ARQ CONSULTING ENGINEERS

MBSA HIGH SPEED PROVING GROUND

Geotechnical Investigation Report

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TITLE

IngenAix Proving Ground Project
Geotechnical Investigation Report

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EXECUTIVE SUMMARY

ARQ (Pty) Ltd. was requested by WSP Parsons Brinckerhoff on behalf of IngenAix GmbH to conduct the geotechnical investigation for the proposed new proving ground development 40km north-east of Upington. The development consists of various components and the investigation entailed test pits excavated with an excavator or tractor loader backhoe (TLB) to maximum depths of 5m and 3m, respectively.

The investigation was conducted from 9 to 16 June 2015. The test pits were profiled according to Brink and Bruin (2002) and representative soil strata were sampled for laboratory testing at Roadlab in Germiston, a SANAS accredited soil testing laboratory.

The investigation also entailed laboratory tests on core samples from a previously conducted rotary core drilling investigation at a possible quarry area. The investigation was aimed at determining the material's suitability for use in the construction of road layerworks or possibly for engineered fill. Testing was conducted at a SANAS accredited rock/ aggregate testing laboratory.

Section 5 of this report discusses the centreline investigation for the oval and handling track and multifunctional area, Section 6 the investigation at the building area and Section 7 the investigation at the bridge area. Section 8 examines the quarry and Section 9 the borrow pit area. Recommendations for the various components of the development are given in Section 10.

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LIST OF ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
Bd	Building area test pit
Br	Bridge test pit
CBR	California Bearing Ratio
FI	Foundation Indicator
GM	Grading Modulus
LL	Liquid Limit
LS	Linear Shrinkage
MAD	Mod AASHTO Density
MDD	Maximum Dry Density
Mod	Moisture-density relationship
MS	Max Swell
OMC	Optimum Moisture Content (%)
OTP	Oval test pit*
RI	Road Indicator
TPH	Test pit handling track
TPMF	Test pit multifunctional area
TPOV	Test pit oval*
XRD	X-ray Diffraction
XRF	X-ray Fluorescence

*Note: Abbreviation for the oval test pits were changed during the investigation from OTP to TPOV

1. INTRODUCTION

ARQ (Pty) Ltd. was requested by the client, WSP (Pty) Ltd., to conduct a geotechnical investigation for the proposed new proving ground development situated some 40km northeast of Upington in the Northern Cape Province, South Africa. The development will consist of various roadways, a 17km long oval track, handling track, bridge or track overpass, buildings and other infrastructure.

Various preliminary investigations were previously conducted in the area comprising test pits on the borrow pit area and rotary core drilling at a possible quarry area.

The investigation conducted by ARQ was aimed at supplying information regarding the following:

- Geology of the site,
- Nature and engineering properties of materials excavated,
- Bearing capacity and settlement of the in-situ material/ soft rock layers,
- Risks or challenges that may be encountered during the excavation/construction activities,
- Suitability of in-situ materials for use in anticipated roadways and infrastructure,
- Potential expansiveness/ collapsibility of the soils, and
- Design recommendations for the foundations, earthworks and materials utilisation.

The investigation was conducted from 9-16 June 2015 by two of ARQ's geotechnical engineers, Hannes Taljaard and Coert van Dyk, together with a team from Roadlab and a WSP representative, Emile van Zyl.

2. THE SITE

The site is located some 40km northeast of Upington on portion 6 of the farm Steenkampspan number 419 in the Siyanda district, Northern Cape. Refer to Figure 1 overleaf for a Google Earth ™ locality image of the site.

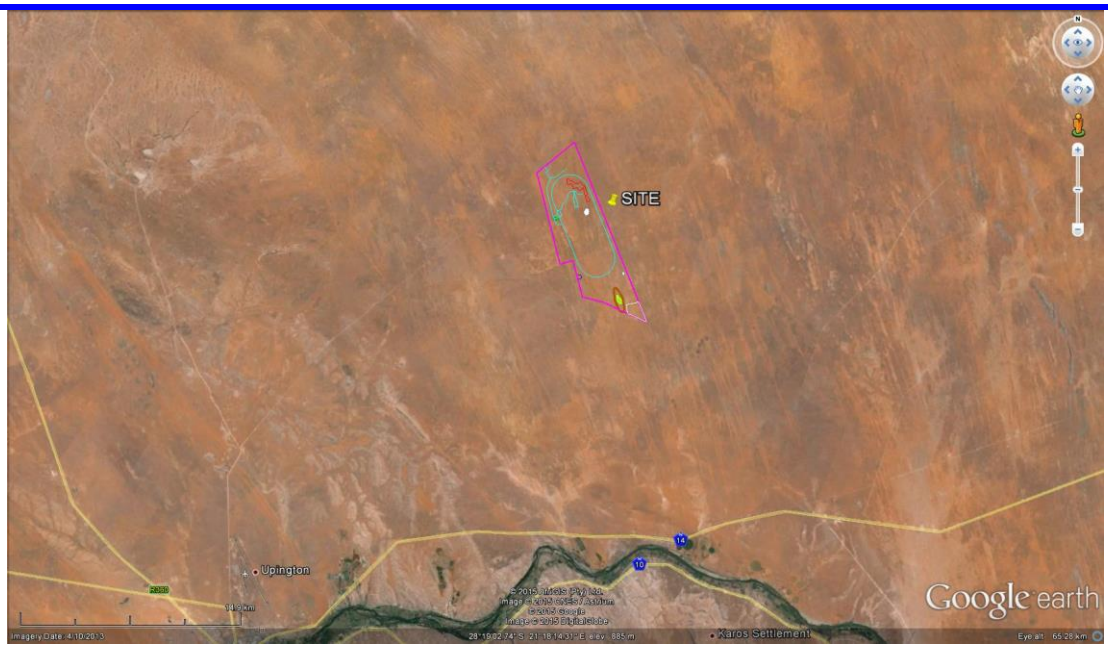

Figure 1: Site locality - Google Earth ™

3. METHOD OF INVESTIGATION

The investigation was planned according to the guidelines set out in SAICE's Site Investigation Code of Practice (SICOP, 2010), but conducted according to the client's requirements.

3.1. TEST PIT INVESTIGATION

The investigation comprised deep test pits excavated with a 28 ton excavator to depths of some 5.5m or effective refusal conditions at the building and bridge areas and in locations where deep cuttings are envisioned along the oval track. A tractor loader backhoe (TLB) was utilised to excavate the test pits for the latter part of the investigation, excavated to depths of some 3m or effective refusal conditions, as the TLB has greater mobility than the heavy excavator. Also, a maximum investigation depth of only 1.5m was required for the remainder of the test pits for the centreline investigation for the oval, handling track and multifunctional area.

47 test pits were conducted in total as part of the geotechnical investigation along the 17km oval, 7km handling track and the multifunctional, bridge and building area. The test pits were profiled according to the latest accepted standards (Brink and Bruin, 2002). The centreline investigation for the access and bad roads were not conducted, as the location and layout thereof was not finalised at the time of investigation. The co-ordinates of the test pits conducted on site are given in **Appendix A,** with Figure 2 overleaf showing the locations of these test pits.

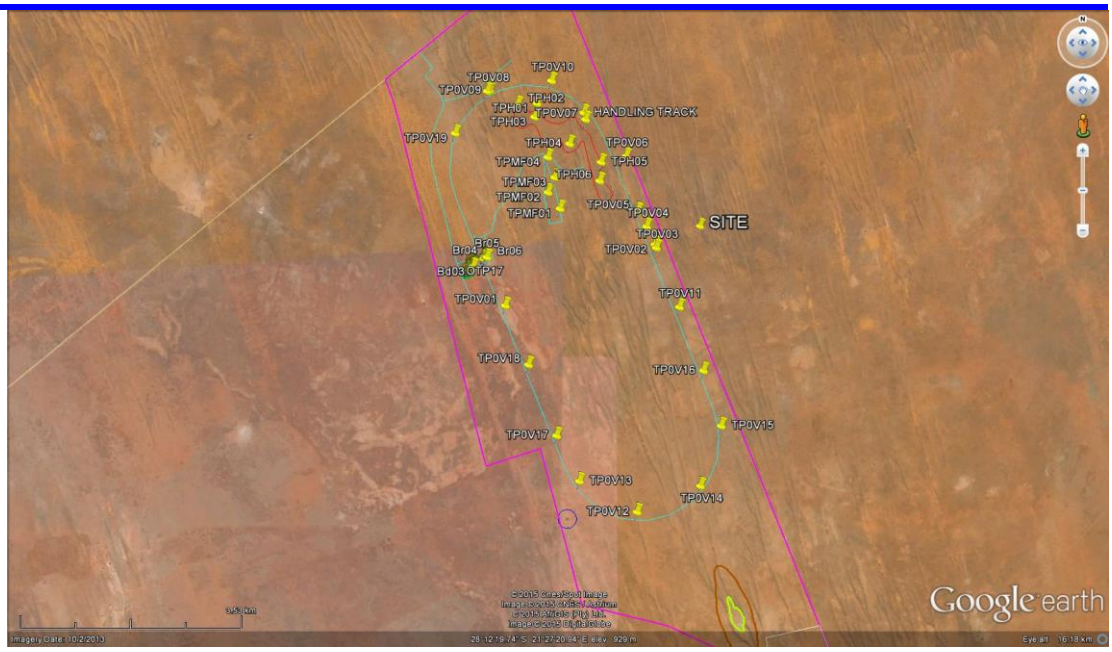

Figure 2: Test pits conducted

As part of the centreline investigation for the oval track, the first test pit conducted was termed OTP17 (oval test pit #), after which it was decided to rather change the test pit names to TPOV (test pit oval #).

Samples were taken during the investigation of representative materials and sent for testing at Roadlab in Germiston, a SANAS accredited soil testing laboratory.

3.2. DCP INVESTIGATION

Dynamic Cone Penetrometer (DCP) testing was not conducted within the test pits as refusal conditions were encountered in most of the test pits and/ or the very loose to loose upper sand layer rendered the test pits unsafe with a high potential of sidewall collapse.

3.3. ROTARY CORE DRILLING

Rotary core drilling was not conducted at the area envisioned for the bridge/ track overpass, as relatively shallow refusal conditions with the excavator were encountered. These test pits were conducted at the planned locations of the bridge abutments and piers, as confirmed with the client on site.

Core samples were collected from the previously conducted rotary core drilling investigation at the granite outcrop to determine the material's suitability for use in the layerworks or engineered fill for the development.

4. GEOLOGY

4.1. REGIONAL GEOLOGY

The regional geology was determined by overlying the 1:250 000 geological map 2820 UPINGTON in Google Earth ™, as shown in Figure 3 overleaf.

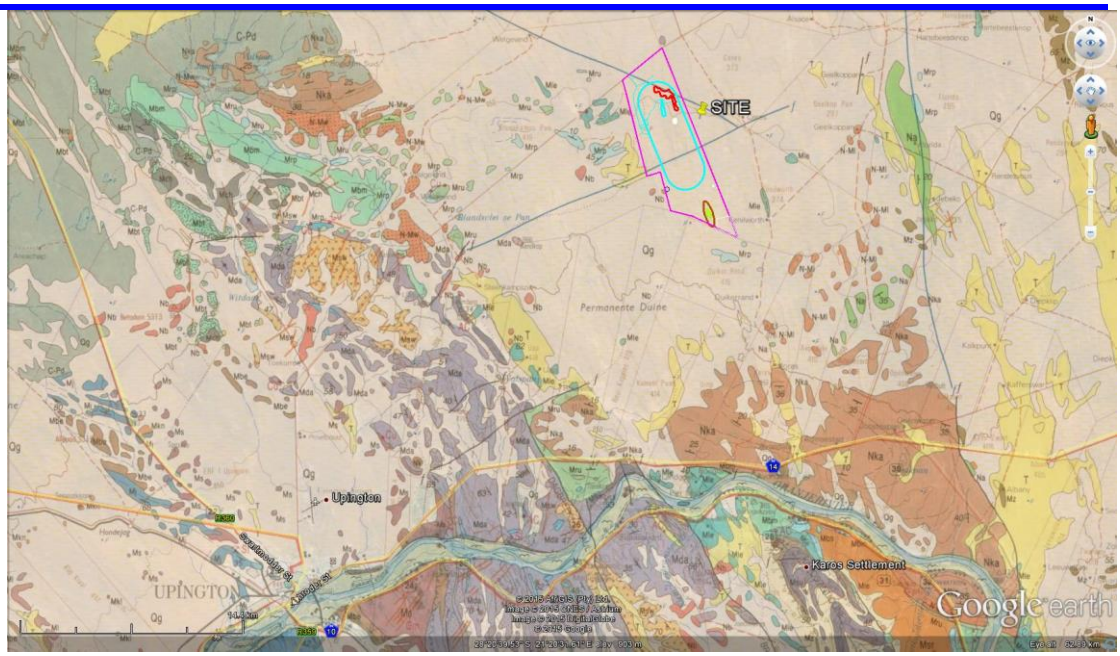

Figure 3: Google Earth overlay of the site geology ™

As seen in Figure 3, the site is underlain by:

Mle - Metabasalt, felsic lavas, greenschist, conglomerate and ferruginous chert of the Leerkrans Formation, Wilgenhoutsdrif Group,

- **T** - Calcrete,
- **Mrp** - Conglomerate and sandstone of the Rusplaas Formation, Koras Group,
- **Nb** - Granite porphyry of the Blouwbosch granites, and
- **Qg** - Red-brown, wind-blown sand and dunes of the Gordonia Formation.

4.2. LOCAL GEOLOGY

Local geology was determined from the test pit investigation. Table 1 overleaf contains a summary of the samples collected from the test pit investigation (in chronological order) and the laboratory tests for which the samples were submitted.

A summary of the test pit profiles, depicting the local geology, are given in the subsequent sections of this report.

Table 1: Summary of samples collected from test pit investigation

No.	Test pit No.	Depth (m)	Laboratory tests requested	Material
1	Bd01	0.0-1.3	MOD and CBR, FI, pH and conductivity	Sand
2		1.3-2.2	MOD and CBR, FI	Pebble marker
3		2.2-2.7	MOD and CBR, FI, pH and conductivity	Granite
4	Bd06	1.4-2.9	MOD and CBR, FI	Granite (manifest as gravel)
5	Bd05	1.1-2.5	MOD and CBR, FI, pH and conductivity	Metabasalt + calcrete
6	Bd08	0.8-3.3	MOD and CBR, FI, pH and conductivity	Metabasalt
7	Bd12	0.6-2.6	MOD and CBR, FI, pH and conductivity	Metabasalt + calcrete
8	OTP17	0.3-1.0	MOD and CBR, Indicator	Pebble marker
9	TPOV2	0.0-1.3	MOD and CBR, Indicator, pH and conductivity	Sand
10		1.4-2.8	MOD and CBR, Indicator, pH and conductivity	Metabasalt
11	TPOV4	0.0-1.4	MOD and CBR, Indicator	Sand
12		1.4-3.1	MOD and CBR, Indicator, pH and conductivity	Metabasalt + calcrete
13	TPOV7	0.0-3.5	MOD and CBR, Indicator	Sand
14	TPOV8	0.0-2.5	MOD and CBR, Indicator, pH and conductivity	Sand
15	TPH02	0.0-2.7	MOD and CBR, Indicator	Sand
16	TPH04	0.0-1.7	MOD and CBR, Indicator	Sand
17	TPH05	0.0-0.7	MOD and CBR, Indicator	Sand
18	TPMF01	0.0-2.6	MOD and CBR, Indicator	Sand
19	TPOV11	0.0-0.8	MOD and CBR, Indicator	Sand
20	TPOV12	0.0-0.8	MOD and CBR, Indicator, pH and conductivity	Sand
21	TPOV13	0.0-1.4	MOD and CBR, Indicator	Sand
22	TPOV15	0.0-1.0	MOD and CBR, Indicator	Sand
23	TPOV16	0.1-0.8	MOD and CBR, Indicator, pH and conductivity	Metabasalt + calcrete
24	TPOV18	0.0-0.6	MOD and CBR, Indicator, pH and conductivity	Sand
25	TPOV19	0.5-1.9	MOD and CBR, Indicator, pH and conductivity	Metabasalt + calcrete

In the subsequent sections of the report, the different components or areas of the investigation will be discussed separately i.e. the centre line investigation (oval track, handling track and multifunctional area), the buildings area, the bridge and the quarry area.

4.2.1. CALCRETE

Various forms of calcrete were encountered throughout the test pit investigation i.e. powder, nodular, honeycombed and hardpan calcrete, the difference originating from the degree or extent of the calcrete formation.

Calcrete is formed when the soil or parent material is replaced or cemented, to a lesser or greater extent, by the carbonate (via precipitation through a fluctuating water table or it may be transported downwards through the soil by rainwater).

Brink (1985) states that crushed hardpan calcretes are rarely used for surfacing chipping due to excessive binder absorption. This problem may be overcome by precoating the chippings. One of the main difficulties of using the calcrete material in construction of the layerworks is the variability of the material, both vertically and horizontally, in the possible borrow pit. This variability in the material quality, layer thickness and even type of calcrete (i.e. nodular or hardpan etc.) was noted during the test pit investigation. Further potential problems include those of alkali-silica, carbonate and alumina reactions. The main method of assessing the quality and suitability of the material is by means of soaked CBR (Brink 1985).

5. CENTRE LINE INVESTIGATION

The centre line investigation comprises the oval track, handling track and multifunctional area investigations.

From the draft design requirements for the preliminary design of the roadways and developments on site, construction material of the following quality are required:

- G7 - G10 as bulk fill material,
- G5 for subbase material,
- G3 for base material, and
- Likely G1 material for the envisaged asphalt surfacing layer.

5.1. OVAL TRACK

The oval track is some 17km in length and will be situated on sections with varying subsurface conditions i.e. shallow bedrock/calcrete or deep sand strata sections (such as dunes) that will require bulk earthworks. The positions of the 20 test pits conducted on the oval track are shown in Figure 4.

Various samples were collected from the centreline test pit investigation and submitted for laboratory testing.

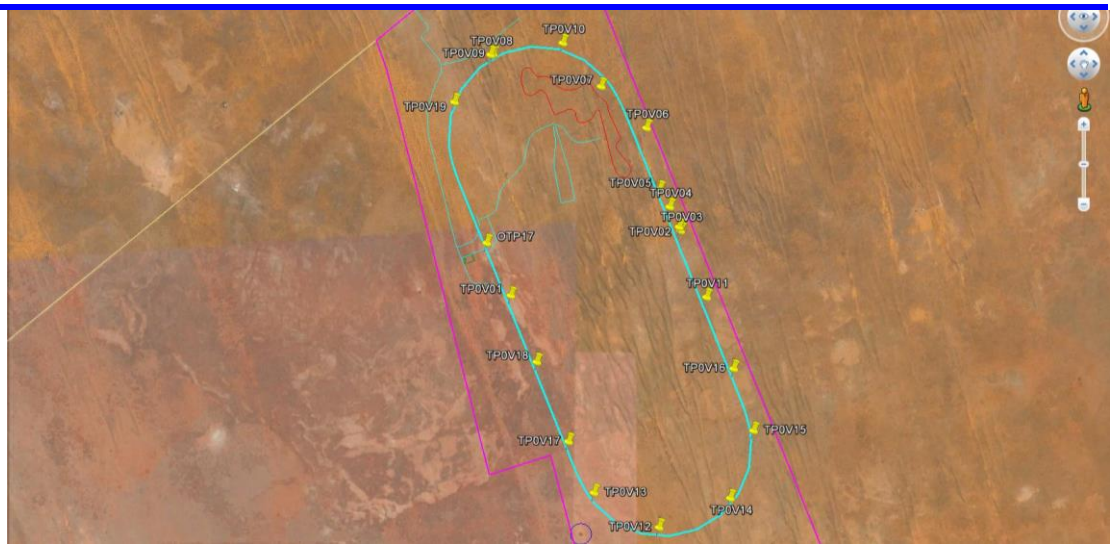

Figure 4: Test pit positions - Oval track from Google Earth ™

5.1.1. MATERIAL PROPERTIES

a) Test pit profiles

A summary of the test pit profiles are given in Table 2 below.

Table 2: Profile summary - Oval track

Test pit	Layer and depth (m)						
	Soils		Rocks/Pedogenic				Refusal depth (m)
	Very loose to loose sand	Quartz pebbles in a sand matrix	Metabasalt	Metabasalt with calcrete	Calcrete	Granite with calcrete	
TPOV01	0-0.1			0.1-0.5			0.5
TPOV02	0-1.3	1.3-1.4	1.4-2.8				2.8
TPOV03	0-1.4	1.4-1.8	1.8-2.8				2.8
TPOV04	0-1.4			1.4-3.1			3.1
TPOV05	0-1.0	1.0-1.3	1.3-2.0				2.0
TPOV06	0-5.0						-
TPOV07	0-3.5			3.5-3.6			3.6
TPOV08	0-2.5						-
TPOV09	0-0.9		0.9-1.8				1.8
TPOV10	0-0.6	0.6-0.7	0.7-1.4				1.4
TPOV11	0-0.8			0.8-0.9			0.9
TPOV12	0-0.8	0.8-1.3	1.3-1.7				1.7
TPOV13	0-1.4	1.4-1.7	1.7-2.0				2.0
TPOV14	0-1.0				1.0-1.3		1.3
TPOV15	0-1.0				1.0-1.1		1.1
TPOV16	0-0.1			0.1-0.8			0.8
TPOV17	0-1.0			1.0-1.8			1.8
OTP17	0-1.0					1.0-3.1	-

The detailed profiles of the centreline investigation for the oval track are given in **Appendix B.**

b) Test pit samples

A summary of the laboratory results for the tests conducted on samples from the oval track centreline investigation are given in Table 4 and Table 5 overleaf. The detailed laboratory results are given in **Appendix C.**

c) Expansive soils

No expansive soils were identified during the investigation.

d) Compressible soils

Compressible soils were identified during the investigation in the form of very loose to loose sand. This compressible characteristic will in all likelihood be mitigated upon compaction at the appropriate moisture condition (generally OMC +2%)

e) Collapsible soils

Collapsible soils were observed during the investigation in the form of a pinholed structure in the sand. The pinholed structure is likely to be destroyed upon compaction.

f) pH and conductivity

The corrosivity of the sand material for the oval track was classified as "non-corrosive" with a slightly basic pH that ranges from 7.6 to 8.1 (a pH of 7.0 indicates a completely neutral material). For the calcrete material, an average pH value of 8.4 and conductivities of 0.0 mS/m was determined, classifying the material as "non-corrosive" as well. The summarised pH and conductivity test results are provided in Table 4 and Table 5, with the comprehensive results contained in **Appendix C.**

According to the criteria in Table C7 of the CSIR Report No: BOU/R9705, a conductivity of >50 mS/m indicates a soil that is very corrosive while 50-20, 20-10 and <10 mS/m indicate corrosive, mildly corrosive and generally not corrosive conditions respectively.

In subclause 3602 (b) of COLTO, it is specified that crushed stone material with an electrical conductivity <150 mS/m and pH >6 may be used as for construction purposes and no further stabilisation is required (COLTO, 1998).

g) Salts

The soluble salt content of the sand layers were determined on the following samples, as given in Table 3.

Table 3: Soluble salt content of sand

Test pit No	TPOV7	TPOV8	TPOV11	TPOV15	TPOV18
Depth (m)	0.00-2.50	0.00-0.35	0.00-0.80	0.00-1.00	0.00-0.700
Soluble salt (%)	0.079	0.100	0.073	0.118	0.106

According to the guidelines in TRH14 (1985), the salt content should be <1% if the PI and -0.002mm fraction is <12% before treatment. Based on these guidelines and also

due to the pH and electrical conductivity values being within acceptable standards (COLTO, 1998), the salt content of the material is not envisaged to be problematic.

Table 4: Laboratory results - Oval track test pits (a)

Sample No.	TPOV2	TPOV2	TPOV4	TPOV4	TPOV7	TPOV8	TPOV11	TPOV12
Depth (m)	0.0-1.3	1.4-2.8	0.0-1.4	1.4-3.1	0.0-3.5	0.0-2.5	0.0-0.8	0.0-0.8
LL	0	0	0	0	0	0	0	0
PI	NP	NP	NP	NP	NP	NP	NP	NP
LS	0	0	0	0	0	0	0	0
GM	0.98	2.44	1.02	2.48	0.96	1.17	1.01	1.09
% P0.425mm	95	24	95	19	99	88	94	84
% P0.075mm	7.2	6	5	5	5	6	7	9
Expansiveness	Low	Low	Low	Low	Low	Low	Low	Low
OMC (%)	6.1	7.3	5.0	5.7	5.2	6.1	7.9	6.5
MDD (kg/m^3)	1 766	2 152	1 756	2 193	1 727	1 731	1 711	1 880
CBR @ 100%	32	116	22	101	16	18	22	32
CBR @ 95%	13	64	9	70	9	9	10	18
CBR @ 93%	11	54	8	62	8	7	9	15
Swell 100%	0.02	0.02	0.02	0.02	2.02	0.02	2.02	0.02
COLTO Class.	G8	G5	G9	G5	G9	G9	G9	G7
AASHTO Class.	A-3 (0)	A-1-a(0)	A-3 (0)	A-1-a(0)	A-3 (0)	A-3 (0)	A-3 (0)	A-3 (0)
pH				8.5	7.8	7.8	7.9	
Conductivity (mS/m)				0.00	0.02	0.03	0.03	

Table 5: Laboratory results - Oval track test pits (b)

Sample No.	TPOV12	TPOV13	TPOV15	TPOV16	TPOV18	TPOV19	TPOV19	OTP17
Depth (m)	1.4 - 2.8	0.0-1.4	0.0-1.0	0.1-0.8	0.0-0.6	0.0-0.5	0.5-1.9	0.3-1.0
LL	0	0	0	0	0	0	0	0
PI	NP	NP	NP	NP	NP	NP	NP	NP
LS	0	0	0	0	0	0	0	0
GM	2.48	1.1	1.01	1.98	1.06	1.06	2.54	2.64
% P0.425mm	24	85	92	46	86	88	19	16
% P0.075mm	4	9	8	6	10	7	4	2
Expansiveness		Low	Low		Low	Low	Low	Low
OMC (%)	7.3	5.8	5.3	6.0	6.8	7.2	5.5	3.3
MDD (kg/m^3)	2152	1880	1802	2067	1837	1873	2227	2176
CBR @ 100%	116	19	28	120	31	40	108	71
CBR @ 95%	64	12	18	76	21	26	64	26
CBR @ 93%	54	10	13	64	16	21	54	23
Swell 100%	0.02	2.00	0.02	0.02	0.82	0.02	0.08	0.03
COLTO Class.	G5	G9	G8	G5	G9	G7	G5	G7
AASHTO Class.	A-1-a(0)	A-3 (0)	A-3 (0)	A-1-b(0)	A-3 (0)	A-3 (0)	A-1-a(0)	A-1-a(0)
pH			8.1	8.3	7.6		8.4	
Conductivity (mS/m)			0.01	0.00	0.02		0.00	

5.1.2. GEOTECHNICAL EVALUATION

a) Groundwater

No groundwater was encountered during the centreline investigation.

b) Excavation conditions

Sand

Based on SABS 1200, soft excavation conditions can be expected for the sand using a 20 ton excavator. The sand depth varies across the site from 0.1m to >5m depending on the topography (i.e. on top of a dune). Refer to the profiles in **Appendix B** for an indication of the sand depth at various positions across the site or to Table 2 for a summary of the profiles.

Calcrete and rock

Based on SABS 1200, intermediate to hard excavation can be expected for the material below the sand i.e. calcrete and/or bedrock.

Blasting through calcrete material along the centreline of the oval, to lower the track, is not recommended due to the varying nature of the calcrete strata (thickness, uniformity etc.). This will most likely result in the material being blasted loose in large slabs that will further require pecking to reduce it to a useable size.

c) Use of in-situ material as construction material

Sand

Most of the sand classified as G9 material and can therefore be used as bulk fill material in the roadway layerwork construction. The sand material has the following particle distribution:

Table 6: Sand particle distribution

Material passing	Min	Max	Average
P425	84.0	99.0	90.1
P075	5.0	10.0	7.6

According to Section 3302 in COLTO, sand with a particle size distribution of P075>20% should be compacted to 95% of the Mod AASHTO density. The material has P075<20% and should therefore be compacted to at least 100% of its Mod AASHTO density in 150mm layers at 0 to +2%. of the OMC with a vibratory smooth drum roller with a 300kN centrifugal force on high amplitude mode.

Calcrete and rock

The calcrete and calcrete mixed with in-situ bedrock material classified as G5 material and it is therefore suited as subbase material for the roadways. The material will most likely have to be crushed to increase the homogeneity and workability of the material.

d) Cuttings

The oval track will traverse some undulating terrain, consisting of sand dunes of varying heights and widths. This will warrant the bulk excavation of such areas (as cuttings) to accommodate the planned profile of the oval track.

Table 7 shows the test pits which are in close proximity to the major cuttings on the oval track with the expected excavation conditions (estimates only). The expected cutting depths were extrapolated from the current layout and profile of the oval track as received from the client and are subject to change should the profile or founding depth be altered.

Table 7: Major cuttings on oval track

Chainage (km)	Expected cutting depth (m)	Test pit No.	Excavation conditions expected		
			Soft	Intermediate	Hard
0.60 – 1.20	3.00	-	0.00 – 1.00		1.00 – 3.00
2.40	4.00	TPOV08	0.00 – 2.50	2.50 – 3.00	3.00 – 4.00
2.45	2.40	TPOV09	0.00 – 0.90		0.90 – 2.40
5.10 - 5.65	3.00	TPOV06	0.00 – 3.00		
6.00	3.00	TPOV05	0.00 – 1.20	1.20 - 2.00	2.00 – 3.00
6.30	8.00	TPOV04	0.00 – 1.40	1.40 – 3.10	3.10 – 8.00
6.62	3.50	TPOV02	0.00 – 1.40	1.40 – 3.50	
6.70	2.00	TPOV03	0.00 – 1.80	1.80 – 2.00	
15.90	1.50	TPOV01	0.00 – 0.10	0.10 – 0.30	0.30 – 1.50
16.75	2.00	OTP17	0.00 – 1.00	1.00 – 2.00	
16.80	2.00	BR02	0.00 – 0.10	0.10 – 0.50	0.50 – 2.00

e) Drainage conditions

The upper stratum of material on site was profiled as very loose to loose sand with the following grading characteristics:

Table 8: Oval track sand grading characteristics

Grading property	Min. sieve size (mm)	Max. sieve size (mm)	Average
D_{10}	0.075	0.085	0.079

The material is expected to display average drainage characteristics with a rough indication of the permeability (according to Hazen from Craig, 2004) in the order of:

$$k = (D_{10})^2/100 = 6.24 \text{ E-5 m/s}$$

This indication of the average expected permeability is calculated based on the average D_{10} = 0.079mm (the effective sieve size at which 10% of the material passes) for the sand material.

The underlying calcrete and bedrock strata beneath the first layer of sand is expected to be less pervious than the sand layer and may act as small catchment basins in low-lying areas (i.e. between two closely spaced dunes) after heavy rainstorms. With an average rainfall of <200mm per annum, this is not deemed problematic.

Recommendations regarding the suitability of the material and the development of the oval track are given in Section 9 of this report.

5.2. HANDLING TRACK

The 5.5km long handling track is situated inside the north-eastern section of the oval track. A total of 6 test pits were conducted as part of the centreline investigation for the track.

The positions of the 6 test pits conducted on the handling track are shown in Figure 5.

Samples were collected from the test pit investigation and submitted for laboratory testing.

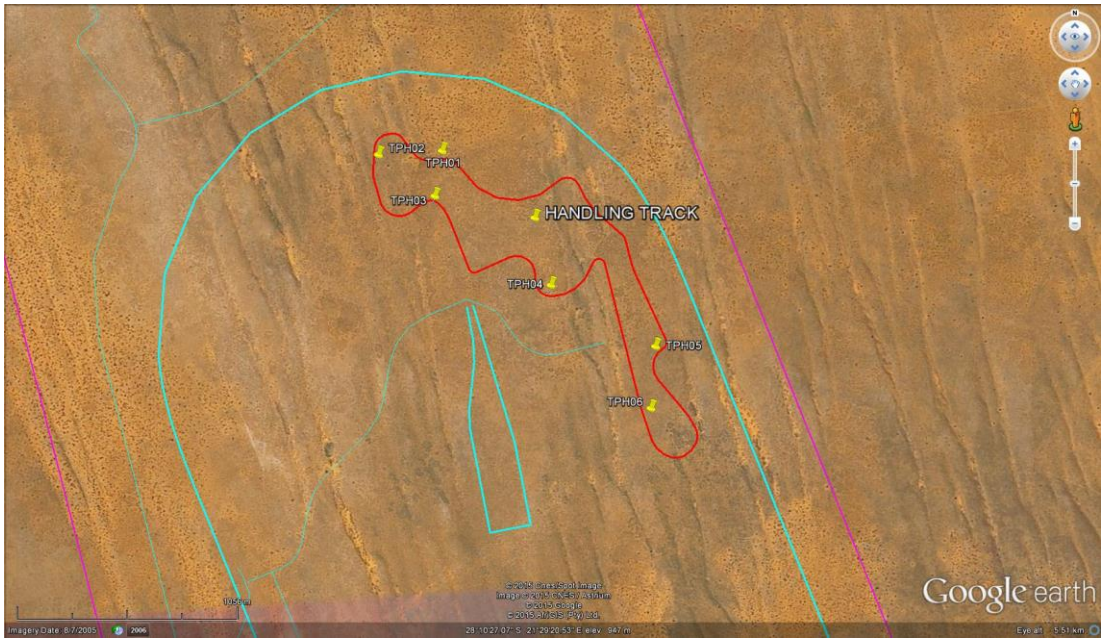

Figure 5: Test pit positions - Handling track

5.2.1. MATERIAL PROPERTIES

a) Test pit profiles

A summary of the test pit profiles are given in Table 9. The detailed profiles are given in **Appendix B.**

Table 9: Profile summary - Handling track

Test pit	Layer and depth (m)				
	Soils			Rocks/ Pedogenic	Refusal depth (m)
	Very loose to loose sand	Quartz pebbles in a sand matrix	Gravelly sand	Metabasalt with calcrete	
TPH01	0.0 - 0.80			0.80 - 1.50	1.50
TPH02	0.0 - 2.70				-
TPH03	0.0 - 0.80	0.80 - 0.90		0.90 - 1.55	1.55
TPH04	0.0 - 1.70		1.70 - 2.00	2.00 - 2.60	2.60
TPH05	0.0 - 0.70			0.70 - 1.00	1.00
TPH06	0.0 - 1.00	1.00 - 1.20		1.20 - 1.70	1.70

b) Test pit samples

A summary of the laboratory results of the tests conducted on the samples from the handling track centreline investigation is given in Table 10. The detailed lab results are given in **Appendix C.**

Table 10: Laboratory results summary – Handling track

Sample No.	TPH02	TPH04	TPH05
Depth (m)	0.0-2.7	0.0-1.7	0.0-0.7
LL	0	0	0
PI	NP	NP	NP
LS	0	0	0
GM	1.02	1.05	1.11
% P0.425mm	93	92	87
% P0.075mm	6	5	8
Expansiveness rating	Low	Low	Low
OMC (%)	5.0	6.3	6.7
MDD (kg/m3)	1 803	1 823	1 843
CBR @ 100% MAD (%)	18	22	16
CBR @ 95% MAD (%)	13	8	9
CBR @ 93% MAD (%)	10	7	7
MS @ 100% MAD (%)	0.02	0.02	0.02
COLTO Class.	G9	G9	G9
AASHTO Class.	A-3(0)	A-3(0)	A-3(0)

c) Expansive soils

No expansive soils were identified during the investigation.

d) Compressible soils

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (d).

e) Collapsible soils

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (e).

f) Salts

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (f).

5.2.2. GEOTECHNICAL EVALUATION

a) Groundwater

No groundwater was encountered during the investigation.

b) Excavation conditions

Sand

Based on SABS 1200, soft excavation conditions can be expected for the sand using a 20 ton excavator. The sand depth varies across the site from 0.7m to some 2.7m depending on the topography. Refer to the profiles in **Appendix B** for an indication of the sand depth at various positions across the site.

Calcrete and rock

Based on SABS 1200, intermediate to hard excavation can be expected for the material below the sand i.e. calcrete and rock.

c) Use of in-situ material as construction material

Sand

The sand classified as G9 material and can therefore be used as fill material for the road construction. The sand material has the following particle distribution:

Table 11: Handling track sand grading characteristics

Material passing	Min	Max	Average
P425	87.0	93.0	90.7
P075	5.0	8.0	6.3

According to COLTO (1998), the sand should be compacted to at least 100% of its Mod AASHTO density (see Section 5.1.2). The sand should be compacted in 150mm layers at 0 to +2% of the OMC with a vibratory smooth drum roller with a 300kN centrifugal force on high amplitude mode.

Calcrete and rock

The calcrete and calcrete mixed with rock classified as G5 material and therefore it can be used as subbase material for the roads.

d) Cuttings

Table 12 shows the test pits which are in close proximity to the major cuttings on the handling track.

Table 12: Major cuttings at handling track

Chainage (km)	Expected cutting depth (m)	Nearby test pits	Excavation conditions expected (m)		
			Soft	Intermediate	Hard
0.58	1	-	0.00 – 0.50	0.50 – 1.00	
1.88	1	TPH03	0.00 – 0.90	0.90 – 1.00	1.00 – 3.00
3.80	2	TPOV7	0.00 – 3.50		

e) Drainage

The upper stratum of material on site was profiled as very loose to loose sand with grading characteristics as shown in Table 13, which is similar to the material for the surrounding oval track.

Table 13: Handling track sand grading characteristics

Grading property	Min. sieve size (mm)	Max. sieve size (mm)	Average
D_{10}	0.078	0.082	0.080

The sand is expected to display similar drainage characteristics to the material from the oval track test pit investigation. Refer to Section 5.1.2 (e) for an indication of the expected permeability of the material.

5.3. MULTIFUNCTIONAL AREA

The multifunctional area is also situated within the oval track. It is located near the centre of the northern part of the oval track. The positions of the 4 test pits conducted on the multifunctional area are shown in Figure 6.

Samples were collected from the test pit investigation and submitted for laboratory testing.

Figure 6: Test pit positions - Multifunctional area

5.3.1. MATERIAL PROPERTIES

a) Test pit profiles

A summary of the test pit profiles are given in Table 14. The detailed profiles are given in **Appendix B.**

Table 14: Profile summary - Multifunctional area

Test pit	Layer and depth (m)		
	Soils	Rocks/Pedogenic	
	Very loose to loose sand	Metabasalt with Calcrete	Refusal depth (m)
TPMF01	0.0 - 2.6	2.6-2.8	2.8
TPMF02	0.0 - 2.0	-	-
TPMF03	0.0 - 1.1	1.1 - 1.4	1.4
TPMF04	0.0 - 1.1	1.1 - 1.4	1.4

b) Test pit samples

A summary of the laboratory results of the tests conducted on the test pit samples taken from the multifunctional area is given in Table 15. The detailed laboratory results are given in **Appendix C.**

Table 15: Laboratory results summary – Multifunctional area

Sample No.	TPMF01
Depth (m)	0.0-2.6
LL	0
PI	NP
LS	0
GM	0.93
% P0.425mm	93
% P0.075mm	7
Expansiveness rating	Low
OMC (%)	6.2
MDD (kg/m³)	1 781
CBR @ 100% MAD (%)	23
CBR @ 95% MAD (%)	15
CBR @ 93% MAD (%)	12
MS @ 100% MAD (%)	0.02
COLTO Class.	G8
AASHTO Class.	A-3(0)

c) Expansive soils

No expansive soils were identified during the investigation.

d) Compressible soils

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (d).

e) Collapsible soils

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (e).

f) Salts

The same material regime was encountered as for the oval test pit investigation; refer to Section 5.1.1 (f).

5.3.2. GEOTECHNICAL EVALUATION

a) Groundwater

No groundwater was encountered during the investigation.

b) Excavation conditions

Sand

Based on SABS 1200, soft excavation conditions can be expected for the sand using a 20 ton excavator. The sand depth varies across the site from 1.1m to >2.6m depending on topography. Refer to the profiles in **Appendix B** for an indication of the sand depth at various positions across the site.

Calcrete and rock

Based on SABS 1200, intermediate to hard excavation can be expected for the material below the sand i.e. calcrete and bedrock.

c) Use of in-situ material as construction material

Sand

The sand classified as G9 material and can therefore be used as fill material for the road construction. According to COLTO (1998), the sand should be compacted to at least 100% of its Mod AASHTO density (refer to Section 5.1.2).

Calcrete and rock

The calcrete and calcrete mixed with rock classified as G5 material and therefore it can be used as subbase material for the roads.

d) Cuttings

No major cuttings are envisioned for the multifunctional area. Should it be required, refer to the recommendations in Section 9.

e) Drainage

The material in the proposed multifunctional area exhibits characteristics similar to that at the oval and handling track. Refer to Section 5.1.2.

6. BUILDINGS AREA

The buildings area will comprise a workshop, fuel station and various other small buildings. It is approximately 1.3ha in size and situated to the west of the oval track.

The shallow subsurface investigation for the buildings area was conducted with a 28 ton excavator to a maximum depth of 4.5m or effective refusal conditions. The test pits were profiled according to Brink and Bruin (2002) and the locations were recorded with a handheld GPS.

The positions of the 12 test pits conducted at the buildings area are shown in Figure 7.

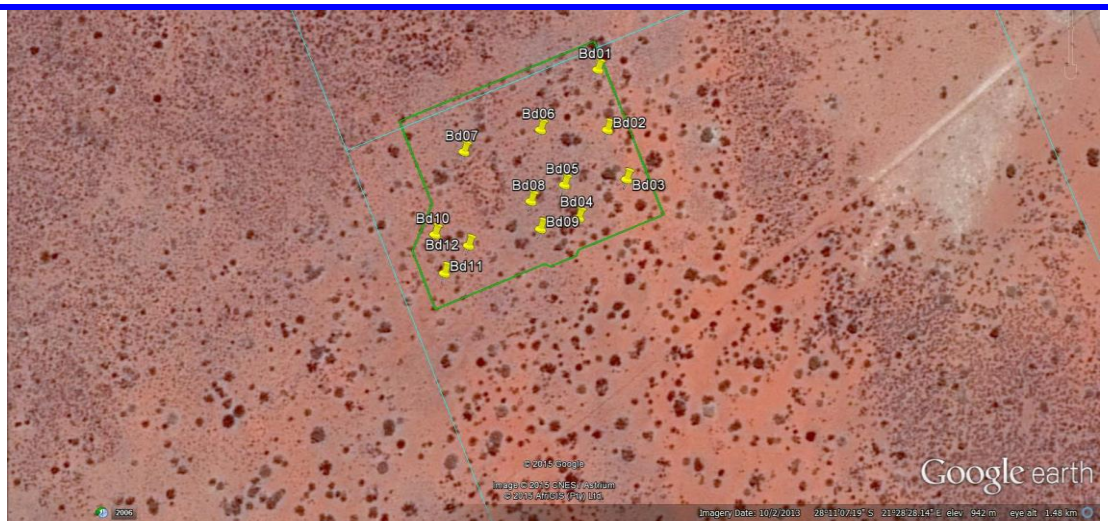

Figure 7: Test pit positions - Buildings area

Various samples were collected from the test pit investigation and submitted for laboratory testing at Roadlab in Germiston, a SANAS accredited soil testing laboratory.

6.1. MATERIAL PROPERTIES

6.1.1. TEST PIT PROFILES

A summary of the test pit profiles are given in Table 16. The detailed profiles are given in **Appendix B.**

Table 16: Profile summary - Buildings area

Test pit	Layer and depth (m)								
	Soils			Rocks/Pedogenic					Refusal depth (m)
	Very loose to loose sand	Quartz pebbles in a sand matrix	Gravel	Meta-basalt	Meta-basalt with calcrete	Calcrete	Green schist	Soft rock granite	
BD01	0-1.3	1.3-2.2						2.2-2.7	2.7
BD02	0-1.4	1.4-1.9		1.9-4.3					-
BD03	0-2.0	2.0-2.5		2.5-4.1					-
BD04	0-0.9	0.9-1.3	1.3-1.6				1.6-3.6		3.6
BD05	0-0.9	0.9-1.1			1.1-2.5				2.5
BD06	0-1.2	1.2-1.4	1.4-2.9						2.9
BD07	0-0.4	0.4-0.6			0.6-2.9				2.9
BD08	0-0.6	0.6-0.8	0.8-3.3						3.3
BD09	0-0.8	0.8-1.0			1.0-3.3				3.3
BD10	0-0.3					0.3-1.4			1.4
BD11	0-0.9	0.9-1.0			1.0-2.3				2.3
BD12	0-0.6				0.6-2.6				2.6

Refusal conditions were encountered at an average depth of some 2.8m. The upper layers (sand and pebble marker) of the test pits in the area were observed to be fairly

similar with slight differences in the deeper material strata encountered i.e. different grades of bedrock weathering with varying forms and amounts of calcrete present.

6.1.2. TEST PIT SAMPLES

A summary of the laboratory results for the buildings area test pit investigation is given in Table 17. The detailed laboratory results are given in **Appendix C.**

Table 17: Laboratory results summary - Buildings area

Sample No.	Bd01	Bd01	Bd01	Bd05	Bd06	Bd08	Bd12
Depth (m)	0.0-1.3	1.3-2.2	2.2-2.7	1.1-2.5	1.4-2.9	0.8-3.3	0.6-2.6
LL	0	0	0	0	0	23	0
PI	NP	NP	SP	SP	NP	5*	NP
LS	0	0	0.7	0.7	0	2.8	0
GM	1.05	2.67	2.38	2.52	2.63	2.65	2.42
% P0.425mm	91	13	21	16	13	11	21
% P0.075mm	5	5	8	6	4	5	7
Expansiveness	Low	Low	Low	Low	Low	Low	Low
OMC (%)	5.9	3.1	7.5	5.5	8	6.5	6.5
MDD (kg/m3)	1375	2189	2214	2153	2259	2193	2067
CBR @ 100%	19	141	39	96	104	72	94
CBR @ 95%	10	90	36	57	73	60	60
CBR @ 93%	8	62	29	51	59	51	53
Swell @ 100%	5.02	0.02	0.03	2.02	0.02	0.06	0.02
COLTO Class.	G9	G1	G7	G5	G5	G5	G5
AASHTO Class.	A-3(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)
pH				8.4			8.4
Conductivity (mS/m)				0.1			0.2

*Note that for BD08 the PI is wrongly indicated as 18 on the laboratory test results instead of 5.

6.1.3. EXPANSIVE SOILS

No expansive soils were identified during the investigation. The laboratory results show the sand, quartz pebble marker and the calcrete and/or metabasalt bedrock material to be non-plastic.

The exception to the aforementioned non-plasticity is the results for the metabasalt material from test pit BD08 with a PI = 5* (see note above), LS = 2.8% and LL = 23. These results are deemed unrealistic (i.e. an error was possibly made during the lab tests). It was requested that the sample from BD08 be re-tested as the PI and LL values do not correspond to the test results of other samples for the same type of material.

The re-test results confirmed the PI = 6, LL = 24 and LS = 2.9%. This is inexplicably higher than different test results for similar material. However, it is not deemed problematic as the material is not expansive, has good strength characteristics and the LL is within acceptable margins. The re-test results and original lab notes for BD08 are attached in **Appendix C.**

6.1.5. COLLAPSIBLE SOILS

Collapsible soils were observed during the investigation in the form of a pinholed structure in the sand layer with an average thickness of some 0.95m. The collapsible structure is likely to be destroyed upon compaction, which renders the probability of collapse settlement occurring negligible.

6.1.6. COMPACTION AND STRENGTH PROPERTIES

CBR tests were conducted on samples taken from the test pits, with the results as shown in Table 17. One sample of the sand material was collected and it classified as a G9 material. It is therefore suitable as a bulk fill material according to the client's requirements.

The calcrete and/or metabasalt bedrock material was sampled 5 times, with the material classifying as G5 material on average. Based on its strength properties, the material will be suitable to construct a subbase layer and depending on its conductivity values, it may even be stabilised with cement to a C4 layer for road layerworks.

A mixture of 50% sand and 50% crushed calcrete/bedrock material is envisioned as a suitable founding material for the buildings, although the laboratory test results (MOD, CBR and FI) are still outstanding for this material mixture. In the absence of the aforementioned founding material's test results, G5 quality calcrete material from the borrow pit should be used as a founding material.

6.1.7. PH AND CONDUCTIVITY

The pH and conductivity of the calcrete material encountered in the building area was determined. As detailed in Table 17, two samples were sent for laboratory testing and the pH values of both samples were determined as 8.4 with a conductivity of 0.1 and 0.2 mS/m. The pH values indicate a slightly basic material which is considered more favourable than an acidic material.

The material's conductivity is sufficiently low (<10mS/m) and it is classified as "non-corrosive". Based on the material's pH and conductivity results, the material is suitable for use in the construction of engineered fill layers.

6.2. GEOTECHNICAL EVALUATION

6.2.1. GROUNDWATER

No groundwater was encountered during the investigation.

6.2.2. EXCAVATION CONDITIONS

a) Sand

Based on SABS 1200, soft excavation conditions can be expected for the sand using a 20 ton excavator. The depth of the sand layer varies across the site from 0.1m to some 2m depending on the topography (i.e. sand layer is generally thicker on dunes). Refer to the profiles in **Appendix B** for an indication of the sand depth at various positions across the site or to the summary in Table 16.

b) Calcrete and rock

Based on SABS 1200, intermediate to hard excavation can be expected for the material below the sand i.e. calcrete and rock strata.

6.3. POSSIBLE FOUNDING SOLUTION

The thickness of the sand at the building area varies from 0.3-2.0m, with an average thickness of some 0.9m.

The workshop at the buildings area will be a single storey structure that is envisaged to be founded via 600mm wide by 250mm deep strip footings. From the laboratory tests conducted, the sand material is deemed unsuitable for founding purposes due to its low CBR strength and material grading, classifying as a G9 material or worse.

An engineered fill or composite material comprising a 50/50 mix between the sand and calcrete/crushed bedrock is envisaged to be a suitable founding material for the single storey structure.

The test results (MOD, CBR and FI) of the 50/50 material mixture is expected to show increased strength properties and based on this, a higher stiffness value for the material can be expected, which will decrease the expected initial settlement for the buildings.

6.4. BEARING CAPACITY AND SETTLEMENT

6.4.1. FOUNDING ON 50/50 MATERIAL MIX

The bearing capacity and settlement calculations are subject to the laboratory test results of the envisaged 50/50 material mixture, which is still outstanding. This section will be updated when the results are received.

6.4.2. FOUNDING ON CALCRETE

The buildings may also be found on G5 quality calcrete material from the borrow pit. According to Theyse (1996), G5 material will generally exhibit the following strength characteristics at the 95% confidence interval:

Cohesion (c) = 9.4kPa
Friction angle (φ) = 35.1°

Utilising the abovementioned shear strength parameters with a Young's Modulus E = 80MPa (Emery, 1987) for G5 material and Vesic's (1975) bearing capacity formulations, the ultimate bearing capacity may be calculated as 827kPa. The allowable bearing capacity may be used as 100kPa at an FoS = 8.2.

According to the settlement formulations by Christian and Carrier (1978) at a bearing pressure of 100kPa (maximum allowable), the calculated initial elastic settlement is δestimated = 2mm. For a strip footing spacing of >1m, the criteria to limit differential settlement of 1/500 (Craig, 2004) will be satisfied for an allowable bearing capacity of 100kPa.

The settlement calculations are included in **Appendix G.**

7. BRIDGE

The bridge is located on the western part of the oval track, close to the buildings area. The bridge will facilitate access over the track to the multifunctional area, handling track, grades and high speed oval from the access road leading toward the buildings area. The positions of the 6 test pits conducted at the bridge are shown in Figure 8, with their co-ordinates given in **Appendix A.**

It is evident from Figure 8 that the alignment of the bridge is not perpendicular to the oval track. This is due to the fact that the layout and size of the bridge was unknown at the time of investigation and the location of the test pits were therefore established on site. The client advised that the bridge will comprise four piers, with an envisaged pier-to-pier and pier-to-abutment spacing of 12-16m.

Figure 8: Test pit positions – Bridge

The area on which the bridge will be founded shows a fairly uniform subsurface profile and it is envisaged that the skew alignment of the test pits will not adversely affect the founding of the structure.

7.1. MATERIAL PROPERTIES

7.1.1. TEST PIT PROFILES

A summary of the test pit profiles are given in Table 18. The detailed profiles are given in **Appendix B.**

Table 18: Profile summary - Bridge

Test pit	Layer and depth (m)		
	Soils	Rocks/Pedogenic	
	Very loose to loose sand	Metabasalt with calcrete	Refusal depth (m)
BR01	0-0.1	0.1-2.0	2.0
BR02	0-0.1	0.1-1.8	1.8
BR03	0-0.1	0.1-2.5	2.5
BR04	0-0.1	0.1-0.3	0.3
BR05	0-0.1	0.1-0.9	0.9
BR06	0-0.1	0.1-3.1	3.1

7.1.2. TEST PIT SAMPLES

No samples were taken from the test pits at the location of the proposed bridge, as the material encountered resembles the material from OTP17 and that which were encountered at the adjacent buildings area.

7.1.3. EXPANSIVE SOILS

No expansive soils were identified during the investigation.

7.1.4. COMPRESSIBLE SOILS

The thin layer of very loose to loose sand encountered on site will most likely be compressible. Founding is, however, not envisaged to take place on the thin sand layer and compressible soils will therefore not be problematic for the founding of the bridge.

7.1.5. COLLAPSIBLE SOILS

The thin sand layer exhibits a collapsible structure and hence collapse settlement is predicted if the material is not densified (i.e. compacted) and the collapsible fabric destroyed. The bridge is, however, not envisaged to be founded on the thin sand layer.

7.2. GEOTECHNICAL EVALUATION

7.2.1. GROUNDWATER

No groundwater was encountered during the investigation.

7.2.2. EXCAVATION CONDITIONS

a) Sand

Based on SABS 1200, soft excavation conditions can be expected for the sand layer using a 20 ton excavator. The thickness of the sand layer in the bridge area was found to be uniform at 0.1m. Refer to the profiles in **Appendix B** for an indication of the sand depth at various positions across the site or the summary in Table 18.

b) Calcrete and rock

Based on SABS 1200, intermediate to hard excavation can be expected for the material below the sand i.e. calcrete and rock.

7.3. BRIDGE FOUNDING RECOMMENDATIONS

The test pits showed some 0.1m of sand followed by calcrete and rock. The bridge is envisioned to be founded directly on the soft to medium hard calcrete/in-situ bedrock via pad footings.

7.3.1. STRENGTH OF CALCRETE/ BEDROCK

From the test pits, the in-situ calcrete/ bedrock material were classified as soft to medium hard rock. The material excavated as gravel with boulders and cobbles with great difficulty, owing to the hardness of the material.

The shear strength parameters of the material were calculated using RocScience's Roclab computer software, which is based on the formulations of Hoek and Diederichs (2006). The following input parameters were used for the soft to medium hard rock calcrete/ bedrock material on which founding is envisaged.

UCS	=	3MPa	(Unconfined Compressive Strength)
GSI	=	27	(Geological Strength Index)
mi	=	9	(Material constant)
d	=	0	(Disturbance factor for blasting)
Mr	=	450	(Modulus ratio)

From the RocLab anaylsis the following shear strength parameters were obtained for the founding material, based on a preliminary bearing capacity of 400kPa. The RocLab results are given in **Appendix F.**

Cohesion (c)	= 40 kPa
Friction angle (φ)	= 32.9°
Deformation modulus (E)	= 182 MPa

To maintain a modicum of conservatism, a 95% confidence interval was applied to the above shear strength parameters. This was done by calculating a parameter at 1.64 standard deviations below the mean. A coefficient of variation of 40% was assumed for the cohesion and 10% for the internal friction angle as per Harr (1987), effectively reducing the parameters to:

Cohesion (c)	= 13.8 kPa
Friction angle (φ)	= 27.5°

7.4. BEARING CAPACITY AND SETTLEMENT

Loads on the piers and abutments are still awaited from the client. It was however stated that a bearing pressure of some 360kPa is required. As a preliminary measure, loads were assumed for the piers and abutments.

7.4.1. PIERS

The piers are envisaged to be founded on 2.5m square pad footings with an applied load of 3 000kN. According to Vesic's (1975) formulations utilised with the shear strength parameters in Section 7.3, the ultimate bearing capacity is calculated as 791kPa at the 95% confidence interval. At an allowable bearing capacity of 400kPa this generates an FoS = 1.97.

The stiffness of the calcrete/ bedrock material was determined to be E = 182MPa from the RocLab analysis. For an allowable bearing pressure of 400kPa and an influence depth of 7.5m below the founding level, the immediate elastic settlement for the pad footing was calculated to be some 3.0mm according to Christian and Carrier's (1978) formulations.

The projected differential settlement is calculated as 3.0/12 000 = 1/4 000 for the 12m bridge support (pier or abutment) spacing. This ratio is below the maximum preferred ratio of 1/500 for buildings where cracking is not permissible (Craig, 2004).

The settlement calculations are included in **Appendix G.**

7.4.2. ABUTMENTS

The abutments are envisaged to be founded via 2m x 6m spread footings on the in-situ calcrete/ bedrock material.

Utilising the formulations of Vesic (1975) and a preliminary vertical load of 3 000kN, the ultimate bearing capacity was calculated to be 703kPa for the shear strength parameters at the 95% confidence interval.

However, due to settlement considerations according to the formulations of Christian and Carrier (1978), the allowable bearing capacity is reduced to 400kPa with a settlement of 4.6mm calculated. The allowable bearing capacity is at a factor of safety of 1.75 against the ultimate.

With the closest support spacing (pier to abutment) assumed to be at least 12m, a differential settlement ratio (angular distortion) of <1/500 is calculated. This is deemed acceptable (Craig, 2004). The settlement calculations for the abutments are subject to the design of the bridge and its layout, and included in **Appendix G.**

8. QUARRY AREA

The proposed quarry area is situated south west of the oval track. A total of 4 rotary core boreholes were previously drilled to an average depth of some 16.5m. The positions of the boreholes are shown in Figure 9 below.

Core samples were sent to a SANAS accredited laboratory for various tests (see Section 8.1.1). The material of granitic origin's suitability was assessed for use as basecourse and surfacing aggregate (possibly asphalt).

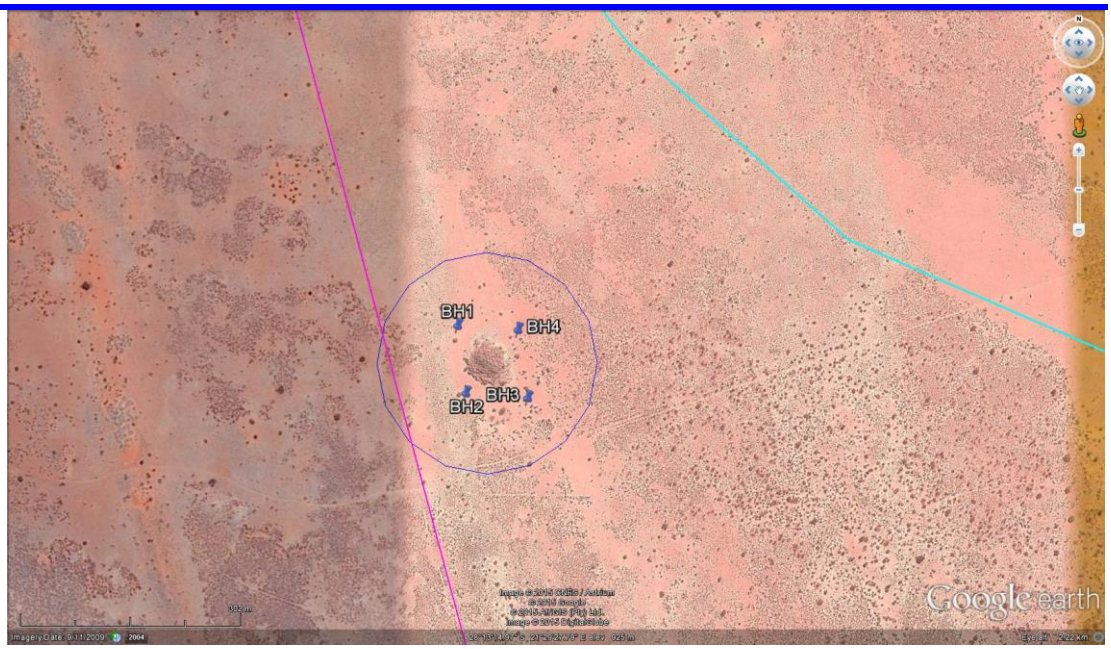

Figure 9: Borehole positions - Quarry area

8.1. MATERIAL PROPERTIES

The following sections discuss tests conducted on cores from the quarry investigation. **Appendix D** contains the comprehensive laboratory results.

8.1.1. BOREHOLE SAMPLES

The following tests were conducted on crushed core samples from the borehole investigation:

- 3x Methylene blue absorption (MBA),
- 3x Clay content,
- 3x Chloride content,
- 3x Organic impurities,
- 3x Presence of sugars,
- 3x Soluble deleterious impurities,
- 3x Ethylene glycol weathering,
- 2x XRD,
- 2x XRF, and
- 3x ACV

The following sections succinctly discuss the test results and the material's suitability.

a) Atterberg limits

Material tested showed low liquid limits and linear shrinkage values of zero and the material was determined to be non-plastic. According to the guidelines in SAPEM Chapter 4 (2013), the material possibly qualifies for use in basecourse construction if other conditions are satisfied.

b) Methylene blue absorption

The methylene blue test is used as a means of assessing the activeness of clay minerals in the material (usually conducted on fine aggregate). The material has an average methylene blue absorption value of 0.13ml/g with a maximum of 0.2ml/g and a minimum of 0.1ml/g. In general, the material is not deemed active as it is below the prescribed value of 0.7 ml/g (SAPEM, 2013).

c) Clay content

Three crushed core samples were submitted for hydrometer testing and the clay content for all three samples was determined to be zero. The test is, however, subject to the degree of crushing of the sample and some clay minerals may still be present in the material. The methylene blue test showed the activity of the material (and expected clay constituents) not to be problematic (i.e. non-deleterious).

d) Chloride content

Samples tested had a chloride content of 0.01% and the material is deemed suitable for use in a granular basecourse and in concrete when a maximum chloride content of 0.03% is specified (Chapter 4 of SAPEM, 2013).

e) Organic impurities

The six laboratory tests conducted according to TMH B6 showed no organic impurities to be present in the samples.

f) Presence of sugars

The presence of sugar was determined according to SANS 5833:2006 on 4 samples (one from each borehole) and no sugar was encountered in the material.

g) Ethylene glycol weathering

The material's durability was determined via ethylene glycol weathering tests and the material did not deteriorate during the 20 days of testing, neither by spalling, fracturing nor disintegrating. The material will therefore be well-suited for use as a surfacing aggregate or basecourse.

Furthermore, decomposition of the material is not expected to be the main weathering agent due to the dry climate (Weinert N>5). In wetter regions (N<5) the material is more likely to decompose to non-expansive kaolinite clay particles (TRH14, 1985).

h) X-ray diffraction (XRD)

X-ray diffraction testing conducted on two core samples showed the material to consist of the following minerals and constituents:

Table 19: Granite mineral composition (XRD)

XRD	BH1	BH4
Depth (m)	2.75 - 2.90	11.30 - 11.50
Chlorite (%)	6.64	7.56
Diopside (%)	3.81	3.75
Microcline (%)	15.11	21.8
Muscovite (%)	7.08	4.13
Plagioclase (%)	28.94	24.83
Quartz (%)	38.41	37.93

XRD testing showed the presence of mica (muscovite) in sufficiently low quantities and problems are not envisioned.

i) X-ray fluorescence (XRF)

X-ray fluorescence testing conducted on two samples showed the material to contain between 2.1 and 2.4% Na_2O (sodium-oxide), which is an indication of the material's susceptibility for alkali-silica reaction (ASR), should it be used as concrete aggregate. The quantities are, however, below the limit of 4.0% and ASR is not expected (Fulton, 2009).

To counter ASR in general, the cement to be used must contain sufficient amounts of fly-ash (20%), or slag (40%), or silica fume (15%) by mass. The following types of concrete may be used to reduce the probability of ASR occurring:

- CEM II B-V 32.5 N, or
- CEM V A (S-V) 42.5 N

A silica (SiO_2) content of 67% and 70% was determined for the material and poor adhesion with bituminous products may be expected, especially in the presence of moisture. According to SAPEM (2013), cationic emulsion is more suitable as a binder for the aggregate type.

j) Aggregate crushing value (ACV)

Four ACV tests were conducted on samples and an average ACV = 17.9% was determined for the material. This is well below the minimum of ACV = 25% required for use as bituminous surfacing aggregate or an ACV = 29% for use as base material (TRH 14, 1986) (COLTO, 1998).

Based on these strength characteristics, the material is deemed suitable for use in the base layer and as surfacing aggregate.

k) Stone polishing value

According to TRH 14 (1986) acid crystalline rocks (such as granite) do not polish much and these tests were not conducted. The aggregate is, however, envisaged to provide good resistance to skidding and the surfacing layer should have a high skid resistance value (SRV) when crushed.

8.2. CONCLUSION

Based on the laboratory tests conducted, granitic material from the proposed quarry area is deemed suitable for use in the construction of basecourse and surfacing layers according to the guidelines detailed in COLTO (1998) and SAPEM (2013).

9. BORROW PIT AREA

Information and test results from the borrow pit investigation that precedes ARQ's, was reviewed. The borrow pit is located in the south east corner of the site in an area expected to yield large quantities of calcrete material. Depending on its availability, calcrete is envisaged to be used in the construction of various layerworks. Locality of the borrow pit area on site is depicted in Figure 10 below.

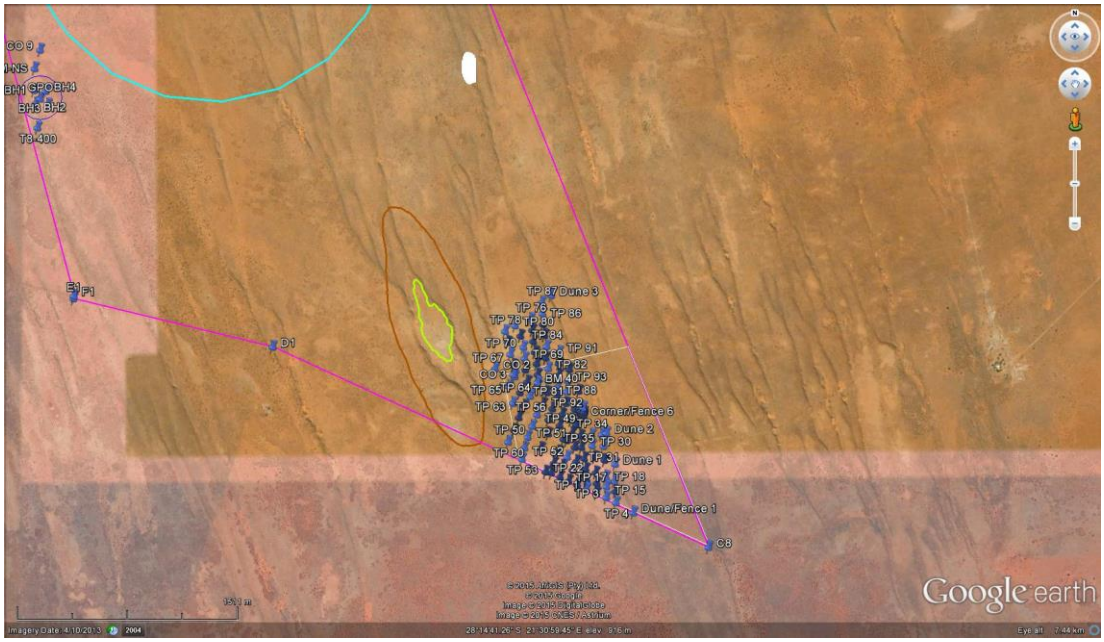

Figure 10: Borrow area test pits

From the test pit profiles received, it is seen that some 96 test pits were conducted with a 20ton excavator to refusal depths. Refusal conditions were encountered in pedogenic material (calcretes) underlying the upper stratum of very loose to loose sand. The material was sampled and sent for CBR, Mod, indicator (sieve analysis and Atterberg limits) and pH and conductivity laboratory tests at Roadlab in Upington.

The test results indicate the calcrete material to generally classify as G5 quality. The pH and conductivity test results show the material to be "non-corrosive" with an average conductivity <10mS/m and a pH>7.0 (average of 8.1). Based on the test results and according to COLTO classifications, material from the borrow pit area is suitable for use as subbase and fill material for the development.

Refer to Appendix E for laboratory results from the borrow pit investigation.

10. RECOMMENDATIONS

In this section, recommendations are made regarding the design and construction of the oval and handling track, multifunctional, bridge and buildings area.

10.1. ROADWAYS

For the oval and handling track and the multifunctional area accommodating light vehicles which may exert large horizontal forces in the surfacing layer due to braking, acceleration and turning at high speeds, the following is recommended:

1. *Rip and re-compact in-situ material (subgrade) to 90% Mod AASHTO density at 0 to +2% of the OMC,
2. 150mm C4 subbase layer,
3. 150mm G3 basecourse,
4. Asphalt surfacing layer

*Note that if the in-situ sand material comprises the subgrade, it should be compacted to 100% of the Mod AASHTO density.

A cemented C4 subbase layer should comply with the following requirements:

- A selected natural material equivalent to G5 or G6 quality meeting the density and strength requirements,
- The maximum size of the material after compaction in place should not exceed two-thirds of the compacted thickness layer or 63mm, whichever is the smaller,
- After treatment the material should have a Plasticity Index not greater than 6,
- In regard to the crushing strength requirements of the cemented material, the laboratory design strength should be in accordance with the following values:
  - Minimum and maximum laboratory design, unconfined compressive strength at 7 days 100% Mod AASHTO density of 0.75 and 1.5MPa respectively,
- The grading modulus for the subbase material should not be less than 1.5,
- A CEM II B-V 32.5N cement may be utilised for stabilisation. A higher cement class may increase the pavement stiffness too much which may lead to a decrease in ductility of the layer and result in cracking.

According to the test results from the borrow pit investigation as received from the client, the calcrete material generally classified as a G5 material and will be suitable for use in the construction of the sub base layer. This material will in all likelihood require crushing to the abovementioned sizes to ensure its suitability.

Section 8 discussed the material from the quarry area's suitability for use in the basecourse layer as well as for surfacing aggregate (asphalt or bitumen).

10.2. CRUSHING

For the borrow pit and quarry operations, the following is recommended:

A permanent, multi-stage crusher with screens should be set up at the quarry to produce crushed stone basecourse and asphalt surfacing material.

A mobile, 2 stage crusher should suffice in the crushing requirements at the borrow pit area for the calcretes (generally sub base material of G5 quality). The nominal maximum size for a G5 crushed material is 53mm before compaction and 63mm for uncrushed material.

This strategy will allow various materials to be available for the consecutive construction of the layerworks.

10.3. BUILDING AREA

10.3.1. FOUNDING OF STRUCTURES

The following procedure is recommended in order to achieve proper site compaction and to reduce the risk of differential settlement beneath the strip footings:

- Excavate and stockpile in situ material on the footprint to a depth of 1.0m below the natural ground level (N.G.L),
- Remove all material > 100mm diameter from the stockpile,
- Mix the sand from the stockpile with the crushed calcrete gravel (< 53mm) from the borrow pit in a 1 to 1 mix ratio (50% sand, 50% calcrete),
- *Compact subgrade material to 100% Mod AASHTO density at 0 to +2% of the optimum moisture content (OMC) using a vibratory roller with a 300kN centrifugal force (e.g. Bomag 219D or similar),
- **Backfill the exposed area with the 50/50 mixture material (stockpiled sand and crushed calcrete), compacted in 150mm layers to 93% of the Mod AASHTO density at a moisture content of 0 to +2% of the OMC with the same vibratory roller,
- Found as shallow as possible (250mm below N.G.L) in the compacted strata at an allowable bearing pressure of 100kPa for the strip footings.

*Note: If the sand comprises the subgrade material – compact to 100% of the Mod AASHTO density. If sand material does not comprise the subgrade material – compact to 93% of the Mod AASHTO density.

**Calcrete material from the borrow pit may also be used as a founding material, compacted to 93% Mod AASHTO density.

10.3.2. EXCAVATIONS

The sand layer with general thickness of 0.95m is considered problematic with regard to the safety of the temporary excavations deeper than 1.2m. The sand material in any excavation should be battered back to a safe angle of 22 degrees to allow for a factor of safety of 1.4 against instability. This is at a ratio of 1(V): 2.5(H).

For permanent excavations in the soft to medium hard calcrete/ bedrock layer, the slope may be battered back to 1(V): 2(H) or 60 degrees according to calculation on chart 1 (dry conditions) from Hoek and Bray (1981).

10.4. BRIDGE

10.4.1. FOUNDING OF BRIDGE STRUCTURE

As mentioned in the preceding section, it is recommended that the bridge be founded via pad footings on the in-situ calcrete/ bedrock material. An allowable bearing capacity of 400kPa may be used when founding the piers and abutments via pad/spread footings.

The founding depths for the bridge components are detailed in Table 20.

Table 20: Bridge founding depths

Test pit no.	Bridge component	Founding depth (m)
Br06	Eastern abutment	1.5
Br05	Pier 1	1.0
Br04	Pier 2	1.0
Br01	Pier 3	1.5
Br02	Pier 4	1.5
Br03	Western abutment	1.5

The excavation for the foundations should be inspected by a competent engineer before the contractor may cast the blinding layer for the footings. It is furthermore expected that groundwater seepage will not be encountered during the foundation excavations.

10.4.2. EXCAVATIONS

The sand layer with general thickness of 0.1m in the bridge area is not considered to be problematic with regard to the safety of the temporary excavations.

For temporary excavations in the soft to medium hard calcrete/ bedrock layer, the slope may be battered back to 1(V): 0.5(H) or 60 degrees according to the first chart from Hoek and Bray (1981).

10.5. CUTTINGS - GENERAL

The depth of the cuttings will vary according to the layout of the oval and handling track and the topography of the terrain. The battering angles given in Table 21 apply to the sand and in-situ calcrete or bedrock material for the dry case.

Table 21: Cutting slope stability recommendations

Material	Consistency/ hardness	Maximum cut depth (m)	Battering ratio	Battering angle	Factor of safety
Sand	Very loose to loose	2	1(V) : 2.5 (H)	22°	1.5
Calcrete/ bedrock	Soft to medium hard rock	3	1(V) : 1(H)	45°	>1.5
Calcrete/ bedrock	Soft to medium hard rock	6	1(V) : 2(H)	27°	>1.5

11. GENERAL

The comments and recommendations contained within this report are based on a limited number of test pit excavations which we believe are representative of the site conditions. Therefore, conditions at variance with what is described herein should not be overlooked.

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APPENDIX A
TEST PIT CO-ORDINATES

Table 1: Oval track test pits

Oval	Latitude	Longitude
TPOV01	28°11'27.40"S	21°28'48.40"E
TPOV02	28°10'56.00"S	21°30'15.90"E
TPOV03	28°10'57.70"S	21°30'16.70"E
TPOV04	28°10'46.80"S	21°30'11.00"E
TPOV05	28°10'38.80"S	21°30'5.80"E
TPOV06	28°10'10.60"S	21°29'59.00"E
TPOV07	28° 9'51.60"S	21°29'35.40"E
TPOV08	28° 9'37.10"S	21°28'38.00"E
TPOV09	28° 9'36.80"S	21°28'39.30"E
TPOV10	28° 9'31.70"S	21°29'15.50"E
TPOV11	28°11'28.20"S	21°30'30.20"E
TPOV12	28°13'13.90"S	21°30'5.50"E
TPOV13	28°12'58.00"S	21°29'31.70"E
TPOV14	28°13'0.50"S	21°30'42.60"E
TPOV15	28°12'29.50"S	21°30'54.70"E
TPOV16	28°12'1.00"S	21°30'44.30"E
TPOV17	28°12'34.50"S	21°29'18.40"E
TPOV18	28°11'57.90"S	21°29'1.90"E
TPOV19	28° 9'58.70"S	21°28'19.20"E
OTP17	28°11'3.30"S	21°28'35.90"E

Table 2: Handling track test pits

Handling track	Latitude	Longitude
TPH01	28° 9'43.30"S	21°29'6.90"E
TPH02	28° 9'43.90"S	21°28'55.70"E
TPH03	28° 9'50.30"S	21°29'5.60"E
TPH04	28°10'4.10"S	21°29'26.00"E
TPH05	28°10'13.60"S	21°29'44.40"E
TPH06	28°10'23.20"S	21°29'43.60"E

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REG 2001/011871/07 | CESA 456
* German

Table 3: Multifunctional area test pits

Multifunctional area	Latitude	Longitude
TPMF01	28°10'37.50"S	21°29'20.40"E
TPMF02	28°10'29.10"S	21°29'13.40"E
TPMF03	28°10'21.40"S	21°29'17.30"E
TPMF04	28°10'11.00"S	21°29'13.30"E

Table 4: Building area test pits

Building area	Latitude	Longitude
BD01	28°11'5.40"S	21°28'29.00"E
BD02	28°11'6.50"S	21°28'29.20"E
BD03	28°11'7.40"S	21°28'29.60"E
BD04	28°11'8.10"S	21°28'28.60"E
BD05	28°11'7.50"S	21°28'28.30"E
BD06	28°11'6.50"S	21°28'27.80"E
BD07	28°11'6.90"S	21°28'26.20"E
BD08	28°11'7.80"S	21°28'27.60"E
BD09	28°11'8.30"S	21°28'27.80"E
BD10	28°11'8.40"S	21°28'25.60"E
BD11	28°11'9.10"S	21°28'25.80"E
BD12	28°11'8.60"S	21°28'26.30"E

Table 5: Bridge area test pits

Bridge	Latitude	Longitude
BR01	28°11'2.10"S	21°28'36.20"E
BR02	28°11'2.00"S	21°28'35.70"E
BR03	28°11'1.90"S	21°28'35.10"E
BR04	28°11'2.20"S	21°28'36.80"E
BR05	28°11'2.40"S	21°28'37.20"E
BR06	28°11'2.50"S	21°28'37.70"E

APPENDIX B
TEST PIT PROFILES

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Test Pit: BD01

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'06.5 "S, 21°28'27.8 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian) (1.3 m)
1.4	D			**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, sand Transported (2.2 m)
2.2	D			**VERY SOFT ROCK, GRANITE** Purpleish grey, highly weathered to completely weathered, fine grained to medium grained, thinly laminated, very soft rock, Granite (2.7 m)
2.8				**Refused On: very soft rock granite**

Excavation Method: EXCAVATOR
Unstable Sides: to 1.3 m
Refusal: 2.7 m on very soft rock granite
Water Table: None

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Test Pit: BD02

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'06.5 "S, 21°28'29.2 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				(1.4 m)
1.6				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian)
1.8				(1.9 m)
2.0				**VERY SOFT ROCK TO SOFT ROCK, METABASALT** Greyish green to white, highly weathered, medium grained to fine grained, very soft rock to soft rock, Metabasalt
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				(4.3 m)
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.4 m
Terminated: No
Water Table: None

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Test Pit: BD03

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'07.4 "S, 21°28'29.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist to moist, brownish red, loose to very loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				(2 m)
2.2				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, sand Transported
2.4				(2.5 m)
2.6				**SOFT ROCK, METABASALTIC** Grey, highly weathered, fine grained to medium grained, soft rock, Metabasaltic Notes: Excavates as gravel
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				(4.1 m)
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 2 m
Terminated: No
Water Table: None

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Test Pit: BD04

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'08.1 "S, 21°28'28.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.9 m)
1.0				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, sand Transported
1.2				(1.3 m)
1.4				**MEDIUM DENSE, SANDY GRAVEL** Slightly moist, dark grey, medium dense, matrix supported, sandy gravel Transported
1.6				(1.6 m)
1.8				**VERY SOFT ROCK TO SOFT ROCK, GREEN SCHIST** Greyish green, highly weathered, fine grained to medium grained, thinly laminated, very soft rock to soft rock, Green schist Notes: Also some medium hardrock quartzite and calcrete
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				(3.6 m)
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.9 m
Terminated: No
Water Table: None

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Test Pit: BD05

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'07.5 "S, 21°28'28.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.9 m)
1.0				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF LOOSE TO VERY LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, loose to very loose, intact, sand Transported
1.2				(1.1 m)
1.4				**SOFT ROCK TO MEDIUM HARD ROCK, METABASALT WITH CALCRETE** White with greenish grey, highly weathered, fine grained to medium grained, soft rock to medium hard rock, Metabasalt with calcrete
1.6				
1.8	D			
2.0				
2.2				
2.4				(2.5 m)
2.6				**Refused On: soft rock to medium hard rock metabasalt with calcrete**
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.9 m
Refusal: 2.5 m on soft rock to medium hard rock metabasalt with calcrete
Water Table: None

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Test Pit: BD06

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'05.4 "S, 21°28'29.0 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				(1.2 m)
1.4				**MEDIUM HARD ROCK, QUARTZ PEBBLES** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles (1.4 m)
1.6	D			**VERY SOFT ROCK TO SOFT ROCK, GRANITE MANIFEST AS DENSE, GRAVEL** Purpleish grey, moderately weathered to highly weathered, medium grained, very soft rock to soft rock, granite manifest as slighly, purplish grey, dense, clast supported, gravel Residual
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				(2.9 m)
3.0				**Refused On: very soft rock to soft rock granite**
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.2 m
Refusal: 2.9 m on very soft rock to soft rock granite
Water Table: None

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Test Pit: BD07

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'06.9 "S, 21°28'26.2 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported
0.4				(0.4 m)
0.6				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, intact, sand Transported
0.8				(0.6 m)
1.0				**MEDIUM HARD ROCK, METABASALT WITH CALCRETE** Greenish grey, highly weathered, fine grained, , medium hard rock, Metabasalt with calcrete
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				(2.9 m)
3.0				**Refused On: medium hard rock metabasalt with calcrete**
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.4 m
Refusal: 2.9 m on medium hard rock metabasalt with calcrete
Water Table: None

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Test Pit: BD08

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'07.8 "S, 21°28'27.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian)
0.4				
0.6				(0.6 m)
0.8				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF LOOSE TO VERY LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, loose to very loose, sand Transported
1.0				(0.8 m)
1.2				**VERY SOFT ROCK TO SOFT ROCK, METABASALT MANIFEST AS VERY DENSE, GRAVEL** Dark grey stained reddish brown, completely weathered, medium grained, closely jointed, very soft rock to soft rock, metabasalt manifest as slightly moist, dark grey stained reddish brown, very dense, clast supported, gravel Residual
1.4				
1.6				
1.8				
2.0	D			
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				(3.3 m)
3.4				**Refused On: very soft rock to soft rock metabasalt**
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.6 m
Refusal: 3.3 m on very soft rock to soft rock metabasalt
Water Table: None

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Test Pit: BD09

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'08.3 "S, 21°28'27.8 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.8 m)
1.0				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF LOOSE TO VERY LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, loose to very loose, intact, sand Transported
1.2				(1 m)
1.4				**VERY SOFT ROCK TO MEDIUM HARD ROCK, METABASALT WITH CALCRETE (SOME PLACES WITH ROUNDED PEBBLES)** White with greenish grey, moderately weathered to highly weathered, fine grained to medium grained, very soft rock to medium hard rock, Metabasalt with calcrete (some places with rounded pebbles)
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				(3.3 m)
3.4				**Refused On: very soft rock to medium hard metabasalt with calcrete (some places with rounded pebbles)**
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.8 m
Refusal: 3.3 m on very soft rock to medium hard metabasalt with calcrete (some places with rounded pebbles)
Water Table: None

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Test Pit: BD10

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'08.4 "S, 21°28'25.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian) (0.3 m)
0.4				**MEDIUM HARD ROCK TO VERY HARD ROCK, CALCRETE (VERY HARD BOULDERS WITH SOFTER OR LESS DEVELOPED PARTS BETWEEN)** Cream white with grey, moderately weathered to highly weathered, fine grained to medium grained, medium hard rock to very hard rock, Calcrete (very hard boulders with softer or less developed parts between)
0.6				
0.8				
1.0				
1.2				
1.4				(1.4 m)
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Terminated: No
Water Table: None

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Test Pit: BD11

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'09.1 "S, 21°28'25.8 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE, SAND** Slightly moist, brownish red, very loose, intact, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.9 m)
1.0				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, intact, sand Transported (1 m)
1.2				
1.4				**SOFT ROCK TO MEDIUM HARD ROCK, METABASALT WITH CALCRETE BOULDERS** White with greenish grey, highly weathered, fine grained to medium grained, thinly laminated, soft rock to medium hard rock, Metabasalt with calcrete boulders
1.6				
1.8				
2.0				
2.2				(2.3 m)
2.4				**Refused On: soft rock to medium hard rock metabasalt with calcrete boulders**
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.9 m
Refusal: 2.3 m on soft rock to medium hard rock metabasalt with calcrete boulders
Water Table: None

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Test Pit: BD12

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/09
Coordinates: 28°11'08.6 "S, 21°28'26.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian)
0.4				
0.6				(0.6 m)
0.8	D			**SOFT ROCK TO MEDIUM HARD ROCK, METABASALT WITH CALCRETE** White with greenish grey, highly weathered, fine grained to medium grained, soft rock to medium hard rock, Metabasalt with calcrete
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				(2.6 m) **Refused On: soft rock to medium hard rock metabasalt with calcrete**
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.6 m
Refusal: 2.6 m on soft rock to medium hard rock metabasalt with calcrete
Water Table: None

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Test Pit: BR01

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'02.1 "S, 21°28'36.2 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.0				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian) (0.1 m)
0.2				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calcrete with metabasalt
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				(2 m) **Refused On: soft rock to medium hard rock calcrete with metabasalt**
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 2 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: BR02

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'02.0 "S, 21°28'35.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.0				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian) (0.1 m)
0.2				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calcrete with metabasalt
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				(1.8 m) **Refused On: soft rock to medium hard rock calcrete with metabasalt**
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 1.8 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: BR03

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'01.9 "S, 21°28'35.1 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.0				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (Aeolian) (0.1 m)
0.2				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calcrete with metabasalt Notes: Calcrete pinnacles
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				(2.5 m)
2.6				**Refused On: soft rock to medium hard rock caclrete with metabasalt**
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 2.5 m on soft rock to medium hard rock caclrete with metabasalt
Water Table: None

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Test Pit: BR04

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'02.2 "S, 21°28'36.8 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian) (0.1 m)
0.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calrete with metabasalt (0.3 m)
0.6				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 0.3 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: BR05

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'02.4 "S, 21°28'37.2 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.0				**LOOSE TO MEDIUM DENSE, SAND**
				Slightly moist, brownish red, loose to medium dense, intact, sand
0.2				Transported (Aeolian) (0.1 m)
				SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT
0.4				Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock,
0.6				Calcrete with metabasalt
0.8				(0.9 m)
1.0				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 0.9 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: BR06

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'02.6 "S, 21°28'37.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO MEDIUM DENSE, SAND** Slightly moist, brownish red, loose to medium dense, intact, sand Transported (Aeolian) (0.1 m)
0.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calcrete with metabasalt
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				(3.1 m)
3.2				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 3.1 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: OTP17

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'03.3 "S, 21°28'35.9 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian) (0.3 m)
0.4	D			**LOOSE TO MEDIUM DENSE, SAND** Slightly moist, brownish red, loose to medium dense, clast supported sub-rounded pale white quartz pebbles, sand Transported
1.0				(1 m)
1.2				**SOFT ROCK TO MEDIUM HARD ROCK, GRANITE WITH CALCRETE** Pinkish white, highly weathered, medium grained, soft rock to medium hard rock, Granite with calcrete
3.0				(3.1 m)

Excavation Method: EXCAVATOR
Unstable Sides: None
Terminated: No
Water Table: None

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Test Pit: TPH01

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/12
Coordinates: 28°09'43.3 "S, 21°29'06.9 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.8 m)
1.0				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, calcrete with metabasalt
1.2				
1.4				(1.5 m)
1.6				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.8 m
Refusal: 1.5 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPH02

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/12
Coordinates: 28°09'43.9 "S, 21°28'55.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2 – 2.6	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, intact, sand Transported (2.7 m)
2.8 – 4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 2.7 m
Terminated: No
Water Table: None

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Test Pit: TPH03

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°09'50.3 "S, 21°29'05.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.8 m)
1.0				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, , sand Transported
1.2				(0.9 m)
1.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete with metabasalt
1.6				(1.55 m)
1.8				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.8 m
Refusal: 1.55 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPH04

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'04.1 "S, 21°29'26.0 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2 – 1.6	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian) (1.7 m)
1.8 – 2.0				**DENSE, GRAVELLY SAND** Slightly moist, grey, dense, matrix supported, gravelly sand Transported (2 m)
2.2 – 2.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete with metabasalt (2.6 m)
2.6				**Refused On: soft rock to medium hard rock calcrete metabasalt**
2.8 – 4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.7 m
Refusal: 2.6 m on soft rock to medium hard rock calcrete metabasalt
Water Table: None

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Test Pit: TPH05

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'13.6 "S, 21°29'44.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				(0.7 m)
0.8				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete with metabasalt
1.0				(1 m) **Refused On: soft rock to medium hard rock calcrete metabasalt**
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 0.7 m
Refusal: 1 m on soft rock to medium hard rock calcrete metabasalt
Water Table: None

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Test Pit: TPH06

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/12
Coordinates: 28°10'23.2 "S, 21°29'43.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1 m)
1.2				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, , sand Transported (1.2 m)
1.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete with metabasalt (1.7 m)
1.6				
1.8				**Refused On: soft rock to medium hard rock calcrete with metabasalt**
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1 m
Refusal: 1.7 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPMF01

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°10'37.5 "S, 21°29'20.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2 – 2.4	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
2.6				(2.6 m)
2.8				**MEDIUM HARD ROCK TO HARD ROCK, CALCRETE BOULDERS WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, medium hard rock to hard rock, Calcrete boulders with metabasalt (2.8 m) **Refused On: medium hard rock to hard rock calcrete boulders with metabasalt**
3.0 – 4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 2.6 m
Refusal: 2.8 m on medium hard rock to hard rock calcrete boulders with metabasalt
Water Table: None

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Test Pit: TPMF02

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°10'29.1 "S, 21°29'13.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				(2 m)
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 2 m
Terminated: No
Water Table: None

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Test Pit: TPMF03

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°10'21.4 "S, 21°29'17.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1.1 m)
1.2				**MEDIUM HARD ROCK, CALCRETE AND METABASALT** White and greyish green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete and metabasalt
1.4				(1.4 m) **Refused On: medium hard rock calcrete and metabasalt**
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.1 m
Refusal: 1.4 m on medium hard rock calcrete and metabasalt
Water Table: None

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Test Pit: TPMF04

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°10'11.0 "S, 21°29'13.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1.1 m)
1.2				**MEDIUM HARD ROCK, CALCRETE AND METABASALT** White and greyish green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete and metabasalt
1.4				(1.4 m) **Refused On: medium hard rock calcrete and metabasalt**
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.1 m
Refusal: 1.4 m on medium hard rock calcrete and metabasalt
Water Table: None

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Test Pit: TPOV01

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/10
Coordinates: 28°11'27.4 "S, 21°28'48.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.0				**LOOSE TO VERY LOOSE, SAND** Slightly moist, brownish red, loose to very loose, intact, sand Transported (Aeolian) (0.1 m)
0.4				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Pale white with greyish green, moderately weathered to highly weathered, fine grained, soft rock to medium hard rock, Calcrete with metabasalt (0.5 m)
0.6				**Refused On: soft rock to medium hard rock calcrete with metabasalt**

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 0.5 m on soft rock to medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPOV02

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'56.0 "S, 21°30'15.9 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				(1.3 m)
1.4	D			**MEDIUM HARD ROCK TO HARD ROCK, QUARTZ IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Dark grey and white, moderately weathered, fine grained, medium hard rock to hard rock, quartz in a matrix of slightly moist, red brown, very loose to loose, sand Transported (1.4 m)
1.6				
1.8				**VERY SOFT ROCK TO SOFT ROCK, METABASALT** Greyish green, highly weathered, fine grained, thinly bedded, very soft rock to soft rock, Metabasalt
2.0				
2.2				
2.4				
2.6				
2.8				(2.8 m) **Refused On: very soft rock to soft rock metabasalt**
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.3 m
Refusal: 2.8 m on very soft rock to soft rock metabasalt
Water Table: None

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Test Pit: TPOV03

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'57.7 "S, 21°30'16.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				(1.4 m)
1.4				**MEDIUM HARD ROCK, METABASALT WITH CALCRETE PEBBLES IN A MATRIX OF LOOSE, SAND** Dark grey and white, moderately weathered, fine grained, medium hard rock, metabasalt with calcrete pebbles in a matrix of slightly moist, brownish red, loose, matrix supported, sand Transported
1.6				
1.8				(1.8 m)
1.8				**VERY SOFT ROCK TO SOFT ROCK, METABASALT** Greyish green, highly weathered, fine grained, thinly bedded, very soft rock to soft rock, Metabasalt
2.0				
2.2				
2.4				
2.6				
2.8				(2.8 m)
2.8				**Refused On: very soft rock to soft rock metabasalt**
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 1.4 m
Refusal: 2.8 m on very soft rock to soft rock metabasalt
Water Table: None

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Test Pit: TPOV04

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°18'46.8 "S, 21°30'11.0 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2 – 1.4	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian) (1.4 m)
1.4 – 3.0	D			**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE AND METABASALT** White greyish green, highly weathered, fine grained, thinly bedded, soft rock to medium hard rock, Calcrete and metabasalt (3.1 m)
3.2 – 4.8				**Refused On: very soft rock to soft rock metabasalt**

Excavation Method: EXCAVATOR
Unstable Sides: to 1.4 m
Refusal: 3.1 m on very soft rock to soft rock metabasalt
Water Table: None

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Test Pit: TPOV05

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'38.8 "S, 21°30'05.8 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1 m)
1.2				**MEDIUM HARD ROCK, METABASALT WITH CALCRETE PEBBLES IN A MATRIX OF LOOSE, SAND (WITH PEBBLES 5MM SEE ROCK DESCRIPTION)** Dark grey and white, moderately weathered, fine grained, medium hard rock, metabasalt with calcrete pebbles in a matrix of slightly moist, brownish red, loose, matrix supported, sand (with pebbles 5mm see rock description) Transported
1.4				(1.3 m)
1.6				**VERY SOFT ROCK TO SOFT ROCK, METABASALT** Greyish green, highly weathered, fine grained, thinly bedded, very soft rock to soft rock, Metabasalt
1.8				
2.0				(2 m)
2.2				**Refused On: very soft rock to soft rock metabasalt**
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: None
Refusal: 2 m on very soft rock to soft rock metabasalt
Water Table: None

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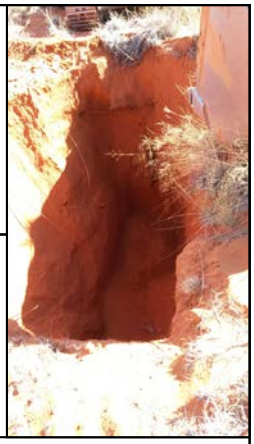
Test Pit: TPOV06

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°10'10.6 "S, 21°29'59.0 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk



Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				
				(5 m)

Excavation Method: EXCAVATOR
Unstable Sides: to 0.5 m
Terminated: No
Water Table: None

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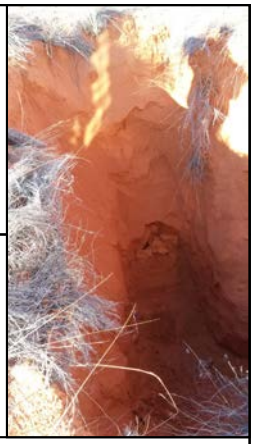
Test Pit: TPOV07

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°09'51.6 "S, 21°29'35.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk



Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				(3.5 m)
3.6				**MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete with metabasalt (3.6 m) **Refused On: medium hard rock calcrete**
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: EXCAVATOR
Unstable Sides: to 3.5 m
Refusal: 3.6 m on medium hard rock calcrete
Water Table: None

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Test Pit: TPOV08

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°09'37.1 "S, 21°28'38.0 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2 – 2.4	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian) (2.5 m)
2.6 – 4.8				

Excavation Method: TLB
Unstable Sides: to 2.5 m
Terminated: No
Water Table: None

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Test Pit: TPOV09

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°09'36.8 "S, 21°28'39.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.9 m)
1.0				**MEDIUM HARD ROCK, CALCRETE WITH METABASALT** White with green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete with metabasalt
1.2				
1.4				
1.6				
1.8				(1.8 m) **Refused On: medium hard rock calcrete with metabasalt**
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 0.9 m
Refusal: 1.8 m on medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPOV10

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/11
Coordinates: 28°09'31.7 "S, 21°29'15.5 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				(0.6 m)
0.8				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, sand Transported (0.7 m)
1.0				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE WITH METABASALT** Cream with greyish green, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete with metabasalt
1.2				
1.4				(1.4 m) **Refused On: soft rock to medium hard rock calcrete**
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 0.6 m
Refusal: 1.4 m on soft rock to medium hard rock calcrete
Water Table: None

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Test Pit: TPOV11

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°10'28.2 "S, 21°30'30.2 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				(0.8 m)
1.0				**MEDIUM HARD ROCK, CALCRETE WITH METABASALT** White and greyish green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete with metabasalt (0.9 m) **Refused On: medium hard rock calcrete and metabasalt**
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 0.8 m
Refusal: 0.9 m on medium hard rock calcrete and metabasalt
Water Table: None

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Test Pit: TPOV12

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°13'13.9 "S, 21°30'05.5 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian) (0.8 m)
0.8				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained, medium hard rock, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, intact, sand Transported (1.3 m)
1.4				**MEDIUM HARD ROCK, CALCRETE AND METABASALT** White with greenish grey, highly weathered, fine grained to medium grained, medium hard rock, Calcrete and metabasalt (1.7 m)
1.8				**Refused On: medium hard rock calcrete and metabasalt**

Excavation Method: TLB
Unstable Sides: to 0.8 m
Refusal: 1.7 m on medium hard rock calcrete and metabasalt
Water Table: None

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Test Pit: TPOV13

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°12'58.0 "S, 21°29'31.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**VERY LOOSE TO LOOSE, SAND** Slightly moist, brownish red, very loose to loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				
1.2				
1.4				(1.4 m)
1.6				**QUARTZ PEBBLES IN A MATRIX OF VERY LOOSE TO LOOSE, SAND** Pale white, slightly weathered to moderately weathered, fine grained to medium grained, quartz pebbles in a matrix of slightly moist, brownish red, very loose to loose, sand Transported
1.8				(1.7 m)
2.0				**SOFT ROCK TO MEDIUM HARD ROCK, METABASALT** Dark grey, moderately weathered to highly weathered, fine grained to medium grained, soft rock to medium hard rock, Metabasalt (2 m) **Refused On: soft rock to medium hard rock metabasalt**
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 1.4 m
Refusal: 2 m on soft rock to medium hard rock metabasalt
Water Table: None

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Test Pit: TPOV14

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/13
Coordinates: 28°13'00.5 "S, 21°30'42.6 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE, SAND** Slightly moist, brownish red, loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1 m)
1.2				**MEDIUM HARD ROCK, CALCRETE** Cream and white, highly weathered, fine grained to medium grained, medium hard rock, Calcrete
1.4				(1.3 m) **Terminated: medium hard rock calcrete**
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 1 m
Terminated: 1.3 m - medium hard rock calcrete
Water Table: None

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Test Pit: TPOV15

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/15
Coordinates: 28°12'29.5 "S, 21°30'54.7 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**LOOSE, SAND** Slightly moist, brownish red, loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1 m)
1.2				**SOFT ROCK TO MEDIUM HARD ROCK, CALCRETE** Cream and white, highly weathered, fine grained to medium grained, soft rock to medium hard rock, Calcrete (1.1 m) **Terminated: soft rock to medium hard rock calcrete**
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 1 m
Terminated: 1.1 m - soft rock to medium hard rock calcrete
Water Table: None

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Test Pit: TPOV16

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/15
Coordinates: 28°12'01.0 "S, 21°30'44.3 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE, SAND** Slightly moist, brownish red, loose, pinholed with roots, sand Transported (Aeolian) (0.1 m)
0.4	D			**MEDIUM HARD ROCK, CALCRETE WITH METABASALT** White green and pinkish, moderately weathered to highly weathered, fine grained to medium grained, medium hard rock, Calcrete with metabasalt
0.6				
0.8				(0.8 m) **Terminated: medium hard rock calcrete with metabasalt**
1.0				
1.2				
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: None
Terminated: 0.8 m - medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPOV17

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/15
Coordinates: 28°12'34.3 "S, 21°29'18.4 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE, SAND** Slightly moist, brownish red, loose, pinholed with roots, sand Transported (Aeolian)
0.4				
0.6				
0.8				
1.0				(1 m)
1.2				**MEDIUM HARD ROCK, CALCRETE WITH METABASALT** White greyish green and pinkish, moderately weathered to highly weathered, fine grained to medium grained, medium hard rock, Calcrete with metabasalt Notes: Boulders
1.4				
1.6				
1.8				(1.8 m) **Terminated: medium hard rock calcrete with metabasalt**
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 1 m
Terminated: 1.8 m - medium hard rock calcrete with metabasalt
Water Table: None

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Test Pit: TPOV18

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/15
Coordinates: 28°11'57.9 "S, 21°29' 1.9 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2	D			**LOOSE, GRAVELLY SAND** Slightly moist, brownish red, loose, pinholed, gravelly sand Aeolian
0.4				
0.6				(0.6 m)
0.8				**MEDIUM HARD ROCK, QUARTZ PEBBLES IN A MATRIX OF LOOSE, SAND** Transparent and grey, moderately weathered, fine grained, medium hard rock, Quartz pebbles in a matrix of slightly moist, brownish red, loose, intact, sand Transported
1.0				(0.65 m)
1.2				**MEDIUM HARD ROCK, CALCRETE AND METABASALT** White and greyish green, highly weathered, fine grained to medium grained, medium hard rock, Calcrete and metabasalt (0.7 m) **Refused On: medium hard rock calcrete and metabasalt**
1.4				
1.6				
1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 0.6 m
Refusal: 0.7 m on medium hard rock calcrete and metabasalt
Water Table: None

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Test Pit: TPOV19

Client: WSP Group
Project: MBSA High Speed Proving Ground - 7345
Date Profiled: 2015/06/15
Coordinates: 28°11'57.9 "S, 21°29' 1.9 "E
Elevation: Not specified
Profiled By: Hannes Taljaard & Coert van Dyk

Depth (m)	Sampling	Ground Water	Symbol	Description
0.2				**LOOSE, GRAVELLY SAND** Slightly moist, brownish red, loose, pinholed, gravelly sand Aeolian
0.4				(0.5 m)
0.6				**VERY SOFT ROCK WITH MEDIUM HARD ROCK BOULDERS, CALCRETE AND METABASALT** White and greyish green, highly weathered, fine grained to medium grained, very soft rock with medium hard rock boulders, Calcrete and metabasalt Notes: Excavates as a gravel with a few boulders
0.8				
1.0				
1.2	D			
1.4				
1.6				
1.8				(1.9 m)
2.0				**Refused On: very soft rock with medium hard rock boulders calcrete and metabasalt**
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.2				
4.4				
4.6				
4.8				

Excavation Method: TLB
Unstable Sides: to 0.5 m
Refusal: 1.9 m on very soft rock with medium hard rock boulders calcrete and metabasalt
Water Table: None

APPENDIX C
TEST PIT LABORATORY RESULTS

ROADLAB
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Established 1965

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91-0059-15 2015/07/23

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

ATTENTION: MR. E VAN ZYL

Dear Sir

Test Report : MBSA HIGH SPEED PROVING GROUND - SALTS & SULPHATES TEST RESULTS

HOLE No. / Km.	TPOV8	TPOV7	TPOV11	TPOV15
LAYER TESTED	0-2500mm	0-350mm	0-800mm	0-1000mm
SAMPLE No.	U4285 (E3006)	U4284 (E3006)	U4290 (E3006)	U4293 (E3006)
DATE SAMPLED	2015/07/13	2015/07/13	2015/07/13	2015/07/13
DATE RECEIVED	2015/07/13	2015/07/13	2015/07/13	2015/07/13
CLIENTS MARKING	None	None	None	None
DESCRIPTION OF SAMPLE				

pH				
Conductivity (µS)				
Cl Content (%)				
Soluble Salts (%)	0.0787	0.1016	0.0729	0.1176
Soluble Sulphate (%)				
Acid Soluble Sulphate (SO_3)				
Water Soluble Sulphate (SO_3)				
Qualitative Sulphate				
CaO Content (%)				
Methylene Blue Adsorption				
Remarks	Not accredited tests	Not accredited tests	Not accredited tests	Not accredited tests

Remarks :
SANAS Accredited Laboratory No. T 0296
The samples were subjected to analysis according to SABS methods
The results reported relate only to the sample tested
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91-0059-15 2015/07/23

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WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

ATTENTION: MR. E VAN ZYL

Dear Sir

Test Report : MBSA HIGH SPEED PROVING GROUND - SALTS & SULPHATES TEST RESULTS

HOLE No. / Km.	TPOV18			
LAYER TESTED	0-700mm			
SAMPLE No.	U4294 (E3006)			
DATE SAMPLED	2015/07/13			
DATE RECEIVED	2015/07/13			
CLIENTS MARKING	None			
DESCRIPTION OF SAMPLE				

pH				
Conductivity (µS)				
Cl Content (%)				
Soluble Salts (%)	0.1058			
Soluble Sulphate (%)				
Acid Soluble Sulphate (SO_3)				
Water Soluble Sulphate (SO_3)				
Qualitative Sulphate				
CaO Content (%)				
Methylene Blue Adsorption				
Remarks	Not accredited tests			

Remarks :
SANAS Accredited Laboratory No. T 0296
The samples were subjected to analysis according to SABS methods
The results reported relate only to the sample tested
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JOB NO: 91-0059-15 **DATE REPORTED :** 2015/07/22

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

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Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4272 (E3006)	U4273 (E3006)	U4274 (E3006)	
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags	Black Sampling Bags	
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's	±70kg's	
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist	Slightly Moist	
HOLE No. / Km. / CHAINAGE		BD 01	BD 01	BD 01	
LAYER TESTED / SAMPLED FROM		0-1300mm	1300-2200mm	2200-2700mm	
DATE SAMPLED		2015/06/10	2015/06/10	2015/06/10	
DATE RECEIVED		2015/06/10	2015/06/10	2015/06/10	
CLIENTS MARKING		None	None	None	
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE	75.0	100	100	100	
	63.0	100	100	100	
	53.0	100	80	93	
	37.5	100	70	93	
ANA -	26.5	100	59	93	
	19.0	100	45	91	
	13.2	100	35	85	
LYSIS	4.75	99	17	54	
(mm)	2.00	99	15	33	
(TMH A1a)	0.425	91	13	21	
	0.075	5.2	5	8	
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG	LL%				
LIMITS	P.I.	NP	NP	SP	
(TMH A2&A3)	LS%			0.7	
GM		10.48	2.67	2.38	
CLASSIFI - CATION	H.R.B.*	A-2-4(0)	A-1-b(0)	A-1-b(0)	
	COLTO*	G9	G1	G7	
	T.R.H. 14*	G9	G1	G7	
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO	OMC%	5.9	3.1	7.5	
(TMH A7)	MDD(KG/M³)	1375	2189	2214	
C.B.R.	COMP MC	5.9	3.1	7.4	
	% SWELL	5.02	0.02	0.03	
U.C.S.	100%	19	141	39	
(TMH A13T)	98%	15	121	38	
C.B.R.	97%	14	110	37	
(TMH A8)	95%	10	90	36	
	93%	8	62	29	
	90%	5	19	19	
MOD ITS : DRY (kPa) **(A16T)**		N/A	N/A	N/A	
PROCTOR ITS : DRY (kPa)		N/A	N/A	N/A	
STABILISED	IN LAB				
WITH	ON SITE	Neat	Neat	Neat	
TEST TYPE		CBR	CBR	CBR	
SAMPLED BY		Roadlab	Roadlab	Roadlab	
DELIVERED BY		Roadlab	Roadlab	Roadlab	
SAMPLED ACCORDING TO		Clients Requirements	Clients Requirements	Clients Requirements	
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny	Sunny	Sunny	
REMARKS & NOTES		None	None	None	

TESTED BY :
ROAD / AREA TESTED :
LAYER TESTED :
TRACK NO:

SAMPLING METHOD :
TEST METHOD :
DATE TESTED :
WEATHER CONDITIONS:

TEST	DEPTH	FIELD DENSITY(kg/m3)		FIELD	AASHTO TMH A7		
POSITION	TESTED	WET DENSITY	DRY DENSITY	MOISTURE(%)	MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/22

ROADLAB
Civil Engineering Materials Laboratory
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Established 1965
HEAD OFFICE
207 Rietfontein Rd Primrose Germiston 1401
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Tel: 011 828 0279 Fax: 011 828 0273
E-mail: info@roadlab.co.za
www.roadlab.co.za

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4275 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		BD 05			
LAYER TESTED / SAMPLED FROM		1100-2500mm			
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	79			
	26.5	75			
	19.0	70			
	13.2	61			
	4.75	39			
	2.00	26			
	0.425	16			
	0.075	6			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	SP			
	LS%	0.7			
GM		2.54			
CLASSIFI - CATION	H.R.B.*	A-1-b(0)			
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.5			
	MDD(KG/M3)	2153			
C.B.R.	COMP MC	5.6			
	% SWELL	2.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	96			
	98%	80			
	97%	73			
	95%	57			
	93%	51			
	90%	43			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

sanas Testing Laboratory
Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/22

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

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www.roadlab.co.za

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4276 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		BD 06			
LAYER TESTED / SAMPLED FROM		1400-2900mm			
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	92			
	63.0	92			
	53.0	92			
	37.5	81			
	26.5	76			
	19.0	61			
	13.2	49			
	4.75	28			
	2.00	20			
	0.425	13			
	0.075	4			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		2.64			
CLASSIFI - CATION	H.R.B.*	A-1-a(0)			
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	8.0			
	MDD(KG/M3)	2259			
C.B.R.	COMP MC	7.9			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	104			
	98%	92			
	97%	85			
	95%	73			
	93%	59			
	90%	37			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	FIELD DENSITY(kg/m3) DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	AASHTO TMH A7 OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

sanas Testing Laboratory
Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/22

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

ROADLAB
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www.roadlab.co.za

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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4277 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		BD 08			
LAYER TESTED / SAMPLED FROM		800-3300mm			
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	73			
	26.5	66			
	19.0	59			
	13.2	49			
	4.75	28			
	2.00	19			
	0.425	11			
	0.075	5			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	SP			
	LS%				
GM		2.67			
CLASSIFI - CATION	H.R.B.*	A-1-a(0)			
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.5			
	MDD(KG/M³)	2193			
C.B.R.	COMP MC	6.6			
	% SWELL	0.06			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	72			
	98%	67			
	97%	65			
	95%	60			
	93%	51			
	90%	38			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

sanas Testing Laboratory
Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/22

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

ROADLAB
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www.roadlab.co.za

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4278 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		BD 12			
LAYER TESTED / SAMPLED FROM		600-2100mm			
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	89			
	53.0	74			
	37.5	70			
	26.5	64			
	19.0	60			
	13.2	55			
	4.75	40			
	2.00	30			
	0.425	21			
	0.075	7			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		2.45			
CLASSIFI - CATION	H.R.B.*	A-1-b(0)			
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.5			
	MDD(KG/M³)	2067			
C.B.R.	COMP MC	6.6			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	94			
	98%	80			
	97%	74			
	95%	60			
	93%	53			
	90%	42			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

sanas Testing Laboratory
Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/22

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

ROADLAB
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Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		1			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE					
LAYER TESTED / SAMPLED FROM					
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75.0				
	63.0				
	53.0				
	37.5				
	26.5				
	19.0				
	13.2				
	4.75				
	2.00				
	0.425				
	0.075				
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.				
	LS%				
GM					
CLASSIFI - CATION	H.R.B.*				
	COLTO*				
	T.R.H. 14*				
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%				
	MDD(KG/M³)				
C.B.R.	COMP MC				
	% SWELL				
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%				
	98%				
	97%				
	95%				
	93%				
	90%				
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY :
ROAD / AREA TESTED :
LAYER TESTED :
TRACK NO:

SAMPLING METHOD :
TEST METHOD :
DATE TESTED :
WEATHER CONDITIONS:

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	*RELATIVE COMPACTION(%)
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
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JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4290 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 11			
LAYER TESTED / SAMPLED FROM		0-800mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	99			
	2.00	98			
	0.425	94			
	0.075	7			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.01			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	7.9			
	MDD(KG/M³)	1711			
C.B.R.	COMP MC	7.6			
	% SWELL	2.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	22			
	98%	17			
	97%	14			
	95%	10			
	93%	9			
	90%	7			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES						
SAMPLE No.		U4281 **(E3006)**	U4281 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 12	TP-OV 12			
LAYER TESTED / SAMPLED FROM		0-800mm	1400-2800mm			
DATE SAMPLED		2015/06/17	2015/06/17			
DATE RECEIVED		2015/06/17	2015/06/17			
CLIENTS MARKING		None	None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Red Sand	Light Reddish Brown Sand with Calcrete & Quartz			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)						
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100	100			
	63.0	100	100			
	53.0	100	100			
	37.5	100	66			
	26.5	100	62			
	19.0	100	53			
	13.2	100	45			
	4.75	99	29			
	2.00	98	26			
	0.425	84	24			
	0.075	9	4			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)						
ATTERBERG LIMITS **(TMH A2&A3)**	LL%					
	P.I.	NP	NP			
	LS%					
GM		1.09	2.48			
CLASSIFI - CATION	H.R.B.*					
	COLTO*	G7	G5			
	T.R.H. 14*	G7	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)						
MOD AASHTO **(TMH A7)**	OMC%	6.5	7.3			
	MDD(KG/M3)	1880	2152			
C.B.R.	COMP MC	6.6	7.4			
	% SWELL	0.02	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	32	116			
	98%	26	95			
	97%	23	85			
	95%	18	64			
	93%	15	54			
	90%	9	39			
MOD ITS : DRY (kPa) (A16T)		N/A	N/A			
PROCTOR ITS : DRY (kPa)		N/A	N/A			
STABILISED WITH	IN LAB					
	ON SITE	Neat	Neat			
TEST TYPE						
SAMPLED BY		Roadlab	Roadlab			
DELIVERED BY		Roadlab	Roadlab			
SAMPLED ACCORDING TO		Clients Requirements	Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny	Sunny			
REMARKS & NOTES		None	None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4292 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 13			
LAYER TESTED / SAMPLED FROM		0-1400mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	99			
	2.00	96			
	0.425	85			
	0.075	9			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.10			
CLASSIFICATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.8			
	MDD(KG/M3)	1880			
C.B.R.	COMP MC	5.9			
	% SWELL	2.00			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	19			
	98%	16			
	97%	15			
	95%	12			
	93%	10			
	90%	7			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4293 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 15			
LAYER TESTED / SAMPLED FROM		0-1000mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Fine Sand & Occasional Calcrete			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	99			
	2.00	99			
	0.425	92			
	0.075	8			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.01			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G8			
	T.R.H. 14*	G8			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.3			
	MDD(KG/M3)	1802			
C.B.R.	COMP MC	5.2			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	28			
	98%	24			
	97%	22			
	95%	18			
	93%	13			
	90%	6			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4294 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 16			
LAYER TESTED / SAMPLED FROM		100-800mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Sand with Calcrete Gravel			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	89			
	63.0	89			
	53.0	89			
	37.5	75			
	26.5	70			
	19.0	65			
	13.2	60			
	4.75	53			
	2.00	50			
	0.425	46			
	0.075	6			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.98			
CLASSIFICATION	H.R.B.*				
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.0			
	MDD(KG/M3)	2067			
C.B.R.	COMP MC	6.1			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	120			
	98%	102			
	97%	94			
	95%	76			
	93%	64			
	90%	47			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4295 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 18			
LAYER TESTED / SAMPLED FROM		0-700mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Dark Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	99			
	2.00	98			
	0.425	86			
	0.075	10			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.06			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.8			
	MDD(KG/M³)	1837			
C.B.R.	COMP MC	6.9			
	% SWELL	0.82			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	31			
	98%	27			
	97%	25			
	95%	21			
	93%	16			
	90%	9			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	FIELD DENSITY(kg/m3) DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	AASHTO TMH A7 OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT					
SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4297 **(E3006)**	U4297 **(E3006)**		
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags		
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's		
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist		
HOLE No. / Km. / CHAINAGE		TP-OV 19	TP-OV 19		
LAYER TESTED / SAMPLED FROM		0-500mm	500-1900mm		
DATE SAMPLED		2015/06/17	2015/06/17		
DATE RECEIVED		2015/06/17	2015/06/17		
CLIENTS MARKING		None	None		
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand	Light Brown Sand		
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100	76		
	63.0	100	76		
	53.0	100	76		
	37.5	100	76		
	26.5	100	72		
	19.0	100	63		
	13.2	100	56		
	4.75	99	31		
	2.00	98	23		
	0.425	88	19		
	0.075	8	4		
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP	NP		
	LS%				
GM		1.06	2.55		
CLASSIFICATION	H.R.B.*				
	COLTO*	G7	G5		
	T.R.H. 14*	G7	G5		
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	7.2	5.5		
	MDD(KG/M³)	1873	2227		
C.B.R.	COMP MC	7.0	5.4		
	% SWELL	0.02	0.08		
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	40	108		
	98%	34	90		
	97%	31	82		
	95%	26	64		
	93%	21	54		
	90%	13	40		
MOD ITS : DRY (kPa) **(A16T)**		N/A	N/A		
PROCTOR ITS : DRY (kPa)		N/A	N/A		
STABILISED WITH	IN LAB				
	ON SITE	Neat	Neat		
TEST TYPE					
SAMPLED BY		Roadlab	Roadlab		
DELIVERED BY		Roadlab	Roadlab		
SAMPLED ACCORDING TO		Clients Requirements	Clients Requirements		
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny	Sunny		
REMARKS & NOTES		None	None		

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: 91-0059-15 **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

ROADLAB
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E-mail: info@roadlab.co.za
www.roadlab.co.za

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4283 **(E006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP/OV 4			
LAYER TESTED / SAMPLED FROM		1400-3100mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Brown Calcrete & Quartz Gravel			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	79			
	37.5	76			
	26.5	75			
	19.0	68			
	13.2	58			
	4.75	39			
	2.00	28			
	0.425	19			
	0.075	5			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		2.48			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G5			
	T.R.H. 14*	G5			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.7			
	MDD(KG/M³)	2193			
C.B.R.	COMP MC	5.7			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	101			
	98%	88			
	97%	82			
	95%	70			
	93%	62			
	90%	51			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY :
ROAD / AREA TESTED :
LAYER TESTED :
TRACK NO:

SAMPLING METHOD :
TEST METHOD :
DATE TESTED :
WEATHER CONDITIONS:

TEST	DEPTH	FIELD DENSITY(kg/m3)		FIELD	AASHTO TMH A7		
POSITION	TESTED	WET DENSITY	DRY DENSITY	MOISTURE(%)	MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

ROADLAB
Civil Engineering Materials Laboratory
(PTY) LTD • 1965/000083/07 • VAT No. 4600715884
Established 1965
HEAD OFFICE
207 Rietfontein Rd Primrose Germiston 1401
P O Box 1476 Germiston 1400
Tel: 011 828 0279 Fax: 011 828 0273
E-mail: info@roadlab.co.za
www.roadlab.co.za

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4280 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 2			
LAYER TESTED / SAMPLED FROM		0-1300mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	100			
	2.00	99			
	0.425	95			
	0.075	7.2			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		0.98			
CLASSIFI - CATION	H.R.B.*	A-1-b(0)			
	COLTO*	G8			
	T.R.H. 14*	G8			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.1			
	MDD(KG/M3)	1766			
C.B.R.	COMP MC	5.8			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	32			
	98%	24			
	97%	21			
	95%	13			
	93%	11			
	90%	7			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

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WSP | PARSONS BRINCKERHOFF

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TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES						
SAMPLE No.		U4283 (E3006)	U4283 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's	±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist	Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV 4	TP-OV 4			
LAYER TESTED / SAMPLED FROM		0-1400mm	1400-3100mm			
DATE SAMPLED		2015/06/17	2015/06/17			
DATE RECEIVED		2015/06/17	2015/06/17			
CLIENTS MARKING		None	None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)						
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)						
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100	100			
	63.0	100	100			
	53.0	100	79			
	37.5	100	76			
	26.5	100	75			
	19.0	100	68			
	13.2	100	58			
	4.75	99	39			
	2.00	99	28			
	0.425	95	19			
	0.075	4.5	3.2			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)						
ATTERBERG LIMITS **(TMH A2&A3)**	LL%					
	P.I.	NP	NP			
	LS%					
GM		1.01	2.49			
CLASSIFI - CATION	H.R.B.*	A-2-4(0)	A-1-b(0)			
	COLTO*	G9	G1			
	T.R.H. 14*	G9	G1			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)						
MOD AASHTO **(TMH A7)**	OMC%	5.1	5.7			
	MDD(KG/M3)	1756	2193			
C.B.R.	COMP MC	5.0	5.7			
	% SWELL	0.02	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	22	100			
	98%	17	88			
	97%	14	83			
	95%	9	71			
	93%	8	63			
	90%	7	50			
MOD ITS : DRY (kPa) (A16T)		N/A	N/A			
PROCTOR ITS : DRY (kPa)		N/A	N/A			
STABILISED WITH	IN LAB					
	ON SITE	Neat	Neat			
TEST TYPE		CBR	CBR			
SAMPLED BY		Roadlab	Roadlab			
DELIVERED BY		Roadlab	Roadlab			
SAMPLED ACCORDING TO		Clients Requirements	Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny	Sunny			
REMARKS & NOTES		None	None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	FIELD DENSITY(kg/m3) DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	AASHTO TMH A7 OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

sanas Testing Laboratory
Accreditation No.: T0296

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4284 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-0V7			
LAYER TESTED / SAMPLED FROM		0-350mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	100			
	2.00	100			
	0.425	99			
	0.075	5			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		0.96			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.2			
	MDD(KG/M³)	1727			
C.B.R.	COMP MC	5.3			
	% SWELL	2.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	16			
	98%	13			
	97%	12			
	95%	9			
	93%	8			
	90%	6			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

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RL-S-150-01

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TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4285 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-OV8			
LAYER TESTED / SAMPLED FROM		0-2500mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Fine Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	98			
	26.5	98			
	19.0	97			
	13.2	95			
	4.75	92			
	2.00	89			
	0.425	88			
	0.075	6			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.17			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.1			
	MDD(KG/M³)	1731			
C.B.R.	COMP MC	6.1			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	18			
	98%	14			
	97%	13			
	95%	9			
	93%	7			
	90%	4			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

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TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4287 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP 404			
LAYER TESTED / SAMPLED FROM		0-1700mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Fine Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	99			
	2.00	98			
	0.425	92			
	0.075	5			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.05			
CLASSIFICATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.3			
	MDD(KG/M3)	1823			
C.B.R.	COMP MC	6.3			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	22			
	98%	16			
	97%	13			
	95%	8			
	93%	7			
	90%	5			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	FIELD DENSITY(kg/m3) DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	AASHTO TMH A7 OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
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The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4279 (E3006)			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		OTP(17			
LAYER TESTED / SAMPLED FROM		300-1000mm			
DATE SAMPLED		2015/06/10			
DATE RECEIVED		2015/06/10			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)					
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	95			
	37.5	87			
	26.5	81			
	19.0	71			
	13.2	54			
	4.75	21			
	2.00	18			
	0.425	16			
	0.075	2.2			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		3.63			
CLASSIFI - CATION	H.R.B.*	A-1-b(0)			
	COLTO*	G7			
	T.R.H. 14*	G7			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	3.3			
	MDD(KG/M³)	2176			
C.B.R.	COMP MC	3.4			
	% SWELL	0.03			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	71			
	98%	53			
	97%	44			
	95%	26			
	93%	23			
	90%	19			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE		CBR			
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
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JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4289 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-MF 01			
LAYER TESTED / SAMPLED FROM		0-2600mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Fine Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	100			
	2.00	99			
	0.425	93			
	0.075	7			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		0.93			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G8			
	T.R.H. 14*	G8			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.2			
	MDD(KG/M³)	1781			
C.B.R.	COMP MC	6.3			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	23			
	98%	20			
	97%	19			
	95%	15			
	93%	12			
	90%	7			
MOD ITS : DRY (kPa) **(A16T)**		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	FIELD DENSITY(kg/m3) DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	AASHTO TMH A7 OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4286 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-H02			
LAYER TESTED / SAMPLED FROM		0-2700mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	100			
	13.2	100			
	4.75	100			
	2.00	99			
	0.425	93			
	0.075	6			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.02			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	5.0			
	MDD(KG/M3)	1803			
C.B.R.	COMP MC	4.9			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	18			
	98%	16			
	97%	15			
	95%	13			
	93%	10			
	90%	6			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

JOB NO: **91-0059-15** **DATE REPORTED :** 2015/07/07

TEST REPORT : **GEOTECHNICAL INVESTIGATION FOR MBSA HIGH SPEED PROVING GROUND - CBR TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty)Ltd in Primrose.
The unambiguous description of the sample/s as received are as follows :

SAMPLE INFORMATION & PROPERTIES					
SAMPLE No.		U4288 **(E3006)**			
CONTAINER USED FOR SAMPLING		Black Sampling Bags			
SIZE / WEIGHT OF SAMPLE		±70kg's			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Slightly Moist			
HOLE No. / Km. / CHAINAGE		TP-H05			
LAYER TESTED / SAMPLED FROM		0-700mm			
DATE SAMPLED		2015/06/17			
DATE RECEIVED		2015/06/17			
CLIENTS MARKING		None			
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Orange Sand			
GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a)					
SIEVE ANALYSIS (mm) **(TMH A1a)**	75.0	100			
	63.0	100			
	53.0	100			
	37.5	100			
	26.5	100			
	19.0	98			
	13.2	96			
	4.75	95			
	2.00	94			
	0.425	87			
	0.075	8			
ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986, TMHA4 1974)					
ATTERBERG LIMITS **(TMH A2&A3)**	LL%				
	P.I.	NP			
	LS%				
GM		1.11			
CLASSIFI - CATION	H.R.B.*				
	COLTO*	G9			
	T.R.H. 14*	G9			
CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7, A8) / UNCONFINED COMPRESSIVE STRENGTH (TMH1 1986 : METHOD A7, A14) (ITS A16T)					
MOD AASHTO **(TMH A7)**	OMC%	6.7			
	MDD(KG/M3)	1843			
C.B.R.	COMP MC	6.8			
	% SWELL	0.02			
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	16			
	98%	13			
	97%	12			
	95%	9			
	93%	7			
	90%	5			
MOD ITS : DRY (kPa) (A16T)		N/A			
PROCTOR ITS : DRY (kPa)		N/A			
STABILISED WITH	IN LAB				
	ON SITE	Neat			
TEST TYPE					
SAMPLED BY		Roadlab			
DELIVERED BY		Roadlab			
SAMPLED ACCORDING TO		Clients Requirements			
ENVIRONMENTAL CONDITION WHEN SAMPLED		Sunny			
REMARKS & NOTES		None			

TESTED BY : **SAMPLING METHOD :**
ROAD / AREA TESTED : **TEST METHOD :**
LAYER TESTED : **DATE TESTED :**
TRACK NO: **WEATHER CONDITIONS:**

TEST POSITION	DEPTH TESTED	FIELD DENSITY(kg/m3) WET DENSITY	DRY DENSITY	FIELD MOISTURE(%)	AASHTO TMH A7 MDD(kg/m³)	OMC(%)	
					AVERAGE COMPACTION:		

MOISTURE CONTENT

SAMPLE NO	HOLE	LAYER	% MOISTURE	TIN NO	

 # MOD SAMPLE TAKEN AT THIS POINT/ PREVIOUS LAYER TESTED FOR MOD

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

MR. E VAN ZYL

RL-S-150-01

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91-0059-15 2015/07/22

WSP PARSONS BRINCKERHOFF DEVELOPMENT, TRANSPORTATION AND INFRASTRUCTURE, AFRICA
WSP HOUSE, BRYANSTON PLACE
199 BRYANSTON DRIVE, BRYANSTON

ATTENTION: MR. E VAN ZYL

Test Report : **MBSA HIGH SPEED PROVING GROUND - PH & CONDUCTIVITY TESTS**

Clients Marking: None
Sample Number: U4284 - U4295
Sample delivered to: Roadlab

Date Sampled: 2015/06/15
Date Received: 2015/06/15

Sample Number	Layer / Road :	Temperature (°C) : Conductivity	Conductivity (ms/m)	Temperature (°C) : pH	pH Value
U4284 (E3006)	0-3500mm	20.2	0.02	20.2	7.80
U4285 (E3006)	0-2500mm	23.0	0.03	23.0	7.8
U4290 (E3006)	0-800mm	20.0	0.03	20.0	7.90
U4293 (E3006)	0-1000mm	20.0	0.01	20.0	8.1
U4295 (E3006)	0-700mm	23.4	0.02	23.4	7.6
					PAGE 1/1

Remarks :
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
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91-0059-15 2015/08/06

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199 BRYANSTON DRIVE, BRYANSTON

ATTENTION: MR. E VAN ZYL

Test Report : **MBSA HIGH SPEED PROVING GROUND - PH & CONDUCTIVITY TESTS**

Clients Marking: None
Sample Number: U4275 - U4297
Sample delivered to: Roadlab

Date Sampled: 2015/06/10
Date Received: 2015/06/10

Sample Number	Layer / Road :	Temperature (°C) : Conductivity	Conductivity (ms/m)	Temperature (°C) : pH	pH Value
U4275 (E3006)	1100-2500mm	21.4	0.1	21.4	8.4
U44278 (E3006)	600-2600mm	20.4	0.2	20.4	8.4
U4283 (E3006)	1400-3100mm	22.0	0.0	22.0	8.5
U4294 (E3006)	100-800mm	20.5	0.0	20.5	8.3
U4297 (E3006)	500-1900mm	20.1	0.00	20.1	8.4
					PAGE 1/1

Remarks :
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
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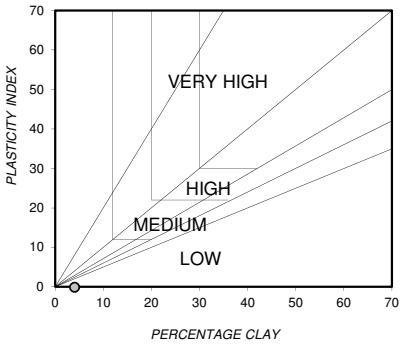
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 2
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-1300mm
SAMPLE No. : U4280 (E3006)
SAMPLE DESCRIPTION : Light Red Sand

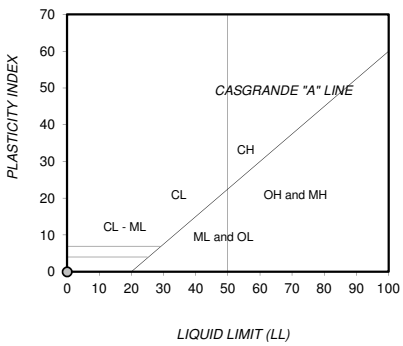
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	99
	0.425	95
	0.250	65
	0.150	35
	0.075	7
	0.050*	6
	0.005*	5
	0.002*	4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4.0
	0.425 - 0.250	28.8
	0.250 - 0.150	28.8
	0.150 - 0.075	26.7
	< 0.075	11.7
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		36.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		0.99
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

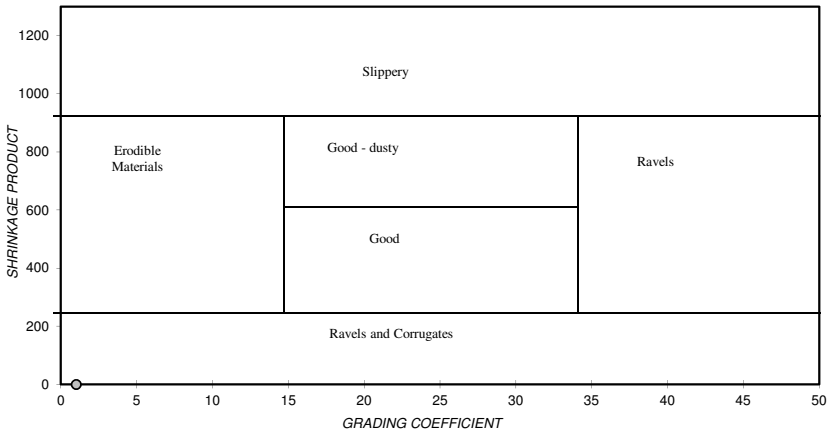
POTENTIAL EXPANSION



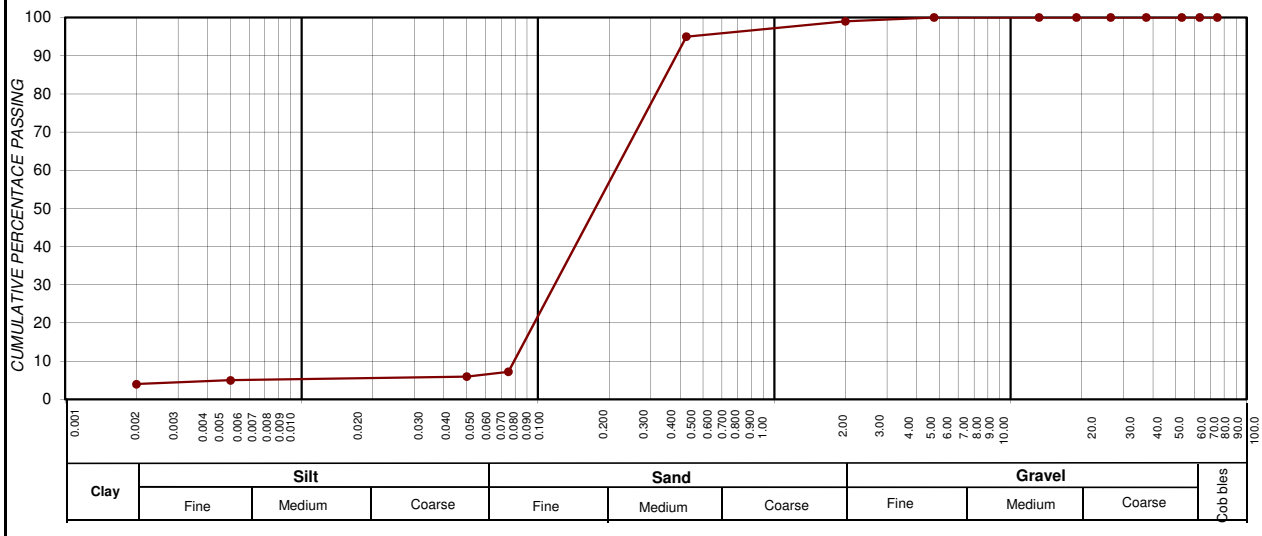
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.0	3.2	91.8	1.0

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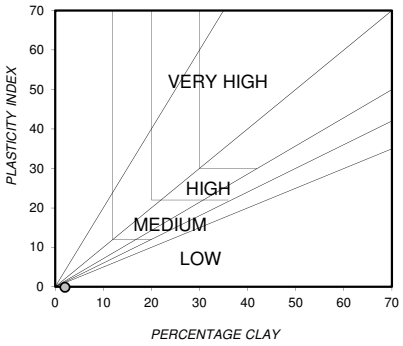
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 4
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-1400mm
SAMPLE No. : U4282 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

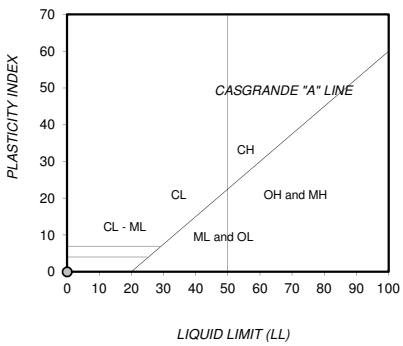
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	99
	0.425	95
	0.250	65
	0.150	35
	0.075	5
	0.050*	3
	0.005*	2
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4.0
	0.425 - 0.250	28.8
	0.250 - 0.150	28.8
	0.150 - 0.075	29.3
	< 0.075	9.1
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		25.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		1.02
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SC_SW
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

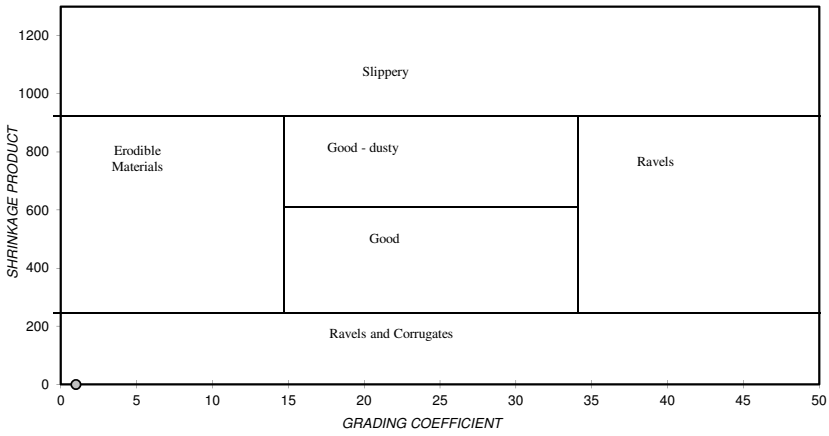
POTENTIAL EXPANSION



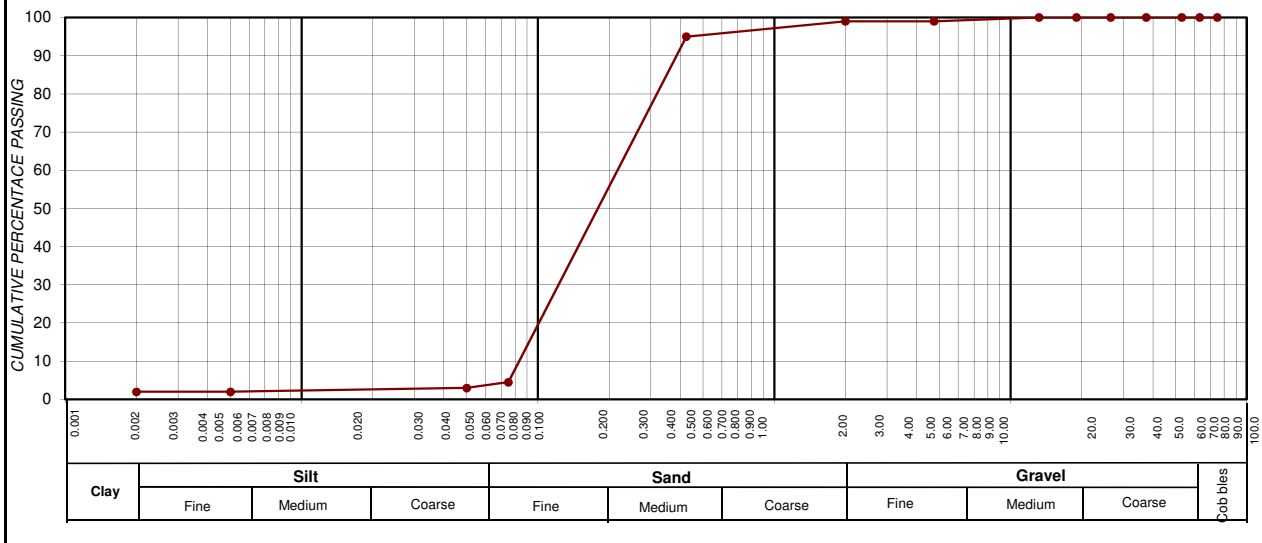
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	2.5	94.5	1.0

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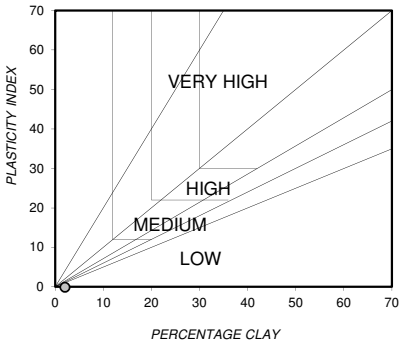
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 4
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 1400-3100mm
SAMPLE No. : U4283 (E3006)
SAMPLE DESCRIPTION : Light Reddish Brown Sandy Gravel

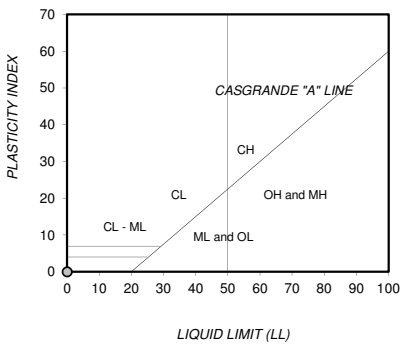
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	79
	37.5	76
	26.5	75
	19.0	68
	13.2	58
	4.75	39
	2.000	28
	0.425	19
	0.250	12
	0.150	10
	0.075	3
	0.050*	3
	0.005*	2
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	32.1
	0.425 - 0.250	4.8
	0.250 - 0.150	1.4
	0.150 - 0.075	4.6
	< 0.075	57.1
Effective size		0.000
Uniformity Coefficient		#DIV/0!
Curvature Coefficient		#DIV/0!
Oversize Index		24.0
Shrinkage Product		0.0
Grading Coefficient		18.3
Grading modulus		2.50
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

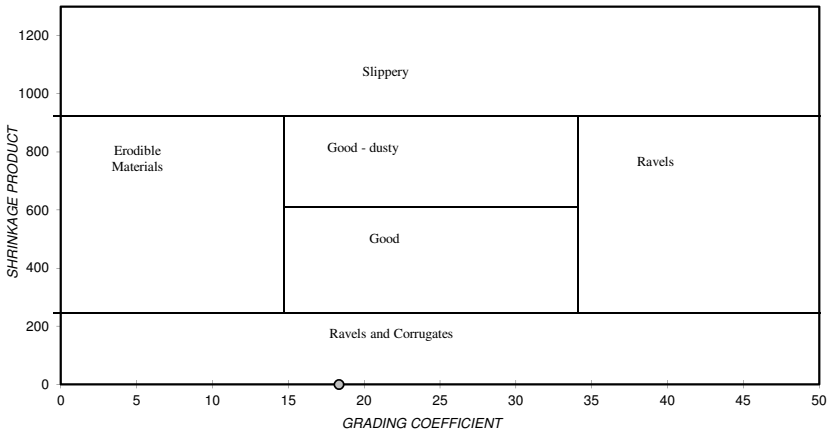
POTENTIAL EXPANSION



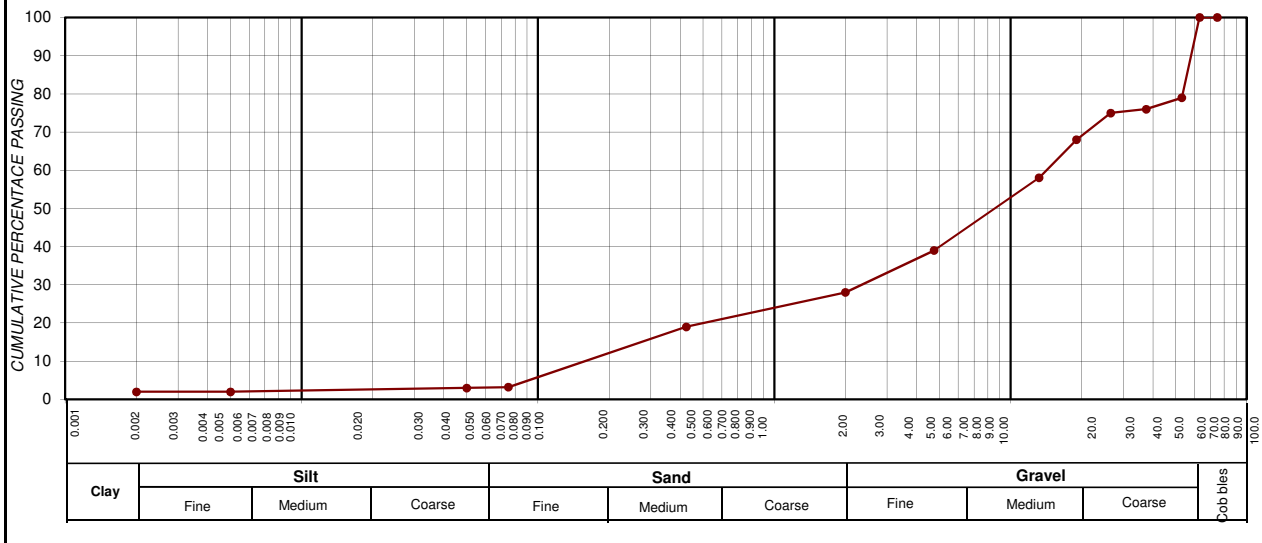
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	1.2	24.8	72.0

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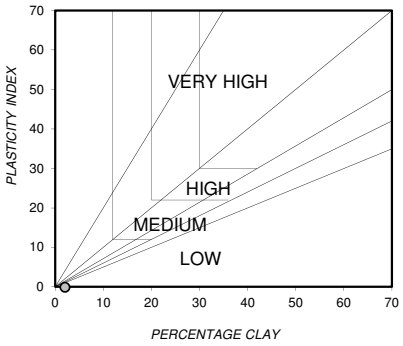
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 7
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-350mm
SAMPLE No. : U4284 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

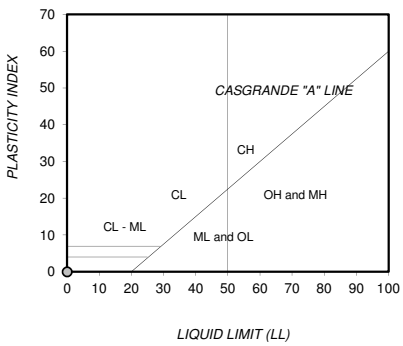
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	100
	0.425	99
	0.250	65
	0.150	35
	0.075	6
	0.050*	5
	0.005*	4
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1.0
	0.425 - 0.250	33.7
	0.250 - 0.150	29.7
	0.150 - 0.075	28.7
	< 0.075	6.9
Effective size		0.000
Uniformity Coefficient		100.0
Curvature Coefficient		56.3
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		0.0
Grading modulus		0.95
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SC-SW
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

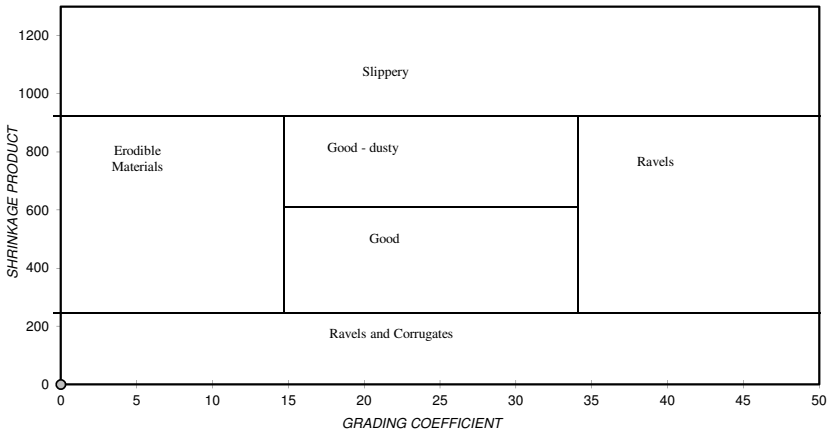
POTENTIAL EXPANSION



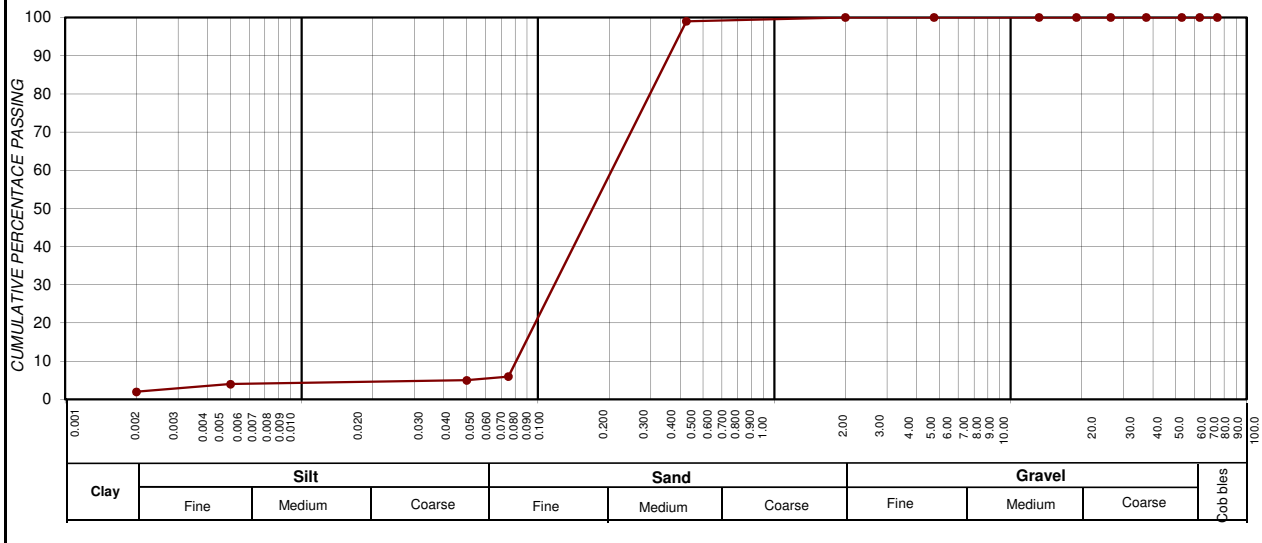
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	4.0	94.0	0.0

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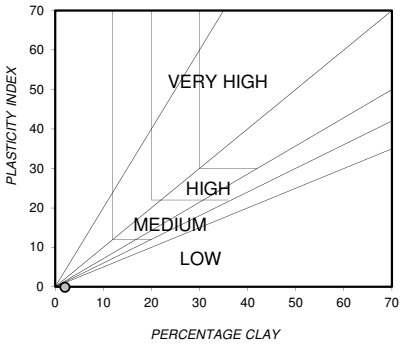
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 8
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-2500mm
SAMPLE No. : U4285 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Gravelly Sand

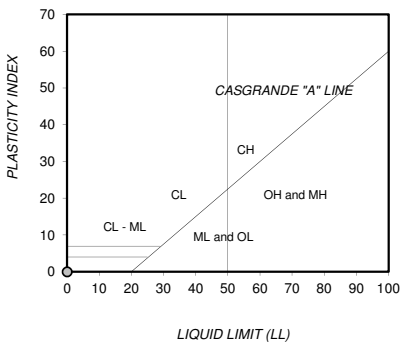
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	98
	26.5	98
	19.0	97
	13.2	95
	4.75	92
	2.000	89
	0.425	88
	0.250	65
	0.150	35
	0.075	6
	0.050*	4
	0.005*	3
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	1.1
	0.425 - 0.250	22.7
	0.250 - 0.150	29.7
	0.150 - 0.075	28.7
	< 0.075	17.8
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		56.3
Oversize Index		2.0
Shrinkage Product		0.0
Grading Coefficient		8.3
Grading modulus		1.17
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SC-SW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

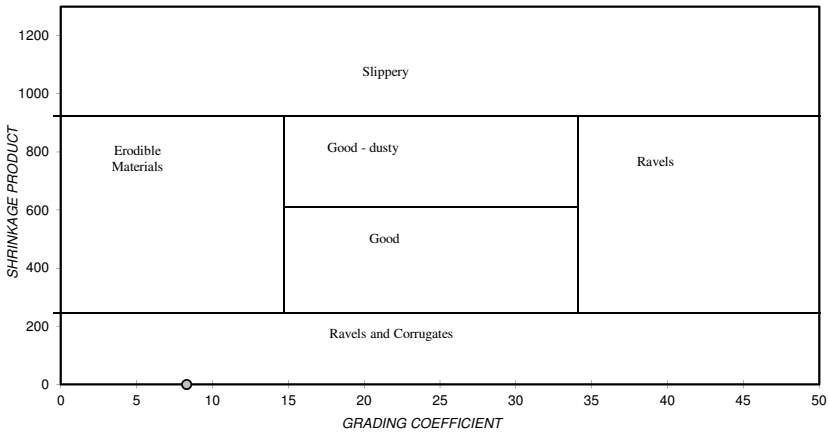
POTENTIAL EXPANSION



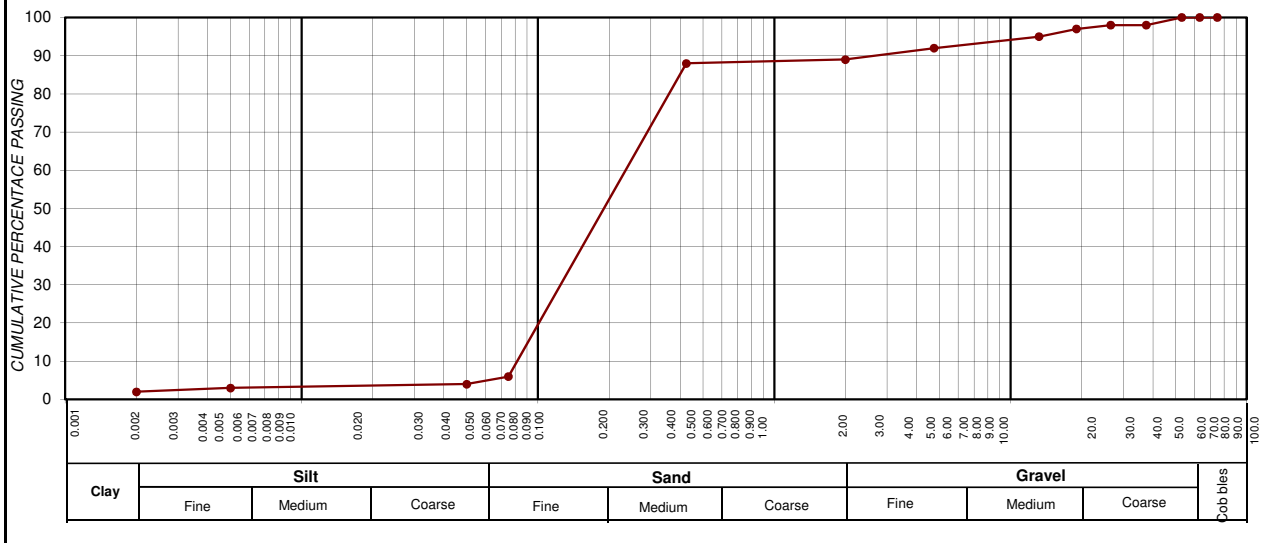
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	4.0	83.0	11.0

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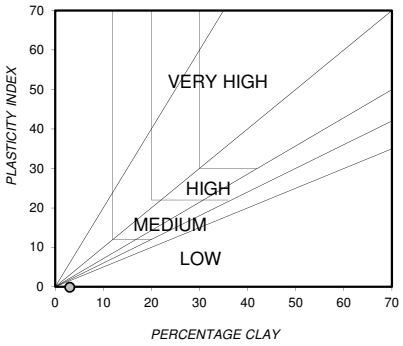
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 11
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-800mm
SAMPLE No. : U4290 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

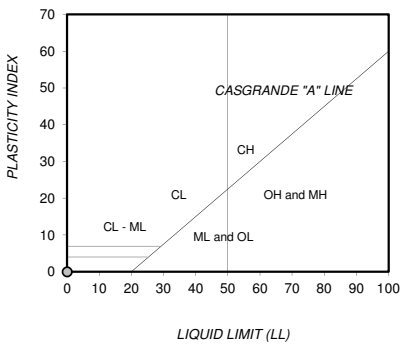
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	94
	0.250	65
	0.150	35
	0.075	7
	0.050*	6
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	4.1
	0.425 - 0.250	27.8
	0.250 - 0.150	28.8
	0.150 - 0.075	26.9
	< 0.075	12.5
Effective size		0.000
Uniformity Coefficient		100.0
Curvature Coefficient		25.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		2.0
Grading modulus		1.01
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

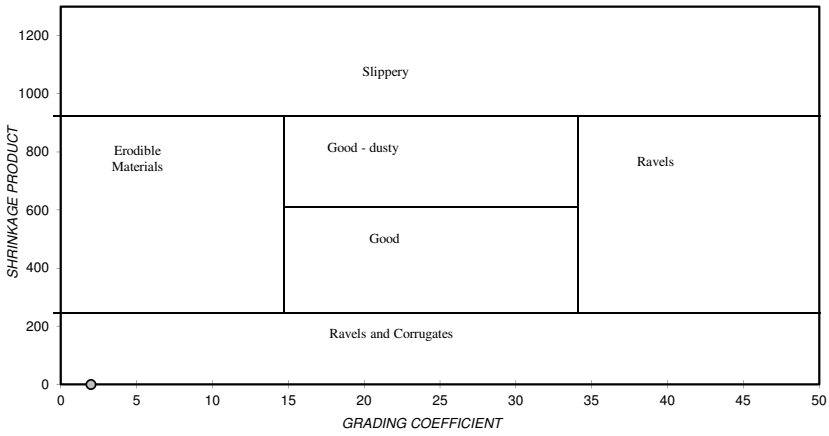
POTENTIAL EXPANSION



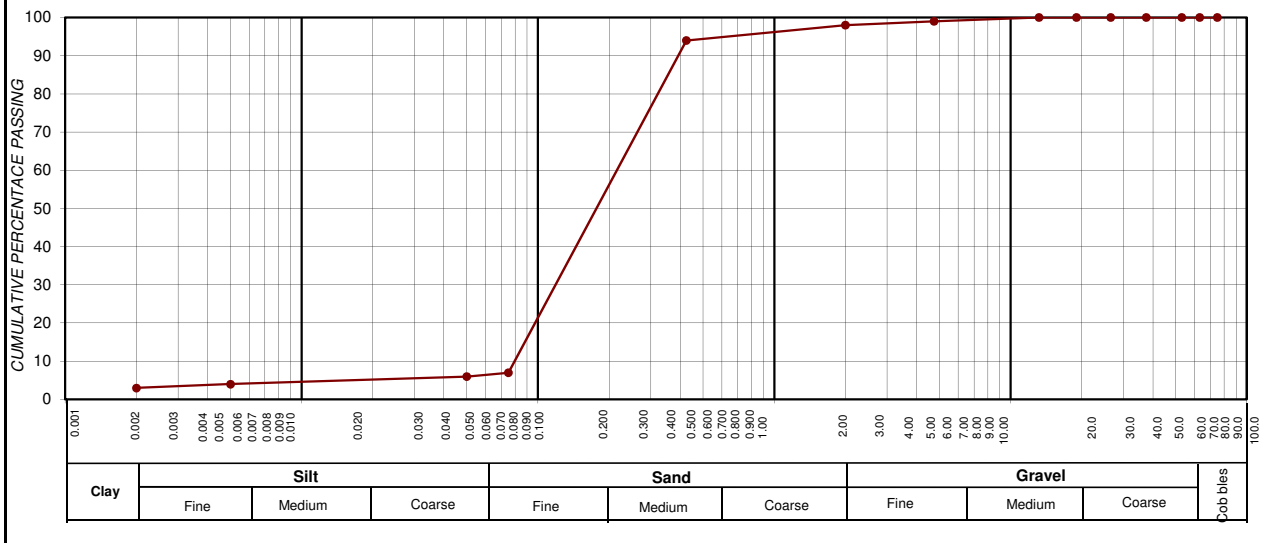
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	4.0	91.0	2.0

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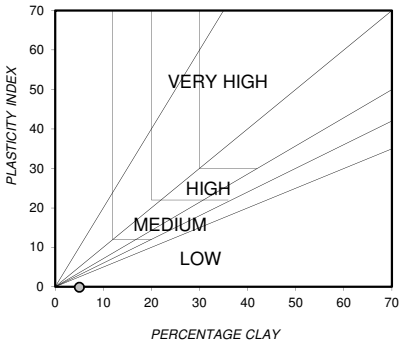
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 12
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-800mm
SAMPLE No. : U4291 (E3006)
SAMPLE DESCRIPTION : Light Red Sand

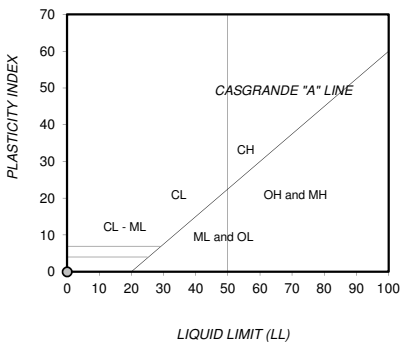
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	84
	0.250	55
	0.150	35
	0.075	35
	0.050*	8
	0.005*	7
	0.002*	5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	14.3
	0.425 - 0.250	24.9
	0.250 - 0.150	17.1
	0.150 - 0.075	0.0
	< 0.075	43.7
Effective size		0.000
Uniformity Coefficient		125.0
Curvature Coefficient		20.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		2.0
Grading modulus		0.83
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

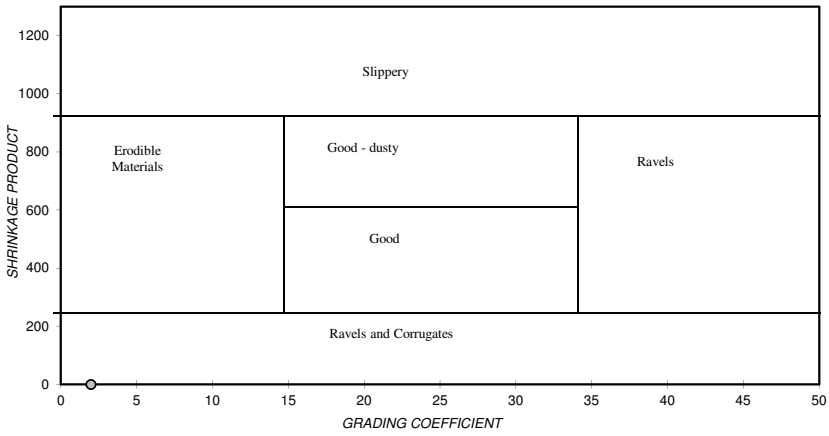
POTENTIAL EXPANSION



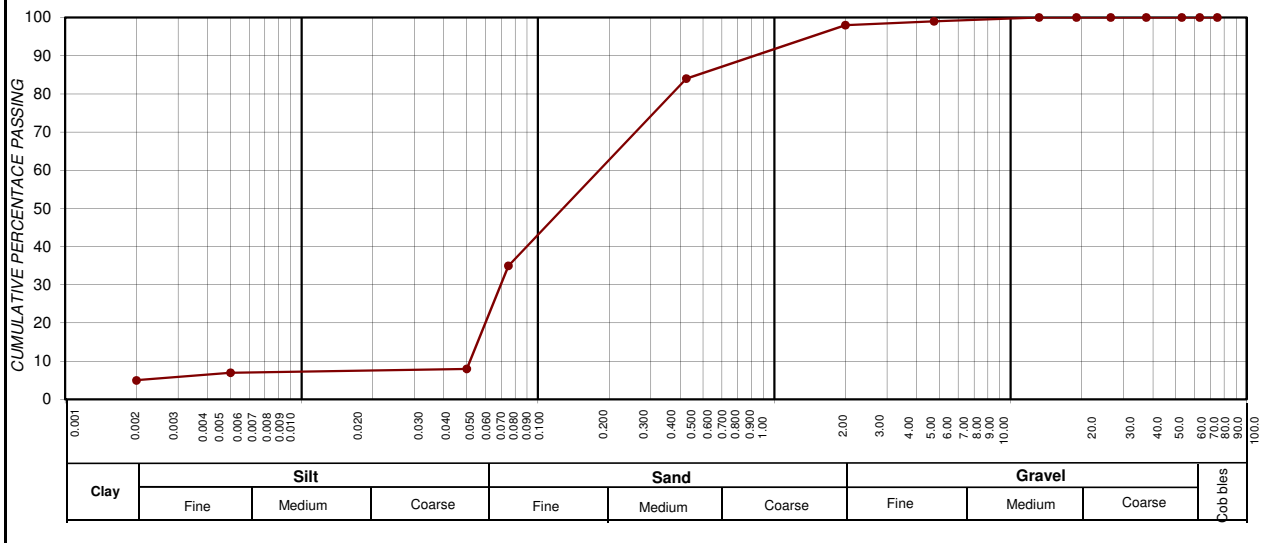
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.0	30.0	63.0	2.0

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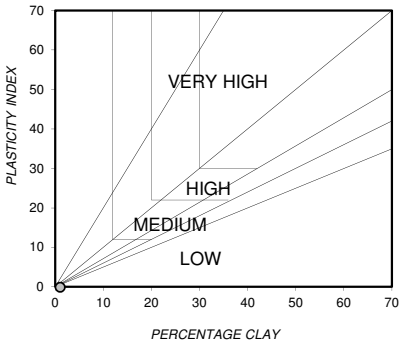
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 12
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 1400-2800mm
SAMPLE No. : U4281 (E3006)
SAMPLE DESCRIPTION : Light Reddish Brown Sandy Gravel

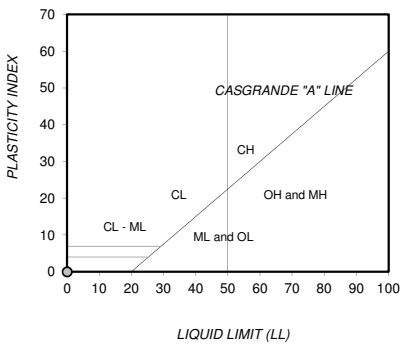
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	66
	26.5	62
	19.0	53
	13.2	45
	4.75	29
	2.000	26
	0.425	24
	0.250	16
	0.150	10
	0.075	6
	0.050*	4
	0.005*	2
	0.002*	1
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	7.7
	0.425 - 0.250	7.4
	0.250 - 0.150	5.5
	0.150 - 0.075	3.7
	< 0.075	75.7
Effective size		0.002
Uniformity Coefficient		10000.0
Curvature Coefficient		625.0
Oversize Index		34.0
Shrinkage Product		0.0
Grading Coefficient		10.4
Grading modulus		2.44
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

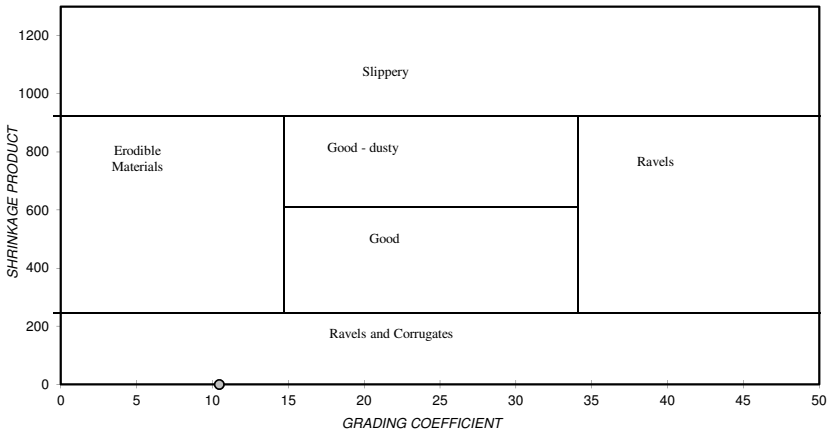
POTENTIAL EXPANSION



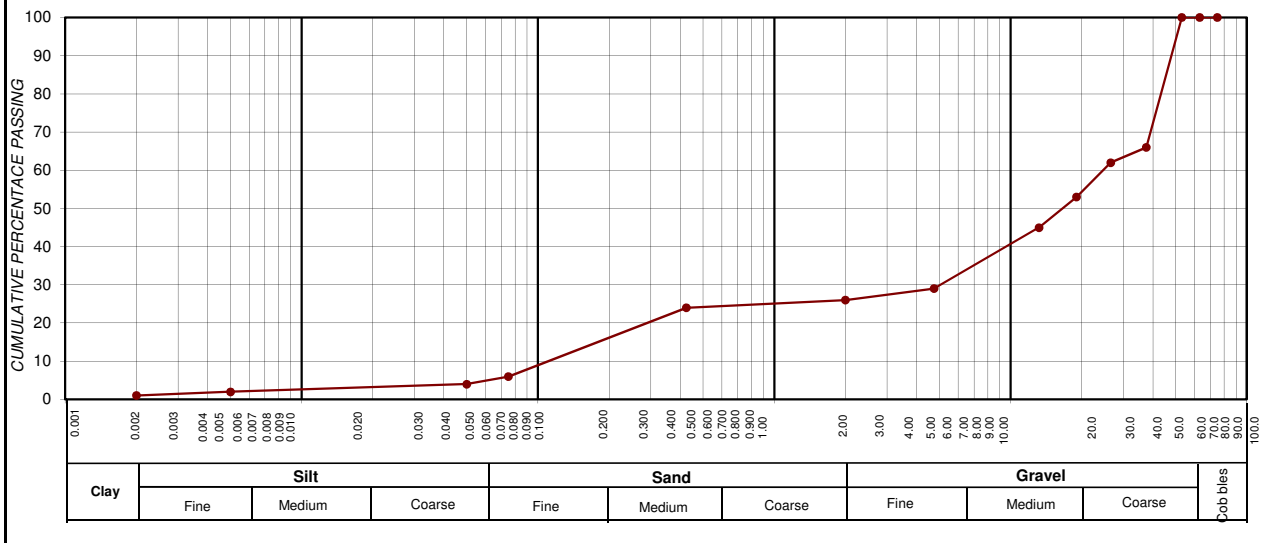
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
1.0	5.0	20.0	74.0

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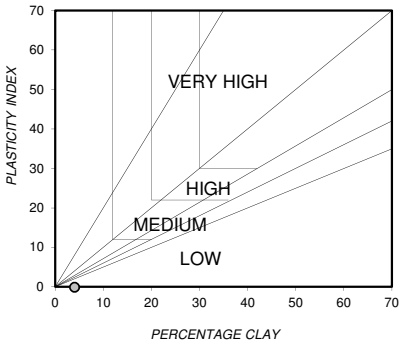
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 15-Jun-15
CHAINAGE : TP-OV 13
LAYER : 0-1400mm
SAMPLE No. : U4292 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

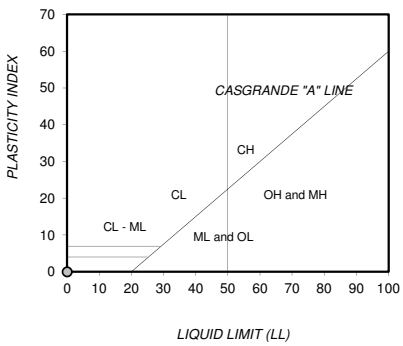
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	97
	0.425	85
	0.250	60
	0.150	35
	0.075	9
	0.050*	7
	0.005*	6
	0.002*	4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	12.1
	0.425 - 0.250	22.2
	0.250 - 0.150	22.0
	0.150 - 0.075	22.9
	< 0.075	20.9
Effective size		0.002
Uniformity Coefficient		125.0
Curvature Coefficient		45.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		3.1
Grading modulus		1.09
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

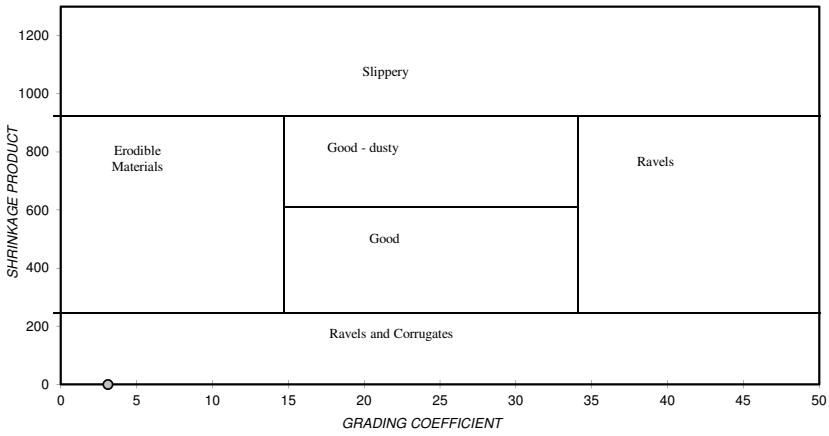
POTENTIAL EXPANSION



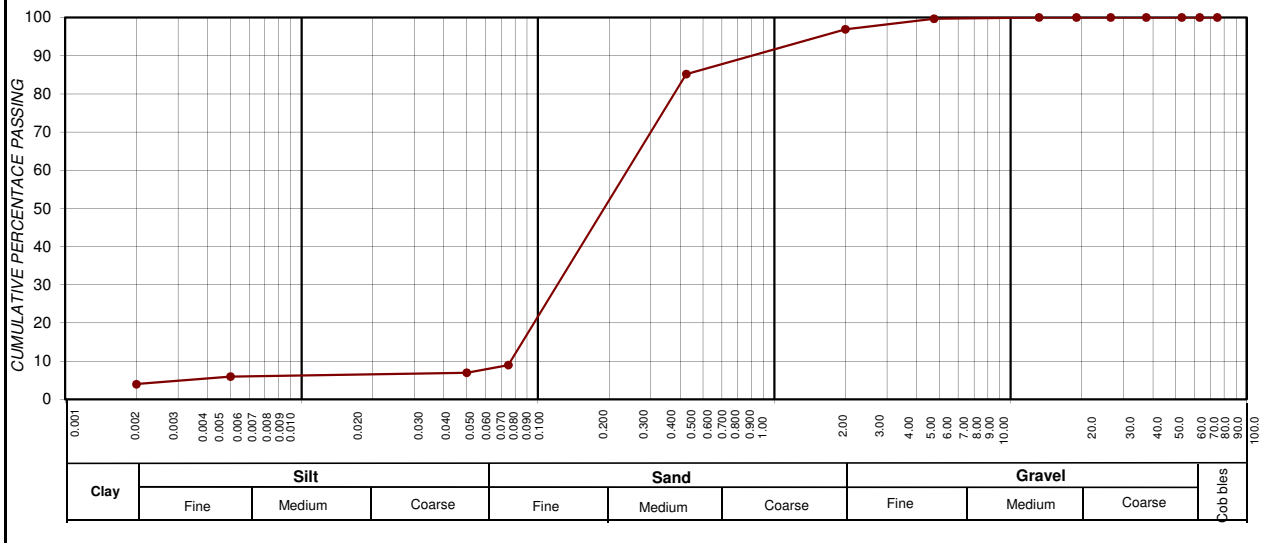
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.0	5.0	87.9	3.1

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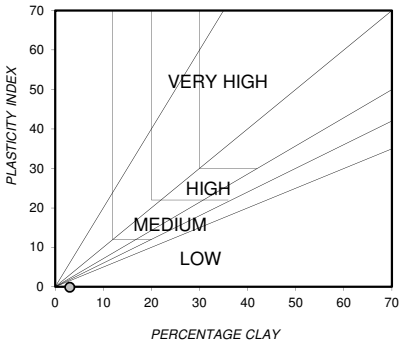
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 15
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-1000mm
SAMPLE No. : U4293 (E3006)
SAMPLE DESCRIPTION : Light Brown Sand

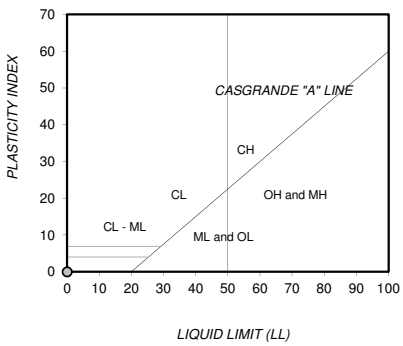
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	99
	0.425	92
	0.250	62
	0.150	35
	0.075	8
	0.050*	7
	0.005*	5
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	7.1
	0.425 - 0.250	27.9
	0.250 - 0.150	25.1
	0.150 - 0.075	25.1
	< 0.075	14.9
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		25.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		1.01
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

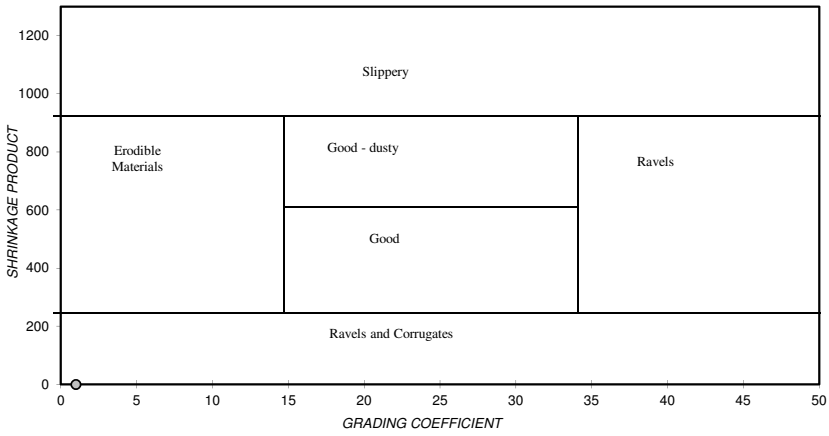
POTENTIAL EXPANSION



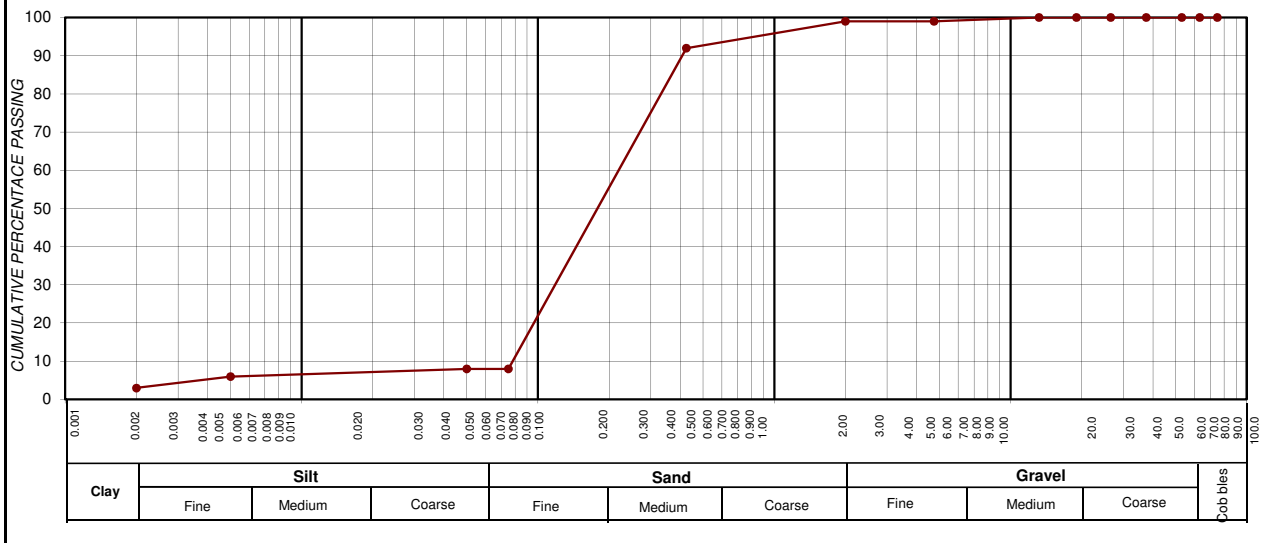
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	5.0	91.0	1.0

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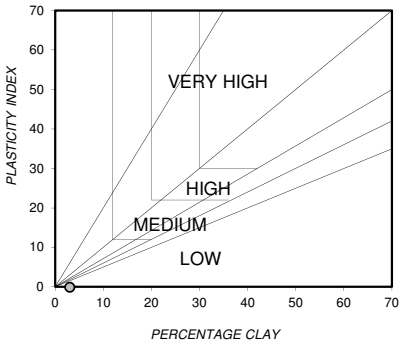
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 16
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 100-800mm
SAMPLE No. : U4294 (E3006)
SAMPLE DESCRIPTION : Light Brown Gravelly Sand

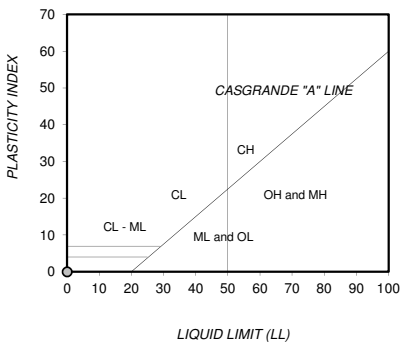
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	89
	63.0	89
	53.0	89
	37.5	75
	26.5	70
	19.0	65
	13.2	60
	4.75	53
	2.000	50
	0.425	46
	0.250	30
	0.150	20
	0.075	6
	0.050*	5
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	8.0
	0.425 - 0.250	14.7
	0.250 - 0.150	9.2
	0.150 - 0.075	12.9
	< 0.075	55.2
Effective size		0.000
Uniformity Coefficient		5000.0
Curvature Coefficient		2.0
Oversize Index		25.0
Shrinkage Product		0.0
Grading Coefficient		10.6
Grading modulus		1.98
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SC-SW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

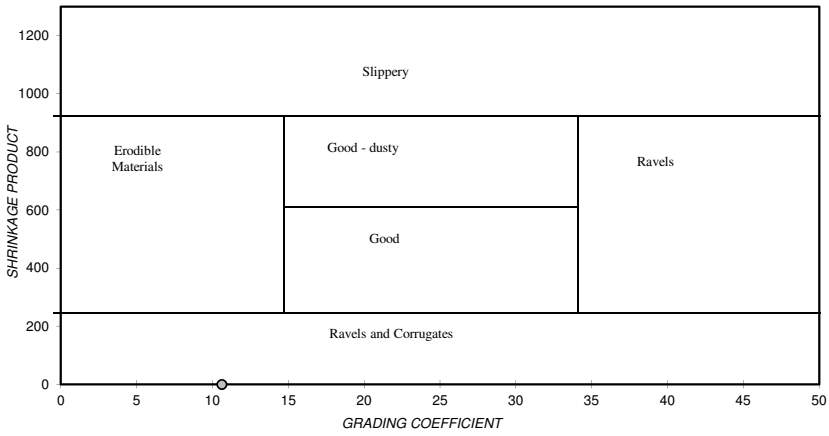
POTENTIAL EXPANSION



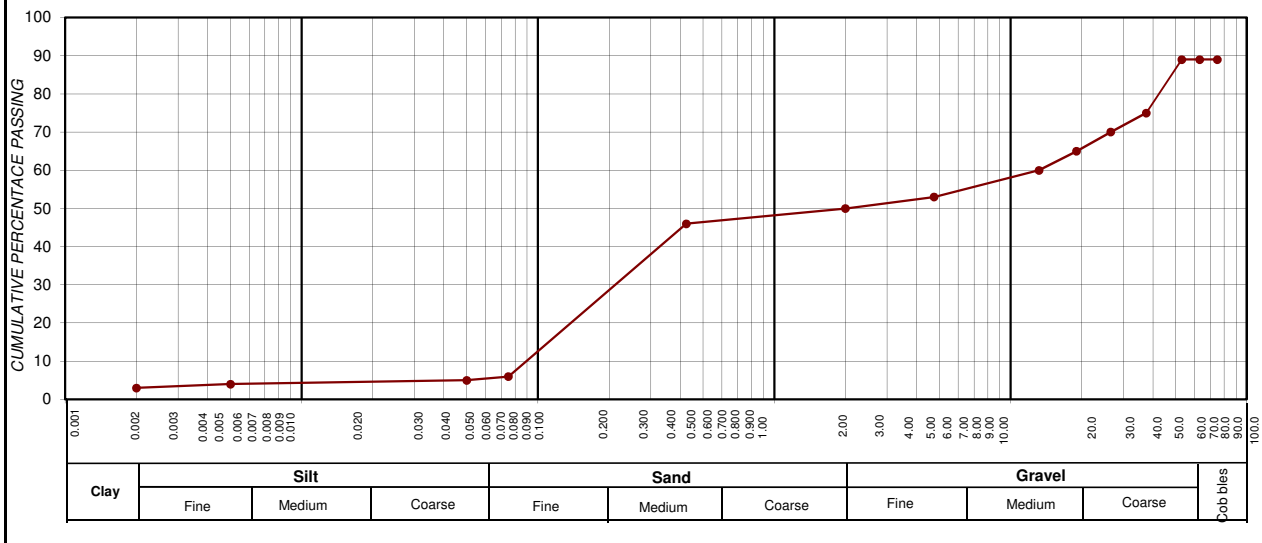
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	3.0	44.0	39.0

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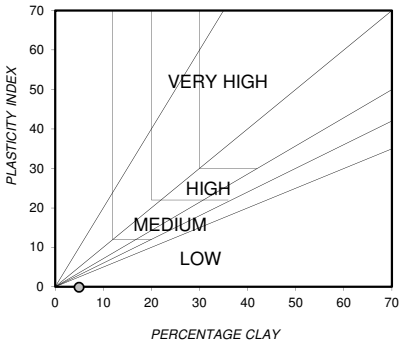
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 15-Jun-15
CHAINAGE : TP-OV 18
LAYER : 0-700mm
SAMPLE No. : U4295 (E3006)
SAMPLE DESCRIPTION : Dark Reddish Orange Sand

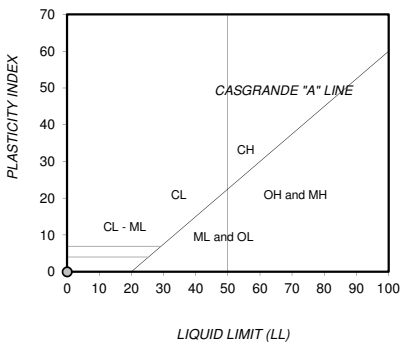
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	86
	0.250	60
	0.150	35
	0.075	9
	0.050*	7
	0.005*	6
	0.002*	5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	12.2
	0.425 - 0.250	22.8
	0.250 - 0.150	21.9
	0.150 - 0.075	23.2
	< 0.075	19.8
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		56.3
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		2.0
Grading modulus		1.07
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

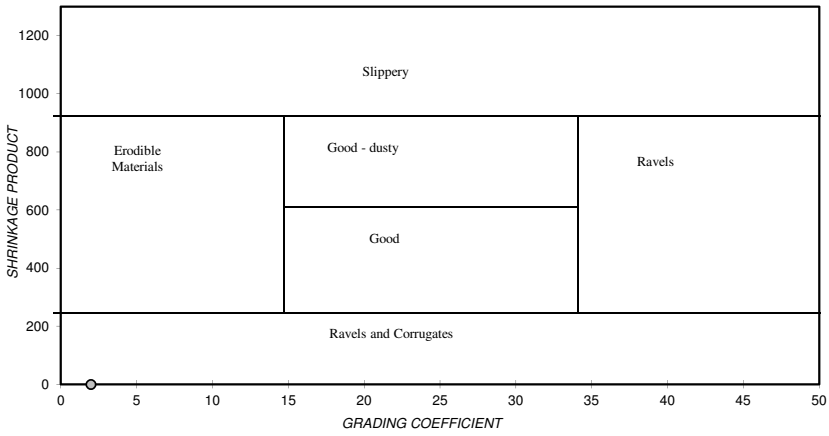
POTENTIAL EXPANSION



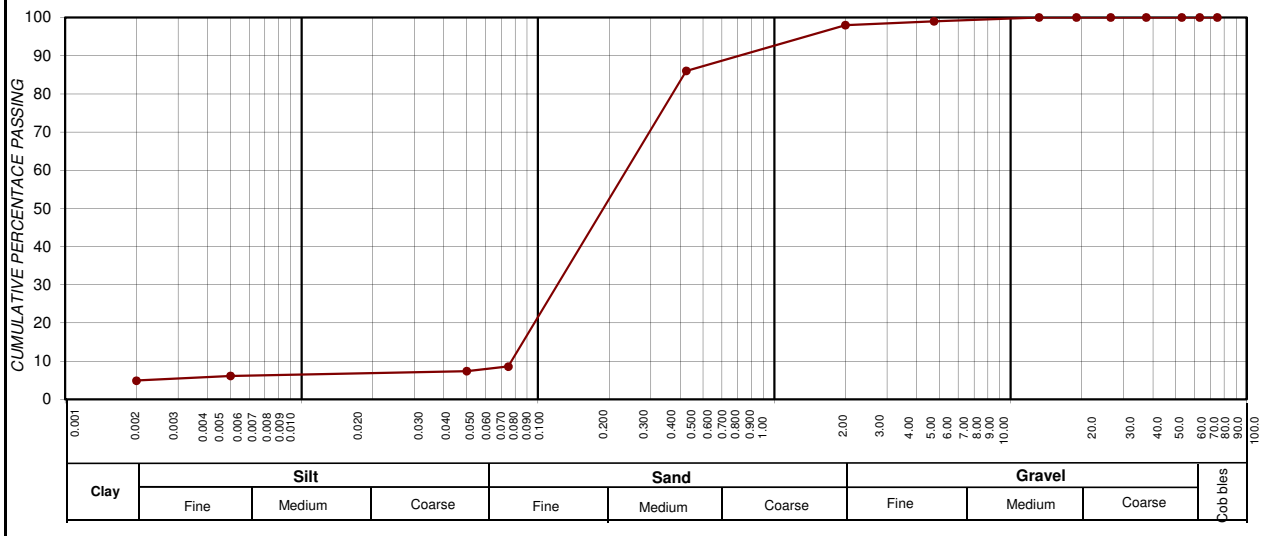
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.9	3.7	89.4	2.0

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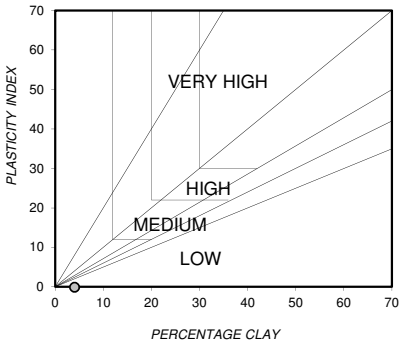
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 19
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-500mm
SAMPLE No. : U4296 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

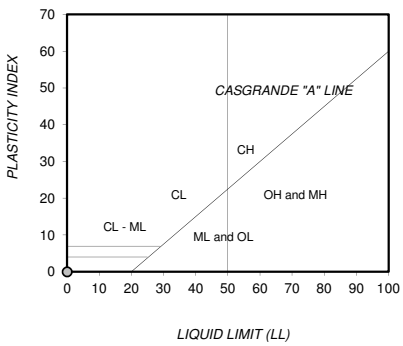
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	88
	0.250	60
	0.150	35
	0.075	7
	0.050*	6
	0.005*	5
	0.002*	4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	10.2
	0.425 - 0.250	25.1
	0.250 - 0.150	22.4
	0.150 - 0.075	25.0
	< 0.075	17.2
Effective size		0.002
Uniformity Coefficient		115.0
Curvature Coefficient		31.3
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		2.0
Grading modulus		1.07
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

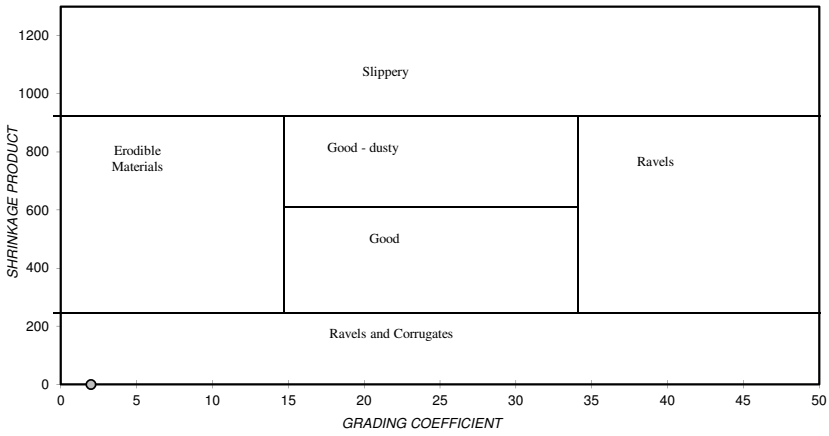
POTENTIAL EXPANSION



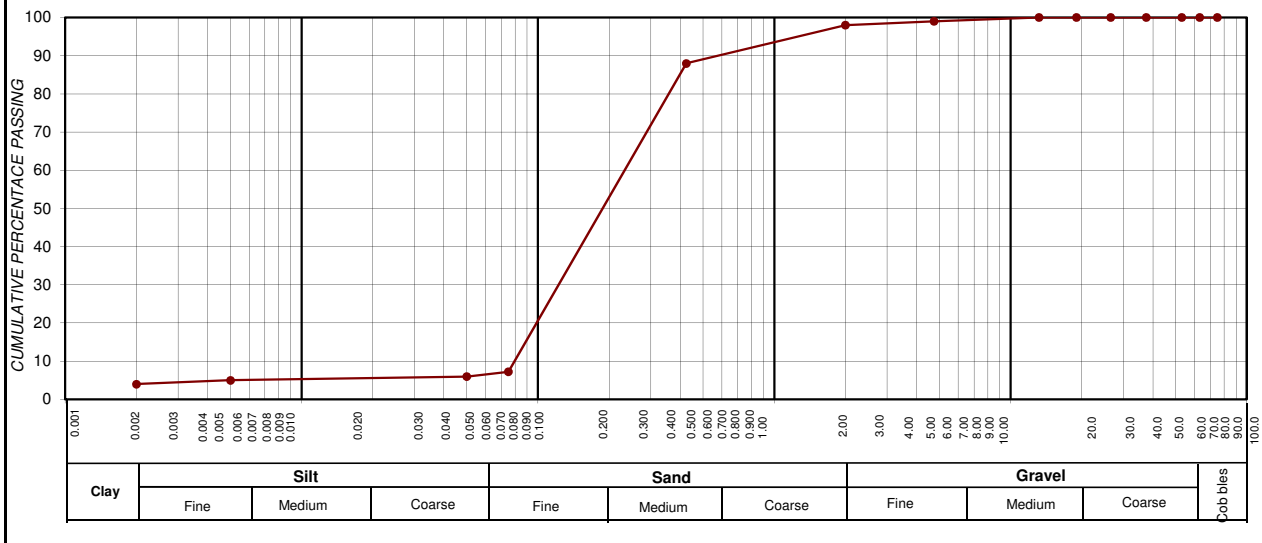
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.0	3.2	90.8	2.0

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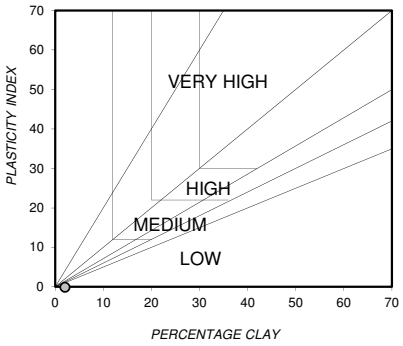
OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-OV 19
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 500-1900mm
SAMPLE No. : U4297 (E3006)
SAMPLE DESCRIPTION : Light Brown Sandy Gravel

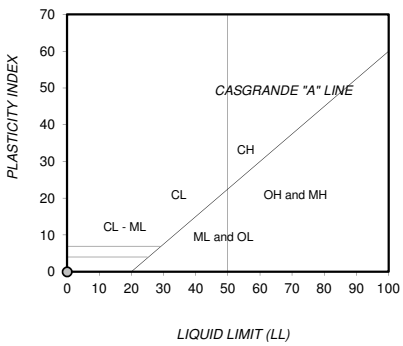
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	76
	63.0	76
	53.0	76
	37.5	76
	26.5	72
	19.0	63
	13.2	56
	4.75	31
	2.000	23
	0.425	19
	0.250	13
	0.150	10
	0.075	4
	0.050*	3
	0.005*	2
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	17.4
	0.425 - 0.250	5.0
	0.250 - 0.150	2.5
	0.150 - 0.075	5.0
	< 0.075	70.2
Effective size		0.002
Uniformity Coefficient		5250.0
Curvature Coefficient		761.9
Oversize Index		24.0
Shrinkage Product		0.0
Grading Coefficient		15.2
Grading modulus		2.54
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

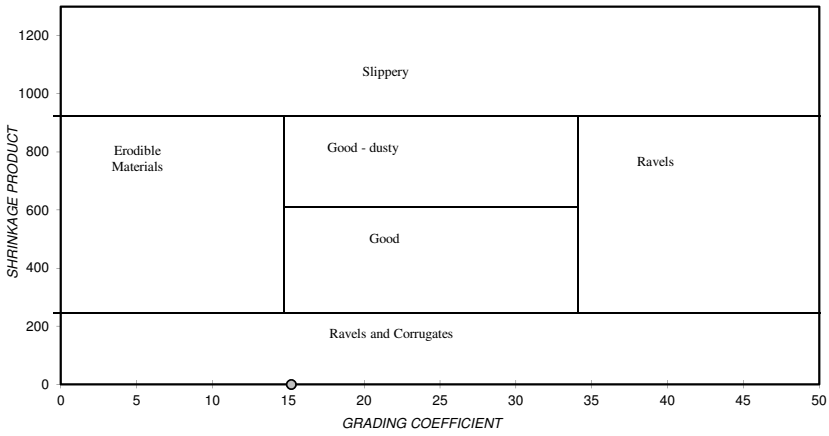
POTENTIAL EXPANSION



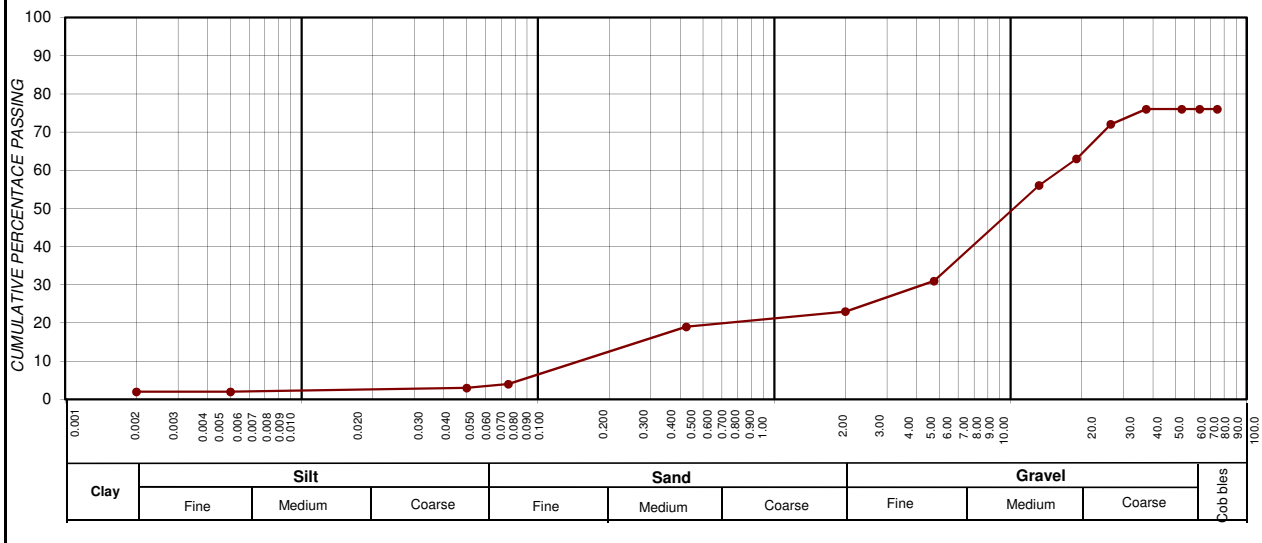
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	2.0	19.0	53.0

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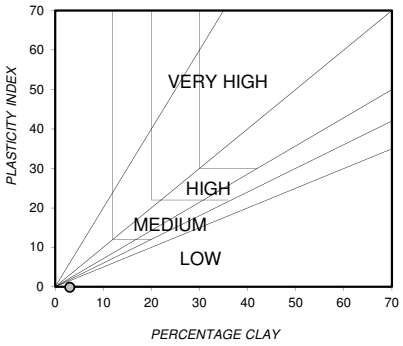
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** OTP 17
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 300-1000mm
SAMPLE No. : U4279 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sandy Gravel

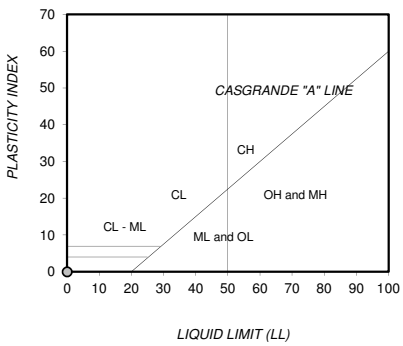
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	95
	37.5	87
	26.5	81
	19.0	71
	13.2	54
	4.75	21
	2.000	18
	0.425	16
	0.250	10
	0.150	7
	0.075	2
	0.050*	5
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	11.1
	0.425 - 0.250	5.3
	0.250 - 0.150	2.7
	0.150 - 0.075	4.3
	< 0.075	76.6
Effective size		0.002
Uniformity Coefficient		5000.0
Curvature Coefficient		2.0
Oversize Index		13.0
Shrinkage Product		0.0
Grading Coefficient		13.2
Grading modulus		2.64
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

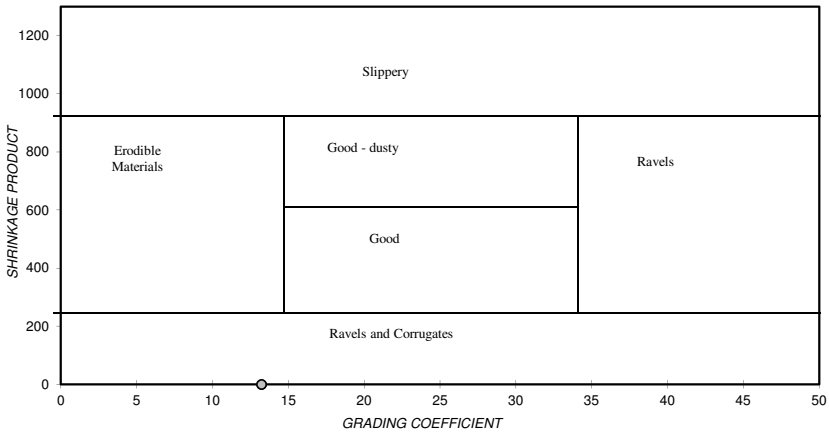
POTENTIAL EXPANSION



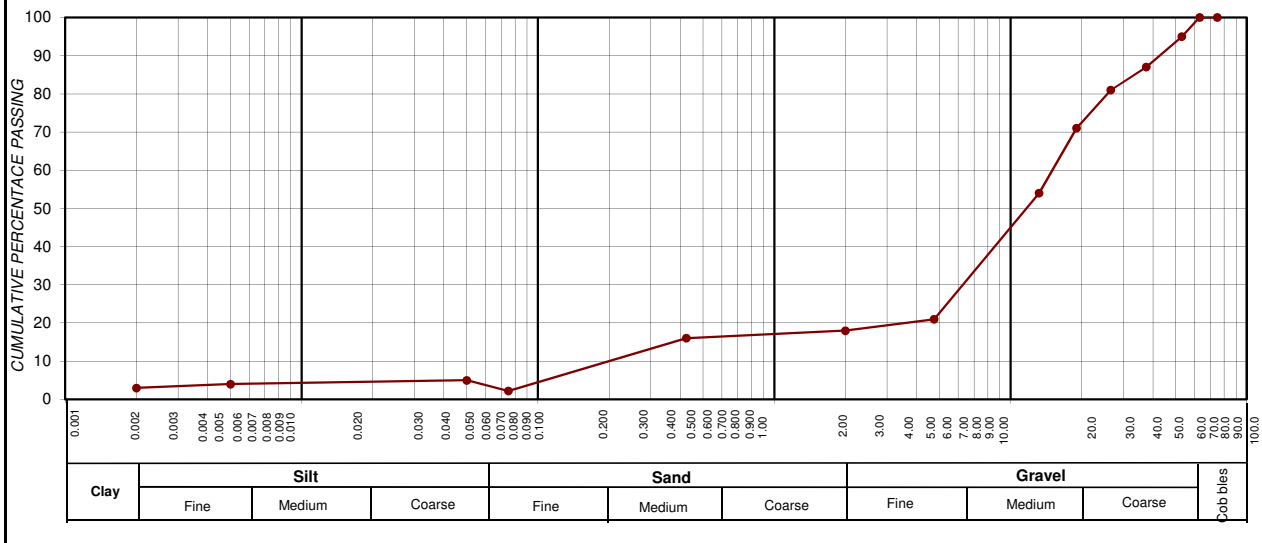
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	-0.8	15.8	82.0

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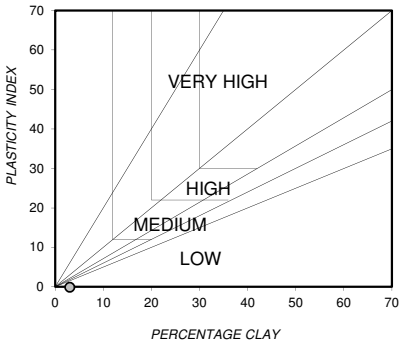
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 01
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-1300mm
SAMPLE No. : U4272 **(E3006)**
SAMPLE DESCRIPTION : Light Reddish Orange Sand

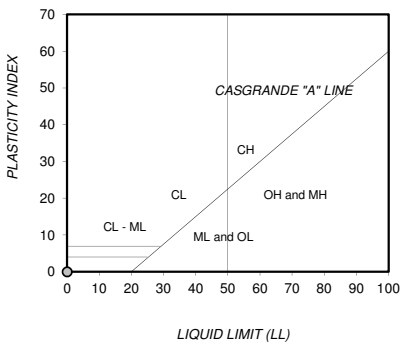
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	99
	0.425	91
	0.250	65
	0.150	35
	0.075	5
	0.050*	5
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	8.1
	0.425 - 0.250	23.9
	0.250 - 0.150	27.6
	0.150 - 0.075	27.4
	< 0.075	13.1
Effective size		0.002
Uniformity Coefficient		5000.0
Curvature Coefficient		2.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		1.05
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

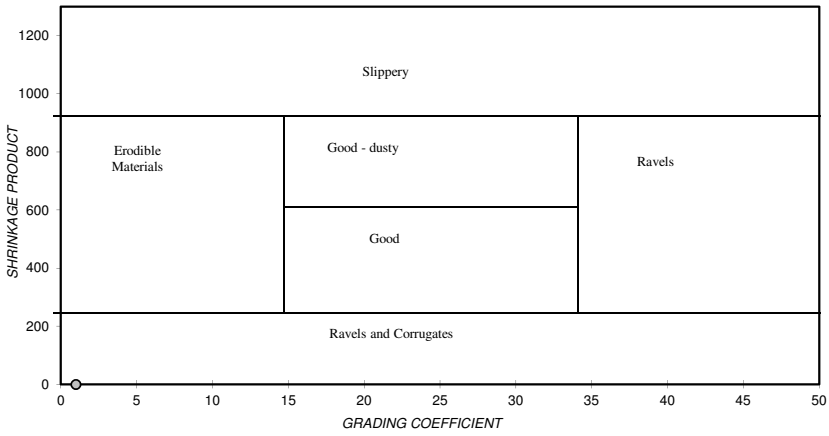
POTENTIAL EXPANSION



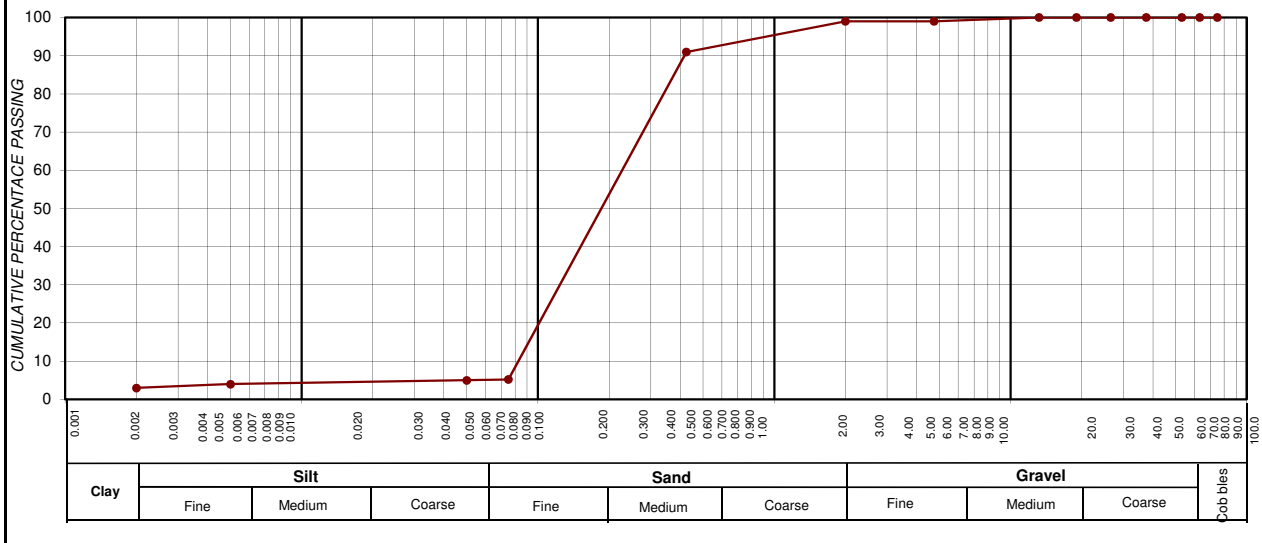
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	2.2	93.8	1.0

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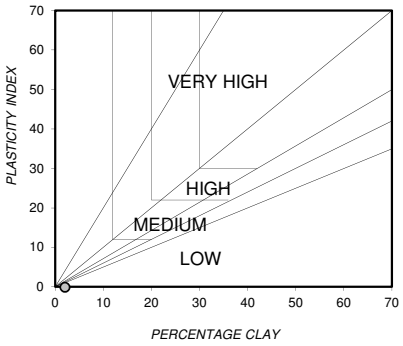
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 01
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 1300-2200mm
SAMPLE No. : U4273 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sandy Gravel

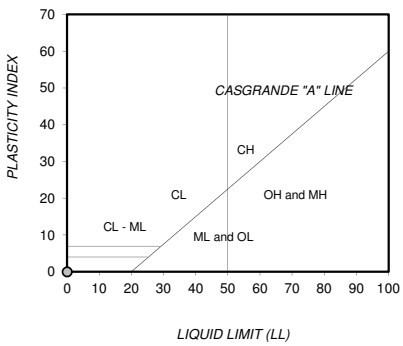
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	80
	37.5	70
	26.5	59
	19.0	45
	13.2	35
	4.75	17
	2.000	15
	0.425	13
	0.250	10
	0.150	6
	0.075	5
	0.050*	5
	0.005*	4
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	13.3
	0.425 - 0.250	2.6
	0.250 - 0.150	3.5
	0.150 - 0.075	0.9
	< 0.075	79.7
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		56.3
Oversize Index		30.0
Shrinkage Product		0.0
Grading Coefficient		7.5
Grading modulus		2.67
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

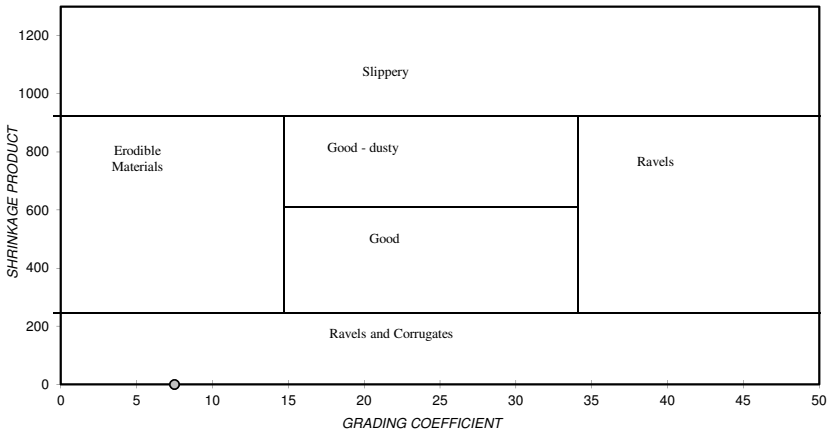
POTENTIAL EXPANSION



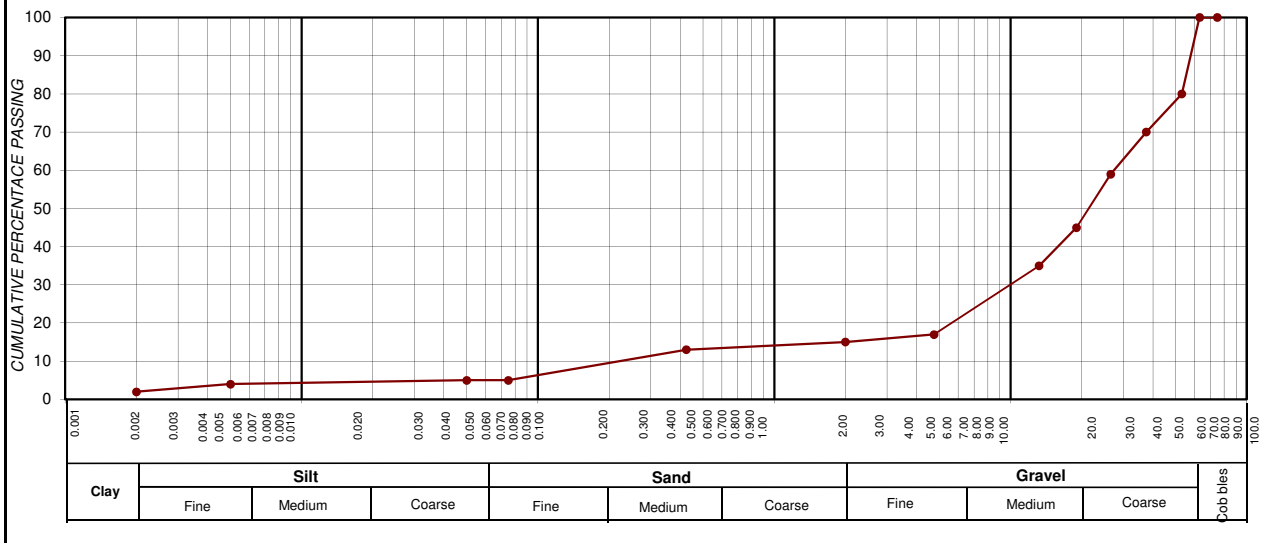
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	3.0	10.0	85.0

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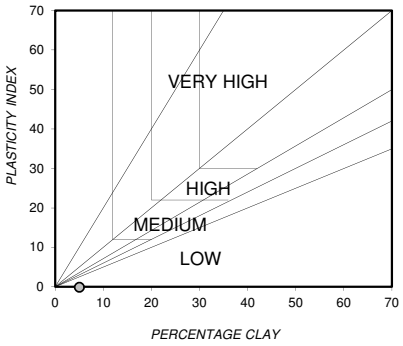
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 01
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 2200-2700mm
SAMPLE No. : U4274 (E3006)
SAMPLE DESCRIPTION : Dusky Red Sandy Gravel

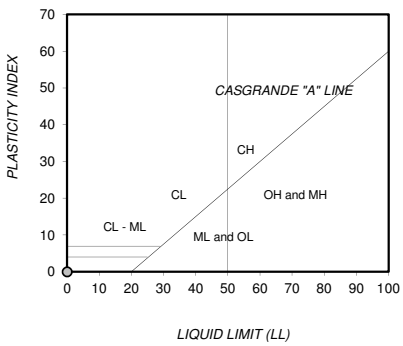
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	93
	37.5	93
	26.5	93
	19.0	91
	13.2	85
	4.75	54
	2.000	33
	0.425	21
	0.250	15
	0.150	10
	0.075	8
	0.050*	7
	0.005*	6
	0.002*	5
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	36.4
	0.425 - 0.250	3.8
	0.250 - 0.150	3.2
	0.150 - 0.075	1.3
	< 0.075	55.4
Effective size		0.002
Uniformity Coefficient		125.0
Curvature Coefficient		20.0
Oversize Index		7.0
Shrinkage Product		14.7
Grading Coefficient		32.4
Grading modulus		2.38
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	SP
	Linear Shrinkage	0.7
Unified Soil Classification		SC-SW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

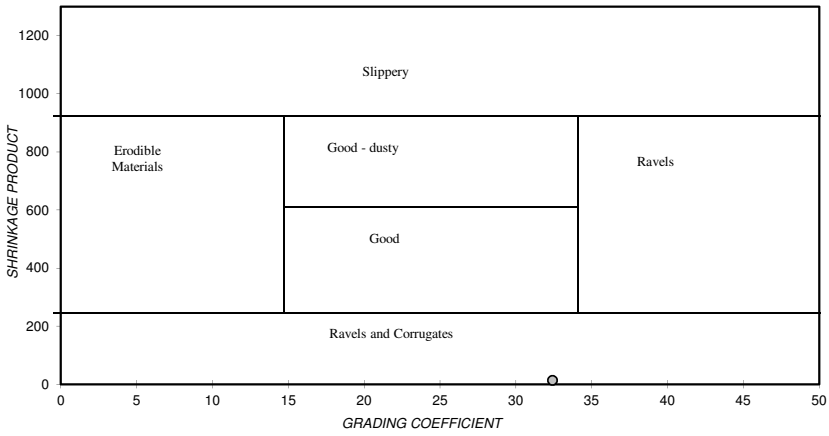
POTENTIAL EXPANSION



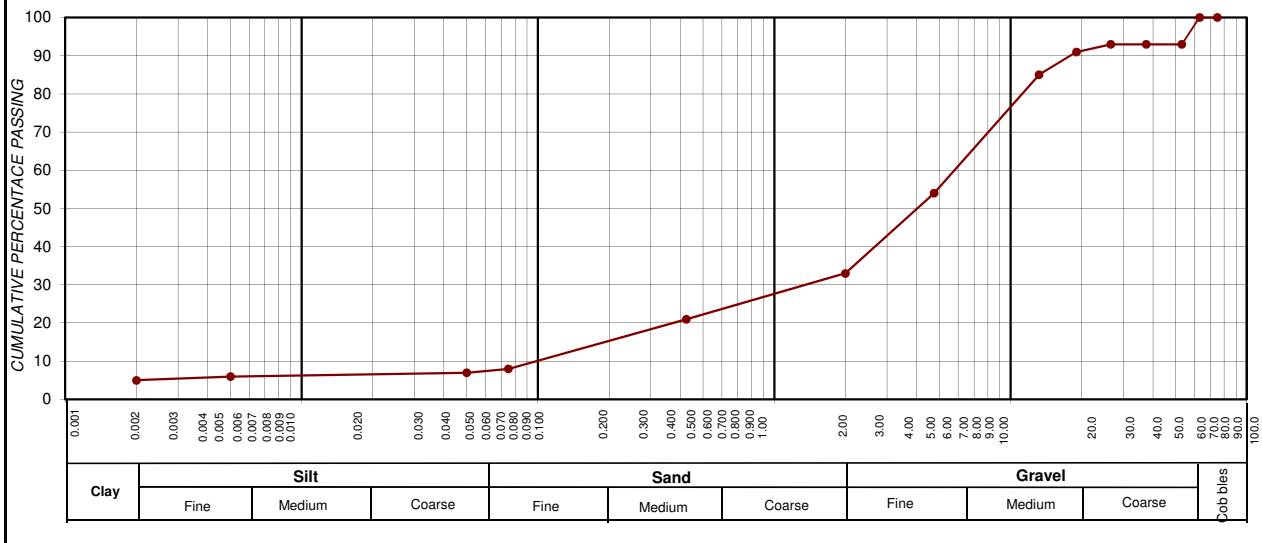
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
5.0	3.0	25.0	67.0

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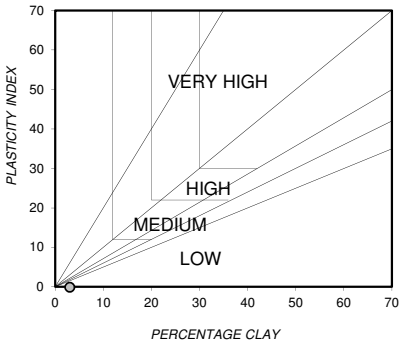
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 05
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 1100-2500mm
SAMPLE No. : U4275 (E3006)
SAMPLE DESCRIPTION : Light Olive Sandy Gravel

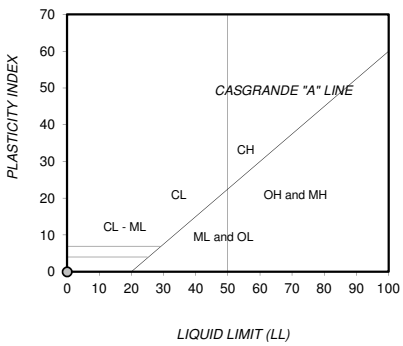
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	79
	26.5	75
	19.0	70
	13.2	61
	4.75	39
	2.000	26
	0.425	16
	0.250	11
	0.150	9
	0.075	6
	0.050*	5
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	38.5
	0.425 - 0.250	3.1
	0.250 - 0.150	1.2
	0.150 - 0.075	1.8
	< 0.075	55.4
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		25.0
Oversize Index		21.0
Shrinkage Product		11.2
Grading Coefficient		19.1
Grading modulus		2.52
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	SP
	Linear Shrinkage	0.7
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

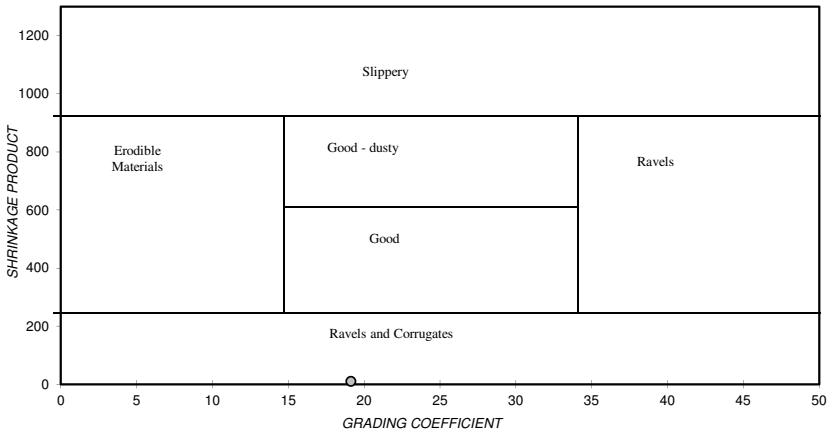
POTENTIAL EXPANSION



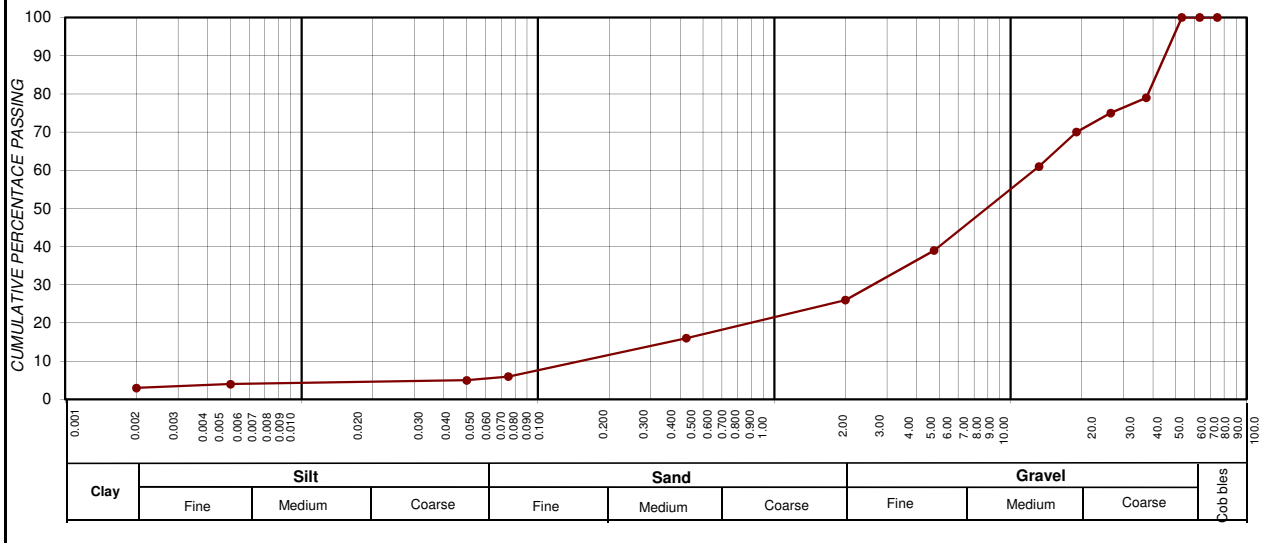
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	3.0	20.0	74.0

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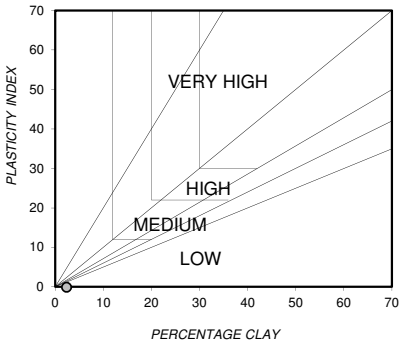
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 06
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 1400-2900mm
SAMPLE No. : U4276 (E3006)
SAMPLE DESCRIPTION : Light Brown Sandy Gravel

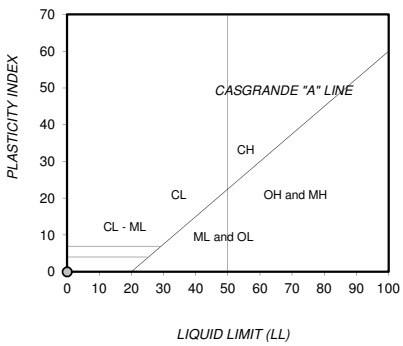
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	92
	63.0	92
	53.0	92
	37.5	81
	26.5	76
	19.0	61
	13.2	49
	4.75	28
	2.000	20
	0.425	13
	0.250	10
	0.150	5
	0.075	4
	0.050*	4
	0.005*	3
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	35.0
	0.425 - 0.250	2.0
	0.250 - 0.150	3.3
	0.150 - 0.075	0.7
	< 0.075	59.2
Effective size		0.002
Uniformity Coefficient		10000.0
Curvature Coefficient		625.0
Oversize Index		19.0
Shrinkage Product		0.0
Grading Coefficient		15.7
Grading modulus		2.63
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

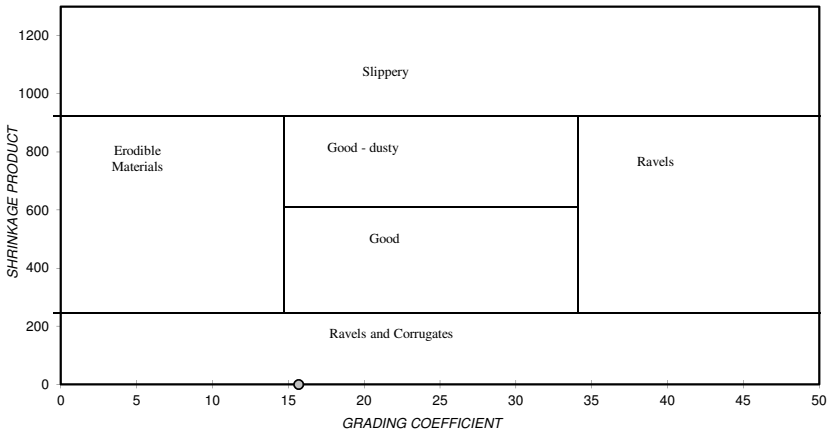
POTENTIAL EXPANSION



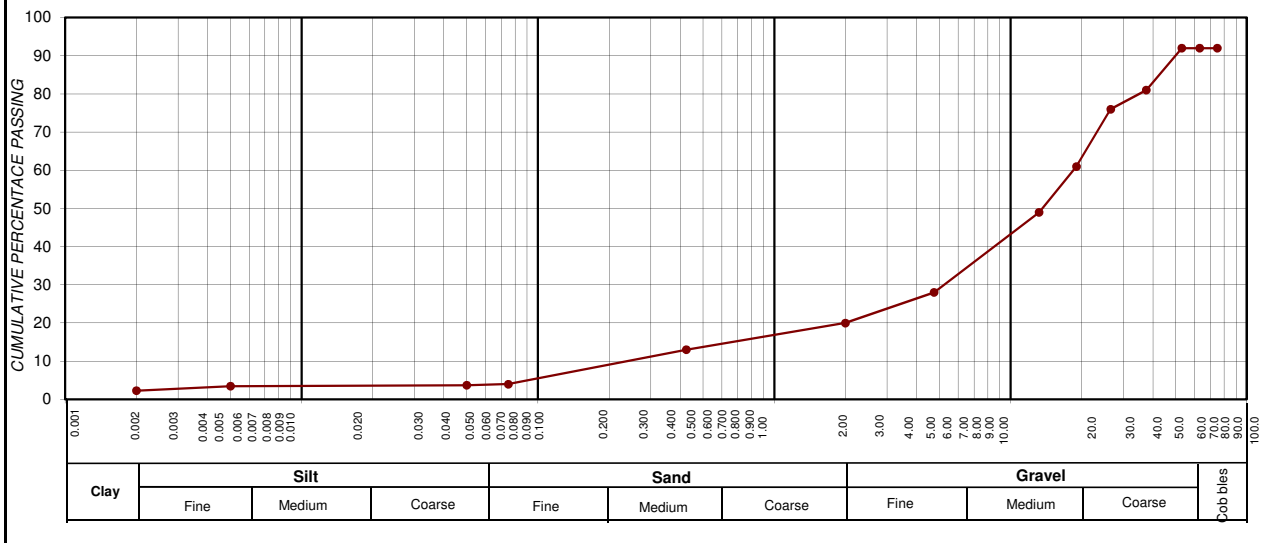
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.3	1.7	16.0	72.0

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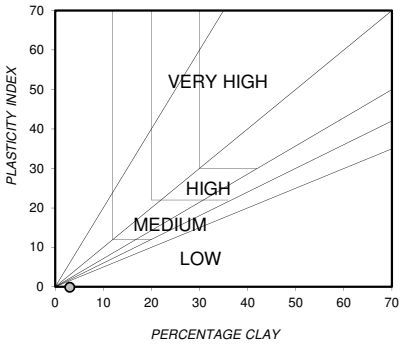
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 10-Jun-15
CHAINAGE : BD 08
LAYER : 800-3300mm
SAMPLE No. : U4277 (E3006)
SAMPLE DESCRIPTION : Light Olive Brown Sandy Gravel

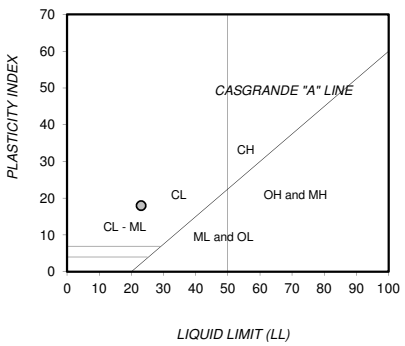
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	73
	26.5	66
	19.0	59
	13.2	49
	4.75	28
	2.000	19
	0.425	11
	0.250	9
	0.150	7
	0.075	5
	0.050*	5
	0.005*	4
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	42.1
	0.425 - 0.250	1.2
	0.250 - 0.150	1.2
	0.150 - 0.075	1.2
	< 0.075	54.4
Effective size		0.002
Uniformity Coefficient		5000.0
Curvature Coefficient		2.0
Oversize Index		27.0
Shrinkage Product		30.8
Grading Coefficient		13.2
Grading modulus		2.65
Atter-berg Limits	Liquid Limit	23
	Plasticity Index	18
	Linear Shrinkage	2.8
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-2-6(0)
pH - Value		N/A
Conductivity mS/cm		N/A

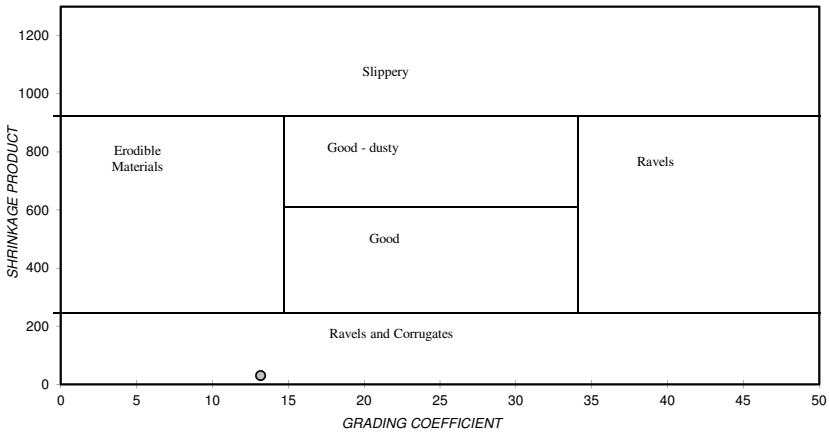
POTENTIAL EXPANSION



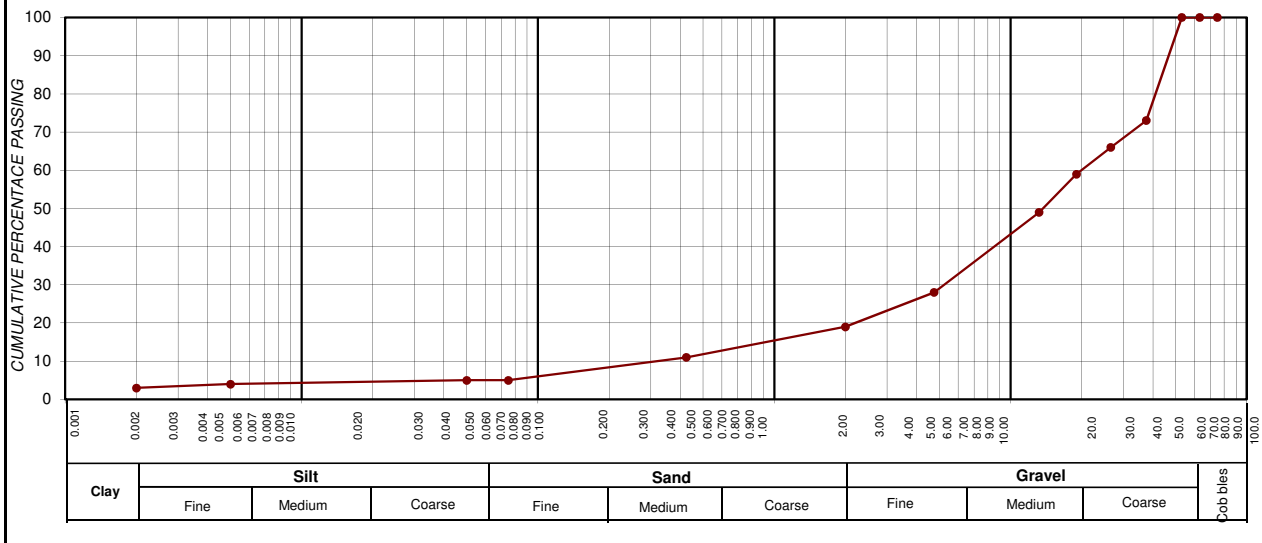
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	2.0	14.0	81.0

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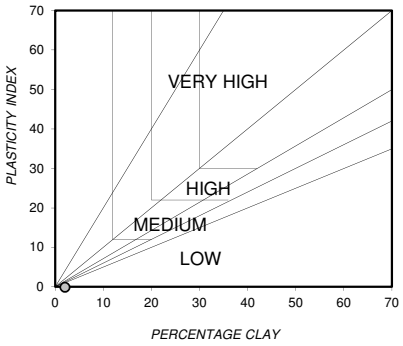
OUR REF : 91-0059-15 **DATE RECEIVED :** 10-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** BD 12
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 600-2100mm
SAMPLE No. : U4278 (E3006)
SAMPLE DESCRIPTION : Light Brown Sandy Gravel

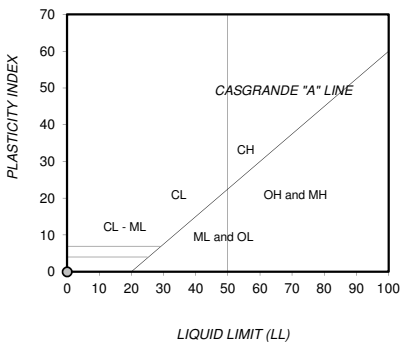
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	89
	53.0	74
	37.5	70
	26.5	64
	19.0	60
	13.2	55
	4.75	40
	2.000	30
	0.425	21
	0.250	15
	0.150	10
	0.075	7
	0.050*	5
	0.005*	4
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	30.0
	0.425 - 0.250	4.2
	0.250 - 0.150	3.5
	0.150 - 0.075	2.1
	< 0.075	60.2
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		56.3
Oversize Index		30.0
Shrinkage Product		0.0
Grading Coefficient		13.6
Grading modulus		2.42
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		GC-GW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

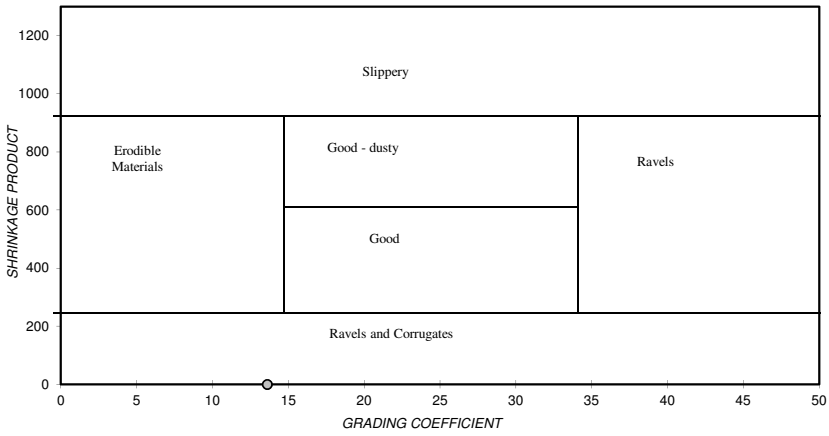
POTENTIAL EXPANSION



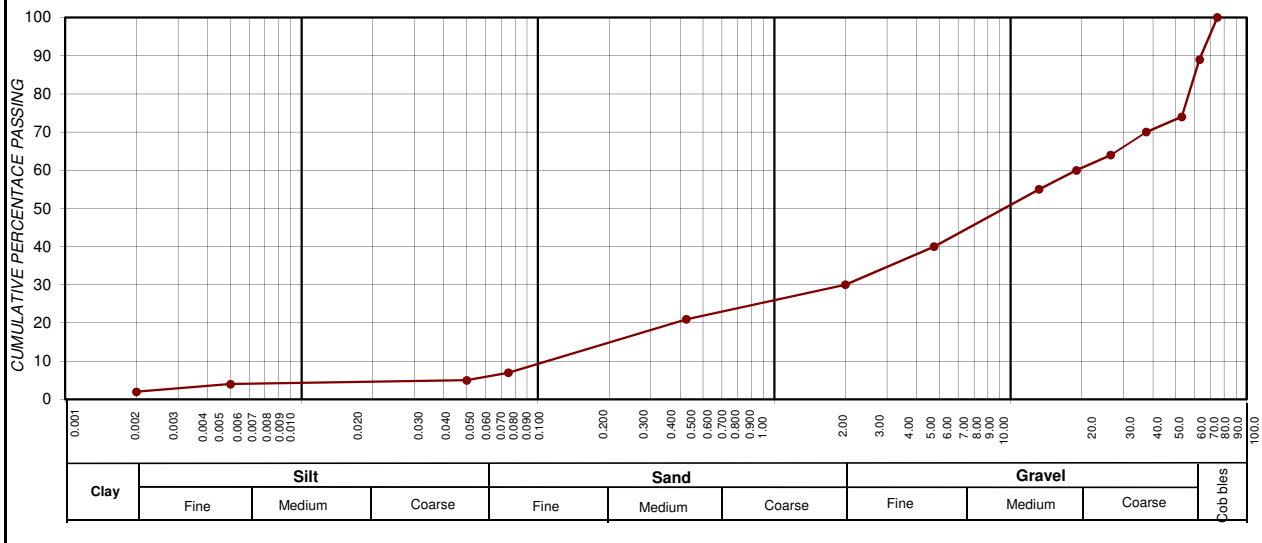
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	5.0	23.0	59.0

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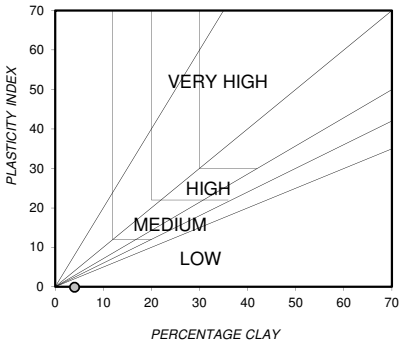
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 15-Jun-15
CHAINAGE : TP-MF 01
LAYER : 0-2600mm
SAMPLE No. : U4289 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

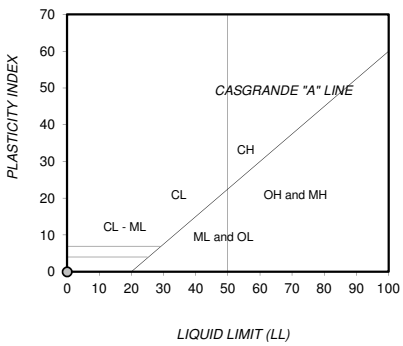
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	99
	0.425	93
	0.250	63
	0.150	35
	0.075	7
	0.050*	6
	0.005*	5
	0.002*	4
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	6.1
	0.425 - 0.250	28.2
	0.250 - 0.150	26.3
	0.150 - 0.075	26.3
	< 0.075	13.2
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		36.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		1.01
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

POTENTIAL EXPANSION

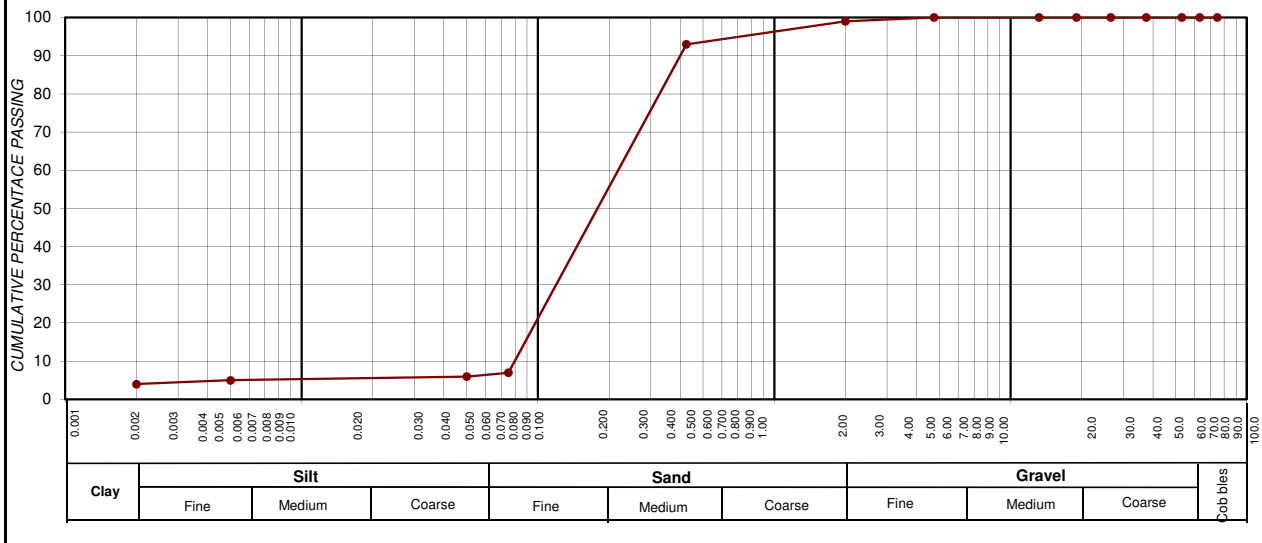


PLASTICITY CHART



PERFORMANCE AS WEARING COURSE

SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
4.0	3.0	92.0	1.0

ROADLAB
Civil Engineering Materials Laboratory
(PTY) LTD • 1965/008083/07 • VAT No. 4660115884
Established 1965

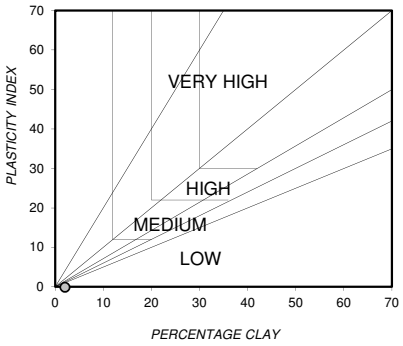
HEAD OFFICE
207 Rietfontein Rd Primrose Germiston 1401
P O Box 1476 Germiston 1400
Tel: 011 828 0279 Fax: 011 828 0273
E-mail: info@roadlab.co.za
www.roadlab.co.za

OUR REF : 91-0059-15 **DATE RECEIVED :** 15-Jun-15
CLIENT : WSP GROUP **CHAINAGE :** TP-H 02
SITE : MBSA HIGH SPEED PROVING GROUND **LAYER :** 0-2700mm
SAMPLE No. : U4286 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

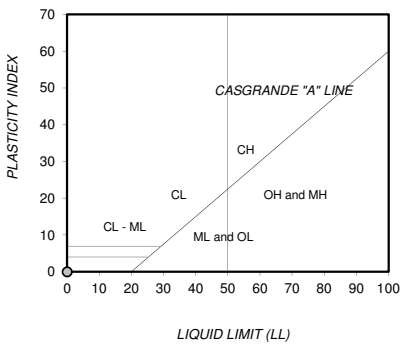
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	100
	2.000	99
	0.425	93
	0.250	60
	0.150	30
	0.075	6
	0.050*	5
	0.005*	4
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	6.1
	0.425 - 0.250	31.0
	0.250 - 0.150	28.2
	0.150 - 0.075	22.5
	< 0.075	12.2
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		42.3
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		1.0
Grading modulus		1.02
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

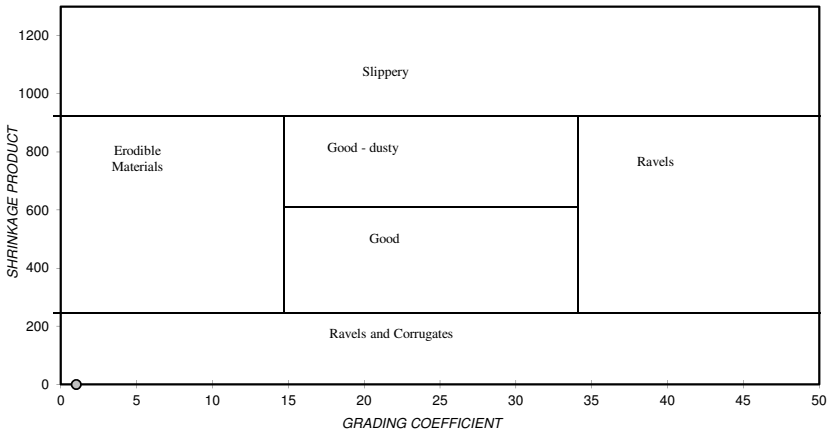
POTENTIAL EXPANSION



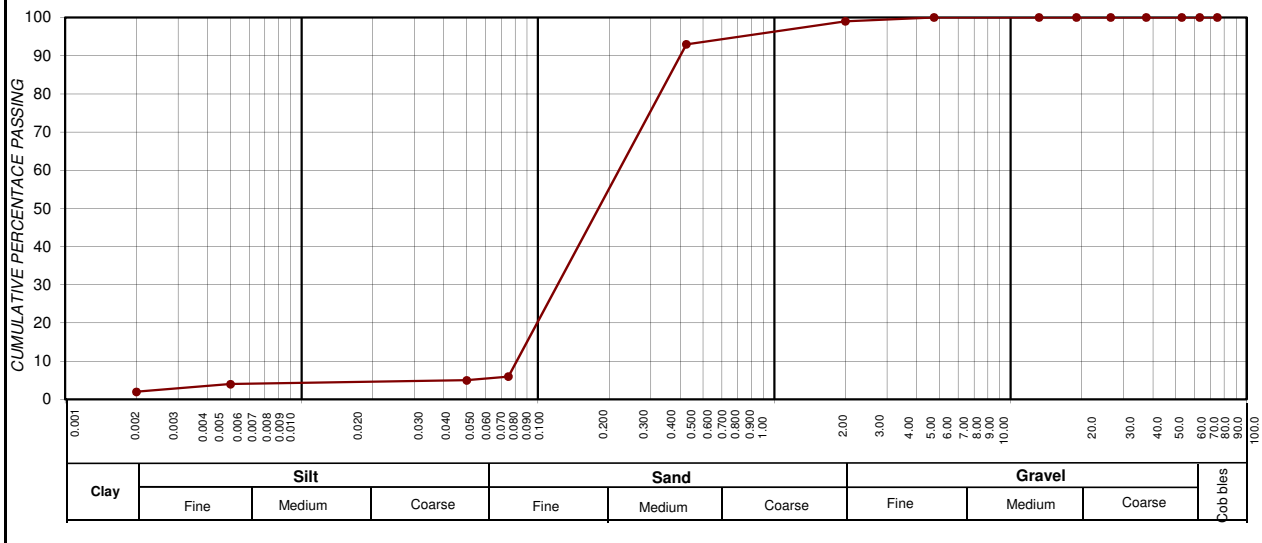
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	4.0	93.0	1.0

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Tel: 011 828 0279 Fax: 011 828 0273
E-mail: info@roadlab.co.za
www.roadlab.co.za

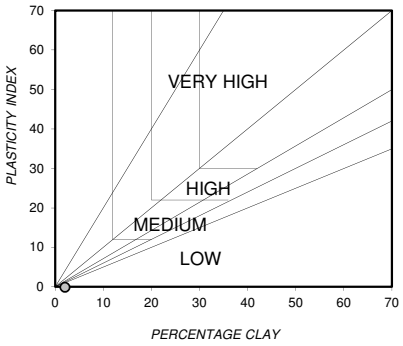
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 15-Jun-15
CHAINAGE : TP 404
LAYER : 0-1700mm
SAMPLE No. : U4287 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

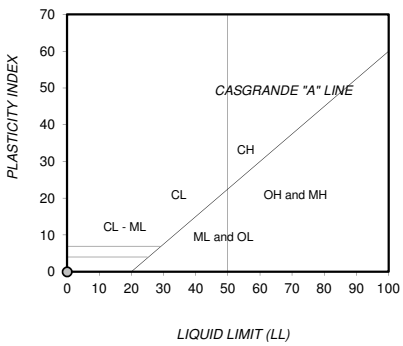
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	92
	0.250	64
	0.150	35
	0.075	5
	0.050*	4
	0.005*	3
	0.002*	2
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	6.1
	0.425 - 0.250	26.3
	0.250 - 0.150	27.2
	0.150 - 0.075	28.4
	< 0.075	12.0
Effective size		0.002
Uniformity Coefficient		100.0
Curvature Coefficient		42.3
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		2.0
Grading modulus		1.05
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SC-SW
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

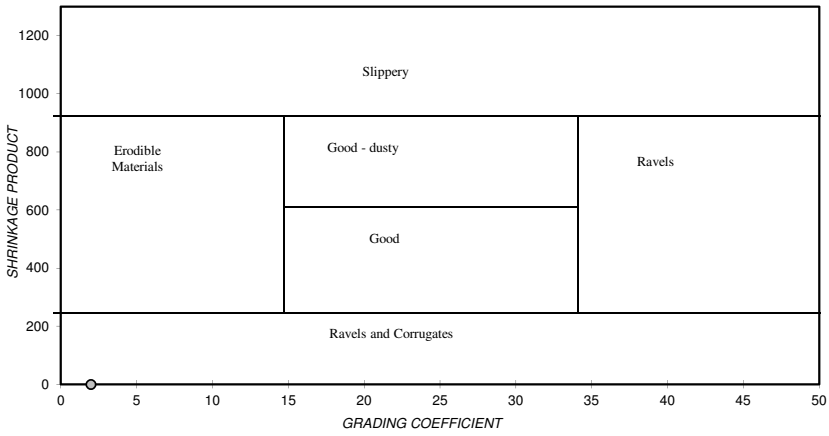
POTENTIAL EXPANSION



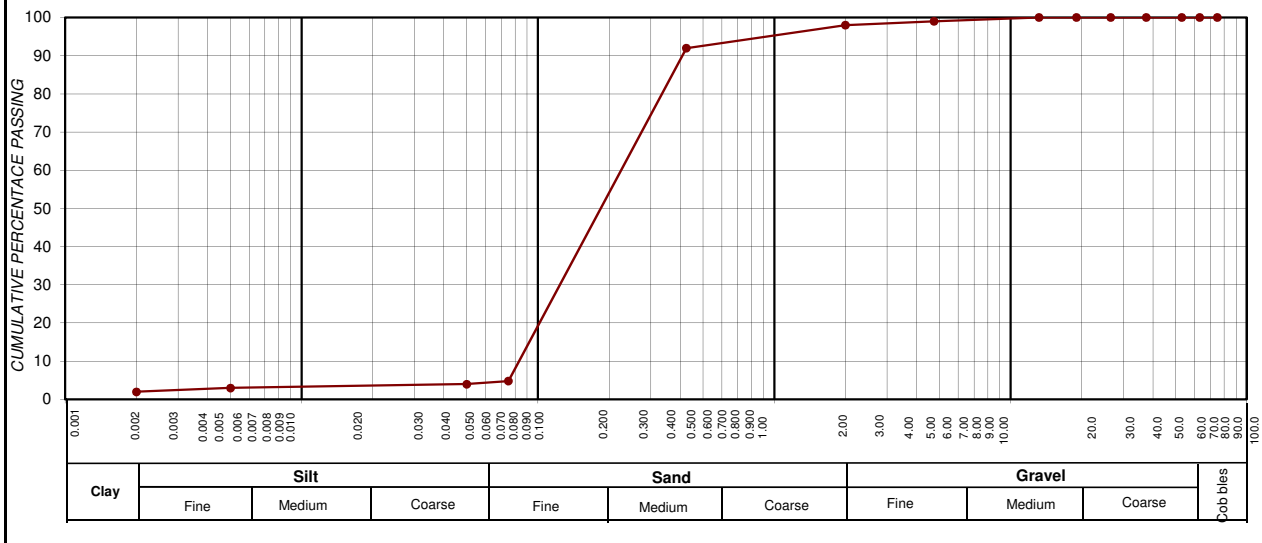
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
2.0	2.8	93.2	2.0

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www.roadlab.co.za

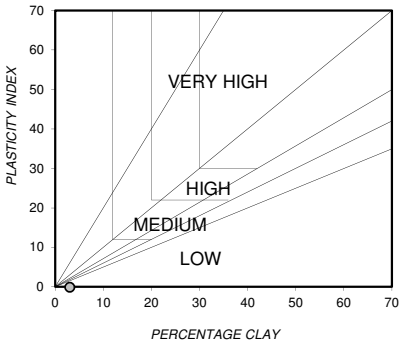
OUR REF : 91-0059-15
CLIENT : WSP GROUP
SITE : MBSA HIGH SPEED PROVING GROUND

DATE RECEIVED : 15-Jun-15
CHAINAGE : TP-H 05
LAYER : 0-700mm
SAMPLE No. : U4288 (E3006)
SAMPLE DESCRIPTION : Light Reddish Orange Sand

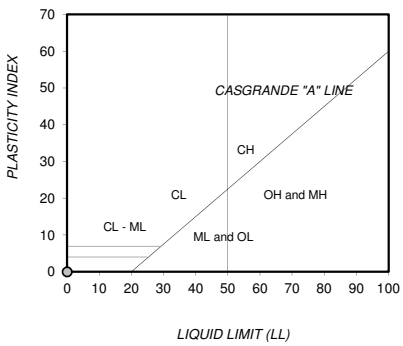
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	98
	13.2	96
	4.75	95
	2.000	94
	0.425	87
	0.250	60
	0.150	35
	0.075	8
	0.050*	7
	0.005*	5
	0.002*	3
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	7.4
	0.425 - 0.250	25.0
	0.250 - 0.150	23.1
	0.150 - 0.075	25.0
	< 0.075	19.4
Effective size		0.002
Uniformity Coefficient		110.0
Curvature Coefficient		32.7
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		5.7
Grading modulus		1.11
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-b(0)
pH - Value		N/A
Conductivity mS/cm		N/A

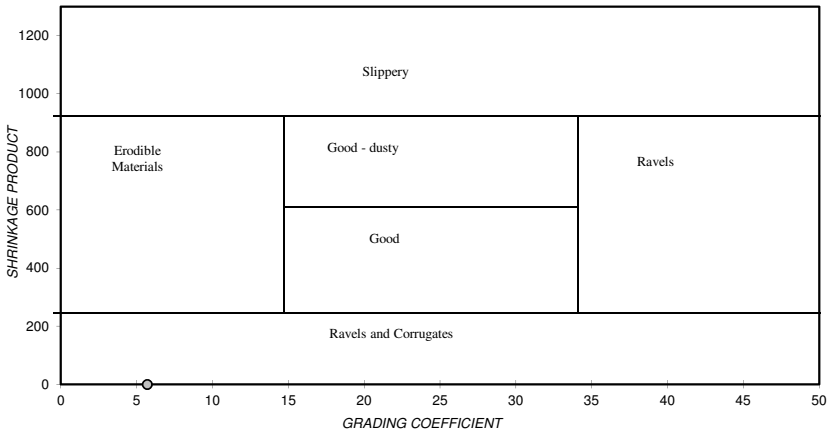
POTENTIAL EXPANSION



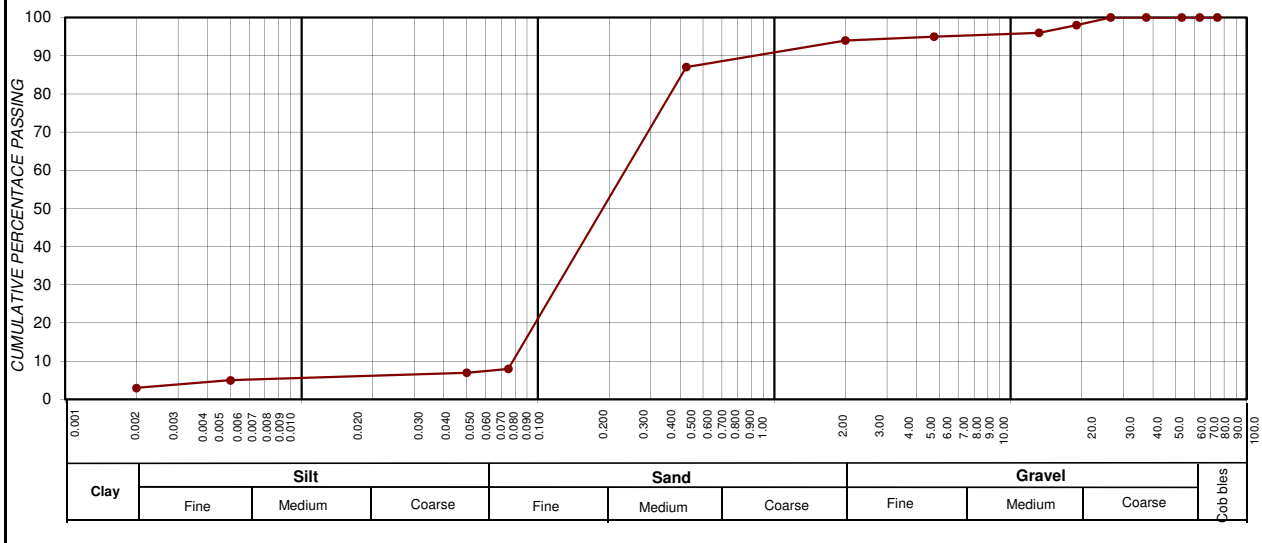
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
3.0	5.0	86.0	6.0

BD08 TEST AND RE-TEST RESULTS

ROADLAB Civil Engineering Materials Laboratory
PREHAB JV - Upington

ATTERBERG LIMITS
TMH1 Method A2 / A3 / A4

Premises 1050
Olyvenhoudtsdrift
Upington 8800
Tel: 054 334 0838
upington@prehab.co.za

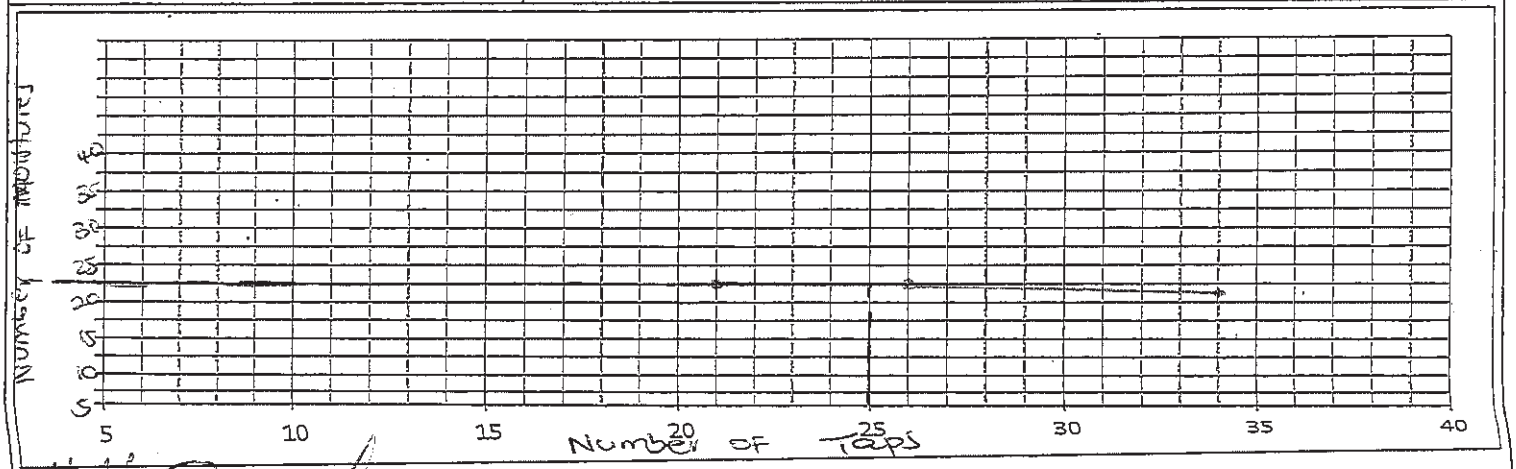
CLIENT	WSP	JOB NO	E 3006
PROJECT	Eugenaux	SAMPLE NUMBER	44277
DATE RECEIVED	10/06/15	HOLE No. / Km. / CHAINAGE	BH/08.
DATE REPORTED	16/06/15.	ROAD No. OR NAME	Bldg Area
MATERIAL DESCRIPTION	light olive brown quartsite stone	LAYER TESTED / SAMPLED FROM	0.8 – 3.3

TECHNICIAN	SCALE NUMBER	MASS OF SOIL FINES USED	CASEGRANDE MACHINE	GROVING TOOL	OVEN NUMBER
Mauru	Sc – 10	50g	T31	GT1	OV-03
			Checked: Mauru	Checked: Mauru	Checked: Mauru

SOIL CONSTANTS	LIQUID LIMIT			PLASTIC LIMIT	
CONTAINER NUMBER	6	7	8	9	10
MASS OF WET MATERIAL	16.42	17.18	17.93	24.93	23.29
MASS OF DRY MATERIAL	15.98	16.62	17.20	23.28	21.89
MASS OF CONTAINER	13.99	14.19	14.07	14.12	14.10
MASS OF MOISTURE	0.48	0.6	0.73	1.65	1.40
MASS OF DRY MATERIAL	1.99	2.43	3.13	9.16	7.79
MASS OF WATER Mℓ	12.3	13.5	13.8	—	—
% MOISTURE	22	23	23	18	18
NUMBER OF TAPS	34	26	21	—	—
MEAN					

LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTIC INDEX (PI)
23	18	5

TROUGH NUMBER	SHRINKAGE mm	LINEAR SHRINKAGE %
ST 5	4.2	2.8



M. Silinda
Checked By Sr. Materials Technician

Approved By Manager

Rev - 01 Retest Bench Form - RLPHU - 27

ROADLAB Civil Engineering Materials Laboratory
PREHAB JV - Upington

28 Jul 2015

ATTERBERG LIMITS
TMH1 Method A2 / A3 / A4

Premises 1050
Olyvenhoudtsdrift
Upington 8800
Tel: 054 334 0838
upington@prehab.co.za

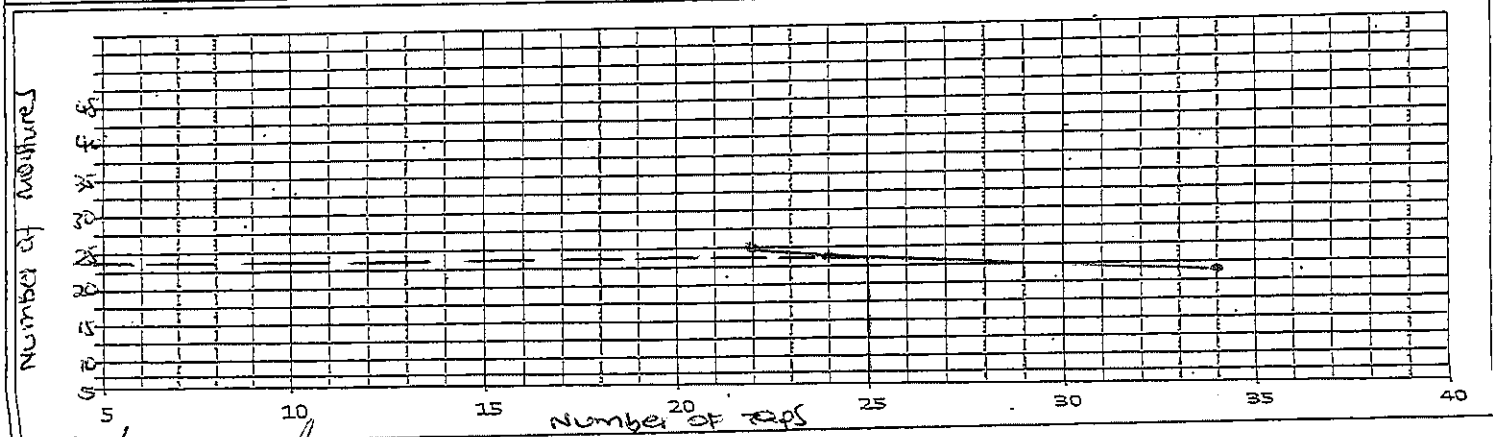
CLIENT	WSP	JOB NO	E3006
PROJECT	Engerau	SAMPLE NUMBER	04277
DATE RECEIVED	10/06/15	HOLE No. / Km. / CHAINAGE	BH 08
DATE REPORTED	16/06/15.	ROAD No. OR NAME	Bldg Area
MATERIAL DESCRIPTION	light olive brown Quartzitic stone	LAYER TESTED / SAMPLED FROM	0.8 – 3.3

TECHNICIAN	SCALE NUMBER	MASS OF SOIL FINES USED	CASEGRANDE MACHINE	GROVING TOOL	OVEN NUMBER
Mantu	SCI-10	509	(3)	GT 1	OV-03
			Checked: Mantu	Checked: Mantu	Checked: MAntu

SOIL CONSTANTS	LIQUID LIMIT			PLASTIC LIMIT	
CONTAINER NUMBER	16	17	18	19	20
MASS OF WET MATERIAL	15.80	16.08	16.55	26.50	26.12
MASS OF DRY MATERIAL	15.46	15.68	16.13	24.61	24.26
MASS OF CONTAINER	13.91	14.00	14.44	14.10	13.99
MASS OF MOISTURE	0.34	0.40	0.42	1.89	1.85
MASS OF DRY MATERIAL	1.55	1.67	1.68	10.51	10.28
MASS OF WATER Mr	12.4	14.0	15.0	—	—
% MOISTURE	22	24	25	18	18
NUMBER OF TAPS	34	24	22	—	—
MEAN					

LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTIC INDEX (PI)
24	18	6.0

TROUGH NUMBER	SHRINKAGE mm	LINEAR SHRINKAGE %
ST.9	4.4	2.9



M.M. Steyn
Checked By Sr. Materials Technician

Approved By Manager

APPENDIX D
BOREHOLE LABORATORY RESULTS

ROADLAB
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95/WSP003/08/0001/15 30/07/2015

WSP Group Africa (Pty) Ltd
P.O. Box 98867
Sloane Park
2152

ATTENTION: **Mr. Willem Du Toit**

Dear Sir

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		15/A520	15/A520	15/A521	XRD		
CONTAINER USED FOR SAMPLING		Plastic Sampling Bag	Plastic Sampling Bag	Plastic Sampling Bag			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry	Dry			
DEPTH (M) / KM OR CHAINAGE		3.90 - 4.20 & 4.75 - 5.30	7.70 - 7.90,11.75 - 12.00 & 13.00 - 13.4	2.55 - 3.20 & 5.50 - 5.60			
ROAD NO OR NAME		Upington	Upington	Upington			
LAYER TESTED / SAMPLED FROM		Not Specified	Not Specified	Not Specified			
DATE SAMPLED		N/A	N/A	N/A			
DATE RECEIVED		08/07/2015	08/07/2015	08/07/2015			
CLIENTS MARKING / BORE HOLE NO.		BH 1-A (Top)	BH 1-B (Bottom)	BH2 A (Top)			
REQUEST NO.		F-64	F-64	F-64			
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Light Grey Crushed Core	Light Grey Crushed Core	Light Grey Crushed Core	After splitting & milling the material was prepared for XRD analysis using a backloading preparation method.It was analysed with a PANalytical Empyrean diffractometer with PIXcel deterctor and fixed slits with Fe filtered Co-Ka radiation.The phases were identified using X'Pert Highscore plus software.The relative phase amounts(weigh%)were estimated using the Reitveld method.Errors are on the 3 sigma level in the column to the right of the amount (in weight per cent)		
NOMINAL SIZE OF STONE					SPECIFICATION		
		ACCUMULATIVE % PASSING	ACCUMULATIVE % PASSING	ACCUMULATIVE % PASSING	MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM	TMH 1 [B13]					-	
ACV (%) - DRY #	[SANS 5841:2008]			15.7%		-	
10 % FACT (kN) - DRY #	[SANS 5841:2008]			64 kN		-	
ACV (%) - WET	[B2]					-	
10 % FACT (kN) - WET	[B2]					-	
Ethylene Glycol Durability Index #	[B8105]					-	
Flakiness Index (%)	[B3]					-	
Organic Material (Y / N) #	[B6]	No - Lighter	No - Lighter	No - Lighter		-	
Methylene Blue Adsorption #	[SABS SM 1243*]	0.1 ml/g	0.1 ml/g	0.2 ml/g		-	
Loose Bulk Density Kg/m3 #	[B9]					-	
Compacted Bulk Density Kg/ #	[B9]					-	
Bulking Factor #						-	
Shrinkage (%) #	[B10]					-	
Expansion (%) #	[B10]					-	
Del. Subs (%) #	[B12]					-	
Soluble salt (%) #	[B16]					-	
Binder Absorption % #						-	
Ave.Least Dimension:(mm)	[B18(a)]					-	
Sand Equivalent (%) #	[B19]					-	
Apparent Relative density Kg #	COLTO 8108b					-	
pH #	[A20]					-	
Conductivity (ms/m) #	[A21T]					-	
Chloride Content *#	[SANS 202:2006]		0.01%	0.01%		-	
Presence of Sugar *#	[SANS 5833:2006]	No Sugar		No Sugar		-	
ARD (-4.75mm) Kg/m3	[B15]					-	
BRD (-4.75mm) Kg/m3	[B15]					-	
Water absorption (%)	[B15]					-	
ARD (+4.75mm) Kg/m3	[B14]					-	
BRD (+4.75mm) Kg/m3	[B14]					-	
Water absorption (%)	[B14]					-	
Mg2SO4 Soundness #	[839]					-	
Polished Stone Value #						-	
XRD						-	
Chlorite *#		6.64 - 1.38				-	
Diopside *#		3.81 - 0.84				-	
Microcline *#		15.11 - 0.96				-	
Muscovite *#		7.08 - 1.08				-	
Plagioclase *#		28.94 - 1.08				-	
Quartz *#		38.41 - 1.11				-	
Sample Method used	TMH 5 #	N/A	N/A	N/A		-	

- This is not a accredited test
*# - This test was performed at an outsource facility & reported by Roadlab.
Çomments - Mineral names may not reflect the actual composition of minerals identified but rather the mineral group.
-Due to the preferred orientation and crystallite size effects results may not be as accurate as shown.
-Traces of additional phases such as smectite and kaolinite may be present,Amorphous phases if present were not taken into account in the quantification.

Kind Regards

Mr Deon Juckers
Technical Signatory

Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab

Compiled By : Miss Zandile Mokoena

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95/WSP003/08/0001/15 30/07/2015

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P.O. Box 98867
Sloane Park
2152

ATTENTION: **Mr. Willem Du Toit**

Dear Sir

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		15/A521	15/A522	15/A522	REMARKS & NOTES		
CONTAINER USED FOR SAMPLING		Plastic Sampling Bag	Plastic Sampling Bag	Plastic Sampling Bag			
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry	Dry			
DEPTH (M) / KM OR CHAINAGE		6.30 - 7.45 & 8.68 - 8.85	2.03 - 2.65 , 4.70 - 5.22 & 4.45 - 4.70	6.40 - 6.95 & 12.25 - 12.45			
ROAD NO OR NAME		Upington	Upington	Upington			
LAYER TESTED / SAMPLED FROM		Not Specified	Not Specified	Not Specified			
DATE SAMPLED		N/A	N/A	N/A			
DATE RECEIVED		08/07/2015	08/07/2015	08/07/2015			
CLIENTS MARKING / BORE HOLE NO.		BH2 B (Bottom)	BH3 A (Top)	BH3 B (Bottom)			
REQUEST NO.		F-64	F-64				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Light Grey Crushed Core	Light Grey Crushed Core	Light Grey Crushed Core	SPECIFICATION		
NOMINAL SIZE OF STONE					MIN	-	MAX
		ACCUMULATIVE % PASSING	ACCUMULATIVE % PASSING	ACCUMULATIVE % PASSING			
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM TMH 1 [B13]					-	
ACV (%) - DRY # [SANS 5841:2008]	19.6%	18.0%	18.3%		-	
10 % FACT (kN) - DRY # [SANS 5841:2008]	53 kN	56 kN	56 kN		-	
ACV (%) - WET [B2]					-	
10 % FACT (kN) - WET [B2]					-	
Ethylene Glycol Durability Index # [B8105]					-	
Flakiness Index (%) [B3]					-	
Organic Material (Y / N) # [B6]	No - Lighter	No - Lighter	No - Lighter		-	
Methylene Blue Adsorption # [SABS SM 1243*]	0.15 ml/g	0.15 ml/g	0.1 ml/g		-	
Loose Bulk Density Kg/m3 # [B9]					-	
Compacted Bulk Density Kg/ # [B9]					-	
Bulking Factor #					-	
Shrinkage (%) # [B10]					-	
Expansion (%) # [B10]					-	
Del. Subs (%) # [B12]					-	
Soluble salt (%) # [B16]					-	
Binder Absorption % #					-	
Ave.Least Dimension:(mm) [B18(a)]					-	
Sand Equivalent (%) # [B19]					-	
Apparent Relative density K(# COLTO 8108b					-	
pH # [A20]					-	
Conductivity (ms/m) # [A21T]					-	
Chloride Content *# [SANS 202:2006]		0.01%			-	
Presence of Sugar *# [SANS 5833:2006]		No Sugar			-	
ARD (-4.75mm) Kg/m3 [B15]					-	
BRD (-4.75mm) Kg/m3 [B15]					-	
Water absorption (%) [B15]					-	
ARD (+4.75mm) Kg/m3 [B14]					-	
BRD (+4.75mm) Kg/m3 [B14]					-	
Water absorption (%) [B14]					-	
Mg2SO4 Soundness # [839]					-	
Polished Stone Value #					-	
Alkali reactive (Y / N) #					-	
Sample Method used TMH 5 #	N/A	N/A	N/A		-	

- This is not a accredited test
- Sanas method & TMH procedures used.
Kind Regards

Mr Deon Juckers
Technical Signatory

Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab
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Compiled By : Miss Zandile Mokoena

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95/WSP003/08/0001/15 30/07/2015

WSP Group Africa (Pty) Ltd
P.O. Box 98867
Sloane Park
2152

ATTENTION: **Mr. Willem Du Toit**

Dear Sir

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**

Please find the attached test results for the sample/s as submitted to and tested by Roadlab (Pty) Ltd in Primrose, Germiston.
The unambiguous description of the sample/s as received are as follows:

SAMPLE NO		15/A523	15/A523		XRD		
CONTAINER USED FOR SAMPLING		Plastic Sampling Bag	Plastic Sampling Bag				
MOISTURE CONDITION OF SAMPLE ON ARRIVAL		Dry	Dry		After splitting & milling the material was prepared for XRD analysis using a backloading preparation method.It was analysed with a PANalytical Empyrean diffractometer with PIXcel deterctor and fixed slits with Fe filtered Co-Ka radiation.The phases were identified using X'Pert Highscore plus software.The relative phase amounts(weigh%)were estimated using the Reitveld method.Errors are on the 3 sigma level in the column to the right of the amount (in weight per cent)		
DEPTH (M) / KM OR CHAINAGE		8.75 - 9.00 & 10.90 - 11.10	11.30 - 11.50				
ROAD NO OR NAME		Upington	Upington				
LAYER TESTED / SAMPLED FROM		Not Specified	Not Specified				
DATE SAMPLED		N/A	N/A				
DATE RECEIVED		08/07/2015	08/07/2015				
CLIENTS MARKING / BORE HOLE NO.		BH 4-A (Top)	BH 4-B (Bottom)				
REQUEST NO.		F-64	F-64				
DESCRIPTION OF SAMPLE (COLOR & TYPE)		Light Grey Crushed Core	Light Grey Crushed Core				
NOMINAL SIZE OF STONE					SPECIFICATION		
		ACCUMULATIVE % PASSING	ACCUMULATIVE % PASSING		MIN	-	MAX
Sieve size (mm) TMH 1 B4	75.0					-	
	53.0					-	
	37.5					-	
	26.5					-	
	19.0					-	
	13.2					-	
	9.5					-	
	6.7					-	
	4.75					-	
	2.36					-	
	1.18					-	
	0.600					-	
	0.300					-	
	0.150					-	
Dust %	0.075					-	

FM TMH 1 [B13]						-	
ACV (%) - DRY [B1]						-	
10 % FACT (kN) - DRY [B2]						-	
ACV (%) - WET [B2]						-	
10 % FACT (kN) - WET [B2]						-	
Ethylene Glycol Durability Index # [B8105]						-	
Flakiness Index (%) [B3]						-	
Organic Material (Y / N) # [B6]						-	
Methylene Blue Adsorption # [SABS SM 1243*]						-	
Loose Bulk Density Kg/m3 # [B9]						-	
Compacted Bulk Density Kg/ # [B9]						-	
Bulking Factor #						-	
Shrinkage (%) # [B10]						-	
Expansion (%) # [B10]						-	
Del. Subs (%) # [B12]						-	
Soluble salt (%) # [B16]						-	
Binder Absorption % #						-	
Ave.Least Dimension:(mm) [B18(a)]						-	
Sand Equivalent (%) # [B19]						-	
Apparent Relative density Kg # COLTO 8108b						-	
pH # [A20]						-	
Conductivity (ms/m) # [A21T]						-	
Chloride Content *# [SANS 202:2006]		0.01%				-	
Presence of Sugar *# [SANS 5833:2006]		No Sugar				-	
ARD (-4.75mm) Kg/m3 [B15]						-	
BRD (-4.75mm) Kg/m3 [B15]						-	
Water absorption (%) [B15]						-	
ARD (+4.75mm) Kg/m3 [B14]						-	
BRD (+4.75mm) Kg/m3 [B14]						-	
Water absorption (%) [B14]						-	
Mg2SO4 Soundness # [839]						-	
Polished Stone Value #						-	
XRD						-	
Chlorite *#			7.56 - 1.41			-	
Diopside *#			3.75 - 0.9			-	
Microcline *#			21.8 - 1.17			-	
Muscovite *#			4.13 - 1.2			-	
Plagioclase *#			24.83 - 1.23			-	
Quartz *#			37.93 - 1.29			-	
Sample Method used TMH 5 #		N/A	N/A			-	

- This is not a accredited test
*# - This test was performed at an outsource facility & reported by Roadlab.
Çomments - Mineral names may not reflect the actual composition of minerals identified but rather the mineral group.
-Due to the preferred orientation and crystallite size effects results may not be as accurate as shown.
-Traces of additional phases such as smectite and kaolinite may be present,Amorphous phases if present were not taken into account in the quantification.

Kind Regards

Mr Deon Juckers
Technical Signatory

Mr Charel van Biljon
Laboratory Manager

Remarks :
* Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
Sanas Accredited Laboratory - T 0296
The results reported relate only to the sample tested
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Compiled By : Miss Zandile Mokoena

MASTERS\AGGREGATE\AGG-SPEC

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95/WSP003/08/0001 30/07/2015

WSP Group Africa (Pty) Ltd
P.O. Box 98867
Sloane Park
2152

ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A521 - BH2 A - 3.55 - 3.75 (Top)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	2
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

Compiled By: Miss Zandile Mokoena

Deon Juckers
Technical Signatory

Charel van Biljon
Asphalt Lab Manager

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95/WSP003/08/0001 30/07/2015

WSP Group Africa (Pty) Ltd
P.O. Box 98867
Sloane Park
2152

ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A521 - BH2 B - 3.55 - 3.75 (Bottom)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	2
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

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Charel van Biljon
Asphalt Lab Manager

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2152

ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A522 - BH3 A - 4.05 - 4.45 (Top)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	2
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

Compiled By: Miss Zandile Mokoena

Deon Juckers
Technical Signatory

Charel van Biljon
Asphalt Lab Manager

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ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A522 - BH3 B - 4.05 - 4.45 (Bottom)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	2
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

Compiled By: Miss Zandile Mokoena

Deon Juckers
Technical Signatory

Charel van Biljon
Asphalt Lab Manager

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2152

ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A523 - BH4 A - 9.00 - 9.30 (Top)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	**2**
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

Compiled By: Miss Zandile Mokoena

Deon Juckers
Technical Signatory

Charel van Biljon
Asphalt Lab Manager

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ATTENTION: Mr. Willem Du Toit

Test Report: **UPINGTON : AGGREGATE TEST RESULTS**
Sample identification: Sample # 15/A523 - BH4 B - 9.00 - 9.30 (Bottom)

TEST METHOD USED: **SANS 3001-AG14:2013**

1	2	3	4	5	6	7	8
Day	**Spalled [a]**	***Ds***	**Fractured [b]**	***Df***	**Disintegrated [c]**	***Dd***	**Durability index**
1	0	**0**	0	**0**	0	**0**	0
5	0	**0**	0	**0**	0	**0**	0
10	0	**0**	0	**0**	0	**0**	0
20	0	**0**	0	**0**	0	**0**	0
a	Weighting Factor		**0.5**		Start Date:		**09/07/2015**
b	Weighting Factor		**1**		Completion date:		**29/07/2015**
c	Weighting Factor		**2.5**				

5 day mEGDI	20 day mEGDI	1.5 x 5 day mEGDI
0	**0**	0

Classification of aggregate deterioration

1	2
Type of deterioration	**Definition**
Spalled (Ds)	Shedding of small fragments from aggregate edges
Fractured (Df)	Splitting into two or three pieces
Disintegrated (Dd)	Splitting into more than three pieces

Remarks :

NOTE: This test was done by using only 32 pieces of stone and not the prescribed 40 pieces as per the test method.

Compiled By: Miss Zandile Mokoena

Deon Juckers
Technical Signatory

Charel van Biljon
Asphalt Lab Manager

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Test Certificate

Project Information			
Project number 851	Report number 851_1	Report date 16 July 2015	Pages 3

Customer Information	
Customer XRD Analytical & Consulting cc	Contact person Sabine Verryn
Address 75 Kafue Street Lynnwood Glen Pretoria 0001	Email sabine.verryn@xrd.co.za
	Telephone (+27) 83 548 0586
	Fax none
	Order number none

Contents

1 Sample List

Sci-Ba Sample ID	Customer Sample ID	Comment
851:1	15/A522	Sample arrived milled. Integrity is good.
851:2	15/A521	Sample arrived milled. Integrity is good.

2 XRF01 - Major Analysis by XRF

Determinand	Analyte	Unit	15/A522	15/A521			
Silica	SiO_2	% g/g	67.71	70.11			
Titanium	TiO_2	% g/g	0.85	0.81			
Aluminium	Al_2O_3	% g/g	13.70	13.38			
Iron	Fe_2O_3	% g/g	6.23	6.22			
Manganese	MnO	% g/g	0.08	0.08			
Magnesium	MgO	% g/g	0.91	0.83			
Calcium	CaO	% g/g	2.49	2.23			
Sodium	Na_2O	% g/g	2.10	2.44			
Potassium	K_2O	% g/g	4.05	3.95			
Phosphorous	P_2O_5	% g/g	0.13	0.12			
Chromium	Cr_2O_3	% g/g	0.03	0.03			
Sulphur	SO_3	% g/g	0.09	0.09			
Loss on Ignition (1000 °C)	LOI	% g/g	0.60	0.67			
Total	Total	% g/g	99.11	101.05			
Loss of Moisture (105 °C)	H_2O-	% g/g	0.12	0.10			

Notes: % g/g is equivalent to wt %; mg/kg is equivalent to ppm; n.d. = not determined; bold italicised font represents semi-quantitative data; * represents measurements reported in % g/g or wt%.

3 XRF02 - Trace Element Analysis by XRF

Determinand	Analyte	Unit	15/A522	15/A521			
Arsenic	As	mg/kg	<0.43	<0.43			
Barium	Ba	mg/kg	750	685			
Bismuth	Bi	mg/kg	1.37	1.61			
Cadmium	Cd	mg/kg	6.68	4.63			
Cerium	Ce	mg/kg	83.3	117			
Chlorine	Cl	mg/kg	145	147			
Cobalt	Co	mg/kg	<0.56	<0.56			
Caesium	Cs	mg/kg	1.38	4.18			
Copper	Cu	mg/kg	19.0	26.8			
Galium	Ga	mg/kg	17.4	16.9			
Germanium	Ge	mg/kg	<0.50	<0.50			
Hafnium	Hf	mg/kg	6.10	1.49			
Mercury	Hg	mg/kg	<1.00	<1.00			
Lanthanum	La	mg/kg	30.0	32.6			
Lutetium	Lu	mg/kg	2.57	2.52			
Molybdenum	Mo	mg/kg	5.87	5.63			
Niobium	Nb	mg/kg	19.8	18.2			
Neodymium	Nd	mg/kg	18.3	48.5			
Nickel	Ni	mg/kg	24.4	20.0			
Lead	Pb	mg/kg	<2.03	<2.03			
Rubidium	Rb	mg/kg	146	159			
Antimony	Sb	mg/kg	<1.48	<1.48			
Scandium	Sc	mg/kg	28.1	25.2			
Selenium	Se	mg/kg	<0.36	<0.36			
Samarium	Sm	mg/kg	33.4	23.6			
Tin	Sn	mg/kg	5.26	5.63			
Strontium	Sr	mg/kg	143	132			
Tantalum	Ta	mg/kg	1.75	1.55			
Tellurium	Te	mg/kg	<0.16	<0.16			
Thorium	Th	mg/kg	25.0	26.8			
Thallium	Tl	mg/kg	0.47	0.62			
Uranium	U	mg/kg	5.81	5.09			
Vanadium	V	mg/kg	<7.60	<7.60			
Tungsten	W	mg/kg	1.22	1.25			
Yttrium	Y	mg/kg	44.1	44.5			
Ytterbium	Yb	mg/kg	8.90	9.82			
Zinc	Zn	mg/kg	66.6	59.7			
Zirconium	Zr	mg/kg	257	264			

Notes: % g/g is equivalent to wt %; mg/kg is equivalent to ppm; n.d. = not determined; bold italicised font represents semi-quantitative data; * represents measurements reported in % g/g or wt%.

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Established 1965

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95/WSP003/05/0001/15 2015/08/03

WSP Group Africa (Pty) Ltd
P. O. Box 98867
Sloane Park
2152

ATTENTION: **Mr. Willem du Toit**

Dear Sir

Test Report : **Upington - Foundation Indicator Test Results**

Herewith the laboratory foundation indicator test results for above mentioned project, as requested by you.
3x Samples were Delivered to Roadlab.
*** Non accredited tests**

Kind Regards

Mr D Juckers
TECHNICAL SIGNATORY

Remarks :

The samples were subjected to analysis according to TMH 1

The results reported relate only to the sample tested

Further use of the above information is not the responsibility or liability of Roadlab

Compiled By : Laaiqa Stenekamp

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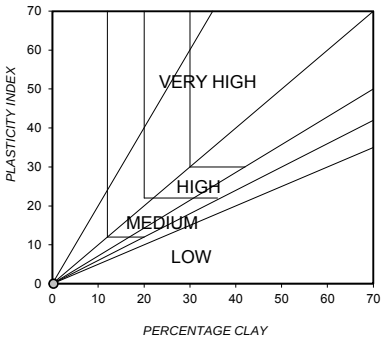
www.roadlab.co.za

OUR REF : 95/WSP003/05/0001/15 | **DATE RECEIVED :** 08-Jul-15
CLIENT : WSP Group Africa (Pty) Ltd | **CHAINAGE :** BH1 - 3.90 - 4.20
SITE : Upington | **LAYER :** Core Sample A
SAMPLE No. : 15/A520
SAMPLE DESCRIPTION : Light Grey

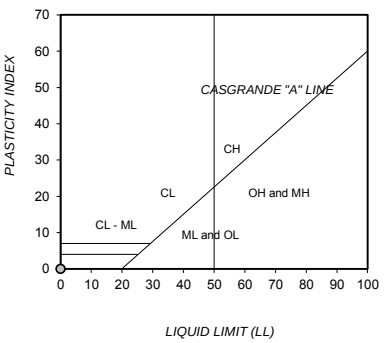
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	92
	13.2	62
	4.75	27
	2.000	15
	0.425	6
	0.250	3
	0.150	2
	0.075	1
	0.050*	1
	0.005*	1
	0.002*	0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	60.0
	0.425 - 0.250	13.0
	0.250 - 0.150	10.0
	0.150 - 0.075	7.0
	< 0.075	10.0
Effective size		0.001
Uniformity Coefficient		10000.0
Curvature Coefficient		0.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		23.0
Grading modulus		2.78
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0.0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

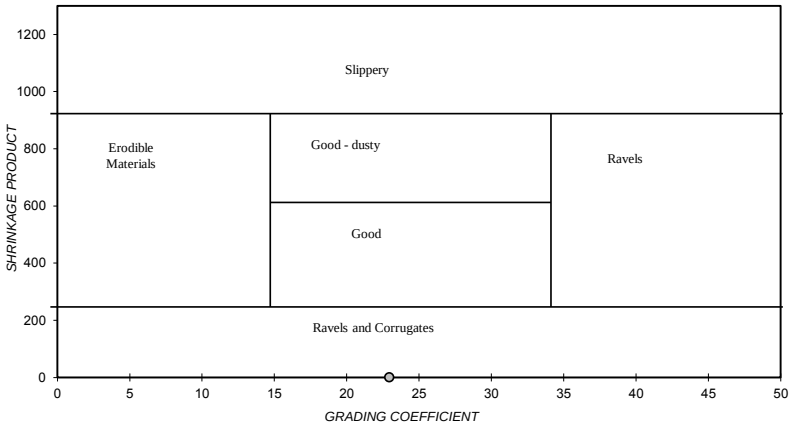
POTENTIAL EXPANSION



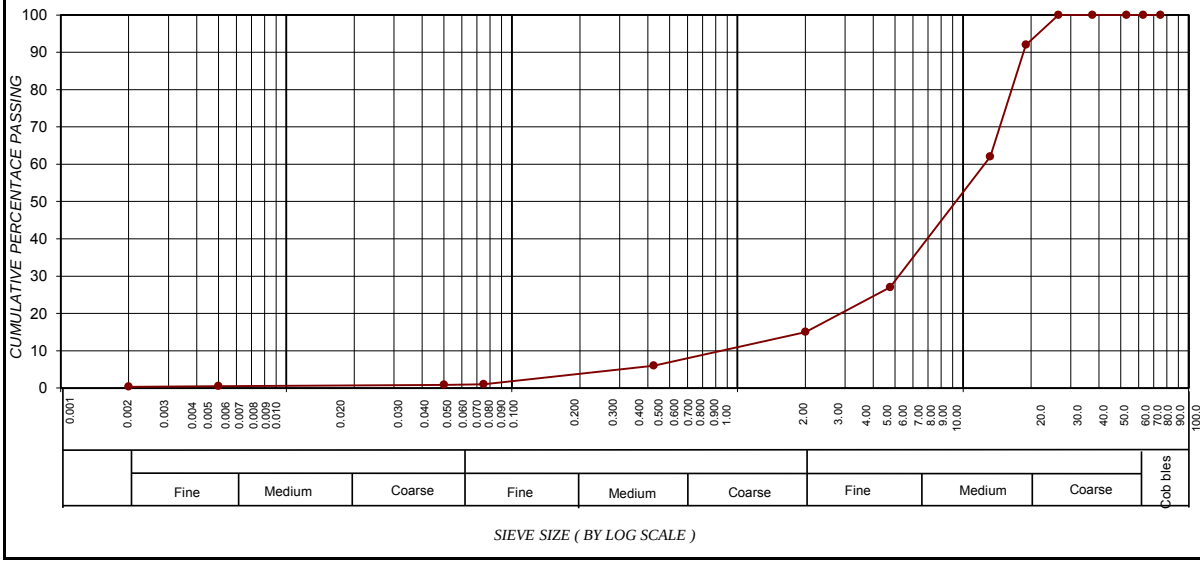
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
0.3	0.7	14.0	85.0

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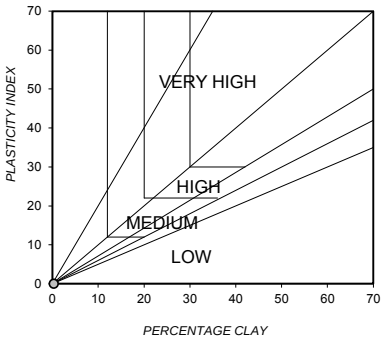
OUR REF : 95/WSP003/05/0001/15 | **DATE RECEIVED :** 08-Jul-15
CLIENT : WSP Group Africa (Pty) Ltd | **CHAINAGE :** BH2 2.15 - 2.55
SITE : Upington | **LAYER :** Core Sample A
SAMPLE No. : 15/A521
SAMPLE DESCRIPTION : Light Grey

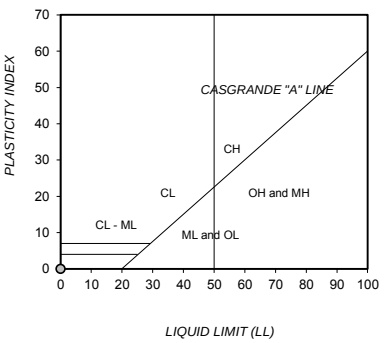
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	97
	13.2	67
	4.75	30
	2.000	17
	0.425	6
	0.250	3
	0.150	2
	0.075	1
	0.050*	1
	0.005*	1
	0.002*	0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	65.0
	0.425 - 0.250	11.0
	0.250 - 0.150	9.0
	0.150 - 0.075	6.0
	< 0.075	9.0
Effective size		0.001
Uniformity Coefficient		10000.0
Curvature Coefficient		0.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		24.9
Grading modulus		2.76
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0.0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

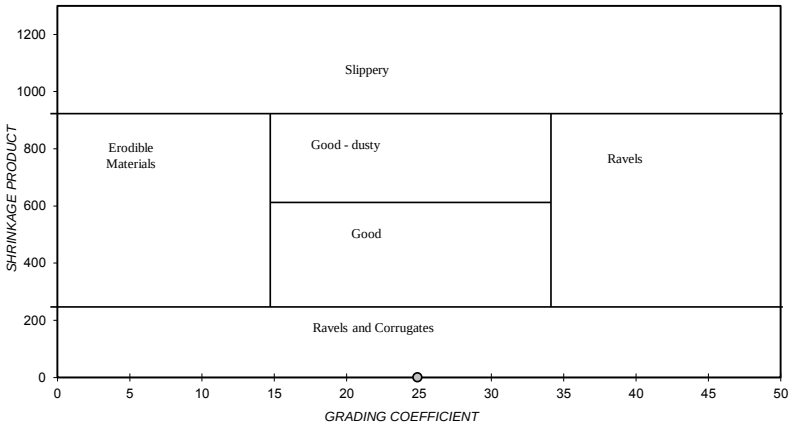
POTENTIAL EXPANSION



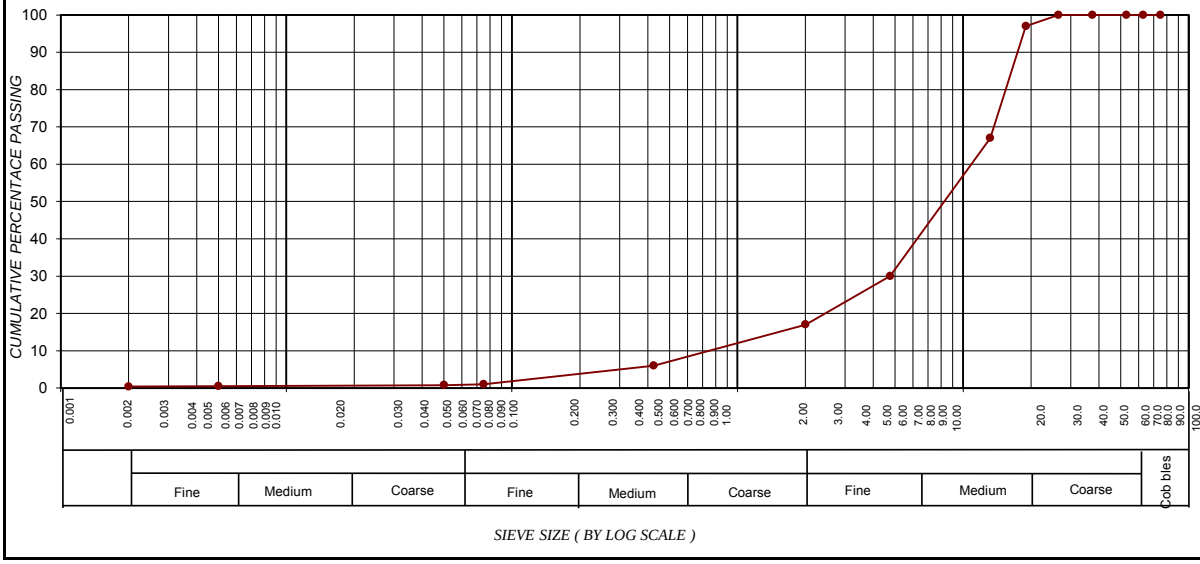
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
0.4	0.6	16.0	83.0

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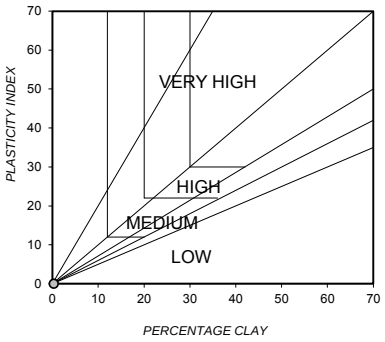
OUR REF : 92/WSP003/05/0001/15
CLIENT : WSP Group Africa (Pty) Ltd
SITE : Upington

DATE RECEIVED : 08-Jul-15
CHAINAGE : BH4 5.25 - 6.30
LAYER : Core Sample A
SAMPLE No. : 15/A523
SAMPLE DESCRIPTION : Light Grey

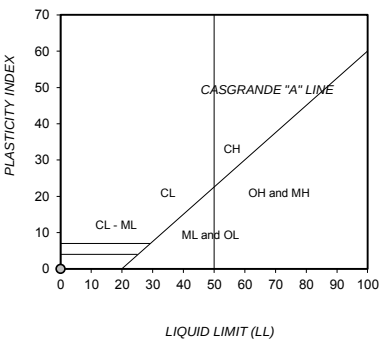
*FOUNDATION INDICATOR RESULTS (TMH 1 : A1, A2, A3, A4, A5 & *ASTM D422)*

Weighted PI		**0.0**
Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	82
	13.2	50
	4.75	21
	2.000	11
	0.425	4
	0.250	3
	0.150	2
	0.075	1
	0.050*	1
	0.005*	1
	0.002*	0
Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	65.0
	0.425 - 0.250	11.0
	0.250 - 0.150	9.0
	0.150 - 0.075	6.0
	< 0.075	9.0
Effective size		0.001
Uniformity Coefficient		15000.0
Curvature Coefficient		0.0
Oversize Index		0.0
Shrinkage Product		0.0
Grading Coefficient		18.7
Grading modulus		2.84
Atter-berg Limits	Liquid Limit	0
	Plasticity Index	NP
	Linear Shrinkage	0.0
Unified Soil Classification		SP
U.S. Highway Classification		A-1-a(0)
pH - Value		N/A
Conductivity mS/cm		N/A

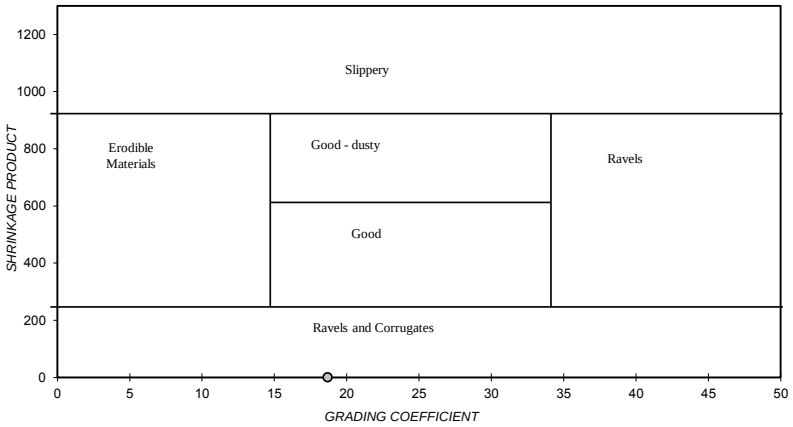
POTENTIAL EXPANSION



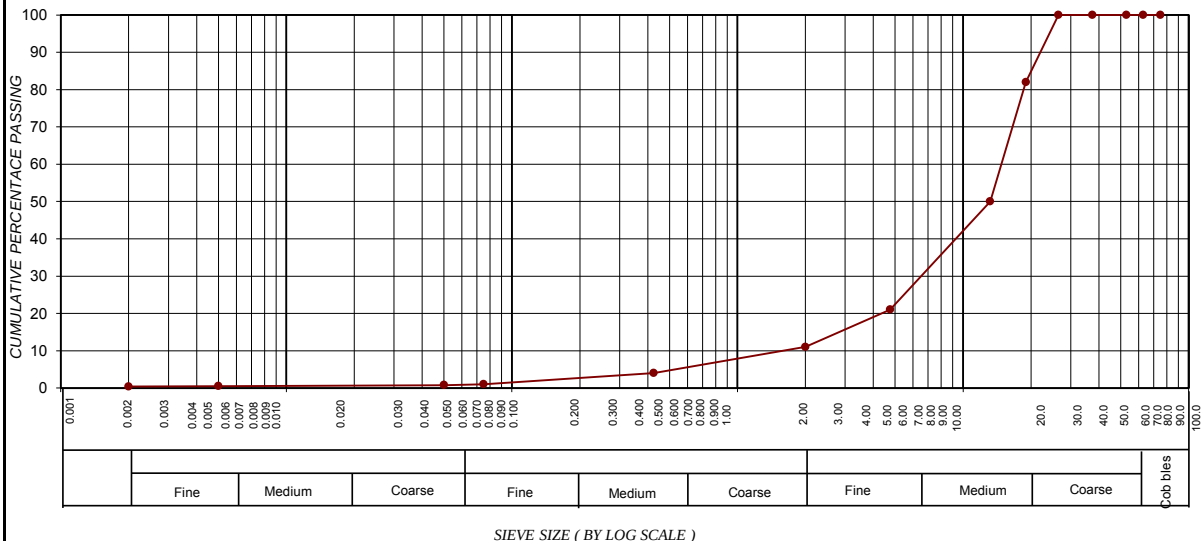
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)

CLAY (%) (0.001-0.002)	SILT (%) (0.002-0.060)	SAND (%) (0.060-2.00)	GRAVEL (%) (2.00-60.0)
0.4	0.6	10.0	89.0

APPENDIX E
BORROW PIT LABORATORY RESULTS

Premisses 1050
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054 334 0837
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Roelof Lategan
upington@prehab.co.za

ROADLAB PREHAB JV (Pty) Ltd. - REG NO: 2010/017402/07 - VAT NO: 4730237031
Bellville · Bloemfontein · Mosselbaai · Postmasburg · Pretoria · Sishen · Upington · Kimberley · Springbok

CLIENT:	IngenAIX GmbH	**Tel:**	+491655804362
ADDRESS:	Schurzelter Str 27, 52074 Aachen Germany	**Fax:**	+49 (0) 24189491849
	-	**E-mail:**	Marc.Schmits-Lapainer@ingenaix.de
ATTENTION:	Marc Schmits-Lapainer	**Cell:**	-

TEST REPORT

PROJECT	Steenkampspan Project
CLIENT REFERENCE	-
JOB No:	2381
ORDER No:	Steenkampspan
DATE	08/10/2014
Sampled By	Petrus Burger
Date Sampled	22/09/2014
Date Received	22/09/2014
Sampling Method	TMH5
Test Method	TMH1
Road / Structure	-
Section	-
Layer	-
TEST TYPE	MoD CBR IND pH EC
Sampled By	Roadlab Prehab JV Upington
Delivered By	Roadlab Prehab JV Upington
Temp. ˚C inside Laboratory	-
Laboratory Tester	Puma Twalo
Environmental Condition	Warm
REMARKS & NOTES by Lab	-
Number of pages	2

Client Instructions

NONE SPECIFIED

Accreditaion No: Test Method not Accredited

Roelof Lategan
Technical Signatory

Remarks :

*Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab Prehab JV (Pty)Ltd.
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Dry density reported to 1kg/m^3

Compiled by: Mareze Lategan

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Civil Engineering Materials Laboratory
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Bellville · Bloemfontein · Mosselbaai · Postmasburg · Pretoria · Sishen · Upington · Kimberley · Springbok

CLIENT: IngenAIX GmbH
Schurzelter Str 27, 52074 Aachen
Germany
-

ATTENTION: Marc Schmits-Lapainer

PROJECT: Steenkampspan Project

DATE TESTED: 22/09/2014

MoD CBR IND pH EC

SAMPLE No.		U3843	U3844	U3845	U3846
CONTAINER USED FOR SAMPLING		Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags
SIZE / WEIGHT OF SAMPLE		±70kg	±70kg	±70kg	±70kg
MOISTURE CONDITION OFSAMPLE ON ARRIVAL		Moist	Moist	Moist	Moist
HOLE No. / Km. / CHAINAGE		TP 1	TP 2	TP 3	TP 4
ROAD No. OR NAME		Borrow Pit	Borrow Pit	Borrow Pit	Borrow Pit
LAYER TESTED / SAMPLED FROM		0-400	0-300	0-400	0-400
DATE SAMPLED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
DATE RECEIVED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
CLIENTS MARKING					
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone	Light Reddish Orange Silty Sand Mix Calcrete	Light Brown Silty Sand Mix Calcrete Stone
		GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a))			
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75,0	100		100	88
	63,0	91		91	79
	53,0	67	100	91	75
	37,5	66	86	77	70
	26,5	56	67	68	59
	19,0	50	57	58	54
	13,2	46	48	49	50
	4,75	40	35	35	44
	2,00	39	33	31	42
	0,425	36	30	27	39
	0,075	5,6	7,5	5,3	3,1
		pH & Conductivity (TMH1 1986 : METHOD A20 & A21T)			
pH # **(A20)**				8,20	8,20
Conductivity # **(A21 T)**				0,03	0,03
		ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)			
ATTERBERG LIMITS **(TMH A2&A3)**	LL%	0	0	0	0
	P.I.	0	0	0	0
	LS%	0,0	0,0	0,0	0,0
GM		2,19	2,30	2,37	2,16
CLASSIFI - CATION	H.R.B.	A-1-b	A-1-a	A-1-a	A-1-b
	COLTO				
	T.R.H. 14	G5	G5	G5	G5
		MDD AASHTO & OMC%; CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)			
MOD AASHTO **(TMH A7)**	OMC%	6,2	5,3	8,4	6,5
	MDD(KG/M^3)	2053	2030	1971	195
COMP MC		6,3	5,3	8,4	6,6
C.B.R.	% SWELL	0,02	0,03	0,03	0,03
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	117	128	130	99
	98%	91	95	100	81
	97%	78	78	84	72
	95%	56	46	57	56
	93%	51	31	44	47
	90%	44	9	24	33
COMPACTION (100%) : ITS (kPa)		Ave:	Ave:	Ave:	Ave:
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE				
TEST TYPE		MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC
SAMPLED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
DELIVERED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
SAMPLED ACCORDING TO		TMH5	TMH5	TMH5	TMH5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Warm	Warm	Warm	Warm
REMARKS & NOTES					

Kind Regards

Roelof Lategan
Technical Signatory

Remarks :

The samples were subjected to analysis according to TMH 1

The results reported relate only to the sample tested

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ADDRESS:	Schurzelter Str 27, 52074 Aachen Germany	**Fax:**	+49 (0) 24189491849
	-	**E-mail:**	Marc.Schmits-Lapainer@ingenaix.de
ATTENTION:	Marc Schmits-Lapainer	**Cell:**	-

TEST REPORT

PROJECT	Steenkampspan Project
CLIENT REFERENCE	-
JOB No:	2381
ORDER No:	Steenkampspan
DATE	08/10/2014
Sampled By	Petrus Burger
Date Sampled	22/09/2014
Date Received	22/09/2014
Sampling Method	TMH5
Test Method	TMH1
Road / Structure	-
Section	-
Layer	-
TEST TYPE	MoD CBR IND pH EC
Sampled By	Roadlab Prehab JV Upington
Delivered By	Roadlab Prehab JV Upington
Temp. ˚C inside Laboratory	-
Laboratory Tester	Puma Twalo
Environmental Condition	Warm
REMARKS & NOTES by Lab	-
Number of pages	2

Client Instructions

NONE SPECIFIED

Accreditaion No: Test Method not Accredited

Roelof Lategan
Technical Signatory

Remarks :

*Opinions & Interpretations are not included in our schedule of Accreditation
The samples were subjected to analysis according to TMH 1
The results reported relate only to the sample tested
Further use of the above information is not the responsibility or liability of Roadlab Prehab JV (Pty)Ltd.
Documents may only be reproduced or published in their full context
Dry density reported to 1kg/m^3

Compiled by: Mareze Lategan

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Civil Engineering Materials Laboratory
PREHAB JV

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Bellville · Bloemfontein · Mosselbaai · Postmasburg · Pretoria · Sishen · Upington · Kimberley · Springbok

CLIENT: IngenAIX GmbH
Schurzelter Str 27, 52074 Aachen
Germany
-

ATTENTION: Marc Schmits-Lapainer

PROJECT: Steenkampspan Project

DATE TESTED: 22/09/2014

MoD CBR IND pH EC

SAMPLE No.		U3848	U3850	U3852	U3854
CONTAINER USED FOR SAMPLING		Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags
SIZE / WEIGHT OF SAMPLE		±70kg	±70kg	±70kg	±70kg
MOISTURE CONDITION OFSAMPLE ON ARRIVAL		Moist	Moist	Moist	Moist
HOLE No. / Km. / CHAINAGE		TP 6	TP 8	TP 10	TP 12
ROAD No. OR NAME		Borrow Pit	Borrow Pit	Borrow Pit	Borrow Pit
LAYER TESTED / SAMPLED FROM		0-300	0-600	0-500	0-400
DATE SAMPLED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
DATE RECEIVED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
CLIENTS MARKING					
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete	Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone
		GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a))			
	75,0			100	
SIEVE	63,0	100	100	90	100
	53,0	84	94	81	91
	37,5	69	74	71	76
ANA -	26,5	61	63	65	70
	19,0	54	55	59	64
	13,2	47	49	55	59
LYSIS	4,75	42	40	48	51
(mm)	2,00	40	39	46	47
(TMH A1a)	0,425	38	36	44	43
	0,075	7,3	3,8	6,2	7,0
		pH & Conductivity (TMH1 1986 : METHOD A20 & A21T)			
pH # **(A20)**				8,10	
Conductivity # **(A21 T)**				0,03	
		ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)			
ATTERBERG	LL%	0	0	0	0
LIMITS	P.I.	0	0	0	0
(TMH A2&A3)	LS%	0,0	0,0	0,0	0,0
GM		2,15	2,21	2,04	2,03
CLASSIFI - CATION	H.R.B.	A-1-b	A-1-b	A-1-b	A-1-b
	COLTO				
	T.R.H. 14	G5	G5	G5	G5
		MDD AASHTO & OMC%; CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)			
MOD AASHTO **(TMH A7)**	OMC%	6,8	6,6	8,1	6,4
	MDD(KG/M^3)	2045	2044	2023	2008
COMP MC		7,4	6,8	8,2	6,6
C.B.R.	% SWELL	0,02	0,02	0,02	0,02
	100%	171	103	66	84
U.C.S.	98%	150	89	61	74
(TMH A13T)	97%	140	83	59	70
C.B.R.	95%	119	69	54	61
(TMH A8)	93%	96	51	50	54
	90%	61	26	44	45
COMPACTION (100%) : ITS (kPa)		Ave:	Ave:	Ave:	Ave:
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE				
TEST TYPE		MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC
SAMPLED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
DELIVERED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
SAMPLED ACCORDING TO		TMH5	TMH5	TMH5	TMH5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Warm	Warm	Warm	Warm
REMARKS & NOTES					

Kind Regards

Roelof Lategan
Technical Signatory

Remarks :

The samples were subjected to analysis according to TMH 1

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Compiled By: E. Mostert

Approved By: E. Mostert

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ATTENTION:	Marc Schmits-Lapainer	**Cell:**	-

TEST REPORT

PROJECT	Steenkampspan Project
CLIENT REFERENCE	-
JOB No:	2381
ORDER No:	Steenkampspan
DATE	08/10/2014
Sampled By	Petrus Burger
Date Sampled	22/09/2014
Date Received	22/09/2014
Sampling Method	TMH5
Test Method	TMH1
Road / Structure	-
Section	-
Layer	-
TEST TYPE	MoD CBR IND pH EC
Sampled By	Roadlab Prehab JV Upington
Delivered By	Roadlab Prehab JV Upington
Temp. ˚C inside Laboratory	-
Laboratory Tester	Puma Twalo
Environmental Condition	Warm
REMARKS & NOTES by Lab	-
Number of pages	2

Client Instructions

NONE SPECIFIED

Accreditaion No: Test Method not Accredited

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Technical Signatory

Remarks :

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Dry density reported to 1kg/m^3

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Schurzelter Str 27, 52074 Aachen
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-

ATTENTION: Marc Schmits-Lapainer

PROJECT: Steenkampspan Project

DATE TESTED: 22/09/2014

MoD CBR IND pH EC

SAMPLE No.		U3854	U3856	U3857	U3858
CONTAINER USED FOR SAMPLING		Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags
SIZE / WEIGHT OF SAMPLE		±70kg	±70kg	±70kg	±70kg
MOISTURE CONDITION OFSAMPLE ON ARRIVAL		Moist	Moist	Moist	Moist
HOLE No. / Km. / CHAINAGE		TP 13	TP 14	TP 15	TP 16
ROAD No. OR NAME		Borrow Pit	Borrow Pit	Borrow Pit	Borrow Pit
LAYER TESTED / SAMPLED FROM		0-600	0-600	0-400	100-600
DATE SAMPLED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
DATE RECEIVED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
CLIENTS MARKING					
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone
		GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a))			
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75,0		89		
	63,0	100	89		
	53,0	94	85	100	100
	37,5	82	73	91	83
	26,5	71	67	86	64
	19,0	66	61	78	54
	13,2	61	54	70	50
	4,75	56	48	62	45
	2,00	54	46	61	44
	0,425	51	43	58	41
	0,075	7,7	9,1	8,2	8,6
		pH & Conductivity (TMH1 1986 : METHOD A20 & A21T)			
pH # **(A20)**					
Conductivity # **(A21 T)**					
		ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)			
ATTERBERG LIMITS **(TMH A2&A3)**	LL%	0	0	0	0
	P.I.	0	0	0	0
	LS%	0,0	0,0	0,0	0,0
GM		1,87	2,02	1,73	2,06
CLASSIFI - CATION	H.R.B.	A-3	A-1-b	A-3	A-1-b
	COLTO				
	T.R.H. 14	G5	G5	G5	G5
		MDD AASHTO & OMC%; CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)			
MOD AASHTO **(TMH A7)**	OMC%	5,7	7,3	7,3	7,2
	MDD(KG/M^3)	2088	2084	1996	1952
COMP MC		5,9	7,2	7,4	7,2
C.B.R.	% SWELL	0,03	0,03	0,03	0,03
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	103	108	75	101
	98%	82	100	71	85
	97%	72	95	69	78
	95%	53	87	62	64
	93%	37	72	47	57
	90%	13	49	24	48
COMPACTION (100%) : ITS (kPa)		Ave:	Ave:	Ave:	Ave:
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE				
TEST TYPE		MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC
SAMPLED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
DELIVERED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
SAMPLED ACCORDING TO		TMH5	TMH5	TMH5	TMH5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Warm	Warm	Warm	Warm
REMARKS & NOTES					

Kind Regards

Roelof Lategan
Technical Signatory

Remarks :

The samples were subjected to analysis according to TMH 1

The results reported relate only to the sample tested

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ATTENTION:	Marc Schmits-Lapainer	**Cell:**	-

TEST REPORT

PROJECT	Steenkampspan Project
CLIENT REFERENCE	-
JOB No:	2381
ORDER No:	Steenkampspan
DATE	08/10/2014
Sampled By	Petrus Burger
Date Sampled	22/09/2014
Date Received	22/09/2014
Sampling Method	TMH5
Test Method	TMH1
Road / Structure	-
Section	-
Layer	-
TEST TYPE	MoD CBR IND pH EC
Sampled By	Roadlab Prehab JV Upington
Delivered By	Roadlab Prehab JV Upington
Temp. ˚C inside Laboratory	-
Laboratory Tester	Puma Twalo
Environmental Condition	Warm
REMARKS & NOTES by Lab	-
Number of pages	2

Client Instructions

NONE SPECIFIED

Accreditaion No: Test Method not Accredited

Roelof Lategan
Technical Signatory

Remarks :

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Dry density reported to 1kg/m^3

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ATTENTION: Marc Schmits-Lapainer

PROJECT: Steenkampspan Project

DATE TESTED: 22/09/2014

MoD CBR IND pH EC

SAMPLE No.		U3859	U3861	U3864	U3866
CONTAINER USED FOR SAMPLING		Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags	Plastic Sampling Bags
SIZE / WEIGHT OF SAMPLE		±70kg	±70kg	±70kg	±70kg
MOISTURE CONDITION OFSAMPLE ON ARRIVAL		Moist	Moist	Moist	Moist
HOLE No. / Km. / CHAINAGE		TP 17	TP 19	TP 22	TP 24
ROAD No. OR NAME		Borrow Pit	Borrow Pit	Borrow Pit	Borrow Pit
LAYER TESTED / SAMPLED FROM		600-1100	0-400	100-800	0-400
DATE SAMPLED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
DATE RECEIVED		22/09/2014	22/09/2014	22/09/2014	22/09/2014
CLIENTS MARKING					
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Reddish Brown Silty Sand Mix Calcrete	Light Brown Silty Sand Mix Calcrete Stone	Light Brown Silty Sand Mix Calcrete Stone	Light Reddish Orange Silty Sand Mix Calcrete
		GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a))			
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75,0	90			100
	63,0	90	100	100	84
	53,0	90	90	86	75
	37,5	81	77	77	71
	26,5	71	67	65	62
	19,0	68	60	60	55
	13,2	66	54	56	47
	4,75	64	44	51	34
	2,00	63	43	50	31
	0,425	59	41	48	28
	0,075	2,4	8,4	5,5	5,0
		pH & Conductivity (TMH1 1986 : METHOD A20 & A21T)			
pH # **(A20)**			7,80		
Conductivity # **(A21 T)**			0,03		
		ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)			
ATTERBERG LIMITS **(TMH A2&A3)**	LL%	0	0	0	0
	P.I.	0	0	0	0
	LS%	0,0	0,0	0,0	0,0
GM		1,76	2,08	1,97	2,36
CLASSIFI - CATION	H.R.B.	A-3	A-1-b	A-1-b	A-1-a
	COLTO				
	T.R.H. 14	G9	G5	G5	G5
		MDD AASHTO & OMC%; CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)			
MOD AASHTO **(TMH A7)**	OMC%	6,6	7,2	7,5	8,3
	MDD(KG/M^3)	1994	2021	2001	2091
COMP MC		6,8	7,2	7,6	8,1
C.B.R.	% SWELL	0,03	0,02	0,02	0,03
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	61	123	107	143
	98%	41	109	94	122
	97%	31	101	87	112
	95%	14	88	75	93
	93%	12	78	70	92
	90%	9	62	63	90
COMPACTION (100%) : ITS (kPa)		Ave:	Ave:	Ave:	Ave:
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE				
TEST TYPE		MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC	MoD CBR IND pH EC
SAMPLED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
DELIVERED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington	Roadlab Prehab JV Upington
SAMPLED ACCORDING TO		TMH5	TMH5	TMH5	TMH5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Warm	Warm	Warm	Warm
REMARKS & NOTES					

Kind Regards

Roelof Lategan
Technical Signatory

Remarks :

The samples were subjected to analysis according to TMH 1

The results reported relate only to the sample tested

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Compiled By: E. Mostert

Approved By: E. Mostert

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TEST REPORT

PROJECT	Steenkampspan Project
CLIENT REFERENCE	-
JOB No:	2381
ORDER No:	Steenkampspan
DATE	08/10/2014
Sampled By	Petrus Burger
Date Sampled	22/09/2014
Date Received	22/09/2014
Sampling Method	TMH5
Test Method	TMH1
Road / Structure	-
Section	-
Layer	-
TEST TYPE	MoD CBR IND pH EC
Sampled By	Roadlab Prehab JV Upington
Delivered By	Roadlab Prehab JV Upington
Temp. ˚C inside Laboratory	-
Laboratory Tester	Puma Twalo
Environmental Condition	Warm
REMARKS & NOTES by Lab	-
Number of pages	2

Client Instructions

NONE SPECIFIED

Accreditaion No: Test Method not Accredited

Roelof Lategan
Technical Signatory

Remarks :

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Dry density reported to 1kg/m^3

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ATTENTION: Marc Schmits-Lapainer

PROJECT: Steenkampspan Project

DATE TESTED: 22/09/2014

MoD CBR IND pH EC

SAMPLE No.		U3849	U3895		
CONTAINER USED FOR SAMPLING		Plastic Sampling Bags	Plastic Sampling Bags		
SIZE / WEIGHT OF SAMPLE		±70kg	±70kg		
MOISTURE CONDITION OFSAMPLE ON ARRIVAL		Moist	Moist		
HOLE No. / Km. / CHAINAGE		TP 92	TP 95		
ROAD No. OR NAME		Borrow Pit	Borrow Pit		
LAYER TESTED / SAMPLED FROM		0-400	0-400		
DATE SAMPLED		22/09/2014	22/09/2014		
DATE RECEIVED		22/09/2014	22/09/2014		
CLIENTS MARKING					
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Light Brown Silty Sand Mix Calcrete	Light Reddish Orange Silty Sand Mix Calcrete		
		GRADING ANALYSIS - % PASSING SIEVES (TMH1 1986 : METHOD A1 (a))			
SIEVE ANA - LYSIS (mm) **(TMH A1a)**	75,0	100			
	63,0	92	100		
	53,0	87	86		
	37,5	78	76		
	26,5	70	72		
	19,0	63	68		
	13,2	59	66		
	4,75	51	61		
	2,00	49	60		
	0,425	46	51		
	0,075	7,7	4,0		
		pH & Conductivity (TMH1 1986 : METHOD A20 & A21T)			
pH # **(A20)**			8,30		
Conductivity # **(A21 T)**			0,02 mS/cm		
		ATTERBERG LIMITS ANALYSIS (TMH1 1986 : METHOD A2 & A3 ; TMH1 1986; TMHA4 1974)			
ATTERBERG LIMITS **(TMH A2&A3)**	LL%	0	0		
	P.I.	0	0		
	LS%	0,0	0,0		
GM		1,97	1,85		
CLASSIFI - CATION	H.R.B.	A-1-b	A-3		
	COLTO				
	T.R.H. 14	G6	G6		
		MDD AASHTO & OMC%; CALIFORNIA BEARING RATIO (TMH1 1986 : METHOD A7 & A8)			
MOD AASHTO **(TMH A7)**	OMC%	7,1	7,6		
	MDD(KG/M^3)	1968	1939		
COMP MC		6,9	7,7		
C.B.R.	% SWELL	0,02	0,03		
U.C.S. **(TMH A13T)** C.B.R. **(TMH A8)**	100%	78	71		
	98%	61	58		
	97%	52	52		
	95%	36	39		
	93%	29	30		
	90%	19	16		
COMPACTION (100%) : ITS (kPa)		Ave:	Ave:	Ave:	Ave:
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE				
TEST TYPE		MoD CBR IND pH EC	MoD CBR IND pH EC		
SAMPLED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington		
DELIVERED BY		Roadlab Prehab JV Upington	Roadlab Prehab JV Upington		
SAMPLED ACCORDING TO		TMH5	TMH5		
ENVIRONMENTAL CONDITION WHEN SAMPLED		Warm	Warm		
REMARKS & NOTES					

Kind Regards

Roelof Lategan
Technical Signatory

Remarks :

The samples were subjected to analysis according to TMH 1

The results reported relate only to the sample tested

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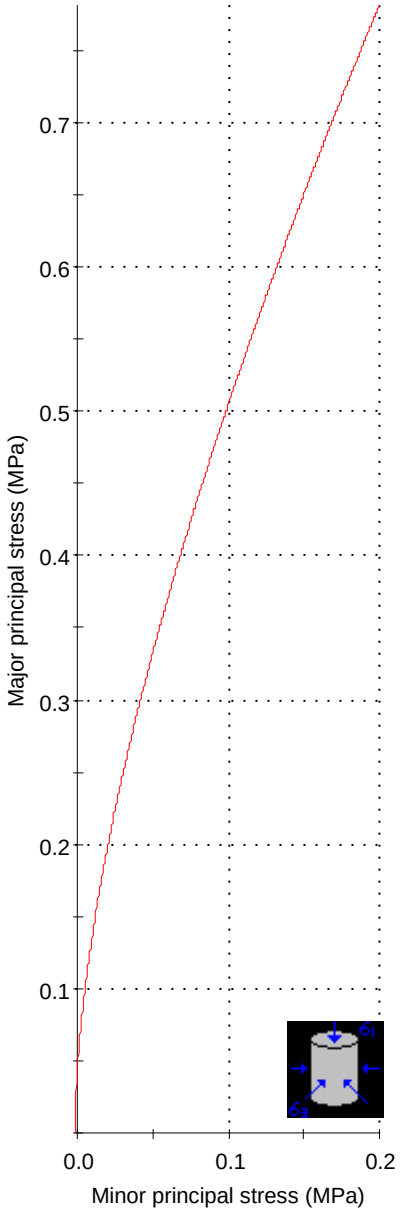
Compiled By: E. Mostert

Approved By: E. Mostert

APPENDIX F
ROCLAB ANALYSIS RESULTS

Analysis of Rock Strength using RocLab

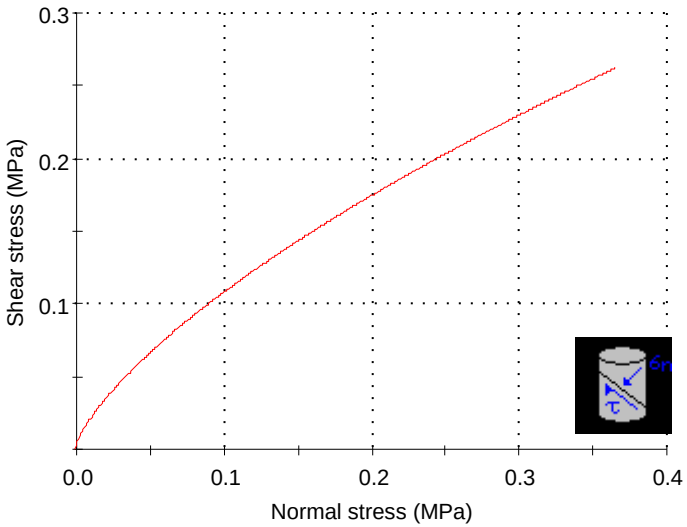


Hoek-Brown Classification
intact uniaxial comp. strength (sigci) = 3 MPa
GSI = 27 mi = 9 Disturbance factor (D) = 0
intact modulus (Ei) = 2700 MPa
modulus ratio (MR) = 900

Hoek-Brown Criterion
mb = 0.664 s = 0.0003 a = 0.527

Mohr-Coulomb Fit
cohesion = 0.040 MPa friction angle = 32.82 deg

Rock Mass Parameters
tensile strength = -0.001 MPa
uniaxial compressive strength = 0.042 MPa
global strength = 0.287 MPa
deformation modulus = 182.05 MPa



APPENDIX G
SETTLEMENT CALCULATIONS

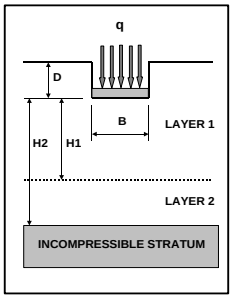
ARQ GEOTECHNICAL CALCULATION SHEET

AVERAGE ELASTIC SETTLEMENT CALCULATION

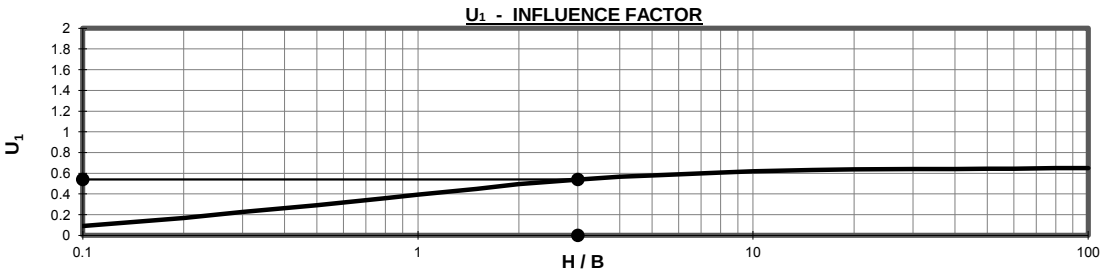
ARQ Project name & no:	7345 MBSA High Speed Proving Ground - Track overpass				
Description:	Elastic settlement predictions for bridge piers				
Client Project No:	19606			Page no.	1 of 1
Calculations by:	*Hannes Taljaard*	Checked By:	*Alan Parrock*	Date:	2015/08/13

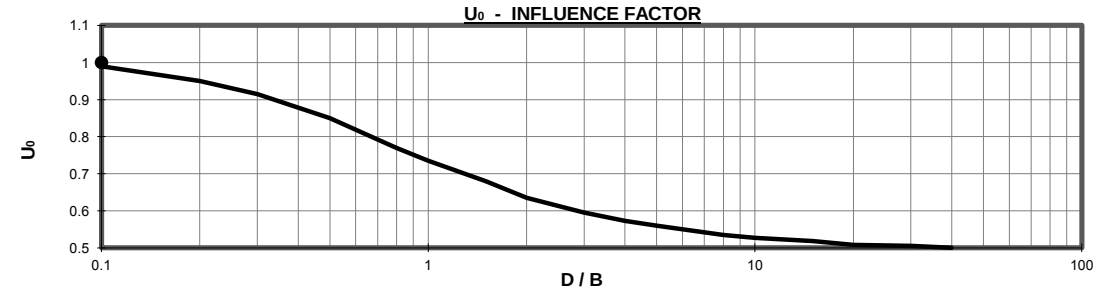
PREDICTION OF THE AVERAGE ELASTIC SETTLEMENT OF A SQUARE FOOTING

INPUT PARAMETER	LAYER 1	LAYER 2	UNIT
FOUNDING DEPTH (D)	0.0	-	m
WIDTH OF THE FOOTING (B)	2.50	-	m
DEPTH OF LAYER (H_1, H_2)	8	-	m
STIFFNESS OF COMPRESSIBLE STRATUM	182	-	MPa
FOUNDATION PRESSURE (q)	400.0	-	kPa
H / B	3.00	-	
D / B	0.00	-	
U_1 - INFLUENCE FACTOR	0.54	-	
U_0 - INFLUENCE FACTOR	1.00	-	
	2.97	-	
TOTAL IMMEDIATE SETTLEMENT PREDICTED		**3.0**	**mm**



*** - *After Janbu, Bjerrum and Kjaernsli*





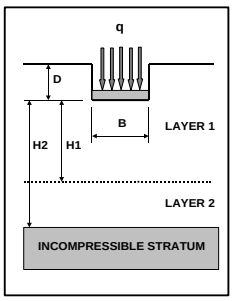
ARQ GEOTECHNICAL CALCULATION SHEET

AVERAGE ELASTIC SETTLEMENT CALCULATION

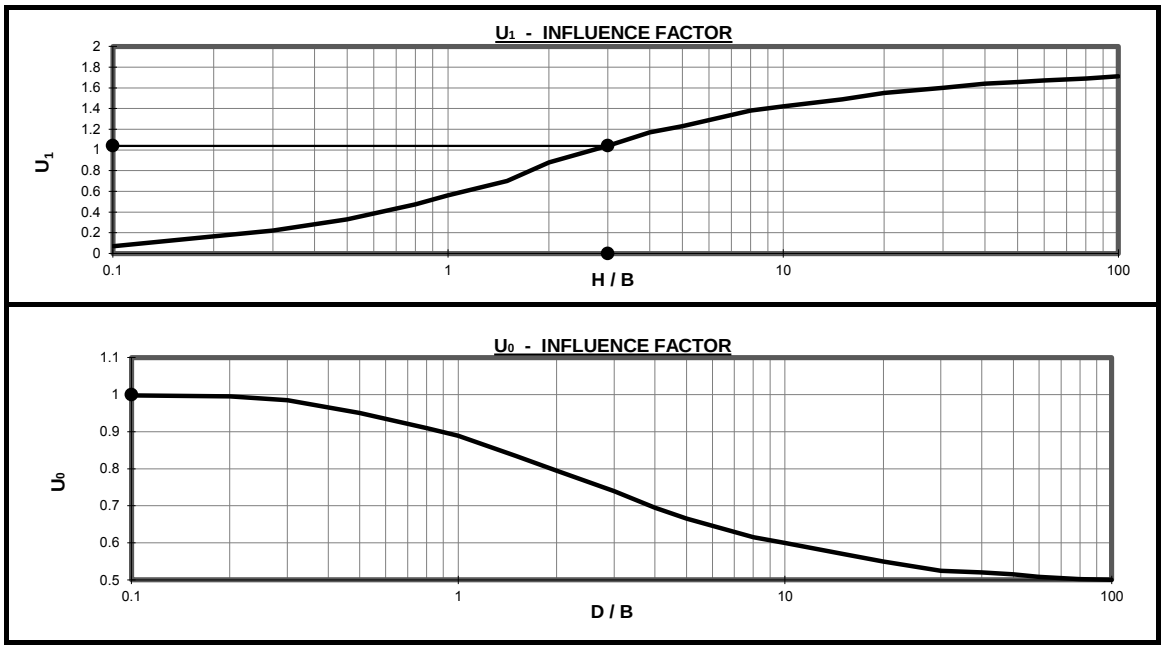
ARQ Project name & no:	7345 MBSA High Speed Proving Ground - Track overpass				
Description:	Elastic settlement predictions for bridge abutments				
Client Project No:	19606			Page no.	1 of 1
Calculations by:	*Hannes Taljaard*	Checked By:	*Alan Parrock*	Date:	2015/08/13

PREDICTION OF THE AVERAGE ELASTIC SETTLEMENT OF A STRIP FOOTING

INPUT PARAMETER	LAYER 1	LAYER 2	UNIT
FOUNDING DEPTH (D)	0.0	-	m
WIDTH OF THE FOOTING (B)	2.00	-	m
DEPTH OF LAYER (H_1, H_2)	6	-	m
STIFFNESS OF COMPRESSIBLE STRATUM	182	-	MPa
FOUNDATION PRESSURE (q)	400.0	-	kPa
H / B	3.00	-	
D / B	0.00	-	
U_1 - INFLUENCE FACTOR	1.04	-	
U_0 - INFLUENCE FACTOR	1.00	-	
	4.57	-	
TOTAL IMMEDIATE SETTLEMENT PREDICTED		**4.6**	**mm**



**** - After Janbu, Bjerrum and Kjaernsli for L/D <10 only*



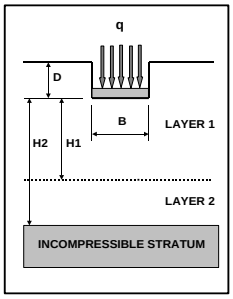
ARQ GEOTECHNICAL CALCULATION SHEET

AVERAGE ELASTIC SETTLEMENT CALCULATION

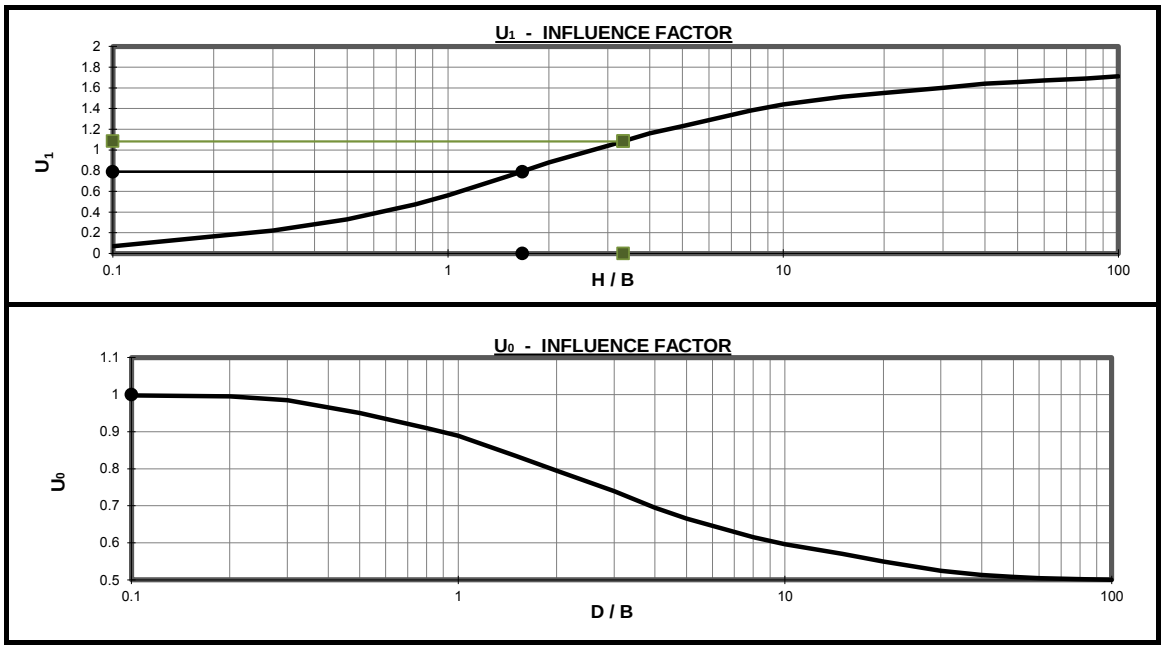
ARQ Project name & no:	7345 MBSA High Speed Proving Ground - Buildings				
Description:	Elastic settlement predictions for buildings				
Client Project No:	19606			Page no.	1 of 1
Calculations by:	*Hannes Taljaard*	Checked By:	*Alan Parrock*	Date:	2015/08/13

PREDICTION OF THE AVERAGE ELASTIC SETTLEMENT OF A STRIP FOOTING

INPUT PARAMETER	LAYER 1	LAYER 2	UNIT
FOUNDING DEPTH (D)	0.0	0.0	m
WIDTH OF THE FOOTING (B)	0.60	0.6	m
DEPTH OF LAYER (H_1, H_2)	1	2	m
STIFFNESS OF COMPRESSIBLE STRATUM	50	15	MPa
FOUNDATION PRESSURE (q)	100.0	100.0	kPa
H / B	1.67	3.33	
D / B	0.00	0.00	
U_1 - INFLUENCE FACTOR	0.79	1.08	
U_0 - INFLUENCE FACTOR	1.00	1.00	
	1.00	1.00	
TOTAL IMMEDIATE SETTLEMENT PREDICTED		**2.00**	**mm**



*** - *After Janbu, Bjerrum and Kjaernsli*



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