CG Holdings Belgium NV
Systems Division

Antwerpsesteenweg 167, B-2800 Mechelen Tel.: +32(0)15/283 33 Fax: +32(0)15/283 491 www.cgglobal.com

Client:	**Republic of Kenya – Ministry of Energy**
Project Name:	**Nanyuki - Isiolo - Meru Electrification Project**
Contract Number:	MOE-P4-2011

Document Title: **GEOTECHNICAL REPORT POWERLINE**

Project Number: 100008
Document Number: 100008-L0-RE-CW01
Revision: 01

This document contains the following:

No.	Vendor Document number	Vendor Rev.	Description	Pages
1	n/a	n/a	Geotechnical report	486

Rev.	dd/mm/yyyy	Description	Created	Checked	Approved
01	12/04/2013	First issue	TERRAGIS	TERRAGIS	RCAV

GEOPHYSICAL & GEOTECHNICAL REPORT

NANYUKI –ISIOLO –MERU POWERLINE

This geotechnical report presents our result for geotechnical & geophysical investigations carried out at the proposed Nanyuki –Isiolo –Meru powerline.

The field study was carried out in the months of February/March 2013. The weather at the time of the investigation was characterized by dry spell with mild rainfall experienced in some days.

Trial pits were excavated in all the 39 angle points as provided by the client. Our field geologist accompanied the client's survey team during setting out and pegging of the powerline to execute a geological reconnaissance. The data gathered was used to locate the trial pit test location in-between the angle points as well as the geophysical sounding locations.

The purpose of the investigation was to gather subsurface data at the site to facilitate in the design of the substructures and establish other engineering parameters relevant to other auxiliary work. This would determine the most appropriate foundation type, depth and size for the proposed structures. Details of the onsite works, laboratory tests and analysis are given in the following sections of this report.

This report contains both the geophysical results and the soil testing results.

It also has two appendices, one for geophysical data sheets and the other for laboratory test Sheets.

GEOTECHINCAL INVESTIGATION

1. INTRODUCTION

This report presents our result for geotechnical soil investigations carried out at the proposed Nanyuki–Isiolo-Meru powerline. The purpose of the investigation was to gather subsurface data at the site to facilitate in the design of the substructures and establish other engineering parameters relevant to other auxiliary work. This would determine the most appropriate foundation type, depth and size for the proposed structures. Details of the onsite works, laboratory tests and analysis are given in the following sections of this report.

1.1 SCOPE OF WORKS

The extent of the investigation as per our contract required us to carry out the following tasks;

- Geotechnical investigation along the powerline
- Laboratory soil testing and analysis.
- Preparation of Geotechnical report

The work involved the following:

- ❖ Excavation of eighty nine Trial pits.
- ❖ Soil Sample Collection of undisturbed U_{100} core cutter and undisturbed bag samples where feasible.
- ❖ Logging of all the trial pits including monitoring of the ground water regime whenever encountered.
- ❖ Carry out conclusive relevant laboratory test on the recovered samples.
- ❖ Preparation of a geotechnical report after analysis of the test results.

All the field work was carried out according to BS 5930 (Code of Practice for site investigations). Whereas laboratory testing was done in accordance to British Standard (BS 1377) and the American Society for Testing Material, (ASTM) designated to 2938 – 39.

2. SITE DESCRIPTION

2.1 Location & Accessibility

The investigated powerline area is approximately 100 km long from Nanyuki town via Isiolo up to Meru. The powerline is within a corridor of approximately 5km of the main tarmac road from Nanyuki to Isiolo to Meru (via Ruiri).
The corridor is considered fairly accessible throughout the powerline especially during dry season.

2.2 Soils

The project area is characterized by shallow red soils in most part of the line. Pockets of black cotton soil are present in a few areas specifically near Nanyuki town, and some section between MN 29 and MN 32. The engineering properties of this black cotton soils together with the other soil types in the project are considered favorable.

3. GENERAL GEOLOGY

The investigated area lies on Pleistocene to Miocene volcanic material overlying the Basement rocks at greater depth. The geology of the project site has been discussed in details at the section on geophysical survey. In general the powerline will be underlain by very stable rock stratum that is present throughout the entire powerline. This stratum was determined to be very near surface in all parts of the line, in some sections around Isiolo substation the bedrock outcrops are visible on the surface.

4. FIELD WORK

A visit was made to the site by our Field geologists and senior laboratory Technologist in the company of the client's representative, whereby 88 trial pits were excavated at selected points along the powerline to depths in the order of maximum 3.0 meters or hard stratum whichever is earlier, using picks and shovels. Soil samples were collected at depth indicated in the attached datasheets. The material encountered mostly comprise of clayey and silty SAND with gravel but with pockets of sandy lean CLAY to sandy SILT to GRAVEL with silt/clay and sand. The exercise followed guidelines outlined in BS 5930: 1999 - The Code of Practice for Site Investigations.

4.1 SAFETY

Standard safety equipment was issued to the staff on site including overalls, safety boots and helmets.

4.2 SAMPLING

Disturbed bulk bag samples were taken from selected trial pits depth where best laboratory sample was recoverable and put in polythene bags then secured by double tying the mouth. A label was inserted between the two string knots. Undisturbed soil sample and insitu density was also undertaken whenever feasible at site. Further excavation was carried out where ground conditions allowed to check for any stratigraphical change. We note that no noticeable stratigraphical changes were observed below the test depth in all the trail pits.

4.3 LABORATORY TESTS

Recovered undisturbed soil samples and the bulk samples were transported to our laboratories and subjected to testing in accordance with the Client's instructions.
The test methods and the results obtained are presented in the following section of this report.

4.4 Classification Tests

The test results indicate presence of silty and clayey SAND. Atterberg's Limit results are consistent with the soil classification as set out in BS 5930: Site Investigations. Results of this test have been attached in Appendix of this report for reference.

4.5 Chemical Analysis

This was undertaken in order to establish the presence of harmful levels chemicals, especially to buried concrete. The testing regime outlined in BS 1377-5: 1990 was adopted with the aim of establishing these properties. These results have been presented in the Appendix.

4.6 Dry Density/Moisture Content Relationship

The soil samples recovered at the test locations were subjected to testing in accordance with procedures described BS 1377-4: 1990. The objective of this test was to establish the maximum dry density, optimum moisture content of the material at the investigation depths.
Sub-samples for testing were obtained by reduction of the bulk samples to representative fractions sufficient for testing. Thereafter, the sub-samples were subjected to compaction in a standard mould using a 2.5 kg hammer, at incremental moisture contents. Results of this test have been presented in the Appendix of this report.

5. CONCLUSION AND RECOMMENDATIONS

Soils encountered during the investigations showed variation in properties. From a review of data presented, it can be seen that the material mostly comprise of clayey and silty SAND with gravel but with pockets of sandy lean CLAY to sandy SILT to GRAVEL with silt/clay and sand.

Laboratory tests carried out in all the samples collected from all the test location indicate that these soils have safe ground bearing values at the test depth ranging from **165kPa to 368kPa**, and Plasticity Indices values in the order of 12% to 25%.

Because of the substantial variance, for design purposes, the specific safe bearing capacity at all angle point has been provided and should be adopted. Similarly specific bearing capacity at selected representative points along the line has also been provided and should be adopted, keeping all excavations free from general water. Note that a safety factor of three has already been factored in.

See *table 1* below showing the safe bearing capacity at all the test locations. *Table 2* below shows the unconfined compressive strength of rocks encountered at the named test locations.

During trial pit excavation, hard strata was encountered very near the surface, dynamic cone penetrometer test carried out at the angle points encountered boulders and packed gravel that inhibited penetration, similarly hard and shovel excavation was Limited by occurrence of hard ground, boulders and gravel as well as bedrock. The ground bearing capacity increases substantially with increase in depth as revealed by the geophysical investigations. We recommend use of machinery to excavate the foundations to the desired depth.

The chemical tests on the soil samples show no harmful concentrations. It is recommended however that the concrete to be used in this project be designed to withstand Moderate Conditions of Exposure; these should include minimum cover to reinforcement being 50mm, maximum free water/cement ratio being 0.5, and minimum cement content of 350kg/m3 for Portland Pozzolana Cement (PPC) and 320kg/m3 for Ordinary Portland Cement (OPC).

Considering the typical layout of structures for such installations, and the soil properties encountered therein, it is our recommendation to have normal foundation levels. Therefore the preferred foundation types for the above structures would be PAD and RAFT.

Table 1: Safe bearing capacity at all test locations ***(kPa) (<u>safety factor 3 has been adopted</u>)***

Angle point	SEGMENT	Trial Pit	Bearing Capacity
MN 1			230
MN 2			229
	MN 1-2		
	MN2-3	TP2-3	230
MN 3			337
	MN3-4	TP3-4A	229
		TP3-4B	337
MN 4			229
	MN4-5		
MN 5			314
	MN5-6		
MN 6			316
	MN6-7	TP6-7A	229
		TP6-7B	314
MN7			319
	MN7-8	TP7-8A	318
		TP7-8B	319
MN8			233
	MN8-9	TP8-9A	233
		TP8-9B	214
MN9			214
	MN9-10	TP9-10	
MN10			237
	MN10-11	TP10-11	237
MN11			218
	MN11-12	TP11-12A	218
		TP11-12B	
		TP11-12C	242
MN12			280
	MN12-13	TP12-13A	232
		TP12-13B	
MN13			242
	MN13-14		
MN14			232
	MN14-15	TP14-15A	254
		TP14-15B	214
MN15			254
	MN15-16		
MN16			214
	MN16-17	TP16-17A	
		TP16-17B	215
MN17			215
	MN17-18	TP17-18A	232
		TP17-18B	236
		TP17-18C	202
		TP17-18D	218
MN18			232
	MN18-19	TP18-19A	368
		TP18-19B	235

Angle point	SEGMENT	Trial Pit	Bearing Capacity
MN19			236
	MN19-20	TP19-20	263
MN20			202
	MN20-21	TP20-21	
MN21			218
	MN21-22	TP21-22	
MN22			368
	MN22-23	TP22-23A	283
		TP22-23B	
MN23			235
	MN23-24	TP23-24A	
		TP23-24B	
MN24			263
	MN24-25	TP24-25	
MN25			283
	MN25-26		
MN26			325
	MN26-27	TP26-27A	
		TP26-27B	
MN27			168
	MN27-28	TP27-28	325
MN28			255
	MN28-29	TP28-29	
MN29			353
	MN29-30	TP29-30A	
		TP29-30B	
		TP29-30C	
MN30			295
	MN30-31	TP30-31	
MN31			259
	MN31-32	TP31-32A	168
		TP31-32B	
MN32			235
	MN32-33	TP32-33	255
MN33			317
	MN33-34	TP33-34A	
		TP33-34B	
		TP33-34C	353
MN34			362
	MN34-35		
MN35			265
	MN35-36		
MN36			171
	MN36-37	TP36-37	295
MN37			185
	MN37-38	TP37-38	259
MN38			218
	MN38-39	TP38-39	151
MN39			236

Table 2: unconfined compressive strength of rocks

UNCONFINED COMPRESSIVE STRENGTH OF ROCK

ASTM D7102

B H NO:	Depth (m)	Height of Specimen (mm)	Area of Specimen (mm)	Mass of Specimen (g)	Density (kg/m^3)	Load at Faiure (kN)	Compressive Strength (N/mm2)	Remarks
MN 12(TP12-13B)MN 13	1.0M	50	2500	287	2296	100.0	**40.0**	**DRY**
		50	2500	285	2280	95.0	**38.0**	
		50	2500	289	2312	105.0	**42.0**	
		50	2500	294	2352	75.0	**30.0**	**SOAKED**
		50	2500	296	2368	85.0	**34.0**	
		50	2500	293	2344	70.0	**28.0**	
MN 16(TP16-17A)MN 17	1.0M	50	2500	276	2208	80.0	**32.0**	**DRY**
		50	2500	273	2184	70.0	**28.0**	
		50	2500	275	2200	60.0	**24.0**	
		50	2500	279	2232	55.0	**22.0**	**SOAKED**
		50	2500	280	2240	40.0	**16.0**	
		50	2500	283	2264	50.0	**20.0**	

B H NO:	Depth (m)	Height of Specimen (mm)	Area of Specimen (mm)	Mass of Specimen (g)	Density (kg/m^3)	Load at Faiure (kN)	Compressive Strength (N/mm2)	Remarks
MN 20(TP20-21)MN 21	1.0M	50	2500	300	2400	77.5	**31.0**	**DRY**
		50	2500	304	2432	75.0	**30.0**	
		50	2500	306	2448	70.0	**28.0**	
		50	2500	310	2480	56.3	**22.5**	**SOAKED**
		50	2500	309	2472	50.0	**20.0**	
		50	2500	312	2496	46.3	**18.5**	
MN 21(TP21-22)MN 22	1.9M	50	2500	309	2472	138.8	**55.5**	**DRY**
		50	2500	312	2496	132.5	**53.0**	
		50	2500	308	2464	125.0	**50.0**	
		50	2500	314	2512	116.3	**46.5**	**SOAKED**
		50	2500	313	2504	107.5	**43.0**	
		50	2500	316	2528	118.8	**47.5**	
MN 22(TP22-23B)MN 23	1.8M	50	2500	315	2520	151.3	**60.5**	**DRY**
		50	2500	317	2536	145.0	**58.0**	
		50	2500	318	2544	153.8	**61.5**	
		50	2500	320	2560	126.3	**50.5**	**SOAKED**
		50	2500	323	2584	135.0	**54.0**	
		50	2500	319	2552	140.0	**56.0**	
MN 23(TP23-24A)MN 24	1.2M	50	2500	290	2320	92.5	**37.0**	**DRY**
		50	2500	288	2304	86.3	**34.5**	
		50	2500	291	2328	97.5	**39.0**	
		50	2500	294	2352	67.5	**27.0**	**SOAKED**
		50	2500	297	2376	78.8	**31.5**	
		50	2500	296	2368	72.5	**29.0**	

B H NO:	Depth (m)	Height of Specimen (mm)	Area of Specimen (mm)	Mass of Specimen (g)	Density (kg/m^3)	Load at Faiure (kN)	Compressive Strength (N/mm2)	Remarks
MN 23(TP23-24B)MN 24	1.2M	50	2500	280	2240	90.0	**36.0**	**DRY**
		50	2500	283	2264	80.0	**32.0**	
		50	2500	279	2232	87.5	**35.0**	
		50	2500	286	2288	67.5	**27.0**	**SOAKED**
		50	2500	285	2280	65.0	**26.0**	
		50	2500	287	2296	57.5	**23.0**	
MN 24(TP24-25)MN 25	0.3M	50	2500	265	2120	102.5	**41.0**	**DRY**
		50	2500	260	2080	117.5	**47.0**	
		50	2500	263	2104	132.5	**53.0**	
		50	2500	271	2168	93.8	**37.5**	**SOAKED**
		50	2500	268	2144	82.5	**33.0**	
		50	2500	267	2136	95.0	**38.0**	

MN 26(TP26-27)MN 27	1.0M	50	2500	265	2120	87.5	**35.0**	**DRY**
		50	2500	260	2080	80.0	**32.0**	
		50	2500	263	2104	68.8	**27.5**	
		50	2500	271	2168	55.0	**22.0**	**SOAKED**
		50	2500	268	2144	46.3	**18.5**	
		50	2500	267	2136	57.5	**23.0**	
MN 28(TP28-29)MN 29	1.5M	50	2500	318	2544	162.5	**65.0**	**DRY**
		50	2500	316	2528	153.8	**61.5**	
		50	2500	319	2552	145.0	**58.0**	
		50	2500	320	2560	133.8	**53.5**	**SOAKED**
		50	2500	323	2584	140.0	**56.0**	
		50	2500	321	2568	128.8	**51.5**	

B H NO:	Depth (m)	Height of Specimen (mm)	Area of Specimen (mm)	Mass of Specimen (g)	Density (kg/m^3)	Load at Faiure (kN)	Compressive Strength (N/mm2)	Remarks
MN 29(TP29-30A)MN 30	0.8M	50	2500	281	2248	107.5	**43.0**	**DRY**
		50	2500	279	2232	98.8	**39.5**	
		50	2500	282	2256	87.5	**35.0**	
		50	2500	284	2272	70.0	**28.0**	**SOAKED**
		50	2500	283	2264	67.5	**27.0**	
		50	2500	286	2288	75.0	**30.0**	
MN 29(TP29-30B)MN 30	01.5M	50	2500	273	2184	120.0	**48.0**	**DRY**
		50	2500	277	2216	107.5	**43.0**	
		50	2500	275	2200	90.0	**36.0**	
		50	2500	281	2248	72.5	**29.0**	**SOAKED**
		50	2500	283	2264	83.8	**33.5**	
		50	2500	279	2232	67.5	**27.0**	
MN 29(TP29-30C)MN 30	1.2M	50	2500	254	2032	85.0	**34.0**	**DRY**
		50	2500	256	2048	97.5	**39.0**	
		50	2500	253	2024	105.0	**42.0**	
		50	2500	261	2088	62.5	**25.0**	**SOAKED**
		50	2500	260	2080	50.0	**20.0**	
		50	2500	259	2072	48.8	**19.5**	
MN 31(TP30-31)MN 31	1.5M	50	2500	298	2384	145.0	**58.0**	**DRY**
		50	2500	297	2376	125.0	**50.0**	
		50	2500	299	2392	115.0	**46.0**	
		50	2500	302	2416	81.3	**32.5**	**SOAKED**
		50	2500	304	2432	92.5	**37.0**	
		50	2500	301	2408	75.0	**30.0**	

B H NO:	Depth (m)	Height of Specimen (mm)	Area of Specimen (mm)	Mass of Specimen (g)	Density (kg/m^3)	Load at Faiure (kN)	Compressive Strength (N/mm2)	Remarks
MN 31(TP31-32B)MN 32	0.8M	50	2500	245	1960	51.3	**20.5**	**DRY**
		50	2500	248	1984	65.0	**26.0**	
		50	2500	251	2008	76.3	**30.5**	
		50	2500	256	2048	43.8	**17.5**	**SOAKED**
		50	2500	260	2080	35.0	**14.0**	
		50	2500	258	2064	41.3	**16.5**	
MN 33(TP33-34A)MN 34	1.2M	50	2500	310	2480	158.8	**63.5**	**DRY**
		50	2500	314	2512	142.5	**57.0**	
		50	2500	312	2496	152.5	**61.0**	
		50	2500	318	2544	132.5	**53.0**	**SOAKED**
		50	2500	316	2528	118.8	**47.5**	
		50	2500	319	2552	125.0	**50.0**	
MN 33(TP33-34B)MN 34	1.8M	50	2500	307	2456	148.8	**59.5**	**DRY**
		50	2500	305	2440	137.5	**55.0**	
		50	2500	308	2464	142.5	**57.0**	
		50	2500	311	2488	98.8	**39.5**	**SOAKED**
		50	2500	313	2504	102.5	**41.0**	
		50	2500	312	2496	107.5	**43.0**	

GEOPHYSICAL INVESTIGATION

Executive Summary

This section describes the results of geophysical site investigations on the proposed Nanyuki - Isiolo - Meru power line in Kenya.

Climate

The area exhibits varying climatic conditions which can be correlated with proximity to Mt. Kenya. Meru receives highest rainfall followed by Nanyuki and least rainfall is at the area near Isiolo substation. The areas on the lee ward side of Mt Kenya are arid to semi-arid with vegetation type varying with amount of rainfall received. The wind ward side of the mountain receives substantial rainfall with fertile soils for agricultural farming.

Geology

The geology is variable in the region, with volcanic rocks being predominant. The rocks in the area consist of
(i) *Precambrian Basement System ro*cks. And forms the floor upon which all other rocks rest. These rocks consist of schist, granulites and heterogeneous gneisses of varying composition. The basement system of rocks is not exposed in this area.
(ii) Tertiary to Recent Volcanic rocks, these are rocks formed from volcanic activity, erosion and deposition (Rocks of Mount Kenya volcanics and Recent Superficial deposits of soils laterites, ashes, younger moraines, glacial-fluvial deposits.)

The power line traverses through an area with variable geology raging from Tertiary to recent volcanic deposits to Precambrian Basement System. These Basalts are overlain by superficial deposits which are in turn overlain by black cotton soils and red soils depending on the area.

Geophysics

Geophysical measurements were executed at selected points along the line. The vertical electrical measurements were done by employing the Schlumbger array with the survey depth probing to a maximum depth of 50 m bgl

The close proximity of the potentials during investigation in the order of 1.0m enabled delineation of near surface stratigraphy which is highly relevant to the foundation depth of the pylons. Subsequent increment in potential distance enabled us to delineate stratigraphy up to 50m.

Conclusions

The top most layer has been observed to be thinnest at areas near Isiolo substation (angle point 19 all through to angle point 30. In some parts the bedrock is observed to outcrop above ground surface with other places the rocks are covered by a thin soil layer of less than one foot.

The top soil thickens as you approach Meru substation, similarly in the areas near Nanyuki substation and Kisima plantations the top soils layer is thicker than at Isiolo.

Measured ground Resistivity significantly increases with depth indicating hard rock near surface throughout the line. These high resistance rock strata are persistence throughout the power line. The high resistance strata is observed to be very near surface (above five meters bgl) We therefore conclude that there is a solid base rock near surface consistence with volcanic lava flows in the area.

Ground water table is below 50m below ground level in all test locations except at six test locations namely VES 20, VES 26, VES 28, VES 32, VES 35 and VES 41 where the water table is between 41 and 50 meters below the ground level as determined by electrical sounding. We therefore conclude that there is no risk of ground water table rise that would affect the foundations as proposed in the report.

No structural anomalies were identified throughout the line -sampling interval notwithstanding. We therefore conclude that no major considerations need to be factored-in the design.

TABLE OF CONTENTS

TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS: (NOTE: SI spellings used throughout).

EC	Electrical Conductivity (in micro Seimens/centimetre)
Km	Kilometres
M	Metres
M amsl	metres above mean sea level
m bgl	Metres below ground level
VES	Vertical Electrical Sounding

1. INTRODUCTION

This section describes the results of geophysical site investigations on proposed Nanyuki-Isiolo-Meru power line. The power line starts at Nanyuki substation though Isiolo substation (not constructed) and ends at the existing power substation at Meru. The distance along the line is approximately 100kms. The survey was carried out in the month of February and March 2013. A total of 44 electrical soundings were carried out throughout the line profile to determine the ground parameters necessary for the design of the power line.

1.1 Objectives of the study

The objective of the study was to evaluate the stratigraphy of the subsurface geology through measurements of the electrical resistance/resistivity properties of the underlying materials in order to enable optimal structural design of the towers. The study also investigated the near surface ground water regime along the line to aid the design engineer accordingly.

The investigation comprised a detailed desk study in which the available relevant geological and geophysical data were collected, analyzed, collated and evaluated within the context of the Client's requirements. This was followed by geological and geophysical field investigations, data acquisition, analysis and reporting. The data sources included information gathered from reports of previous geophysical and geological investigations in the area.

BACKGROUND INFORMATION

1.2 Location

The proposed power line is located in laikipia, Isiolo and Meru counties. The area lies between Easting 37.0591333 Northings 0.0002 at VES 1 and Easting 37.6840333, Northings 0.1097833 at Meru. The geology of the area is described in ''The Geology of the Meru - Isiolo Area'' by P. Mason (1953)

1.3 Climate

The area exhibits varying climates which is related with proximity to Mt. Kenya. Meru receives highest rainfall followed by Nanyuki and least rainfall is at the area near Isiolo substation. the areas on the lee ward side of Mt Kenya are arid to semi-arid with vegetation type varying with amount of rainfall received. The areas from angle point one to angle point 29 have similar climatic conditions as compared to the areas from angle point thirty to thirty nine at Meru substation.

1.4 Physiography

The area can be divided into two distinct physiographic units, the North western slopes of Mount Kenya and the Basement System terrain. Mount Kenya has a relatively flat profile and builds gradually up to its present elevation of 5680 m.

The Basement in this area has for the greater part been lowered well below the level of sub-miocene peniplain, now preserved intact only under eastern-most flows of the Mount Kenya series.

1.5 General Drainage

The drainage pattern in this area is determined chiefly by three factors:

- the direction of slope of Mount Kenya volcanic series
- the slope of the end-Tertiary peniplain
- the Basement System structures

2. GEOLOGY

The investigated area lies on Pleistocene to Miocene volcanic material overlying the Basement rocks at greater depth. Below we discuss the regional geology as well as the detailed assessment of the geology at the investigated area

Regional Geology

The rocks of the area fall naturally into two distinct groups, those very ancient constituting the Basement rocks and the rocks that are comparatively recent which include Tertiary and later volcanic plus the subordinate sediments. The geological history of the area can be traced through the following chief phases: -

Deposition of the Basement System

Metamorphism of the Basement System

Erosion between the Archean and the Tertiary period

Sub-Miocene peneplanation and Miocene sedimentation

Eruption of Mount Kenya

The End-tertiary peneplanation

The Pleistocene basalt eruptions

Middle and Upper Pleistocene erosion and deposition

The investigated areas are located on the northwestern side of Mount Kenya. Before the formation of the Mount Kenya the whole area was made up of Pre-Cambrian Basement System crystalline rocks of the Mozambique Belt. These very old rocks were laid down, metamorphosed, exposed and eroded and were in Pre- Tertiary times an 'ancient' land surface (OLS)

The formation of Mount Kenya was followed by extensive and widespread volcanic and wide spread volcanic activity throughout much of Kenya. In Meru central area this activity covered the Old Land Surfaces, and was characterized by periods of extrusive activity followed by periods of relative calm during which erosion by wind, water and glaciation occurred.

The Mount Kenya Suite in which the area under investigation falls is divided into two parts –the volcanics of the main eruptive episode, and the volcanics of the satellite vents. The former are mainly the volcanics erupted from the main vents that is now blocked, and the latter are volcanics erupted from satellite vents and from fissures of the main crater. The two periods of vulcanicity are separated by the consolidation of syenites and phonolites of the central plug

The Basement System

The Basement System Rocks forms the floor on which other rocks of the area lie. It is composed of heterogeneous gneisses, granulites and schists of varied and complex origin. Metamorphic gneisses and schists of basement System outcrop at the southern, eastern and northern margins of the Mt. Kenya volcanic field, and occur as inliers in the south west part of the Mt. Kenya area. Blocks of metamorphic rocks are common high on Mt. Kenya in trachytic agglomerates west of Ithanguni, and it's clear that Basement System rocks form the foundation of the volcanics in the area. Minor intrusions of dioritic type are widespread but relatively rare.

The Mount Kenya Suite

The Mount Kenya Suite include all the volcanic rocks erupted from Mt. Kenya and from satellite volcanoes on its flanks, excepting only those that appear to belong to separate and petrographically dissimilar volcanic episode, namely the Thiba Basalts and the basaltic pumice cones of the northern slopes.

The Mt. Kenya suite covers an area of approximately 2700 sq. miles. The age of the first volcanics of the suite is not known with any accuracy, but can be estimated in general way from the erosional history of the area to a period in the upper Pliocene. The relatively young Thiba Basalts which overlie the Mt. Kenya suite on the southern flanks of the mountain are much younger than the maturation of the mid Pliocene peneplain, and are probably comparable in age with basalts of the northern slopes found to be overlain by soils.

The Mount Kenya Volcanic Series

The western half of the area is covered by a succession of lava flows, which have erupted from the central and subsidiary vents of Mount Kenya

The succession falls into four main and a fifth subsidiary group according to age and lava type: -

(5). Basalts of the parasitic craters

(4). Olivine basalts.

(3) Finely porphyritic and dense phonolites.

(2) Kenytes.

(1) Basalts with phonolites.

The lowermost flows are of olivine basalts which underline the kenytes in the area north of Kituri rest camp, and are themselves underlain by tuffs and agglomerates. They are accompanied by some dense phonolites. (2) Overlying the basalts in the north and resting elsewhere directly on the sub-miocene peneplain are successions of Kenyte flows gradually increasing from a negligible thickness across the southern part. Interbedded in this series are considerable thickness of ash and agglomerate and a few basalt flows of limited extent. (3) The kenytes are followed by eruptions of finely porphyritic or dense phonolites and subordinate ash beds having their maximum development along the central part of the lava area of the total thickness of over 656 m. (4) In the north-eastern part the phonolites are overlain by flows of olivine- basalts. The extent of their distribution could not be determined, as the densely forested area was not traversed during the geological mapping. (5) Within the forest in this part of the area, a group of three small and well preserved craters named Kiruini, representing the latest manifestation of volcanism within the area. The basalts of (4) above are thought to belong to an earlier period.

The Nyambene Volcanic Series

Some miles northeast of the area volcanic accumulations build the Nyambeni Mountain ranges, which cover a big area and rise to many thousands of meters above the great flat expanses of the end-Tertiary peneplain. Extensive sheets of lava spread out on the surrounding plains, a few of which fall within the area. The greatly different stages of erosion seen in these cones perhaps indicate a protected period of eruption. The basaltic sheets have a fairly large extent in the north eastern part of the area, but a few widely separated outliers show that the flows originally stretched over most of the eastern half of the area to a distance of well over thirty miles south of the Nyambeni Range.

The flows consist of finely porphyritic and vesicular olivine basalt, some of which has a markedly columnar structure.

Pleistocene Sediments

Gravels of Pleistocene age on a the small plain on the Northern side of the Thingishu River South-west of Lansa Hill consist chiefly of pebbles of Nyambeni basalt with less frequent Basement System and Kenyte pebbles set in a sandy friable matrix. No good vertical exposures were found to show the thickness of the beds. The remnants of apparently younger, torrential deposits, probably upper Pleistocene in age, occur in places along the basement System streams.

Recent

The soils of the District vary according to the rainfall, the underlying formations and the local drainage conditions. Deep soil and subsoil has developed over greater part of Mount Kenya volcanic and Nyambeni hills on the ash beds, owing to the good rainfall and their easily decomposed nature. The top soil is generally a medium to dark brown loam grading downwards into darker more clayey subsoil.

Geology of the investigated area

In the investigated area the superficial deposits made up of black cotton soil which results from the weathered basalts, volcanic ashes and glacial –fluvial deposit. These are underlain by the Mount Kenya Volcanic series which were laid down by explosive activity around Mount Kenya where there was the main eruptive episode and later fissures eruptions. At greater depth these volcanic rocks are underlain by the basement system rocks.

The Mount Kenya volcanics are considered to be –Pleistocene in age because vulcanicity of Mount Kenya began shortly before maturation of the end-Tertiary (Mid- Pliocene) erosion surface and continued for considerable time after it had begun to be incised by a new erosion cycle.

Structural geology

The structure of the Mount Kenya volcano and its satellites is that of a large volcanic pile with radial outward dips centered on the plug, which forms the present peak of the mountain. Within volcanics of the satellites, however, various altitudes of the beds are found. The trachytic formations which out crop in the head of Hohnel and Teleki valleys, and underlie the kenytes, dip to the south and south east, and suggest that they were erupted from a centre to the west of the peaks. Similarly the Ithanguni volcanics show radial out ward dip about the centre.

3. HYDROGEOLOGY

The hydrogeology of an area is normally intimately dependent upon the nature of the parent rock, structural features, weathering processes, recharge mechanism and the form and frequency of precipitation. When evaluating the groundwater potential of an area, several criteria have to be considered, these are satisfied best by considering the geological formations identified in the area in terms of their hydrogeological properties. This section considers the various hydrogeological parameters such as sub-surface storage and presence of structures that can enhance it.

In general the area is drained by the Ewaso Ng'iro River catchment. A number of boreholes have been drilled in the area and it is believed that the upstream play a major role in the recharge of ground water in the general area. Ground water in volcanic rocks is limited to fractures and erosion levels within the volcanic succession. Lavas are generally not water bearing because of their unfractured and impervious character.

The recharge mechanism and replenishment of the confined aquifers that underlie the area of investigation can be described broadly as follows;

There is evidence of direct recharge from the surface to the confined aquifers, particularly to the Laikipian Basalts, as they near the surface and at places are exposed locally. It is possible that the Trachytic tuffs and the Basaltic agglomerates of the Simbara Series are replenished directly through the soil or via the local stream systems which act as a recharge conduit to deeper aquifers.

The Mount Kenya forest belt forms the most important recharge area for the aquifers in the area where rainfall reaches 2200mm/year. Here water percolates directly into the faults and cracks within the Pleistocene rocks of the Mount Kenya Volcanics through the soil or via the local stream system, which act as a recharge conduit to deeper aquifers.

Additional recharge may be expected to the aquifers on the slopes of Mount Kenya area via fractures and faults where some of the ground water from higher parts of this area flow to the east and west through the high concentration of faults and fracture zones running east –west.

Regional Hydrogeology

Lavas usually have considerable, but not indefinite, lateral extensions, lengths of flow being measured in miles or occasionally tens of miles and their breadths in hundreds or thousands of meters. As the OLS deposits interbedded with the lavas presumably run together at the margins and extremities of the lavas, they must form a system of only locally connected stratiform aquifers within the series of volcanic rocks.

Some borehole logs records tuffs interbedded between the lavas and those of others, lava flows that are in a highly weathered condition. Few good aquifers have been recorded within such materials, which process cracks in the former and microscopic interstices in the latter collapse, rendering the rocks impermeable. Most of the boreholes are confined in this area.

4. GEOPHYSICAL INVESTIGATION METHODS

A great variety of geophysical methods are available to assist in the assessment of geological subsurface conditions. In the present survey the geo-electrical method has been used. Investigations of the electrical resistance at the project area included the use of geophysical techniques to probe the sub-surface. The main emphasis of the fieldwork undertaken was to determine the electrical resistance, thicknesses and composition of the sub-surface formations and to identify water-bearing zones. This information was principally obtained in the field using ABEM SAS 4000 Terrameter for resistivity soundings

Resistivity Method

Vertical electrical resistance measurement was carried out to probe the condition of the sub-surface and unveil the stratigraphy of the ground. The VES investigates the resistance and resistivity layering below the site of measurement.

Basic Principles

The electrical properties of rocks in the upper part of the earth's crust are dependent upon the lithology, porosity, degree of pore space saturation and the salinity of the pore water. Saturated rocks have lower resistivity than unsaturated and dry rocks. The higher the porosity of the saturated rock results in lower resistivity and the higher the salinity of the saturating fluids, the lower the resistivity. The presence of clays and conductive minerals also reduces the resistivity of the rock.

The resistivity of earth materials can be studied by measuring the electrical potential distribution produced at the earth's surface by an electric current that is passed through the earth.

The resistance R of a certain material is directly proportional to its length L and cross-sectional area A, expressed as:

$$R = Rs * L/A \qquad (Ohm) \qquad (1)$$

where Rs is known as the specific resistivity, characteristic of the material and independent of its shape or size. With Ohm's Law,

$$R = dV/I \qquad (Ohm) \qquad (2)$$

where dV is the potential difference across the resistor and I is the electric current through the resistor, the specific resistivity may be determined by:

$$Rs = (A/L) * (dV/I) \qquad (Ohm.m) \qquad (3)$$

Vertical Electrical Soundings (VES)

When carrying out a resistivity sounding, current is led into the ground by means of two electrodes. With two other electrodes, situated near the centre of the array, the potential field generated by the current is measured. From the observations of the current strength and the potential difference, and taking into account the electrode separations, the ground resistivity can be determined.

A total of forty four (44) resistivity soundings were carried out with the separation between the electrodes being step-wise increased (in what is known as a Schlumbger Array), thus causing the flow of current to penetrate greater depths. When plotting the observed resistivity values against depth on double logarithmic paper, a resistivity graph is formed, which depicts the variation of resistivity with depth.

The graphs can be interpreted with the aid of a computer program and the actual resistivity layering of the subsoil is obtained. The depths and resistivity values provide the geophysicist with information on the geological layering and thus the depth to the bedrock.

GEOPHYSICAL FIELDWORK AND RESULTS

Fieldwork

Fieldwork was carried out on February and March 2013. Resistivity measurements were used to estimate the depth and thickness to the different sedimentary rock formations. A total of forty four (44) Vertical Electrical Sounding measurements were executed at selected points along the line.

Resistivity Computations Results

The resistivities of the measured depths were computed in order to present the resistivity (Ohm-m) for the vertical profile. The calculation used constants calculated from the formula:

K = π ((AB/2)2 – (MN/2)2)

MN

Where: K is a geometric constant

AB is the current electrode separation, and

MN is the potential electrode separation

The table presents the computed resistivity values for the investigated site

Resistivity Measurement Results

The table below presents the measured resistivities (Ohm-m) with their respective depths (m). The data acquired from the survey has been studied to determine whether any particular depth intervals displayed high resistivities values, which would indicate presence of unsaturated material, bedrock. Such variations are caused primarily by differences in the characteristics of the subsurface strata. Resistivities decreases as porosity, hydraulic conductivity, water conductivity and water salinity increase. Dry formations are poor electrical conductors and show very high resistivities. Dry sand and gravel have higher resistivity values. The resistivity values are also affected by electrode spacing, whereby short spaced electrodes read a smaller part of the formation, which makes possible more precise identification of formation interfaces. As the electrode spacing is not constant, a truer measurement of formation resistivity is obtained since greater penetration of the formation is achieved.

The values represent resistivity for the vertical section of the formations. The depths defined from these results were progressively increased to determine the variation in resistivity with depth. The changes in resistivity/resistance with increased electrode spacing signify change in formation with increase in depth.

The table below presents the resistivity measurements for 44 vertical electrical soundings executed in the proposed power line to a depth of 50 m bgl.

Resistivity Interpretation Results

Interpreted results of the soundings are shown in the following table:

Table 1: Resistivity Interpretation Results for the Project Area

VES No.	Depth (m)	Resistivity (Ohm-m)	Geological Interpretation
VES 1	0-0.8	719	Top superficial layer comprising of dry clay soils
	0.8 -8	21.4	Compact brown lateritic material
	8-15	65.6	Slightly weathered Basalts
VES 2	0 - 2	222	Dry black clays soils
	2 – 6.3	46.7	Slightly weathered to compact reddish laterites
	16.3-50	77.6	Fresh and compact Basalts

VES 3	0 - 2	7.06	Top superficial layer comprising of wet black clay soils
	2 – 5.0	8.63	Weathered brown lateritic material
	5- 50	7.56	Slightly weathered to compact Basalts
VES 4	0 – 2	27	Top superficial layer comprising of wet black clay soils
	2 – 7	25	Weathered brown lateritic material
	7 – 15	32	Slightly weathered to compact Basalts
VES 5	0 - 0.8	17	Top superficial layer comprising of black clay soils
	0.8 – 6	32	Slightly weathered to compact brown lateritic material
	6 - 50	40	Compact Basalts
VES 6	0 – 1	26	Top superficial layer comprising of black clay soils
	1 – 3	15	Weathered brown lateritic material
	3 – 50	35	Slightly weathered to compact Basalts
VES 7	0 – 1	27	Top superficial layer comprising of black clay

			soils
	1 – 5	68	Slightly weathered Basalts material
	5 – 50	70	Slightly weathered to compact Basalts
VES 8	0 – 0.5	127	Top superficial layer comprising of black clay soils
	0.5 – 2	20	Highly weathered Basalts material
	2 – 50	40	Slightly weathered to compact Basalts
VES 9	0 – 0.8	0.8	Top superficial layer comprising of black clay soils
	0.8 -7	47	Compact Basalts material
	7 – 50	35	Slightly weathered to compact Basalt
VES 10	0 – 0.7	78	Top superficial layer comprising of Brown soils
	0.7 – 8	15	Highly weathered Basalts material
	8 – 15	50	Compact Basalts
VES 11	0 – 1.2	33	Top superficial layer comprising of Brown soils
	1.2 – 13	114	Slightly compact Basalts material
	13 – 50	35	Compact Basalts

VES 12	0 – 0.7	8	Top superficial layer comprising of Brown soils
	0.7 – 12	45	Slightly weathered Basalts material
	12 – 50	30	Compact Basalts
VES 13	0 – 1.6	18	Top superficial layer comprising of Brown soils
	1.6 – 8	9	Highly weathered Basalts material
	8 – 50	30	Compact Basalts
VES 14	0 – 0.4	16	Top superficial layer comprising of Red soils
	0.4 – 16	75	Weathered Laterite material
	>16	51.6	Compact Basalts
VES 15	0 – 0.3	8	Top superficial layer comprising of Red soils
	0.3 -8	90	Weathered Laterite material
	> 8	75.71	Compact Basalts
VES 16	0 – 0.3	474	Top superficial layer comprising of Reddish brown soils
	0.3 -8	55.9	Highly weathered Laterite material

	> 8	75.71	Compact Basalts
VES 17	0 – 0.4	3375	Top superficial layer comprising of Red soils
	0.4 -8	55.9	Highly weathered Laterite material
	> 8	175.71	Compact Basalts
VES 18	0 – 0.7	275	Top superficial layer comprising of Red soils
	0.7 -4	55.9	Highly weathered Laterite material
	> 4	175.71	Compact Basalts
VES 19	0 – 0.8	615	Top superficial layer comprising of Red soils
	0.8 - 8	49.7	Highly weathered Laterite material
	> 8	167	Compact Basalts
VES 20	0 – 0.4	343	Top superficial layer comprising of Red soils
	0.4 - 4	31.98	Highly weathered Laterite material
	> 4	155	Compact Basalts
VES 21	0 – 1.14	98	Top superficial layer comprising of Red soils
	1.14 – 9.86	9.86	Highly weathered Laterite material
	> 9.86	155	Compact Basalts

VES 22	0 – 0.38	2617	Top superficial layer comprising of Red soils
	0.38 – 7.513	134	Highly weathered Laterite material
	> 7.513	359	Compact Basalts
VES 23	0 – 0.9	32	Top superficial layer comprising of Red soils
	0.9 – 7.6	7.8	Highly weathered Laterite material
	> 7.6	8875	Compact Basalts
VES 24	0 – 3.57	159	Top superficial layer comprising of Reddish brown soils
	3.57 – 8.27	34.1	Highly weathered Laterite material
	> 8.27	311	Compact Basalts
VES 25	0 – 0.53	24.6	Top superficial layer comprising of Brown soils
	0.53 – 9.72	56.8	Highly weathered Laterite material
	>9.72	8875	Compact Basalts
VES 26	0 – 0.4	766	Top superficial layer comprising of Brown

			soils
	0.4 – 6.68	56.8	Highly weathered Basalts material
	>6.68	1240	Compact Basalts
VES 27	0 – 0.6	20.1	Top superficial layer comprising of Brown soils
	0.6 – 4.73	6.89	Highly weathered Basalts material
	>4.73	1599	Compact Basalts
VES 28	0 – 0.96	354	Top superficial layer comprising of Brown soils
	0.9 – 9.31	3503	Highly weathered Basalts material
	>9.31	1599	Compact Basalts
VES 29	0 – 0.5	252	Top superficial layer comprising of Red soils
	0.5 – 8.14	4.17	Highly weathered Basalts material
	>8.14	45.8	Slightly Compact Basalts
VES 30	0 – 2.08	92.7	Top superficial layer comprising of Red soils
	2.08 – 4.9	3.6	Highly weathered Basalts material
	>4.9	97.2	Slightly Compact Basalts

VES 31	0 – 0.86	650	Top superficial layer comprising of Red soils
	0..86 – 2.9	252	Highly weathered Basalts material
	>2.9	996	Slightly Compact Basalts
VES 32	0 – 0.7	104	Top superficial layer comprising of Red soils
	0..7 – 14	11	Highly weathered Basalts material
	>14	215	Slightly Compact Basalts
VES 33	0 – 1.39	104	Top superficial layer comprising of Red soils
	1.39 – 32	92	Weathered Basalts material
	>32	453	Slightly Compact Basalts
VES 34	0 – 4	10.7	Top superficial layer comprising of Black cotton soils
	4 – 17	175	Weathered Basalts material
	>17	324	Slightly Compact Basalts
VES 35	0 – 0.4	403	Top superficial layer comprising of Red soils
	0.4 – 20	19.86	Weathered Basalts material
	>20	247	Slightly Compact Basalts
VES 36	0 – 0.3	548	Top superficial layer comprising of Red soils

	0.3 – 3	42.8	Weathered Basalts material
	>3	335	Slightly Compact Basalts
VES 37	0 – 2.18	317	Top superficial layer comprising of Red soils
	2.18 – 15.4	17.3	Weathered Basalts material
	>15.4	3721	Slightly Compact Basalts
VES 38	0 – 1.11	339	Top superficial layer comprising of Red soils
	1.11 – 11	175	Slightly Weathered Basalts material
	>11	939	Slightly Compact Basalts
VES 39	0 – 0.7	970	Top superficial layer comprising of Red soils
	0.7 – 4.9	89	Slightly Weathered Basalts material
	>4.9	7296	Slightly Compact Basalts
VES 40	0 – 0.96	88.6	Top superficial layer comprising of Brown soils
	0.96 – 4.9	26.7	Slightly Weathered Basalts material
	>4.9	117	Slightly Compact Basalts
VES 41	0 – 1.6	65	Top superficial layer comprising of Brown

			soils
	1.6 – 2.85	1187	Fresh Basalts material
	>2.85	117	Slightly Compact Basalts
VES 42	0 – 0.6	149	Top superficial layer comprising of Red soils
	0.6 – 19	22.8	Slightly Weathered Basalts material
	>19	117	Slightly Compact Basalts
VES 43	0 – 0.96	354	Top superficial layer comprising of Brown soils
	0.9 – 9.31	3503	Highly weathered Basalts material
	>9.31	1599	Compact Basalts
VES 44	0 – 0.34	256	Top superficial layer comprising of Red soils
	0.34 – 12	11	Highly Weathered Basalts material
	>12	2658	Slightly Compact Basalts

5. TOMOGRAPHIC INTERPRETATION

Tomography

The tomographic image of VES 1 to VES 8 shows that the top superficial layer extends to about 2 m bgl. There is a dome-shaped geological formation, which is an indication of a volcanic dike as from VES 4 to VES 7. The resistivities in this area range are consistent with Basaltic and phonolites resistivity. The ground is thus fairly stable.

VES 1 - 2

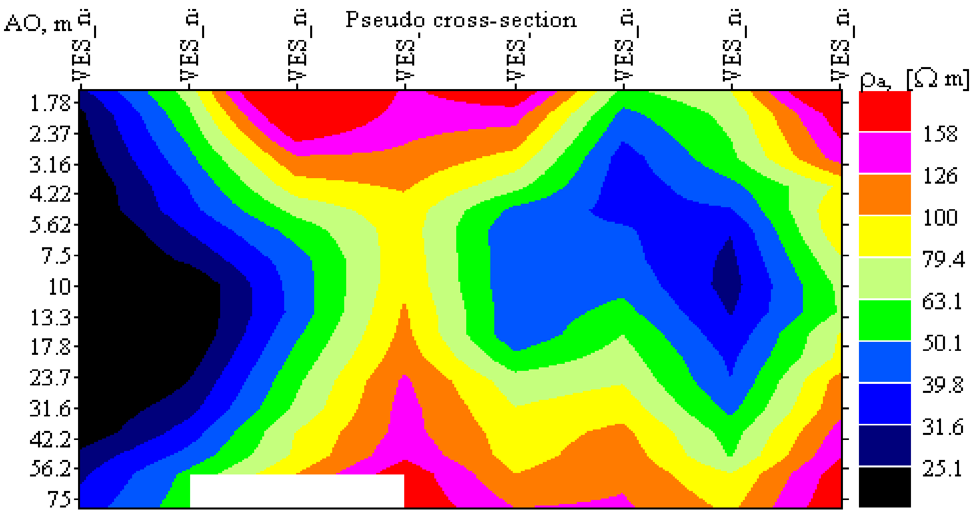


Figure 1: Tomographic Image of VES 1 to VES 8

The tomographic image of VES 9 to VES 14 is a little bit consistent with homogeneity of the area being high as compared to Fig 1 The top superficial layer extends below 1.9 m bgl followed by a compact layer which extends up to around 8 m bgl, this is underlain by fresh basalt which is well visible below VES 12 but VES 13 is weathered below 3 m bgl.

VES 9 -14

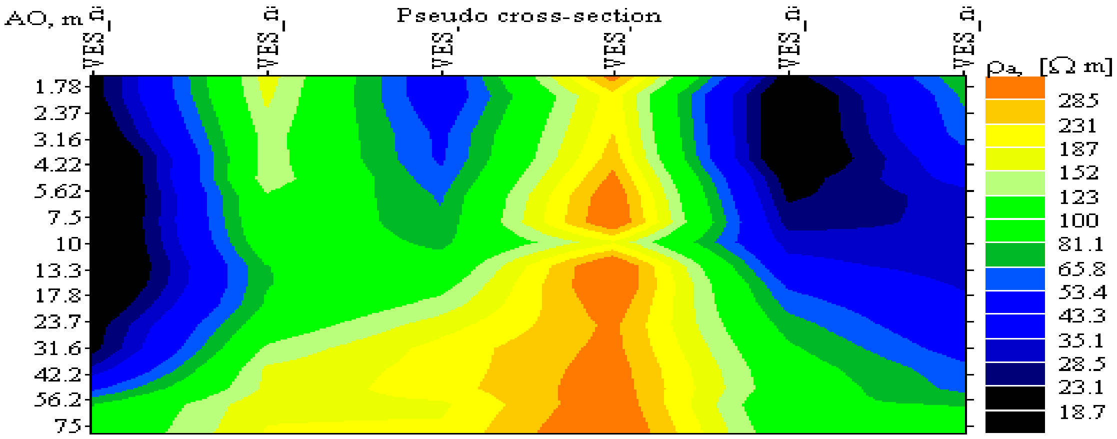


Figure 2: Tomographic Image of VES 9 to VES 14

VES 15 -22

The tomographic image of VES 15 to VES 22 shows that the top superficial layer extends to about 2 m bgl. There is a dome-shaped geological formation, which is an indication of a weak zone below VES 21 and VES 22. The resistivities in this area range are consistent with Basaltic and phonolites resistivity. The ground is thus fairly stable.

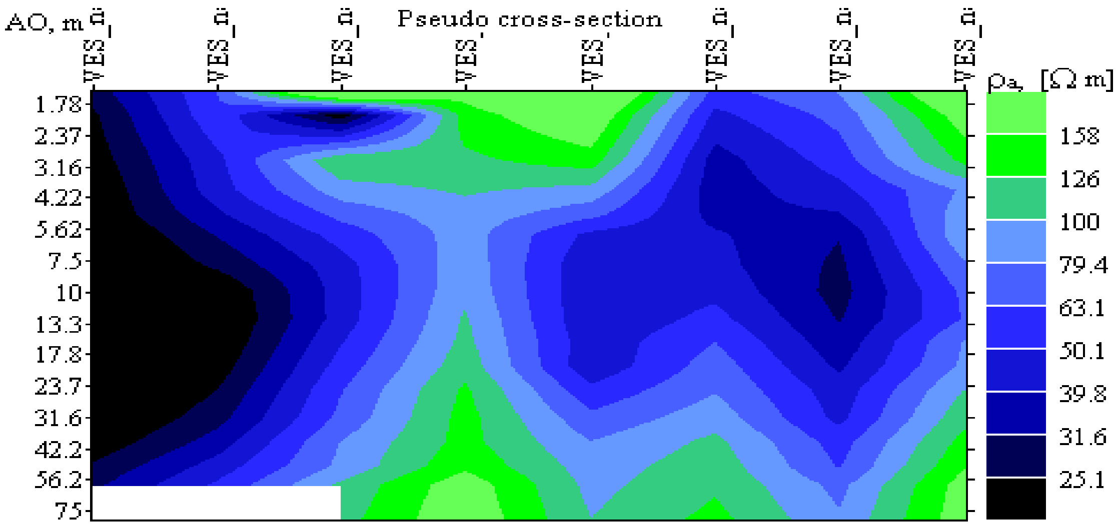


Figure 3: Tomographic Image of VES 15 to VES 22

Tomographic Image of VES 23 to VES 29 indicates a top superficial layer up to 1.78 m bgl except for VES 27 which extends below 3 m bgl. This is underlain by a compact layer of basalt which extends to 50 m bgl with resistivity increasing downwards.

Hydrogeologically VES 27 has the greatest hydrological potential while VES 28 has the hardest formation with resistivity range of 400 to 550 OhmM

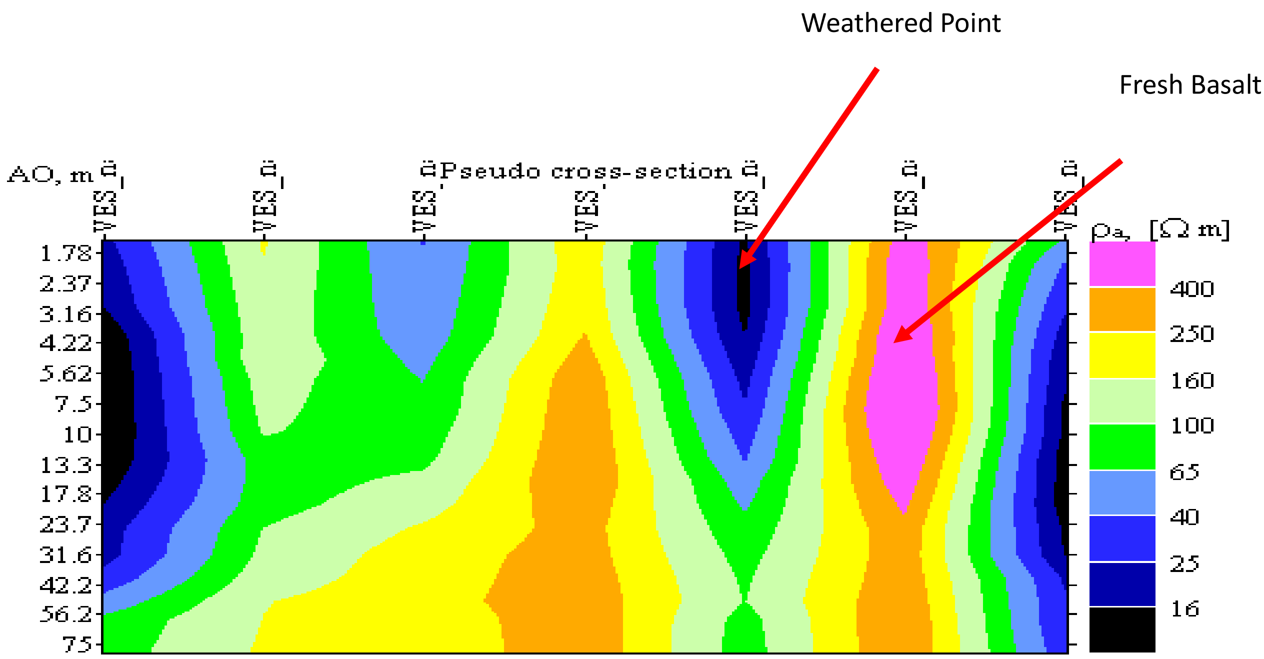


Figure 4: Tomographic Image of VES 23 to VES 29

VES 30 -35

Tomographic Image of VES 30 to VES 35 shows that there is a homogeneous geological formation comprising volcanic sediments with a resistivity range as from 300-500 OhmM except for VES 34 which is weathered up to about 4 m bgl. There is also a dyke below VES 31 with a resistivity of 700 OhmM.

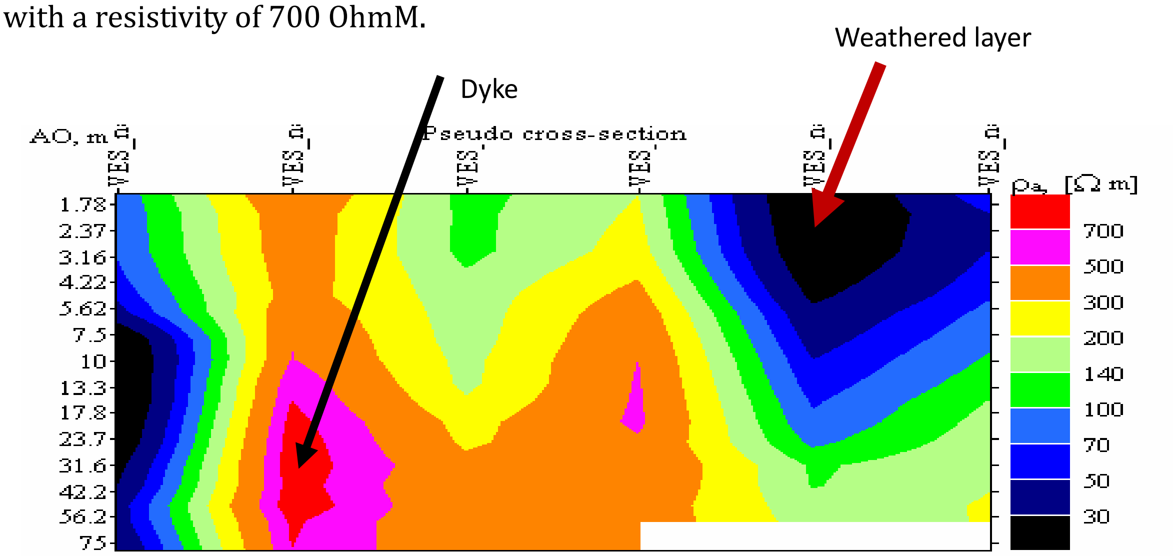


Figure 5: Tomographic Image of VES 30 to VES 35

VES 36 -41

Tomographic image of VES 36 to VES 41 shows the existence of a weathered layer below VES 37 at about 13 m bgl followed by a large dyke from VES 38 to VES 39 at about 8 m bgl to 40 m bgl which marks the beginning of another weathering at 13 m bgl below VES 40.

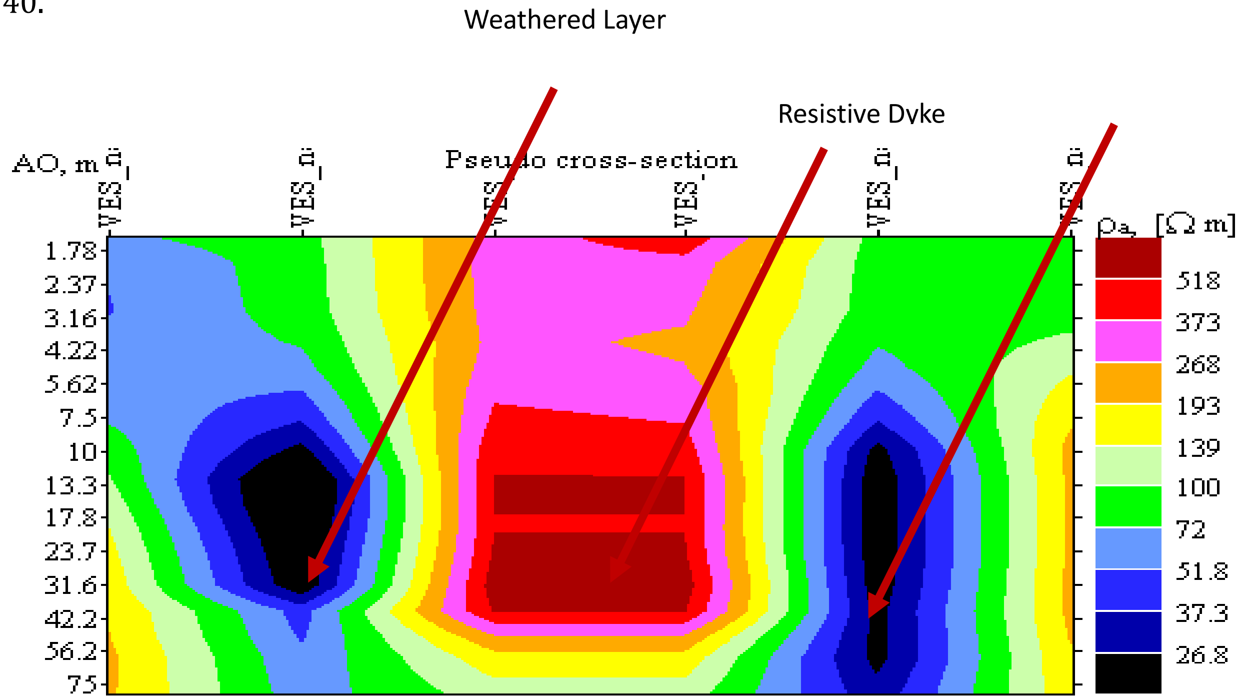


Figure 6: Tomographic Image of VES 36 to VES 41

CONCLUSION AND DISCUSSION

Conclusion

The following conclusions are made:-

(i) The resistivity variations in the area are related to the geology of the subsurface, revealing the stratigraphic layering of the underlying formations.

(ii) The top most layer of the whole area of survey is composed of unconsolidated material which should be excavated to a depth of between 0.5 to 2 m bgl or as determined by laboratory test results and calculated bearing capacity values. This top layer extends deeper up to about 4 m bgl in areas around VES 13, VES 27 and VES 34 as determined by a 2 D tomographic analysis of the data which involves combination of at least four VESs to get the interconnection of the resistivity between them. This approach provides a clearer picture of the weathering profile as opposed to 1D analysis or resistivity values at single points independently.

(iii) The decline in the resistivity values with depth is coincidental with weathering profile of the top most formation. (The resistivity values decrease with depth due to the weathering of the formation underlying the top superficial layer which gets into contact with the percolating water from the surface).

(iv) The clay layer goes to a depth range of 1.0 to 3 m bgl in areas near Nanyuki Town and also the same thickness through Kisima where the Red/black cotton soil is about 3 m bgl. In areas around Meru Isiolo Junction, you find Basalts rock outcrops with some sections having shallow brown soil of about <0.5 to 1 m bgl. This is underlain by dry weathered Basalts materials which are further underlain by fresh Basalts.

(v) Towards Isiolo and the Sub-station, the clay is less thick to depth of about <1.0 m bgl and then underlain by weathered Basalts.

(vi) Generally, in the entire surveyed area the geophysics is favorable for the proposed powerline. The geology and stratigraphy is favorable too and there is minimal likelihood or danger of settlements.

Recommendations

Recommendations have been made in the section of laboratory soil testing in this report

From the resistivity measurements it is clear that at the proposed power line from Nanyuki Sub-station runs through a uniform ground and the decrease in the resistivity values is coincidental with the weathering profile.

At sections around VES 13, VES 27 and VES 34 as discussed above, slight changes in the weathering profile should be expected.

Generally, in the whole surveyed area there is no evidence of saturated ground due to presence of groundwater to depths of about 40 m bgl and therefore there is no any adverse effect or possibilities of frozen ground that may interfere with the intended development.

APPENDICES
APPENDIX1: GEOTECHNICAL INVESTIGATION
APPENDIX2: GEOPHYSICAL INVESTIGATION

Appendix 1: Interpretation VES Graphs

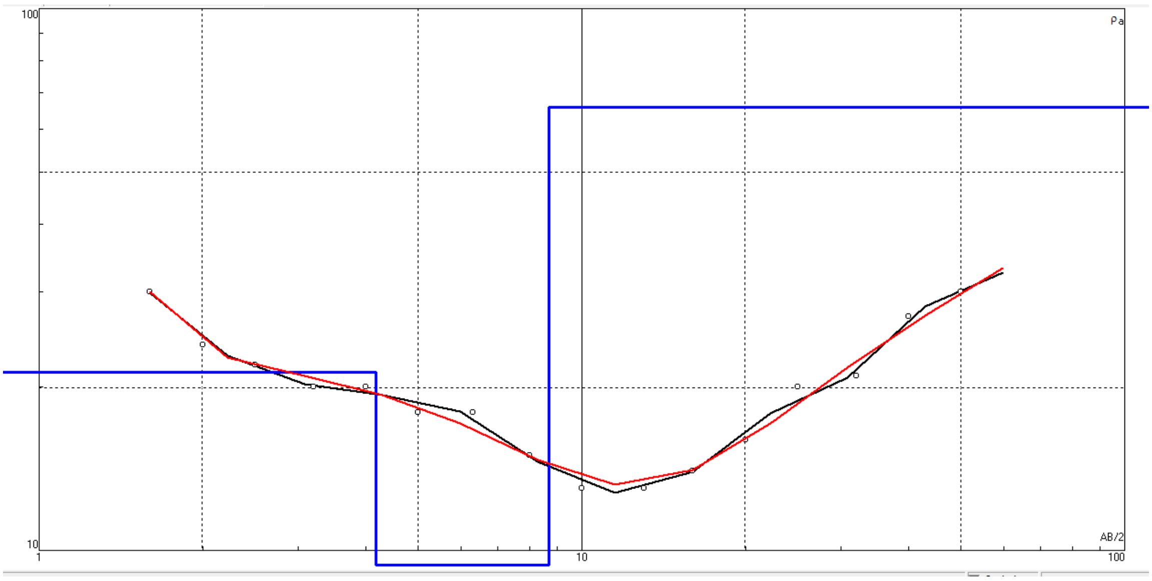


Figure 7: Interpreted Graph for VES 1

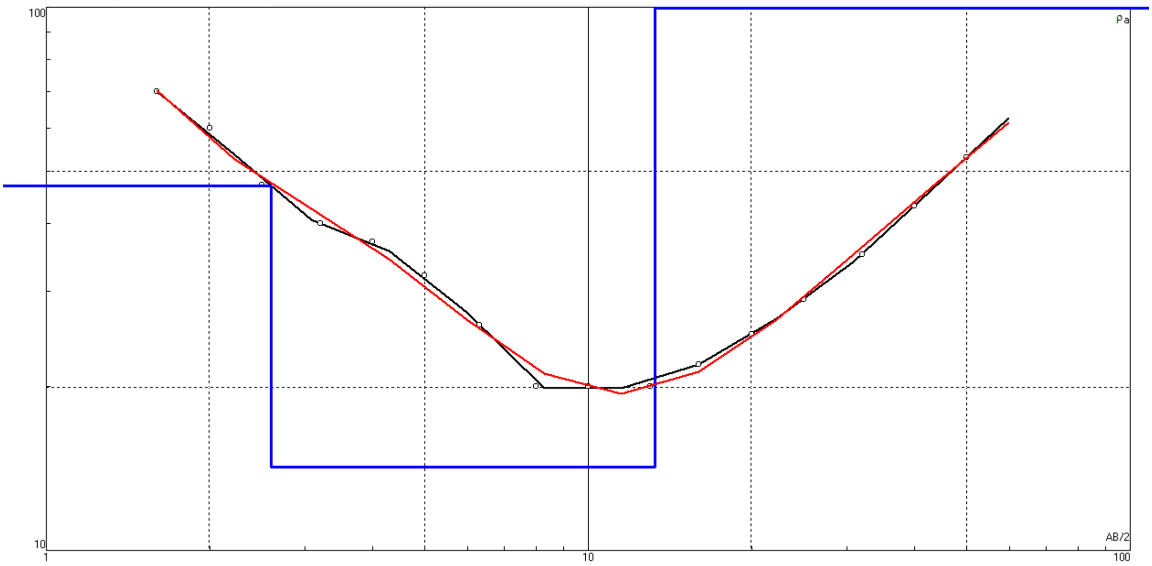


Figure 8: Interpreted Graph for VES 2

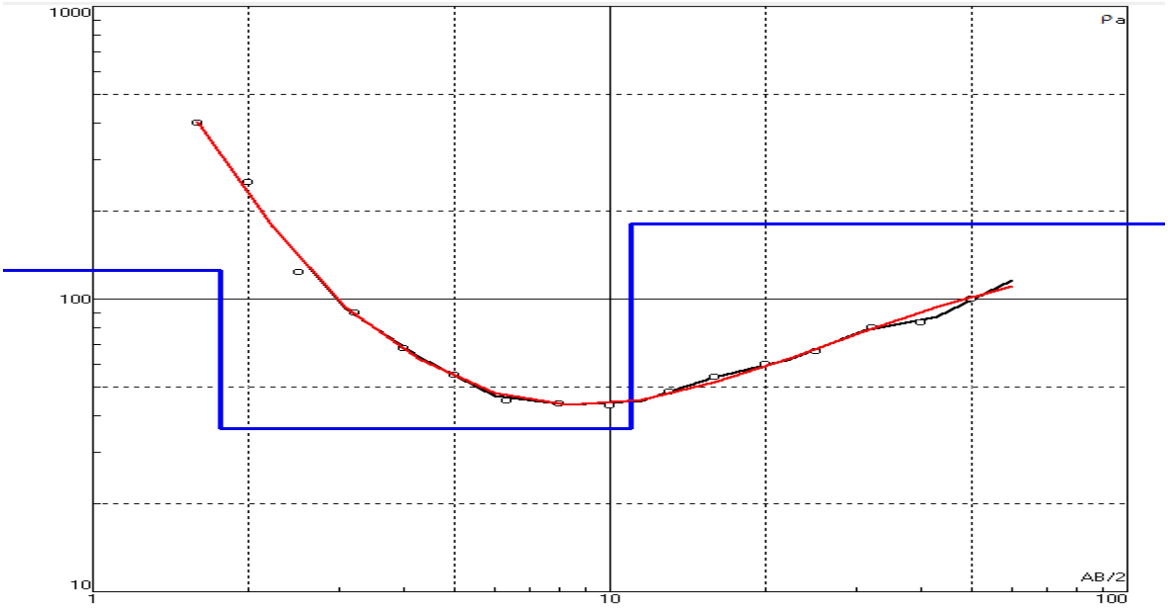


Figure 9: Interpreted Graph for VES 3

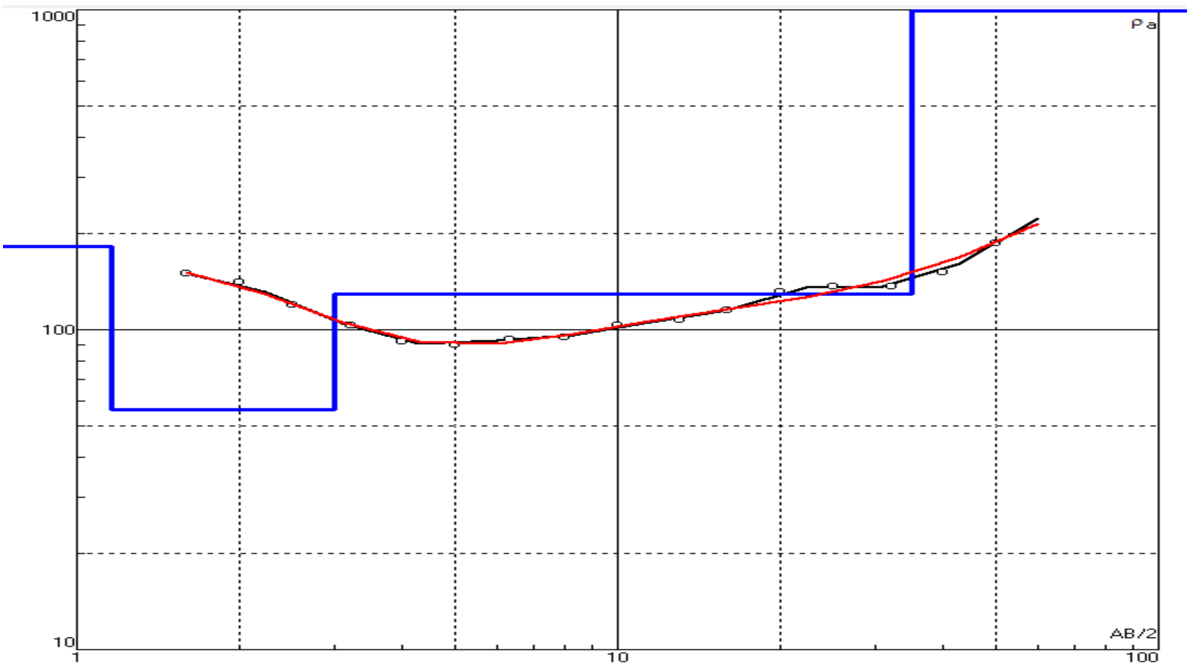


Figure 10: Interpreted Graph for VES 4

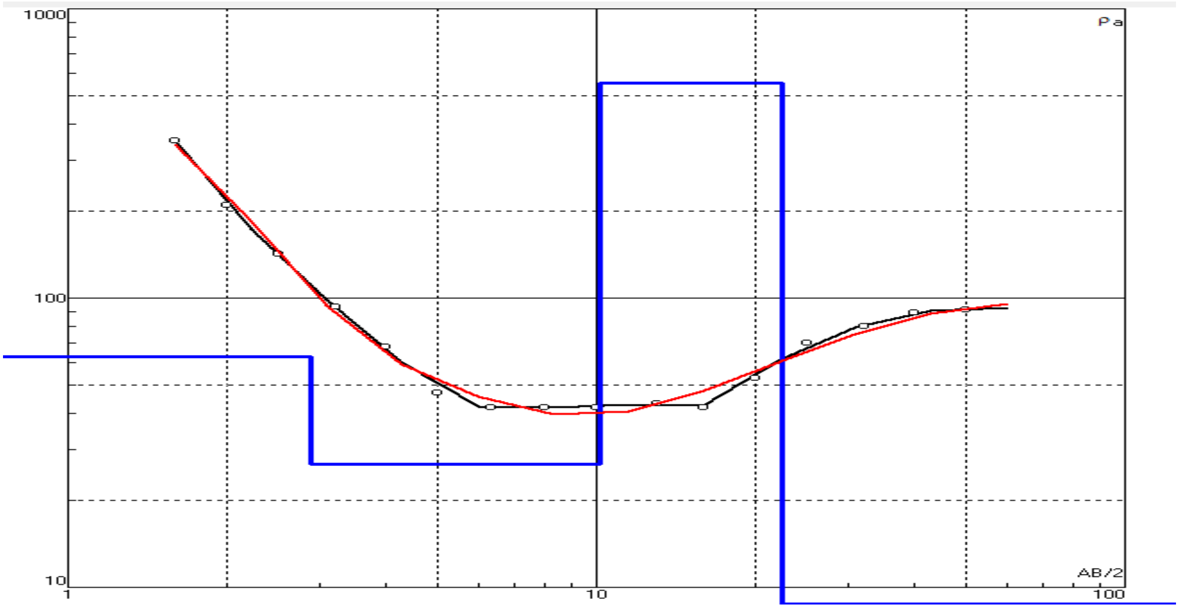


Figure 11: Interpreted Graph for VES 5

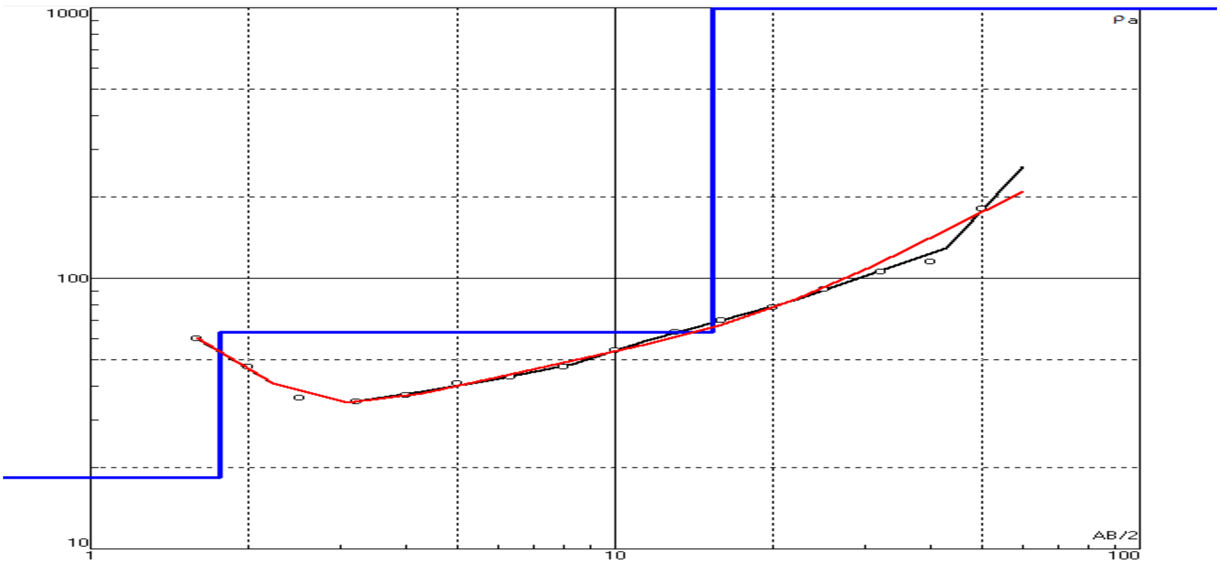


Figure 12: Interpreted Graph for VES 6

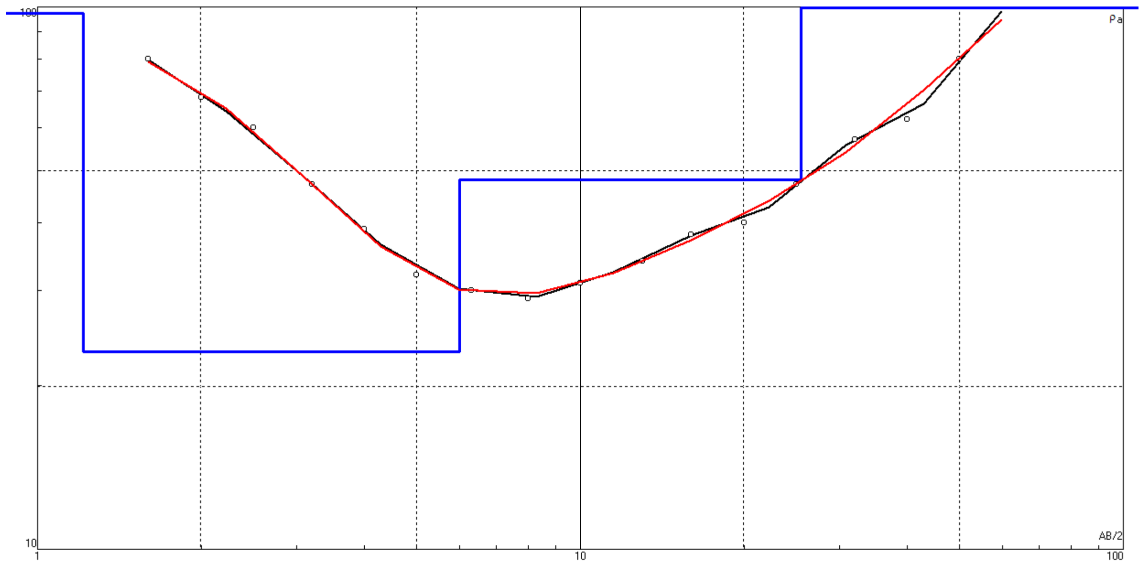


Figure 13: Interpreted Graph for VES 7

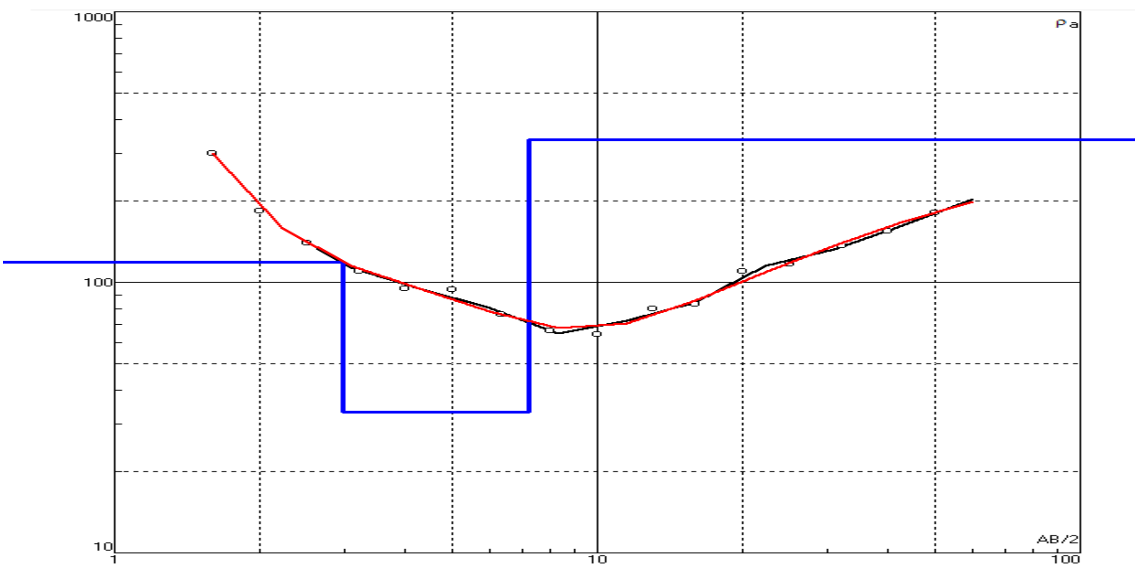


Figure 14: Interpreted Graph for VES 8

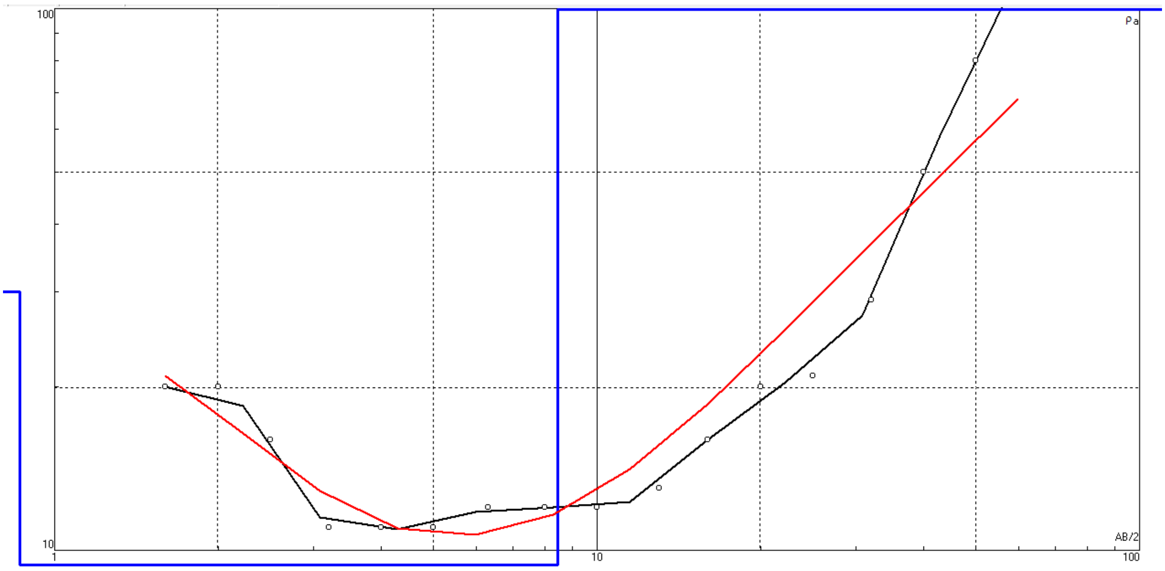


Figure 15: Interpreted Graph for VES 9

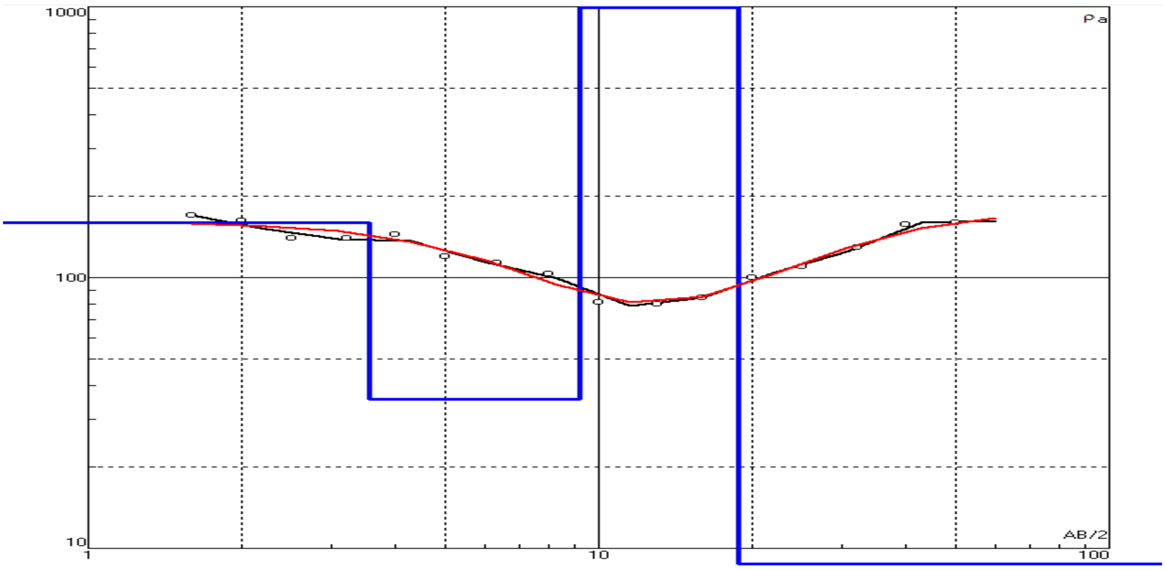


Figure 16: Interpreted Graph for VES 10

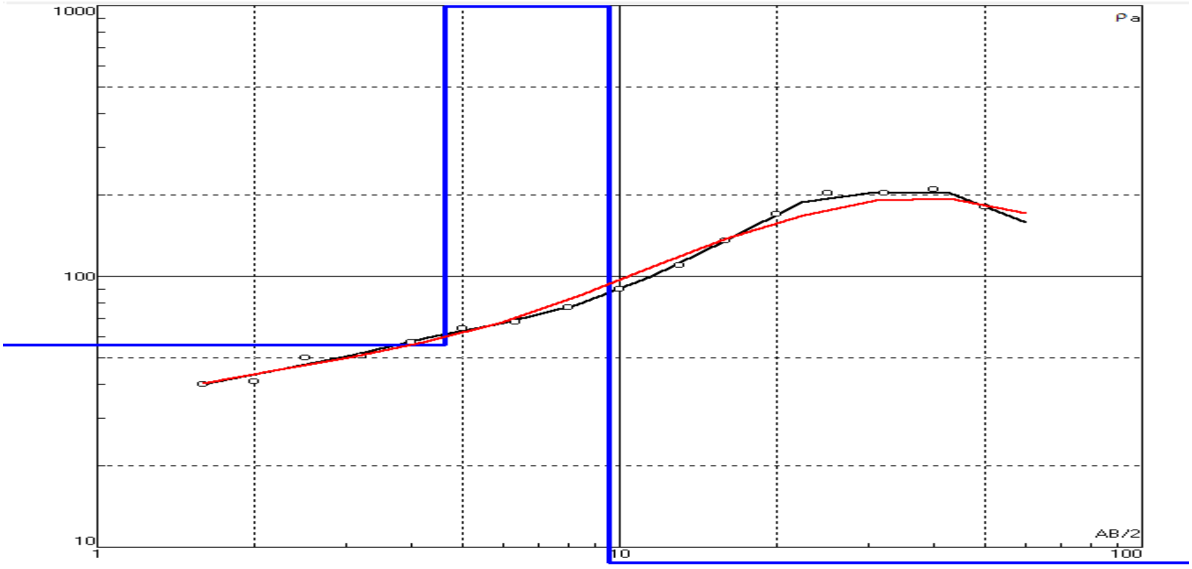


Figure 17: Interpreted Graph for VES 11

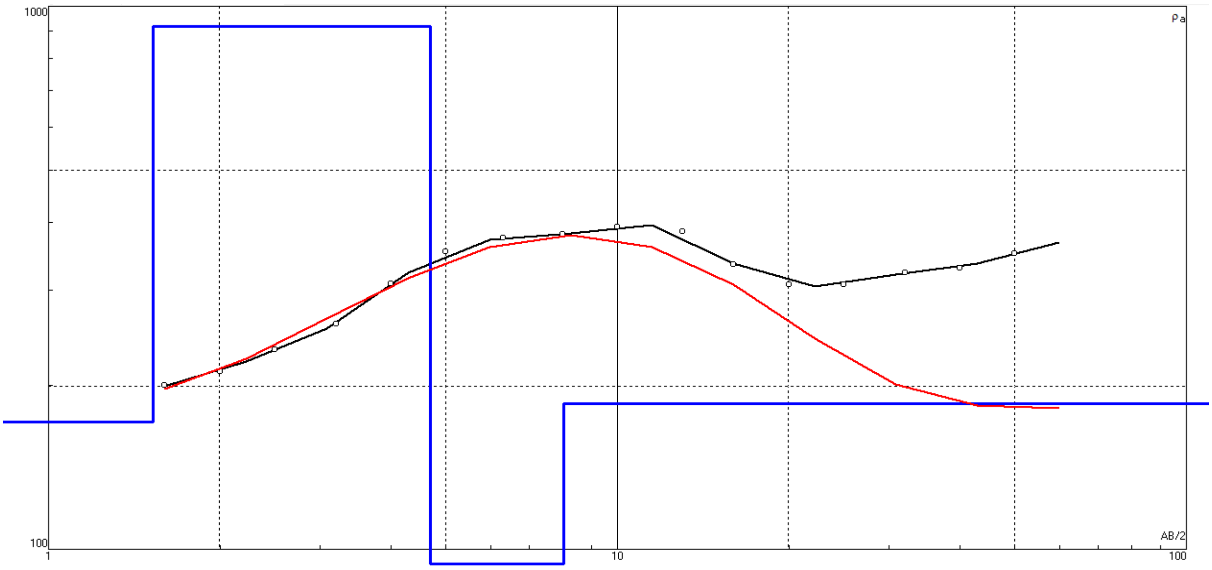


Figure 18: Interpreted Graph for VES 12

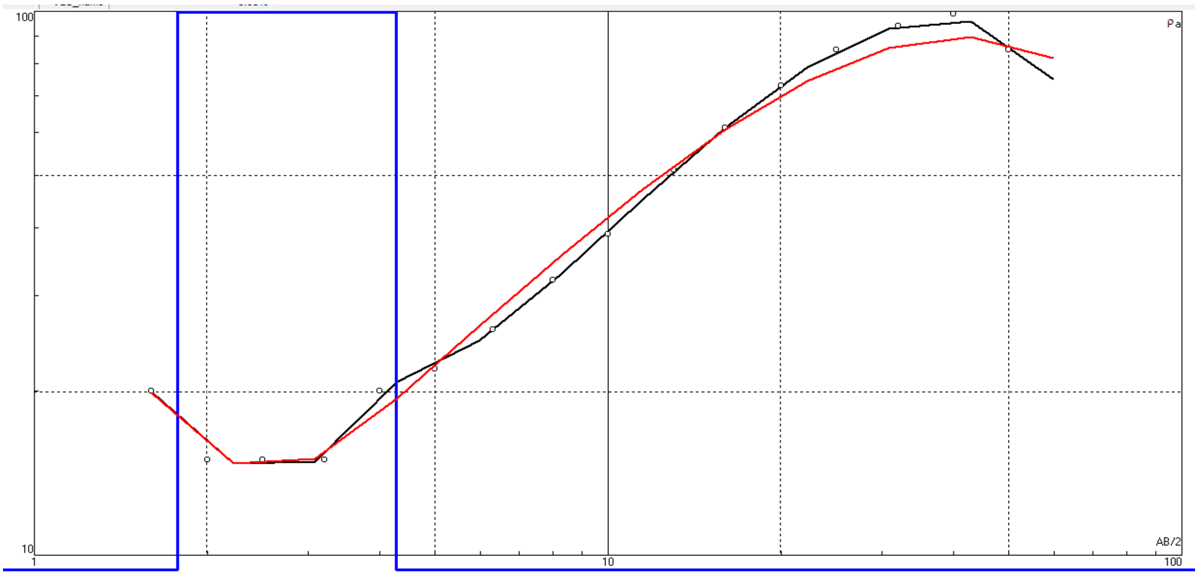


Figure 19: Interpreted Graph for VES 13

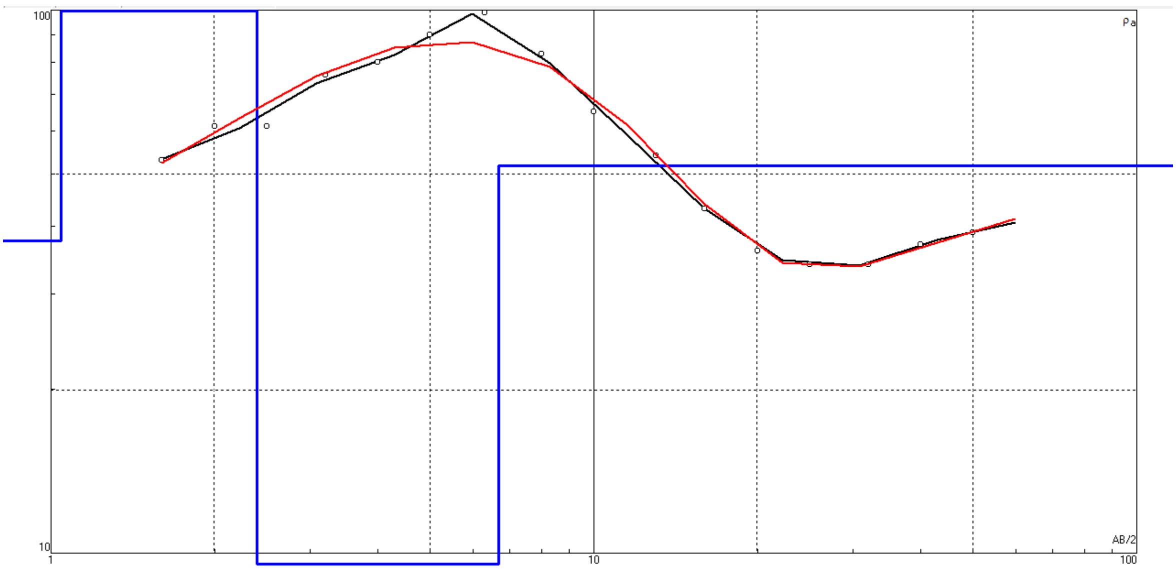


Figure 20: Interpreted Graph for VES 14

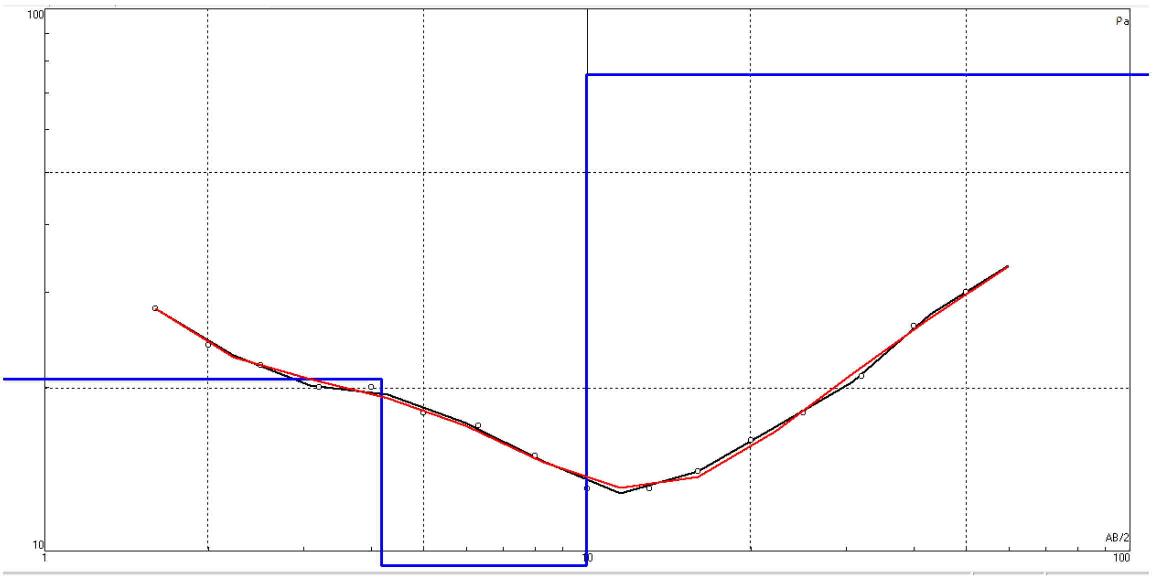


Figure 21: Interpreted Graph for VES 15

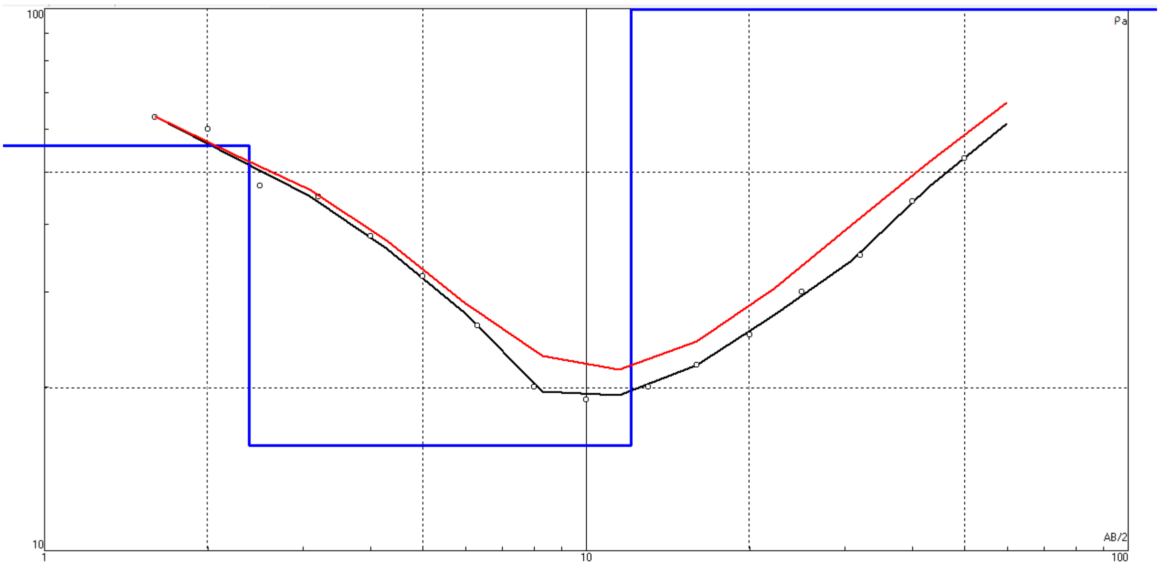


Figure 22: Interpreted Graph for VES 16

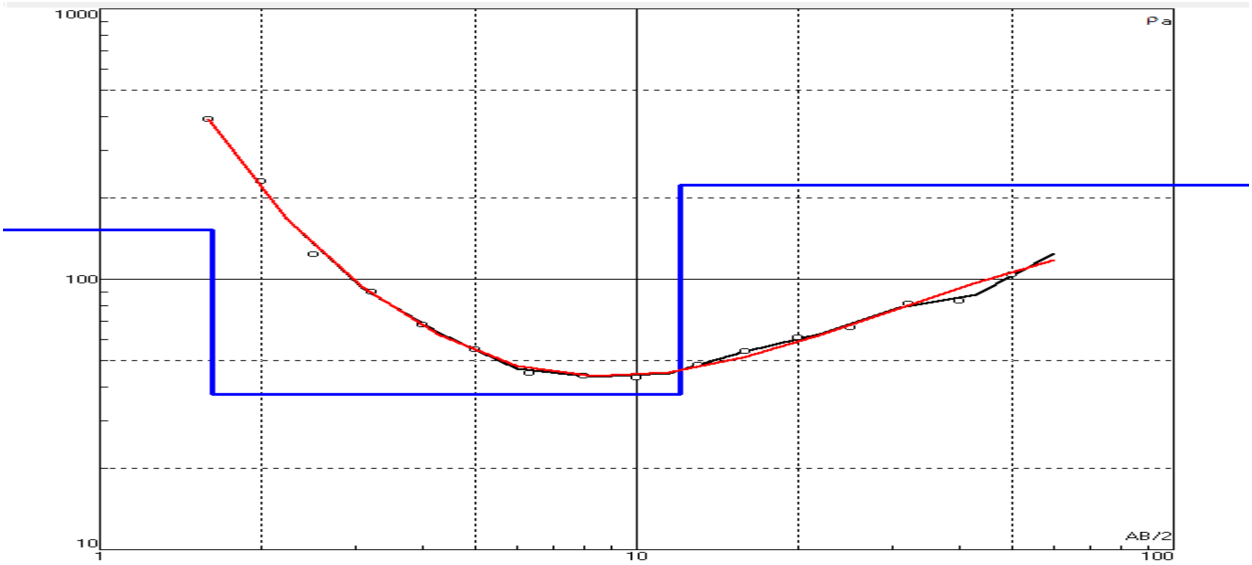


Figure 23: Interpreted Graph for VES 17

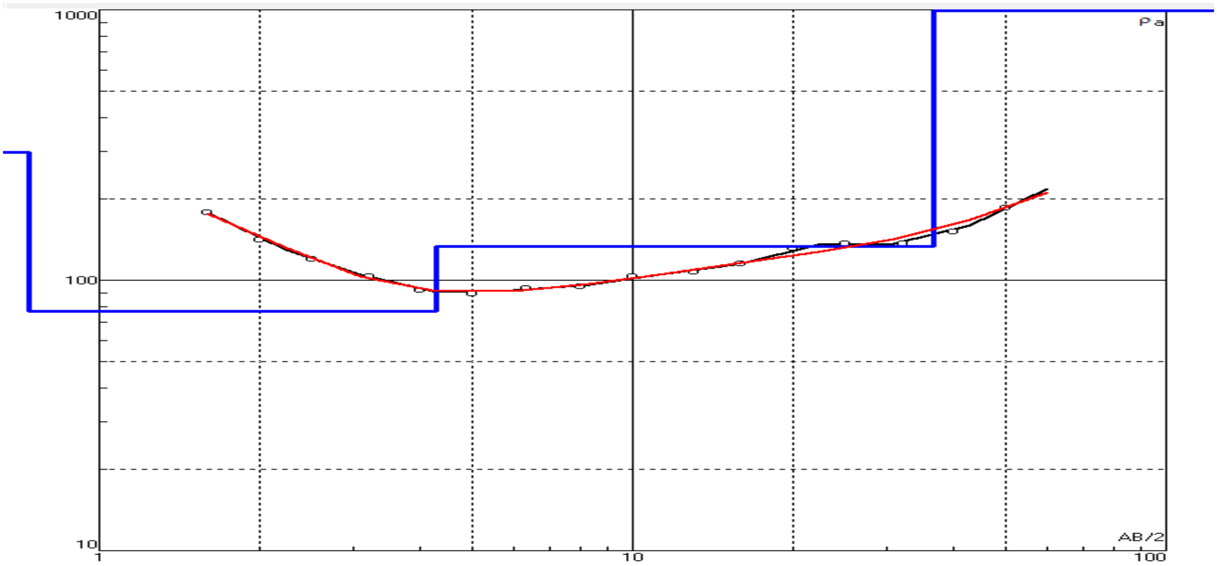


Figure 24: Interpreted Graph for VES 18

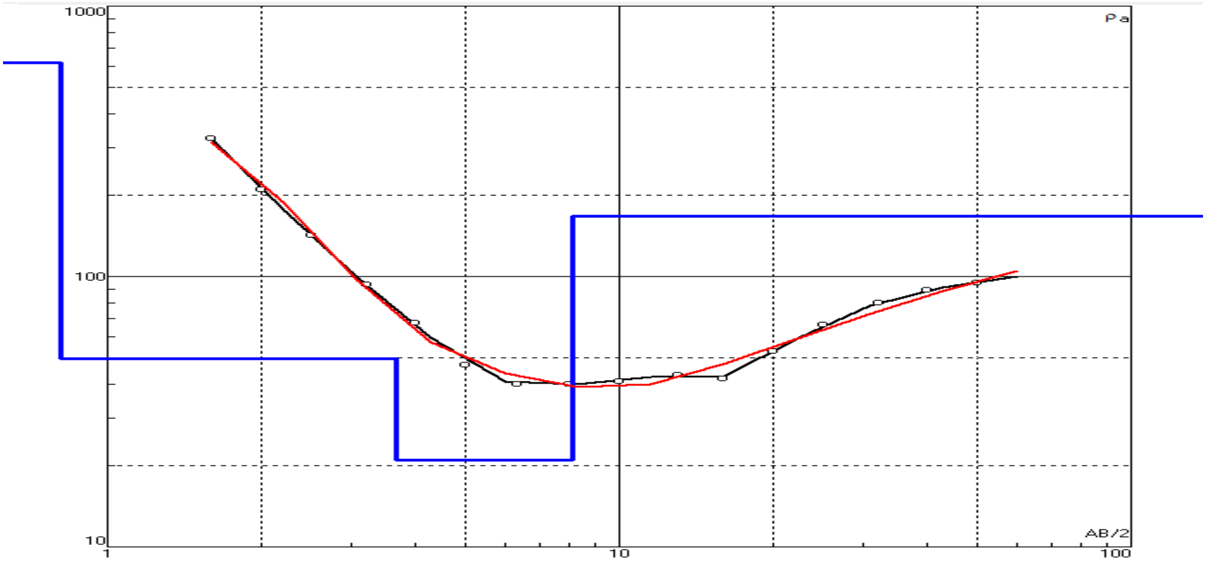


Figure 25: Interpreted Graph for VES 19

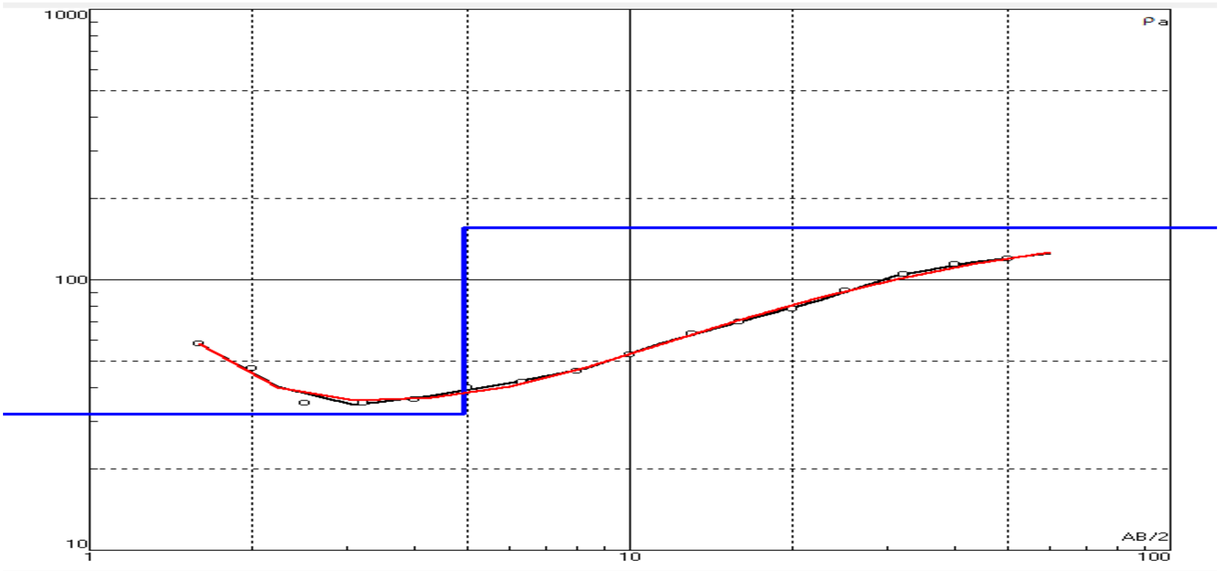


Figure 26: Interpreted Graph for VES 20

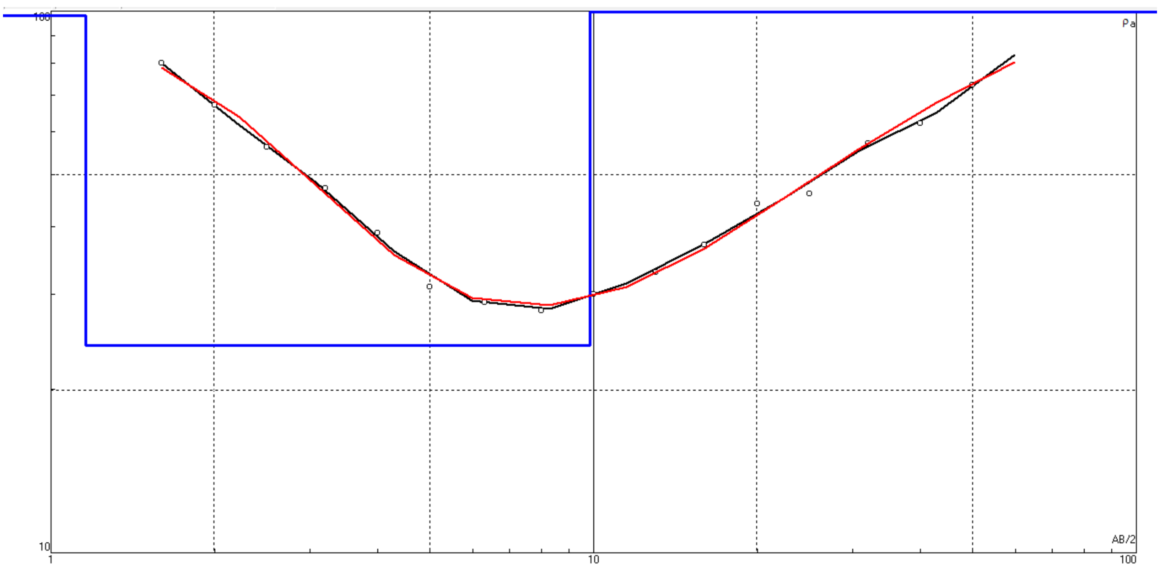


Figure 27: Interpreted Graph for VES 21

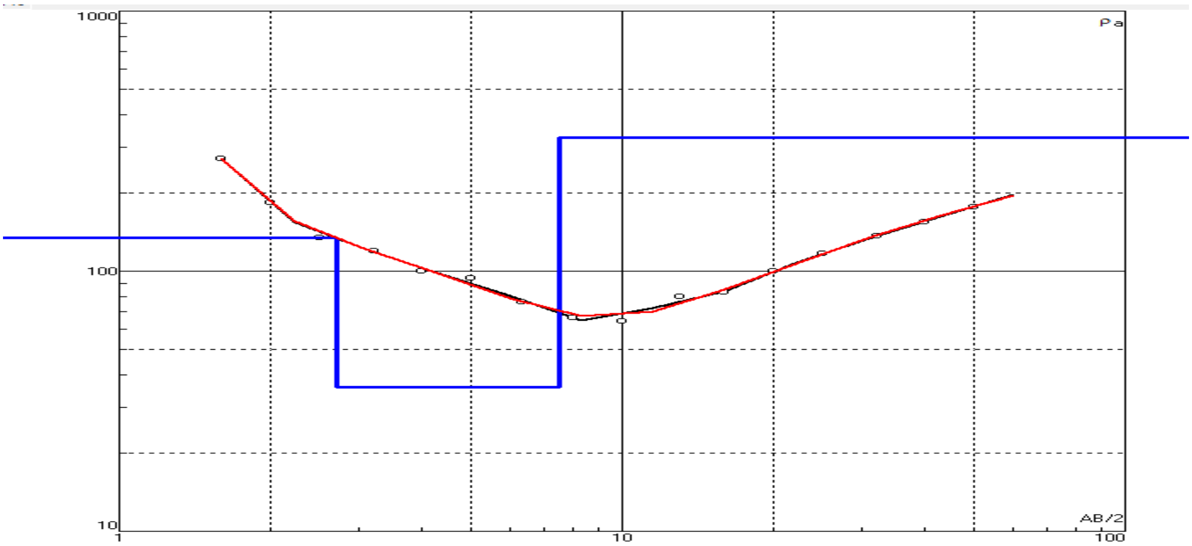


Figure 28: Interpreted Graph for VES 22

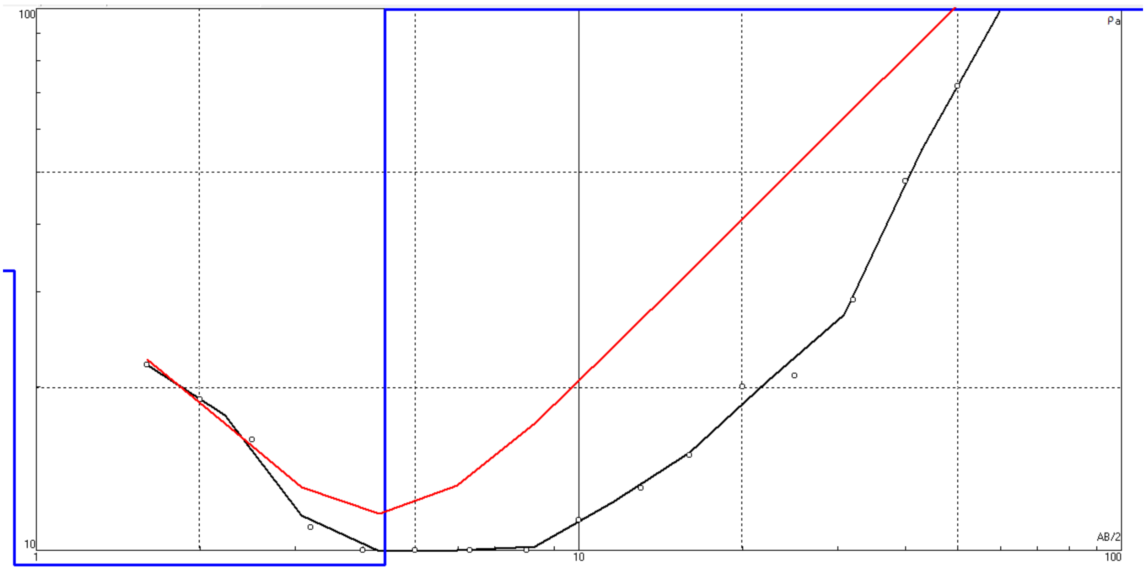


Figure 29: Interpreted Graph for VES 23

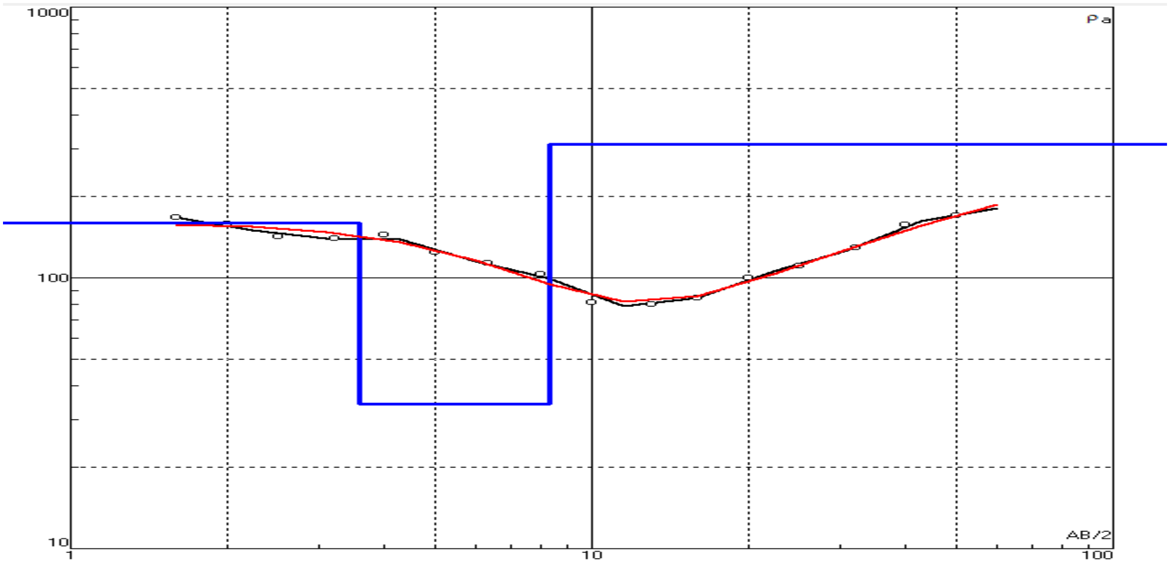


Figure 30: Interpreted Graph for VES 24

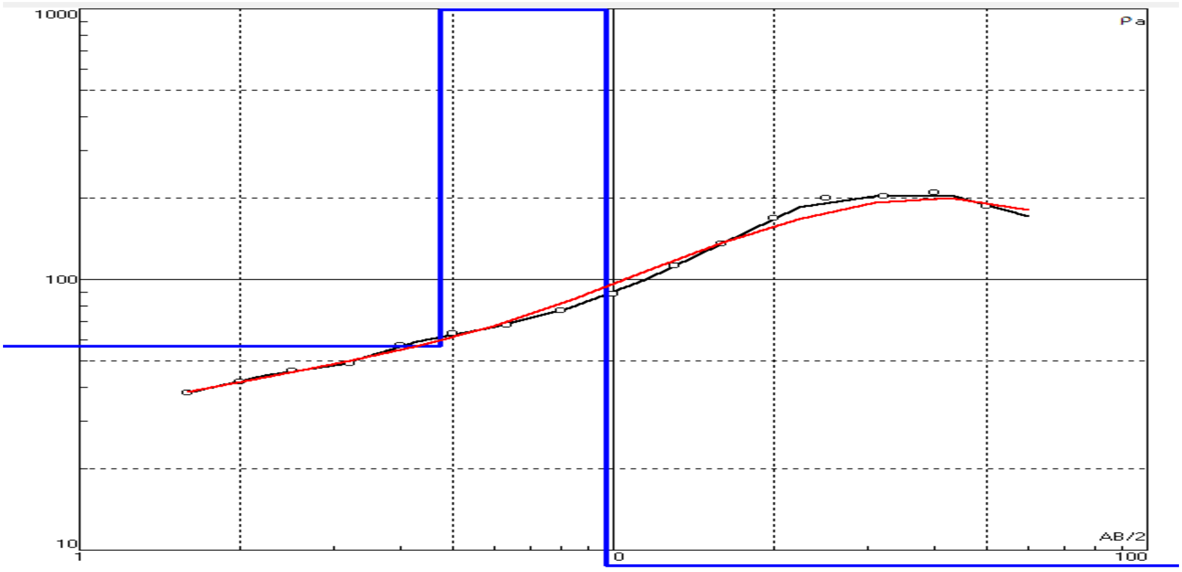


Figure 31: Interpreted Graph for VES 25

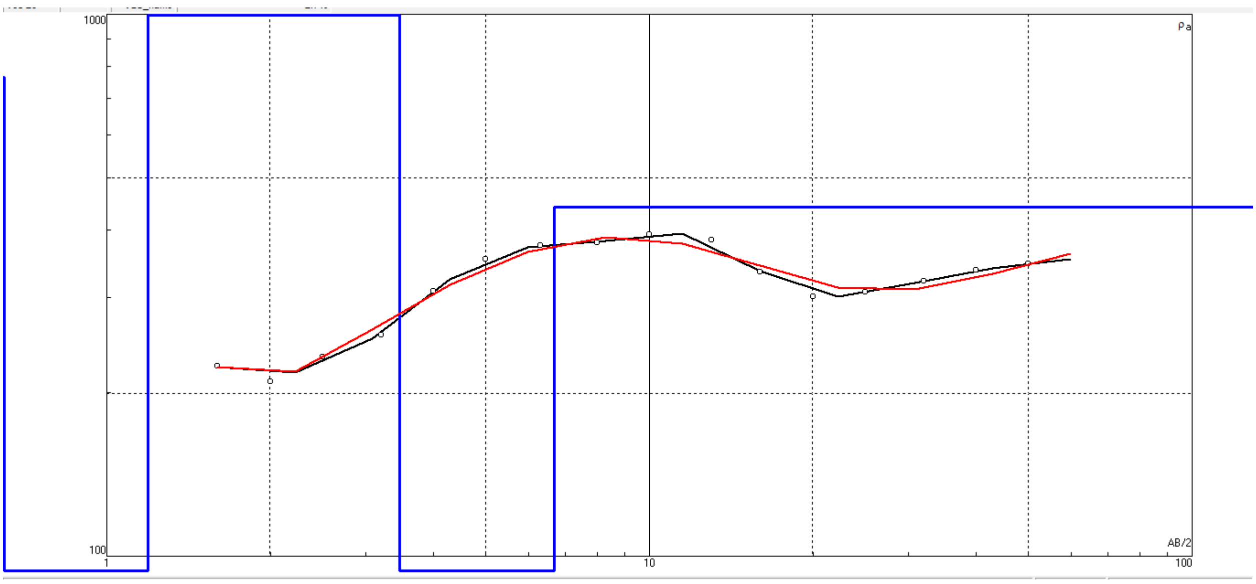


Figure 32: Interpreted Graph for VES 26

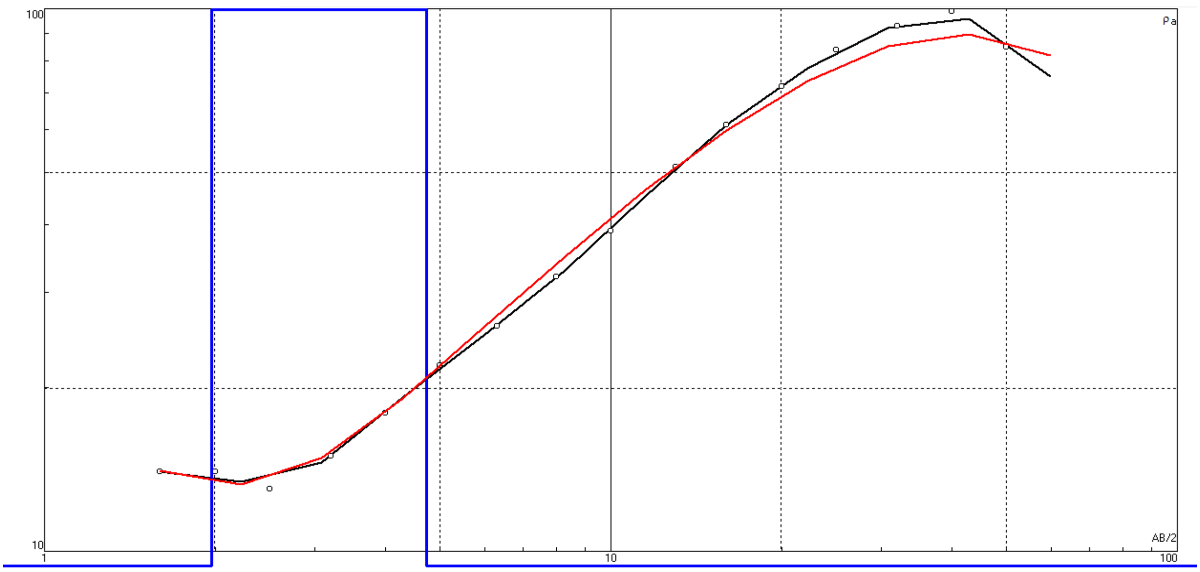


Figure 33: Interpreted Graph for VES 27

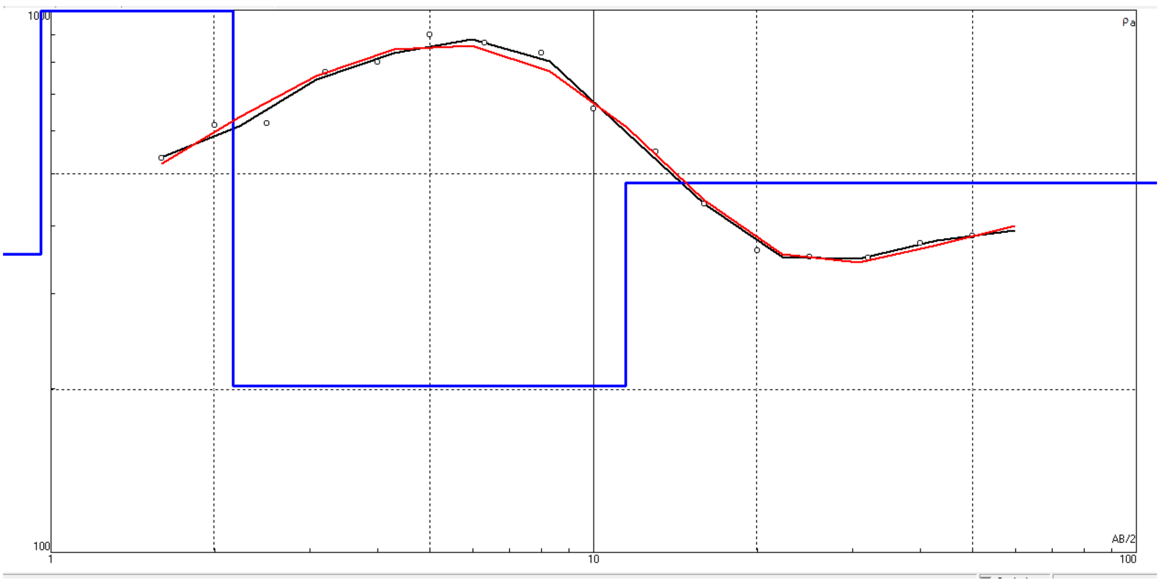


Figure 34: Interpreted Graph for VES 28

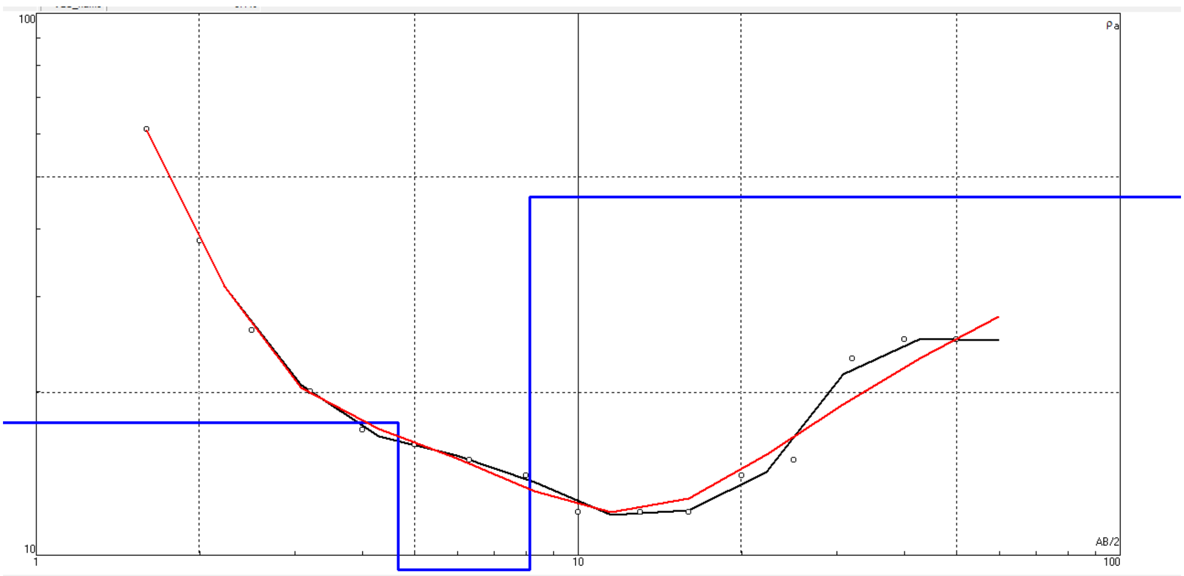


Figure 35: Interpreted Graph for VES 29

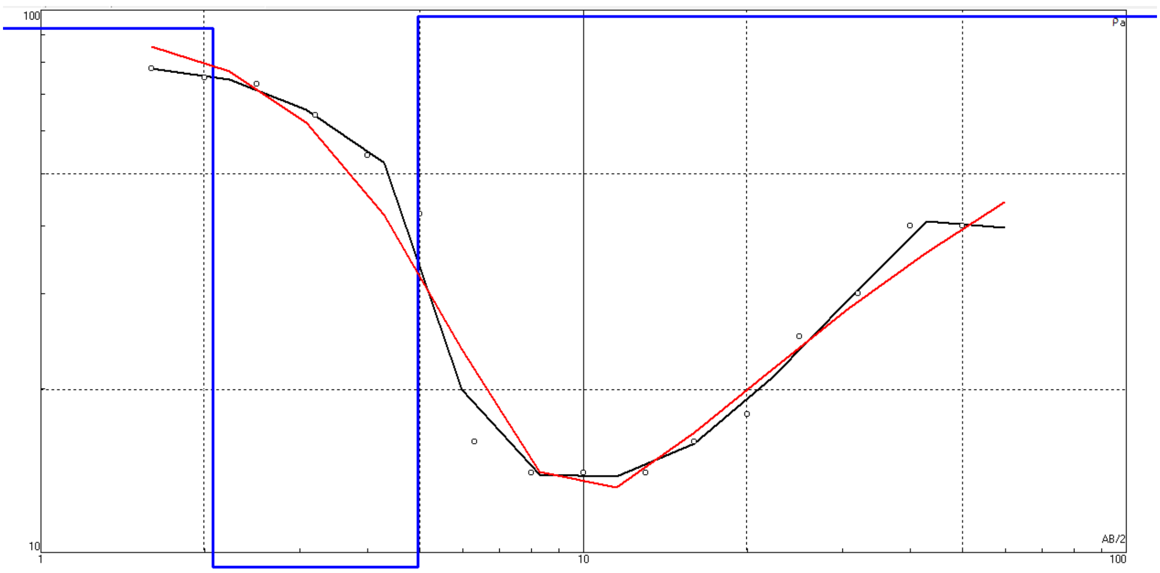


Figure 36: Interpreted Graph for VES 30

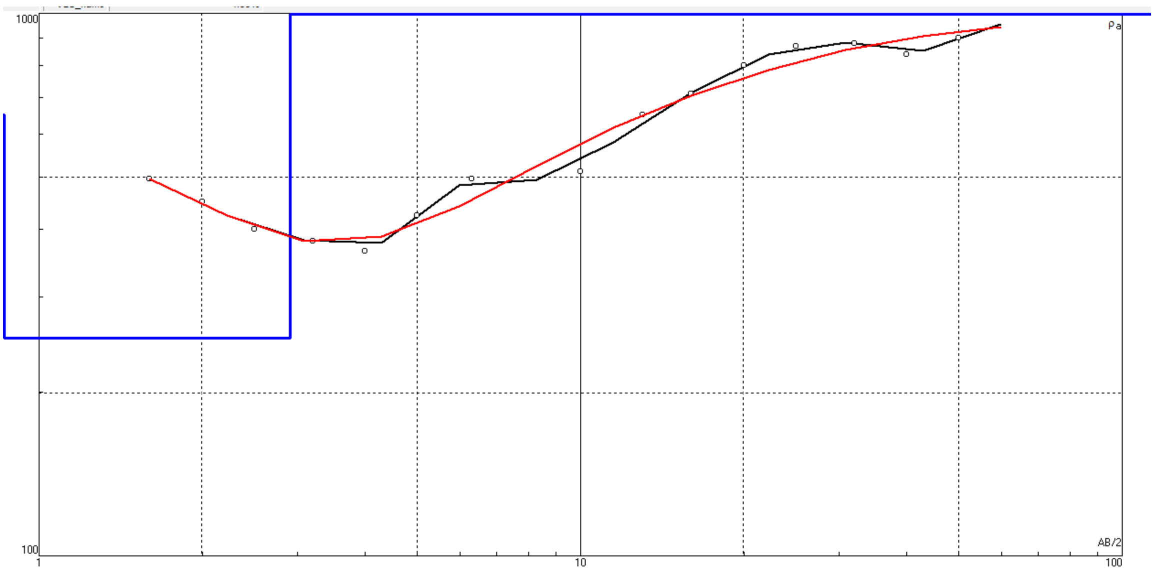


Figure 37: Interpreted Graph for VES 31

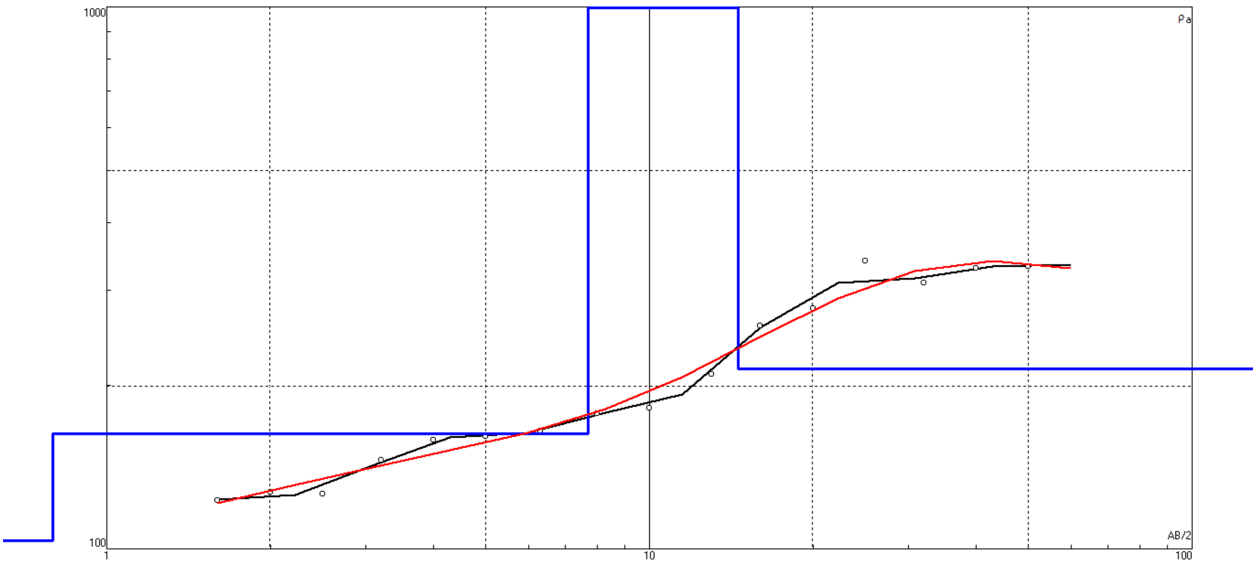


Figure 38: Interpreted Graph for VES 32

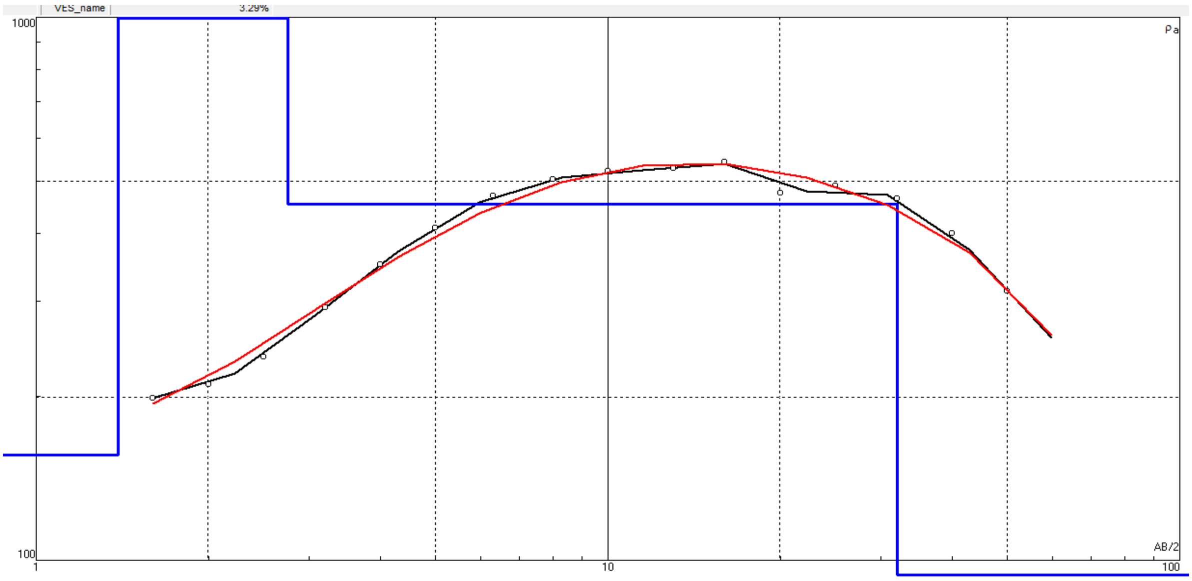


Figure 39: Interpreted Graph for VES 33

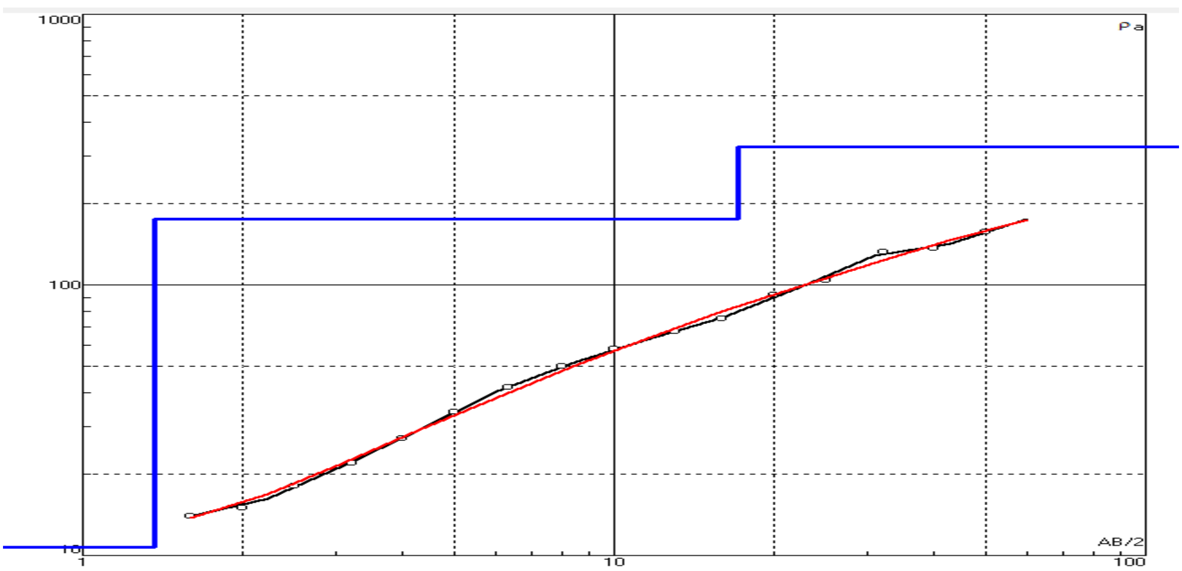


Figure 40: Interpreted Graph for VES 34

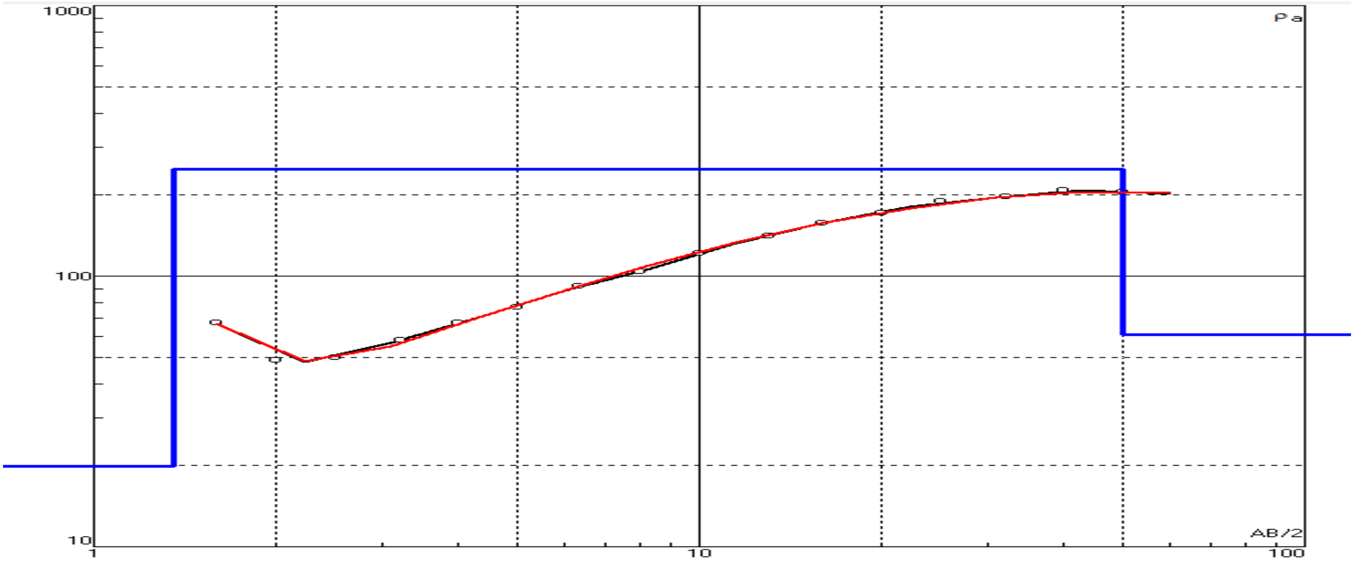


Figure 41: Interpreted Graph for VES 35

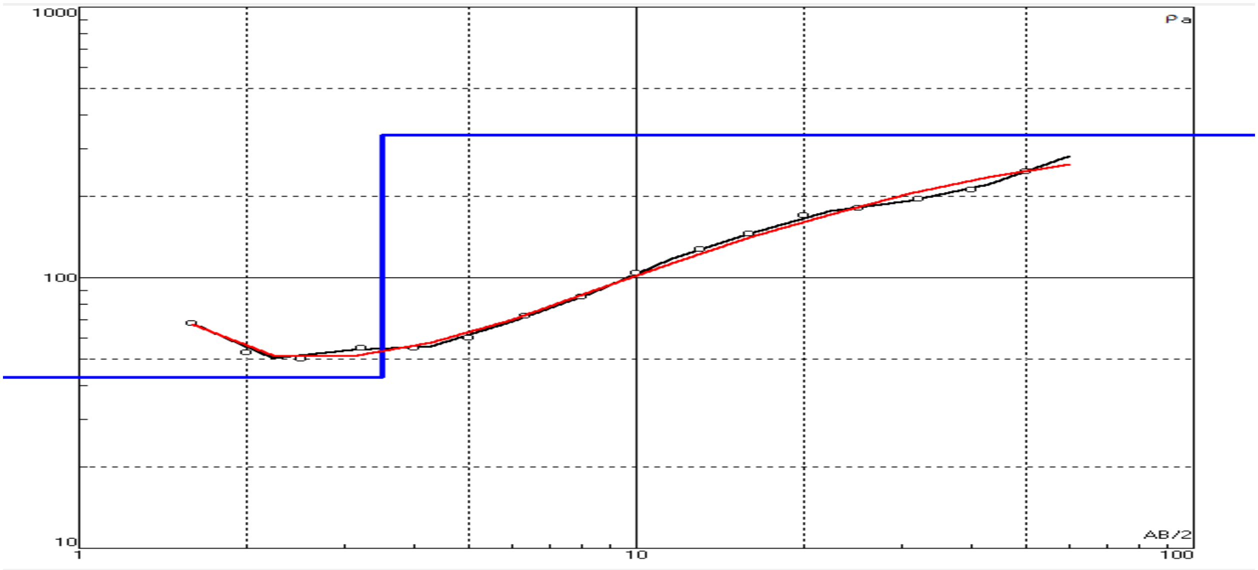


Figure 42: Interpreted Graph for VES 36

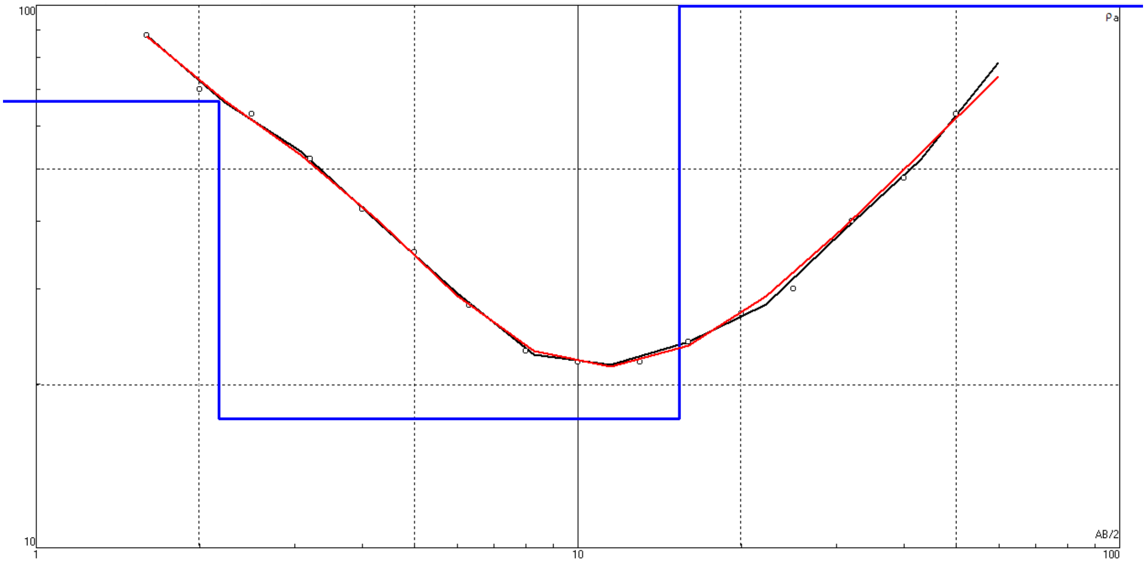


Figure 43: Interpreted Graph for VES 37

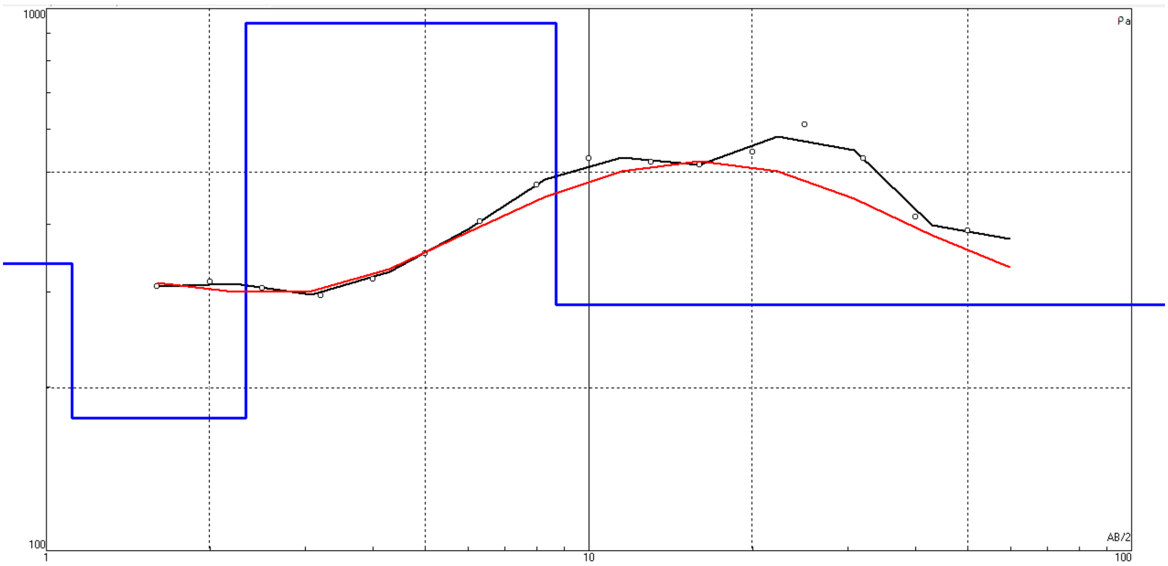


Figure 44: Interpreted Graph for VES 38

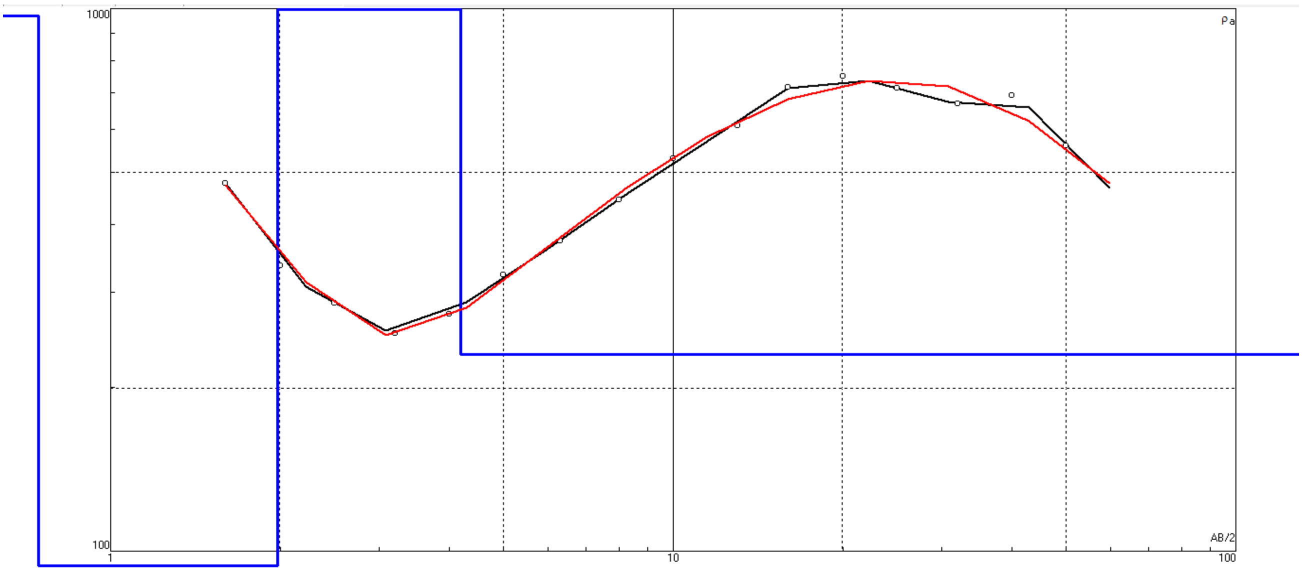


Figure 45: Interpreted Graph for VES 39

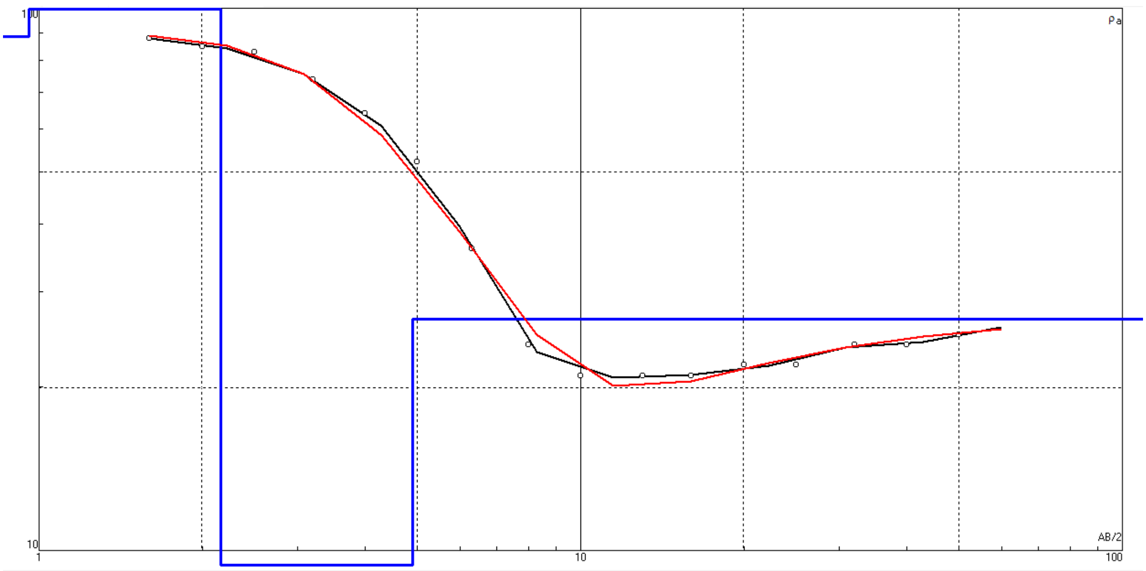


Figure 46: Interpreted Graph for VES 40

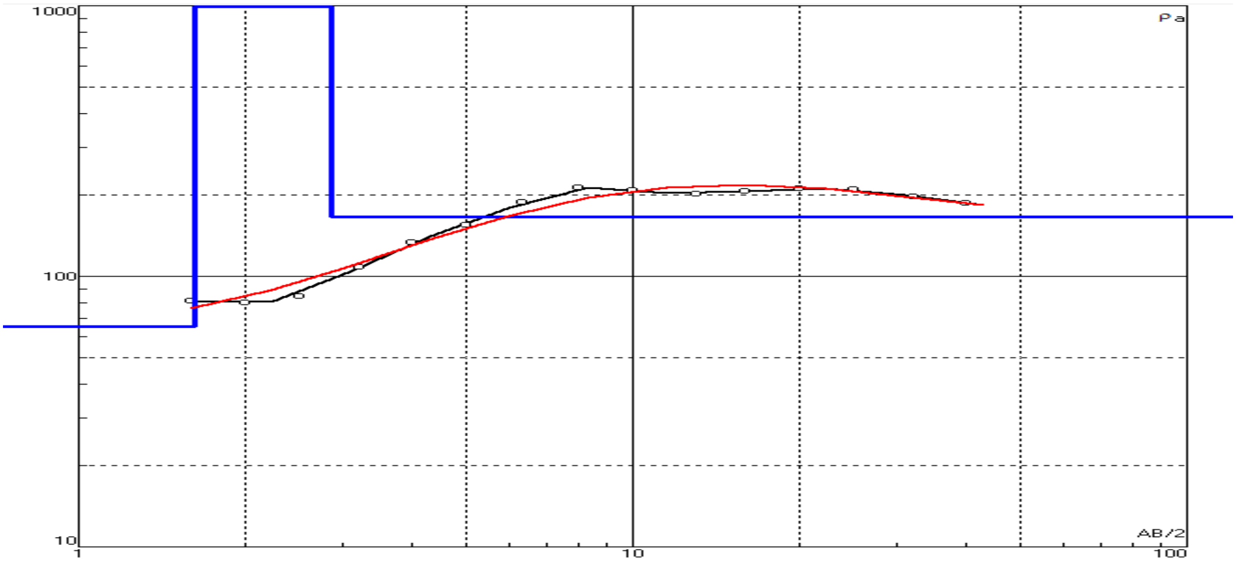


Figure 47: Interpreted Graph for VES 41

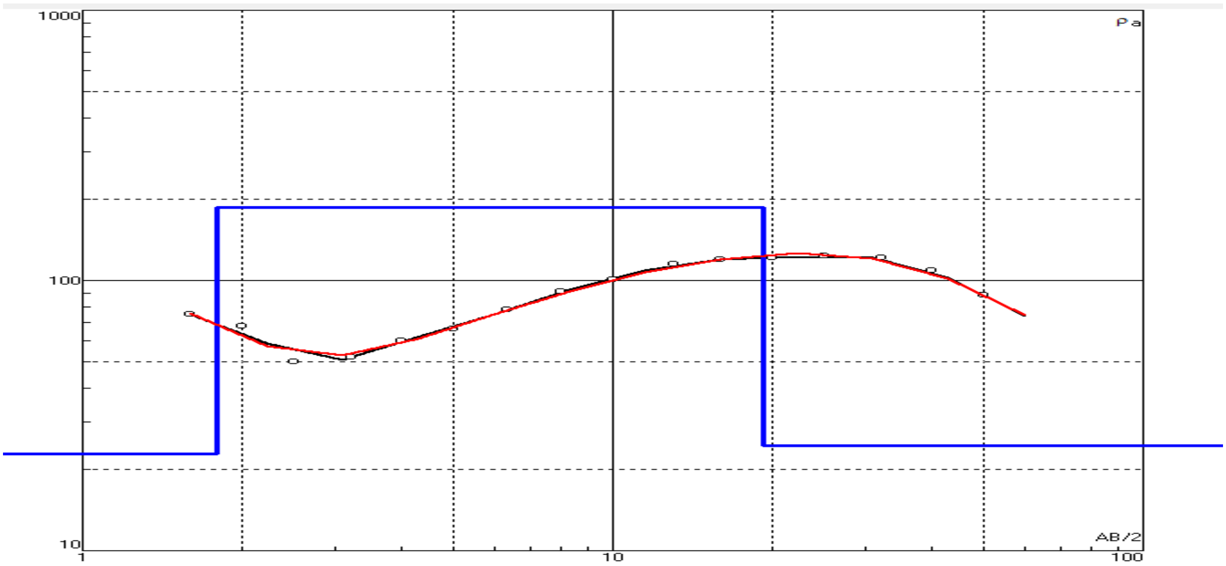


Figure 48: Interpreted Graph for VES 42

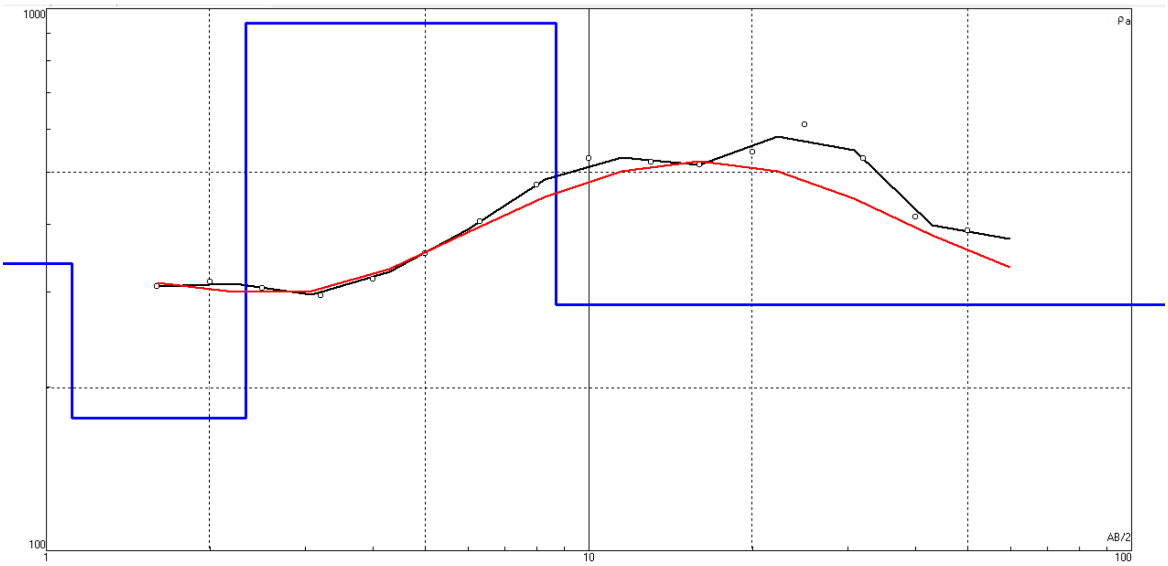
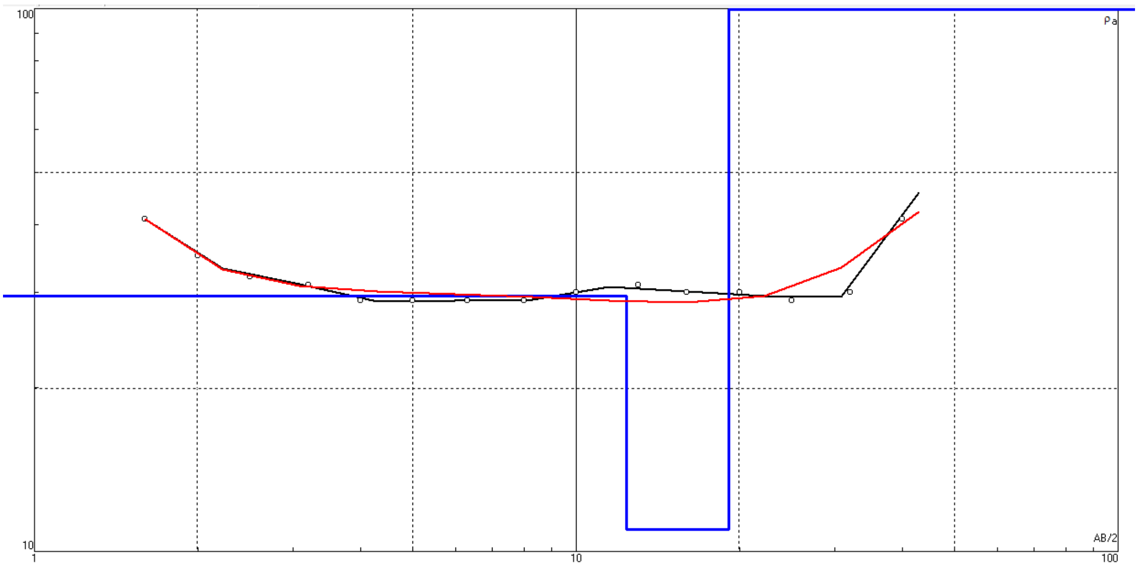


Figure 49: Interpreted Graph for VES 43



Field photos

SEGMENTS DEFINITION

Segment 1: Angle Point 1 (MN01) – Angle Point 2 (MN02) (Inclusive Test Points In-between)

Segment 2: Angle Point 2 (MN02) – Angle Point 3 (MN03) (Inclusive Test Points In-between)

Segment 3: Angle Point 3 (MN03) – Angle Point 4 (MN04) (Inclusive Test Points In-between)

Segment 4: Angle Point 4 (MN04) – Angle Point 5 (MN05) (Inclusive Test Points In-between)

Segment 5: Angle Point 5 (MN05) – Angle Point 6 (MN06) (Inclusive Test Points In-between)

Segment 6: Angle Point 6 (MN06) – Angle Point 7 (MN07) (Inclusive Test Points In-between)

Segment 7: Angle Point 7 (MN07) – Angle Point 8 (MN08) (Inclusive Test Points In-between)

Segment 8: Angle Point 8 (MN08) – Angle Point 9 (MN09) (Inclusive Test Points In-between)

Segment 9: Angle Point 9 (MN09) – Angle Point 10 (MN10) (Inclusive Test Points In-between)

Segment 10: Angle Point 10 (MN10) – Angle Point 11 (MN11) (Inclusive Test Points In-between)

Segment 11: Angle Point 11 (MN11) – Angle Point 12 (MN12) (Inclusive Test Points In-between)

Segment 12: Angle Point 12 (MN12) – Angle Point 13 (MN13) (Inclusive Test Points In-between)

Segment 13: Angle Point 13 (MN13) – Angle Point 14 (MN14) (Inclusive Test Points In-between)

Segment 14: Angle Point 14 (MN14) – Angle Point 15 (MN15) (Inclusive Test Points In-between)

Segment 15: Angle Point 15 (MN15) – Angle Point 16 (MN16) (Inclusive Test Points In-between)

Segment 16: Angle Point 16 (MN16) – Angle Point 17 (MN17) (Inclusive Test Points In-between)

Segment 17: Angle Point 17 (MN17) – Angle Point 18 (MN18) (Inclusive Test Points In-between)

Segment 18: Angle Point 18 (MN18) – Angle Point 19 (MN19) (Inclusive Test Points In-between)

Segment 19: Angle Point 19 (MN19) – Angle Point 20 (MN20) (Inclusive Test Points In-between)

Segment 20: Angle Point 20 (MN20) – Angle Point 21 (MN21) (Inclusive Test Points In-between)

Segment 21: Angle Point 21 (MN21) – Angle Point 22 (MN22) (Inclusive Test Points In-between)

Segment 22: Angle Point 22 (MN22) – Angle Point 23 (MN23) (Inclusive Test Points In-between)

Segment 23: Angle Point 23 (MN23) – Angle Point 24 (MN24) (Inclusive Test Points In-between)

Segment 24: Angle Point 24 (MN24) – Angle Point 25 (MN25) (Inclusive Test Points In-between)

Segment 25: Angle Point 25 (MN25) – Angle Point 26 (MN26) (Inclusive Test Points In-between)

Segment 26: Angle Point 26 (MN26) – Angle Point 27 (MN27) (Inclusive Test Points In-between)

Segment 27: Angle Point 27 (MN27) – Angle Point 28 (MN28) (Inclusive Test Points In-between)

Segment 28: Angle Point 28 (MN28) – Angle Point 29 (MN29) (Inclusive Test Points In-between)

Segment 29: Angle Point 29 (MN29) – Angle Point 30 (MN30) (Inclusive Test Points In-between)

Segment 30: Angle Point 30 (MN30) – Angle Point 31 (MN31) (Inclusive Test Points In-between)

Segment 31: Angle Point 31 (MN31) – Angle Point 32 (MN32) (Inclusive Test Points In-between)

Segment 32: Angle Point 32 (MN32) – Angle Point 33 (MN33) (Inclusive Test Points In-between)

Segment 33: Angle Point 33 (MN33) – Angle Point 34 (MN34) (Inclusive Test Points In-between)

Segment 34: Angle Point 34 (MN34) – Angle Point 35 (MN35) (Inclusive Test Points In-between)

Segment 35: Angle Point 35 (MN35) – Angle Point 36 (MN36) (Inclusive Test Points In-between)

Segment 36: Angle Point 36 (MN36) – Angle Point 37 (MN37) (Inclusive Test Points In-between)

Segment 37: Angle Point 37 (MN37) – Angle Point 38 (MN38) (Inclusive Test Points In-between)

Segment 38: Angle Point 38 (MN38) – Angle Point 39 (MN39) (Inclusive Test Points In-between)

APPENDIX

CLASSIFICATION TESTS

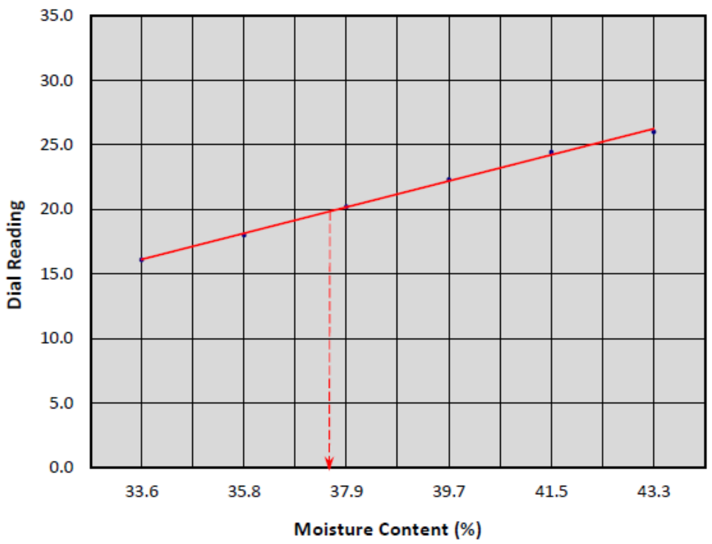
SEGMENT 1

ATTERBERG LIMITS BS 1377 - 2: 1990

MN01

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1079
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.0	20.2	22.3	24.4	26.0	-	-	
Tin No	**69**	**53**	**72**	**17**	**27**	**33**	**16**	**29**	
Mass of Wet Soil (g)	49.71	40.97	35.05	40.56	47.35	54.22	20.45	24.00	
Mass of Dry Soil (g)	37.21	30.17	25.41	29.04	33.46	37.84	16.49	19.32	
Mass of Moisture (g)	12.50	10.80	9.64	11.52	13.89	16.38	3.96	4.68	
Moisture Content (%)	33.6	35.8	37.9	39.7	41.5	43.3	24.0	24.2	24.1



PLASTIC LIMIT
PL = 24.1 %

LIQUID LIMIT
LL = 37.5 %

Proportion Passing 425 µm BS Sieve
= 82.7 %

PLASTICITY INDEX
PI = 13.4 %

PLASTIC MODULUS
PM = 1107

LINEAR SHRINKAGE
LS = 6.4 %

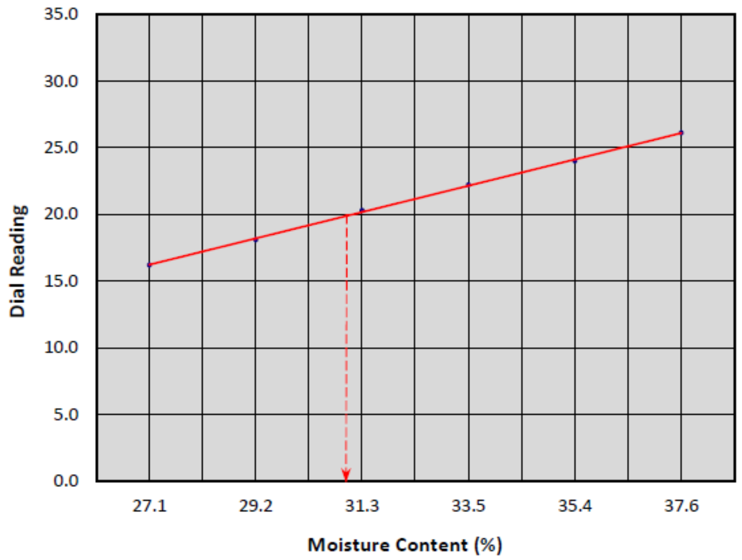
GROUP SYMBOL (USC SYSTEM)
CL

Tested By: LUCAS Date Reported: 19.12.2012 Checked: WK

MN02

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1080
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.3	22.2	24.0	26.1	-	-	
Tin No	**4**	**9**	**11**	**7**	**12**	**8**	**5**	**3**	
Mass of Wet Soil (g)	60.04	56.36	58.20	60.56	54.36	54.04	12.69	16.98	
Mass of Dry Soil (g)	47.24	43.62	44.34	45.36	40.15	39.27	10.72	14.32	
Mass of Moisture (g)	12.80	12.74	13.86	15.20	14.21	14.77	1.97	2.66	
Moisture Content (%)	27.1	29.2	31.3	33.5	35.4	37.6	18.4	18.6	18.5



PLASTIC LIMIT
PL = 18.5 %

LIQUID LIMIT
LL = 30.9 %

Proportion Passing 425 µm BS Sieve
= 86.9 %

PLASTICITY INDEX
PI = 12.4 %

PLASTIC MODULUS
PM = 1080

LINEAR SHRINKAGE
LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)
CL

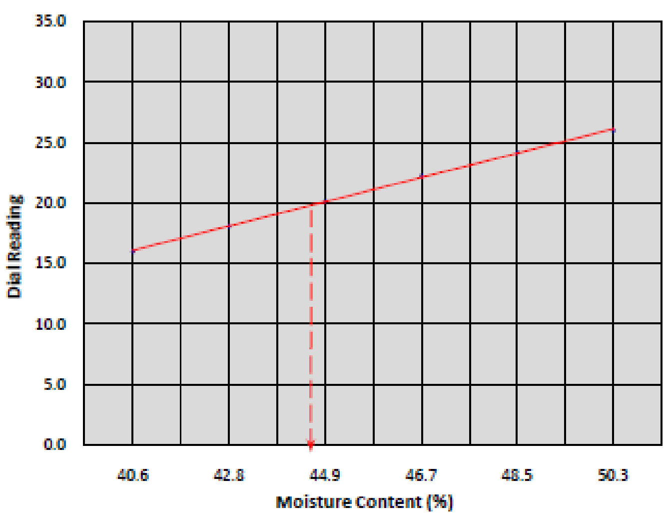
Tested By: LUCAS Date Reported: 19.11.2012 Checked: WK

TP2-3

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	Site / Location:	MN2 (TP2-3)MN3	Date Received:	06.03.2013
Material Description:	SILT with Sand	Job Reference:	GCL/NAS-356/13	Sample No.:	1174
Sampled By:	GEO CON	Depth:	2.0M	Date Tested:	16.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.1	20.2	22.3	24.2	26.0	-	-	
Tin No	12	20	8	9	25	32	74	51	
Mass of Wet Soil (g)	37.13	47.97	45.04	55.17	43.84	37.15	21.11	19.12	
Mass of Dry Soil (g)	26.41	33.59	31.08	37.61	29.52	24.72	16.31	14.75	
Mass of Moisture (g)	10.72	14.38	13.96	17.56	14.32	12.43	4.80	4.37	
Moisture Content (%)	40.6	42.8	44.9	46.7	48.5	50.3	29.4	29.6	29.5



PLASTIC LIMIT
PL = 29.5 %

LIQUID LIMIT
LL = 44.5 %

Proportion Passing 425 µm BS Sieve
= 80.9 %

PLASTICITY INDEX
PI = 15.0 %

PLASTIC MODULUS
PM = 1211

LINEAR SHRINKAGE
LS = 7.1 %

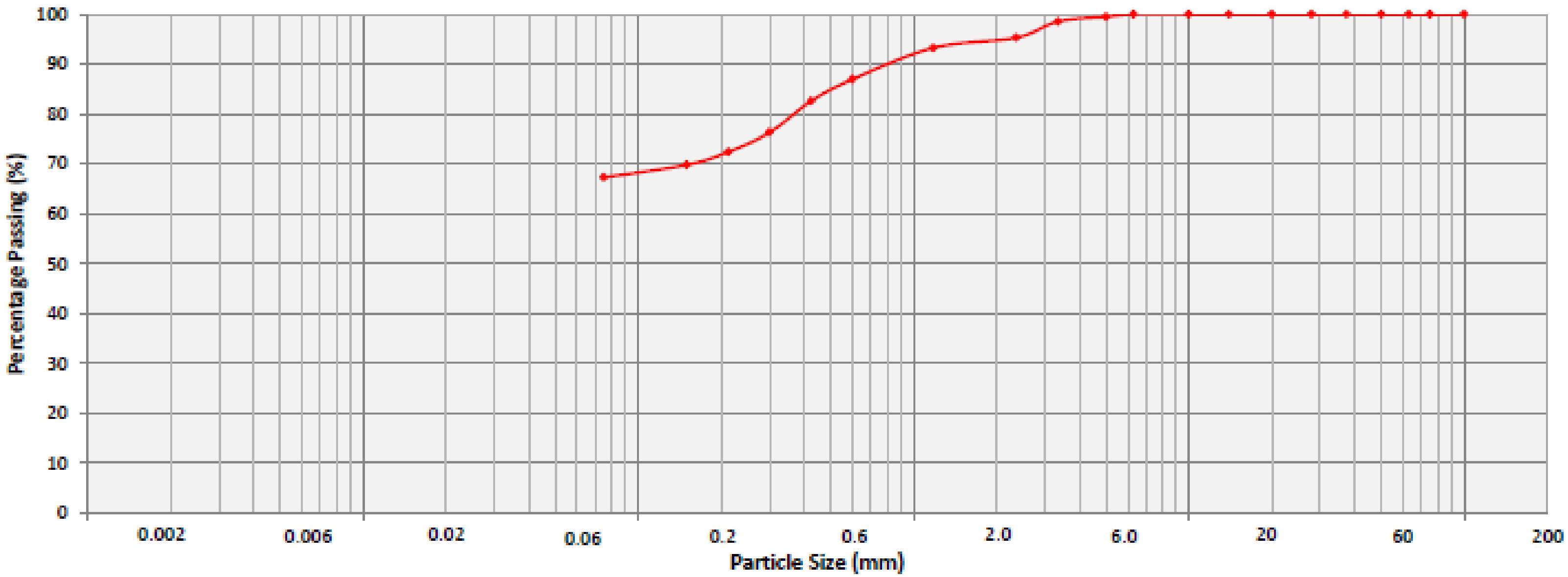
GROUP SYMBOL (USC SYSTEM)
ML

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN01

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 01	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1079



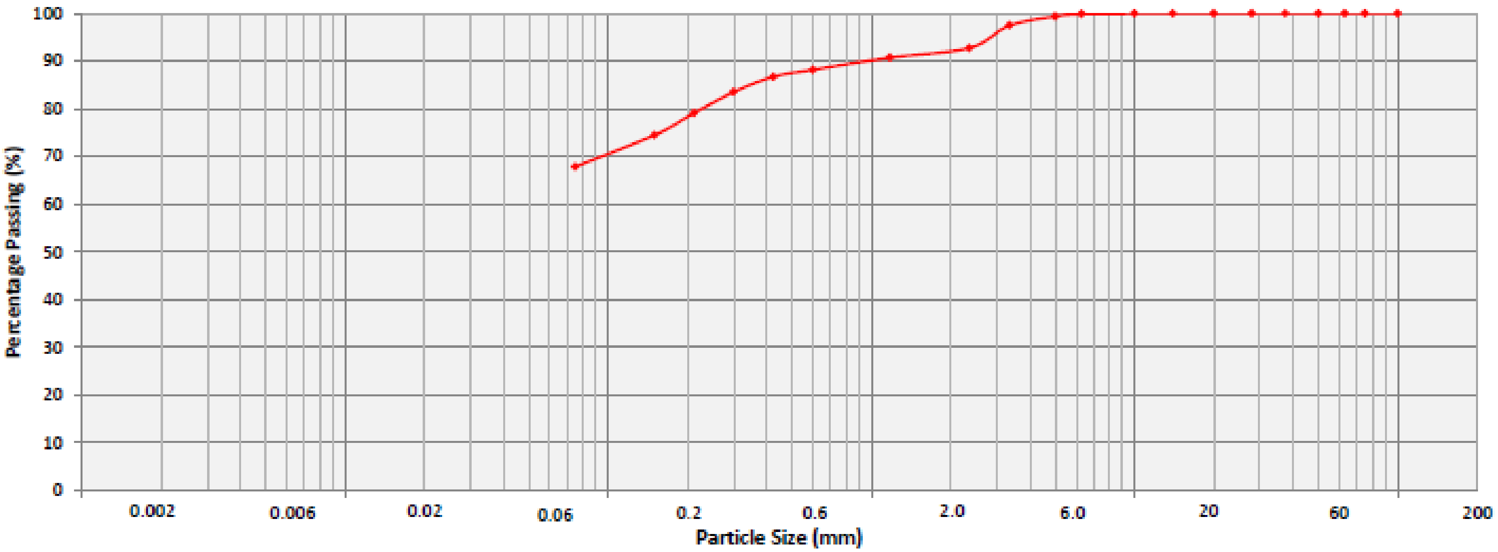
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

MN02

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 02	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	JOB REF:	GCL/TGA-342/12	DATE TESTED:	13.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1080



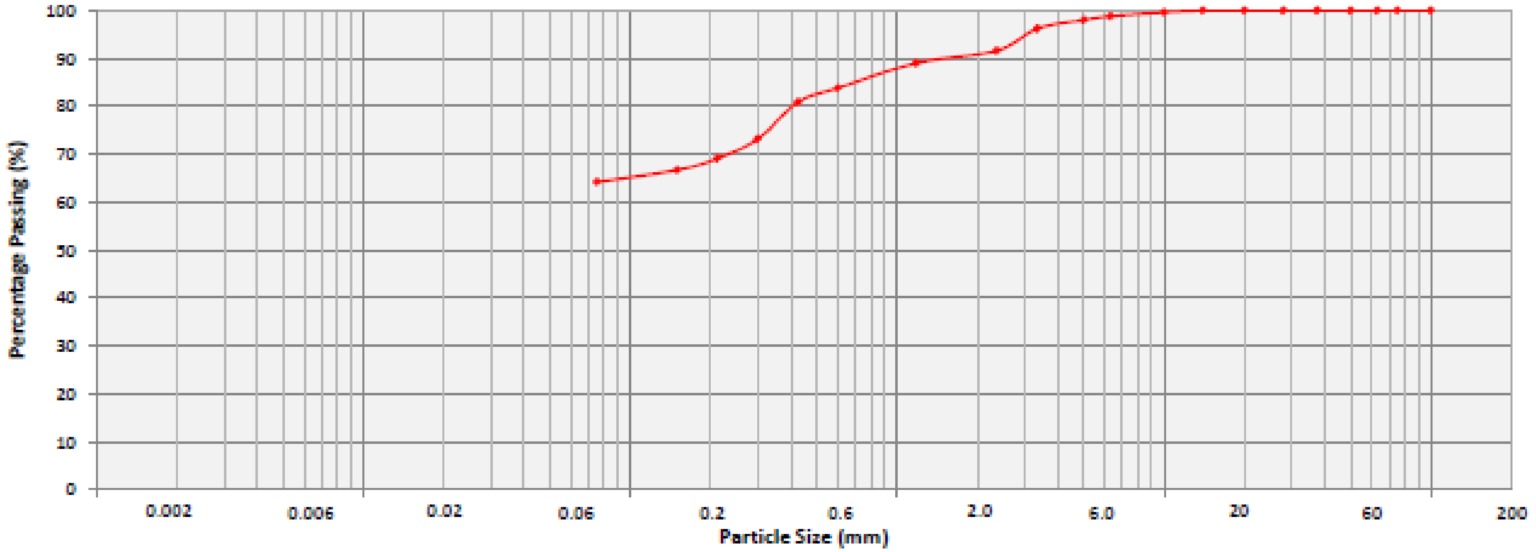
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP2-3

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN2 (TP2-3)MN3	DATE RECEIVED:	06.03.2013
MATERIAL DESCRIPTION:	SILT with Sand	JOB REF:	GCL/NAS-356/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1174



<table>
<tr><td rowspan="2">CLAY</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td rowspan="2">COBBLES</td><td rowspan="2">BOULDERS</td></tr>
<tr><td colspan="3">SILT</td><td colspan="3">SAND</td><td colspan="3">GRAVEL</td></tr>
</table>

DCP - CBR CORRELATION

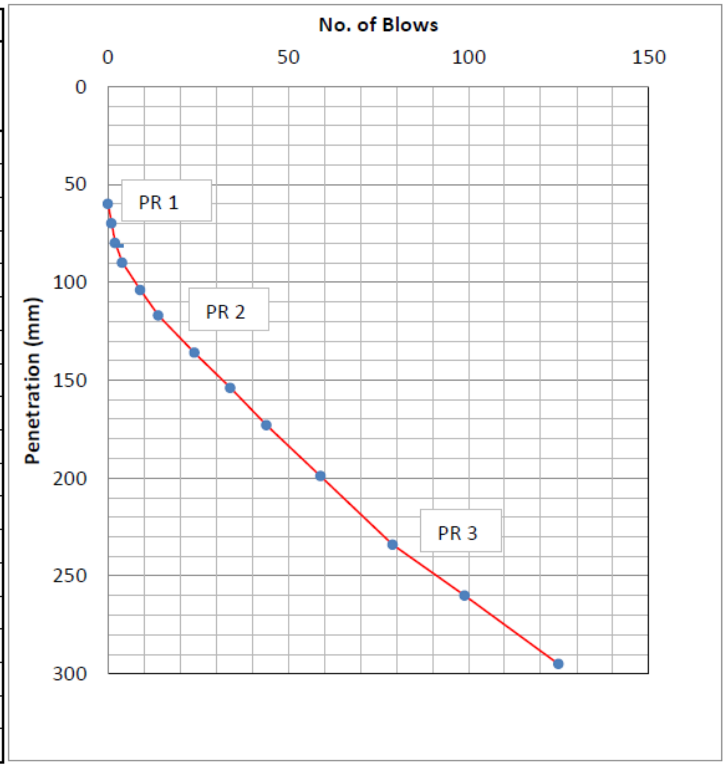
MN01

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 01	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1079

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	60	
1	1	1	70	10.0
2	1	2	80	10.0
3	2	4	90	5.0
4	5	9	104	2.8
5	5	14	117	2.6
6	10	24	136	1.9
7	10	34	154	1.8
8	10	44	173	1.9
9	15	59	199	1.7
10	20	79	234	1.8
11	20	99	260	1.3
12	26	125	295	1.3



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	10	22.5	
PR 2	4.2	68.3	
PR 3	1.3	306.3	

Test By: LUCAS **Checked:** WK

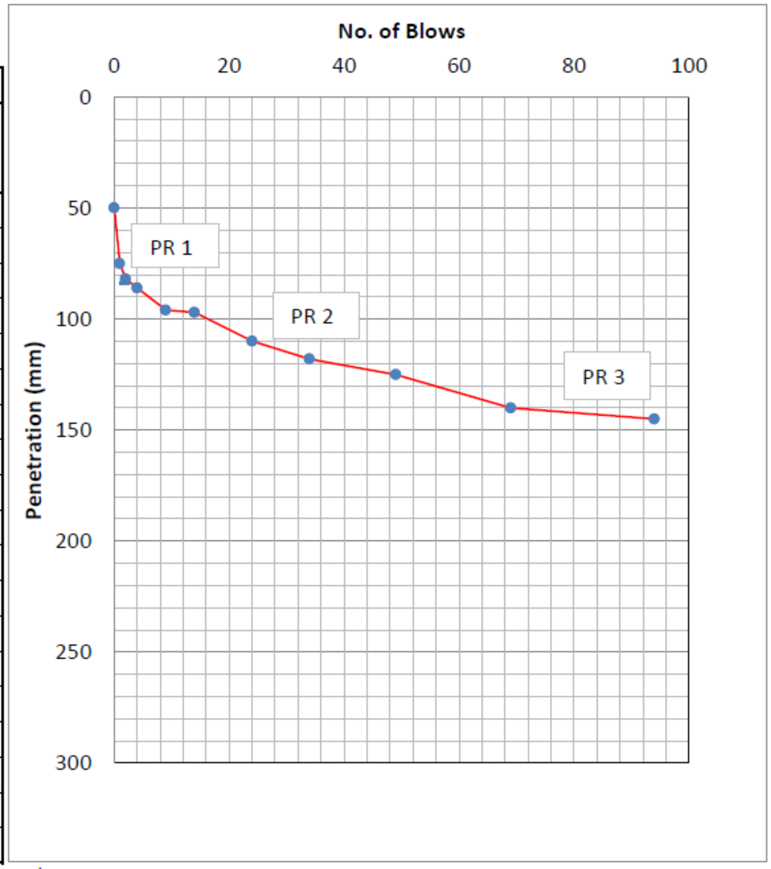
MN02

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 02	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1080

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	75	25.0
2	1	2	82	7.0
3	2	4	86	2.0
4	5	9	96	2.0
5	5	14	97	0.2
6	10	24	110	1.3
7	10	34	118	0.8
8	15	49	125	0.5
9	20	69	140	0.8
10	25	94	145	0.2



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	25	7.0	
PR 2	1.4	278.6	
PR 3	0.5	1040.7	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN01

CALCULATION OF SAFE BEARING CAPACITY: TP MN 01					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1079

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
C(kN/m^2) =	23	γ (kg/m^3) =	1744
ø (°) =	21	γ (kN/m^3) =	17.11

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_q = 7.07	
	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.11 x 2.0 x 7.07) + (0.4 x 17.11 x 1.0 x 3.42)	**690 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 690/3.0	**230 kN/m^2**

Calculations By: B.K. **Checked:** WK

MN02

CALCULATION OF SAFE BEARING CAPACITY: TP MN 02					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1080

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1718
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	16.85

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma\ BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 16.85 x 2.0 x 7.07) + (0.4 x 16.85 x 1.0 x 3.42)	**687 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 687/3.0	**229 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP2-3

CALCULATION OF SAFE BEARING CAPACITY: TP MN 02(TP2-3)M3					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	SILT with Sand			**Sample No.:**	1174

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1744
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	17.11

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.11 x 2.0 x 7.07) + (0.4 x 17.11 x 1.0 x 3.42)	**690 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 690/3.0	**230 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

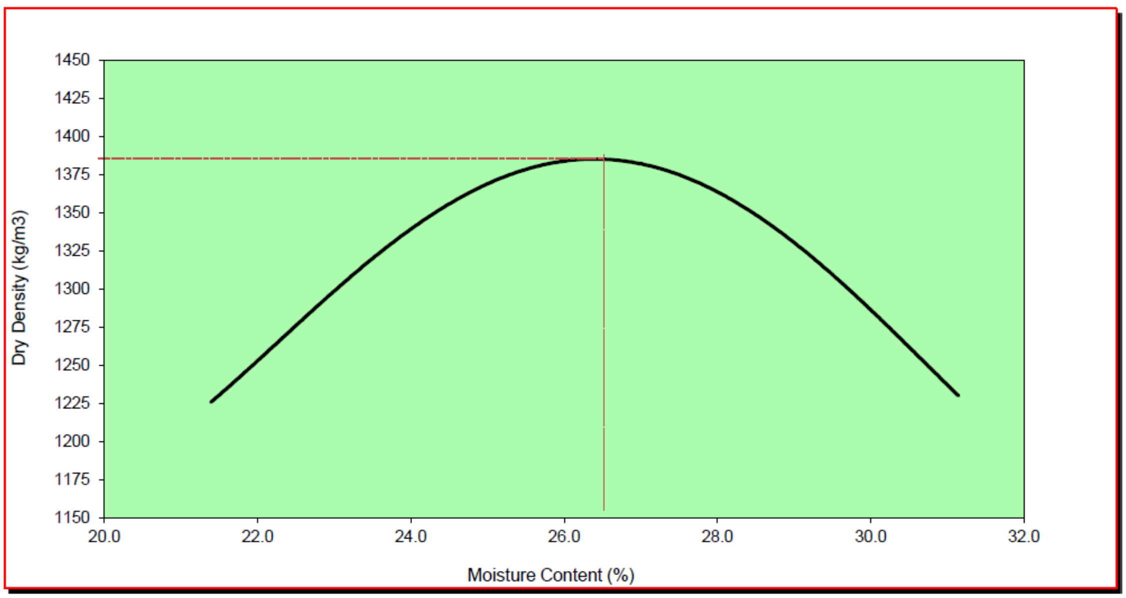
BS 1377 – 4: 1990

MN01

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1079
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 01	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5483	5621	5720	5750	5702	5608
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1488	1626	1725	1755	1707	1613
Bulk Density (Kgs/m^3)	**1488**	**1626**	**1725**	**1755**	**1707**	**1613**
Tin No.	G16	G01	G03	G21	G27	G19
Weight Wet Soil	244.0	237.0	272.0	314.0	305.0	240.0
Weight of Dry Soil	201.0	192.0	217.0	247.0	236.0	183.0
Weight of Water	43.0	45.0	55.0	67.0	69.0	57.0
Moisture Content (%)	**21.4**	**23.4**	**25.3**	**27.1**	**29.2**	**31.1**
Dry Density (Kgs/m^3)	**1226**	**1317**	**1376**	**1381**	**1321**	**1230**



Maximum Dry Density (Kg/m^3): 1380 **Optimum Moisture Content (%):** 26.4%

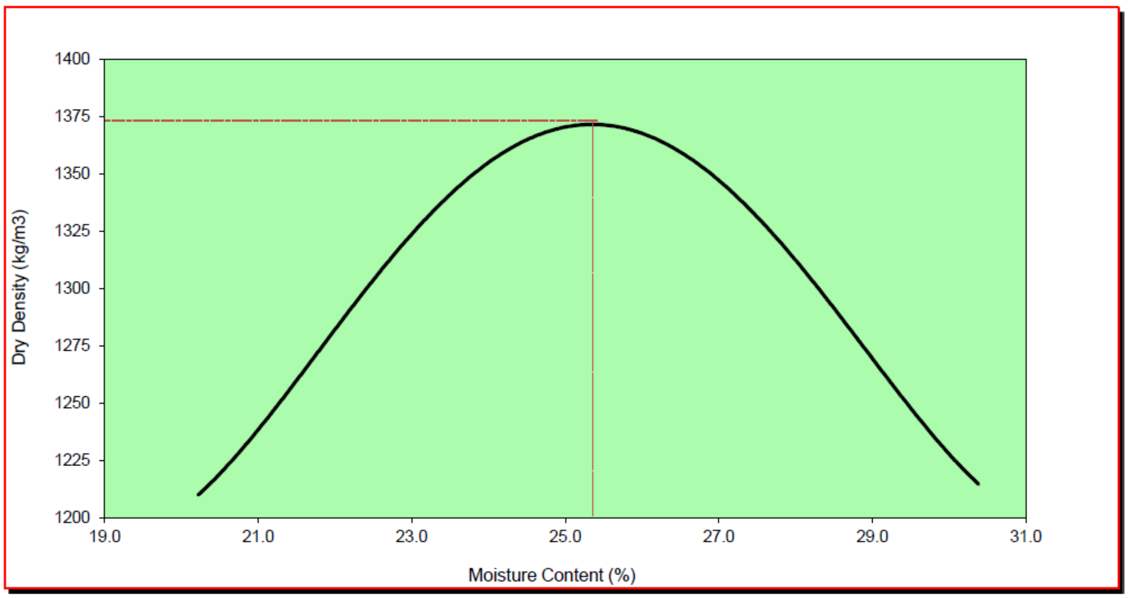
Tested By: STEVE **Date Reported:** 22.01.2013 **Checked By:** WK

MN02

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1080
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 02	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5449	5587	5689	5723	5665	5579
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1454	1592	1694	1728	1670	1584
Bulk Density (Kgs/m^3)	**1454**	**1592**	**1694**	**1728**	**1670**	**1584**
Tin No.	G16	G27	G33	G35	G23	G41
Weight Wet Soil	231.3	253.1	272.8	292.1	275.2	308.1
Weight of Dry Soil	192.4	206.8	219.1	231.3	214.7	236.3
Weight of Water	38.9	46.3	53.7	60.8	60.5	71.8
Moisture Content (%)	**20.2**	**22.4**	**24.5**	**26.3**	**28.2**	**30.4**
Dry Density (Kgs/m^3)	**1209**	**1301**	**1361**	**1368**	**1303**	**1215**



Maximum Dry Density (Kg/m^3): 1370 **Optimum Moisture Content (%):** 25.4%

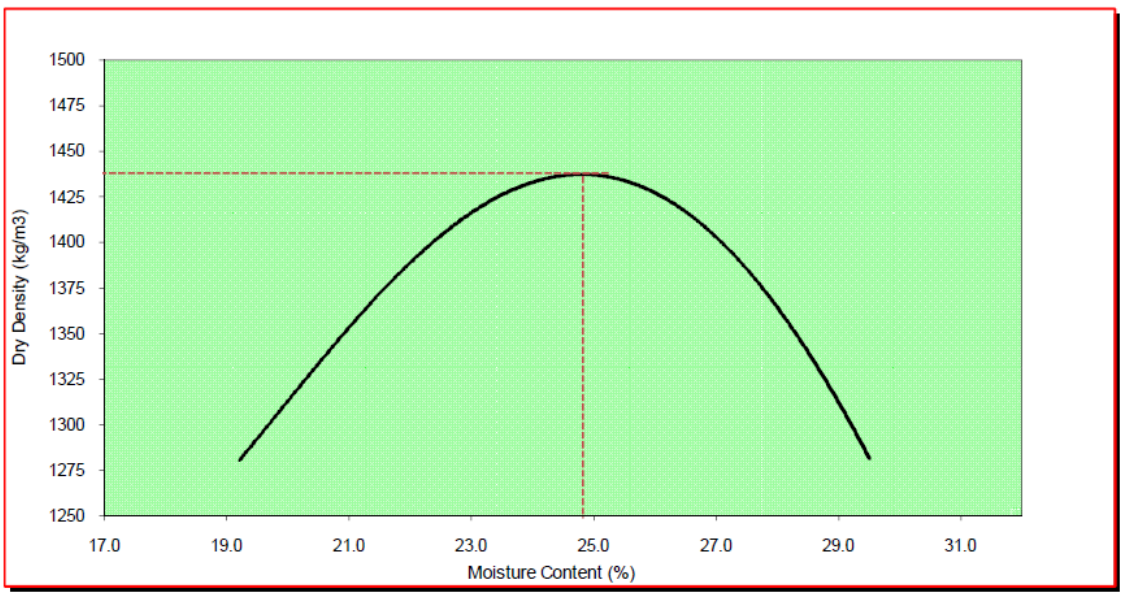
Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

TP2-3

NESHCONSULT ENGINEERING

Project:	NANYUKI-ISIOLO-MERU TRANSMISSION LINE	**LOCATION:**	MN2 - MN3	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU COUNTIES	**Job Ref.:**	GCL/NC-356/03	**Sample No.:**	1178
Material Description:		**Sample Ref:**	MN2 (TP2-3) MN3	**Date received:**	06.03.2013

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	4485	4622	4720	4762	4715	4619
Mass of Mould+Base	2959	2959	2959	2959	2959	2959
Mass of Compacted Soil	1526	1663	1761	1803	1756	1660
Bulk Density (Kgs/m^3)	**1526**	**1663**	**1761**	**1803**	**1756**	**1660**
Tin No.	G07	G28	G17	G38	G32	G35
Weight Wet Soil	311.6	335.2	298.2	301.5	335.9	352.0
Weight of Dry Soil	261.4	276.1	241.3	239.7	263.0	271.8
Weight of Water	50.2	59.1	56.9	61.8	72.9	80.2
Moisture Content (%)	**19.2**	**21.4**	**23.6**	**25.8**	**27.7**	**29.5**
Dry Density (Kgs/m^3)	**1280**	**1370**	**1425**	**1433**	**1375**	**1282**



Maximum Dry Density (Kg/m^3): 1438 **Optimum Moisture Content (%):** 24.8%

CHEMICAL ANALYSIS

Angle Point MN01	
Depth	2.0m
pH	7.42
Chloride(%) mg/l	0.32
Sulphate (mg/l)	-

Angle Point MN02	
Depth	2.0m
pH	7.69
Chloride(%) mg/l	0.46
Sulphate (mg/l)	0.001

TP2-3	
Depth	2.0m
pH	7.24
Chloride(%) mg/l	0.05
Sulphate (mg/l)	0.017

INSITU DENSITY TEST

TP2-3	
Depth (m)	2.0
Bulk density (kg/m3)	1535
Moisture Content (%)	22.7
Dry Density (kg/m3)	1251
Maximum Dry Density (kg/m3)	1438
Relative Compaction (%)	87

ANGLE POINT 1-2 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE			**JOB REF:**	GCL/NCE_342/12	
SITE:	NANYUKI-ISIOLO-MERU					
	MN 01			**MN 02**		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5		0.9	Dark Grey CLAY (Black Cotton Soil)		1.0	Dark Grey CLAY (Black Cotton Soil)
1 1.5 2		2.0	Grey Elastic SILT with Sand		2.0	Light Grey Elastic SILT with Sand and Gravel
2.5						

TEST POINT 2-3 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN2 (TP2-3) MN3		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 / 0.5 / 1		1.0	Dark Grey CLAY (Black Cotton Soil)
1.5 / 2		2.0	Grey Elastic SILT with Sand
2.5			

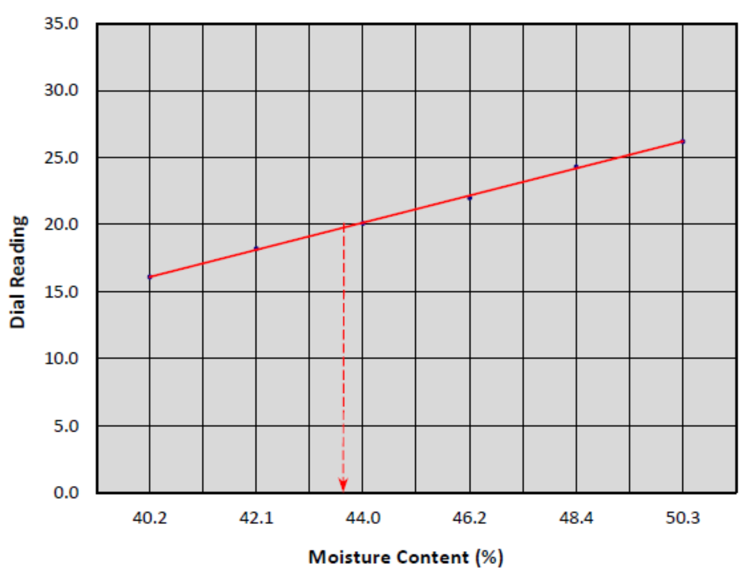
SEGMENT 2

ATTERBERG LIMITS BS 1377 - 2: 1990

MN03

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	POORLY-GRADED GRAVEL	**Job Reference:**	GCL/TGA-332/12	**Sample No.:**	1081
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.1	22.0	24.3	26.2	-	-	
Tin No	**6**	**26**	**47**	**28**	**21**	**33**	**12**	**20**	
Mass of Wet Soil (g)	30.51	35.47	39.65	44.46	39.13	42.37	26.15	28.66	
Mass of Dry Soil (g)	21.76	24.96	27.53	30.41	26.37	28.19	20.51	22.46	
Mass of Moisture (g)	8.75	10.51	12.12	14.05	12.76	14.18	5.64	6.20	
Moisture Content (%)	40.2	42.1	44.0	46.2	48.4	50.3	27.5	27.6	27.6



PLASTIC LIMIT

PL = 27.6 %

LIQUID LIMIT

LL = 43.6 %

Proportion Passing 425 µm BS Sieve

= 7.9 %

PLASTICITY INDEX

PI = 16.0 %

PLASTIC MODULUS

PM = 127

LINEAR SHRINKAGE

LS = 7.9 %

GROUP SYMBOL (USC SYSTEM)

GP

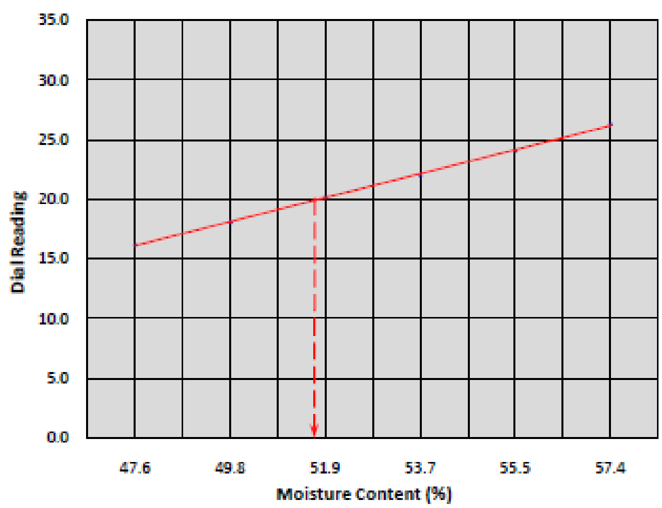
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP3-4A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	Site / Location:	MN3 (TP3-4A)MN4	Date Received:	06.03.2013
Material Description:	ELASTIC SILT with Sand	Job Reference:	GCL/NAS-356/13	Sample No.:	1175
Sampled By:	GEO CON	Depth:	2.0M	Date Tested:	16.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.2	22.0	24.1	26.3	-	-	
Tin No	1	30	26	9	41	29	33	23	
Mass of Wet Soil (g)	40.13	33.17	30.98	40.59	37.82	36.26	20.56	24.86	
Mass of Dry Soil (g)	27.19	22.14	20.39	26.41	24.32	23.04	15.26	18.43	
Mass of Moisture (g)	12.94	11.03	10.59	14.18	13.50	13.22	5.30	6.43	
Moisture Content (%)	47.6	49.8	51.9	53.7	55.5	57.4	34.7	34.9	34.8



PLASTIC LIMIT

PL = 34.8 %

LIQUID LIMIT

LL = 51.7 %

Proportion Passing 425 µm BS Sieve

= 64.9 %

PLASTICITY INDEX

PI = 16.9 %

PLASTIC MODULUS

PM = 1096

LINEAR SHRINKAGE

LS = 7.9 %

GROUP SYMBOL (USC SYSTEM)

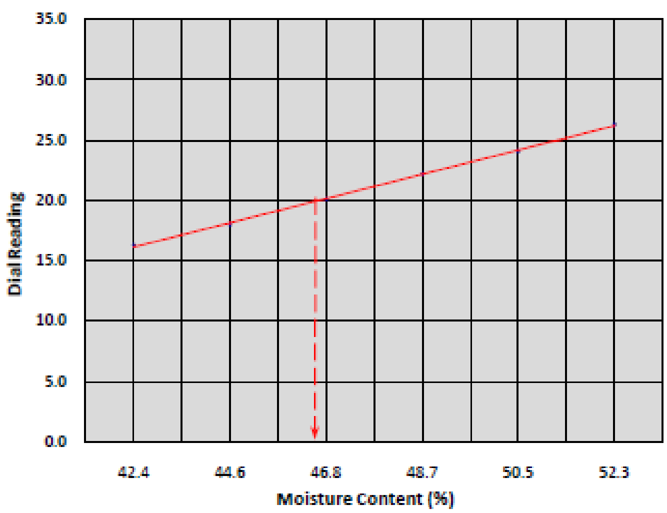
MH

TP3-4B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	Site / Location:	MN3 (TP3-4B)MN4	Date Received:	06.03.2013
Material Description:	Silty SAND with Gravel	Job Reference:	GCL/NAS-356/13	Sample No.:	1176
Sampled By:	GEO CON	Depth:	2.0M	Date Tested:	16.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.2	24.1	26.3	-	-	
Tin No	8	59	42	27	12	55	46	2	
Mass of Wet Soil (g)	53.57	60.33	48.79	52.06	59.48	65.03	14.89	18.88	
Mass of Dry Soil (g)	37.62	41.72	33.24	35.01	39.52	42.70	11.63	14.73	
Mass of Moisture (g)	15.95	18.61	15.55	17.05	19.96	22.33	3.26	4.15	
Moisture Content (%)	42.4	44.6	46.8	48.7	50.5	52.3	28.0	28.2	28.1



PLASTIC LIMIT
PL = 28.1 %

LIQUID LIMIT
LL = 46.6 %

Proportion Passing 425 µm BS Sieve
= 56.6 %

PLASTICITY INDEX
PI = 18.5 %

PLASTIC MODULUS
PM = 1047

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
SM

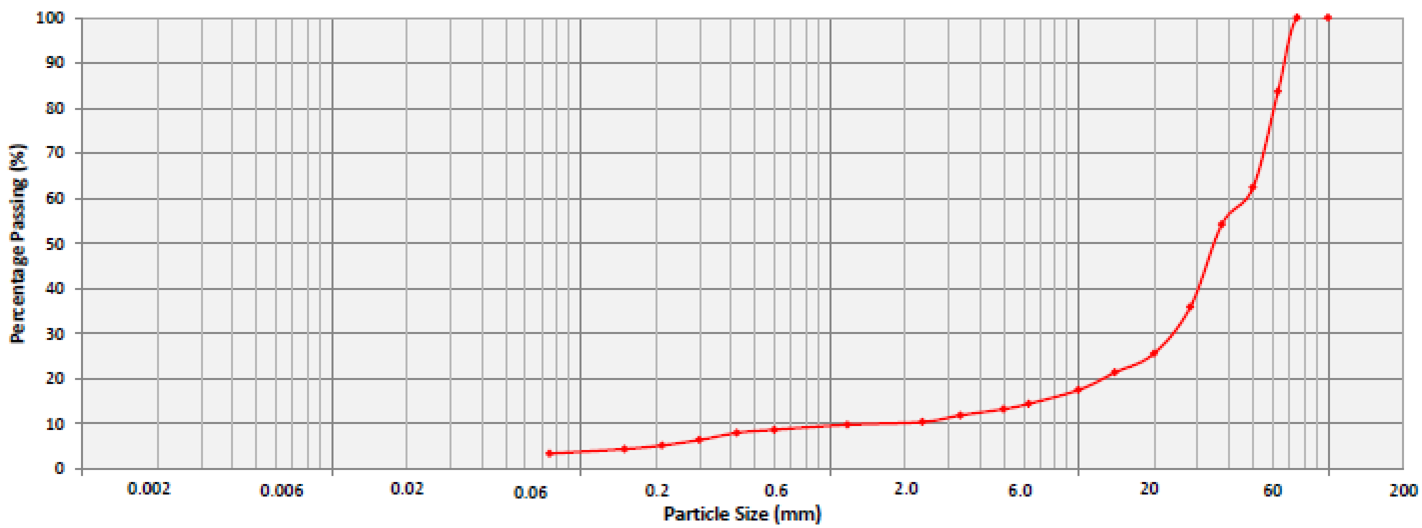
Tested By: STEVE Date Reported: 22.03.2013 Checked: ________________

PARTICLE SIZE ANALYSIS   BS 1377 - 2: 1990

MN03

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 03	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	POORLY-GRADED GRAVEL	JOB REF:	GCL/TGA-342/12	DATE TESTED:	13.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1081



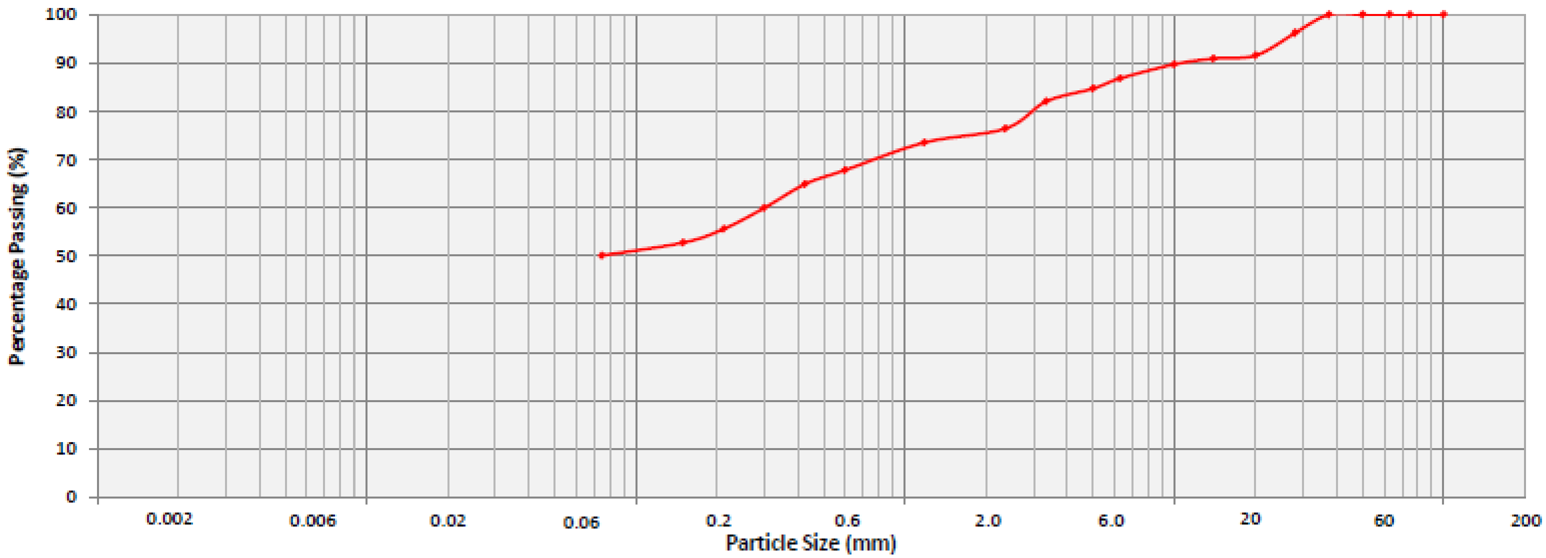
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA   DATE REPORTED 19.12.2012   CHECKED: WK

TP3-4A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN3 (TP3-4A)MN4	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand and Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1175

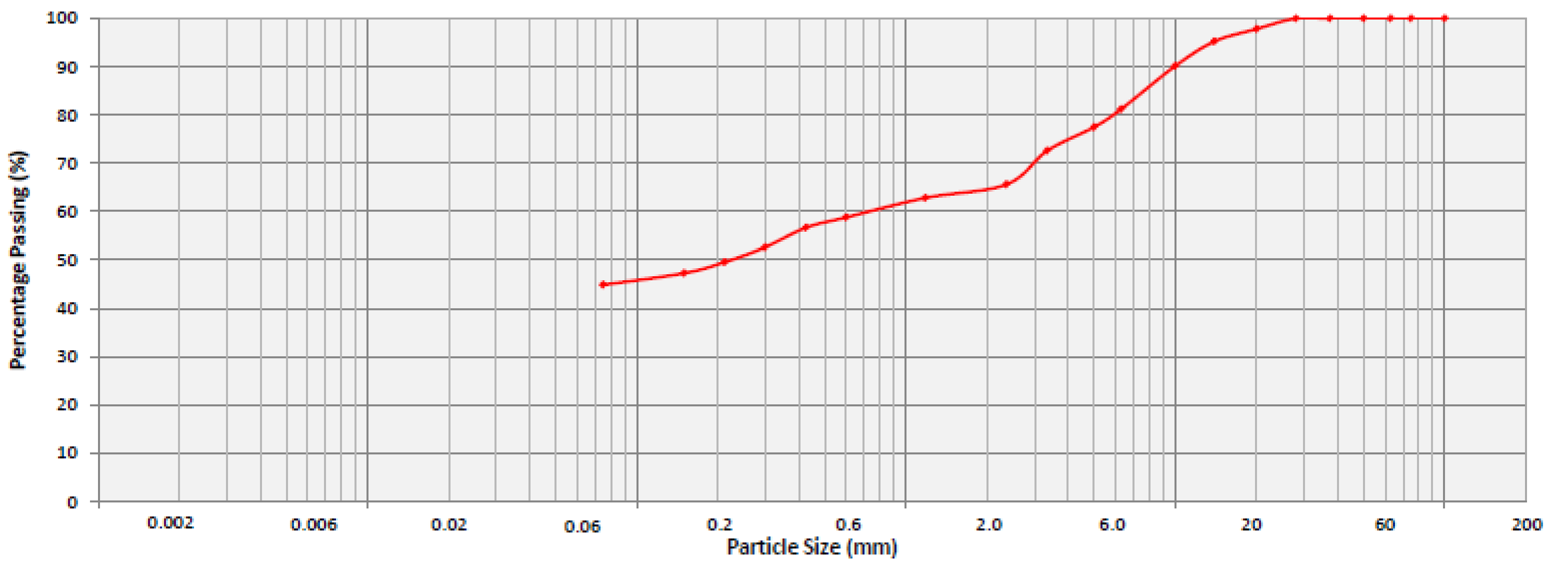


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP3-4B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN3(TP3-4B)MN4	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Silty SAND with Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1176



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

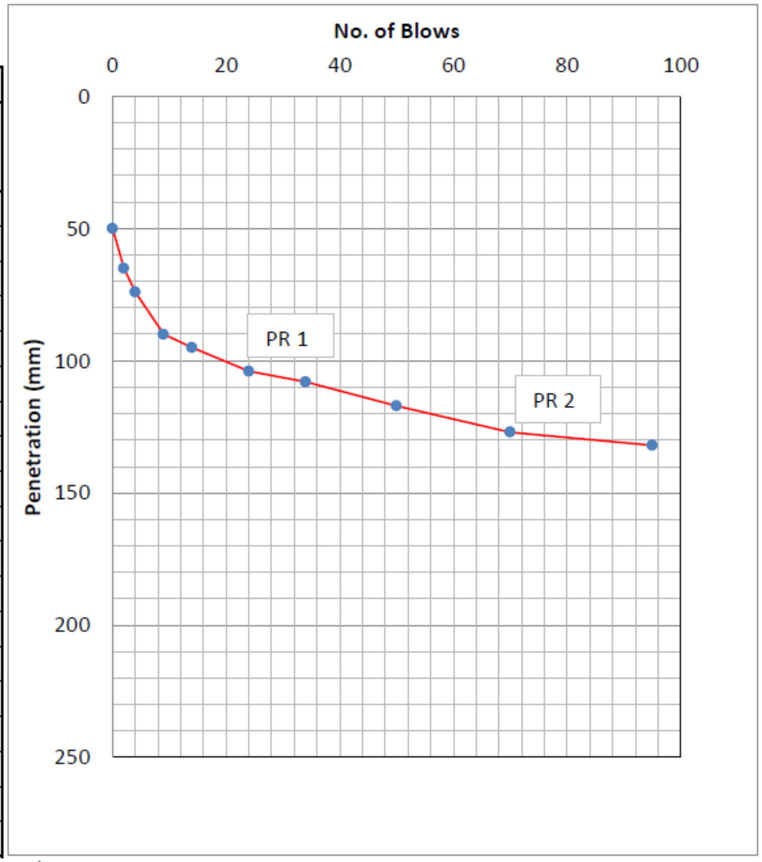
MN03

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 03	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1081

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	2	2	65	7.5
2	2	4	74	4.5
3	5	9	90	3.2
4	5	14	95	1.0
5	10	24	104	0.9
6	10	34	108	0.4
7	16	50	117	0.6
8	20	70	127	0.5
9	25	95	132	0.2



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.1	70.4	
PR 2	1.3	306.3	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN03

CALCULATION OF SAFE BEARING CAPACITY: TP MN 03					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	POORLY-GRADED GRAVEL			**Sample No.:**	1081

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	28	$\gamma\,(kg/m^3)$ =	1780
$\phi\,(^\circ)$ =	24	$\gamma\,(kN/m^3)$ =	17.46

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 19.32	
	N_q = 9.60	
	N_γ = 5.72	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 19.32) + (0.8 x 17.46 x 2.0 x 9.60) + (0.4 x 17.46 x 1.0 x 5.72)	**1012 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 1012/3.0	**337 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP3-4A

CALCULATION OF SAFE BEARING CAPACITY: MN2 (TP2-3) MN3					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	Elastic SILT with Sand			**Sample No.:**	1175

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1718
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	16.85

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 16.85 x 2.0 x 7.07) + (0.4 x 16.85 x 1.0 x 3.42)	**687 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 687/3.0	**229 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP3-4B

CALCULATION OF SAFE BEARING CAPACITY: MN3 (TP3-4B) MN4					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	POORLY-GRADED GRAVEL			Sample No.:	1176
	Silty SAND with Gravel				

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2)$ =	28	$\gamma\ (kg/m^3)$ =	1780
$\phi\ (^\circ)$ =	24	$\gamma\ (kN/m^3)$ =	17.46

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 19.32	
	N_q = 9.60	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 5.72	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 19.32) + (0.8 x 17.46 x 2.0 x 9.60) + (0.4 x 17.46 x 1.0 x 5.72)	**1012 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 1012/3.0	**337 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

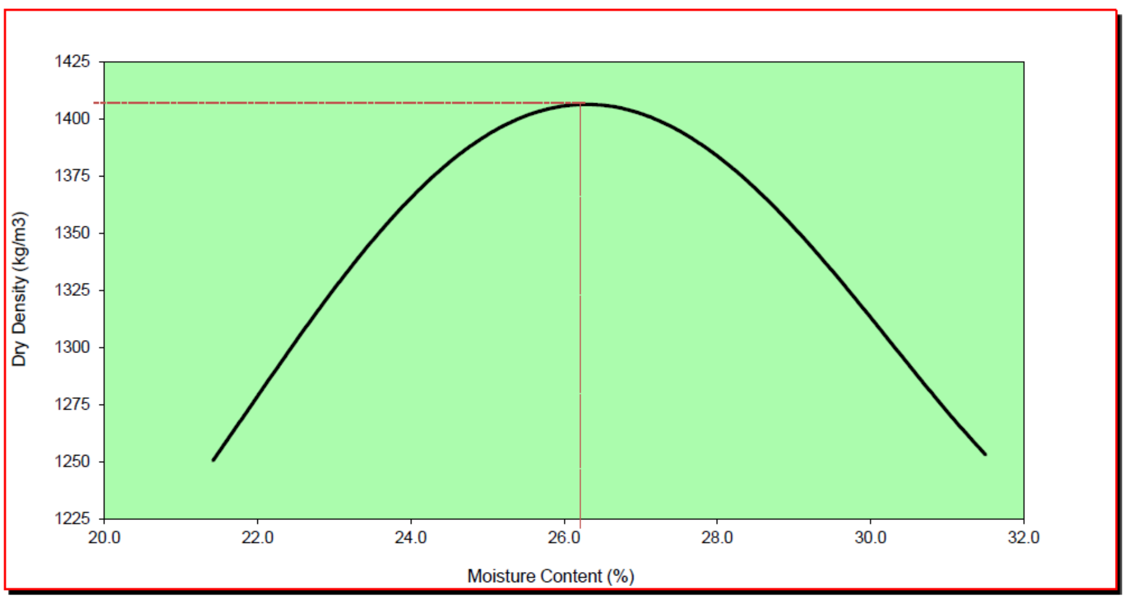
BS 1377 – 4: 1990

MN03

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1081
Material Description:	POORLY-GRADED GRAVEL	**Sample Ref:**	TP MN 03	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5513	5640	5735	5778	5728	5643
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1518	1645	1740	1783	1733	1648
Bulk Density (Kgs/m^3)	**1518**	**1645**	**1740**	**1783**	**1733**	**1648**
Tin No.	G29	G39	G11	G43	G25	G38
Weight Wet Soil	229.6	273.0	267.3	306.7	307.0	318.9
Weight of Dry Soil	189.1	221.6	213.8	241.3	237.4	242.5
Weight of Water	40.5	51.4	53.5	65.4	69.6	76.4
Moisture Content (%)	**21.4**	**23.2**	**25.0**	**27.1**	**29.3**	**31.5**
Dry Density (Kgs/m^3)	**1250**	**1335**	**1392**	**1403**	**1340**	**1253**



Maximum Dry Density (Kg/m^3): 1408 **Optimum Moisture Content (%):** 26.4%

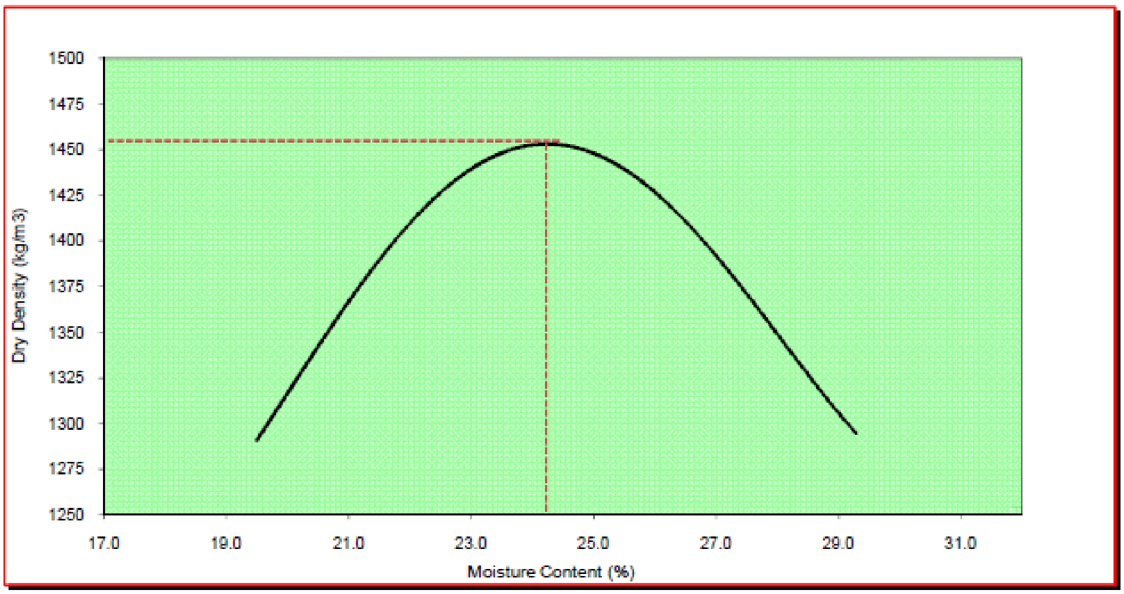
Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

TP3-4

NESHCONSULT ENGINEERING

Project:	NANYUKI-ISIOLO-MERU TRANSMISSION LINE	**LOCATION:**	MN3 - MN4	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU COUNTIES	**Job Ref.:**	GCL/NC-356/03	**Sample No.:**	1175
Material Description:		**Sample Ref:**	MN3 (TP3-4A) MN4	**Date received:**	06.03.2013

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	4501	4635	4738	4774	4721	4633
Mass of Mould+Base	2959	2959	2959	2959	2959	2959
Mass of Compacted Soil	1542	1676	1779	1815	1762	1674
Bulk Density (Kgs/m^3)	**1542**	**1676**	**1779**	**1815**	**1762**	**1674**
Tin No.	G02	G34	G23	G50	G45	G24
Weight Wet Soil	292.3	259.3	322.4	310.2	278.3	307.2
Weight of Dry Soil	244.6	213.8	261.3	247.8	219.0	237.6
Weight of Water	47.7	45.5	61.1	62.4	59.3	69.6
Moisture Content (%)	**19.5**	**21.3**	**23.4**	**25.2**	**27.1**	**29.3**
Dry Density (Kgs/m^3)	**1290**	**1382**	**1442**	**1450**	**1387**	**1295**



Maximum Dry Density (Kg/m^3): 1453 **Optimum Moisture Content (%):** 24.3%

CHEMICAL ANALYSIS

Angle Point MN03	
Depth	2.0m
pH	7.5
Chloride(%) mg/l	0.39
Sulphate (mg/l)	0.001

TP3-4A	
Depth	2.0m
pH	7.92
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.033

TP3-4B	
Depth	2.0m
pH	7.90
Chloride(%) mg/l	0.009
Sulphate (mg/l)	0.037

ANGLE POINT 3 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 03		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.8	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Fragmented ROCK boulder and cobble fraction

TEST POINT 3-4A, 3-4B LOGS

JOB REF:	GCL/NCE_356/03		**DATE:**	23 - 28.02.2013	
			LOGGED BY:	STEVE	
MN3 (TP3-4A) MN4			**MN3 (TP3-4B) MN4**		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.2	Dark Grey CLAY (Black Cotton Soil)		0.8	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Elastic SILT with Sand and Gravel			Greyish Brown Silty SAND with Gravel

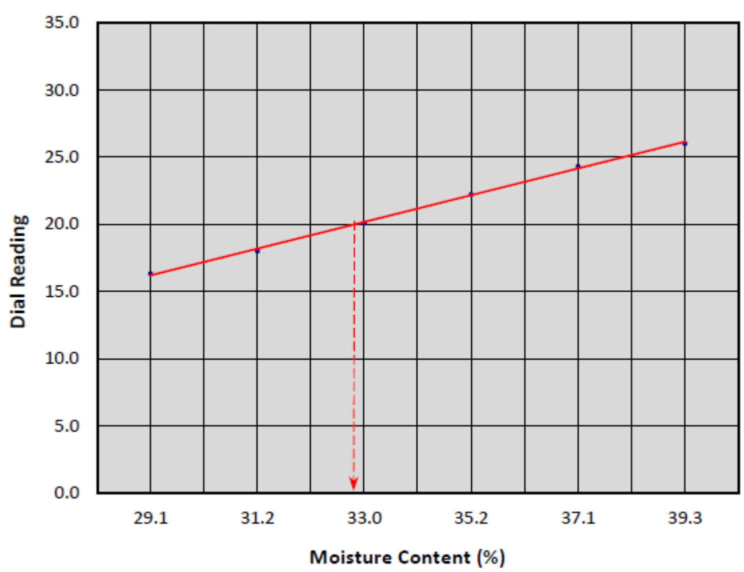
SEGMENT 3

ATTERBERG LIMITS BS 1377 - 2: 1990

MN04

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1082
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.2	24.3	26.0	-	-	
Tin No	**17**	**32**	**46**	**51**	**67**	**72**	**16**	**15**	
Mass of Wet Soil (g)	42.62	39.15	33.99	46.82	39.43	48.64	25.52	28.56	
Mass of Dry Soil (g)	33.01	29.84	25.56	34.63	28.76	34.92	22.31	24.94	
Mass of Moisture (g)	9.61	9.31	8.43	12.19	10.67	13.72	3.21	3.62	
Moisture Content (%)	29.1	31.2	33.0	35.2	37.1	39.3	14.4	14.5	14.5



PLASTIC LIMIT
PL = 14.5 %

LIQUID LIMIT
LL = 32.6 %

Proportion Passing 425 µm BS Sieve
= 86.3 %

PLASTICITY INDEX
PI = 18.1 %

PLASTIC MODULUS
PM = 1566

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
CL

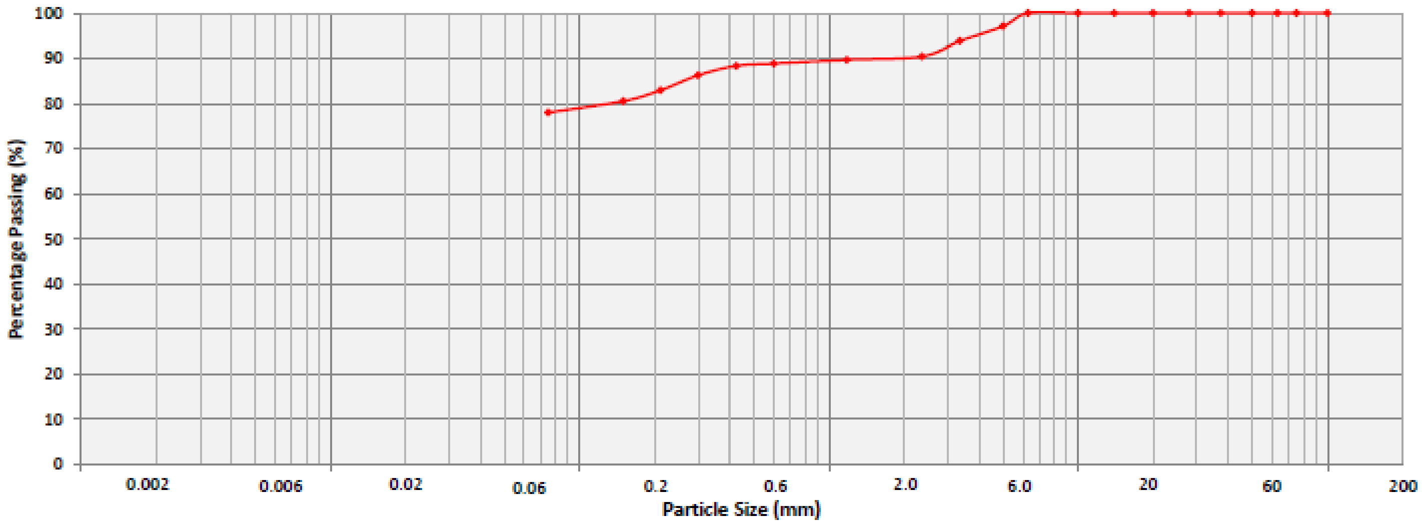
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN04

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 04	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1082



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

MN04

ANGLE POINT BEARING CAPACITY

MN04

CALCULATION OF SAFE BEARING CAPACITY: TP MN 04					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1082

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1710
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	16.78

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 16.78 x 2.0 x 7.07) + (0.4 x 16.78 x 1.0 x 3.42)	**686 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 686/3.0	**229 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

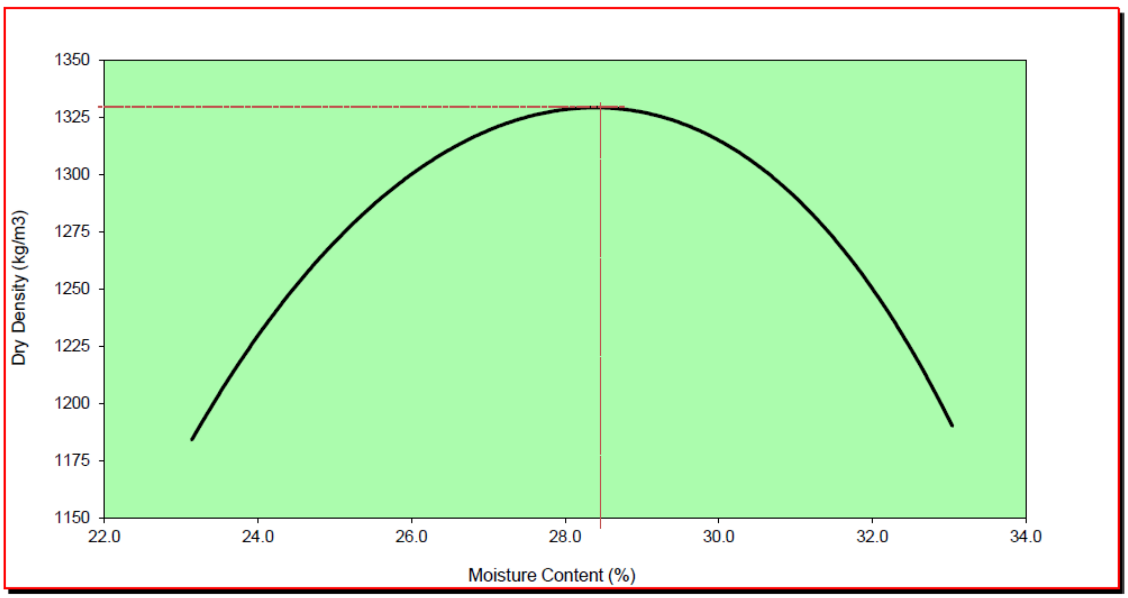
BS 1377 – 4: 1990

MN04

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1082
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 04	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	4414	4544	4638	4668	4646	4539
Mass of Mould+Base	2956	2956	2956	2956	2956	2956
Mass of Compacted Soil	1458	1588	1682	1712	1690	1583
Bulk Density (Kgs/m^3)	**1458**	**1588**	**1682**	**1712**	**1690**	**1583**
Tin No.	G37	G01	G38	G04	G27	G40
Weight Wet Soil	149.0	200.0	213.7	200.0	169.0	153.0
Weight of Dry Soil	121.0	160.0	168.0	155.0	129.0	115.0
Weight of Water	28.0	40.0	45.7	45.0	40.0	38.0
Moisture Content (%)	**23.1**	**25.0**	**27.2**	**29.0**	**31.0**	**33.0**
Dry Density (Kgs/m^3)	**1184**	**1270**	**1322**	**1327**	**1290**	**1190**



Maximum Dry Density (Kg/m^3): 1330 **Optimum Moisture Content (%):** 28.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN04	
Depth	2.0m
pH	7.3
Chloride(%) mg/l	-
Sulphate (mg/l)	-

ANGLE POINT LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 04		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5 1		1.1	Dark Grey CLAY (Black Cotton Soil)
1.5 2		2.0	Grey Elastic SILT with Sand
2.5			NOTE: Presence of water attributed to leaking pipe

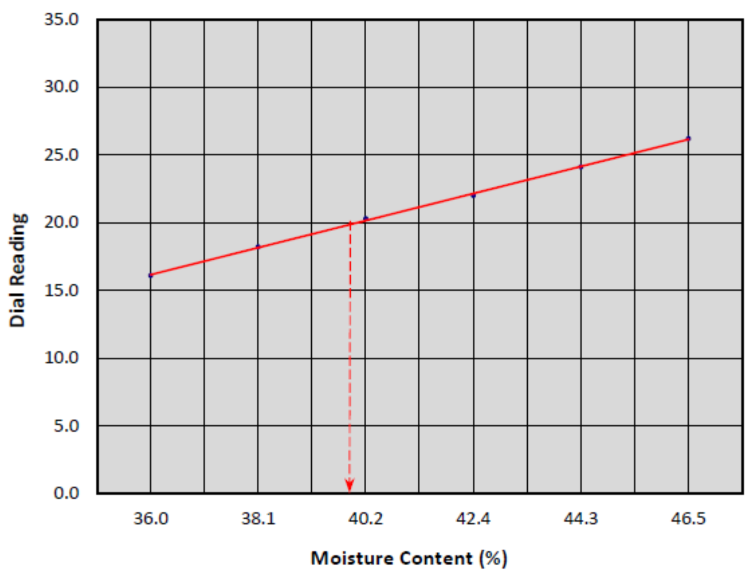
SEGMENT 4

ATTERBERG LIMITS BS 1377 - 2: 1990

MN05

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1083
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.3	22.0	24.1	26.2	-	-	
Tin No	**19**	**36**	**56**	**41**	**76**	**27**	**61**	**57**	
Mass of Wet Soil (g)	32.99	29.09	32.24	36.18	39.52	35.45	23.97	17.01	
Mass of Dry Soil (g)	24.26	21.07	22.99	25.41	27.39	24.20	18.99	13.46	
Mass of Moisture (g)	8.73	8.02	9.25	10.77	12.13	11.25	4.98	3.55	
Moisture Content (%)	36.0	38.1	40.2	42.4	44.3	46.5	26.2	26.4	26.3



PLASTIC LIMIT
PL = 26.3 %

LIQUID LIMIT
LL = 39.8 %

Proportion Passing 425 µm BS Sieve
= 55.2 %

PLASTICITY INDEX
PI = 13.5 %

PLASTIC MODULUS
PM = 745

LINEAR SHRINKAGE
LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)
SC

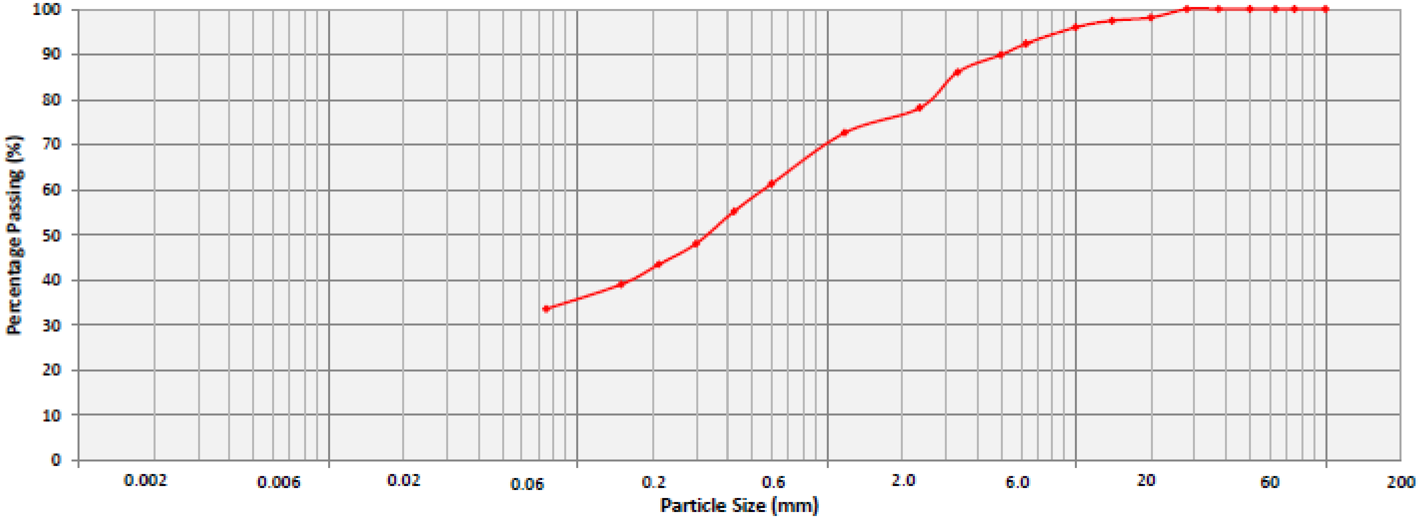
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN05

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 05	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1083



CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

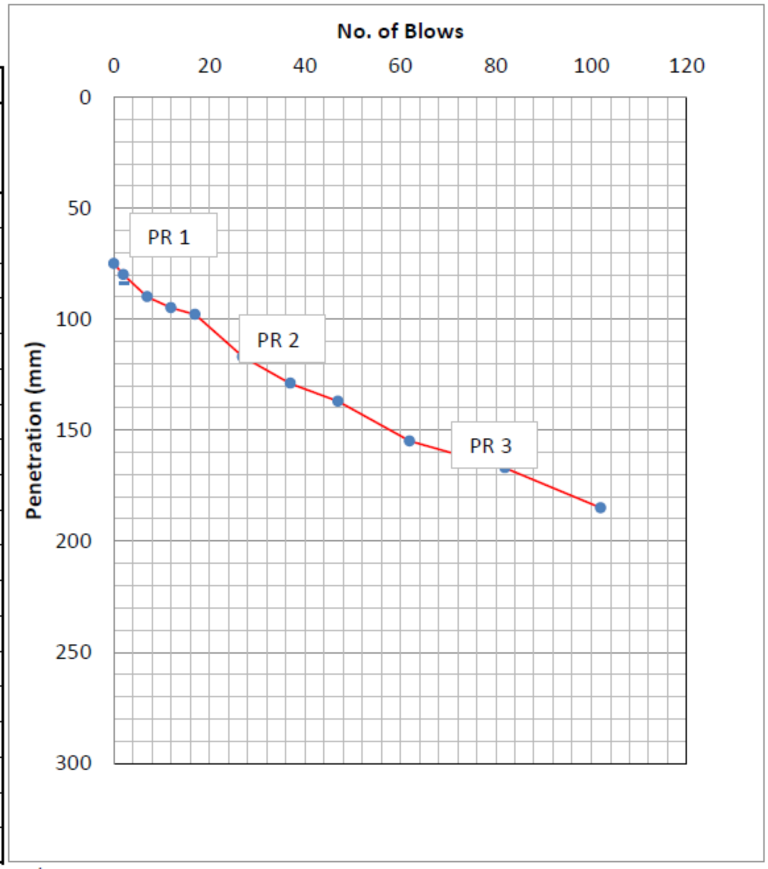
MN05

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 05	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1083

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	75	
1	2	2	80	2.5
2	5	7	90	2.0
3	5	12	95	1.0
4	5	17	98	0.6
5	10	27	117	1.9
6	10	37	129	1.2
7	10	47	137	0.8
8	15	62	155	1.2
9	20	82	167	0.6
10	20	102	185	0.9



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	2.1	165.8	
PR 2	1.4	278.6	
PR 3	0.7	676.5	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN05

CALCULATION OF SAFE BEARING CAPACITY: TP MN 05					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1083

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	28	$\gamma\ (kg/m^3)$ =	1842
$\phi\ (^\circ)$ =	23	$\gamma\ (kN/m^3)$ =	18.07

REFERENCE	CALCULATIONS	RESULTS
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**Ultimate Bearing Capacity** $q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$ **Bearing Capacity Factors : Meyerhof's Analyses** N_c= 18.05 N_q = 8.66 N_γ = 4.82 **The Ultimate Bearing Capacity of a Pad Foundation** B(m)= 1.0 **Z (m)= 2.0** q_f = (1.3 x 28 x 18.05) + (0.8 x 18.07 x 2.0 x 8.66) + (0.4 x 18.07 x 1.0 x 4.82) **The Safe Bearing Capacity of the foundation is : (Fs = 3.0)** q_s = 942/3.0	**942 kN/m^2** **314 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

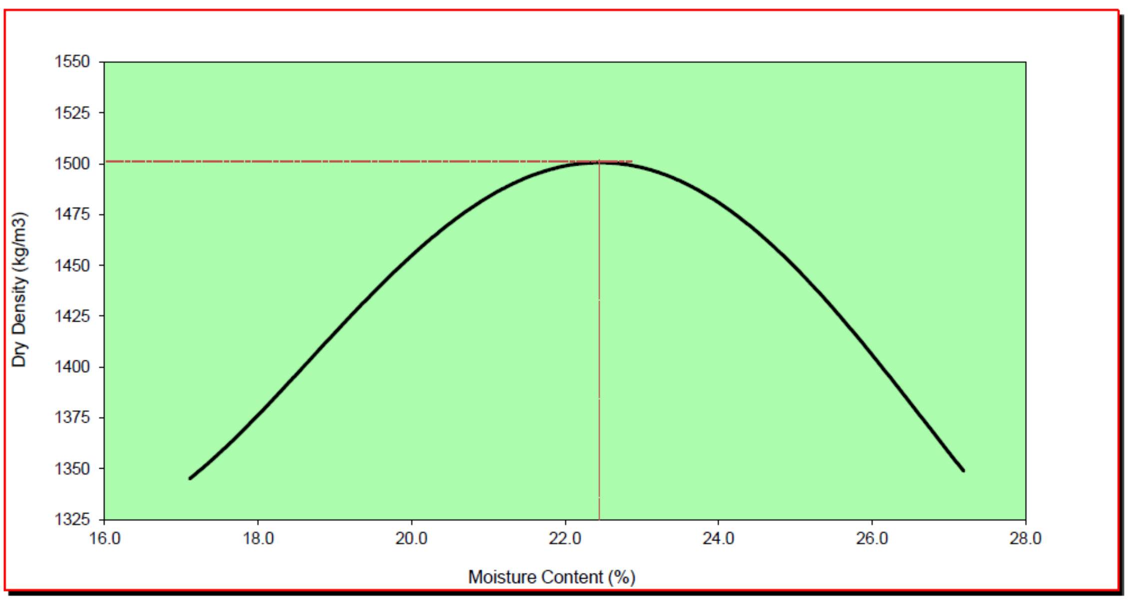
BS 1377 – 4: 1990

MN05

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1083
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 05	**Date received:**	09.12.2012

Moisture Addition	**50cc**	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**
Mass of Mould+Base+Soil	5570	5701	5804	5840	5792	5711
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1575	1706	1809	1845	1797	1716
Bulk Density (Kgs/m^3)	**1575**	**1706**	**1809**	**1845**	**1797**	**1716**
Tin No.	G27	G19	G35	G37	G41	G13
Weight Wet Soil	308.0	309.0	340.0	336.0	272.0	290.0
Weight of Dry Soil	263.0	259.0	280.0	272.0	217.0	228.0
Weight of Water	45.0	50.0	60.0	64.0	55.0	62.0
Moisture Content (%)	**17.1**	**19.3**	**21.4**	**23.5**	**25.3**	**27.2**
Dry Density (Kgs/m^3)	**1345**	**1430**	**1490**	**1494**	**1434**	**1349**



Maximum Dry Density (Kg/m^3): 1500 **Optimum Moisture Content (%):** 22.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN05	
Depth	2.0m
pH	8.05
Chloride(%) mg/l	0.53
Sulphate (mg/l)	0.002

ANGLE POINT 5 LOG

JOB REF:		GCL/NCE_342/12
MN 05		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.9	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Fragmented ROCK boulder

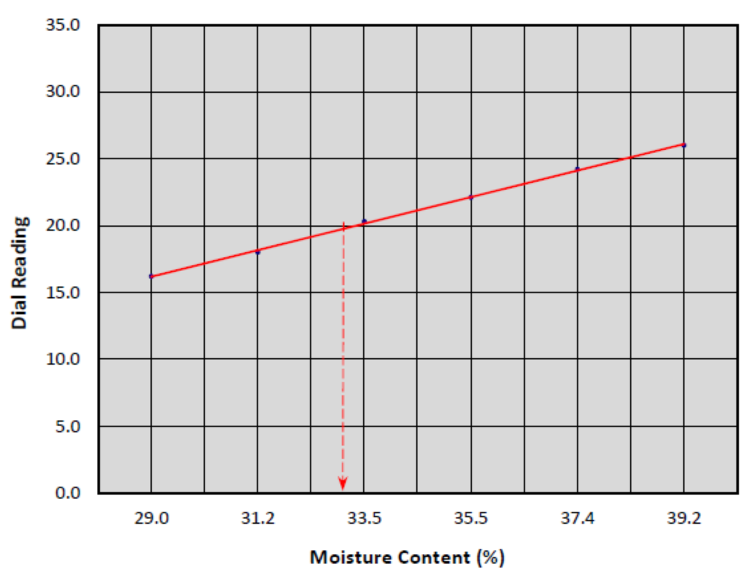
SEGMENT 5

ATTERBERG LIMITS BS 1377 - 2: 1990

MN06

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1084
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	17.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.0	20.3	22.1	24.2	26.0	-	-	
Tin No	**18**	**67**	**28**	**37**	**59**	**55**	**61**	**49**	
Mass of Wet Soil (g)	28.88	32.89	36.64	40.54	41.37	45.02	12.22	15.26	
Mass of Dry Soil (g)	22.39	25.07	27.45	29.92	30.11	32.34	10.37	12.94	
Mass of Moisture (g)	6.49	7.82	9.19	10.62	11.26	12.68	1.85	2.32	
Moisture Content (%)	29.0	31.2	33.5	35.5	37.4	39.2	17.8	17.9	17.9



PLASTIC LIMIT

PL = 17.9 %

LIQUID LIMIT

LL = 32.8 %

Proportion Passing 425 µm BS Sieve

= 40.4 %

PLASTICITY INDEX

PI = 14.9 %

PLASTIC MODULUS

PM = 603

LINEAR SHRINKAGE

LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)

SC

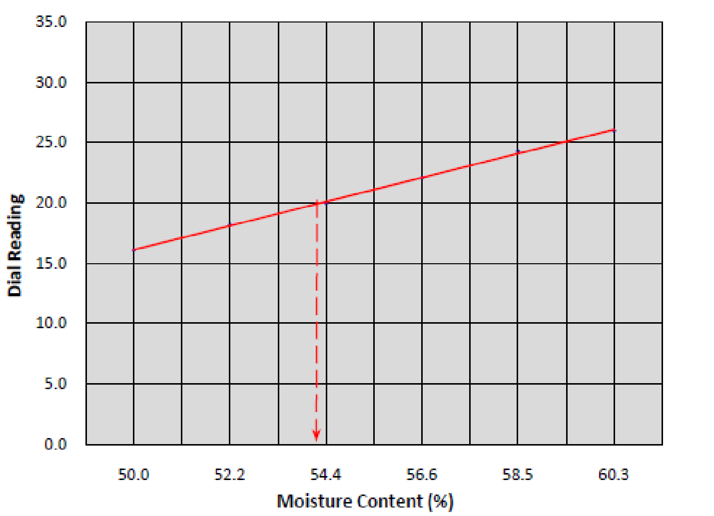
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP6-7A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN6 (TP6-7A)MN7	**Date Received:**	06.03.2013
Material Description:	Clayey SAND with Gravel	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1177
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	16.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.0	22.1	24.3	26.0	-	-	
Tin No	17	32	46	51	67	72	16	15	
Mass of Wet Soil (g)	47.46	36.48	49.88	40.78	47.79	43.95	28.83	35.54	
Mass of Dry Soil (g)	31.64	23.97	32.30	26.04	30.15	27.42	21.14	26.02	
Mass of Moisture (g)	15.82	12.51	17.58	14.74	17.64	16.53	7.69	9.52	
Moisture Content (%)	50.0	52.2	54.4	56.6	58.5	60.3	36.4	36.6	36.5



PLASTIC LIMIT
PL = 36.5 %

LIQUID LIMIT
LL = 54.2 %

Proportion Passing 425 µm BS Sieve
= 49.6 %

PLASTICITY INDEX
PI = 17.7 %

PLASTIC MODULUS
PM = 879

LINEAR SHRINKAGE
LS = 8.6 %

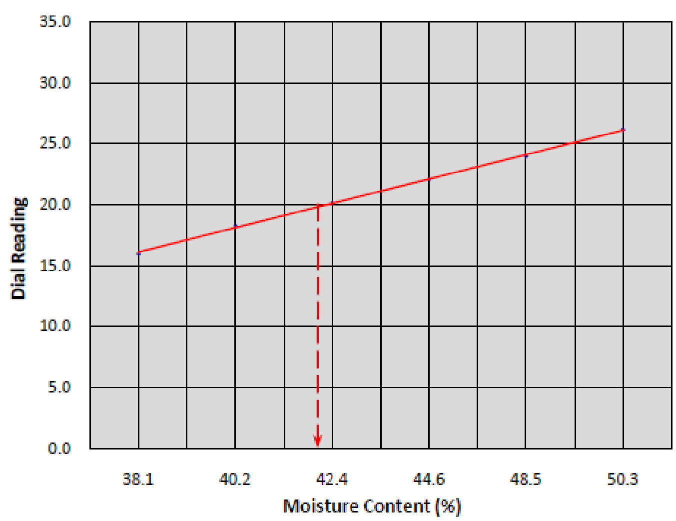
GROUP SYMBOL (USC SYSTEM)
SC

TP6-7B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN6 (TP6-7B)MN7	**Date Received:**	06.03.2013
Material Description:	Silty SAND with Gravel	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1178
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	17.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.2	22.1	24.0	26.2	-	-	
Tin No	3	63	56	41	59	27	16	57	
Mass of Wet Soil (g)	50.28	33.26	39.03	37.02	46.82	39.26	24.30	32.10	
Mass of Dry Soil (g)	36.41	23.72	27.41	25.60	31.53	26.12	18.62	24.56	
Mass of Moisture (g)	13.87	9.54	11.62	11.42	15.29	13.14	5.68	7.54	
Moisture Content (%)	38.1	40.2	42.4	44.6	48.5	50.3	30.5	30.7	30.6



PLASTIC LIMIT

PL = 30.6 %

LIQUID LIMIT

LL = 42.0 %

Proportion Passing 425 µm BS Sieve

= 54.5 %

PLASTICITY INDEX

PI = 11.4 %

PLASTIC MODULUS

PM = 621

LINEAR SHRINKAGE

LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)

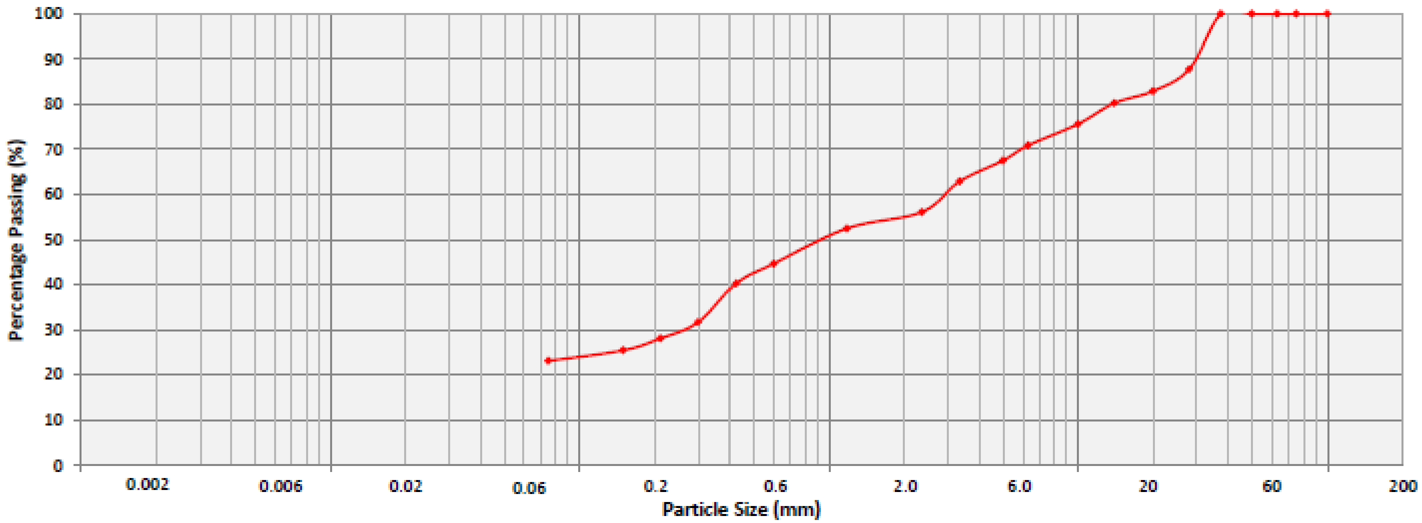
SM

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN06

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 06	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1084



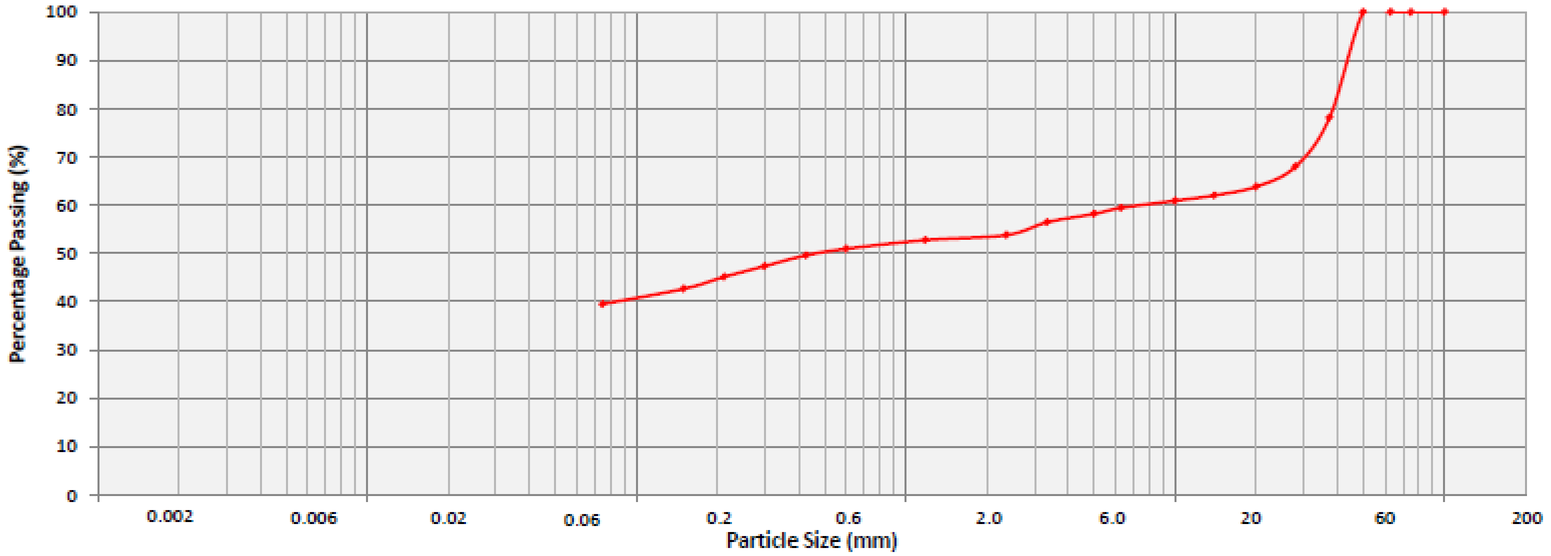
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
		SILT			**SAND**			**GRAVEL**			

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP6-7A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN6(TP6-7A)MN7	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Clayey SAND with Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1177

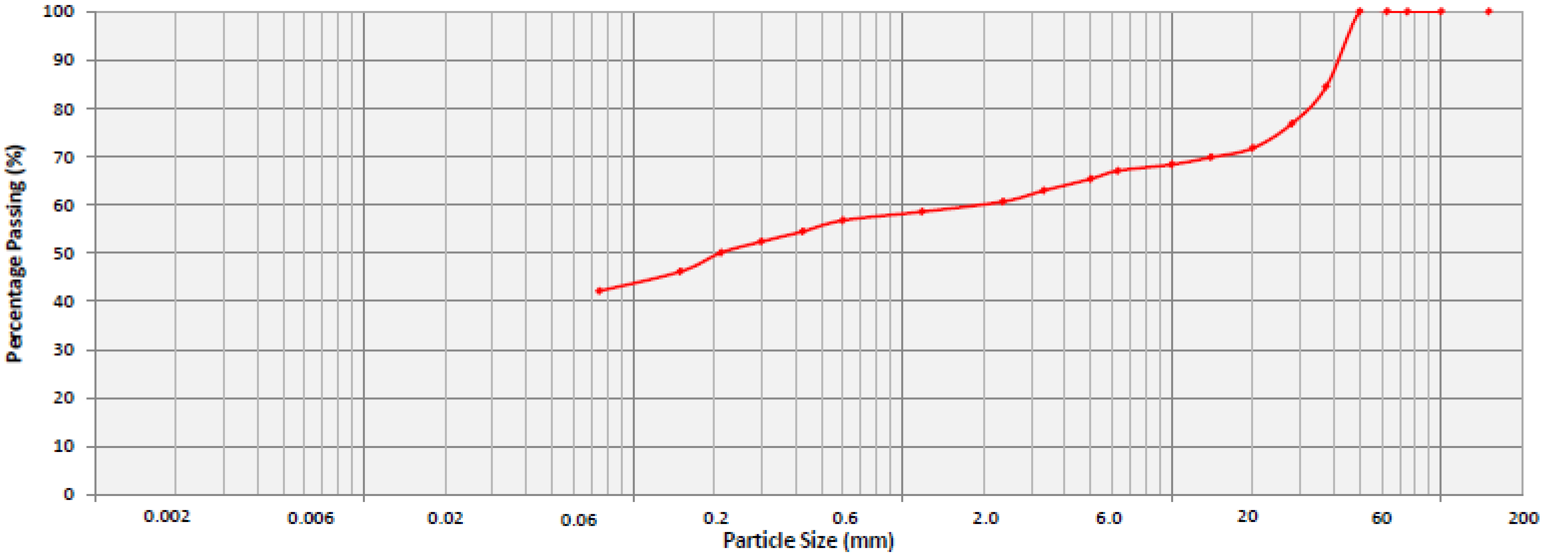


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP6-7B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN6(TP6-7B)MN7	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Silty SAND with Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1178



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

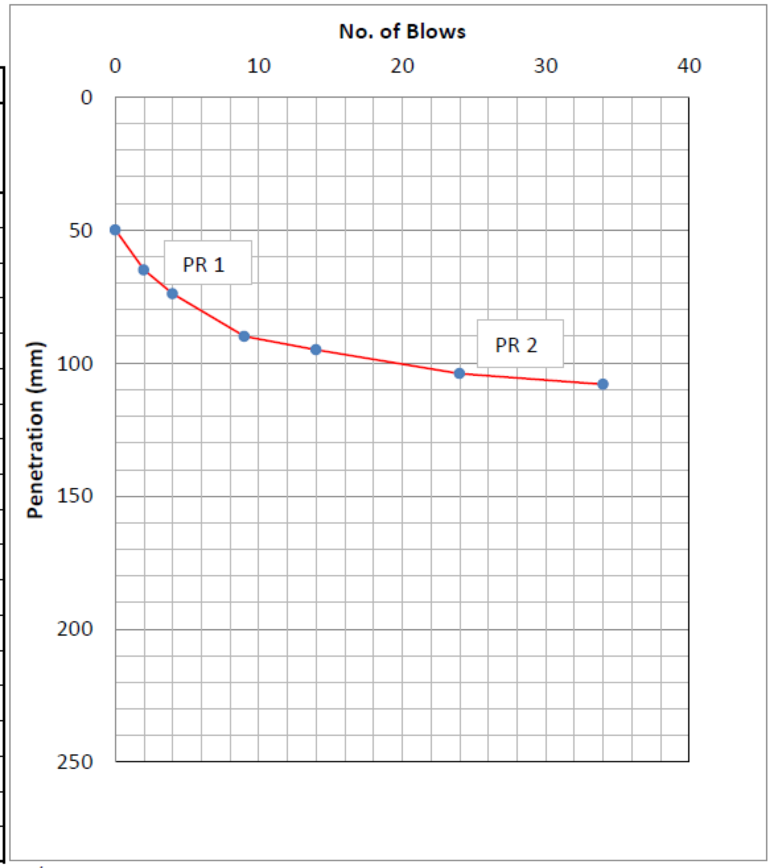
MN06

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 06	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1084

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	2	2	65	7.5
2	2	4	74	4.5
3	5	9	90	3.2
4	5	14	95	1.0
5	10	24	104	0.9
6	10	34	108	0.4



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.1	70.4	
PR 2	0.9	490.4	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN06

CALCULATION OF SAFE BEARING CAPACITY: TP MN 06					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1084

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2) =$	28	$\gamma\ (kg/m^3) =$	1912
$\phi\ (^\circ) =$	23	$\gamma\ (kN/m^3) =$	18.76

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 18.05	
	$N_q =$ 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 28 \times 18.05) + (0.8 \times 18.76 \times 2.0 \times 8.66) + (0.4 \times 18.76 \times 1.0 \times 4.82)$	**953 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 953/3.0$	**318 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP6-7A

CALCULATION OF SAFE BEARING CAPACITY: TP MN 04					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	Clayey SAND with Gravel			Sample No.:	1177

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2) =$	23	$\gamma\,(kg/m^3) =$	1710
$\phi\,(^\circ) =$	21	$\gamma\,(kN/m^3) =$	16.78

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 15.81	
	$N_q =$ 7.07	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	$N_\gamma =$ 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 15.81) + (0.8 \times 16.78 \times 2.0 \times 7.07) + (0.4 \times 16.78 \times 1.0 \times 3.42)$	**686 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 686/3.0$	**229 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP6-7B

CALCULATION OF SAFE BEARING CAPACITY: MN 6 (TP6-7B) MN7					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	Silty SAND with Gravel			Sample No.:	1178

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2) =$	28	$\gamma\,(kg/m^3) =$	1842
$\phi\,(^\circ) =$	23	$\gamma\,(kN/m^3) =$	18.07

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 18.05	
	$N_q =$ 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 28 \times 18.05) + (0.8 \times 18.07 \times 2.0 \times 8.66) + (0.4 \times 18.07 \times 1.0 \times 4.82)$	**942 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 942/3.0$	**314 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

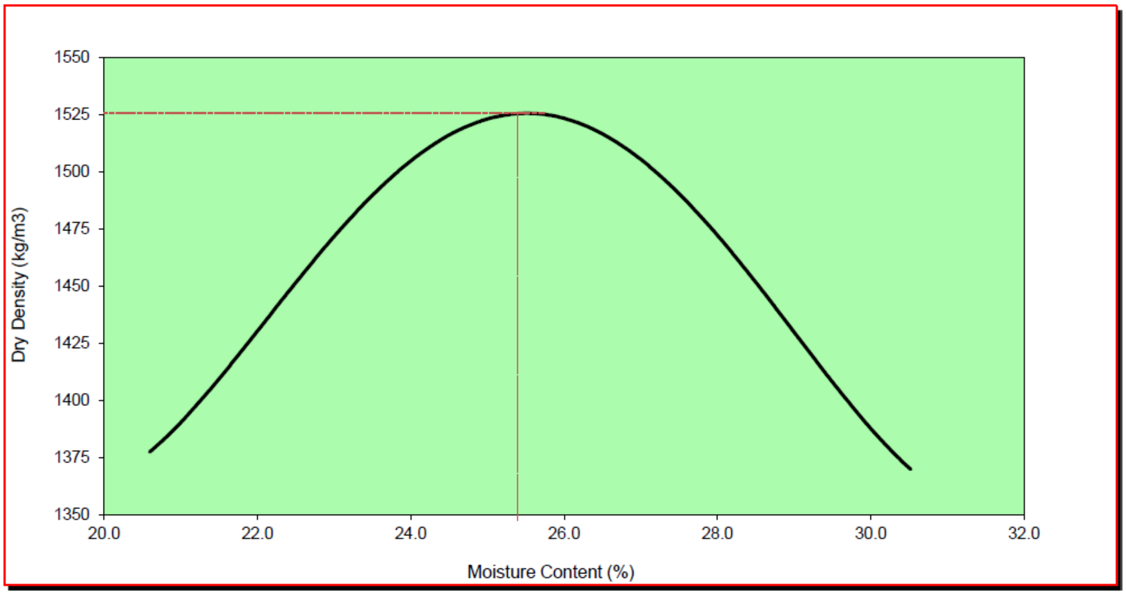
BS 1377 – 4: 1990

MN06

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1084
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 06	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5656	5788	5892	5914	5863	5783
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1661	1793	1897	1919	1868	1788
Bulk Density (Kgs/m^3)	**1661**	**1793**	**1897**	**1919**	**1868**	**1788**
Tin No.	G37	G14	G05	G16	G27	G49
Weight Wet Soil	210.2	237.1	234.5	240.9	237.2	258.7
Weight of Dry Soil	174.3	193.2	187.9	190.3	184.7	198.2
Weight of Water	35.9	43.9	46.6	50.6	52.5	60.5
Moisture Content (%)	**20.6**	**22.7**	**24.8**	**26.6**	**28.4**	**30.5**
Dry Density (Kgs/m^3)	**1377**	**1461**	**1520**	**1516**	**1455**	**1370**



Maximum Dry Density (Kg/m^3): 1525 **Optimum Moisture Content (%):** 25.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN06	
Depth	2.0m
pH	7.98
Chloride(%) mg/l	-
Sulphate (mg/l)	0.001

TP6-7A	
Depth	2.0m
pH	7.81
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.025

TP6-7B	
Depth	2.0m
pH	7.20
Chloride(%) mg/l	0.012
Sulphate (mg/l)	0.033

ANGLE POINT 6 LOG

MN 06		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.8	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Fragmented ROCK boulder and cobble fraction

TEST POINT 6-7A, 6-7B LOGS

				TRIAL PIT LOGS		
PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE			JOB REF:	GCL/NCE_356/03	
SITE:	NANYUKI-ISIOLO-MERU					
	MN6 (TP6-7A) MN7			MN6 (TP6-7B) MN7		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 – 0.7					0.7	Brown Silty SAND
0 – 1.2		1.2	Greyish Brown Lean CLAY			
1.2 – 2.0		2.0	Greyish Brown Clayey SAND with Gravel			
0.7 – 2.0					2.0	Brown Silty SAND with Gravel

Scale: 0, 0.5, 1, 1.5, 2, 2.5

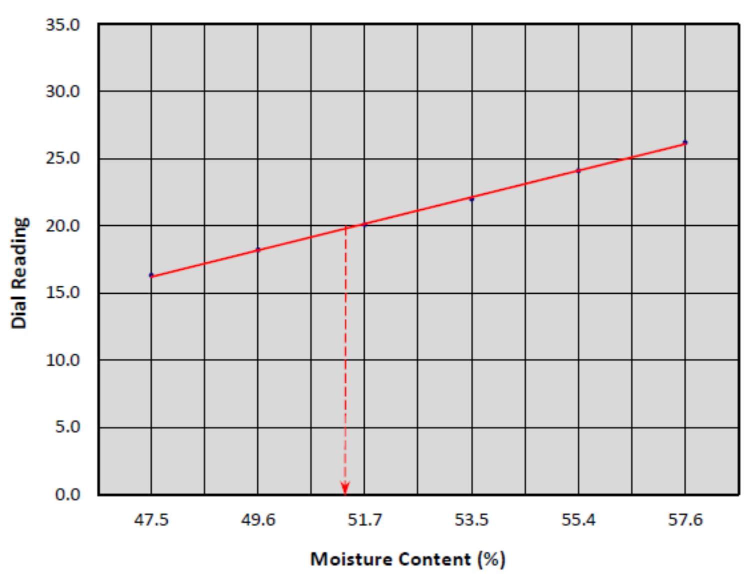
SEGMENT 6

ATTERBERG LIMITS BS 1377 - 2: 1990

MN07

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1085
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.2	20.1	22.0	24.1	26.2	-	-	
Tin No	**17**	**36**	**11**	**22**	**41**	**87**	**51**	**10**	
Mass of Wet Soil (g)	48.19	43.76	37.23	48.67	40.42	52.64	23.27	26.74	
Mass of Dry Soil (g)	32.67	29.25	24.54	31.71	26.01	33.40	16.92	19.42	
Mass of Moisture (g)	15.52	14.51	12.69	16.96	14.41	19.24	6.35	7.32	
Moisture Content (%)	47.5	49.6	51.7	53.5	55.4	57.6	37.5	37.7	37.6



PLASTIC LIMIT
PL = 37.6 %

LIQUID LIMIT
LL = 51.1 %

Proportion Passing 425 µm BS Sieve
= 58.8 %

PLASTICITY INDEX
PI = 13.5 %

PLASTIC MODULUS
PM = 793

LINEAR SHRINKAGE
LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)
SC

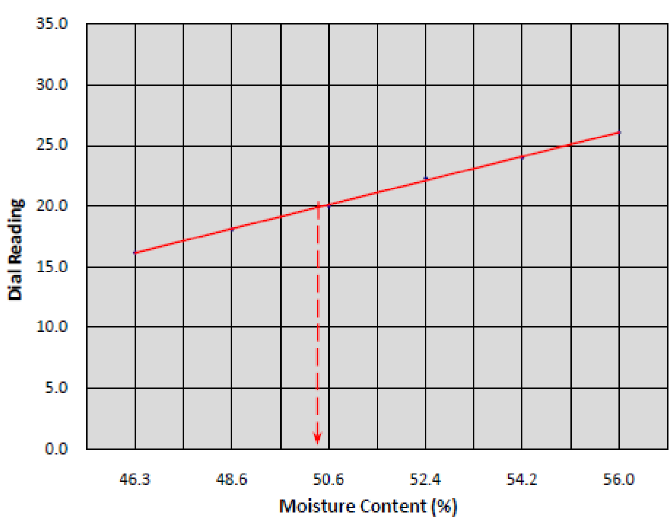
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP7-8A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN7 (TP7-8A)MN8	**Date Received:**	06.03.2013
Material Description:	ELASTIC SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1179
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	17.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.3	24.0	26.1	-	-	
Tin No	26	57	55	2	34	63	22	3	
Mass of Wet Soil (g)	36.82	55.03	50.35	43.30	54.14	59.61	18.89	25.62	
Mass of Dry Soil (g)	25.17	37.03	33.43	28.41	35.11	38.21	14.26	19.31	
Mass of Moisture (g)	11.65	18.00	16.92	14.89	19.03	21.40	4.63	6.31	
Moisture Content (%)	46.3	48.6	50.6	52.4	54.2	56.0	32.5	32.7	32.6



PLASTIC LIMIT
PL = 32.6 %

LIQUID LIMIT
LL = 50.4 %

Proportion Passing 425 µm BS Sieve
= 88.4 %

PLASTICITY INDEX
PI = 17.8 %

PLASTIC MODULUS
PM = 1576

LINEAR SHRINKAGE
LS = 8.6 %

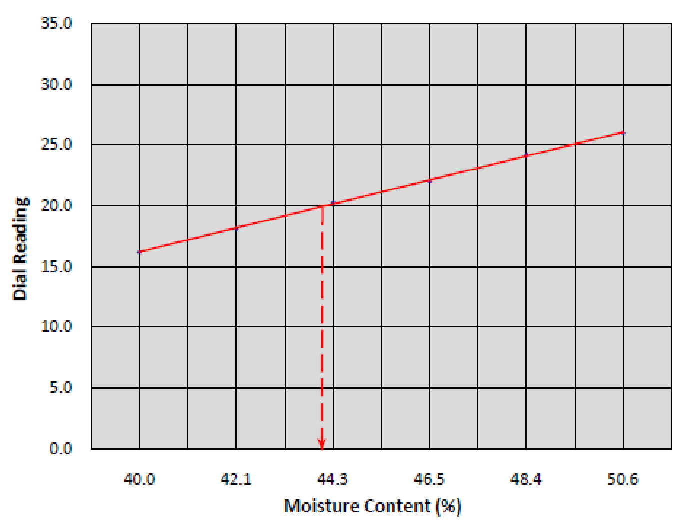
GROUP SYMBOL (USC SYSTEM)
MH

TP7-8B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN7 (TP7-8B)MN8	**Date Received:**	06.03.2013
Material Description:	ELASTIC SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1180
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	17.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.3	22.0	24.2	26.0	-	-	
Tin No	**8**	**57**	**49**	**26**	**34**	**21**	**21**	**10**	
Mass of Wet Soil (g)	30.30	39.89	44.79	53.36	47.73	59.52	20.90	25.87	
Mass of Dry Soil (g)	21.64	28.07	31.05	36.42	32.16	39.52	16.23	20.12	
Mass of Moisture (g)	8.66	11.82	13.74	16.94	15.57	20.00	4.67	5.75	
Moisture Content (%)	40.0	42.1	44.3	46.5	48.4	50.6	28.8	28.6	28.7



PLASTIC LIMIT
PL = 28.7 %

LIQUID LIMIT
LL = 44.1 %

Proportion Passing 425 µm BS Sieve
= 83.2 %

PLASTICITY INDEX
PI = 15.4 %

PLASTIC MODULUS
PM = 1283

LINEAR SHRINKAGE
LS = 7.1 %

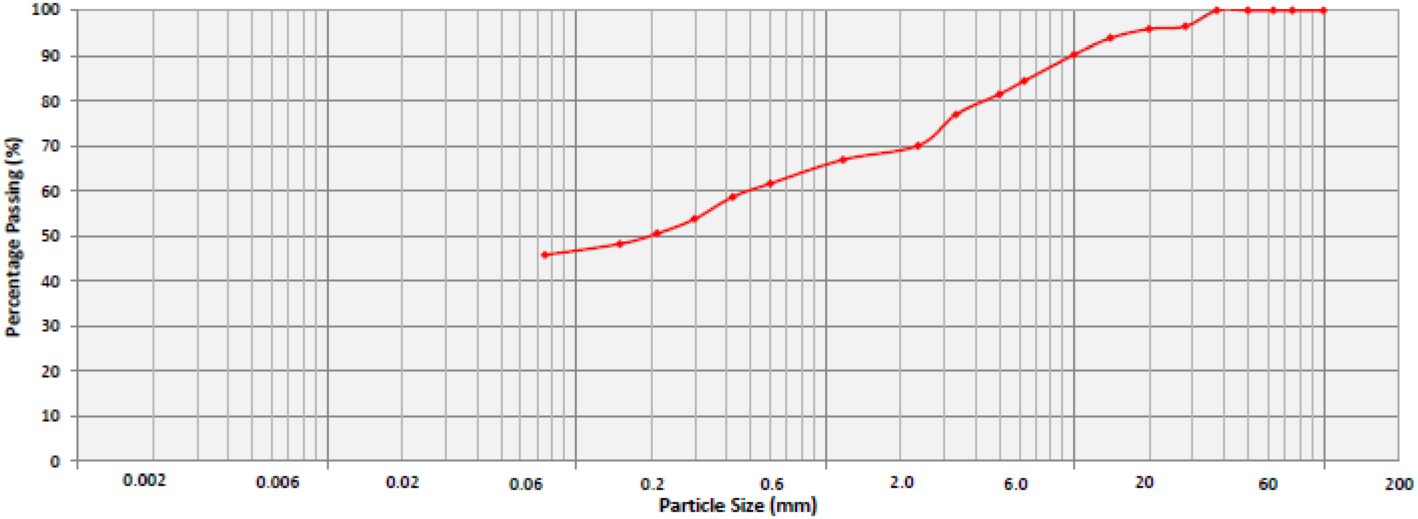
GROUP SYMBOL (USC SYSTEM)
MH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN07

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 07	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1085



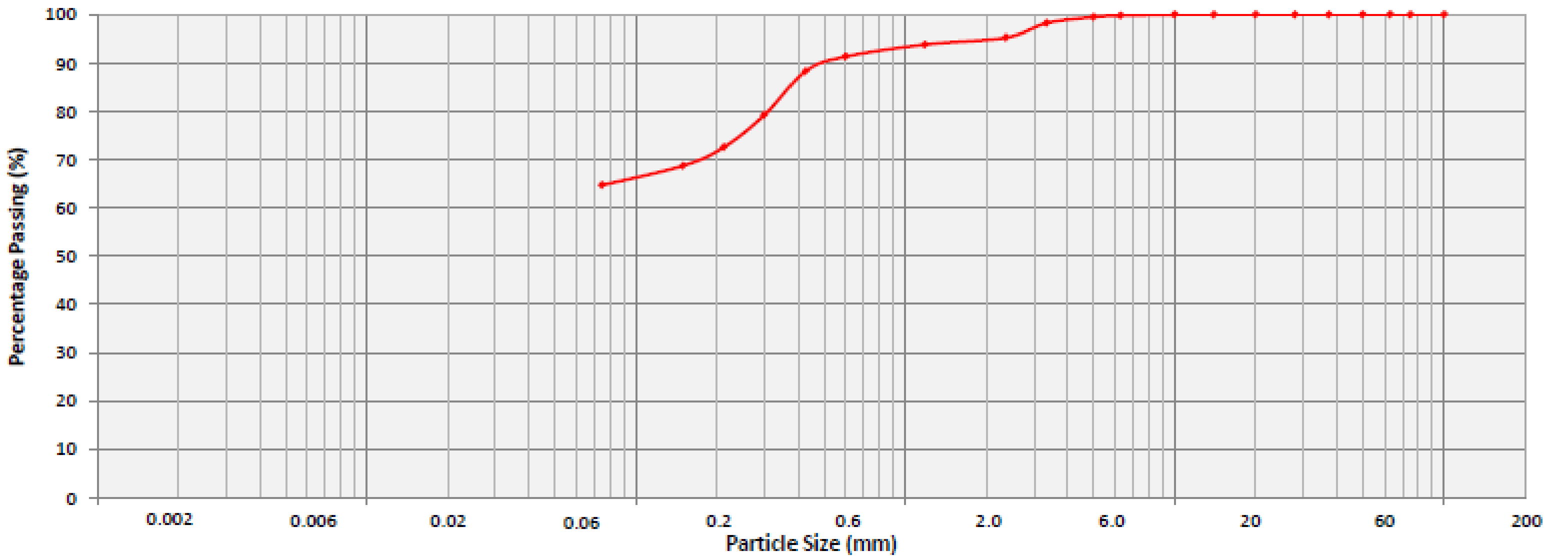
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP7-8A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN7(TP7-8A)MN8	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	13.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1179

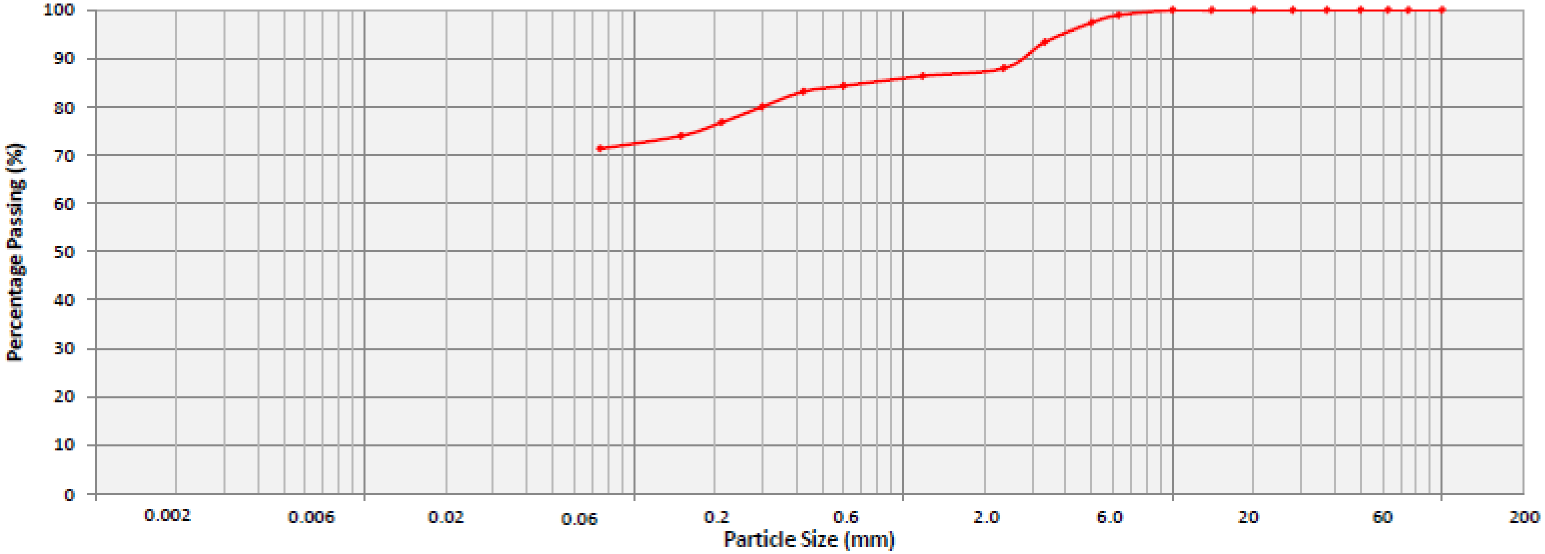


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP7-8B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN7(TP7-8B)MN8	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1180



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

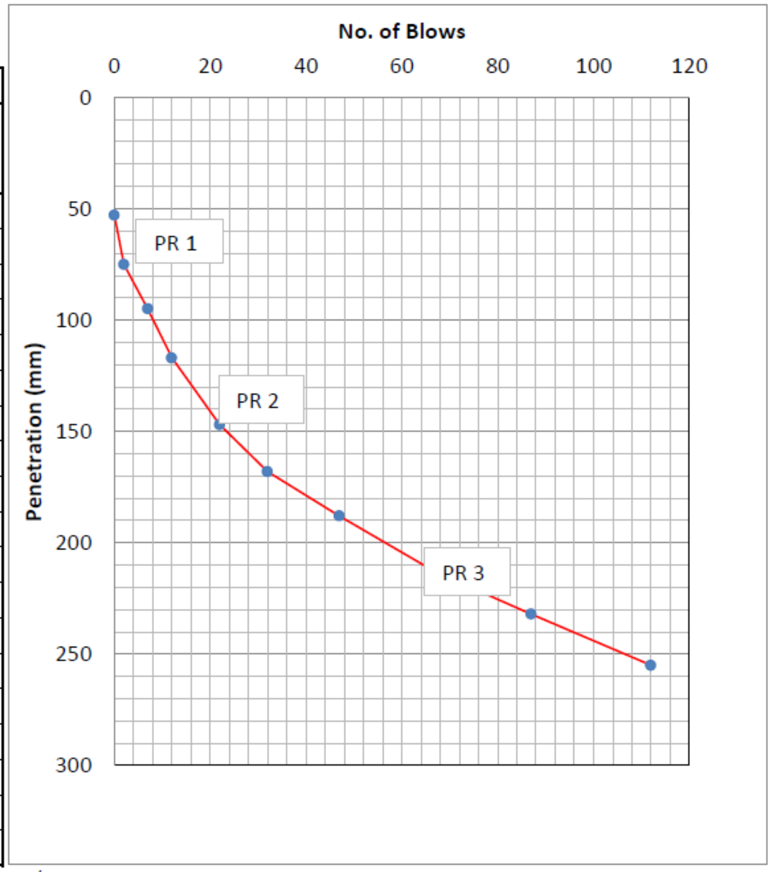
MN07

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 07	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1085

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	53	
1	2	2	75	11.0
2	5	7	95	4.0
3	5	12	117	4.4
4	10	22	147	3.0
5	10	32	168	2.1
6	15	47	188	1.3
7	20	67	213	1.3
8	20	87	232	1.0
9	25	112	255	0.9



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	11	19.9	
PR 2	4.2	68.3	
PR 3	1.2	339.4	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN07

CALCULATION OF SAFE BEARING CAPACITY: TP MN 07					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1085

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	28	γ (kg/m^3) =	1939
ø (°) =	23	γ (kN/m^3) =	19.02

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 19.02 x 2.0 x 8.66) + (0.4 x 19.02 x 1.0 x 4.82)	**957 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 957/3.0	**319 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP7-8A

CALCULATION OF SAFE BEARING CAPACITY: MN7 (TP7-8A) MN8

PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	Elastic SILT with Sand			**Sample No.:**	1179

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
C(kN/m^2) =	28	γ (kg/m^3) =	1912
ø (°) =	23	γ (kN/m^3) =	18.76

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	q_f = 1.3cNc + 0.8γZNq + 0.4γ BNγ	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
	$N_γ$ = 4.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 18.76 x 2.0 x 8.66) + (0.4 x 18.76 x 1.0 x 4.82)	**953 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 953/3.0	**318 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP7-8B

CALCULATION OF SAFE BEARING CAPACITY: MN7 (TP7-8B) MN8					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	Elastic SILT with Sand			Sample No.:	1085

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2)$ =	28	$\gamma\,(kg/m^3)$ =	1939
$\phi\,(^\circ)$ =	23	$\gamma\,(kN/m^3)$ =	19.02

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 19.02 x 2.0 x 8.66) + (0.4 x 19.02 x 1.0 x 4.82)	**957 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 957/3.0	**319 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

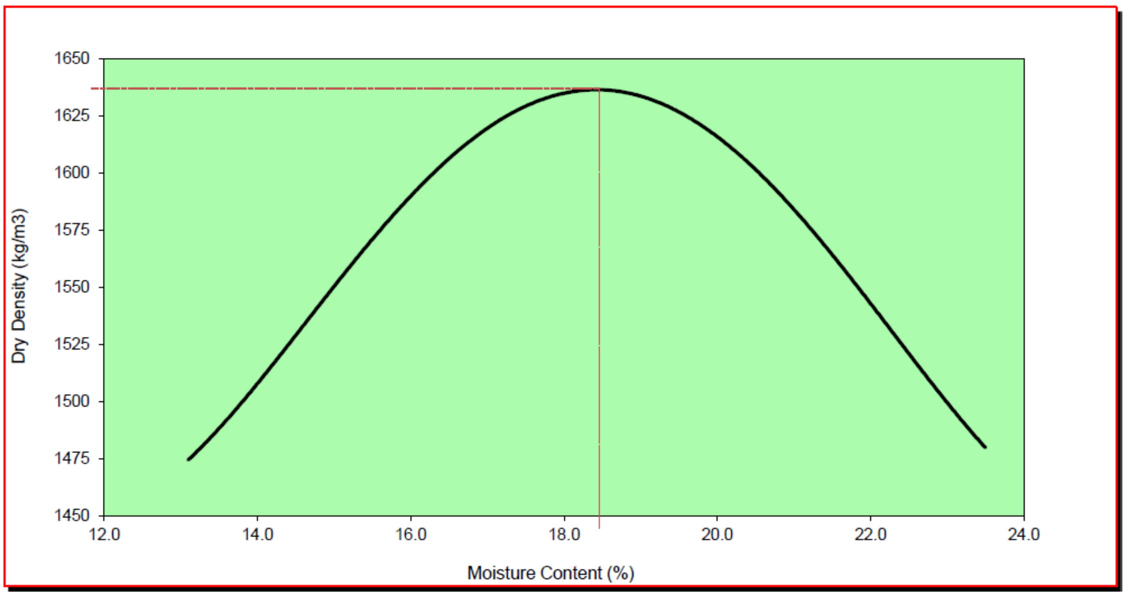
BS 1377 – 4: 1990

MN07

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1085
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 07	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5662	5792	5898	5944	5896	5823
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1667	1797	1903	1949	1901	1828
Bulk Density (Kgs/m^3)	**1667**	**1797**	**1903**	**1949**	**1901**	**1828**
Tin No.	G29	G43	G21	G12	G35	G07
Weight Wet Soil	272.0	272.3	246.0	283.1	296.6	312.7
Weight of Dry Soil	240.5	236.4	209.7	236.9	244.3	253.2
Weight of Water	31.5	35.9	36.3	46.2	52.3	59.5
Moisture Content (%)	**13.1**	**15.2**	**17.3**	**19.5**	**21.4**	**23.5**
Dry Density (Kgs/m^3)	**1474**	**1560**	**1622**	**1631**	**1566**	**1480**



Maximum Dry Density (Kg/m^3): 1635 **Optimum Moisture Content (%):** 18.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN07	
Depth	2.0m
pH	7.45
Chloride(%) mg/l	0.32
Sulphate (mg/l)	0.002

TP7-8A	
Depth	2.0m
pH	6.92
Chloride(%) mg/l	0.08
Sulphate (mg/l)	0.036

TP7-8B	
Depth	2.0m
pH	7.98
Chloride(%) mg/l	0.012
Sulphate (mg/l)	0.028

ANGLE POINT 7 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 07		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1			Brownish Red Elastic SILT with Sand
1.5			
2		2.0	
2.5			

TEST POINT 7-8A, 7-8B LOGS

DATE:	23 - 28.02.2013
LOGGED BY:	STEVE

MN7 (TP7-8A) MN8

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.2	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Elastic SILT

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE
SITE:	NANYUKI-ISIOLO-MERU

MN7 (TP7-8B) MN8

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1		1.0	Dark Grey CLAY (Black Cotton Soil)
1.5			
2		2.0	Grey Elastic SILT with Sand
2.5			

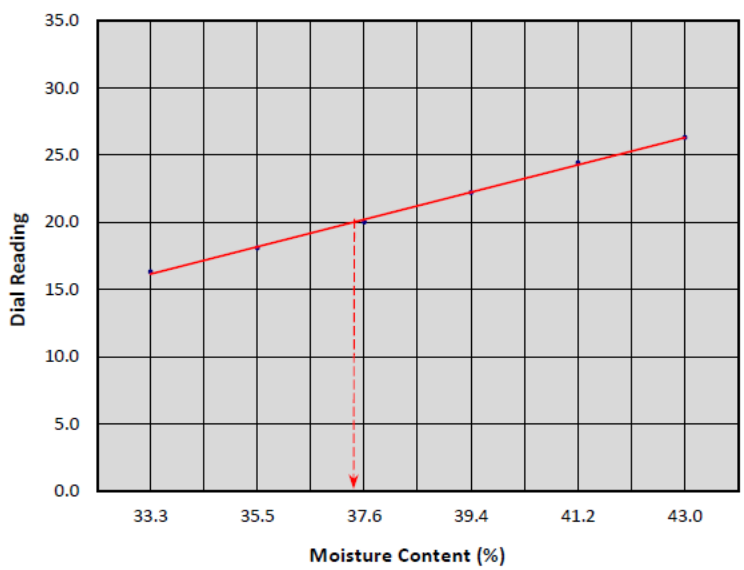
SEGMENT 7

ATTERBERG LIMITS BS 1377 - 2: 1990

MN08

Project:	PROPOSED POWERLINE	Site/Location:	NANYUKI-ISIOLO-MERU	Date Received:	09.12.2012
Material Description:	SANDY LEAN CLAY	Job Reference:	GCL/TGA-342/12	Sample No.:	1086
Sampled By:	GCL	Depth:	2.0M	Date Tested:	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.1	20.0	22.2	24.4	26.3	-	-	
Tin No	56	7	28	29	36	41	52	17	
Mass of Wet Soil (g)	39.62	48.97	45.76	54.38	39.56	48.82	14.00	17.52	
Mass of Dry Soil (g)	29.72	36.14	33.25	39.01	28.02	34.14	11.39	14.24	
Mass of Moisture (g)	9.90	12.83	12.51	15.37	11.54	14.68	2.61	3.28	
Moisture Content (%)	33.3	35.5	37.6	39.4	41.2	43.0	22.9	23.0	23.0



PLASTIC LIMIT
PL = 23.0 %

LIQUID LIMIT
LL = 37.4 %

Proportion Passing 425 µm BS Sieve
= 88.4 %

PLASTICITY INDEX
PI = 14.4 %

PLASTIC MODULUS
PM = 1275

LINEAR SHRINKAGE
LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)
CL

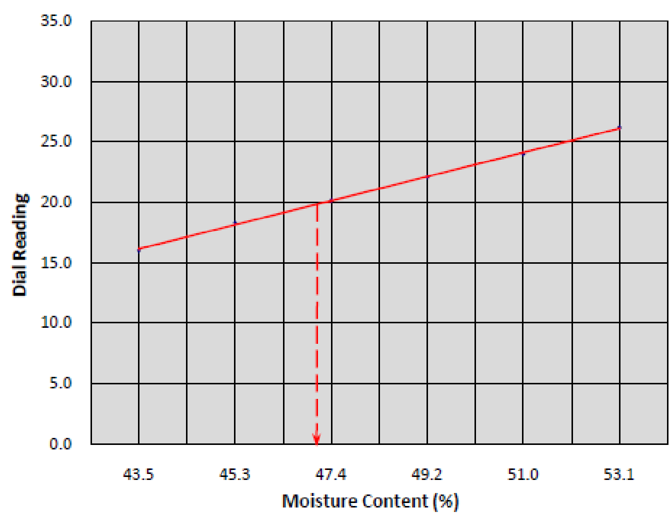
Tested By: LUCAS Date Reported: 19.12.2012 Checked: WK

TP8-9A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN8(TP8-9A)MN9	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1181
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	17.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.2	22.1	24.0	26.2	-	-	
Tin No	**14**	**12**	**23**	**19**	**33**	**26**	**15**	**11**	
Mass of Wet Soil (g)	52.35	40.13	44.83	59.59	49.45	40.59	13.35	16.94	
Mass of Dry Soil (g)	36.48	27.62	30.41	39.94	32.75	26.51	10.75	13.63	
Mass of Moisture (g)	15.87	12.51	14.42	19.65	16.70	14.08	2.60	3.31	
Moisture Content (%)	43.5	45.3	47.4	49.2	51.0	53.1	24.2	24.3	24.2



PLASTIC LIMIT

PL = 24.2 %

LIQUID LIMIT

LL = 47.0 %

Proportion Passing 425 µm BS Sieve

= 89.7 %

PLASTICITY INDEX

PI = 22.8 %

PLASTIC MODULUS

PM = 2042

LINEAR SHRINKAGE

LS = 10.7 %

GROUP SYMBOL (USC SYSTEM)

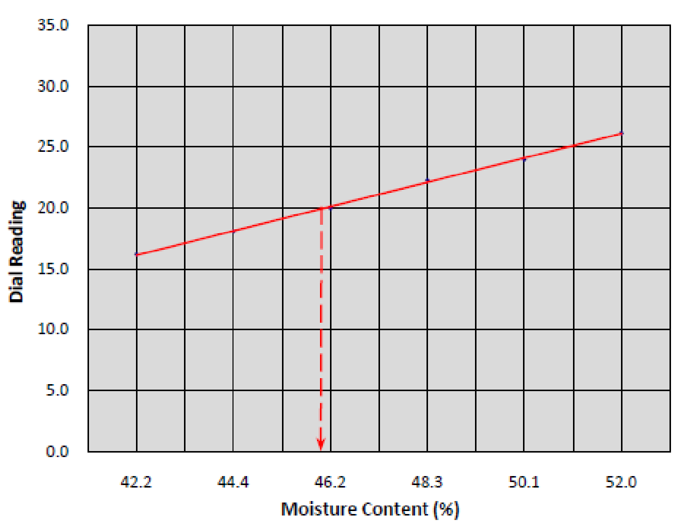
CL

TP8-9B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN8 (TP8-9B)MN9	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1236
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.3	24.0	26.2	-	-	
Tin No	**22**	**32**	**26**	**17**	**49**	**58**	**64**	**50**	
Mass of Wet Soil (g)	32.95	39.36	37.15	43.96	45.74	49.38	23.30	25.64	
Mass of Dry Soil (g)	23.17	27.26	25.41	29.64	30.47	32.49	18.48	20.32	
Mass of Moisture (g)	9.78	12.10	11.74	14.32	15.27	16.89	4.82	5.32	
Moisture Content (%)	42.2	44.4	46.2	48.3	50.1	52.0	26.1	26.2	26.1



PLASTIC LIMIT

PL = 26.1 %

LIQUID LIMIT

LL = 46.0

Proportion Passing 425 µm BS Sieve

= 88.2 %

PLASTICITY INDEX

PI = 19.9 %

PLASTIC MODULUS

PM = 1752

LINEAR SHRINKAGE

LS = 9.3 %

GROUP SYMBOL (USC SYSTEM)

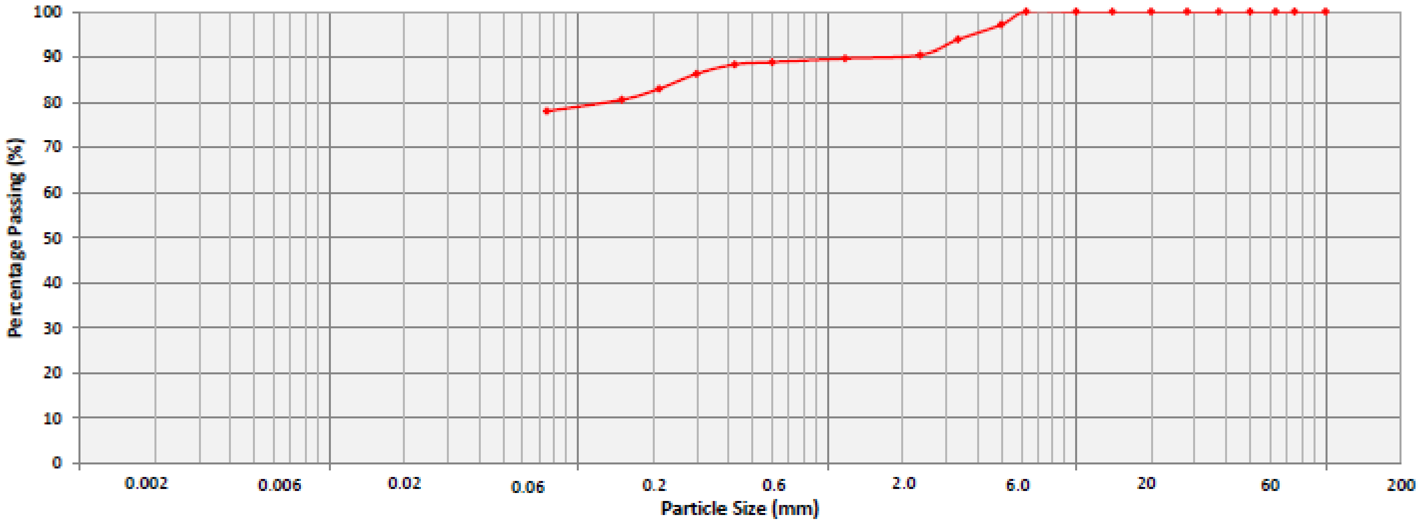
CL

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN08

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 08	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1086



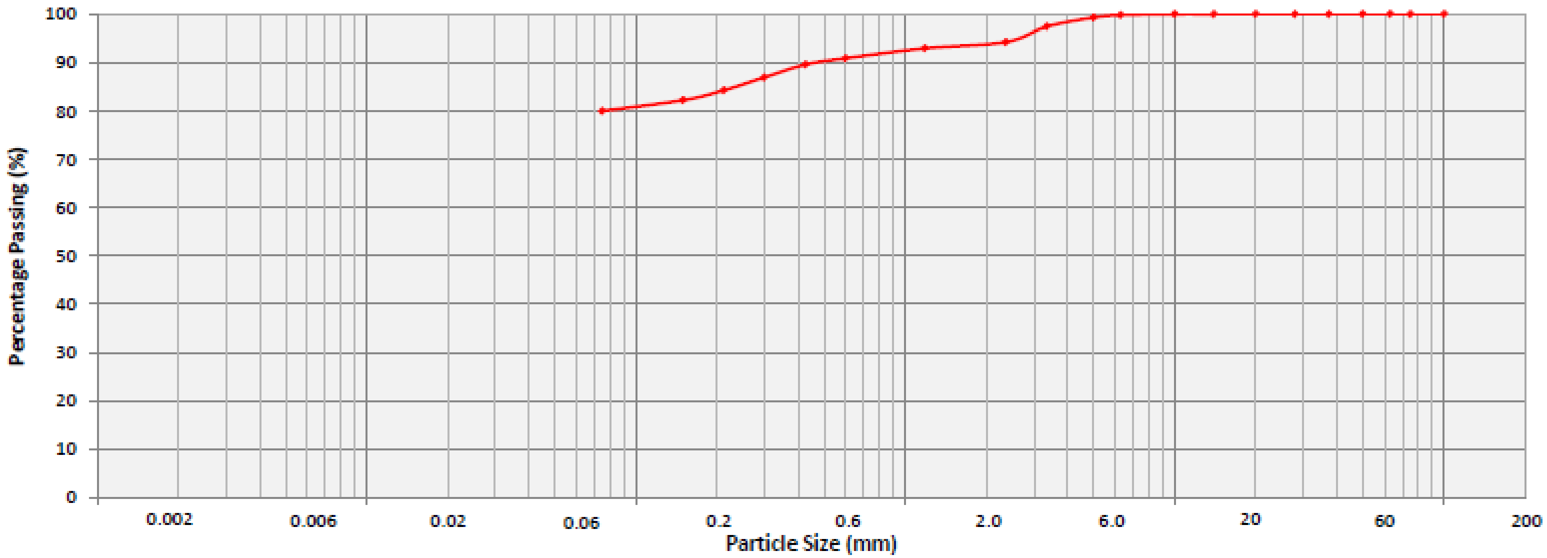
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP8-9A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN8(TP8-9)MN9	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1181

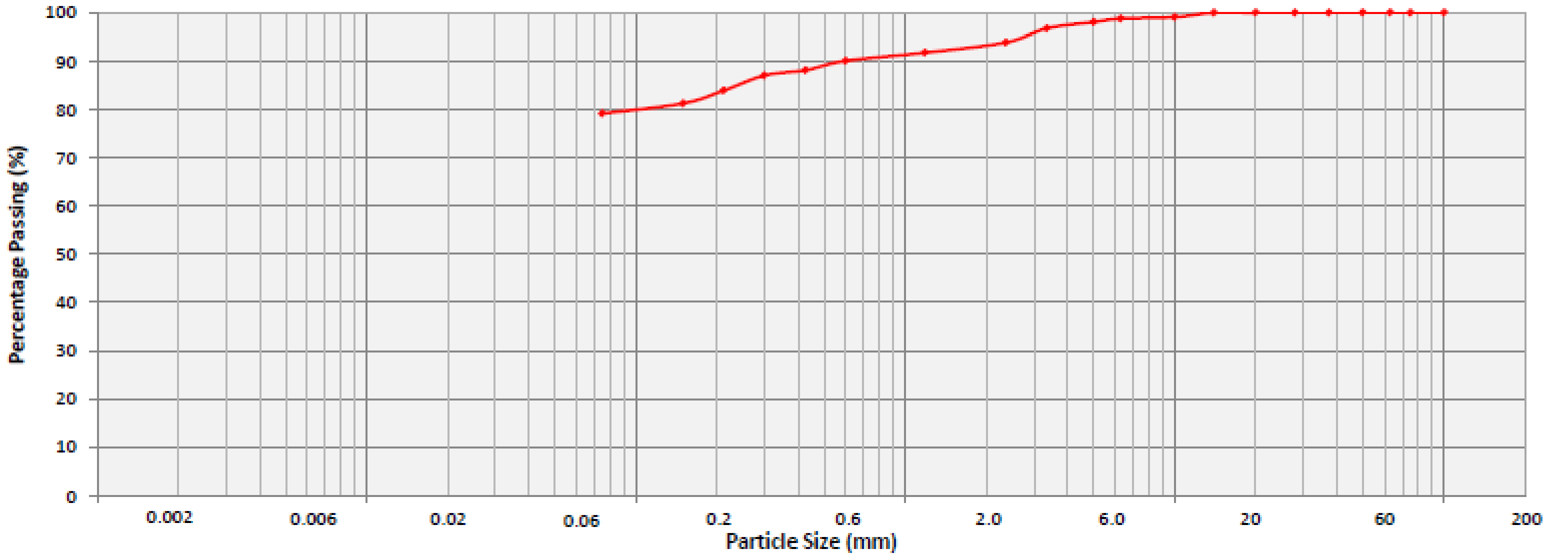


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP8-9B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN8(TP8-9B)MN9	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1236



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

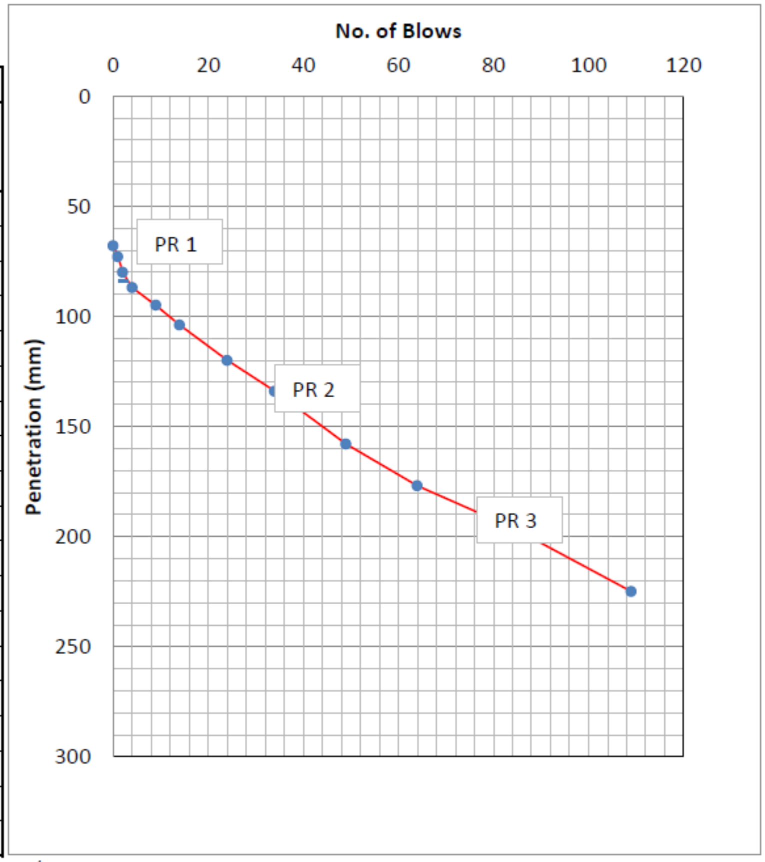
MN08

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 08	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1086

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	68	
1	1	1	73	5.0
2	1	2	80	7.0
3	2	4	87	3.5
4	5	9	95	1.6
5	5	14	104	1.8
6	10	24	120	1.6
7	10	34	134	1.4
8	15	49	158	1.6
9	15	64	177	1.3
10	20	84	196	1.0
11	25	109	225	1.2



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.2	68.3	
PR 2	1.4	278.6	
PR 3	1.1	379.3	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN08

CALCULATION OF SAFE BEARING CAPACITY: TP MN 08					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1086

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1816
ø (˚) =	21	$\gamma\ (kN/m^3)$ =	17.81

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.81 x 2.0 x 7.07) + (0.4 x 17.81 x 1.0 x 3.42)	**699 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 699/3.0	**233 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP8-9A

CALCULATION OF SAFE BEARING CAPACITY: MN8 (TP8-9A) MN9					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	Lean CLAY with Sand			Sample No.:	1181

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C (kN/m^2)$ =	23	$\gamma (kg/m^3)$ =	1816
ϕ (°) =	21	$\gamma (kN/m^3)$ =	17.81

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.81 x 2.0 x 7.07) + (0.4 x 17.81 x 1.0 x 3.42)	**699 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 699/3.0	**233 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP8-9B

CALCULATION OF SAFE BEARING CAPACITY: MN8 (TP8-9B) MN9					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	Lean CLAY with Sand			**Sample No.:**	1236

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1784
$\phi\ (^\circ)$ =	20	$\gamma\ (kN/m^3)$ =	17.50

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
	N_γ = 2.87	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 17.50 x 2.0 x 6.40) + (0.4 x 17.50 x 1.0 x 2.87)	**643 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 643/3.0	**214 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

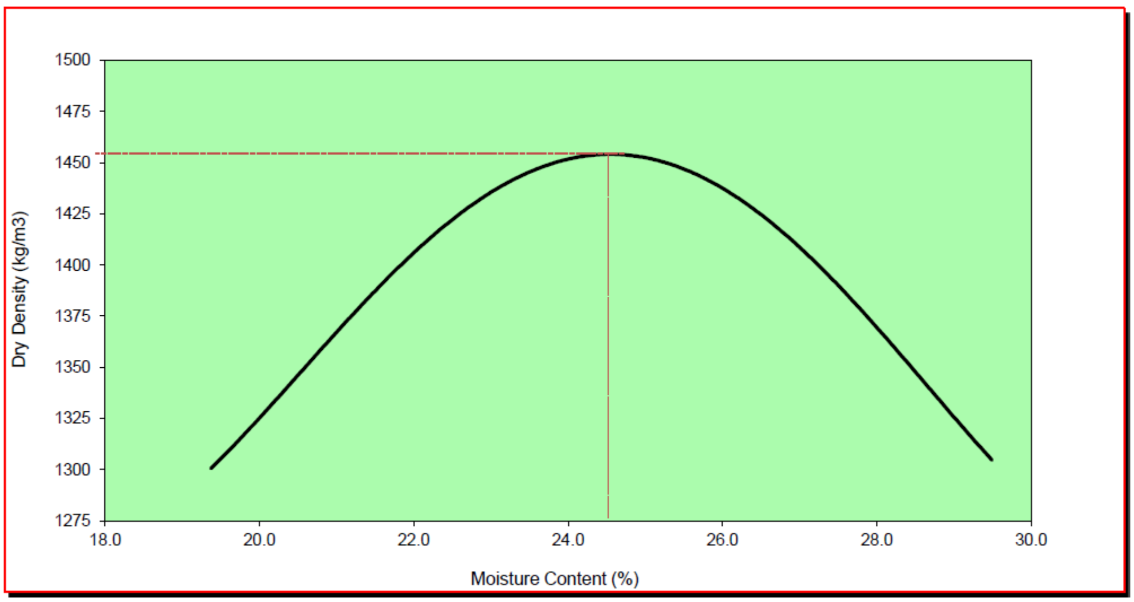
BS 1377 – 4: 1990

MN08

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1086
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 08	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5547	5676	5776	5816	5766	5685
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1552	1681	1781	1821	1771	1690
Bulk Density (Kgs/m^3)	**1552**	**1681**	**1781**	**1821**	**1771**	**1690**
Tin No.	G25	G15	G19	G29	G33	G39
Weight Wet Soil	228.0	210.0	273.0	265.0	260.0	281.0
Weight of Dry Soil	191.0	173.0	221.0	211.0	204.0	217.0
Weight of Water	37.0	37.0	52.0	54.0	56.0	64.0
Moisture Content (%)	**19.4**	**21.4**	**23.5**	**25.6**	**27.5**	**29.5**
Dry Density (Kgs/m^3)	**1300**	**1385**	**1442**	**1450**	**1390**	**1305**



Maximum Dry Density (Kg/m^3): 1455 **Optimum Moisture Content (%):** 24.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN08	
Depth	2.0m
pH	6.93
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP8-9A	
Depth	2.0m
pH	7.45
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.017

TP8-9B	
Depth	2.0m
pH	8.12
Chloride(%) mg/l	0.018
Sulphate (mg/l)	0.033

ANGLE POINT 8 LOG

JOB REF:		GCL/NCE_342/12
MN 08		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.8	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Elastic SILT with Sand

TEST POINT 8-9A, 8-9B LOGS

(TP8-9A erroneously labelled as TP7-8A in below figure)

DATE:	23 - 28.02.2013	**PROJECT:**	NANYUKI-ISIOLO-MERU POWERLINE
LOGGED BY:	STEVE	**SITE:**	NANYUKI-ISIOLO-MERU

MN7 (TP7-8A) MN8

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.2	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Grey Elastic SILT

MN8 (TP8-9B) MN9

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1			Brownish Red Elastic SILT
1.5			
2		2.0	
2.5			

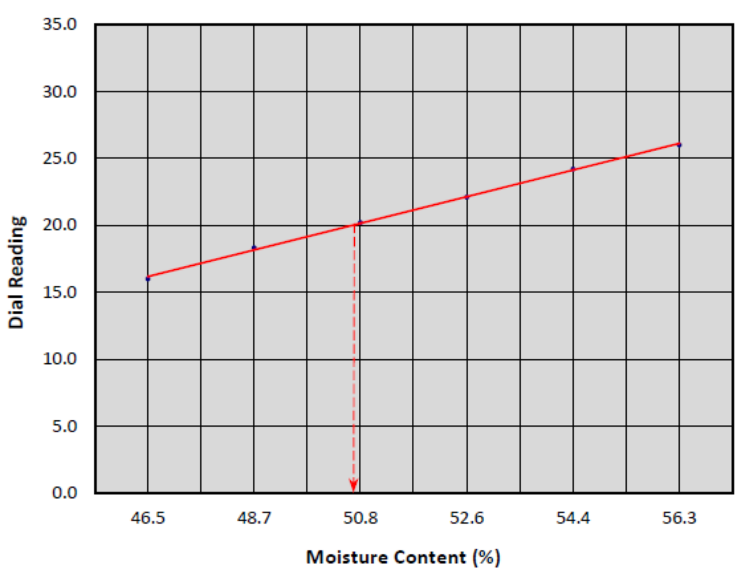
SEGMENT 8

ATTERBERG LIMITS BS 1377 - 2: 1990

MN09

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1093
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.2	22.1	24.2	26.0	-	-	
Tin No	**14**	**12**	**23**	**19**	**33**	**26**	**15**	**11**	
Mass of Wet Soil (g)	40.01	39.29	43.84	47.40	39.36	48.03	19.18	23.29	
Mass of Dry Soil (g)	27.31	26.42	29.08	31.06	25.49	30.73	14.52	17.61	
Mass of Moisture (g)	12.70	12.87	14.76	16.34	13.87	17.30	4.66	5.68	
Moisture Content (%)	46.5	48.7	50.8	52.6	54.4	56.3	32.1	32.3	32.2



PLASTIC LIMIT
PL = 32.2 %

LIQUID LIMIT
LL = 50.6 %

Proportion Passing 425 µm BS Sieve
= 95.1 %

PLASTICITY INDEX
PI = 18.4 %

PLASTIC MODULUS
PM = 1752

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
MH

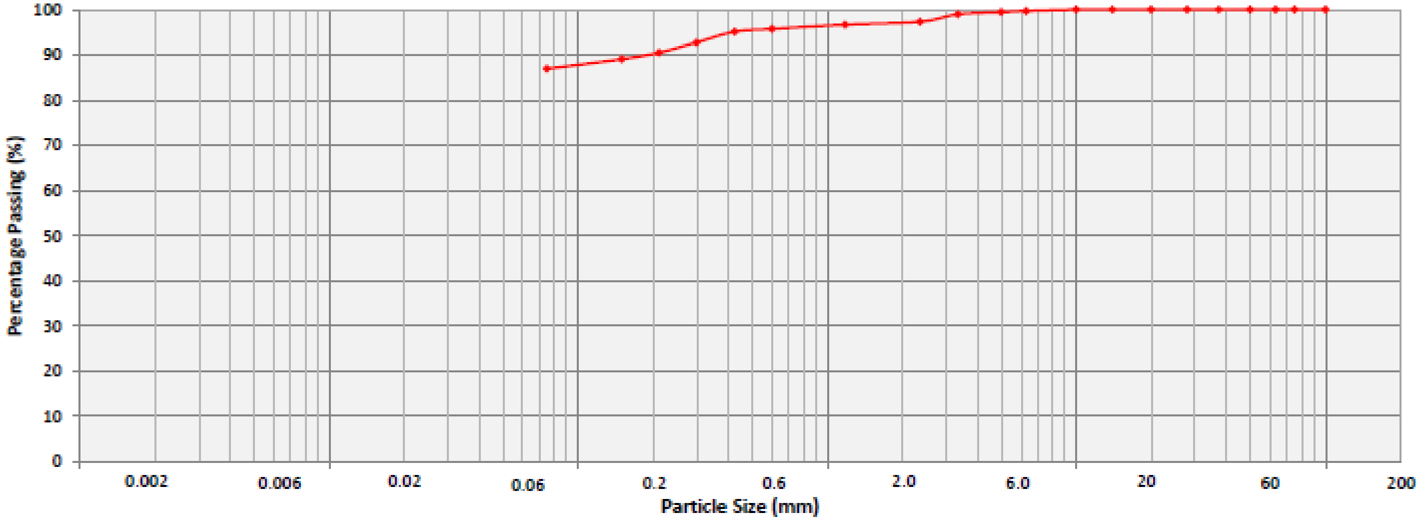
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN09

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 09	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	JOB REF:	GCL/TGA-342/12	DATE TESTED:	13.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1087



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

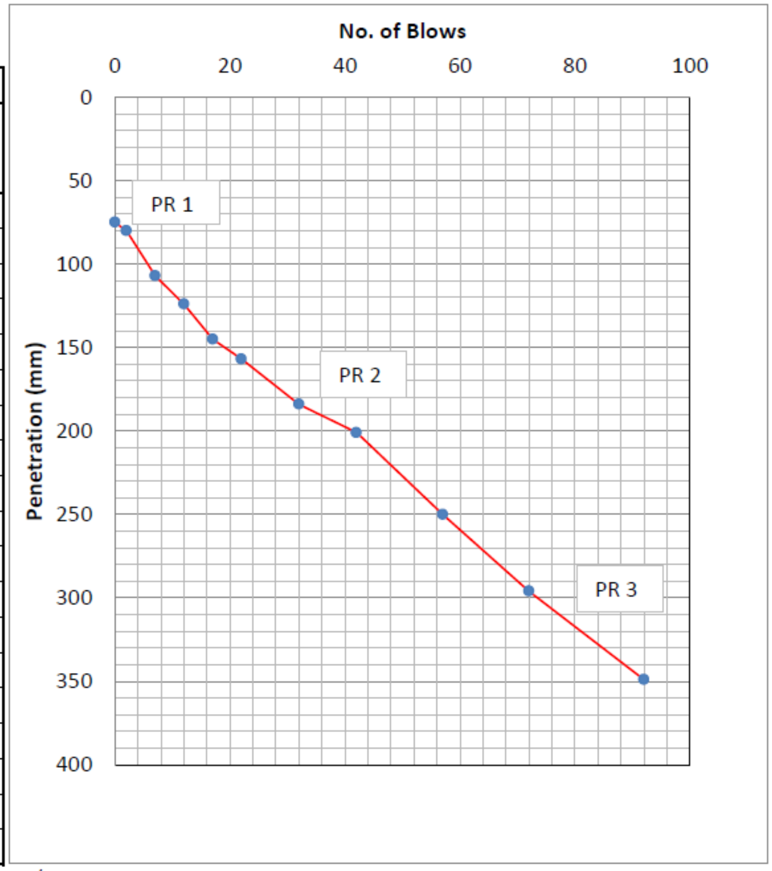
MN09

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 09	**Date of Test:**	02.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1087

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	75	
1	2	2	80	2.5
2	5	7	107	5.4
3	5	12	124	3.4
4	5	17	145	4.2
5	5	22	157	2.4
6	10	32	184	2.7
7	10	42	201	1.7
8	15	57	250	3.3
9	15	72	296	3.1
10	20	92	349	2.7



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.2	68.3	
PR 2	2.4	139.7	
PR 3	2.3	147.6	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN09

CALCULATION OF SAFE BEARING CAPACITY: TP MN 09					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1087

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1784
ø (°) =	20	$\gamma\ (kN/m^3)$ =	17.50

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 14.83) + (0.8 \times 17.50 \times 2.0 \times 6.40) + (0.4 \times 17.50 \times 1.0 \times 2.87)$	**643 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 643/3.0$	**214 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

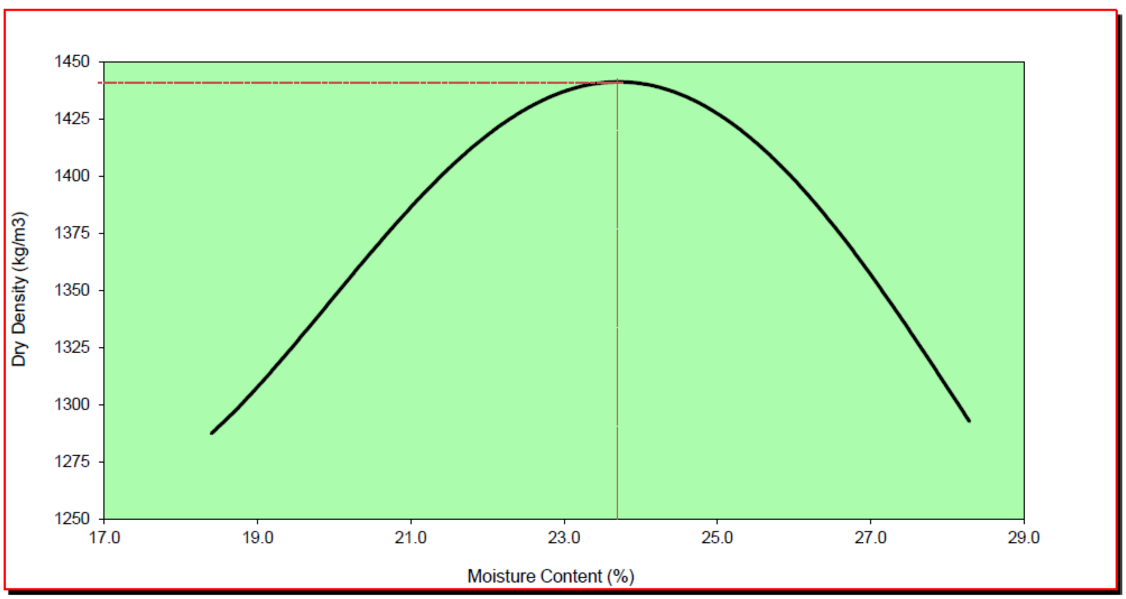
BS 1377 – 4: 1990

MN09

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1087
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 09	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5519	5650	5753	5787	5738	5654
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1524	1655	1758	1792	1743	1659
Bulk Density (Kgs/m^3)	**1524**	**1655**	**1758**	**1792**	**1743**	**1659**
Tin No.	G06	G19	G21	G37	G16	G28
Weight Wet Soil	204.0	219.0	220.2	243.4	233.6	248.5
Weight of Dry Soil	172.3	181.6	179.3	195.2	184.7	193.7
Weight of Water	31.7	37.4	40.9	48.2	48.9	54.8
Moisture Content (%)	**18.4**	**20.6**	**22.8**	**24.7**	**26.5**	**28.3**
Dry Density (Kgs/m^3)	**1287**	**1372**	**1431**	**1437**	**1378**	**1293**



Maximum Dry Density (Kg/m^3): 1443 **Optimum Moisture Content (%):** 23.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

Angle Point MN09	
Depth	2.0m
pH	7.72
Chloride(%) mg/l	0.39
Sulphate (mg/l)	0.001

ANGLE POINT 9 LOG

DATE:	03 - 09.12.2012
LOGGED BY:	LUCAS

MN 09

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.8	Dark Grey CLAY (Black Cotton Soil)
	2.0	Greyish Brown SILT with Sand

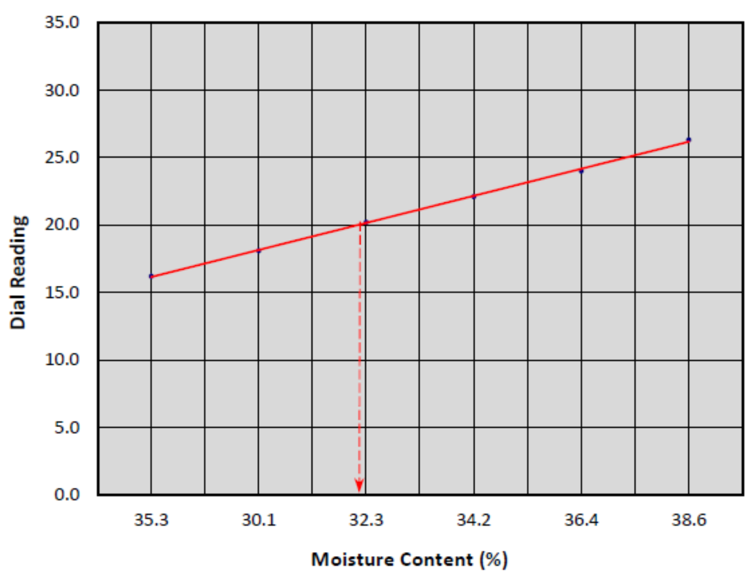
SEGMENT 9

ATTERBERG LIMITS BS 1377 - 2: 1990

MN10

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1088
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.2	22.1	24.0	26.3	-	-	
Tin No	**41**	**12**	**23**	**17**	**21**	**27**	**55**	**10**	
Mass of Wet Soil (g)	41.85	48.18	44.99	39.20	49.34	46.21	25.18	20.69	
Mass of Dry Soil (g)	30.92	37.03	34.00	29.21	36.17	33.34	21.30	17.49	
Mass of Moisture (g)	10.93	11.15	10.99	9.99	13.17	12.87	3.88	3.20	
Moisture Content (%)	35.3	30.1	32.3	34.2	36.4	38.6	18.2	18.3	18.3



PLASTIC LIMIT
PL = 18.3 %

LIQUID LIMIT
LL = 32.1 %

Proportion Passing 425 µm BS Sieve
= 92.0 %

PLASTICITY INDEX
PI = 13.8 %

PLASTIC MODULUS
PM = 1274

LINEAR SHRINKAGE
LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)
CL

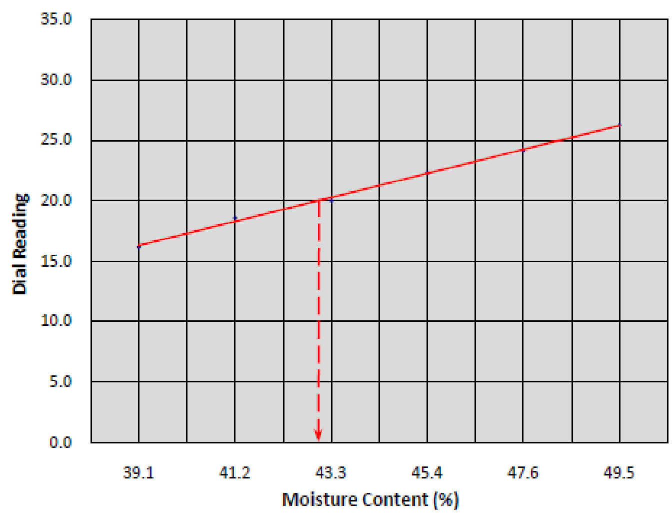
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP10-11

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN10 (TP10-11)MN11	**Date Received:**	06.03.2013
Material Description:	FAT CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1182
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	17.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.6	20.0	22.3	24.2	26.3	-	-	
Tin No	**14**	**25**	**32**	**51**	**12**	**50**	**40**	**37**	
Mass of Wet Soil (g)	32.94	45.38	41.42	50.32	43.42	50.38	23.35	25.80	
Mass of Dry Soil (g)	23.68	32.14	28.91	34.61	29.42	33.70	18.62	20.54	
Mass of Moisture (g)	9.26	13.24	12.51	15.71	14.00	16.68	4.73	5.26	
Moisture Content (%)	39.1	41.2	43.3	45.4	47.6	49.5	25.4	25.6	25.5



PLASTIC LIMIT

PL = 25.5 %

LIQUID LIMIT

LL = 51.5 %

Proportion Passing 425 µm BS Sieve

= 66.9 %

PLASTICITY INDEX

PI = 26.0 %

PLASTIC MODULUS

PM = 1739

LINEAR SHRINKAGE

LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)

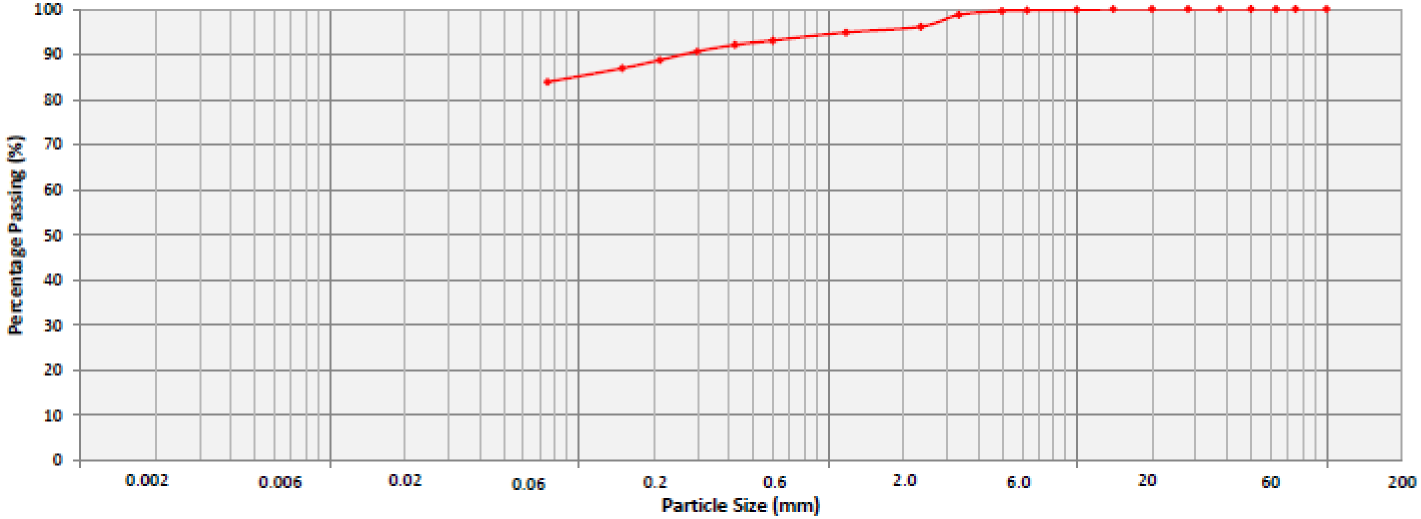
CH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN10

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 10	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	JOB REF:	GCL/TGA-342/12	DATE TESTED:	13.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1088



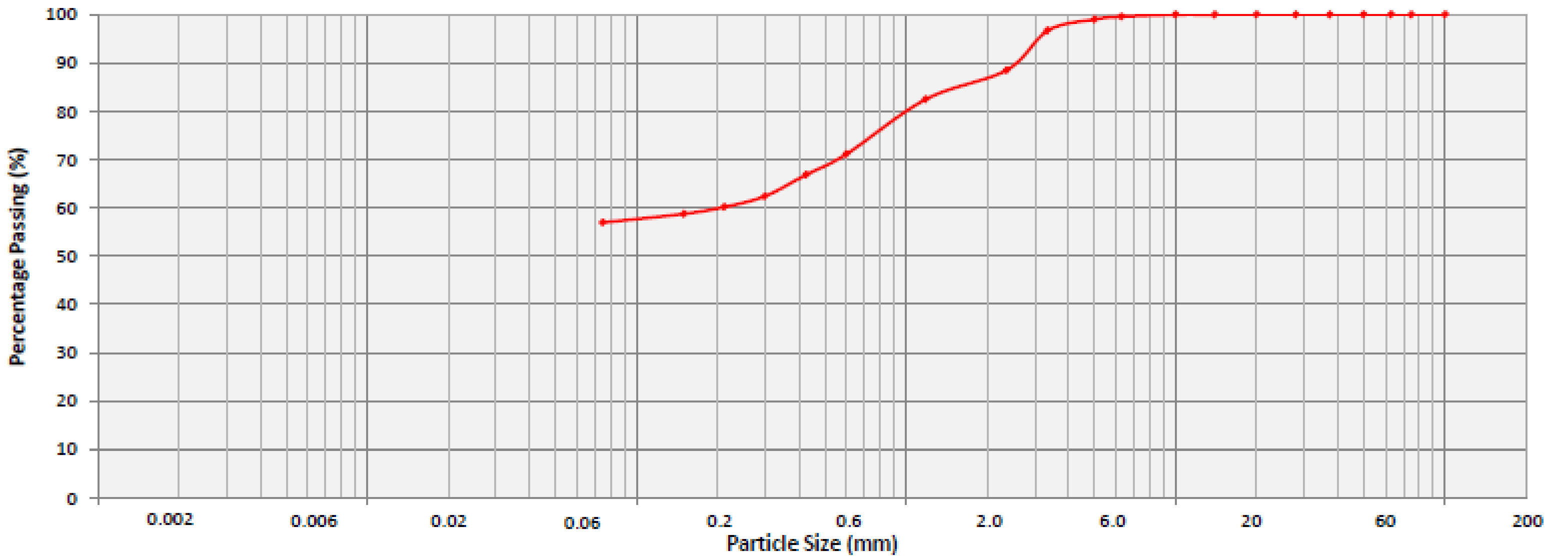
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP10-11

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN10(TP10-11)MN11	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	FAT CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1182



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

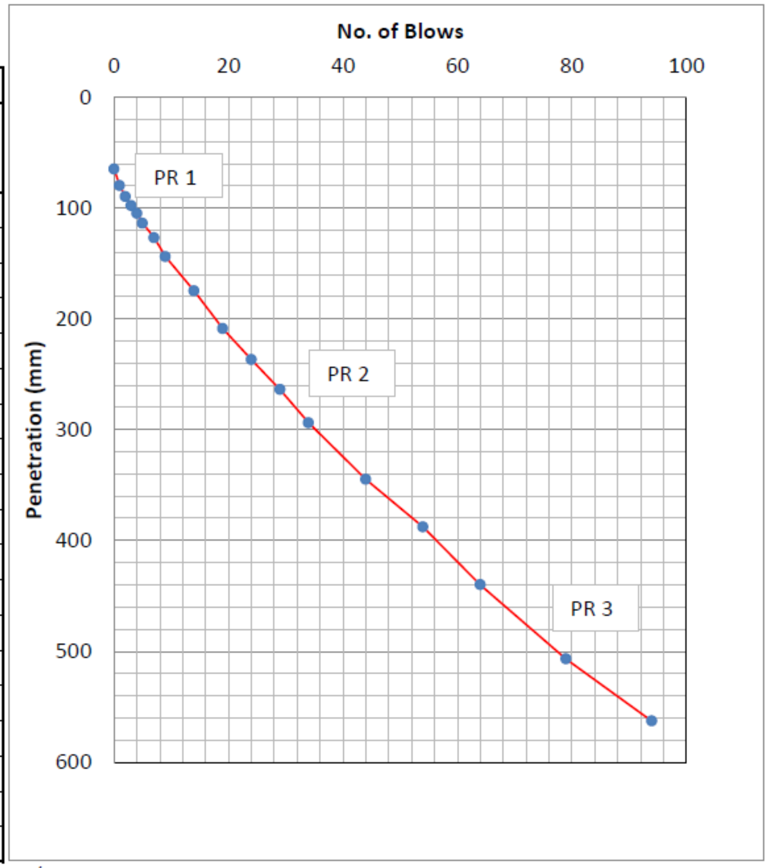
DCP - CBR CORRELATION

MN10

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	Location:	EASTERN	Test Locatior	MN 10	Date of Test:	02.12.2012
Site:	NANYUKI-ISIOLO-MERU	Job No.:	GCL/TGA-342/12	Depth:	2.0M	Sample No.	1088

DCP TEST RESULTS				
Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	65	
1	1	1	80	15.0
2	1	2	90	10.0
3	1	3	98	8.0
4	1	4	105	7.0
5	1	5	114	9.0
6	2	7	127	6.5
7	2	9	144	8.5
8	5	14	175	6.2
9	5	19	209	6.8
10	5	24	237	5.6
11	5	29	264	5.4
12	5	34	294	6.0
13	10	44	345	5.1
14	10	54	388	4.3
15	10	64	440	5.2
16	15	79	507	4.5
17	15	94	563	3.7



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	13	16.1	
PR 2	6.2	41.5	
PR 3	4.2	68.3	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN10

CALCULATION OF SAFE BEARING CAPACITY: TP MN 10					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1088

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1911
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	18.75

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 18.75 x 2.0 x 7.07) + (0.4 x 18.75 x 1.0 x 3.42)	**711 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 711/3.0	**237 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP10-11

CALCULATION OF SAFE BEARING CAPACITY: MN10 (TP10-11) MN11					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	Fat CLAY with Sand			**Sample No.:**	1182

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
C(kN/m^2) =	23	γ (kg/m^3) =	1911
ϕ (°) =	21	γ (kN/m^3) =	18.75

REFERENCE	CALCULATIONS	RESULTS
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**Ultimate Bearing Capacity** $q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$ **Bearing Capacity Factors : Meyerhof's Analyses** N_c= 15.81 N_q = 7.07 N_γ = 3.42 **The Ultimate Bearing Capacity of a Pad Foundation** B(m)= 1.0 Z (m)= 2.0 q_f = (1.3 x 23 x 15.81) + (0.8 x 18.75 x 2.0 x 7.07) + (0.4 x 18.75 x 1.0 x 3.42) **The Safe Bearing Capacity of the foundation is : (Fs = 3.0)** q_s = 711/3.0	**711 kN/m^2** **237 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

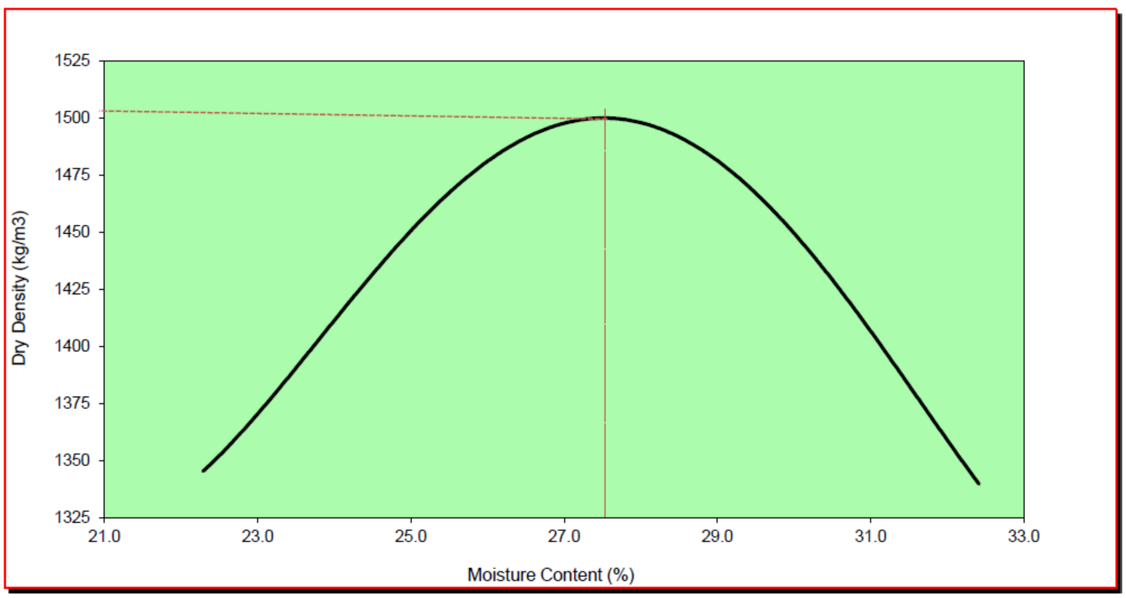
BS 1377 – 4: 1990

MN10

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1088
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 10	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5640	5779	5885	5910	5856	5769
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1645	1784	1890	1915	1861	1774
Bulk Density (Kgs/m^3)	**1645**	**1784**	**1890**	**1915**	**1861**	**1774**
Tin No.	G23	G41	G61	G01	G20	G47
Weight Wet Soil	250.2	246.8	267.8	279.6	296.3	284.3
Weight of Dry Soil	204.6	198.2	211.5	217.1	226.9	214.7
Weight of Water	45.6	48.6	56.3	62.5	69.4	69.6
Moisture Content (%)	**22.3**	**24.5**	**26.6**	**28.8**	**30.6**	**32.4**
Dry Density (Kgs/m^3)	**1345**	**1433**	**1493**	**1487**	**1425**	**1340**



Maximum Dry Density (Kg/m^3): 1500 **Optimum Moisture Content (%):** 27.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN10	
Depth	2.0m
pH	8.16
Chloride(%) mg/l	0.16
Sulphate (mg/l)	0.002

TP10-11	
Depth	2.0m
pH	7.34
Chloride(%) mg/l	0.014
Sulphate (mg/l)	0.035

ANGLE POINT 10 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 10		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5		0.6	Dark Grey CLAY (Black Cotton Soil)
1 1.5 2		2.0	Light Grey Elastic SILT with Sand
2.5			

TEST POINT 10-11 LOG

DATE:		23 - 28.02.2013
LOGGED BY:		STEVE
MN10 (TP10-11) MN11		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.0	Light Brown Sandy CLAY
	2.0	Brown CLAY with Sand

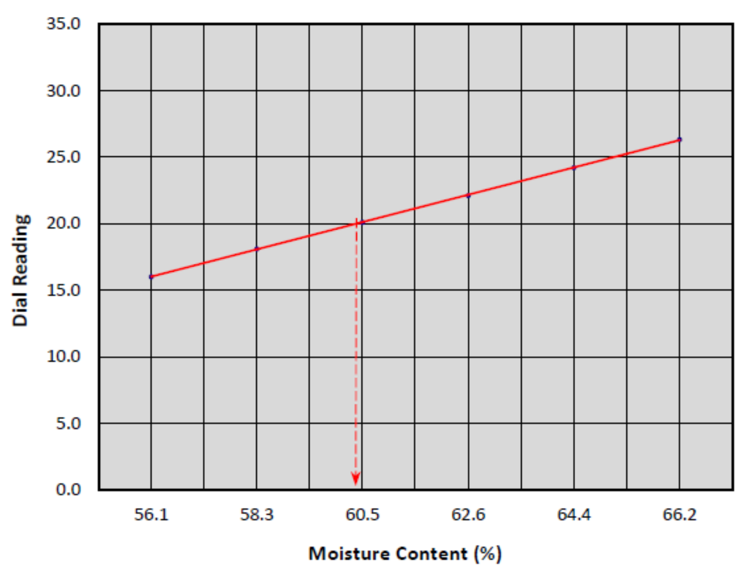
SEGMENT 10

ATTERBERG LIMITS BS 1377 - 2: 1990

MN11

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1089
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.1	20.1	22.1	24.2	26.3	-	-	
Tin No	**52**	**6**	**54**	**48**	**10**	**23**	**7**	**11**	
Mass of Wet Soil (g)	42.65	54.96	63.33	34.65	48.20	55.51	31.34	24.73	
Mass of Dry Soil (g)	27.32	34.72	39.46	21.31	29.32	33.40	22.94	18.08	
Mass of Moisture (g)	15.33	20.24	23.87	13.34	18.88	22.11	8.40	6.65	
Moisture Content (%)	56.1	58.3	60.5	62.6	64.4	66.2	36.6	36.8	36.7



PLASTIC LIMIT
PL = 36.7 %

LIQUID LIMIT
LL = 60.4 %

Proportion Passing 425 µm BS Sieve
= 95.9 %

PLASTICITY INDEX
PI = 23.7 %

PLASTIC MODULUS
PM = 2273

LINEAR SHRINKAGE
LS = 11.4 %

GROUP SYMBOL (USC SYSTEM)
MH

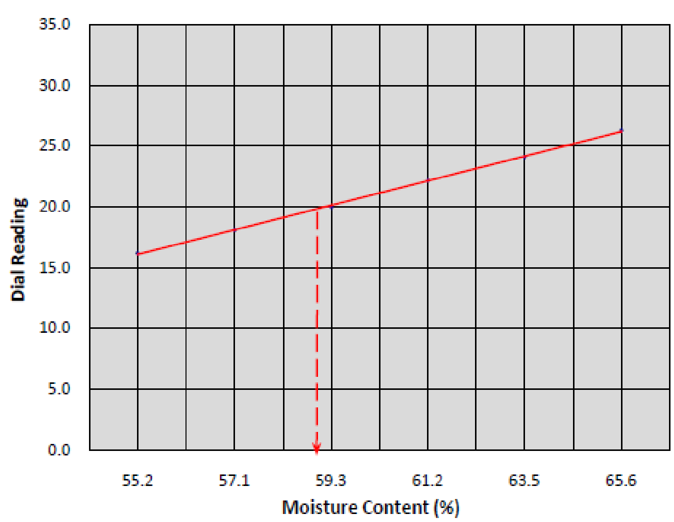
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP11-12A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN11 (TP11-12A)MN12	**Date Received:**	06.03.2013
Material Description:	ELASTIC SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1183
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.2	24.1	26.3	-	-	
Tin No	54	45	22	6	37	24	30	29	
Mass of Wet Soil (g)	36.77	43.06	34.09	45.46	42.82	44.93	23.27	29.82	
Mass of Dry Soil (g)	23.69	27.41	21.40	28.20	26.19	27.13	17.29	22.14	
Mass of Moisture (g)	13.08	15.65	12.69	17.26	16.63	17.80	5.98	7.68	
Moisture Content (%)	55.2	57.1	59.3	61.2	63.5	65.6	34.6	34.7	34.6



PLASTIC LIMIT
PL = 34.6 %

LIQUID LIMIT
LL = 58.9 %

Proportion Passing 425 µm BS Sieve
= 92.4 %

PLASTICITY INDEX
PI = 24.3 %

PLASTIC MODULUS
PM = 2242

LINEAR SHRINKAGE
LS = 11.4 %

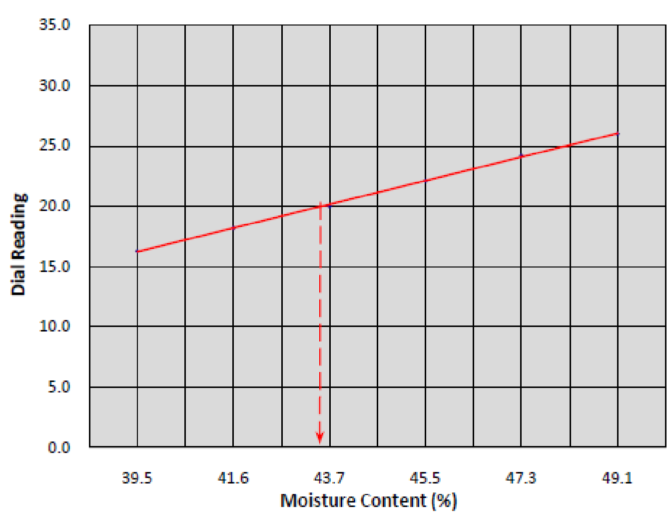
GROUP SYMBOL (USC SYSTEM)

TP11-12B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN11 (TP11-12B)MN12	**Date Received:**	06.03.2013
Material Description:	ELASTIC SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1184
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.2	20.0	22.1	24.2	26.0	-	-	
Tin No	77	58	21	6	37	24	16	36	
Mass of Wet Soil (g)	43.36	35.64	43.52	38.54	41.69	47.92	16.36	19.96	
Mass of Dry Soil (g)	31.08	25.17	30.29	26.49	28.30	32.14	13.09	15.94	
Mass of Moisture (g)	12.28	10.47	13.23	12.05	13.39	15.78	3.27	4.02	
Moisture Content (%)	39.5	41.6	43.7	45.5	47.3	49.1	25.0	25.2	25.1



PLASTIC LIMIT

PL = 25.1 %

LIQUID LIMIT

LL = 43.5 %

Proportion Passing 425 µm BS Sieve

= 70.5 %

PLASTICITY INDEX

PI = 18.4 %

PLASTIC MODULUS

PM = 1297

LINEAR SHRINKAGE

LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)

MH

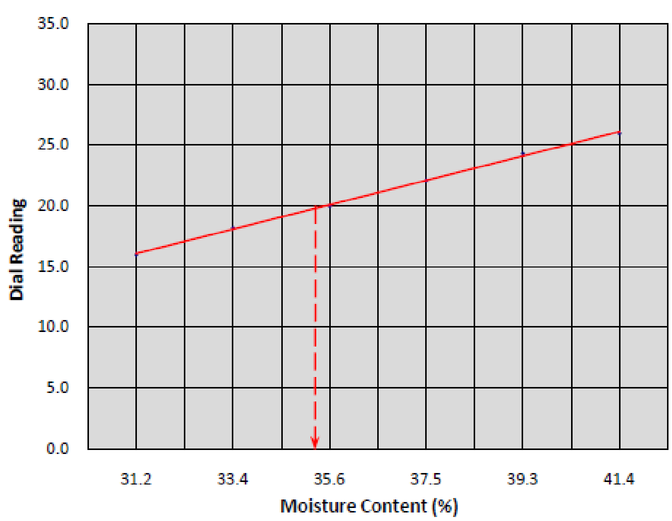
Tested By: STEVE   Date Reported: 22.03.2013   Checked: ________________

TP11-12C

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN11 (TP11-12C)MN12	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1185
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.2	20.0	22.1	24.3	26.0	-	-	
Tin No	8	58	23	65	20	32	42	11	
Mass of Wet Soil (g)	38.59	42.69	46.60	51.34	40.61	51.54	12.76	15.01	
Mass of Dry Soil (g)	29.41	32.00	34.37	37.34	29.15	36.45	10.63	12.49	
Mass of Moisture (g)	9.18	10.69	12.23	14.00	11.46	15.09	2.13	2.52	
Moisture Content (%)	31.2	33.4	35.6	37.5	39.3	41.4	20.0	20.2	20.1



PLASTIC LIMIT
PL = 20.1 %

LIQUID LIMIT
LL = 35.2 %

Proportion Passing 425 µm BS Sieve
= 94.8 %

PLASTICITY INDEX
PI = 15.1 %

PLASTIC MODULUS
PM = 1431

LINEAR SHRINKAGE
LS = 7.1 %

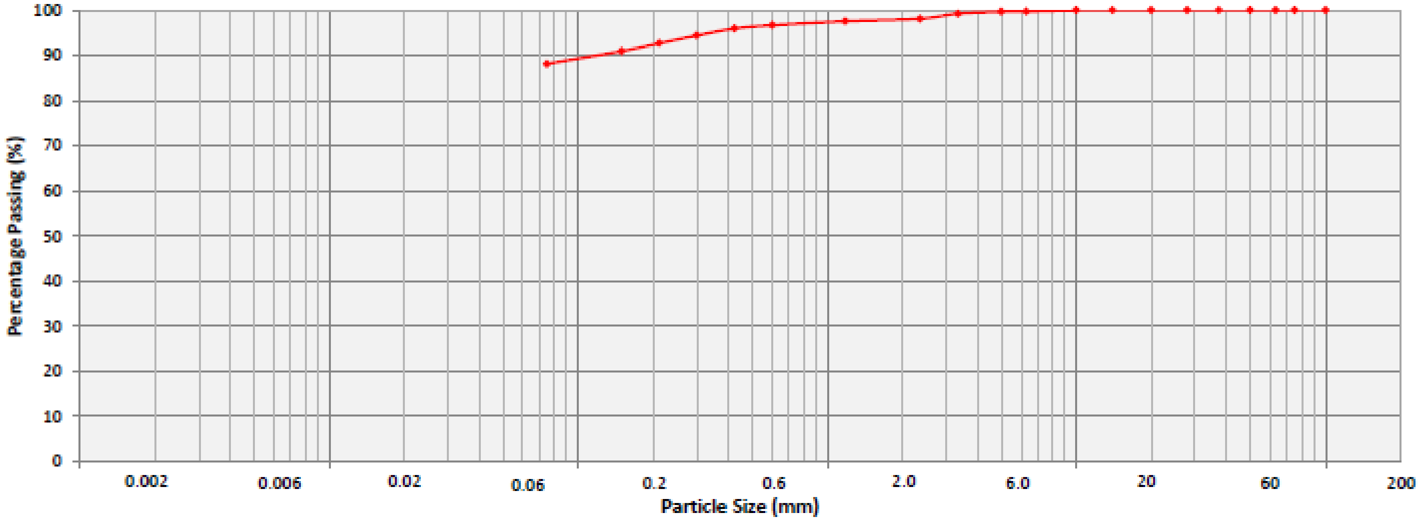
GROUP SYMBOL (USC SYSTEM)
CL

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN11

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 11	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	JOB REF:	GCL/TGA-342/12	DATE TESTED:	14.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1089



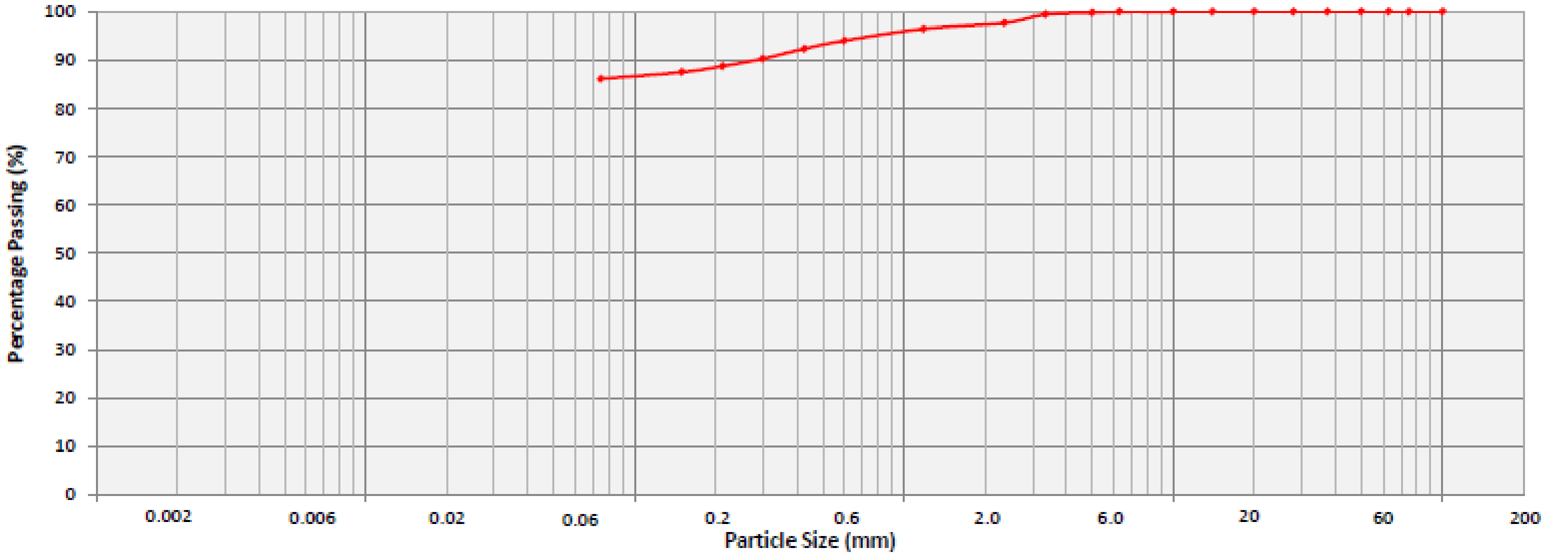
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP11-12A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN11(TP11-12A)MN12	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1183

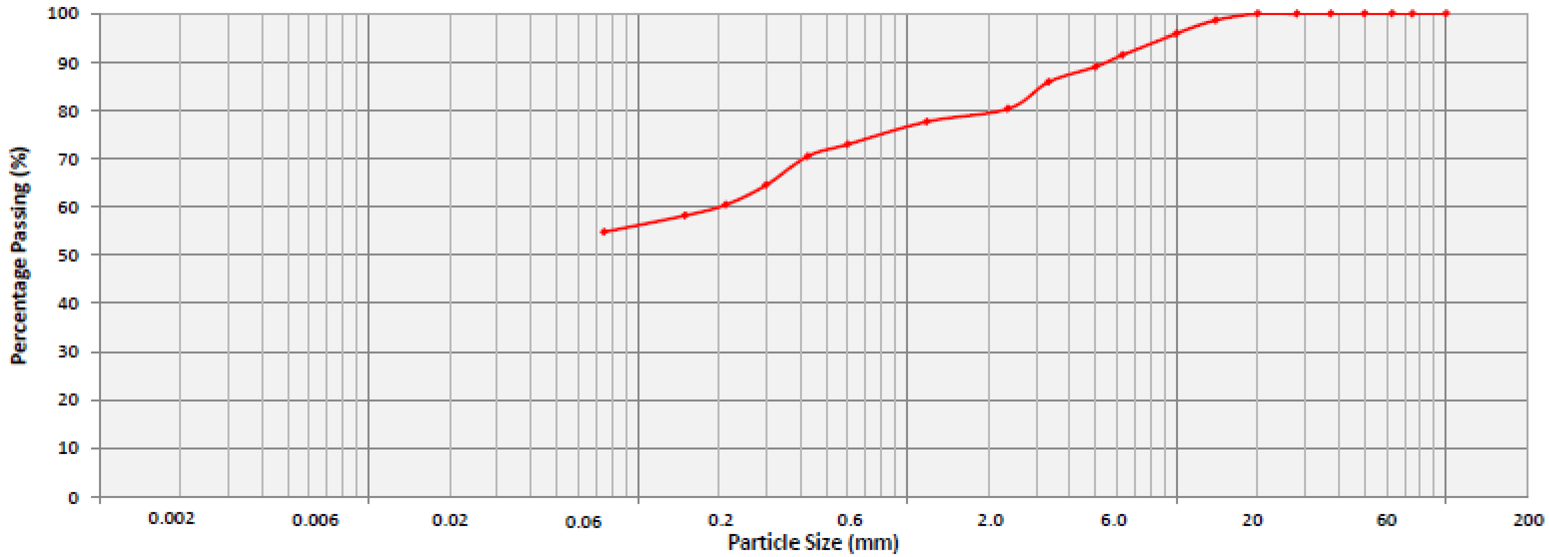


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP11-12B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN11(TP11-12B)MN12	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand and Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1184

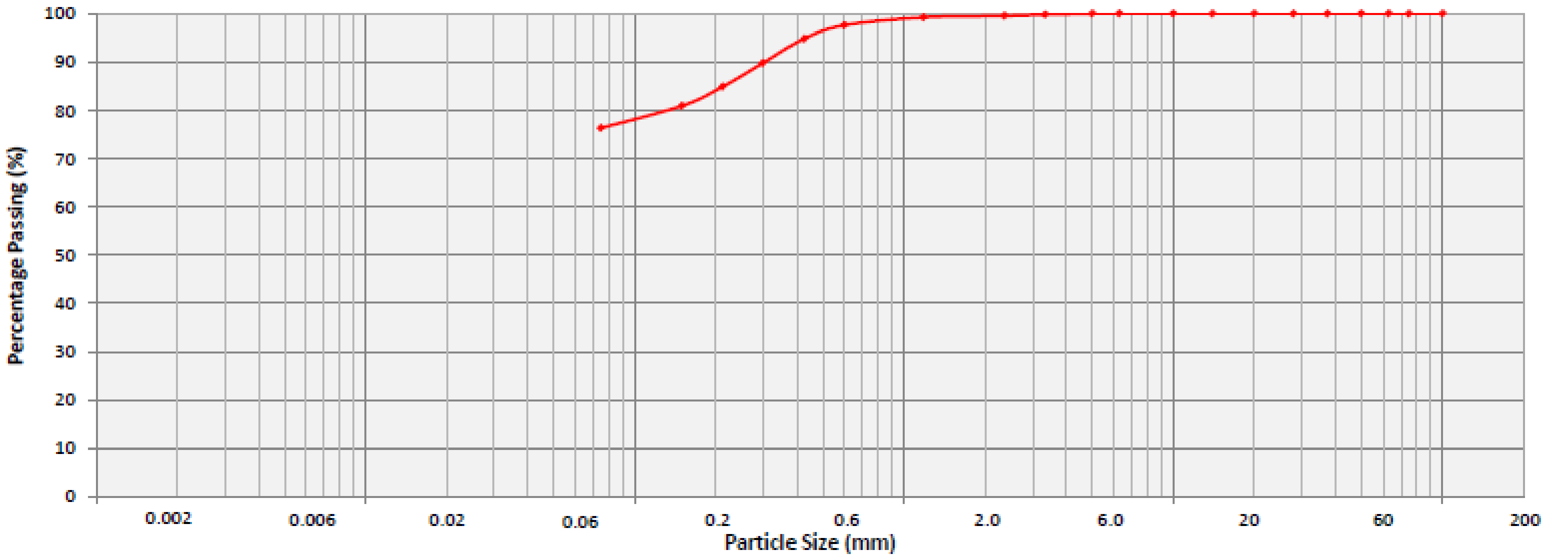


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP11-12C

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN11(TP11-12C)MN12	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1185



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

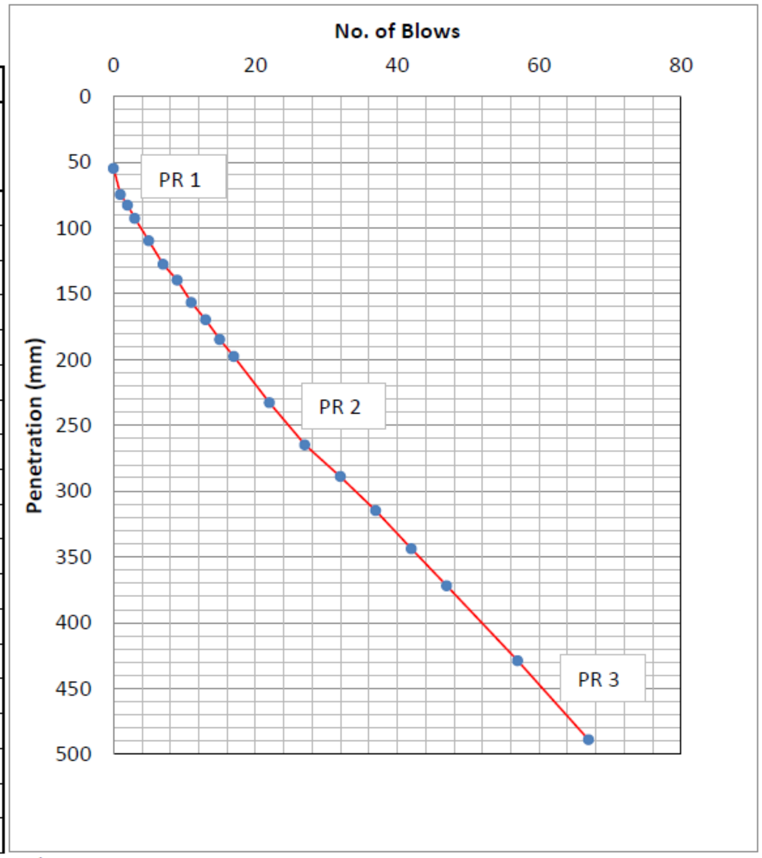
MN11

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Location**	MN 11	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1089

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	55	
1	1	1	75	20.0
2	1	2	83	8.0
3	1	3	93	10.0
4	2	5	110	8.5
5	2	7	128	9.0
6	2	9	140	6.0
7	2	11	157	8.5
8	2	13	170	6.5
9	2	15	185	7.5
10	2	17	198	6.5
11	5	22	233	7.0
12	5	27	265	6.4
13	5	32	289	4.8
14	5	37	315	5.2
15	5	42	344	5.8
16	5	47	372	5.6
17	10	57	429	5.7
18	10	67	489	6.0



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	19	9.9	
PR 2	7.5	32.5	
PR 3	5	54.6	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN11

CALCULATION OF SAFE BEARING CAPACITY: TP MN 11					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1089

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1883
$\phi\ (^\circ)$ =	20	$\gamma\ (kN/m^3)$ =	18.47

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 18.47 x 2.0 x 6.40) + (0.4 x 18.47 x 1.0 x 2.87)	**654 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 654/3.0	**218 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP11-12A

CALCULATION OF SAFE BEARING CAPACITY: MN 11 (TP11-12A) MN 12					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	Elastic SILT with Sand			Sample No.:	1183

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma\,(kg/m^3)$ =	1883
$\phi\,(^\circ)$ =	20	$\gamma\,(kN/m^3)$ =	18.47

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma\,BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 18.47 x 2.0 x 6.40) + (0.4 x 18.47 x 1.0 x 2.87)	**654 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 654/3.0	**218 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP11-12C

CALCULATION OF SAFE BEARING CAPACITY: MN 11 (TP11-12C) MN12					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			Sample No.:	1185

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C (kN/m^2) =$	24	$\gamma (kg/m^3) =$	1873
$\phi (^\circ) =$	21	$\gamma (kN/m^3) =$	18.38

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c = 15.81$	
	$N_q = 7.07$	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	$N_\gamma = 3.42$	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 24 \times 15.81) + (0.8 \times 18.38 \times 2.0 \times 7.07) + (0.4 \times 18.38 \times 1.0 \times 3.42)$	**726 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 726/3.0$	**242 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

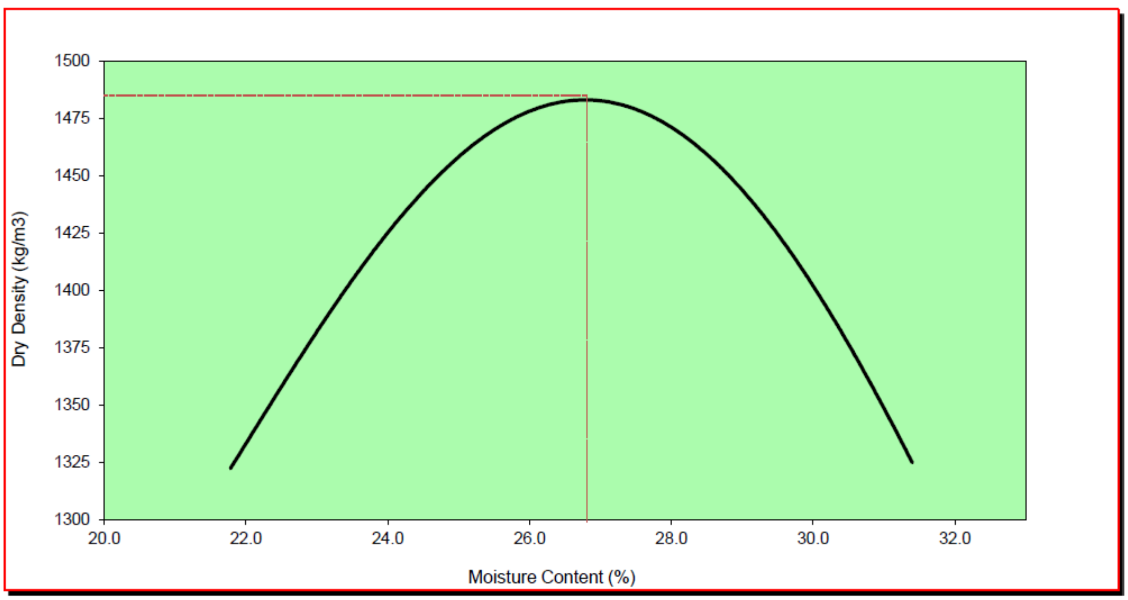
BS 1377 – 4: 1990

MN11

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1089
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 11	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5605	5737	5845	5883	5834	5736
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1610	1742	1850	1888	1839	1741
Bulk Density (Kgs/m^3)	**1610**	**1742**	**1850**	**1888**	**1839**	**1741**
Tin No.	G63	G08	G17	G13	G47	G15
Weight Wet Soil	199.6	211.1	235.3	246.7	241.6	235.6
Weight of Dry Soil	163.9	170.8	187.2	193.5	186.4	179.3
Weight of Water	35.7	40.3	48.1	53.2	55.2	56.3
Moisture Content (%)	**21.8**	**23.6**	**25.7**	**27.5**	**29.6**	**31.4**
Dry Density (Kgs/m^3)	**1322**	**1409**	**1472**	**1481**	**1419**	**1325**



Maximum Dry Density (Kg/m^3): 1485 **Optimum Moisture Content (%):** 26.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN11	
Depth	2.0m
pH	6.84
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP11-12A	
Depth	2.0m
pH	8.01
Chloride(%) mg/l	0.012
Sulphate (mg/l)	0.034

TP11-12B	
Depth	2.0m
pH	7.85
Chloride(%) mg/l	0.010
Sulphate (mg/l)	0.023

TP11-12C	
Depth	2.0m
pH	7.41
Chloride(%) mg/l	0.009
Sulphate (mg/l)	0.036

INSITU DENSITY TEST

TP11-12A	
Depth (m)	2.0
Bulk density (kg/m3)	1554
Moisture Content (%)	30.2
Dry Density (kg/m3)	1193
Maximum Dry Density (kg/m3)	1383
Relative Compaction (%)	86.3

ANGLE POINT 11 LOG

JOB REF:		GCL/NCE_342/12
MN 11		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	2.0	Grey SILT with Sand

TEST POINT 11-12A, 11-12B, 11-12C LOGS

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE	**JOB REF:**	GCL/NCE_356/03	**DATE:**	23 - 28.02.2013
SITE:	NANYUKI-ISIOLO-MERU			**LOGGED BY:**	STEVE

	MN11 (TP11-12A) MN12			MN11 (TP11-12B) MN12			MN11 (TP11-12C) MN12		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0									
0.5			Dark Grey CLAY (Black Cotton Soil)			Brownish Red Sandy SILT			Brownish Red Sandy SILT
1		1.0			1.2			1.2	
1.5			Greyish Brown Elastic SILT with Sand			Brownish Red Elastic SILT with Sand and Gravel			Brownish Red Elastic SILT with Sand and Gravel
2		2.0			2.0				
2.5									

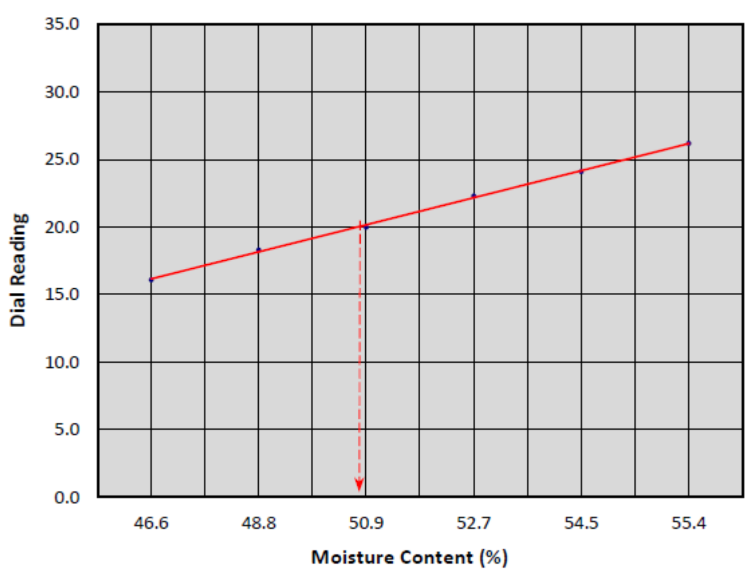
SEGMENT 11

ATTERBERG LIMITS BS 1377 - 2: 1990

MN12

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1090
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.3	20.0	22.3	24.1	26.2	-	-	
Tin No	**24**	**51**	**66**	**20**	**8**	**79**	**54**	**63**	
Mass of Wet Soil (g)	39.64	48.32	42.65	35.75	43.37	51.48	19.79	23.48	
Mass of Dry Soil (g)	27.04	32.47	28.27	23.41	28.07	33.13	14.39	17.05	
Mass of Moisture (g)	12.60	15.85	14.38	12.34	15.30	18.35	5.40	6.43	
Moisture Content (%)	46.6	48.8	50.9	52.7	54.5	55.4	37.5	37.7	37.6



PLASTIC LIMIT
PL = 37.6 %

LIQUID LIMIT
LL = 50.8 %

Proportion Passing 425 µm BS Sieve
= 77.5 %

PLASTICITY INDEX
PI = 13.2 %

PLASTIC MODULUS
PM = 1022

LINEAR SHRINKAGE
LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)
MH

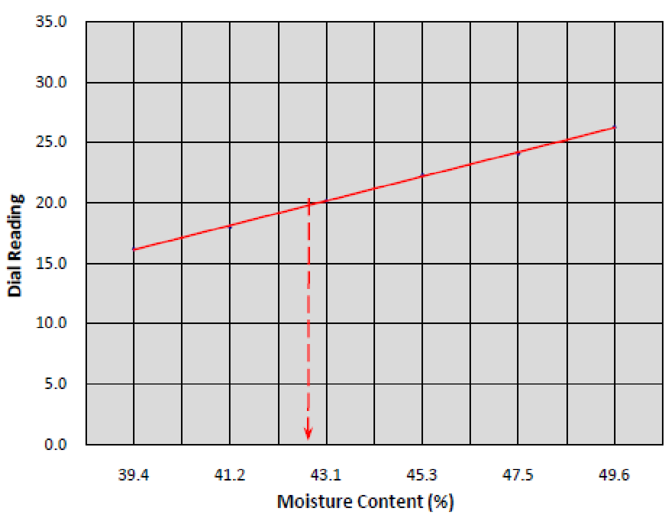
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP12-13A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN12 (TP12-13A)MN13	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1186
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.0	20.2	22.3	24.1	26.3	-	-	
Tin No	**23**	**25**	**16**	**24**	**53**	**26**	**58**	**14**	
Mass of Wet Soil (g)	37.99	42.57	47.86	38.39	44.53	48.52	26.05	32.92	
Mass of Dry Soil (g)	27.25	30.15	33.45	26.42	30.19	32.43	20.43	25.78	
Mass of Moisture (g)	10.74	12.42	14.41	11.97	14.34	16.09	5.62	7.14	
Moisture Content (%)	39.4	41.2	43.1	45.3	47.5	49.6	27.5	27.7	27.6



PLASTIC LIMIT

PL = 27.6 %

LIQUID LIMIT

LL = 42.5 %

Proportion Passing 425 µm BS Sieve

= 94.8 %

PLASTICITY INDEX

PI = 14.9 %

PLASTIC MODULUS

PM = 1412

LINEAR SHRINKAGE

LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)

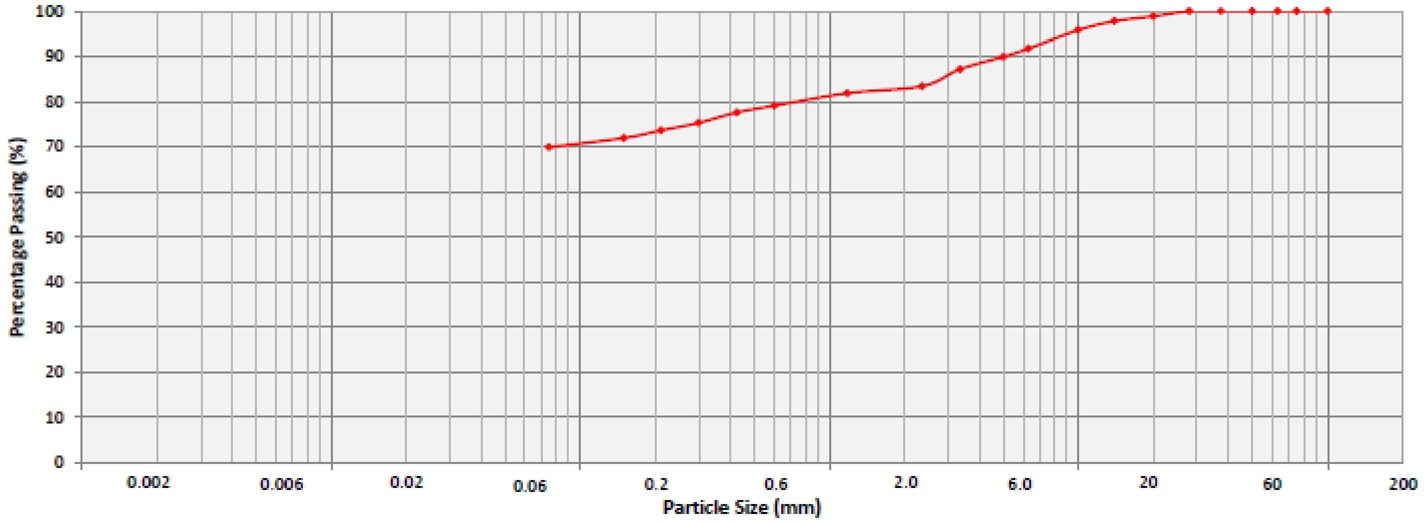
CL

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN12

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 12	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT + GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1090



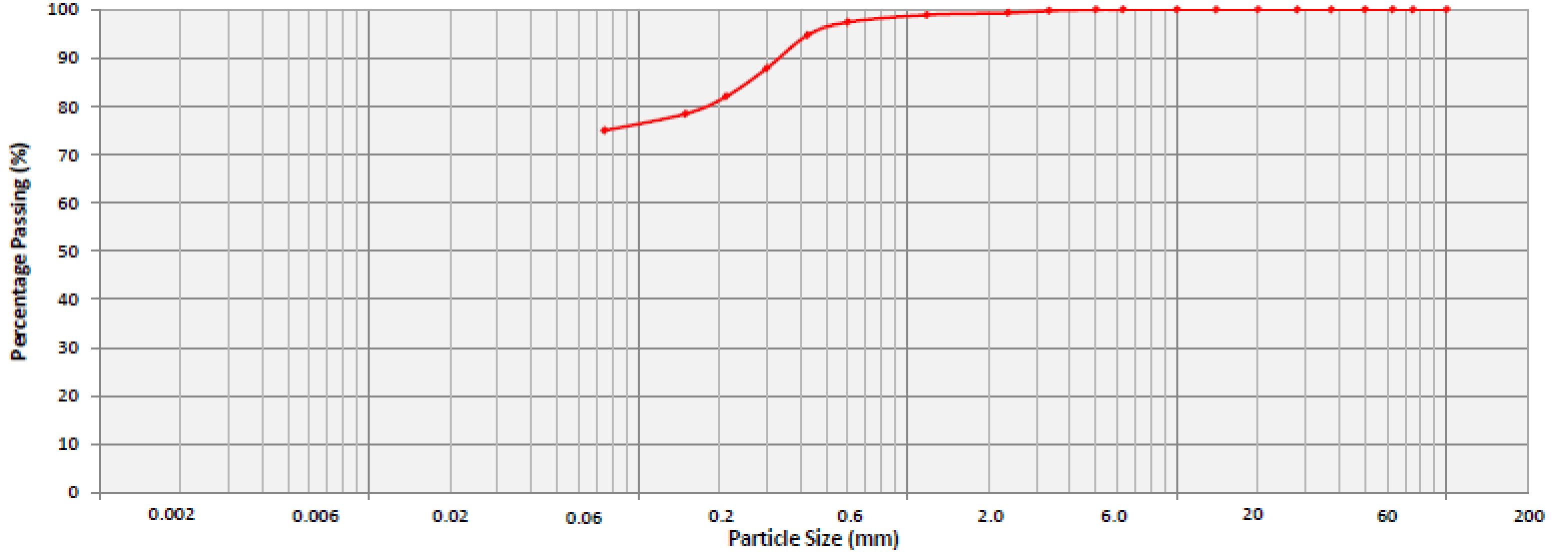
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP12-13A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN12(TP12-13A)MN13	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1186



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

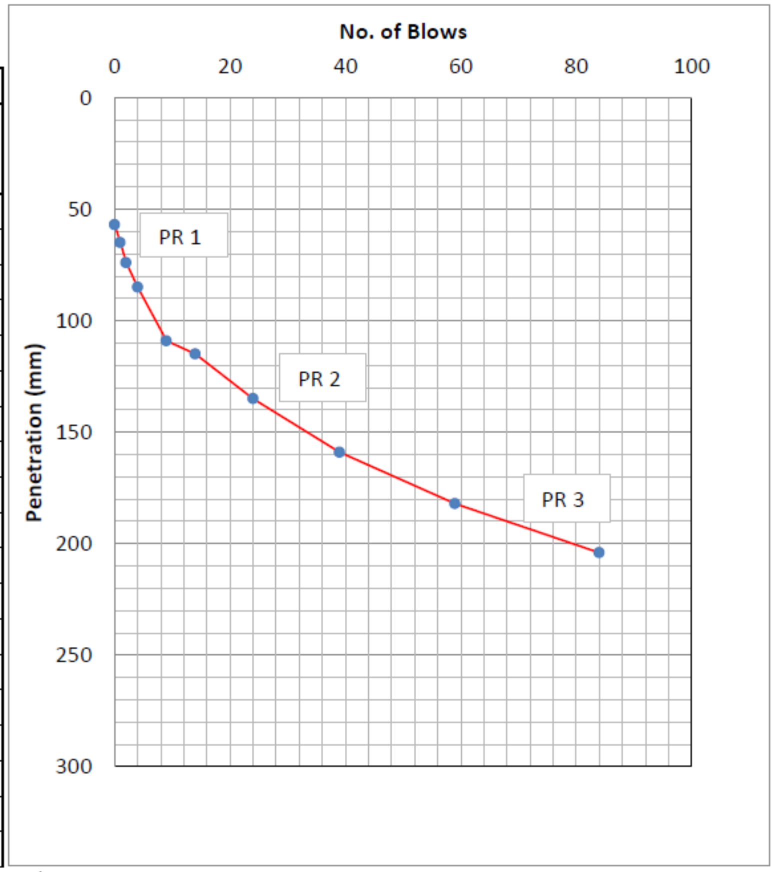
MN12

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 12	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1090

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	57	
1	1	1	65	8.0
2	1	2	74	9.0
3	2	4	85	5.5
4	5	9	109	4.8
5	5	14	115	1.2
6	10	24	135	2.0
7	15	39	159	1.6
8	20	59	182	1.2
9	25	84	204	0.9



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	8	29.9	
PR 2	3.4	89.5	
PR 3	1.2	339.4	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN12

CALCULATION OF SAFE BEARING CAPACITY: TP MN 12					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT WITH GRAVEL			**Sample No.:**	1090

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	26	$\gamma\ (kg/m^3)$ =	1944
$\phi\ (^\circ)$ =	22	$\gamma\ (kN/m^3)$ =	19.07

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 26 x 16.88) + (0.8 x 19.07 x 2.0 x 7.82) + (0.4 x 19.07 x 1.0 x 4.07)	**840 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 840/3.0	**280 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP12-13

CALCULATION OF SAFE BEARING CAPACITY: MN12 (TP12-13) MN13					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1186

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\,(kg/m^3)$ =	1785
$\phi\,(^\circ)$ =	21	$\gamma\,(kN/m^3)$ =	17.51

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cN_c + 0.8\gamma ZN_q + 0.4\gamma BN_\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.51 x 2.0 x 7.07) + (0.4 x 17.51 x 1.0 x 3.42)	**695 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 695/3.0	**232 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

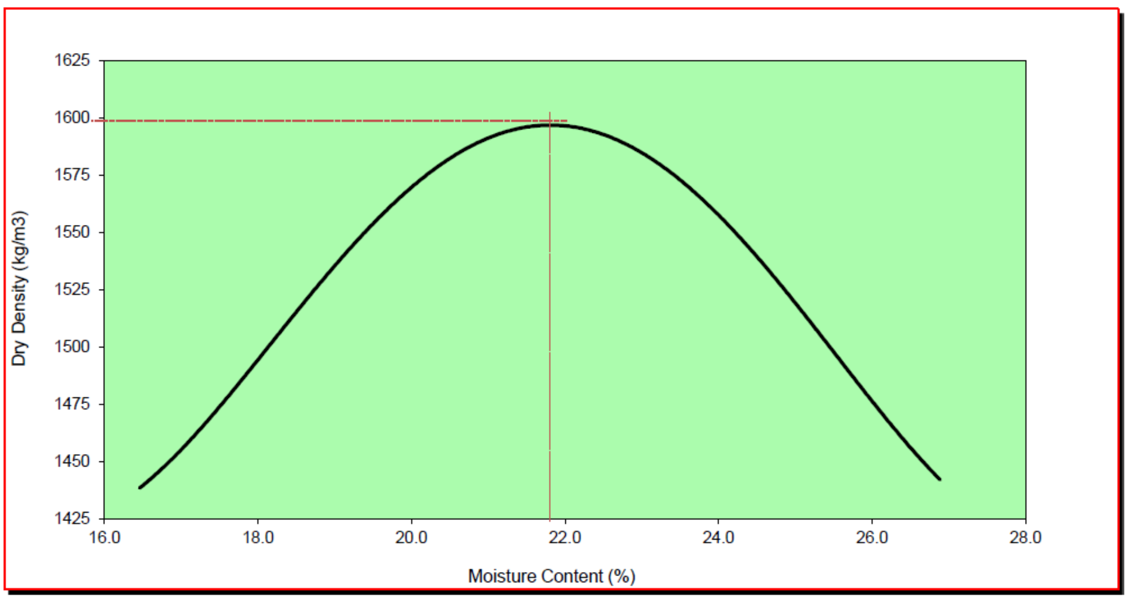
BS 1377 – 4: 1990

MN12

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1090
Material Description:	SANDY ELASTIC SILT WITH GRAVEL	**Sample Ref:**	TP MN 12	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5670	5804	5910	5949	5903	5825
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1675	1809	1915	1954	1908	1830
Bulk Density (Kgs/m^3)	**1675**	**1809**	**1915**	**1954**	**1908**	**1830**
Tin No.	G14	G06	G23	G31	G18	G49
Weight Wet Soil	179.7	217.8	261.0	256.0	223.5	280.8
Weight of Dry Soil	154.3	183.5	216.1	208.8	179.2	221.3
Weight of Water	25.4	34.3	44.9	47.2	44.3	59.5
Moisture Content (%)	**16.5**	**18.7**	**20.8**	**22.6**	**24.7**	**26.9**
Dry Density (Kgs/m^3)	**1438**	**1524**	**1586**	**1594**	**1530**	**1442**



Maximum Dry Density (Kg/m^3): 1599 **Optimum Moisture Content (%):** 21.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN12	
Depth	2.0m
pH	7.76
Chloride(%) mg/l	0.39
Sulphate (mg/l)	0.001

TP12-13A	
Depth	2.0m
pH	8.22
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.027

TP12-13	
Depth	1.0m
pH	7.32
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.025

INSITU DENSITY TEST

TP12-13A	
Depth (m)	2.0
Bulk density (kg/m3)	1571
Moisture Content (%)	32.9
Dry Density (kg/m3)	1182
Maximum Dry Density (kg/m3)	1383
Relative Compaction (%)	85.5

ANGLE POINT 12 LOG

DATE:		03 - 09.12.2012
LOGGED BY:		LUCAS
MN 12		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.6	Dark Grey CLAY (Black Cotton Soil)
	2.0	Light Brown Silty SAND with Gravel

TEST POINT 12-13A, 12-13B LOGS

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE			**JOB REF:**	GCL/NCE_356/03	
SITE:	NANYUKI-ISIOLO-MERU					
	MN12 (TP12-13A) MN13			MN11 (TP12-13B) MN13		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0						
0.5						Brown Sandy CLAY
					0.9	
1			Brown Sandy CLAY			Cobble and boulder fractions
					1.2	
1.5						
		1.8				
2		2.0	Greyish Brown Lean CLAY with sand			
2.5						

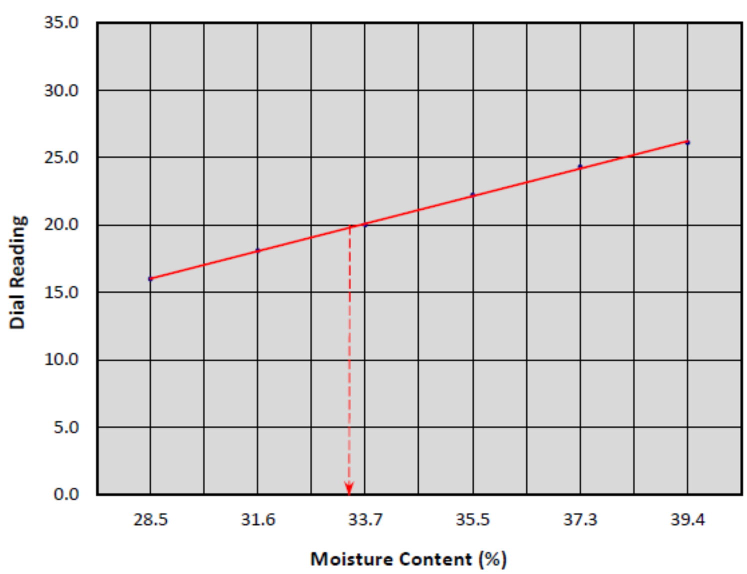
SEGMENT 12

ATTERBERG LIMITS BS 1377 - 2: 1990

MN13

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1091
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.1	20.0	22.2	24.3	26.1	-	-	
Tin No	8	58	23	65	20	32	42	11	
Mass of Wet Soil (g)	54.86	52.73	52.17	52.45	47.26	56.19	13.54	17.61	
Mass of Dry Soil (g)	42.69	40.07	39.02	38.71	34.42	40.30	11.24	14.63	
Mass of Moisture (g)	12.17	12.66	13.15	13.74	12.84	15.89	2.30	2.98	
Moisture Content (%)	28.5	31.6	33.7	35.5	37.3	39.4	20.5	20.4	20.4



PLASTIC LIMIT
PL = 20.4 %

LIQUID LIMIT
LL = 33.3 %

Proportion Passing 425 µm BS Sieve
= 75.7 %

PLASTICITY INDEX
PI = 12.9 %

PLASTIC MODULUS
PM = 975

LINEAR SHRINKAGE
LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)
CL

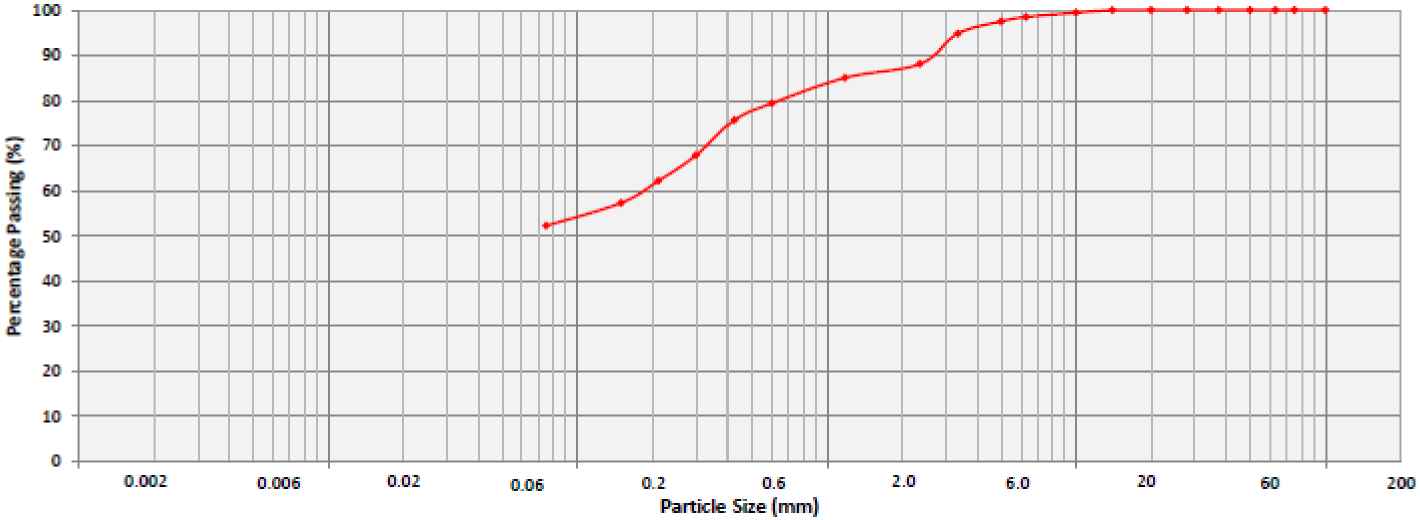
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN13

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 13	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1091



CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 20.12.2012 CHECKED: WK

DCP - CBR CORRELATION

MN13

ANGLE POINT BEARING CAPACITY

MN13

CALCULATION OF SAFE BEARING CAPACITY: TP MN 13					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1091

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	24	$\gamma\ (kg/m^3)$ =	1873
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	18.38

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 24 \times 15.81) + (0.8 \times 18.38 \times 2.0 \times 7.07) + (0.4 \times 18.38 \times 1.0 \times 3.42)$	**726 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 726/3.0$	**242 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

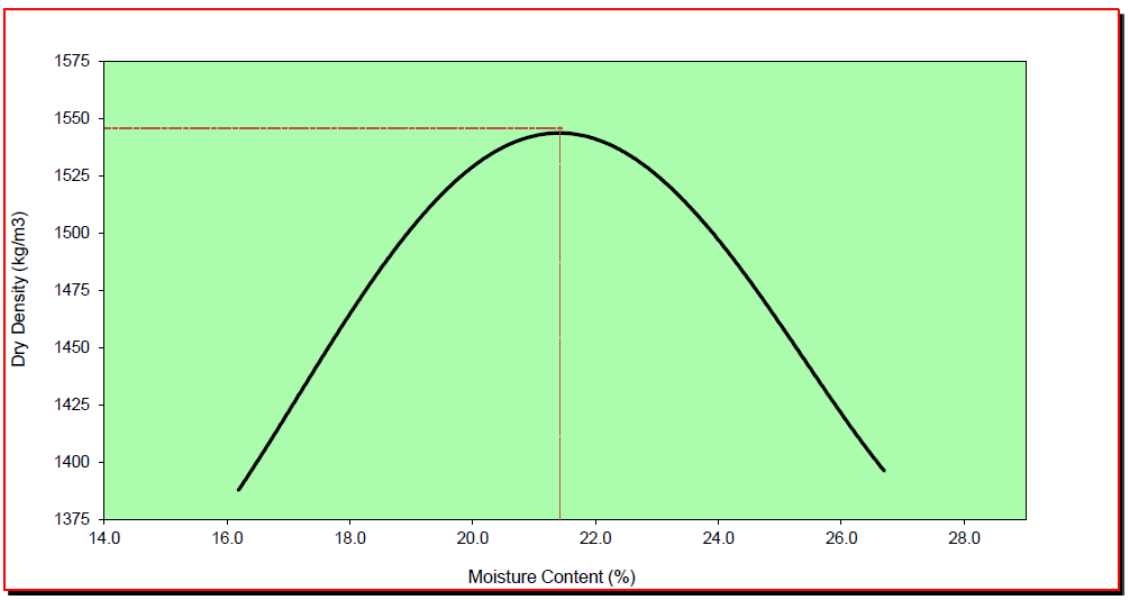
BS 1377 – 4: 1990

MN13

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1091
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 13	**Date received:**	09.12.2013

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5607	5731	5835	5878	5836	5764
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1612	1736	1840	1883	1841	1769
Bulk Density (Kgs/m^3)	**1612**	**1736**	**1840**	**1883**	**1841**	**1769**
Tin No.	G31	G19	G11	G47	G36	G45
Weight Wet Soil	181.6	176.8	207.7	227.8	239.9	255.3
Weight of Dry Soil	156.3	149.7	172.8	186.3	192.7	201.5
Weight of Water	25.3	27.1	34.9	41.5	47.2	53.8
Moisture Content (%)	**16.2**	**18.1**	**20.2**	**22.3**	**24.5**	**26.7**
Dry Density (Kgs/m^3)	**1387**	**1470**	**1531**	**1540**	**1479**	**1396**



Maximum Dry Density (Kg/m^3): 1543 **Optimum Moisture Content (%):** 21.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN13	
Depth	2.0m
pH	8.41
Chloride(%) mg/l	0.53
Sulphate (mg/l)	0.002

ANGLE POINT 13 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 13		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5		0.6	Greyish Brown SILT with sand
1 1.5 2		2.0	Light Brown Silty SAND with Gravel
2.5			

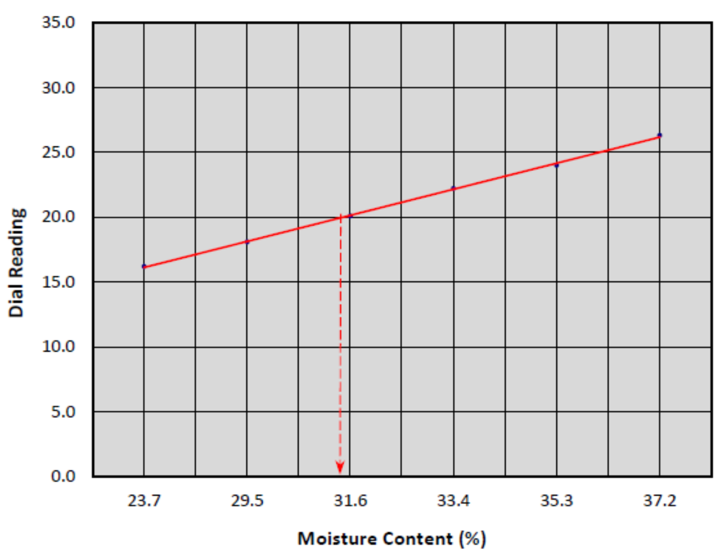
SEGMENT 13

ATTERBERG LIMITS BS 1377 - 2: 1990

MN14

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1092
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.1	22.2	24.0	26.3	-	-	
Tin No	**23**	**25**	**16**	**24**	**53**	**26**	**58**	**14**	
Mass of Wet Soil (g)	40.77	35.51	40.19	46.70	51.16	39.28	19.88	15.65	
Mass of Dry Soil (g)	32.96	27.42	30.53	35.01	37.81	28.63	16.79	13.21	
Mass of Moisture (g)	7.81	8.09	9.66	11.69	13.35	10.65	3.09	2.44	
Moisture Content (%)	23.7	29.5	31.6	33.4	35.3	37.2	18.4	18.5	18.4



PLASTIC LIMIT

PL = 18.4 %

LIQUID LIMIT

LL = 31.2 %

Proportion Passing 425 µm BS Sieve

= 82.5 %

PLASTICITY INDEX

PI = 12.8 %

PLASTIC MODULUS

PM = 1053

LINEAR SHRINKAGE

LS = 6.4 %

GROUP SYMBOL (USC SYSTEM)

CL

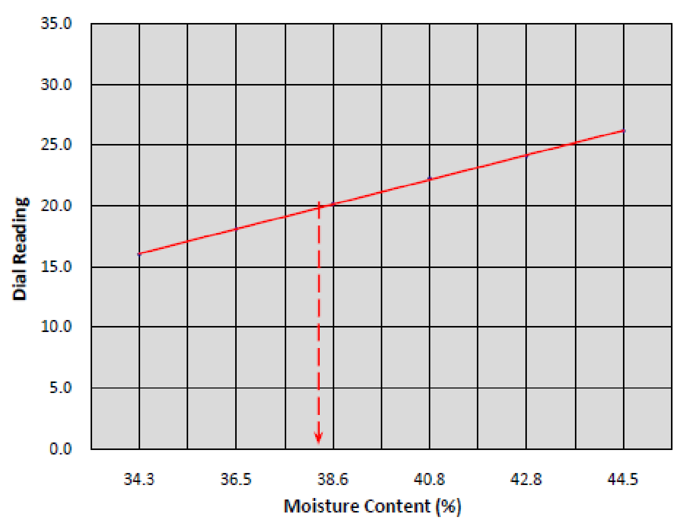
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP14-15A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	Site / Location:	MN14 (TP14-15A)MN15	Date Received:	06.03.2013
Material Description:	LEAN CLAY with Sand	Job Reference:	GCL/NAS-356/13	Sample No.:	1188
Sampled By:	GEO CON	Depth:	2.0M	Date Tested:	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.1	20.2	22.3	24.1	26.2	-	-	
Tin No	14	21	3	37	30	52	61	45	
Mass of Wet Soil (g)	50.54	56.91	48.02	53.28	60.05	58.90	25.15	28.02	
Mass of Dry Soil (g)	37.63	41.69	34.65	37.84	42.05	40.76	20.45	22.74	
Mass of Moisture (g)	12.91	15.22	13.37	15.44	18.00	18.14	4.70	5.28	
Moisture Content (%)	34.3	36.5	38.6	40.8	42.8	44.5	23.0	23.2	23.1



PLASTIC LIMIT
PL = 23.1 %

LIQUID LIMIT
LL = 38.2 %

Proportion Passing 425 µm BS Sieve
= 85.4 %

PLASTICITY INDEX
PI = 15.1 %

PLASTIC MODULUS
PM = 1289

LINEAR SHRINKAGE
LS = 7.1 %

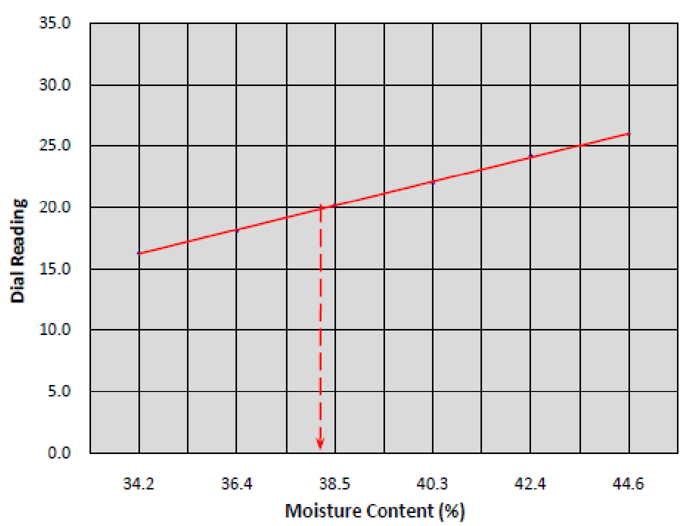
GROUP SYMBOL (USC SYSTEM)
CL

TP14-15B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	Site / Location:	MN14 (TP14-15B)MN15	Date Received:	06.03.2013
Material Description:	SILT with Sand	Job Reference:	GCL/NAS-356/13	Sample No.:	1189
Sampled By:	GEO CON	Depth:	2.0M	Date Tested:	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.1	20.2	22.0	24.2	26.0	-	-	
Tin No	8	52	61	24	15	2	34	29	
Mass of Wet Soil (g)	58.75	44.33	55.88	64.43	61.26	54.12	23.03	31.00	
Mass of Dry Soil (g)	43.78	32.50	40.34	45.92	43.02	37.43	18.09	24.31	
Mass of Moisture (g)	14.97	11.83	15.54	18.51	18.24	16.69	4.94	6.69	
Moisture Content (%)	34.2	36.4	38.5	40.3	42.4	44.6	27.3	27.5	27.4



PLASTIC LIMIT

PL = 27.4 %

LIQUID LIMIT

LL = 38.1 %

Proportion Passing 425 µm BS Sieve

= 82.9 %

PLASTICITY INDEX

PI = 10.7 %

PLASTIC MODULUS

PM = 886

LINEAR SHRINKAGE

LS = 5.0 %

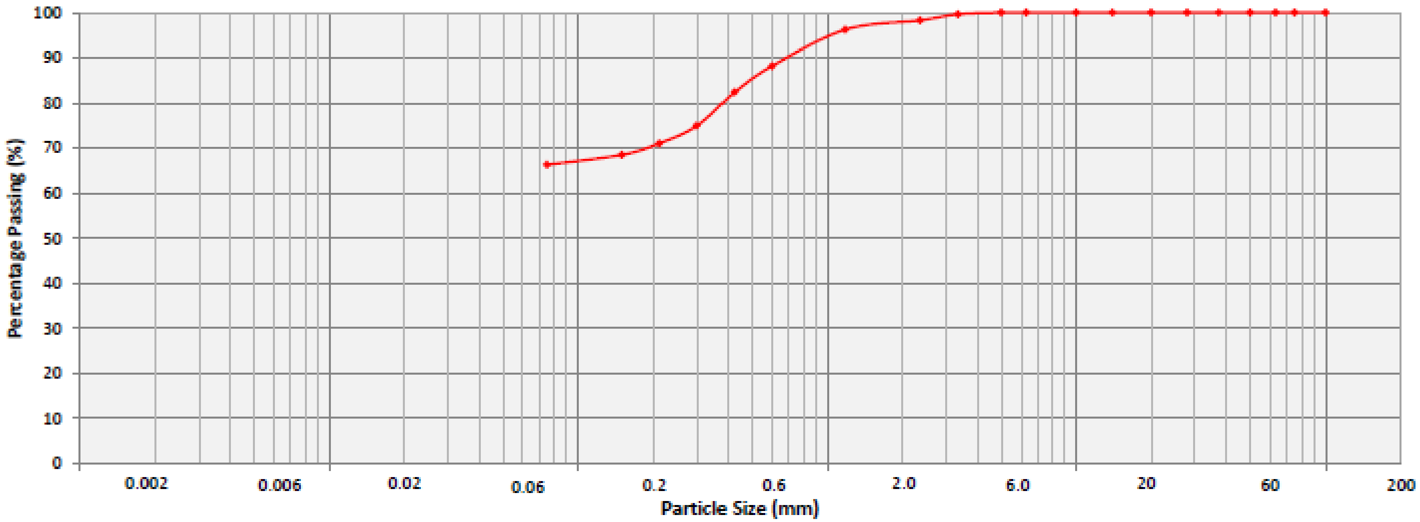
GROUP SYMBOL (USC SYSTEM)

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN14

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 14	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	13.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1092



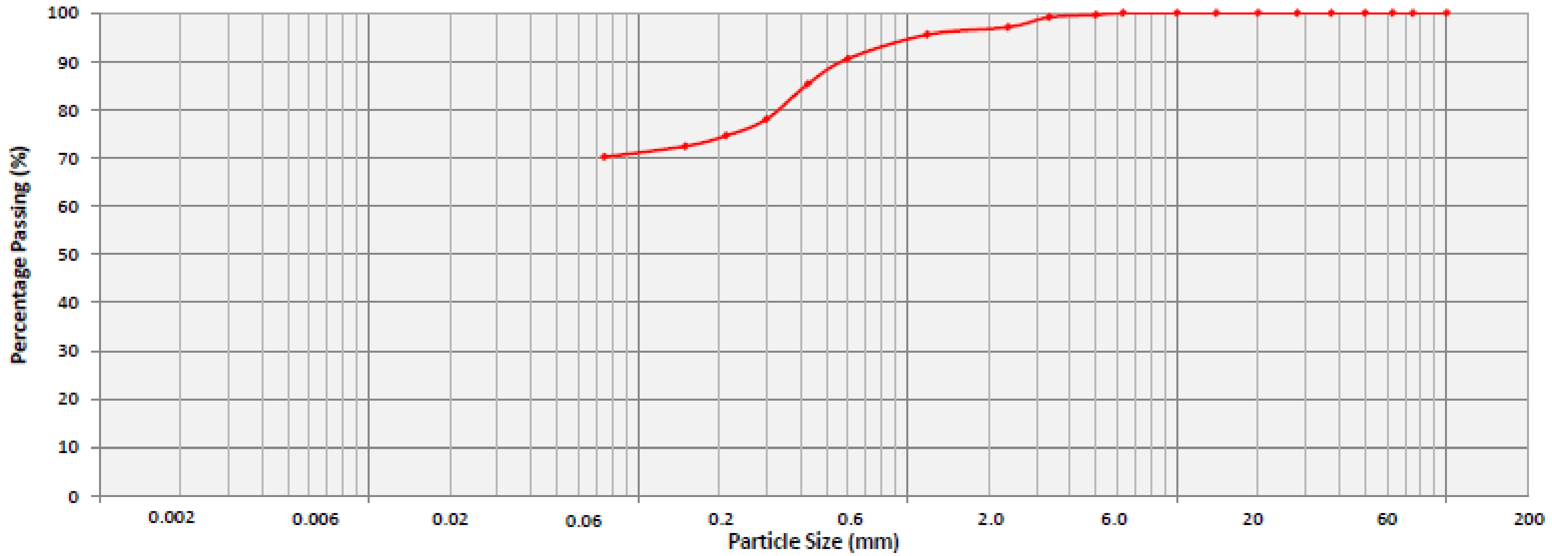
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP14-15A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN14(TP14-15A)MN15	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1188

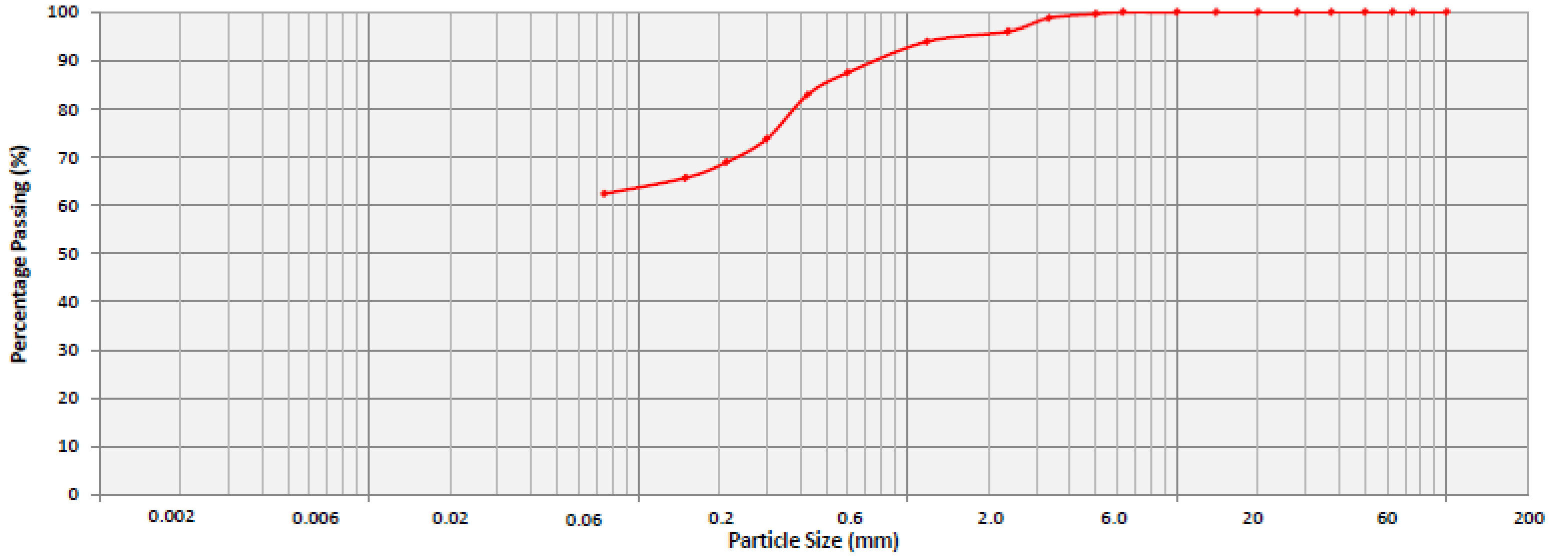


<table>
<tr><td rowspan="2">CLAY</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td>FINE</td><td>MEDIUM</td><td>COARSE</td><td rowspan="2">COBBLES</td><td rowspan="2">BOULDERS</td></tr>
<tr><td colspan="3">SILT</td><td colspan="3">SAND</td><td colspan="3">GRAVEL</td></tr>
</table>

TP14-15B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN14(TP14-15B)MN15	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1189



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

MN14

ANGLE POINT BEARING CAPACITY

MN14

CALCULATION OF SAFE BEARING CAPACITY: TP MN 14					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1092

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1785
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	17.51

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
	N_γ = 3.42	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.51 x 2.0 x 7.07) + (0.4 x 17.51 x 1.0 x 3.42)	**695 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 695/3.0	**232 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP14-15A

CALCULATION OF SAFE BEARING CAPACITY: MN14 (TP14-15A) MN15					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			Sample No.:	1188

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2) =$	23	$\gamma (kg/m^3) =$	1860
$\phi (°) =$	22	$\gamma (kN/m^3) =$	18.25

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 16.88	
	$N_q =$ 7.82	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	$N_\gamma =$ 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 16.88) + (0.8 \times 18.25 \times 2.0 \times 7.82) + (0.4 \times 18.25 \times 1.0 \times 4.07)$	**763 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 763/3.0$	**254 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP14-15B

CALCULATION OF SAFE BEARING CAPACITY: MN14 (TP14-15) MN15					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY SILT			Sample No.:	1189

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
C(kN/m^2) =	23	γ (kg/m^3) =	1770
ϕ (°) =	20	γ (kN/m^3) =	17.37

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 17.37 x 2.0 x 6.40) + (0.4 x 17.37 x 1.0 x 2.87)	**641 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 641/3.0	**214 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

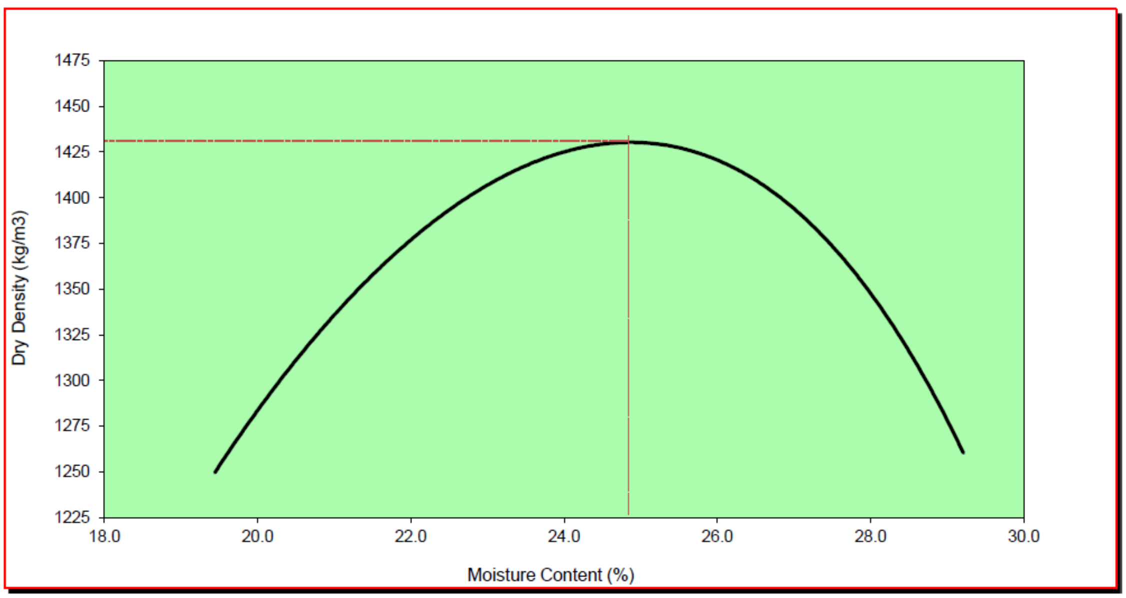
BS 1377 – 4: 1990

MN14

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1092
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 14	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	4449	4589	4701	4743	4719	4584
Mass of Mould+Base	2956	2956	2956	2956	2956	2956
Mass of Compacted Soil	1493	1633	1745	1787	1763	1628
Bulk Density (Kgs/m^3)	**1493**	**1633**	**1745**	**1787**	**1763**	**1628**
Tin No.	G33	G27	G37	G21	G01	G29
Weight Wet Soil	215.0	228.0	265.0	257.0	224.0	230.0
Weight of Dry Soil	180.0	188.0	215.0	205.0	176.0	178.0
Weight of Water	35.0	40.0	50.0	52.0	48.0	52.0
Moisture Content (%)	**19.4**	**21.3**	**23.3**	**25.4**	**27.3**	**29.2**
Dry Density (Kgs/m^3)	**1250**	**1347**	**1416**	**1425**	**1385**	**1260**



Maximum Dry Density (Kg/m^3): 1430 **Optimum Moisture Content (%):** 24.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN14	
Depth	2.0m
pH	8.54
Chloride(%) mg/l	0.69
Sulphate (mg/l)	0.001

TP14-15A	
Depth	2.0m
pH	7.08
Chloride(%) mg/l	0.060
Sulphate (mg/l)	0.023

TP14-15B	
Depth	2.0m
pH	7.25
Chloride(%) mg/l	0.014
Sulphate (mg/l)	0.033

ANGLE POINT 14 LOG

JOB REF:		GCL/NCE_342/12
MN 14		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.9	Brown SILT
	2.0	Brown Silty SAND with Gravel

TEST POINT 14-15A, 14-15B LOGS

DATE:	23 - 28.02.2013	**PROJECT:**	NANYUKI-ISIOLO-MERU POWERLINE
LOGGED BY:	STEVE	**SITE:**	NANYUKI-ISIOLO-MERU

MN14 (TP14-15A) MN15

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
		Brown Lean CLAY with sand
	2.0	

MN14 (TP14-15B) MN15

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			Grey Silty SAND
1		1.0	
1.5			Brown Sandy SILT
2		2.0	
2.5			

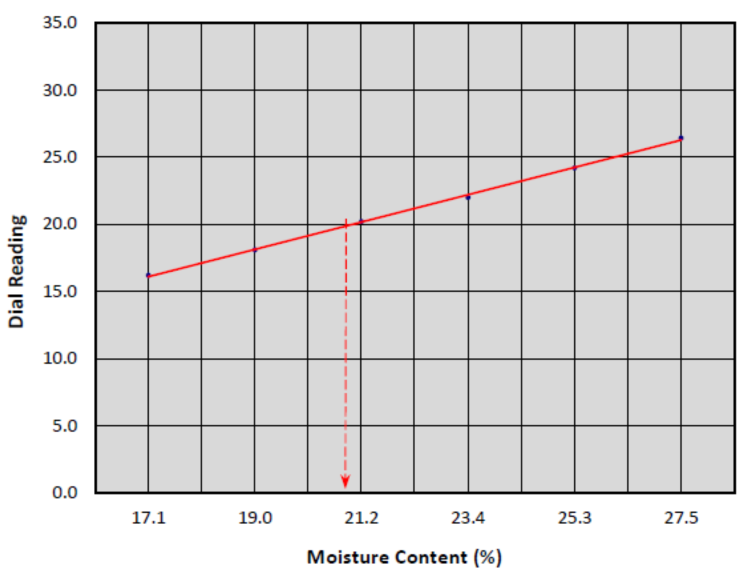
SEGMENT 14

ATTERBERG LIMITS BS 1377 - 2: 1990

MN15

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1093
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.2	22.0	24.2	26.4	-	-	
Tin No	**41**	**21**	**23**	**39**	**33**	**26**	**15**	**11**	
Mass of Wet Soil (g)	27.92	36.94	48.19	43.32	50.21	45.95	19.68	16.67	
Mass of Dry Soil (g)	23.84	31.04	39.76	35.11	40.07	36.04	18.12	15.32	
Mass of Moisture (g)	4.08	5.90	8.43	8.21	10.14	9.91	1.56	1.35	
Moisture Content (%)	17.1	19.0	21.2	23.4	25.3	27.5	8.6	8.8	8.7



PLASTIC LIMIT
PL = 8.7 %

LIQUID LIMIT
LL = 20.8 %

Proportion Passing 425 µm BS Sieve
= 78.2 %

PLASTICITY INDEX
PI = 12.1 %

PLASTIC MODULUS
PM = 945

LINEAR SHRINKAGE
LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)
CL

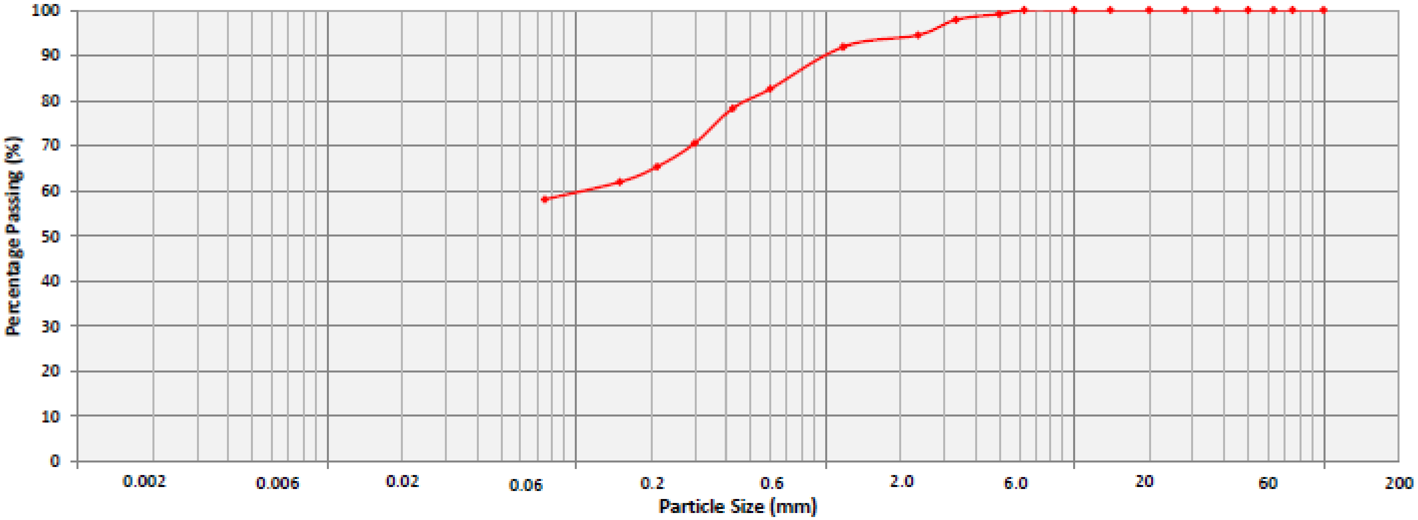
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN15

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 15	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1093



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

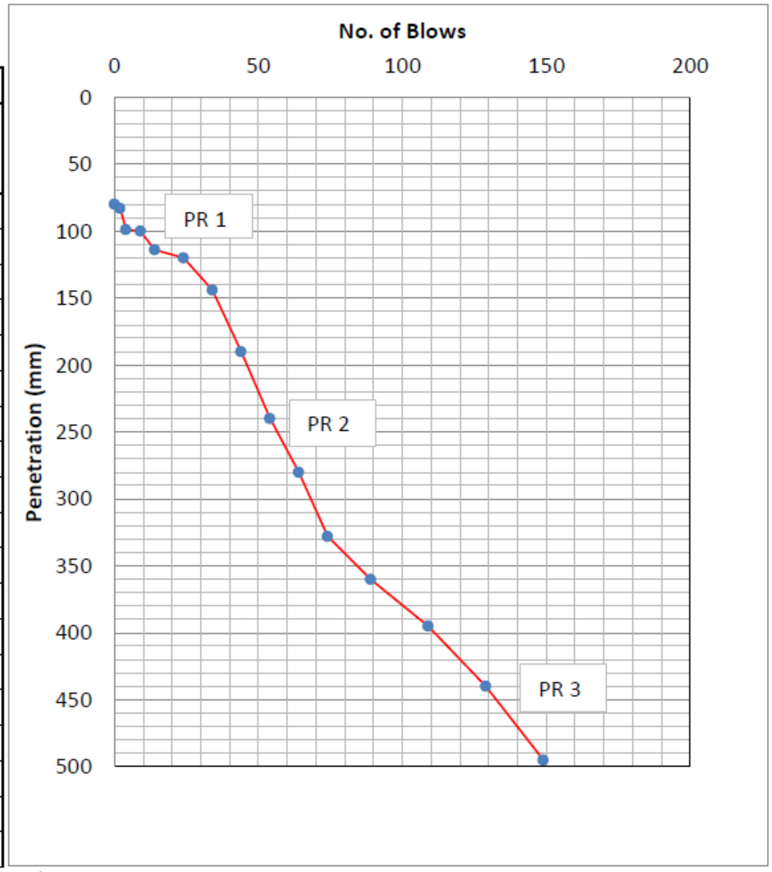
MN15

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 15	**Date of Test:**	07.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1093

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	80	
1	2	2	83	1.5
2	2	4	99	8.0
3	5	9	100	0.2
4	5	14	114	2.8
5	10	24	120	0.6
6	10	34	144	2.4
7	10	44	190	4.6
8	10	54	240	5.0
9	10	64	280	4.0
10	10	74	328	4.8
11	15	89	360	2.1
12	20	109	395	1.8
13	20	129	440	2.3
14	20	149	495	2.8



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.4	64.3	
PR 2	4.2	68.3	
PR 3	2.2	156.2	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN15

CALCULATION OF SAFE BEARING CAPACITY: TP MN 15					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1093

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1860
ø (˚) =	22	$\gamma\ (kN/m^3)$ =	18.25

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 16.88) + (0.8 \times 18.25 \times 2.0 \times 7.82) + (0.4 \times 18.25 \times 1.0 \times 4.07)$	**763 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 763/3.0$	**254 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

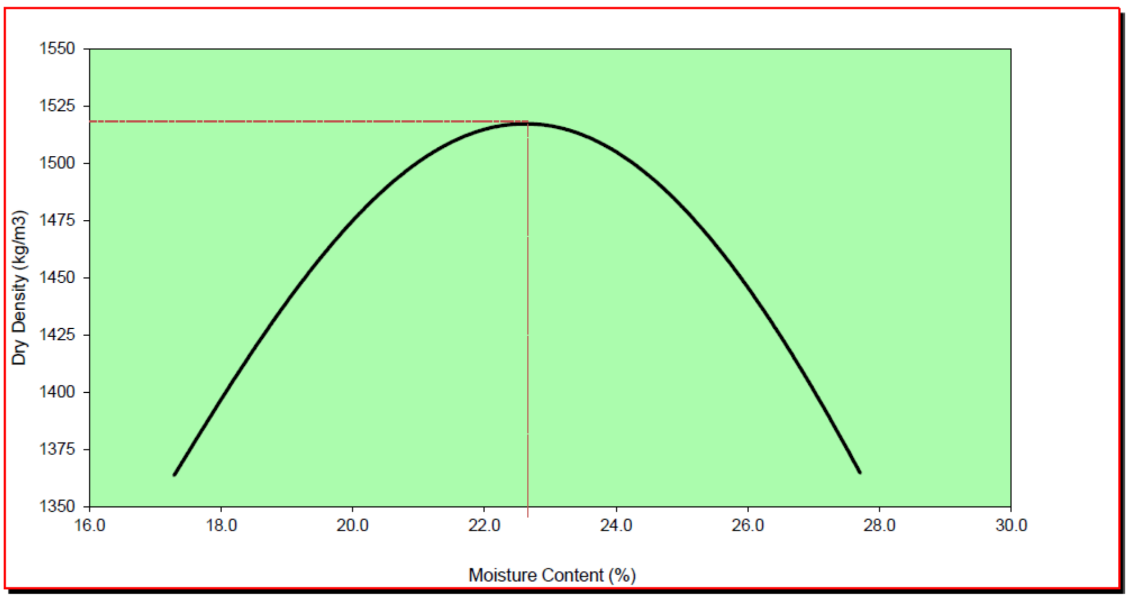
BS 1377 – 4: 1990

MN15

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1093
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 15	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5594	5721	5823	5865	5823	5738
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1599	1726	1828	1870	1828	1743
Bulk Density (Kgs/m^3)	**1599**	**1726**	**1828**	**1870**	**1828**	**1743**
Tin No.	G27	G64	G19	G07	G23	G43
Weight Wet Soil	254.4	276.3	240.6	265.1	275.6	283.0
Weight of Dry Soil	216.9	231.8	198.2	214.5	219.1	221.6
Weight of Water	37.5	44.5	42.4	50.6	56.5	61.4
Moisture Content (%)	**17.3**	**19.2**	**21.4**	**23.6**	**25.8**	**27.7**
Dry Density (Kgs/m^3)	**1363**	**1448**	**1506**	**1513**	**1453**	**1365**



Maximum Dry Density (Kg/m^3): 1515 **Optimum Moisture Content (%):** 22.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN15	
Depth	2.0m
pH	8.06
Chloride(%) mg/l	0.39
Sulphate (mg/l)	

ANGLE POINT 15 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 15		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.1	Grey SILT with Sand
	2.0	Greyish Brown Silty SAND with Gravel

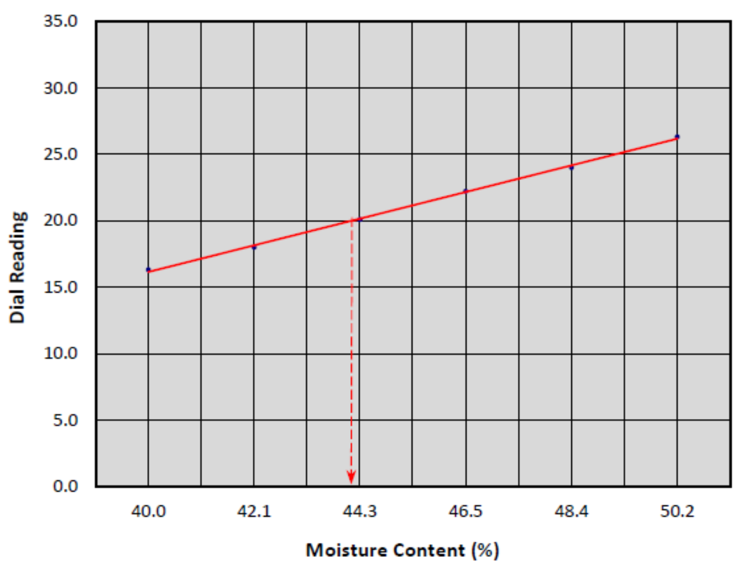
SEGMENT 15

ATTERBERG LIMITS BS 1377 - 2: 1990

MN16

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1094
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.2	24.0	26.3	-	-	
Tin No	**41**	**21**	**32**	**62**	**32**	**8**	**74**	**51**	
Mass of Wet Soil (g)	38.67	44.46	54.01	49.68	56.75	51.61	23.24	29.03	
Mass of Dry Soil (g)	27.62	31.29	37.43	33.91	38.24	34.36	18.79	23.43	
Mass of Moisture (g)	11.05	13.17	16.58	15.77	18.51	17.25	4.45	5.60	
Moisture Content (%)	40.0	42.1	44.3	46.5	48.4	50.2	23.7	23.9	23.8



PLASTIC LIMIT
PL = 23.8 %

LIQUID LIMIT
LL = 44.1 %

Proportion Passing 425 µm BS Sieve
= 99.5 %

PLASTICITY INDEX
PI = 20.3 %

PLASTIC MODULUS
PM = 2021

LINEAR SHRINKAGE
LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)
CL

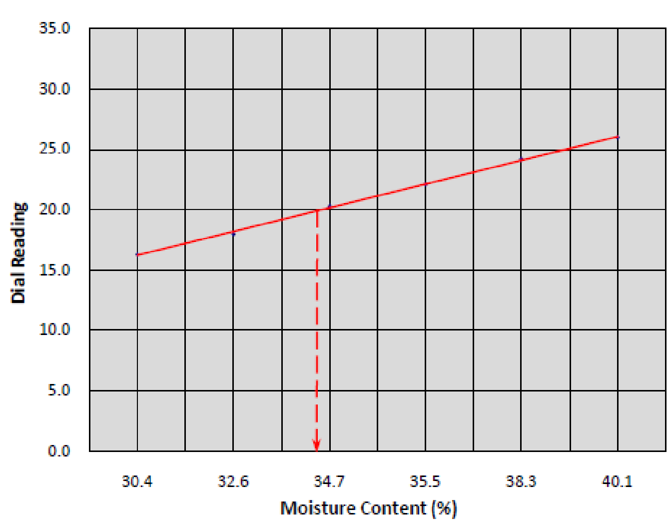
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP16-17B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN16 (TP16-17B)MN17	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1191
Sampled By:	GEO CON	**Depth:**	1.7M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.3	22.1	24.2	26.0	-	-	
Tin No	2	52	63	35	14	28	24	51	
Mass of Wet Soil (g)	49.71	47.79	54.32	62.00	68.47	57.72	25.26	22.91	
Mass of Dry Soil (g)	38.12	36.04	40.33	45.76	49.51	41.20	20.64	18.73	
Mass of Moisture (g)	11.59	11.75	13.99	16.24	18.96	16.52	4.62	4.18	
Moisture Content (%)	30.4	32.6	34.7	35.5	38.3	40.1	22.4	22.3	22.4



PLASTIC LIMIT

PL = 22.4 %

LIQUID LIMIT

LL = 34.3 %

Proportion Passing 425 µm BS Sieve

= 65.4 %

PLASTICITY INDEX

PI = 11.9 %

PLASTIC MODULUS

PM = 782

LINEAR SHRINKAGE

LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)

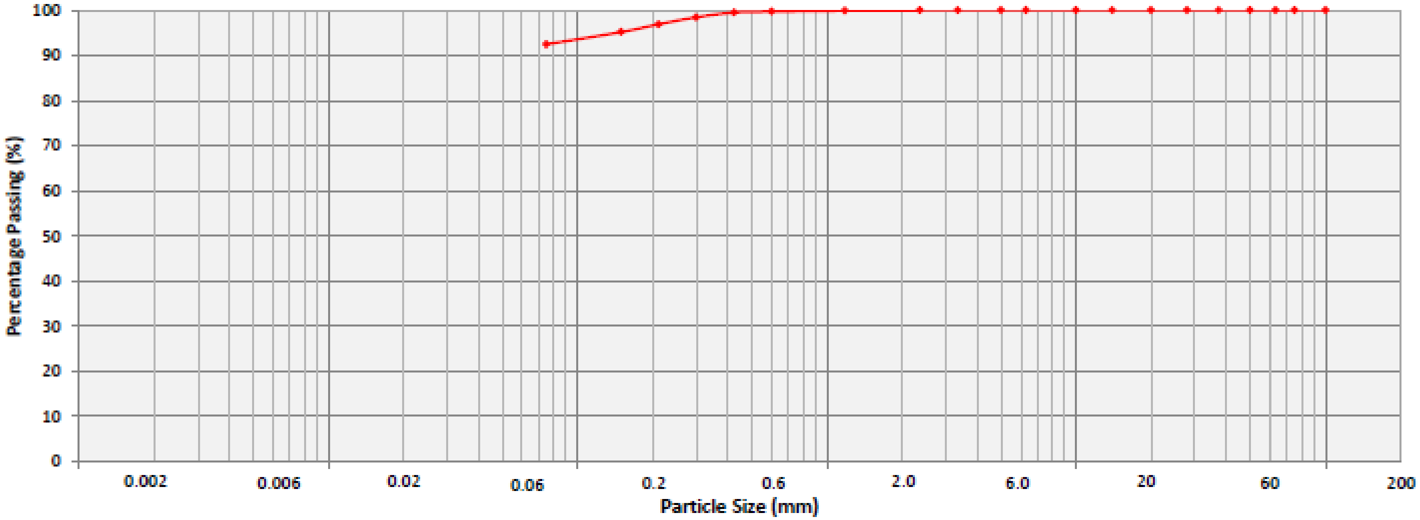
CL

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN16

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 16	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1094



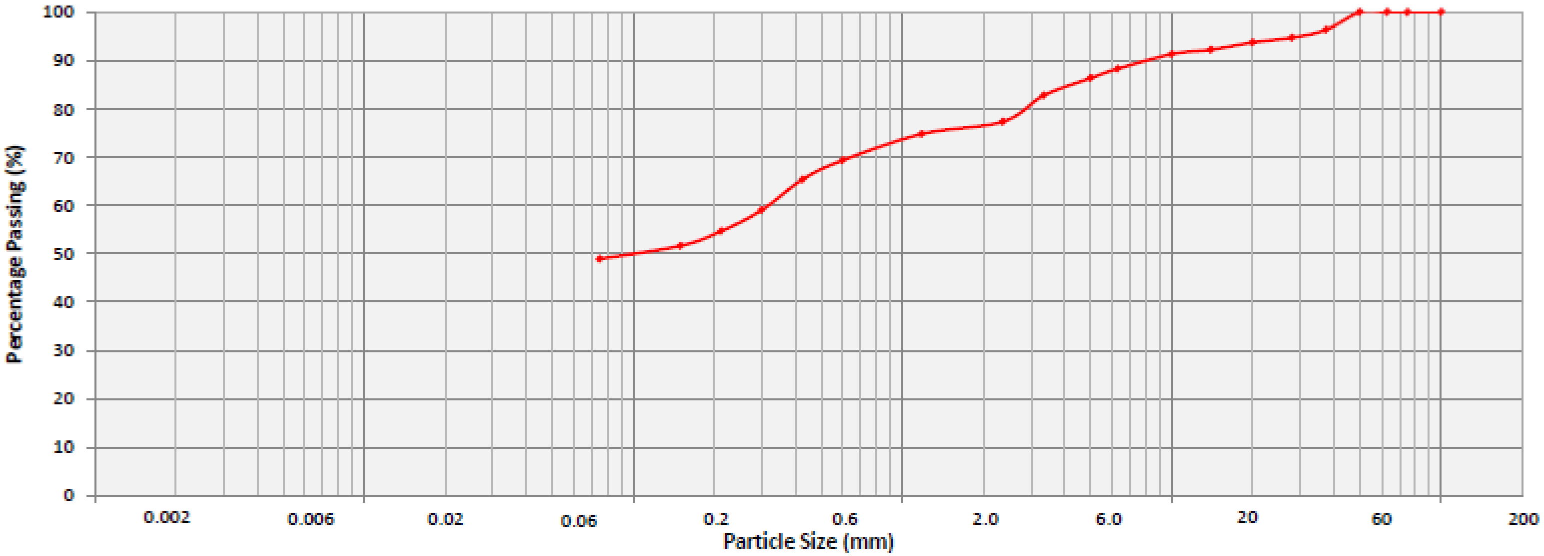
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP16-17B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN16(TP16-17B)MN17	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand and Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1191



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

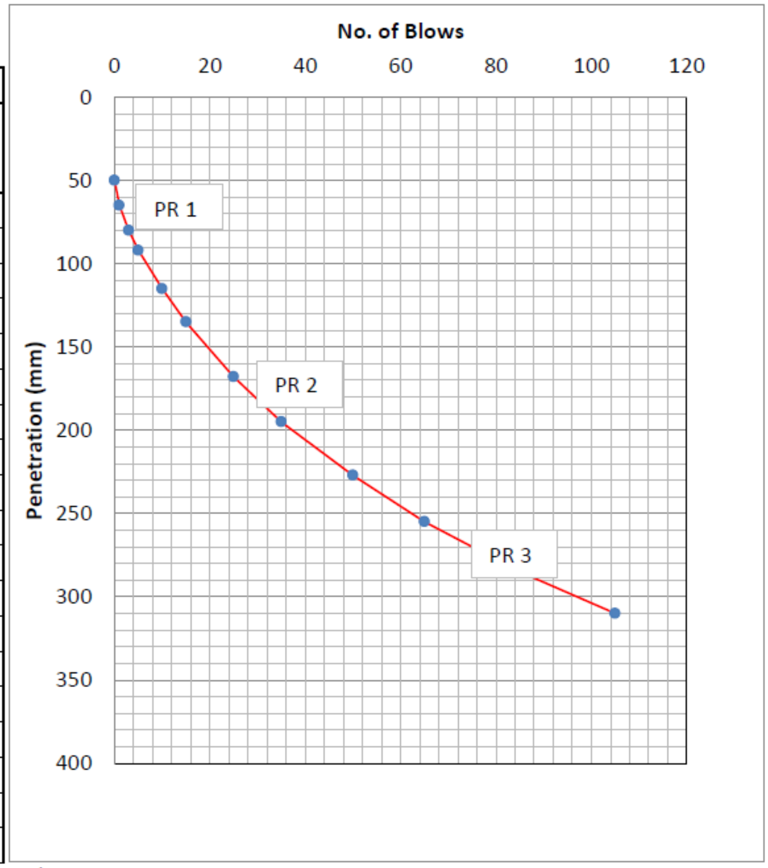
MN16

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 16	**Date of Test:**	03.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1094

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	65	15.0
2	2	3	80	7.5
3	2	5	92	6.0
4	5	10	115	4.6
5	5	15	135	4.0
6	10	25	168	3.3
7	10	35	195	2.7
8	15	50	227	2.1
9	15	65	255	1.9
10	20	85	285	1.5
11	20	105	310	1.3



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	11	19.9	
PR 2	3.8	77.6	
PR 3	1.4	278.6	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN16

CALCULATION OF SAFE BEARING CAPACITY: TP MN 16					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1094

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	23	$\gamma (kg/m^3)$ =	1770
$ø (°)$ =	20	$\gamma (kN/m^3)$ =	17.37

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 14.83) + (0.8 \times 17.37 \times 2.0 \times 6.40) + (0.4 \times 17.37 \times 1.0 \times 2.87)$	**641 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 641/3.0$	**214 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP16-17B

CALCULATION OF SAFE BEARING CAPACITY: MN 16 (TP16-17B) MN17					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			Sample No.:	1191

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma (kg/m^3)$ =	1804
ϕ (°) =	20	$\gamma (kN/m^3)$ =	17.69

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
	N_γ = 2.87	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 17.69 x 2.0 x 6.40) + (0.4 x 17.69 x 1.0 x 2.87)	**645 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 645/3.0	**215 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

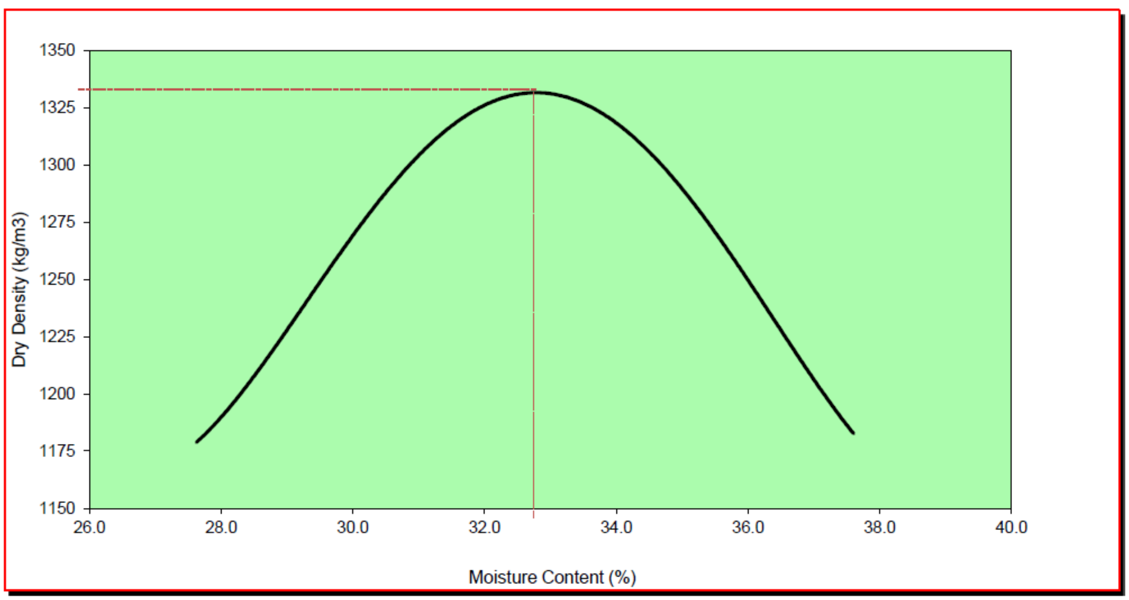
BS 1377 – 4: 1990

MN16

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1094
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 16	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5499	5636	5736	5773	5713	5623
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1504	1641	1741	1778	1718	1628
Bulk Density (Kgs/m^3)	**1504**	**1641**	**1741**	**1778**	**1718**	**1628**
Tin No.	G44	G36	G55	G61	G39	G62
Weight Wet Soil	219.9	251.2	267.4	282.9	295.8	325.3
Weight of Dry Soil	172.3	193.5	202.7	211.6	218.3	236.4
Weight of Water	47.6	57.7	64.7	71.3	77.5	88.9
Moisture Content (%)	**27.6**	**29.8**	**31.9**	**33.7**	**35.5**	**37.6**
Dry Density (Kgs/m^3)	**1178**	**1264**	**1320**	**1330**	**1268**	**1183**



Maximum Dry Density (Kg/m^3): 1333 **Optimum Moisture Content (%):** 32.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN16	
Depth	2.0m
pH	6.88
Chloride(%) mg/l	-
Sulphate (mg/l)	0.001

TP16-17A	
Depth	1.0m
pH	7.27
Chloride(%) mg/l	-
Sulphate (mg/l)	0.022

TP16-17B	
Depth	1.7m
pH	7.80
Chloride(%) mg/l	0.011
Sulphate (mg/l)	0.027

ANGLE POINT 16 LOG

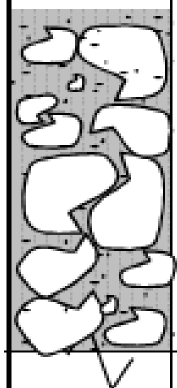
PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 16		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1			Brownish Red Elastic SILT with Sand
1.5			
2		2.0	
2.5			

TEST POINT 16-17A, 16-17B LOGS

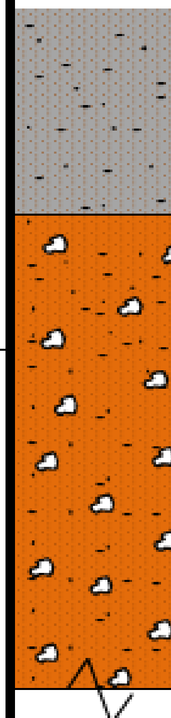
(TP16-17B erroneously labelled TP14-15A in below figure)

JOB REF:	GCL/NCE_356/03	**DATE:**	23 - 28.02.2013
		LOGGED BY:	STEVE

MN16 (TP16-17A) MN17

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.0	Grey Volcanic fragmented rock fractions

MN11 (TP14-15A) MN15

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.6	Dark Grey CLAY (Black Cotton soil)
	2.0	Brown Lean CLAY with Sand and Gravel fraction

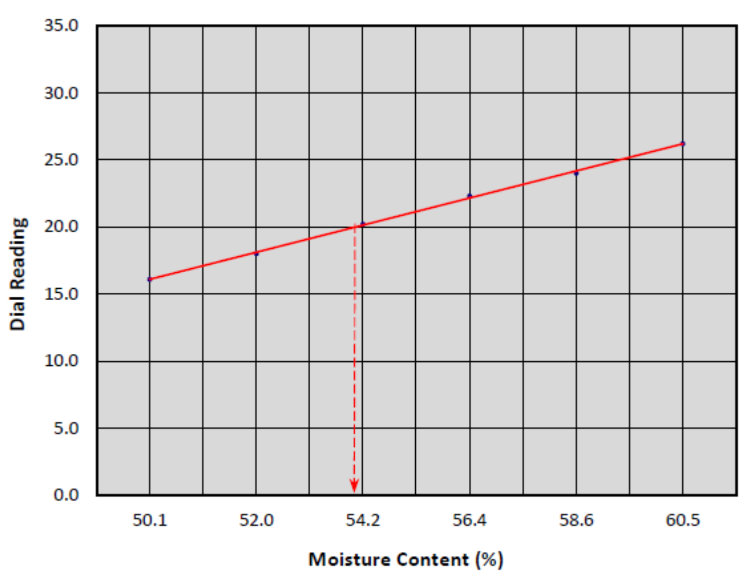
SEGMENT 16

ATTERBERG LIMITS BS 1377 - 2: 1990

MN17

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1095
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.0	20.2	22.3	24.0	26.2	-	-	
Tin No	**2**	**52**	**63**	**35**	**14**	**28**	**24**	**51**	
Mass of Wet Soil (g)	40.69	47.52	40.76	44.89	55.73	42.03	25.40	33.91	
Mass of Dry Soil (g)	27.11	31.26	26.44	28.70	35.14	26.19	18.22	24.31	
Mass of Moisture (g)	13.58	16.26	14.32	16.19	20.59	15.84	7.18	9.60	
Moisture Content (%)	50.1	52.0	54.2	56.4	58.6	60.5	39.4	39.5	39.4



PLASTIC LIMIT
PL = 39.4 %

LIQUID LIMIT
LL = 54.0 %

Proportion Passing 425 µm BS Sieve
= 98.3 %

PLASTICITY INDEX
PI = 14.6 %

PLASTIC MODULUS
PM = 1430

LINEAR SHRINKAGE
LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)
MH

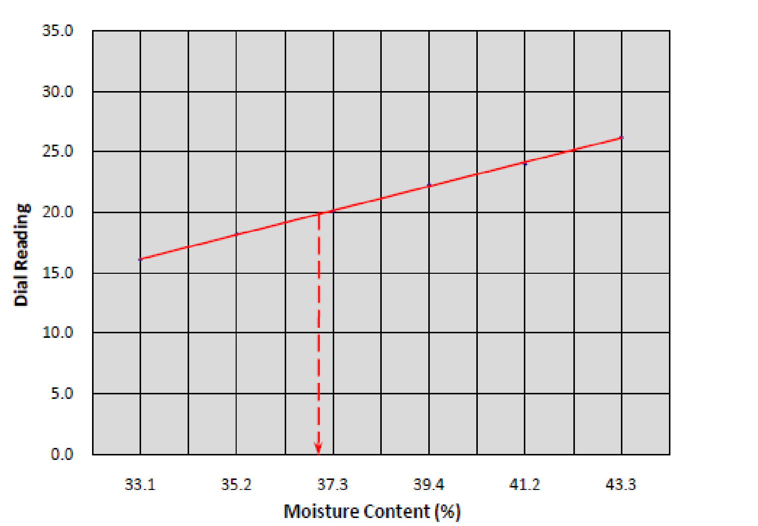
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP17-18A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN17 (TP17-18A)MN18	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1192
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.1	22.3	24.0	26.2	-	-	
Tin No	8	53	66	45	4	24	56	3	
Mass of Wet Soil (g)	56.95	49.31	56.33	60.95	63.55	61.92	19.00	24.38	
Mass of Dry Soil (g)	42.79	36.47	41.02	43.72	45.01	43.21	15.42	19.76	
Mass of Moisture (g)	14.16	12.84	15.31	17.23	18.54	18.71	3.58	4.62	
Moisture Content (%)	33.1	35.2	37.3	39.4	41.2	43.3	23.2	23.4	23.3



PLASTIC LIMIT
PL = 23.3 %

LIQUID LIMIT
LL = 36.9 %

Proportion Passing 425 µm BS Sieve
= 82.0 %

PLASTICITY INDEX
PI = 13.6 %

PLASTIC MODULUS
PM = 1115

LINEAR SHRINKAGE
LS = 6.4 %

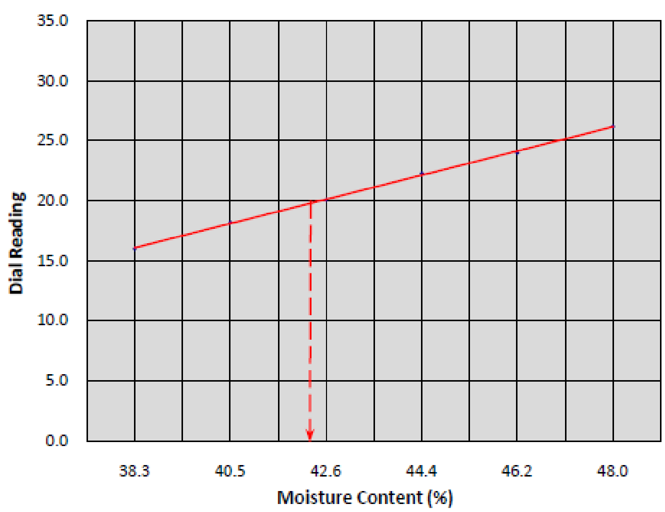
GROUP SYMBOL (USC SYSTEM)

TP17-18B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN17 (TP17-18B)MN18	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1193
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	18.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.2	20.1	22.3	24.0	26.2	-	-	
Tin No	**57**	**46**	**25**	**19**	**13**	**6**	**23**	**18**	
Mass of Wet Soil (g)	32.79	36.47	47.27	39.45	51.30	42.03	17.14	23.67	
Mass of Dry Soil (g)	23.71	25.96	33.15	27.32	35.09	28.40	14.00	19.31	
Mass of Moisture (g)	9.08	10.51	14.12	12.13	16.21	13.63	3.14	4.36	
Moisture Content (%)	38.3	40.5	42.6	44.4	46.2	48.0	22.4	22.6	22.5



PLASTIC LIMIT
PL = 22.5 %

LIQUID LIMIT
LL = 42.2 %

Proportion Passing 425 µm BS Sieve
= 84.2 %

PLASTICITY INDEX
PI = 19.7 %

PLASTIC MODULUS
PM = 1658

LINEAR SHRINKAGE
LS = 9.3 %

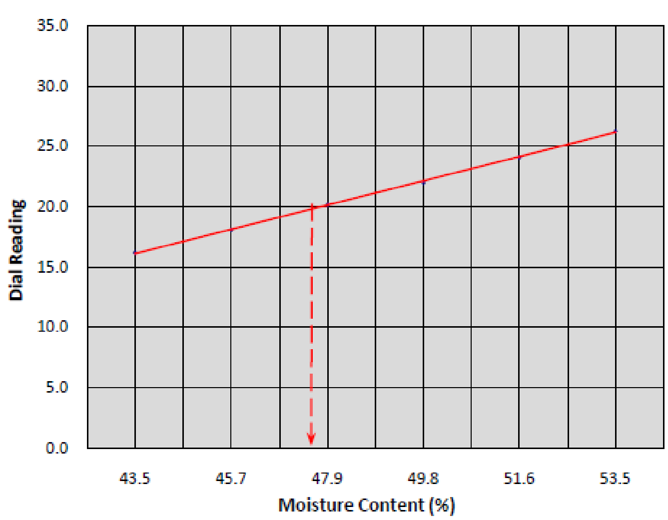
GROUP SYMBOL (USC SYSTEM)
CL

TP17-18C

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN17 (TP17-18C)MN18	**Date Received:**	06.03.2013
Material Description:	SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1194
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	19.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.2	22.0	24.1	26.3	-	-	
Tin No	59	45	62	33	21	13	6	51	
Mass of Wet Soil (g)	38.95	45.69	37.06	50.11	34.72	45.01	30.67	34.82	
Mass of Dry Soil (g)	27.14	31.36	25.06	33.45	22.90	29.32	24.02	27.30	
Mass of Moisture (g)	11.81	14.33	12.00	16.66	11.82	15.69	6.65	7.52	
Moisture Content (%)	43.5	45.7	47.9	49.8	51.6	53.5	27.7	27.5	27.6



PLASTIC LIMIT

PL = 27.6 %

LIQUID LIMIT

LL = 47.5 %

Proportion Passing 425 µm BS Sieve

= 90.1 %

PLASTICITY INDEX

PI = 19.9 %

PLASTIC MODULUS

PM = 1792

LINEAR SHRINKAGE

LS = 9.3 %

GROUP SYMBOL (USC SYSTEM)

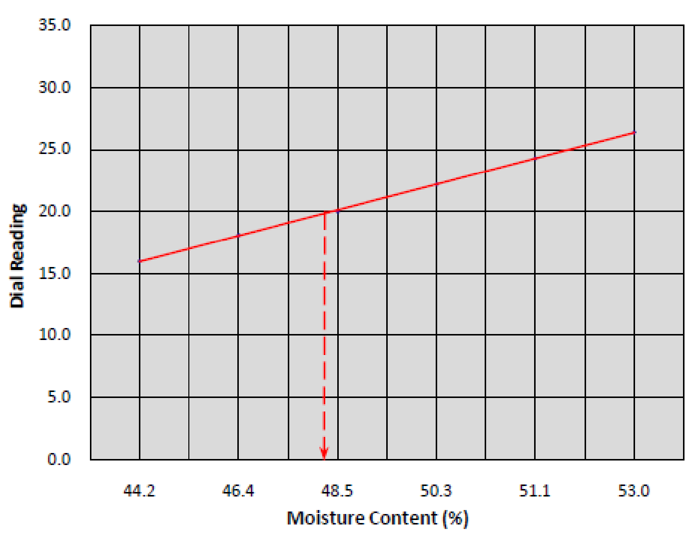
MH

TP17-18D

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN17 (TP17-18D)MN18	**Date Received:**	06.03.2013
Material Description:	LEAN CLAY	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1195
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	19.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.1	20.0	22.2	24.3	26.4	-	-	
Tin No	**42**	**21**	**51**	**19**	**43**	**7**	**15**	**34**	
Mass of Wet Soil (g)	61.96	49.29	45.22	62.87	54.88	62.44	26.88	33.87	
Mass of Dry Soil (g)	42.97	33.67	30.45	41.83	36.32	40.81	21.08	26.52	
Mass of Moisture (g)	18.99	15.62	14.77	21.04	18.56	21.63	5.80	7.35	
Moisture Content (%)	44.2	46.4	48.5	50.3	51.1	53.0	27.5	27.7	27.6



PLASTIC LIMIT

PL = 27.6 %

LIQUID LIMIT

LL = 48.1 %

Proportion Passing 425 µm BS Sieve

= 91.5 %

PLASTICITY INDEX

PI = 20.5 %

PLASTIC MODULUS

PM = 1874

LINEAR SHRINKAGE

LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)

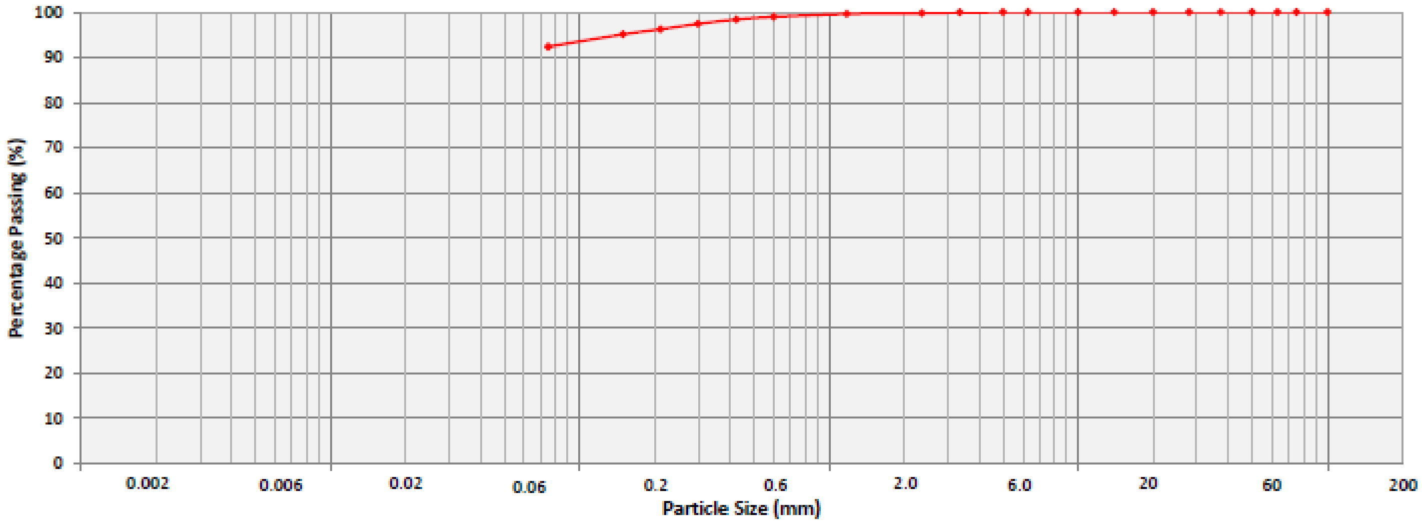
CL

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN17

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 17	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:		**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1095



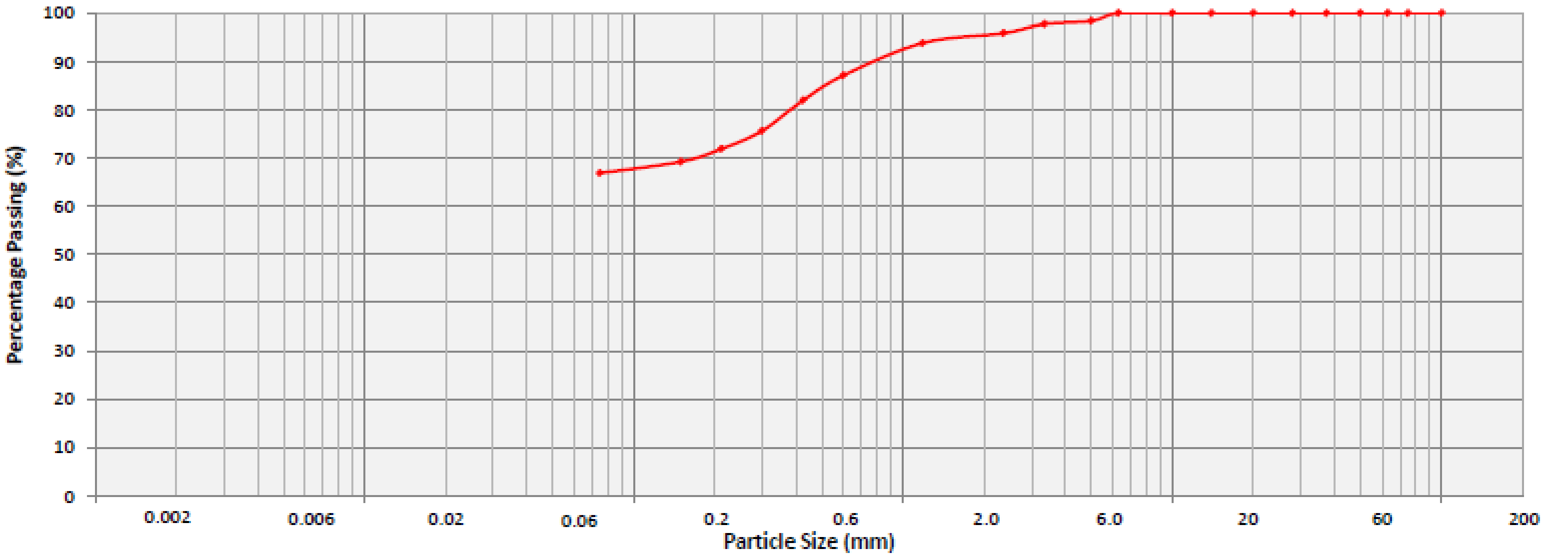
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP17-18A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN17(TP17-18A)MN18	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	1.7M	SAMPLE No.:	1192

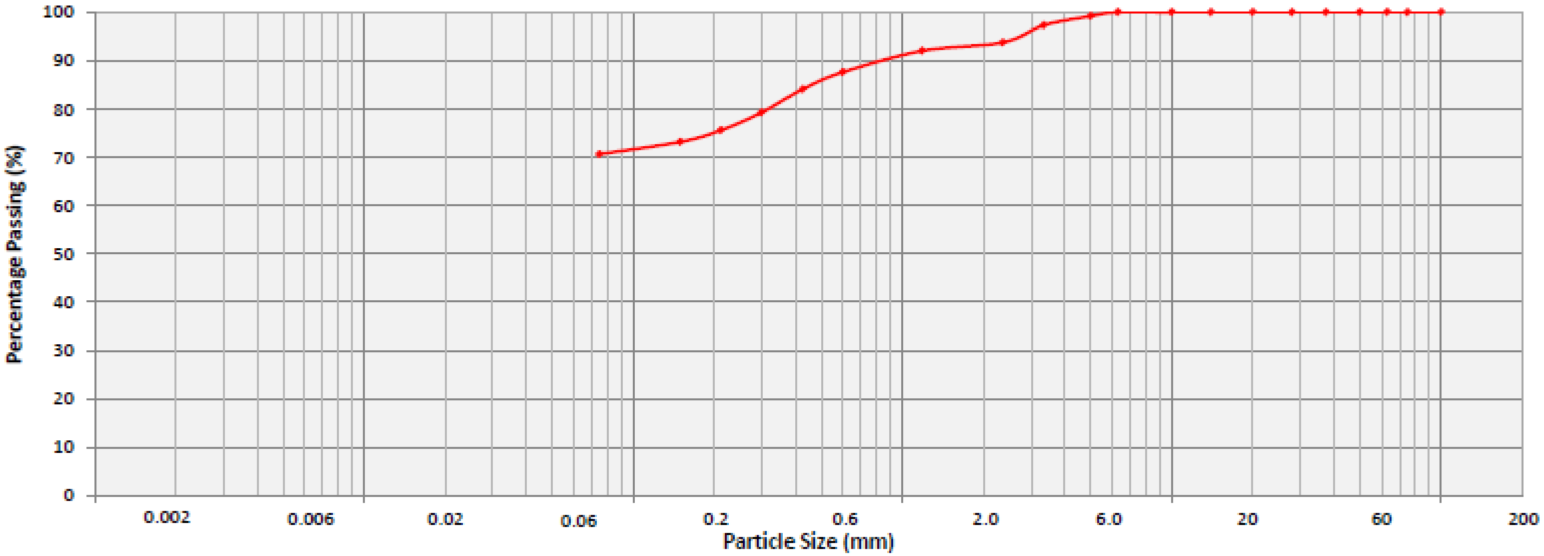


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP17-18B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN17(TP17-18B)MN18	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1193

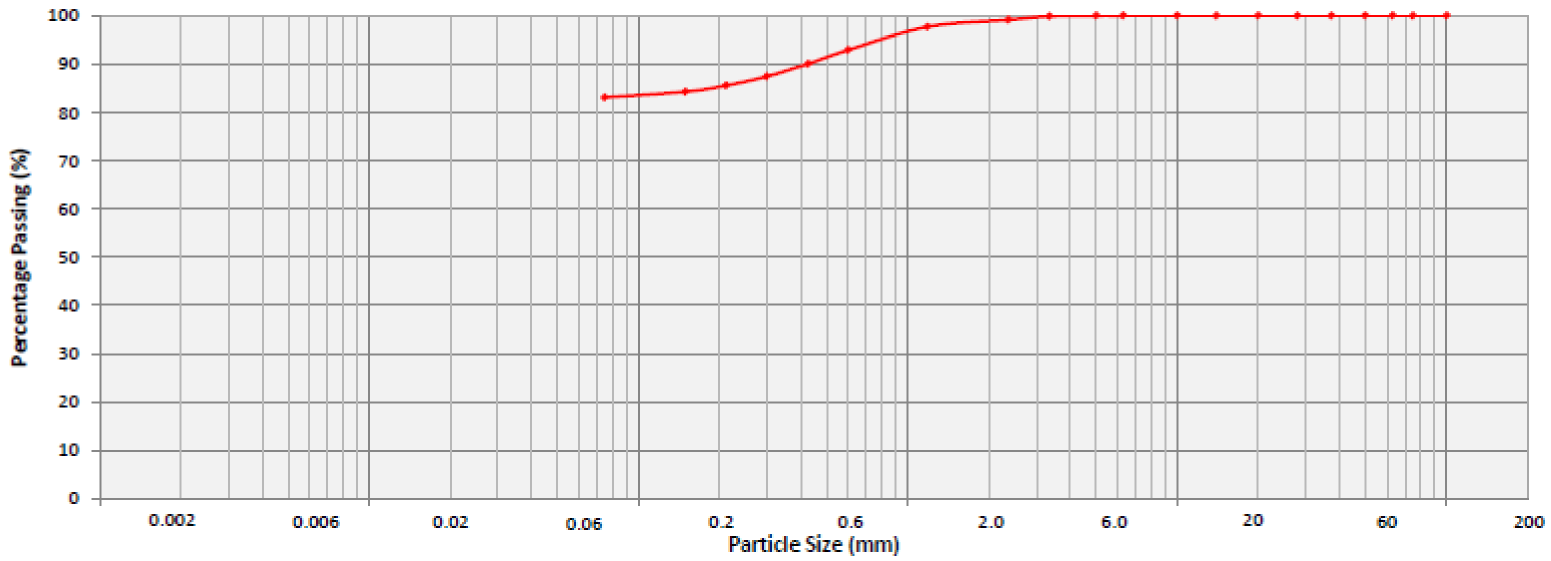


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP17-18C

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN1(TP17-18C)MN18	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1194

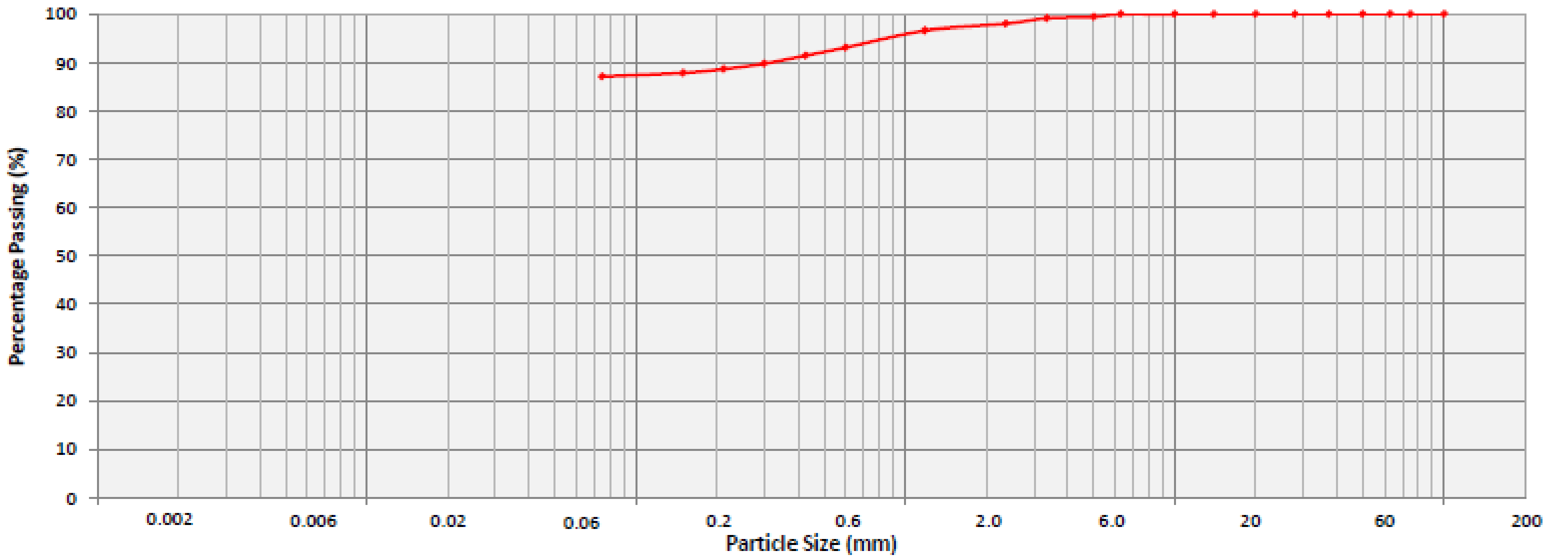


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP17-18D

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN17(TP17-18D)MN18	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	LEAN CLAY	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1195



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

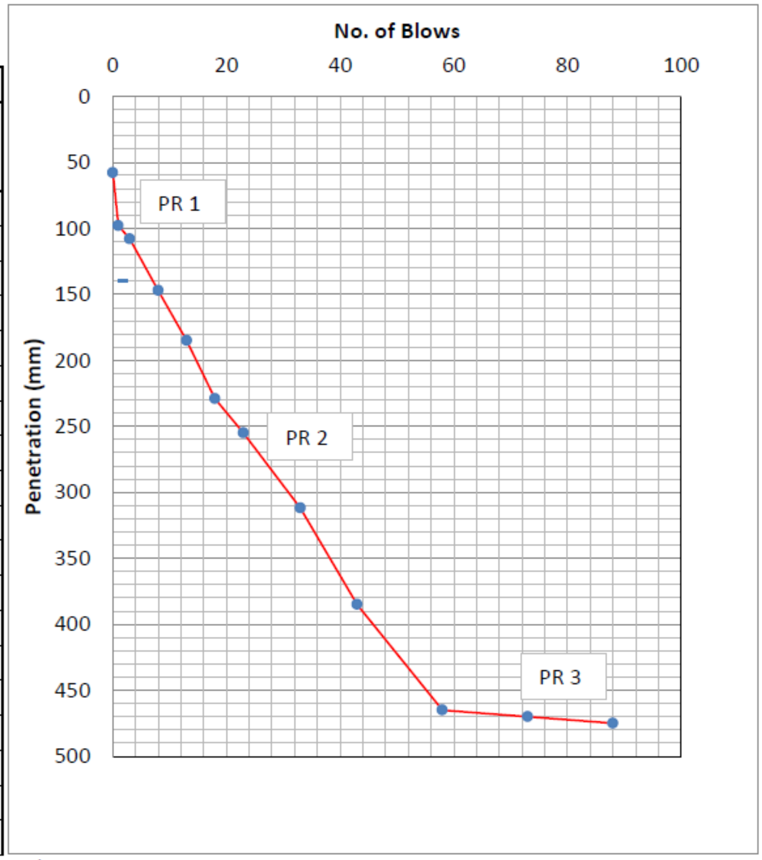
MN17

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 17	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1095

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	58	
1	1	1	98	40.0
2	2	3	108	5.0
3	5	8	147	7.8
4	5	13	185	7.6
5	5	18	229	8.8
6	5	23	255	5.2
7	10	33	312	5.7
8	10	43	385	7.3
9	15	58	465	5.3
10	15	73	470	0.3
11	15	88	475	0.3



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	40	3.8	
PR 2	6	43.2	
PR 3	0.3	2001.2	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN17

CALCULATION OF SAFE BEARING CAPACITY: TP MN 17					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1095

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1804
ø (°) =	20	$\gamma\ (kN/m^3)$ =	17.69

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 17.69 x 2.0 x 6.40) + (0.4 x 17.69 x 1.0 x 2.87)	**645 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 645/3.0	**215 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP17-18A

CALCULATION OF SAFE BEARING CAPACITY: MN17 (TP17-18A) MN18					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1192

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\,(kg/m^3)$ =	1794
$\phi\,(^\circ)$ =	21	$\gamma\,(kN/m^3)$ =	17.60

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
	N_γ = 3.42	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 17.60 x 2.0 x 7.07) + (0.4 x 17.60 x 1.0 x 3.42)	**696 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 696/3.0	**232 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP17-18B

CALCULATION OF SAFE BEARING CAPACITY: MN17 (TP17-18B) MN18					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	0.3M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	LEAN CLAY WITH SAND			Sample No.:	1193

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	27	$\gamma (kg/m^3)$ =	1912
ϕ (°) =	23	$\gamma (kN/m^3)$ =	18.75

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 0.3	
	q_f = (1.3 x 27 x 18.05) + (0.8 x 18.75 x 0.3 x 8.66) + (0.4 x 18.75 x 1.0 x 4.82)	**709 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 709/3.0	**236 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP17-18C

CALCULATION OF SAFE BEARING CAPACITY: MN17 (TP17-18C) MN18					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			Sample No.:	1098

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma\,(kg/m^3)$ =	1873
$\phi\,(^\circ)$ =	19	$\gamma\,(kN/m^3)$ =	18.37

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 13.93	
	N_q = 5.80	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.40	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 13.93) + (0.8 x 18.37 x 2.0 x 5.80) + (0.4 x 18.37 x 1.0 x 2.40)	**605 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 605/3.0	**202 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP17-18D

CALCULATION OF SAFE BEARING CAPACITY: MN17 (TP17-18D) MN18					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1195

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1885
$\phi\ (^\circ)$ =	20	$\gamma\ (kN/m^3)$ =	18.49

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 18.49 x 2.0 x 6.40) + (0.4 x 18.49 x 1.0 x 2.87)	**654 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 654/3.0	**218 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

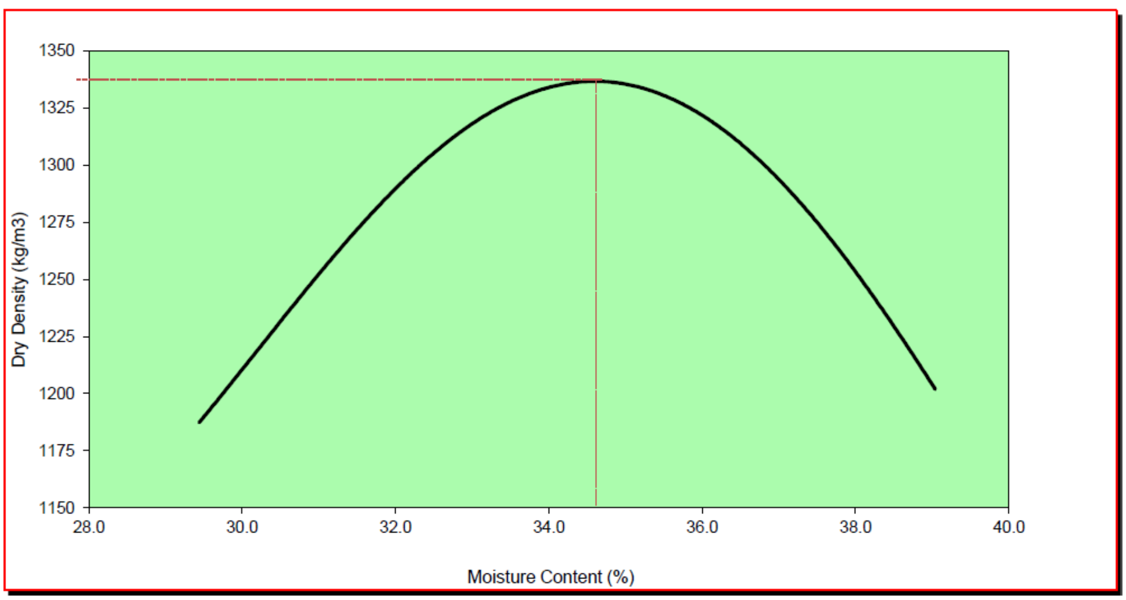
BS 1377 – 4: 1990

MN17

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1095
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 17	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5532	5664	5763	5797	5756	5666
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1537	1669	1768	1802	1761	1671
Bulk Density (Kgs/m^3)	**1537**	**1669**	**1768**	**1802**	**1761**	**1671**
Tin No.	G18	G22	G31	G43	G23	G35
Weight Wet Soil	299.0	280.0	228.0	303.0	298.0	406.0
Weight of Dry Soil	231.0	213.0	171.0	224.0	217.0	292.0
Weight of Water	68.0	67.0	57.0	79.0	81.0	114.0
Moisture Content (%)	**29.4**	**31.5**	**33.3**	**35.3**	**37.3**	**39.0**
Dry Density (Kgs/m^3)	**1187**	**1270**	**1326**	**1332**	**1282**	**1202**



Maximum Dry Density (Kg/m^3): 1338 **Optimum Moisture Content (%):** 34.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN17	
Depth	2.0m
pH	8.62
Chloride(%) mg/l	0.46
Sulphate (mg/l)	0.002

TP17-18A	
Depth	2.0m
pH	8.10
Chloride(%) mg/l	0.002
Sulphate (mg/l)	0.023

TP17-18B	
Depth	2.0m
pH	7.58
Chloride(%) mg/l	0.014
Sulphate (mg/l)	0.038

TP17-18C	
Depth	2.0m
pH	7.59
Chloride(%) mg/l	0.018
Sulphate (mg/l)	0.030

TP17-18D	
Depth	2.0m
pH	7.82
Chloride(%) mg/l	0.015
Sulphate (mg/l)	0.035

INSITU DENSITY TEST

TP17-18A	
Depth (m)	2.0
Bulk density (kg/m3)	1461
Moisture Content (%)	21.8
Dry Density (kg/m3)	1199
Maximum Dry Density (kg/m3)	1367
Relative Compaction (%)	87.7

ANGLE POINT 17 LOG

JOB REF:		GCL/NCE_342/12
MN 17		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.9	Brownish Red SILT with Sand
	2.0	Brown Silty SAND with Gravel

TEST POINT 17-18A, 17-18B, 17-18C, 17-18D LOGS

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE	JOB REF:	GCL/NCE_356/03	DATE:	23 - 28.02.2013
SITE:	NANYUKI-ISIOLO-MERU			LOGGED BY:	STEVE

	MN17 (TP17-18A) MN18			MN17 (TP17-18B) MN18			MN17 (TP17-18C) MN18		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0									
0.5			Dark Grey CLAY (Black Cotton Soil)						Reddish Brown Sandy CLAY
1						Brown Lean CLAY with Sand		1.2	
1.5			Grey Elastic SILT with Sand						Brown SILT with Sand
2		2.0			2.0				
2.5									

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE
SITE:	NANYUKI-ISIOLO-MERU

MN17 (TP17-18D) MN18

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1			Brownish Red Elastic SILT with Sand
1.5			
2		2.0	
2.5			

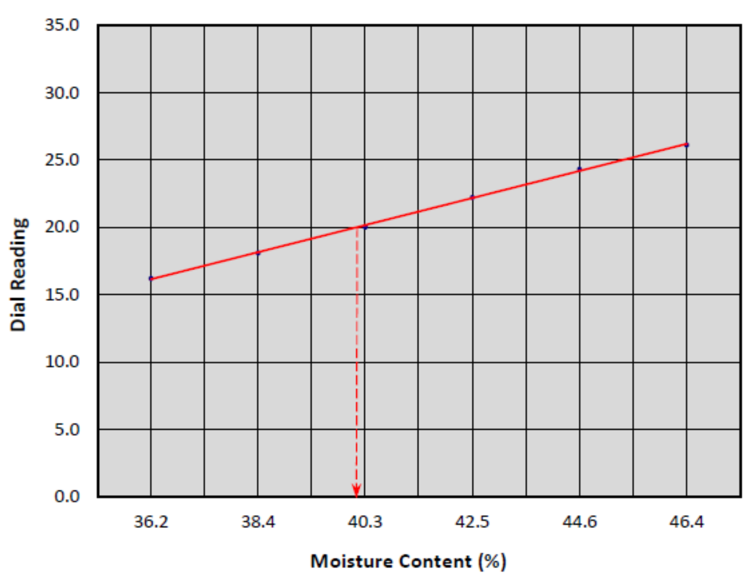
SEGMENT 17

ATTERBERG LIMITS BS 1377 - 2: 1990

MN18

Project:	PROPOSED POWERLINE	**Site/Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1096
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.2	24.3	26.1	-	-	
Tin No	**25**	**59**	**8**	**45**	**20**	**15**	**42**	**30**	
Mass of Wet Soil (g)	34.79	36.22	34.92	41.24	45.74	37.17	17.61	20.80	
Mass of Dry Soil (g)	25.54	26.17	24.89	28.94	31.63	25.39	14.72	17.36	
Mass of Moisture (g)	9.25	10.05	10.03	12.30	14.11	11.78	2.89	3.44	
Moisture Content (%)	36.2	38.4	40.3	42.5	44.6	46.4	19.6	19.8	19.7



PLASTIC LIMIT
PL = 19.7 %

LIQUID LIMIT
LL = 40.1 %

Proportion Passing 425 µm BS Sieve
= 98.7 %

PLASTICITY INDEX
PI = 20.4 %

PLASTIC MODULUS
PM = 2011

LINEAR SHRINKAGE
LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)
CL

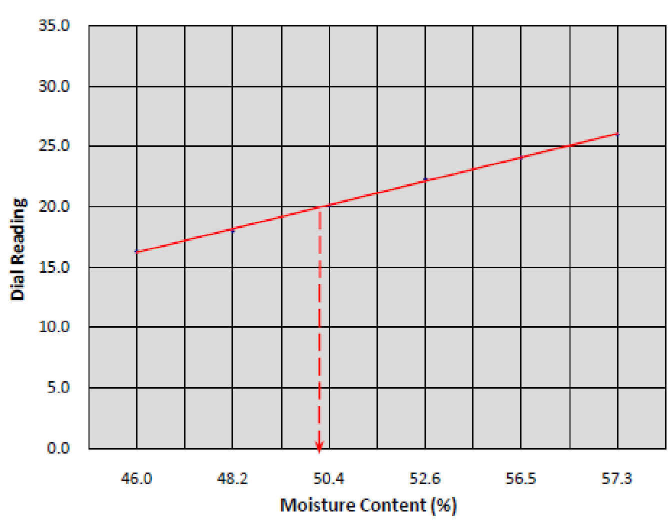
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP18-19A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN18 (TP18-19A)MN19	**Date Received:**	06.03.2013
Material Description:	ELASTIC SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1196
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	19.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.3	24.1	26.0	-	-	
Tin No	21	3	54	62	52	35	22	18	
Mass of Wet Soil (g)	48.21	42.33	47.92	52.14	45.85	56.79	30.17	33.12	
Mass of Dry Soil (g)	33.02	28.56	31.87	34.17	29.30	36.10	23.17	25.40	
Mass of Moisture (g)	15.19	13.77	16.05	17.97	16.55	20.69	7.00	7.72	
Moisture Content (%)	46.0	48.2	50.4	52.6	56.5	57.3	30.2	30.4	30.3



PLASTIC LIMIT
PL = 30.3 %

LIQUID LIMIT
LL = 50.2 %

Proportion Passing 425 µm BS Sieve
= 91.3 %

PLASTICITY INDEX
PI = 19.9 %

PLASTIC MODULUS
PM = 1817

LINEAR SHRINKAGE
LS = 9.3 %

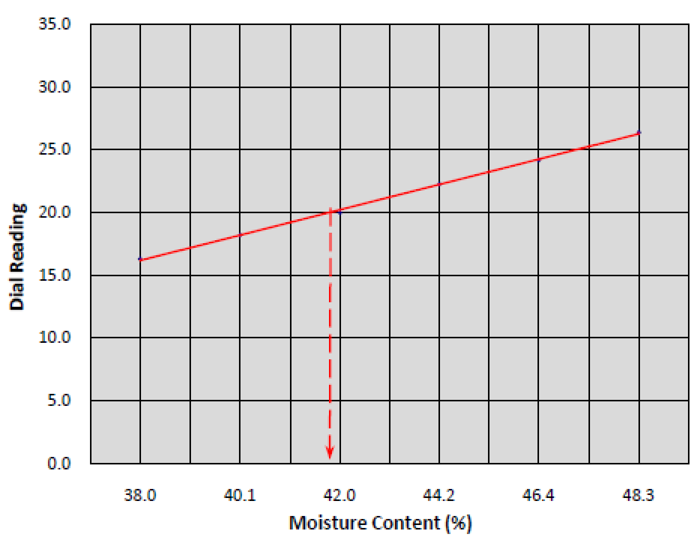
GROUP SYMBOL (USC SYSTEM)
MH

TP18-19B

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN18 (TP18-19B)MN19	**Date Received:**	06.03.2013
Material Description:	SILT with Sand	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1197
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	19.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.2	20.0	22.3	24.2	26.4	-	-	
Tin No	77	45	52	39	17	24	38	23	
Mass of Wet Soil (g)	41.08	49.04	51.16	45.06	49.41	57.90	23.91	30.06	
Mass of Dry Soil (g)	29.77	35.00	36.03	31.25	33.75	39.04	18.68	23.45	
Mass of Moisture (g)	11.31	14.04	15.13	13.81	15.66	18.86	5.23	6.61	
Moisture Content (%)	38.0	40.1	42.0	44.2	46.4	48.3	28.0	28.2	28.1



PLASTIC LIMIT
PL = 28.1 %

LIQUID LIMIT
LL = 41.8 %

Proportion Passing 425 µm BS Sieve
= 92.2 %

PLASTICITY INDEX
PI = 13.7 %

PLASTIC MODULUS
PM = 1264

LINEAR SHRINKAGE
LS = 6.4 %

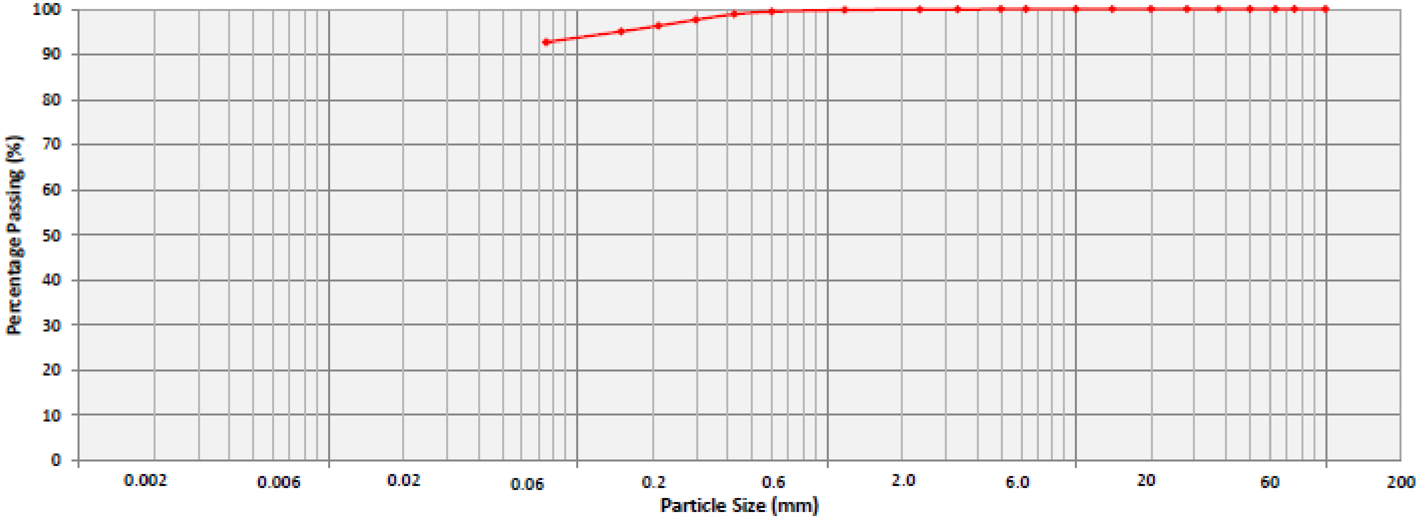
GROUP SYMBOL (USC SYSTEM)
ML

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN18

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 18	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1096



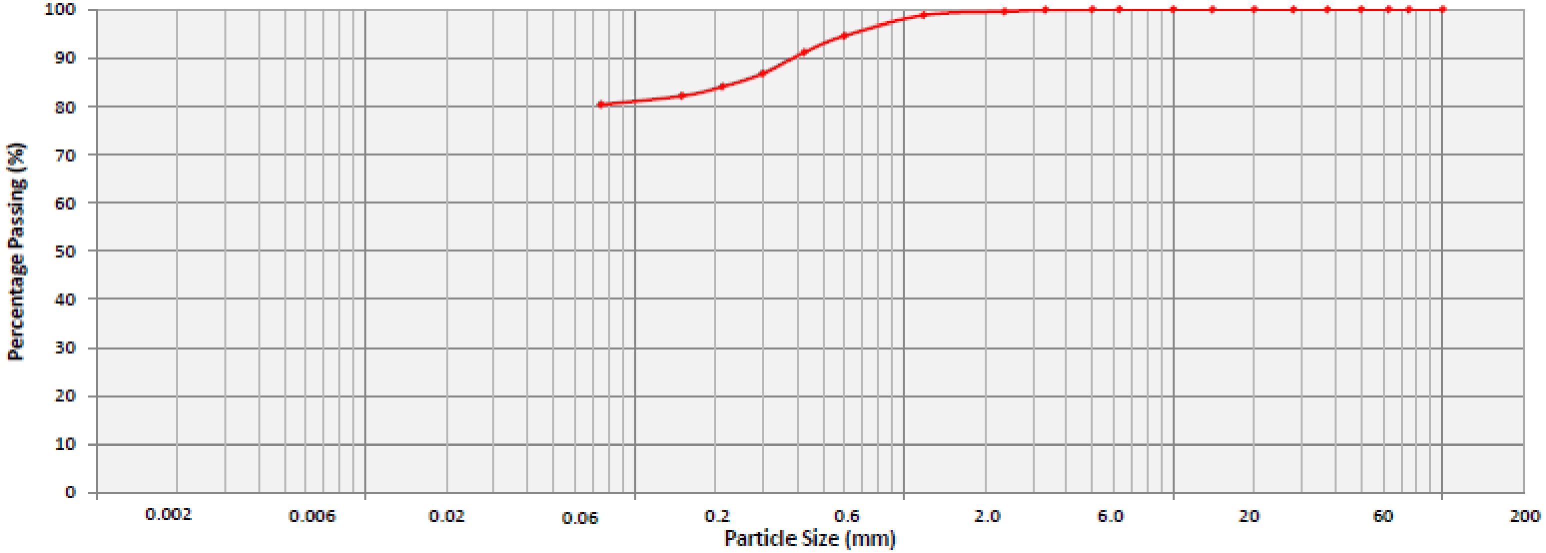
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP18-19A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN18(TP18-19A)MN19	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	ELASTIC SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1196

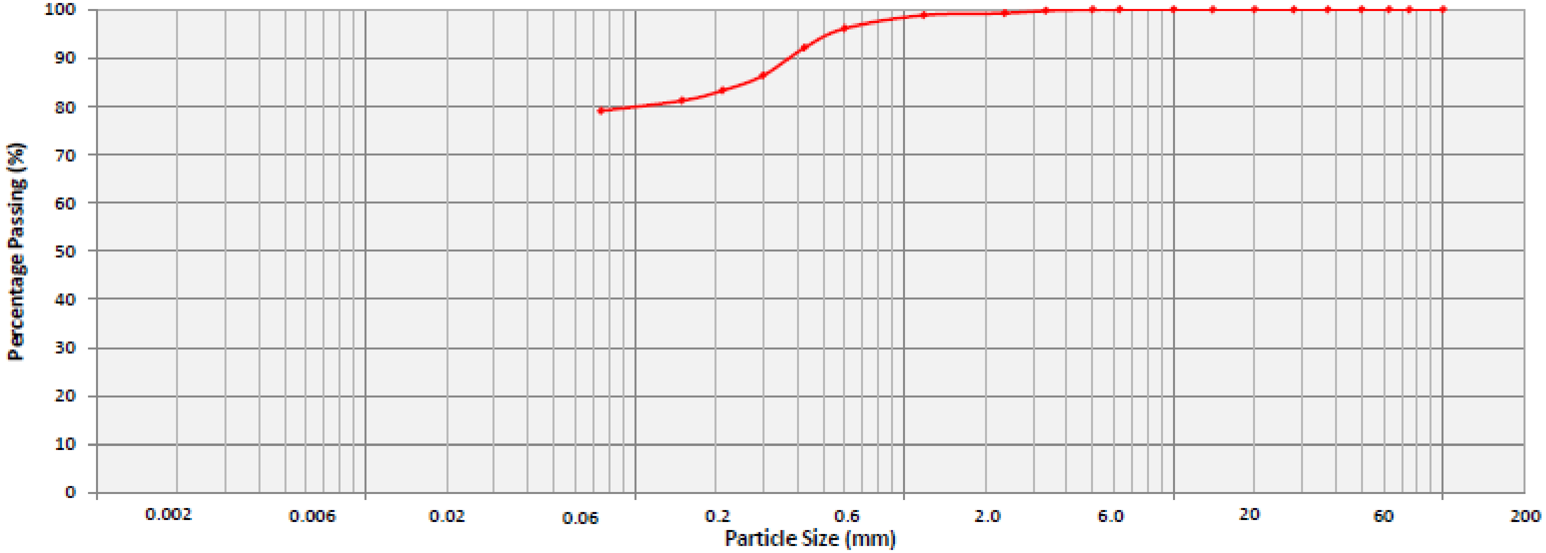


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TP18-19B

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN18(TP18-19B)MN19	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	SILT with Sand	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1197



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

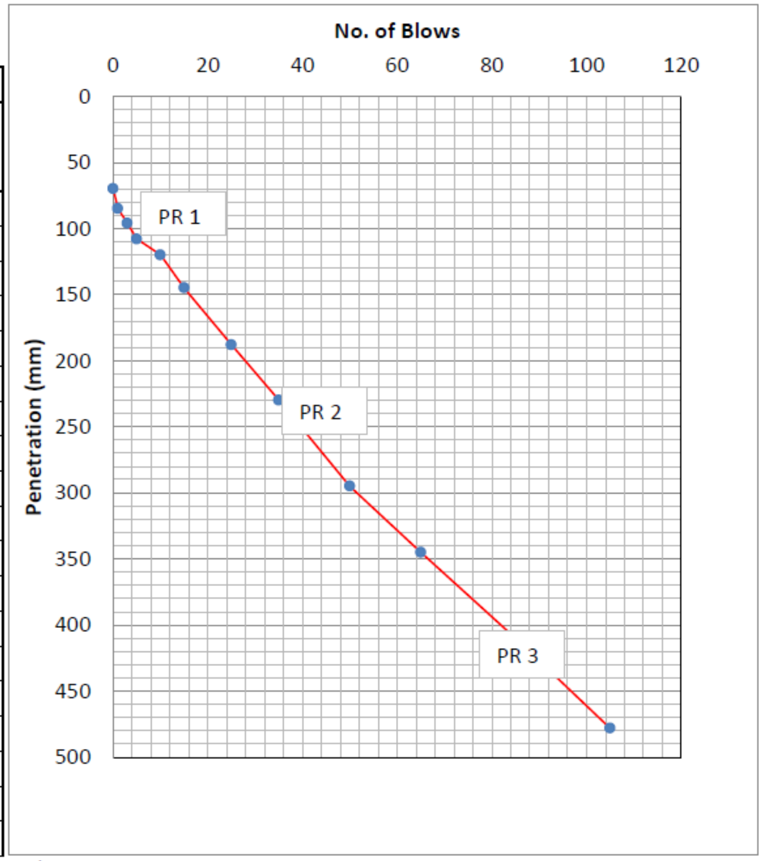
DCP - CBR CORRELATION

MN18

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	Location:	EASTERN	Test Locatio	MN 18	Date of Test:	07.12.2012
Site:	NANYUKI-ISIOLO-MERU	Job No.:	GCL/TGA-342/12	Depth:	2.0M	Sample No.	1096

DCP TEST RESULTS				
Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	70	
1	1	1	85	15.0
2	2	3	96	5.5
3	2	5	108	6.0
4	5	10	120	2.4
5	5	15	145	5.0
6	10	25	188	4.3
7	10	35	230	4.2
8	15	50	295	4.3
9	15	65	345	3.3
10	20	85	410	3.3
11	20	105	478	3.4



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	15	13.4	
PR 2	4.2	68.3	
PR 3	3.3	93.0	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN18

CALCULATION OF SAFE BEARING CAPACITY: TP MN 18					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1096

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1794
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	17.60

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cN_c + 0.8\gamma ZN_q + 0.4\gamma BN_\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 15.81) + (0.8 \times 17.60 \times 2.0 \times 7.07) + (0.4 \times 17.60 \times 1.0 \times 3.42)$	**696 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 696/3.0$	**232 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP18-19A

CALCULATION OF SAFE BEARING CAPACITY: MN18 (TP18-19A) MN19					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			Sample No.:	1196

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2) =$	30	$\gamma\ (kg/m^3) =$	2020
$\phi\ (^\circ) =$	24	$\gamma\ (kN/m^3) =$	19.82

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 19.32	
	$N_q =$ 9.60	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 5.72	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 30 \times 19.32) + (0.8 \times 19.82 \times 2.0 \times 9.60) + (0.4 \times 19.82 \times 1.0 \times 5.72)$	**1103 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 1103/3.0$	**368 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP18-19B

CALCULATION OF SAFE BEARING CAPACITY: MN18 (TP18-19B) MN19					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SILT WITH SAND			Sample No.:	1197

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2)$ =	23	$\gamma(kg/m^3)$ =	1866
ø (°) =	21	$\gamma(kN/m^3)$ =	18.31

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 18.31 x 2.0 x 7.07) + (0.4 x 18.31 x 1.0 x 3.42)	**705 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 705/3.0	**235 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

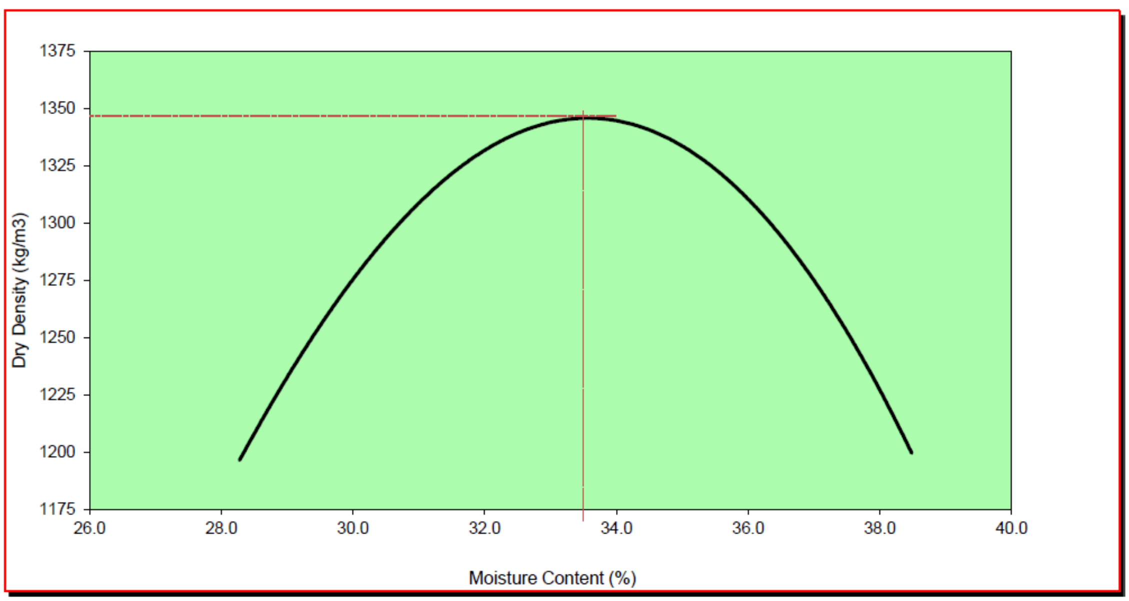
BS 1377 – 4: 1990

MN18

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1096
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 18	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5529	5665	5767	5804	5752	5657
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1534	1670	1772	1809	1757	1662
Bulk Density (Kgs/m^3)	**1534**	**1670**	**1772**	**1809**	**1757**	**1662**
Tin No.	G49	G09	G20	G17	G36	G42
Weight Wet Soil	213.2	229.2	255.0	270.4	255.4	247.2
Weight of Dry Soil	166.2	176.1	192.3	200.6	186.9	178.5
Weight of Water	47.0	53.1	62.7	69.8	68.5	68.7
Moisture Content (%)	**28.3**	**30.2**	**32.6**	**34.8**	**36.7**	**38.5**
Dry Density (Kgs/m^3)	**1196**	**1283**	**1336**	**1342**	**1286**	**1200**



Maximum Dry Density (Kg/m^3): 1345 **Optimum Moisture Content (%):** 33.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN18	
Depth	2.0m
pH	7.28
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP18-19A	
Depth	2.0m
pH	7.14
Chloride(%) mg/l	0.013
Sulphate (mg/l)	0.018

TP18-19B	
Depth	2.0m
pH	7.05
Chloride(%) mg/l	0.015
Sulphate (mg/l)	0.013

INSITU DENSITY TEST

TP18-19A	
Depth (m)	2.0
Bulk density (kg/m3)	1726
Moisture Content (%)	30.1
Dry Density (kg/m3)	1326
Maximum Dry Density (kg/m3)	1513
Relative Compaction (%)	87.7

ANGLE POINT 18 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 18		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.0	Brownish Red SILT with Sand
	2.0	Brown Silty SAND with Gravel

TEST POINT 18-19A, 18-19B LOGS

JOB REF:	GCL/NCE_356/03	DATE:	23 - 28.02.2013
		LOGGED BY:	STEVE

MN18 (TP18-19A) MN19			MN18 (TP18-19B) MN19		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.2	Brownish Red Sandy SILT		1.2	Brownish Red Sandy SILT
	2.0			2.0	Brownish Red Elastic SILT with Sand and Gravel

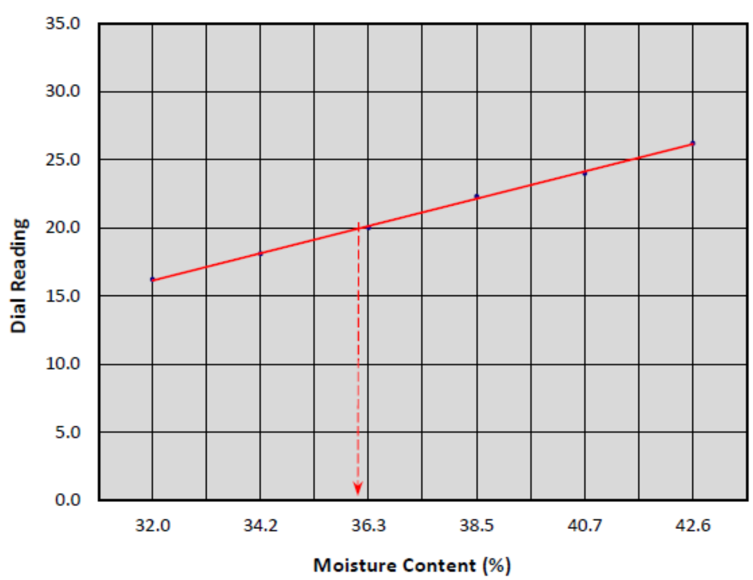
SEGMENT 18

ATTERBERG LIMITS BS 1377 - 2: 1990

MN19

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1097
Sampled By:	GCL	**Depth:**	0.3M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.3	24.0	26.2	-	-	
Tin No	**21**	**18**	**19**	**58**	**47**	**53**	**62**	**75**	
Mass of Wet Soil (g)	56.72	59.09	55.57	63.31	55.86	50.25	16.11	20.43	
Mass of Dry Soil (g)	42.97	44.03	40.76	45.71	39.70	35.24	13.02	16.49	
Mass of Moisture (g)	13.75	15.06	14.81	17.60	16.16	15.01	3.09	3.94	
Moisture Content (%)	32.0	34.2	36.3	38.5	40.7	42.6	23.7	23.9	23.8



PLASTIC LIMIT
PL = 23.8 %

LIQUID LIMIT
LL = 35.9 %

Proportion Passing 425 µm BS Sieve
= 54.8 %

PLASTICITY INDEX
PI = 12.1 %

PLASTIC MODULUS
PM = 662

LINEAR SHRINKAGE
LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)
SC

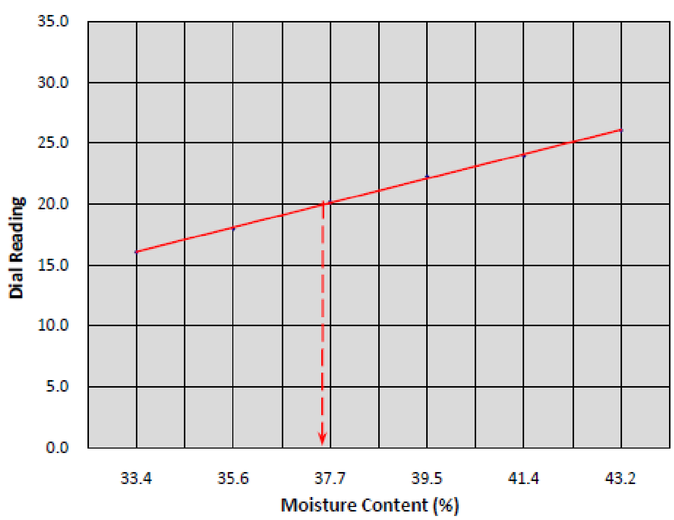
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP19-20

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN19 (TP19-20)MN20	**Date Received:**	06.03.2013
Material Description:	Silt with Sand & Gravel	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1198
Sampled By:	GEO CON	**Depth:**	1.9M	**Date Tested:**	19.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.0	20.2	22.3	24.0	26.1	-	-	
Tin No	52	16	24	18	47	59	64	12	
Mass of Wet Soil (g)	55.92	50.76	44.31	60.98	64.00	52.28	28.10	32.18	
Mass of Dry Soil (g)	41.92	37.43	32.17	43.70	45.26	36.51	22.41	25.62	
Mass of Moisture (g)	14.00	13.33	12.14	17.28	18.74	15.77	5.69	6.56	
Moisture Content (%)	33.4	35.6	37.7	39.5	41.4	43.2	25.4	25.6	25.5



PLASTIC LIMIT
PL = 25.5 %

LIQUID LIMIT
LL = 37.5 %

Proportion Passing 425 µm BS Sieve
= 64.7 %

PLASTICITY INDEX
PI = 12.0 %

PLASTIC MODULUS
PM = 777

LINEAR SHRINKAGE
LS = 7.1 %

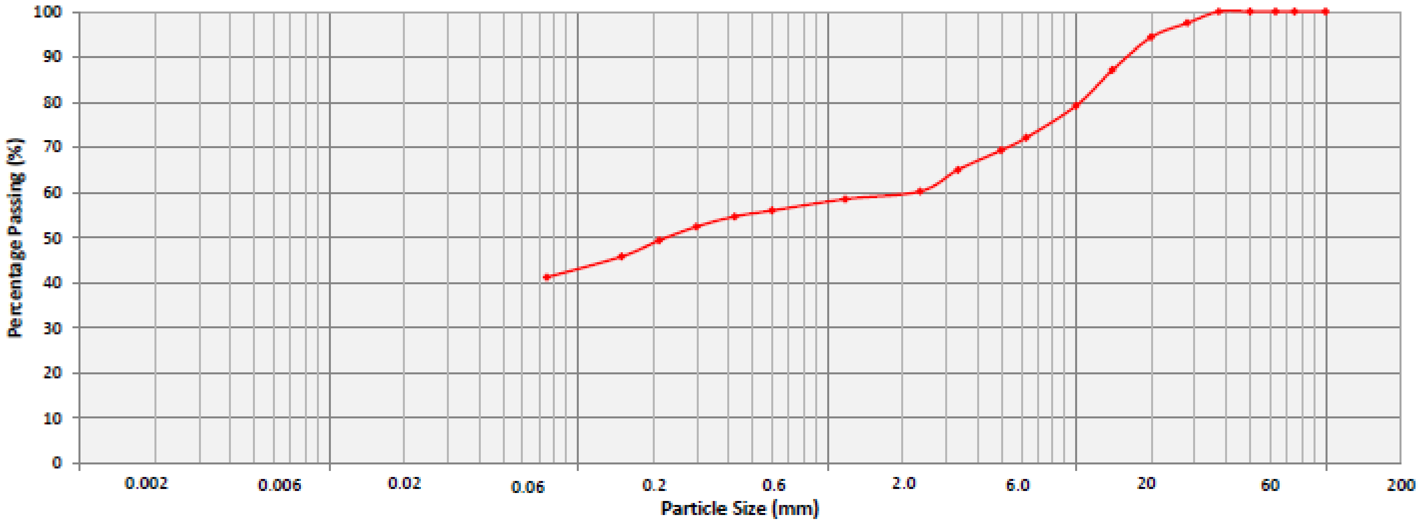
GROUP SYMBOL (USC SYSTEM)
ML

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN19

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 19	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	14.12.2012
SAMPLED BY:	GCL	**DEPTH:**	0.3M	**SAMPLE No.:**	1097



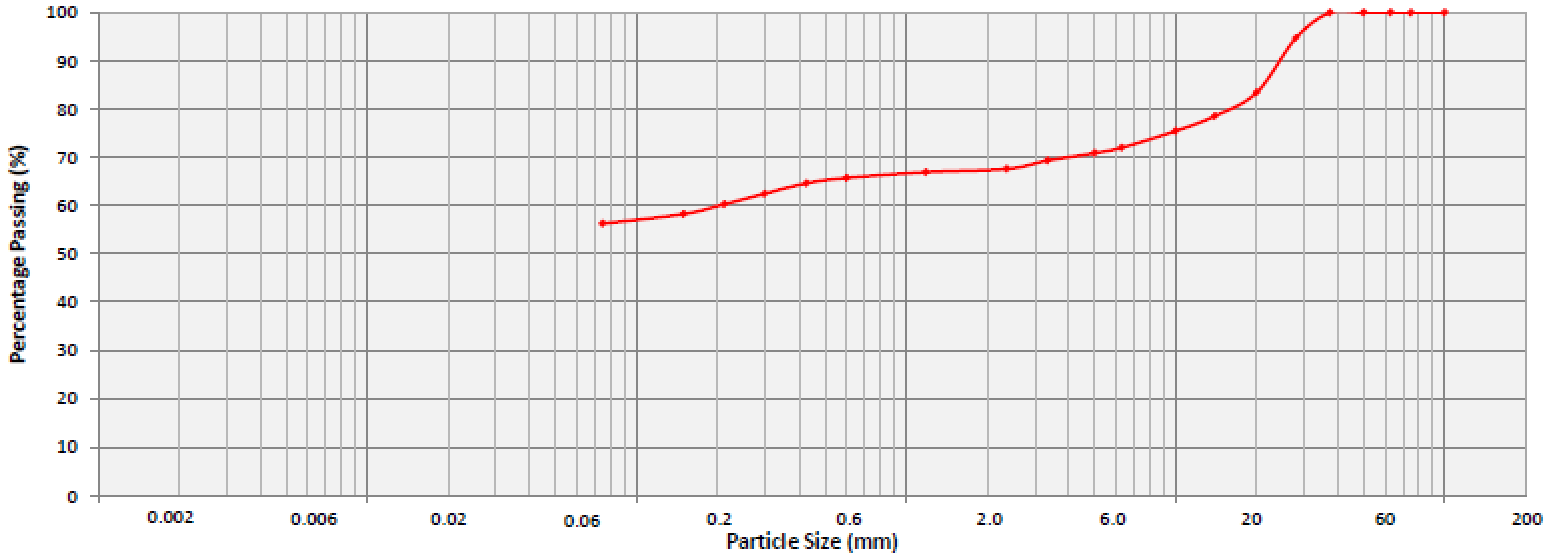
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP19-20

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN19(TP19-20)MN20	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	SILT with Sand and Gravel	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	1.9M	SAMPLE No.:	1198



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

MN19

ANGLE POINT BEARING CAPACITY

MN19

CALCULATION OF SAFE BEARING CAPACITY: TP MN 19					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	0.3M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1097

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	27	$\gamma\ (kg/m^3)$ =	1912
$\phi\ (^\circ)$ =	23	$\gamma\ (kN/m^3)$ =	18.75

REFERENCE	CALCULATIONS	RESULTS
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**Ultimate Bearing Capacity** $q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$ **Bearing Capacity Factors : Meyerhof's Analyses** N_c= 18.05 N_q = 8.66 N_γ = 4.82 **The Ultimate Bearing Capacity of a Pad Foundation** B(m)= 1.0 **Z (m)= 0.3** q_f = (1.3 x 27 x 18.05) + (0.8 x 18.75 x 0.3 x 8.66) + (0.4 x 18.75 x 1.0 x 4.82) **The Safe Bearing Capacity of the foundation is : (Fs = 3.0)** q_s = 709/3.0	**709 kN/m^2** **236 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP19-20

CALCULATION OF SAFE BEARING CAPACITY: MN19 (TP19-20) MN20					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	1.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SILT WITH GRAVEL AND SAND			Sample No.:	1198

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2)$ =	29	$\gamma\ (kg/m^3)$ =	1980
$\phi\ (^\circ)$ =	22	$\gamma\ (kN/m^3)$ =	19.43

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	$q_f = (1.3 \times 29 \times 16.88) + (0.8 \times 19.43 \times 1.0 \times 7.82) + (0.4 \times 19.43 \times 1.0 \times 4.07)$	**790 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 790/3.0$	**263 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

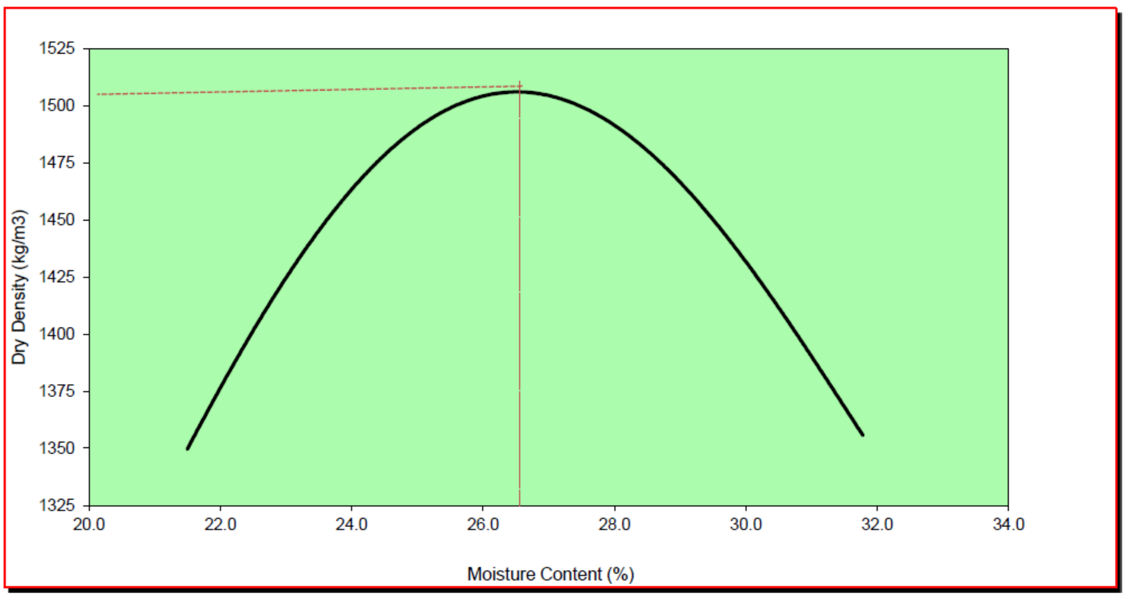
BS 1377 – 4: 1990

MN19

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	0.3M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1097
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 19	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5634	5768	5860	5912	5868	5782
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1639	1773	1865	1917	1873	1787
Bulk Density (Kgs/m^3)	**1639**	**1773**	**1865**	**1917**	**1873**	**1787**
Tin No.	G01	G15	G26	G37	G41	G53
Weight Wet Soil	262.8	297.8	293.7	305.0	293.9	303.5
Weight of Dry Soil	216.3	241.6	234.6	239.4	226.8	230.3
Weight of Water	46.5	56.2	59.1	65.6	67.1	73.2
Moisture Content (%)	**21.5**	**23.3**	**25.2**	**27.4**	**29.6**	**31.8**
Dry Density (Kgs/m^3)	**1349**	**1438**	**1490**	**1505**	**1445**	**1356**



Maximum Dry Density (Kg/m^3): 1510 **Optimum Moisture Content (%):** 26.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN19	
Depth	0.3m
pH	7.36
Chloride(%) mg/l	0.32
Sulphate (mg/l)	

TP19-20	
Depth	2.0
pH	7.87
Chloride(%) mg/l	0.014
Sulphate (mg/l)	0.032

ANGLE POINT 19 LOG

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
PROJECT:		NANYUKI-ISIOLO-MERU POWERLINE	
SITE:		NANYUKI-ISIOLO-MERU	
	MN 19		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0		0.3	Dark Grey SILT
0.5			Grey Fragmented ROCK strata
1			
1.5			
2			
2.5			

TEST POINT 19-20 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN19 (TP19-20) MN20		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5		1.0	Brownish Red Elastic SILT with Sand
1		1.2	ROCK Cobble and Boulder fractions
1.5		1.9	Brownish Red Elastic SILT with Sand
2		2.0	ROCK Cobble and Boulder fractions
2.5			

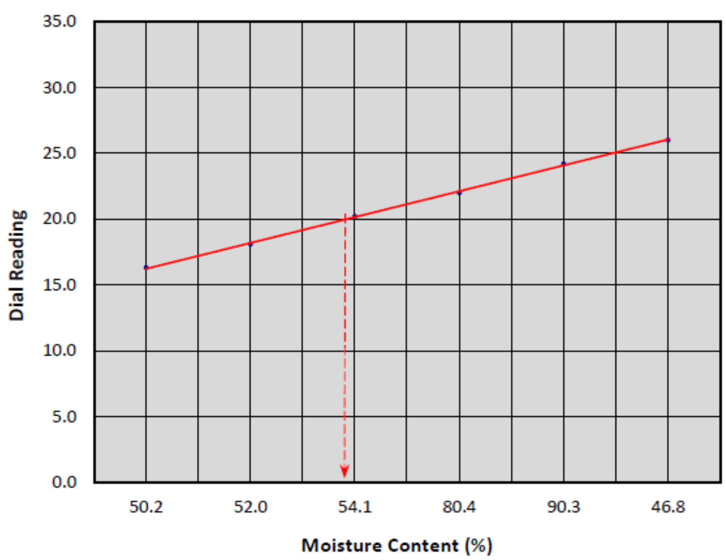
SEGMENT 19

ATTERBERG LIMITS BS 1377 - 2: 1990

MN20

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1098
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.1	20.2	22.0	24.2	26.0	-	-	
Tin No	**72**	**21**	**26**	**45**	**35**	**21**	**10**	**47**	
Mass of Wet Soil (g)	55.96	46.85	48.27	63.31	55.86	50.25	34.78	29.08	
Mass of Dry Soil (g)	37.26	30.82	31.33	35.09	29.36	34.23	26.90	22.47	
Mass of Moisture (g)	18.70	16.03	16.94	28.22	26.50	16.02	7.88	6.61	
Moisture Content (%)	50.2	52.0	54.1	80.4	90.3	46.8	29.3	29.4	29.4



PLASTIC LIMIT
PL = 29.4 %

LIQUID LIMIT
LL = 53.9 %

Proportion Passing 425 µm BS Sieve
= 96.4 %

PLASTICITY INDEX
PI = 24.5 %

PLASTIC MODULUS
PM = 2366

LINEAR SHRINKAGE
LS = 11.4 %

GROUP SYMBOL (USC SYSTEM)
MH

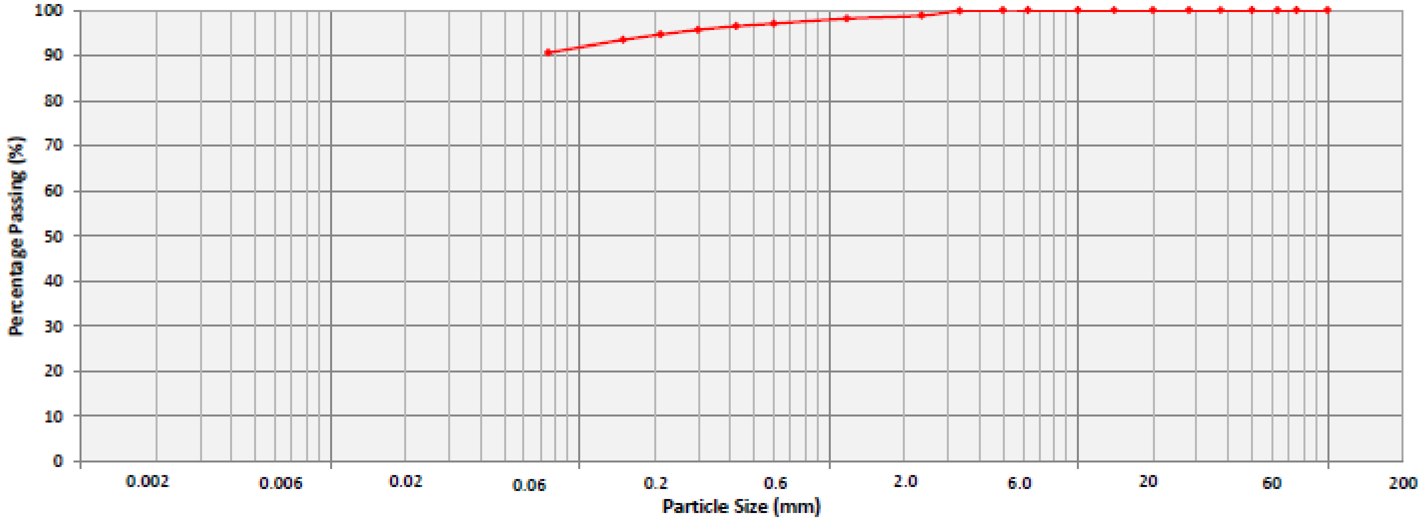
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN20

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 20	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	JOB REF:	GCL/TGA-342/12	DATE TESTED:	14.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1098



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

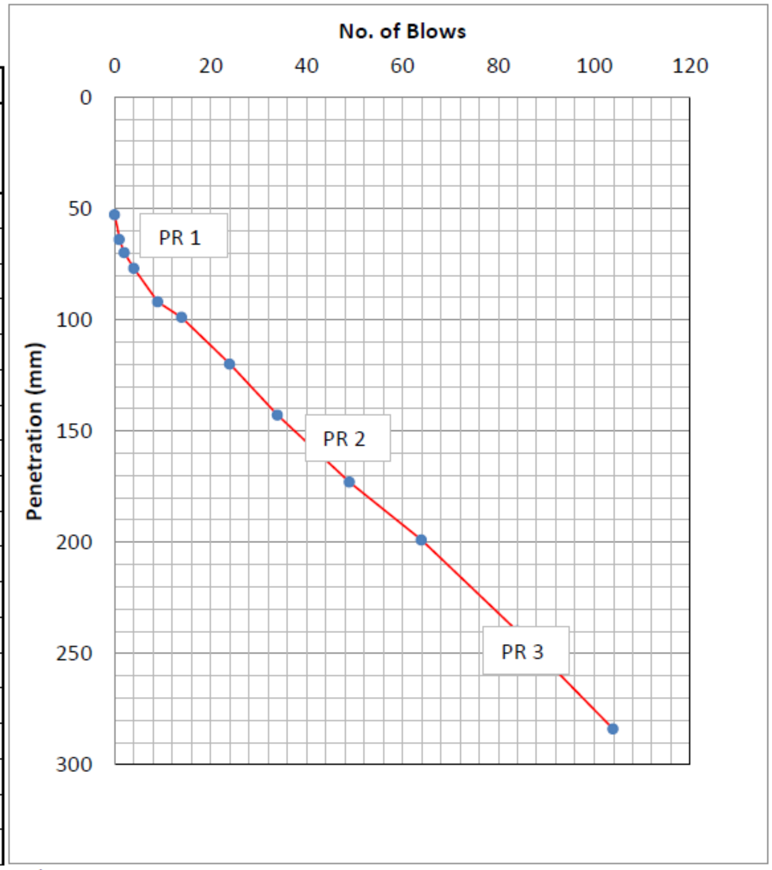
MN20

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 20	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1098

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	53	
1	1	1	64	11.0
2	1	2	70	6.0
3	2	4	77	3.5
4	5	9	92	3.0
5	5	14	99	1.4
6	10	24	120	2.1
7	10	34	143	2.3
8	15	49	173	2.0
9	15	64	199	1.7
10	20	84	240	2.1
11	20	104	284	2.2



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	11	19.9	
PR 2	2.8	114.7	
PR 3	2.1	165.8	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN20

CALCULATION OF SAFE BEARING CAPACITY: TP MN 20					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1098

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1873
ø (°) =	19	$\gamma\ (kN/m^3)$ =	18.37

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma\ BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 13.93	
	N_q = 5.80	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.40	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 13.93) + (0.8 x 18.37 x 2.0 x 5.80) + (0.4 x 18.37 x 1.0 x 2.40)	**605 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 605/3.0	**202 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

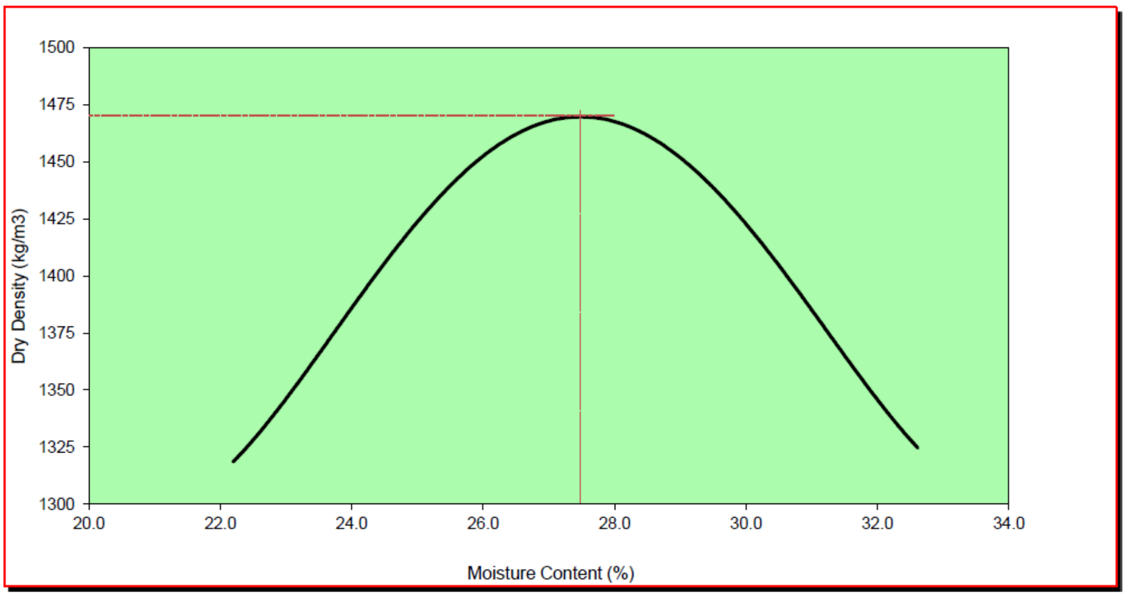
BS 1377 – 4: 1990

MN20

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1098
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 20	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5606	5740	5841	5877	5830	5752
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1611	1745	1846	1882	1835	1757
Bulk Density (Kgs/m^3)	**1611**	**1745**	**1846**	**1882**	**1835**	**1757**
Tin No.	G36	G61	G53	G03	G15	G36
Weight Wet Soil	257.1	274.3	252.6	274.9	289.9	289.9
Weight of Dry Soil	210.4	220.5	199.7	214.3	222.3	218.6
Weight of Water	46.7	53.8	52.9	60.6	67.6	71.3
Moisture Content (%)	**22.2**	**24.4**	**26.5**	**28.3**	**30.4**	**32.6**
Dry Density (Kgs/m^3)	**1318**	**1403**	**1459**	**1467**	**1407**	**1325**



Maximum Dry Density (Kg/m^3): 1470 **Optimum Moisture Content (%):** 27.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN20	
Depth	2.0m
pH	8.3
Chloride(%) mg/l	0.61
Sulphate (mg/l)	0.002

TP20-21A	
Depth	1.9m
pH	7.56
Chloride(%) mg/l	0.010
Sulphate (mg/l)	0.033

ANGLE POINT 20 LOG

JOB REF:		GCL/NCE_342/12
MN 20		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.0	Greyish Brown SILT with Sand
	2.0	Greyish Brown Silty SAND

TEST POINT 20-21 LOG

JOB REF:		GCL/NCE_356/03
MN20 (TP20-21) MN21		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.5	Brownish Red Sandy SILT
	1.9	Grey Waethered rock cobble and boulder fragments

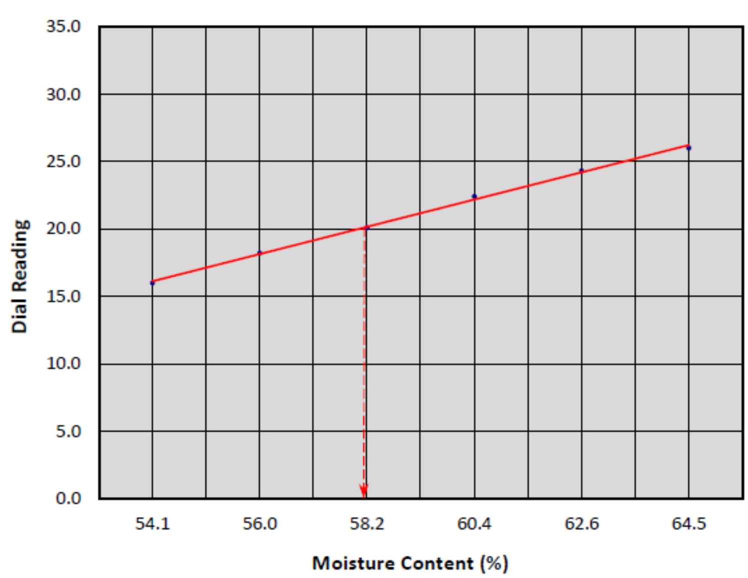
SEGMENT 20

ATTERBERG LIMITS BS 1377 - 2: 1990

MN21

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1099
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.2	20.1	22.4	24.3	26.0	-	-	
Tin No	**24**	**12**	**15**	**19**	**34**	**58**	**51**	**14**	
Mass of Wet Soil (g)	36.07	42.23	31.48	40.61	48.15	43.97	21.05	24.60	
Mass of Dry Soil (g)	23.41	27.07	19.90	25.32	29.61	26.73	15.79	18.43	
Mass of Moisture (g)	12.66	15.16	11.58	15.29	18.54	17.24	5.26	6.17	
Moisture Content (%)	54.1	56.0	58.2	60.4	62.6	64.5	33.3	33.5	33.4



PLASTIC LIMIT
PL = 33.4 %

LIQUID LIMIT
LL = 58.2 %

Proportion Passing 425 µm BS Sieve
= 97.7 %

PLASTICITY INDEX
PI = 24.8 %

PLASTIC MODULUS
PM = 2423

LINEAR SHRINKAGE
LS = 11.4 %

GROUP SYMBOL (USC SYSTEM)
MH

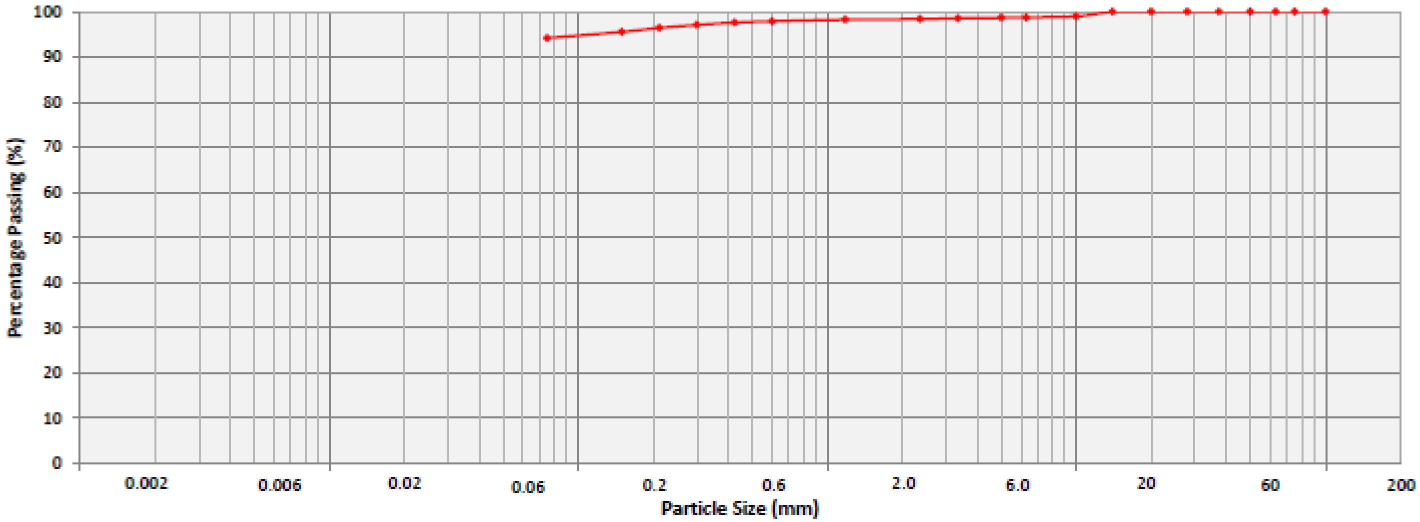
Tested By: LUCAS　　Date Reported: 19.12.2012　　Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN21

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 21	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1099



CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
		SILT			**SAND**			**GRAVEL**			

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

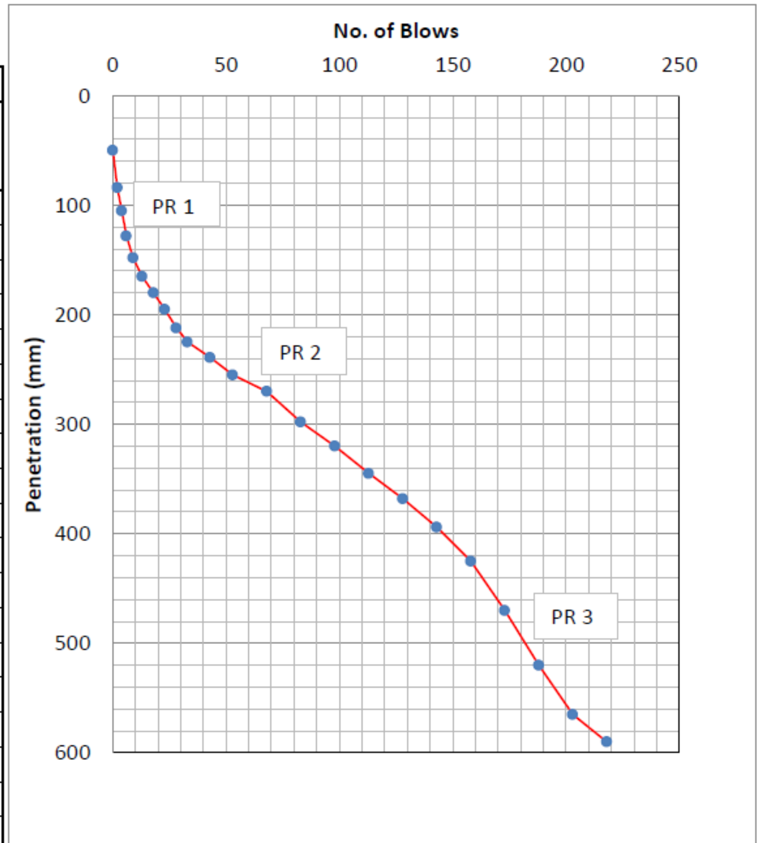
MN21

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 21	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1099

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	2	2	84	17.0
2	2	4	105	10.5
3	2	6	128	11.5
4	3	9	148	6.7
5	4	13	165	4.3
6	5	18	180	3.0
7	5	23	195	3.0
8	5	28	212	3.4
9	5	33	225	2.6
10	10	43	239	1.4
11	10	53	255	1.6
12	15	68	270	1.0
13	15	83	298	1.9
14	15	98	320	1.5
15	15	113	345	1.7
16	15	128	368	1.5
17	15	143	394	1.7
18	15	158	425	2.1
19	15	173	470	3.0
20	15	188	520	3.3
21	15	203	565	3.0
22	15	218	590	1.7



	Average (mm/blow)	Estimated CBR (%)	
PR 1	13	16.1	
PR 2	4.4	64.3	
PR 3	1.8	202.0	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN21

CALCULATION OF SAFE BEARING CAPACITY: TP MN 21					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1099

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	23	$\gamma (kg/m^3)$ =	1885
ϕ (°) =	20	$\gamma (kN/m^3)$ =	18.49

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 18.49 x 2.0 x 6.40) + (0.4 x 18.49 x 1.0 x 2.87)	**654 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 654/3.0	**218 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

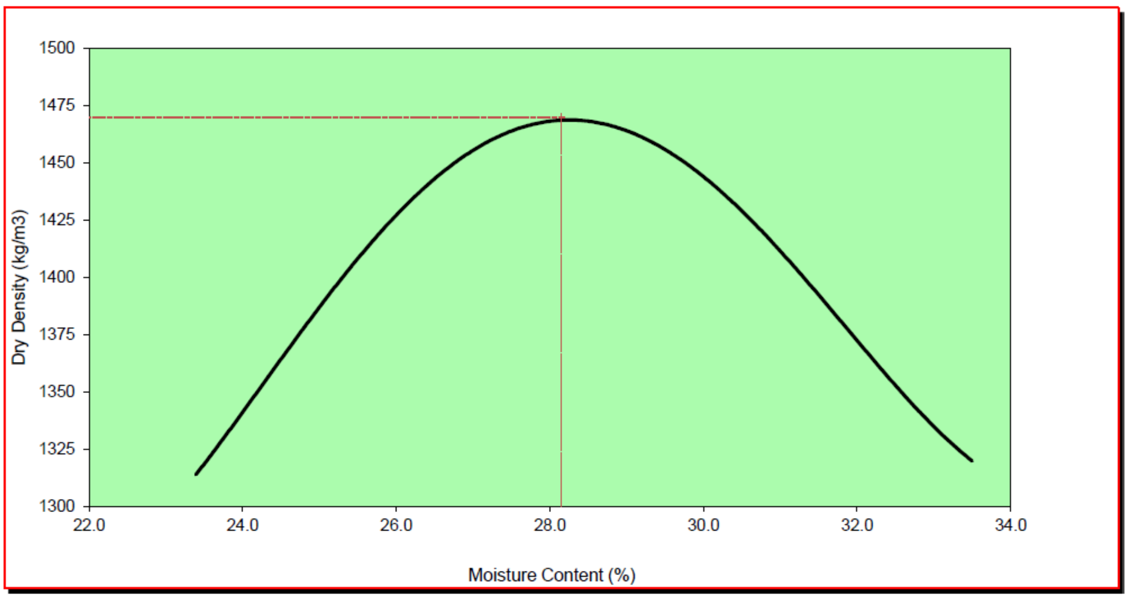
BS 1377 – 4: 1990

MN21

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1099
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 21	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5616	5739	5842	5884	5833	5757
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1621	1744	1847	1889	1838	1762
Bulk Density (Kgs/m^3)	**1621**	**1744**	**1847**	**1889**	**1838**	**1762**
Tin No.	G16	G27	G39	G45	G08	G14
Weight Wet Soil	226.3	262.3	272.0	299.0	297.4	291.7
Weight of Dry Soil	183.4	209.6	214.2	231.6	226.5	218.5
Weight of Water	42.9	52.7	57.8	67.4	70.9	73.2
Moisture Content (%)	**23.4**	**25.1**	**27.0**	**29.1**	**31.3**	**33.5**
Dry Density (Kgs/m^3)	**1314**	**1394**	**1455**	**1463**	**1400**	**1320**



Maximum Dry Density (Kg/m^3): 1468 **Optimum Moisture Content (%):** 28.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN21	
Depth	2.0m
pH	8.48
Chloride(%) mg/l	0.78
Sulphate (mg/l)	0.002

TP21-22	
Depth	1.8m
pH	8.03
Chloride(%) mg/l	0.013
Sulphate (mg/l)	0.042

ANGLE POINT 21 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 21		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	2.0	Dark Brown Elastic SILT with Sand

TEST POINT 21-22 LOG

DATE:		23 - 28.02.2013
LOGGED BY:		STEVE
MN21 (TP21-22) MN22		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.5	Brownish Red Sandy SILT
	1.8	

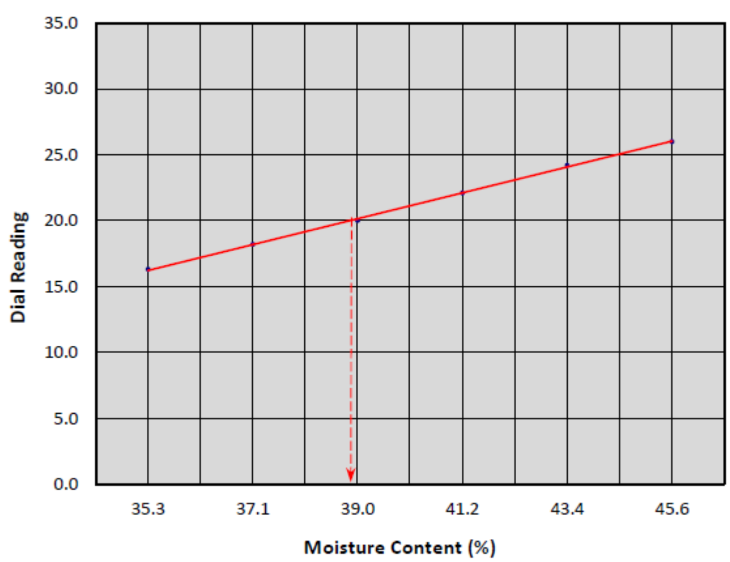
SEGMENT 21

ATTERBERG LIMITS BS 1377 - 2: 1990

MN22

Project:	PROPOSED POWERLINE	Site / Location:	NANYUKI-ISIOLO-MERU	Date Received:	09.12.2012
Material Description:	CLAYEY GRAVEL WITH SAND	Job Reference:	GCL/TGA-342/12	Sample No.:	1100
Sampled By:	GCL	Depth:	2.0M	Date Tested:	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.2	20.0	22.1	24.2	26.0	-	-	
Tin No	21	3	54	62	52	35	22	18	
Mass of Wet Soil (g)	53.11	48.82	50.50	56.68	66.27	55.12	30.59	32.92	
Mass of Dry Soil (g)	39.25	35.61	36.34	40.14	46.21	37.86	25.41	27.30	
Mass of Moisture (g)	13.86	13.21	14.16	16.54	20.06	17.26	5.18	5.62	
Moisture Content (%)	35.3	37.1	39.0	41.2	43.4	45.6	20.4	20.6	20.5



PLASTIC LIMIT
PL = 20.5 %

LIQUID LIMIT
LL = 38.8 %

Proportion Passing 425 µm BS Sieve
= 32.7 %

PLASTICITY INDEX
PI = 18.3 %

PLASTIC MODULUS
PM = 599

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
GC

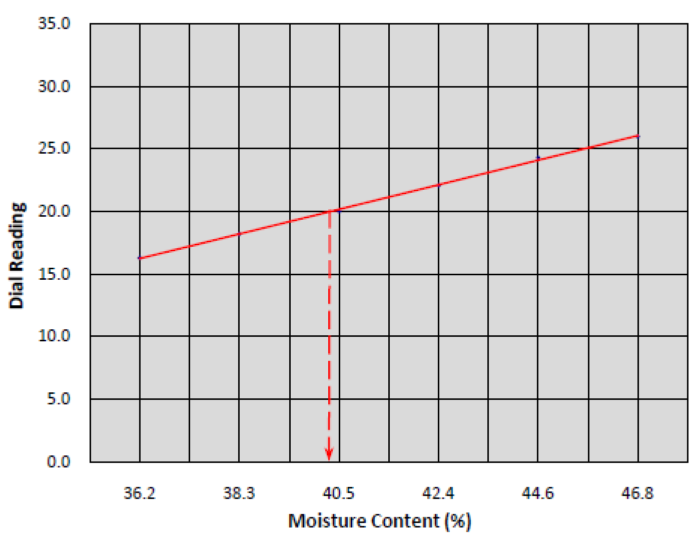
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP22-23A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN22 (TP22-23A)MN23	**Date Received:**	06.03.2013
Material Description:	Clayey GRAVEL	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1201
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.2	20.0	22.1	24.3	26.0	-	-	
Tin No	**35**	**27**	**19**	**8**	**26**	**36**	**29**	**58**	
Mass of Wet Soil (g)	36.05	30.47	32.51	39.16	37.48	40.52	23.58	28.96	
Mass of Dry Soil (g)	26.47	22.03	23.14	27.50	25.92	27.60	19.14	23.47	
Mass of Moisture (g)	9.58	8.44	9.37	11.66	11.56	12.92	4.44	5.49	
Moisture Content (%)	36.2	38.3	40.5	42.4	44.6	46.8	23.2	23.4	23.3



PLASTIC LIMIT

PL = 23.3 %

LIQUID LIMIT

LL = 40.4

Proportion Passing 425 µm BS Sieve

= 14.8 %

PLASTICITY INDEX

PI = 17.1 %

PLASTIC MODULUS

PM = 253

LINEAR SHRINKAGE

LS = 7.9 %

GROUP SYMBOL (USC SYSTEM)

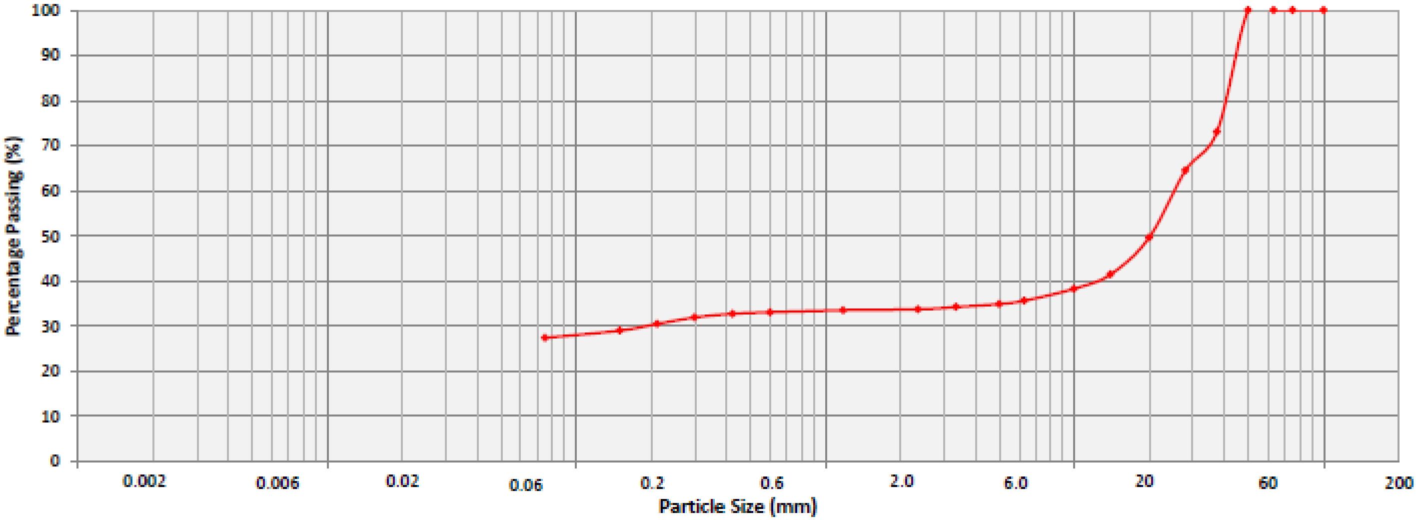
GC

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN22

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 22	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY GRAVEL WITH SAND	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1100



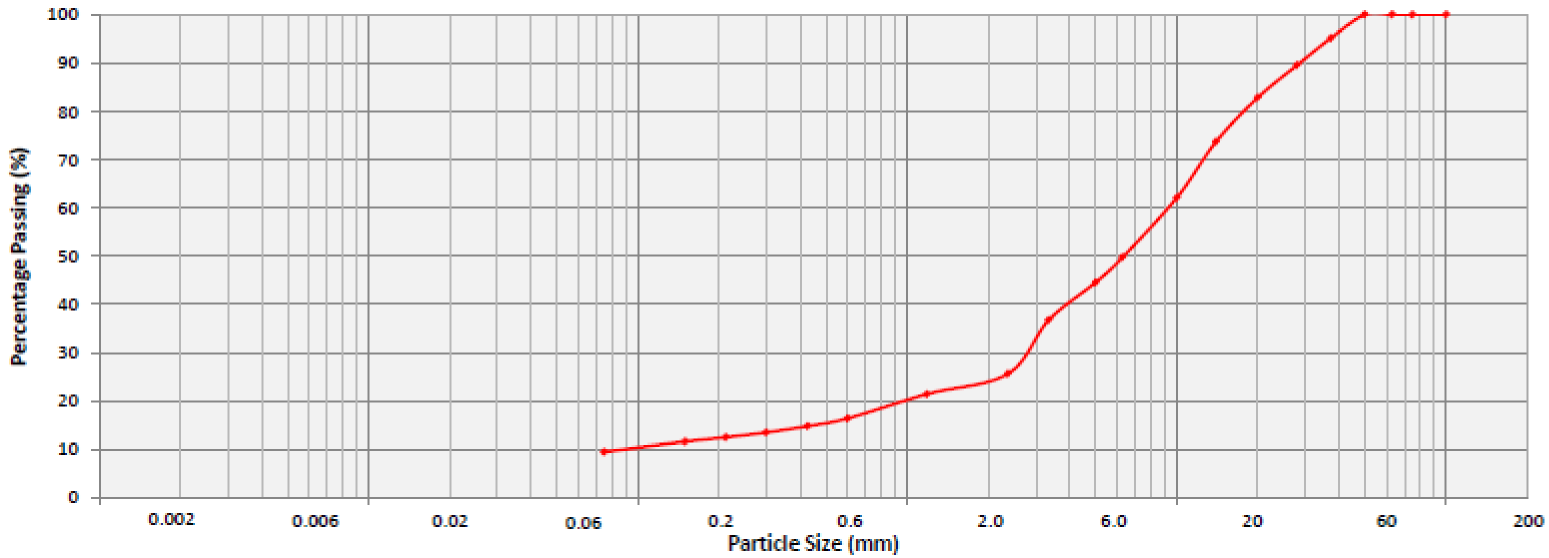
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP22-23A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN22(TP22-23A)MN23	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	CLAYEY GRAVEL	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1201



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

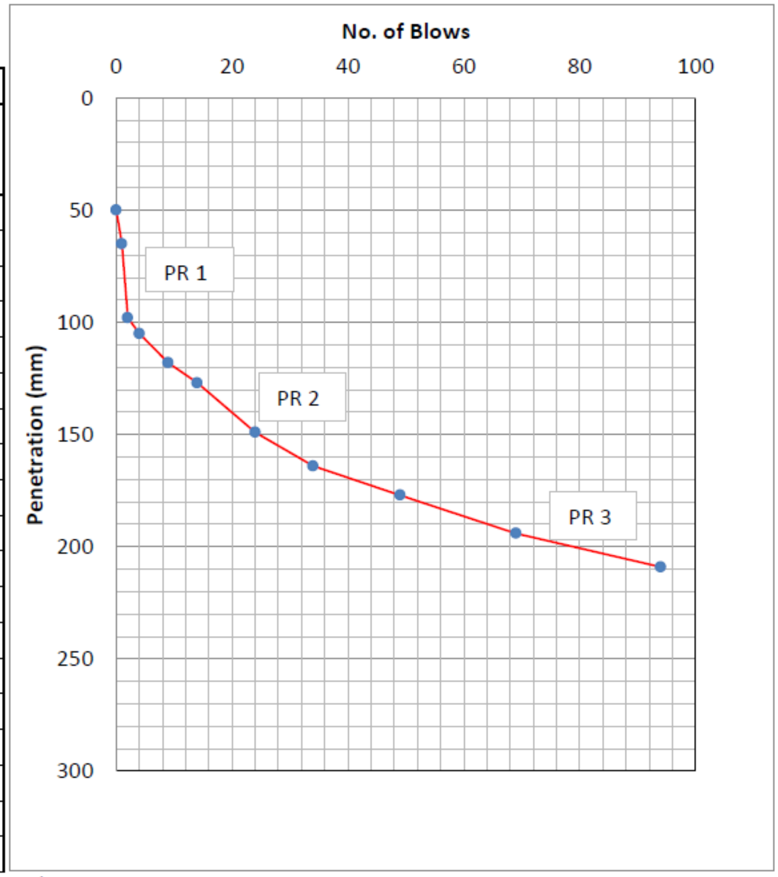
MN22

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	Location:	EASTERN	Test Location	MN 22	Date of Test:	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	Job No.:	GCL/TGA-342/12	Depth:	2.0M	Sample No.	1100

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	65	15.0
2	1	2	98	33.0
3	2	4	105	3.5
4	5	9	118	2.6
5	5	14	127	1.8
6	10	24	149	2.2
7	10	34	164	1.5
8	15	49	177	0.9
9	20	69	194	0.9
10	25	94	209	0.6



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	24	7.3	
PR 2	2.6	126.1	
PR 3	0.8	570.2	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN22

CALCULATION OF SAFE BEARING CAPACITY: TP MN 22					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY GRAVEL WITH SAND			**Sample No.:**	1100

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	30	$\gamma\ (kg/m^3)$ =	2020
ø (°) =	24	$\gamma\ (kN/m^3)$ =	19.82

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 19.32	
	N_q = 9.60	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 5.72	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 30 x 19.32) + (0.8 x 19.82 x 2.0 x 9.60) + (0.4 x 19.82 x 1.0 x 5.72)	**1103 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 1103/3.0	**368 kN/m^2**

Calculations By: B.K.	**Checked:** WK

TP22-23A

CALCULATION OF SAFE BEARING CAPACITY: MN22 (TP22-23A) MN23

PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	CLAYEY GRAVEL			**Sample No.:**	1201

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C (kN/m^2)$ =	28	$\gamma\ (kg/m^3)$ =	2054
$\phi\ (^\circ)$ =	22	$\gamma\ (kN/m^3)$ =	20.15

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	q_f = (1.3 x 28 x 16.88) + (0.8 x 20.15 x 1.6 x 7.82) + (0.4 x 20.15 x 1.0 x 4.07)	**849 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 849/3.0	**283 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

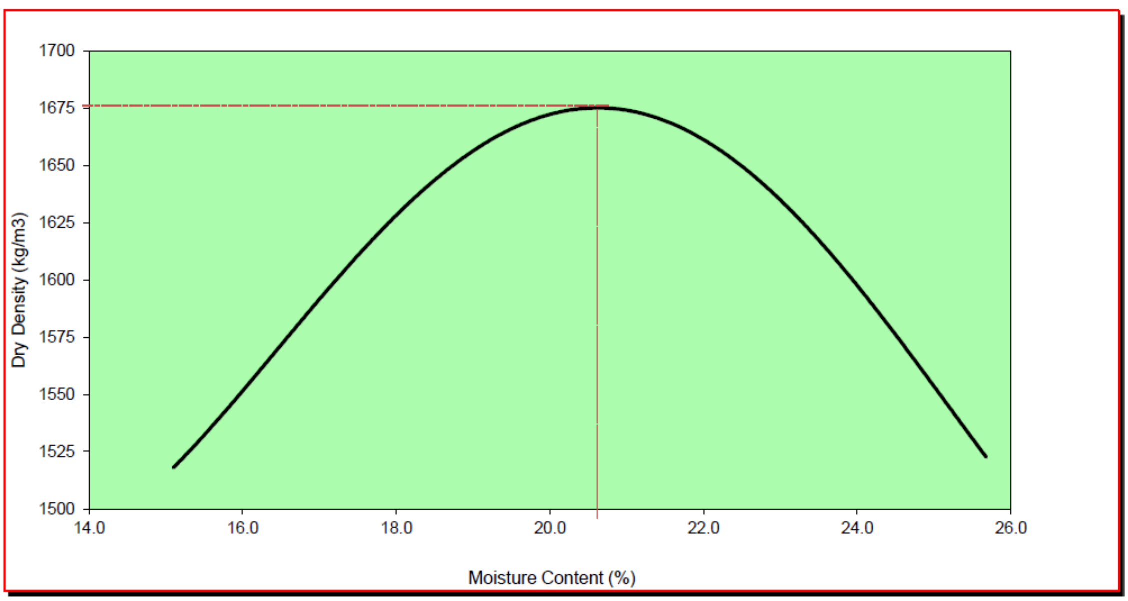
BS 1377 – 4: 1990

MN22

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1100
Material Description:	CLAYEY GRAVEL WITH SAND	**Sample Ref:**	TP MN 22	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5742	5870	5979	6026	5982	5909
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1747	1875	1984	2031	1987	1914
Bulk Density (Kgs/m^3)	**1747**	**1875**	**1984**	**2031**	**1987**	**1914**
Tin No.	G04	G16	G39	G51	G11	G43
Weight Wet Soil	250.1	261.8	276.6	303.8	275.3	296.1
Weight of Dry Soil	217.3	223.4	231.7	249.8	222.4	235.6
Weight of Water	32.8	38.4	44.9	54.0	52.9	60.5
Moisture Content (%)	**15.1**	**17.2**	**19.4**	**21.6**	**23.8**	**25.7**
Dry Density (Kgs/m^3)	**1518**	**1600**	**1662**	**1670**	**1605**	**1523**



Maximum Dry Density (Kg/m^3): 1675 **Optimum Moisture Content (%):** 20.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN22	
Depth	2.0m
pH	6.9
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP22-23A	
Depth	2.0m
pH	7.51
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.026

TP22-23B	
Depth	1.8m
pH	7.17
Chloride(%) mg/l	0.005
Sulphate (mg/l)	

ANGLE POINT 22 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 22		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0		0.3	Greyish Brown Silty SAND
0.5			
1		1.0	Brown Lateritic GRAVEL
1.5			
2			
2.5			

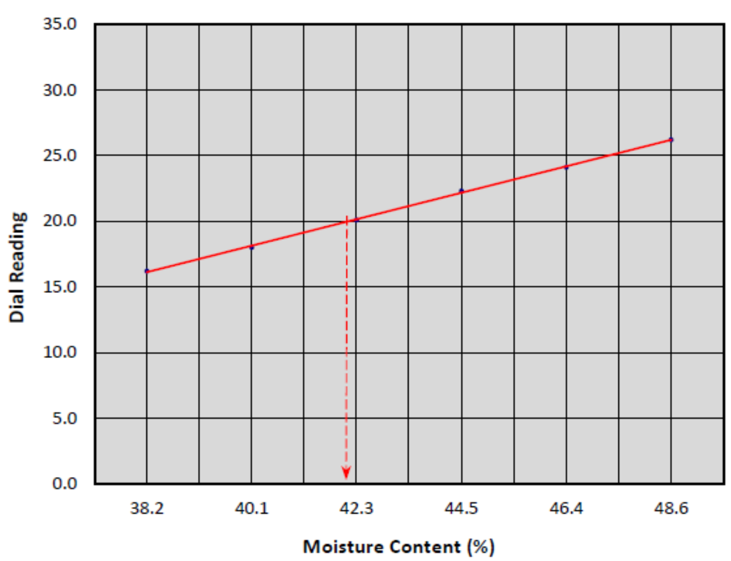
SEGMENT 22

ATTERBERG LIMITS BS 1377 - 2: 1990

MN23

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1101
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.0	20.1	22.3	24.1	26.2	-	-	
Tin No	**45**	**15**	**77**	**18**	**24**	**36**	**22**	**11**	
Mass of Wet Soil (g)	43.70	33.58	28.92	36.73	44.84	46.14	23.04	17.43	
Mass of Dry Soil (g)	31.62	23.97	20.32	25.42	30.63	31.06	18.21	13.76	
Mass of Moisture (g)	12.08	9.61	8.60	11.31	14.21	15.08	4.83	3.67	
Moisture Content (%)	38.2	40.1	42.3	44.5	46.4	48.6	26.5	26.7	26.6



PLASTIC LIMIT
PL = 26.6 %

LIQUID LIMIT
LL = 41.9 %

Proportion Passing 425 µm BS Sieve
= 97.4 %

PLASTICITY INDEX
PI = 15.3 %

PLASTIC MODULUS
PM = 1490

LINEAR SHRINKAGE
LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)
CL

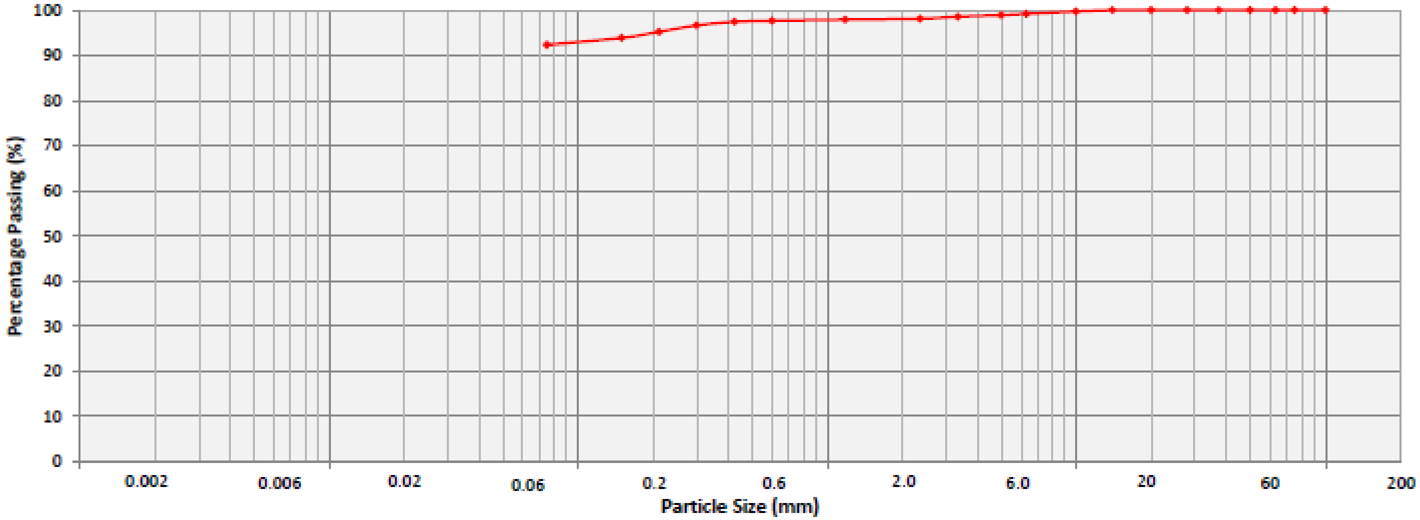
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN23

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 23	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	JOB REF:	GCL/TGA-342/12	DATE TESTED:	17.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1101



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

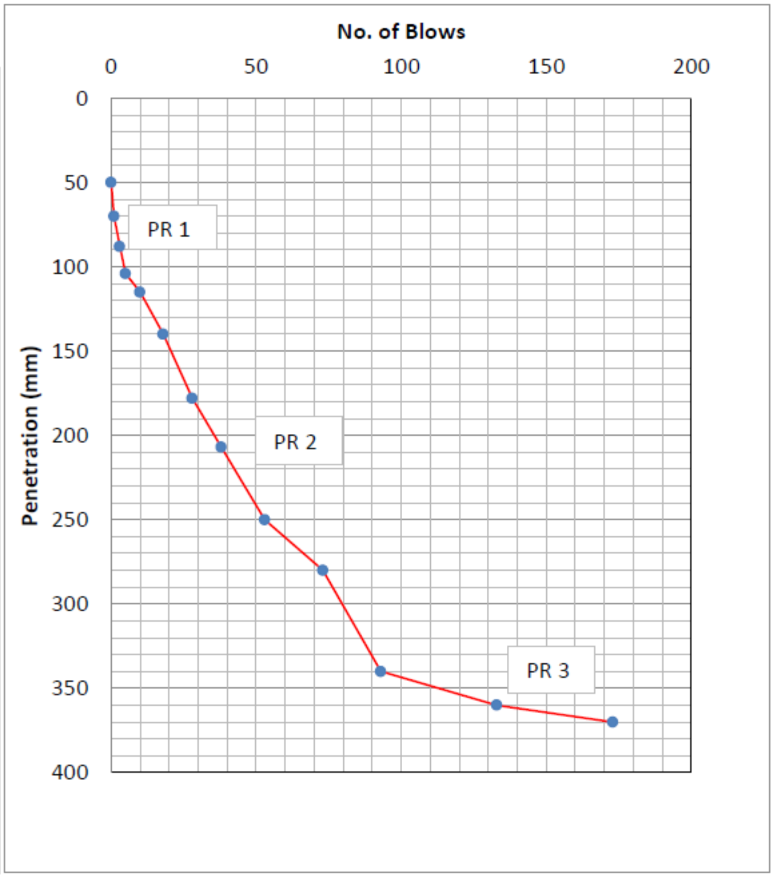
MN23

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 23	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1101

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	70	20.0
2	2	3	88	9.0
3	2	5	104	8.0
4	5	10	115	2.2
5	8	18	140	3.1
6	10	28	178	3.8
7	10	38	207	2.9
8	15	53	250	2.9
9	20	73	280	1.5
10	20	93	340	3.0
11	40	133	360	0.5
12	40	173	370	0.3



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	12	17.8	
PR 2	4.3	66.2	
PR 3	0.4	1384.7	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN23

CALCULATION OF SAFE BEARING CAPACITY: TP MN 23					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1101

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1866
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	18.31

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 18.31 x 2.0 x 7.07) + (0.4 x 18.31 x 1.0 x 3.42)	**705 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 705/3.0	**235 kN/m^2**

Calculations By: B.K.   **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

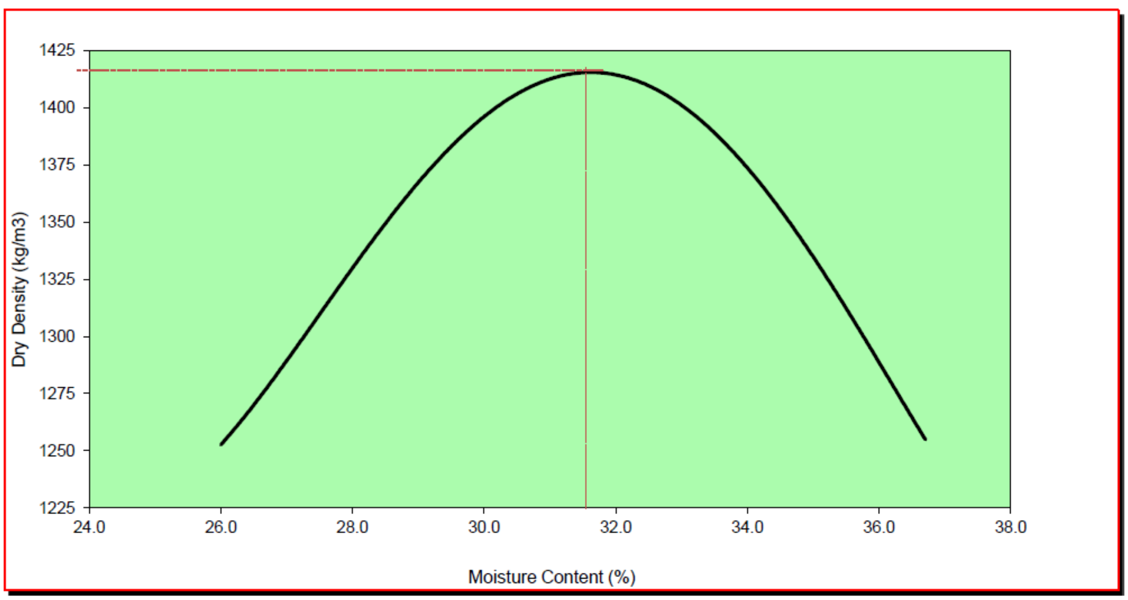
BS 1377 – 4: 1990

MN23

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1101
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 23	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5573	5712	5822	5866	5805	5711
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1578	1717	1827	1871	1810	1716
Bulk Density (Kgs/m^3)	**1578**	**1717**	**1827**	**1871**	**1810**	**1716**
Tin No.	G59	G64	G29	G34	G47	G42
Weight Wet Soil	213.3	224.1	245.9	266.9	267.8	278.2
Weight of Dry Soil	169.3	174.8	188.6	201.3	198.7	203.5
Weight of Water	44.0	49.3	57.3	65.6	69.1	74.7
Moisture Content (%)	**26.0**	**28.2**	**30.4**	**32.6**	**34.8**	**36.7**
Dry Density (Kgs/m^3)	**1252**	**1339**	**1401**	**1411**	**1343**	**1255**



Maximum Dry Density (Kg/m^3): 1418 **Optimum Moisture Content (%):** 31.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN23	
Depth	2.0m
pH	8.22
Chloride(%) mg/l	0.53
Sulphate (mg/l)	0.001

TP23-24A	
Depth	1.2m
pH	7.65
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.020

TP23-24B	
Depth	1.2m
pH	6.97
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.018

ANGLE POINT 23 LOG

JOB REF:		GCL/NCE_342/12
MN 23		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.7	Greyish Brown SILT with Sand
	2.0	Brown Lateritic GRAVEL

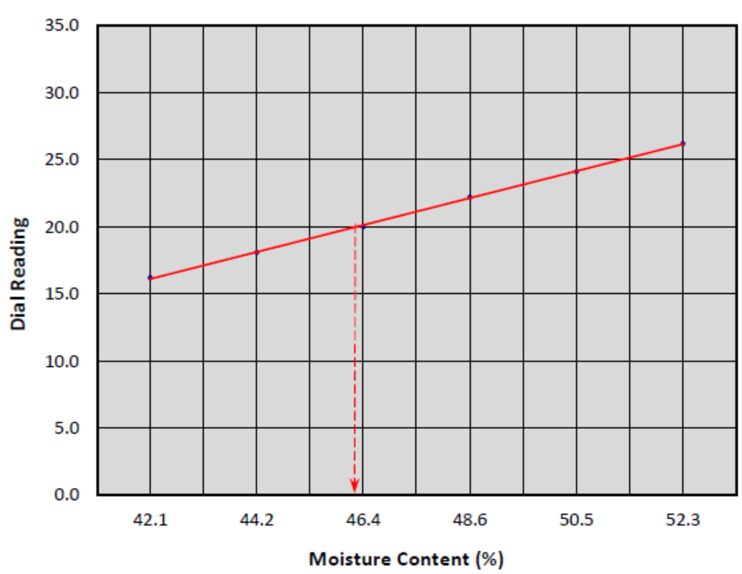
SEGMENT 23

ATTERBERG LIMITS BS 1377 - 2: 1990

MN24

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY GRAVEL WITH SAND	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1102
Sampled By:	GCL	**Depth:**	1.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.2	24.1	26.2	-	-	
Tin No	**32**	**64**	**53**	**28**	**23**	**16**	**49**	**12**	
Mass of Wet Soil (g)	33.73	28.94	31.31	36.14	42.28	33.29	18.17	20.87	
Mass of Dry Soil (g)	23.74	20.07	21.38	24.32	28.09	21.86	14.31	16.41	
Mass of Moisture (g)	9.99	8.87	9.93	11.82	14.19	11.43	3.86	4.46	
Moisture Content (%)	42.1	44.2	46.4	48.6	50.5	52.3	27.0	27.2	27.1



PLASTIC LIMIT
PL = 27.1 %

LIQUID LIMIT
LL = 46.2 %

Proportion Passing 425 µm BS Sieve
= 37.4 %

PLASTICITY INDEX
PI = 19.1 %

PLASTIC MODULUS
PM = 715

LINEAR SHRINKAGE
LS = 9.3 %

GROUP SYMBOL (USC SYSTEM)
GM

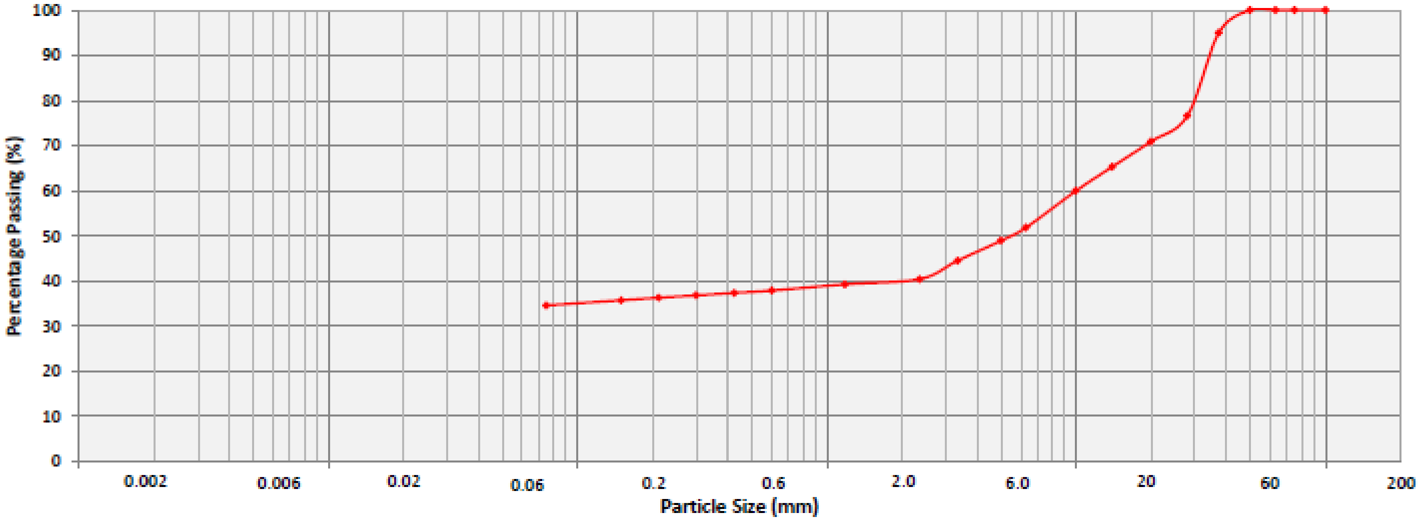
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN24

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 24	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.0M	**SAMPLE No.:**	1102



CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

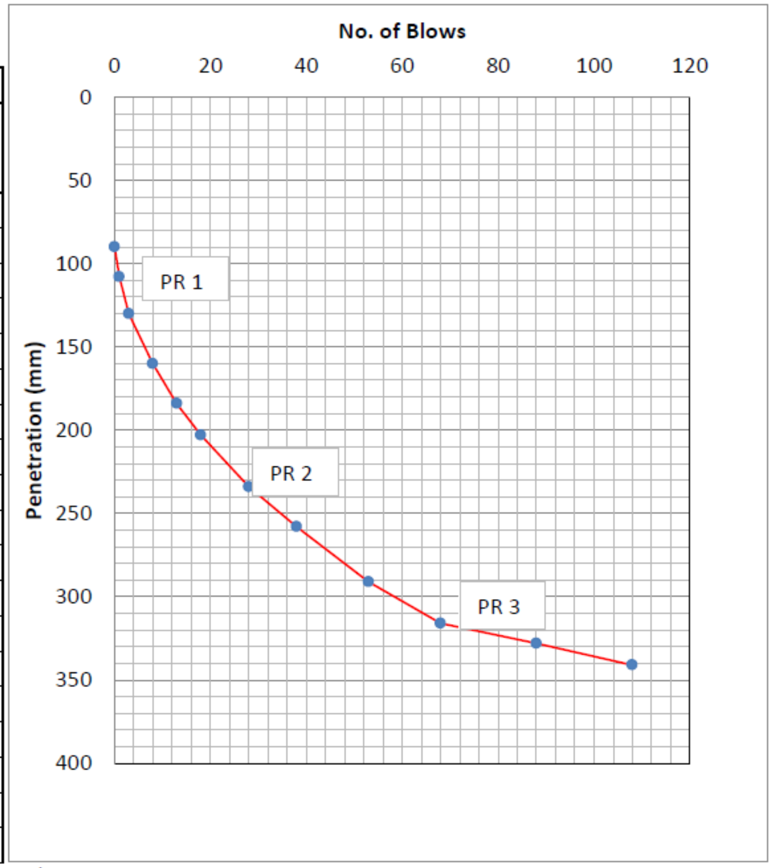
MN24

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Location**	MN 24	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.0M	**Sample No.**	1102

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	90	
1	1	1	108	18.0
2	2	3	130	11.0
3	5	8	160	6.0
4	5	13	184	4.8
5	5	18	203	3.8
6	10	28	234	3.1
7	10	38	258	2.4
8	15	53	291	2.2
9	15	68	316	1.7
10	20	88	328	0.6
11	20	108	341	0.7



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	14	14.6	
PR 2	4.5	62.5	
PR 3	1.1	379.3	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN24

CALCULATION OF SAFE BEARING CAPACITY: TP MN 24					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND			**Sample No.:**	1102

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	29	$\gamma\ (kg/m^3)$ =	1980
ø (°) =	22	$\gamma\ (kN/m^3)$ =	19.43

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	$q_f = (1.3 \times 29 \times 16.88) + (0.8 \times 19.43 \times 1.0 \times 7.82) + (0.4 \times 19.43 \times 1.0 \times 4.07)$	**790 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 790/3.0$	**263 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

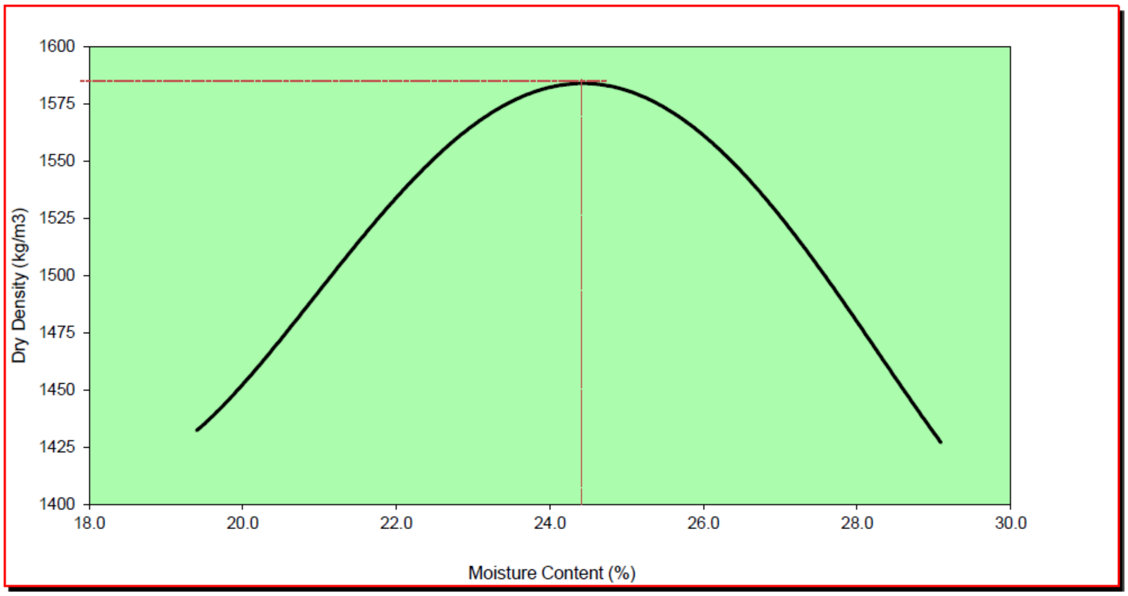
BS 1377 – 4: 1990

MN24

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1102
Material Description:	SILTY GRAVEL WITH SAND	**Sample Ref:**	TP MN 24	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5705	5841	5949	5969	5922	5837
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1710	1846	1954	1974	1927	1842
Bulk Density (Kgs/m^3)	**1710**	**1846**	**1954**	**1974**	**1927**	**1842**
Tin No.	G52	G22	G43	G07	G18	G25
Weight Wet Soil	276.1	275.9	304.7	300.6	266.9	282.2
Weight of Dry Soil	231.2	226.9	246.3	239.5	209.7	218.6
Weight of Water	44.9	49.0	58.4	61.1	57.2	63.6
Moisture Content (%)	**19.4**	**21.6**	**23.7**	**25.5**	**27.3**	**29.1**
Dry Density (Kgs/m^3)	**1432**	**1518**	**1579**	**1573**	**1514**	**1427**



Maximum Dry Density (Kg/m^3): 1592	**Optimum Moisture Content (%):** 24.4%

Tested By: STEVE	**Date Reported:** 25.01.2013	**Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN24	
Depth	1.0m
pH	8.08
Chloride(%) mg/l	0.39
Sulphate (mg/l)	0.001

TP24-25A	
Depth	0.8m
pH	8.11
Chloride(%) mg/l	0.011
Sulphate (mg/l)	0.042

ANGLE POINT 24 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 24		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.2	Dark Grey Silty SAND
	1.0	Brown Lateritic GRAVEL
	2.0	

TEST POINT 24-25 LOG

JOB REF:		GCL/NCE_356/03
MN24 (TP24-25) MN25		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.3	Grey ROCK Boulder and cobble fractions

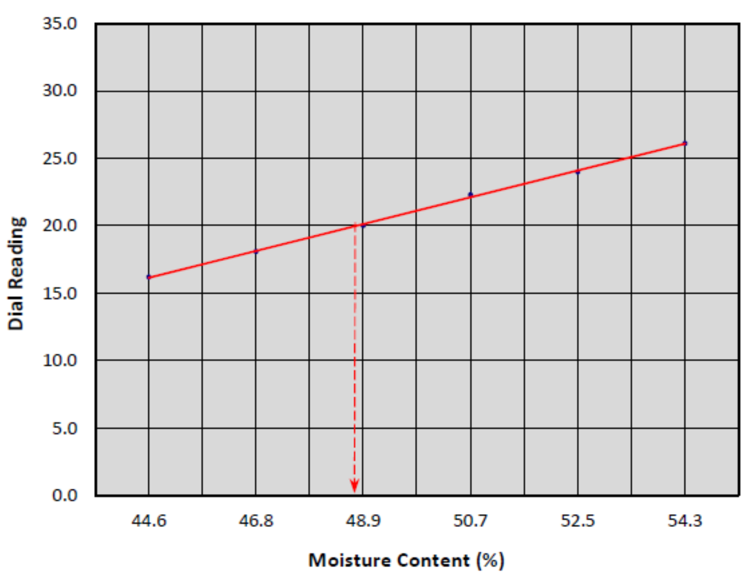
SEGMENT 24

ATTERBERG LIMITS BS 1377 - 2: 1990

MN25

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY GRAVEL WITH SAND	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1103
Sampled By:	GCL	**Depth:**	1.6M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.3	24.0	26.1	-	-	
Tin No	**6**	**16**	**72**	**53**	**57**	**66**	**71**	**5**	
Mass of Wet Soil (g)	36.68	40.56	36.96	44.79	46.36	57.49	30.50	28.54	
Mass of Dry Soil (g)	25.37	27.63	24.83	29.72	30.40	37.26	22.36	20.89	
Mass of Moisture (g)	11.31	12.93	12.13	15.07	15.96	20.23	8.14	7.65	
Moisture Content (%)	44.6	46.8	48.9	50.7	52.5	54.3	36.4	36.6	36.5



PLASTIC LIMIT
PL = 36.5 %

LIQUID LIMIT
LL = 48.7 %

Proportion Passing 425 µm BS Sieve
= 27.9 %

PLASTICITY INDEX
PI = 12.2 %

PLASTIC MODULUS
PM = 340

LINEAR SHRINKAGE
LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)
GM

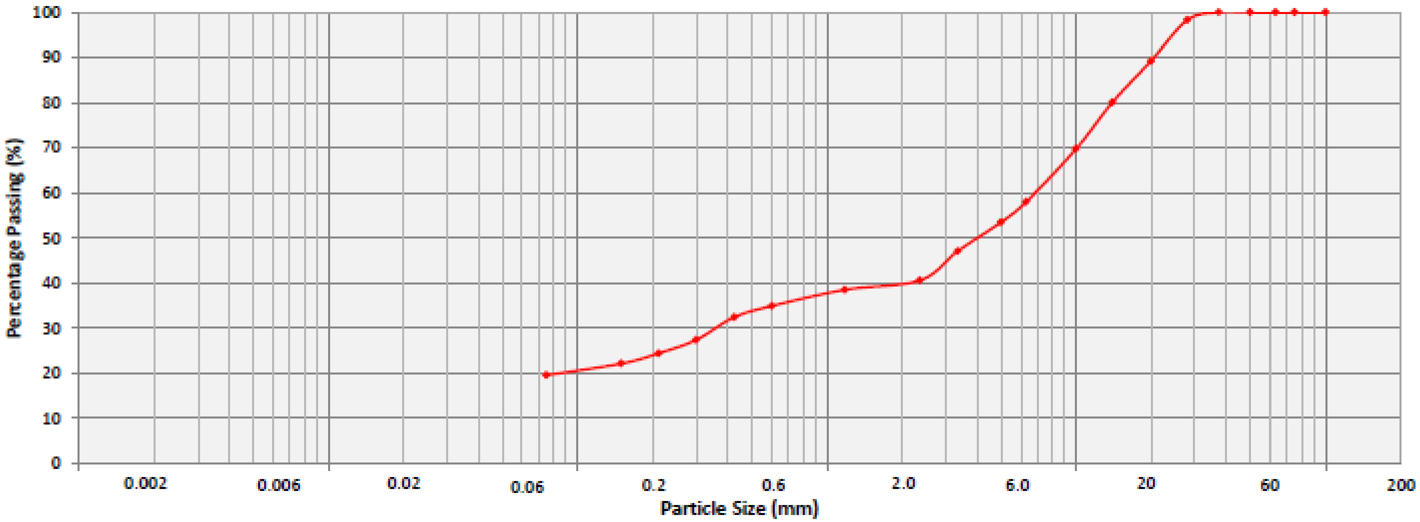
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN25

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 25	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.6M	**SAMPLE No.:**	1103



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

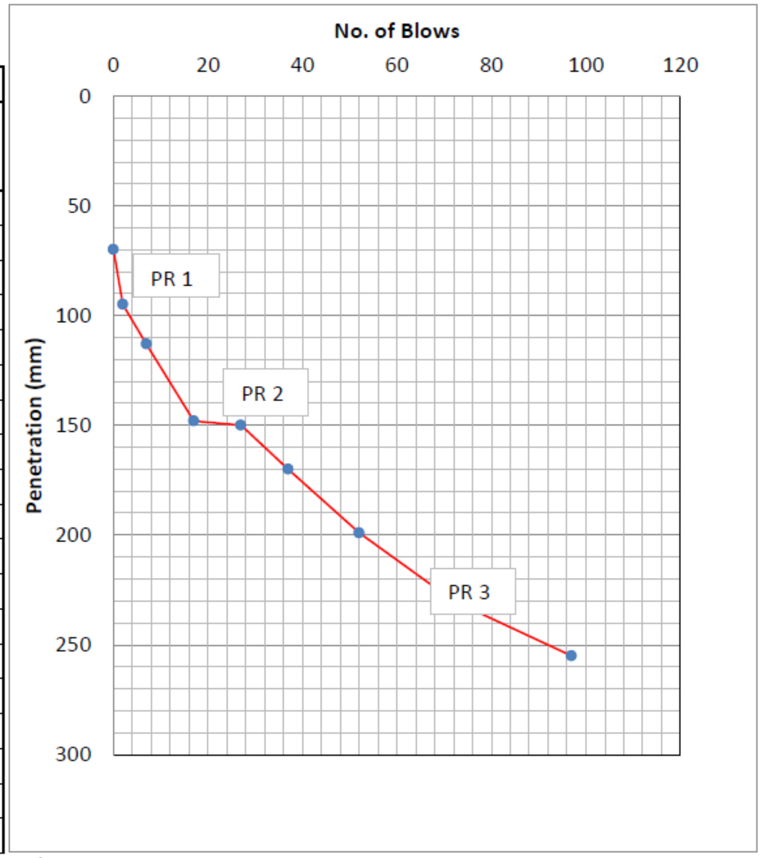
MN25

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 25	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.6M	**Sample No.**	1103

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	70	
1	2	2	95	12.5
2	5	7	113	3.6
3	10	17	148	3.5
4	10	27	150	0.2
5	10	37	170	2.0
6	15	52	199	1.9
7	20	72	230	1.6
8	25	97	255	1.0



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	12.5	16.9	
PR 2	3.4	89.5	
PR 3	1.5	255.0	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN25

CALCULATION OF SAFE BEARING CAPACITY: TP MN 25					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND			**Sample No.:**	1103

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	28	$\gamma (kg/m^3)$ =	2054
$\phi (^\circ)$ =	22	$\gamma (kN/m^3)$ =	20.15

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	$q_f = (1.3 \times 28 \times 16.88) + (0.8 \times 20.15 \times 1.6 \times 7.82) + (0.4 \times 20.15 \times 1.0 \times 4.07)$	**849 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 849/3.0$	**283 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

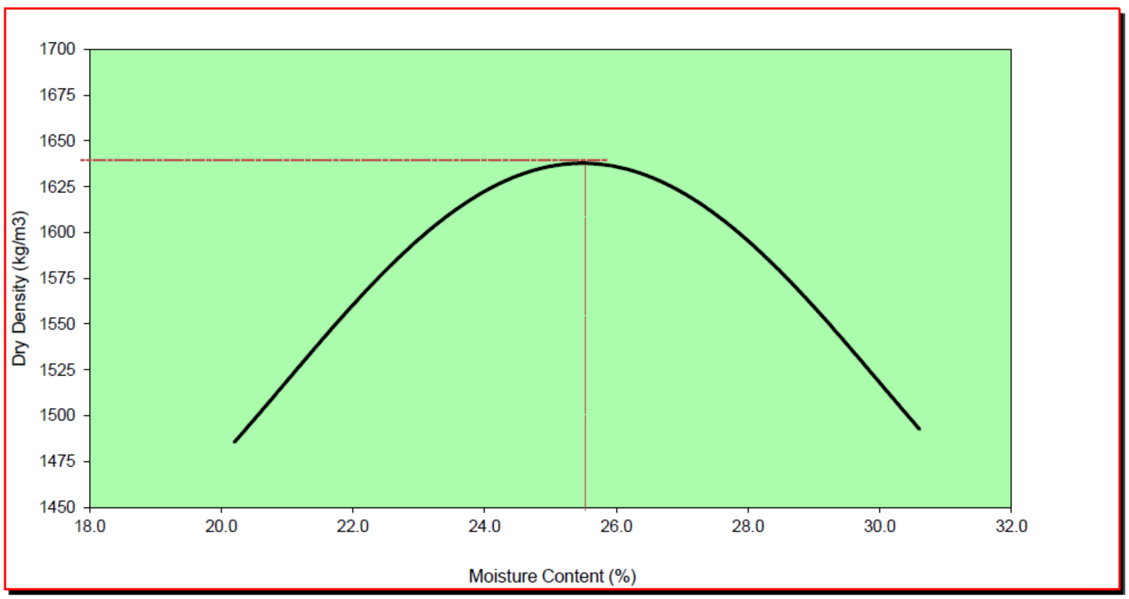
BS 1377 – 4: 1990

MN25

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.6M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1103
Material Description:	SILTY GRAVEL WITH SAND	**Sample Ref:**	TP MN 25	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5780	5908	6013	6063	6023	5945
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1785	1913	2018	2068	2028	1950
Bulk Density (Kgs/m^3)	**1785**	**1913**	**2018**	**2068**	**2028**	**1950**
Tin No.	G12	G49	G19	G46	G34	G25
Weight Wet Soil	258.1	282.8	285.1	306.5	322.2	320.9
Weight of Dry Soil	214.7	231.6	229.4	242.3	250.9	245.7
Weight of Water	43.4	51.2	55.7	64.2	71.3	75.2
Moisture Content (%)	**20.2**	**22.1**	**24.3**	**26.5**	**28.4**	**30.6**
Dry Density (Kgs/m^3)	**1485**	**1567**	**1624**	**1635**	**1579**	**1493**



Maximum Dry Density (Kg/m^3): 1638 **Optimum Moisture Content (%):** 25.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN25	
Depth	1.6m
pH	8.33
Chloride(%) mg/l	0.69
Sulphate (mg/l)	0.002

ANGLE POINT 25 LOG

PROJECT:		NANYUKI-ISIOLO-MERU POWERLINE	
SITE:		NANYUKI-ISIOLO-MERU	
	MN 25		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 – 0.5		0.6	Dark Brown Silty SAND
1 – 1.5		1.6	Dark Brown Lateritic GRAVEL
2			
2.5			

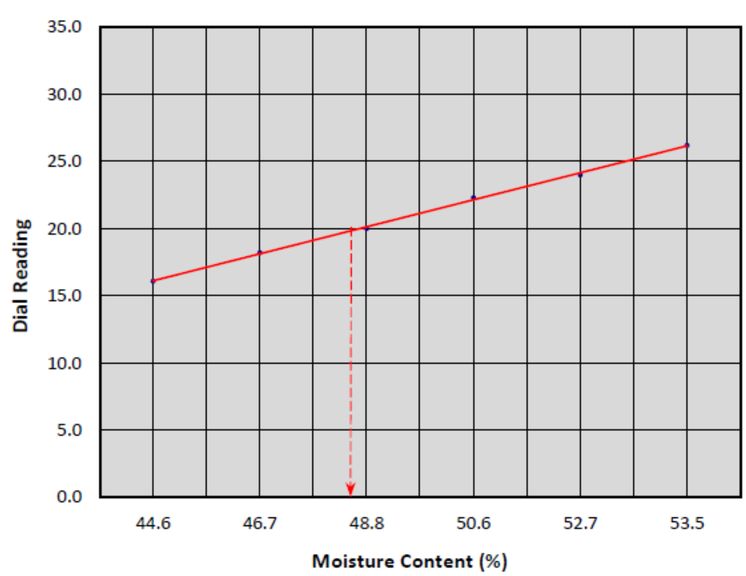
SEGMENT 25

ATTERBERG LIMITS BS 1377 - 2: 1990

MN26

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1104
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.0	22.3	24.0	26.2	-	-	
Tin No	9	16	54	45	63	33	37	39	
Mass of Wet Soil (g)	33.85	38.90	46.14	54.83	44.85	34.86	13.35	15.49	
Mass of Dry Soil (g)	23.41	26.52	31.00	36.41	29.37	22.71	10.63	12.31	
Mass of Moisture (g)	10.44	12.38	15.14	18.42	15.48	12.15	2.72	3.18	
Moisture Content (%)	44.6	46.7	48.8	50.6	52.7	53.5	25.6	25.8	25.7



PLASTIC LIMIT
PL = 25.7 %

LIQUID LIMIT
LL = 48.4 %

Proportion Passing 425 µm BS Sieve
= 32.4 %

PLASTICITY INDEX
PI = 22.7 %

PLASTIC MODULUS
PM = 735

LINEAR SHRINKAGE
LS = 10.7 %

GROUP SYMBOL (USC SYSTEM)
SC

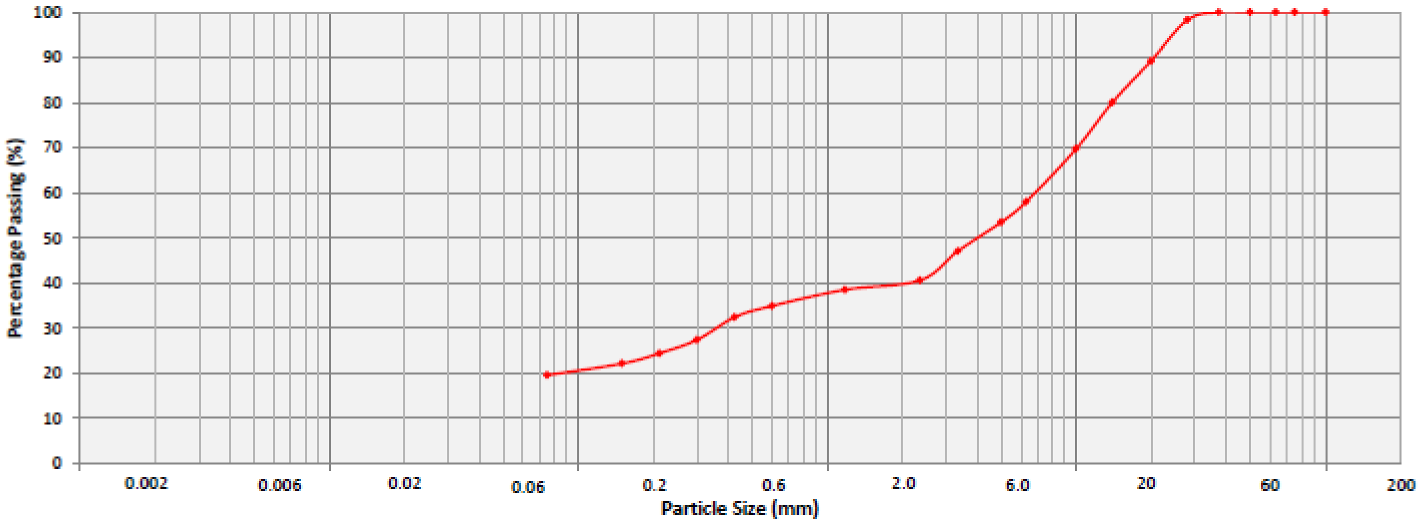
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN26

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 26	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	JOB REF:	GCL/TGA-342/12	DATE TESTED:	17.12.2012
SAMPLED BY:	GCL	DEPTH:	2.0M	SAMPLE No.:	1104



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

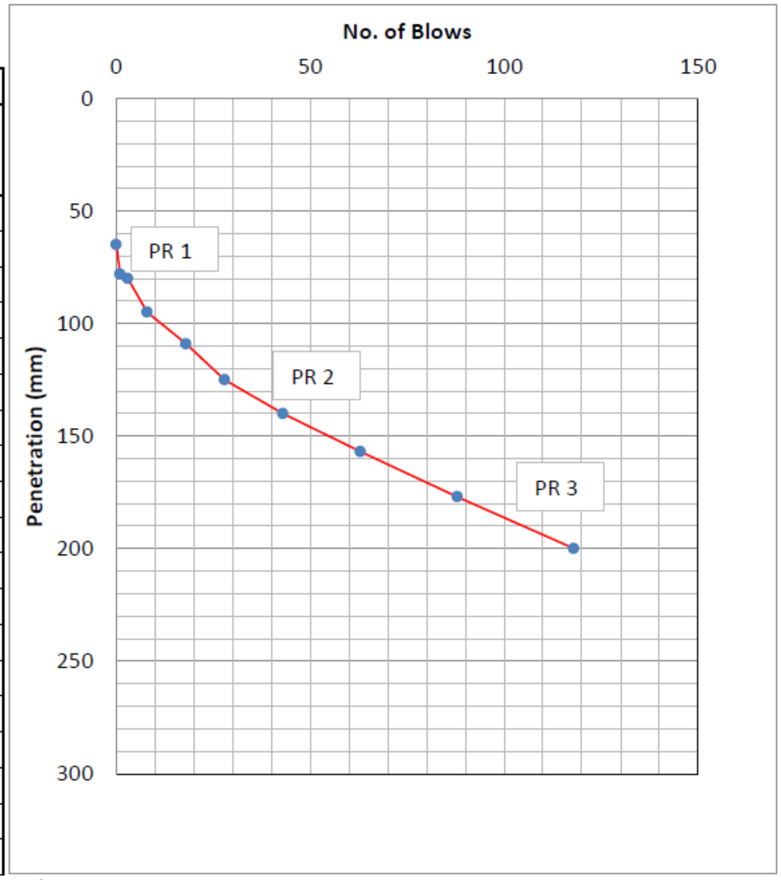
MN26

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 26	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1104

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	65	
1	1	1	78	13.0
2	2	3	80	1.0
3	5	8	95	3.0
4	10	18	109	1.4
5	10	28	125	1.6
6	15	43	140	1.0
7	20	63	157	0.9
8	25	88	177	0.8
9	30	118	200	0.8



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	13	16.1	
PR 2	1.5	255.0	
PR 3	0.8	570.2	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN26

CALCULATION OF SAFE BEARING CAPACITY: TP MN 26					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1104

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	28	$\gamma\,(kg/m^3)$ =	2063
$\phi\,(^\circ)$ =	23	$\gamma\,(kN/m^3)$ =	20.23

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 20.23 x 2.0 x 8.66) + (0.4 x 20.23 x 1.0 x 4.82)	**976 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 976/3.0	**325 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

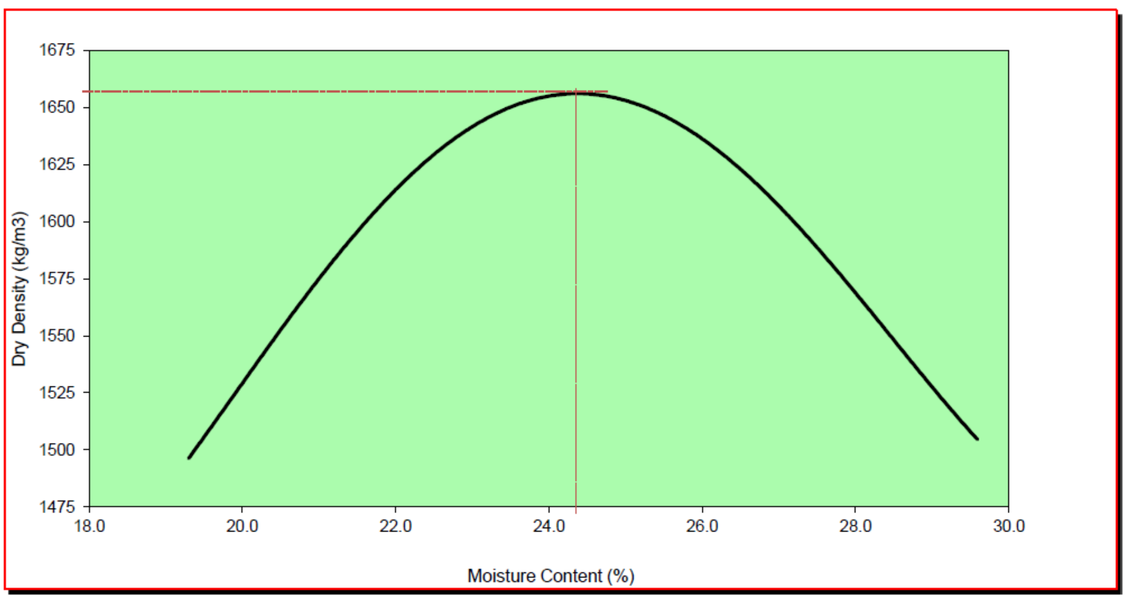
BS 1377 – 4: 1990

MN26

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1104
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 26	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5780	5908	6013	6063	6023	5945
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1785	1913	2018	2068	2028	1950
Bulk Density (Kgs/m^3)	**1785**	**1913**	**2018**	**2068**	**2028**	**1950**
Tin No.	G54	G43	G16	G07	G32	G51
Weight Wet Soil	262.6	280.7	298.9	271.4	295.2	323.2
Weight of Dry Soil	220.1	231.8	243.0	216.8	231.7	249.4
Weight of Water	42.5	48.9	55.9	54.6	63.5	73.8
Moisture Content (%)	**19.3**	**21.1**	**23.0**	**25.2**	**27.4**	**29.6**
Dry Density (Kgs/m^3)	**1496**	**1580**	**1641**	**1652**	**1592**	**1505**



Maximum Dry Density (Kg/m^3): 1658 **Optimum Moisture Content (%):** 24.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN26	
Depth	2.0m
pH	8.41
Chloride(%) mg/l	0.87
Sulphate (mg/l)	0.002

TP26-27A	
Depth	1.0m
pH	8.28
Chloride(%) mg/l	0.014
Sulphate (mg/l)	0.050

ANGLE POINT 26 LOG

JOB REF:		GCL/NCE_342/12
MN 26		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.9	Reddish Brown SILT with Sand
	2.0	Brown Lateritic GRAVEL

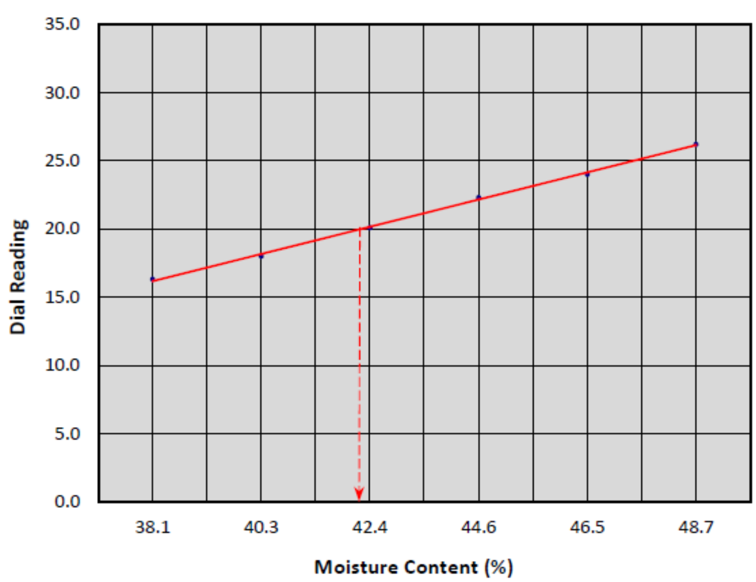
SEGMENT 26

ATTERBERG LIMITS BS 1377 - 2: 1990

MN27

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1105
Sampled By:	GCL	**Depth:**	1.6M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.3	24.0	26.2	-	-	
Tin No	**28**	**59**	**63**	**14**	**74**	**25**	**1**	**32**	
Mass of Wet Soil (g)	32.40	38.15	41.72	49.63	39.12	46.20	16.75	20.09	
Mass of Dry Soil (g)	23.46	27.19	29.30	34.32	26.70	31.07	13.40	16.03	
Mass of Moisture (g)	8.94	10.96	12.42	15.31	12.42	15.13	3.35	4.06	
Moisture Content (%)	38.1	40.3	42.4	44.6	46.5	48.7	25.0	25.3	25.2



PLASTIC LIMIT
PL = 25.2 %

LIQUID LIMIT
LL = 42.2

Proportion Passing 425 µm BS Sieve
= 99.4 %

PLASTICITY INDEX
PI = 17.0 %

PLASTIC MODULUS
PM = 1693

LINEAR SHRINKAGE
LS = 7.9 %

GROUP SYMBOL (USC SYSTEM)
ML

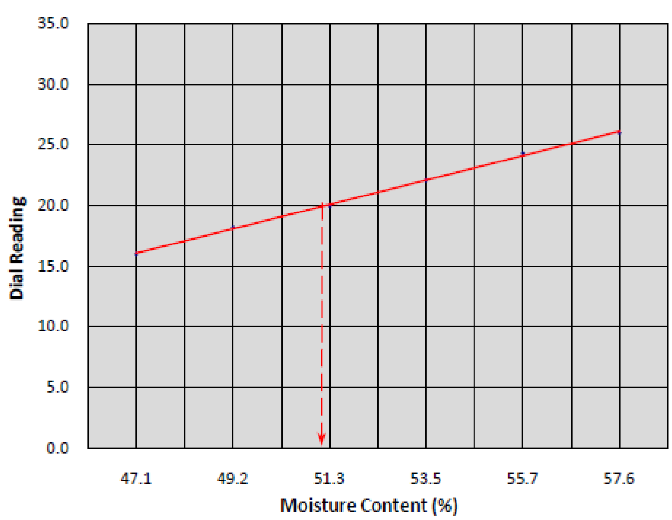
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP27-28

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN27(TP27-28)MN28	**Date Received:**	06.03.2013
Material Description:	Elastic SILT	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1207
Sampled By:	GEO CON	**Depth:**	1.9M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.2	20.0	22.1	24.3	26.0	-	-	
Tin No	**6**	**16**	**72**	**53**	**57**	**66**	**71**	**5**	
Mass of Wet Soil (g)	41.95	40.16	39.13	46.69	43.06	52.76	33.90	28.89	
Mass of Dry Soil (g)	28.52	26.92	25.86	30.42	27.65	33.48	26.00	22.14	
Mass of Moisture (g)	13.43	13.24	13.27	16.27	15.41	19.28	7.90	6.75	
Moisture Content (%)	47.1	49.2	51.3	53.5	55.7	57.6	30.4	30.5	30.4



PLASTIC LIMIT

PL = 30.4 %

LIQUID LIMIT

LL = 51.1 %

Proportion Passing 425 µm BS Sieve

= 97.1 %

PLASTICITY INDEX

PI = 20.7 %

PLASTIC MODULUS

PM = 2006

LINEAR SHRINKAGE

LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)

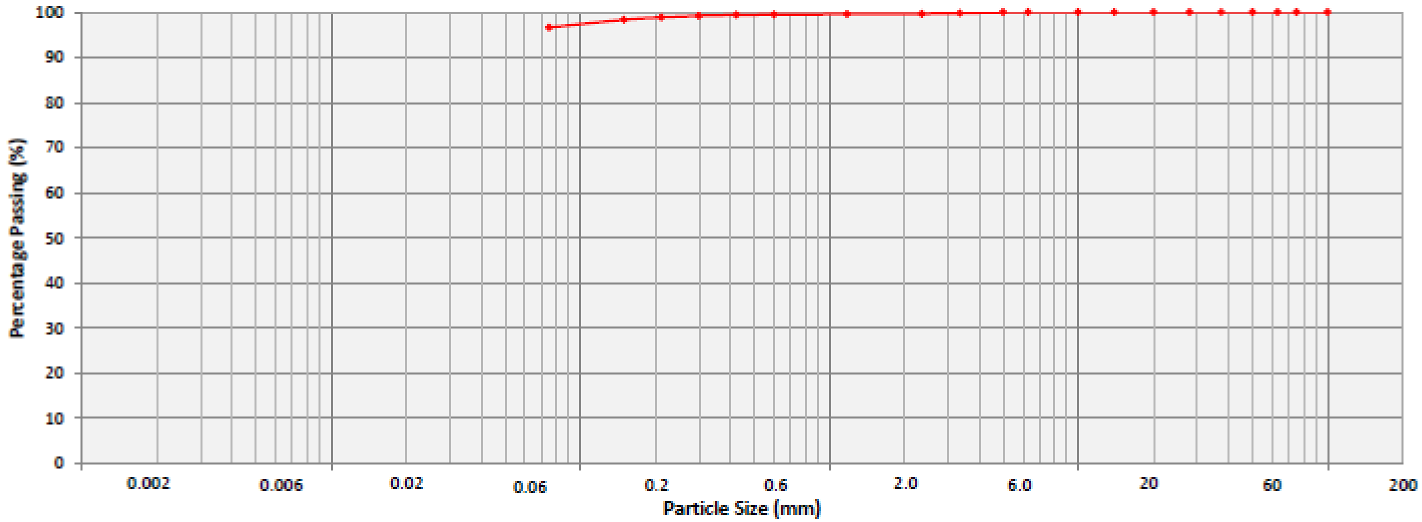
MH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN27

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 27	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY SILT	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.6M	**SAMPLE No.:**	1105



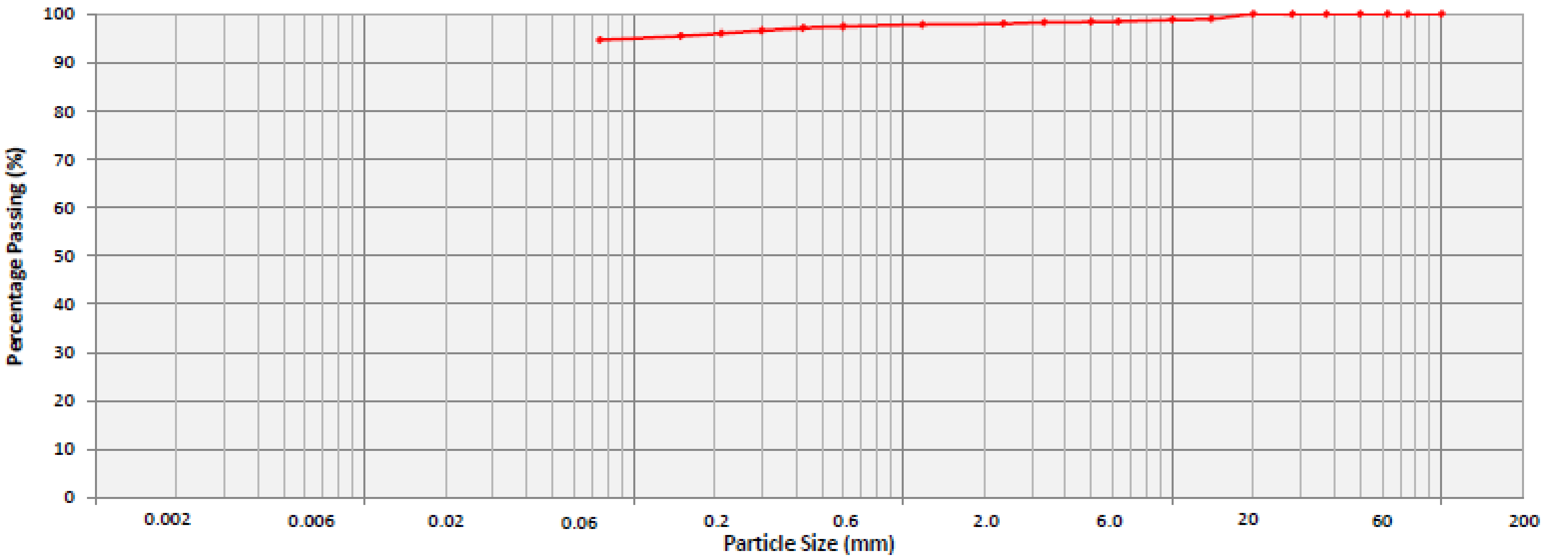
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
		SILT			**SAND**			**GRAVEL**			

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP27-28

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN27(TP27-28)MN28	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Elastic SILT	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1207



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

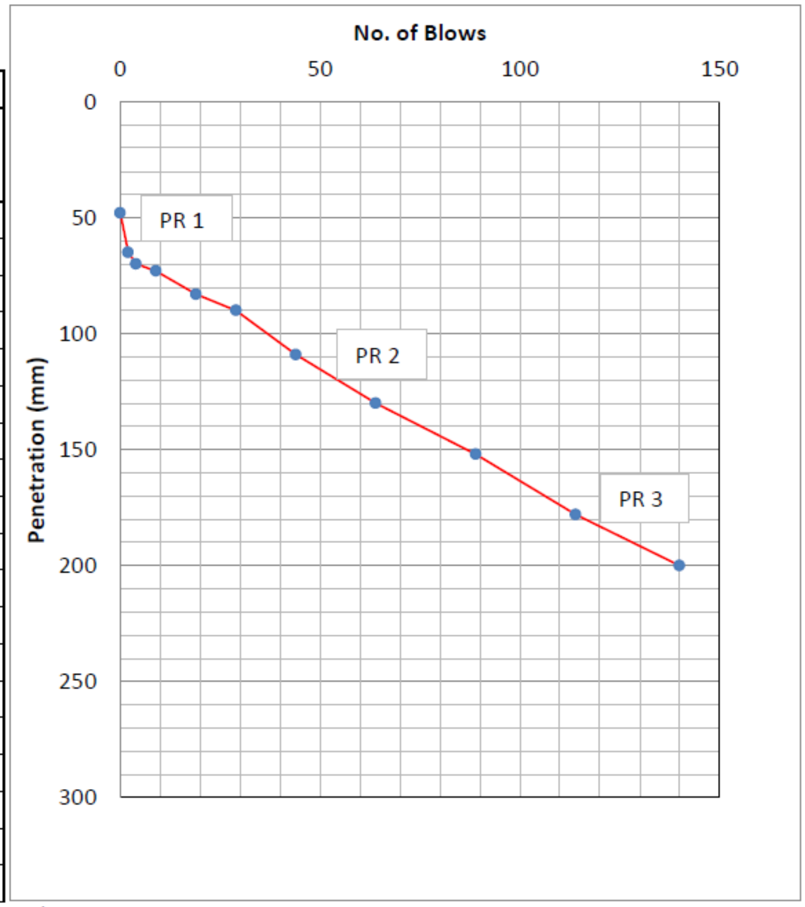
MN27

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Location**	MN 27	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.6M	**Sample No.**	1105

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	48	
1	2	2	65	8.5
2	2	4	70	2.5
3	5	9	73	0.6
4	10	19	83	1.0
5	10	29	90	0.7
6	15	44	109	1.3
7	20	64	130	1.1
8	25	89	152	0.9
9	25	114	178	1.0
10	26	140	200	0.8



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	8.5	27.7	
PR 2	1	428.5	
PR 3	0.8	570.2	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN27

CALCULATION OF SAFE BEARING CAPACITY: TP MN 27					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY SILT			**Sample No.:**	1105

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2) =$	22	$\gamma\,(kg/m^3) =$	1766
$\phi\,(^\circ) =$	18	$\gamma\,(kN/m^3) =$	17.32

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 13.10	
	$N_q =$ 5.26	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 2.00	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	$q_f = (1.3 \times 22 \times 13.10) + (0.8 \times 17.32 \times 1.6 \times 5.26) + (0.4 \times 17.32 \times 1.0 \times 2.00)$	**505 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 505/3.0$	**168 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP27-28

CALCULATION OF SAFE BEARING CAPACITY: TMN27 (TP27-28) MN28					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	ELASTIC SILT			Sample No.:	1207

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C (kN/m^2)$ =	28	$\gamma (kg/m^3)$ =	2063
ϕ (°) =	23	$\gamma (kN/m^3)$ =	20.23

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 20.23 x 2.0 x 8.66) + (0.4 x 20.23 x 1.0 x 4.82)	**976 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 976/3.0	**325 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

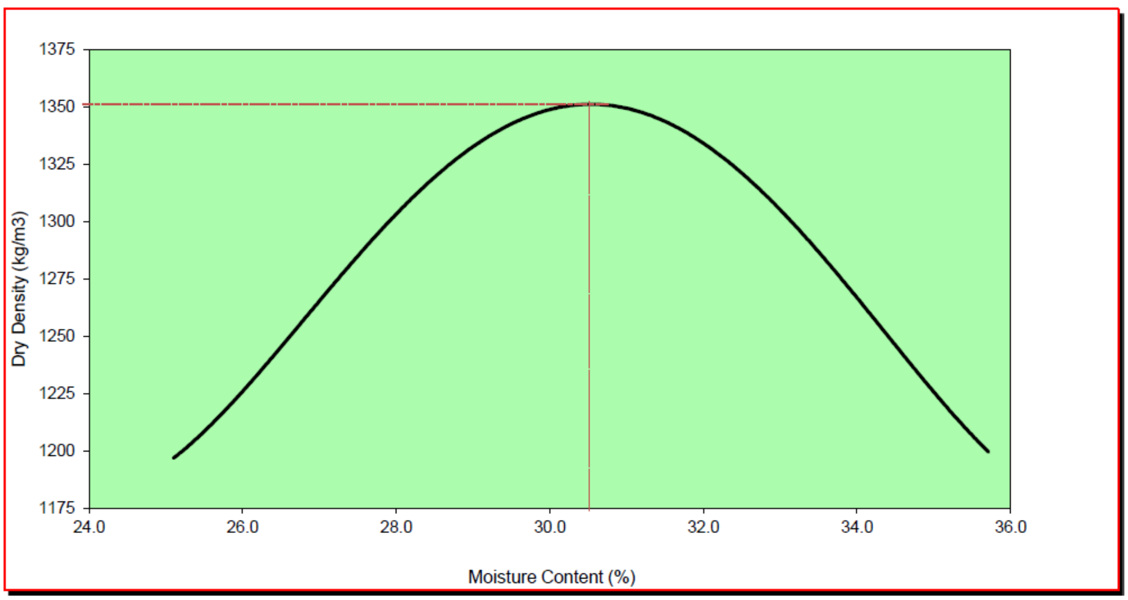
BS 1377 – 4: 1990

MN27

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.6M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1105
Material Description:	SANDY SILT	**Sample Ref:**	TP MN 27	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5492	5621	5722	5764	5712	5623
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1497	1626	1727	1769	1717	1628
Bulk Density (Kgs/m^3)	**1497**	**1626**	**1727**	**1769**	**1717**	**1628**
Tin No.	G18	G31	G36	G49	G41	G32
Weight Wet Soil	233.1	216.9	243.2	264.9	258.2	286.9
Weight of Dry Soil	186.3	170.4	188.2	201.6	193.4	211.4
Weight of Water	46.8	46.5	55.0	63.3	64.8	75.5
Moisture Content (%)	**25.1**	**27.3**	**29.2**	**31.4**	**33.5**	**35.7**
Dry Density (Kgs/m^3)	**1197**	**1277**	**1336**	**1346**	**1286**	**1200**



Maximum Dry Density (Kg/m^3): 1350 **Optimum Moisture Content (%):** 30.8%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN27	
Depth	1.6m
pH	8.32
Chloride(%) mg/l	0.53
Sulphate (mg/l)	0.001

TP27-28	
Depth	2.0m
pH	7.14
Chloride(%) mg/l	0.015
Sulphate (mg/l)	0.018

ANGLE POINT 27 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 27		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.9	Brownish Grey Silty SAND
	1.6	Dark Brown Lateritic GRAVEL
	2.0	

TEST POINT 27-28A LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN27 (TP27-28A) MN28		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5 1 1.5 2		2.0	Brown Elastic SILT
2.5			

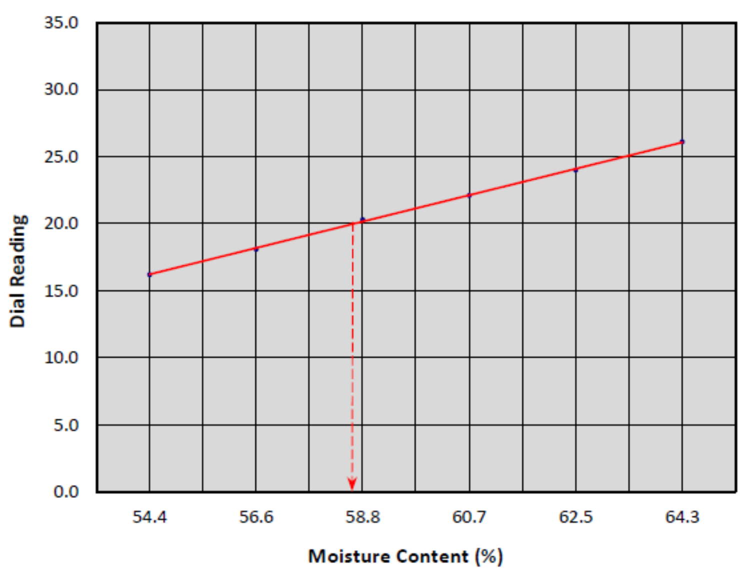
SEGMENT 27

ATTERBERG LIMITS BS 1377 - 2: 1990

MN28

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1106
Sampled By:	GCL	**Depth:**	1.2M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.3	22.1	24.0	26.1	-	-	
Tin No	**20**	**31**	**25**	**64**	**68**	**47**	**41**	**2**	
Mass of Wet Soil (g)	31.08	38.15	35.19	42.60	47.19	41.86	20.66	16.78	
Mass of Dry Soil (g)	20.13	24.36	22.16	26.51	29.04	25.48	15.77	12.82	
Mass of Moisture (g)	10.95	13.79	13.03	16.09	18.15	16.38	4.89	3.96	
Moisture Content (%)	54.4	56.6	58.8	60.7	62.5	64.3	31.0	30.9	30.9



PLASTIC LIMIT

PL = 30.9 %

LIQUID LIMIT

LL = 58.4

Proportion Passing 425 µm BS Sieve

= 40.5 %

PLASTICITY INDEX

PI = 27.5 %

PLASTIC MODULUS

PM = 1112

LINEAR SHRINKAGE

LS = 12.9 %

GROUP SYMBOL (USC SYSTEM)

SM

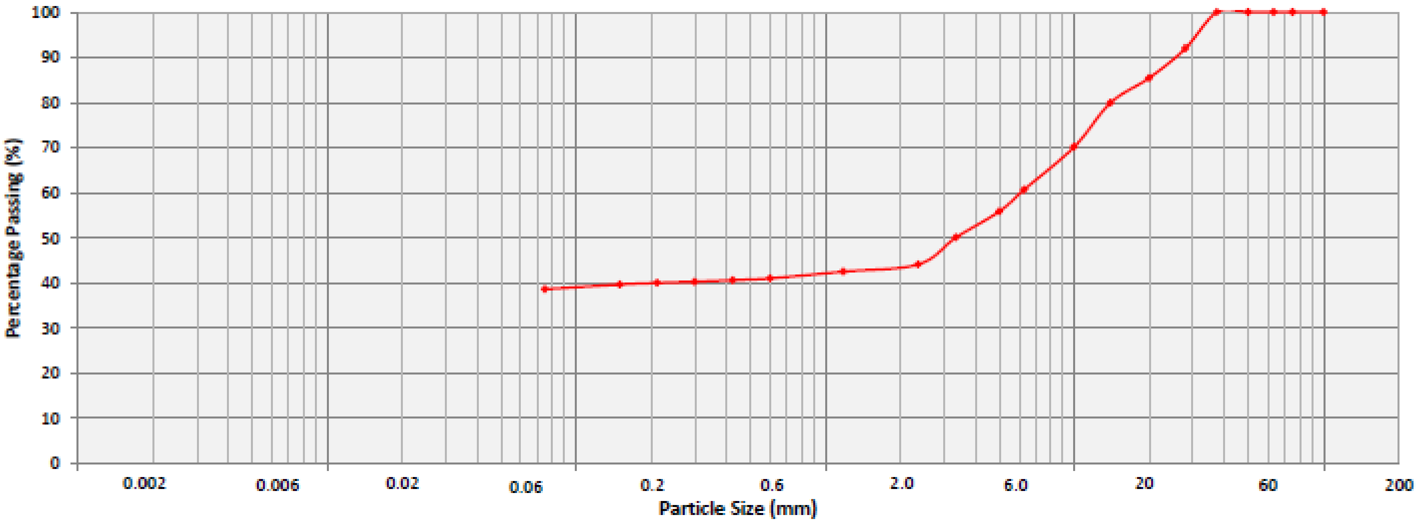
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN28

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 28	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL	JOB REF:	GCL/TGA-342/12	DATE TESTED:	17.12.2012
SAMPLED BY:	GCL	DEPTH:	1.2M	SAMPLE No.:	1106



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

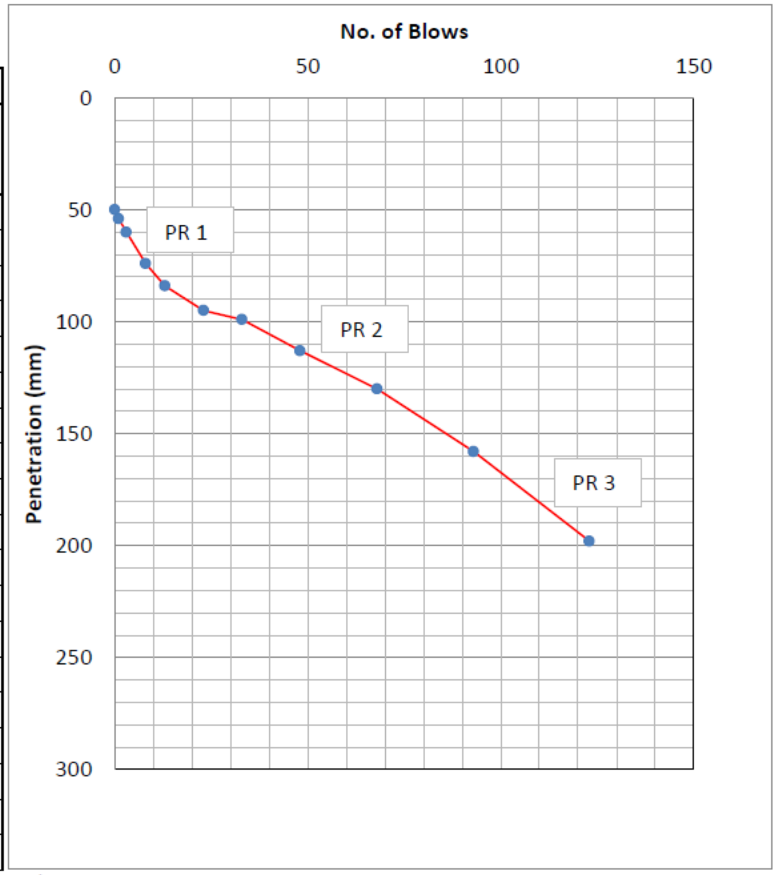
MN28

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 28	**Date of Test:**	06.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.2M	**Sample No.**	1106

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	54	4.0
2	2	3	60	3.0
3	5	8	74	2.8
4	5	13	84	2.0
5	10	23	95	1.1
6	10	33	99	0.4
7	15	48	113	0.9
8	20	68	130	0.9
9	25	93	158	1.1
10	30	123	198	1.3



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	3.5	86.2	
PR 2	2.4	139.7	
PR 3	0.6	824.1	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN28

CALCULATION OF SAFE BEARING CAPACITY: TP MN 28					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.2M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL			**Sample No.:**	1106

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
C(kN/m^2) =	27	γ (kg/m^3) =	1921
ø (˚) =	22	γ (kN/m^3) =	18.85

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.2	
	q_f = (1.3 x 27 x 16.88) + (0.8 x 18.85 x 1.2 x 7.82) + (0.4 x 18.85 x 1.0 x 4.07)	**765 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 765/3.0	**255 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

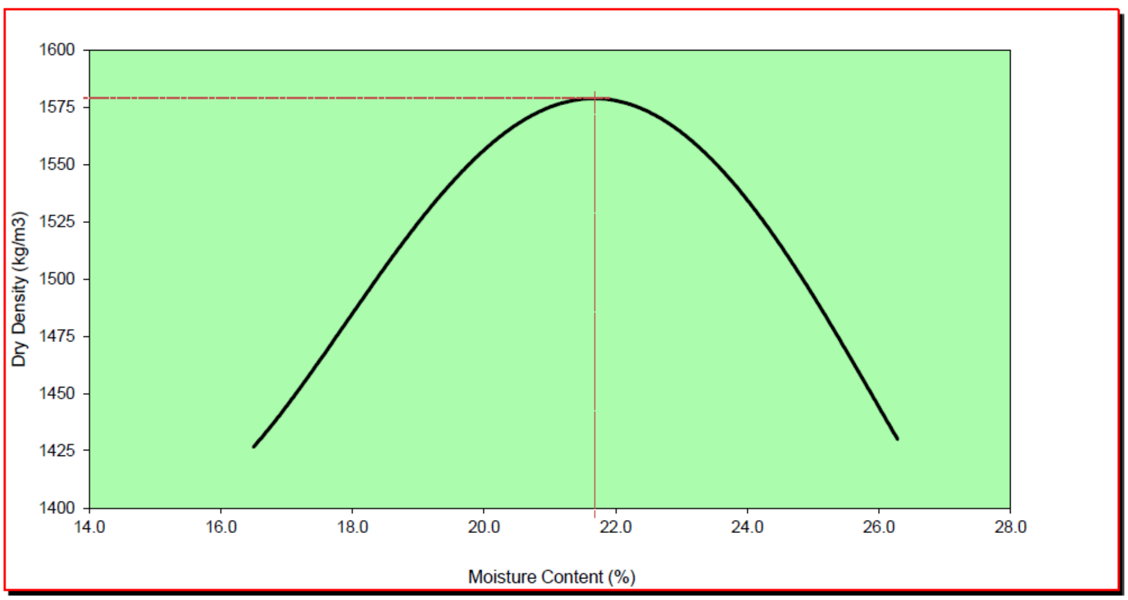
BS 1377 – 4: 1990

MN28

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.2M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1106
Material Description:	SILTY SAND WITH GRAVEL	**Sample Ref:**	TP MN 28	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5657	5791	5886	5923	5881	5801
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1662	1796	1891	1928	1886	1806
Bulk Density (Kgs/m^3)	**1662**	**1796**	**1891**	**1928**	**1886**	**1806**
Tin No.	G55	G11	G17	G23	G12	G34
Weight Wet Soil	303.4	259.1	286.5	274.8	312.1	304.6
Weight of Dry Soil	260.4	218.3	237.6	224.5	250.7	241.2
Weight of Water	43.0	40.8	48.9	50.3	61.4	63.4
Moisture Content (%)	**16.5**	**18.7**	**20.6**	**22.4**	**24.5**	**26.3**
Dry Density (Kgs/m^3)	**1427**	**1513**	**1568**	**1575**	**1515**	**1430**



Maximum Dry Density (Kg/m^3): 1580 **Optimum Moisture Content (%):** 21.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN28	
Depth	1.2m
pH	8.93
Chloride(%) mg/l	1.17
Sulphate (mg/l)	0.002

TP28-29	
Depth	1.5m
pH	7.73
Chloride(%) mg/l	0.009
Sulphate (mg/l)	0.015

ANGLE POINT 28 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 28		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
		0.6	Brown Silty SAND
		1.2	Brown Lateritic GRAVEL

TEST POINT 28-29 LOG

JOB REF:		GCL/NCE_356/03
MN28(TP28-29) MN29		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.4	Brown Clayey SAND with Gravel fractions
	1.5	Fragmented rock Boulders

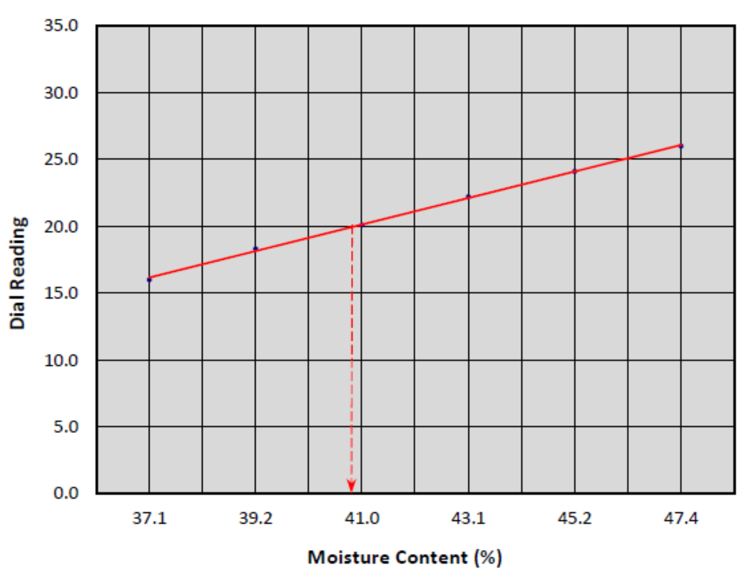
SEGMENT 28

ATTERBERG LIMITS BS 1377 - 2: 1990

MN29

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	GRAVEL WITH SILT AND SAND	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1107
Sampled By:	GCL	**Depth:**	1.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.1	22.2	24.1	26.0	-	-	
Tin No	**27**	**36**	**62**	**51**	**47**	**43**	**9**	**12**	
Mass of Wet Soil (g)	49.92	41.23	46.49	28.90	33.48	40.73	16.67	18.08	
Mass of Dry Soil (g)	36.41	29.62	32.97	20.19	23.06	27.63	13.20	14.30	
Mass of Moisture (g)	13.51	11.61	13.52	8.71	10.42	13.10	3.47	3.78	
Moisture Content (%)	37.1	39.2	41.0	43.1	45.2	47.4	26.3	26.4	26.4



PLASTIC LIMIT

PL = 26.4 %

LIQUID LIMIT

LL = 40.8

Proportion Passing 425 µm BS Sieve

= 20.4 %

PLASTICITY INDEX

PI = 14.4 %

PLASTIC MODULUS

PM = 295

LINEAR SHRINKAGE

LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)

GW-GM

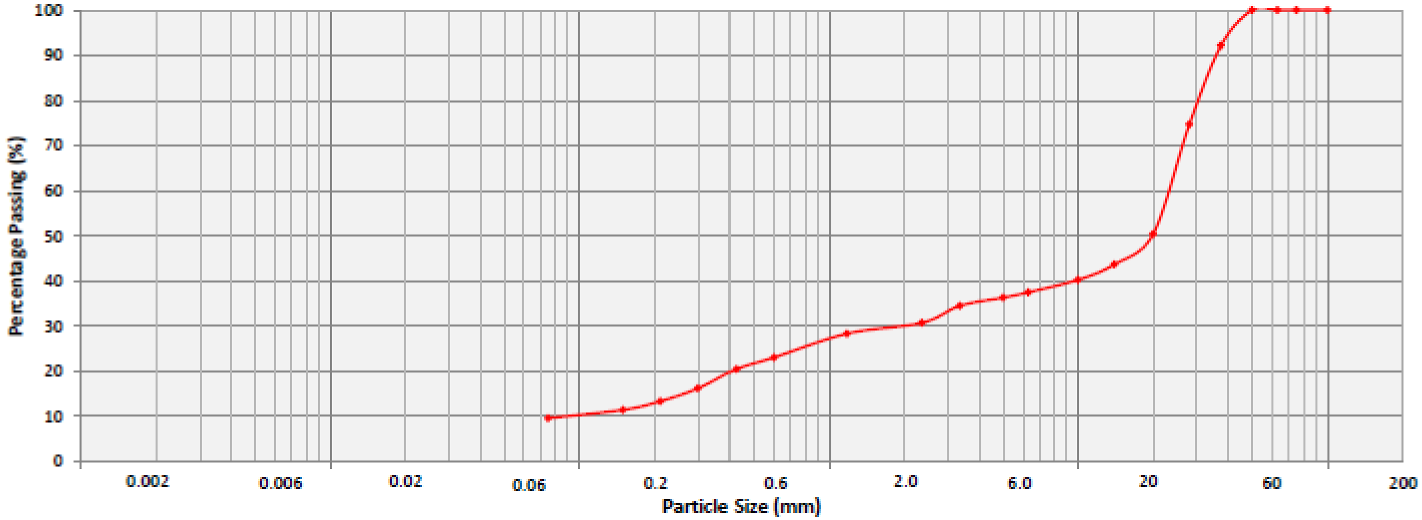
Tested By: LUCAS Date Reported: 19.12.2012 Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN29

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 29	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	WELL-GRADED GRAVEL WITH SILT AND SA	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.0M	**SAMPLE No.:**	1107



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

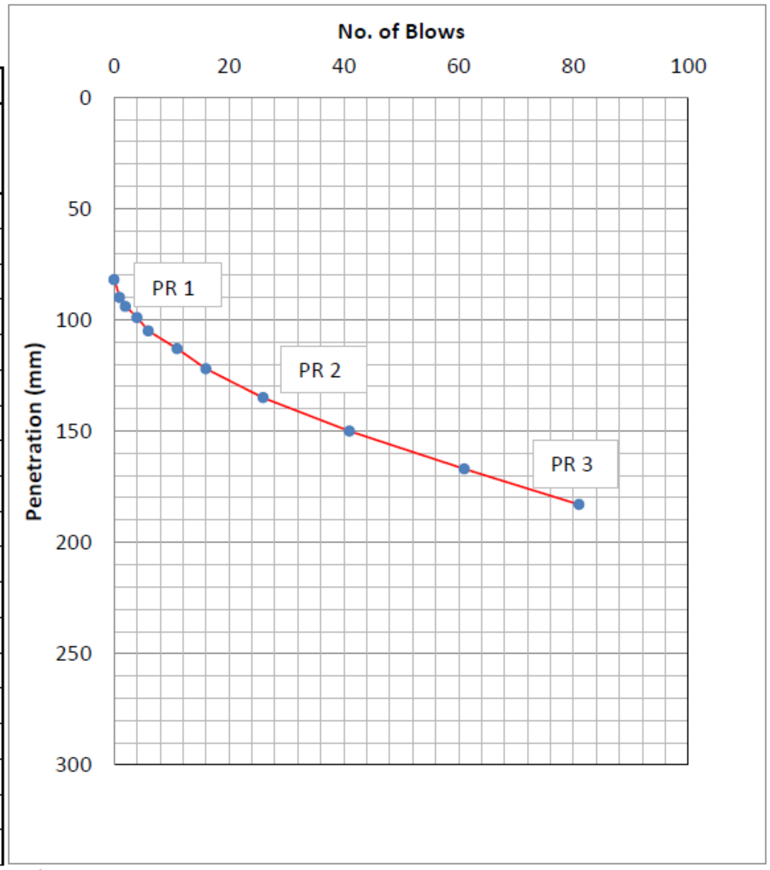
MN29

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 29	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.0M	**Sample No.**	1107

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	82	
1	1	1	90	8.0
2	1	2	94	4.0
3	2	4	99	2.5
4	2	6	105	3.0
5	5	11	113	1.6
6	5	16	122	1.8
7	10	26	135	1.3
8	15	41	150	1.0
9	20	61	167	0.9
10	20	81	183	0.8



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	6	43.2	
PR 2	1.8	202.0	
PR 3	0.85	527.6	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN29

CALCULATION OF SAFE BEARING CAPACITY: TP MN 29					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	GRAVEL WITH SILT AND SAND			**Sample No.:**	1107

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	31	$\gamma\,(kg/m^3)$ =	2036
$\phi\,(^\circ)$ =	25	$\gamma\,(kN/m^3)$ =	19.97

REFERENCE	CALCULATIONS	RESULTS
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	**Ultimate Bearing Capacity** $q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$ **Bearing Capacity Factors : Meyerhof's Analyses** N_c= 20.72 N_q = 10.66 N_γ = 6.77 **The Ultimate Bearing Capacity of a Pad Foundation** B(m)= 1.0 **Z (m)= 1.0** q_f = (1.3 x 31 x 20.72) + (0.8 x 19.97 x 1.0 x 10.66) + (0.4 x 19.97 x 1.0 x 6.77) **The Safe Bearing Capacity of the foundation is : (Fs = 3.0)** q_s = 1059/3.0	**1059 kN/m^2** **353 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

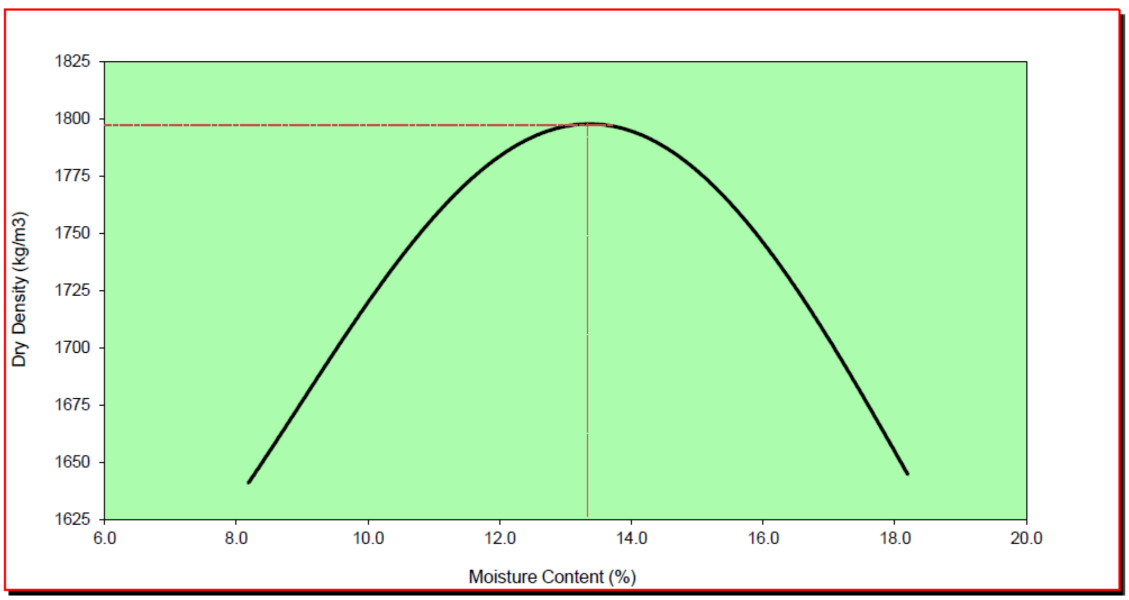
BS 1377 – 4: 1990

MN29

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1107
Material Description:	GRAVEL WITH SILT AND SAND	**Sample Ref:**	TP MN 29	**Date received:**	09.12.2012

Moisture Addition	**50cc**	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**
Mass of Mould+Base+Soil	5770	5894	5992	6043	6009	5939
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1775	1899	1997	2048	2014	1944
Bulk Density (Kgs/m^3)	**1775**	**1899**	**1997**	**2048**	**2014**	**1944**
Tin No.	G38	G11	G15	G24	G27	G43
Weight Wet Soil	253.8	274.5	307.9	307.6	285.6	271.5
Weight of Dry Soil	234.6	249.3	274.9	269.1	245.4	229.7
Weight of Water	19.2	25.2	33.0	38.5	40.2	41.8
Moisture Content (%)	**8.2**	**10.1**	**12.0**	**14.3**	**16.4**	**18.2**
Dry Density (Kgs/m^3)	**1641**	**1725**	**1783**	**1792**	**1731**	**1645**



Maximum Dry Density (Kg/m^3): 1795 **Optimum Moisture Content (%):** 13.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN29	
Depth	1.0m
pH	8.6
Chloride(%) mg/l	1.06
Sulphate (mg/l)	0.002

TP29-30A	
Depth	0.8m
pH	7.03
Chloride(%) mg/l	-
Sulphate (mg/l)	-

TP29-30B	
Depth	1.2m
pH	7.86
Chloride(%) mg/l	0.010
Sulphate (mg/l)	0.033

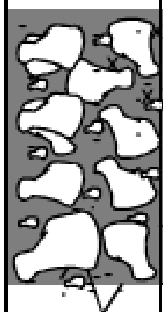
TP29-30C	
Depth	1.2m
pH	7.18
Chloride(%) mg/l	0.005
Sulphate (mg/l)	

ANGLE POINT 29 LOG

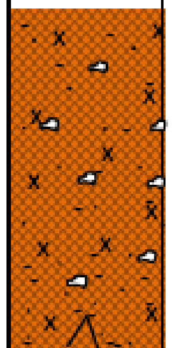
JOB REF:		GCL/NCE_342/12
MN 29		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.4	Brown Silty SAND
	1.2	Brown Lateritic GRAVEL

TEST POINT 29-30A, 29-30C LOG

DATE:	23 - 28.02.2013
LOGGED BY:	STEVE

MN29 (TP29-30A) MN30		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.8	Fragmented ROCK boulders and cobble fractions

DATE:	23 - 28.02.2013
LOGGED BY:	STEVE

MN29 (TP29-30C) MN30		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.0	Brown Silty SAND with Gravel
	1.2	Fragmented rock Boulders and cobble fractions

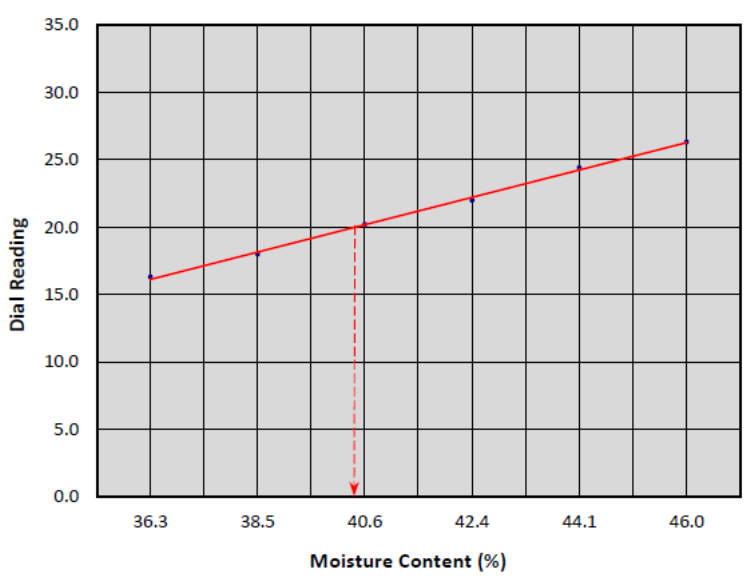
SEGMENT 29

ATTERBERG LIMITS BS 1377 - 2: 1990

MN30

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	CLAYEY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1108
Sampled By:	GCL	**Depth:**	1.6M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.2	22.0	24.4	26.3	-	-	
Tin No	**35**	**26**	**24**	**59**	**78**	**8**	**47**	**51**	
Mass of Wet Soil (g)	23.78	25.22	38.12	32.95	27.61	29.65	12.75	15.42	
Mass of Dry Soil (g)	17.45	18.21	27.11	23.14	19.16	20.31	10.45	12.62	
Mass of Moisture (g)	6.33	7.01	11.01	9.81	8.45	9.34	2.30	2.80	
Moisture Content (%)	36.3	38.5	40.6	42.4	44.1	46.0	22.0	22.2	22.1



PLASTIC LIMIT
PL = 22.1 %

LIQUID LIMIT
LL = 40.2

Proportion Passing 425 µm BS Sieve
= 17.8 %

PLASTICITY INDEX
PI = 18.1 %

PLASTIC MODULUS
PM = 322

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
CL

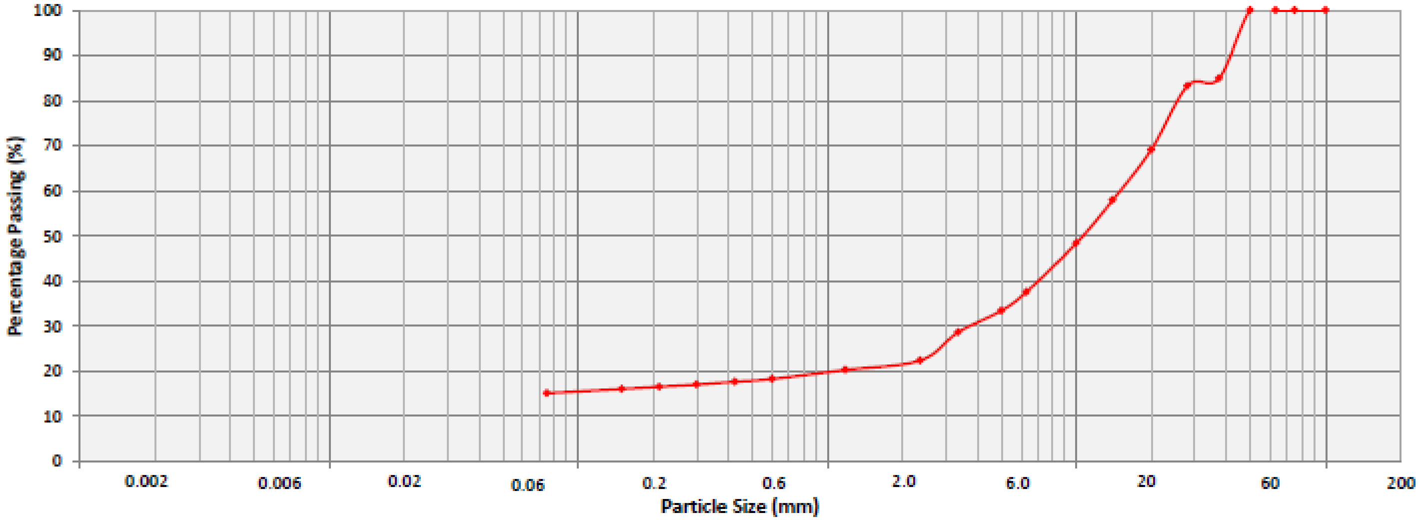
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN30

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 30	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	17.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.6M	**SAMPLE No.:**	1108



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

MN30

ANGLE POINT BEARING CAPACITY

MN30

CALCULATION OF SAFE BEARING CAPACITY: TP MN 30					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	CLAYEY SAND WITH GRAVEL			**Sample No.:**	1108

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	28	$\gamma\ (kg/m^3)$ =	1796
$\phi\ (^\circ)$ =	23	$\gamma\ (kN/m^3)$ =	17.62

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 17.62 x 1.6 x 8.66) + (0.4 x 17.62 x 1.0 x 4.82)	**886 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 886/3.0	**295 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

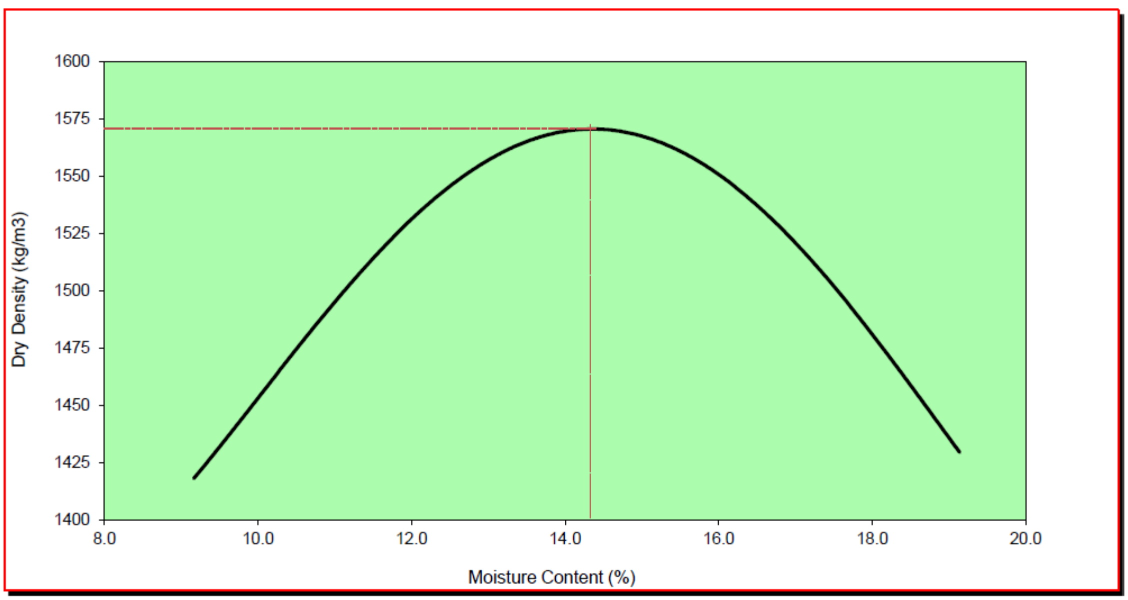
BS 1377 – 4: 1990

MN30

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.6M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1108
Material Description:	CLAYEY SAND WITH GRAVEL	**Sample Ref:**	TP MN 30	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5543	5658	5765	5798	5768	5698
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1548	1663	1770	1803	1773	1703
Bulk Density (Kgs/m^3)	**1548**	**1663**	**1770**	**1803**	**1773**	**1703**
Tin No.	G03	G21	G37	G42	G15	G39
Weight Wet Soil	262.0	251.0	324.0	258.0	204.0	249.0
Weight of Dry Soil	240.0	226.0	286.0	224.0	174.0	209.0
Weight of Water	22.0	25.0	38.0	34.0	30.0	40.0
Moisture Content (%)	**9.2**	**11.1**	**13.3**	**15.2**	**17.2**	**19.1**
Dry Density (Kgs/m^3)	**1418**	**1497**	**1562**	**1565**	**1512**	**1429**



Maximum Dry Density (Kg/m^3): 1570 **Optimum Moisture Content (%):** 14.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN30	
Depth	1.6m
pH	6.92
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP30-31A	
Depth	1.5m
pH	7.32
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.023

ANGLE POINT 30 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 30		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
		Brownish Red SILT with Sand
	1.6	Reddish Brown Lateritic GRAVEL

TEST POINT 30-31 LOG

JOB REF:	GCL/NCE_356/03

MN30 (TP30-31) MN31		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.4	Dark Grey CLAY (Black Cotton Soil)
	1.5	Fragmented rock Boulders

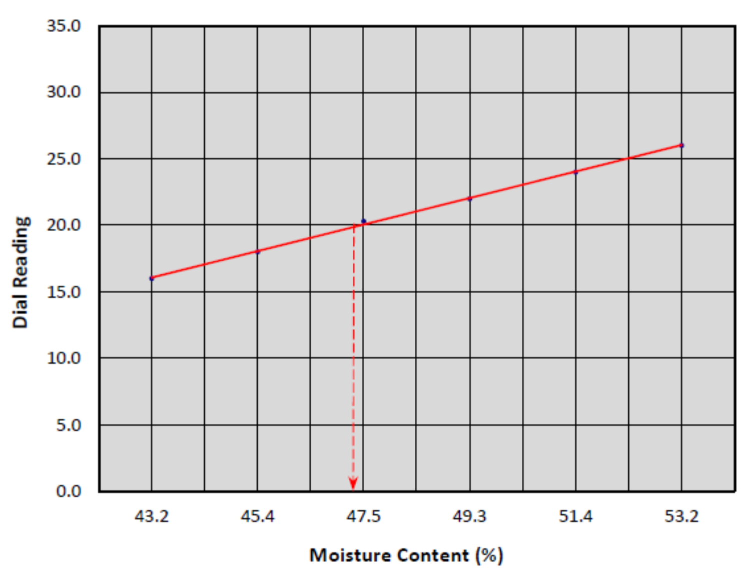
SEGMENT 30

ATTERBERG LIMITS BS 1377 - 2: 1990

MN31

Project:	PROPOSED POWERLI E	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1109
Sampled By:	GCL	**Depth:**	1.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.0	20.3	22.0	24.0	26.0	-	-	
Tin No	**57**	**43**	**45**	**61**	**21**	**23**	**45**	**56**	
Mass of Wet Soil (g)	33.05	39.46	32.41	29.94	33.93	40.32	20.79	26.43	
Mass of Dry Soil (g)	23.08	27.14	21.98	20.06	22.41	26.32	15.76	20.02	
Mass of Moisture (g)	9.97	12.32	10.43	9.88	11.52	14.00	5.03	6.41	
Moisture Content (%)	43.2	45.4	47.5	49.3	51.4	53.2	31.9	32.0	32.0



PLASTIC LIMIT
PL = 32.0 %

LIQUID LIMIT
LL = 47.1

Proportion Passing 425 µm BS Sieve
= 42.6 %

PLASTICITY INDEX
PI = 15.1 %

PLASTIC MODULUS
PM = 645

LINEAR SHRINKAGE
LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)
SM

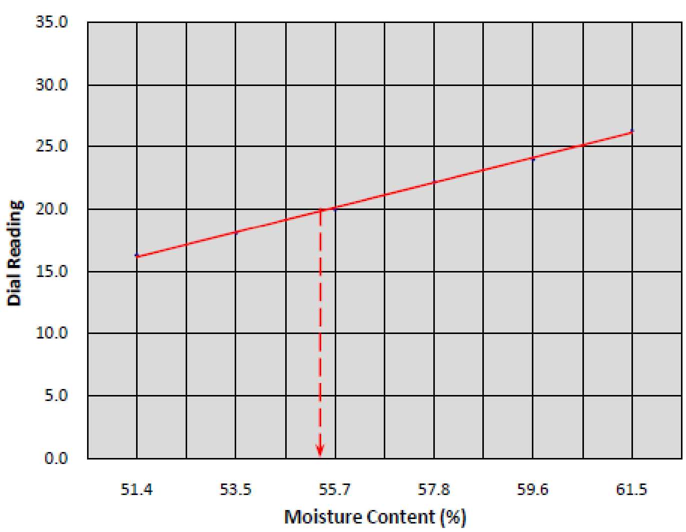
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP31-32A

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN31 (TP31-32A)MN32	**Date Received:**	06.03.2013
Material Description:	Elastic SILT	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1213
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.1	20.0	22.2	24.0	26.3	-	-	
Tin No	**42**	**15**	**26**	**35**	**17**	**84**	**37**	**29**	
Mass of Wet Soil (g)	64.54	68.69	49.88	60.25	64.33	55.72	23.50	28.23	
Mass of Dry Soil (g)	42.63	44.75	32.03	38.18	40.31	34.50	17.94	21.52	
Mass of Moisture (g)	21.91	23.94	17.85	22.07	24.02	21.22	5.56	6.71	
Moisture Content (%)	51.4	53.5	55.7	57.8	59.6	61.5	31.0	31.2	31.1



PLASTIC LIMIT

PL = 31.1 **%**

LIQUID LIMIT

LL = 55.3 **%**

Proportion Passing 425 µm BS Sieve

= 91.5 **%**

PLASTICITY INDEX

PI = 24.2 **%**

PLASTIC MODULUS

PM = 2216

LINEAR SHRINKAGE

LS = 11.4 **%**

GROUP SYMBOL (USC SYSTEM)

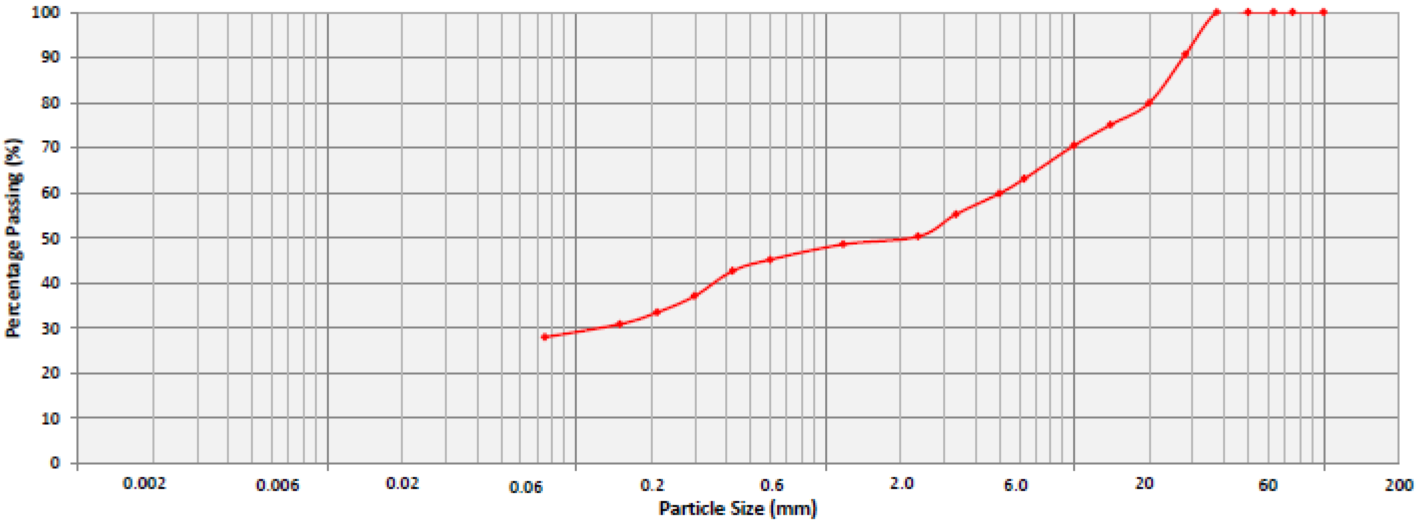
MH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN31

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 31	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.0M	**SAMPLE No.:**	1109



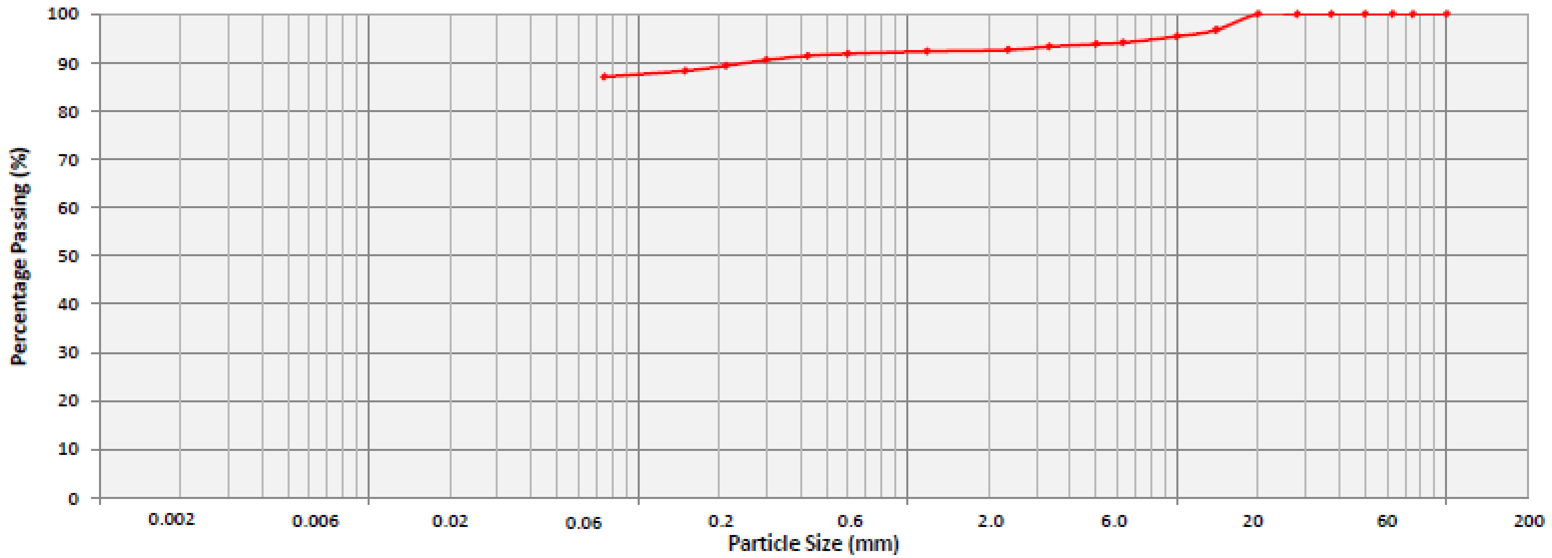
CLAY	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**FINE**	**MEDIUM**	**COARSE**	**COBBLES**	**BOULDERS**
	SILT			**SAND**			**GRAVEL**				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP31-32A

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN31(TP31-32A)MN32	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Elastic SILT	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1213



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

MN31

ANGLE POINT BEARING CAPACITY

MN31

CALCULATION OF SAFE BEARING CAPACITY: TP MN 31					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL			**Sample No.:**	1109

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C (kN/m^2) =$	26	$\gamma (kg/m^3) =$	1918
$\varnothing (^\circ) =$	23	$\gamma (kN/m^3) =$	18.82

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cN_c + 0.8\gamma ZN_q + 0.4\gamma BN_\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 18.05	
	$N_q =$ 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	$q_f = (1.3 \times 26 \times 18.05) + (0.8 \times 18.82 \times 1.0 \times 8.66) + (0.4 \times 18.82 \times 1.0 \times 4.82)$	**777 kN/m²**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 777/3.0$	**259 kN/m²**

Calculations By: B.K. **Checked:** WK

TP31-32A

CALCULATION OF SAFE BEARING CAPACITY: MN31 (TP31-32A) MN32					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	06.03.2013
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/NC_356/03
MATERIAL DESCRIPTION:	ELASTIC SILT			**Sample No.:**	1213

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2) =$	22	$\gamma\,(kg/m^3) =$	1766
$\phi\,(^\circ) =$	18	$\gamma\,(kN/m^3) =$	17.32

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 13.10	
	$N_q =$ 5.26	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 2.00	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	$q_f = (1.3 \times 22 \times 13.10) + (0.8 \times 17.32 \times 1.6 \times 5.26) + (0.4 \times 17.32 \times 1.0 \times 2.00)$	**505 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 505/3.0$	**168 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

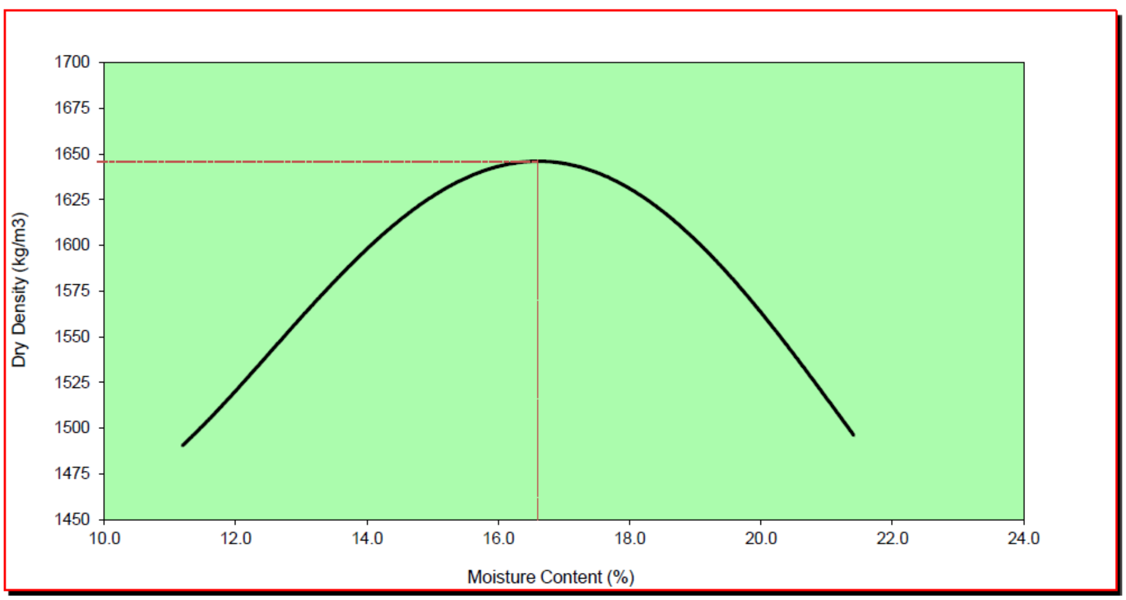
BS 1377 – 4: 1990

MN31

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1109
Material Description:	SILTY SAND WITH GRAVEL	**Sample Ref:**	TP MN 31	**Date received:**	09.12.2012

Moisture Addition	**50cc**	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**
Mass of Mould+Base+Soil	5652	5779	5882	5925	5883	5812
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1657	1784	1887	1930	1888	1817
Bulk Density (Kgs/m^3)	**1657**	**1784**	**1887**	**1930**	**1888**	**1817**
Tin No.	G53	G22	G58	G27	G29	G31
Weight Wet Soil	232.5	257.0	281.1	254.6	297.8	330.0
Weight of Dry Soil	209.1	226.8	243.4	216.3	249.0	271.8
Weight of Water	23.4	30.2	37.7	38.3	48.8	58.2
Moisture Content (%)	**11.2**	**13.3**	**15.5**	**17.7**	**19.6**	**21.4**
Dry Density (Kgs/m^3)	**1490**	**1574**	**1634**	**1640**	**1579**	**1497**



Maximum Dry Density (Kg/m^3): 1645 **Optimum Moisture Content (%):** 16.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN31	
Depth	1.0m
pH	7.9
Chloride(%) mg/l	0.61
Sulphate (mg/l)	0.001

TP31-32	
Depth	2.0m
pH	7.22
Chloride(%) mg/l	0.006
Sulphate (mg/l)	0.033

TP31-32B	
Depth	0.8m
pH	7.10
Chloride(%) mg/l	-
Sulphate (mg/l)	-

ANGLE POINT 31 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 31		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5 1		1.0	Brownish Grey Highly weathered Fragmented Rock Strata
1.5 2 2.5			

TEST POINT 31-32A, 31-32B LOGS

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE	DATE:	23 - 28.02.2013
SITE:	NANYUKI-ISIOLO-MERU	LOGGED BY:	STEVE

MN31 (TP31-32A) MN32

SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 – 2.5		2.0	Brown Elastic SILT

MN31 (TP31-32B) MN32

LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.6	Brownish Red Sandy CLAY
	0.8	Fragmented rock Boulders

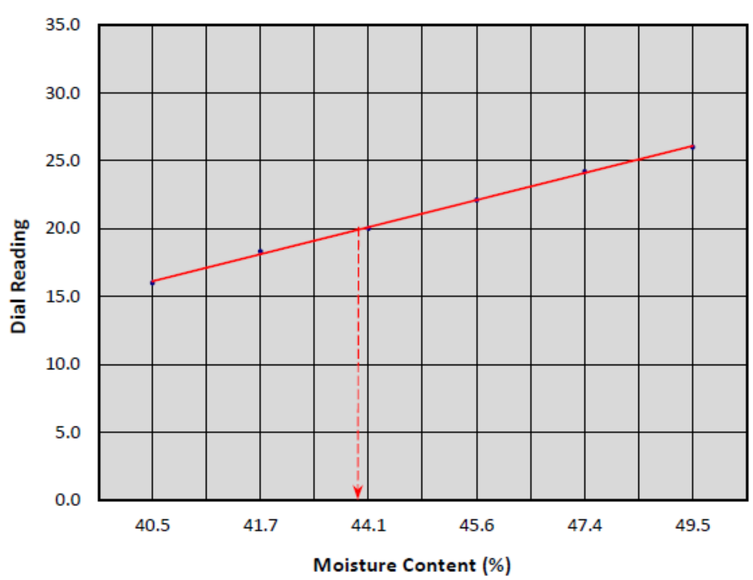
SEGMENT 31

ATTERBERG LIMITS BS 1377 - 2: 1990

MN32

Project:	PROPOSED POWERLINE	Site / Location:	NANYUKI-ISIOLO-MERU	Date Received:	09.12.2012
Material Description:	SANDY LEAN CLAY	Job Reference:	GCL/TGA-342/12	Sample No.:	1110
Sampled By:	GCL	Depth:	2.0M	Date Tested:	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.0	22.1	24.2	26.0	-	-	
Tin No	69	42	21	28	23	52	17	48	
Mass of Wet Soil (g)	43.22	36.12	33.99	39.34	49.23	41.99	23.40	27.42	
Mass of Dry Soil (g)	30.76	25.49	23.58	27.02	33.40	28.09	19.07	22.31	
Mass of Moisture (g)	12.46	10.63	10.41	12.32	15.83	13.90	4.33	5.11	
Moisture Content (%)	40.5	41.7	44.1	45.6	47.4	49.5	22.7	22.9	22.8



PLASTIC LIMIT
PL = 22.8 %

LIQUID LIMIT
LL = 43.6

Proportion Passing 425 µm BS Sieve
= 98.1 %

PLASTICITY INDEX
PI = 20.8 %

PLASTIC MODULUS
PM = 2040

LINEAR SHRINKAGE
LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)
CL

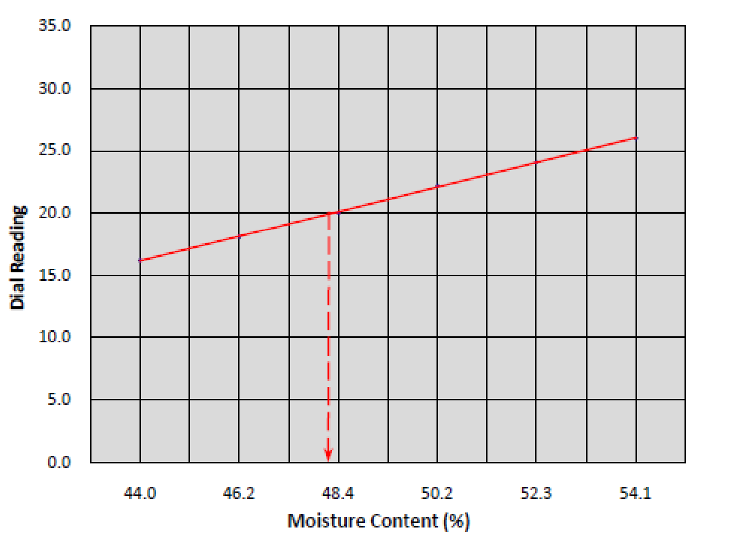
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP32-33

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN32 (TP32-33)MN33	**Date Received:**	06.03.2013
Material Description:	SILT	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1215
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.2	24.1	26.0	-	-	
Tin No	22	15	32	62	54	18	49	27	
Mass of Wet Soil (g)	41.64	54.71	46.54	38.17	41.17	50.14	38.95	41.07	
Mass of Dry Soil (g)	28.92	37.42	31.37	25.41	27.03	32.54	30.74	32.39	
Mass of Moisture (g)	12.72	17.29	15.17	12.76	14.14	17.60	8.21	8.68	
Moisture Content (%)	44.0	46.2	48.4	50.2	52.3	54.1	26.7	26.8	26.8



PLASTIC LIMIT

PL = 26.8 %

LIQUID LIMIT

LL = 48.2

Proportion Passing 425 µm BS Sieve

= 95.1 %

PLASTICITY INDEX

PI = 21.4 %

PLASTIC MODULUS

PM = 2040

LINEAR SHRINKAGE

LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)

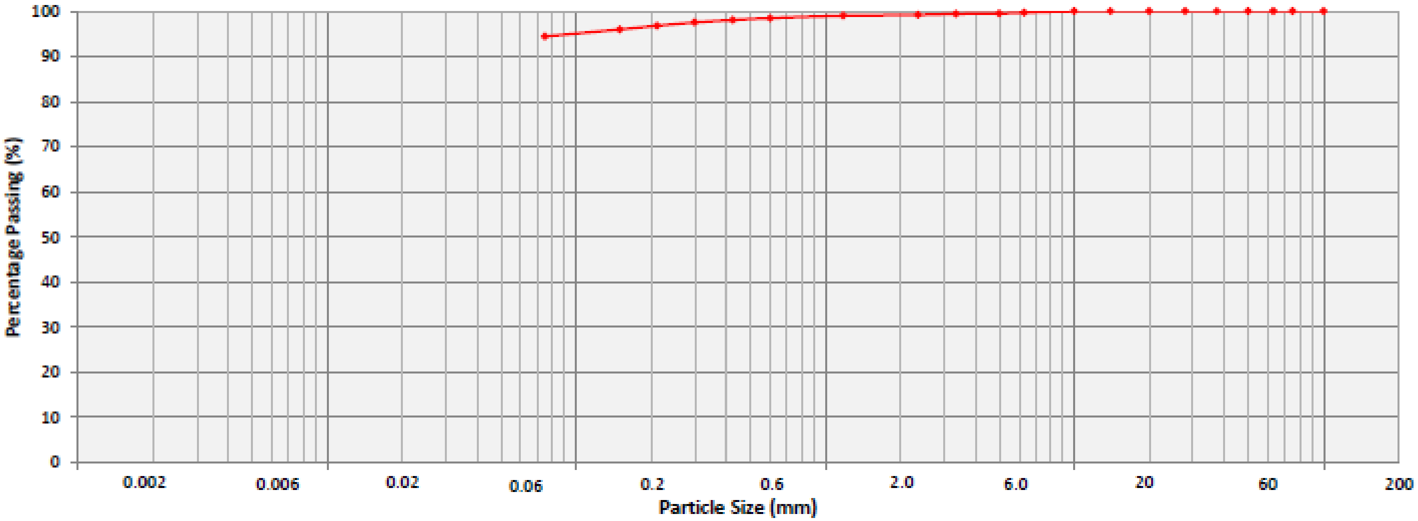
ML

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN32

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 32	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1110



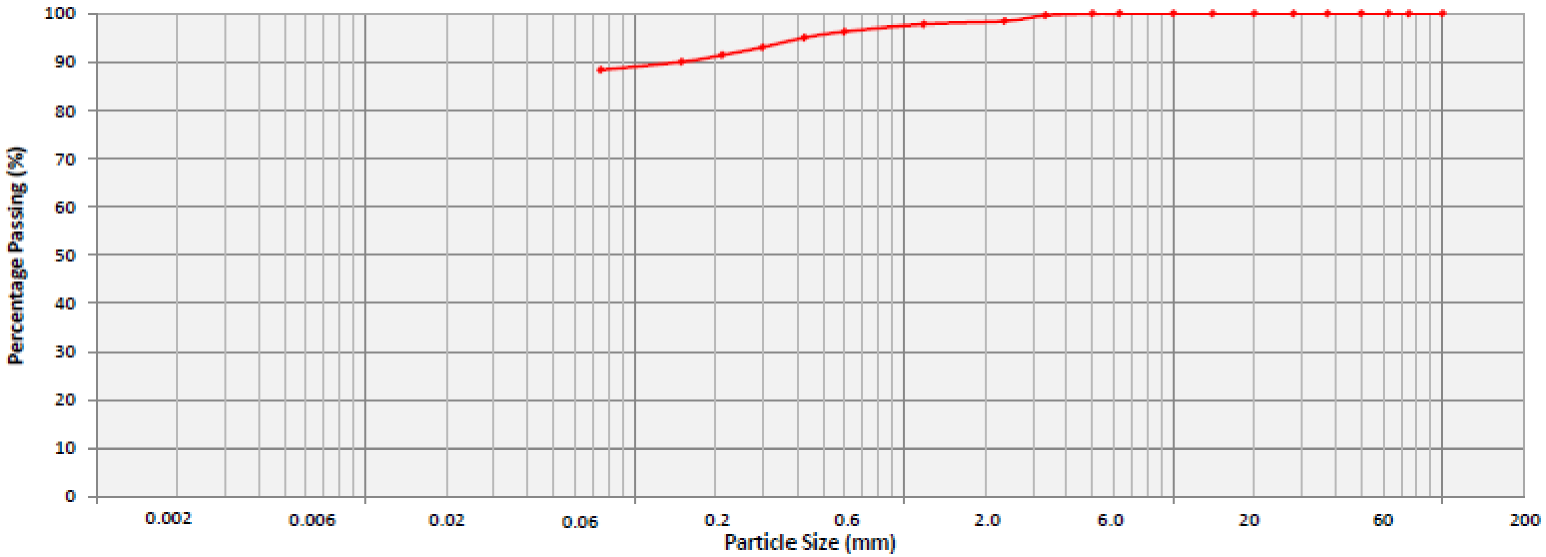
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP32-33

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN32(TP32-33)MN33	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	SILT	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1215



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

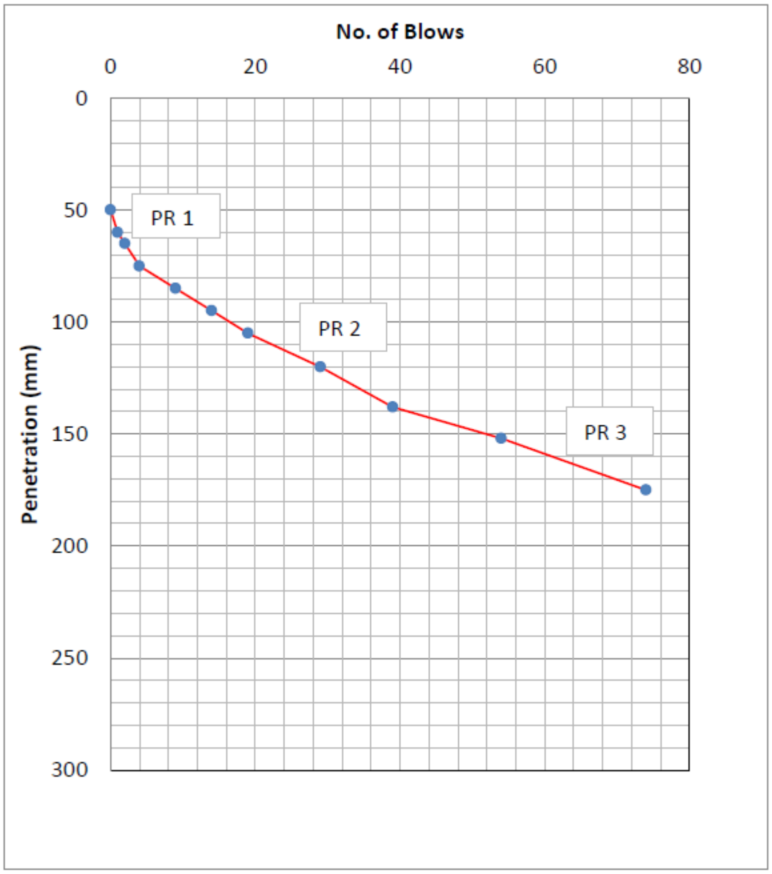
MN32

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 32	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1110

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	60	10.0
2	1	2	65	5.0
3	2	4	75	5.0
4	5	9	85	2.0
5	5	14	95	2.0
6	5	19	105	2.0
7	10	29	120	1.5
8	10	39	138	1.8
9	15	54	152	0.9
10	20	74	175	1.2



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	10	22.5	
PR 2	5	54.6	
PR 3	1.5	255.0	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN32

CALCULATION OF SAFE BEARING CAPACITY: TP MN 32					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1110

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C (kN/m^2) =$	23	$\gamma\ (kg/m^3) =$	1873
$\phi\ (^\circ) =$	21	$\gamma\ (kN/m^3) =$	18.38

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 15.81	
	$N_q =$ 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	$q_f = (1.3 \times 23 \times 15.81) + (0.8 \times 18.38 \times 2.0 \times 7.07) + (0.4 \times 18.38 \times 1.0 \times 3.42)$	**706 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 706/3.0$	**235 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP32-33

CALCULATION OF SAFE BEARING CAPACITY: MN32 (TP32-33) MN33					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	1.2M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	SANDY SILT			Sample No.:	1215

LABORATORY TEST RESULTS

SHEARBOX		DENSITY	
$C(kN/m^2) =$	27	$\gamma\,(kg/m^3) =$	1921
$\phi\,(^\circ) =$	22	$\gamma\,(kN/m^3) =$	18.85

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c = 16.88$	
	$N_q = 7.82$	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	$N_\gamma = 4.07$	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.2	
	$q_f = (1.3 \times 27 \times 16.88) + (0.8 \times 18.85 \times 1.2 \times 7.82) + (0.4 \times 18.85 \times 1.0 \times 4.07)$	**765 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 765/3.0$	**255 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

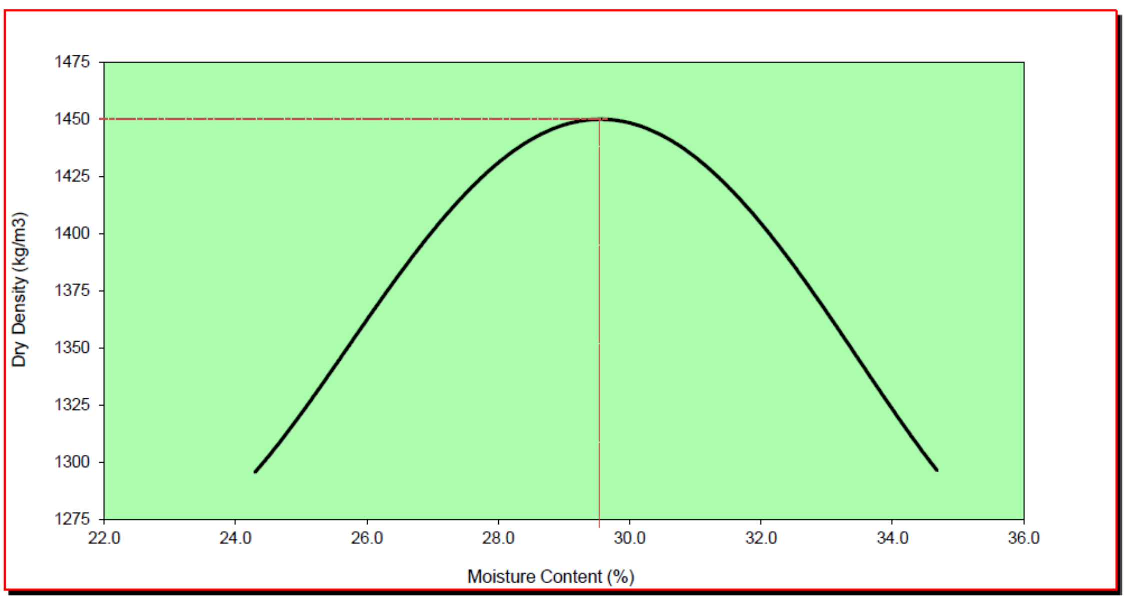
BS 1377 – 4: 1990

MN32

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1110
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 32	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5605	5746	5848	5881	5831	5741
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1610	1751	1853	1886	1836	1746
Bulk Density (Kgs/m^3)	**1610**	**1751**	**1853**	**1886**	**1836**	**1746**
Tin No.	G29	G37	G57	G11	G13	G04
Weight Wet Soil	246.6	237.6	256.7	276.1	289.2	302.9
Weight of Dry Soil	198.4	187.8	199.6	211.7	218.3	224.9
Weight of Water	48.2	49.8	57.1	64.4	70.9	78.0
Moisture Content (%)	**24.3**	**26.5**	**28.6**	**30.4**	**32.5**	**34.7**
Dry Density (Kgs/m^3)	**1295**	**1384**	**1441**	**1446**	**1386**	**1296**



Maximum Dry Density (Kg/m^3): 1450 **Optimum Moisture Content (%):** 29.2%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN32	
Depth	2.0m
pH	6.94
Chloride(%) mg/l	-
Sulphate (mg/l)	

TP32-33	
Depth	2.0m
pH	7.16
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.035

ANGLE POINT 32 LOG

JOB REF:		GCL/NCE_342/12
MN 32		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	2.0	Reddish Brown Elastic SILT

TEST POINT 32-33 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE
SITE:	NANYUKI-ISIOLO-MERU

	MN32 (TP32-33) MN33		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5			
1			Brown Elastic SILT with Sand
1.5		1.5	
2		2.0	Brown Elastic SILT
2.5			

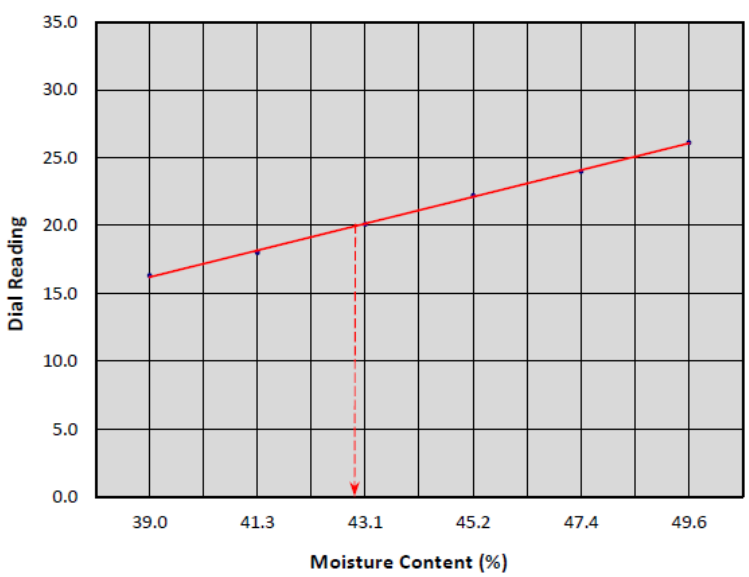
SEGMENT 32

ATTERBERG LIMITS BS 1377 - 2: 1990

MN33

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY SAND WITH GRAVEL	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1111
Sampled By:	GCL	**Depth:**	2.7M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.1	22.2	24.0	26.1	-	-	
Tin No	**35**	**27**	**19**	**8**	**26**	**36**	**29**	**58**	
Mass of Wet Soil (g)	36.79	25.76	31.13	34.86	42.19	38.57	24.97	29.87	
Mass of Dry Soil (g)	26.47	18.23	21.76	24.01	28.62	25.78	20.09	24.00	
Mass of Moisture (g)	10.32	7.53	9.37	10.85	13.57	12.79	4.88	5.87	
Moisture Content (%)	39.0	41.3	43.1	45.2	47.4	49.6	24.3	24.5	24.4



PLASTIC LIMIT
PL = 24.4 %

LIQUID LIMIT
LL = 42.7

Proportion Passing 425 µm BS Sieve
= 43.9 %

PLASTICITY INDEX
PI = 18.3 %

PLASTIC MODULUS
PM = 804

LINEAR SHRINKAGE
LS = 8.6 %

GROUP SYMBOL (USC SYSTEM)
SM

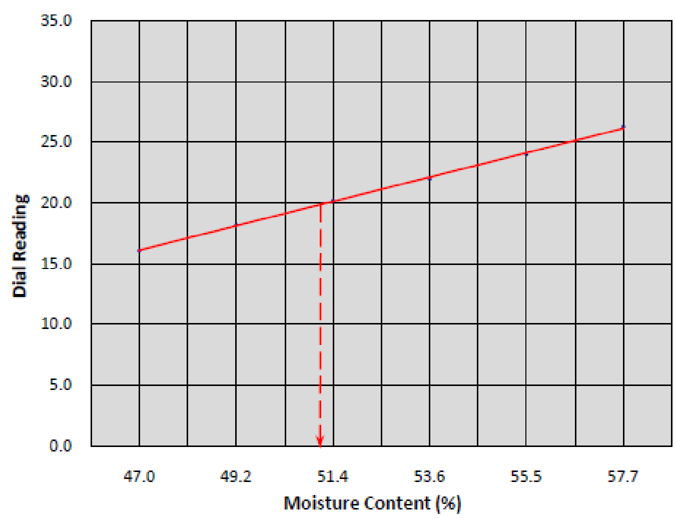
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP33-34C

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN33 (TP33-34C)MN34	**Date Received:**	06.03.2013
Material Description:	Elastic SILT	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1218
Sampled By:	GEO CON	**Depth:**	1.2M 2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.2	20.2	22.0	24.0	26.3	-	-	
Tin No	**20**	**31**	**25**	**64**	**68**	**47**	**41**	**2**	
Mass of Wet Soil (g)	34.46	37.33	41.72	45.04	49.29	42.44	13.24	17.32	
Mass of Dry Soil (g)	23.44	25.02	27.56	29.32	31.70	26.91	10.34	13.51	
Mass of Moisture (g)	11.02	12.31	14.16	15.72	17.59	15.53	2.90	3.81	
Moisture Content (%)	47.0	49.2	51.4	53.6	55.5	57.7	28.0	28.2	28.1



PLASTIC LIMIT
PL = 28.1 %

LIQUID LIMIT
LL = 51.0

Proportion Passing 425 µm BS Sieve
= 97.0 %

PLASTICITY INDEX
PI = 22.9 %

PLASTIC MODULUS
PM = 2219

LINEAR SHRINKAGE
LS = 10.7 %

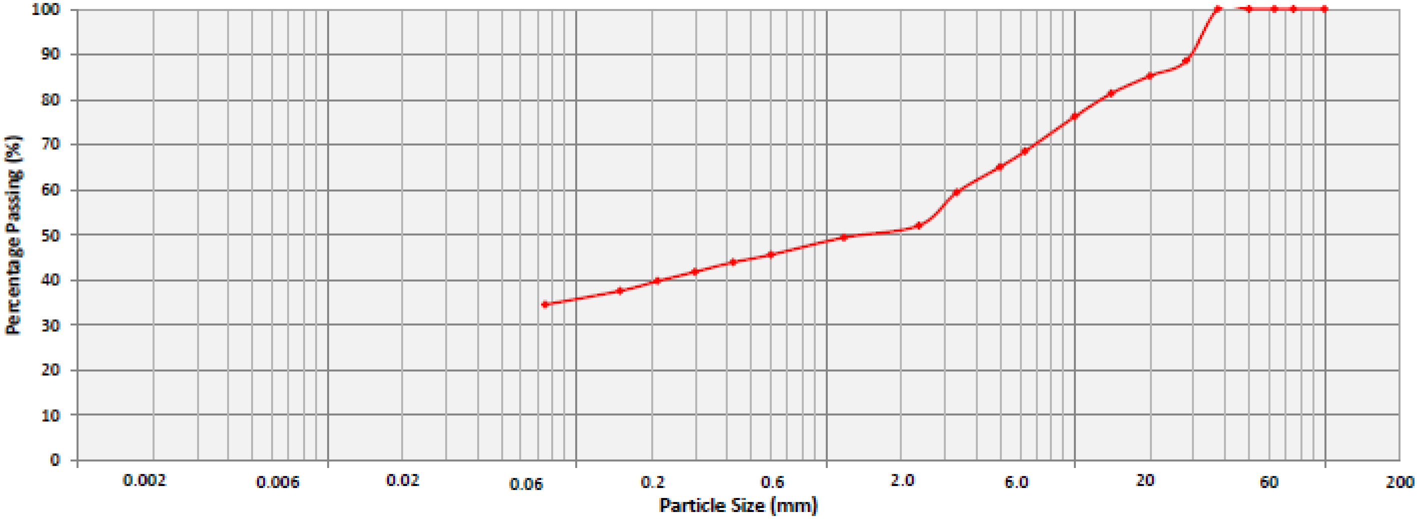
GROUP SYMBOL (USC SYSTEM)
MH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN33

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	LOCATION	MN 33	DATE RECEIVED:	09.12.2012
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL	JOB REF:	GCL/TGA-342/12	DATE TESTED:	18.12.2012
SAMPLED BY:	GCL	DEPTH:	2.7M	SAMPLE No.:	1111



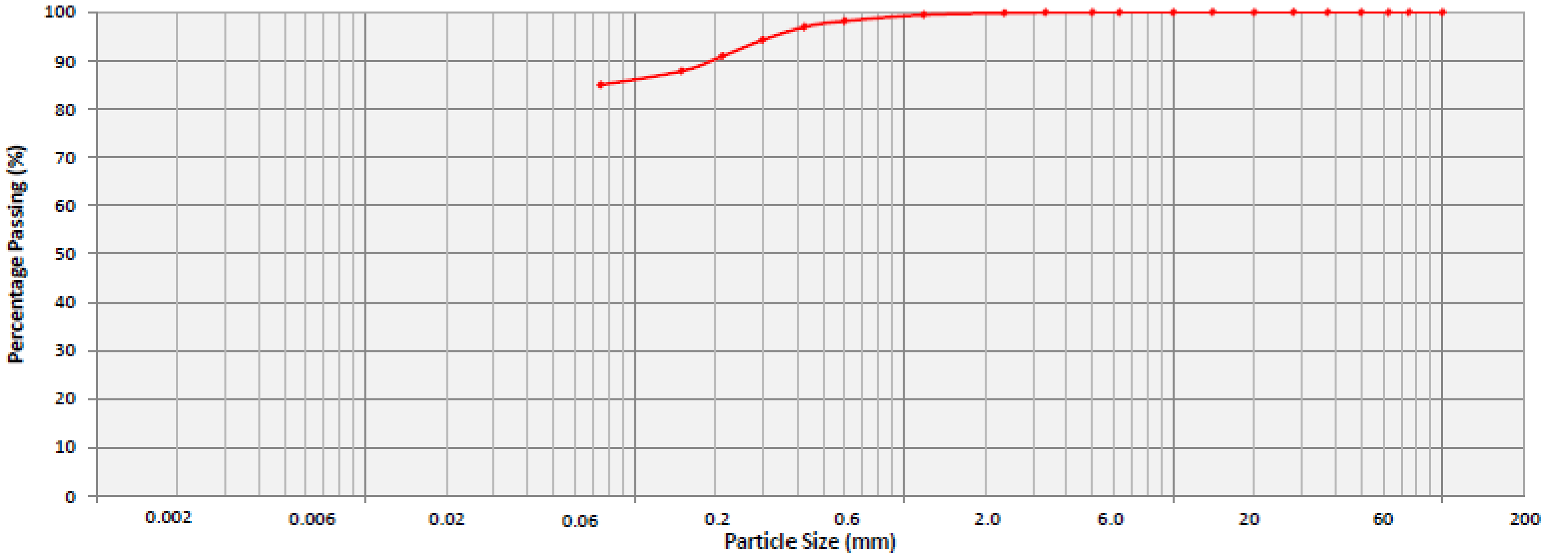
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 20.12.2012 CHECKED: WK

TP33-34C

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN33(TP33-34C)MN34	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Elastic SILT	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1218



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

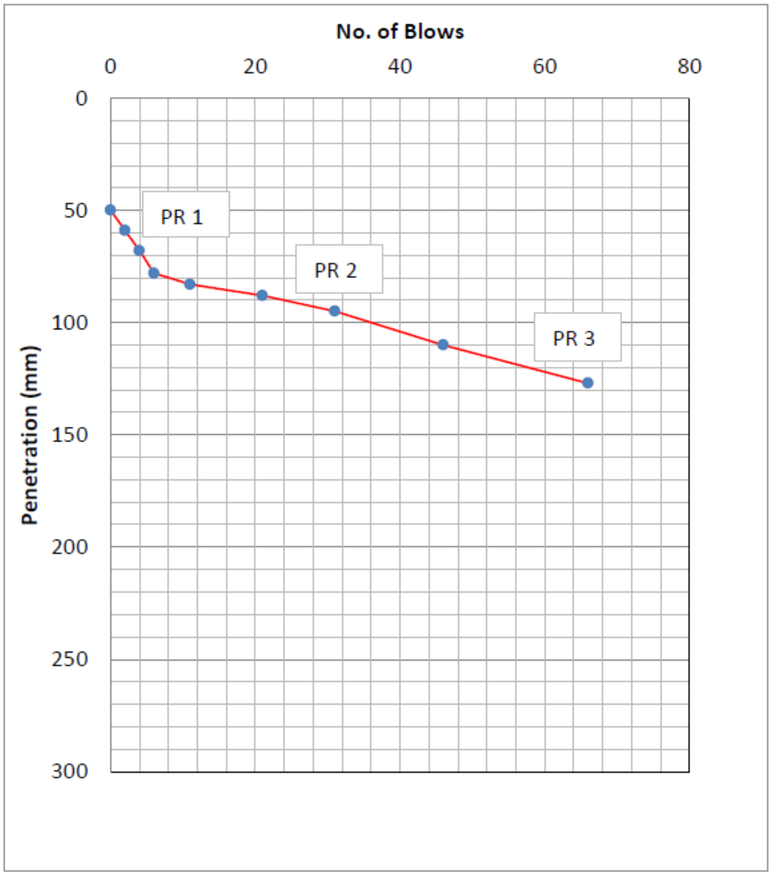
MN33

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 33	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.7M	**Sample No.**	1111

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	2	2	59	4.5
2	2	4	68	4.5
3	2	6	78	5.0
4	5	11	83	1.0
5	10	21	88	0.5
6	10	31	95	0.7
7	15	46	110	1.0
8	20	66	127	0.9



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	4.5	62.5	
PR 2	2	176.5	
PR 3	0.8	570.2	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN33

CALCULATION OF SAFE BEARING CAPACITY: TP MN 33					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.7M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY SAND WITH GRAVEL			**Sample No.:**	1111

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2) =$	27	$\gamma\,(kg/m^3) =$	1972
$\phi\,(^\circ) =$	22	$\gamma\,(kN/m^3) =$	19.35

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c =$ 16.88	
	$N_q =$ 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma =$ 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.7	
	$q_f = (1.3 \times 27 \times 16.88) + (0.8 \times 19.35 \times 2.7 \times 7.82) + (0.4 \times 19.35 \times 1.0 \times 4.07)$	**951 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 951/3.0$	**317 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP33-34C

CALCULATION OF SAFE BEARING CAPACITY: MN33 (TP33-34C) MN34					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	1.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	ELASTIC SILT			Sample No.:	1218

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	31	$\gamma\ (kg/m^3)$ =	2036
$\phi\ (^\circ)$ =	25	$\gamma\ (kN/m^3)$ =	19.97

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 20.72	
	N_q = 10.66	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	N_γ = 6.77	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	q_f = (1.3 x 31 x 20.72) + (0.8 x 19.97 x 1.0 x 10.66) + (0.4 x 19.97 x 1.0 x 6.77)	**1059 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 1059/3.0	**353 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

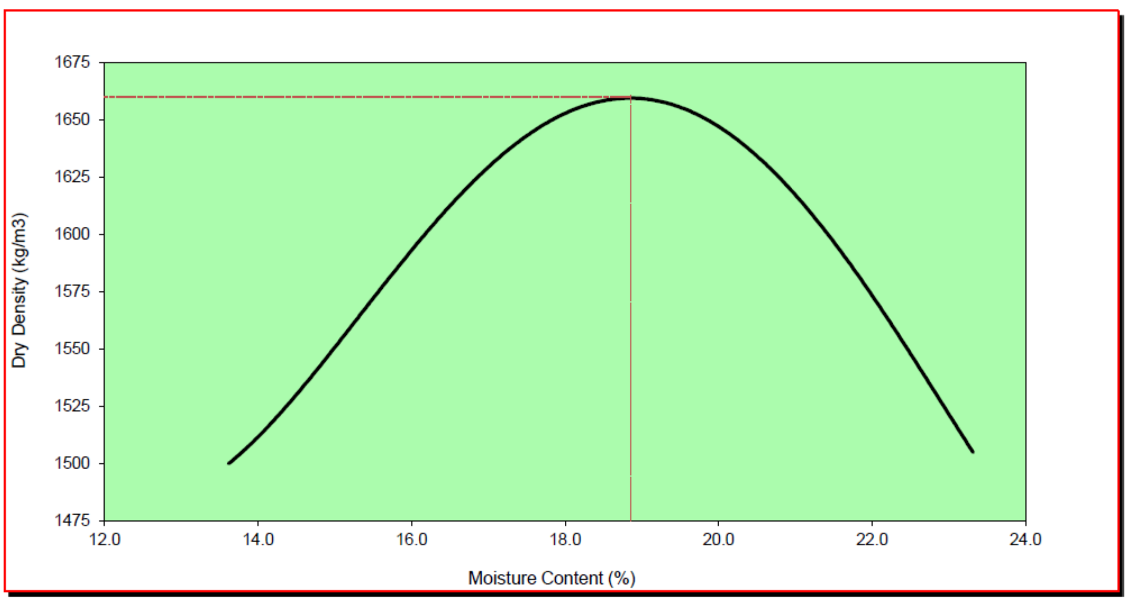
BS 1377 – 4: 1990

MN33

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.7M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1111
Material Description:	SILTY SAND WITH GRAVEL	**Sample Ref:**	TP MN 33	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5699	5830	5939	5976	5933	5851
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1704	1835	1944	1981	1938	1856
Bulk Density (Kgs/m^3)	**1704**	**1835**	**1944**	**1981**	**1938**	**1856**
Tin No.	G16	G27	G21	G43	G09	G21
Weight Wet Soil	297.0	275.1	317.7	292.1	307.2	329.5
Weight of Dry Soil	261.4	237.6	269.5	244.0	252.8	267.2
Weight of Water	35.6	37.5	48.2	48.1	54.4	62.3
Moisture Content (%)	**13.6**	**15.8**	**17.9**	**19.7**	**21.5**	**23.3**
Dry Density (Kgs/m^3)	**1500**	**1585**	**1649**	**1655**	**1595**	**1505**



Maximum Dry Density (Kg/m^3): 1660	**Optimum Moisture Content (%):** 18.8%

Tested By: STEVE	**Date Reported:** 25.01.2013	**Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN33	
Depth	2.7m
pH	7.85
Chloride(%) mg/l	0.46
Sulphate (mg/l)	0.001

TP33-34A	
Depth	1.2m
pH	7.72
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.021

TP33-34B	
Depth	1.8m
pH	8.01
Chloride(%) mg/l	0.010
Sulphate (mg/l)	0.038

TP33-34C	
Depth	2.0m
pH	7.08
Chloride(%) mg/l	0.011
Sulphate (mg/l)	0.020

INSITU DENSITY TEST

TP33-34C	
Depth (m)	2.0
Bulk density (kg/m3)	1634
Moisture Content (%)	35.9
Dry Density (kg/m3)	1202
Maximum Dry Density (kg/m3)	1463
Relative Compaction (%)	82.2

ANGLE POINT 33 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 33		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.9	Brownish Red Elastic SILT with Sand
	1.7	Brownish/Reddish Grey Highly weathered and fragmented Rock strata

TEST POINT 33-34A, 33-34B, 33-34C LOGS

JOB REF:		GCL/NCE_356/03
MN33 (TP33-34A) MN34		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.8	Brownish Red Sandy SILT
	1.2	Grey Fragmented ROCK boulders and cobble fractions

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE	JOB REF:	GCL/NCE_356/03
SITE:	NANYUKI-ISIOLO-MERU		

	MN33 (TP33-34B) MN34			MN33 (TP33-34C) MN34		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0						
0.5						
1			Dark Brown elastic SILT			Brownish Red Sandy SILT
					1.2	
1.5						
		1.9				
2		2.0			2.0	
2.5						

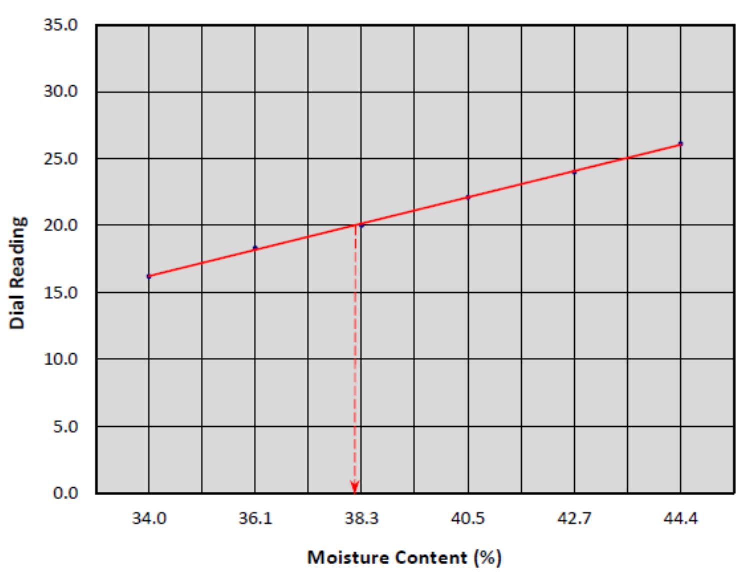
SEGMENT 33

ATTERBERG LIMITS BS 1377 - 2: 1990

MN34

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	GRAVEL WITH SILT AND SAND	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1112
Sampled By:	GCL	**Depth:**	1.3M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.3	20.0	22.1	24.0	26.1	-	-	
Tin No	**42**	**51**	**63**	**35**	**62**	**14**	**9**	**24**	
Mass of Wet Soil (g)	40.88	30.81	45.67	39.23	36.30	40.52	21.53	17.90	
Mass of Dry Soil (g)	30.51	22.64	33.02	27.92	25.44	28.06	17.03	14.14	
Mass of Moisture (g)	10.37	8.17	12.65	11.31	10.86	12.46	4.50	3.76	
Moisture Content (%)	34.0	36.1	38.3	40.5	42.7	44.4	26.4	26.6	26.5



PLASTIC LIMIT
PL = 26.5 %

LIQUID LIMIT
LL = 38.1

Proportion Passing 425 µm BS Sieve
= 14.6 %

PLASTICITY INDEX
PI = 11.6 %

PLASTIC MODULUS
PM = 169

LINEAR SHRINKAGE
LS = 5.7 %

GROUP SYMBOL (USC SYSTEM)
GW-GM

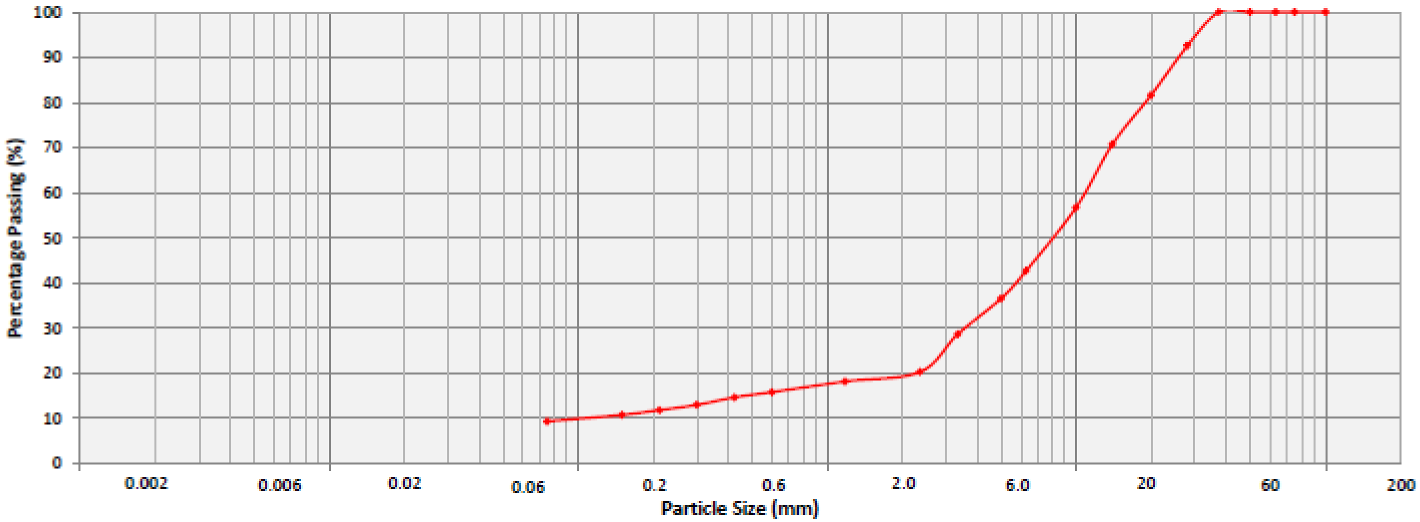
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN34

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 34	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	WELL-GRADED GRAVEL WITH SILT AND SA	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.3M	**SAMPLE No.:**	1112



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
		SILT			SAND			GRAVEL			

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

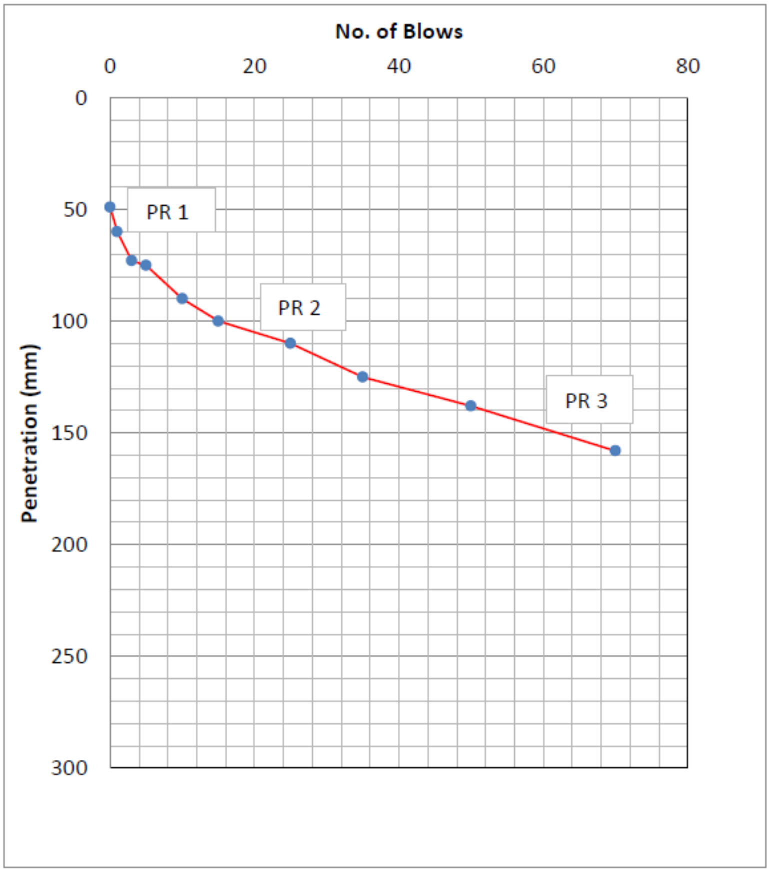
MN34

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 34	**Date of Test:**	04.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.3M	**Sample No.**	1112

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	49	
1	1	1	60	11.0
2	2	3	73	6.5
3	2	5	75	1.0
4	5	10	90	3.0
5	5	15	100	2.0
6	10	25	110	1.0
7	10	35	125	1.5
8	15	50	138	0.9
9	20	70	158	1.0



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	11	19.9	
PR 2	3.3	93.0	
PR 3	1.1	379.3	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN34

CALCULATION OF SAFE BEARING CAPACITY: TP MN 34					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.3M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	GRAVEL WITH SILT AND SAND			**Sample No.:**	1112

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C (kN/m^2)$ =	30	$\gamma (kg/m^3)$ =	2047
ϕ (°) =	25	$\gamma (kN/m^3)$ =	20.08

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 20.72	
	N_q = 10.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 6.77	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.3	
	$q_f = (1.3 \times 30 \times 20.72) + (0.8 \times 20.08 \times 1.3 \times 10.66) + (0.4 \times 20.08 \times 1.0 \times 6.77)$	**1085 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 1085/3.0$	**362 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

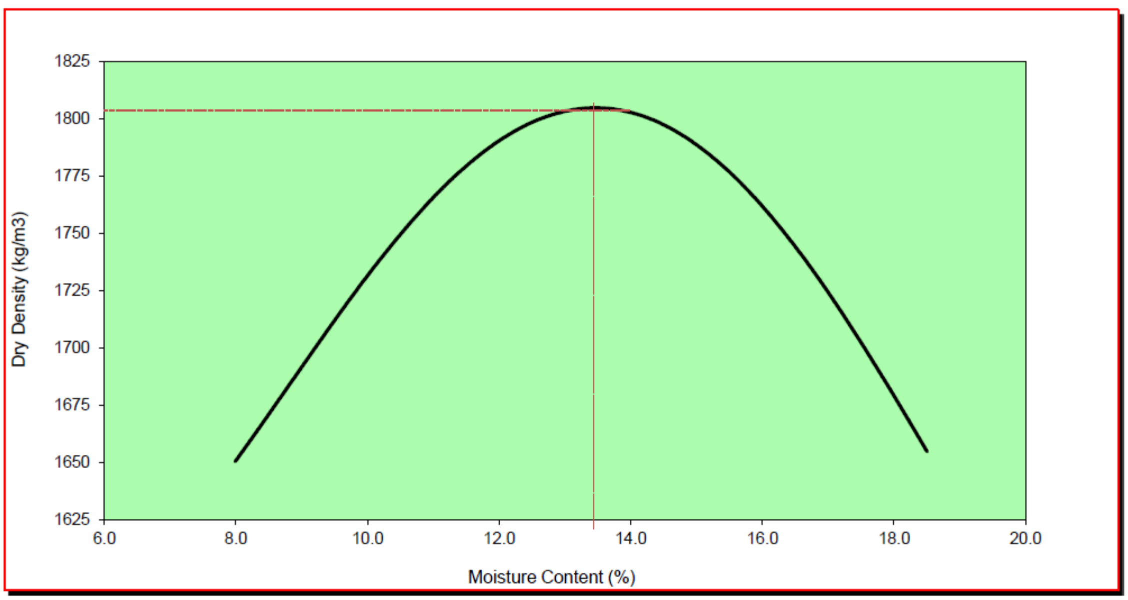
BS 1377 – 4: 1990

MN34

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.3M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1112
Material Description:	GRAVEL WITH SILT AND SAND	**Sample Ref:**	TP MN 34	**Date received:**	09.12.2012

Moisture Addition	**0cc**	**50cc**	**100cc**	**150cc**	**200cc**	**250cc**
Mass of Mould+Base+Soil	5777	5905	6006	6054	6024	5956
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1782	1910	2011	2059	2029	1961
Bulk Density (Kgs/m^3)	**1782**	**1910**	**2011**	**2059**	**2029**	**1961**
Tin No.	G03	G57	G08	G52	G21	G28
Weight Wet Soil	227.1	257.7	278.1	288.7	321.9	283.7
Weight of Dry Soil	210.3	234.1	247.9	252.4	276.1	239.4
Weight of Water	16.8	23.6	30.2	36.3	45.8	44.3
Moisture Content (%)	**8.0**	**10.1**	**12.2**	**14.4**	**16.6**	**18.5**
Dry Density (Kgs/m^3)	**1650**	**1735**	**1793**	**1800**	**1740**	**1655**



Maximum Dry Density (Kg/m^3): 1805 **Optimum Moisture Content (%):** 13.4s%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

Angle Point MN34	
Depth	1.3m
pH	8.2
Chloride(%) mg/l	0.87
Sulphate (mg/l)	0.002

ANGLE POINT 34 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 34		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0			
0.5		0.9	Brownish Red Elastic SILT with Sand
1		1.3	Brownish/Reddish Grey Highly weathered and fragmented Rock strata
1.5			
2			
2.5			

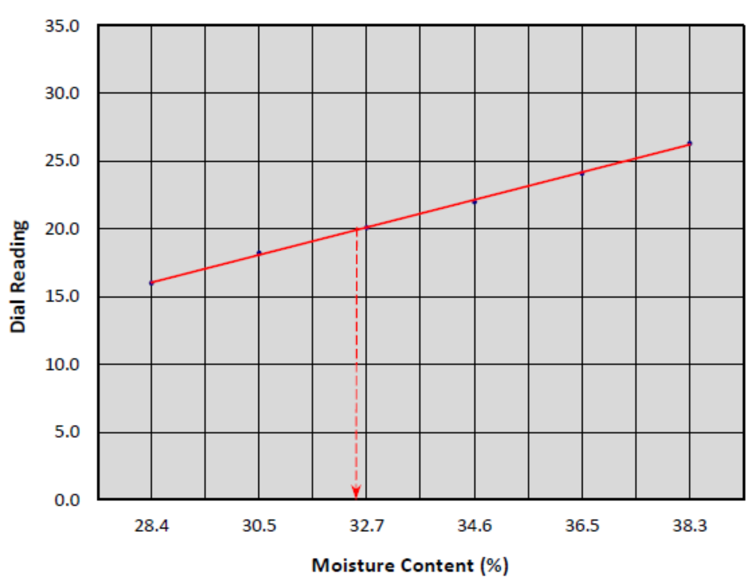
SEGMENT 34

ATTERBERG LIMITS BS 1377 - 2: 1990

MN35

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SILTY GRAVEL WITH SAND	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1113
Sampled By:	GCL	**Depth:**	1.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.2	20.1	22.0	24.1	26.3	-	-	
Tin No	**27**	**13**	**17**	**43**	**64**	**57**	**9**	**1**	
Mass of Wet Soil (g)	37.51	42.36	48.59	41.40	51.06	43.26	26.29	29.40	
Mass of Dry Soil (g)	29.21	32.46	36.61	30.76	37.41	31.28	21.37	23.84	
Mass of Moisture (g)	8.30	9.90	11.98	10.64	13.65	11.98	4.92	5.56	
Moisture Content (%)	28.4	30.5	32.7	34.6	36.5	38.3	23.0	23.3	23.2



PLASTIC LIMIT

PL = 23.2 %

LIQUID LIMIT

LL = 32.5

Proportion Passing 425 µm BS Sieve

= 20.0 %

PLASTICITY INDEX

PI = 9.3 %

PLASTIC MODULUS

PM = 187

LINEAR SHRINKAGE

LS = 4.3 %

GROUP SYMBOL (USC SYSTEM)

GM

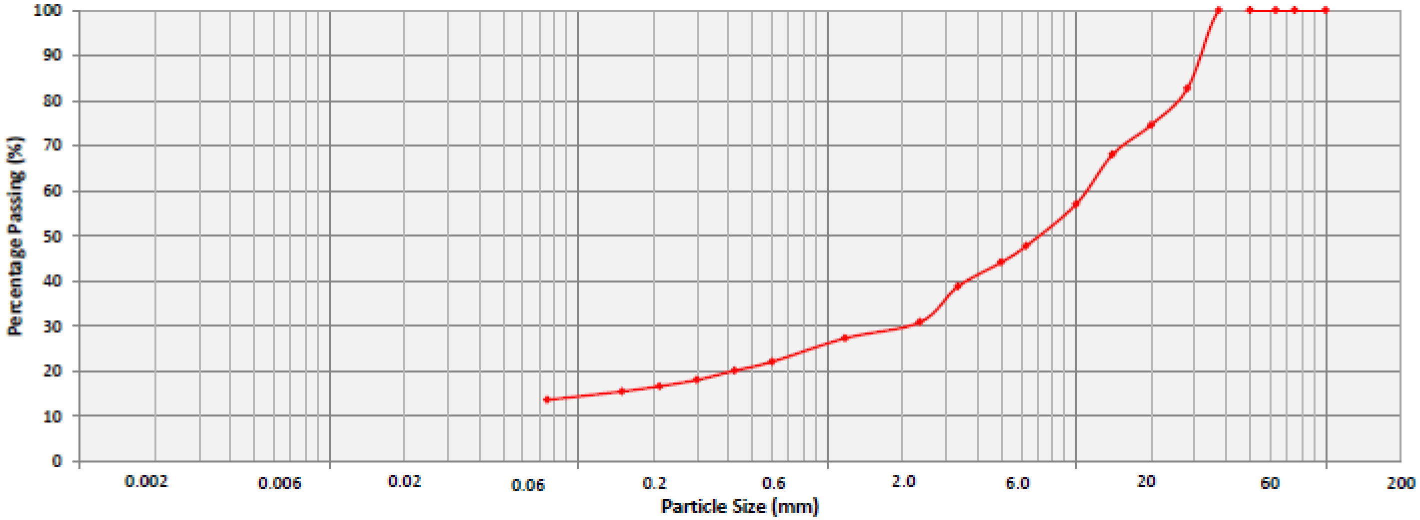
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN35

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 35	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.0M	**SAMPLE No.:**	1113



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

DCP - CBR CORRELATION

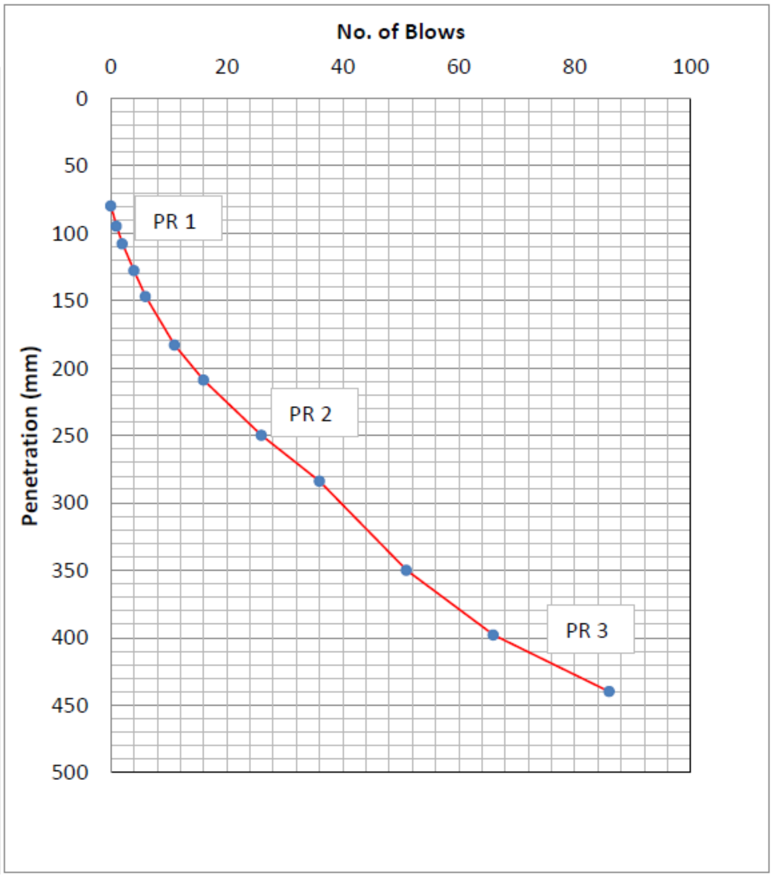
MN35

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 35	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.0M	**Sample No.**	1113

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	80	
1	1	1	95	15.0
2	1	2	108	13.0
3	2	4	128	10.0
4	2	6	147	9.5
5	5	11	183	7.2
6	5	16	209	5.2
7	10	26	250	4.1
8	10	36	284	3.4
9	15	51	350	4.4
10	15	66	398	3.2
11	20	86	440	2.1



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	13	16.1	
PR 2	7.2	34.2	
PR 3	3.4	89.5	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN35

CALCULATION OF SAFE BEARING CAPACITY: TP MN 35					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SILTY GRAVEL WITH SAND			**Sample No.:**	1113

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	29	$\gamma\ (kg/m^3)$ =	2045
ø (°) =	22	$\gamma\ (kN/m^3)$ =	20.06

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 16.88	
	N_q = 7.82	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.07	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	q_f = (1.3 x 29 x 16.88) + (0.8 x 20.06 x 1.0 x 7.82) + (0.4 x 20.06 x 1.0 x 4.07)	**795 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 795/3.0	**265 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

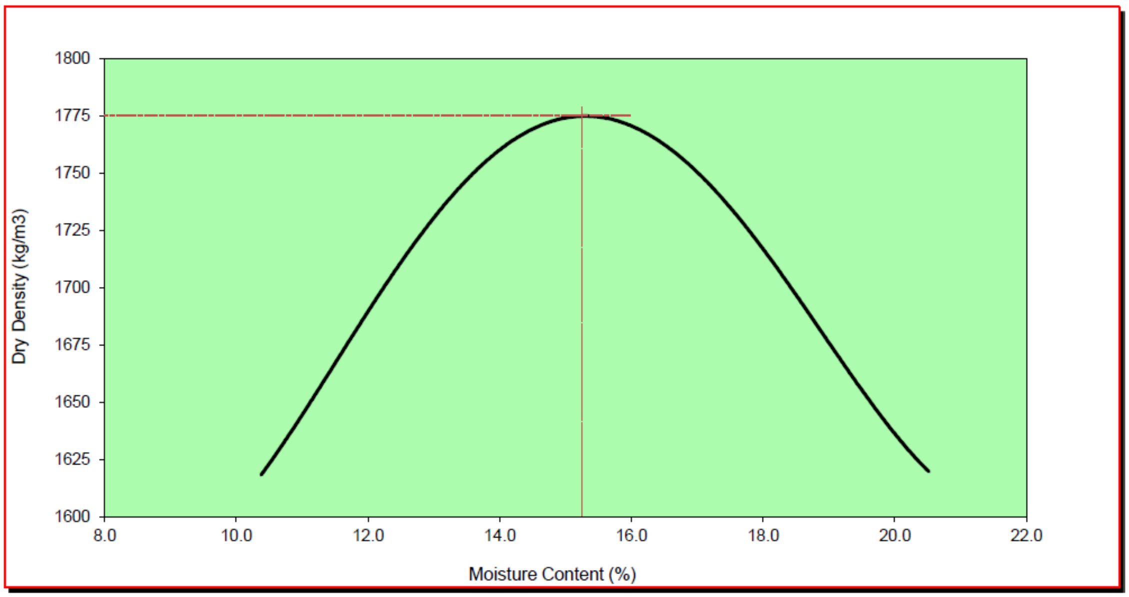
BS 1377 – 4: 1990

MN35

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1113
Material Description:	SILTY GRAVEL WITH SAND	**Sample Ref:**	TP MN 35	**Date received:**	09.12.2012

Moisture Addition	**50cc**	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**
Mass of Mould+Base+Soil	5781	5902	6001	6050	6012	5947
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1786	1907	2006	2055	2017	1952
Bulk Density (Kgs/m^3)	**1786**	**1907**	**2006**	**2055**	**2017**	**1952**
Tin No.	G22	G14	G06	G36	G25	G49
Weight Wet Soil	227.6	240.7	263.7	306.4	258.7	264.9
Weight of Dry Soil	206.2	214.5	231.3	263.9	218.7	219.8
Weight of Water	21.4	26.2	32.4	42.5	40.0	45.1
Moisture Content (%)	**10.4**	**12.2**	**14.0**	**16.1**	**18.3**	**20.5**
Dry Density (Kgs/m^3)	**1618**	**1699**	**1760**	**1770**	**1705**	**1620**



Maximum Dry Density (Kg/m^3): 1775 **Optimum Moisture Content (%):** 15.2%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN35	
Depth	1.0m
pH	8.04
Chloride(%) mg/l	0.69
Sulphate (mg/l)	0.002

ANGLE POINT 35 LOG

JOB REF:	GCL/NCE_342/12

MN 35		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.1	Dark Grey SILT
	1.0	Brown Silty Sand with Gravel and Fragmented Rock Boulders

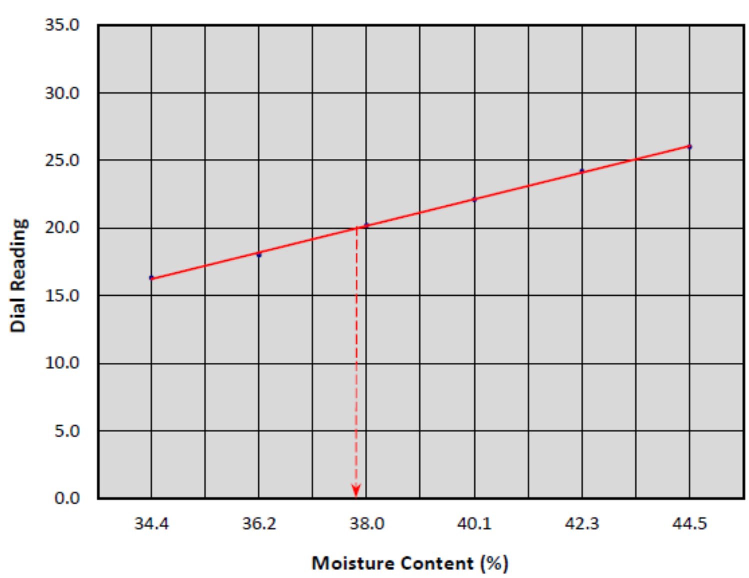
SEGMENT 35

ATTERBERG LIMITS BS 1377 - 2: 1990

MN36

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1114
Sampled By:	GCL	**Depth:**	1.6M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.0	20.2	22.1	24.2	26.0	-	-	
Tin No	**21**	**12**	**16**	**25**	**48**	**7**	**45**	**68**	
Mass of Wet Soil (g)	46.50	34.31	37.80	42.06	52.88	38.15	25.81	22.65	
Mass of Dry Soil (g)	34.60	25.19	27.40	30.02	37.16	26.40	21.05	18.46	
Mass of Moisture (g)	11.90	9.12	10.40	12.04	15.72	11.75	4.76	4.19	
Moisture Content (%)	34.4	36.2	38.0	40.1	42.3	44.5	22.6	22.7	22.7



PLASTIC LIMIT
PL = 22.7 %

LIQUID LIMIT
LL = 37.6

Proportion Passing 425 µm BS Sieve
= 98.0 %

PLASTICITY INDEX
PI = 14.9 %

PLASTIC MODULUS
PM = 1465

LINEAR SHRINKAGE
LS = 7.1 %

GROUP SYMBOL (USC SYSTEM)
ML

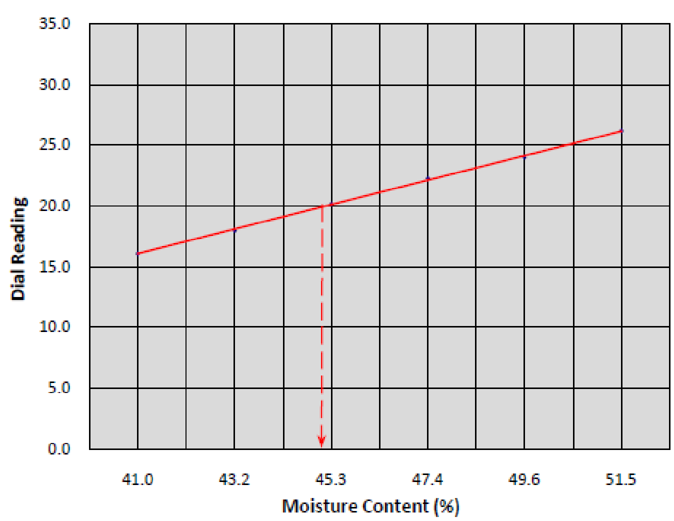
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP36-37

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN36 (TP36-37)MN37	**Date Received:**	06.03.2013
Material Description:	Clayey GRAVEL	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1219
Sampled By:	GEO CON	**Depth:**	1.2M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.1	18.0	20.2	22.3	24.0	26.2	-	-	
Tin No	62	35	24	16	59	54	7	20	
Mass of Wet Soil (g)	43.01	53.86	50.23	59.27	58.39	64.75	15.77	20.07	
Mass of Dry Soil (g)	30.50	37.61	34.57	40.21	39.03	42.74	12.70	16.13	
Mass of Moisture (g)	12.51	16.25	15.66	19.06	19.36	22.01	3.07	3.94	
Moisture Content (%)	41.0	43.2	45.3	47.4	49.6	51.5	24.2	24.4	24.3



PLASTIC LIMIT

PL = 24.3 %

LIQUID LIMIT

LL = 45.0

Proportion Passing 425 µm BS Sieve

= 23.3 %

PLASTICITY INDEX

PI = 20.7 %

PLASTIC MODULUS

PM = 482

LINEAR SHRINKAGE

LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)

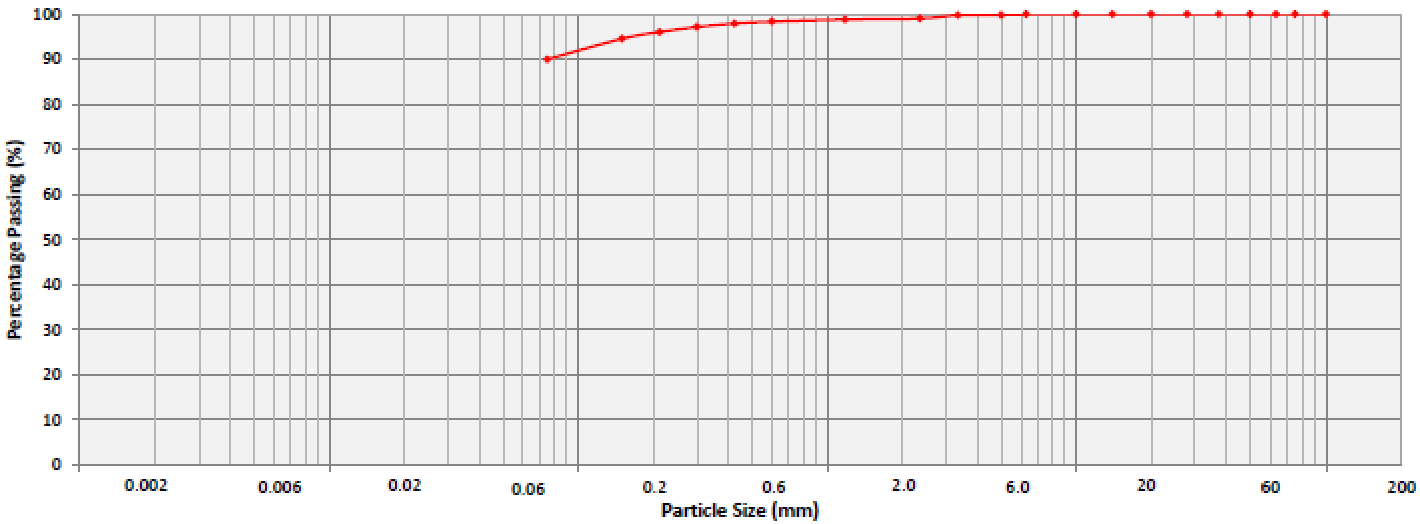
GC

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN36

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 36	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY SILT	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.6M	**SAMPLE No.:**	1114



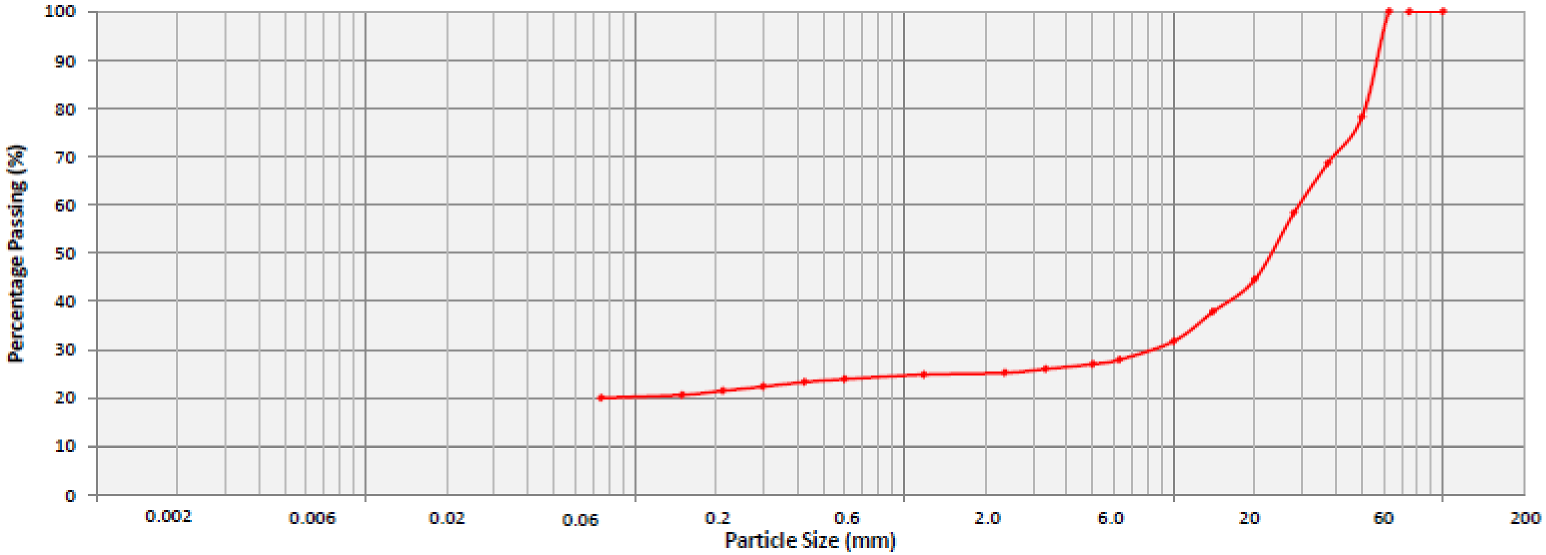
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP36-37

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN36(TP36-37)MN37	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Clayey GRAVEL	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	1.2M	SAMPLE No.:	1219



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

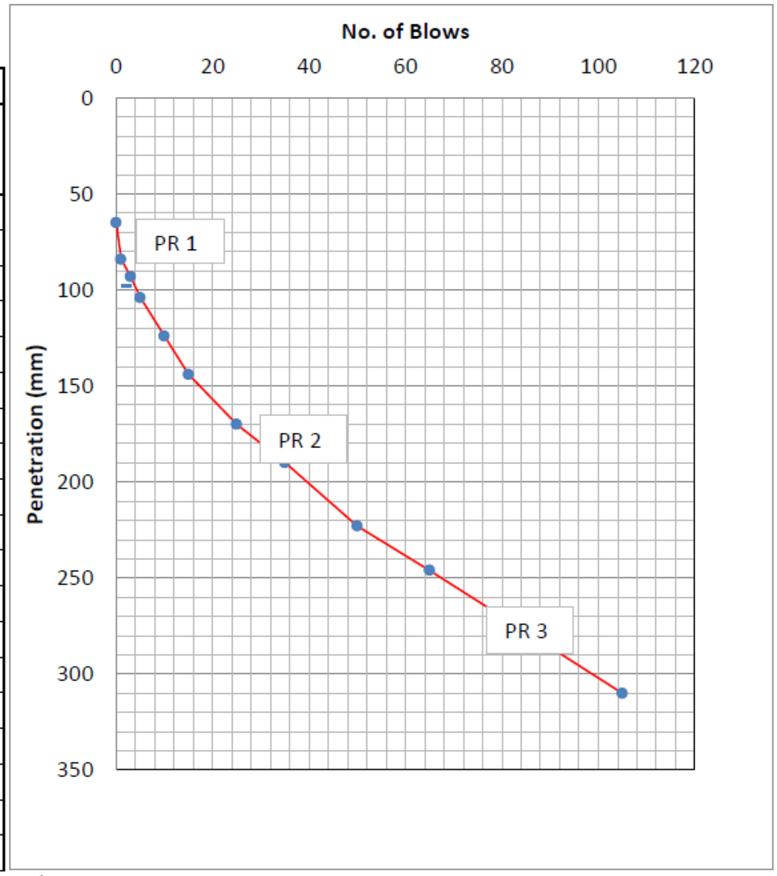
MN36

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatio**	MN 36	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.6M	**Sample No.**	1114

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	65	
1	1	1	84	19.0
2	2	3	93	4.5
3	2	5	104	5.5
4	5	10	124	4.0
5	5	15	144	4.0
6	10	25	170	2.6
7	10	35	190	2.0
8	15	50	223	2.2
9	15	65	246	1.5
10	20	85	278	1.6
11	20	105	310	1.6



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	19	9.9	
PR 2	4	72.7	
PR 3	1.8	202.0	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN36

CALCULATION OF SAFE BEARING CAPACITY: TP MN 36					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.6M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY SILT			**Sample No.:**	1114

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	22	$\gamma\ (kg/m^3)$ =	1878
$\phi\ (^\circ)$ =	18	$\gamma\ (kN/m^3)$ =	18.42

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cN_c + 0.8\gamma ZN_q + 0.4\gamma BN_\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 13.10	
	N_q = 5.26	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.00	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.6	
	q_f = (1.3 x 22 x 13.10) + (0.8 x 18.42 x 1.6 x 5.26) + (0.4 x 18.42 x 1.0 x 2.00)	**513 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 513/3.0	**171 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP36-37

CALCULATION OF SAFE BEARING CAPACITY: TMN36 (TP36-37) MN37					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	1.6M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	CLAYEY GRAVEL			Sample No.:	1108

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2)$ =	28	$\gamma\,(kg/m^3)$ =	1796
$\phi\,(^\circ)$ =	23	$\gamma\,(kN/m^3)$ =	17.62

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
	N_γ = 4.82	
Whitlow. R Basic Soil Mech. Tomlinson. M.J. Foundation Design & Construction	**The Ultimate Bearing Capacity of a Pad Foundation**	
	B(m)= 1.0	
	Z (m)= 1.6	
	q_f = (1.3 x 28 x 18.05) + (0.8 x 17.62 x 1.6 x 8.66) + (0.4 x 17.62 x 1.0 x 4.82)	**886 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 886/3.0	**295 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

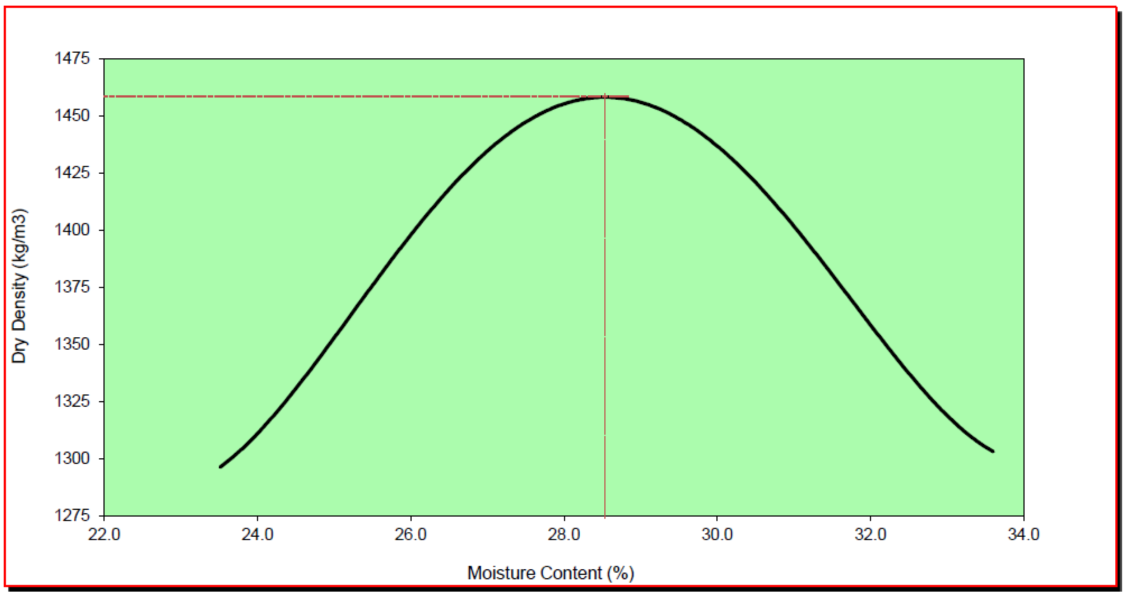
BS 1377 – 4: 1990

MN36

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.6M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1114
Material Description:	SANDY SILT	**Sample Ref:**	TP MN 36	**Date received:**	09.12.2012

Moisture Addition	**100cc**	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**
Mass of Mould+Base+Soil	5596	5737	5840	5874	5814	5736
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1601	1742	1845	1879	1819	1741
Bulk Density (Kgs/m^3)	**1601**	**1742**	**1845**	**1879**	**1819**	**1741**
Tin No.	G24	G14	G34	G07	G21	G12
Weight Wet Soil	324.1	291.4	343.4	290.7	321.3	312.1
Weight of Dry Soil	262.4	231.8	269.3	224.9	244.5	233.6
Weight of Water	61.7	59.6	74.1	65.8	76.8	78.5
Moisture Content (%)	**23.5**	**25.7**	**27.5**	**29.3**	**31.4**	**33.6**
Dry Density (Kgs/m^3)	**1296**	**1386**	**1447**	**1454**	**1384**	**1303**



Maximum Dry Density (Kg/m^3): 1460 **Optimum Moisture Content (%):** 28.6%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN36	
Depth	1.6m
pH	8
Chloride(%) mg/l	0.61
Sulphate (mg/l)	0.001

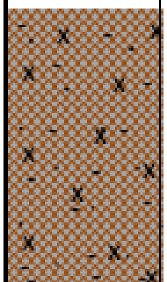
TP36-37	
Depth	1.2m
pH	7.20
Chloride(%) mg/l	0.008
Sulphate (mg/l)	0.030

ANGLE POINT 36 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 36		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	1.6	Reddish Brown Elastic SILT

TEST POINT 36-37 LOG

DATE:	23 - 28.02.2013
LOGGED BY:	STEVE

MN36 (TP36-37) MN37		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	0.8	Greyish Brown Sandy SILT
	1.2	Grey Clayey GRAVEL with cobble and rock fractions

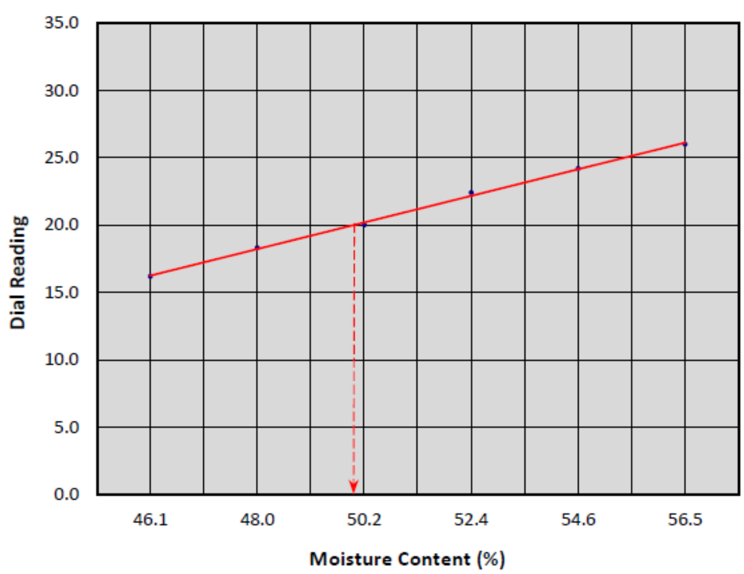
SEGMENT 36

ATTERBERG LIMITS BS 1377 - 2: 1990

MN37

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY LEAN CLAY	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1115
Sampled By:	GCL	**Depth:**	1.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	1	2	3	4	5	6	1	2	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.3	20.0	22.4	24.2	26.0	-	-	
Tin No	21	12	20	14	1	92	32	15	
Mass of Wet Soil (g)	34.20	33.98	41.25	38.74	44.93	42.77	20.32	24.55	
Mass of Dry Soil (g)	23.41	22.96	27.46	25.42	29.06	27.33	16.00	19.30	
Mass of Moisture (g)	10.79	11.02	13.79	13.32	15.87	15.44	4.32	5.25	
Moisture Content (%)	46.1	48.0	50.2	52.4	54.6	56.5	27.0	27.2	27.1



PLASTIC LIMIT
PL = 27.1 %

LIQUID LIMIT
LL = 49.8

Proportion Passing 425 µm BS Sieve
= 61.3 %

PLASTICITY INDEX
PI = 22.7 %

PLASTIC MODULUS
PM = 1391

LINEAR SHRINKAGE
LS = 10.7 %

GROUP SYMBOL (USC SYSTEM)
CL

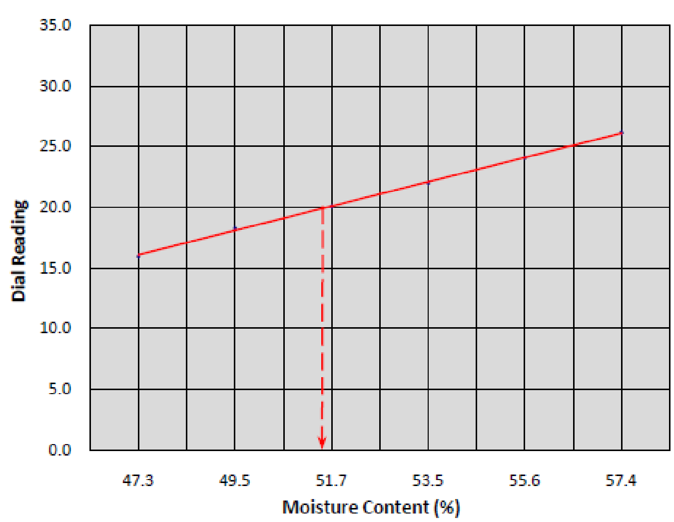
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP37-38

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN37 (TP37-38)MN38	**Date Received:**	06.03.2013
Material Description:	Elastic SILT	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1220
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.1	22.0	24.1	26.2	-	-	
Tin No	**22**	**12**	**32**	**26**	**15**	**48**	**67**	**49**	
Mass of Wet Soil (g)	58.52	60.11	54.68	50.90	67.65	58.41	33.84	28.99	
Mass of Dry Soil (g)	39.74	40.21	36.04	33.16	43.48	37.11	26.17	22.40	
Mass of Moisture (g)	18.78	19.90	18.64	17.74	24.17	21.30	7.67	6.59	
Moisture Content (%)	47.3	49.5	51.7	53.5	55.6	57.4	29.3	29.4	29.4



PLASTIC LIMIT
PL = 29.4 %

LIQUID LIMIT
LL = 51.5

Proportion Passing 425 µm BS Sieve
= 94.0 %

PLASTICITY INDEX
PI = 22.1 %

PLASTIC MODULUS
PM = 2081

LINEAR SHRINKAGE
LS = 10.7 %

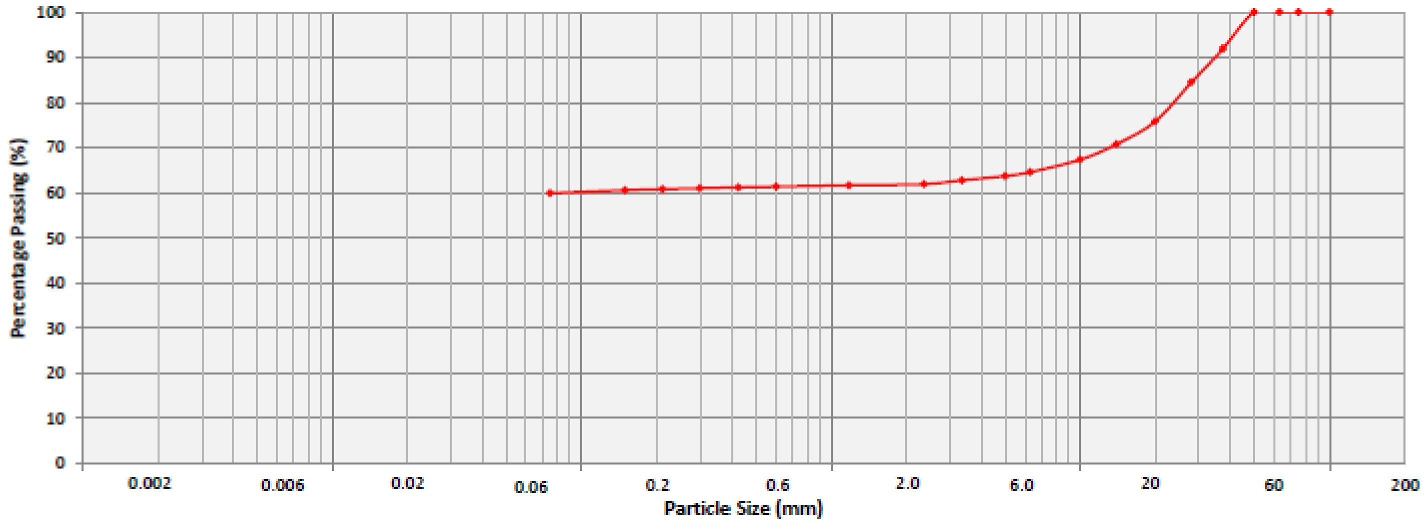
GROUP SYMBOL (USC SYSTEM)
MH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN37

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 37	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY LEAN CLAY	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	1.0M	**SAMPLE No.:**	1115



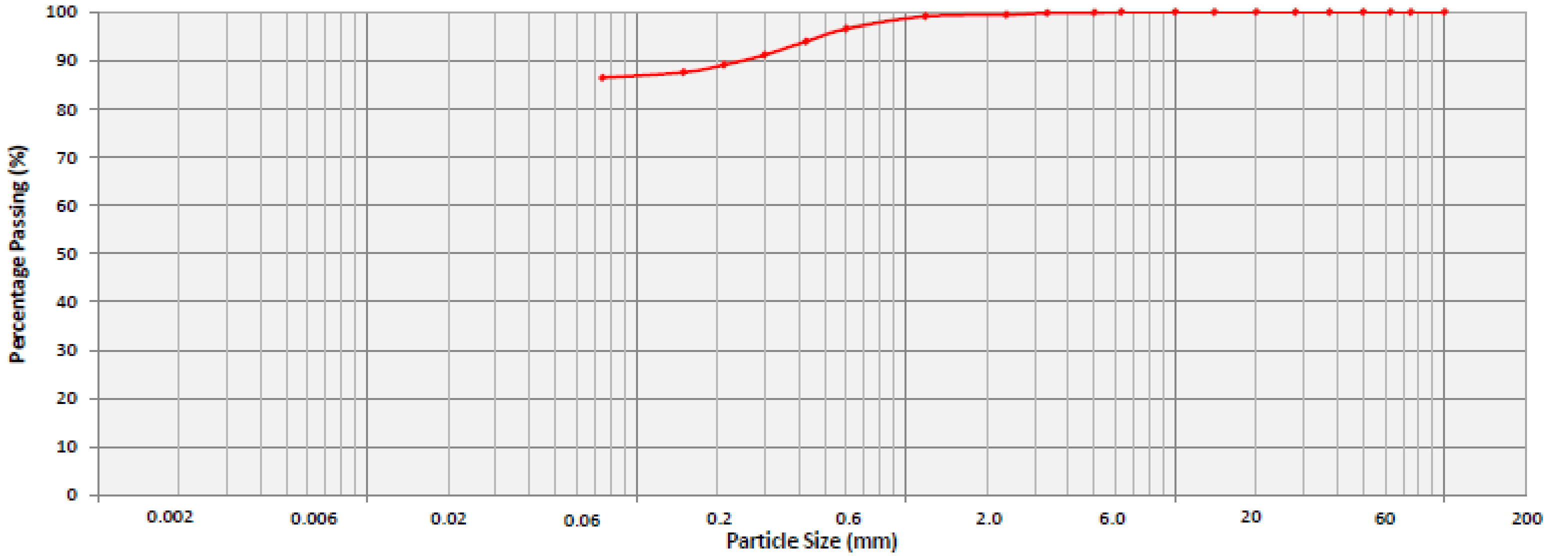
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 19.12.2012 CHECKED: WK

TP37-38

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN37(TP37-38)MN38	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Elastic SILT	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1218



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

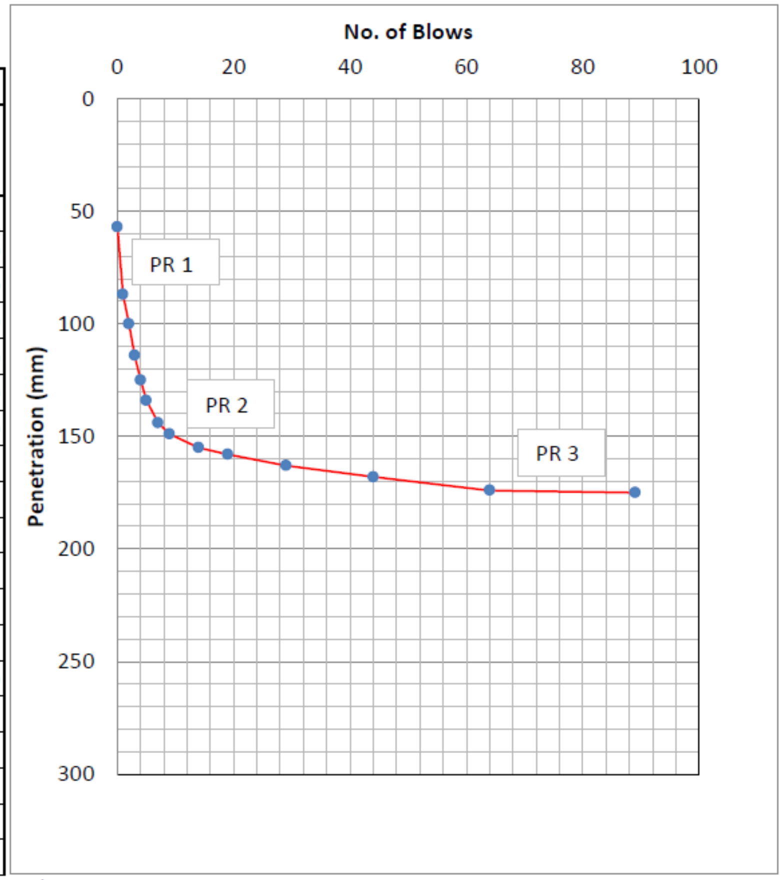
MN37

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Location**	MN 37	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	1.0M	**Sample No.**	1115

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	57	
1	1	1	87	30.0
2	1	2	100	13.0
3	1	3	114	14.0
4	1	4	125	11.0
5	1	5	134	9.0
6	2	7	144	5.0
7	2	9	149	2.5
8	5	14	155	1.2
9	5	19	158	0.6
10	10	29	163	0.5
11	15	44	168	0.3
12	20	64	174	0.3
13	25	89	175	0.0



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	30	5.5	
PR 2	8	29.9	
PR 3	0.3	2001.2	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN37

CALCULATION OF SAFE BEARING CAPACITY: TP MN 37					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	1.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY LEAN CLAY			**Sample No.:**	1115

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma (kg/m^3)$ =	1833
ø (°) =	20	$\gamma (kN/m^3)$ =	17.98

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 17.98 x 1.0 x 6.40) + (0.4 x 17.98 x 1.0 x 2.87)	**556 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 556/3.0	**185 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP37-38

CALCULATION OF SAFE BEARING CAPACITY: MN37 (TP37-38)MN38					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	1.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	ELASTIC SILT			Sample No.:	1220

LABORATORY TEST RESULTS			
SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	26	$\gamma\ (kg/m^3)$ =	1918
$\phi\ (^\circ)$ =	23	$\gamma\ (kN/m^3)$ =	18.82

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 18.05	
	N_q = 8.66	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 4.82	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 1.0	
	q_f= (1.3 x 26 x 18.05) + (0.8 x 18.82 x 1.0 x 8.66) + (0.4 x 18.82 x 1.0 x 4.82)	**777 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 777/3.0	**259 kN/m^2**

Calculations By: B.K.	**Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

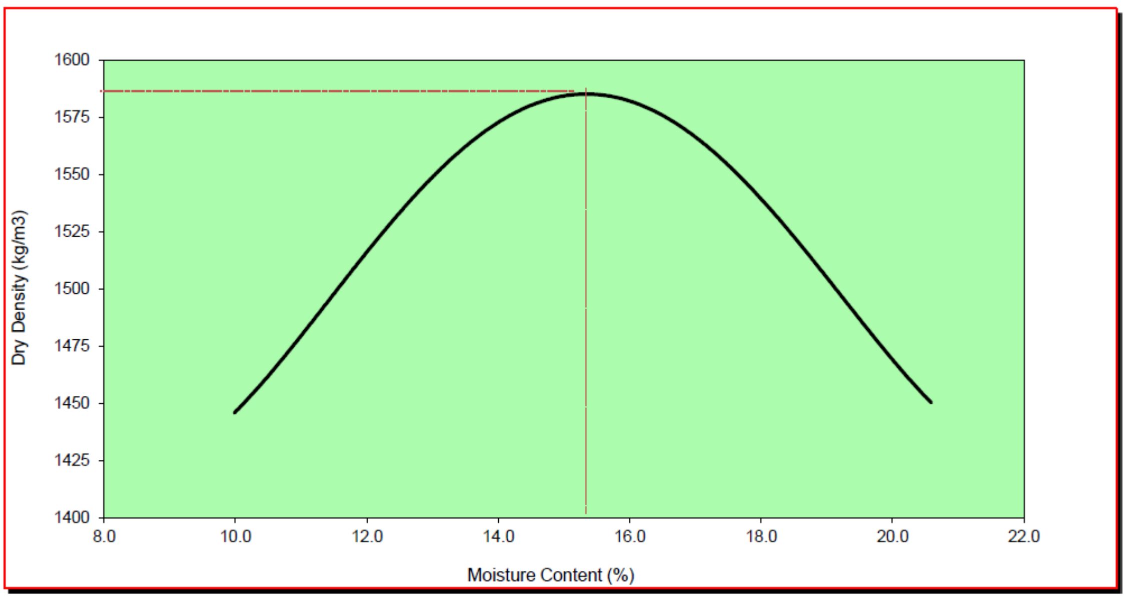
BS 1377 – 4: 1990

MN37

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	1.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1115
Material Description:	SANDY LEAN CLAY	**Sample Ref:**	TP MN 37	**Date received:**	09.12.2012

Moisture Addition	**150cc**	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**
Mass of Mould+Base+Soil	5585	5699	5796	5833	5801	5744
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1590	1704	1801	1838	1806	1749
Bulk Density (Kgs/m^3)	**1590**	**1704**	**1801**	**1838**	**1806**	**1749**
Tin No.	G40	G12	G29	G16	G55	G20
Weight Wet Soil	296.3	305.9	239.2	280.9	309.4	286.4
Weight of Dry Soil	269.4	272.9	209.3	241.7	261.3	237.5
Weight of Water	26.9	33.0	29.9	39.2	48.1	48.9
Moisture Content (%)	**10.0**	**12.1**	**14.3**	**16.2**	**18.4**	**20.6**
Dry Density (Kgs/m^3)	**1446**	**1520**	**1576**	**1582**	**1525**	**1450**



Maximum Dry Density (Kg/m^3): 1588 **Optimum Moisture Content (%):** 15.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN37	
Depth	1.0m
pH	7.62
Chloride(%) mg/l	0.32
Sulphate (mg/l)	

TP37-38	
Depth	2.0m
pH	7.04
Chloride(%) mg/l	0.007
Sulphate (mg/l)	0.017

INSITU DENSITY TEST

TP37-38	
Depth (m)	2.0
Bulk density (kg/m3)	1572
Moisture Content (%)	37.3
Dry Density (kg/m3)	1145
Maximum Dry Density (kg/m3)	1440
Relative Compaction (%)	79.5

ANGLE POINT 37 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN 37		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5		0.8	Brownish Red Elastic SILT
1		1.0	Dark Brown GRAVEL
1.5 2 2.5			Fragmented ROCK strata

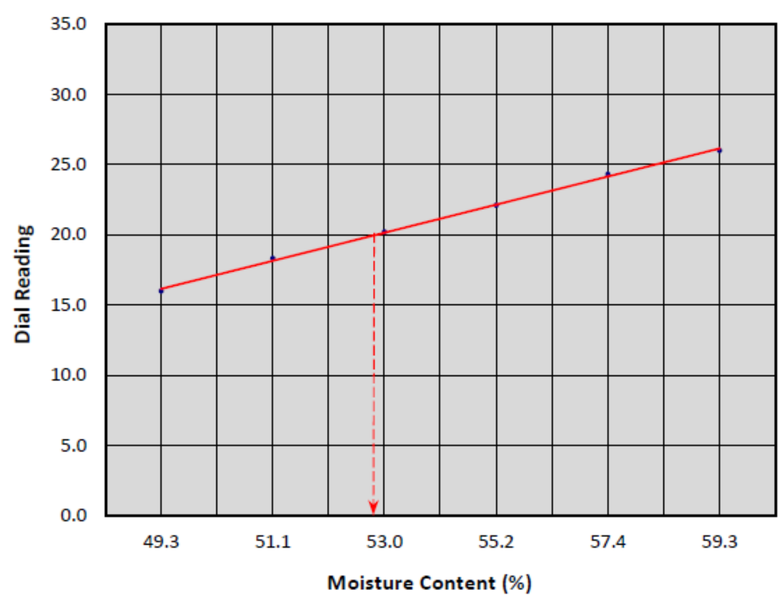
SEGMENT 37

ATTERBERG LIMITS BS 1377 - 2: 1990

MN38

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1116
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.0	18.3	20.2	22.1	24.3	26.0	-	-	
Tin No	**2118**	**47**	**57**	**59**	**68**	**40**	**21**	**31**	
Mass of Wet Soil (g)	27.19	28.77	33.50	38.46	41.14	36.85	33.93	37.17	
Mass of Dry Soil (g)	18.21	19.04	21.90	24.78	26.14	23.13	26.02	28.42	
Mass of Moisture (g)	8.98	9.73	11.60	13.68	15.00	13.72	7.91	8.75	
Moisture Content (%)	49.3	51.1	53.0	55.2	57.4	59.3	30.4	30.8	30.6



PLASTIC LIMIT
PL = 30.6 %

LIQUID LIMIT
LL = 52.6

Proportion Passing 425 µm BS Sieve
= 99.2 %

PLASTICITY INDEX
PI = 22.0 %

PLASTIC MODULUS
PM = 2183

LINEAR SHRINKAGE
LS = 10.7 %

GROUP SYMBOL (USC SYSTEM)
MH

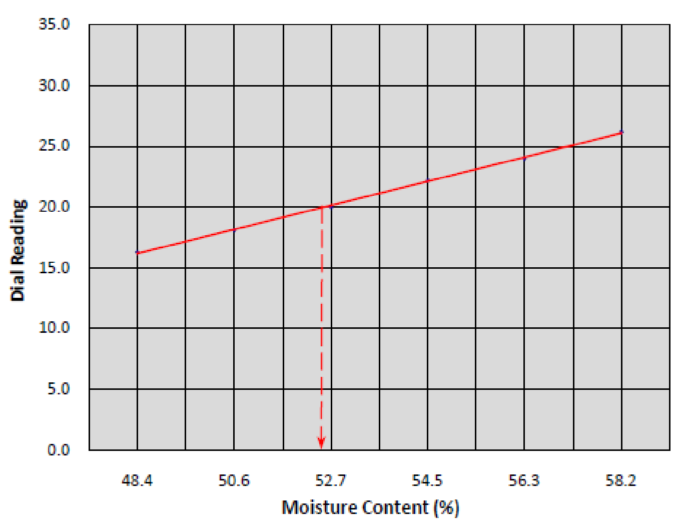
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

TP38-39

NESHCONSULT ENGINEERING

Project:	NANYUKI ISIOLO MERU POW	**Site / Location:**	MN38 (TP38-39)MN39	**Date Received:**	06.03.2013
Material Description:	Fat CLAY	**Job Reference:**	GCL/NAS-356/13	**Sample No.:**	1221
Sampled By:	GEO CON	**Depth:**	2.0M	**Date Tested:**	20.03.2013

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**Av.**
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.3	18.1	20.0	22.2	24.0	26.2	-	-	
Tin No	**20**	**3**	**25**	**16**	**35**	**14**	**26**	**37**	
Mass of Wet Soil (g)	66.72	63.30	53.62	57.54	65.22	56.90	17.94	23.51	
Mass of Dry Soil (g)	44.96	42.03	35.12	37.24	41.73	35.97	14.31	18.72	
Mass of Moisture (g)	21.76	21.27	18.50	20.30	23.49	20.93	3.63	4.79	
Moisture Content (%)	48.4	50.6	52.7	54.5	56.3	58.2	25.4	25.6	25.5



PLASTIC LIMIT

PL = 25.5 %

LIQUID LIMIT

LL = 52.5

Proportion Passing 425 µm BS Sieve

= 99.3 %

PLASTICITY INDEX

PI = 27.0 %

PLASTIC MODULUS

PM = 2683

LINEAR SHRINKAGE

LS = 12.9 %

GROUP SYMBOL (USC SYSTEM)

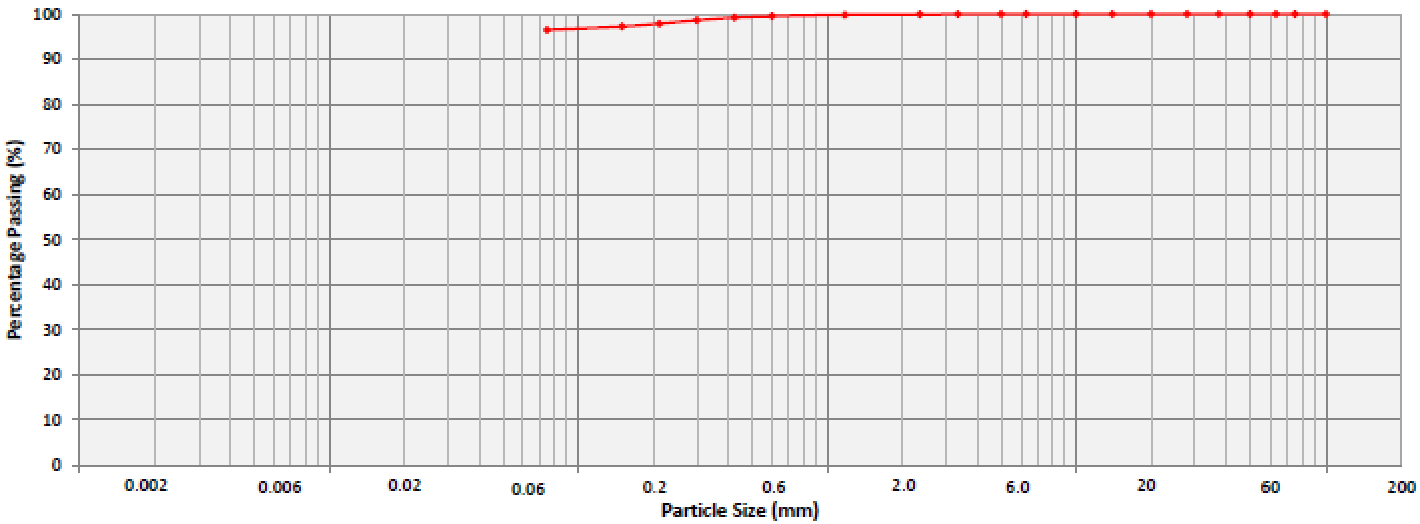
CH

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN38

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 38	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1116



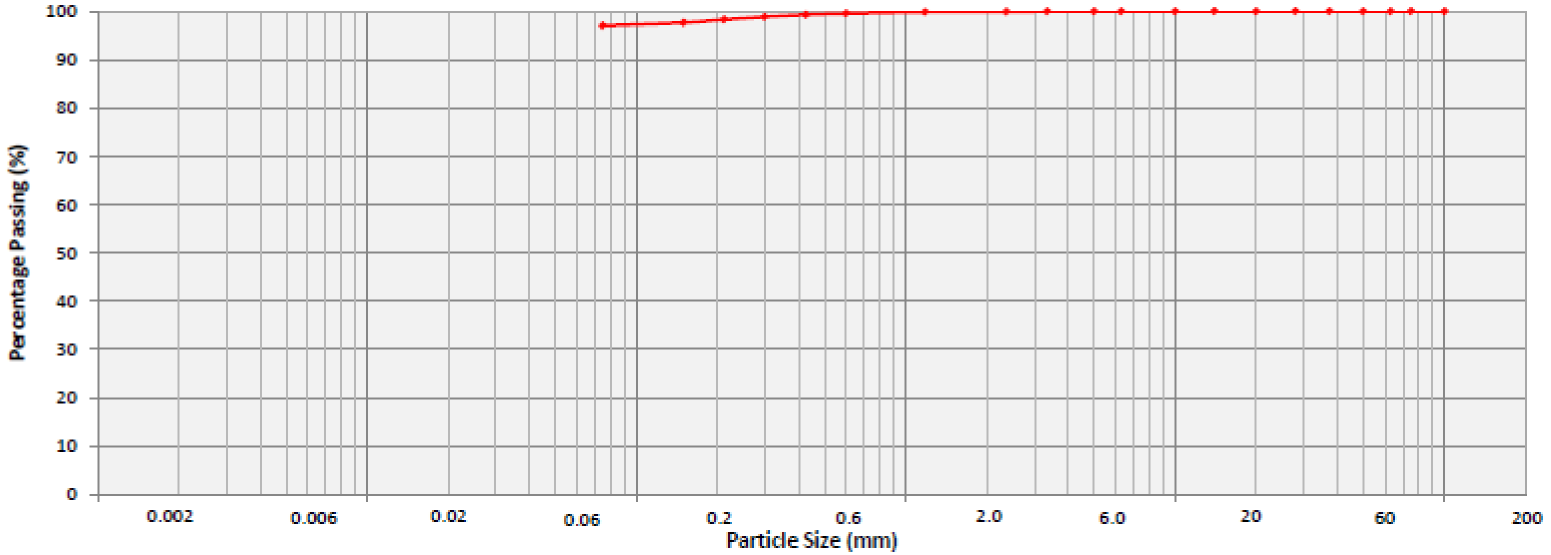
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 20.12.2012 CHECKED: WK

TP38-39

NESHCONSULT ENGINEERING

PROJECT:	NANYUKI ISIOLO MERU POWERLINE	LOCATION	MN38(TP38-39)MN39	DATE RECEIVED:	09.02.2013
MATERIAL DESCRIPTION:	Fat CLAY	JOB REF:	GCL/NAS-355/13	DATE TESTED:	14.03.2013
SAMPLED BY:	GEOCON LIMITED	DEPTH:	2.0M	SAMPLE No.:	1219



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

DCP - CBR CORRELATION

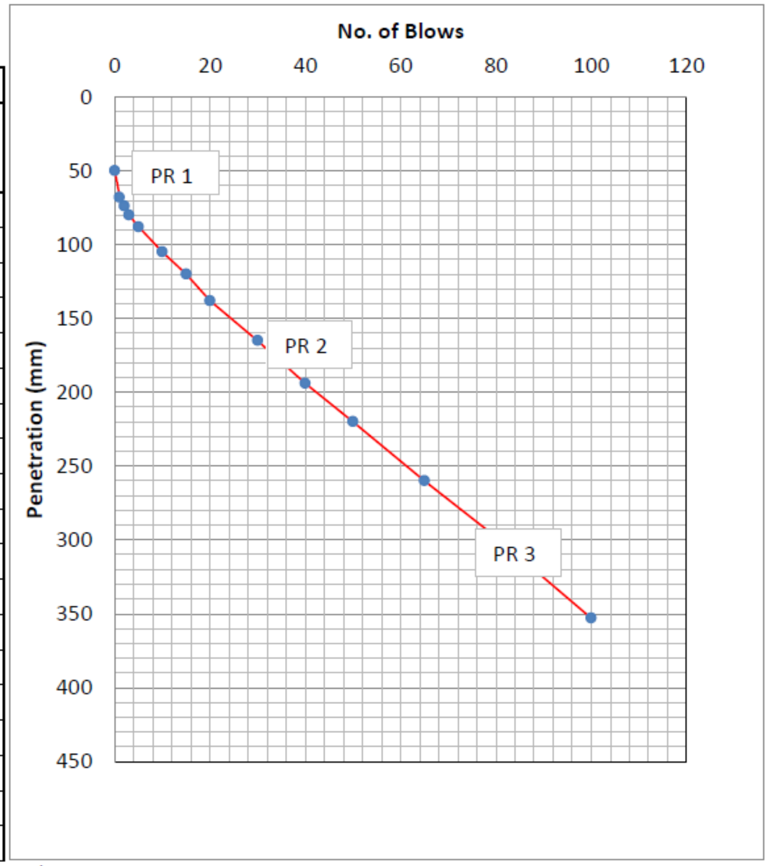
MN38

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 38	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1116

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	50	
1	1	1	68	18.0
2	1	2	74	6.0
3	1	3	80	6.0
4	2	5	88	4.0
5	5	10	105	3.4
6	5	15	120	3.0
7	5	20	138	3.6
8	10	30	165	2.7
9	10	40	194	2.9
10	10	50	220	2.6
11	15	65	260	2.7
12	15	80	298	2.5
13	20	100	353	2.8



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	18	10.6	
PR 2	4	72.7	
PR 3	2.6	126.1	

Test By: LUCAS

Checked: WK

ANGLE POINT BEARING CAPACITY

MN38

CALCULATION OF SAFE BEARING CAPACITY: TP MN 38					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1116

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\,(kg/m^3)$ =	1887
$\phi\,(^\circ)$ =	20	$\gamma\,(kN/m^3)$ =	18.51

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c= 14.83	
	N_q = 6.40	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 2.87	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 14.83) + (0.8 x 18.51 x 2.0 x 6.40) + (0.4 x 18.51 x 1.0 x 2.87)	**654 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 654/3.0	**218 kN/m^2**

Calculations By: B.K. **Checked:** WK

TP38-39

CALCULATION OF SAFE BEARING CAPACITY: MN38 (TP38-39) MN39					
PROJECT:	PROPOSED POWERLINE	SITE:	NANYUKI-ISIOLO-MERU	DATE RECEIVED:	06.03.2013
DEPTH:	2.0M	LOCATION:	EASTERN	JOB No.:	GCL/NC_356/03
MATERIAL DESCRIPTION:	FAT CLAY			Sample No.:	1221

LABORATORY TEST RESULTS			
SHEARBOX		DENSITY	
$C(kN/m^2) =$	23	$\gamma\,(kg/m^3) =$	1873
$\phi\,(^\circ) =$	15	$\gamma\,(kN/m^3) =$	18.38

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	$N_c = 10.98$	
	$N_q = 3.94$	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	$N_\gamma = 1.13$	
	The Ultimate Bearing Capacity of a Pad Foundation	
	$B(m) = 1.0$	
	$Z\,(m) = 2.0$	
	$q_f = (1.3 \times 23 \times 10.98) + (0.8 \times 18.38 \times 2.0 \times 3.94) + (0.4 \times 18.38 \times 1.0 \times 1.13)$	**452 kN/m²**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	$q_s = 706/3.0$	**151 kN/m²**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

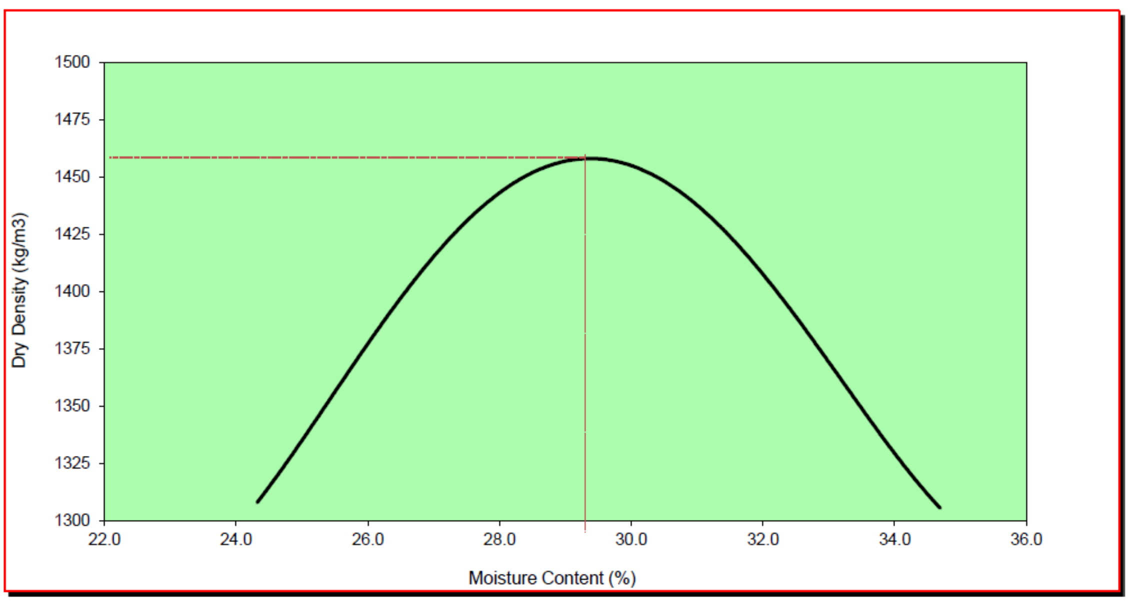
BS 1377 – 4: 1990

MN38

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1116
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 38	**Date received:**	09.12.2012

Moisture Addition	**200cc**	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**
Mass of Mould+Base+Soil	5621	5760	5859	5882	5837	5753
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1626	1765	1864	1887	1842	1758
Bulk Density (Kgs/m^3)	**1626**	**1765**	**1864**	**1887**	**1842**	**1758**
Tin No.	G13	G59	G52	G37	G18	G34
Weight Wet Soil	310.3	282.3	308.9	370.6	313.2	333.5
Weight of Dry Soil	249.6	223.2	240.6	283.8	236.4	247.6
Weight of Water	60.7	59.1	68.3	86.8	76.8	85.9
Moisture Content (%)	**24.3**	**26.5**	**28.4**	**30.6**	**32.5**	**34.7**
Dry Density (Kgs/m^3)	**1308**	**1395**	**1452**	**1445**	**1390**	**1305**



Maximum Dry Density (Kg/m^3): 1458 **Optimum Moisture Content (%):** 29.4%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN38	
Depth	2.0m
pH	7.84
Chloride(%) mg/l	0.39
Sulphate (mg/l)	0.002

TP38-39	
Depth	2.0m
pH	7.08
Chloride(%) mg/l	0.005
Sulphate (mg/l)	0.013

ANGLE POINT 38 LOG

JOB REF:	GCL/NCE_342/12	
MN 38		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	2.0	Brownish Red Elastic SILT

TEST POINT 38-39 LOG

PROJECT:	NANYUKI-ISIOLO-MERU POWERLINE		
SITE:	NANYUKI-ISIOLO-MERU		
	MN38 (TP38-39) MN39		
SCALE	LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
0 0.5 1 1.5		1.5	Dark Grey CLAY (Black Cotton Soil)
2		2.0	Grey Sandy CLAY
2.5			

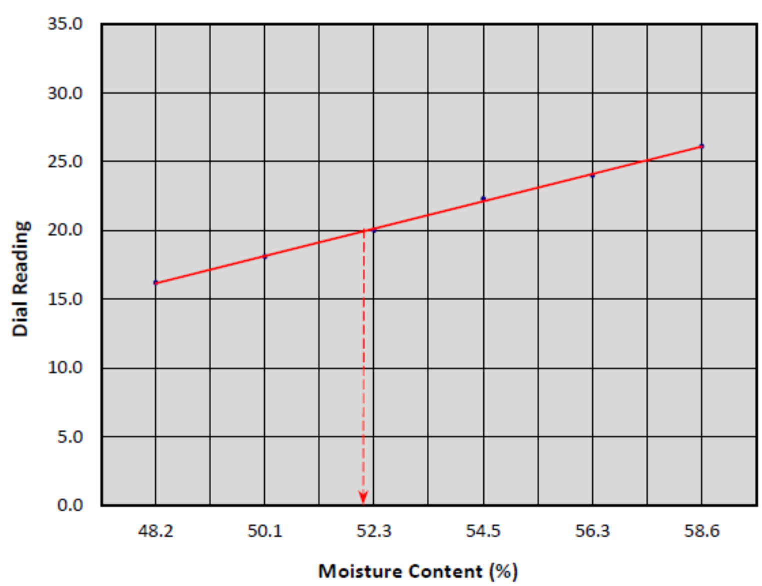
SEGMENT 38

ATTERBERG LIMITS BS 1377 - 2: 1990

MN39

Project:	PROPOSED POWERLINE	**Site / Location:**	NANYUKI-ISIOLO-MERU	**Date Received:**	09.12.2012
Material Description:	SANDY ELASTIC SILT	**Job Reference:**	GCL/TGA-342/12	**Sample No.:**	1117
Sampled By:	GCL	**Depth:**	2.0M	**Date Tested:**	18.12.2012

	LIQUID LIMIT						PLASTIC LIMIT		
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	Av.
Initial Gauge Reading (mm)	0.0	0.0	0.0	0.0	0.0	0.0	-	-	
Final Gauge Reading (mm)	16.2	18.1	20.0	22.3	24.0	26.1	-	-	
Tin No	**16**	**25**	**41**	**15**	**9**	**24**	**1**	**47**	
Mass of Wet Soil (g)	52.17	55.75	51.67	63.24	66.87	61.98	20.35	23.69	
Mass of Dry Soil (g)	35.20	37.14	33.92	40.93	42.77	39.08	15.49	18.04	
Mass of Moisture (g)	16.97	18.61	17.75	22.31	24.10	22.90	4.86	5.65	
Moisture Content (%)	48.2	50.1	52.3	54.5	56.3	58.6	31.4	31.3	31.3



PLASTIC LIMIT
PL = 31.3 %

LIQUID LIMIT
LL = 52.1

Proportion Passing 425 µm BS Sieve
= 99.7 %

PLASTICITY INDEX
PI = 20.8 %

PLASTIC MODULUS
PM = 2069

LINEAR SHRINKAGE
LS = 10.0 %

GROUP SYMBOL (USC SYSTEM)
MH

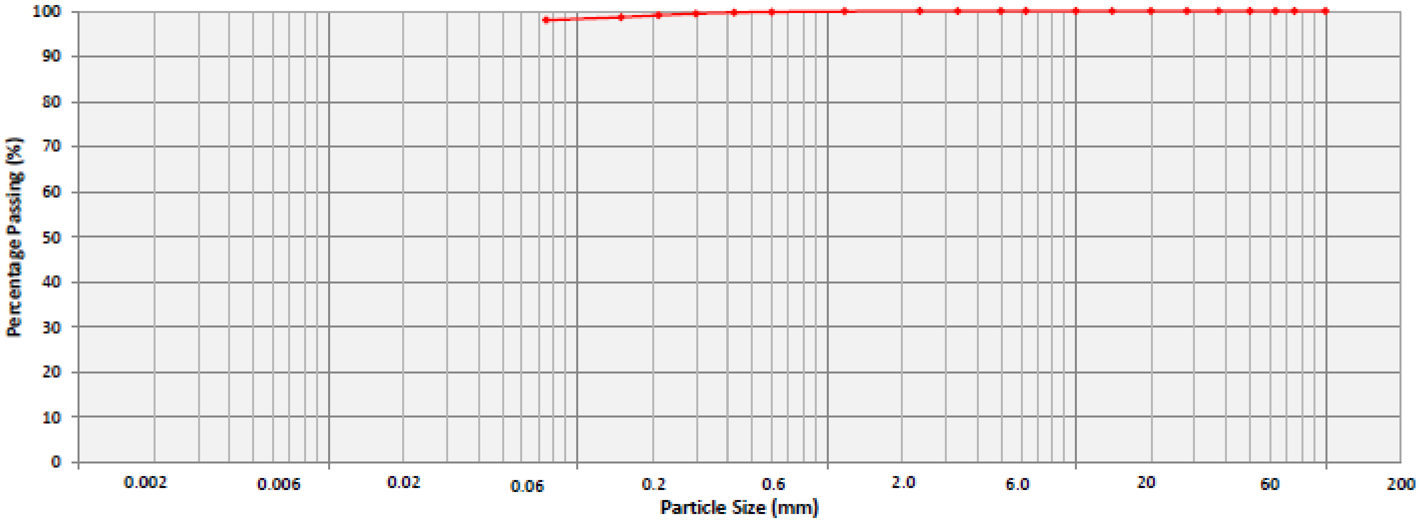
Tested By: LUCAS   Date Reported: 19.12.2012   Checked: WK

PARTICLE SIZE ANALYSIS BS 1377 - 2: 1990

MN39

NESHCONSULT ENGINEERING

PROJECT:	PROPOSED POWERLINE	**LOCATION**	MN 39	**DATE RECEIVED:**	09.12.2012
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT	**JOB REF:**	GCL/TGA-342/12	**DATE TESTED:**	18.12.2012
SAMPLED BY:	GCL	**DEPTH:**	2.0M	**SAMPLE No.:**	1117



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

TESTED BY: MONICA DATE REPORTED 20.12.2012 CHECKED: WK

DCP - CBR CORRELATION

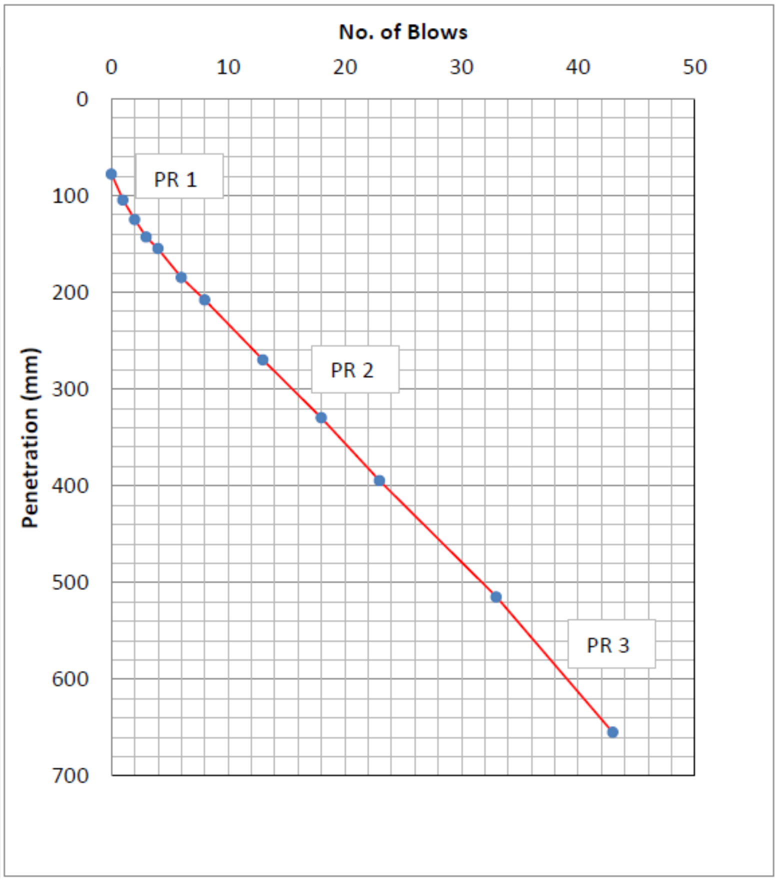
MN39

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**Location:**	EASTERN	**Test Locatior**	MN 39	**Date of Test:**	05.12.2012
Site:	NANYUKI-ISIOLO-MERU	**Job No.:**	GCL/TGA-342/12	**Depth:**	2.0M	**Sample No.**	1117

DCP TEST RESULTS

Point No.	Blow Count	Cum. Blows	Penetration (mm)	Penetration Index (mm/blow)
0	0	0	78	
1	1	1	105	27.0
2	1	2	125	20.0
3	1	3	143	18.0
4	1	4	155	12.0
5	2	6	185	15.0
6	2	8	208	11.5
7	5	13	270	12.4
8	5	18	330	12.0
9	5	23	395	13.0
10	10	33	515	12.0
11	10	43	655	14.0



DCP/CBR CORRELATION

Penetration Index	Average (mm/blow)	Estimated CBR (%)	
PR 1	21	8.7	
PR 2	13	16.1	
PR 3	12	17.8	

Test By: LUCAS **Checked:** WK

ANGLE POINT BEARING CAPACITY

MN39

CALCULATION OF SAFE BEARING CAPACITY: TP MN 39					
PROJECT:	PROPOSED POWERLINE	**SITE:**	NANYUKI-ISIOLO-MERU	**DATE RECEIVED:**	09.12.2012
DEPTH:	2.0M	**LOCATION:**	EASTERN	**JOB No.:**	GCL/TGA_342/12
MATERIAL DESCRIPTION:	SANDY ELASTIC SILT			**Sample No.:**	1116

LABORATORY TEST RESULTS

SHEARBOX		**DENSITY**	
$C(kN/m^2)$ =	23	$\gamma\ (kg/m^3)$ =	1887
$\phi\ (^\circ)$ =	21	$\gamma\ (kN/m^3)$ =	18.51

REFERENCE	CALCULATIONS	RESULTS
	Ultimate Bearing Capacity	
	$q_f = 1.3cNc + 0.8\gamma ZNq + 0.4\gamma BN\gamma$	
	Bearing Capacity Factors : Meyerhof's Analyses	
	N_c = 15.81	
	N_q = 7.07	
Whitlow. R Basic Soil Mech. **Tomlinson. M.J.** Foundation Design & Construction	N_γ = 3.42	
	The Ultimate Bearing Capacity of a Pad Foundation	
	B(m)= 1.0	
	Z (m)= 2.0	
	q_f = (1.3 x 23 x 15.81) + (0.8 x 18.51 x 2.0 x 7.07) + (0.4 x 18.51 x 1.0 x 3.42)	**708 kN/m^2**
	The Safe Bearing Capacity of the foundation is : (Fs = 3.0)	
	q_s = 708/3.0	**236 kN/m^2**

Calculations By: B.K. **Checked:** WK

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

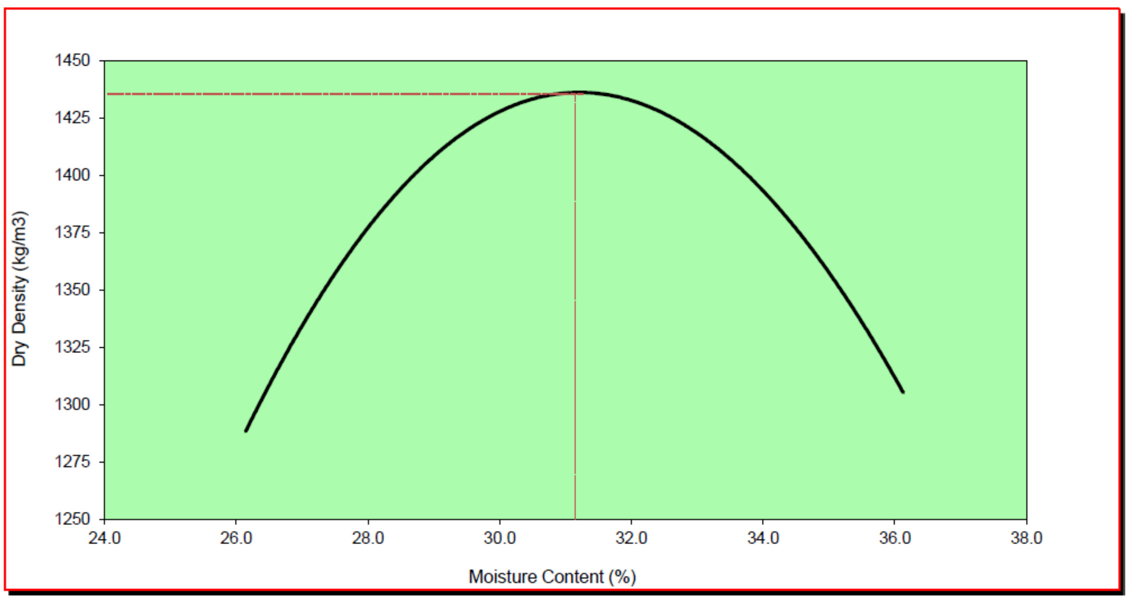
BS 1377 – 4: 1990

MN39

NESHCONSULT ENGINEERING

Project:	PROPOSED POWERLINE	**LOCATION:**	EASTERN	**Depth:**	2.0M
Site:	NANYUKI-ISIOLO-MERU	**Job Ref.:**	GCL/TGA-342/12	**Sample No.:**	1116
Material Description:	SANDY ELASTIC SILT	**Sample Ref:**	TP MN 39	**Date received:**	09.12.2012

Moisture Addition	**250cc**	**300cc**	**350cc**	**400cc**	**450cc**	**500cc**
Mass of Mould+Base+Soil	5620	5760	5857	5888	5858	5772
Mass of Mould+Base	3995	3995	3995	3995	3995	3995
Mass of Compacted Soil	1625	1765	1862	1893	1863	1777
Bulk Density (Kgs/m^3)	**1625**	**1765**	**1862**	**1893**	**1863**	**1777**
Tin No.	G01	G04	G45	G23	G19	G31
Weight Wet Soil	193.0	233.0	211.0	223.0	228.0	211.0
Weight of Dry Soil	153.0	182.0	162.0	169.0	170.0	155.0
Weight of Water	40.0	51.0	49.0	54.0	58.0	56.0
Moisture Content (%)	**26.1**	**28.0**	**30.2**	**32.0**	**34.1**	**36.1**
Dry Density (Kgs/m^3)	**1288**	**1379**	**1430**	**1435**	**1389**	**1305**



Maximum Dry Density (Kg/m^3): 1438 **Optimum Moisture Content (%):** 31.2%

Tested By: STEVE **Date Reported:** 25.01.2013 **Checked By:** WK

CHEMICAL ANALYSIS

Angle Point MN39	
Depth	2.0m
pH	6.83
Chloride(%) mg/l	-
Sulphate (mg/l)	

INSITU DENSITY TEST

TP38-39	
Depth (m)	2.0
Bulk density (kg/m3)	1560
Moisture Content (%)	37.5
Dry Density (kg/m3)	1134
Maximum Dry Density (kg/m3)	1450
Relative Compaction (%)	78.2

ANGLE POINT 39 LOG

DATE:	03 - 09.12.2012	
LOGGED BY:	LUCAS	
MN 39		
LEGEND	DEPTH (m)	MATERIAL DESCRIPTION
	2.0	Brownish Red Elastic SILT