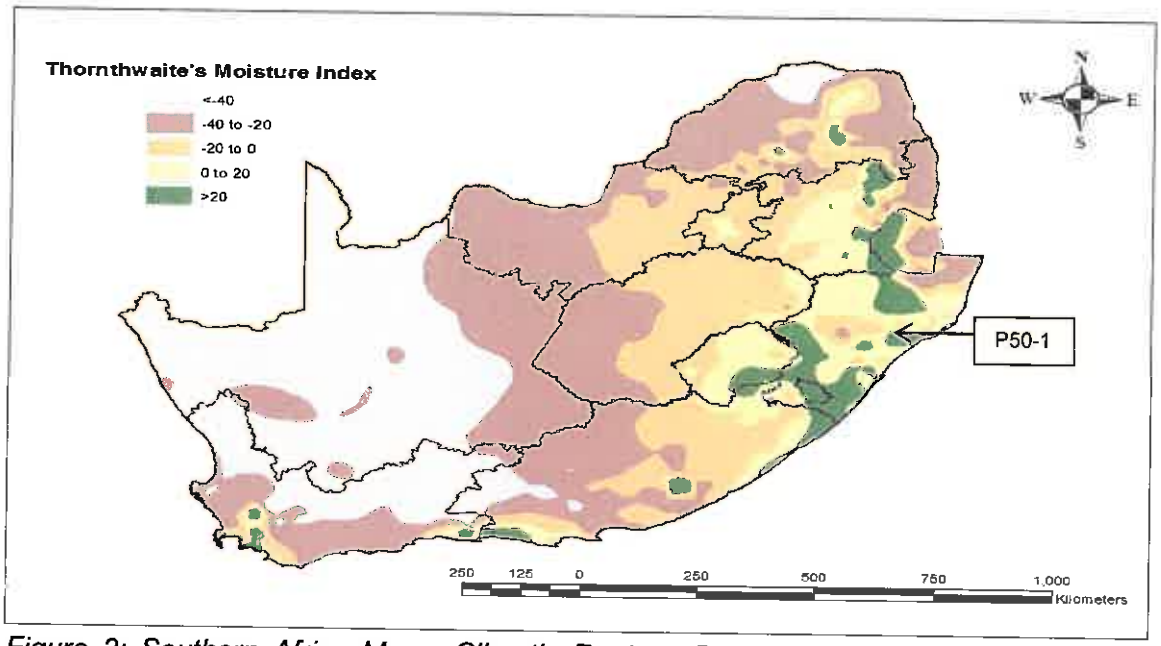


Figure 2: Southern Africa Macro-Climatic Regions Based on Thornthwaite's Moisture Index

b) Rainfall

The rainfall of Eshowe indicates that the average highest rainfall for this area is 186mm in December and the lowest is 33mm in July. Most of the rain occurs during the summer months as indicated in the figure below. **See figure below**.

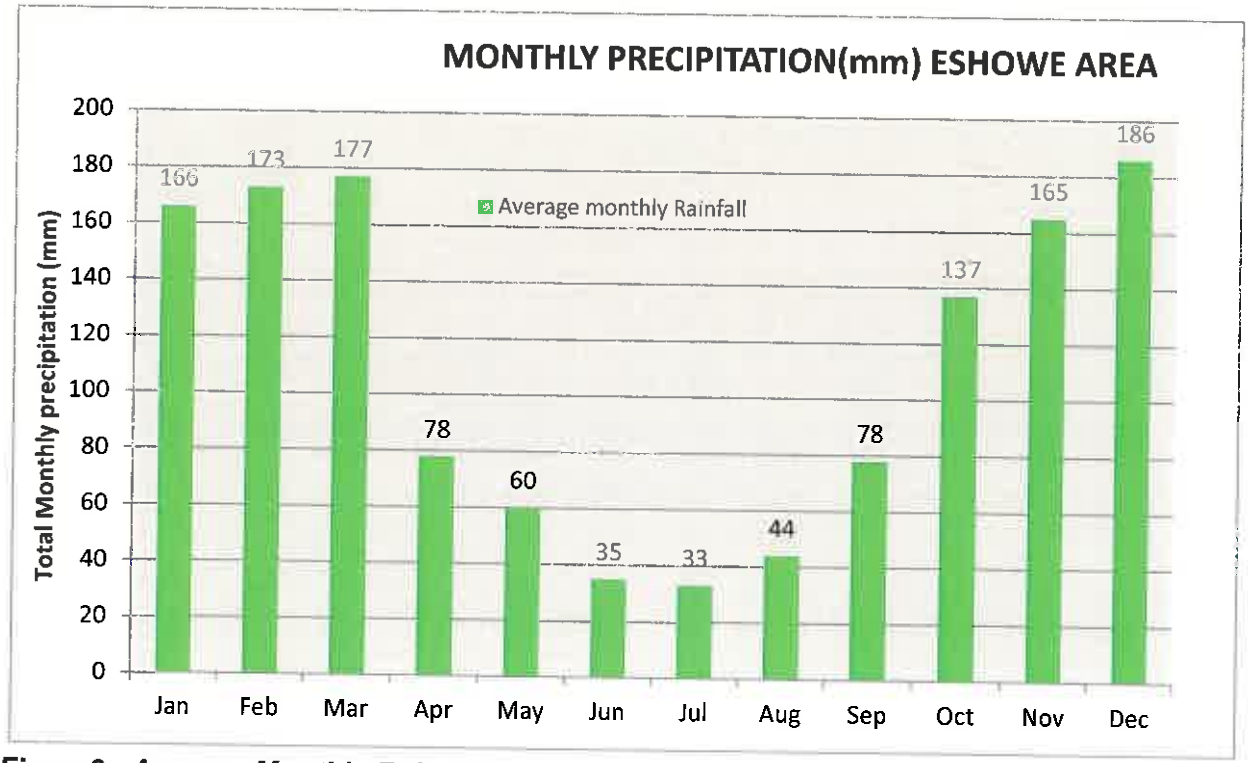


Figure3: Average Monthly Rain Fall

(c) **Temperature**

The average summer Mid-daytime temperatures are about 27°C, with the average minimum temperature of 9°C in winter. The winter seasons are generally mild throughout.

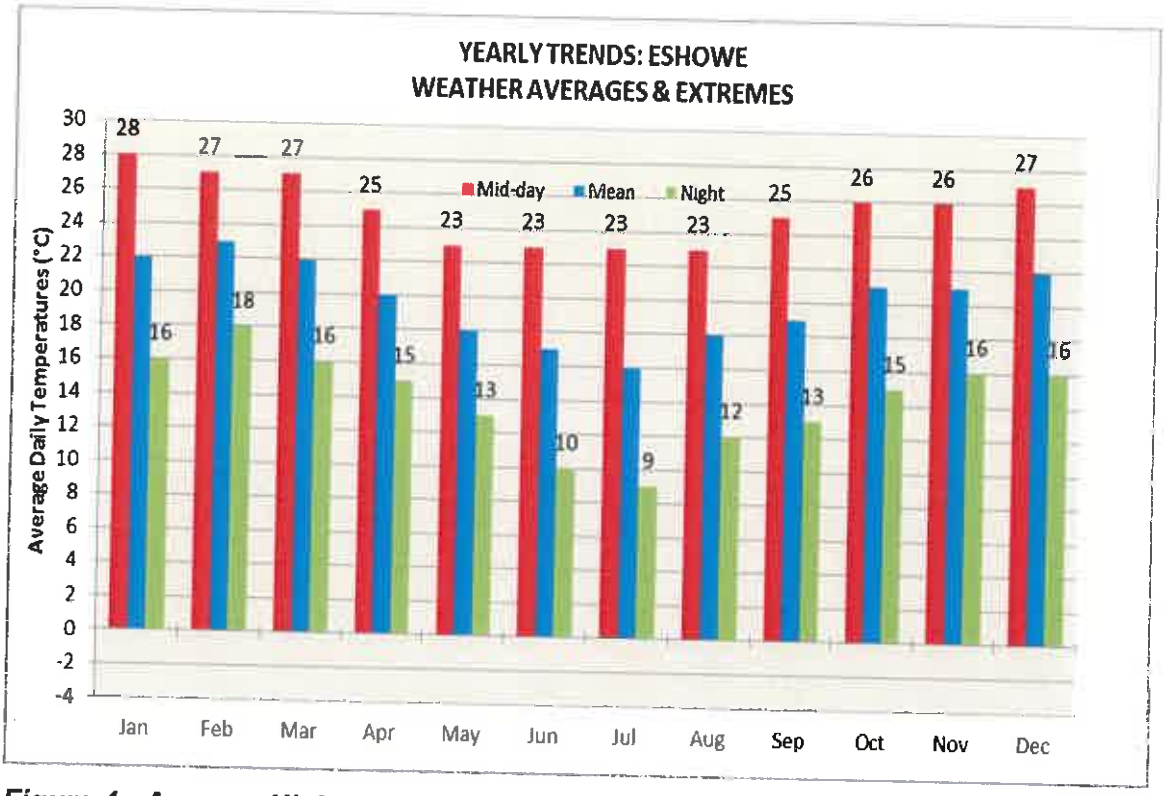


Figure 4: Average High and Low Temperature

3.3 VEGETATION

The vegetation along the route is mainly sugarcane and timber plantations.

3.4 LAND USE

The road passes through an area that is surrounded by sugarcane and timber plantations and with some farm accesses.

3.5 ENVIRONMENTAL ASPECTS

All works of road construction are likely to have some effect on the natural environment. Due to the potential disruptive effect, it is always advisable to conduct an Environmental impact study into the effects on the surrounding environment.

Minimal environmental impact is expected when the road is being widened to 10 meters (km 22.00 to 26.00). The majority of the material for the fill layers will be procured from existing borrow pit.

3.3 ROAD CONSTRUCTION

The road construction is confined within the road servitude for drainage and ancillary works. The activities are within the existing road prism for all layer works.

3.6.1 Borrow pits and material supply

The nearest borrow pit situated at the intersection of P50-2 with P326, can provide material suitable for the fills and widening of the pavement structure and make up layer to construct the new C3 subbase layer.

The nearest commercial source is situated in Ndlangubo area, adjacent to the route P230 (R102) at approximately km 32. The haulage distance is approximately 47km to the site (km 18.00 of P50-1).

3.7 GEOLOGY

The area comprises of Maroon Sandstone that has been identified in the Test pits, and Dolerite material with a fine to coarse grain, dark grey rocks are available on sections of the route.

Table 3-2: Geological Description

GEOLOGICAL DESCRIPTION	
Maroon Sandstone	O-Sn
Dolerite	Jd

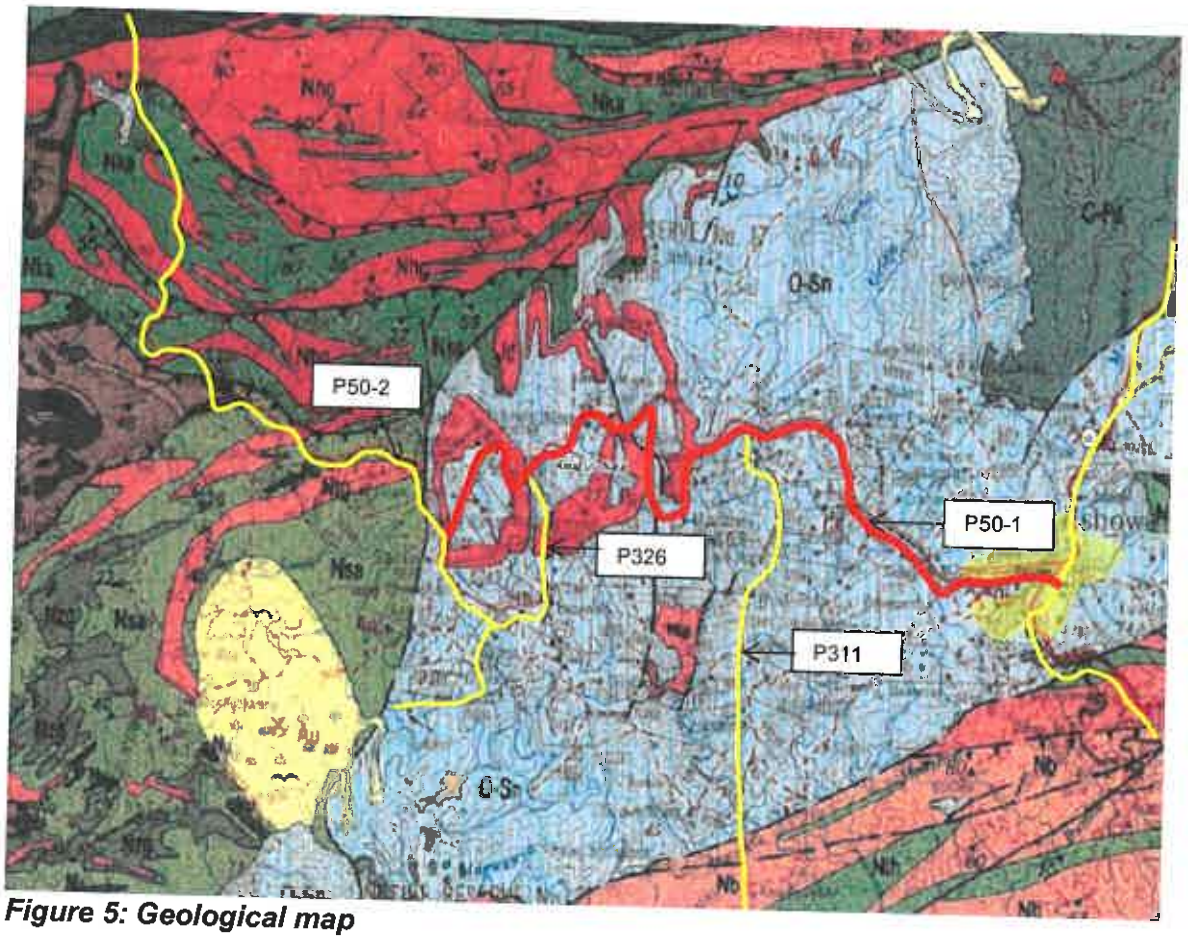


Figure 5: Geological map

4 TRAFFIC ANALYSIS

4.1 TRAFFIC LOADING

The traffic loading was determined in order to assess different pavement options for the rehabilitation of this road.

4.2 TRAFFIC DATA

4.2.1 TRAFFIC COUNTING STATIONS

Mikros Traffic Monitoring (Pty) Ltd conducted seven days traffic counts at two locations on P50-1 during the 29th of July to 7th of August 2015. The locations of the traffic counting stations are given in Table 4.1 below.

Table 4-1: Location of counting Stations on P50-1

Station N°	Location	ADT	% H V's	Date
280054	East of P326 (Km 26)	1568	9,0	July 2015
280053	East of D258 (Km 3.5)	3660	9.9	July 2015

4.2.2 Traffic counts

The ADT of 3660 with 9,9 percentage of heavies in both directions was used to determine the expected design traffic. A detailed traffic counts data is provided in Appendix B. The data is summarised in Table 4.2.

Table 4-2: Summary of Traffic Data on P50-1

Station 280053			
Traffic Characteristics	Total	To D258	To Eshowe
Average Daily Traffic (ADT)	3660	1835	1825
Average Daily Truck Split(ADTT)	362	181	181
% Heavies	9.9	9.9	9.9
Truck Split % (Short: Medium: Long)	57: 16 :27		

Station 280054			
Traffic Characteristics	Total	To P326	To Eshowe
Average Daily Traffic (ADT)	1568	771	797
Average Daily Truck Split(ADTT)	140	67	73
% Heavies	9.0	8.7	9.2
Truck Split % (Short: Medium: Long)	66 : 13 : 21		

4.2.3 Peak Hour Traffic

The data indicates that P50-1 carries a high volume of traffic from morning between 7h00 and 8h00. This pattern is indicative of commuters travelling to work and returning between 17h00 and 18h00.

4.3 TRAFFIC GROWTH RATE

It was difficult to estimate the expected traffic growth rate as no historical traffic data was available for P50-1. Typically, traffic rates on provincial roads are of the order 1% to 4% per annum. A sensitivity analysis was therefore conducted on the influence of the growth rate on the design E80s.

The three growth rates analysed were:

- Low traffic growth (2,0%)
- High traffic growth (4,0%)

4.4 ANALYSIS PERIOD

P50-1 could be classified as Category B major rural road, according to TRH4: 1996 with the respective design analysis 15-30 years. A 20-year design period was used in this study.

Every road in the provincial road network is ranked in terms of its strategic role, which in turn is based on a wide range of criteria. P50-1 has been classified as a Class R2 (Rural major Arterial) as per the "TRH26 South African Road Classification and Access Management Manual (RCAM)".

4.5 EQUIVALENT 80KN STANDARD AXLE LOAD (ESAL'S)

As the E80's per heavy vehicle were measured in the field, a sensitivity analysis of the influence of E80's on the pavement design was conducted. Three scenarios were identified in order to estimate the average axle loading:

- Light loading by Micros with an average axle loading of 0.6 E80's per heavy vehicle.
- Medium loading by Micros with an average axle loading of 2.5 E80's per heavy vehicle.
- Long loading by Micros with an average axle loading of 2.1 E80's per heavy vehicle.

Table 4-3: Equivalent 80kn Standard Axle Load (ESAL'S)

Section	Average E80's /Heavy Vehicle for various Loading Conditions		
Km 18,00 to km 26,00	**Light**	**Medium**	**Long**
E80s/Truck	0.6	2.5	2.1
Truck Split %	57	16	27

The average calculated E80 per heavy vehicle for the above split and axle load was calculated as 1.3 E80 per heavy vehicle.

4.6 SENSITIVITY ANALYSIS OF TRAFFIC DATA

Since the construction will be done in half width, the total traffic will be channelled into one lane. It was then advisable to double the Average Daily Traffic in determining the traffic class to accommodate the stresses in one lane during construction period. A sensitivity analysis was conducted as part of the traffic loading calculation in order to determine the sensitivity of traffic loading to changes in the following variables:

- Growth rate (2,4 and 6)
- Axle loading(1.3 E80's/HV)
- Construction period 2year

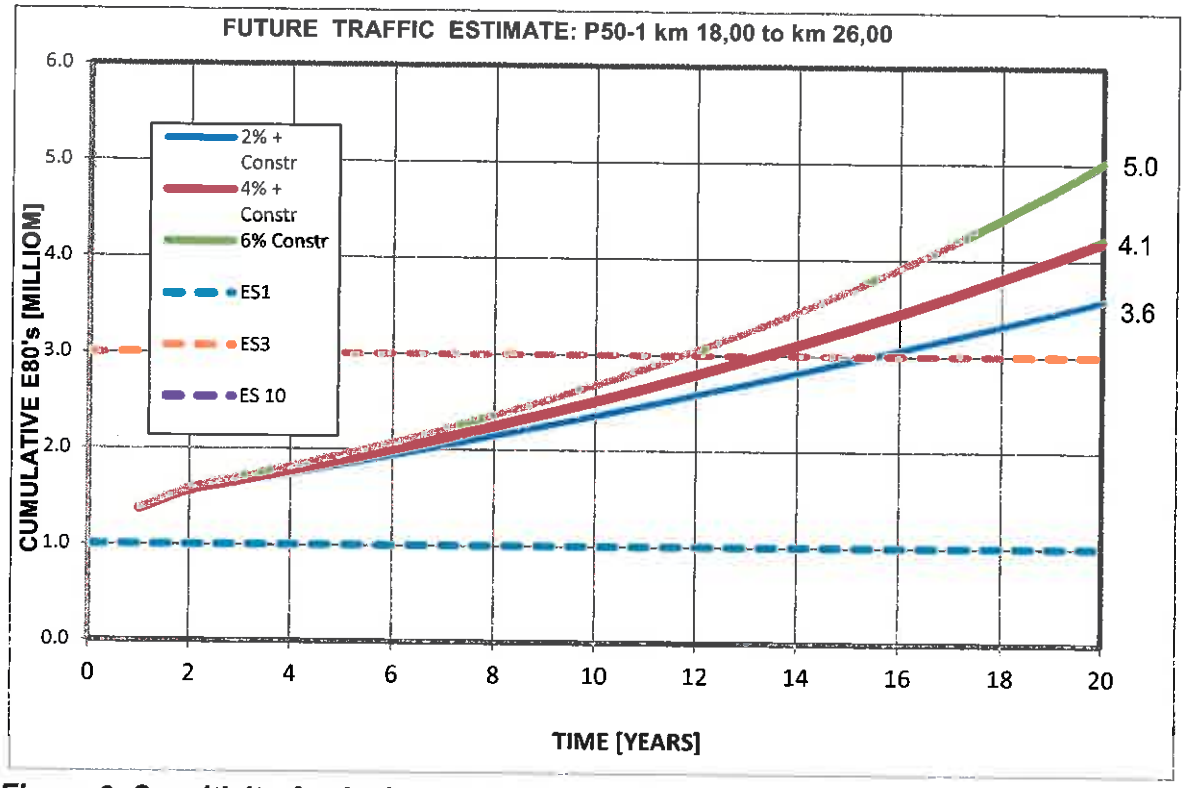


Figure 6: Sensitivity Analysis with traffic growth rate

Figure 6 includes the summary of the sensitivity analysis. It can be concluded from the analysis that the traffic analysis is not equally sensitive to changes in growth, construction traffic and to changes in average axle loading. For the pavement design, the design traffic loading was calculated as 4,1million E80's over a 20 design period. The Design pavement class for the design traffic is an **ES10** class for a 20 years design period.

5 DETAILED VISUAL ASSESSMENT

A detailed visual assessment of P50-1 was conducted on 10 February 2015 from km 0.00 to km 26.00 in accordance with TMH 9 (1992) standards. The results of the assessment are provided in a strip map Appendix C. A photographic record is provided in Appendix G.

5.1 DISTRESSES EVIDENT

The following general pavement structural and functional distresses are evident along the length of the road. Note that, although these distresses have been categorised as either functional or structural, there exists an interrelationship which results in functional distress as a result of structural failure and vice versa.

The structural failure mechanism of the pavement is dependent on a number of factors that have contributed to the deterioration of the pavement , namely lack of maintenance, the wet environmental conditions, traffic loading, base failure, subbase failure and poor subgrade support.

- Functional:
  - Poor riding quality.
- Structural:
  - Rutting;
  - Deformation;
  - Patches; and
  - Failures/Potholes.

Based on the visual assessment and the information contained in Appendix C, the section can be divided into six uniform sections as follows:

- Uniform Section 1 – km 0,00 to km 2,00;
- Uniform Section 2 – km 3,00 to km 4,00 ;
- Uniform Section 3 – km 4,0 to km 10,00
- Uniform Section 4 – km 10,0 to km 13,00 and
- Uniform Section 5– km 13,0 to km 18,0
- Uniform Section 6– km 18,0 to km 26,0

5.1.1 KM 0.00 TO KM 2.00

The road starts at Eshowe where it intersects with P47-5 (R66). This first section of road has recently been rehabilitated between km 0,00 and 0.60 km (intersection with Mangosuthu Buthelezi Dr) and is in a good condition . From km 0,60 up to km1,15 (intersection with Hulett Street) the road has a double carriageway with two lanes in each direction which was under reconstruction during the time of visit. This section of main road P50-1 also forms part of uMlalazi Municipality, and the rehabilitation section was funded by the Municipality.

Figure 3: Reconstruction of pavement structure at km 0,65

After km 1,15 (intersect with Hulett Street) the road width varies between 7.5m to 8.5m, and the surfacing characterised by dry brittle 13.2mm single seal with slurry . The section in a severe condition with the major distress presented is crocodile cracks and patches. These type of distress occurs extensive over the entire length of the section.

Figure 4: Severe crocodile cracks and patches at km1.65

5.1.2 KM 3,00 TO KM 4,00

The surface road width varies from 7.5m to 8.0m with a 19mm single seal. The section is in a good condition with isolated surface cracks and patches that shows signs of distress in the form of crocodile cracks. The drainage is poor along the road and resulting in water into the pavement structure.

Figure 5: Multiple patches with cracks at km 3.4

The section has driveway access situated at a spacing of 250m to 600m apart that serves households along the route.

Figure 6: Block cracks at km 3.7

5.1.3 KM 4,00 TO KM 10,00

The section is 9 meters wide with two 3.5 meter lanes and narrow shoulders. The surface is brittle with stone loss and bleeding throughout the section. The section is in a good to warning condition, with few isolated crocodile cracks with pumping to a warning degree.

Figure 7: Distinct bleeding at km 8,6

5.1.4 KM 10,00 TO KM 13,00

The large portion of this section is characterised by block cracks with pumping in a warning condition and multiple patches that are performing. The drainage has not been provided, as a result erosion has formed next to the edge of road surface. The vegetation verge is also overgrown resulting in water ponding on the road. The section surface consists of 19/6,7mm double seal that has a course texture with many voids. The surface is dry and brittle with stone loss noticeable throughout. There are isolated potholes in a warning condition.

Figure 12: Block cracks with pumping at km 10.8

Severe isolated potholes and crocodile cracks were noted in this section. Maintenance in the form of patches has been on going and guardrail installation was in process during the time of visit.

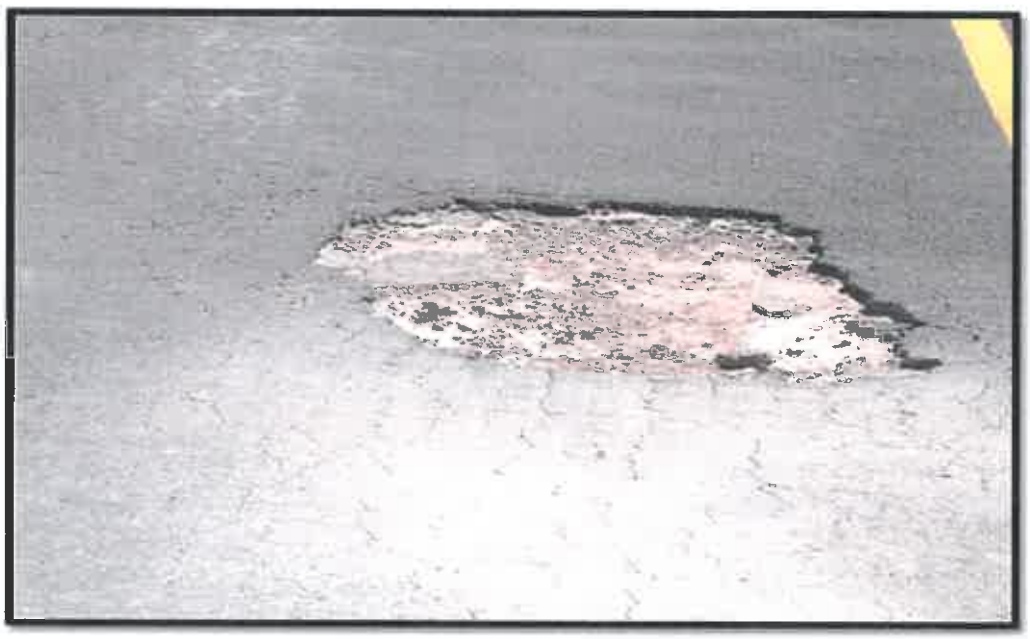


Figure 13: Severe pothole and crocodile cracks at km 12.4

5.1.5 KM 13,0 TO KM 16,0

The section is 8.0 meter wide with 13.2 mm single seal that is still a fair condition. There are surfacing cracks and patches noticeable throughout the section which are in a warning condition.

Figure 14: Surface cracks at km 14.8

5.1.6 KM 16,00 TO KM 18,00

The surface road width varies from 7.5m to 8.0m with a 13.2mm single seal. The surface appears to be polished with isolated block cracks with pumping that are in a warning condition. Patches were noticeable in this section but they are in a good condition. Side drain is not provided and vegetation has overgrown on the side of the road.

Figure 15: Block crack and asphalt patches at km 17.4

5.1.7 KM 18,0 TO KM 26,0

The surface road width varies from 7.5m to 8.5m with a 19/6,7mm single seal. The section is in an extremely poor condition, structural failure is evident with large potholes extensive throughout the section. Block cracks is extensive with the pumping fines are also evident throughout the section. Maintenance in the form of patches has been on-going during the time of the visit but it was noted that the patches on this section are not performing well, the road has reached its end of its design life.

Figure 16: Severe block crack and surface crack at km 18.5

Figure 17: Extensive occurrence of potholes and patches at km 24.6

6 ROAD PAVEMENT INVESTIGATION

6.1 VISUAL INSPECTION OF THE ROAD CONDITION AND PAVEMENT MATERIAL ALONG THE ROAD

The visual assessment was used to identify the limits of uniform pavement sections. Test pits were excavated at localised areas of potentially weak pavement materials and areas with drainage deficiencies that could influence the performance of the pavement.

6.2 TEST PIT PROFILING, SAMPLING AND LABORATORY TESTING OF THE PAVEMENT LAYERS

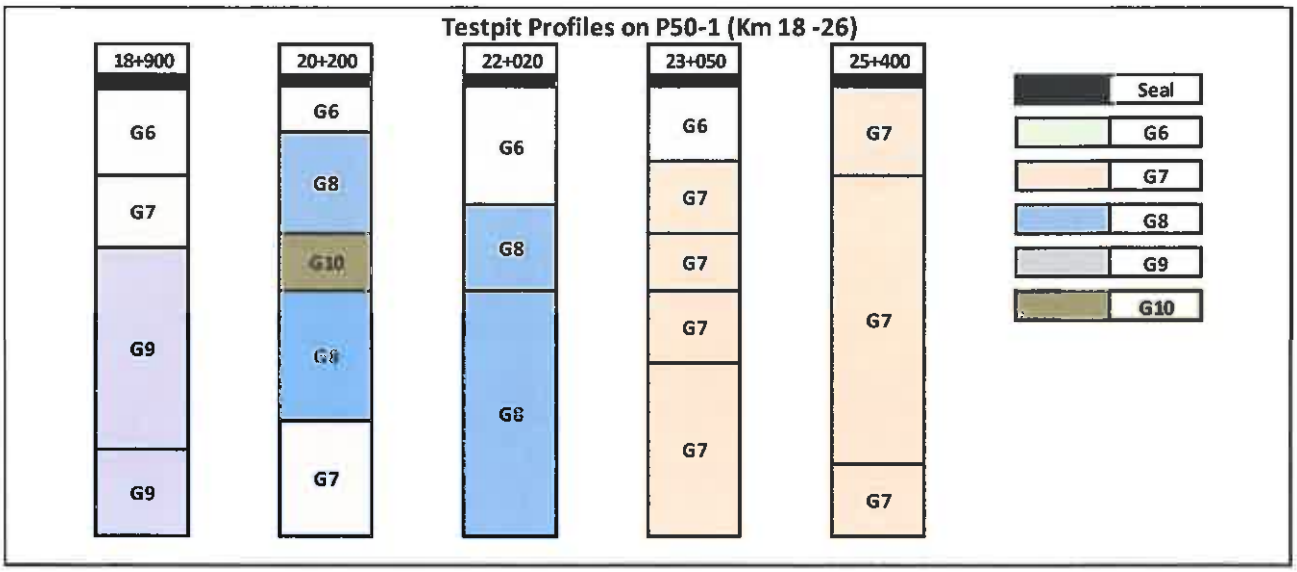
Five (5) test pits were excavated from the 23rd to 25th March 2015 by Matrolab group (Pty) Ltd. The Test pits were located alternates left and right lanes of the road in ascending kilometre order from Eshowe (East) Km 18+900 to Inkandla km 25+400 (West).

The testpits were profiled and the material of the different layers were tested for AASHTO soil classification (Atterberg limits, sieve analysis and moisture- density relationship) as well as standard CBR test. The summary of the test results are provided in Table 6-1.

7 PAVEMENT EVALUATION

Table 7-1: Summary of Laboratory Test results

Chainage (km)	Test Pit No	Depth (m)	GM	MDD (Kg/m³)	OMC (%)	In-Situ Dry Density (Kg/m3)	Moisture Content (%)	Relative Compaction (%)	LL	PI	CBR Values (%)						CBR Swell (%)	Classification	
											100	98	97	95	93	90		AASHTO	TRH 14
18 + 900	LHS	35-200	2.44	1861	11	1764	6	94.8	N/A	NP	73	58	52	42	32	22	0.02	A-1-a(0)	G6
		200-320	2.02	2102	7.9	1812	11.2	86.2	N/A	NP	35	28	25	20	17	14	0.04	A-1-b(0)	G7
		320-660	1.44	2001	8.9	1793	12.4	89.6	N/A	NP	11	10	9.4	8.4	6.8	4.5	0.59	A-1-b(0)	G9
		660-800	1.53	1996	9.1	1888	11.3	94.6	N/A	NP	17	15	14	12	8.6	4.1	0.69	A-1-b(0)	G9
20+200	LHS	30-110	2.04	2016	9.3	1891	5.3	93.8	21	SP	49	42	39	33	25	16	0.01	A-1-b(0)	G6
		110-300	1.7	2127	7.2	1893	10	89	19	SP	25	19	17	13	10	7	0.31	A-1-b(0)	G8
		300-400	1.13	1980	8.8	1866	12	94.2	5	8	6.2	5.1	4.7	4	3.8	3.4	2.78	A-2-4(0)	G10
		400-630	1.07	1876	11.3	1766	14.2	94.9	30	SP	20	17	16	14	13	10	0.38	A-2-4(0)	G8
		630-800	1.06	1718	13.5	1762	15.3	102	42	SP	24	22	20	18	16	13	0.17	A-2-5(0)	G7
22+020	RHS	35-250	1.51	2140	7	1889	8.8	88.3	26	SP	47	38	35	27	22	15	0.26	A-2-4(0)	G6
		250-380	2.01	2070	7.3	1781	10.7	86	N/A	NP	36	29	27	22	12	3.7	0.77	A-1-b(0)	G8
		380-800	1.02	1742	11.8	1664	12.2	95.5	N/A	NP	24	21	20	17	14	10	0.67	A-2-4(0)	G8
23+050	RHS	35-150	1.85	2118	7.1	1889	7.5	89.2	32	6	45	37	33	26	20	13	0.86	A-1-b(0)	G7
		150-280	1.55	2156	6.8	1808	8.6	83.9	25	6	69	51	44	33	24	16	0.3	A-2-4(0)	G7
		280-400	1.18	1642	17.1	1678	11.5	102.2	3	SP	32	26	24	20	16	11	0.73	A-2-4(0)	G7
		400-500	1.61	1881	12.2	1748	12.1	92.9	25	SP	46	38	34	27	2	12	0.26	A-2-4(0)	G7
		500-800	0.92	1695	17.2	1768	12.4	104.3	39	4	32	23	19	14	11	7.3	0.47	A-4(0)	G8
25+400	LHS	40-200	2	2169	6.8	1919	6.3	88.5	22	SP	47	36	32	25	18	12	0.1	A-1-b(0)	G7
		200-700	0.96	1827	13.2	1719	12.2	94.1	26	4	28	25	24	22	19	16	0.18	A-2-4(0)	G7
		700-800	0.97	1734	16.1	1744	13.2	100.6	35	SP	29	25	24	20	16	11	0.09	A-2-4(0)	G7



The existing surfacing consists of various seals. The surface is brittle, cracked and aggregate appeared to be polished. The pavement structure is in a severe condition with base failures and potholes extensive throughout the section.

Test Pit No 1 at km 18+900 (LHS)

- The underlying base layer consists of slightly moist weathered Sandstone gravel of **G6** material quality. Testing with phenolphthalein and hydrochloric acid indicates that carbonation is still taking place. The phenolphthalein turned pink when sprayed onto the material, indicates previous stabilisation and the hydrochloric acid fizzed. The Plasticity Index (PI) and Liquid Limit (LL) were recorded as non-plastic, with a medium dense consistency. This is poor for the base material and it is possibly the result of deterioration of the material.

- The subbase material consists of slightly moist fine Sand and highly weathered Sandstone gravel. The subbase material can be classified as G7 quality mainly due to CBR values.

- The existing selected layer observed was of a dark orange brown to dark grey weathered Sandstone with consistency of a medium dense and slightly moist. It is classified as G9 material.

- The Insitu material was observed to be medium dense slightly moist dark yellow brown to light grey weathered Sandstone. It is classified as G9 material.

Test Pit No. 2 at km 20+200 (LHS)

- The base layer consists of slightly moist weathered Sandstone gravel of **G6** material quality. Testing with phenolphthalein and hydrochloric acid indicates that carbonation is still taking place. The phenolphthalein turned pink when sprayed onto the material, indicates previous stabilisation and the hydrochloric acid fizzed. The colour was light grey yellow to light grey with a consistency

recorded as medium dense. The Plasticity Index (PI) was recorded as slightly-plastic and Liquid Limit as 21.

- The subbase material was found to be weathered Sandstone gravel of G8 material quality and was slightly moist with a medium dense consistency. The Plasticity Index (PI) was recorded as slightly plastic and the Liquid Limit (LL) recorded as 19.

- The existing selected layer observed to be pale red weathered Sandstone with medium dense and slightly moist. It is classified as G10 material.

- The Insitu material (subgrade) was observed to be medium dense slightly moist dark grey to brown orange Clayed Sand with weathered Sandstone. It is classified as G10 material.

Test Pit No. 3 at km 22+020 (RHS)

- The base layer consists of slightly moist weathered Sandstone gravel of **G6** material quality. The colour was light yellow brown to light grey with a consistency recorded as medium dense. The Plasticity Index (PI) was recorded as slightly-plastic and Liquid Limit as 26. Testing with phenolphthalein and hydrochloric acid indicates that carbonation is still taking place. The phenolphthalein turned colourless when sprayed onto the material, indicates that the existing base was not previously stabilised.

- The subbase material was found to be weathered Sandstone gravel of G8 material quality and was slightly moist with a medium dense consistency. The Plasticity Index (PI) and Liquid Limit (LL) were recorded as non-plastic.

- The existing selected layer observed to be dark brown weathered Sandstone with medium dense and slightly moist. It is classified as G8 material.

Test Pit No. 4 at km 23+050 (RHS)

- The base layer consists of slightly moist weathered Sandstone gravel of **G6** material quality. The colour was light yellow brown to light grey with a consistency recorded as medium dense. The Plasticity Index (PI) was recorded as 6 and Liquid Limit as 36. Testing with phenolphthalein and hydrochloric acid indicates that carbonation is still taking place. The phenolphthalein turned colourless when sprayed onto the material, indicates that the existing base was not previously.

- The subbase material was found to be weathered Sandstone gravel of G7 material quality and was slightly moist with a medium dense consistency. The Plasticity Index (PI) was recorded as 6 and the Liquid Limit (LL) recorded as 25.

- The existing selected layer observed to be dark grey to brown Silty Sand with medium dense and slightly moist. It is classified as G10 material.

- The Insitu material was observed to be medium dense slightly moist light grey to spotted orange weathered Sandstone. It is classified as G8 material.

Test Pit No. 5 at km 25+400 (LHS)

- The base layer consists of slightly moist weathered Sandstone gravel of **G6** material quality. The colour was dark reddish brown with a consistency recorded as medium dense. The Plasticity Index (PI) was recorded as slightly-plastic and Liquid Limit as 26. Testing with phenolphthalein and hydrochloric acid indicates that carbonation is still taking place. The phenolphthalein turned pink when sprayed onto the material, indicates that the existing base was previously stabilised.

- The subbase material was found to be Silty Sand of G7 material quality and was slightly moist with a medium dense consistency. The Plasticity Index (PI) were recorded as 4 and Liquid Limit (LL) were 26.

- The existing selected layer observed to be dark reddish brown Fine Sand with medium dense and slightly moist. It is classified as G8 material.

8 DCP ANALYSIS

Table 8-1: Summary of DCP Parameters

Km	Test Pit No.	DSN800	Depth 0 - 150mm			Depth 150 -300mm			Depth 300 -450mm			Depth 450 - 600mm			Depth 600 - 750mm			Depth 750 - 950mm		
			PenRate1	CBR1	Emod 1	PenRate2	CBR2	Emod 2	PenRate 3	CBR 3	Emod3	PenRate4	CBR 4	Emod 4	PenRate5	CBR5	Emod5	PenRate6	CBR6	Emod6
18+900	No.1	110.0	5.6	46.0	179.0	8.0	46.0	123.0	7.0	35.0	141.0	7.0	35.0	141.0	8.0	29.0	123.0	9.3	24.0	104.0
20+22	No.2	61.0	6.0	42.0	167.0	8.7	26.0	113.0	16.0	12.0	58.8	29.0	6.0	31.1	33.0	5.0	27.3	20.0	9.0	46.4
22+020	No.3	92.0	4.3	65.0	238.0	7.3	33.0	135.0	10.7	20.0	90.4	11.7	18.0	82.2	5.0	53.0	202.0	18.7	10.0	49.9
23+050	No.4	126.0	4.3	65.0	238.0	11.0	20.0	87.5	8.8	26.0	112.0	6.2	40.0	161.0	5.4	48.0	186.0	6.2	40.0	161.0
25+400	No.5	118.0	3.8	77.0	274.0	7.0	35.0	141.0	5.5	47.0	183.0	13.3	15.0	71.3	9.0	25.0	108.0	8.3	28.0	117.0
Average		101.4	4.8	59.0	219.2	8.4	32.0	119.9	9.6	28.0	117.0	13.4	22.8	97.3	12.1	32.0	129.3	12.5	22.2	95.7
Standard Deviation		25.9	1.0	14.6	44.9	1.6	9.8	21.1	4.1	13.5	47.6	9.2	14.2	53.0	11.8	19.3	69.6	6.4	13.0	48.3
20th Percentile		85.8	4.2	45.2	176.6	7.3	24.8	107.9	6.7	18.4	84.1	6.8	13.2	63.3	5.3	21.0	91.9	7.9	9.8	49.2
80st Percentile		119.6	5.7	67.4	245.2	9.1	37.2	136.2	11.8	37.4	149.4	16.4	36.0	145.0	13.8	49.0	189.2	19.0	30.4	125.8

Dynamic Cone Penetration (DCP) was carried along the road at 1000m spacing and at each test pit location from km 18, 00 to km 26, 00. The DCP tests were performed in the outside wheel track alternating between the left hand lane and right hand lane. The processed DCP data is provided in Appendix E.

With reference to Table 8-1, the following conclusions were drawn from the DCP results:

Main Road P50-1 is classified as a Class C, Lightly trafficked rural roads. The risk for this type of pavement is medium, with approximate design reliability of 80%. To examine the DCP, we have to analyse the 20 Percentile of the CBR and Stiffness values to have 80% design reliability. The 20th percentile of the data analysed indicate that the material in the first layer is equivalent CBR strength of 45.2 % at prevailing insitu moisture regime. The average penetration in this zone is approximately 5.7 mm/blow. The material quality is equivalent to **G5** quality material with the estimated stiffness that is close to **176.3 Mpa.**

The material quality between depths of 150 mm to 300 mm is equivalent CBR strength of 24.6% at prevailing insitu moisture regime. The quality of this material is equivalent **G7** with the average penetration of 9.1 mm/blow, and the material estimated stiffness that is close to **107.9 Mpa**.

The average of the material quality between depths of 300mm to 450 mm is equivalent CBR strength of 18.4% at prevailing insitu moisture regime. The quality of this material is equivalent to **G7** with the average penetration of 11.8 mm/blow, and the material estimated stiffness that is close to **84.1 Mpa.**

The average of the material quality between depths of 450mm to 600 mm is equivalent CBR strength of 13.2% at prevailing insitu moisture regime. The quality of this material is equivalent to **G8** with the average penetration of 13.8 mm/blow, and the material estimated stiffness that is close to **63.3 Mpa**

From the depth of 750mm and downwards, the existing material is equivalent CBR strength of 9.4 % at prevailing insitu moisture regime. The average penetration in this zone is approximately 19 mm/blow. The quality of this material is equivalent to **G9** material quality with the estimated stiffness that is close to **49.2 Mpa**.

In the analysis it was assumed that the thicknesses of the base, sub-base and selected layers were 150mm,

The layer-strength diagram revealed gradual decrease in layer-strength with an increase in depth that implies that the pavement is in a balanced state

9 PAVEMENT BEARING CAPACITY

The representative of DSN800 was used to calculate the pavement bearing capacity of the existing pavement and it shows that the pavement is averagely-balanced deep (ABDD), meaning that the pavement distributes the load evenly over the full depth of the pavement

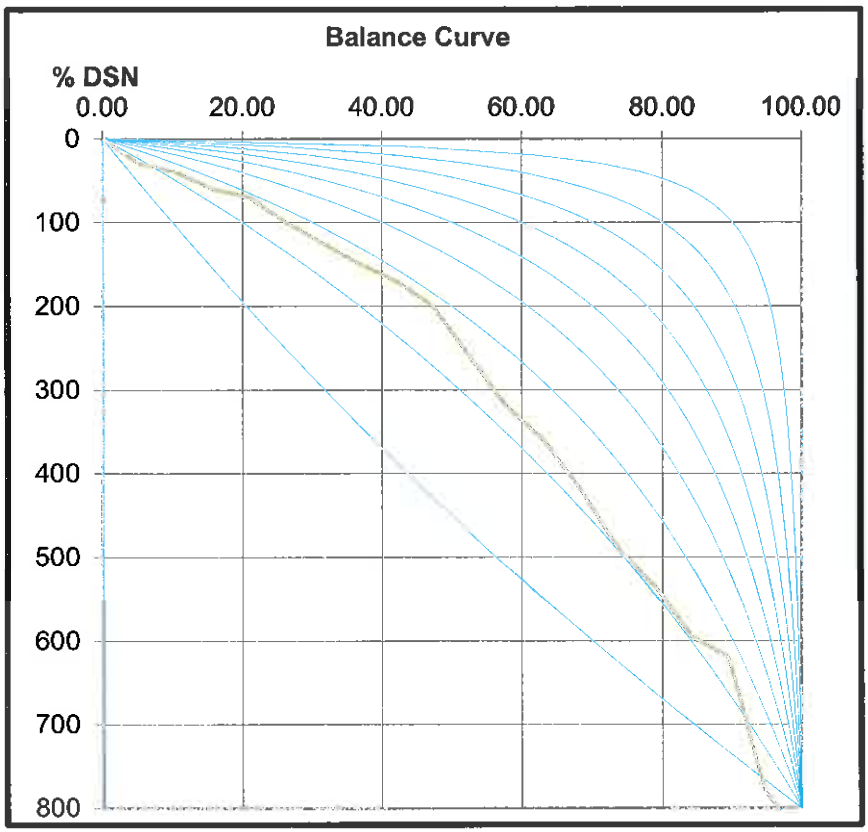


Figure 18: 20th Percentile Balance Curve

Using the 20th percentile values for the DSN800, the remaining life for the pavement can be calculated using the formula below.

$$\mathbf{MISA = Cm \times 10^{-9} \times (DSN_{800})^{3.5}}$$
$$= 14 \times 10^{-9} \times (85.8)^{3.5}$$
$$= 0.082 \times 10^{6}\ E80$$

The above calculation confirms that the road is in severe condition with a remaining life of 0.082×10^6 E80's. The DCP values indicate a low bearing capacity that warrants the rehabilitation of the entire section.

The problem is further exacerbated by the non-existence of proper drainage of the storm water from the road prism. The relative high in-situ moisture contents measured in the sub-grade, particularly in test pits, indicates the presence of sub-surface water in the sub-grade layers. This is also highlighted in the very low strengths of the sub-grades (below about 300mm) recorded on the DCP plots.

9.1 COVER REQUIRED BASED ON DYNAMIC CONE PENETROMETER PENETRATION OF 20TH PERCENTILE AND FUTURE EXPECTED TRAFFIC

Presented below is the cover required for each layer to carry the future design traffic of 4.0×10^6 E80s.

Table 9-1: Minimum cover required to carry the future expected traffic

Depth (mm)	Penetration	Cover Required (mm)
0 -150	4.2	240mm required
150 - 300	7.3	360 mm required, but layer is situated 150mm below final level , therefore 210mm cover required for this layer
300 – 450	6.7	340 mm required, but layer is situated 300mm below final level , therefore 40mm cover required for this layer
450 - downwards	6.8	350 mm required, but layer is situated 450mm below final level , therefore 100mm cover required for this layer

Table 9-1 indicates that 240mm of cover is required on top of the existing pavement layer in order to carry the future design traffic of 4.0×10^6 E80s.

9.2 PERFORMANCE CRITERIA RECOMMENDED FOR THE ASSESSMENT OF PAVEMENT CONDITION

Below is the table that shows criteria recommended for the pavement condition using DSN 800.

Table 9-2: Recommended criteria for assessment of the pavement condition

Structural Number DSN 800	Moisture Regime	Road Category C	
		X	Y
110	M3	240	110
61	M3	240	110
92	M3	240	110
126	M3	240	110
118	M3	240	110

Where: M3 = an wet moisture regime or poor drainage condition

And:
DSN 800 > X = Sound condition
DSN 800 between X and Y = Warning condition
DSN 800 < Y = Severe condition

The DSN 800 values were used to determine the condition of the pavement and its shows that the pavement structure is in a severe condition.

9.3 PAVEMENT REMAINING LIFE

The pavement structure is weak as manifested by the many crocodile cracks with pumping, edge breaks, surface failure and potholes. The failures occur along the entire length (Km 18 - Km 26) of road due to moisture ingress and poor maintenance relative to the high traffic loading. The pavement is in a severe condition and is unsuitable for the future design traffic and requires strengthening.

10 REHABILITATION PROPOSAL

10.1 GENERAL PHILOSOPHY

The proposed rehabilitation design is based on the future design traffic and the material test results. The rehabilitation proposal considered the widening of the surface width to 10m, the strengthening of the pavement and the construction of ancillary roadworks like concrete drains for drainage, guardrails and gabions to improve the safety of the road for the road user.

10.2 RECOMMENDED REHABILITATION MEASURE

- The recommended rehabilitation therefore consists of: - Extension of the prefabricated pipe culvert cross-drainage together with the reconstruction of the affected inlet and outlet structures.
- Widening of the existing fills to accommodate the new roadway formation width, using gravel material imported from the existing borrow pit
- Depending on the proposed pavement design construct a new stabilized sub base layer.
- Construct a new base layer, different options will be investigated, between Stabilized, Granular, Bitumen Treated or Bitumen Stabilized Base.
- Construction of shoulder fill (G7) using gravel material imported from the existing borrow pit.
- Priming to protect the base layer.
- 40mm Continues graded medium grade wearing coarse recommended for surfacing.
- Construction of road prism drainage, including open concrete lined drains where necessary.
- Application of road markings and installation of roadstuds.
- Grass sodding and hydroseeding to protect the cut and fill slopes where required, and to reinstate the vegetation at spoil, stockpile and borrow areas.
- Improvements to existing minor access along the road.
- Erection of new guardrails and fencing.
- Installation of road signs and road marking.
- Finishing and cleaning up the road reserve.

11 PAVEMENT DESIGN

11.1 TRH4 CATALOGUE DESIGN

For the design traffic loading required, the TRH4 catalogue design proposed two alternative pavements, namely a:

- Granular Base
- Cemented Base.
- Hot Mix Asphalt and
- BSM 1

The alternative pavement structures are presented in table 11-1 below.

Table 11-1: TRH4 pavement options available for km 18. 00 to km 26.00

Description	TRH 4 (ES10) (Granular Bases)	TRH 4 (ES10) (Cemented Bases)	TRH 4 (ES10) Hot Mix Asphalt Base	BSM1(ES10) TG2 (2009)
Surfacing	40mm, (A-E 2)	40mm, (A-E 2)/S	30mm, (A-E 2)	40mm AC
Base	150mm (G2)	150mm (C3)	80mm (BC)	250mm (BSM1)
Sub-Base	300mm (C4)	150mm (C4)	300mm (C3)	300mm (C3)
Upper Selected	150mm (G7)	150mm (G7)	150mm (G7)	150mm (G7)
Lower Selected	150mm (G9)	150mm (G9)	150mm (G9)	250mm (G9)
Sub-Grade	200mm The existing road prism to be reworked in-situ and compacted to 93% Mod. AASHTO density (G10).			

COST COMPARISONS FOR PAVEMENT DESIGN OPTIONS

Table 11-2: Granular Base Cost

Description	TRH 4 (ES10) (Granular Bases)	Rate	Unit	/km QTY	Amount/km
Surfacing	40mm, (A-E 2)	R 1500	/t	1040	R 1 560 000
Base	150mm (G2)	R 980	/m³	1545	R 1 514 100
Sub-Base	300mm (C4)	R 550	/m³	3000	R 1 650 000
Upper Selected	150mm (G7)	R 290	/m³	1600	R 464 000
Lower Selected	150mm (G9)	R 200	/m³	1600	R 320 000
Sub-Grade	200mm reworked existing (G10).	R 70	/m³	2000	R 140 000
TOTAL					**R 5 648 100**

Table 11-3: Hot Mix Asphalt Base Cost

Description	TRH 4(ES10) (Hot mix Asphalt Bases)	Rate	Unit	/km QTY	Amount/km
Surfacing	40mm, (A-E 2)	R 1500	/t	1040	R 1 560 000
Base	80mm (BC)	R 1400	/t	2000	R 2 800 000
Sub-Base	300mm (C3)	R 550	/m³	3000	R 1 650 000
Upper Selected	150mm (G7)	R 290	/m³	1600	R 464 000
Lower Selected	150mm (G9)	R 200	/m³	1600	R 320 000
Sub-Grade	200mm reworked existing (G10)	R 70	/m³	2000	R 140 000
TOTAL					**R 6 934 000**

Table 11-4: BSM1 Base Cost

Description	BSM1(ES10) TG2 (2009)	Rate	Unit	/km QTY	Amount/km
Surfacing	40mm AC	R1500	/t	1040	R 1 560 000
Base	150mm (BSM1)	R 1100	m³	2500	R 2 750 000
Sub-Base	300mm (C3)	R 550	/m³	3180	R 1 650 000
Upper Selected	150mm (G7)	R 280	/m³	1600	R 464 000
Lower Selected	150mm (G9)	R 200	/m³	1600	R 320 000
Sub-Grade	200mm reworked existing (G10)	R 70	/m³	2000	R 140 000
TOTAL					**R 6 884 000**

Table 11-5: Cemented Base Cost

Description	TRH 4 (ES10) (Cemented Bases)	Rate	Unit	/km QTY	Amount/km
Surfacing	40mm, (A-E 2)/S	R 1500	/t	1040	R 1 560 000
Base	150mm (C3)	R 630	/m³	1500	R 945 000
Sub-Base	300 mm (C4)	R 550	/m³	3090	R 1 699 500
Upper Selected	150mm (G7)	R 280	/m³	1600	R 464 000
Lower Selected	150mm (G9)	R 200	/m³	1600	R 320 000
Sub-Grade	200mm reworked existing (G10)	R 70	/m³	2000	R 140 000
TOTAL					**R 5 128 500**

a) GRANULAR BASE PAVEMENT

This type of pavement comprises of crushed stone for both base layer and subbase layer. The nearest commercial source is situated in Ndlangubo area; adjacent to the route P230 (R102) at approximately km 47 can supply material for the base layer. The advantage of the granular base pavement structure is

that it is an unbounded stress hardening therefore can take high load, performs well under expected traffic conditions, if maintained.

The base layer needs to be free from ingress of water or it may be prone to premature failure. The main disadvantage of granular base includes a longer construction period, the availability and high transportation cost of the material.

b) CEMENTED BASE PAVEMENT (C3)

A cemented base minimises ingress of water in the layers.
The advantages of a cemented base layer is most of the traffic stress are absorbed by the cemented layers and relatively little by the sub-grade. The disadvantage of the cemented base is the block cracking that will be evident early in the life of the pavement. The cracks are caused by the mechanisms of drying shrinkage and thermal stresses and will reflect through the overlying asphalt surfacing.

c) HOT MIX ASPHALT BASE PAVEMENTS

The advantage of a BTB is that the layer are easy to construct and can eliminate long traffic queue. The asphalt base can deform and fail by fatigue cracking. When the base is overlaid on a cemented subbase, there is a possibility that shrinkage or thermal cracking will reflect to the surfacing.

d) BITUMEN STABILISED BASE (BC and BSM)

The advantage of a BC and BSM base it behaves similar to unbound granular materials with improved cohesion strength and reduced moisture sensitivity. The source material is a typically well graded crushed stone. The disadvantage is the high cost of construction.

11.2 MECHANISTIC DESIGN

The mechanistic design was done using Rubicon software package. Table 11-6 presents the results of the mechanistic design with the expected bearing capacity of the different pavement structure alternatives. The pavement structures derived using mechanistic designs are less conservative than that of the TRH4 design.

Table 11-6: Design life of the different pavement options

Pavement Option	Granular Base	Cemented Base	BSM Base	BTB Base
Design Life ($1x\ 10^{6}$E80's)	8.28	10.68	8.74	6.1

12 SUMMARY OF COST

Table 11-2 to table 11-5 give the estimated cost per Km for the different pavement options. It must be noted that these amounts are not the total cost per Km but just the total of the layer works section of the bill of quantities. These amounts are also excluding VAT. See estimated costs below:

Table 11-6: Summary of road works costs

Pavement Option	Granular Base	Cemented Base	BSM Base	BTB Base
Cost per KM	R 5 650 000	R 5 130 000	R 6 880 000	R 6 900 000

The above table gives the construction cost only and does not take into consideration future maintenance cost.

The Cemented base option is initially the cheapest cost but require more maintenance during the life of the pavement. The Bitumen base option (BTB) is the most expensive to construct but has the shortest construction time, reducing disruption to the traveling public. With the BTB's shorter construction time there are also a saving in cost for Traffic Accommodation and the contractors General P&G costs.

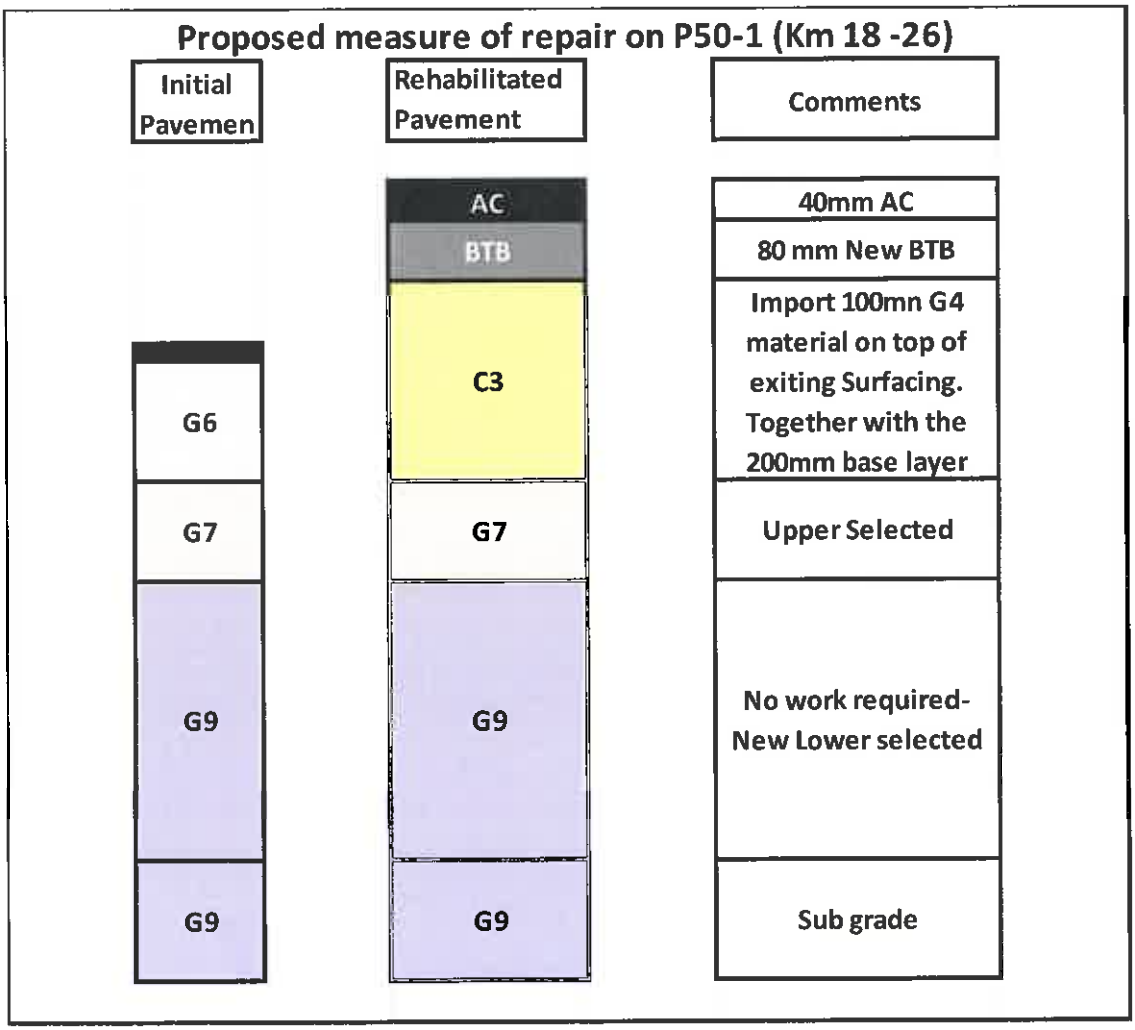
12.1 CONSTRUCTABILITY

When choosing between different design options one should also consider constructability and the practicality around the project.

- Of all the options the Granular Base options is the most difficult to construct. Contractors have become used to using a Recycler to build a cemented or a Bitumen stabilized layer. Some of them have lost the expertise to construct a granular base with a well knitted mosaic surface finish, and as a result we have seen premature failures of a granular base, either due to the lack of slushing or to lack of compaction. A Granular base is also not advisable for a wet region.

- The Bitumen asphalt base option is the least difficult to construct with the least amount of construction risks. The base is paved with a specialized paver with a constant mix from the plant; there are therefore no issues with the mixing on site as in the case with the BSM or cemented base. The BTB base is also ideal for wet conditions.

The figure below indicates the measure of repair and how the exiting pavement structure will be utilized to for the new pavement structure


Proposed measure of repair on P50-1 (Km 18 -26)
Initial Pavemen
Rehabilitated Pavement
Comments
AC
BTB
C3
G7
G9
G9
G6
G7
G9
G9
40mm AC
80 mm New BTB
Import 100mn G4 material on top of exiting Surfacing. Together with the 200mm base layer
Upper Selected
No work required- New Lower selected
Sub grade

13 UPGRADE AND WIDENING

Table 13-1: Cross Drainage positions and size

Chainage (m)	Remarks	Proposed
18+700	Replace existing pipe	1 x 600 Pipe
20+300	Replace existing pipe	1 x 600 Pipe
22+300	Replace existing pipe	1 x 600 Pipe
22+400	Replace existing pipe	1 x 600 Pipe
22+600	Replace existing PC	1 x 600 Pipe
22+680	Replace existing PC	1 x 600 Pipe
23+200	Replace existing PC	1 x 600 Pipe
23+400	Replace existing PC	1 x 600 Pipe
23+700	Replace existing PC	1 x 600 Pipe
24+500	Replace existing PC	1 x 900 Pipe
24+700	Replace existing PC	1 x 600 Pipe
25+800	Replace existing PC	1 x 600 Pipe

13.1 DRAINAGE STRUCTURES

The existing drainage structures will require lengthening, cleaning, headwalls and gabion mattress. Clearing of vegetation and excavating of earth side drains will be required. Below is a list of drainage structures that requires treatment.

14 ROAD BUILDING MATERIAL

14.1 Borrow pit investigation

All fill material shall be sourced from the existing borrow pit situated at km 0,02 just after the intersection P50-2 with P326.

The gravel sub base, base layer material shall be obtained from commercial sources.

Figure 20: Borrow Pit Location

14.2 Construction materials

The following pavement materials will be required for this project:

- Asphalt;
- Bituminous Prime;
- Cement for stabilising (CEM III);
- Crushed stone obtained from commercial sources;
- Water for all roadworks.

a) Asphalt

There are two asphalt plants situated in the area of Empangeni, Much asphalt plant and Enseleni plant. The asphalt mix design will be approved by the engineer prior to use.

b) Crushed Stone

The proposed rehabilitation design and widening of the cross section to 10 m require a considerable quantity of material. The material requirements are presented in table 14-1.

c) Cement

Cement utilised in cement stabilisation of the base material will be sourced from the commercial source in the area and will be approved by the engineer prior to use.

d) Water

All water used on site will be tested by the contractor for compatibility with cement stabilisation and will be approved by the engineer prior to use.

14.3 Problematic soils

No problematic soils such as active clays or collapsible sands were found during the test pitting of the subsurface soils investigation.

Table 14-1: Quantities

The approximate leading quantities for the permanent Works to be constructed are as follows:

Description	Source	Approximate quantity
Earthworks (cut or borrow to fill) Earthworks (cut to spoil)	In situ material	4 500m^3 4 500m^3
Pipe culvert (new pipe)	commercial source	200m
Selected subgrade layer -in situ reconstruction -new layer	In situ reconstruction commercial source	4 500m^3 1500m^3
Gravel shoulders (G7)	Borrow pit	4 800m^3
Stabilised subbase layer (G5 stabilised to C4)	In situ reconstruction and commercial source	17 000m^3
Stabilised base layer – (G5 stabilised to C3)	Commercial source	12 100m^3
Cape seal with double slurry	Commercial source	80 000m^2
Concrete for lined drains	Commercial sources	950m^3
Guardrails	Commercial sources/ and site batching	2 500m
Asphalt surfacing for patching and edge break repairs to the existing road	Commercial sources	195 t

15 ACCOMMODATION OF TRAFFIC

It is proposed that all works on Road P50-1 (km 18,00 to km 26,00) are undertaken in half width methods under stop/go traffic accommodation. Two closures with a maximum closure distance of 2.0 km (0.25km tapper either side) are proposed. The minimum distance of 2 km between two closures shall be maintained at all time to allow for overtaking, no temporary bypasses will be constructed.

Allowance must be made for night closures. It is proposed that night closures be managed utilising traffic signals.

16 RECOMMENDED PAVEMENT DESIGN

The existing pavement is in an extremely poor condition and will require strengthening for the predicted long term traffic loading. Construction of new pavement layers and re-using the existing good quality where necessary is therefore recommended.

The recommendation is to widening the width from 7,5m to 10m in order to meet the Kwa-Zulu Natal Department of Transport standards for such category road.

In cost comparisons it can be observed that the most economical pavement is the cemented base option. This option was not selected due to the fact that the pavement structure required more maintenance during the pavement life time. It also takes longer to construct with each layer requiring seven days to cure.

The Granular and Bitumen stabilized base option was not selected due to the lack of availability of crushed stone material in the area and due to its construction period.

For this type of project, the Bitumen Base option was selected, due to the following reasons:

1. Construction Time
2. Construction Risk
3. Region – Wet region
4. Material availability

The scope of work is therefore as follows

- The borrow pits material will be used as shoulder fill in order to achieve a 10m surface width.
- The G6 quality material from the existing borrow pits will be used as make up in conjunction with any excessive good quality material obtained from the existing base material to form new cemented C3 subbase of 300 mm.
- The 80mm Asphalt base layer will then be constructed/paved over the cemented sub base layer
- The recommended surfacing is a continues graded medium grade asphalt wearing course with AE-2 binder.

Table 16-1: Proposed pavement design for reconstruction of P50-1 km 18,00 to km 26,00

Cemented Base From km 18.00 to 26.00							
Surfacing	40 mm Continues Medium asphalt with AE-2 Binder						
Layer	**Thickness**	**UCS or CBR**	**Compaction**	**Material quality and size**	**PI**	**Swell**	**ITS**
Base	80 mm (BTB)		97% (TRD – design voids)	26mm maximum size			Min ITS < 1000
Sub-base	300mm (C3)	UCS: 1 – 2MPa at 100 % Mod AASHTO	Compacted to 97% Mod AASHTO Density	Constructed from type G6 minimum material quality	Maximum PI =6 after stabilization	Maximum swell 0,2 % @ 100 % Mod. AASHTO and	Minimum ITS = 250 kPa at 100 % Mod. AASHTO
Upper Selected	150mm (G7)	Minimum CBR =15% @ 93% Mod. AASHTO	Compacted to 93% Mod. AASHTO Density	Maximum aggregate size 2/3 of layer thickness	Maximum PI <12	Maximum swell 1,5 % @ 100 % Mod. AASHTO	
Lower Selected	150mm (G9)	Minimum CBR =10% @ 93% Mod. AASHTO	Compacted to 93% Mod. AASHTO Density	Maximum aggregate size 2/3 of layer thickness	Maximum PI <12	Maximum swell 1,5 % @ 100 % Mod. AASHTO	
Subgrade	200mm (G9)	Minimum CBR =7% @ 95% Mod. AASHTO	Compacted to 95% Mod. AASHTO	Maximum aggregate size 2/3 of layer thickness	Maximum PI <12	Maximum swell 1,5 % @ 100 % Mod. AASHTO	

REFERENCES

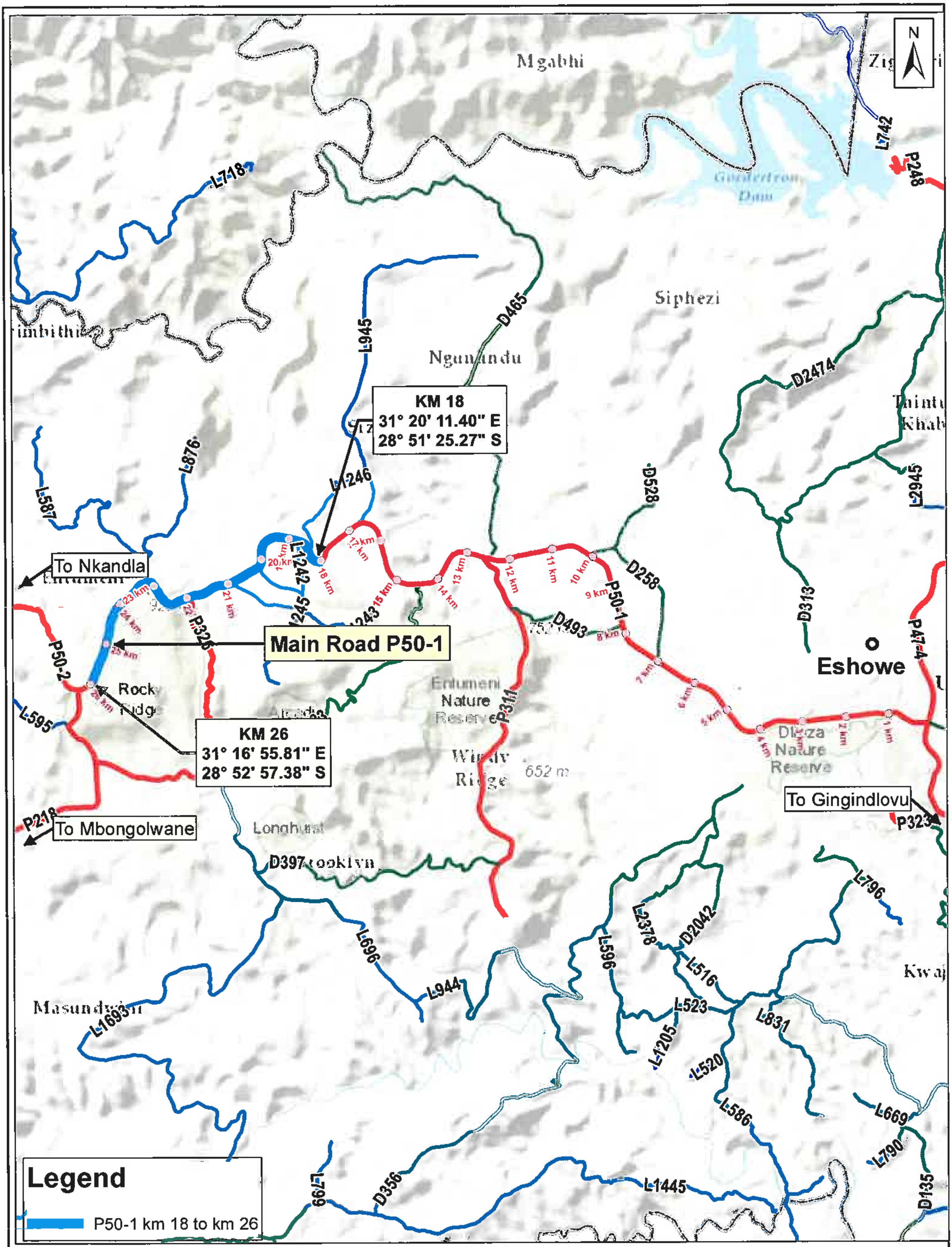
- Committee of Land Transportation Officials (COLTO), 1996, TRH 4: structural design of flexible pavements for interurban and rural roads, Pretoria, South Africa.

- Committee of Land Transportation Officials (COLTO), 1997, TRH12: Flexible Pavement Rehabilitation Investigation and design, Pretoria, South Africa.

- Committee of State Road Authorities (CSRA), 1992, TMH9: Pavement Management Systems: standard visual assessment for flexible pavements, Pretoria, South Africa.

- Standard Specification for Road and Bridge Works for State Road Authorities, 1998, COLTO.

APPENDIX A
LOCALITY MAP



PROVINCE OF KWAZULU-NATAL DEPARTMENT OF TRANSPORT	LOCALITY PLAN PROVINCIAL MAIN ROAD 50-1 UMLALAZI LOCAL MUNICIPALITY	PREPARED BY: Royal HaskoningDHV Enhancing Society Together
Disclaimer: RHDHV is not responsible for the accuracy of the data displayed on this plan. The information should be checked against the records held at the offices of the Surveyor General. SCALE: NTS DATE: AUGUST 2015		

APPENDIX B
TRAFFIC DATA

CLASSIFIED COUNT REPORT
Compiled for RHDHV

P50 - 1 Electronic Counts

MIKROS TRAFFIC MONITORING KZN (Pty) Ltd

August 2015

Contents Page

Electronic Counts

	TRAFFIC HIGHLIGHTS OF SITE 280053			
1.1	Site Identifier			280053
1.2	Site Name			P50-1 Stn 2
1.3	Site Description			East of D258
1.4	Road Description	Route :	Road : P50-1	Section : Distance : 0.0km
1.5	GPS Position			31 26 48.4E -28 53 25.4S
1.6	Number of Lanes			2
1.7	Station Type			Secondary
1.8	Requested Period			2015/01/01 - 2015/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2015/07/29 - 2015/08/07
1.11	Actual available data (hours)			216
1.12	Percentage data available for requested period			2.5
		To Eshowe	To D258	Total
2.1	Total number of vehicles	16432	16520	32952
2.2	Average daily traffic (ADT)	1825	1835	3660
2.3	Average daily truck traffic (ADTT)	181	181	362
2.4	Percentage of trucks	9.9	9.9	9.9
2.5	Truck split % (short:medium:long)	57 : 17 : 26	58 : 14 : 28	57 : 16 : 27
2.6	Percentage of night traffic (20:00 - 06:00)	8.1	8.9	8.5
3.1	Speed limit (km/hr)			60
3.2	Average speed (km/hr)	59.2	57.5	58.3
3.3	Average speed - light vehicles (km/hr)	59.7	58.1	58.9
3.4	Average speed - heavy vehicles (km/hr)	53.6	52.2	52.9
3.5	Average night speed (km/hr)	64.1	61.4	62.7
3.6	15th centile speed (km/hr)	54.5	54.5	54.5
3.7	85th centile speed (km/hr)	69.9	65.9	67.9
3.8	Percentage vehicles in excess of speed limit	29.1	22.9	26.0
4.1	Percentage vehicles in flows over 600 vehicles/hr	0.0	0.0	0.0
4.2	Highest volume on the road (vehicles/hr)		2015/08/03 08:00:00	394
4.3	Highest volume in the North (vehs/hr)		2015/07/31 14:00:00	226
4.4	Highest volume in the South (vehs/hr)		2015/08/03 18:00:00	238
4.5	Highest volume in a lane (vehicles/hr)		2015/08/03 18:00:00	238
4.6	15th highest volume on the road (vehicles/hr)		2015/08/01 16:00:00	331
4.7	15th highest volume in the North direction (vehs/hr)		2015/07/31 08:00:00	179
4.8	15th highest volume in the South direction (vehs/hr)		2015/08/07 08:00:00	177
4.9	30th highest volume on the road (vehicles/hr)		2015/07/29 17:00:00	293
4.10	30th highest volume in the North direction (vehs/hr)		2015/08/01 16:00:00	145
4.11	30th highest volume in the South direction (vehs/hr)		2015/08/05 17:00:00	153
5.1	Percentage of vehicles less than 2s behind vehicle ahead			
6.1	Total number of heavy vehicles	1626	1633	3259
6.2	Estimated average number of axles per truck	3.8	3.8	3.8
6.3	Estimated truck mass (Ton/truck)	21.8	21.9	21.9
6.4	Estimated average E80/truck	1.3	1.3	1.3
6.5	Estimated daily E80 on the road			470
6.6	Estimated daily E80 in the North direction			236
6.7	Estimated daily E80 in the South direction			234
6.8	Estimated daily E80 in the worst North lane			236
6.9	Estimated daily E80 in the worst South lane			234
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

L/H/Volume Report

Date : 2015/07/29
Site : 280053 - P50-1 Stn 2
Description : East of D258

Date	Time	Dur.	Lane 1			Lane 2			To Eshowe			To D258			P50-1		
			Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total
150729	00:00	11:58	*751*	*116*	*867*	*873*	*79*	*952*	*751*	*116*	*867*	*873*	*79*	*952*	*1624*	*195*	*1819*
150730	00:00	24:00	1522	189	1711	1482	185	1667	1522	189	1711	1482	185	1667	3004	374	3378
150731	00:00	24:00	1866	203	2069	1955	193	2148	1866	203	2069	1955	193	2148	3821	396	4217
150801	00:00	24:00	1916	149	2065	2013	161	2174	1916	149	2065	2013	161	2174	3929	310	4239
150802	00:00	24:00	1266	87	1353	1163	80	1243	1266	87	1353	1163	80	1243	2429	167	2596
150803	00:00	24:00	1875	183	2058	1861	194	2055	1875	183	2058	1861	194	2055	3736	377	4113
150804	00:00	24:00	1616	185	1801	1656	194	1850	1616	185	1801	1656	194	1850	3272	379	3651
150805	00:00	24:00	1603	192	1795	1638	229	1867	1603	192	1795	1638	229	1867	3241	421	3662
150806	00:00	24:00	1571	222	1793	1649	231	1880	1571	222	1793	1649	231	1880	3220	453	3673
150807	00:00	12:04	*820*	*101*	*921*	*597*	*90*	*687*	*820*	*101*	*921*	*597*	*90*	*687*	*1417*	*191*	*1608*
			14806	1627	16433	14887	1636	16523	14806	1627	16433	14887	1636	16523	29693	3263	32956

	TRAFFIC HIGHLIGHTS OF SITE 280054			
1.1	Site Identifier			280054
1.2	Site Name			P50-1 Stn 1
1.3	Site Description			East of P326
1.4	Road Description	Route :	Road : P50-1	Section : Distance : 0.0km
1.5	GPS Position			31 16 54.8E -28 52 58.3S
1.6	Number of Lanes			2
1.7	Station Type			Secondary
1.8	Requested Period			2015/01/01 - 2015/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2015/07/29 - 2015/08/07
1.11	Actual available data (hours)			218
1.12	Percentage data available for requested period			2.5
		To Eshowe	To P326	Total
2.1	Total number of vehicles	7250	7008	14258
2.2	Average daily traffic (ADT)	797	771	1568
2.3	Average daily truck traffic (ADTT)	73	67	140
2.4	Percentage of trucks	9.2	8.7	9.0
2.5	Truck split % (short:medium:long)	67 : 13 : 20	65 : 13 : 22	66 : 13 : 21
2.6	Percentage of night traffic (20:00 - 06:00)	7.8	9.3	8.5
3.1	Speed limit (km/hr)			60
3.2	Average speed (km/hr)	63.3	64.0	63.7
3.3	Average speed - light vehicles (km/hr)	64.6	64.7	64.6
3.4	Average speed - heavy vehicles (km/hr)	48.6	56.5	52.4
3.5	Average night speed (km/hr)	61.5	61.8	61.7
3.6	15th centile speed (km/hr)	54.5	54.5	54.5
3.7	85th centile speed (km/hr)	75.9	77.9	77.9
3.8	Percentage vehicles in excess of speed limit	53.0	57.6	55.3
4.1	Percentage vehicles in flows over 600 vehicles/hr	0.0	0.0	0.0
4.2	Highest volume on the road (vehicles/hr)		2015/08/03 16:00:00	181
4.3	Highest volume in the North (vehs/hr)		2015/07/31 14:00:00	101
4.4	Highest volume in the South (vehs/hr)		2015/08/03 08:00:00	103
4.5	Highest volume in a lane (vehicles/hr)		2015/08/03 08:00:00	103
4.6	15th highest volume on the road (vehicles/hr)		2015/08/05 17:00:00	138
4.7	15th highest volume in the North direction (vehs/hr)		2015/08/05 17:00:00	79
4.8	15th highest volume in the South direction (vehs/hr)		2015/08/07 08:00:00	75
4.9	30th highest volume on the road (vehicles/hr)		2015/07/30 08:00:00	127
4.10	30th highest volume in the North direction (vehs/hr)		2015/07/29 16:00:00	69
4.11	30th highest volume in the South direction (vehs/hr)		2015/08/06 17:00:00	62
5.1	Percentage of vehicles less than 2s behind vehicle ahead			
6.1	Total number of heavy vehicles	666	611	1277
6.2	Estimated average number of axles per truck	3.4	3.5	3.4
6.3	Estimated truck mass (Ton/truck)	19.4	20.0	19.7
6.4	Estimated average E80/truck	1.1	1.2	1.2
6.5	Estimated daily E80 on the road			163
6.6	Estimated daily E80 in the North direction			84
6.7	Estimated daily E80 in the South direction			79
6.8	Estimated daily E80 in the worst North lane			84
6.9	Estimated daily E80 in the worst South lane			79
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)

L/H/Volume Report

Date : 2015/07/29
Site : 280054 - P50-1 Stn 1
Description : East of P326

Date	Time	Dur.	Lane 1			Lane 2			To Eshowe			To P326			P50-1		
			Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total	Light	Hvy	Total
150729	00:00	13:32	*428*	*44*	*472*	*401*	*34*	*435*	*428*	*44*	*472*	*401*	*34*	*435*	*829*	*78*	*907*
150730	00:00	24:00	655	80	735	642	62	704	655	80	735	642	62	704	1297	142	1439
150731	00:00	24:00	825	82	907	839	73	912	825	82	907	839	73	912	1664	155	1819
150801	00:00	24:00	799	66	865	850	64	914	799	66	865	850	64	914	1649	130	1779
150802	00:00	24:00	563	36	599	454	30	484	563	36	599	454	30	484	1017	66	1083
150803	00:00	24:00	811	83	894	805	78	883	811	83	894	805	78	883	1616	161	1777
150804	00:00	24:00	689	78	767	687	73	760	689	78	767	687	73	760	1376	151	1527
150805	00:00	24:00	715	88	803	728	94	822	715	88	803	728	94	822	1443	182	1625
150806	00:00	24:00	717	76	793	724	72	796	717	76	793	724	72	796	1441	148	1589
150807	00:00	12:39	*382*	*34*	*416*	*267*	*31*	*298*	*382*	*34*	*416*	*267*	*31*	*298*	*649*	*65*	*714*
			6584	667	7251	6397	611	7008	6584	667	7251	6397	611	7008	12981	1278	14259

7484 14968

2015 DATA		Capacity
AADT	3 660	
% Heavy vehicles	9.9	
Light vehicles	3 298	2
Heavy vehicles	362	

Analysis Period		Analysis Period (Year)	Light vehicle growth rate (%)	Heavy vehicle growth rate (%)	E80's growth rate (%)
Year	Year No				
2016	1	1	2.00	2.00	2.00
2017	2	2	2.00	2.00	2.00
2018	3	3	2.00	2.00	2.00
2019	4	4	2.00	2.00	2.00
2020	5	5	2.00	2.00	2.00
2021	6	6	2.00	2.00	2.00
2022	7	7	2.00	2.00	2.00
2023	8	8	2.00	2.00	2.00
2024	9	9	2.00	2.00	2.00
2025	10	10	2.00	2.00	2.00
2026	11	11	2.00	2.00	2.00
2027	12	12	2.00	2.00	2.00
2028	13	13	2.00	2.00	2.00
2029	14	14	2.00	2.00	2.00
2030	15	15	2.00	2.00	2.00
2031	16	16	2.00	2.00	2.00
2032	17	17	2.00	2.00	2.00
2033	18	18	2.00	2.00	2.00
2034	19	19	2.00	2.00	2.00
2035	20	20	2.00	2.00	2.00
2036	21	21	2.00	2.00	2.00
2037	22	22	2.00	2.00	2.00

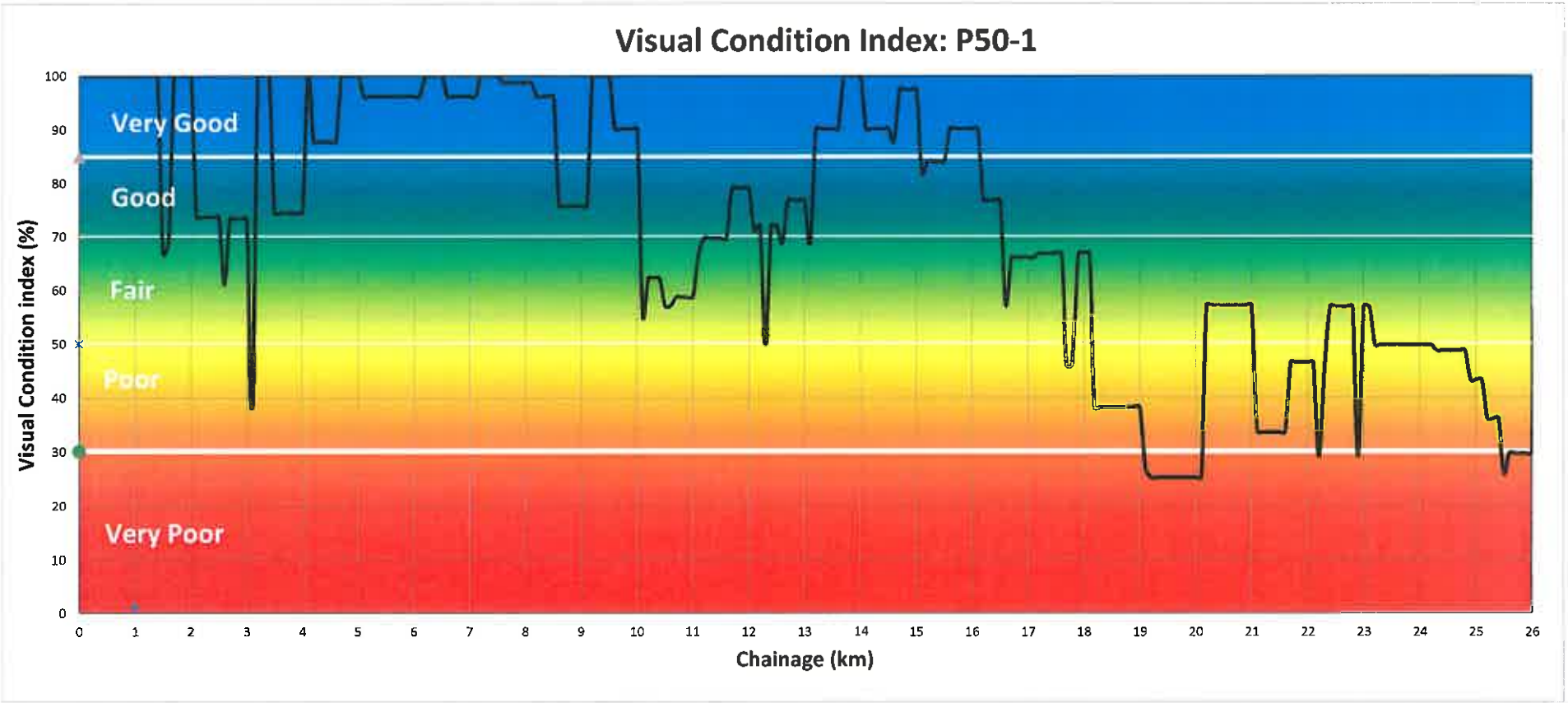
2015 DATA		Capacit
AADT	3 660	
% Heavy vehicles	9.9	
Light vehicles	3 298	
Heavy vehicles	362	

Analysis Period		Analysis Period (Year)	Light vehicle growth rate (%)	Heavy vehicle growth rate (%)	E80's growth rate (%)
Year	Year No				
2016	1	1	4.00	4.00	4.00
2017	2	2	4.00	4.00	4.00
2018	3	3	4.00	4.00	4.00
2019	4	4	4.00	4.00	4.00
2020	5	5	4.00	4.00	4.00
2021	6	6	4.00	4.00	4.00
2022	7	7	4.00	4.00	4.00
2023	8	8	4.00	4.00	4.00
2024	9	9	4.00	4.00	4.00
2025	10	10	4.00	4.00	4.00
2026	11	11	4.00	4.00	4.00
2027	12	12	4.00	4.00	4.00
2028	13	13	4.00	4.00	4.00
2029	14	14	4.00	4.00	4.00
2030	15	15	4.00	4.00	4.00
2031	16	16	4.00	4.00	4.00
2032	17	17	4.00	4.00	4.00
2033	18	18	4.00	4.00	4.00
2034	19	19	4.00	4.00	4.00
2035	20	20	4.00	4.00	4.00
2036	21	21	4.00	4.00	4.00
2037	22	22	4.00	4.00	4.00

2015 DATA		Capa
AADT	3 660	
% Heavy vehicles	9.9	
Light vehicles	3 298	
Heavy vehicles	362	

Analysis Period		Analysis Period (Year)	Light vehicle growth rate (%)	Heavy vehicle growth rate (%)	E80's growth r (%)
Year	Year No				
2016	1	1	6.00	6.00	6.00
2017	2	2	6.00	6.00	6.00
2018	3	3	6.00	6.00	6.00
2019	4	4	6.00	6.00	6.00
2020	5	5	6.00	6.00	6.00
2021	6	6	6.00	6.00	6.00
2022	7	7	6.00	6.00	6.00
2023	8	8	6.00	6.00	6.00
2024	9	9	6.00	6.00	6.00
2025	10	10	6.00	6.00	6.00
2026	11	11	6.00	6.00	6.00
2027	12	12	6.00	6.00	6.00
2028	13	13	6.00	6.00	6.00
2029	14	14	6.00	6.00	6.00
2030	15	15	6.00	6.00	6.00
2031	16	16	6.00	6.00	6.00
2032	17	17	6.00	6.00	6.00
2033	18	18	6.00	6.00	6.00
2034	19	19	6.00	6.00	6.00
2035	20	20	6.00	6.00	6.00
2036	21	21	6.00	6.00	6.00
2037	22	22	6.00	6.00	6.00

APPENDIX C
VISUAL ASSESMENT DATA


Visual Condition Index: P50-1
Very Good
Good
Fair
Poor
Very Poor
Visual Condition index (%)
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Chainage (km)

Start Chainage (kilometres)		**km**	**0.0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**2.0**	**2.1**
Finish Chainage (kilometres)		**km**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**2.0**	**2.1**	**2.2**
Chainage used (kilometres)		**km**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**2.0**	**2.1**	**2.2**
Defects																								
CONDITION	Surfacing Failure	Degree																						
		Extent																						
	Surfacing Cracks	Degree																						
		Extent																						
	Stone Loss	Degree																						
		Extent																						
	Dry/Brittle	Degree																						
		Extent																						
	Bleeding/Flushing	Degree																						
		Extent																						
	Block Cracking	Degree																						
		Extent																						
	Longitudinal Cracks	Degree																						
		Extent																						
	Transverse Cracks	Degree																						
		Extent																						
	Crocodile Cracks	Degree															3	5						
		Extent															5	5						
	Rutting	Degree																						
		Extent																						
	Pumping	Degree																					3	3
		Extent																					3	3
	Deformation	Degree																						
		Extent																						
	Patching	Degree															3						3	3
		Extent															5						3	3
	Potholes	Degree																					3	3
		Extent																					1	1
	Edge Breaks	Degree																						
		Extent																						
	Undulation/Settlement	Degree																						
		Extent																						
	General Appearance	Key	good																					
		Index	0	0	0	0	0	0	0	0	0	0	0	0	0	0	270	250	0	0	0	0	207	207

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		Extent of Distress	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)		**km**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**4.0**	**4.1**	**4.2**	**4.3**
Finish Chainage (kilometres)		**km**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**4.0**	**4.1**	**4.2**	**4.3**	**4.4**
Chainage used (kilometres)		**km**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**3.0**	**3.1**	**3.2**	**3.3**	**3.4**	**3.5**	**3.6**	**3.7**	**3.8**	**3.9**	**4.0**	**4.1**	**4.2**	**4.3**	**4.4**
Defects																								
CONDITION	Surfacing Failure	Degree																						
		Extent																						
	Surfacing Cracks	Degree																						
		Extent																						
	Stone Loss	Degree																						
		Extent																						
	Dry/Brittle	Degree																						
		Extent																						
	Bleeding/Flushing	Degree																						
		Extent																						
	Block Cracking	Degree																						
		Extent																						
	Longitudinal Cracks	Degree																						
		Extent																						
	Transverse Cracks	Degree																						
		Extent																						
	Crocodile Cracks	Degree									5											3	3	3
		Extent									5											3	3	3
	Rutting	Degree				5	5	5	5	5	5													
		Extent				3	3	3	3	3	3													
	Pumping	Degree	3	3	3	3	3	3	3	3	3													
		Extent	3	3	3	3	3	3	3	3	3													
	Deformation	Degree																						
		Extent																						
	Patching	Degree	3	3	3	3									5	5	5	5	5	5				
		Extent	3	3	3	3									5	5	5	5	5	5				
	Potholes	Degree	3	3	3	3					3													
		Extent	1	1	1	1					3													
	Edge Breaks	Degree																						
		Extent																						
	Undulation/Settlement	Degree																						
		Extent																						
	General Appearance	Key																						
		Index	207	207	207	327	210	210	210	210	595	0	0	0	200	200	200	200	200	200	0	90	90	90

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**	**5.0**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**	**5.7**	**5.8**	**5.9**	**6.0**	**6.1**	**6.2**	**6.3**	
Finish Chainage (kilometres)	**km**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**	**5.0**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**	**5.7**	**5.8**	**5.9**	**6.0**	**6.1**	**6.2**	**6.3**	**6.4**	
Chainage used (kilometres)	**km**	**4.5**	**4.6**	**4.7**	**4.8**	**4.9**	**5.0**	**5.1**	**5.2**	**5.3**	**5.4**	**5.5**	**5.6**	**5.7**	**5.8**	**5.9**	**6.0**	**6.1**	**6.2**	**6.3**	**6.4**	
Defects																						
CONDITION	Surfacing Failure	Degree																				
		Extent																				
	Surfacing Cracks	Degree																				
		Extent																				
	Stone Loss	Degree																				
		Extent																				
	Dry/Brittle	Degree																				
		Extent																				
	Bleeding/Flushing	Degree							3	3	3	3	3	3	3	3	3	3	3			
		Extent							3	3	3	3	3	3	3	3	3	3	3			
	Block Cracking	Degree																				
		Extent																				
	Longitudinal Cracks	Degree																				
		Extent																				
	Transverse Cracks	Degree																				
		Extent																				
	Crocodile Cracks	Degree	3	3																		
		Extent	3	3																		
	Rutting	Degree																				
		Extent																				
	Pumping	Degree																				
		Extent																				
	Deformation	Degree																				
		Extent																				
	Patching	Degree																				
		Extent																				
	Potholes	Degree																				
		Extent																				
	Edge Breaks	Degree																				
		Extent																				
	Undulation/Settlement	Degree																				
		Extent																				
	General Appearance	Key																				
		Index	90	90	0	0	0	0	27	27	27	27	27	27	27	27	27	27	27	0	0	0

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)	
Degree 1:	No distress visible or distress difficult to discern
Degree 2:	Easily discernable distress but of little immediate consequence
Degree 3:	Notable with respect to possible consequences
Degree 4:	Serious with respect to possible consequences
Degree 5:	Extreme with respect to possible consequences

Extent of Distress	
Extent 1:	Isolated occurrence (seldom)
Extent 2:	Intermittent occurrence (more than isolated)
Extent 3:	Occurs over most of the segment length
Extent 4:	More frequent occurrence, over major part of the segment length
Extent 5:	Extensive occurrence

Start Chainage (kilometres)		**km**	**6.4**	**6.5**	**6.6**	**6.7**	**6.8**	**6.9**	**7.0**	**7.1**	**7.2**	**7.3**	**7.4**	**7.5**	**7.6**	**7.7**	**7.8**	**7.9**	**8.0**	**8.1**
Finish Chainage (kilometres)		**km**	**6.5**	**6.6**	**6.7**	**6.8**	**6.9**	**7.0**	**7.1**	**7.2**	**7.3**	**7.4**	**7.5**	**7.6**	**7.7**	**7.8**	**7.9**	**8.0**	**8.1**	**8.2**
Chainage used (kilometres)		**km**	**6.5**	**6.6**	**6.7**	**6.8**	**6.9**	**7.0**	**7.1**	**7.2**	**7.3**	**7.4**	**7.5**	**7.6**	**7.7**	**7.8**	**7.9**	**8.0**	**8.1**	**8.2**
Defects																				
CONDITION	Surfacing Failure	Degree																		
		Extent																		
	Surfacing Cracks	Degree																		
		Extent																		
	Stone Loss	Degree																		
		Extent																		
	Dry/Brittle	Degree																		
		Extent																		
	Bleeding/Flushing	Degree		3	3	3	3	3	3					3	3	3	3	3	3	3
		Extent		3	3	3	3	3	3					1	1	1	1	1	1	3
	Block Cracking	Degree																		
		Extent																		
	Longitudinal Cracks	Degree																		
		Extent																		
	Transverse Cracks	Degree																		
		Extent																		
	Crocodile Cracks	Degree																		
		Extent																		
	Rutting	Degree																		
		Extent																		
	Pumping	Degree																		
		Extent																		
	Deformation	Degree																		
		Extent																		
	Patching	Degree																		
		Extent																		
	Potholes	Degree																		
		Extent																		
	Edge Breaks	Degree																		
		Extent																		
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	0	27	27	27	27	27	27	0	0	0	0	9	9	9	9	9	9	27

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**8.2**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**8.8**	**8.9**	**9.0**	**9.1**	**9.2**	**9.3**	**9.4**	**9.5**	**9.6**	**9.7**	**9.8**	**9.9**
Finish Chainage (kilometres)	**km**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**8.8**	**8.9**	**9.0**	**9.1**	**9.2**	**9.3**	**9.4**	**9.5**	**9.6**	**9.7**	**9.8**	**9.9**	**10.0**
Chainage used (kilometres)	**km**	**8.3**	**8.4**	**8.5**	**8.6**	**8.7**	**8.8**	**8.9**	**9.0**	**9.1**	**9.2**	**9.3**	**9.4**	**9.5**	**9.6**	**9.7**	**9.8**	**9.9**	**10.0**
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree																	
		Extent																	
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree	3	3	3	3	3	3	3	3	3								
		Extent	3	3	3	3	3	3	3	3	3								
	Block Cracking	Degree				3	3	3	3	3	3								
		Extent				3	3	3	3	3	3								
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree																	
		Extent																	
	Crocodile Cracks	Degree																	
		Extent																	
	Rutting	Degree																	
		Extent																	
	Pumping	Degree				3	3	3	3	3	3								
		Extent				3	3	3	3	3	3								
	Deformation	Degree																	
		Extent																	
	Patching	Degree													3	3	3	3	3
		Extent													3	3	3	3	3
	Potholes	Degree																	
		Extent																	
	Edge Breaks	Degree																	
		Extent																	
	Undulation/Settlement	Degree																	
		Extent																	
	General Appearance	Key																	
		Index	27	27	27	189	189	189	189	189	189	0	0	0	0	72	72	72	72	72

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		Extent of Distress	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	km	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7
Finish Chainage (kilometres)	km	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8
Chainage used (kilometres)	km	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree	3	3	3	3	3	3											
		Extent	3	3	3	3	3	3											
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree	3	3	3	3	3	3	3	3	3	3	3						
		Extent	3	3	3	3	3	3	3	3	3	3	3						
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree																	
		Extent																	
	Crocodile Cracks	Degree					3	3	3	3	3	3	3	3	3	3	3	3	5	5
		Extent					1	1	1	1	1	1	1	3	3	3	3	3	3	3
	Rutting	Degree																	
		Extent																	
	Pumping	Degree																	
		Extent																	
	Deformation	Degree																	
		Extent																	
	Patching	Degree	3				3	3	3	3	3	3	3	1	1	1	1	1		
		Extent	3				1	1	1	1	1	1	1	1	1	1	1	1		
	Potholes	Degree	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	3		
		Extent	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
	Edge Breaks	Degree											3	3	3	3	3	3	3	3
		Extent											1	1	1	1	1	1	1	1
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	387	315	315	315	369	369	351	351	351	351	272	244	244	244	244	244	161	161

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		Extent of Distress	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**11.8**	**11.9**	**12.0**	**12.1**	**12.2**	**12.3**	**12.4**	**12.5**	**12.6**	**12.7**	**12.8**	**12.9**	**13.0**	**13.1**	**13.2**	**13.3**	**13.4**	**13.5**
Finish Chainage (kilometres)	**km**	**11.9**	**12.0**	**12.1**	**12.2**	**12.3**	**12.4**	**12.5**	**12.6**	**12.7**	**12.8**	**12.9**	**13.0**	**13.1**	**13.2**	**13.3**	**13.4**	**13.5**	**13.6**
Chainage used (kilometres)	**km**	**11.9**	**12.0**	**12.1**	**12.2**	**12.3**	**12.4**	**12.5**	**12.6**	**12.7**	**12.8**	**12.9**	**13.0**	**13.1**	**13.2**	**13.3**	**13.4**	**13.5**	**13.6**
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree																	
		Extent																	
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree																	
		Extent																	
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree																	
		Extent																	
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	3	3	3	3	3	3				
		Extent	3	3	3	3	3	3	3	3	3	3	3	3	3				
	Rutting	Degree																	
		Extent																	
	Pumping	Degree								3	3	3	3	3	3				
		Extent								3	3	3	3	3	3				
	Deformation	Degree																	
		Extent																	
	Patching	Degree			3	3	3	3	3	3					3	3	3	3	3	3
		Extent			3	3	3	3	3	3					3	3	3	3	3	3
	Potholes	Degree					5													
		Extent					3													
	Edge Breaks	Degree	3	3	3															
		Extent	1	1	1															
	Undulation/Settlement	Degree																	
		Extent																	
	General Appearance	Key																	
		Index	161	161	233	222	447	222	222	252	180	180	180	180	252	72	72	72	72	72

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	13.6	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3
Finish Chainage (kilometres)	**km**	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
Chainage used (kilometres)	**km**	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree										3	3	3	3	3	3		
		Extent										3	3	3	3	3	3		
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree																	
		Extent																	
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree																	
		Extent																	
	Crocodile Cracks	Degree																	
		Extent																	
	Rutting	Degree																	
		Extent																	
	Pumping	Degree																	
		Extent																	
	Deformation	Degree																	
		Extent																	
	Patching	Degree					3	3	3	3	3	3					3	3	3	3
		Extent					3	3	3	3	3	3					5	5	5	5
	Potholes	Degree																	
		Extent																	
	Edge Breaks	Degree																	
		Extent																	
	Undulation/Settlement	Degree																	
		Extent																	
	General Appearance	Key																	
		Index	0	0	0	0	72	72	72	72	72	90	18	18	18	18	138	120	120	120

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		Extent of Distress	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**15.4**	**15.5**	**15.6**	**15.7**	**15.8**	**15.9**	**16.0**	**16.1**	**16.2**	**16.3**	**16.4**	**16.5**	**16.6**	**16.7**	**16.8**	**16.9**	**17.0**	**17.1**
Finish Chainage (kilometres)	**km**	**15.5**	**15.6**	**15.7**	**15.8**	**15.9**	**16.0**	**16.1**	**16.2**	**16.3**	**16.4**	**16.5**	**16.6**	**16.7**	**16.8**	**16.9**	**17.0**	**17.1**	**17.2**
Chainage used (kilometres)	**km**	**15.5**	**15.6**	**15.7**	**15.8**	**15.9**	**16.0**	**16.1**	**16.2**	**16.3**	**16.4**	**16.5**	**16.6**	**16.7**	**16.8**	**16.9**	**17.0**	**17.1**	**17.2**
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree																	
		Extent																	
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree																	
		Extent																	
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree												5	5	5	5	5	5	
		Extent												3	3	3	3	3	3	
	Crocodile Cracks	Degree								3	3	3	3	3	3	3	3	3	3	5
		Extent								3	3	3	3	3	3	3	3	3	3	3
	Rutting	Degree																		5
		Extent																		3
	Pumping	Degree								3	3	3	3	3						
		Extent								3	3	3	3	3						
	Deformation	Degree																		
		Extent																		
	Patching	Degree	3	3	3	3	3	3	3					5	5	5	5	5	5	
		Extent	5	3	3	3	3	3	3					3	3	3	3	3	3	
	Potholes	Degree																		
		Extent																		
	Edge Breaks	Degree																		
		Extent																		
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	120	72	72	72	72	72	72	180	180	180	180	368	278	278	278	278	278	270

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)	
Degree 1:	No distress visible or distress difficult to discern
Degree 2:	Easily discernable distress but of little immediate consequence
Degree 3:	Notable with respect to possible consequences
Degree 4:	Serious with respect to possible consequences
Degree 5:	Extreme with respect to possible consequences

Extent of Distress	
Extent 1:	Isolated occurrence (seldom)
Extent 2:	Intermittent occurrence (more than isolated)
Extent 3:	Occurs over most of the segment length
Extent 4:	More frequent occurrence, over major part of the segment length
Extent 5:	Extensive occurrence

Start Chainage (kilometres)	km	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9
Finish Chainage (kilometres)	km	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0
Chainage used (kilometres)	km	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0

Defects

CONDITION	Surfacing Failure	Degree																		
		Extent																		
	Surfacing Cracks	Degree																		
		Extent																		
	Stone Loss	Degree																		
		Extent																		
	Dry/Brittle	Degree																		
		Extent																		
	Bleeding/Flushing	Degree																		
		Extent																		
	Block Cracking	Degree																		
		Extent																		
	Longitudinal Cracks	Degree																		
		Extent																		
	Transverse Cracks	Degree																		
		Extent																		
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5
	Rutting	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5
	Pumping	Degree										5	5	5	5	5	5	5	5	5
		Extent										3	3	3	3	3	3	3	3	3
	Deformation	Degree																		
		Extent																		
	Patching	Degree																		
		Extent																		
	Potholes	Degree					5	5												
		Extent					3	3												
	Edge Breaks	Degree																		
		Extent																		
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	270	270	270	270	495	495	270	270	270	600	600	600	600	600	600	600	600	600

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		Extent of Distress	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**19.0**	**19.1**	**19.2**	**19.3**	**19.4**	**19.5**	**19.6**	**19.7**	**19.8**	**19.9**	**20.0**	**20.1**	**20.2**	**20.3**	**20.4**	**20.5**	**20.6**	**20.7**
Finish Chainage (kilometres)	**km**	**19.1**	**19.2**	**19.3**	**19.4**	**19.5**	**19.6**	**19.7**	**19.8**	**19.9**	**20.0**	**20.1**	**20.2**	**20.3**	**20.4**	**20.5**	**20.6**	**20.7**	**20.8**
Chainage used (kilometres)	**km**	**19.1**	**19.2**	**19.3**	**19.4**	**19.5**	**19.6**	**19.7**	**19.8**	**19.9**	**20.0**	**20.1**	**20.2**	**20.3**	**20.4**	**20.5**	**20.6**	**20.7**	**20.8**
Defects																			
CONDITION	Surfacing Failure	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Surfacing Cracks	Degree																		
		Extent																		
	Stone Loss	Degree																		
		Extent																		
	Dry/Brittle	Degree																		
		Extent																		
	Bleeding/Flushing	Degree	3	5	5	5	5	5	5	5	5	5	5							
		Extent	3	3	3	3	3	3	3	3	3	3	3							
	Block Cracking	Degree																		
		Extent																		
	Longitudinal Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5							
		Extent	3	3	3	3	3	3	3	3	3	3	3							
	Transverse Cracks	Degree																		
		Extent																		
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Rutting	Degree	5	5	5	5	5	5	5	5	5	5	5							
		Extent	5	3	3	3	3	3	3	3	3	3	3							
	Pumping	Degree	5																	
		Extent	3																	
	Deformation	Degree																		
		Extent																		
	Patching	Degree		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Potholes	Degree		5	5	5	5	5	5	5	5	5	5							
		Extent		3	3	3	3	3	3	3	3	3	3							
	Edge Breaks	Degree																		
		Extent																		
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	785	818	818	818	818	818	818	818	818	818	818	368	368	368	368	368	368	368

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)		**km**	**20.8**	**20.9**	**21.0**	**21.1**	**21.2**	**21.3**	**21.4**	**21.5**	**21.6**	**21.7**	**21.8**	**21.9**	**22.0**	**22.1**	**22.2**	**22.3**	**22.4**	**22.5**
Finish Chainage (kilometres)		**km**	**20.9**	**21.0**	**21.1**	**21.2**	**21.3**	**21.4**	**21.5**	**21.6**	**21.7**	**21.8**	**21.9**	**22.0**	**22.1**	**22.2**	**22.3**	**22.4**	**22.5**	**22.6**
Chainage used (kilometres)		**km**	**20.9**	**21.0**	**21.1**	**21.2**	**21.3**	**21.4**	**21.5**	**21.6**	**21.7**	**21.8**	**21.9**	**22.0**	**22.1**	**22.2**	**22.3**	**22.4**	**22.5**	**22.6**
Defects																				
CONDITION	Surfacing Failure	Degree	5	5	5															
		Extent	3	3	3															
	Surfacing Cracks	Degree																		
		Extent																		
	Stone Loss	Degree																		
		Extent																		
	Dry/Brittle	Degree																		
		Extent																		
	Bleeding/Flushing	Degree																		
		Extent																		
	Block Cracking	Degree			5	5	5	5	5	5	5	5	5	5	5					
		Extent			3	3	3	3	3	3	3	3	3	3	3					
	Longitudinal Cracks	Degree			5	5	5	5	5	5										
		Extent			3	3	3	3	3	3										
	Transverse Cracks	Degree																		
		Extent																		
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Rutting	Degree			5	5	5	5	5	5										
		Extent			3	3	3	3	3	3										
	Pumping	Degree																		
		Extent																		
	Deformation	Degree																		
		Extent																		
	Patching	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Potholes	Degree														5	3			
		Extent														3	3			
	Edge Breaks	Degree																		
		Extent																		
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	368	368	668	670	670	670	670	670	490	490	490	490	490	745	505	370	370	370

LEGEND	**Condition**	**Key**
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	**km**	**22.6**	**22.7**	**22.8**	**22.9**	**23.0**	**23.1**	**23.2**	**23.3**	**23.4**	**23.5**	**23.6**	**23.7**	**23.8**	**23.9**	**24.0**	**24.1**	**24.2**	**24.3**
Finish Chainage (kilometres)	**km**	**22.7**	**22.8**	**22.9**	**23.0**	**23.1**	**23.2**	**23.3**	**23.4**	**23.5**	**23.6**	**23.7**	**23.8**	**23.9**	**24.0**	**24.1**	**24.2**	**24.3**	**24.4**
Chainage used (kilometres)	**km**	**22.7**	**22.8**	**22.9**	**23.0**	**23.1**	**23.2**	**23.3**	**23.4**	**23.5**	**23.6**	**23.7**	**23.8**	**23.9**	**24.0**	**24.1**	**24.2**	**24.3**	**24.4**
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree																	
		Extent																	
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree																	
		Extent																	
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree																	
		Extent																	
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3
	Rutting	Degree																		
		Extent																		
	Pumping	Degree																		
		Extent																		
	Deformation	Degree																	5	5
		Extent																	3	3
	Patching	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		Extent	3	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5
	Potholes	Degree			5															
		Extent			5															
	Edge Breaks	Degree																	5	5
		Extent																	3	3
	Undulation/Settlement	Degree																		
		Extent																		
	General Appearance	Key																		
		Index	370	370	745	370	370	450	450	450	450	450	450	450	450	450	450	450	463	463

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)		**Extent of Distress**	
Degree 1:	No distress visible or distress difficult to discern	Extent 1:	Isolated occurrence (seldom)
Degree 2:	Easily discernable distress but of little immediate consequence	Extent 2:	Intermittent occurrence (more than isolated)
Degree 3:	Notable with respect to possible consequences	Extent 3:	Occurs over most of the segment length
Degree 4:	Serious with respect to possible consequences	Extent 4:	More frequent occurrence, over major part of the segment length
Degree 5:	Extreme with respect to possible consequences	Extent 5:	Extensive occurrence

Start Chainage (kilometres)	km	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	
Finish Chainage (kilometres)	km	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	
Chainage used (kilometres)	km	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	
Defects																			
CONDITION	Surfacing Failure	Degree																	
		Extent																	
	Surfacing Cracks	Degree																	
		Extent																	
	Stone Loss	Degree																	
		Extent																	
	Dry/Brittle	Degree																	
		Extent																	
	Bleeding/Flushing	Degree																	
		Extent																	
	Block Cracking	Degree																	
		Extent																	
	Longitudinal Cracks	Degree																	
		Extent																	
	Transverse Cracks	Degree					5	5	5	5	5	5	5						
		Extent					3	3	3	3	3	3	3						
	Crocodile Cracks	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
		Extent	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5	
	Rutting	Degree																	
		Extent																	
	Pumping	Degree																	
		Extent																	
	Deformation	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
		Extent	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Patching	Degree	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
		Extent	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Potholes	Degree											5	5	5	5	5	5	
		Extent											3	3	3	3	3	3	
	Edge Breaks	Degree	5	5	5	5	5	5	5	5	5	5							
		Extent	3	3	3	3	3	3	3	3	3	3							
	Undulation/Settlement	Degree																	
		Extent																	
	General Appearance	Key																	
		Index	463	463	463	463	530	530	530	630	630	630	803	735	735	735	735	735	0

LEGEND	Condition	Key
	Excellent	1
	Good	2
	Fair	3
	Poor	4
	Bad	5

Degree of Distress (Severity)	
Degree 1:	No distress visible or distress difficult to discern
Degree 2:	Easily discernable distress but of little immediate consequence
Degree 3:	Notable with respect to possible consequences
Degree 4:	Serious with respect to possible consequences
Degree 5:	Extreme with respect to possible consequences

Extent of Distress	
Extent 1:	Isolated occurrence (seldom)
Extent 2:	Intermittent occurrence (more than isolated)
Extent 3:	Occurs over most of the segment length
Extent 4:	More frequent occurrence, over major part of the segm
Extent 5:	Extensive occurrence

APPENDIX D
CENTRE LINE MATERIALS DATA

MATROLAB GROUP (PTY) LTD

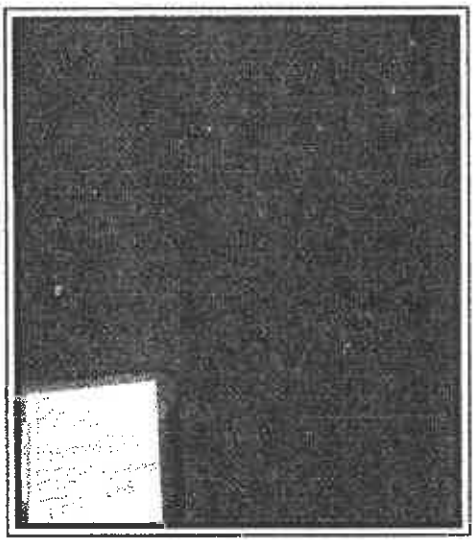
CIVIL ENGINEERING SERVICES

Unit 7, Pennylane Park, 64 Ebonyfield Avenue, Springfield Park
P O Box 74663, Rochdale Park, 4034
Tel: 031 - 579 1220
Fax: 031 - 579 1344

CLIENT	ROYAL HASKONING DHV
ATTENTION	MR. HEIN ARNOLD

PROJECT	P50 - 1
JOB REFERENCE	101893
DATE	23 / 03 / 2015

TEST PIT PROFILE REPORT



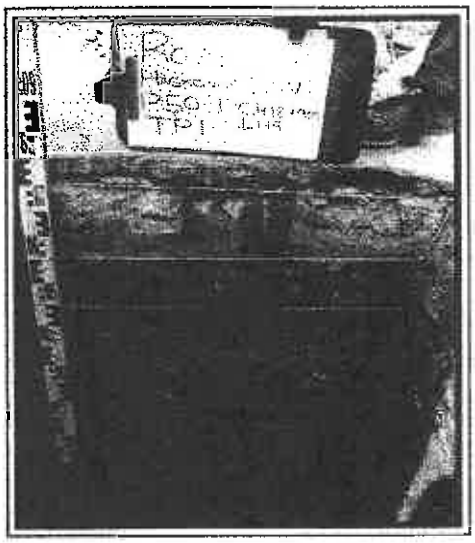
TEST PIT	
1	

PROFILED BY
MR. R. RAMDEEN

GPS CO-ORDINATES	
S	28° 51'09,2"
E	31° 19'47,7"
Lo 31, WGS 84	

CHAINAGE
18+900 LHS LWP

EXCAVATION BY
HAND



Water Table	Soil Legend	Depth (mm)	SOIL DESCRIPTION Moisture, Colour, Consistency, Structure, Soil Type, Origin, General	SAMPLING TYPE AND NUMBER
		0	ASPHALT - Semi-gap-graded,double seal,semi-porous, Tacky,bonded,rutting=0	
		35	Slightly moist,light grey + yellow,stongly cemented,uniform, Weathered SANDSTONE,base,imported. Moisture:3.4%	1A (PHEN+) (HCL+)
		200	Slightly moist,pale red + orange,medium dense,uniform, Fine SAND+Weathered SANDTSONE,Sub base,Imported Moisture:6.6%	1B (PHEN-) (HCL-)
		320	Slightly moist,dark orange brown+dark grey,medium dense, uniform,fine SAND+highly weathered SANDSTONE,Selected, Insitu Moisture:5.8%	1C (PHEN-) (HCL-)
		660	Slightly moist,dark yellow brown+orange+light grey,medium dense,uniform,fine SAND+highly weatherd SANDSTONE,Insitu Moisture:5.3%	1D (PHEN-) (HCL-)
		800		

REMARKS	

MATROLAB GROUP (PTY.) LTD.
- CIVIL ENGINEERING SERVICES -

a SANAS Accredited Testing Laboratory, No. TO239

UNIT 7, PENNYLANE PARK, 64 EBONYFIELD AVE., SPRINGFIELD PARK
P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/A
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8516	E8517	E8518	E8519
HOLE NO.	TP1A	TP1B	TP1C	TP1D
ROAD NO.	LWP	LWP	LWP	LWP
DEPTH (mm)	35-200	200-320	320-660	660-800
CHAINAGE	CH18+900LHS	CH18+900LHS	CH18+900LHS	CH18+900LHS
LAYER TYPE				
STABILISED WITH	Natural	Natural	Natural	Natural
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Gr+Yel W/ Sandstone	Pale Rd+Or Fine Sand+W/S/Stone	Dk Or Br+Dk Gr F/ Sand+H/W S/Stone	Dk Yel Br+Or+Gr Sand+H/W S/Stone
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm	100	100		
37.5 mm	85	80		
26.5 mm	72	69		
19.0 mm	63	66		
13.2 mm	55	64	100	100
4.75 mm	39	59	97	99
2.0 mm	32	56	91	98
0.425 mm	19	33	50	39
0.075 mm	5	9	15	10
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	41	41	45	60
FINE SAND <0.425mm >0.075mm	44	43	38	30
MATERIAL <0.075mm	15	16	17	10
CONSTANTS				
GRADING MODULUS	2.44	2.02	1.44	1.53
PRA CLASSIFICATION	A-1-a(0)	A-1-b(0)	A-1-b(0)	A-1-b(0)
COLTO CLASSIFICATION	G6	G7	---	G9
TRH CLASSIFICATION	G6	G7	-	-
TRH Class.(INSITU |93%|90%|)	- | -	- | -	G10|G10	G9|G10
LIQUID LIMIT (%)	-	-	-	-
PLASTICITY INDEX (0.425mm)	NP	NP	NP	NP
LINEAR SHRINKAGE (%)	0.0	0.0	0.0	0.0
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	1861	2102	2001	1996
OPTIMUM MOISTURE CONTENT (%)	11.0	7.9	8.9	9.1
MOULDING MOISTURE (%)	10.8	7.7	9.0	8.9
TYPE OF TEST	CBR	CBR	CBR	CBR
CBR-UCS @ 100% MOD AASHTO	73	35	11	17
CBR-UCS @ 98% MOD AASHTO	58	28	10	15
CBR-UCS @ 97% MOD AASHTO	52	25	9.4	14
CBR-UCS @ 95% MOD AASHTO	42	20	8.4	12
CBR-UCS @ 93% MOD AASHTO	32	17	6.8	8.6
CBR-UCS @ 90% MOD AASHTO	22	14	4.5	4.1

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.01	0.02	0.02	0.02	0.04	0.07	0.50	0.80	0.93	0.47	0.77	0.84

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

MATROLAB GROUP (PTY.) LTD.
- CIVIL ENGINEERING SERVICES -

a SANAS Accredited Testing Laboratory, No. TO239

UNIT 7, PENNYLANE PARK, 64 EBONYFIELD AVE., SPRINGFIELD PARK
P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/A
Date Reported : 24.04.2015

IN-SITU DRY DENSITY REPORT (TMH1 A10(b))

Section	: P50-1	Tested By	: Mr R Ramdeen	Date Tested	: 23.03.2015
Layer Type	: See Test Positions	Compaction Energy	: MOD AASHTO		

Position	Depth (mm)	Material Description	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	In-Situ Dry Density (kg/m^3)	Moisture Content (%)	Relative Compaction (%)
1A	35-135	Lt Gr+Yel W/S/Stone	1861	11.0	1764	6.0	94.8
1B	200-300	Rd+Or Sand+W/S/Stone	2102	7.9	1812	11.2	86.2
1C	320-420	Or Br +Gr Sand+S/Stone	2001	8.9	1793	12.4	89.6
1D	660-760	Yel Br+Or Gr Sand+S/Stone	1996	9.1	1888	11.3	94.6

Tests done by means of Nuclear method.

Test Positions

Layer Type:

1A-Base
1B-Subbase
1C-Selected
1D-Insitu

Deviation from test method
1. Dry Density reported to 1 kg/m^3
2. Nuclear Gauge calibrated annually.

Remarks :

FORM: A10(b) Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalis Bhikam

MATROLAB GROUP (PTY.) LTD.
- CIVIL ENGINEERING SERVICES -

a SANAS Accredited Testing Laboratory, No. TO239

UNIT 7, PENNYLANE PARK, 64 EBONYFIELD AVE., SPRINGFIELD PARK
P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

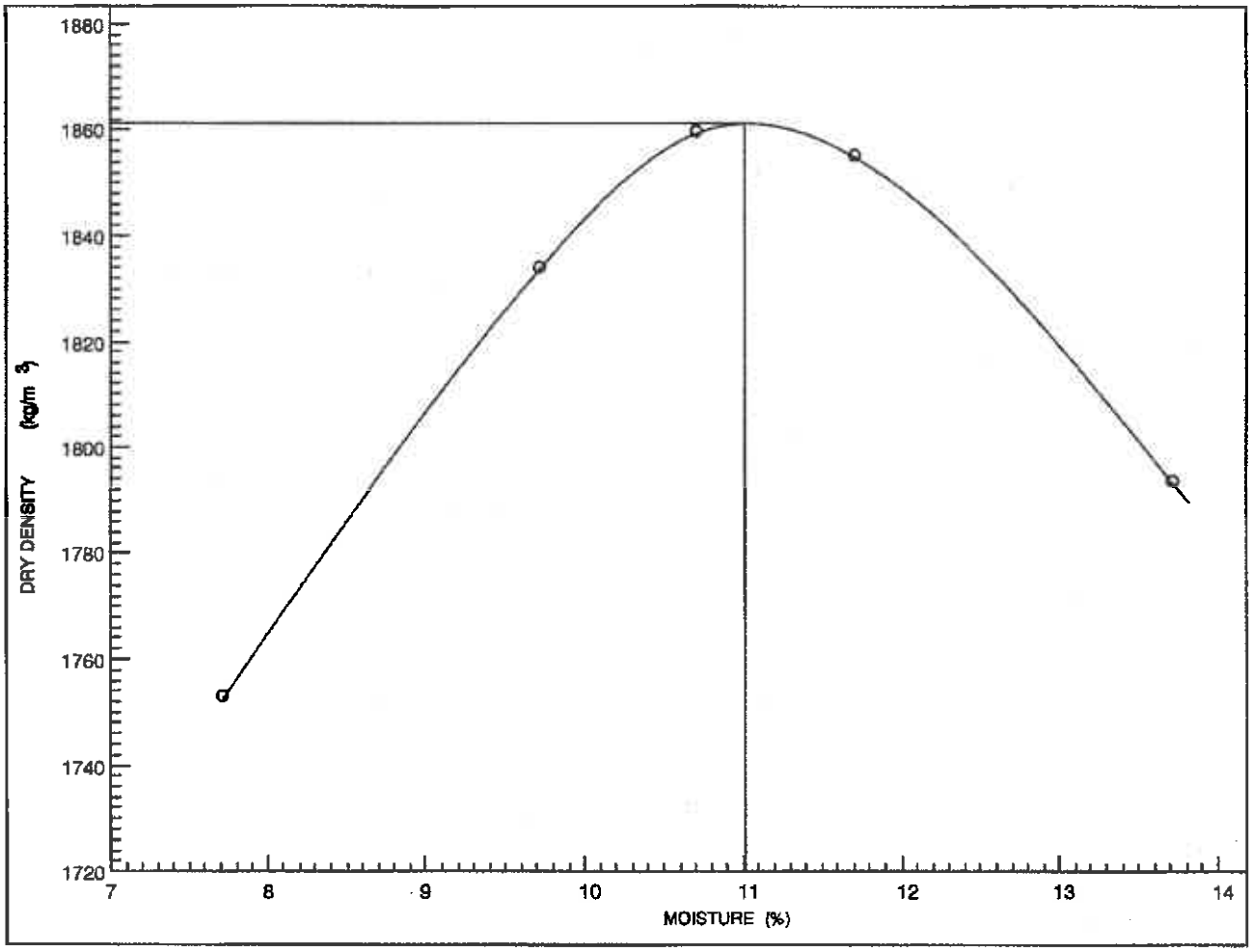
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8516	Hole No. : TP1A	Depth (mm) : 35-200
Origin : CH18+900LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Light Grey+Yellow Weathered Sandstone		

Maximum Dry Density (kg/m^3) : 1861
Optimum Moisture Content (%) : 11.0

Point No.	1	2	3	4	5			
Moisture (%)	7.7	9.7	10.7	11.7	13.7			
Density (kg/m^3)	1753	1834	1859	1855	1793			



Remarks :

FORM: A7 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

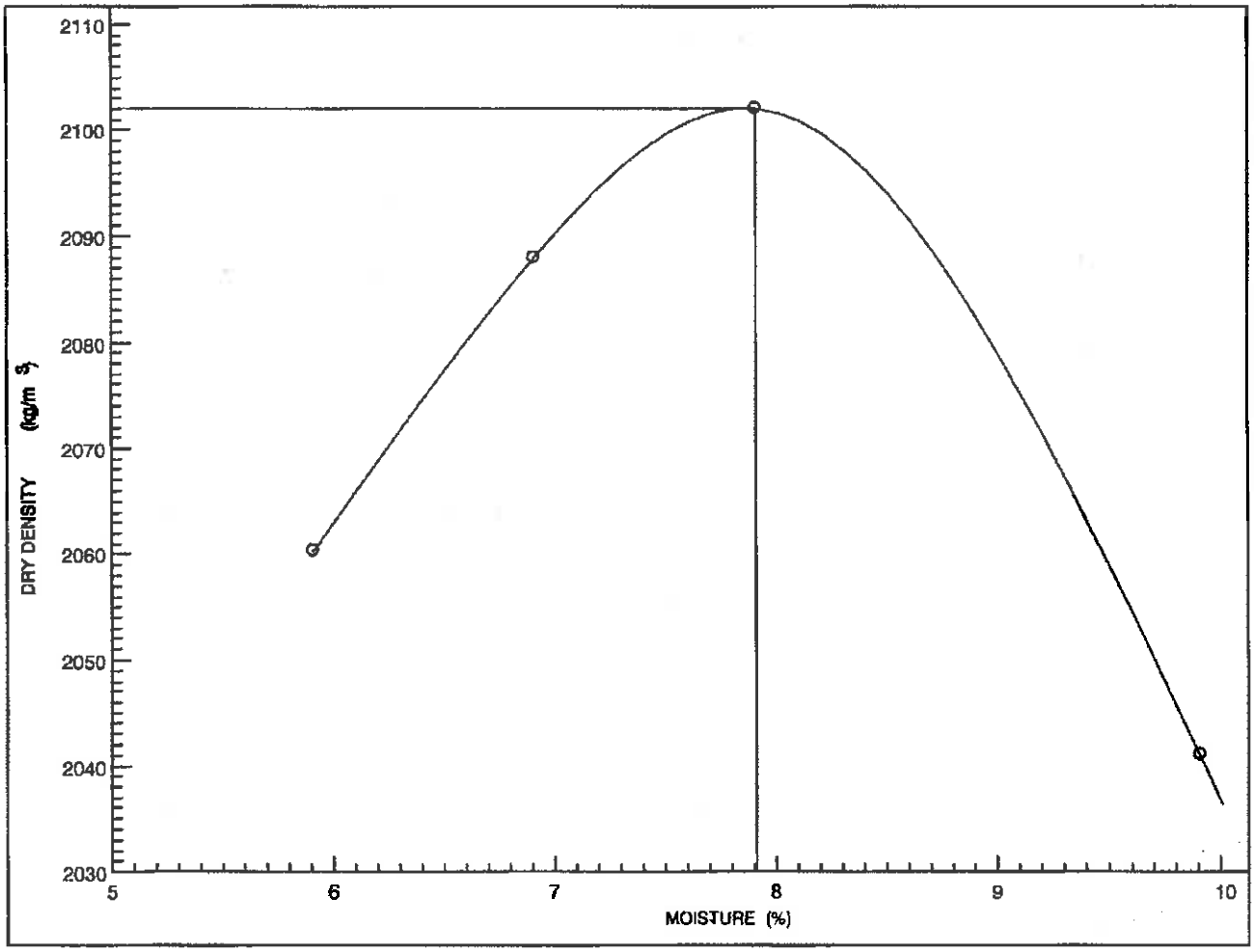
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101693
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8517	Hole No. : TP1B	Depth (mm) : 200-320
Origin : CH18+900LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Pale Red+Orange Fine Sand+Weathered Sandstone		

Maximum Dry Density (kg/m^3) : 2102
Optimum Moisture Content (%) : 7.9

Point No.	1	2	3	4				
Moisture (%)	5.9	6.9	7.9	9.9				
Density (kg/m^3)	2060	2088	2102	2041				



Remarks :

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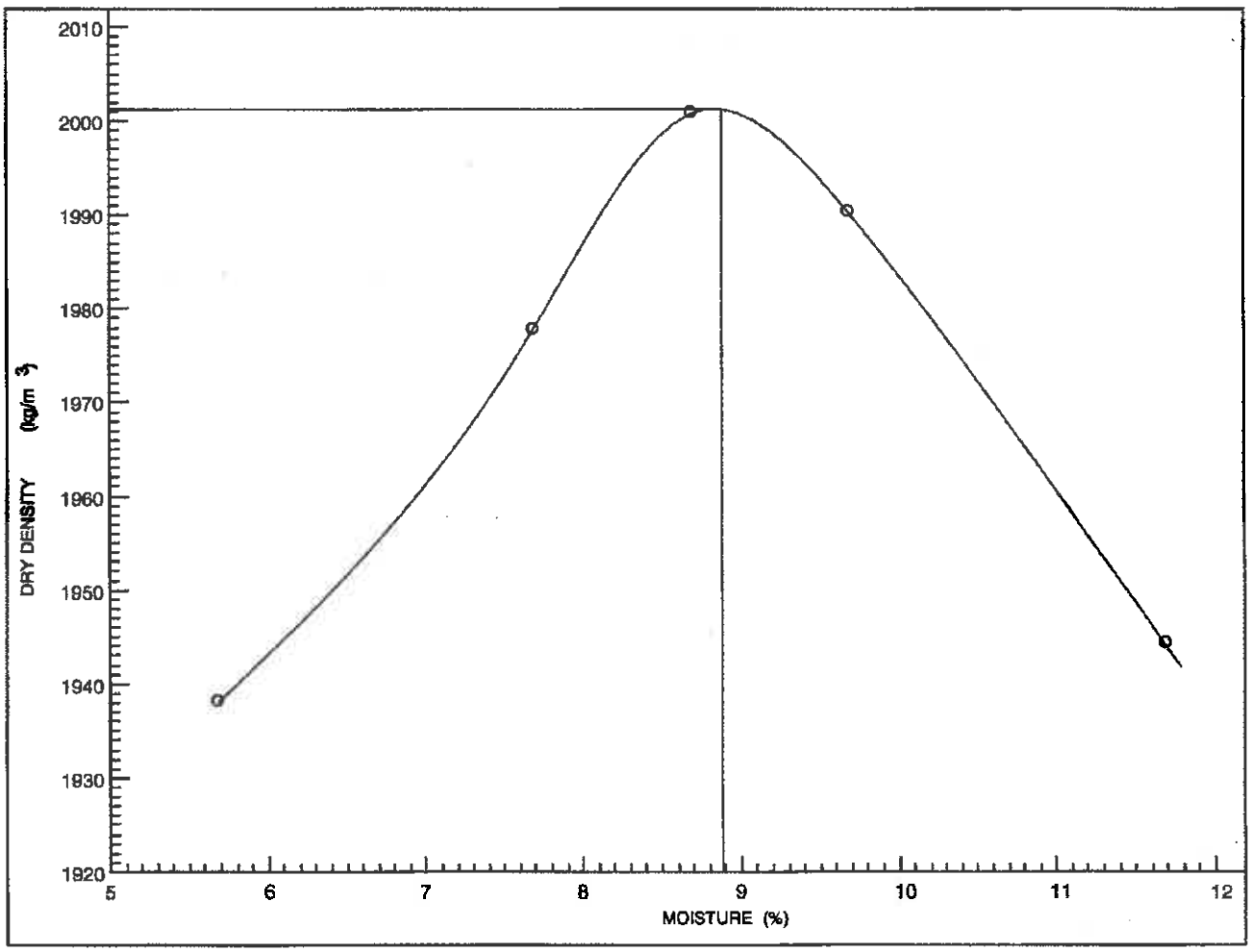
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8518	Hole No. : TP1C	Depth (mm) : 320-660
Origin : CH18+900LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Or Br+Dk Gr Fine Sand+H/W Sandstone		

Maximum Dry Density (kg/m^3) : 2001
Optimum Moisture Content (%) : 8.9

Point No.	1	2	3	4	5			
Moisture (%)	5.7	7.7	8.7	9.7	11.7			
Density (kg/m^3)	1938	1978	2001	1990	1944			



Remarks :

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Our Ref : 101893
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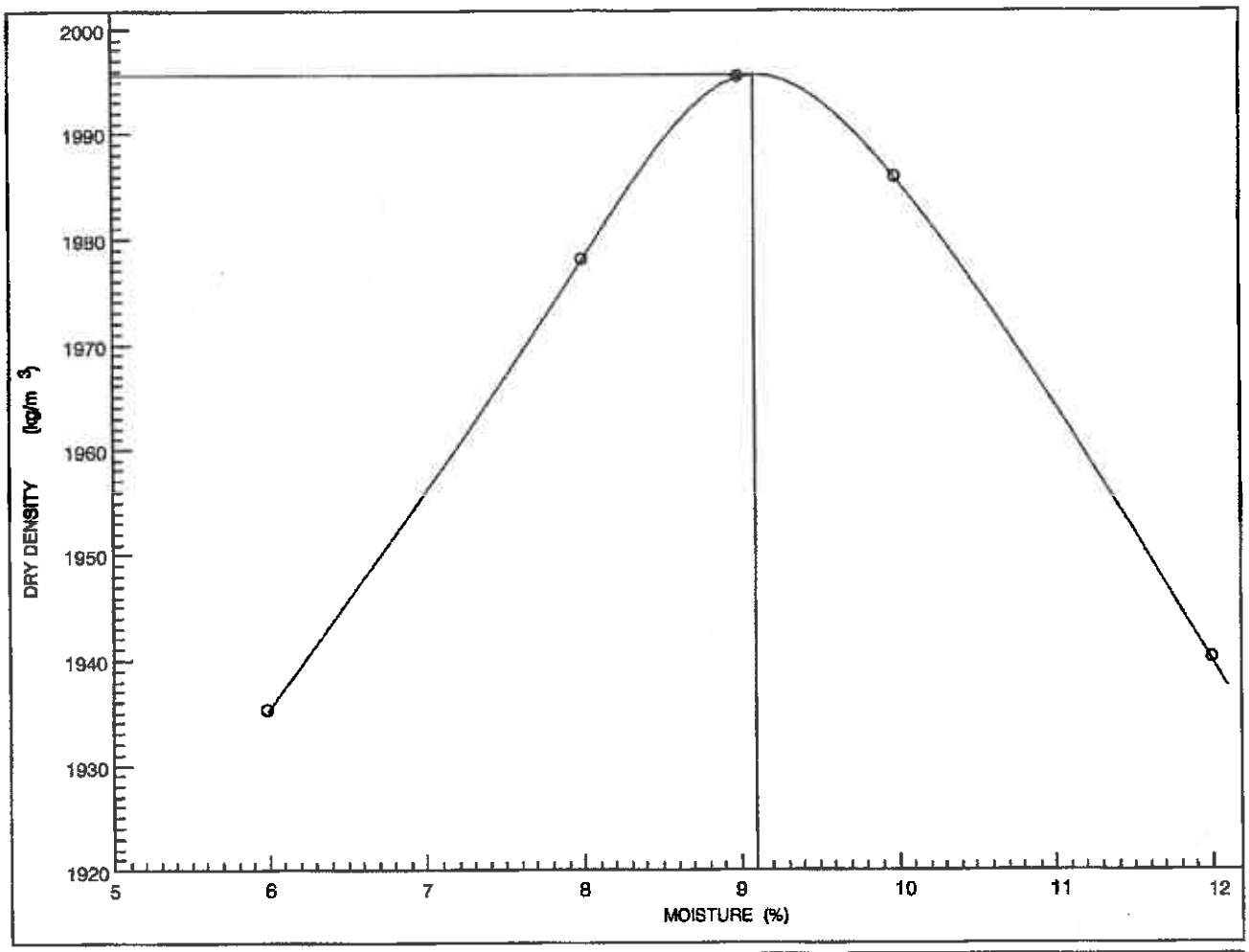
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8519	Hole No. : TP1D	Depth (mm) : 660-800
Origin : CH18+900LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Yel Br+Or+Lt Gr Fine Sand+H/W Sandstone		

Maximum Dry Density (kg/m^3) : 1996
Optimum Moisture Content (%) : 9.1

Point No.	1	2	3	4	5			
Moisture (%)	6.0	8.0	9.0	10.0	12.0			
Density (kg/m^3)	1935	1978	1995	1986	1940			



Remarks :

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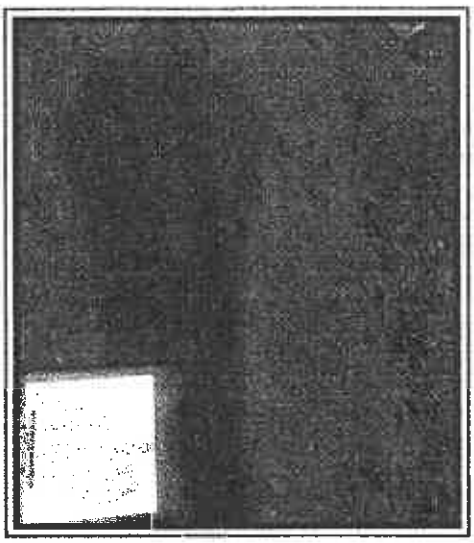
Tel: 031 - 579 1220
Fax: 031 - 579 1344

CLIENT	ROYAL HASKONING DHV
ATTENTION	MR. HEIN ARNOLD

PROJECT	P50 - 1
JOB REFERENCE	101893
DATE	23 / 03 / 2015

TEST PIT PROFILE REPORT



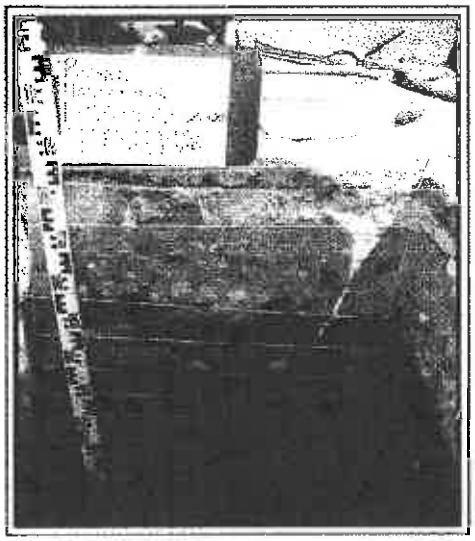
TEST PIT	
2	

PROFILED BY
MR. R. RAMDEEN

GPS CO-ORDINATES	
S	28° 51'29,6"
E	31° 19'18,7"
Lo 31, WGS 84	

CHAINAGE
20+200 LHS LWP

EXCAVATION BY
HAND



Water Table	Soil Legend	Depth (mm)	SOIL DESCRIPTION Moisture, Colour, Consistency, Structure, Soil Type, Origin, General	SAMPLING TYPE AND NUMBER
		0	ASPHALT- Crocodile cracking on surface,patching,potholing, Double seal,semi-gaped graded,semi-porous,fresh,bonding, rutting=10mm	
		30	Slightly moist,light grey yellow+light grey,strongly cemented,uniform,weathered SANDSTONE,Base,Imported Moisture:3.8%	2A (PHEN+) (HCL+)
		110	Slightly moist,light yellow brown+light grey+spotted orange, Medium dense,uniform,weathered SANDSTONE,Sub base, Imported Moisture:5.3%	2B (PHEN-) (HCL-)
		300	Slightly moist,pale red,medium dense,uniform,highly weathered SANDSTONE,selected, Imported Moisture:6.8%	2C (PHEN-) (HCL-)
		400	Slightly moist,dark orange brown+pale red,medium dense, Uniform,highly weathered SANDSTONE,selected,imported Moisture:5.8%	2D (PHEN-) (HCL-)
		500	Slightly moist,dark grey brown+orange,medium dense,uniform, slightly CLAYEY SAND+weathered SANDSTONE,Insitu Moisture:7.9%	2E (PHEN-) (HCL-)
		580	Slightly moist,dark orange+spotted yellow,medium dense, uniform,CLAYEY SAND,insitu Moisture:7.6%	2F (PHEN-) (HCL-)
		630	Slightly moist,dark grey brown + orange,medium dense, Uniform,slightly CLAYEY SAND+weathered SANDSTONE, Insitu Moisture:6.9%	2G (PHEN-) (HCL-)
		800		

REMARKS	

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TEST RESULTS

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PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/B
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8520	E8521	E8522	
HOLE NO.	TP2A	TP2B	TP2C	
ROAD NO.	LWP	LWP	LWP	
DEPTH (mm)	30-110	110-300	300-400	
CHAINAGE	CH20+200 LHS	CH20+200 LHS	CH20+200 LHS	
LAYER TYPE				
STABILISED WITH	Natural	Natural	Natural	
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Gr Yel+Lt Gr W/Sandstone	Lt Yel Br+Lt Gr+Or W/Sandstone	Pale Rd H/W Sandstone	
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm	100			
37.5 mm	78	100		
26.5 mm	69	90		
19.0 mm	64	84	100	
13.2 mm	59	83	99	
4.75 mm	50	72	98	
2.0 mm	46	66	96	
0.425 mm	36	50	68	
0.075 mm	14	14	23	
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	22	24	29	
FINE SAND <0.425mm >0.075mm	48	55	47	
MATERIAL <0.075mm	30	21	24	
CONSTANTS				
GRADING MODULUS	2.04	1.70	1.13	
PRA CLASSIFICATION	A-1-b(0)	A-1-b(0)	A-2-4(0)	
COLTO CLASSIFICATION	G6	G8	---	
TRH CLASSIFICATION	G6	-	-	
TRH Class.(INSITU |93%|90%|)	- | -	G8|G9	- | -	
LIQUID LIMIT (%)	21	19	5	
PLASTICITY INDEX (0.425mm)	SP	SP	8	
LINEAR SHRINKAGE (%)	1.0	0.5	4.0	
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	2016	2127	1980	
OPTIMUM MOISTURE CONTENT (%)	9.3	7.2	8.8	
MOULDING MOISTURE (%)	9.6	7.2	9.1	
TYPE OF TEST	CBR	CBR	CBR	
CBR-UCS @ 100% MOD AASHTO	49	25	6.2	
CBR-UCS @ 98% MOD AASHTO	42	19	5.1	
CBR-UCS @ 97% MOD AASHTO	39	17	4.7	
CBR-UCS @ 95% MOD AASHTO	33	13	4.0	
CBR-UCS @ 93% MOD AASHTO	25	10	3.8	
CBR-UCS @ 90% MOD AASHTO	16	7.0	3.4	

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.00	0.02	0.02	0.26	0.26	0.41	2.72	2.76	2.91			

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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Our Ref : 101893/C
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SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8523	E8524		
HOLE NO.	TP2 D,E,F	TP2 G		
ROAD NO.	LWP	LWP		
DEPTH (mm)	400-630	630-800		
CHAINAGE	CH20+200 LHS	CH20+200 LHS		
LAYER TYPE				
STABILISED WITH	Natural	Natural		
SUPPLIER				
CURING METHOD				
DESCRIPTION	Refer To Profile	Dk Gr Br+Or Cl W/S/Stone		
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm				
37.5 mm				
26.5 mm				
19.0 mm	100			
13.2 mm	99	100		
4.75 mm	98	100		
2.0 mm	94	96		
0.425 mm	72	71		
0.075 mm	27	27		
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	23	26		
FINE SAND <0.425mm >0.075mm	48	46		
MATERIAL <0.075mm	29	28		
CONSTANTS				
GRADING MODULUS	1.07	1.06		
PRA CLASSIFICATION	A-2-4(0)	A-2-5(0)		
COLTO CLASSIFICATION	G8	G7		
TRH CLASSIFICATION	-	G7		
TRH Class.(INSITU |93%|90%|)	G8|G8	- | -		
LIQUID LIMIT (%)	30	42		
PLASTICITY INDEX (0.425mm)	SP	SP		
LINEAR SHRINKAGE (%)	0.5	1.0		
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	1876	1718		
OPTIMUM MOISTURE CONTENT (%)	11.3	13.5		
MOULDING MOISTURE (%)	11.6	13.8		
TYPE OF TEST	CBR	CBR		
CBR-UCS @ 100% MOD AASHTO	20	24		
CBR-UCS @ 98% MOD AASHTO	17	22		
CBR-UCS @ 97% MOD AASHTO	16	20		
CBR-UCS @ 95% MOD AASHTO	14	18		
CBR-UCS @ 93% MOD AASHTO	13	16		
CBR-UCS @ 90% MOD AASHTO	10	13		

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.31	0.40	0.43	0.16	0.17	0.18						

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010)

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TEST RESULTS

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P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/B
Date Reported : 24.04.2015

IN-SITU DRY DENSITY REPORT (TMH1 A10(b))

Section	: P50-1	Tested By	: Mr R Ramdeen	Date Tested	: 23.03.2015
Layer Type	: See Test Positions	Compaction Energy	: MOD AASHTO		

Position	Depth (mm)	Material Description	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	In-Situ Dry Density (kg/m^3)	Moisture Content (%)	Relative Compaction (%)
2A	30-130	Gr Yel + Gr W/Sandstone	2016	9.3	1891	5.3	93.8
2B	110-210	Yel Br+Or W/Sandstone	2127	7.2	1893	10.0	89.0
2C	300-400	Rd W/Sandstone	1980	8.8	1866	12.0	94.2
2D	400-500	Refer to Profile	1876	11.3	1790	13.3	95.4
2E	500-550	Refer to Profile	1876	11.3	1792	14.3	95.5
2F	580-630	Refer to Profile	1876	11.3	1760	15.0	93.8
2G	630-730	Gr Br Or C/Sand+W/S/Stone	1718	13.5	1762	15.3	102.6

Tests done by means of Nuclear method.

Test Positions

Layer Type:

2A-Base
2B-Subbase
2C-Selected
2D-Selected
2E-Insitu
2F-Insitu
2G-Insitu

Note:
2D,2E,2F - Combined Together For Testing

Deviation from test method
1. Dry Density reported to 1 kg/m^3
2. Nuclear Gauge calibrated annually.

Remarks :

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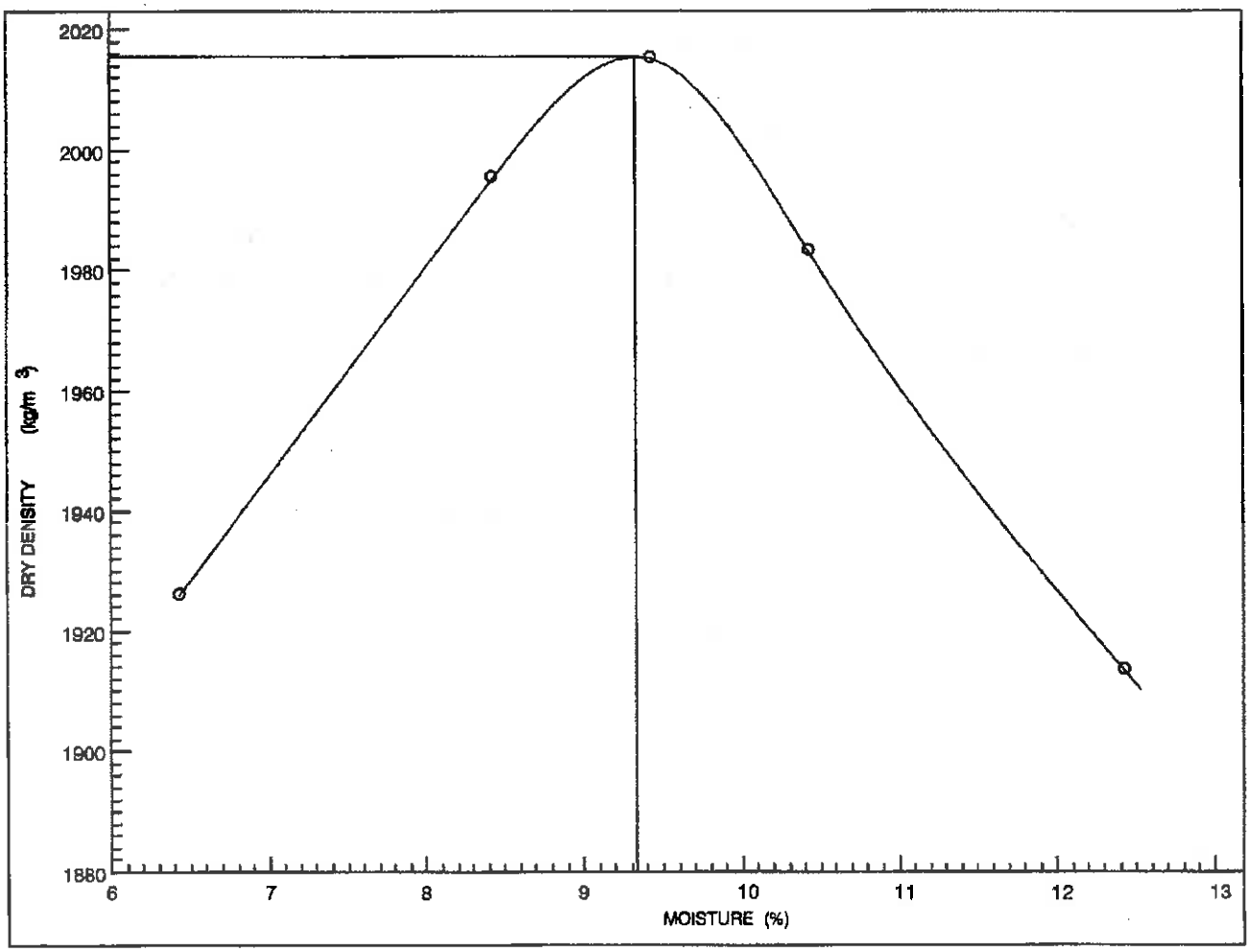
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8520	Hole No. : TP2A	Depth (mm) : 30-110
Origin : CH20+200LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Gr Yel+Lt Gr W/ Sandstone		

Maximum Dry Density (kg/m^3) : 2016
Optimum Moisture Content (%) : 9.3

Point No.	1	2	3	4	5			
Moisture (%)	6.4	8.4	9.4	10.4	12.4			
Density (kg/m^3)	1926	1995	2015	1983	1913			



Remarks :

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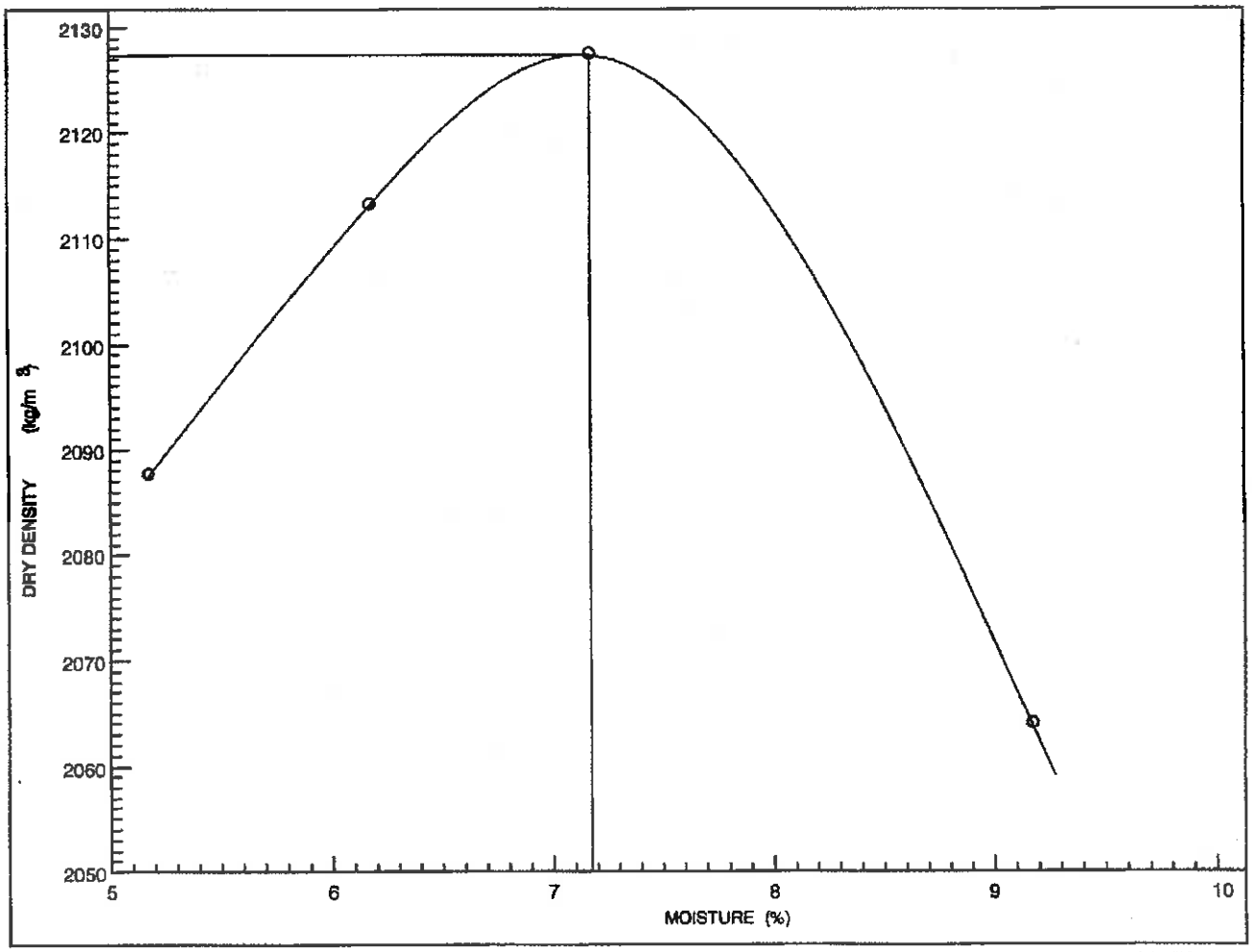
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8521	Hole No. : TP2B	Depth (mm) : 110-300
Origin : CH20+200LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Yel Br+Lt Gr+Or W/ Sandstone		

Maximum Dry Density (kg/m^3) : 2127
Optimum Moisture Content (%) : 7.2

Point No.	1	2	3	4				
Moisture (%)	5.2	6.2	7.2	9.2				
Density (kg/m^3)	2088	2113	2127	2064				



Remarks :

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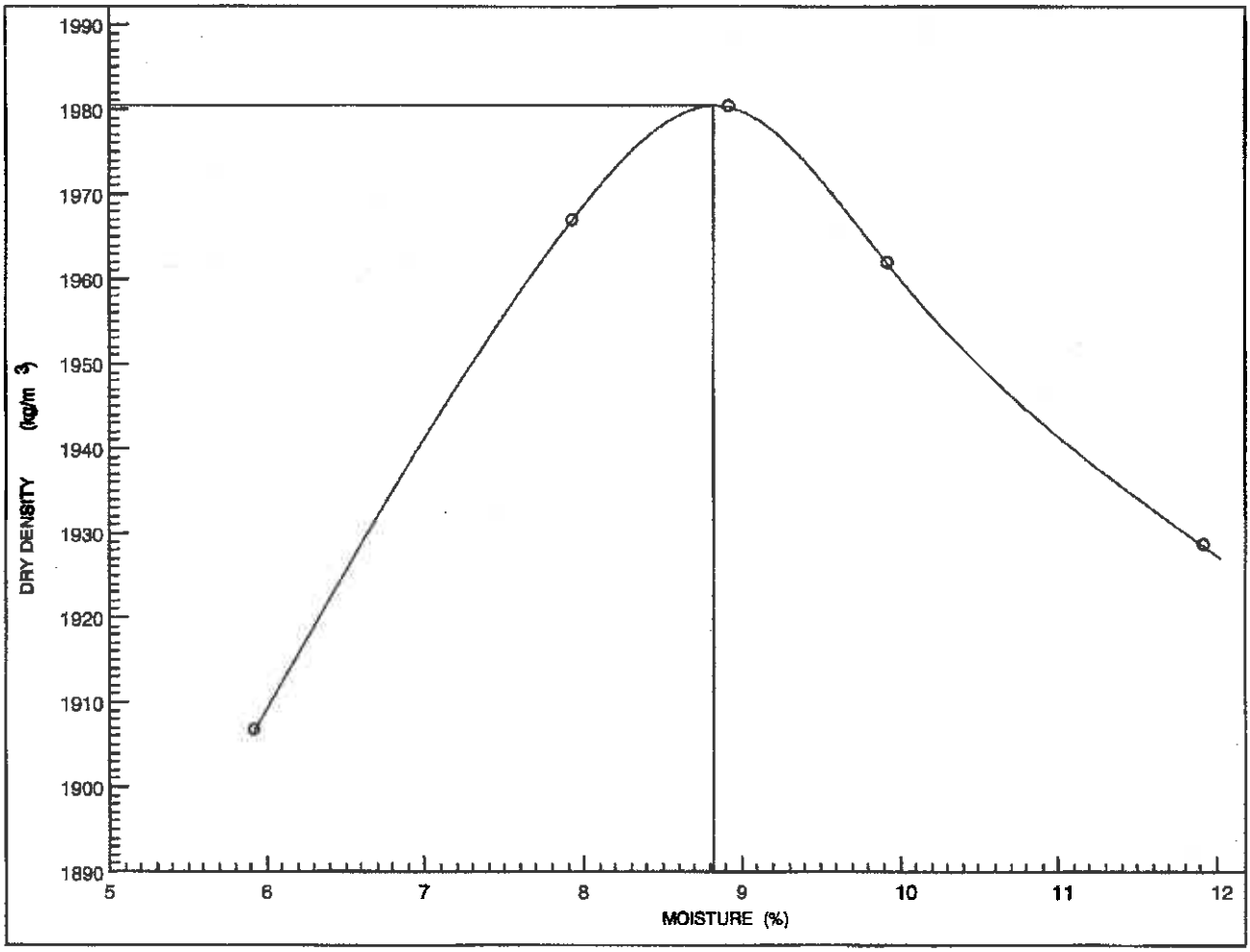
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8522	Hole No. : TP2C	Depth (mm) : 300-400
Origin : CH20+200LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Pale Rd H/ W Sandstone		

Maximum Dry Density (kg/m^3) : 1980
Optimum Moisture Content (%) : 8.8

Point No.	1	2	3	4	5			
Moisture (%)	5.9	7.9	8.9	9.9	11.9			
Density (kg/m^3)	1907	1967	1980	1962	1928			



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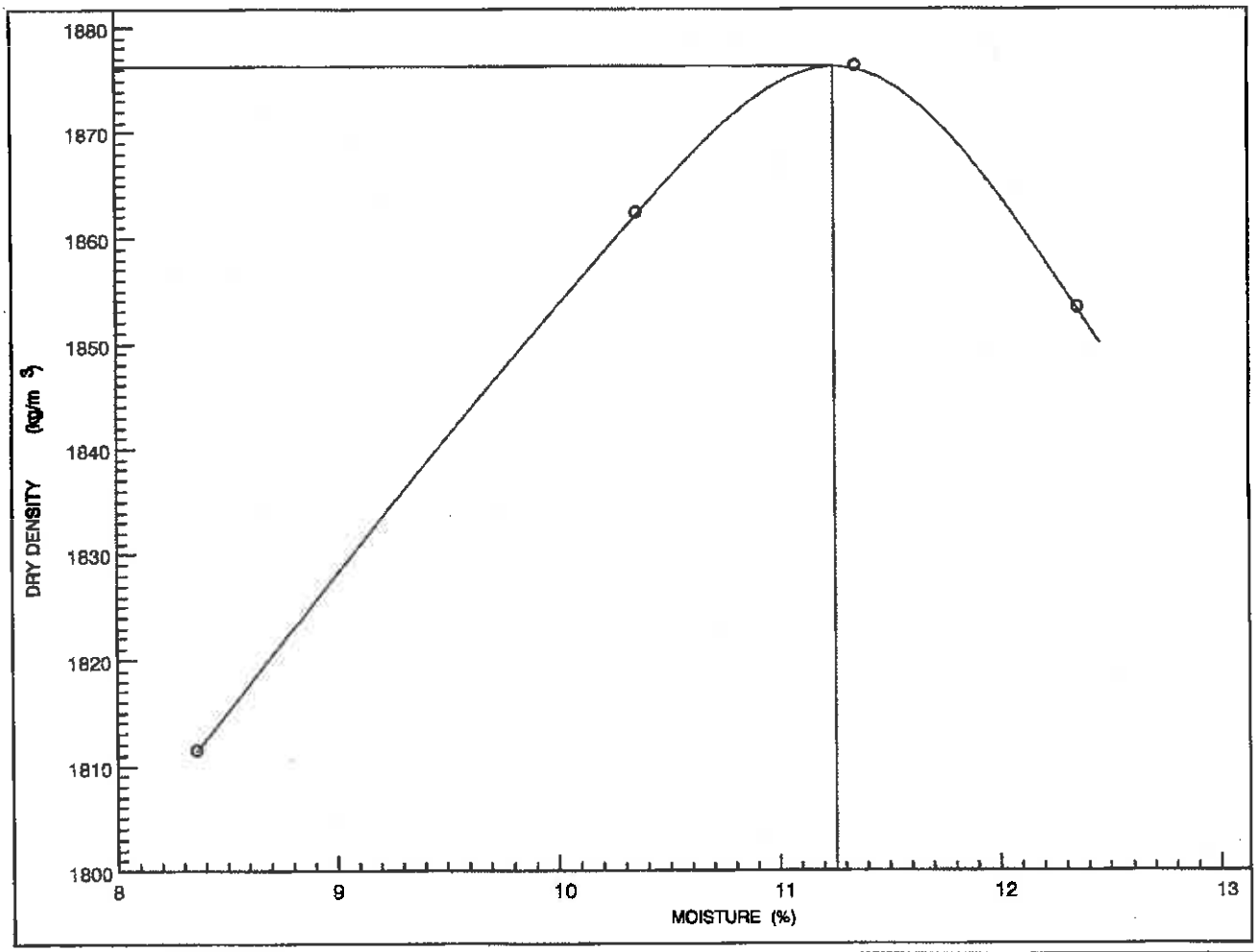
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8523	Hole No. : TP2D,E,F	Depth (mm) : 400-630
Origin : CH18+900LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Refer To Profile		

Maximum Dry Density (kg/m^3) : 1876
Optimum Moisture Content (%) : 11.3

Point No.	1	2	3	4				
Moisture (%)	8.4	10.4	11.4	12.4				
Density (kg/m^3)	1811	1862	1876	1853				



Remarks :

FORM: A7 Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalis Bhikam

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P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

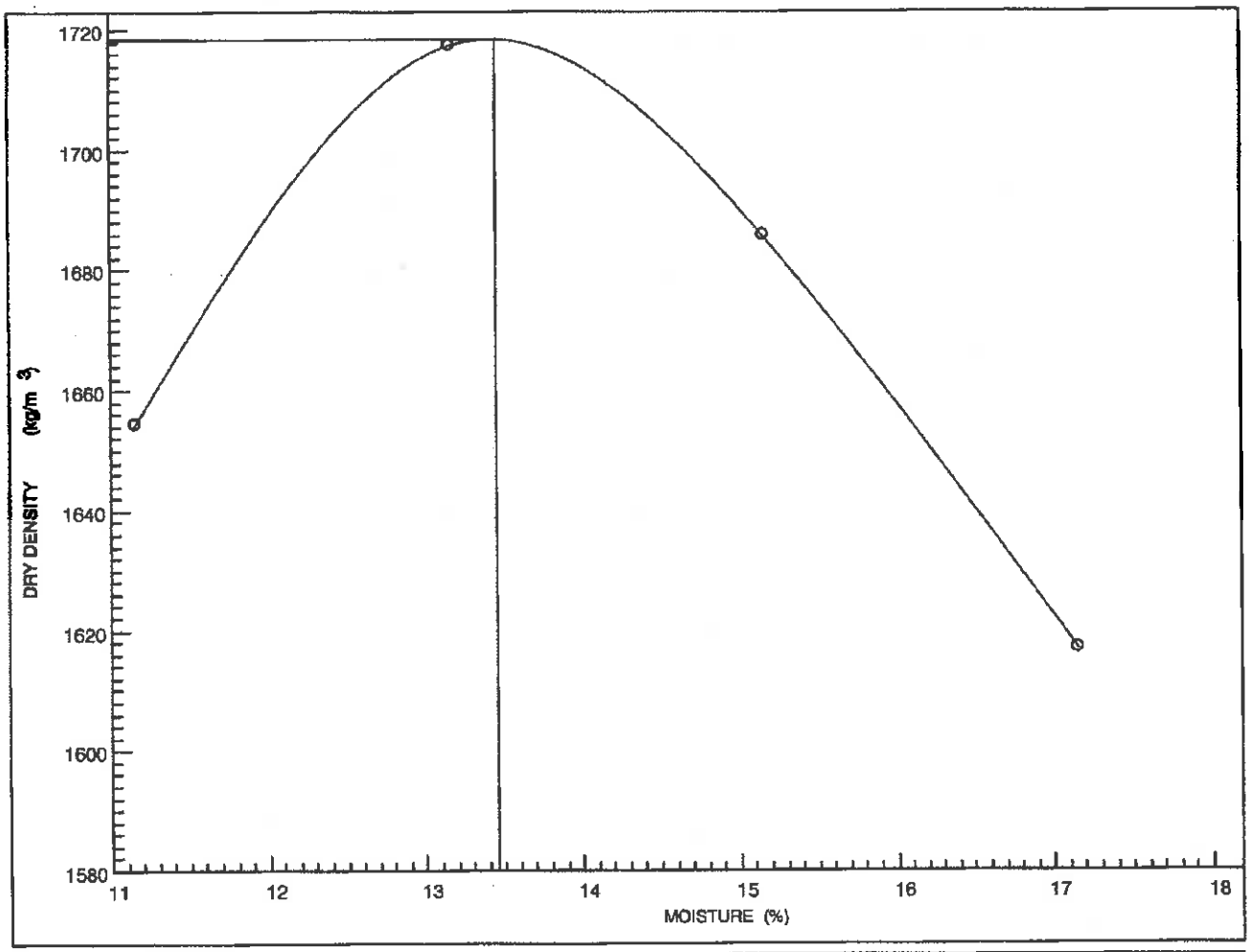
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8524	Hole No. : TP2G	Depth (mm) : 630-800
Origin : CH20+200LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Gr Br+Or S/Clayey Sand+W/ Sandstone		

Maximum Dry Density (kg/m^3) : 1718
Optimum Moisture Content (%) : 13.5

Point No.	1	2	3	4				
Moisture (%)	11.2	13.2	15.2	17.2				
Density (kg/m^3)	1654	1717	1686	1617				



Remarks :

FORM: A7 Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalis Bhikam

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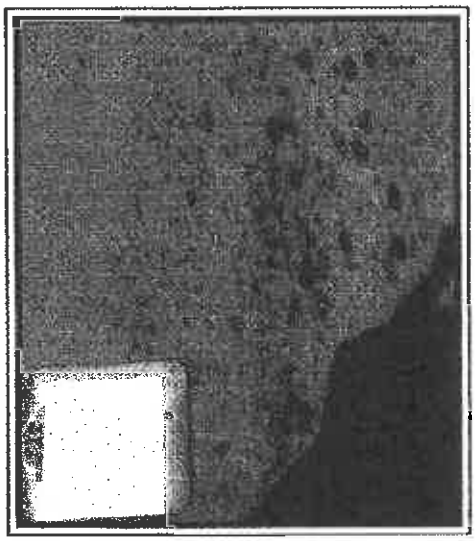
Unit 7, Pennylane Park, 84 Ebonyfield Avenue, Springfield Park
P O Box 74663, Rochdale Park, 4034
Tel: 031 - 579 1220
Fax: 031 - 579 1344

CLIENT	ROYAL HASKONING DHV
ATTENTION	MR. HEIN ARNOLD

PROJECT	P50 - 1
JOB REFERENCE	101893
DATE	23 / 03 / 2015

TEST PIT PROFILE REPORT



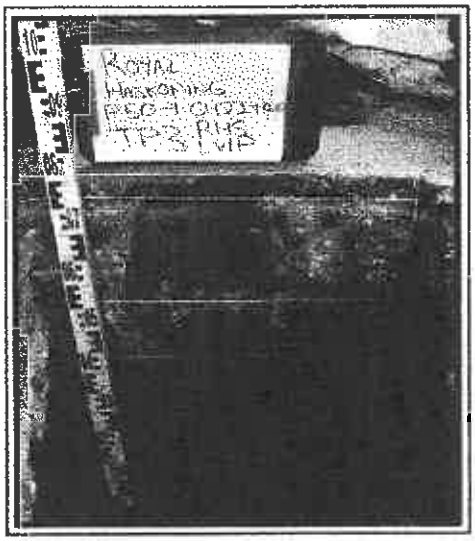
TEST PIT	
3	

PROFILED BY	
MR. R. RAMDEEN	

GPS CO-ORDINATES	
S	28° 51' 52,4"
E	31° 18' 18,4"
Lo 31, WGS 84	

CHAINAGE
22+020 RHS LWP

EXCAVATION BY
HAND



Water Table	Soil Legend	Depth (mm)	SOIL DESCRIPTION Moisture, Colour, Consistency, Structure, Soil Type, Origin, General	SAMPLING TYPE AND NUMBER
		0	ASPHALT- Crocodile cracking,patches and potholing,double seal,semi-porous,semi-gaped graded,fresh,bonded,rutting=0	
		35	Slightly moist,light yellow brown +light grey,medium dense, uniform,weathered SANDSTONE,base,imported Moisture:4.8%	3A (PHEN-) (HCL-)
		250	Slightly moist,dark yellow brown+orange,medium dense,uniform weathered SANDSTONE.sub base , imported Moisture:5.5%	3B (PHEN-) (HCL-)
		380	Slightly moist,dark brown,medium dense,uniform,SAND, insitu Moisture:7.9%	3C (PHEN-) (HCL-)
		800		

REMARKS	

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Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/D
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8525	E8526	E8527	
HOLE NO.	TP3A	TP3B	TP3C	
ROAD NO.	LWP	LWP	LWP	
DEPTH (mm)	35-250	250-380	380-800	
CHAINAGE	CH22+020 RHS	CH22+020 RHS	CH22+020 RHS	
LAYER TYPE				
STABILISED WITH	Natural	Natural	Natural	
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Yel Br+Lt Gr W/Sandstone	Dk Yel Br+Or W/Sandstone	Dk Br Sand	
SIEVE ANALYSIS (% PASSING)				
75 mm		100		
63 mm		73		
53 mm		58		
37.5 mm	100	58		
26.5 mm	93	55		
19.0 mm	93	55		
13.2 mm	91	53	100	
4.75 mm	82	51	99	
2.0 mm	72	48	97	
0.425 mm	54	39	80	
0.075 mm	23	12	21	
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	25	19	18	
FINE SAND <0.425mm >0.075mm	43	56	61	
MATERIAL <0.075mm	32	25	21	
CONSTANTS				
GRADING MODULUS	1.51	2.01	1.02	
PRA CLASSIFICATION	A-2-4(0)	A-1-b(0)	A-2-4(0)	
COLTO CLASSIFICATION	G6	G8	G8	
TRH CLASSIFICATION	G7	-	-	
TRH Class.(INSITU |93%|90%|)	- | -	G8|G10	G8|G8	
LIQUID LIMIT (%)	26	-	-	
PLASTICITY INDEX (0.425mm)	SP	NP	NP	
LINEAR SHRINKAGE (%)	0.5	0.0	0.0	
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	2140	2070	1742	
OPTIMUM MOISTURE CONTENT (%)	7.0	7.3	11.8	
MOULDING MOISTURE (%)	7.2	7.3	12.1	
TYPE OF TEST	CBR	CBR	CBR	
CBR-UCS @ 100% MOD AASHTO	47	36	24	
CBR-UCS @ 98% MOD AASHTO	38	29	21	
CBR-UCS @ 97% MOD AASHTO	35	27	20	
CBR-UCS @ 95% MOD AASHTO	27	22	17	
CBR-UCS @ 93% MOD AASHTO	22	12	14	
CBR-UCS @ 90% MOD AASHTO	15	3.7	10	

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.22	0.28	0.28	0.67	0.80	0.83	0.47	0.47	1.07		

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/C
Date Reported : 24.04.2015

IN-SITU DRY DENSITY REPORT (TMH1 A10(b))

Section	: P50-1	Tested By	: Mr R Ramdeen	Date Tested	: 23.03.2015
Layer Type	: See Test Positions	Compaction Energy	: MOD AASHTO		

Position	Depth (mm)	Material Description	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	In-Situ Dry Density (kg/m^3)	Moisture Content (%)	Relative Compaction (%)
3A	35-135	Yel Br+Gr W/S/Stone	2140	7.0	1889	8.8	88.3
3B	250-350	Yel Br+Or W/S/Stone	2070	7.3	1781	10.7	86.0
3C	380-480	Dk Br Sand	1742	11.8	1664	12.2	95.5

Tests done by means of Nuclear method.

Test Positions

Layer Type:

3A-Base
3B-Subbase
3C-Insitu

Deviation from test method
1. Dry Density reported to 1 kg/m^3
2. Nuclear Gauge calibrated annually.

Remarks :

FORM: A10(b) Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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Fax : 031-5791344
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TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

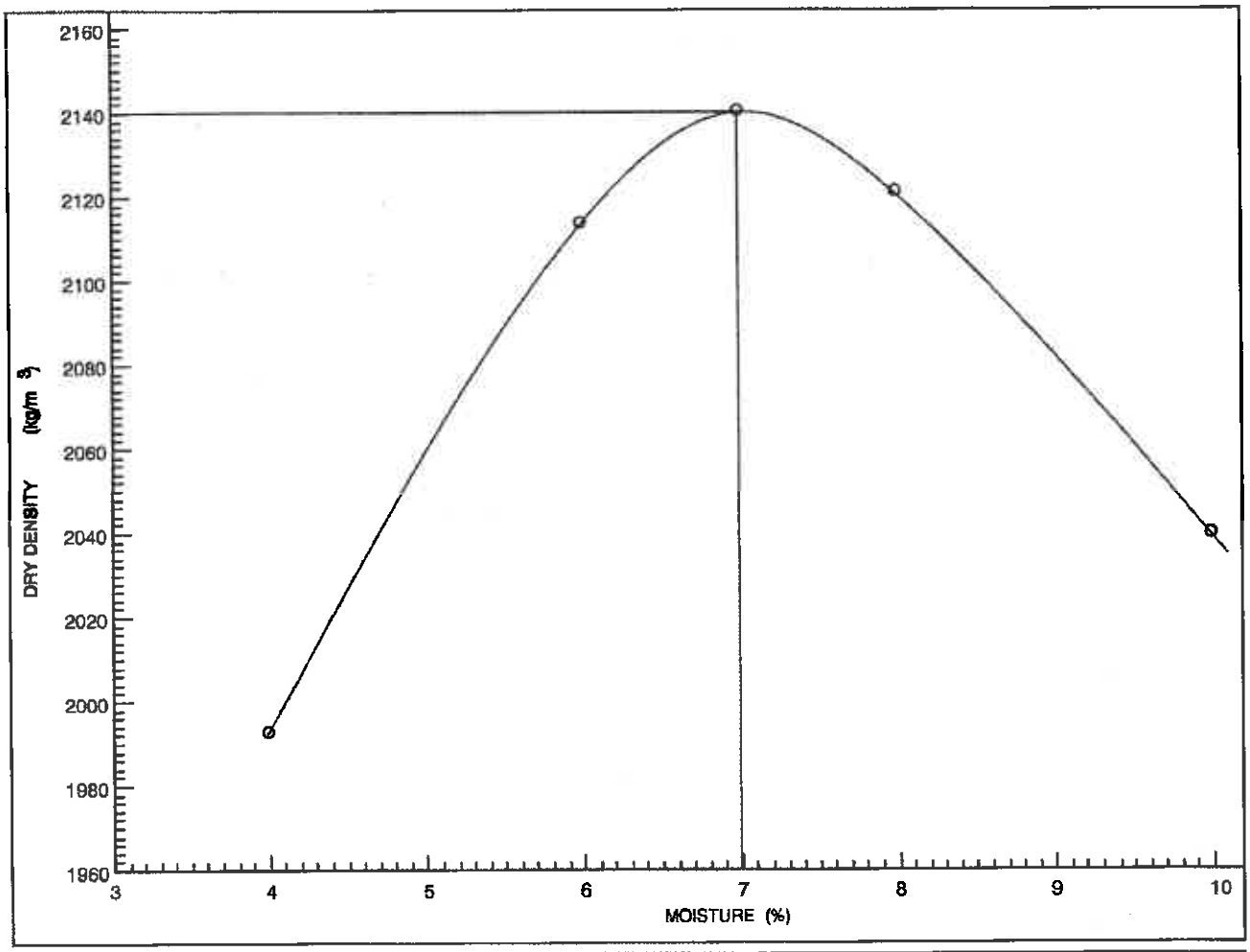
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8525	Hole No. : TP3A	Depth (mm) : 35-250
Origin : CH22+020RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Yel Br+Lt Gr W/Sandstone		

Maximum Dry Density (kg/m^3) : 2140
Optimum Moisture Content (%) : 7.0

Point No.	1	2	3	4	5			
Moisture (%)	4.0	6.0	7.0	8.0	10.0			
Density (kg/m^3)	1992	2114	2140	2121	2039			



Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

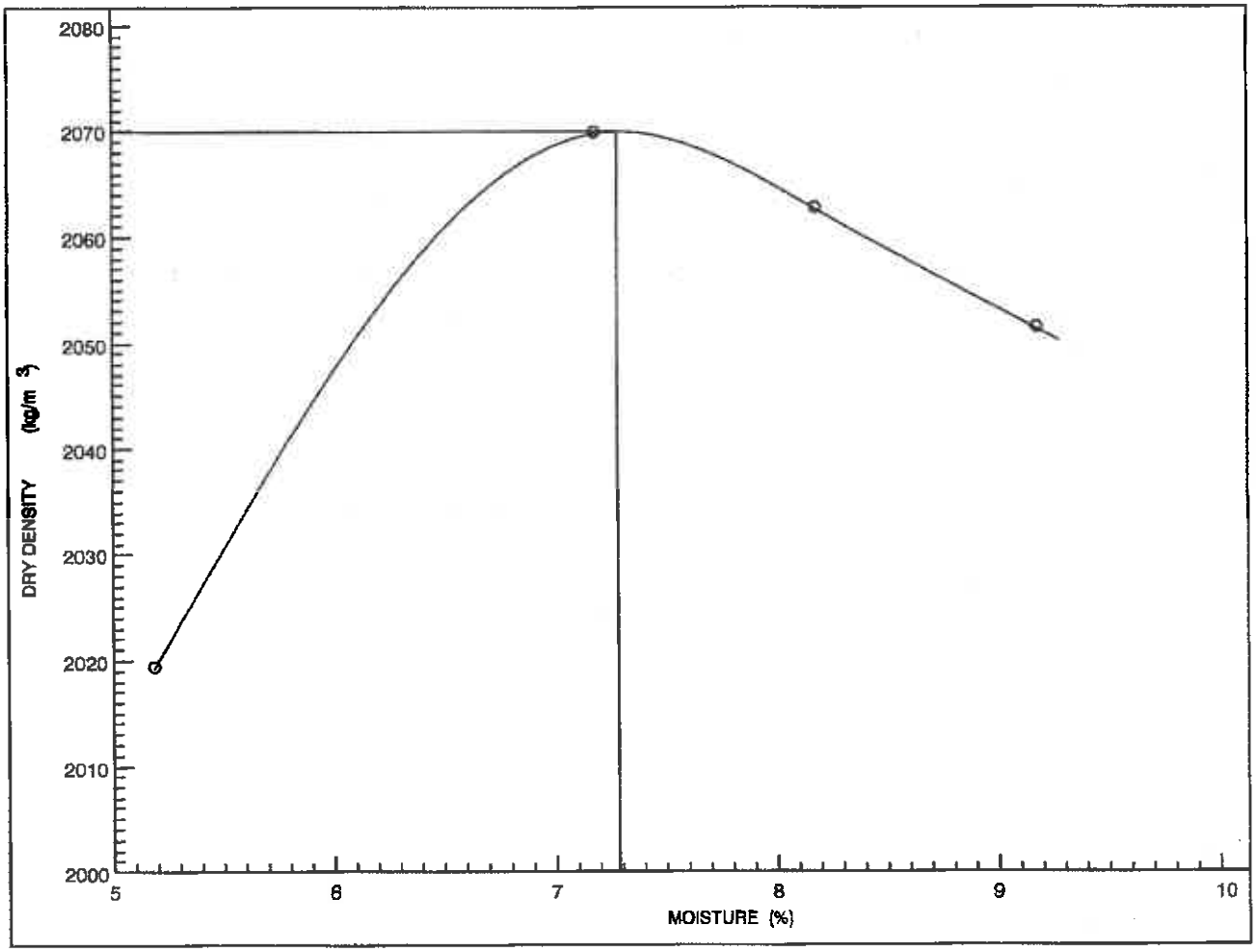
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8526	Hole No. : TP3B	Depth (mm) : 250-380
Origin : CH22+020RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Yel Br + Or W/ Sandstone		

Maximum Dry Density (kg/m^3) : 2070
Optimum Moisture Content (%) : 7.3

Point No.	1	2	3	4				
Moisture (%)	5.2	7.2	8.2	9.2				
Density (kg/m^3)	2019	2070	2063	2051				



Remarks :

FORM: A7 Program ver 3.3(26.01.2010)

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Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

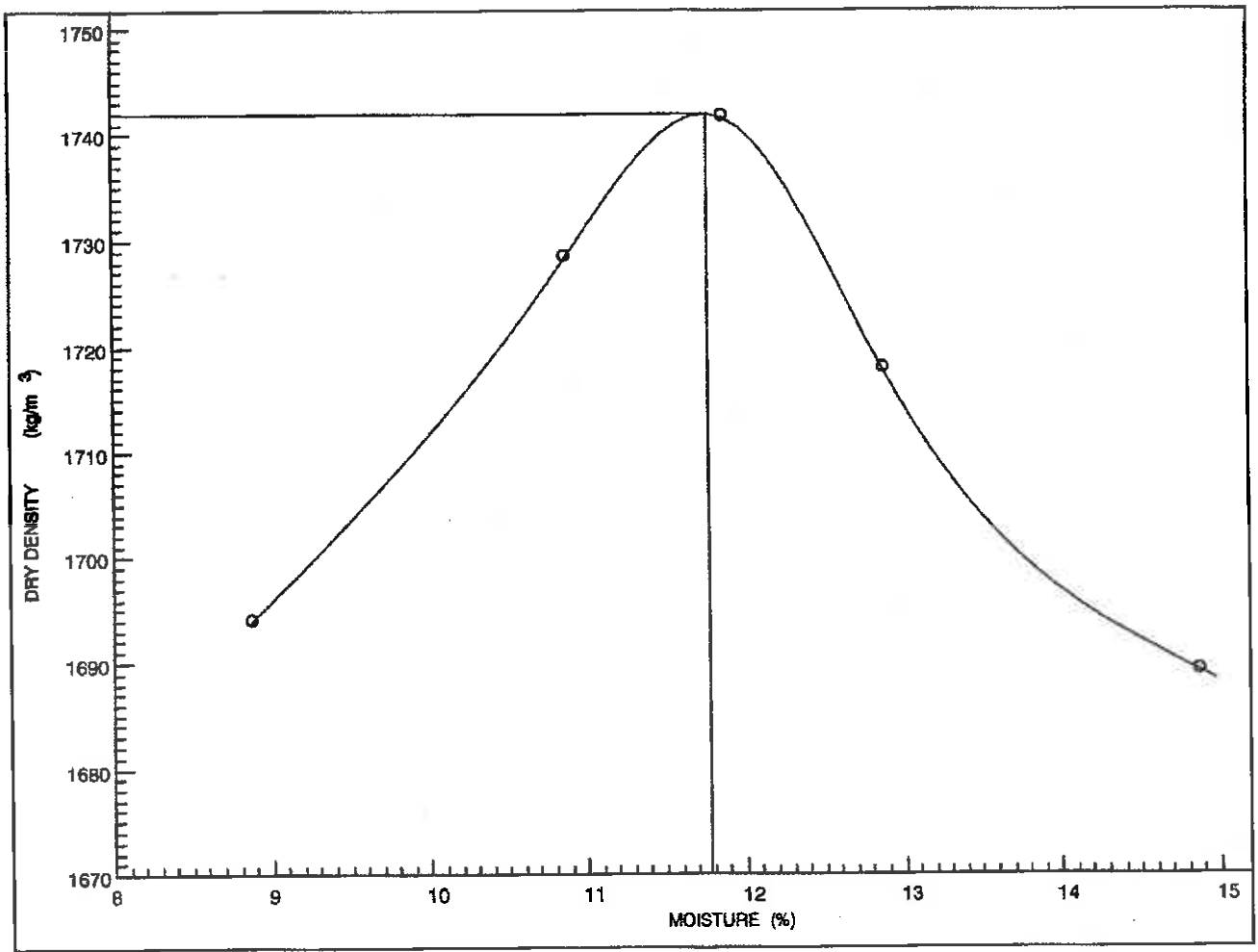
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8527	Hole No. : TP3C	Depth (mm) : 380-800
Origin : CH22+020RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Br Sand		

Maximum Dry Density (kg/m^3) : 1742
Optimum Moisture Content (%) : 11.8

Point No.	1	2	3	4	5			
Moisture (%)	8.9	10.9	11.9	12.9	14.9			
Density (kg/m^3)	1694	1728	1742	1718	1689			



Remarks :

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Technical Signatory : Lawrence Govender/Rasalis Bhikam

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CIVIL ENGINEERING SERVICES

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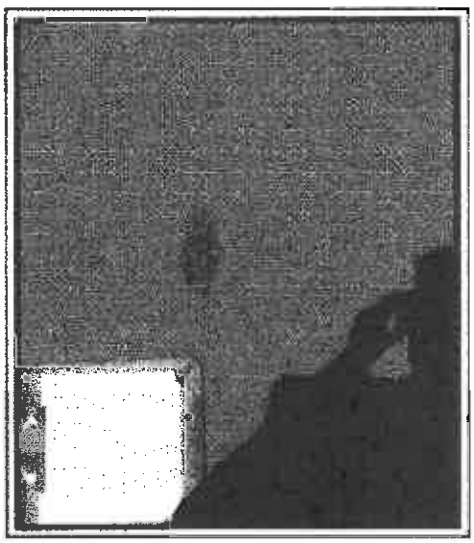
P O Box 74663, Rochdale Park, 4034
Tel: 031 - 579 1220
Fax: 031 - 579 1344

CLIENT	ROYAL HASKONING DHV
ATTENTION	MR. HEIN ARNOLD

PROJECT	P50 - 1
JOB REFERENCE	101893
DATE	23 / 03 / 2015

TEST PIT PROFILE REPORT



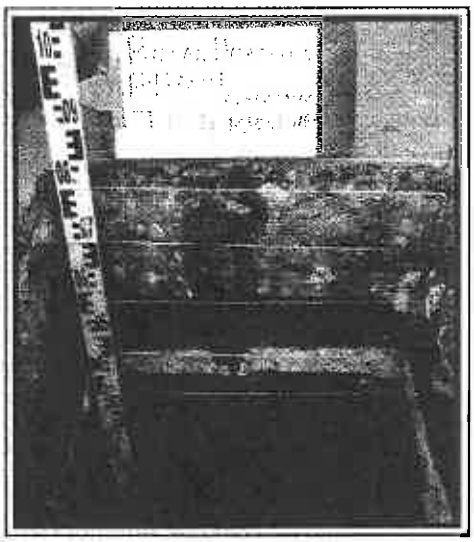
TEST PIT	
4	

PROFILED BY
MR. R. RAMDEEN

GPS CO-ORDINATES	
S	28° 51' 42,6"
E	31° 17' 48,4"
Lo 31, WGS 84	

CHAINAGE
23+050 RHS LWP

EXCAVATION BY
HAND



Water Table	Soil Legend	Depth (mm)	SOIL DESCRIPTION Moisture, Colour, Consistency, Structure, Soil Type, Origin, General	SAMPLING TYPE AND NUMBER
		0	ASPHALT - Cracking on surface,potholing ,semi-gaped graded, Semi-porous,fresh,bonded,rutting=0	
		35	Slightly moist,light yellow brown+light grey,medium dense, uniform,weathered SANDSTONE,base,imported Moisture:5.1%	4A (PHEN-) (HCL-)
		150	Slightly moist,dark yellow brown,medium dense,uniform, weathered SANDSTONE,sub base, imported Moisture:4.8%	4B (PHEN-) (HCL-)
		280	Slightly moist,dark grey brown,medium dense,uniform, SAND,selected,imported Moisture:7.3%	4C (PHEN-) (HCL-)
		400	Slightly moist,light grey+spotted orange,medium dense, uniform,highly weathered SANDSTONE,insitu Moisture:5.3%	4D (PHEN-) (HCL-)
		500	Slightly moist,dark reddish brown,loose,uniform,SAND, Insitu Moisture:8.1%	4E (PHEN-) (HCL-)
		800		

REMARKS	

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Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/E
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8528	E8529	E8530	
HOLE NO.	TP4A	TP4B	TP4C	
ROAD NO.	LWP	LWP	LWP	
DEPTH (mm)	35-150	150-280	280-400	
CHAINAGE	CH23-050 RHS	CH23-050 RHS	CH23-050 RHS	
LAYER TYPE				
STABILISED WITH	Natural	Natural	Natural	
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Yel Br+Lt Gr W/Sandstone	Dk Yel Br W/ Sandstone	Dk Gr Br Sand	
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm	100			
37.5 mm	89		100	
26.5 mm	80	100	90	
19.0 mm	74	98	87	
13.2 mm	72	94	86	
4.75 mm	65	81	85	
2.0 mm	56	72	83	
0.425 mm	41	52	67	
0.075 mm	18	21	32	
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	27	28	19	
FINE SAND <0.425mm >0.075mm	41	43	42	
MATERIAL <0.075mm	32	29	39	
CONSTANTS				
GRADING MODULUS	1.85	1.55	1.18	
PRA CLASSIFICATION	A-1-b(0)	A-2-4(0)	A-2-4(0)	
COLTO CLASSIFICATION	G6	G6	G7	
TRH CLASSIFICATION	G7	G7	G7	
LIQUID LIMIT (%)	32	25	3	
PLASTICITY INDEX (0.425mm)	6	6	SP	
LINEAR SHRINKAGE (%)	3.0	3.0	0.5	
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	2118	2156	1642	
OPTIMUM MOISTURE CONTENT (%)	7.1	6.8	17.1	
MOULDING MOISTURE (%)	7.3	6.6	16.8	
TYPE OF TEST	CBR	CBR	CBR	
CBR-UCS @ 100% MOD AASHTO	45	69	32	
CBR-UCS @ 98% MOD AASHTO	37	51	26	
CBR-UCS @ 97% MOD AASHTO	33	44	24	
CBR-UCS @ 95% MOD AASHTO	26	33	20	
CBR-UCS @ 93% MOD AASHTO	20	24	16	
CBR-UCS @ 90% MOD AASHTO	13	16	11	

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.22	0.29	0.35	0.08	0.09	0.13	0.60	0.67	0.91			

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalis Bhikam

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TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/F
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8531	E8532		
HOLE NO.	TP4D	TP4E		
ROAD NO.	LWP	LWP		
DEPTH (mm)	400-500	500-800		
CHAINAGE	CH23-050 RHS	CH23-050 RHS		
LAYER TYPE				
STABILISED WITH	Natural	Natural		
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Gr+Or H/W Sandstone	Dk Rd Br Sand		
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm	100			
37.5 mm	88			
26.5 mm	81			
19.0 mm	76			
13.2 mm	74	100		
4.75 mm	72	99		
2.0 mm	68	94		
0.425 mm	53	78		
0.075 mm	18	36		
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	22	17		
FINE SAND <0.425mm >0.075mm	51	45		
MATERIAL <0.075mm	27	38		
CONSTANTS				
GRADING MODULUS	1.61	0.92		
PRA CLASSIFICATION	A-2-4(0)	A-4(0)		
COLTO CLASSIFICATION	G6	G8		
TRH CLASSIFICATION	G7	-		
TRH Class.(INSITU |93%|90%|)	- | -	G8|G9		
LIQUID LIMIT (%)	25	39		
PLASTICITY INDEX (0.425mm)	SP	4		
LINEAR SHRINKAGE (%)	1.0	2.0		
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	1881	1695		
OPTIMUM MOISTURE CONTENT (%)	12.2	17.2		
MOULDING MOISTURE (%)	11.9	16.9		
TYPE OF TEST	CBR	CBR		
CBR-UCS @ 100% MOD AASHTO	46	32		
CBR-UCS @ 98% MOD AASHTO	38	23		
CBR-UCS @ 97% MOD AASHTO	34	19		
CBR-UCS @ 95% MOD AASHTO	27	14		
CBR-UCS @ 93% MOD AASHTO	20	11		
CBR-UCS @ 90% MOD AASHTO	12	7.3		

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.19	0.25	0.33	0.37	0.46	0.57						

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

FORM: A1 Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalls Bhikam

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Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/D
Date Reported : 24.04.2015

IN-SITU DRY DENSITY REPORT (TMH1 A10(b))

Section	: P50-1	Tested By	: Mr R Ramdeen	Date Tested	: 23.03.2015
Layer Type	: See Test Positions	Compaction Energy	: MOD AASHTO		

Position	Depth (mm)	Material Description	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	In-Situ Dry Density (kg/m^3)	Moisture Content (%)	Relative Compaction (%)
4A	35-135	Yel Br Gr W/S/Stone	2118	7.1	1889	7.5	89.2
4B	150-250	Yel Br W/Sandstone	2156	6.8	1808	8.6	83.9
4C	280-380	Gr Br Sand	1642	17.1	1678	11.5	102.2
4D	400-500	Gr+Or W/Sandstone	1881	12.2	1748	12.1	92.9
4E	500-600	Rd Br Sand	1695	17.2	1768	12.4	104.3

Tests done by means of Nuclear method.

Test Positions

Layer Type:

4A-Base
4B-Subbase
4C-Selected
4D-Insitu
4E-Insitu

Deviation from test method
1. Dry Density reported to 1 kg/m^3
2. Nuclear Gauge calibrated annually.

Remarks :

FORM: A10(b) Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalls Bhikam

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3200
Attention: Mr Hein Arnold

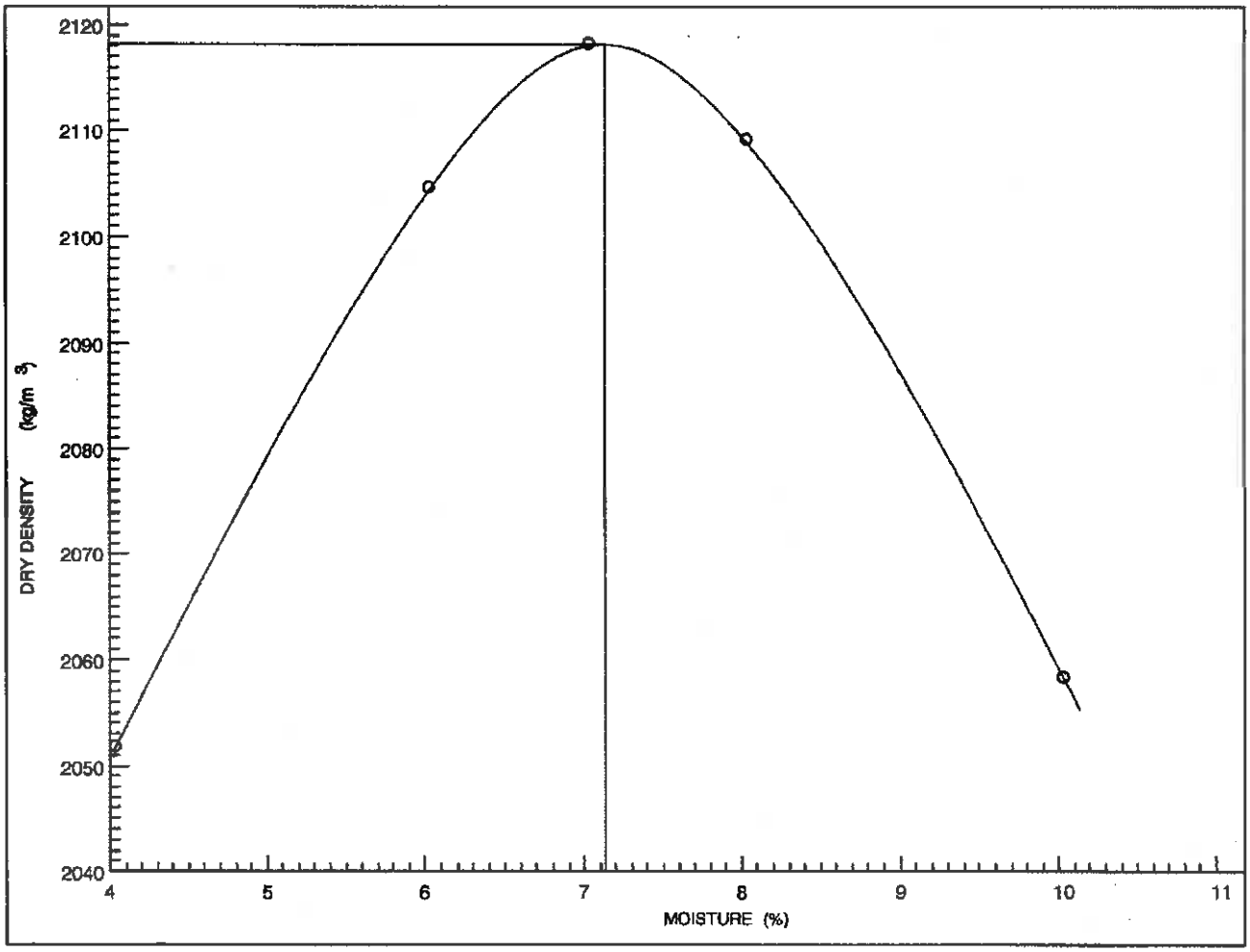
Project : The Rehablitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8528	Hole No. : TP4A	Depth (mm) : 35-150
Origin : CH23+050RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Yel Br+Lt Gr W/ Sandstone		

Maximum Dry Density (kg/m^3) : 2118
Optimum Moisture Content (%) : 7.1

Point No.	1	2	3	4	5			
Moisture (%)	4.0	6.0	7.0	8.0	10.0			
Density (kg/m^3)	2052	2104	2118	2109	2058			



Remarks :

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TEST RESULTS

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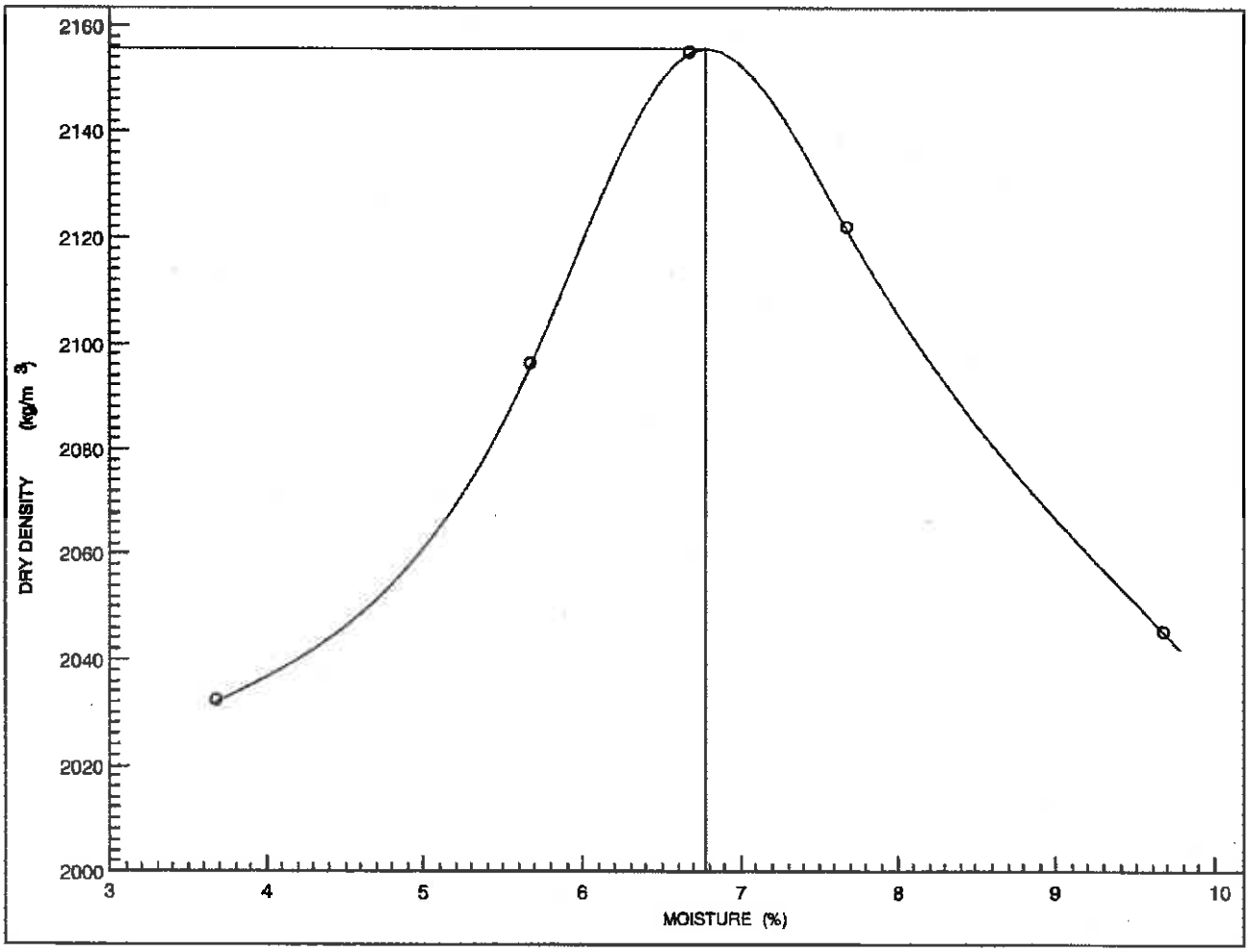
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8529	Hole No. : TP4B	Depth (mm) : 150-280
Origin : CH23+050RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Yel Br W/ Sandstone		

Maximum Dry Density (kg/m^3) : 2156
Optimum Moisture Content (%) : 6.8

Point No.	1	2	3	4	5			
Moisture (%)	3.7	5.7	6.7	7.7	9.7			
Density (kg/m^3)	2032	2096	2155	2122	2045			



Remarks :

FORM: A7 Program ver 3.3(26.01.2010)

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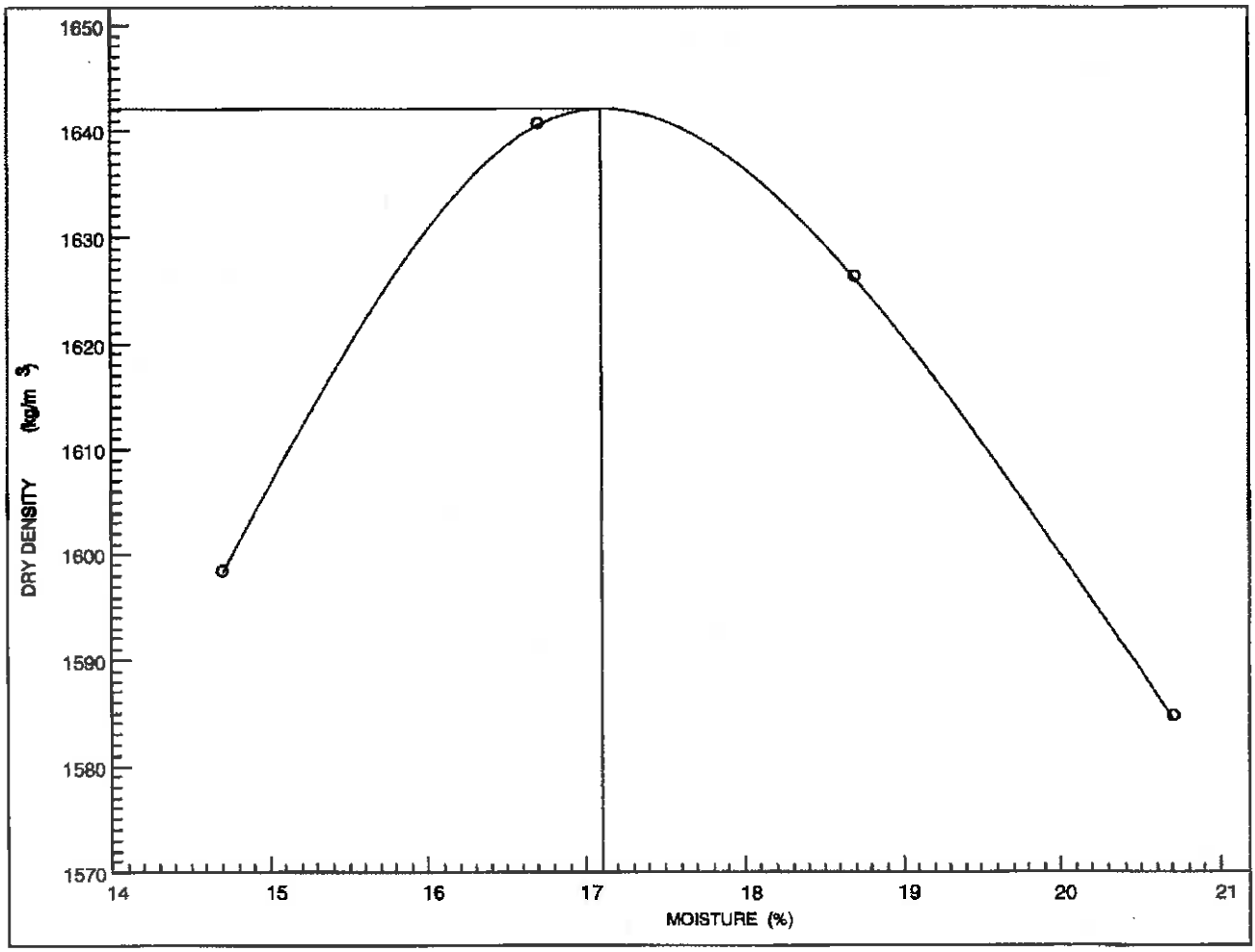
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8530	Hole No. : TP4C	Depth (mm) : 280-400
Origin : CH23+050RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Gr Br Sand		

Maximum Dry Density (kg/m^3) : 1642
Optimum Moisture Content (%) : 17.1

Point No.	1	2	3	4				
Moisture (%)	14.7	16.7	18.7	20.7				
Density (kg/m^3)	1598	1641	1626	1585				



Remarks :

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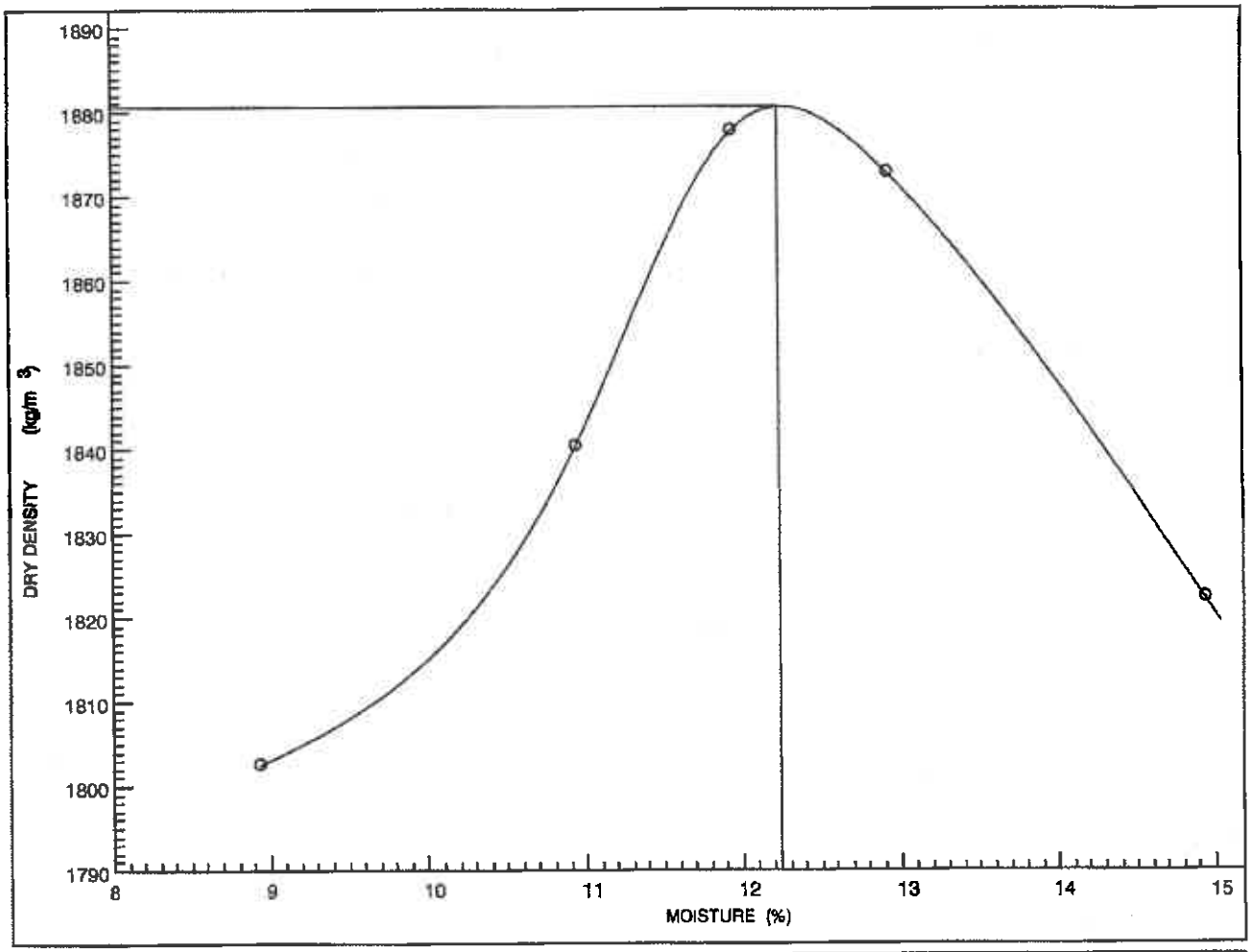
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8531	Hole No. : TP4D	Depth (mm) : 400-500
Origin : CH23+050RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Gr+Or H/W Sandstone		

Maximum Dry Density (kg/m^3) : 1881
Optimum Moisture Content (%) : 12.2

Point No.	1	2	3	4	5			
Moisture (%)	8.9	10.9	11.9	12.9	14.9			
Density (kg/m^3)	1802	1840	1878	1873	1822			



Remarks :

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TEST RESULTS

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Attention: Mr Hein Arnold

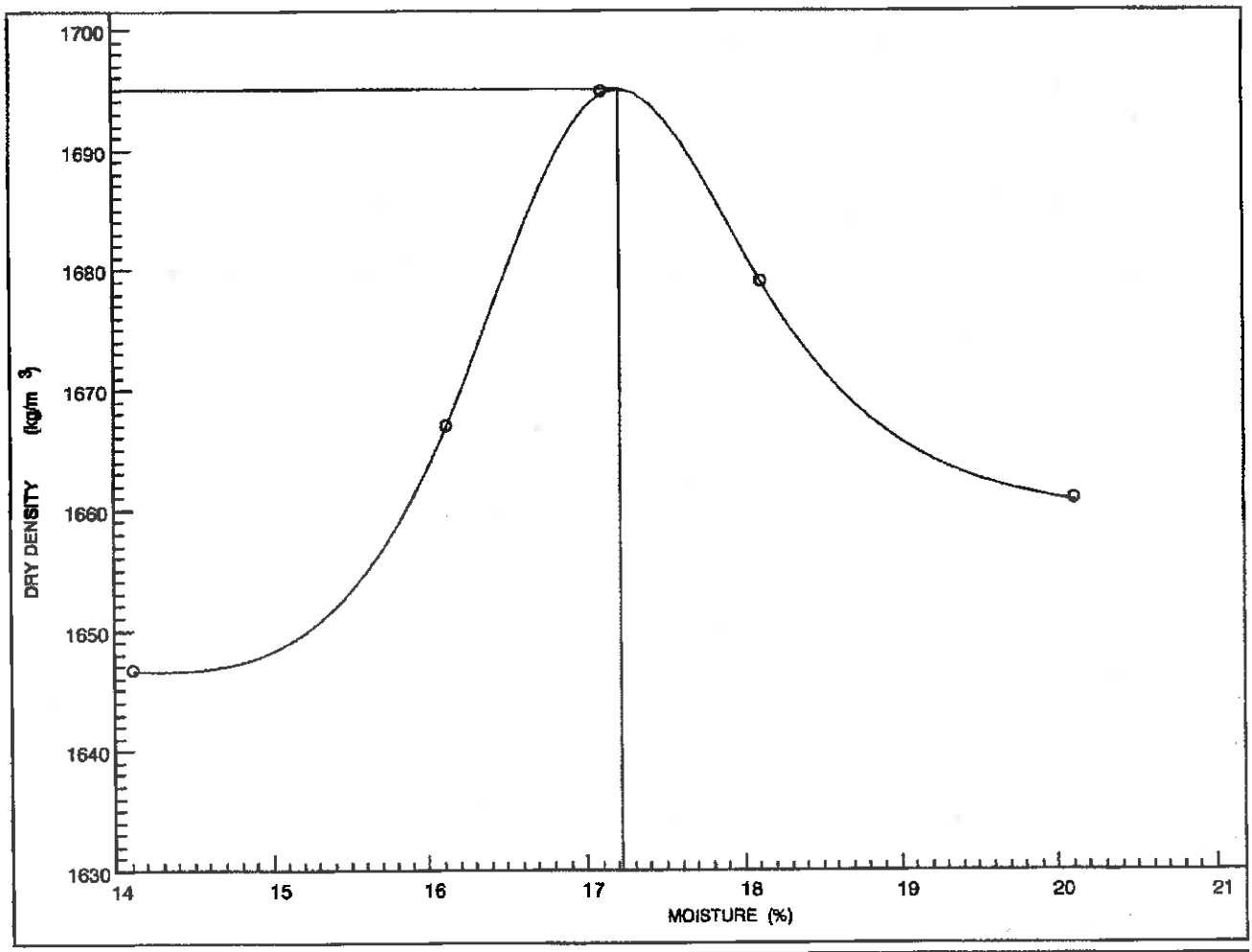
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8532	Hole No. : TP4E	Depth (mm) : 500-800
Origin : CH23+050RHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Rd Br Sand		

Maximum Dry Density (kg/m^3) : 1695
Optimum Moisture Content (%) : 17.2

Point No.	1	2	3	4	5			
Moisture (%)	14.1	16.1	17.1	18.1	20.1			
Density (kg/m^3)	1647	1667	1695	1679	1661			



Remarks :

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Tel: 031 - 579 1220
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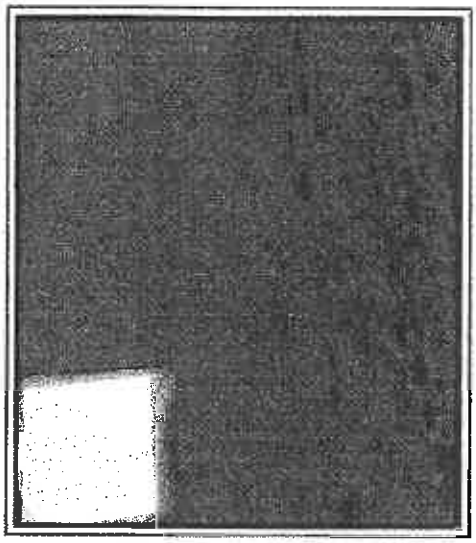
CLIENT	ROYAL HASKONING DHV
ATTENTION	MR. HEIN ARNOLD

PROJECT	P50 - 1
JOB REFERENCE	101893
DATE	23 / 03 / 2015

TEST PIT PROFILE REPORT



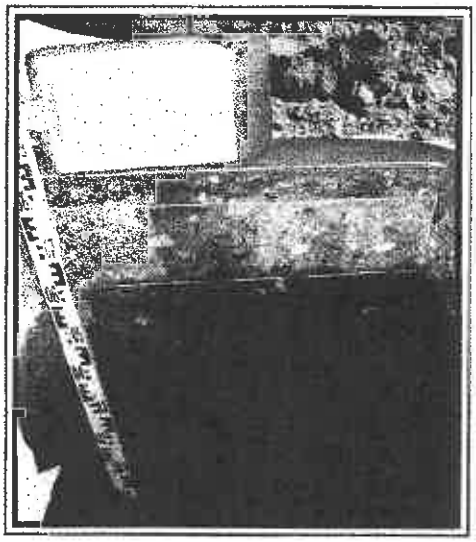
TEST PIT	
5	

PROFILED BY
MR. R. RAMDEEN

GPS CO-ORDINATES	
S	28° 52'43,18"
E	31° 17'02,97"
Lo 31, WGS 84	

CHAINAGE
25+400 LHS LWP

EXCAVATION BY
HAND



Water Table	Soil Legend	Depth (mm)	SOIL DESCRIPTION Moisture, Colour, Consistency, Structure, Soil Type, Origin, General	SAMPLING TYPE AND NUMBER
		0	ASPHALT - Longitudinal cracking,crocodile cracking,bleeding, potholing,semi-gaped graded,semi-porous,double seal,fresh, bonded,rutting=0	
		40	Slightly moist,light yellow brown+light grey,medium dense, uniform,weathered SANDSTONE,Imported Moisture:3.9%	5A (PHEN-) (HCL-)
		200	Slightly moist,dark brown,medium dense,uniform, SAND,Insitu Moisture:7.2%	5B (PHEN-) (HCL-)
		700	Slightly moist,dark reddish brown,medium dense,uniform, Fine SAND,insitu Moisture:8.6%	5C (PHEN-) (HCL-)
		800		

REMARKS	

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TEST RESULTS

ROYAL HASKONING DHV
P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/G
Date Reported : 24.04.2015

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(TMH1:A1-A5,A7,A8)

SAMPLE NO.	E8533	E8534	E8535	
HOLE NO.	TP5A	TP5B	TP5C	
ROAD NO.	LWP	LWP	LWP	
DEPTH (mm)	40-200	200-700	700-800	
CHAINAGE	CH25+400 LHS	CH25+400 LHS	CH25+400 LHS	
LAYER TYPE				
STABILISED WITH	Natural	Natural	Natural	
SUPPLIER				
CURING METHOD				
DESCRIPTION	Lt Yel Br+Lt Gr W/Sandstone	Dk Br Sand	Dk Rd Br Fine Sand	
SIEVE ANALYSIS (% PASSING)				
75 mm				
63 mm				
53 mm	100			
37.5 mm	86		100	
26.5 mm	80		92	
19.0 mm	77		92	
13.2 mm	73	100	92	
4.75 mm	61	98	92	
2.0 mm	50	97	91	
0.425 mm	37	79	81	
0.075 mm	13	28	31	
SOIL MORTAR				
COARSE SAND<2.000mm >0.425mm	26	19	11	
FINE SAND <0.425mm >0.075mm	48	53	55	
MATERIAL <0.075mm	26	28	34	
CONSTANTS				
GRADING MODULUS	2.00	0.96	0.97	
PRA CLASSIFICATION	A-1-b(0)	A-2-4(0)	A-2-4(0)	
COLTO CLASSIFICATION	G6	G7	G7	
TRH CLASSIFICATION	G7	G7	G7	
LIQUID LIMIT (%)	22	26	35	
PLASTICITY INDEX (0.425mm)	SP	4	SP	
LINEAR SHRINKAGE (%)	0.5	2.0	0.5	
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	2169	1827	1734	
OPTIMUM MOISTURE CONTENT (%)	6.8	13.2	16.1	
MOULDING MOISTURE (%)	6.5	13.0	15.8	
TYPE OF TEST	CBR	CBR	CBR	
CBR-UCS @ 100% MOD AASHTO	47	28	29	
CBR-UCS @ 98% MOD AASHTO	36	25	25	
CBR-UCS @ 97% MOD AASHTO	32	24	24	
CBR-UCS @ 95% MOD AASHTO	25	22	20	
CBR-UCS @ 93% MOD AASHTO	18	19	16	
CBR-UCS @ 90% MOD AASHTO	12	16	11	

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	0.07	0.11	0.12	0.16	0.18	0.19	0.07	0.09	0.11			

Remarks : Deviation from TMH 1 : A8 : 90% compaction achieved using mechanical compactor.

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TEST RESULTS

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P O BOX 1066
PIETERMARITZBURG
3200
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893/E
Date Reported : 24.04.2015

IN-SITU DRY DENSITY REPORT (TMH1 A10(b))

Section	: P50-1	Tested By	: Mr R Ramdeen	Date Tested	: 23.03.2015
Layer Type	: See Test Positions	Compaction Energy	: MOD AASHTO		

Position	Depth (mm)	Material Description	Maximum Dry Density (kg/m^3)	Optimum Moisture Content (%)	In-Situ Dry Density (kg/m^3)	Moisture Content (%)	Relative Compaction (%)
5A	40-140	Yel Br+Gr W/Sandstone	2169	6.8	1919	6.3	88.5
5B	200-300	Dk Br Sand	1827	13.2	1719	12.2	94.1
5C	700-800	Dk Rd Br Fine Sand	1734	16.1	1744	13.2	100.6

Tests done by means of Nuclear method.

Test Positions

Layer Type:

5A-Base
5B-Subbase
5C-Insitu

Deviation from test method
1. Dry Density reported to 1 kg/m^3
2. Nuclear Gauge calibrated annually.

Remarks :

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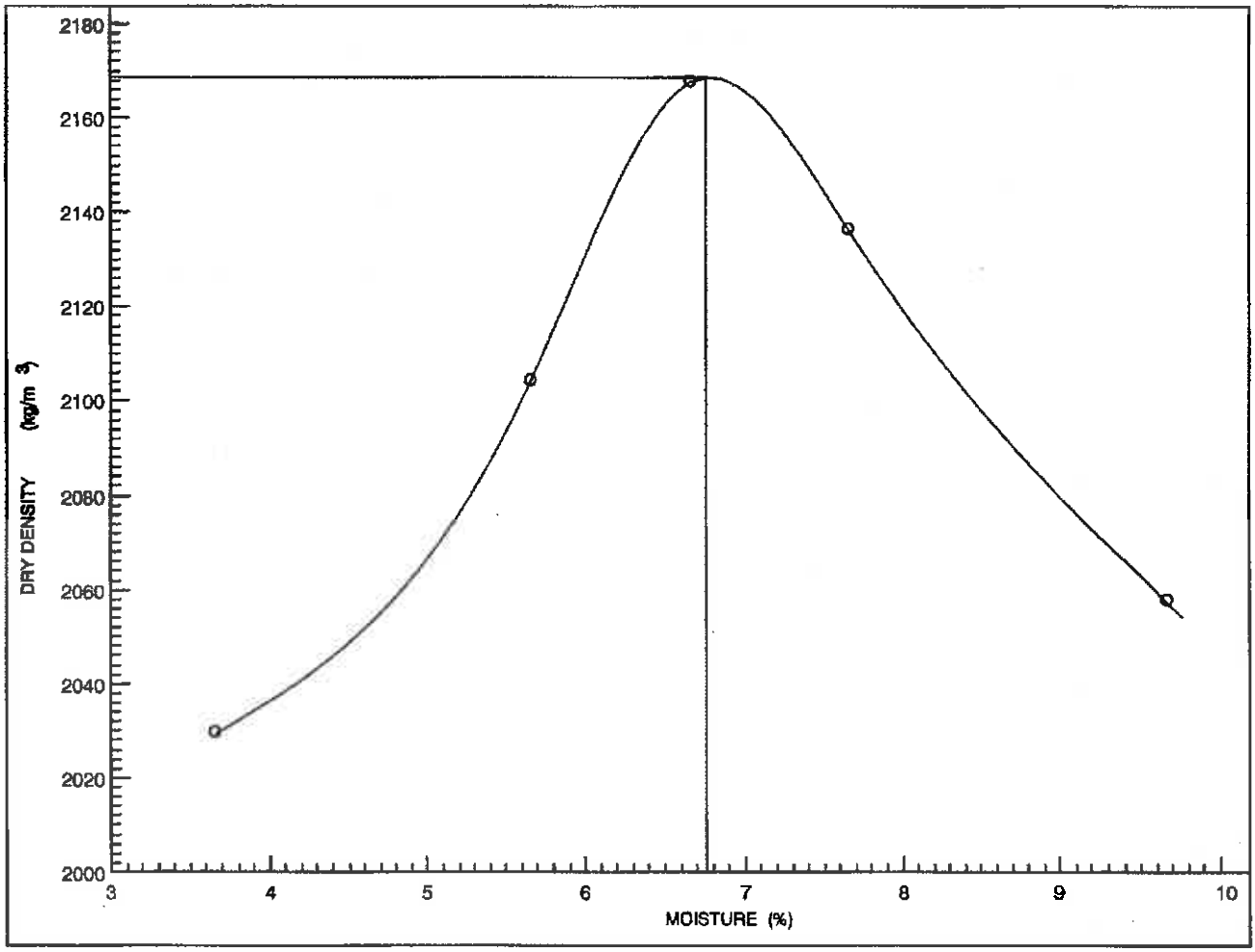
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8533	Hole No. : TP5A	Depth (mm) : 40-200
Origin : CH25+400LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Lt Yel Br+Lt Gr W/Sandstone		

Maximum Dry Density (kg/m^3) : 2169
Optimum Moisture Content (%) : 6.8

Point No.	1	2	3	4	5			
Moisture (%)	3.7	5.7	6.7	7.7	9.7			
Density (kg/m^3)	2029	2104	2168	2136	2057			



Remarks :

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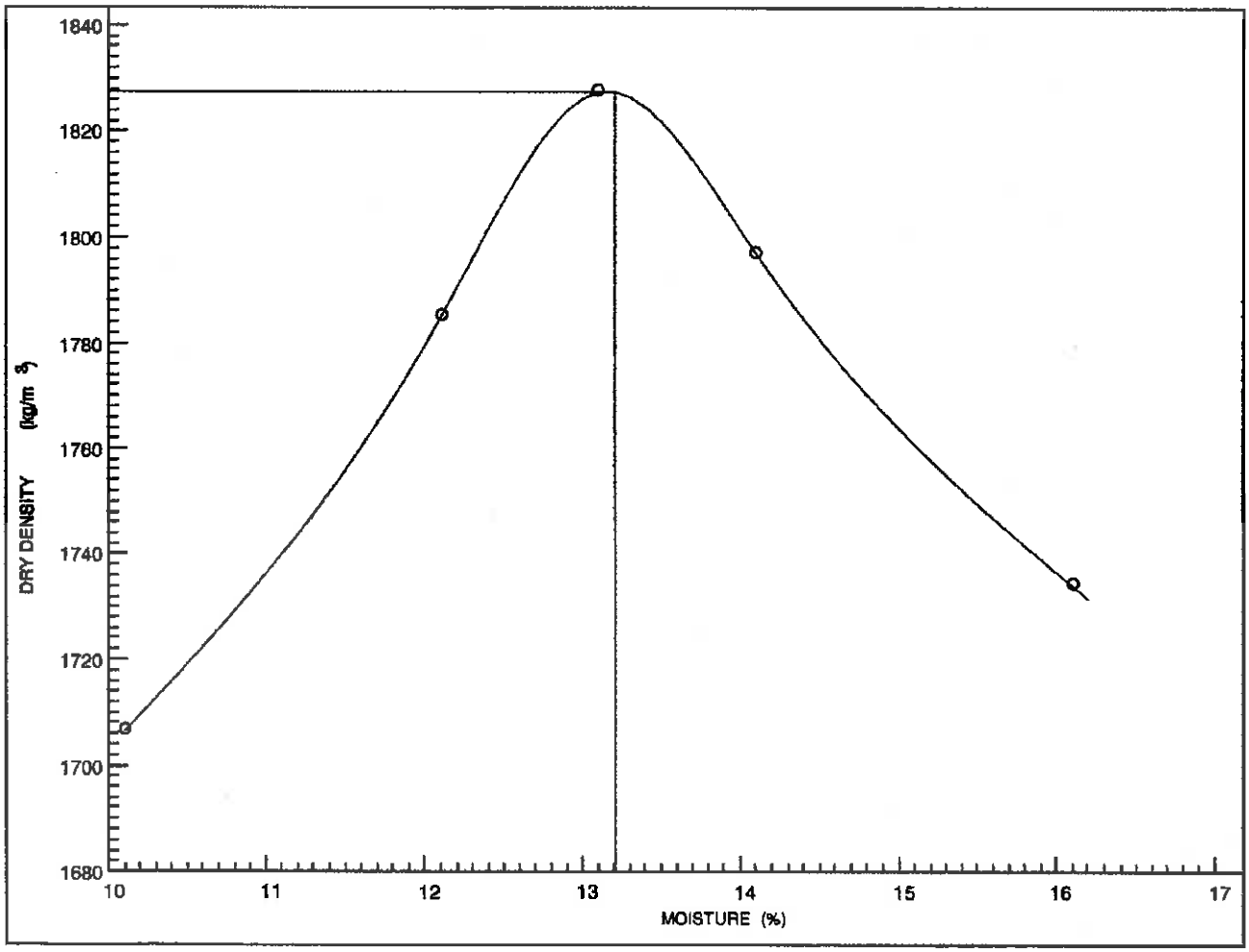
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8534	Hole No. : TP5B	Depth (mm) : 200-700
Origin : CH25+400LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Br Sand		

Maximum Dry Density (kg/m^3) : 1827
Optimum Moisture Content (%) : 13.2

Point No.	1	2	3	4	5			
Moisture (%)	10.1	12.1	13.1	14.1	16.1			
Density (kg/m^3)	1707	1785	1827	1797	1734			



Remarks :

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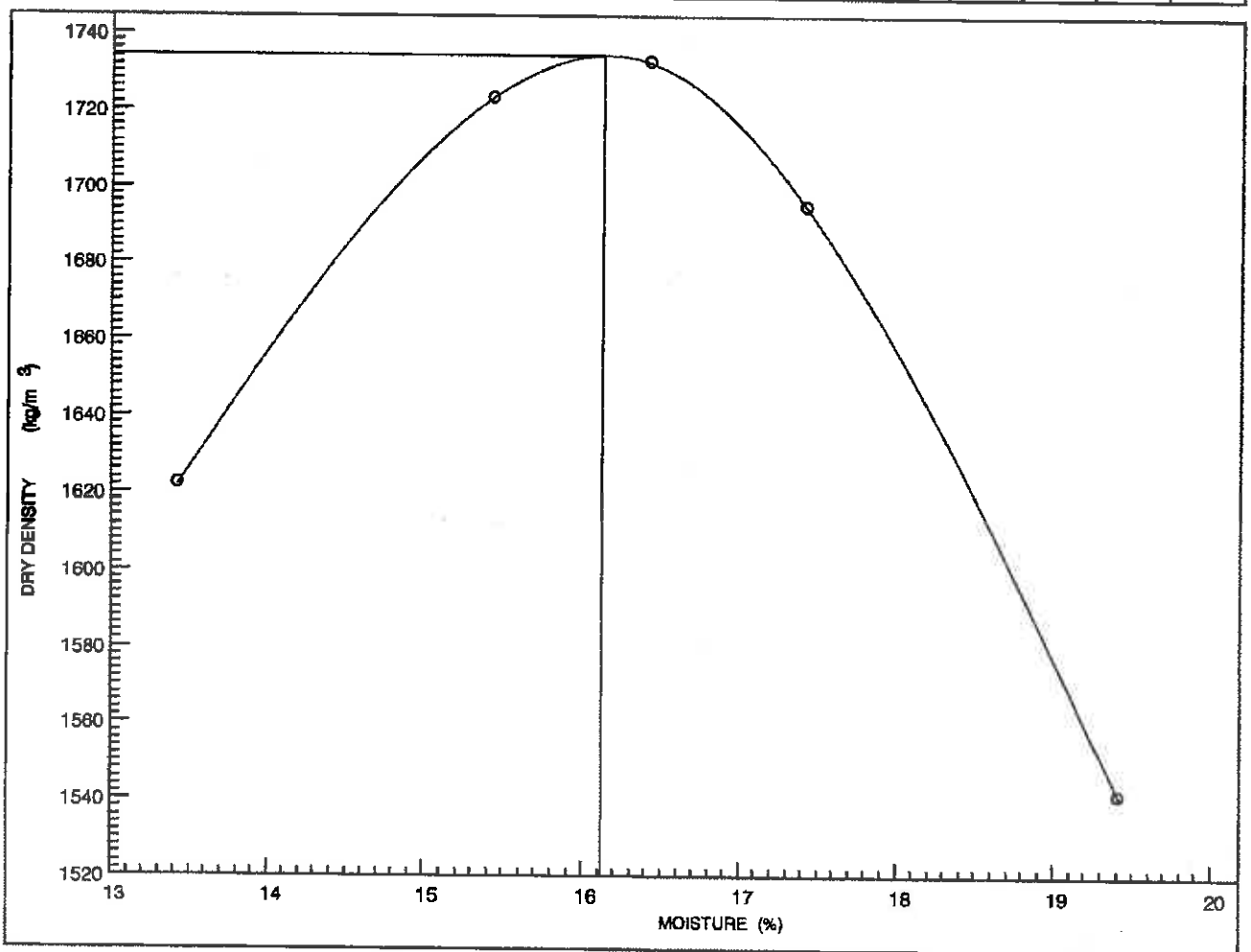
MOISTURE / DENSITY RELATIONSHIP (TMH1 : A7)

Sample No. : E8535	Hole No. : TP5C	Depth (mm) : 700-800
Origin : CH25+400LHS LWP	Stabilized With : Natural	Compaction Energy : MOD AASHTO
Material Description : Dk Rd Br Fine Sand		

Maximum Dry Density (kg/m^3) : 1734
Optimum Moisture Content (%) : 16.1

Point No.	1	2	3	4	5			
Moisture (%)	13.4	15.4	16.4	17.4	19.4			
Density (kg/m^3)	1622	1723	1732	1695	1541			



Remarks :

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APPENDIX E
RUBICON ANALYSIS SUMMARY

Pavement Situation At Start of Phase 1 of 2

Method: Distinct Phase Calculation Without Adjustment For Incremental Damage

Design Name: [Not Provided]

[No Description Provided]

Detailed view for axle type: 80 kN Axle, Dual 750 kPa, 330 mm Spacing

Total Capacity for All Phases is 6.1 million

Applied Cumulative axles of this type at phase end is 5.84 million

Critical layer for this phase and axle: Layer 3

Phase starts in year 0 and ends in year 24.5

Note: Damages & critical parameters shown are for this axle type only.

Thickness = 40 Millimetres; **Continuously Graded Asphalt** **Stiffness = 3000 MPa; Poisson = 0.4;** **Layer Was Not Evaluated**	Design Parameter: N/A Position: N/A Axle Capacity: N/A Cumulative damage at Phase end N/A;
Thickness = 80 Millimetres; RSA Thick Asphalt Base Layer Stiffness = 3500 MPa; Poisson = 0.44; Criterion: RSA Thick Asphalt Cat A None	Max. Horizontal Tensile Strain: 57.8 Microstrain Position: Load Centreline/Bottom of Layer Axle Capacity: >100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to 0.06
Thickness = 300 Millimetres; C3 Cement Stabilized Material Stiffness = 1800 MPa; Poisson = 0.35; Criterion: RSA Cemented Fatigue, Cat A Strain-at-Break = 125 Microstrain;	Max. Horizontal Tensile Strain: 72.7 Microstrain Position: Between Loads/Bottom of Layer Axle Capacity: 5.75 million (Effective: 5.75 million) Cum. Damage, Phase Start to End: < 0.01 to > 1.0
Thickness = 150 Millimetres; **Sandy gravel subgrade, RSA Criterion** **Stiffness = 120 MPa; Poisson = 0.35;** **Criterion: RSA Subgrade Rut, Cat B** None	Vertical Compressive Strain: 160 Microstrain Position: Between Loads/Top of Layer Axle Capacity: >100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to < 0.01
Thickness = Semi-Infinite; **Silty sand subgrade, RSA Criterion** **Stiffness = 80 MPa; Poisson = 0.35;** **Criterion: RSA Subgrade Rut, Cat B** **None**	Vertical Compressive Strain: 156 Microstrain Position: Between Loads/Top of Layer Axle Capacity: >100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: **< 0.01 to < 0.01**

Standard Axle Load Details:

Setup: 80 kN Axle, Dual 750 kPa, 330 **mm** Spacing; Daily Count = 375; Growth Rate = **4** (%)

Description: 80kN Axle, Dual Wheel, 750 tyre pressure and 330 mm spacing

Pavement Notes:

Pavement Situation At Start of Phase 3 of 3

Method: Distinct Phase Calculation Without Adjustment For Incremental Damage

Design Name: [Not Provided]

[No Description Provided]

Detailed view for axle type: 80 kN Axle, Dual 750 kPa, 330 mm Spacing

Total Capacity for All Phases is 10.68 million

Applied Cumulative axles of this type at phase end is 9.05 million

Critical layer for this phase and axle: Layer 2

Phase starts in year 31.75 and ends in year 32

Note: Damages & critical parameters shown are for this axle type only.

Thickness = 40 Millimetres; Continuously Graded Asphalt Stiffness = 3000 MPa; Poisson = 0.4; Layer Was Not Evaluated	Design Parameter: N/A Position: N/A Axle Capacity: N/A Cumulative damage at Phase end N/A:
Thickness = 150 Millimetres; EG4 (equiv. granular) material in dry condition Stiffness = 350 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 31.2 kPa; Angle of Friction = 41.9	Shear Safety Factor: 0.706 Position: Load Centreline/Middle of Layer Axle Capacity: 0.35 million (Effective: 0.35 million) Cum. Damage, Phase Start to End: < 0.01 to > 1.0
Thickness = 300 Millimetres; EG4 (equiv. granular) material in dry condition Stiffness = 350 MPa; Poisson = 0.35; Criterion: Granular Materials Cat B Cohesion = 31.2 kPa; Angle of Friction = 41.9	Shear Safety Factor: 1.55 Position: Between Loads/Middle of Layer Axle Capacity: 55.71 million (Effective: 55.71 million) Cum. Damage, Phase Start to End: < 0.01 to < 0.01
Thickness = 150 Millimetres; Sandy gravel subgrade, RSA Criterion Stiffness = 120 MPa; Poisson = 0.35; Criterion: RSA Subgrade Rut, Cat B None	Vertical Compressive Strain: 303 Microstrain Position: Between Loads/Top of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to < 0.01
Thickness = Semi-Infinite; Silty sand subgrade, RSA Criterion Stiffness = 80 MPa; Poisson = 0.35; Criterion: RSA Subgrade Rut, Cat B None	Vertical Compressive Strain: 273 Microstrain Position: Between Loads/Top of Layer Axle Capacity: > 100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to < 0.01

Standard Axle Load Details:

Setup: 80 kN Axle, Dual 750 kPa, 330 mm Spacing; Daily Count = 375; Growth Rate = 4 (%)

Description: 80kN Axle, Dual Wheel, 750 tyre pressure and 330 mm spacing

Pavement Notes:

Pavement Situation At Start of Phase 1 of 2

Method: Distinct Phase Calculation Without Adjustment For Incremental Damage

Design Name: [Not Provided]

[No Description Provided]

Detailed view for axle type: 80 kN Axle, Dual 750 kPa, 330 mm Spacing

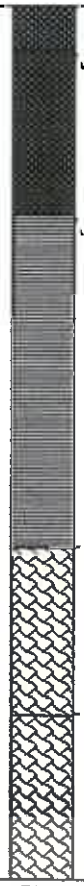
Total Capacity for All Phases is 8.74 million

Applied Cumulative axles of this type at phase end is 7.54 million

Critical layer for this phase and axle: Layer 3

Phase starts in year 0 and ends in year 28.75

Note: Damages & critical parameters shown are for this axle type only.



Thickness = 40 Millimetres; Continuously Graded Asphalt Stiffness = 3000 MPa; Poisson = 0.4; Layer Was Not Evaluated	Design Parameter: N/A Position: N/A Axle Capacity: N/A Cumulative damage at Phase end N/A:
Thickness = 150 Millimetres; **BSM 1** **Stiffness = 256 MPa; Poisson = 0.35;** **Criterion: GranularMaterials CatB** **Cohesion = 29.7 kPa; Angle of Friction = 43.7**	**Shear Safety Factor: 1.33** **Position: Load Centreline/Middle of Layer** **Axle Capacity: 14.6 million (Effective: 14.6 million)** **Cum. Damage, Phase Start to End: < 0.01 to 0.52**
Thickness = 300 Millimetres; C4 Cement Stabilized Material Stiffness = 1500 MPa; Poisson = 0.35; Criterion: RSA Cemented Fatigue, Cat B Strain-at-Break = 145 Microstrain;	**Max. Horizontal Tensile Strain: 85.3 Microstrain** **Position: Between Loads/Bottom of Layer** **Axle Capacity: 7.49 million (Effective: 7.49 million)** **Cum. Damage, Phase Start to End: < 0.01 to > 1.0**
Thickness = 150 Millimetres; **Sandy gravel subgrade, RSA Criterion** **Stiffness = 120 MPa; Poisson = 0.35;** **Criterion: RSA Subgrade Rut, Cat B** **None**	Vertical Compressive Strain: 195 Microstrain Position: Between Loads/Top of Layer Axle Capacity: >100 million (Effective: > 100 million) Cum. Damage, Phase Start to End: < 0.01 to < 0.01
Thickness = Semi-Infinite; **Silty sand subgrade, RSA Criterion** **Stiffness = 80 MPa; Poisson = 0.35;** **Criterion: RSA Subgrade Rut, Cat B** **None**	**Vertical Compressive Strain: 189 Microstrain** **Position: Between Loads/Top of Layer** **Axle Capacity: >100 million (Effective: > 100 million)** **Cum. Damage, Phase Start to End: < 0.01 to < 0.01**

Standard Axle Load Details:

Setup: 80 kN Axle, Dual 750 kPa, 330 mm Spacing; Daily Count = 375; Growth Rate = 4 (%)

Description: 80kN Axle, Dual Wheel, 750 tyre pressure and 330 mm spacing

Pavement Notes:

Rehabilitation of P50-1 (Km 18 - Km 26)

BSM Base Option

APPENDIX F
DCP ANALYSIS SUMMARY

MATROLAB GROUP (PTY.) LTD.
- CIVIL ENGINEERING SERVICES -

UNIT 7, PENNYLANE PARK, 64 EBONYFIELD AVE., SPRINGFIELD PARK
P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

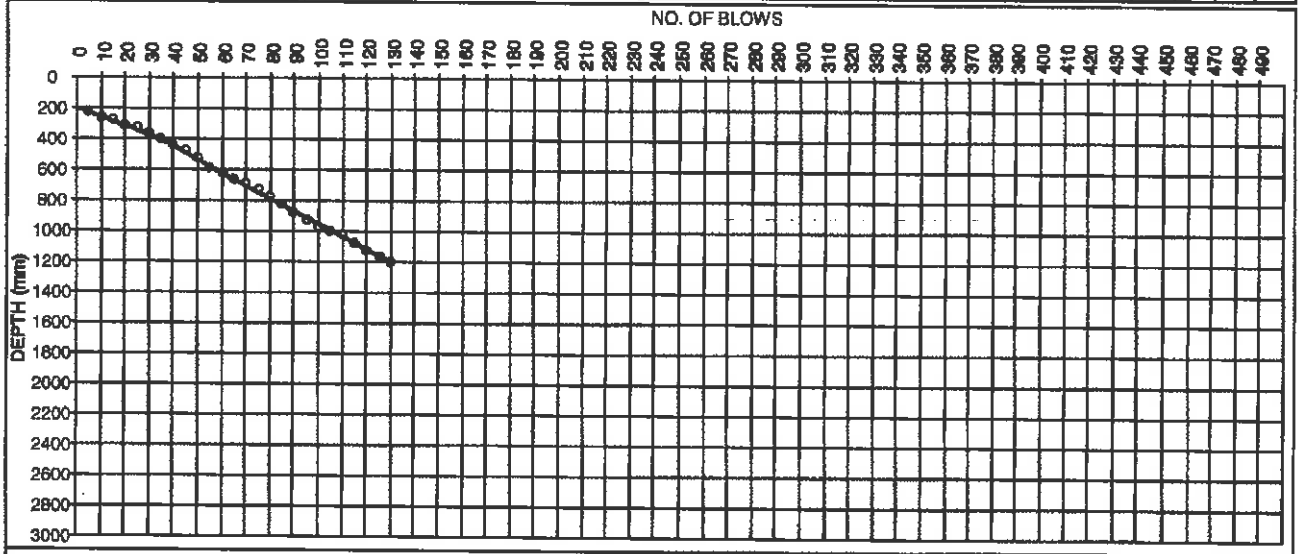
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

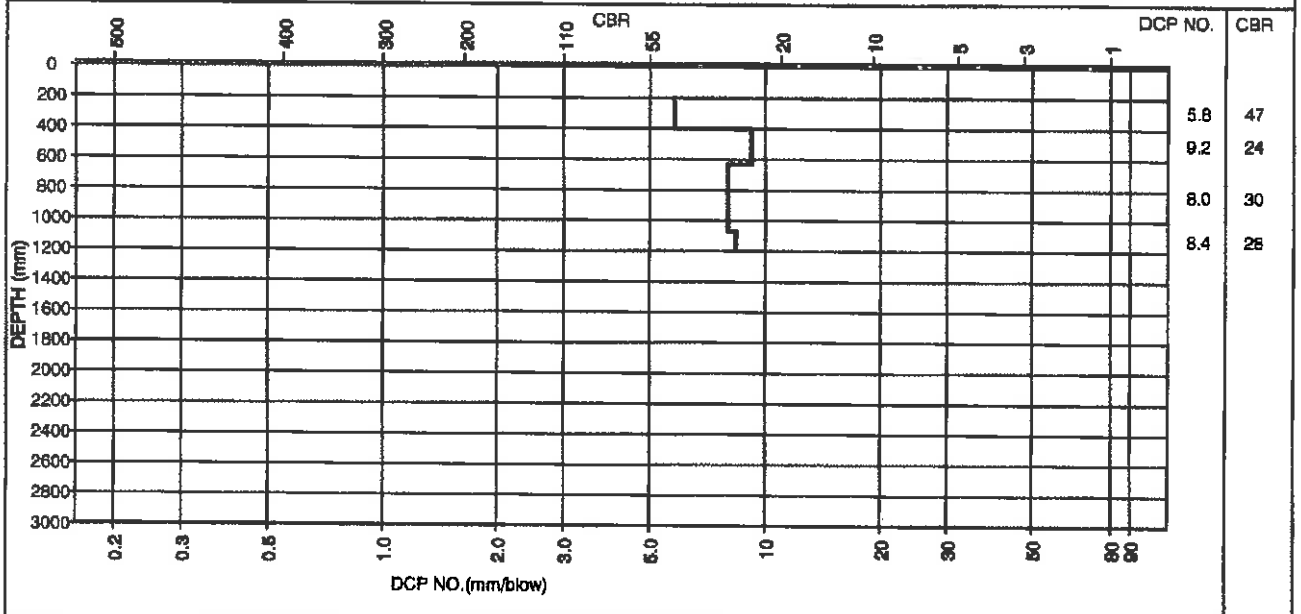
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP1 - CH18+200 RHS

INITIAL DEPTH (mm) : 200

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130
DEPTH	230	260	280	310	325	360	400	440	480	530	585	630	660	690	730	770	820	870	925	970	1000	1030	1070	1125	1160	1195
CBR	45	45	75	45	110	35	30	30	30	22	20	25	45	45	30	30	22	22	20	25	45	45	30	20	35	35





DCP NO.	CBR
5.8	47
9.2	24
8.0	30
8.4	28

Remarks :

FORM: ST6 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

MATROLAB GROUP (PTY.) LTD.
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TEST RESULTS

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72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

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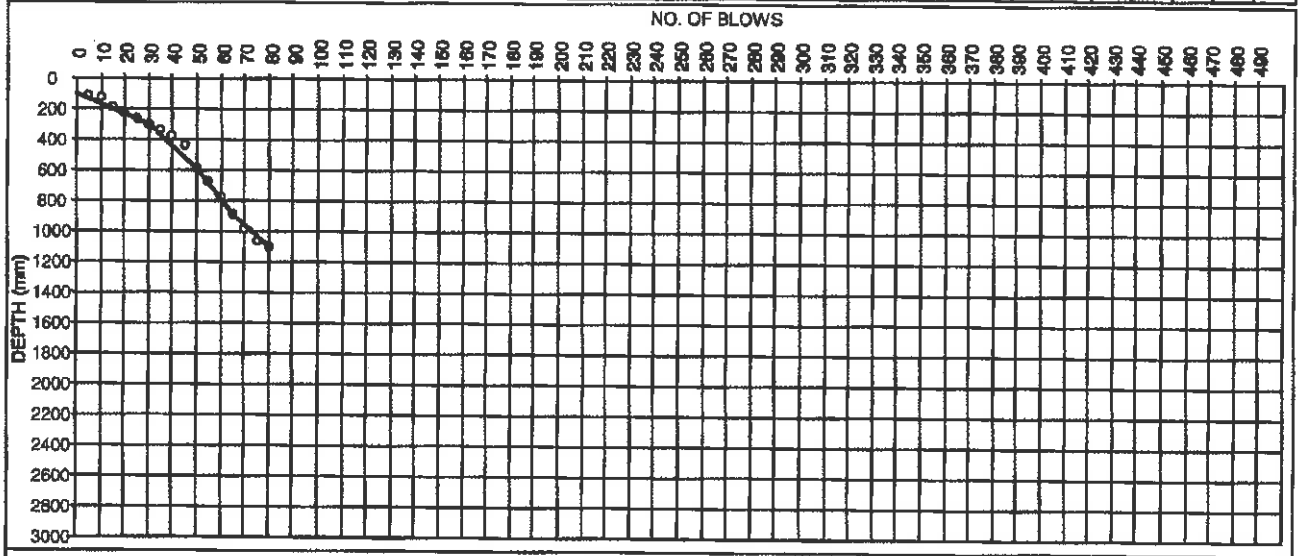
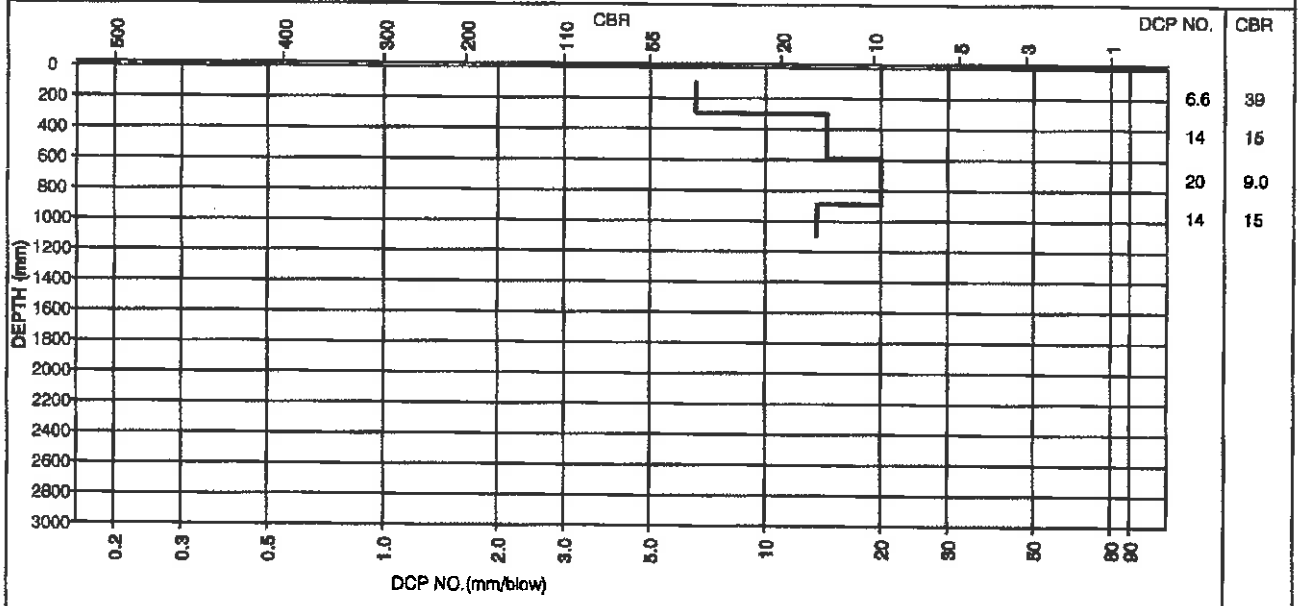
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP2 - CH19+300 RHS

INITIAL DEPTH (mm) : 100

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
DEPTH	115	130	190	230	265	300	340	370	440	590	670	770	890	990	1060	1095
CBR	110	110	18	30	35	35	30	45	15	6	13	9	7	9	15	35





DCP NO.	CBR
6.6	39
14	15
20	9.0
14	15

Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

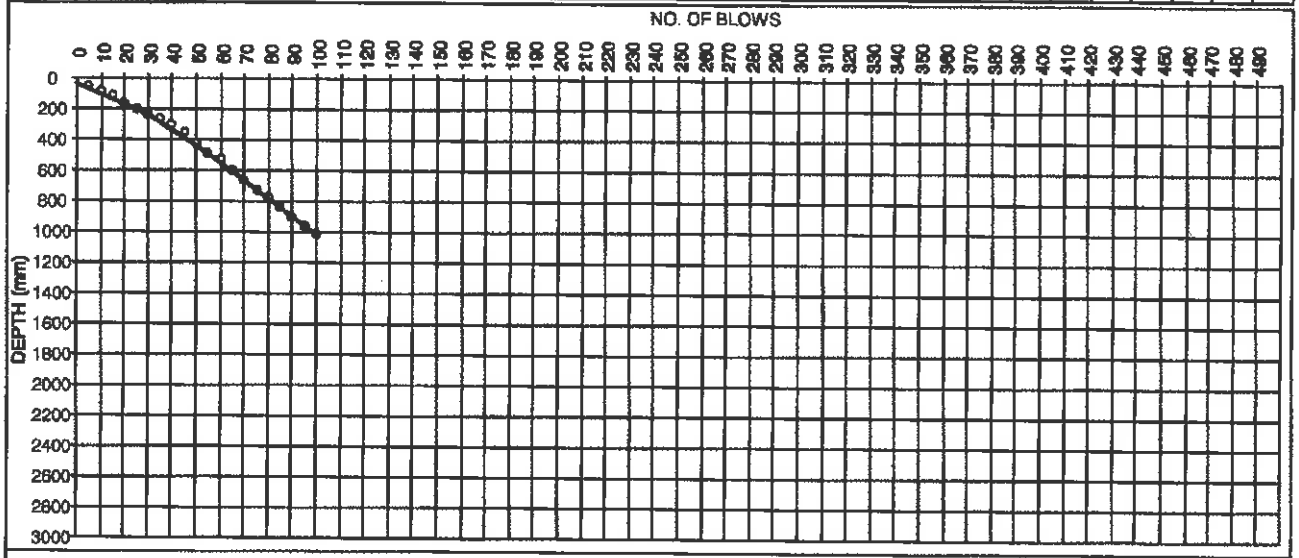
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

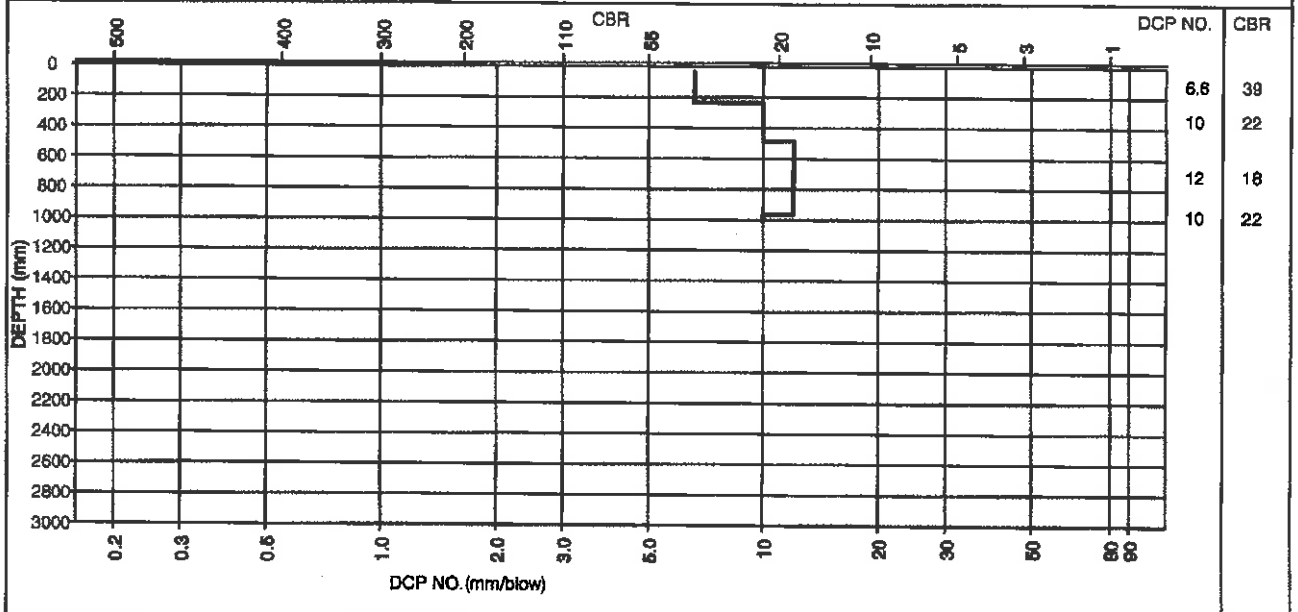
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP3 - CH21+100 LHS

INITIAL DEPTH (mm) : 35

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
DEPTH	50	85	115	165	195	235	260	295	345	425	485	530	595	665	725	775	835	905	965	1015
CBR	110	35	45	22	45	30	55	35	22	13	18	25	16	15	16	22	18	15	18	22





DCP NO.	CBR
6.6	39
10	22
12	18
10	22

Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

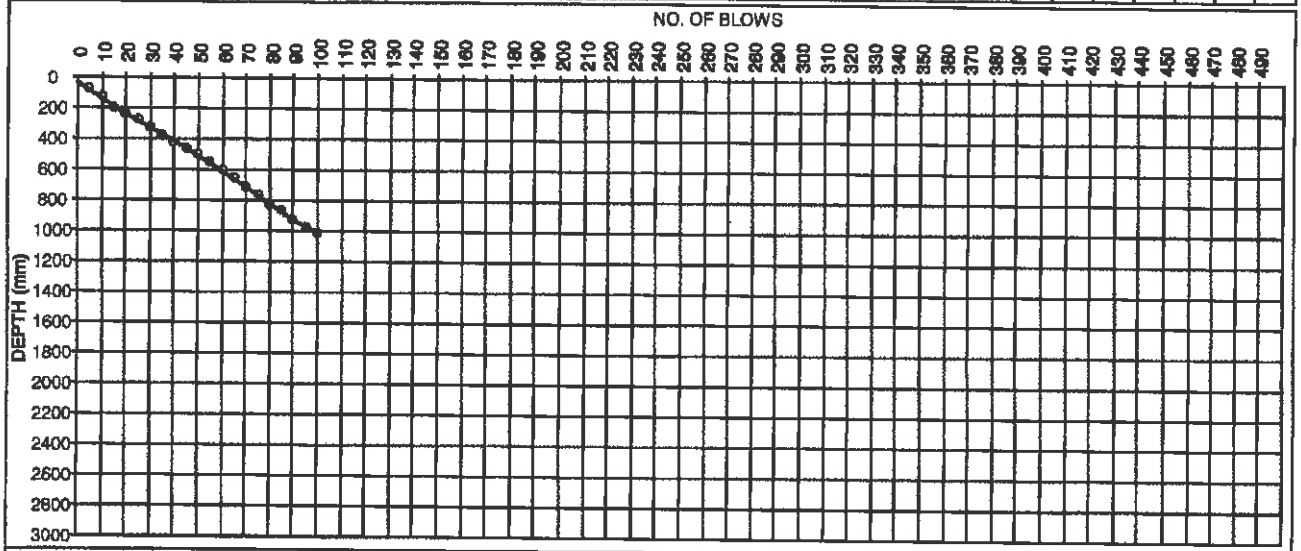
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

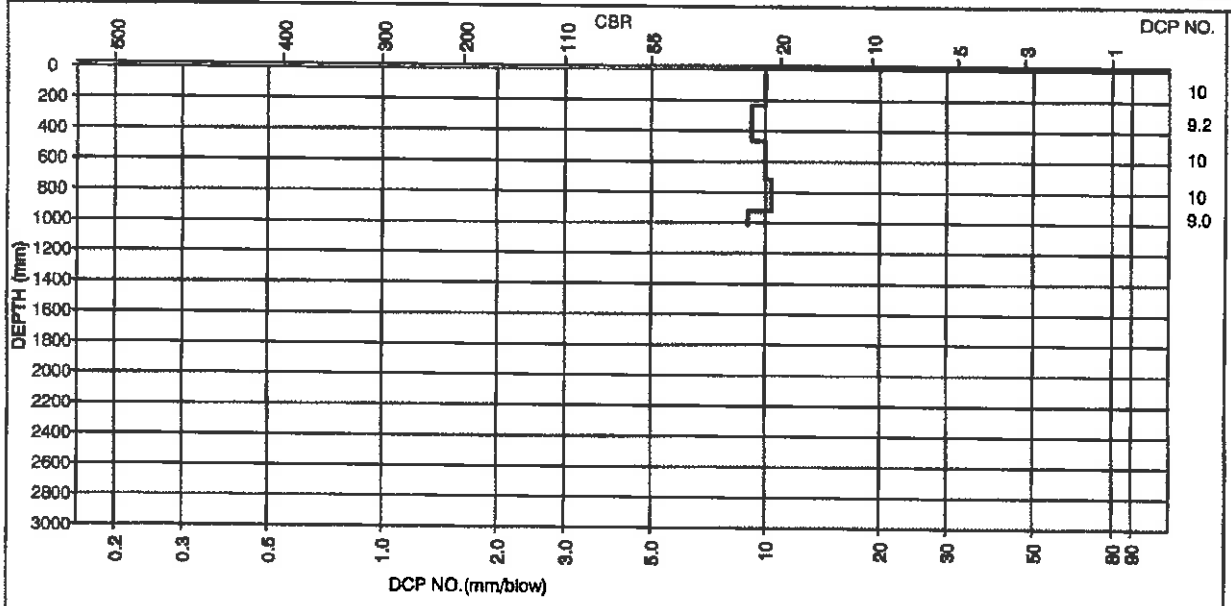
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP4 - CH23+800 LHS

INITIAL DEPTH (mm) : 35

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
DEPTH	75	125	195	235	270	325	380	425	465	505	545	595	650	715	760	825	860	925	970	1015
CBR	30	22	15	30	35	20	20	25	30	30	30	22	20	16	25	16	35	16	25	25





DCP NO.	CBR
10	22
9.2	24
10	22
10	21
9.0	25

Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

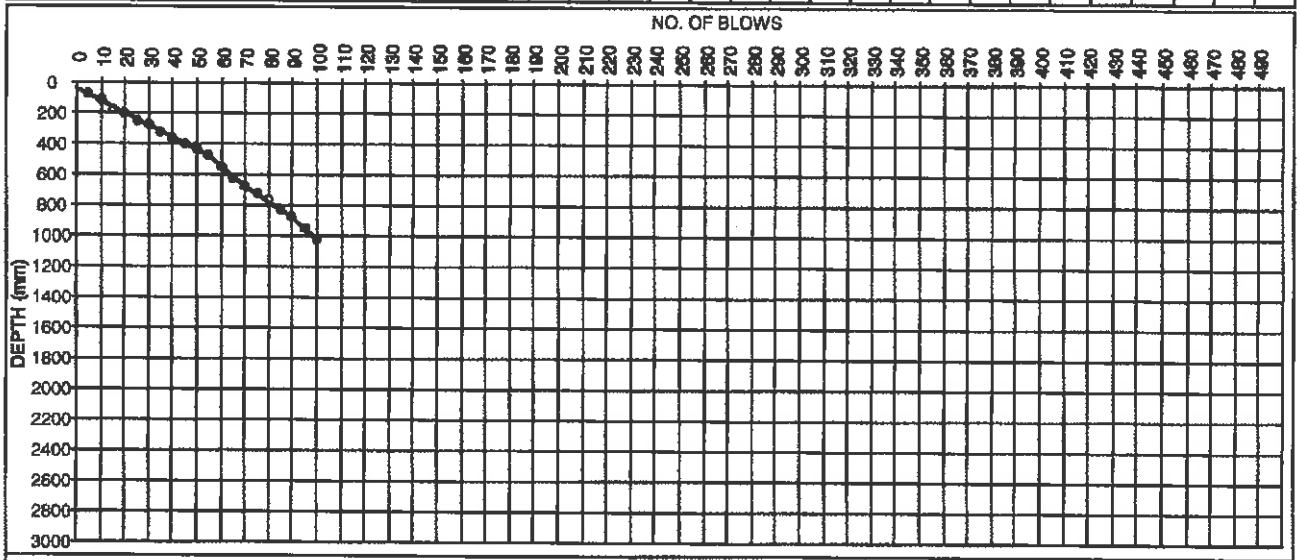
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

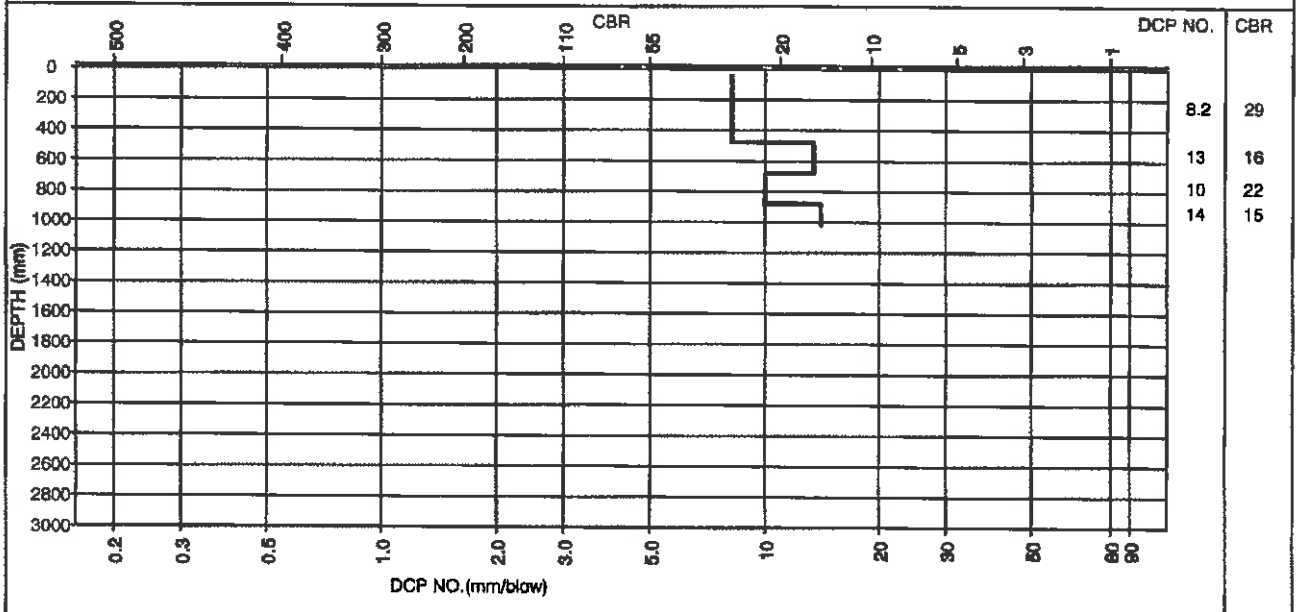
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP5 - CH24+800 RHS

INITIAL DEPTH (mm) : 40

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
DEPTH	70	110	170	200	245	280	320	360	400	440	480	550	630	680	730	765	830	880	950	1020
CBR	45	30	18	45	25	35	30	30	30	30	30	15	13	22	22	35	16	22	15	15





DCP NO.	CBR
8.2	29
13	16
10	22
14	15

Remarks :

FORM: ST6 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

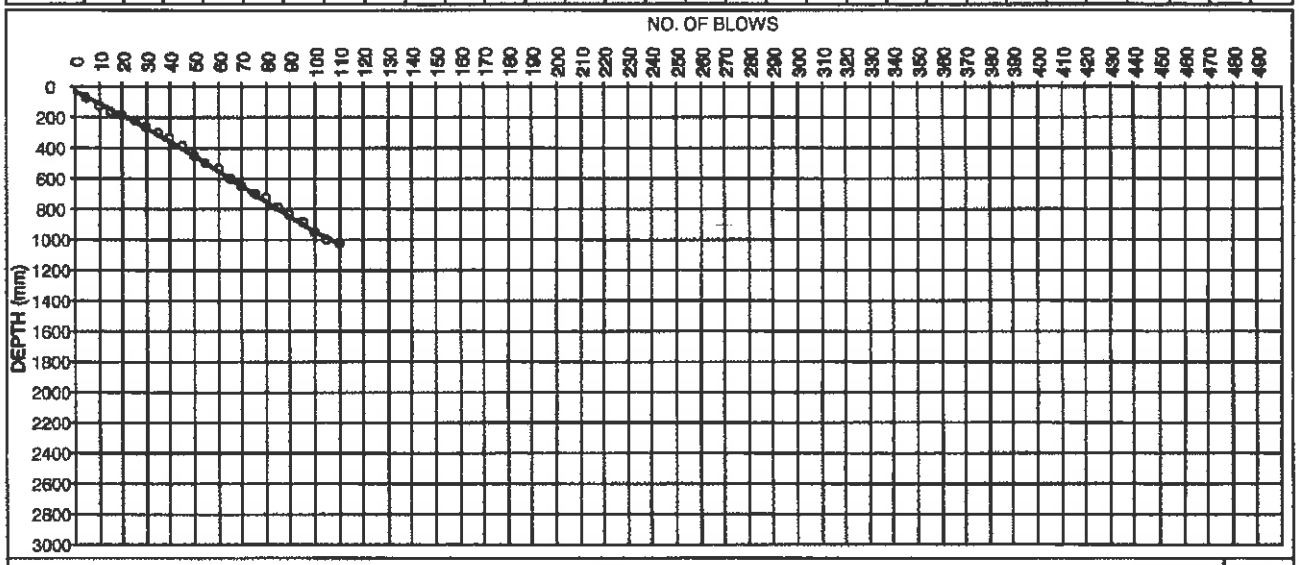
Attention: Mr Hein Arnold

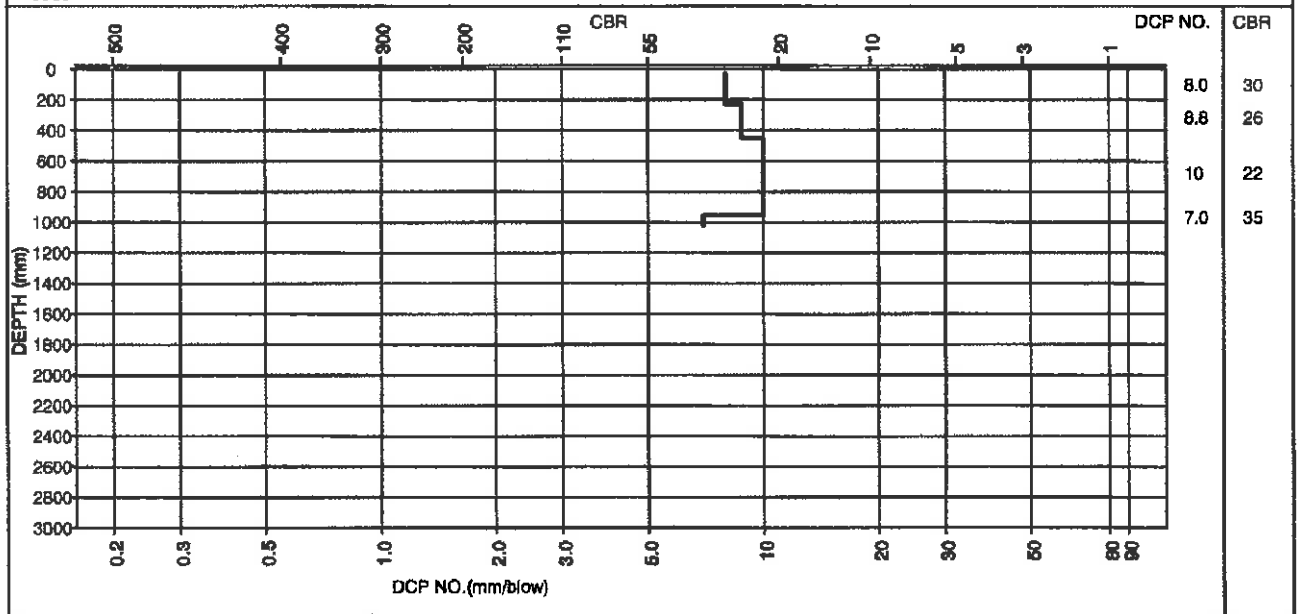
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : DCP6 - CH25+950 RHS INITIAL DEPTH (mm) : 30

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110
DEPTH	70	120	160	190	230	265	300	340	385	450	500	535	600	645	700	730	790	835	890	955	1000	1025
CBR	30	22	30	45	30	35	35	30	25	16	22	35	16	25	20	45	18	25	20	16	25	55





DCP NO.	CBR
8.0	30
8.8	26
10	22
7.0	35

Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

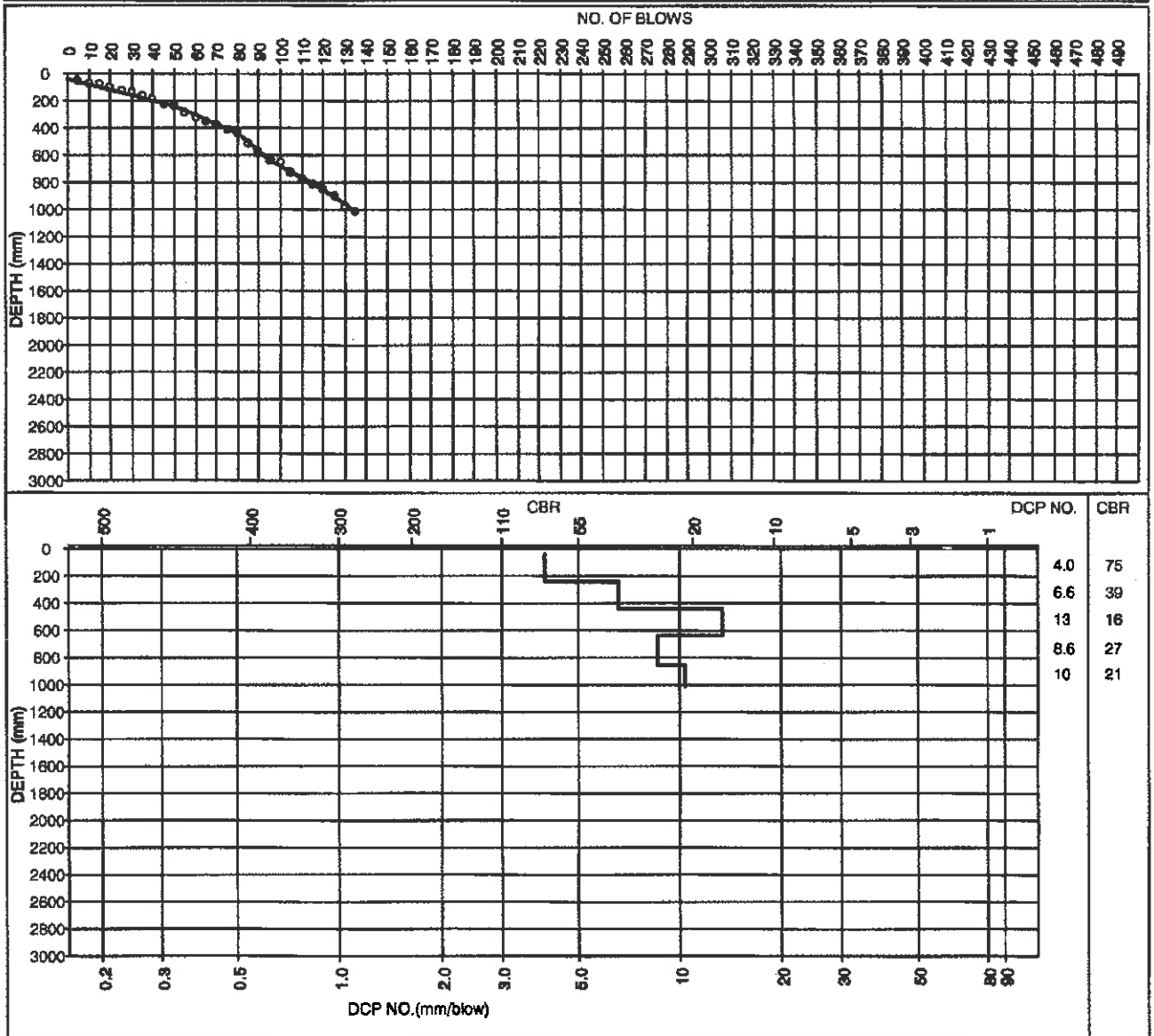
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : 5 - CH25+400 INITIAL DEPTH (mm) : 40

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
DEPTH	55	70	80	100	120	140	165	190	220	240	290	330	355	380	410	440	515	570	640	655	730	775	815	855	900	970	1010
CBR	110	110	170	75	75	75	55	55	45	75	22	30	55	55	45	45	14	20	15	110	14	25	30	30	25	15	30



Remarks :

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TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

Attention: Mr Hein Arnold

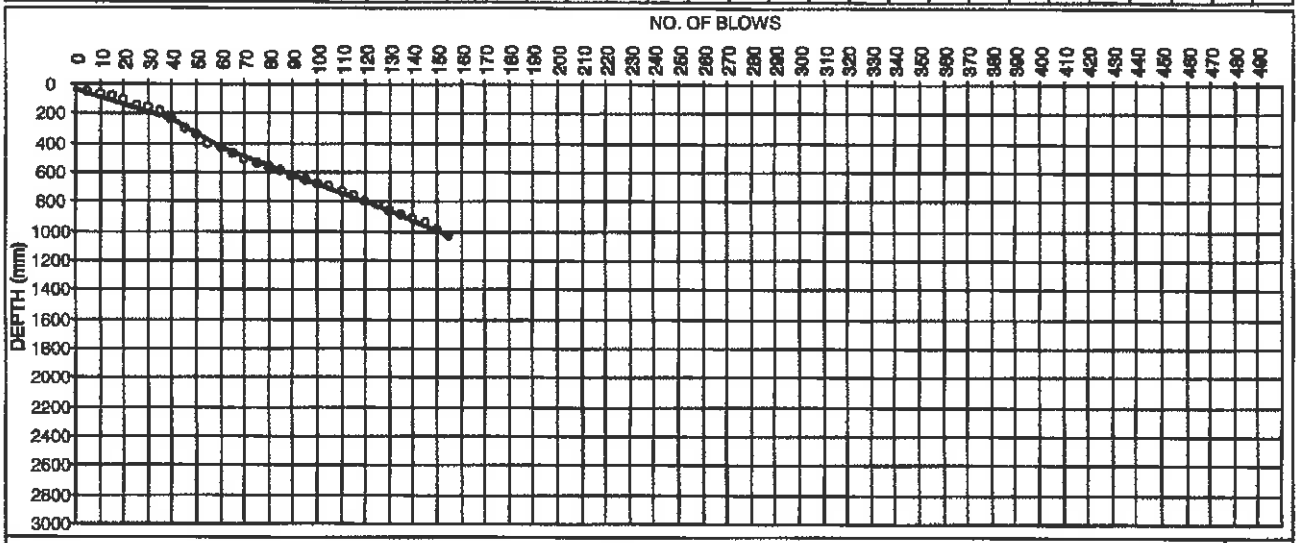
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

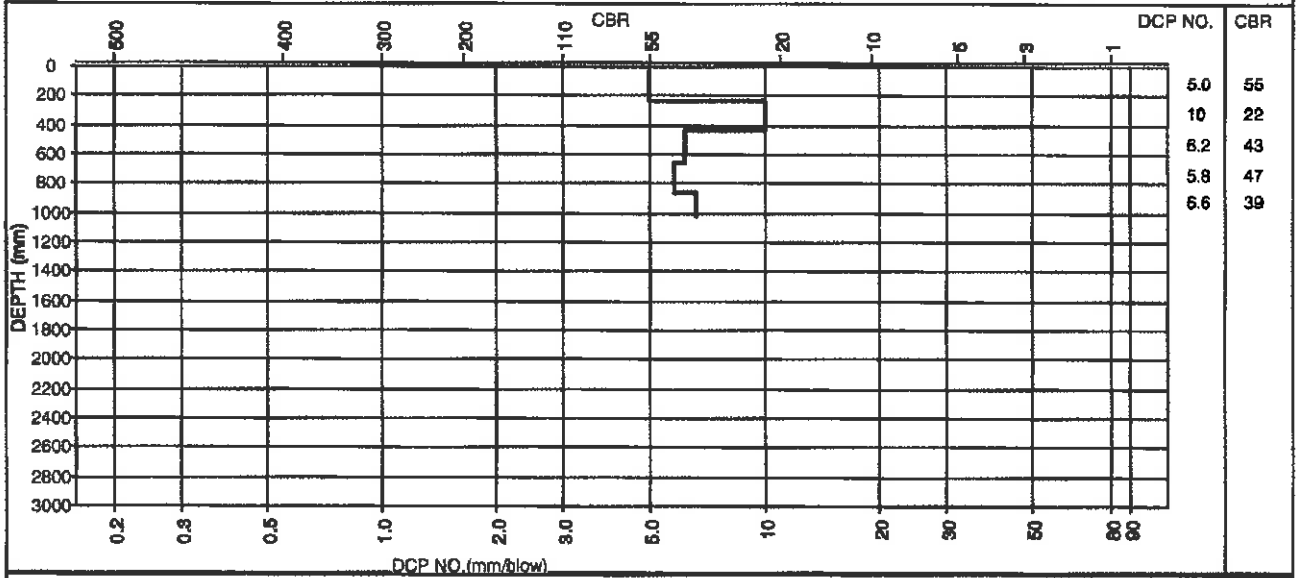
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : 4 - CH23+050 INITIAL DEPTH (mm) : 35

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
DEPTH	55	65	75	105	145	160	185	235	295	340	405	435	470	505	535	560	585	625	655	675	695	725	760	795	825	860	885	915	940	995
CBR	75	170	170	45	30	110	55	22	18	25	16	45	35	35	45	55	55	30	45	75	75	45	35	35	45	35	55	45	55	20

BLOWS	155																													
DEPTH	1025																													
CBR	45																													





Remarks :

FORM: ST6 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

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- CIVIL ENGINEERING SERVICES -

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TEST RESULTS

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72 COTSHOLD DRIVE
WESTVILLE

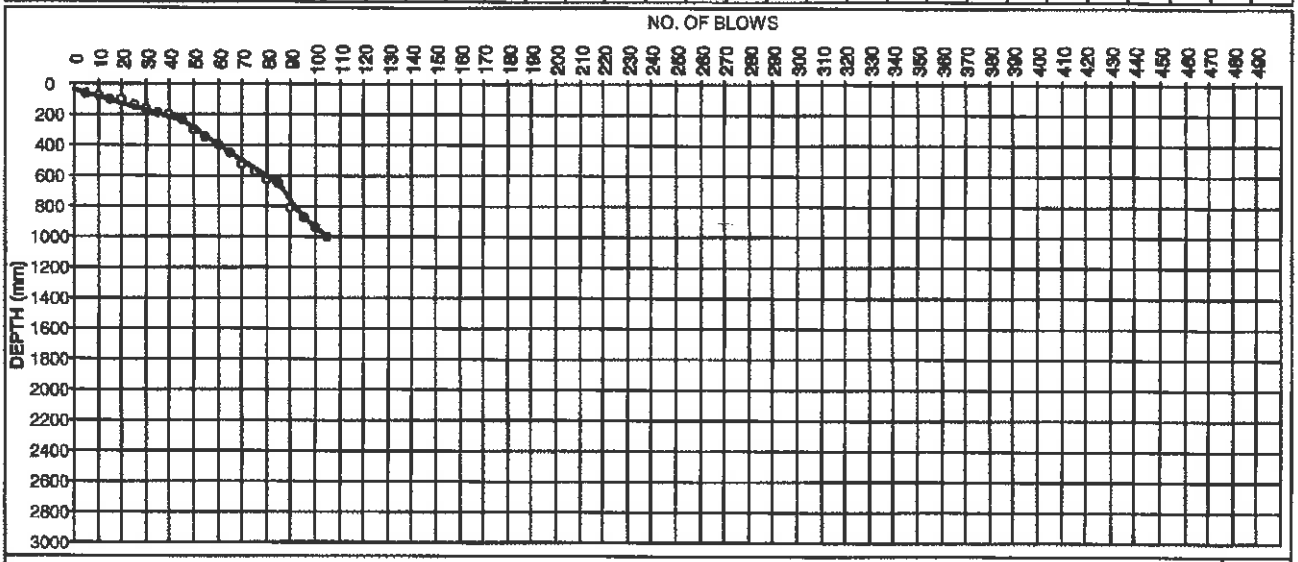
Attention: Mr Hein Arnold

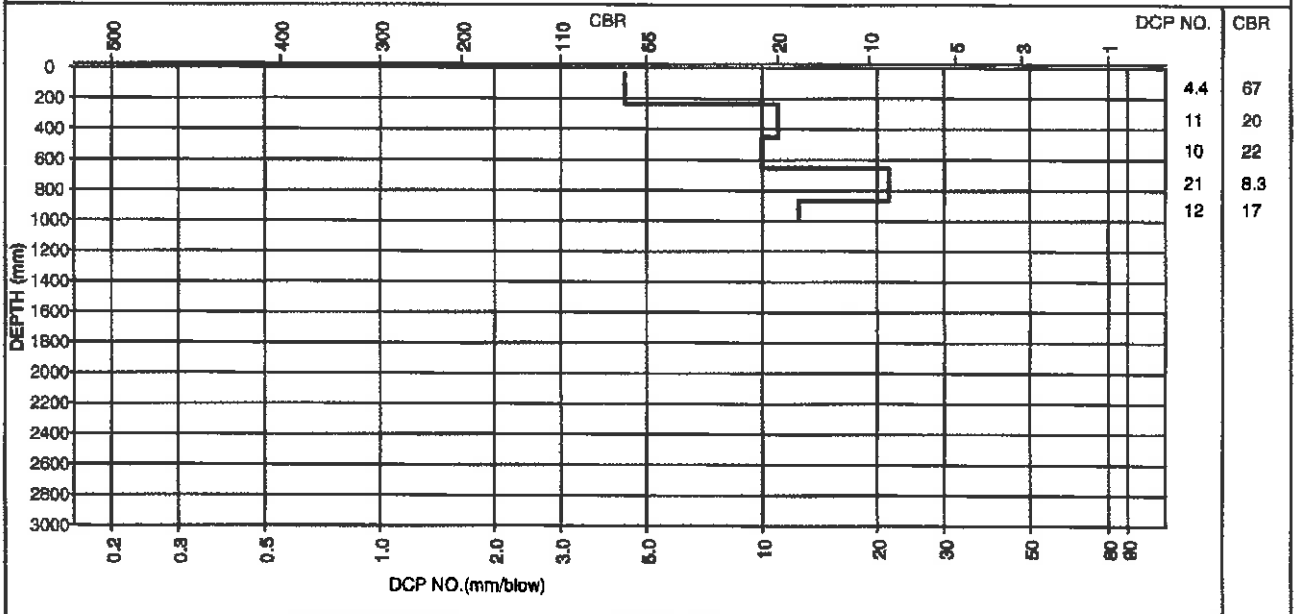
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : 3 - CH22+020 INITIAL DEPTH (mm) : 35

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
DEPTH	65	75	95	105	135	160	185	205	235	295	355	395	455	525	570	630	655	815	870	935	995
CBR	45	170	75	170	45	55	55	75	45	18	18	30	18	15	25	18	55	5	20	16	18





DCP NO.	CBR
4.4	67
11	20
10	22
21	8.3
12	17

Remarks :

FORM: ST6 Program ver 3.3(26.01.2010) Technical Signatory : Lawrence Govender/Rasalis Bhikam

MATROLAB GROUP (PTY.) LTD.
- CIVIL ENGINEERING SERVICES -

UNIT 7, PENNYLANE PARK, 64 EBONYFIELD AVE., SPRINGFIELD PARK
P.O.BOX 74663, ROCHDALE PARK, 4034

Tel. : 031-5791220/1
Fax : 031-5791344
Email : lawrenceg@matrolab.co.za

TEST RESULTS

ROYAL HASKONING DHV
72 COTSHOLD DRIVE
WESTVILLE

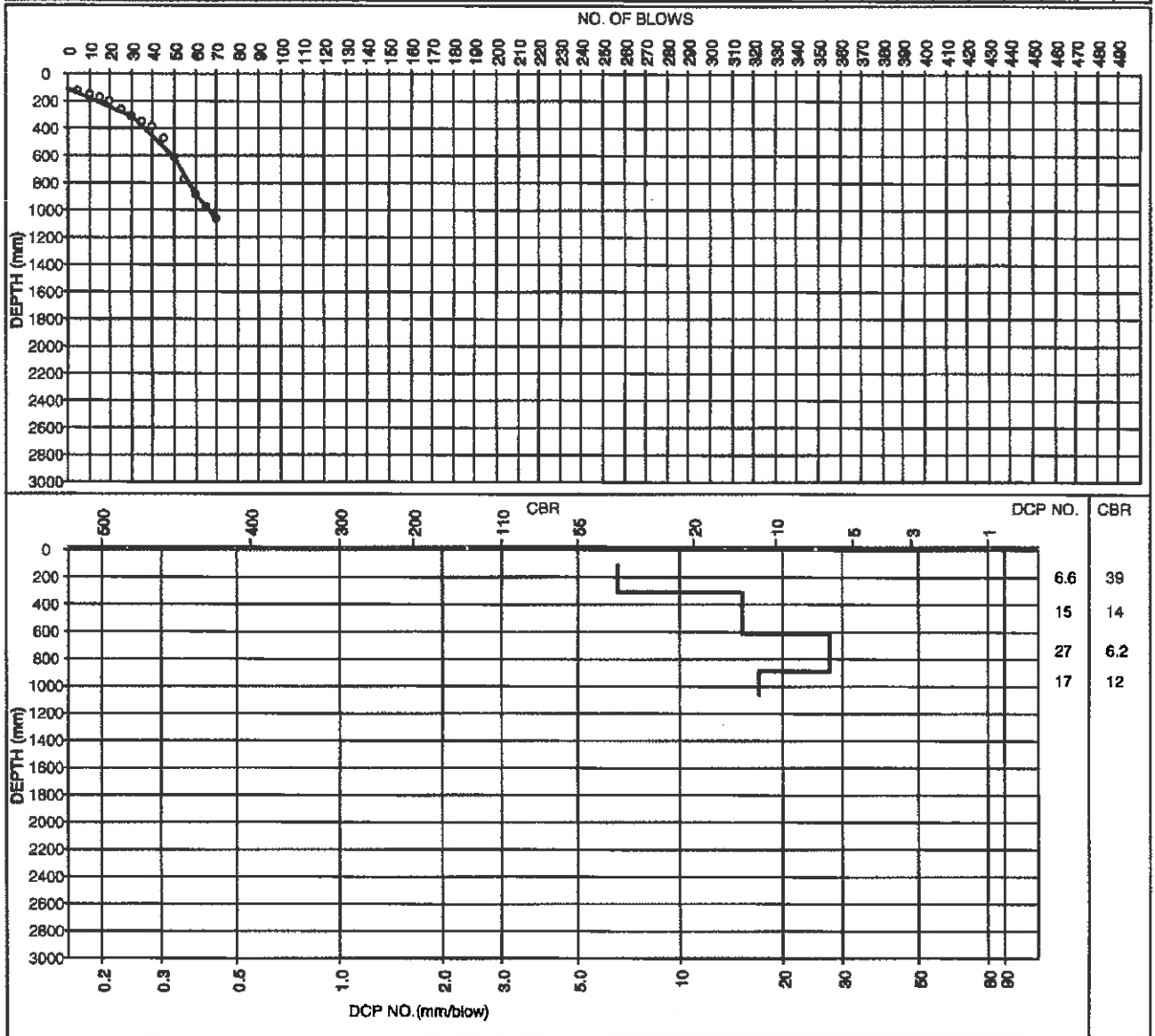
Attention: Mr Hein Arnold

Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : 2 - CH20+200 INITIAL DEPTH (mm) : 110

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70
DEPTH	120	150	175	200	260	310	345	390	470	615	780	890	980	1060
CBR	170	45	55	55	18	22	35	25	13	6	5	8	11	13



Remarks :

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TEST RESULTS

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Attention: Mr Hein Arnold

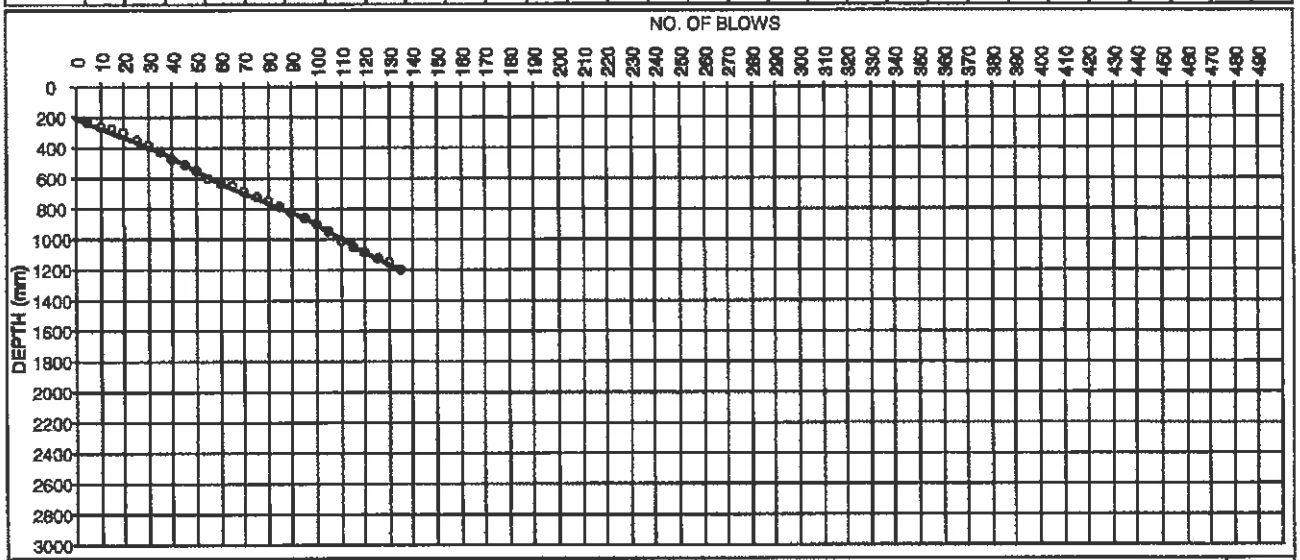
Project : The Rehabilitation Of Main Route P50-1
: From KM 18,00 - KM 26,00
Your Ref :
Our Ref : 101893
Date Reported : 24.04.2015

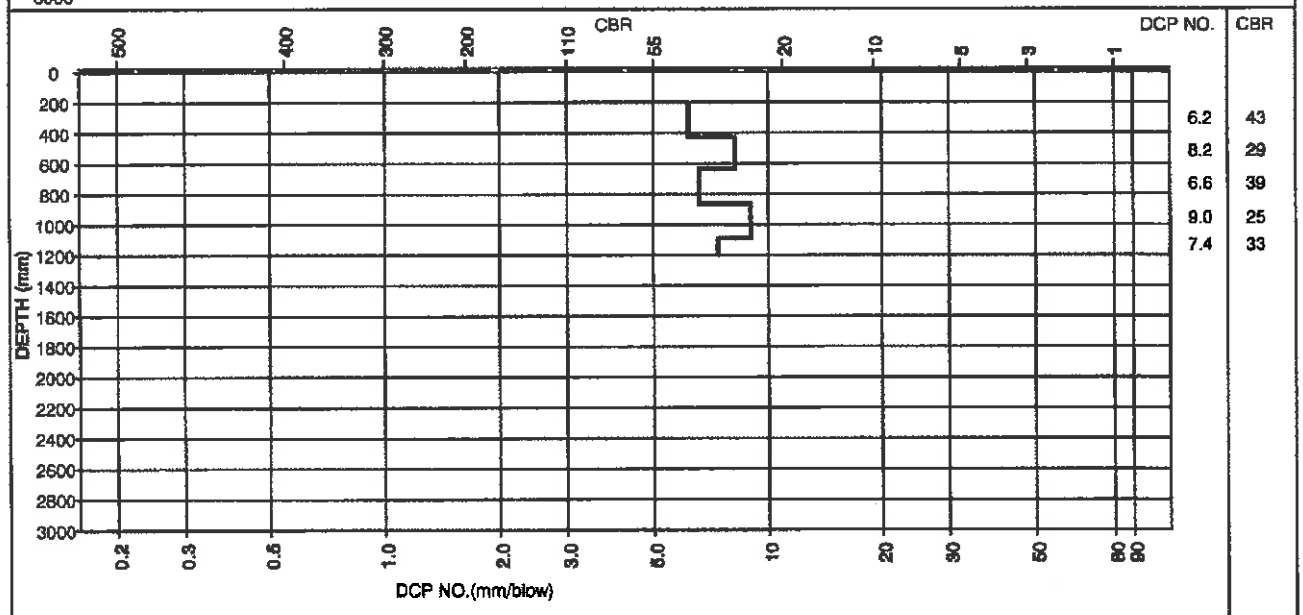
DYNAMIC CONE PENETRATION TEST (TMH6-ST6)

TEST POSITION : 1 - CH18+900 LHS

INITIAL DEPTH (mm) : 210

BLOWS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135
DEPTH	235	260	280	305	350	390	430	480	510	545	605	635	650	690	725	750	790	825	865	900	950	1010	1045	1090	1120	1155	1200
CBR	55	55	75	55	25	30	30	22	45	35	18	45	110	30	35	55	30	35	30	35	22	18	35	25	45	35	25





Remarks :

FORM: ST6 Program ver 3.3(26.01.2010)

Technical Signatory : Lawrence Govender/Rasalis Bhikam

APPENDIX G
PHOTOGRAPHS

The Rehabilitation of the first 2 Km through Eshowe

Severe Crocodiles and patching at Km 2

Severe crocodile cracks at KM 3, the section through Eshowe

Severe crocodile cracks and distress patches.

Neglected cleaning of drainage next to the road at Km 5

Block crack with pumping at KM 10

Drainage issues at the bottom of the Super elevation at Km 15

Access discharges water to pond next to the road at Km 20

Crocodile cracks with pumping and pothole at Km 20.

Severe block cracks at KM 21

Potholes Repair at Km 22

Potholes repair ongoing at Km 22

Surface Failure at Km 23

Potholes severe and extensive between Km 24 and Km 26

Structural failure and exposure of the base layer at Km 24

APPENDIX H
COST SUMMARY