KENYA AIRPORT AUTHORITY

KAA

GEOTECHNICAL INVESTIGATIONS FOR THE PROPOSED DEVELOPMENT AND MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

FACTUAL PROGRESS REPORT

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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
BH	Borehole
BS	British Standard
CBR	California Bearing Ratio
DCP	Dynamic Cone Penetrometer
DN	Dynamic Number
IS (50)	Point Load Strength Index
JKIA	Jomo Kenyatta International Airport
km	Kilometer
KVS	Kerichwa Valley Series
kN/m^2	Kilonewtons per square meter
LL	Liquid Limit
LS	Linear Shrinkage
MDD	Maximum Dry Density
mm	Millimeters
MPa	Megapascal
OMC	Optimum Moisture Content
PI	Plasticity Index
PL	Plastic Limit
PLT	Point Load Test
PR	Penetration Rate
RQD	Rock Quality Designation
TP	Trial Pit
TRRL	Transport and Road Research Laboratory
UCS	Unconfined Compressive Strength
USCS	Unified Soil Classification System

1. INTRODUCTION

1.1. Overview

The geotechnical investigation for the proposed development and modernization of facilities at Jomo Kenyatta International Airport (JKIA) was commissioned by the Kenya Airports Authority. Gallcons Engineering Technology Ltd, referred to as the Geotechnical Contractor, was appointed to carry out subsurface exploration works.

The primary objective of the investigation was to assess the subsurface conditions and determine the engineering properties of soils and rocks to support preliminary foundation design and related civil works. The findings of this investigation provide essential data for the design of foundations, pavements, and other infrastructure at the airport.

1.2. Scope of Works

The geotechnical investigation comprised field and laboratory activities aimed at characterizing the subsurface conditions at the JKIA project site.
The scope of works included:

- Drilling and detailed logging of three boreholes to determine soil and rock profiles.
- Excavation of trial pits at selected locations for near-surface soil investigations.
- Conducting Dynamic Cone Penetrometer (DCP) tests within trial-pitted areas to assess in-situ soil strength and density to depths of up to 1.5 meters. DCP results were used to corroborate laboratory findings.
- Recovery of disturbed soil samples from various depths for laboratory testing.
- Recording of groundwater levels encountered during excavation.
- Laboratory testing of soil and rock samples to determine physical and chemical properties, providing data for foundation design and site assessment.

2. GENERAL PHYSIOGRAPHIC FEATURES

2.1. Topography

The Jomo Kenyatta International Airport area is located in the southeastern part of Nairobi at an average elevation of approximately 1,620 meters above sea level. The topography is generally characterized by low-lying, gently undulating plains with minimal variation in elevation across the site. **Figure 2.1** below shows the general elevation of the site at Jomo Kenyatta International Airport.

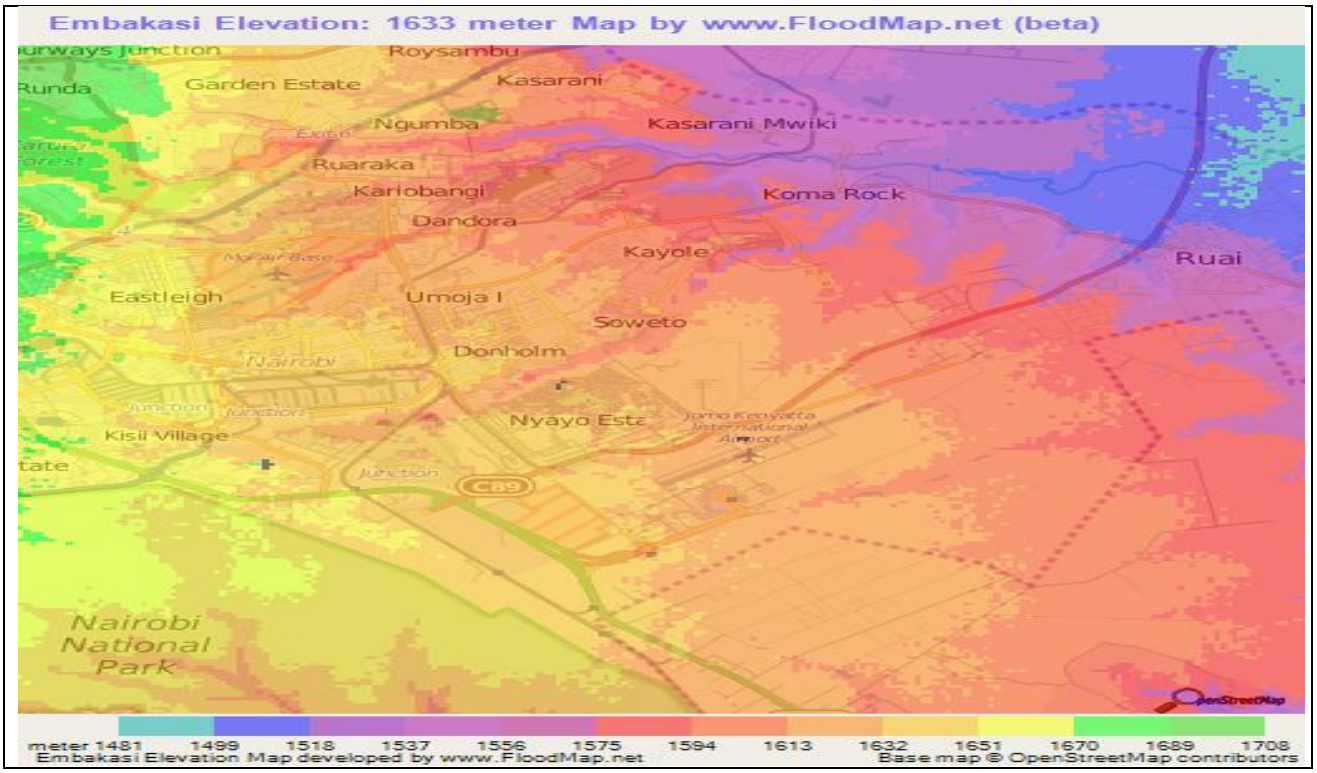

Figure 2.1: *Elevation map of Embakasi area ,Nairobi Kenya.*

The J.K.I.A area forms part of the extensive Athi Plains, which are typified by relatively flat terrain with occasional shallow depressions and slight rises. Ground slopes are generally mild, facilitating surface drainage, which is predominantly seasonal and directed towards the Athi River drainage system.

Physiographically, the site can be classified as a plateau plain developed on volcanic formations, mainly comprising tuffs and associated pyroclastic deposits. Unlike regions with pronounced escarpments or rugged relief, the airport area exhibits no significant topographic breaks, escarpments, or rocky outcrops.

The existing landscape has been substantially modified by extensive engineering works associated with airport development, including the construction of runways, taxiways, and aprons. The **Figure 2-2** below shows the location map of the site in Jomo Kenyatta international Airport, Nairobi Kenya.

Figure 2.2: *A location map of Jomo Kenyatta International Airport within Kenya showing its position in the south-eastern part of Nairobi.*

2.2. Climate

The area experiences a bimodal rainfall pattern typical of the south-eastern part of Nairobi. The long rains generally occur between March and May, with peak precipitation recorded in April, while the short rains are experienced from October to December, peaking in November. The driest periods are typically from January to February and June to September. Average annual rainfall in the area ranges between approximately 800 mm and 1,000 mm, often occurring as moderate to heavy showers, occasionally accompanied by thunderstorms. Rainfall intensity can be significant, influencing surface runoff and infiltration characteristics relevant to geotechnical considerations.

The area experiences moderate temperatures throughout the year, with mean maximum temperatures ranging between 24°C and 28°C and mean minimum temperatures between 12°C and 16°C. Daytime temperatures are generally higher, while cooler conditions are experienced during the night and early mornings. Mean annual evaporation is relatively high, typically ranging between 1,800 mm and 2,200 mm, influenced by solar radiation and wind conditions. Humidity levels are moderate, and evaporation rates may exceed precipitation during dry periods, which can affect soil moisture variation and behavior, particularly for fine-grained soils.

2.3. Drainage

The area surrounding Jomo Kenyatta International Airport is generally well-drained due to its location on the gently sloping Athi Plains. Surface water runoff is seasonal, following the long and short rainy seasons, and is directed towards the Athi River and its minor drainage channels.
The airport site contains a few shallow natural depressions and small channels that collect and convey rainwater.

During heavy rainfall, water temporarily accumulates in low-lying areas but generally flows towards the minor streams surrounding the site. The flat terrain, combined with extensive airport infrastructure such as runways, taxiways, and aprons, has altered natural water paths, making engineered drainage systems, culverts, swales, and lined channels essential to prevent ponding and flooding. Overall, the site exhibits favorable drainage conditions for civil works, provided that designed drainage systems are implemented and maintained.

2.4.Assessment of Seismic risks and Hazards

OCHA (2007) and WHO (2010) researched seismic activities in Kenya, and documented a useful data that can be applied in identifying areas prone to seismic ground motion, and their impacts in design of structure. The report identifies literature that assesses seismic risk in Kenya. In the report, seismic risk, as a concept, is understood to be the product of seismic hazard (the probability of harmful seismic phenomena) and seismic vulnerability the degree of loss from seismic phenomena).

In terms of overall seismic risk, the presence of part of the East African Rift, which runs through the west of Kenya and the Davie fracture just south of the Mombasa, means that Kenya is vulnerable to seismic activity and related natural disasters: earthquakes, volcanic eruption and tsunamis.

Although Kenya is considered a country of low to moderate seismic activity, it has experienced numerous historical large earthquakes and damage has been reported ranging from minor to great. The cities with the greatest degree of hazard are Nakuru, Eldoret, Kisumu and Kakamega, which have a medium degree of seismic hazard. Nairobi which forms part of the site faces a moderate degree of hazard

2.4.1. Risks

The seismically active Great African Rift Valley, one of the most earthquake-prone regions in the world, traverses Kenya. Consequently, areas within the Rift Valley and parts of the Nyanza Basin are susceptible to both earthquake and volcanic activity.

Figure 2-3 below illustrates the distribution of seismic risk across Kenya and the surrounding region. From the map, the project site is located within a zone of moderate seismic activity, as indicated by the yellow band representing areas of relatively low earthquake magnitudes.

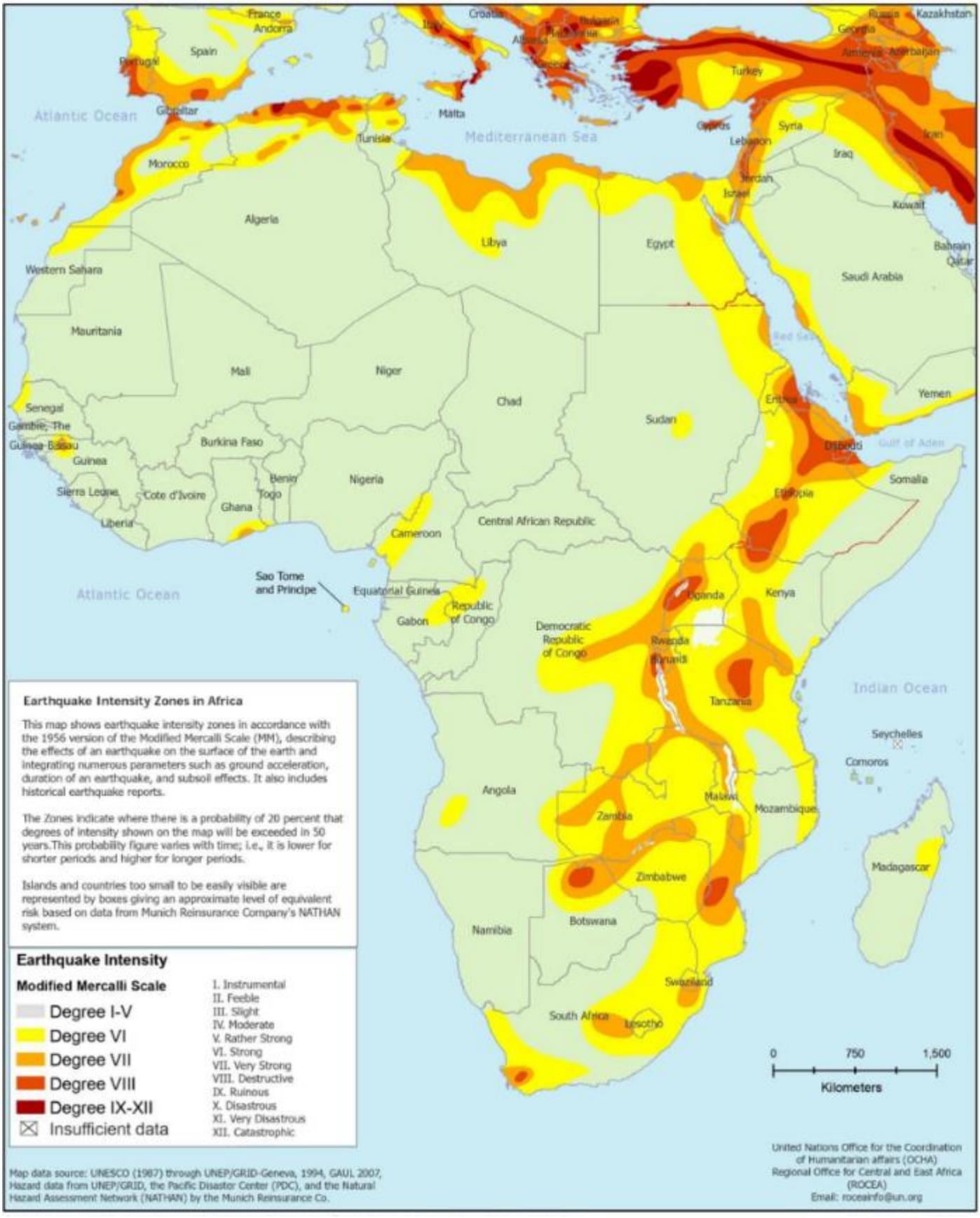

Figure 2.3: *Seismic classification map of Africa (Source: OCHA Regional Office for Central and East Africa)*

2.5.Geology

2.5.1. Regional Geology

The Jomo Kenyatta International Airport (JKIA) area lies within the Nairobi region, which has undergone multiple phases of peneplanation from the late Precambrian to the Tertiary period. Subsequent tectonic activity associated with the development of the Great Rift Valley initiated extensive volcanicity during the Mid-Miocene, resulting in successive lava flows and pyroclastic deposits that covered the eastern plains, including the JKIA area. Intermittent volcanic activity persisted into relatively recent geological times.

The regional geology is dominated by volcanic and sedimentary formations of the southeastern Athi Plains. These include Tertiary volcanic deposits such as tuffs, agglomerates, and lava flows, often interbedded with volcanic ash and pyroclastic materials. The volcanic rocks are part of the East African alkaline suite and include strongly alkaline types (phonolites, basanites, tephrites) and mildly alkaline rocks (trachytes, rhyolites, and obsidians). These materials were derived from fissure eruptions within the Rift system and nearby volcanic centres such as Ngong Hills and Ol Esayeiti.

The terrain is generally flat to gently undulating, with localized depressions filled by alluvial and colluvial sediments. These superficial deposits, together with Quaternary soils and gravels, influence drainage, compaction, and foundation conditions. Radiometric dating indicates that volcanic activity in the region occurred between approximately 13.4 and 0.8 million years ago, while faulting associated with Rift Valley tectonics has shaped the present-day geological structure and topography.

2.5.1.1. Volcanic and Sedimentary cover

The area is underlain by a complex sequence of volcanic and sedimentary materials that reflect the geological evolution of the Nairobi region within the Great Rift Valley setting. The subsurface is dominated by a thick succession of alkaline volcanic rocks and associated pyroclastic deposits, which accumulated from the Mid-Miocene to Upper Pleistocene period. These volcanic deposits overlie older metamorphic basement rocks of Neo-Proterozoic age.

The volcanic sequence primarily consists of phonolitic and trachytic lavas interbedded with tuffs and other pyroclastic materials. Tuffs, which are fine- to medium-grained volcanic ash deposits, occur extensively within the subsurface profile. Where intact, these materials are relatively competent and capable of supporting shallow to moderate foundation loads. However, in zones where weathering has been significant, tuffs may exhibit reduced cohesion, increased porosity, and lower bearing capacity. Such conditions require careful geotechnical evaluation, particularly where weak ash lenses or volcanic silts are present, as these may adversely affect drainage and compaction characteristics.

Agglomerates are also encountered within the volcanic sequence and comprise coarse, fragmental materials with larger pyroclastic clasts embedded in a finer matrix. In weathered conditions, these materials tend to be weakly cemented and highly variable in composition, leading to inconsistent stiffness. This variability may result in differential settlement if not adequately addressed during foundation design.

Overlying the volcanic formations are Quaternary alluvial and colluvial deposits, particularly within localized depressions and low-lying areas across the site. These materials are typically loose and unconsolidated, consisting of silty and clayey soils with low shear strength and high compressibility. As a result, they are prone to settlement under applied loads and may require ground improvement measures, especially beneath critical infrastructure such as runways, taxiways, and aprons.

Generally, the volcanic and sedimentary cover at JKIA has been significantly influenced by weathering, erosion, and depositional processes, resulting in heterogeneous subsurface conditions. This variability affects key engineering properties such as stiffness, plasticity, permeability, and bearing capacity, and must therefore be carefully considered in both geotechnical design.

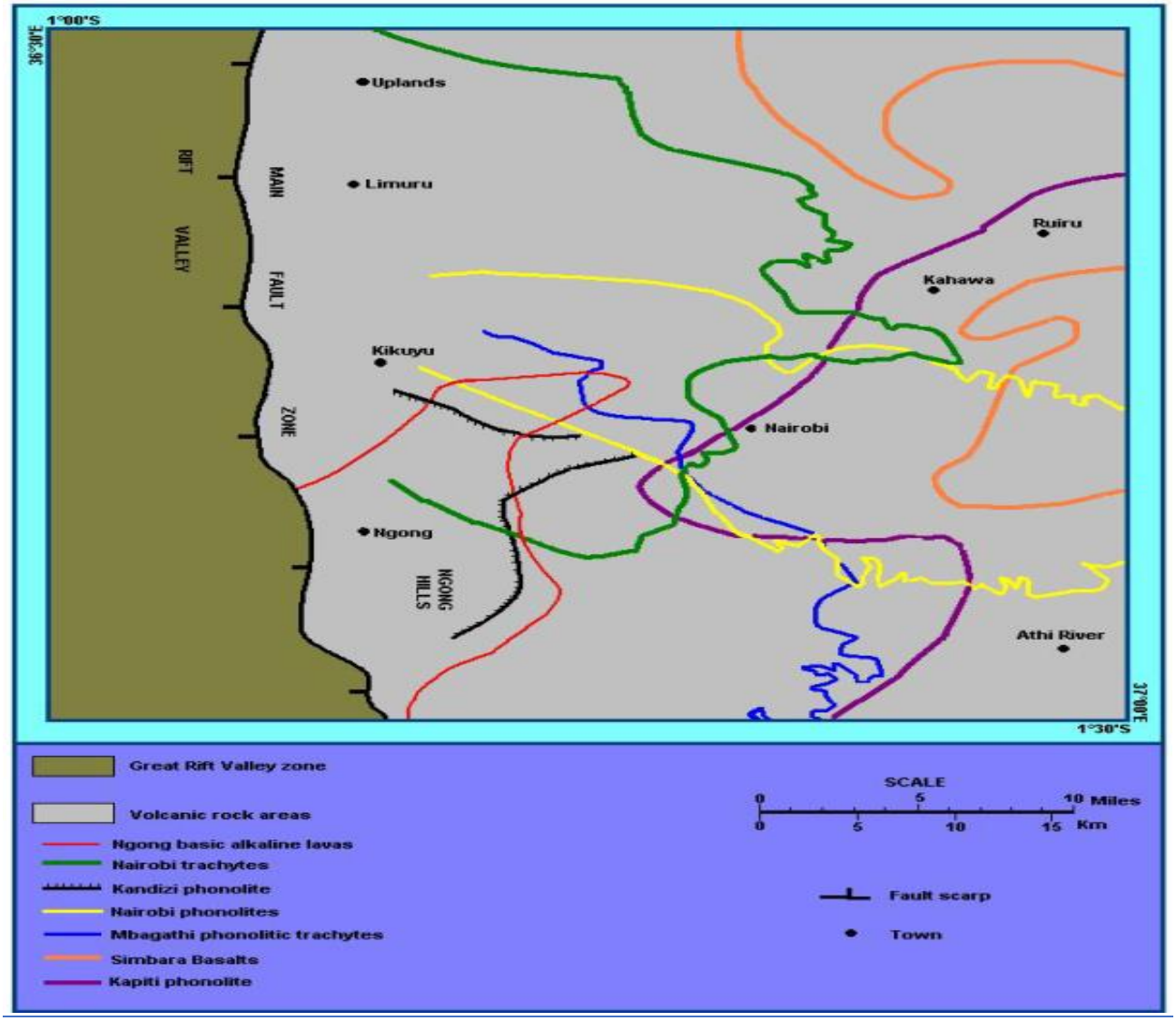

Figure 2.4: *Relative position of Great Rift Valley and extent of early lava flows in Nairobi area (Modified from Saggerson, 1991)*

		SOUTH Kajiado (Matheson, 1966)	CENTRAL Nairobi (Saggerson, 1968)	NORTH Kijabe (Thompson, 1964)
RECENT		Soils	Soils, ashes, alluvium, loess, gypsiferous beds	Soils and ashes
PLEIST-OCENE	U		Longonot trachytes	Trachytes Lacustrine deposists
		xxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxxxxxxxxxxxxxxxx
	M	Olorgesailie Lake Beds	Sediments (Kandizi Valley) Upper Trachyte Division of rhyolites, trachyrhyolites and obsidians (with interbedded diatomites)	Pyroclastics xxxxxxxxxxxxxxxx Trachytes, Kijabe basalts, welded tuffs
		xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
	L		Upper Trachyte Division of: Welded tuffs & pyroclastics,	Pyroclastics and Laikipian basalts (Sattima Series/ Laikipian lavas)
		Orthophrye trachyte	Orthophrye trachyte, and	
		Alkali trachyte	Limuru trachytes xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
PLIOCENE		Ol Keju Nero basalts xxxxxxxxxxxxxxxxxxxxxxxx Ol Esayeti volcanics Kerichwa valley tuffs and Ol Doinyo Narok agglomerate	Middle Trachyte Division: Tigoni & Karura trachyte Ruiru Dam trachyte Kabete trachyte Kerichwa Valley tuffs Ol Esayeti volcanics	Sattima Series and
		Olorgesailie Volcanic Series	Lower Trachyte Division: Ngong volcanics Ol Doinyo Narok agglomerate Ololua trachyte Nairobi / Kiambu trachytes	Laikipian lavas
		Mbagathi trachyte	Sediments & tuffs Nairobi & Kandizi phonolites Mbagathi phonolitic trachytes	
		Upper Athi tuffs	x-x-x-x-x-x-x-x-x-x-x-x-x-x-x-x-x- Athi tuffs and Lake Beds	
MIOCENE		Kapiti phonolite	Lower Trachyte Division: Simbara basalt Kapiti phonolite	Simbara Series
PRECAMB-RIAN		Basement System	Metamorphic rocks of the Mozambique Belt	not exposed
xxx Faulting			_ _ _ Erosion surface	___ Major unconformity

Figure 2.5: *Stratigraphic correlation of rocks in the Nairobi region (Saggerson, 1991)*

2.5.1.2. Precambrian rocks of the Mozambique Belt

The area is underlain at depth by crystalline metamorphic rocks of Precambrian age, belonging to the Mozambique Belt. These rocks are generally not exposed at the site but may occur locally in surrounding areas where the overlying volcanic cover has been removed by erosion (Saggerson, 1991)

The basement rocks consist mainly of weathered schists and gneisses, occasionally intruded by pegmatitic veins. Structurally, they exhibit predominantly north–south and northeast–southwest trending folds, indicating multiple phases of deformation (Saggerson, 1991).These rocks are typically

highly weathered near the surface and occur at variable depths due to an irregular pre-volcanic erosion surface.

In most parts of the area, the metamorphic basement is separated from the overlying volcanic sequence by an unconformity representing an ancient erosional surface formed prior to volcanic deposition in the early Miocene (Saggerson E. , 1991). This interface is sometimes marked by thin layers of weathered material or residual soils. Borehole records from the wider Nairobi region indicate that the depth to basement rock varies significantly, reflecting an uneven buried topography (Skies, 1939)

Precambrian basement rocks generally occur at considerable depths beneath the JKIA area and are unlikely to influence shallow foundation design. However, their irregular surface and degree of weathering may be relevant for deep foundations or heavily loaded structures where founding levels approach the rock interface.

2.5.1.3. Nairobi Phonolite

The Jomo Kenyatta International Airport (JKIA) area is underlain by the Nairobi phonolite, a widespread volcanic unit that covers much of the Athi Plains within the Nairobi region. The phonolite overlies the Athi Series, likely across a disconformity, and forms a significant component of the subsurface geology in the project area (Saggerson, 1991)

The Nairobi phonolite comprises multiple lava flows, with radiometric ages ranging between approximately 5.2 and 10.2 million years, indicating successive eruptive phases. Individual flow units are typically 30–46 m thick, while borehole records indicate total thicknesses of up to about 79 m in the Embakasi (JKIA) area and approximately 65 m near Wilson Airport (Saggerson, 1991)). The lavas are interpreted to have originated from volcanic centres to the west of Nairobi and flowed in a south-easterly direction, resulting in maximum accumulation in the eastern parts of the region, including the JKIA site.

Lithologically, the Nairobi phonolite is generally fine-grained, dark grey to bluish in colour when fresh, and exhibits features such as platy structure, fissility, and localized vesicular textures near the surface. The base of the flows commonly consists of pumiceous and irregular lava overlying agglomeratic tuffs. The rock mass is typically massive but may be jointed, with weathering concentrated along discontinuities.

Weathering of the phonolite is extensive in the JKIA area, often transforming the upper zones into reddish-brown ferricrete (murram) or highly weathered materials. In some locations, particularly towards the eastern and south-eastern parts of the site, the rock is auto-brecciated, forming boulder beds of angular to rounded fragments within a weathered matrix. Additionally, sub-circular weathered zones beneath black cotton soils have been observed, likely associated with intensified weathering along joint intersections (Scott, 1963).

The degree of weathering significantly influences the geotechnical behavior of the Nairobi phonolite. Fresh rock may provide competent founding conditions, while weathered zones may exhibit reduced strength and increased variability, necessitating careful site-specific evaluation for foundation design.

2.5.1.4. Kerichwa Tuff

The Kerichwa Valley Series (KVS) forms an important component of the volcanic cover within the Jomo Kenyatta International Airport (JKIA) area and the wider Nairobi region. It comprises a sequence of pumice-rich trachytic tuffs and agglomeratic tuffs that are younger than the Nairobi Trachyte and overlie most of the older volcanic formations (Saggerson E. , 1991).

The KVS deposits were emplaced over a pre-existing erosional landscape, effectively burying earlier valleys, which are now being re-exposed through erosion in some areas, revealing underlying units such as Nairobi Trachyte and Nairobi Phonolite. In terms of composition, the series ranges from well-cemented, fine-grained pumiceous ash to coarse agglomeratic tuffs containing rock fragments of up to approximately 0.5 m in size. Despite the presence of coarse fragments, these materials are classified as agglomeratic tuffs due to the dominance of the fine-grained matrix.

The tuffs are typically yellow, grey, or black in colour and are interpreted to have formed from explosive volcanic activity associated with Rift Valley tectonics. Unlike many volcanic deposits, the Kerichwa Valley Series cannot be directly linked to a specific volcanic vent, and it is believed that the deposits may have resulted from rapid pressure release during rift faulting and graben formation. The source of the eruptions is inferred to have been relatively proximal, possibly within or near the Nairobi area.

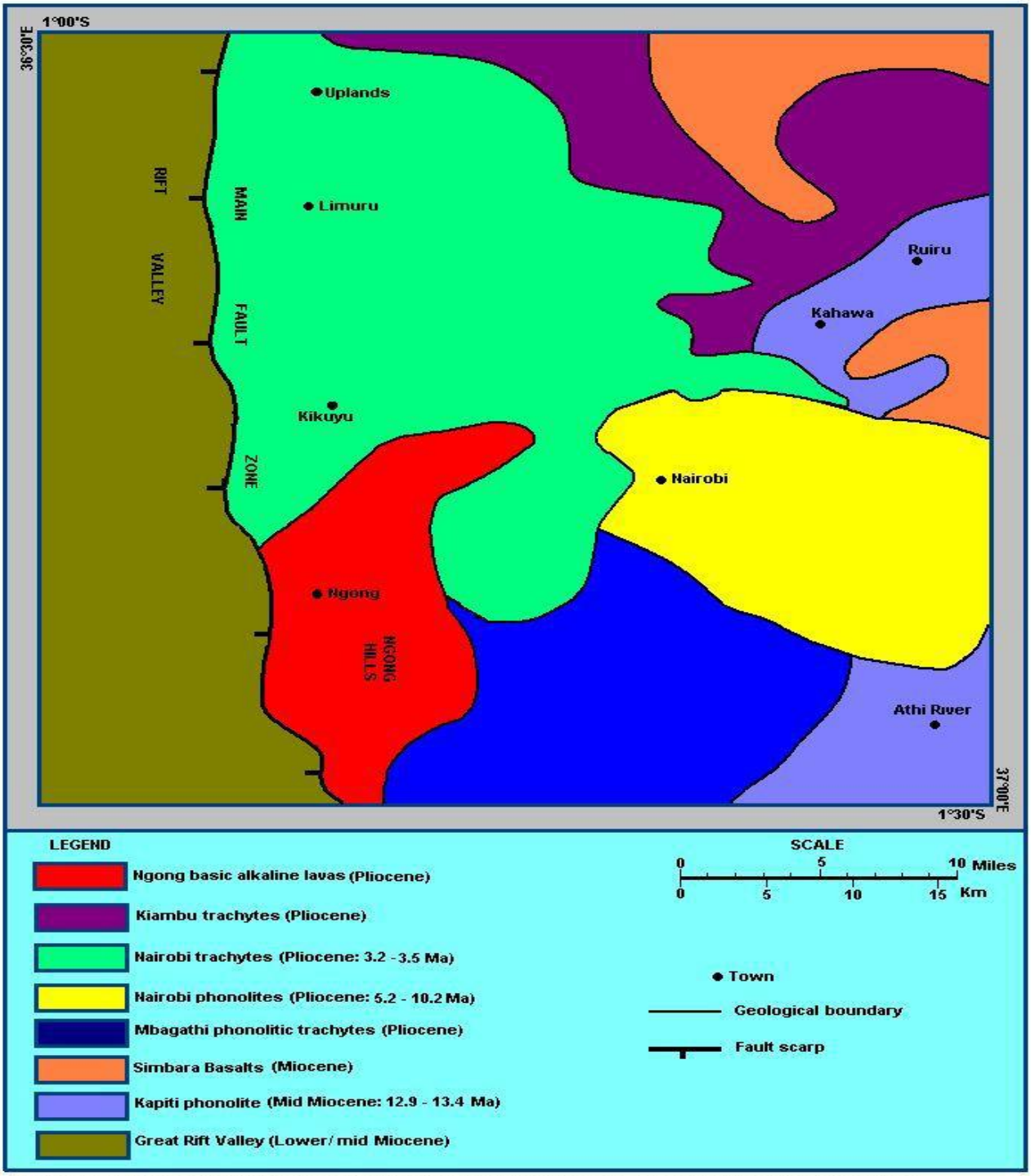

Figure 2.6: *Geology of Nairobi region showing relative volcanic rock formations (Modified from Saggerson, 1991)*

2.6. Site Specific Geology

2.6.1. Tuff

Tuff deposits are widely distributed within the Jomo Kenyatta International Airport (JKIA) area and form a significant component of the near-surface geology. These deposits generally overlie older volcanic formations such as the Nairobi Trachyte and Nairobi Phonolite, and are comparable to the Athi Tuffs and Lake Beds within the Nairobi region. The tuffs are associated with the Kerichwa Valley Series and are interpreted to have been deposited over a pre-existing landscape, now partially re-exposed through erosion (Saggerson, 1991).

In terms of composition, the tuffs range from fine-grained, wind-deposited pumiceous ash to agglomeratic tuffs containing rock fragments of up to about 40 mm in size. They are typically yellow, grey to dark grey in colour and consist predominantly of fine material, hence their classification as agglomeratic tuffs rather than true agglomerates. The deposits are believed to have originated from explosive volcanic activity associated with Rift Valley tectonics, possibly linked to localized eruptive centers within or near the Nairobi area.

Core samples and field observations indicate that the tuffs are generally fine-grained, occasionally porphyritic with feldspar phenocrysts, and may display lamination or banding due to depositional processes. Variations such as dark streaks and patches are common and reflect compositional differences within the material.

Weathering of the tuffs is typically extensive, with depths of weathering ranging from approximately 2m to greater depths as observed in boreholes across the JKIA site. Weathered tuffs are commonly transformed into pale brown, weak, and soft materials with reduced strength and increased compressibility.

The tuff deposits exhibit variable properties depending on the degree of cementation and weathering. While intact tuffs may provide moderate bearing capacity, highly weathered zones are significantly weaker and may pose challenges for foundation support, compaction, and drainage

3. SITE DESCRIPTION

The proposed development site as shown in **Figure 3.1** is located in the southeastern part of Nairobi, with an average elevation of approximately 1,615 meters above sea level. The site coordinates of selected test points range from 1.31795°E to 1.31926°E longitude and 36.94252°S to 36.94336°S latitude, indicating a relatively uniform plateau.

Access to the site is facilitated via the main airport road network, providing all-weather connectivity to the surrounding infrastructure, including terminal buildings, runways, and service areas. The terrain is generally flat to gently undulating, consistent with the Athi Plains, with only minor localized depressions. Slopes are mild, making the area favorable for construction of airport facilities and associated civil works.

Vegetation cover across the site is sparse, mainly consisting of grass and scattered shrubs in open areas, with minimal tree cover. This cover provides limited natural protection against erosion. During site visits, occasional fauna, including snakes, was observed, indicating the need for caution during fieldwork.

No significant streams traverse the site; however, shallow drainage channels in low-lying areas convey surface runoff during the rainy seasons. The site appears well-drained overall, with minimal risk of flooding. The surface soil is generally stable, with no visible signs of severe erosion or recent disturbance.

Figure 3.1: *General view photograph of the area under investigation*

4. FIELD INVESTIGATION

4.1. Methodology

4.1.1. Reconnaissance

A reconnaissance survey was conducted on 18th March 2026, during which the team identified and mapped the terminal and runway areas at Jomo Kenyatta International Airport (JKIA) that were to be designed. On the same day, the drilling rig and associated equipment were mobilized to the site, and all logistical arrangements, including obtaining airport access passes, were completed to ensure smooth operations. Field equipment was also set up, ensuring full readiness for drilling, sampling, and in-situ testing activities.

4.1.2. Site Investigations

The positions of the Trial Pits (TPs) and Boreholes (BHs) within the proposed development area at Jomo Kenyatta International Airport (JKIA) were set out on site and verified by a representative from the Airport Authority prior to commencement of fieldwork.

Trial pits were excavated manually to depths of up to 1.5 m below ground level. During excavation, soil samples were collected for laboratory testing. The samples were handled with care to ensure they remained representative of the in-situ soil conditions. These disturbed samples were used for soil classification, moisture content determination, and strength testing, providing key data for soil characterization.

4.1.3. Sequence of Works

Subsurface investigations were conducted between 18th March and 24th March 2026. The works comprised excavation of eleven (11) trial pits and drilling of three (3) boreholes across the runway and terminal areas.

Trial pits were advanced to depths ranging from 1.0 m to 1.3 m below existing ground level using hand tools such as mattocks, spades, and jembes. The Coordinates of the trial pits are as shown in Table 4-1 below. The following sequence was adopted:

i. Terminal area-TP1T, TP2T, TP3T, TP4T, TP5T and TP6T
ii. Runway area - TP1R, TP2R, TP3R, TP4R, TP5R
iii. Boreholes-BH1, BH2 and BH3

Table 4-1:*Trial Pits and Borehole Coordinates*

Location	Depth (m)			
		Easting	Northing	Elevation(m)
TP 1T	0.8	36.942523	-1.317999	1615
TP 2T	0.8	36.942521	-1.317953	1615
TP3T	0.8	36.943359	-1.319259	1615
TP4T	0.8	36.942521	-1.319259	1615
TP5T	0.8	36.942563	-1.319163	1615
BH1	30	36.944828	-1.326894	1605
BH2	30	36.955417	-1.318972	1581
BH3	30	36.965165	-1.311936	1576
TP 1R	1.1	36.944613	-1.3270353	1611
TP 2R	0.6	36.945600	-1.32612	1599
TP3R	0.6	36.950250	-1.322738	1611
TP4R	1.1	36.955707	-1.314533	1103
TP5R	1.2	36.961531	-1.318847	1595
TP 6R	0.6	36.970863	-1.308375	1595

The **Figure 4.1** below shows a satellite map showing the locations of the trial pits that were excavated and sampled and boreholes that were drilled for the geotechnical investigation.

Figure 4.1: *Satellite Map showing Borehole and Trial Pit locations.*

4.1.4. In situ testing approach

In-situ strength characterization of the subsoil was carried out using the Dynamic Cone Penetrometer (DCP). This method was selected due to its suitability for rapid assessment of near-surface soil strength and stiffness, particularly for pavement and foundation investigations.

The DCP test provides an indirect measure of soil strength through penetration resistance, which can be correlated to engineering parameters such as California Bearing Ratio (CBR) and relative density using established empirical relationship.

5. ANALYSIS AND DISCUSSION OF TEST RESULTS

5.1. General

A program of laboratory testing was carried out on soil and rock samples collected during the field investigations. The testing program was designed to determine key engineering properties of the materials to support the project's design and construction. Comprehensive data sheets are provided in the Appendices and should be referred to for detailed results.

5.2. Field Tests

5.2.1. Dynamic Cone Penetrometer

Ground penetration sounding was conducted using a Dynamic Cone Penetrometer as shown in **Figure 5.1** below. The equipment comprised two steel rods of 16 mm diameter, an anvil, and a replaceable cone with a 60° apex angle. The cone had a diameter of 20 mm, which is larger than the rod diameter to ensure that penetration resistance is mobilized at the cone tip alone and not along the rod shaft. The upper rod was fitted with an 8 kg sliding hammer operating at a drop height of 850 mm, together with a top handle and coupling system for rod extension.

Figure 5.1: *Setting up of the Dynamic Cone Penetrometer apparatus*

The test was carried out by driving the cone vertically into the ground using repeated hammer blows. During testing, the number of blows required to achieve a penetration of 100 mm was recorded and subsequently converted into penetration rate, expressed as millimeters per blow (mm/blow). The results are reported in terms of the Dynamic Number (DN), defined as the penetration per blow. In general, lower DN values indicate stronger or stiffer soils, while higher DN values indicate weaker or more compressible soils.

The results of DCP test were analysed using UK 3.1 software programme to get PR(Penetration Rate).The soils were classified by USCS classification System using excel template see appendix of this report. The PR was substituted in equation 1 or 2 depending on the soil class to give CBR as recommended by US Corps of Engineers.

CL Soils; CBR<10: CBR=1/(0.017019*PR)2..... Equation 1

CH Soils; CBR=1/(0.002871*PR) .....Equation 2

Where CBR = California Bearing Ratio (%), for CBR<150.CBR>150 is taken as 150.

PR = Penetration Rate

For analysis of analysis of shallow foundations, the following equations was adopted from Portland Cement Association:

$$q = 3.794 * CBR^{0.664}$$ .....Equation 3

Where q = Ultimate Bearing Capacity in psi

Say for TP1 (1.8-2.8m), CBR = 150, Soil is classified as CH and therefore using Equation 3 above

$q = 3.794 * 150^{0.664}$ =106 psi = 106*6.895=731 KN/m2

For a factor of safety of 2.0

Safe bearing capacity for TP 1 = 731/2 = 366 KN/m^2

Replacing the parameters in equation 1 or 2. The safe bearing capacity from DCP results is computed and presented in the table below:

Table 5-1: Processed DCP results from *(TRRL (Transport and Road Research Laboratory), 1977)*.

Location	Depth (m)	Penetration rate(mm/blow)	Depth to layer bottom	CBR (%)	Ultimate Bearing capacity (KN/m^2)	Safe Bearing Capacity (KN/ m^2)
TP 1T	0.8	1.0	50	302(150)	731	365
TP 1T	0.8	0.24	85	1357(150)	731	365
TP 2T	1.1	1.8	190	162(150)	731	365
TP2T	0.6	0.2	110	1655(150)	731	365

TP3T	0.8	2.8	28	102	81	40
TP3T	30	0.4	50	795(150)	731	365
TP4T	0.8	2.5	50	115(150)	731	365
TP4T	0.8	0.4	62	795(150)	731	365
TP 5T	1.1	1.8	190	162(150)	731	365
TP5T	0.6	0.2	110	1655(150)	731	365

The estimated CBR results range from 102% and 1655%, with higher calculated values conservatively capped at 150% in accordance with standard practice.

This capping is necessary because the empirical correlations used to derive CBR values from DCP penetration rates become unreliable at very low penetration rates (i.e., very high strength materials). At such levels, the DCP test is no longer sensitive enough to accurately differentiate material strength, and the resulting CBR values (often exceeding 150%) are considered non-representative and of limited practical significance for design. Therefore, values above 150% are treated as indicative of very strong or near rock-like conditions, rather than exact quantitative measures.

Based on the derived CBR values, the ultimate bearing capacity was estimated and a factor of safety of 2.0 applied. The results show that most locations have an ultimate bearing capacity of approximately 365 kN/m^2, corresponding to a safe bearing capacity of about 53 kN/m^2, while localized weaker zones (e.g., TP3T) yield lower safe bearing capacities of approximately 40 kN/m^2.

5.3.Laboratory Tests

Laboratory tests were performed in accordance with the relevant BS 1377 standards to ensure consistency and reliability. The results were used to characterize the soil and rock materials and to inform subsequent engineering analyses, including the evaluation of foundation alternatives and construction methods. The full set of individual test results is presented in the Appendices, while the standard codes applicable to each test are presented in **Table 5.2** below;

Table 5-2: *Summary of Tests to be done and standard codes*

Material	Test	Standard Code	No. of Tests
Soil	Standard Proctor Density	AASHTO T99	11
	Atterberg Limits	BS 1377-2:90	11
	Particle Size Distribution (Sieves and Hydrometer)	BS 1377-2:90	11
	California Bearing Ratio (CBR)	BS 1377-9	11
Rocks	Unconfined Compressive Strength (UCS) of Rocks	ASTM D7012-04	3 BH Locations
	Point Load Test	ASTM D5731-02	3 BH Locations

5.3.1. Compaction Test

The compaction behavior of the soils was evaluated using the standard Proctor compaction test. In this procedure, soil samples passing the 20 mm sieve were prepared at varying moisture contents and compacted in a standard 1-litre mould. Compaction was carried out in layers using a 2.5 kg rammer falling through a height of 300 mm, with a specified number of blows applied to each layer to achieve consistent compactive effort.

For each moisture content, the bulk density of the compacted soil was determined, and corresponding moisture content samples were oven-dried to establish the dry density. A compaction curve was then plotted by relating dry density to moisture content. The peak of this curve represents the Maximum Dry Density (MDD), while the corresponding moisture content defines the Optimum Moisture Content (OMC).

The test data on individual samples was as recorded in **Table 6.3** below.

Table 5-3: *Compaction samples test results*

TP ID	CHAINAGE	DEPTH	MDD(Kg/m^3)	OMC (%)
TP1R	km 0+600	1.1	1404	27.0
TP2R	km 0+800	0.6	1458	24.2
TP3R	km 1+500	0.6	1584	22.2
TP4R	km 2+200	1.1	1545	21.0

TP5R	km 3+000	1.1	1414	26.2
TP6R	km 4+200	0.6	1462	30.4
TP1T	-	1.2	1328	29.0
TP2T	-	1.0	1346	29.4
TP3T	-	1.0	1324	31.2
TP4T	-	1.0	1324	32
TP5T	-	1.0	1454	23.8

The runway compaction results range from 1404 to 1584 kg/m^3 and OMC between 21.0% and 30.4%, generally clustering around 1450–1550 kg/m^3 and 21–27%. These values suggest relatively denser material.

The terminal area results indicate MDD values ranging from 1324 to 1454 kg/m^3, while OMC ranges from 23.8% to 32.0%, with most values clustering around 1320–1350 kg/m^3 and 29–32% indicating a soft, compressible, and highly moisture-sensitive material. These properties are typical of expansive clays and are associated with shrink–swell behavior, reduced bearing capacity, and a high potential for deformation under load (Nelson, 1992).

5.3.2. California Bearing ratio

Subgrade strength is expressed in terms of its California Bearing Ratio (CBR) value. The CBR value is measured by an empirical test devised by the California State Highway Association and is simply the resistance to a penetration of 2.5 mm of a standard cylindrical plunger of 49.65 mm diameter, expressed as a percentage of the known resistance of the plunger to various penetrations in crushed aggregate, notably 13.2 kN at 2.5 mm penetration and 20.0 kN at 5.0 mm penetration.

Table 6-4 below presents a summary of the CBR values of soil samples compacted to their maximum, standard proctor and dry densities:

Table 5-4;Summary of CBR values

TP ID	CHAINAGE	DEPTH	CBR (%)
TP1R	km 0+600	1.1	3.6
TP2R	km 0+800	0.6	2.6

TP3R	km 1+500	0.6	3.0
TP4R	km 2+200	1.1	5.4
TP5R	km 3+000	1.1	2.0
TP6R	km 4+200	0.6	7.3
TP1T	-	1.2	2.4
TP2T	-	1.0	1.6
TP3T	-	1.0	2.6
TP4T	-	1.0	1.6
TP5T	-	1.0	3.1

5.3.3. Atterberg Limit

The Atterberg limit tests were undertaken to assess the consistency characteristics of the soils and to evaluate their suitability for supporting the proposed structures under varying moisture conditions. These tests apply to the fraction of soil passing the 0.425 mm sieve and are essential for classifying fine-grained soils.

The Liquid Limit (LL) is defined as the moisture content at which the soil transitions from a liquid state to a plastic state. It is an indicator of soil compressibility, with higher LL values generally corresponding to higher compressibility. The liquid limit was determined using a cone penetrometer apparatus, which relates the moisture content to the penetration depth of a standardized cone under controlled conditions.

The Plastic Limit (PL) is the moisture content at which soil changes from a plastic to a semi-solid state. It was determined by rolling soil samples into threads of approximately 3 mm diameter until crumbling occurred.

The Plasticity Index (PI), calculated as the difference between the Liquid Limit and Plastic Limit (PI = LL − PL), represents the range of moisture content over which the soil remains plastic. It provides an indication of the degree of plasticity and is closely related to the clay content of the soil.

The tests were conducted on representative disturbed samples obtained from trial pits, boreholes, and bulk samples. The results of the Atterberg limit tests are summarized in Table 6-5, and the implications of the soil plasticity characteristics are discussed in the subsequent sections.

Table 5-5: Atterberg Limit Results

TP ID	Depth (M)	Liquid Limit (LL)	Plastic Limit (PL)	Plastic Index (PI) PI =LL-PL	Linear Shrinkage (%)
TP1R	1.1	67	35	32	16
TP2R	0.6	69	35	34	16
TP3R	0.6	59	34	25	12
TP4R	1.1	68	44	24	20
TP5R	1.1	66	33	33	20
TP6R	0.6	76	43	33	18
TP1T	1.2	81	33	48	16
TP2T	1.0	76	32	45	15
TP3T	1.0	79	45	33	17
TP4T	1.0	89	59	30	16
TP5T	1.0	90	48	42	15

5.3.4. Plasticity Index

The Plasticity Index values range from 24% to 48%, indicating that the soils are moderately to highly plastic clays. Several samples fall within the very high plasticity range, suggesting a strong potential for shrink–swell behavior, high compressibility, and reduced strength when wet.

According to Donald Burmister (1949), such soils exhibit high cohesion but are sensitive to moisture changes, making them less suitable for subgrade support without proper treatment.

5.3.5. Liquid Limit

The Liquid Limit values range from 59% to 90%, indicating that the soils are highly plastic clay materials with a strong tendency for compressibility and shrink–swell behavior. Several samples fall within the high to very high compressibility range, confirming the presence of expansive soils.

According to Mills et al. (1980), soils with LL values above 55% are classified as highly compressible, while those above 75% exhibit very high compressibility. Overall, the results indicate that the soils are prone to significant volume changes with moisture variation, which may affect their performance as subgrade or foundation materials.

Table 5-6; *Ratings for compressibility and shrink-swell potential based on liquid limit (Mills et al. 1980)*

Rating	Liquid Limit (%)	Degree of Compressibility
Low	< 35	Low
Medium	35 – 55	Medium
High	55 – 75	High
Very High	> 75	Very High

5.3.6. Linear Shrinkage

Linear shrinkage (LS) is an index property used to assess the shrink–swell potential of soils. It represents the reduction in one dimension of a soil sample as it dries from a near-saturated condition to an oven-dried state, expressed as a percentage of its original length. This parameter is particularly important in evaluating the behavior of expansive soils, where significant volume changes may occur with fluctuations in moisture content.

The test is conducted by placing a moist soil sample in a standard mould and allowing it to dry under controlled conditions. As moisture is lost, the soil undergoes shrinkage, and the change in length is measured to determine the linear shrinkage value. Linear shrinkage is widely used as an indicator of cracking potential and volume instability in clayey soils.

The results for the indicate linear shrinkage values ranging from approximately 12% to 20%. These values are relatively high and are characteristic of highly plastic, moisture-sensitive clay soils typical of expansive soil deposits (black cotton soils).

Studies on expansive soils indicate that linear shrinkage values exceeding about 8% generally suggest moderate to high volume change potential (Das, 2018). Based on this criterion, the soils at the site are classified as expansive, exhibiting a high tendency for shrink–swell behavior.

5.3.7. Classification

The soil classification was carried out using both the AASHTO (American Association of State Highway and Transportation Officials) system and the Unified Soil Classification System (USCS), based on sieve analysis and Atterberg limit test results.

Under the AASHTO classification system, the measured particle size distribution and Atterberg parameters indicate that the soils fall within fine-grained categories, suggesting poor subgrade performance with relatively high plasticity.

Further interpretation of the Atterberg limits was conducted using the Casagrande plasticity chart as shown in Figure 5-2. The plotted values lie above the A-line, confirming that the soils are predominantly

clayey in nature. Their position within the high plasticity region (CH zone) indicates that the soils are inorganic clays of high plasticity.

This classification is consistent with the typical characteristics of black cotton soils, which are known for their high compressibility and pronounced shrink–swell behavior. The linear shrinkage results further support this interpretation, confirming that the soils are expansive and highly susceptible to volume changes with variations in moisture content. (Das, 2018)

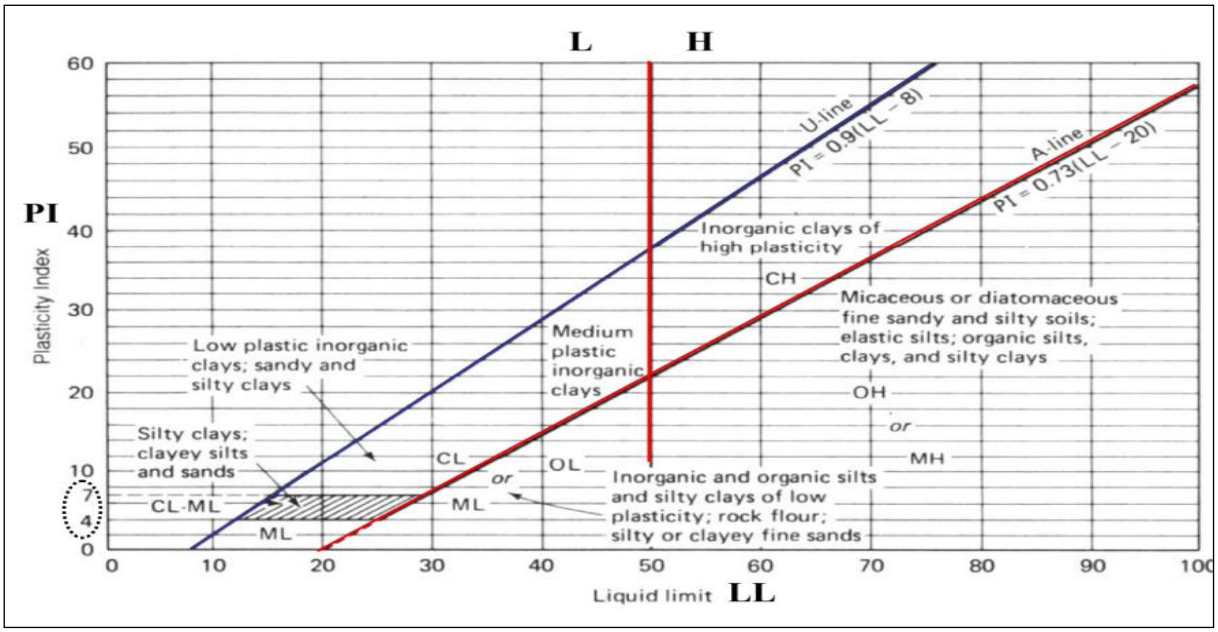

Figure 5-1: Casagrande plasticity chart showing several representative soil types (developed from Casagrande 1948 and Howard 1977)

5.3.8. Particle size distribution test

Particle size distribution analysis is used to evaluate the relative proportions of different soil particle sizes. This enables identification of whether the soil is predominantly composed of gravel, sand, silt, or clay fractions, and helps determine the particle size range that governs the engineering behavior of the soil.

In sieve analysis, a representative dry soil sample is passed through a series of standard sieves with progressively smaller mesh sizes. The mass of soil retained on each sieve is measured, allowing the development of a grading curve that represents the distribution of particle sizes from coarse to fine fractions.

The particle size distribution results indicate that the subgrade soils are predominantly fine-grained, with a high percentage of fines (31%–96% passing the 0.075 mm sieve). Most sections exhibit very high fines content (>50%), confirming the dominance of silt and clay fractions with minimal granular material.

The soils are generally poorly graded, with limited sand and gravel content, resulting in low permeability, poor drainage, and weak engineering properties. This grading is consistent with their

classification as high plasticity clays (CH) and silts (MH) and explains their low strength and poor suitability as subgrade material without improvement.

5.3.9. Unconfined Compressive Strength (UCS)

The Unconfined Compressive Strength (UCS) is defined as the maximum axial compressive stress that a right-cylindrical specimen can sustain under unconfined conditions, that is, in the absence of lateral confining pressure.

Intact rock core samples recovered from the underlying bedrock at the project sites were prepared and trimmed in the laboratory with the aim of achieving the standard height-to-diameter (L/D) ratio of 2.0. However, in some instances, the available core lengths were insufficient to meet this requirement. It is well established that specimens with L/D ratios less than 2.0 tend to yield relatively higher UCS values.

To account for this deviation, all measured UCS values were corrected to equivalent strengths corresponding to a standard L/D ratio of 2.0. The ultimate bearing capacity of the rock was estimated from the UCS values using the empirical relationship proposed by Goodman (1980), expressed as:

$$q_u = q_{ur}(N_\emptyset + 1)$$

Where; q_u =Ultimate Bearing Capacity

q_{ur}= Factored unconfined compressive strength of the rock core.

It is recognized that UCS values are influenced by specimen size, a phenomenon referred to as the *scale effect*, whereby larger specimens generally exhibit lower strength. Beyond a specimen diameter of approximately 1 m, UCS values tend to stabilize. According to Braja (2014), a reduction factor of about 4 to 5 is typically applied to laboratory UCS results to account for this effect. In this analysis, a conservative reduction factor of 5 was adopted for use in bearing capacity calculations.

$N_\emptyset$ = Bearing capacity factor, defined as:

$$N_\emptyset = tan^2(45 + {}^{\emptyset}/_{2})$$

Φ = Angle of internal friction of the rock (degrees), estimated empirically as: $0.145 \times UCS + 25$

The results of the Unconfined Compressive Strength (UCS) testing and the corresponding computed bearing capacity values are summarized in the table 6-8 below, with material descriptions based on the BS 5930(table 6-7) rock strength classification. The allowable (design) bearing pressure was derived by applying a factor of safety of 7 to the computed ultimate bearing capacity, in line with recommendations by (Murthy, 2002).

Table 5-7 *Rock length classification table according to BS5930*

Term	Field Identification of Specimen	Unconfined Compressive Strength, qu (MPa)	Point load strength
Extremely strong	Can only be chipped with a geological hammer	> 250	> 10
Very strong	Requires many blows of geological hammer to break it	100-250	5-10
Strong	Requires more than one blow of geological hammer to fracture it	50-100	2-5
Moderately Strong	Cannot be scraped or peeled with a pocket knife; fractured with a single firm hammer blow	20-50	1-2
Weak	Can be peeled by a pocket knife with difficulty; shallow indentations under firm hammer blows.	5-20	1
Very Weak	Crumbles under firm hammer blows; can be peeled by a pocket knife	1-5	< 1
Extremely weak	Indented by thumbnail; behavior similar to very stiff soils	< 1	-

Table 5-8;*Compression test results*

JKIA-BH1	Hole ID		Density (Kg/m^3)	Stress (kN/m2)	(q_u) Goodman (KN/m^2)	(q_d) Murthy (KN/m^2)	Description of UCS
	From	To					
	6.20	6.40	2152	4,139	2916	417	Very Weak
	16.00	16.20	2263	59,323	53135	7591	Strong
	23.00	23.20	2373	52,742	45809	6544	Medium
	24.40	24.60	2457	115,951	139155	19879	Very Strong
	25.40	25.60	2196	57,379	50926	7275	Strong
	26.40	26.60	3170	77,509	75832	10833	Strong
	27.65	27.85	2563	40,738	33505	4786	Medium
	28.80	29.00	2593	93,425	99165	14166	Strong

JKIA-BH2	5.80	6.00	2897	9,545	6872	982	Weak
	7.60	7.80	2160	2,459	1721	246	Very Weak
	8.00	8.20	2303	13,687	10022	1432	Weak
	10.40	10.60	2548	60,108	54038	7720	Strong
	12.00	12.20	1696	25,126	19304	2758	Weak
	13.00	13.20	2407	61,500	55656	7951	Strong
	15.90	16.10	2395	33,575	26754	3822	Medium
	17.10	17.30	2406	34,903	27974	3996	Medium
	20.70	20.90	2094	20,387	15352	2193	Weak
	23.10	23.30	2222	70,245	66304	9472	Strong
	26.80	27.00	2038	19,481	14613	2088	Weak
	27.70	27.90	2413	64,236	58895	8414	Strong
	28.80	29.00	2283	23,721	18115	2588	Weak
	29.50	29.70	1969	27,462	21310	3044	Weak
JKIA-BH3	5.00	5.17	1671	16,017	11843	1692	Weak
	16.00	16.18	2186	8,054	5763	823	Weak
	18.00	18.20	1677	3,266	2292	327	Very Weak
	19.80	19.90	1788	11,185	8106	1158	Weak
	22.50	22.70	2536	24,352	18648	2664	Weak
	25.70	25.90	2374	22,695	17256	2465	Weak
	27.80	28.00	2578	17,698	13178	1883	Weak
	28.50	28.70	2620	31,266	24664	3523	Weak

Sample Calculation

Consider the core sample from BH 1, 6.2-6.40m;

$$q_u = q_{ur}(N_\emptyset + 1)$$

$$q_{ur} = \frac{UCS}{5} = \frac{4.139}{5} = 0.8278\ MPa$$

$$N_\emptyset = tan^2(45 + {}^{\emptyset}/_{2})$$

$$\emptyset = 0.145 \times UCS + 25 = 0.145 \times 4.139 + 25 = 25.6°$$

$$\therefore N_{\emptyset} = tan^2\left(45 + {}^{25.6}/_{2}\right) = 2.5217$$

$$\therefore q_u = 0.8278(2.5217 + 1) = 2.9152MPa$$

$$Applying\ a\ safety\ factor\ of\ 7\ as\ proposed\ by\ Murthy, 2002)$$

$$q_d = \frac{q_u}{7} = \frac{29152}{7} = 416\ (\mathrm{KN/m^2})$$

5.3.10. Point Load Test (PLT)

The point load test is an index test by which the rock is classified according to strength. The test is often used to estimate other characteristics of intact rocks with which it correlates, such as UCS and tensile strength.

Fractured rock cores that did not meet the minimum dimension tolerances for UCS testing were trimmed to achieve L/D ratios between 0.3 and 1.0 before being axially tested for the point load strength indices IS (50).

Existing correlations between point load strength indices and unconfined compressive strength have been derived from experimental evidence, but unfortunately the multiplying factor appears to vary from one rock type to another (Bowden, 1988) record authors giving correlation factors (UCS/ IS (50)) ranging from 4 to 50, with the majority falling in the range 10 to 30. Experience shows that for stronger rocks correlation factors of about 24 seem reasonable. ASTM D5731-16 recommends a generalized conversion factor of 24.5 for estimating UCS from IS (50) where the diameters of the test samples exceed 60 mm i.e.;

$$Equivalent\ UCS = 24.5 \times I_{S(50)}$$

Design bearing capacities were then computed from the estimated UCS values using the equations highlighted in the preceding section. A summary of the point load test results is provided below:

Table 5-9 PLT Test Results

JKIA-BH1	Hole ID		Density (Kg/m³)	$I_{S(50)}$ (kN/m²)	Equivalent UCS (kN/m²)	(q_d) (kN/m²)	Description
	From	To					
	3.20	3.33	1901	353	8648.5	1235.5	Weak
	5.10	5.12	1962	314	7693	1099	Weak
	10.00	10.15	1911	384	9408	1344	Weak
	13.00	13.11	2085	2676	65562	9366	Strong
	16.90	17.00	2267	3816	93492	13356	Strong
	19.90	20.00	2240	3834	93933	13419	Strong
	21.35	21.50	2374	4520	110740	15820	Very strong
	23.50	23.60	2304	1728	42336	6048	Medium
JKIA-BH2	2.9	3	1763	9,545	8060.5	1151.5	Weak
	4.7	4.85	1936	2,459	9163	1309	Weak
	7	7.15	2015	13,687	8379	1197	Weak
	9	9.14	2187	60,108	41356	5908	Medium
	10.9	11	2346	25,126	57305.5	8186.5	Strong
	14	14.15	1706	61,500	33418	4774	Medium
	16.8	16.9	2335	33,575	122990	17570	Very strong
	19	19.1	2346	34,903	101969	14567	Very strong
	22.9	23	2311	20,387	96922	13846	strong
	24.8	24.9	1726	70,245	63969.5	9138.5	Strong
	26	26.12	2005	19,481	65341.5	9334.5	strong
	28	28.1	2304	64,236	122279.5	17468.5	Very strong
JKIA-BH3	4	4.1	1937	2991	73279.5	10468.5	strong
	5.5	5.6	1963	2250	55125	7875	strong
	10	10.1	1949	2338	57281	8183	strong
	13.4	13.5	1937	2633	64508.5	9215.5	strong
	14	14.1	1752	2792	68404	9772	strong
	15.5	15.6	2244	3109	76170.5	10881.5	strong
	16.5	16.6	2259	1506	36897	5271	Medium
	18.4	18.5	1776	1088	26656	3808	Medium

	20	20.1	2044	2304	56448	8640	Strong
	21.8	21.9	2287	1828	44.786	6.398	Medium
	23.5	23.6	2199	1747	42.8015	6.1145	Medium
	25	25.1	2383	3170	77.665	11.095	Strong
	29.8	29.9	2327	3314	81.193	11.599	Strong

5.3.11. Rock Quality Designation

The Rock Quality Designation (RQD) index, introduced by (Deere, 1988) and later formalized by (Deere D. U., 1967), is a standard geotechnical parameter used to assess the degree of rock mass fracturing and overall quality. It is calculated as the percentage of intact core pieces longer than 100 mm within a core run, thereby excluding highly broken segments to better reflect rock mass condition.

Higher RQD values indicate competent, less fractured rock, while lower values represent highly jointed or poor-quality rock that may require further investigation. The index is widely used in preliminary site characterization and rock mass classification, helping to identify weak zones that may influence engineering design and construction decisions (Deere D. U., 1988)

Table 5-10;*Relationship between the RQD Index proposed be Deere*

RQD (%)	**Rock quality**
< 25	Very Poor
25 – 50	Poor
50 – 75	Fair Good
> 75-90	Excellent

5.3.11.1. RQD for Borehole 1

The Rock Quality Designation (RQD) results for borehole BH17S-01, interpreted using (Deere D. U., 1967)classification, indicate a strong variation in rock mass quality with depth.

The upper strata from 0.0 m to about 15.0 m, comprising black cotton soil and highly weathered tuff, exhibit very poor rock quality with RQD values ranging from 0% to about 18%, reflecting completely decomposed, highly fractured, and non-intact materials unsuitable for structural support.

Between 15.0 m and 23.0 m, the rock mass transitions through poor to very poor quality (RQD 15–45%), characterized by moderately to highly fractured tuff and early phonolite with discontinuous and mechanically disturbed cores, indicating an unstable and heterogeneous zone.

Below approximately 23.0 m depth, a significant improvement in rock quality is observed within the phonolite formation, where RQD values increase from fair to excellent (50–95%), indicating progressively stronger, more intact, and less fractured rock mass.

The best rock conditions occur between 24.0 m and 27.0 m depth, where RQD values exceed 85%, representing good to excellent rock suitable for foundation support. Overall, the borehole reveals a clear progression from highly weathered and incompetent near-surface materials to competent bedrock at grater depths.

5.3.11.2. RQD for Borehole 2

The upper section from 0.0 m to about 4.5 m, consisting of black cotton soil and highly weathered tuff, shows very poor to poor rock quality with RQD values ranging from 0% to about 19%, reflecting completely decomposed, highly fractured, and non-intact materials. Between 4.5 m and 10.0 m, the rock quality improves to poor to fair conditions (RQD 25–51%), characterized by moderately to highly weathered tuff with partial core recovery and persistent mechanical fracturing.

From 10.0 m to 27.0 m, the formation is dominated by alternating tuff, tuff/phonolite, and phonolite with generally poor to fair rock quality (RQD 24–46%), although localized improvements are observed, indicating a highly variable and fractured transition zone.

A significant improvement in rock quality occurs below about 27.0 m depth, where fresh to slightly weathered phonolite exhibits good to excellent RQD values ranging from 75% to 94%, reflecting strong, intact, and competent rock mass conditions. Overall, the borehole profile shows a clear transition from weak near-surface soils and highly fractured volcanic materials to competent phonolite bedrock at depth, with the most favorable foundation conditions occurring below approximately 27.0 m.

5.3.11.3. RDQ for Borehole 3

The upper section from 0.0 m to about 9.0 m, comprising black cotton soil and highly to moderately weathered tuff, shows very poor to poor rock quality with RQD values generally below 20%, reflecting highly fractured, disintegrated, and non-intact materials with very low core recovery.

Between 9.0 m and 18.0 m, the rock quality improves to poor to fair conditions (RQD approximately 14–20%), characterized by weathered tuff and early phonolite transition zones with fragmented cores, moderate fracturing, and variable recovery.

From 18.0 m to about 26.0 m, the formation remains largely fair in quality (RQD about 21–26%), dominated by tuff/phonolite with moderately fractured rock mass and intermittent intact core sections, indicating a transitional and heterogeneous rock profile.

Below approximately 26.0 m depth, a significant improvement is observed within the phonolite formation, where RQD increases from fair to good conditions (approximately 40–51%), reflecting more competent, slightly weathered to fresh rock with higher core recovery and reduced fracturing. Overall,

the borehole indicates a gradual transition from highly weathered, incompetent near-surface materials to increasingly competent phonolite bedrock at depth, with improved foundation conditions becoming more reliable below about 26 m.

5.3.12. Stratigraphy of the boreholes

5.3.12.1. Stratigraphy for Borehole 1

The subsurface profile encountered in Borehole BH-01 comprises expansive clay soils underlain by volcanic rocks, predominantly tuff and phonelite, with varying degrees of weathering, fracturing, and strength.

From ground level to approximately 3.0 m depth, the profile consists of black cotton soil. This layer is characterized by dark grey to black, highly plastic clay that is moist to wet and firm. The material is fissured with prominent shrinkage cracks and is non-intact, disintegrating into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin, indicating high expansiveness and poor engineering properties.

Between 3.0 m and 13.0 m, the formation transitions into completely to highly weathered tuff. The material is brownish-grey, moist, and moderately hard but extensively fractured, with fractures predominantly horizontal to sub-horizontal and widely open. The rock mass is largely disintegrated and recovered mainly as gravel- to cobble-sized corestones, indicating poor rock quality and low structural competence.

From 13.0 m to 17.0 m, the tuff remains dominant but shows slight improvement in quality. The rock is moderately hard with reduced fracturing and improved core recovery, with portions of mostly intact material, indicating moderate rock mass quality.

Between 17.0 m and 18.5 m, the tuff becomes less weathered and more intact, with only minor mechanical fracturing, reflecting a transition towards better rock competence.

From 18.5 m to 21.5 m, the lithology changes to phonolite. This unit is grey, moderately hard, slightly weathered, and generally intact with minor fractures, indicating moderate to good rock quality.

Between 21.5 m and 23.0 m, the phonelite exhibits increased fracturing and zones of broken core, suggesting localized weakening and reduced rock mass quality.

From 23.0 m to the final depth of 30.0 m, strong phonelite is encountered. The rock is grey, slightly weathered to fresh, and predominantly intact with minimal mechanical fracturing. High core recovery and RQD values within this interval indicate very good rock quality and high structural competence.

Overall, the stratigraphic profile shows a transition from weak, highly expansive clay at the surface through highly weathered and fractured tuff, to strong and competent phonelite at depth, indicating a general improvement in ground conditions with increasing depth.

5.3.12.2. Stratigraphy for Borehole 2

The subsurface conditions encountered in BH-02 comprises a sequence of volcanic rocks, predominantly tuff and phonolite, exhibiting varying degrees of weathering, fracturing, and strength with depth.

From ground level to approximately 3.0 m depth, the profile consists of black cotton soil. This layer is characterized by dark grey to black, highly plastic clay that is moist to wet and firm. The material is fissured with prominent shrinkage cracks and is non-intact, disintegrating into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin, indicating high expansiveness and poor engineering properties.

From 3.0 m to 10.0 m, the profile is dominated by highly weathered tuff. The material is brownish-grey, moist, and moderately hard but extensively fractured, with fractures predominantly horizontal to sub-horizontal and widely open. The rock mass is largely disintegrated and was recovered mainly as gravel- to cobble-sized core stones, indicating poor rock quality and low structural competence.

Between 10.0 m and 13.0 m, the formation transitions into slightly weathered tuff interbedded with phonelite. This layer is moderately hard with reduced fracturing and improved core recovery, suggesting a moderate improvement in rock mass quality.

From 13.0 m to 17.0 m, interbedded tuff and phonelite reoccur in a highly weathered and fractured state. The rock mass is disintegrated, with frequent open discontinuities and cores tone formation, indicating weak to very weak rock conditions.

From 17.0 m and 21.0 m, more competent formation is encountered between predominantly phonelite. This unit is grey, moderately strong, slightly weathered, and generally intact, with only minor mechanical fracturing, reflecting a significant improvement in rock strength and quality.

Between 21.0 m and 27.0 m, alternating layers of tuff and phonelite are again present. These materials are highly weathered, fractured, and disintegrated, with widely open discontinuities, indicating reduced rock mass competence.

From 27.0 m to the terminal depth of 30.0 m, strong phonelite is encountered. The rock is grey, slightly weathered to fresh, and largely intact with minimal fracturing. This unit represents the most competent and structurally sound formation within the borehole.

Overall, the stratigraphic profile indicates a general increase in rock strength and competence with depth, transitioning from highly weathered and fractured tuff near the surface to strong, relatively intact phonelite at deeper levels.

5.3.12.3. Stratigraphy for Borehole 3

The subsurface profile encountered in Borehole BH-03 is composed of near-surface expansive soils underlain by volcanic rock formations dominated by tuff and phonelite, exhibiting variable weathering, fracturing, and rock mass quality with depth.

From ground level to approximately 1.5 m, the profile consists of black cotton soil. This material is dark grey to black, highly plastic, and firm when moist to wet. It is non-intact and disintegrates into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin, with prominent shrinkage cracks indicative of high expansiveness and poor engineering performance.

Between 1.5 m and 10.5 m, the formation is dominated by highly to completely weathered tuff. The material is brownish-grey to dark grey, moist, and moderately hard but extensively fractured, with predominantly horizontal to sub-horizontal discontinuities. Core recovery is generally poor, with material recovered mainly as small angular fragments and core stones, indicating a weak and highly disturbed rock mass.

From 10.5 m to 12.0 m, a transitional zone of tuff and phonelite is encountered. The material remains moderately weathered but shows slightly improved core recovery, indicating a gradual increase in rock quality.

Between 12.0 m and 15.0 m, interbedded tuff and phonelite persist in a highly fractured and weathered condition. The rock mass is disintegrated with widely open discontinuities, reflecting continued low to moderate competence.

From 15.0 m to 18.0 m, phonelite becomes more dominant. The material is grey, moderately hard, and moderately weathered, with improved core recovery and more intact core pieces, indicating a transition to better rock quality.

Between 18.0 m and 22.5 m, alternating tuff and phonelite units are encountered. These are moderately to highly weathered and fractured, with variable core recovery and localized zones of weak rock mass.

From 22.5 m to 26.0 m, phonelite is present in a moderately fractured state with generally fair core recovery. Weathering decreases gradually with depth, and discontinuities become less frequent.

From 26.0 m to the final depth of 30.0 m, the formation consists of slightly weathered to fresh phonelite. The rock is grey to bluish-grey, moderately hard, and largely intact with high core recovery and minimal fracturing, representing the most competent rock unit encountered in the borehole.

Overall, the stratigraphy of BH03 shows a clear progression from highly plastic black cotton soil at the surface through heavily weathered tuff, transitioning into increasingly competent phonelite at depth, indicating a general improvement in rock mass quality with increasing depth.

6. CONCLUSION AND RECOMMENDATION.

6.1. Safe Bearing capacity recommendations

The safe design bearing pressures for rock formations at various depths in Boreholes 1 to 3 are presented in **Tables 6.8** and **Table 6.9**. These recommendations have been derived using semi-empirical correlations, complemented by engineering judgment based on experience with similar geological materials in previous projects. Final foundation design, however, remains at the discretion of the Project Structural Engineer.
From

6.2. Excavation and slope stability

It is recommended that the encountered black cotton soils within the runway be excavated to a depth of 1.5 m below the original ground level. The excavation shall extend over the full width of the affected area. The excavated section shall be backfilled with approved fill in hard material to a minimum depth of 500 mm as may be instructed by the Engineer. The material shall be as approved by the geotechnical Engineer with a maximum particle size of 250 mm. The fill material shall be placed in horizontal layers not exceeding 400 mm loose thickness. Each layer shall be spread, levelled, and compacted using a crawler tractor of not less than 15 tonnes to achieve a stable and non-expansive subgrade suitable for runway pavement support. A filter fabric can be used as directed by the Engineer around the fill in hard material. the surface of the hard fill shall be blinded using smaller rock fragments and gravel to fill surface voids and provide a smooth, uniform bedding surface, thereby minimizing the risk of puncturing or damaging the fabric during installation.

The Contractor shall be responsible for the safety of workers and should strictly observe the Occupational Safety and Health Administration (OSHA) requirements for the excavated walls to ensure safety at all times.

6.3. Suitability of on-site material

It is recommended that all footing excavations be inspected and approved by qualified engineering Personnel to ensure that the founding bedrock conditions correspond to those encountered in the boreholes, that footings are placed within the correct strata and that all excavations are dry and free of loosened, fracture and any otherwise deleterious materials. All backfilling operations should also be supervised to ensure that proper material is employed and that the specified compaction is achieved.

6.4.Site Clearance and Preparation

All deleterious materials, including structures, utilities, topsoil, large tree roots, and other vegetation not designated to remain, should be cleared from the areas to receive the planned improvements. Excavations that extend below finished grade should be backfilled with engineered fill placed and compacted as discussed below.

6.5.Material to Fill

Fill in hard material shall be as approved by the Engineer .Fill in Soft material should not contain rocks or pieces larger than 75 mm in greatest dimension, and should contain no more than 15 percent larger than 62 mm. Any required imported fill should be predominantly granular material or low plasticity material with a plasticity index of less than approximately 15 percent. Any proposed fill for import should be approved by geotechnical Engineer, prior to importing to the site. Our approval process may require index testing to establish the expansive potential of the soil; therefore, it is important that we receive samples of any proposed import material at least 3 days prior to planned importing.

6.6.Preparation of Foundations

All excavated surfaces in materials other than hard rock, on which foundations are to be placed, shall be compacted to at least 95% Maximum Dry Density (MDD) in accordance with AASHTO T99 immediately prior to construction. For excavations in hard material, the surface shall be trimmed and further excavated where necessary to allow for a minimum of 50 mm thick blinding concrete layer.

Subsurface conditions at the site indicate that the upper strata consist predominantly of highly plastic, expansive clay soils (black cotton soils) underlain by fairly to well-cemented, fine-grained, moderately to highly weathered trachyte (tuff) at depth. Excavation within the upper soft soils is expected to extend to varying depths, while deeper excavation into the underlying rock may require the use of mechanical breakers due to its cemented nature.

Where a combination of hard and soft materials exists in the excavated surfaces then, dependent on the proportions of existing materials, it is advised to either remove a minimum of 300 mm of soft material below underside of foundation and replace it with lean concrete to the top of blinding level or remove a minimum of about 300 mm of hard material below the underside of blinding concrete and replace it with soft material compacted to 95% MDD (AASHTO T99).

Material used for fill should be placed in uniform lifts, no more than 150mm in thickness. The fill material should be moisture conditioned, as necessary, and compacted in accordance with the standard specifications. Compacted lifts should be firm and non-yielding under the weight of compaction equipment prior to the placement of successive lifts. The material on site that does not conform to required standard specifications should not be used as engineered fill

material. The relative compaction and moisture content specified should be within the BS standard or ASTM D 1557 (latest edition).

If construction proceeds during raining seasons, wet weather conditions, adequate temporary moisture protection for the footing base and concrete must be provided since the soil material within the site retains a lot of water. The rock bearing surface should be inspected by qualified geotechnical personnel. It is critical that the bearing surface is clear of any debris and the method of concrete placement is pre-approved in order to ensure good contact between concrete and bedrock.

The above-mentioned allowable bearing capacity values for soil formation were determined by considering that no settlement values go beyond 25mm as a predetermined condition. However, Settlement of clay under load may take place without the aid of wetting, while expansion of clay will not be realized without moisture increase. There are risks of settlement or slip associated with the clay soils.

It is advisable therefore to ensure that the foundation of the structure are designed to eliminate unacceptable foundation settlement and structural distress and constructed to maintain or promote constant minimal moisture in the foundation. Water proofing should be considered in the design of drainage in the basement. Pumping sump to drain ground water may be considered in during design and implementation of the project.

6.7. Management of anticipated ground water

Groundwater control during excavation is extremely important. Dewatering provides temporary reductions in groundwater levels for structures that extend below water rest levels. Some of the dewatering and groundwater control methods that can be adopted include sump pumping and WellPoint systems

6.8. Limitations of the report

All opinions and conclusions are considered accurate to a reasonable degree of engineering certainty based upon the evidence available at the time of this report. All opinions and conclusions are subject to revision based upon receipt of new or additional or any updated information.

The interpretation and recommendations submitted in this report are based in part upon data obtained from a limited number of boreholes. Advice provided herein is intended for use by the client in the design phase of the project. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant to the revised project or complete.

There is no investigation which is thorough enough to determine all site conditions and anomalies, no matter how comprehensive the investigation program is as site data is derived from extrapolation of limited test locations (non-continuous sampling). The nature and extent of variations between test locations may not become evident until construction. The borings were carried out using investigation techniques consistent with those ordinarily exercised by other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project.

Passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. In particular, caution should be exercised in the consideration of contractual responsibilities as they relate to disturbance of soils.

The recommendations included in this report including any options are confirmation dependent. They are not final since the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. The geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions revealed during construction.

If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

7. References

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APPENDICES

Logs

Appendix 1-1: Bore hole logs

Appendix 1-2: Runway Trial Pit logs

Appendix 1-3: Terminal Area Trial Pit logs

BOREHOLE LOGS

BH-T01

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A.
Location Area: J.K.I.A
Client: Kenya Airport Authourity.

Kenya Airports Authority

ELEVATION: 1605m
co-ordinate Lat: 01 19'36.82'' Long: 36.56'41.38''
Dates: Start: 18-03-2026 End: 19-03-2026

SHEET OF

Date(s) Drilled: 18/19-03-2026 | **Logged By:** Carro Nduta | **Checked By:** Julius
Drilling Method: Augering & Coring | **Auger Bit Size/Type:** 101mm | **Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200 | **Drilled By:** Dancun Otieno | **Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs | **Borehole Number:** B01

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology	MATERIAL DESCRIPTION	Weathering Grade		Fracture Index	Colour	SPT N-Value	N-VALU
0–1	1.5	30	0	Sandy SILT	Smooth	–		Dark grey to black CLAY, moist to wet, firm, highly plastic non-intact, disintegrated into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin; fissured with prominent shrinkage cracks.BLACK COTTON SOIL.	I		NI	Black	I	
1–2	1.5	30	0	Sandy SILT	Smooth	–			V		NI	Black	I	
3–4	2	35	5.5	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard, completely weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.	V		NI	Brownish-grey	Refusal	

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

I=Fresh
II=Slightly weathered
III=Moderately weathered
IV=Highly weathered
V=Completely weathered
VI=Residual material
RQD=Rock quality designation

TCR=Total core recovered
NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

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ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
5													
6	2	45	18	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard to strong , highly to moderately fractures (horizontaly inclined to sub-horizontal) which are mechanically induced; ranging from completely weathered and disintegrated to moderately weathered TUFF.	V	>10	Brownish-grey	Refusal	
7													
8	2	24	0	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard, completely weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.TUFF.	V	>10	Brownish-grey	Refusal	
9													
10								Brownish-grey, moist, moderately hard, highly fractured (mechanically induced); fractures are horizontal to					

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
10	2	30	5.5	Sandy SILT	Rough	–		sub-horizontal and widely open. moderatley weathered, disintegrated TUFF.	V	>10	Brownish-grey	Refusal	
11													
12	2	30	0	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard, completely weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.TUFF.	IV	>10	Brownish-grey	Refusal	
13							TUFF						
14	2	40	0	Sandy SILT	Rough	–			IV	>10	Brownish-grey	Refusal	
15													

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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SHEET **OF**

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Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B01

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value
15												
16	2	50	45	Sandy SILT	Rough	–		Greyish , moderately hard, some mechanical-induced fractures, mostly intact TUFF.	IV	5	Brownish-grey	Refusal
17	1.5	34	31	Sandy SILT	Rough	–			II	4	Greyish	Refusal
18												
19	1.5	43	26	Sandy SILT	Rough	–		Greyish , moderately hard, some	II	5	Greyish	Refusal
20												

N-VALU 0 20 40

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

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ELEVATION: 1605m

co-or dinate: Lat: 01 19'36.82" Long: 36,56'41.38"

Dates: Start: 18-03-2026 End: 19-03-2026

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Date(s) Drilled: 18/19-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B01

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade		Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
20														
21	1.5	44	15	–	Rough	–		mechanical-induced fractures, mostly intact PHONELITE.	II		5	Greyish	Refusal	
22	1.5	30	0	–	Rough	–		Grey , dense sections with intermittent broken cores, moderate fracturing TUFF with Phenolite.	VI		>10	Greyish	Refusal	
23	1	98	70	–	Rough	–			I		>10	Greyish	Refusal	
24	1	96	87	–	Rough	–			I		8	Greyish	Refusal	
25														

Legend Title

- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
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Drilling Method: Augering & Coring | **Auger Bit Size/Type:** 101mm | **Total Depth Drilled (m):** 30m

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Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs | **Borehole Number:** B01

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
25	1	96	91	–	Rough	–	PHONOLITE	Grey ,strong, mostly intact cores, minor mechanical fractures, slight disintegrated PHONELITE.	I	8	Greyish	Refusal	
26	1	99	95	–	Rough	–			I	4	Greyish	Refusal	
27	1	98	65	–	Rough	–			I	9	Greyish	Refusal	
28	1	99	90	–	Rough	–			I	4	Greyish	Refusal	
29	1	40	50	–	Rough	–			I	1	Greyish	Refusal	
30													

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
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- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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V=Completely weathered
VI=Residual material
RQD=Rock quality designation

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NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

BH-T02

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.
Location Area: J.K.I.A
Client: Kenya Airport Authourity.

Kenya Airports Authority

ELEVATION: 1581m
co-or dinate: **Lat:** 01 19'8.3"S; **Long:** 36 57'19.5"E
Dates: **Start:** 23-03-2026; **End:** 24-03-2026

SHEET **OF**

Date(s) Drilled: 18/19-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B02

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value
0–1	1.5	33	0	-	Smooth	I	BLACK COTTON SOIL	Dark grey to black CLAY, moist to wet, firm, highly plastic non-intact, disintegrated into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin; fissured with prominent shrinkage cracks.BLACK COTTON SOIL.	I	NI	Black	I
1–2	1.5	33	15	Sandy SILT	Smooth	I		Brownish-grey, moist, moderately hard, highly fractured (mechanically induced); fractures are horizontal to sub-horizontal and widely open. moderatley weathered, disintegrated TUFF.	I	NI	Black	I
2–3	1.5	50	19	Sandy SILT	Rough	I			IV	NI	Brownish-grey	Refusal
3–4												
4–5												

N-VALU (0, 20, 40)

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

I=Fresh
II=Slightly weathered
III=Moderately weathered
IV=Highly weathered
V=Completely weathered
VI=Residual material
RQD=Rock quality designation

TCR=Total core recovered
NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.

Location Area: J.K.I.A

Client: Kenya Airport Authourity.

Kenya Airports Authority

ELEVATION: 1581m

co-or dinate Lat: 01 19'8.3"S Long: 36 57'19.5"E

Dates: Start: 23-03-2026 End: 24-03-2026

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ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U 100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
5–6	2	67	38	Sandy SILT	Rough	-	TUFF	Grey ,moderatley strong,highly weathered, mostly intact cores, minor mechanical fractures, slight disintegrated TUFF.	IV	>10	Brownish-grey	Refusal	
7–8	1.5	55	51	Sandy SILT	Rough	-		Brownish Grey ,moderatley strong,highly weathered, mostly intact cores, minor mechanical fractures, slight disintegrated TUFF.	IV	4	Brownish-grey	Refusal	
9–10	2	55	25	Sandy SILT	Rough	-		Brownish-grey, moist, moderately hard, Highly weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.TUFF.	IV	>10	Brownish-grey	Refusal	

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greylah brown Sandy SILT
- Greylah brown Volcanic ash TUFF

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Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B02

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
10	1	52	94	Sandy SILT	Rough	I	PHONELITE	Brownish-grey, moist, moderately hard, slightly weathered tuff and phonelite; slightlyly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. TUFF.	III	3	Greyish	Refusal	
11													
12	2	49	42	Sandy SILT	Rough	I		Brownish-grey, moist, moderately hard, slightly weathered tuff and phonelite; slightlyly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. PHONELITE.	III	>10	Brownish-grey	Refusal	
13													
14	2	50	29	Sandy SILT	Rough	I		Brownish-grey, moist, moderately hard, highly weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely	II	>10	Brownish-grey	Refusal	
15													

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

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SHEET **OF**

Date(s) Drilled: 18/19-03-2026 | **Logged By:** Carro Nduta | **Checked By:** Julius

Drilling Method: Augering & Coring | **Auger Bit Size/Type:** 101mm | **Total Depth Drilled (m):** 30m

Drill Rig Types: XY-200 | **Drilled By:** Dancun Otieno | **Inclination From Vertical:** 0^0

Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs | **Borehole Number:** B02

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
15													
16	2	48	31	Sandy SILT	Rough	I		open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.	II	>10	Brownish-grey	Refusal	
17													
18	2	52	46	Sandy SILT	Rough	I	PHONELITE	Grey ,moderatley strong,slightlyy weathered, mostly intact cores, minor mechanical fractures, slight disintegrated PHONELITE.	II	9	Greyish	Refusal	
19													
20													

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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Dates: **Start:** 23-03-2026; **End:** 24-03-2026

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Date(s) Drilled: 18/19-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B02

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALU (0 20 40)
20	2	54	45	Sandy SILT	Rough	I			II	5	Greyish	Refusal	
21													
22	2	55	35	Sandy SILT	Rough	I		Brownish-grey, moist, moderately hard, highly fractured (mechanically induced); fractures are horizontal to sub-horizontal and widely open. moderatley weathered, disintegrated TUFF.	II	>10	Brownish-grey	Refusal	
23													
24	2	50	29	Sandy SILT	Rough	I	TUFF/PHONELITE	Brownish-grey, moist, moderately hard, Highly weathered tuff; highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely	II	>10	Brownish-grey	Refusal	
25													

Legend Title

- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.

Location Area: J.K.I.A

Client: Kenya Airport Authourity.

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co-ordinate Lat: 01 19'8.3"S; Long: 36 57'19.5"E

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SHEET **OF**

Date(s) Drilled: 18/19-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B02

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VALUE (0 20 40)
25–26	2	48	24	Sandy SILT	Rough	I		open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.	II	>10	Brownish-grey	Refusal	
27	1	98	85	Sandy SILT	Rough	I	PHONELITE	Grey ,moderatley strong,slightlyy weathered, mostly intact cores, minor mechanical fractures, slight disintegrated PHONELITE.	I	4	Greyish	Refusal	
28	1	99	94	–	Rough	I		Grey ,strong, mostly intact cores, minor mechanical fractures, slight disintegrated PHONELITE.	I	5	Greyish	Refusal	
29–30	1	80	75	–	Rough	I			I	3	Greyish	Refusal	

Legend Title

- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
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Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
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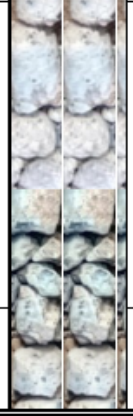
Wk=Weakly cemented

KAA

BH-T03

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A.	Kenya Airports Authority	**ELEVATION:** 1581m
Location Area: J.K.I.A		co-or dinate: Lat: 01 18'42.97"S; Long: 36 57'54.56"E
Client: Kenya Airport Authourity.		Dates: Start: 21-03-2026; End: 23-03-2026
SHEET	**OF**	
Date(s) Drilled: 21/23-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ **m ATD** ___ **m after**___**hrs**____**m after**___ **hrs**		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL (0 20)
0–1	1.5	33	0	–	Smooth	–		Dark grey to black CLAY, moist to wet, firm, highly plastic non-intact, disintegrated into angular to sub-rounded gravel and cobble-sized fragments of volcanic origin; fissured with prominent shrinkage cracks.BLACK COTTON SOIL.	I	NI	Black	I	
1–2	1.5	20	–	Sandy SILT	Smooth	–		Brownish-grey to dark grey, moist, moderately hard TUFF, in a highly to completely weathered state; disintegrated and very highly fractured, with poor core recovery comprising mainly small fragments.	IV	NI	Black	I	
2–4	1.5	48	–	Sandy SILT	Rough	–		Brownish-grey to dark grey, moist, moderately hard TUFF in a moderately weathered condition; highly fractured, with poor to fair core recovery consisting predominantly of small, light grey, angular fragments, with occasional larger but fractured pieces.	IV	NI	Brownish-grey	Refusal	
4–5								Brownish-grey to dark grey, moist, moderately hard TUFF in a					

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
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KAA

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ELEVATION: 1581m

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Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 810)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL (0 20)
5	1.5	45	8	Sandy SILT	Rough	–	TUFF	moderately weathered condition; highly fractured, with poor to fair core recovery consisting predominantly of small, light grey, angular fragments, with occasional larger but fractured pieces.	IV	NI	Brownish-grey	Refusal	
6	1.5	39	–	Sandy SILT	Rough	–		Brownish-grey to dark grey, moist, moderately hard TUFF in a moderately weathered condition; highly fractured, with poor core recovery consisting predominantly of small, light grey, angular fragments, with occasional larger but fractured pieces.	IV	NI	Brownish-grey	Refusal	
7													
8	1.5	27	–	Sandy SILT	Rough	–		Brownish-grey to dark grey, moist, moderately hard TUFF in a moderately weathered condition; highly fractured, consisting predominantly of small, light grey, angular fragments, with occasional larger but fractured pieces.	IV	NI	Brownish-grey	Refusal	
9	1.5	60	14		Rough	–		Brownish-grey to greyish-white, moist, moderately hard tuff, moderately weathered; highly fractured with discontinuities oriented randomly to sub-horizontally. Core recovery is fair, consisting mainly of small,	IV	NI		Refusal	
10													

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greylah brown Sandy SILT
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Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL
10				Sandy SILT				light grey, angular fragments, with occasional intact core pieces greater than 100 mm.			Brownish-grey		
11	1.5	64	–	Sandy SILT	Rough	–	PHONELITE	Brownish-grey to greyish-white, moist, moderately hard tuff, moderately weathered; highly fractured with discontinuities oriented randomly to sub-horizontally. Core recovery is fair, consisting mainly of small, light grey, angular fragments, with occasional intact core pieces greater than 100 mm.	IV	NI	Brownish-grey	Refusal	
12	1.5	30	–	Sandy SILT	Rough	–		Brownish-grey to greyish-white, moist, moderately hard tuff, moderately weathered; highly fractured with discontinuities oriented randomly to sub-horizontally. Core recovery is poor , consisting mainly of small, light grey, angular fragments, with occasional intact core pieces greater than 100 mm.	IV	NI	Brownish-grey	Refusal	
13							TUFF/PHONELITE						
14	1.5	30	–	Sandy SILT	Rough	–		Brownish-grey to dark grey, moist, moderately hard TUFF, in a highly to completely weathered state; disintegrated and very highly fractured, with poor core recovery comprising mainly small fragments.	IV	NI	Brownish-grey	Refusal	
15													

Legend Title
- Brown Sandy SILT
- Brown Volcanic ash TUFF
- Brownish grey Volcanic ash TUFF
- Dark brown Sandy SILT
- Dark brown Silty-SAND
- Dark grey Silty-SAND
- Greenish grey Volcanic ash TUFF
- Grey Sandy SILT
- Grey Volcanic ash TUFF
- Greyish brown Sandy SILT
- Greyish brown Volcanic ash TUFF

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Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 810)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL (0 – 20)
15													
16	1.5	64	16	Sandy SILT	Rough	–	PHONELITE	Brownish-grey to dark grey, moist, moderately hard TUFF in a moderately weathered condition; fractured consisting of small, light grey, angular fragments, with occasional with occasional intact core pieces greater than 100 mm.	IV	NI	Brownish-grey	Refusal	
17	1.5	68	20	Sandy SILT	Rough				IV	NI	Brownish-grey	Refusal	
18	1.5	55	21	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard, highly fractured (mechanically induced); fractures are horizontal to sub-horizontal and widely open. moderatley weathered, disintegrated TUFF.	IV	NI	Brownish-grey	Refusal	
19													
20								Brownish-grey, moist, moderately hard, Highly weathered tuff;					

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Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
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III=Moderately weathered
IV=Highly weathered
V=Completely weathered
VI=Residual material
RQD=Rock quality designation

TCR=Total core recovered
NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A

Location Area: J.K.I.A

Client: Kenya Airport Authourity.

Kenya Airports Authority

ELEVATION: 1581m

co-or dinate	Lat: 01 18'42.97"S
	Long: 36 57'54.56"E
Dates:	Start: 21-03-2026
	End: 23-03-2026

SHEET **OF**

Date(s) Drilled: 21/23-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 810)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL (0 20)
20	1.5	56	–	Sandy SILT	Rough	–	TUFF/PHONELITE	highly fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. The material is disintegrated and recovered mainly as gravel- to cobble-sized corestones with occasional boulders.	IV	NI	Brownish-grey	Refusal	
21	1.5	48	21	Sandy SILT	Rough	–		Brownish-grey, moist, moderately hard, Highly weathered tuff; moderatley fractured (predominantly mechanically induced), with horizontal to sub-horizontal, widely open fractures. with occasional intact core pieces greater than 100 mm	IV	NI	Brownish-grey	Refusal	
22													
23	1	56	8	Sandy SILT	Rough	–		Brownish-grey to grey, moist, moderately hard tuff, moderately to slightly weathered; moderately fractured with predominantly mechanically induced discontinuities oriented horizontal to sub-horizontal, locally irregular and occasionally widely open. Core recovery is fair, consisting of blocky fragments with occasional intact core pieces exceeding 100 mm.	IV	NI	Brownish-grey	Refusal	
24													
25								Brownish-grey, moist, moderately hard, Highly weathered tuff; moderatley fractured (predominantly mechanically					

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

I=Fresh
II=Slightly weathered
III=Moderately weathered
IV=Highly weathered
V=Completely weathered
VI=Residual material
RQD=Rock quality designation

TCR=Total core recovered
NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

Project Name: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A.
Location Area: J.K.I.A
Client: Kenya Airport Authourity.

Kenya Airports Authority

ELEVATION: 1581m
co-or dinate Lat: 01 18'42.97"S; Long: 36 57'54.56"E
Dates: Start: 21-03-2026; End: 23-03-2026

SHEET OF

Date(s) Drilled: 21/23-03-2026	**Logged By:** Carro Nduta	**Checked By:** Julius
Drilling Method: Augering & Coring	**Auger Bit Size/Type:** 101mm	**Total Depth Drilled (m):** 30m
Drill Rig Types: XY-200	**Drilled By:** Dancun Otieno	**Inclination From Vertical:** 0^0
Apparent Groundwater Depth___ m ATD ___ m after___hrs____m after___ hrs		**Borehole Number:** B03

ROCK MASS QUALITY ANALYSIS

Depth (m)	Run (m)	TCR,%	RQD %	Infilling	Asperity	U100 Blows	Lithology (0 2 4 6 8 10)	MATERIAL DESCRIPTION	Weathering Grade	Fracture Index	Colour	SPT N-Value	N-VAL (0 – 20)
25	2	52	26	Sandy SILT	Rough			induced), with horizontal to sub-horizontal, widely open fractures. with occasional intact core pieces greater than 100 mm	III	NI	Brownish-grey	Refusal	
26							PHONELITE						
27	2	52	51	Sandy SILT	Rough			Brownish-grey, moist, moderately hard tuff, highly weathered near the top, becoming slightly weathered to fresh with depth. Core recovery ranges from fragmented material to predominantly large intact core runs.	II	NI	Brownish-grey	Refusal	
28													
29	2	50	40	Sandy SILT	SM			Brownish-grey to light grey/bluish-grey, moist, moderately hard tuff, slightly weathered to fresh; exhibiting high core recovery with predominantly large intact core runs and minimal fracturing.	II	8	Brownish-grey	Refusal	
30													

Legend Title
Brown Sandy SILT
Brown Volcanic ash TUFF
Brownish grey Volcanic ash TUFF
Dark brown Sandy SILT
Dark brown Silty-SAND
Dark grey Silty-SAND
Greenish grey Volcanic ash TUFF
Grey Sandy SILT
Grey Volcanic ash TUFF
Greyish brown Sandy SILT
Greyish brown Volcanic ash TUFF

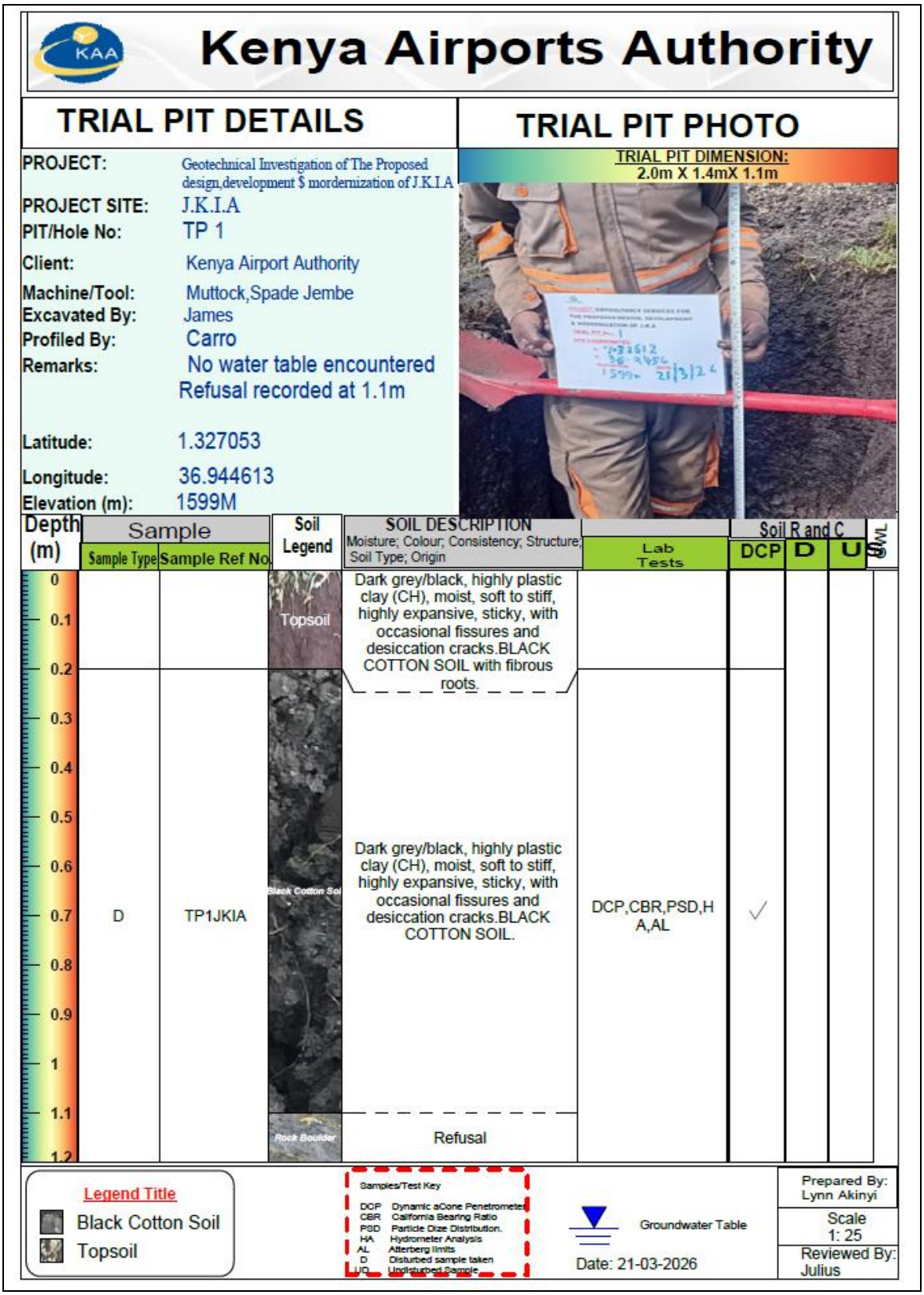
I=Fresh
II=Slightly weathered
III=Moderately weathered
IV=Highly weathered
V=Completely weathered
VI=Residual material
RQD=Rock quality designation

TCR=Total core recovered
NI=Non-intact
Mo=Moderately cemented
Mwk=Moderately-Weakly cemented
Uc=Uncemented
Wk=Weakly cemented

KAA

TRIALPITS LOGS -RUNWAY

TP01



TP02

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 2
Client: Kenya Airport Authority
Machine/Tool: Muttock,spade and Jembe
Profiled By: Carro
Remarks: No water table encountered

Latitude: 1.327053
Longitude: 36.944613
Elevation (m): 1611M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.3mX 0.6m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 0.6	D	TP2JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD, HA,AL	✓	

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

TP03

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 3
Client: Kenya Airport Authority
Machine/Tool: Muttock,spade and Jembe

Profiled By: Carro
Remarks: No water table encountered.

Latitude: 1.322738
Longitude: 36.950220
Elevation (m): 1613M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.3mX 0.6m

Depth (m)	Sample Type	Sample Ref No	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 0.6	D	TP3JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD, HA,AL	✓	

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi
Scale 1: 25
Reviewed By: Julius

TP04

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A

PROJECT SITE: J.K.I.A

PIT/Hole No: TP 4

Client: Kenya Airport Authority

Machine/Tool: Muttock,spade and Jembe

Profiled By: Carro

Remarks: No water table encountered

Latitude: -1.318847

Longitude: 36.955707

Elevation (m): 1600M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.3mX 1.1m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 1.1	D	TP4JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD, HA,AL	✓	

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

TP05

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 5
Client: Kenya Airport Authority
Machine/Tool: JCB Backhoe
Profiled By: Carro
Remarks: No water table encountered
Latitude: 1.322533
Longitude: 36.961581
Elevation (m): 1604M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.3mX 1.1m

Depth (m)	Sample Type	Sample Ref No	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 1.1	D	TP5JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD, HA,AL	✓	

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key
- DCP Dynamic aCone Penetrometer
- CBR California Bearing Ratio
- PSD Particle Dize Distribution.
- HA Hydrometer Analysis
- AL Atterberg limits
- D Disturbed sample taken
- U/Dist Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

TP06

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A

PROJECT SITE: J.K.I.A

PIT/Hole No: TP 6

Client: Kenya Airport Authority

Machine/Tool: JCB Backhoe

Profiled By: Carro

Remarks: No water table encountered.

Latitude: 1.308375

Longitude: 36.970863

Elevation (m): 1595M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.3mX 0.6m

Depth (m)	Sample		Soil Legend	SOIL DESCRIPTION Moisture; Colour; Consistency; Structure; Soil Type; Origin	Lab Tests	Soil R and C			GWL
	Sample Type	Sample Ref No				DCP			
0				Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.					
0.1									
0.2									
0.3	D	TP06JKIA		Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD, HA,AL	✓			
0.4									
0.5									
0.6									

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

TRIALPITS LOGS -TERMINAL AREA

TP01

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT:	Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE:	J.K.I.A
PIT/Hole No:	TP 1-Terminal area
Client:	Kenya Airport Authority
Machine/Tool:	Muttock,Spade Jembe
Excavated By:	James
Profiled By:	Carro
Remarks:	No water table encountered Refusal recorded at 1.1m
Latitude:	-1.317999
Longitude:	36.942523
Elevation (m):	1614M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.4mX 1.1m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 1.1	D	TP1JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.			
1.1			Rock Boulder	Refusal			

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 21-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

TP02

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 2-Terminal area
Client: Kenya Airport Authority
Machine/Tool: Muttock,Spade Jembe
Excavated By: James
Profiled By: Carro
Remarks: No water table encountered
Refusal recorded at 0.8m

Latitude: 1.317953
Longitude: 36.942521
Elevation (m): 1615M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.4mX 0.8m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Shear vane test data: Lab	Shear vane test data: Tests	Soil R and C: DCP	Soil R and C	Soil R and C	GWL
0 – 0.1			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.						
0.1 – 0.7	D	TP2JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD,HA,AL		✓			
0.7 – 1			Rock Boulder							

Legend Title
Black Cotton Soil
Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 31-03-2026

Prepared By: Lynn Akinyi
Scale 1: 25
Reviewed By: Julius

TP03

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 3-Terminal area
Client: Kenya Airport Authority
Machine/Tool: Muttock,Spade Jembe
Excavated By: James
Profiled By: Carro
Remarks: No water table encountered
Refusal recorded at 0.8m

Latitude: 1.319259
Longitude: 36.942521
Elevation (m): 1615M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.4mX 0.8m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Lab Tests	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.			
0.2 – 0.8	D	TP3JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD,HA,AL	✓	
0.8 – 1			Rock Boulder	Refusal			

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 31-03-2026

Prepared By: Lynn Akinyi
Scale 1: 25
Reviewed By: Julius

TP04

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 4-Terminal area
Client: Kenya Airport Authority
Machine/Tool: Muttock,Spade Jembe
Excavated By: James
Profiled By: Carro
Remarks: No water table encountered
Refusal recorded at 0.8m

Latitude: 1.319259
Longitude: 36.943359
Elevation (m): 1615M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.4mX 0.8m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Shear vane test data: Molded	Shear vane test data: Remolded	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.				
0.2 – 0.7	BULK	TP4JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD,HA,AL		✓	
0.7 – 1			Rock Boulder					

Legend Title
Black Cotton Soil
Topsoil

Samples/Test Key
DCP Dynamic aCone Penetrometer
CBR California Bearing Ratio
PSD Particle Dize Distribution.
HA Hydrometer Analysis
AL Atterberg limits
D Disturbed sample taken
UD Undisturbed Sample

Groundwater Table

Date: 31-03-2026

Prepared By: Lynn Akinyi
Scale 1: 25
Reviewed By: Julius

TP05

Kenya Airports Authority

TRIAL PIT DETAILS

PROJECT: Geotechnical Investigation of The Proposed design,development $ mordernization of J.K.I.A
PROJECT SITE: J.K.I.A
PIT/Hole No: TP 5-Terminal area
Client: Kenya Airport Authority
Machine/Tool: Muttock,Spade Jembe
Excavated By: James
Profiled By: Carro
Remarks: No water table encountered
Refusal recorded at 0.8m

Latitude: 1.319163
Longitude: 36.942563
Elevation (m): 1615M

TRIAL PIT PHOTO

TRIAL PIT DIMENSION:
2.0m X 1.4mX 0.8m

Depth (m)	Sample Type	Sample Ref No.	Soil Legend	SOIL DESCRIPTION (Moisture; Colour; Consistency; Structure; Soil Type; Origin)	Shear vane test data: Lab	Shear vane test data: Tests	Soil R and C: DCP	GWL
0 – 0.2			Topsoil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL with fibrous roots.				
0.2 – 0.7	D	TP5JKIA	Black Cotton Soil	Dark grey/black, highly plastic clay (CH), moist, soft to stiff, highly expansive, sticky, with occasional fissures and desiccation cracks.BLACK COTTON SOIL.	DCP,CBR,PSD,HA,AL		✓	
0.7 – 1			Rock Boulder					

Legend Title
- Black Cotton Soil
- Topsoil

Samples/Test Key

DCP	Dynamic aCone Penetrometer
CBR	California Bearing Ratio
PSD	Particle Dize Distribution.
HA	Hydrometer Analysis
AL	Atterberg limits
D	Disturbed sample taken
UD	Undisturbed Sample

Groundwater Table

Date: 31-03-2026

Prepared By: Lynn Akinyi

Scale 1: 25

Reviewed By: Julius

DCP Sheets

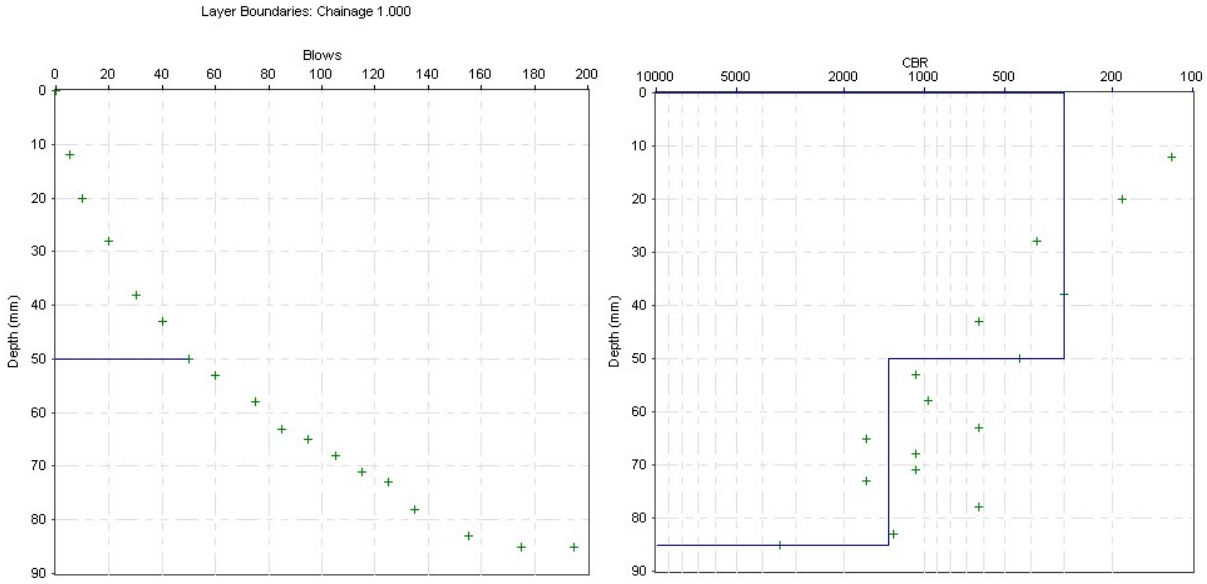
Appendix 2-1: DCP Sheets

UK DCP V3.1

DCP Layer Strength Analysis Report

Project Name: MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

Chainage (km):	KM 0+600	Surface Type:	Unpaved
Direction:	TP 1	Thickness (mm):	0
Location/Offset:	Carriageway/0.10m	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	12	Surface Moisture:	Wet
Test Date:	11/04/2026	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart | CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	1.00	302	50	50	Subgrade	--	--	--	--
2	0.24	1357	35	85	Subgrade	--	--	--	--

Pavement Strength

	Layer Contribution		
Layer	**SN**	**SNC**	**SNP**
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	2.08	2.08
Pavement Strength	--	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

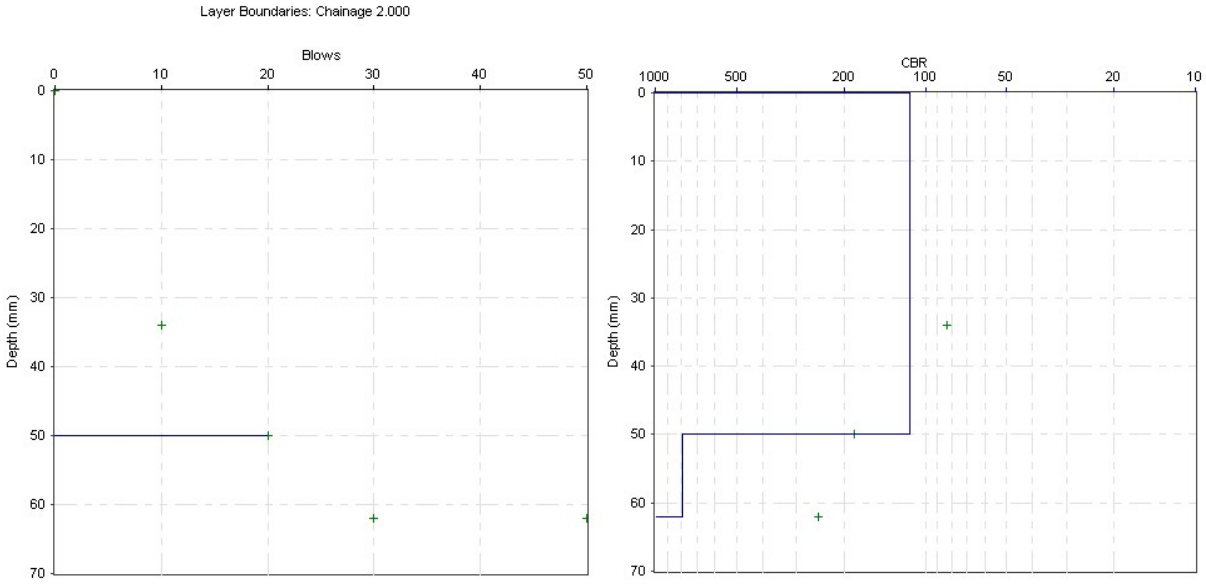
Report produced by .....

UK DCP V3.1

DCP Layer Strength Analysis Report

Project Name: MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

Chainage (km):	KM 3+200	Surface Type:	Unpaved
Direction:	TP4	Thickness (mm):	0
Location/Offset:	Carriageway/0.20m	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	3	Surface Moisture:	Wet
Test Date:	11/04/2026	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	2.50	115	50	50	Subgrade	--	--	--	--
2	0.40	795	12	62	Subgrade	--	--	--	--

Pavement Strength

	Layer Contribution		
Layer	**SN**	**SNC**	**SNP**
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	2.08	2.08
Pavement Strength	--	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

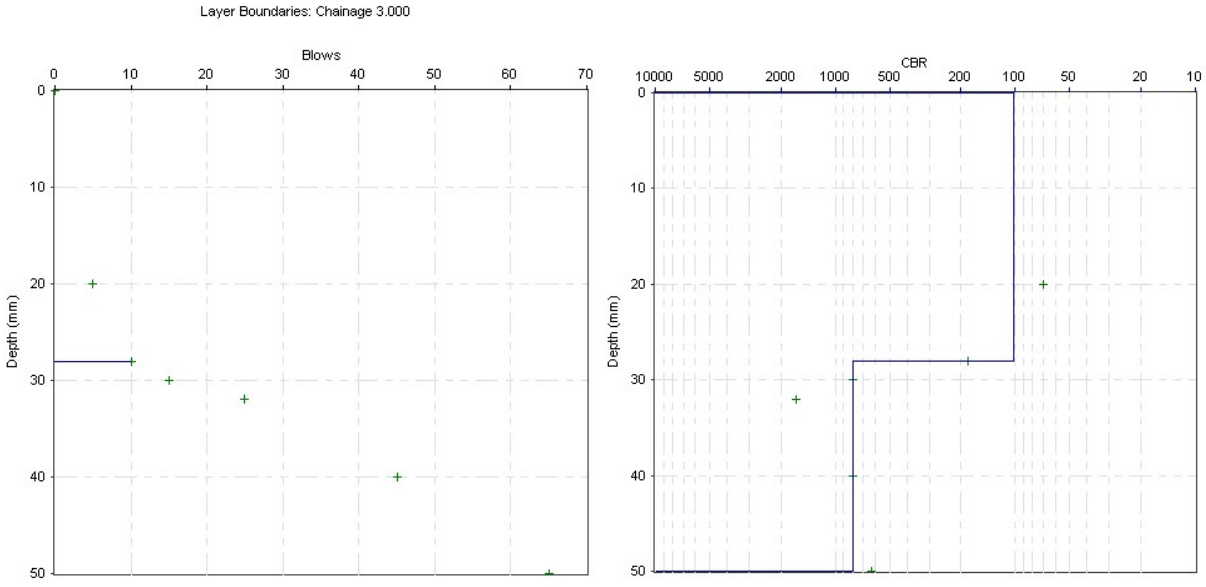
Report produced by .....

UK DCP V3.1

DCP Layer Strength Analysis Report

Project Name: MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

Chainage (km):	KM 1+500	Surface Type:	Unpaved
Direction:	TP3	Thickness (mm):	0
Location/Offset:	Carriageway/0.30m	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	15	Surface Moisture:	Wet
Test Date:	11/04/2026	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	2.80	102	28	28	Subgrade	--	--	--	--
2	0.40	795	22	50	Subgrade	--	--	--	--

Pavement Strength

	Layer Contribution		
Layer	**SN**	**SNC**	**SNP**
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	2.08	2.08
Pavement Strength	--	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

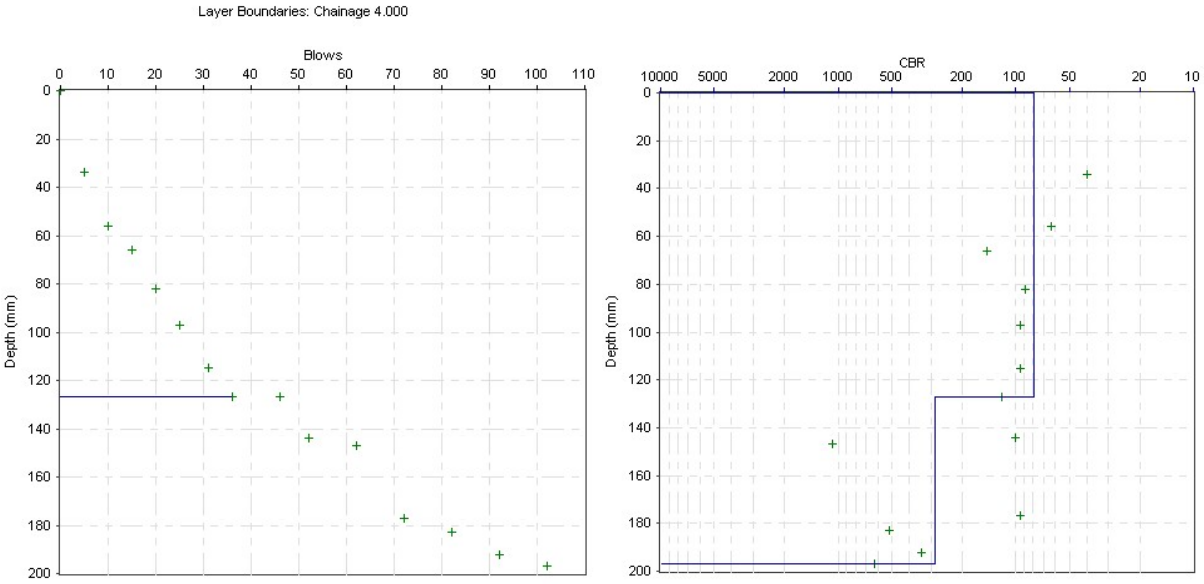
Report produced by .....

UK DCP V3.1

DCP Layer Strength Analysis Report

Project Name: MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

Chainage (km):	KM 4+200	Surface Type:	Unpaved
Direction:	TP5	Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	28	Surface Moisture:	Wet
Test Date:	11/04/2026	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart

CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	3.53	80	127	127	Subgrade	--	--	--	--
2	1.06	284	70	197	Subgrade	--	--	--	--

Pavement Strength

	Layer Contribution		
Layer	**SN**	**SNC**	**SNP**
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	2.08	2.08
Pavement Strength	--	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

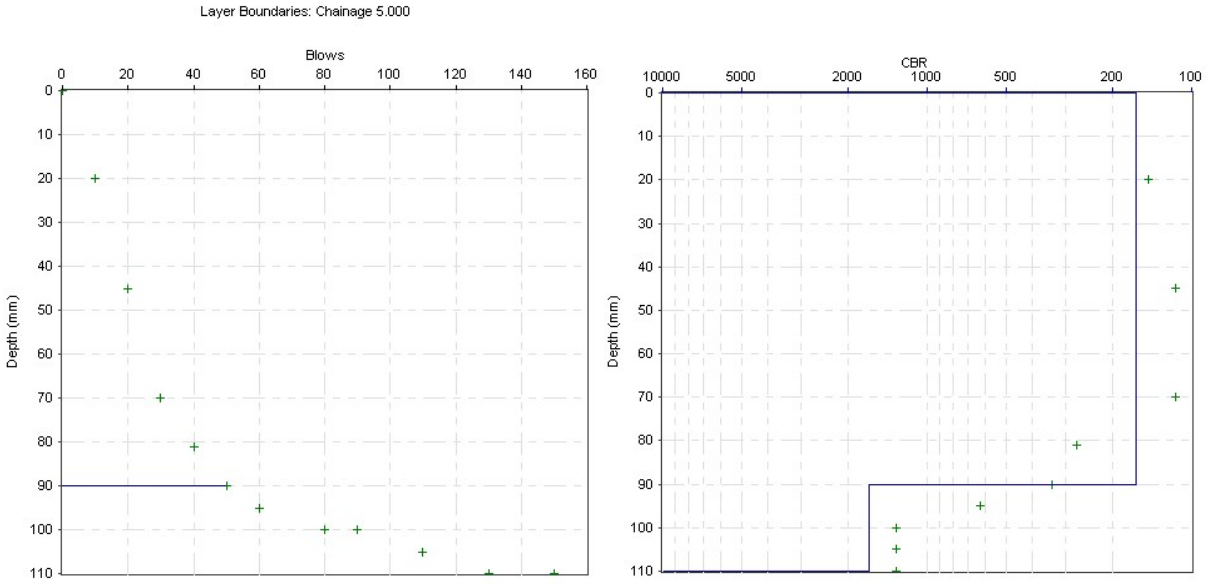
Report produced by .....

UK DCP V3.1

DCP Layer Strength Analysis Report

Project Name: MODERNIZATION OF JOMO KENYATTA INTERNATIONAL AIRPORT

Chainage (km):	KM 0+800	Surface Type:	Unpaved
Direction:	TP 2	Thickness (mm):	0
Location/Offset:	Carriageway	Base Type:	
Cone Angle:	60 degrees	Thickness (mm):	
Zero Error (mm):	30	Surface Moisture:	Wet
Test Date:	11/04/2026	Moisture adjustment factor:	Not adjusted



Layer Boundaries Chart CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	1.80	162	90	90	Subgrade	--	--	--	--
2	0.20	1655	20	110	Subgrade	--	--	--	--

Pavement Strength

	Layer Contribution		
Layer	**SN**	**SNC**	**SNP**
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	2.08	2.08
Pavement Strength	--	2.08	2.08

CBR Relationship:

TRL equation: $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$

Report produced by .....

Laboratory Test Results

Appendix 3-1: Atterberg Limits Test Results

Appendix 3-2: CBR Test Results

Appendix 3-3: Particle Size Distribution

Appendix 3-4: Proctor Compaction Test Results

Appendix 3-5: UCS Test Results

Appendix 3-6: PLT Test Results

Appendix 3-7: Water Absorption Test results

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

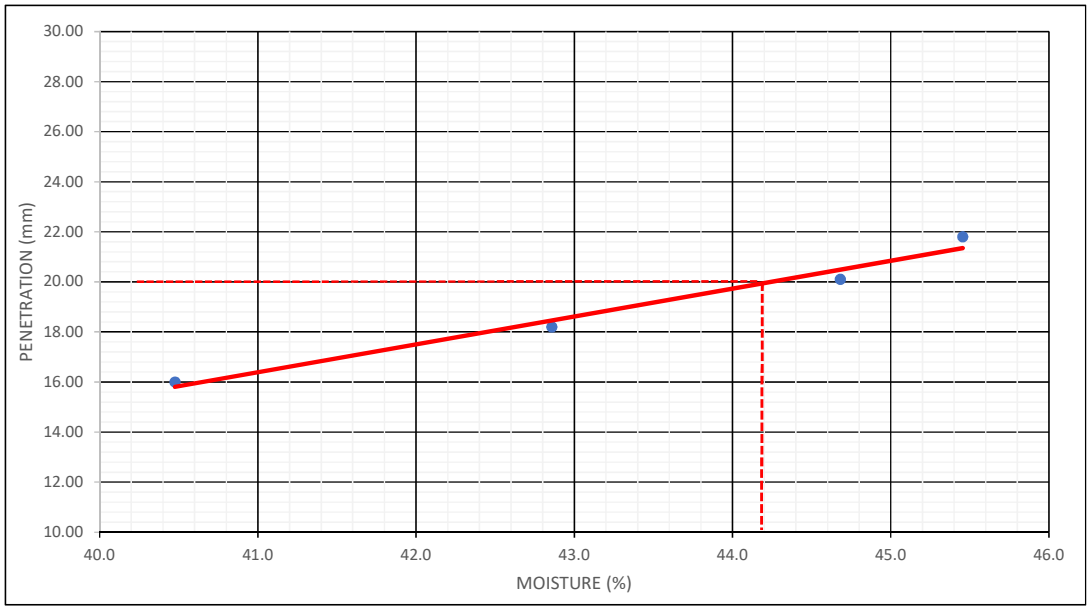
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	JKIA STOCKPILE	TRIAL PIT NO;	TP	TEST DATE;	9/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.00		18.20		20.10		21.80			
TIN NO.		Q7		A8		I		Q3		S8	Q51
Mass of wet soil + container	gms	27.80		27.00		25.20		25.70		26.30	32.40
Mass of dry soil + container	gms	26.10		25.20		23.10		23.70		24.40	30.90
Mass of container	gms	21.90		21.00		18.40		19.30		18.30	26.10
Mass of moisture	gms	1.70		1.80		2.10		2.00		1.90	1.50
Mass of dry soil	gms	4.20		4.20		4.70		4.40		6.10	4.80
Moisture content	%	40.48		42.86		44.68		45.5		31.15	31.25
Average moisture	%	40.5		42.9		44.7		45.5		31.2	



TESTED BY; JAMES

LIQUID LIMIT	%	44.2
PLASTIC LIMIT	%	31.2
PLASTICITY INDEX	%	**13**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	130
LINEAR SHRINKAGE	%	**7**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

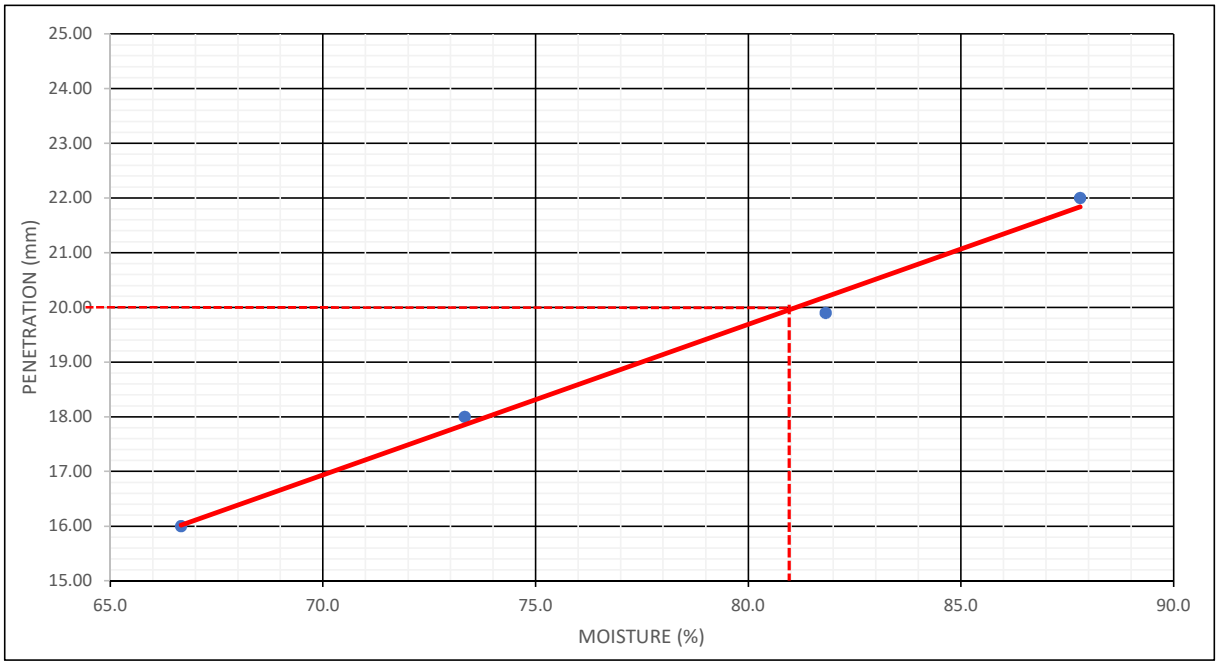
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	JKIA TERMINAL	TRIAL PIT NO;	TP1	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.00		18.00		19.90		22.00			
TIN NO.		Q19		B5		A100		A29C		Z5	Q26
Mass of wet soil + container	gms	24.60		26.00		27.50		28.30		23.50	23.00
Mass of dry soil + container	gms	22.20		23.80		24.80		24.70		22.70	22.00
Mass of container	gms	18.60		20.80		21.50		20.60		20.10	18.70
Mass of moisture	gms	2.40		2.20		2.70		3.60		0.80	1.00
Mass of dry soil	gms	3.60		3.00		3.30		4.10		2.60	3.30
Moisture content	%	66.67		73.33		81.82		87.8		30.77	30.30
Average moisture	%	66.7		73.3		81.8		87.8		30.5	



TESTED BY; JAMES

LIQUID LIMIT	%	81.0
PLASTIC LIMIT	%	30.5
PLASTICITY INDEX	%	**50**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	108
LINEAR SHRINKAGE	%	**23**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

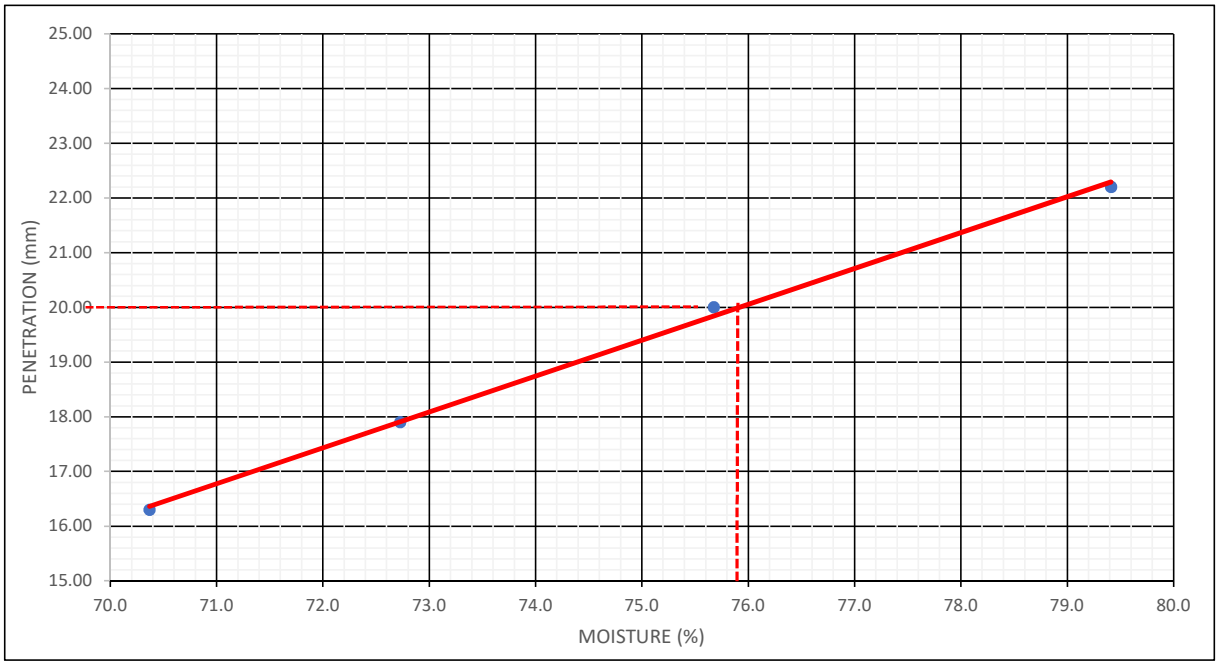
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	JKIA TERMINAL	TRIAL PIT NO;	TP2	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.30		17.90		20.00		22.20			
TIN NO.		D2		Q51		E14		Q32		TR1	Q37
Mass of wet soil + container	gms	24.20		29.90		28.70		26.10		25.30	24.70
Mass of dry soil + container	gms	22.30		28.30		25.90		23.40		24.50	24.00
Mass of container	gms	19.60		26.10		22.20		20.00		22.00	21.70
Mass of moisture	gms	1.90		1.60		2.80		2.70		0.80	0.70
Mass of dry soil	gms	2.70		2.20		3.70		3.40		2.50	2.30
Moisture content	%	70.37		72.73		75.68		79.4		32.00	30.43
Average moisture	%	70.4		72.7		75.7		79.4		31.2	



TESTED BY; JAMES

LIQUID LIMIT	%	75.9
PLASTIC LIMIT	%	31.2
PLASTICITY INDEX	%	**45**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	119
LINEAR SHRINKAGE	%	**15**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

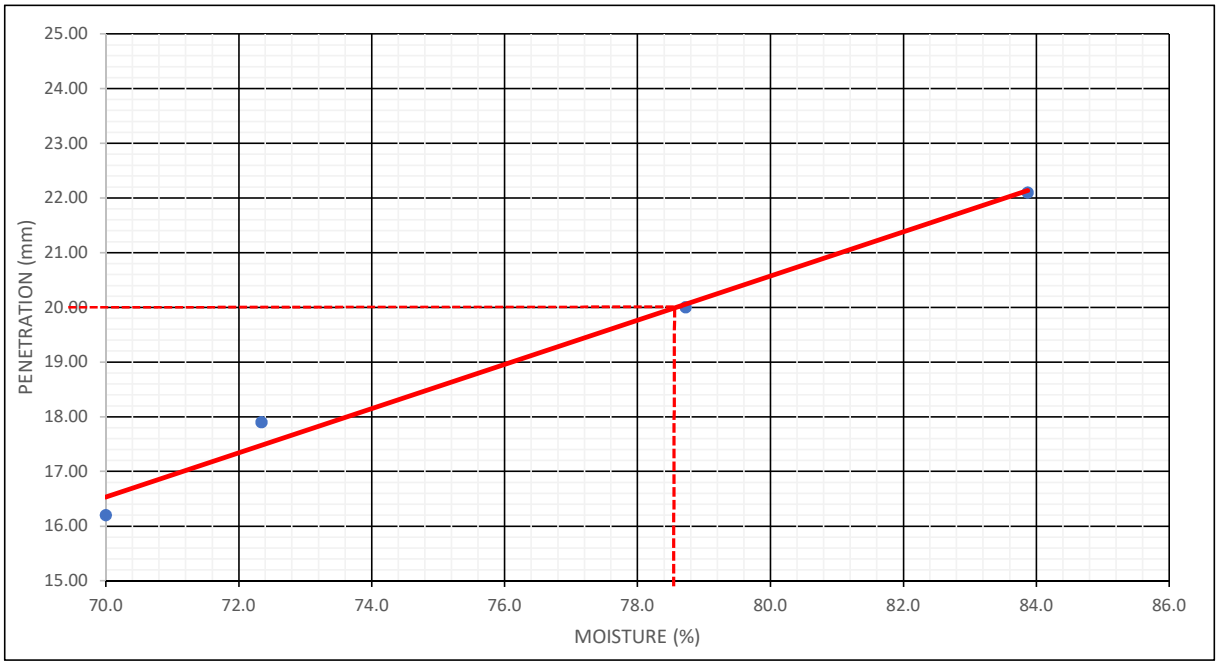
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	JKIA TERMINAL	TRIAL PIT NO;	TP3	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.20		17.90		20.00		22.10			
TIN NO.		ZB101		Q34		D12		C22		S12	C16
Mass of wet soil + container	gms	24.10		27.40		30.40		23.40		26.00	22.90
Mass of dry soil + container	gms	21.30		24.00		26.70		20.80		24.70	21.90
Mass of container	gms	17.30		19.30		22.00		17.70		22.00	19.80
Mass of moisture	gms	2.80		3.40		3.70		2.60		1.30	1.00
Mass of dry soil	gms	4.00		4.70		4.70		3.10		2.70	2.10
Moisture content	%	70.00		72.34		78.72		83.9		48.15	47.62
Average moisture	%	70.0		72.3		78.7		83.9		47.9	



TESTED BY;	JAMES

LIQUID LIMIT	%	78.5
PLASTIC LIMIT	%	47.9
PLASTICITY INDEX	%	**31**

LINEAR SHRINKAGE	9	
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	116
LINEAR SHRINKAGE	%	**17**

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GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

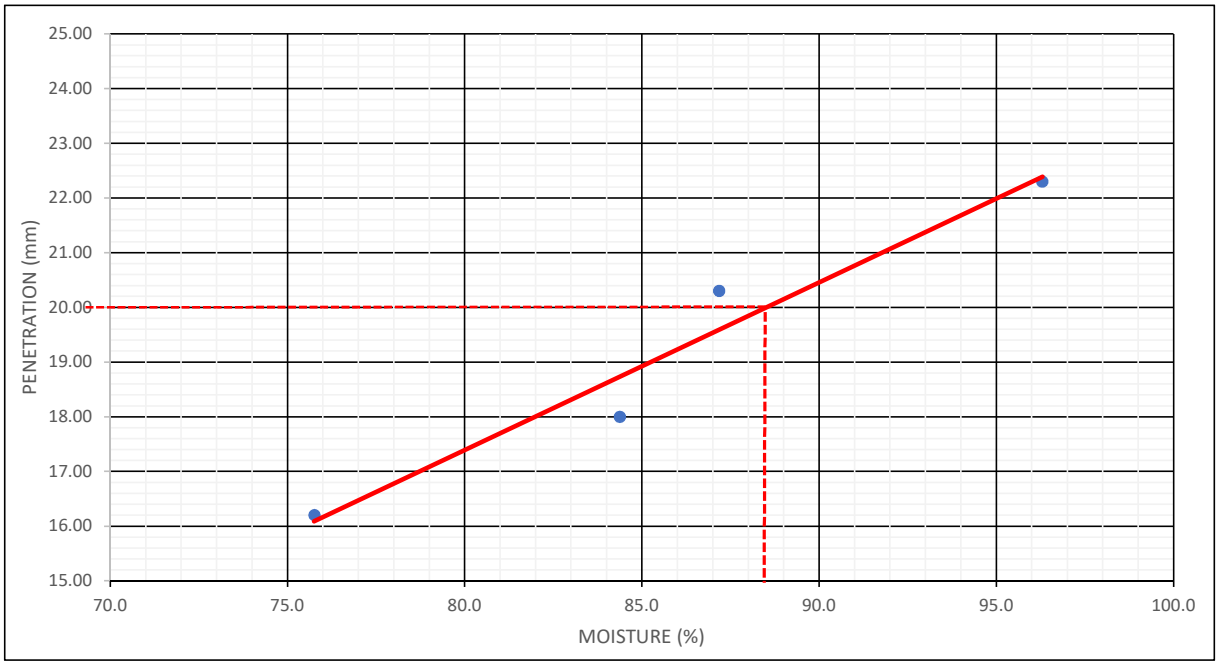
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	JKIA TERMINAL	TRIAL PIT NO;	TP4	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.20		18.00		20.30		22.30			
TIN NO.		RC4		Q39		D7		Z8		Z11	E8
Mass of wet soil + container	gms	26.80		24.70		28.00		24.40		24.70	24.90
Mass of dry soil + container	gms	24.30		22.00		24.60		21.80		23.60	23.60
Mass of container	gms	21.00		18.80		20.70		19.10		21.30	21.00
Mass of moisture	gms	2.50		2.70		3.40		2.60		1.10	1.30
Mass of dry soil	gms	3.30		3.20		3.90		2.70		2.30	2.60
Moisture content	%	75.76		84.38		87.18		96.3		47.83	50.00
Average moisture	%	75.8		84.4		87.2		96.3		48.9	



TESTED BY; JAMES

LIQUID LIMIT	%	88.5
PLASTIC LIMIT	%	48.9
PLASTICITY INDEX	%	**40**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	118
LINEAR SHRINKAGE	%	**16**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

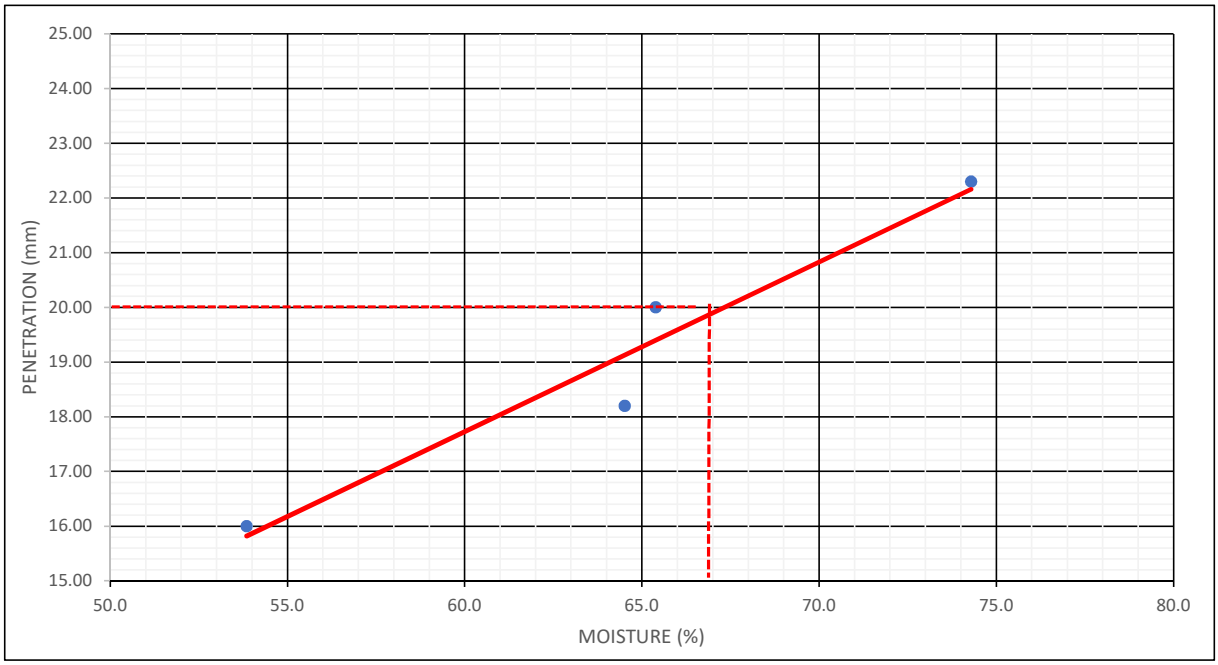
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	0+600	TRIAL PIT NO;	TP1	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.00		18.20		20.00		22.30			
TIN NO.		C16		S12		B103		C22		B10	B1
Mass of wet soil + container	gms	23.60		26.90		26.80		23.80		26.00	27.30
Mass of dry soil + container	gms	22.20		24.90		25.10		21.20		25.30	26.40
Mass of container	gms	19.60		21.80		22.50		17.70		23.20	23.90
Mass of moisture	gms	1.40		2.00		1.70		2.60		0.70	0.90
Mass of dry soil	gms	2.60		3.10		2.60		3.50		2.10	2.50
Moisture content	%	53.85		64.52		65.38		74.3		33.33	36.00
Average moisture	%	53.8		64.5		65.4		74.3		34.7	



TESTED BY;	JAMES

LIQUID LIMIT	%	67.0
PLASTIC LIMIT	%	34.7
PLASTICITY INDEX	%	**32**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	118
LINEAR SHRINKAGE	%	**16**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

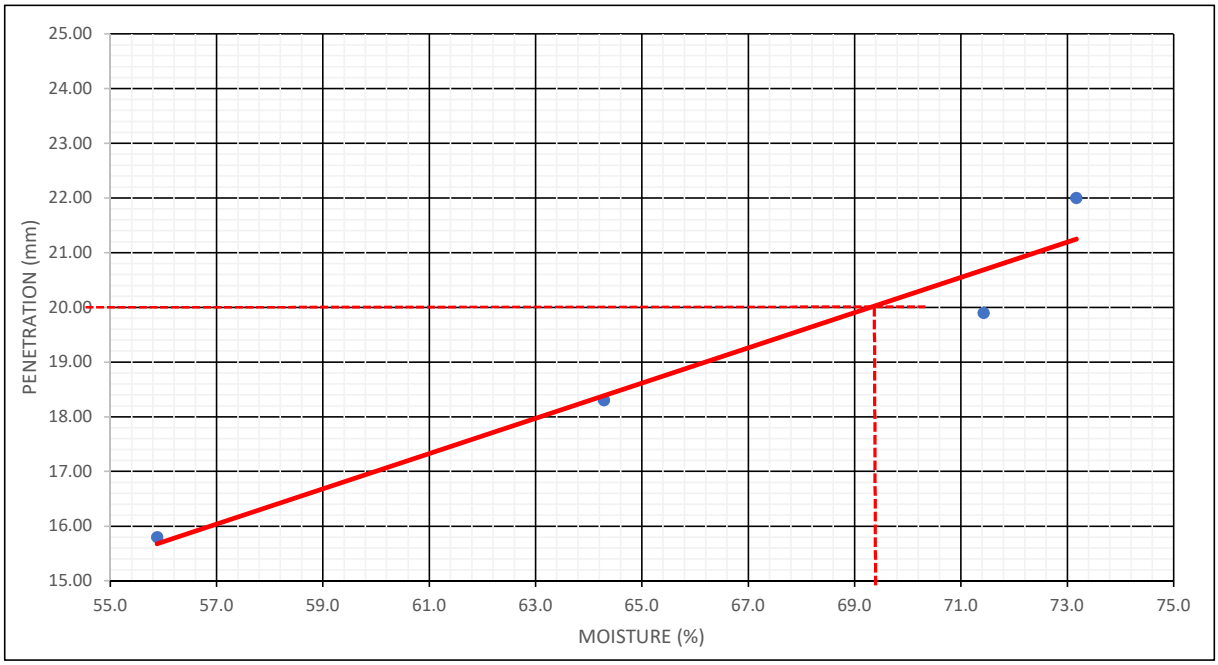
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	0+800	TRIAL PIT NO;	TP2	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	15.80		18.30		19.90		22.00			
TIN NO.		Z7		B47		Q46		Q34		Q11	D10
Mass of wet soil + container	gms	27.20		27.80		28.50		26.40		25.40	26.20
Mass of dry soil + container	gms	25.30		26.00		26.00		23.40		24.40	25.30
Mass of container	gms	21.90		23.20		22.50		19.30		21.70	22.90
Mass of moisture	gms	1.90		1.80		2.50		3.00		1.00	0.90
Mass of dry soil	gms	3.40		2.80		3.50		4.10		2.70	2.40
Moisture content	%	55.88		64.29		71.43		73.2		37.04	37.50
Average moisture	%	55.9		64.3		71.4		73.2		37.3	



TESTED BY;	JAMES

LIQUID LIMIT	%	69.2
PLASTIC LIMIT	%	37.3
PLASTICITY INDEX	%	**32**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	117
LINEAR SHRINKAGE	%	**16**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

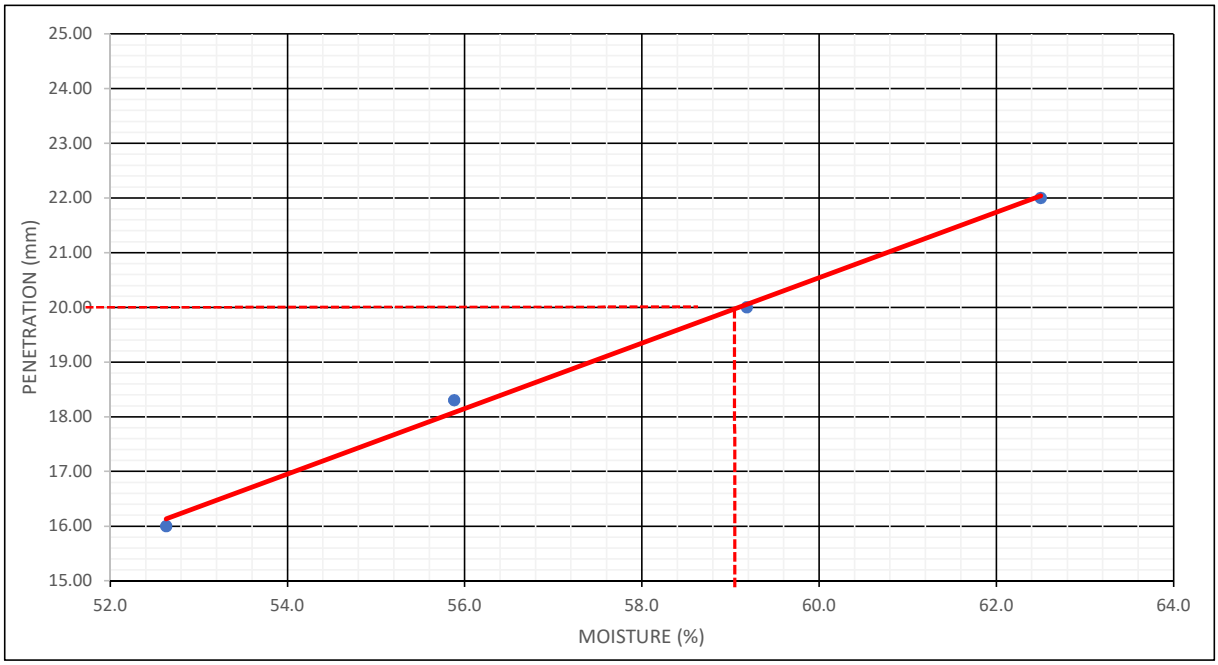
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	1+500	TRIAL PIT NO;	TP3	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.00		18.30		20.00		22.00			
TIN NO.		P20		S8		D12		S10		Q13	T14
Mass of wet soil + container	gms	29.60		23.60		29.70		27.40		25.90	26.40
Mass of dry soil + container	gms	27.60		21.70		26.80		24.90		24.70	25.10
Mass of container	gms	23.80		18.30		21.90		20.90		20.80	20.80
Mass of moisture	gms	2.00		1.90		2.90		2.50		1.20	1.30
Mass of dry soil	gms	3.80		3.40		4.90		4.00		3.90	4.30
Moisture content	%	52.63		55.88		59.18		62.5		30.77	30.23
Average moisture	%	52.6		55.9		59.2		62.5		30.5	



TESTED BY;	JAMES

LIQUID LIMIT	%	59.0
PLASTIC LIMIT	%	30.5
PLASTICITY INDEX	%	**28**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	123
LINEAR SHRINKAGE	%	**12**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

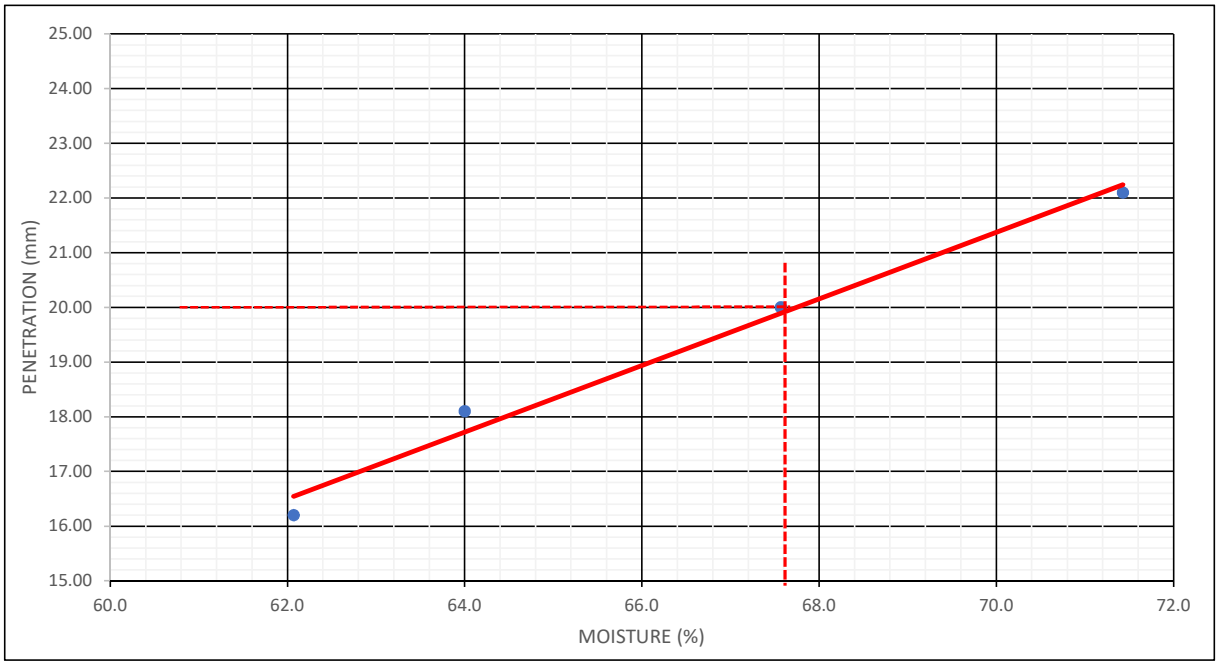
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	2+200	TRIAL PIT NO;	TP4	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	16.20		18.10		20.00		22.10			
TIN NO.		Q51		A29C		Z5		E14		B5	Q26
Mass of wet soil + container	gms	30.80		28.70		26.30		29.60		24.90	22.10
Mass of dry soil + container	gms	29.00		25.50		23.80		26.60		23.90	21.30
Mass of container	gms	26.10		20.50		20.10		22.40		20.80	18.70
Mass of moisture	gms	1.80		3.20		2.50		3.00		1.00	0.80
Mass of dry soil	gms	2.90		5.00		3.70		4.20		3.10	2.60
Moisture content	%	62.07		64.00		67.57		71.4		32.26	30.77
Average moisture	%	62.1		64.0		67.6		71.4		31.5	



TESTED BY; JAMES

LIQUID LIMIT	%	67.6
PLASTIC LIMIT	%	31.5
PLASTICITY INDEX	%	**36**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	112
LINEAR SHRINKAGE	%	**20**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

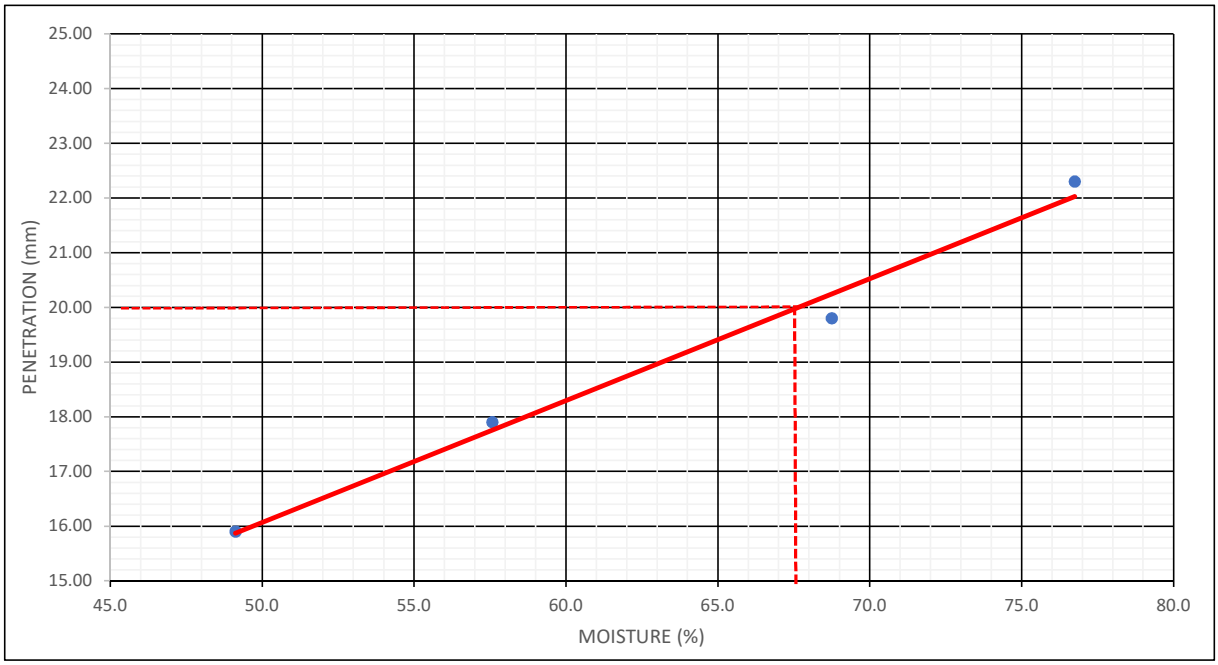
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	3+000	TRIAL PIT NO;	TP5	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	15.90		17.90		19.80		22.30			
TIN NO.		Z7		B1		A31		B102		T53	Q19
Mass of wet soil + container	gms	29.30		29.00		29.80		25.70		26.40	21.90
Mass of dry soil + container	gms	26.50		27.10		26.50		22.40		25.50	21.00
Mass of container	gms	20.80		23.80		21.70		18.10		23.10	18.70
Mass of moisture	gms	2.80		1.90		3.30		3.30		0.90	0.90
Mass of dry soil	gms	5.70		3.30		4.80		4.30		2.40	2.30
Moisture content	%	49.12		57.58		68.75		76.7		37.50	39.13
Average moisture	%	49.1		57.6		68.8		76.7		38.3	



TESTED BY; JAMES

LIQUID LIMIT	%	66.0
PLASTIC LIMIT	%	38.3
PLASTICITY INDEX	%	**28**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	118
LINEAR SHRINKAGE	%	**16**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

WORKING SHEET

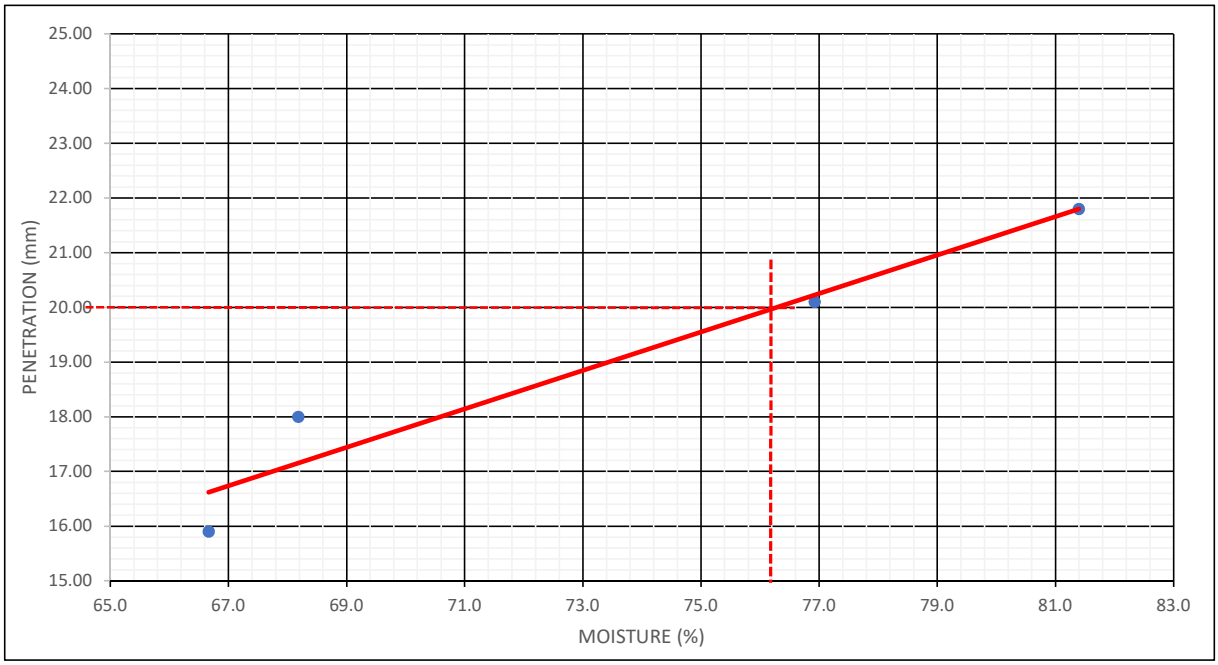
PLASTICITY INDEX TEST

(TEST METHOD: BS 1377 - 2 :1990)

PROJECT:PROPOSED DESIGN ,DEVELOPMENT AND MODERNIZATION OF JKIA

CHAINAGE ;	4+200	TRIAL PIT NO;	TP6	TEST DATE;	8/4/2026	

		LIQUID LIMIT								PLASTIC LIMIT	
TEST NO.		1		2		3		4			
Penetration	mm	15.90		18.00		20.10		21.80			
TIN NO.		Z9		Z2		Q5		B109		Q23	B101
Mass of wet soil + container	gms	22.70		23.00		27.90		29.10		22.20	20.70
Mass of dry soil + container	gms	21.10		21.50		24.90		25.60		20.90	19.70
Mass of container	gms	18.70		19.30		21.00		21.30		18.00	17.30
Mass of moisture	gms	1.60		1.50		3.00		3.50		1.30	1.00
Mass of dry soil	gms	2.40		2.20		3.90		4.30		2.90	2.40
Moisture content	%	66.67		68.18		76.92		81.4		44.83	41.67
Average moisture	%	66.7		68.2		76.9		81.4		43.2	



TESTED BY;	JAMES

LIQUID LIMIT	%	76.2
PLASTIC LIMIT	%	43.2
PLASTICITY INDEX	%	**33**

LINEAR SHRINKAGE		
INITIAL LENGTH	mm	140
OVEN - DRIED LENGTH	mm	115
LINEAR SHRINKAGE	%	**18**

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NOITECH
ENGINEERING LTD

Independent Materials Testing Laboratories

"Balance of Time, Quality and Cost

UNCONFINED COMPRESSION TEST OF NATURAL ROCK CORES (ACCORDING TO ASTM D7012-10)

PROJECT:	**CONSULTANCY SERVICES FOR PROPOSED DESIGN DEVELOPMENT AND MODERNISATION OF JKIA NAIROBI.**		
CLIENT:	**KENYA AIRPORT AUTHORITY.**		
SAMPLED BY:	**NOITECH ENG LTD**	TESTING DATE	**04/04/2026**
SAMPLING DATE:	**21/03/2026**	SITE LOCATION	**NAIROBI COUNTY**

BH ID	Depth (m) From	Depth (m) To	Diameter (mm)	Length (mm)	Weight (Kg)	Cross section Area (m^2)	Volume (m^3)	Density (Kg/m^3)	Proving Ring Reading (kN)	Stress (kN/m2)	Basic Friction angle	qu (Mpa)	qd (Mpa)	Description
1	6.20	6.40	80.0	120	1.298	0.0050	0.000603	2152	20.81	4,139	25.60	2.916	0.417	Very Weak
	16.00	16.20	70.0	110	0.958	0.0038	0.000423	2263	228.33	59,323	33.60	53.135	7.591	Strong
	23.00	23.20	70.0	120	1.096	0.0038	0.000462	2373	203.00	52,742	32.65	45.809	6.544	Medium
	24.40	24.60	70.0	140	1.324	0.0038	0.000539	2457	446.29	115,951	41.81	139.155	19.879	Very Strong
	25.40	25.60	70.0	130	1.099	0.0038	0.000500	2196	220.85	57,379	33.32	50.926	7.275	Strong
	26.40	26.60	70.0	110	1.342	0.0038	0.000423	3170	298.33	77,509	36.24	75.832	10.833	Strong
	27.65	27.85	70.0	140	1.381	0.0038	0.000539	2563	156.80	40,738	30.91	33.505	4.786	Medium
	28.80	29.00	70.0	140	1.397	0.0038	0.000539	2593	359.59	93,425	38.55	99.165	14.166	Strong
	29.80	30.00	70.0	140	1.319	0.0038	0.000539	2448	174.17	45,251	31.56	37.979	5.426	Medium

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2	5.80	6.00	70.0	160	1.784	0.0038	0.000616	2897	36.74	9,545	26.38	6.872	0.982	Weak
	7.60	7.80	82.0	110	1.255	0.0053	0.000581	2160	12.99	2,459	25.36	1.721	0.246	Very Weak
	8.00	8.20	82.0	140	1.703	0.0053	0.000739	2303	72.29	13,687	26.98	10.022	1.432	Weak
	10.40	10.60	82.0	164	2.207	0.0053	0.000866	2548	317.47	60,108	33.72	54.038	7.720	Strong
	12.00	12.20	82.0	140	1.254	0.0053	0.000739	1696	132.71	25,126	28.64	19.304	2.758	Weak
	13.00	13.20	70.0	140	1.297	0.0038	0.000539	2407	236.71	61,500	33.92	55.656	7.951	Strong
	15.90	16.10	70.0	100	0.922	0.0038	0.000385	2395	129.23	33,575	29.87	26.754	3.822	Medium
	17.10	17.30	70.0	130	1.204	0.0038	0.000500	2406	134.34	34,903	30.06	27.974	3.996	Medium
	20.70	20.90	70.0	130	1.048	0.0038	0.000500	2094	78.47	20,387	27.96	15.352	2.193	Weak
	23.10	23.30	70.0	130	1.112	0.0038	0.000500	2222	270.37	70,245	35.19	66.304	9.472	Strong
	26.80	27.00	70.0	110.0	0.863	0.0038	0.000423	2038	74.98	19,481	27.82	14.613	2.088	Weak
	27.70	27.90	70.0	140.0	1.300	0.0038	0.000539	2413	247.24	64,236	34.31	58.895	8.414	Strong
	28.80	29.00	70.0	140.0	1.230	0.0038	0.000539	2283	91.30	23,721	28.44	18.115	2.588	Weak
	29.50	29.70	70.0	130.0	0.985	0.0038	0.000500	1969	105.70	27,462	28.98	21.310	3.044	Weak
3	5.00	5.17	70.0	100	0.643	0.0038	0.000385	1671	61.65	16,017	27.32	11.843	1.692	Weak
	16.00	16.18	70.0	130	1.094	0.0038	0.000500	2186	31.00	8,054	26.17	5.763	0.823	Weak
	18.00	18.20	70.0	90	0.581	0.0038	0.000346	1677	12.57	3,266	25.47	2.292	0.327	Very Weak
	19.80	19.90	70.0	110	0.757	0.0038	0.000423	1788	43.05	11,185	26.62	8.106	1.158	Weak
	22.50	22.70	70.0	100	0.976	0.0038	0.000385	2536	93.73	24,352	28.53	18.648	2.664	Weak
	25.70	25.90	70.0	130	1.188	0.0038	0.000500	2374	87.35	22,695	28.29	17.256	2.465	Weak
	27.80	28.00	70.0	130	1.290	0.0038	0.000500	2578	68.12	17,698	27.57	13.178	1.883	Weak
	28.50	28.70	70.0	140	1.412	0.0038	0.000539	2620	120.34	31,266	29.53	24.664	3.523	Weak

Notes: *Tests results are specific to samples tested*

Tested By: Noitech Labs

Date Reported: 07-04-2026

Checked By: Eng. J.R.O. Ogallo

NOITECH ENGINEERING LIMITED

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

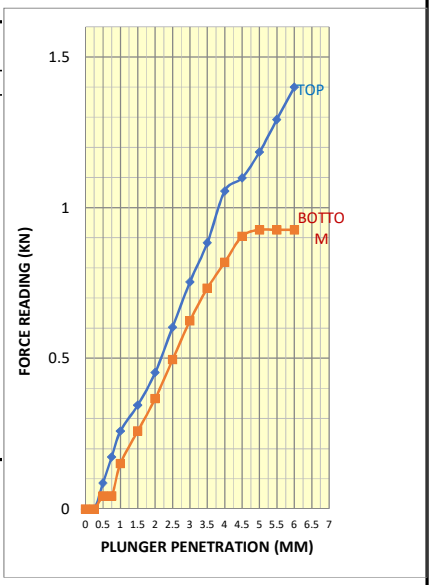
(According to BS 1377:1990)

Location	JKIA STOCKPILE	**Material Source**		JKIA		**Moulding Date**	9-Apr-2026
Layer	STOCKPILE					**Test Date**	13-Apr-2026
Sample No.	**S251**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1328 kg/m3**	**Actual DD :**	1487 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	20.4	Actual MC :	10.8
Intial Dial Reading:	1.62	**Final Dial Reading:**		2.75	**Swell:**		0.89

Relative Compaction Check	
No. of Blows	62
Mould No.	AA
Mould +wet soil (g)	10929
Mould (g)	7132
Wet soil (g)	3797
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1647
M.C (%)	10.8
Dry Density (kg/m^3)	**1487**
Rel. compaction (%)	**112**

REALATIVE MOISTURE		
Tin No.	C13	CR2
Tin+wet soil (g)	106.4	116.3
Tin+drysoil (g)	96.51	108.6
Tin (g)	19.0	21.0
Water (g)	9.89	7.7
Dry soil (g)	77.5	87.6
M.C (%)	**12.8**	**8.8**
Average M.C (%)	**10.8**	

Plunger Penetration	**Force Gauge Reading (Div)**		**Force Gauge Reading (kN)**	
mm	**Top**	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	`
0.25	0	0	0.00	0.00
0.50	4	2	0.09	0.04
0.75	8	2	0.17	0.04
1.00	12	7	0.26	0.15
1.50	16	12	0.34	0.26
2.00	21	17	0.45	0.37
2.50	28	23	**0.60**	**0.50**
3.00	35	29	0.75	0.62
3.50	41	34	0.88	0.73
4.00	49	38	1.06	0.82
4.50	51	42	1.10	0.90
5.00	55	43	**1.18**	**0.93**
5.50	60	43	1.29	0.93
6.00	65	43	1.40	0.93



CBR Results						
Pen	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.6	0.5	**13.2**	**4.6**	**3.8**	**5.9**
5.0	1.2	0.9	**20**	**5.9**	**4.6**	

Materials Technologist	**Snr Materials Technologist**	**Snr Materials Technologist**
Sign	**Sign .....**	**Sign .....**
Date	**Date .....**	**Date .....**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

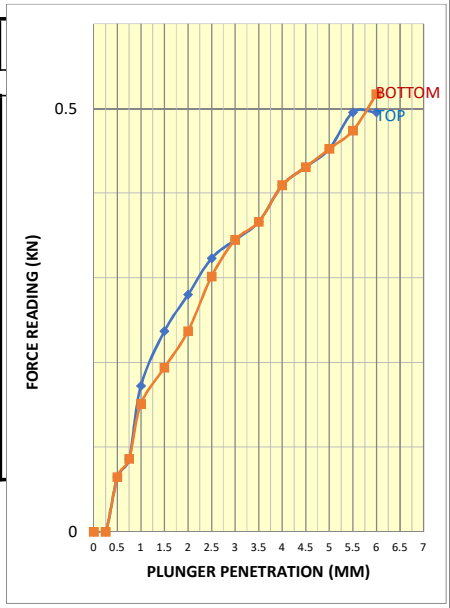
(According to BS 1377:1990)

Location	JKIA TERMINAL	**Material Source**				**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP1)					**Test Date**	13-Apr-2026
Sample No.	**S246**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1328 kg/m3**	**Actual DD :**	1322 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	29	Actual MC :	17.1
Intial Dial Reading:	1.9	**Final Dial Reading:**		4.00	**Swell:**		1.65

Relative Compaction Check	
No. of Blows	62
Mould No.	H1
Mould +wet soil (g)	10579
Mould (g)	7009
Wet soil (g)	3570
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1549
M.C (%)	17.1
Dry Density (kg/m^3)	**1322**
Rel. compaction (%)	**100**

REALATIVE MOISTURE		
Tin No.	A84	C103
Tin+wet soil (g)	129.7	120.2
Tin+drysoil (g)	115.8	106.5
Tin (g)	35.9	25.4
Water (g)	13.9	13.7
Dry soil (g)	79.9	81.1
M.C (%)	**17.4**	**16.9**
Average M.C (%)	**17.1**	

Plunger Penetration	**Force Gauge Reading (Div)**		**Force Gauge Reading (kN)**	
mm	**Top**	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	`
0.25	0	0	0.00	0.00
0.50	3	3	0.06	0.06
0.75	4	4	0.09	0.09
1.00	8	7	0.17	0.15
1.50	11	9	0.24	0.19
2.00	13	11	0.28	0.24
2.50	15	14	**0.32**	**0.30**
3.00	16	16	0.34	0.34
3.50	17	17	0.37	0.37
4.00	19	19	0.41	0.41
4.50	20	20	0.43	0.43
5.00	21	21	**0.45**	**0.45**
5.50	23	22	0.50	0.47
6.00	23	24	0.50	0.52



CBR Results						
Pen	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.3	0.3	**13.2**	**2.4**	**2.3**	**2.4**
5.0	0.5	0.5	**20**	**2.3**	**2.3**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

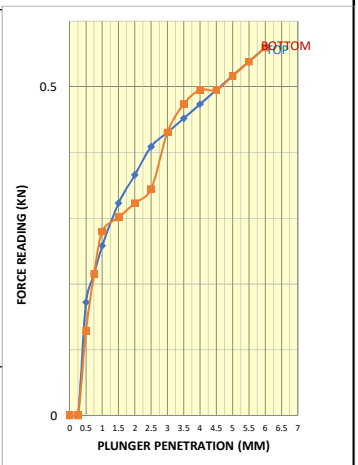
CALIFORNIA BEARING RATIO(1 POINT)

(According to BS 1377:1990)

Location	JKIA TERMINAL	**Material Source**		JKIA TERMINAL		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP2)	**Tested by:**		Duncan		**Test Date**	13-Apr-2026
Sample No.	**S247**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1346 kg/m3**	**Actual DD :**	1276 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	29.4	Actual MC :	19.1
Intial Dial Reading:	4.69	**Final Dial Reading:**		7.24	**Swell:**		2.01

Relative Compaction Check		
No. of Blows	62	
Mould No.	ww3	
Mould +wet soil (g)	10910	
Mould (g)	7406	
Wet soil (g)	3504	
Mould Volume (cm^3)	2305	
Bulk Density (kg/m^3)	1520	
M.C (%)	19.1	
Dry Density (kg/m^3)	**1276**	
Rel. compaction (%)	**95**	
ALATIVE MOISTURE CONTENT		
Tin No.	E11	B37
Tin+wet soil (g)	118	147.7
Tin+drysoil (g)	103	128.5
Tin (g)	19.6	27.6
Water (g)	16	19.2
Dry soil (g)	82.9	100.9
M.C (%)	**19.2**	**19.0**
Average M.C (%)	**19.1**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	8	6	0.17	0.13
0.75	10	10	0.22	0.22
1.00	12	13	0.26	0.28
1.50	15	14	0.32	0.30
2.00	17	15	0.37	0.32
2.50	19	16	**0.41**	**0.34**
3.00	20	20	0.43	0.43
3.50	21	22	0.45	0.47
4.00	22	23	0.47	0.50
4.50	23	23	0.50	0.50
5.00	24	24	**0.52**	**0.52**
5.50	25	25	0.54	0.54
6.00	26	26	0.56	0.56



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.4	0.3	**13.2**	**3.1**	**2.6**	**3.1**
5.0	0.5	0.5	**20**	**2.6**	**2.6**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

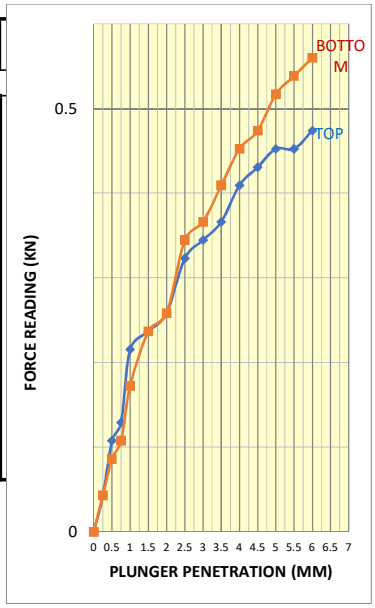
(According to BS 1377:1990)

Location	JKIA TERMINAL	**Material Source**		JKIA		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP3)					**Test Date**	13-Apr-2026
Sample No.	**S43**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1324 kg/m3**	**Actual DD :**	1317 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	31.2	Actual MC :	19.0
Intial Dial Reading:	1.57	**Final Dial Reading:**		4.18	**Swell:**		2.06

Relative Compaction Check	
No. of Blows	62
Mould No.	H1
Mould +wet soil (g)	10774
Mould (g)	7162
Wet soil (g)	3612
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1567
M.C (%)	19.0
Dry Density (kg/m^3)	**1317**
Rel. compaction (%)	**99**

REALATIVE MOISTURE		
Tin No.	B3	10
Tin+wet soil (g)	107.3	110.8
Tin+drysoil (g)	93.5	95.7
Tin (g)	17.8	19.4
Water (g)	13.8	15.1
Dry soil (g)	75.7	76.3
M.C (%)	**18.2**	**19.8**
Average M.C (%)	**19.0**	

Plunger Penetration	**Force Gauge Reading (Div)**		**Force Gauge Reading (kN)**	
mm	**Top**	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	`
0.25	2	2	0.04	0.04
0.50	5	4	0.11	0.09
0.75	6	5	0.13	0.11
1.00	10	8	0.22	0.17
1.50	11	11	0.24	0.24
2.00	12	12	0.26	0.26
2.50	15	16	**0.32**	**0.34**
3.00	16	17	0.34	0.37
3.50	17	19	0.37	0.41
4.00	19	21	0.41	0.45
4.50	20	22	0.43	0.47
5.00	21	24	**0.45**	**0.52**
5.50	21	25	0.45	0.54
6.00	22	26	0.47	0.56



CBR Results						
Pen	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.3	0.3	**13.2**	**2.4**	**2.6**	**2.6**
5.0	0.5	0.5	**20**	**2.3**	**2.6**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

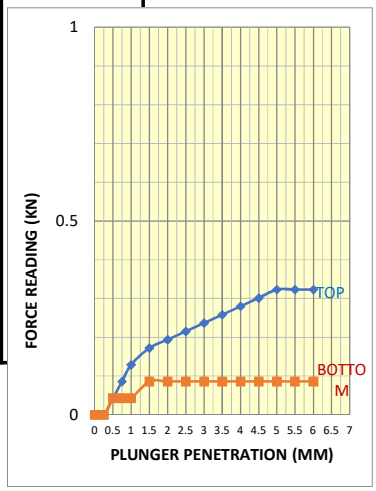
(According to BS 1377:1990)

Location	JKIA TERMINAL	**Material Source**				**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP4)					**Test Date**	13-Apr-2026
Sample No.	**S249**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1324 kg/m3**	**Actual DD :**	1281 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	32	Actual MC :	24.9
Intial Dial Reading:	1.1	**Final Dial Reading:**		2.10	**Swell:**		0.79

Relative Compaction Check	
No. of Blows	62
Mould No.	J11
Mould +wet soil (g)	9872
Mould (g)	6185
Wet soil (g)	3687
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1600
M.C (%)	24.9
Dry Density (kg/m^3)	**1281**
Rel. compaction (%)	**97**

REALATIVE MOISTURE		
Tin No.	D4	RC4
Tin+wet soil (g)	115.5	131.3
Tin+drysoil (g)	96.51	108.6
Tin (g)	17.0	21.0
Water (g)	18.99	22.7
Dry soil (g)	79.5	87.6
M.C (%)	**23.9**	**25.9**
Average M.C (%)	**24.9**	

Plunger Penetration	**Force Gauge Reading (Div)**		**Force Gauge Reading (kN)**	
mm	**Top**	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	`
0.25	0	0	0.00	0.00
0.50	2	2	0.04	0.04
0.75	4	2	0.09	0.04
1.00	6	2	0.13	0.04
1.50	8	4	0.17	0.09
2.00	9	4	0.19	0.09
2.50	10	4	**0.22**	**0.09**
3.00	11	4	0.24	0.09
3.50	12	4	0.26	0.09
4.00	13	4	0.28	0.09
4.50	14	4	0.30	0.09
5.00	15	4	**0.32**	**0.09**
5.50	15	4	0.32	0.09
6.00	15	4	0.32	0.09



CBR Results						
Pen	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.2	0.1	**13.2**	**1.6**	**0.7**	**1.6**
5.0	0.3	0.1	**20**	**1.6**	**0.4**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

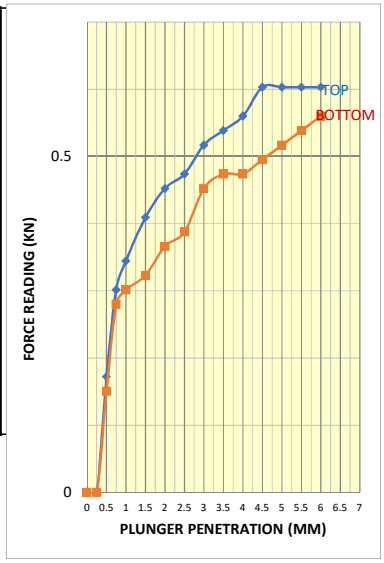
(According to BS 1377:1990)

Location	Km 0+600	**Material Source**		JKIA RUNWAY		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP1)	**Tested by:**		DUNCAN		**Test Date**	13-Apr-2026
Sample No.	**S240**	**Soaking Date**		9-Apr-2026		**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1404 kg/m3**	**Actual DD :**	1254 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	27	Actual MC :	20.9
Intial Dial Reading:	1	**Final Dial Reading:**		2.50	**Swell:**		1.18

Relative Compaction Check		
No. of Blows	62	
Mould No.	JD	
Mould +wet soil (g)	10353	
Mould (g)	6860	
Wet soil (g)	3493	
Mould Volume (cm^3)	2305	
Bulk Density (kg/m^3)	1515	
M.C (%)	20.9	
Dry Density (kg/m^3)	**1254**	
Rel. compaction (%)	**89**	

ALATIVE MOISTURE CONTENT		
Tin No.	Q17	S17
Tin+wet soil (g)	92	98.2
Tin+drysoil (g)	80	85.2
Tin (g)	22.1	21.8
Water (g)	12	13
Dry soil (g)	58.0	63.4
M.C (%)	**21.2**	**20.5**
Average M.C (%)	**20.9**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	8	7	0.17	0.15
0.75	14	13	0.30	0.28
1.00	16	14	0.34	0.30
1.50	19	15	0.41	0.32
2.00	21	17	0.45	0.37
2.50	22	18	**0.47**	**0.39**
3.00	24	21	0.52	0.45
3.50	25	22	0.54	0.47
4.00	26	22	0.56	0.47
4.50	28	23	0.60	0.50
5.00	28	24	**0.60**	**0.52**
5.50	28	25	0.60	0.54
6.00	28	26	0.60	0.56



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.5	0.4	**13.2**	**3.6**	**2.9**	**3.6**
5.0	0.6	0.5	**20**	**3.0**	**2.6**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

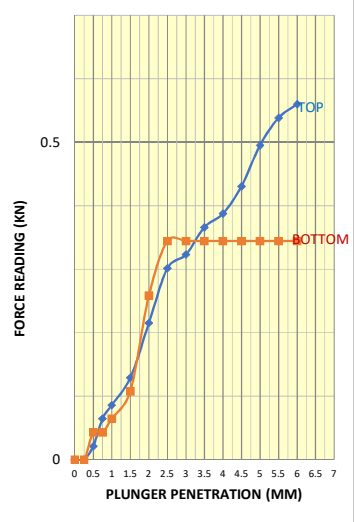
(According to BS 1377:1990)

Location	Km 0+800	**Material Source**		JKIA RUNWAY		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (tp2)	**Tested by:**		DUNCAN		**Test Date**	13-Apr-2026
Sample No.	**S241**	**Soaking Date**		9-Apr-2026		**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1458 kg/m3**	**Actual DD :**	1321 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	24.2	Actual MC :	20.9
Intial Dial Reading:	0.74	**Final Dial Reading:**		5.95	**Swell:**		4.10

Relative Compaction Check		
No. of Blows	62	
Mould No.	ms	
Mould +wet soil (g)	10574	
Mould (g)	6895	
Wet soil (g)	3679	
Mould Volume (cm^3)	2305	
Bulk Density (kg/m^3)	1596	
M.C (%)	20.9	
Dry Density (kg/m^3)	**1321**	
Rel. compaction (%)	**91**	

ALATIVE MOISTURE CONTENT		
Tin No.	Q17	S17
Tin+wet soil (g)	92	98.2
Tin+drysoil (g)	80	85.2
Tin (g)	22.1	21.8
Water (g)	12	13
Dry soil (g)	58.0	63.4
M.C (%)	**21.2**	**20.5**
Average M.C (%)	**20.9**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	1	2	0.02	0.04
0.75	3	2	0.06	0.04
1.00	4	3	0.09	0.06
1.50	6	5	0.13	0.11
2.00	10	12	0.22	0.26
2.50	14	16	**0.30**	**0.34**
3.00	15	16	0.32	0.34
3.50	17	16	0.37	0.34
4.00	18	16	0.39	0.34
4.50	20	16	0.43	0.34
5.00	23	16	**0.50**	**0.34**
5.50	25	16	0.54	0.34
6.00	26	16	0.56	0.34



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.3	0.3	**13.2**	**2.3**	**2.6**	**2.6**
5.0	0.5	0.3	**20**	**2.5**	**1.7**	

Materials Technologist	**Snr Materials Technologist**	**Snr Materials Technologist**
Sign	**Sign .....**	**Sign .....**
Date	**Date .....**	**Date .....**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

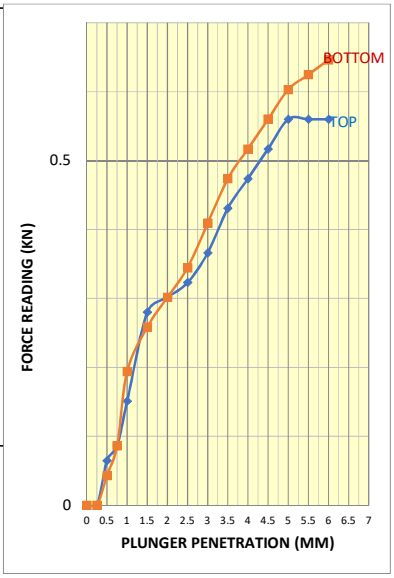
(According to BS 1377:1990)

Location	Km 1+500	**Material Source**		Trial pit		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP3)	**Tested by:**		DUNCAN		**Test Date**	13-Apr-2026
Sample No.	**S242**	**Soaking Date**		9-Apr-2026		**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1584 kg/m3**	**Actual DD :**	1431 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	22.2	Actual MC :	18.4
Intial Dial Reading:	0	**Final Dial Reading:**		0.71	**Swell:**		0.56

Relative Compaction Check	
No. of Blows	62
Mould No.	EP
Mould +wet soil (g)	10476
Mould (g)	6572
Wet soil (g)	3904
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1694
M.C (%)	18.4
Dry Density (kg/m^3)	**1431**
Rel. compaction (%)	**90**

ALATIVE MOISTURE CONTENT		
Tin No.	Q17	Q7
Tin+wet soil (g)	131	128.7
Tin+drysoil (g)	114	111.9
Tin (g)	22.0	21.8
Water (g)	17	16.8
Dry soil (g)	92.0	90.1
M.C (%)	**18.2**	**18.6**
Average M.C (%)	**18.4**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	3	2	0.06	0.04
0.75	4	4	0.09	0.09
1.00	7	9	0.15	0.19
1.50	13	12	0.28	0.26
2.00	14	14	0.30	0.30
2.50	15	16	**0.32**	**0.34**
3.00	17	19	0.37	0.41
3.50	20	22	0.43	0.47
4.00	22	24	0.47	0.52
4.50	24	26	0.52	0.56
5.00	26	28	**0.56**	**0.60**
5.50	26	29	0.56	0.62
6.00	26	30	0.56	0.65



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.3	0.3	**13.2**	**2.4**	**2.6**	**3.0**
5.0	0.6	0.6	**20**	**2.8**	**3.0**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

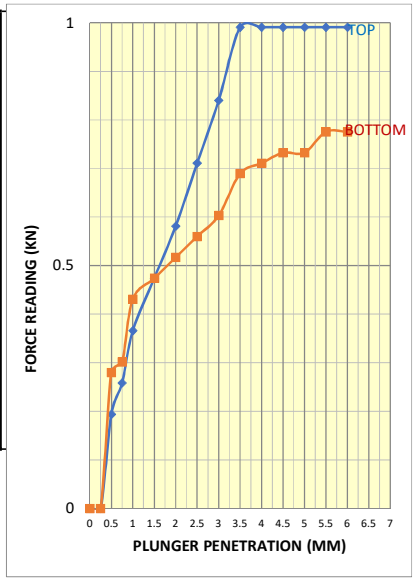
(According to BS 1377:1990)

Location	Km 2+200	**Material Source**		JKIA RUNWAY		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP4)	**Tested by;**		DUNCAN		**Test Date**	13-Apr-2026
Sample No.	**S243**	**Soaking Date**		9-Apr-2026		**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1545 kg/m3**	**Actual DD :**	1470 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	21	Actual MC :	15.1
Intial Dial Reading:	3.42	**Final Dial Reading:**		5.41	**Swell:**		1.57

Relative Compaction Check	
No. of Blows	62
Mould No.	ms
Mould +wet soil (g)	11542
Mould (g)	7644
Wet soil (g)	3898
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1691
M.C (%)	15.1
Dry Density (kg/m^3)	**1470**
Rel. compaction (%)	**95**

ALATIVE MOISTURE CONTENT		
Tin No.	Q27	C16
Tin+wet soil (g)	110	103.8
Tin+drysoil (g)	98	92.6
Tin (g)	19.7	19.6
Water (g)	12	11.2
Dry soil (g)	78.6	73.0
M.C (%)	**14.8**	**15.3**
Average M.C (%)	**15.1**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	9	13	0.19	0.28
0.75	12	14	0.26	0.30
1.00	17	20	0.37	0.43
1.50	22	22	0.47	0.47
2.00	27	24	0.58	0.52
2.50	33	26	**0.71**	**0.56**
3.00	39	28	0.84	0.60
3.50	46	32	0.99	0.69
4.00	46	33	0.99	0.71
4.50	46	34	0.99	0.73
5.00	46	34	**0.99**	**0.73**
5.50	46	36	0.99	0.78
6.00	46	36	0.99	0.78



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.7	0.6	**13.2**	**5.4**	**4.2**	**5.4**
5.0	1.0	0.7	**20**	**5.0**	**3.7**	

Materials Technologist	**Snr Materials Technologist**	**Snr Materials Technologist**
Sign	**Sign .....**	**Sign .....**
Date	**Date .....**	**Date .....**

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

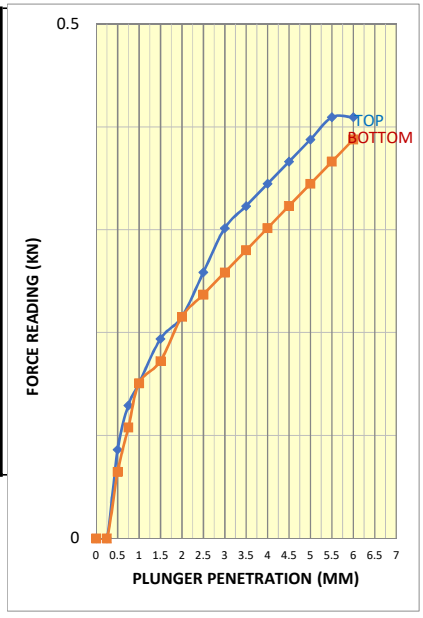
(According to BS 1377:1990)

Location	Km 3+000	**Material Source**		JKIA RUNWAY		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (TP5)					**Test Date**	13-Apr-2026
Sample No.	**S244**	**Soaking Date**				**Days soaked**	4
Compaction Method :	T99	**Mould Fa**	2.305	**Target MDD :**	**1414 kg/m3**	**Actual DD :**	1390 kg/m3
Proving Ring Factor:	0.02154	**Soaking I**	4	OMC :	26.2	Actual MC :	15.0
Intial Dial Reading:	2.11	**Final Dial Reading:**		3.30	**Swell:**		0.94

Relative Compaction Check		
No. of Blows	62	
Mould No.	lm	
Mould +wet soil (g)	10441	
Mould (g)	6757	
Wet soil (g)	3684	
Mould Volume (cm^3)	2305	
Bulk Density (kg/m^3)	1598	
M.C (%)	15.0	
Dry Density (kg/m^3)	**1390**	
Rel. compaction (%)	**98**	

REALATIVE MOISTURE		
Tin No.	I	Q41
Tin+wet soil (g)	108	104.6
Tin+drysoil (g)	96	93.8
Tin (g)	18.4	19.4
Water (g)	12	10.8
Dry soil (g)	77.4	74.4
M.C (%)	**15.5**	**14.5**
Average M.C (%)	**15.0**	

Plunger Penetrat	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	4	3	0.09	0.06
0.75	6	5	0.13	0.11
1.00	7	7	0.15	0.15
1.50	9	8	0.19	0.17
2.00	10	10	0.22	0.22
2.50	12	11	**0.26**	**0.24**
3.00	14	12	0.30	0.26
3.50	15	13	0.32	0.28
4.00	16	14	0.34	0.30
4.50	17	15	0.37	0.32
5.00	18	16	**0.39**	**0.34**
5.50	19	17	0.41	0.37
6.00	19	18	0.41	0.39



CBR Results						
Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	0.3	0.2	**13.2**	**2.0**	**1.8**	**2.0**
5.0	0.4	0.3	**20**	**1.9**	**1.7**	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

CALIFORNIA BEARING RATIO(1 POINT)

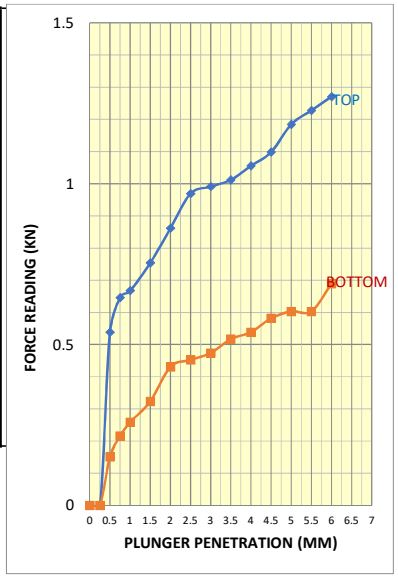
(According to BS 1377:1990)

Location	Km 4+200	**Material Source**		JKIA RUNWAY		**Moulding Date**	9-Apr-2026
Layer	TRIAL PIT (6)	**Tested By:**		DUNCAN		**Test Date**	13-Apr-2026
Sample No.	**S245**	**Soaking Date**		9-Apr-2026		**Days soaked**	4
Compaction Method :	T99	**Mould Factor:**	2.305	**Target MDD :**	**1462 kg/m3**	**Actual DD :**	1323 kg/m3
Proving Ring Factor:	0.02154	**Soaking Days:**	4	OMC :	30.4	Actual MC :	19.3
Intial Dial Reading:	1	**Final Dial Reading:**		5.00	**Swell:**		3.15

Relative Compaction Check	
No. of Blows	62
Mould No.	JF
Mould +wet soil (g)	11399
Mould (g)	7760
Wet soil (g)	3639
Mould Volume (cm^3)	2305
Bulk Density (kg/m^3)	1579
M.C (%)	19.3
Dry Density (kg/m^3)	**1323**
Rel. compaction (%)	**90**

ALATIVE MOISTURE CONTENT		
Tin No.	A7	Y1
Tin+wet soil (g)	121	130
Tin+drysoil (g)	110	99
Tin (g)	33.9	23.5
Water (g)	11	5
Dry soil (g)	76.1	21.0
M.C (%)	**14.8**	**23.8**
Average M.C (%)	**19.3**	

Plunger Penetration(	**Force Gauge Reading (Div)**		**Force Gauge Reading(KN)**	
	Top	**Bottom**	**Top**	**Bottom**
0	0	0	**0**	**0**
0.25	0	0	0.00	0.00
0.50	25	7	0.54	0.15
0.75	30	10	0.65	0.22
1.00	31	12	0.67	0.26
1.50	35	15	0.75	0.32
2.00	40	20	0.86	0.43
2.50	45	21	**0.97**	**0.45**
3.00	46	22	0.99	0.47
3.50	47	24	1.01	0.52
4.00	49	25	1.06	0.54
4.50	51	27	1.10	0.58
5.00	55	28	**1.18**	**0.60**
5.50	57	28	1.23	0.60
6.00	59	32	1.27	0.69



CBR Results

Penetrati	**Load**		**Standard Load**	**CBR**		**Accepted CBR**
mm	Top	Bottom	**KN**	Top	Bottom	%
2.5	1.0	0.5	**13.2**	**7.3**	**3.4**	**7.3**
5.0	1.2	0.6	**20**	**5.9**	**3.0**	

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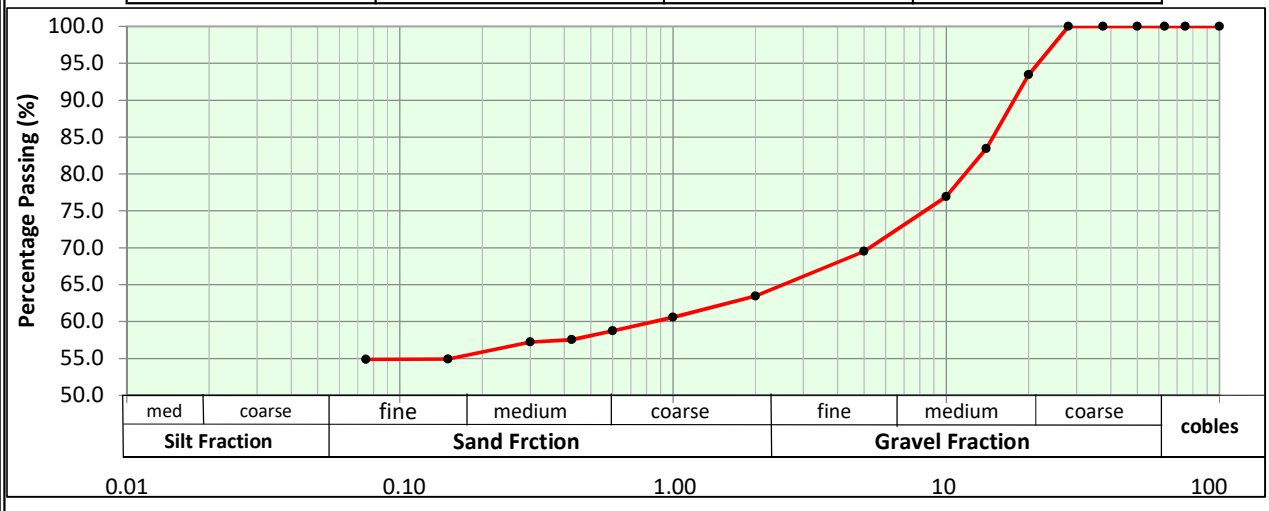
ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:	JKIA	**Date Sampled:**	24-4-2026
sample No.:	S251	**Date Tested:**	10-4-2026
Description:		**Operator:**	
	JKIA STOCKPILE		
Weight before washing (g):	1113.9	**Riffled weight (g):**	1114
Weight After washing (g):	945	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	343.5	0.0	100.0
28	89	8.0	92.0
20	73	6.5	85.5
14	112	10.0	75.5
10	72	6.5	69.0
5	83	7.4	61.5
2	68	6.1	55.5
1	32	2.9	52.6
0.600	21	1.8	50.8
0.425	14	1.2	49.6
0.300	3	0.3	49.3
0.150	26	2.3	47.0
0.075	10	0.9	46.1
<0.075	1	54.9	
	945	108.8	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

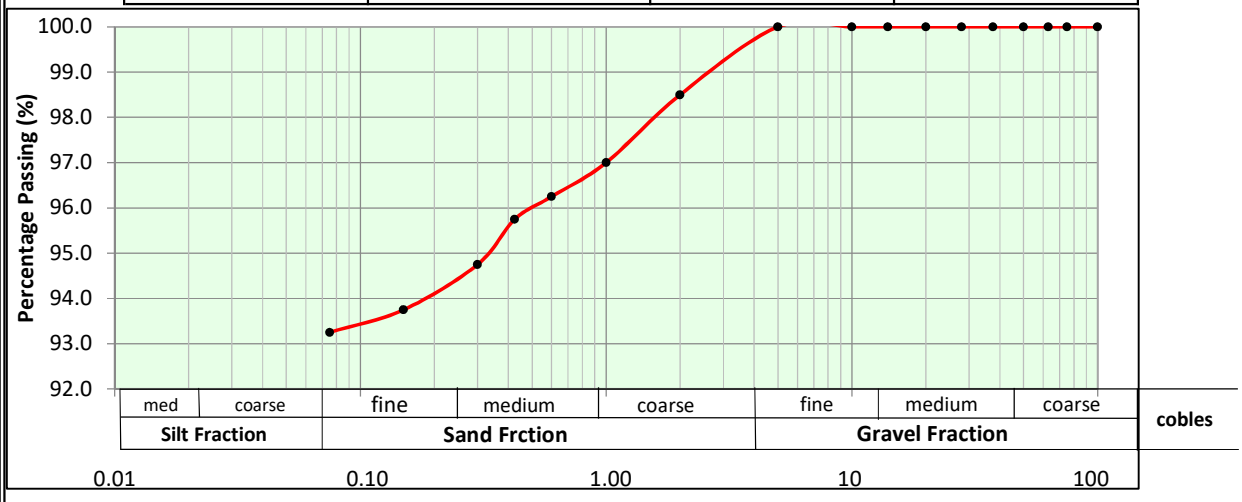
GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:		**Date Sampled:**	24-4-2026
sample No.:	S246	**Date Tested:**	10-4-2026
Description:		**Operator:**	
	JKIA TERMINAL(TP1)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	14	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	0	0.0	100.0
10	0	0.0	100.0
5	0	0.0	100.0
2	3	1.5	98.5
1	3	1.5	97.0
0.600	2	0.8	96.3
0.425	1	0.5	95.8
0.300	2	1.0	94.8
0.150	2	1.0	93.8
0.075	2	1.0	92.8
<0.075	1	93.3	
	16	100.5	



Material Technologist — **Sign:** ..... **Date:** .....

Snr. Material Technologist — **Sign:** ..... **Date:** .....

Materials Engineer. — **Sign:** ..... **Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

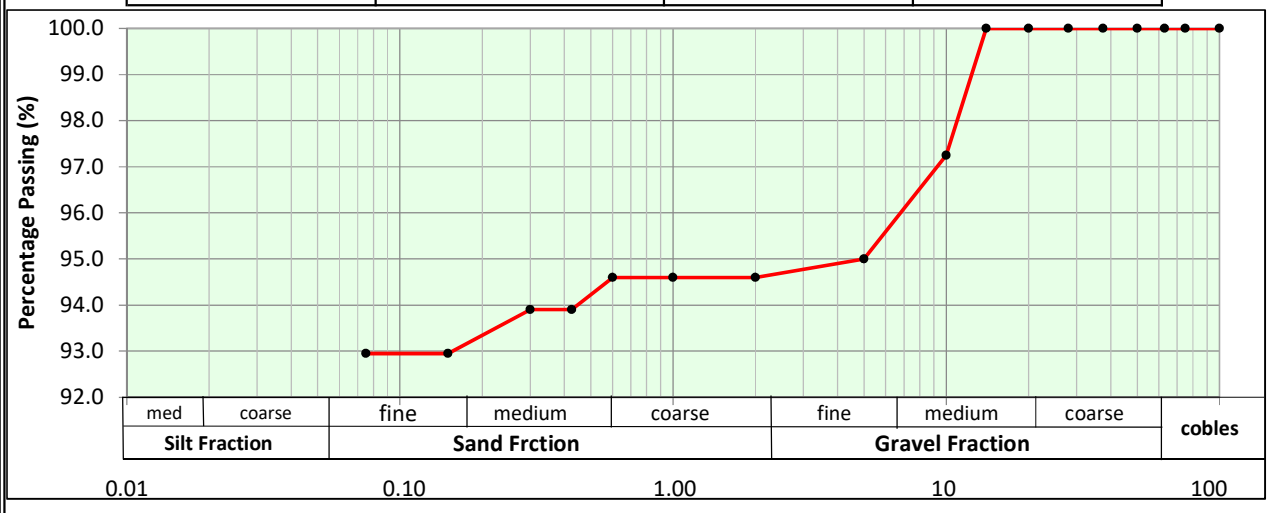
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION

(According to BS 1377:1990)

Source:	JKIA TERMINAL	**Date Sampled:**	24-4-2026
sample No.:	S247	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	JKIA TERMINAL(TP2)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	16	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	0	0.0	100.0
10	6	2.8	97.3
5	5	2.3	95.0
2	1	0.4	94.6
1	0	0.0	94.6
0.600	0	0.0	94.6
0.425	1	0.7	93.9
0.300	0	0.0	93.9
0.150	2	1.0	93.0
0.075	2	1.0	92.0
<0.075	0	93.0	
	16	101.0	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

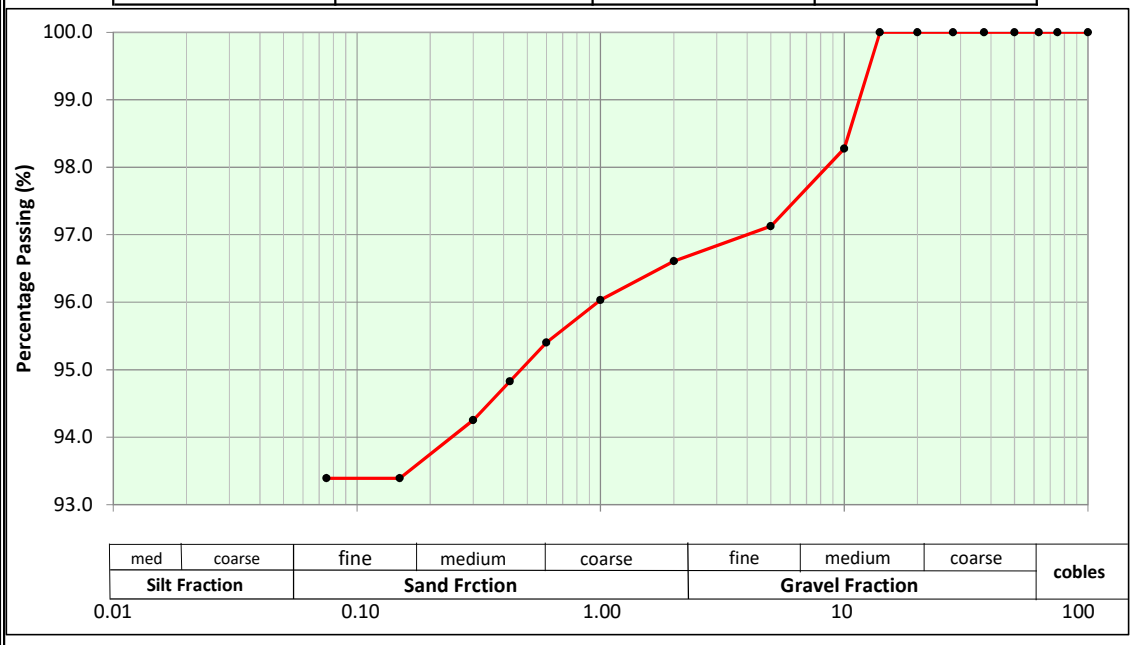
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION

(According to BS 1377:1990)

Source:		**Date Sampled:**	24-4-2026
sample No.:	S43	**Date Tested:**	10-4-2026
Description:		**Operator:**	
	JKIA TERMINAL(TP3)		
Weight before washing (g):	174	**Riffled weight (g):**	174
Weight After washing (g):	13	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	0	0.0	100.0
10	3	1.7	98.3
5	2	1.1	97.1
2	1	0.5	96.6
1	1	0.6	96.0
0.600	1	0.6	95.4
0.425	1	0.6	94.8
0.300	1	0.6	94.3
0.150	2	0.9	93.4
0.075	1	0.8	92.6
<0.075	0	93.4	
	13	100.8	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION

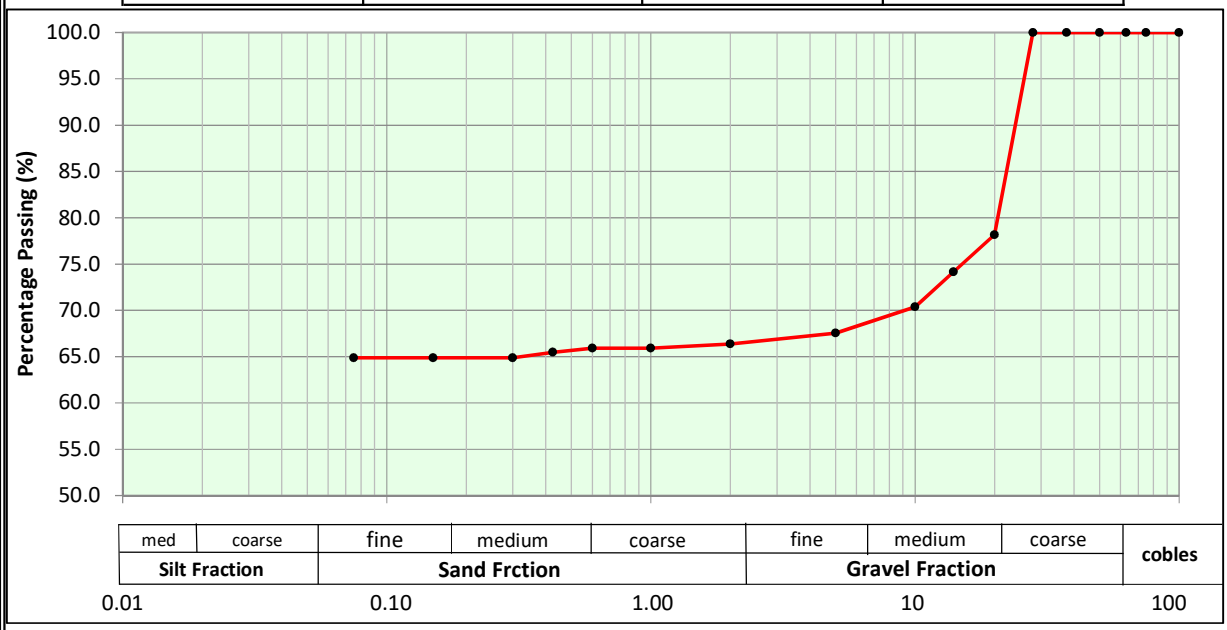
(According to BS 1377:1990)

Source:	JKIA TERMINAL	**Date Sampled:**	24-4-2026
sample No.:	S249	**Date Tested:**	10-4-2026
Description:		**Operator:**	

JKIA TERMINAL(TP4)

Weight before washing (g):	350	**Riffled weight (g):**	350
Weight After washing (g):	124	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	76	21.8	78.2
14	14	4.0	74.2
10	13	3.8	70.4
5	10	2.8	67.5
2	4	1.2	66.4
1	2	0.5	65.9
0.600	0	0.0	65.9
0.425	2	0.4	65.5
0.300	2	0.6	64.9
0.150	0	0.0	64.9
0.075	0	0.0	64.9
<0.075	0	64.9	
	123	100.0	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

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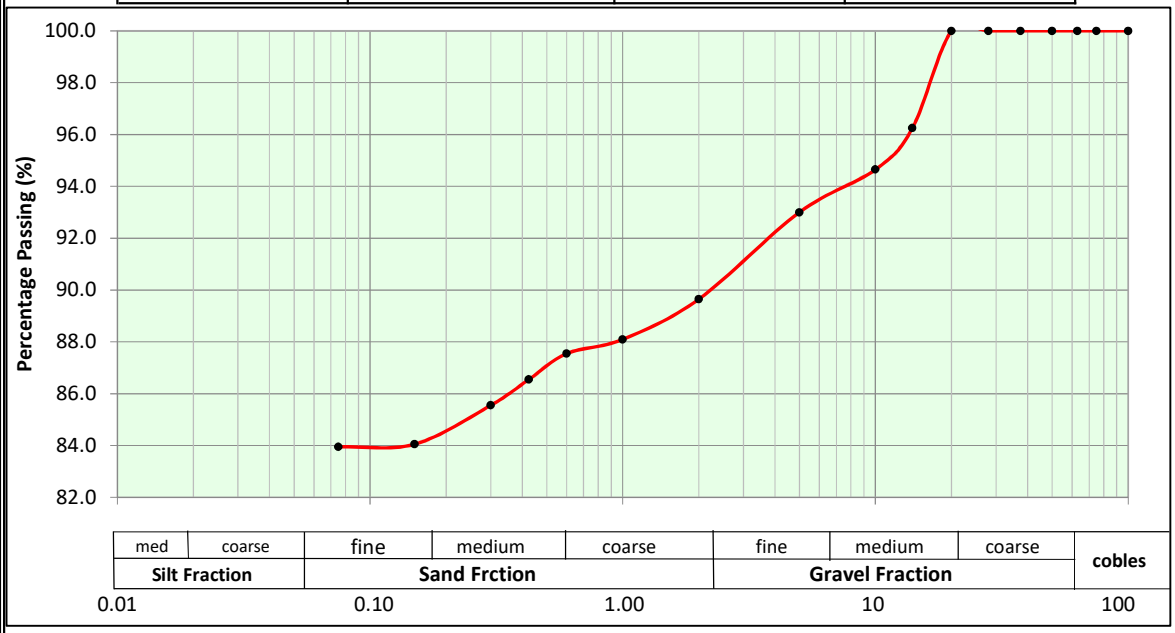
ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S240	**Date Tested:**	10-4-2026
Description:		**Operator:**	
	km 0+600(tp1)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	36	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	8	3.8	96.3
10	3	1.6	94.7
5	3	1.7	93.0
2	7	3.4	89.7
1	3	1.6	88.1
0.600	1	0.6	87.6
0.425	2	1.0	86.6
0.300	2	1.0	85.6
0.150	3	1.5	84.1
0.075	4	1.8	82.3
<0.075	0	84.0	
	36	101.7	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

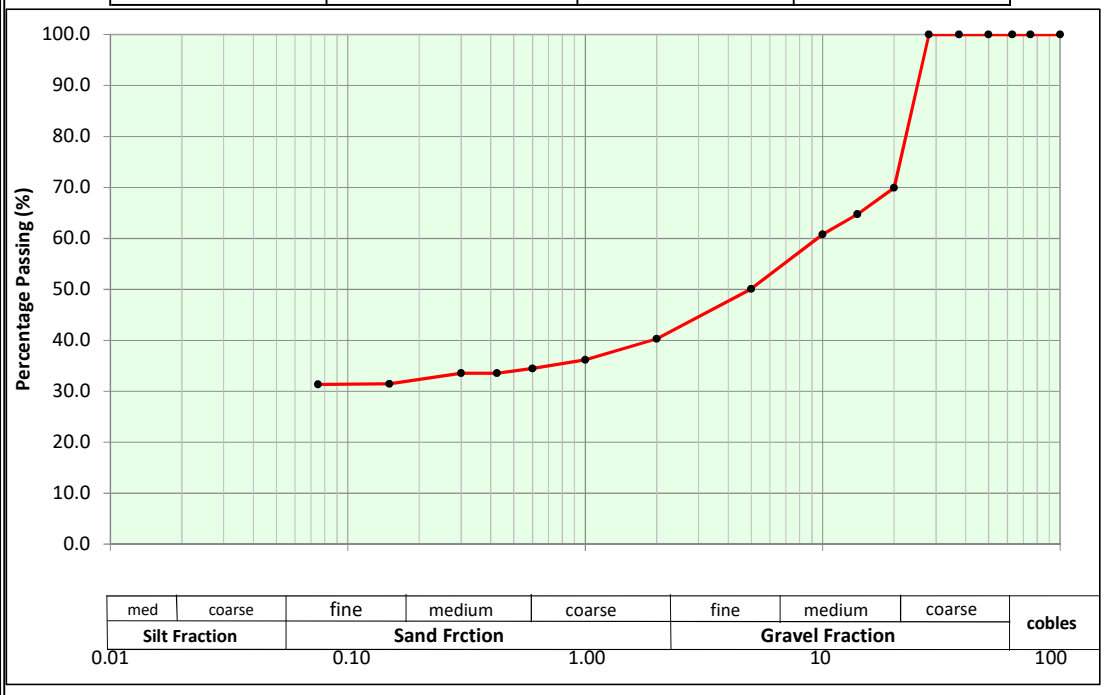
GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S241	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	km 0+800(tp2)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	138	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	60	30.1	70.0
14	10	5.2	64.8
10	8	4.0	60.8
5	21	10.7	50.1
2	20	9.8	40.3
1	8	4.2	36.2
0.600	3	1.7	34.5
0.425	2	0.9	33.6
0.300	0	0.0	33.6
0.150	4	2.1	31.5
0.075	1	0.6	30.9
<0.075	0	31.4	
	138	100.5	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

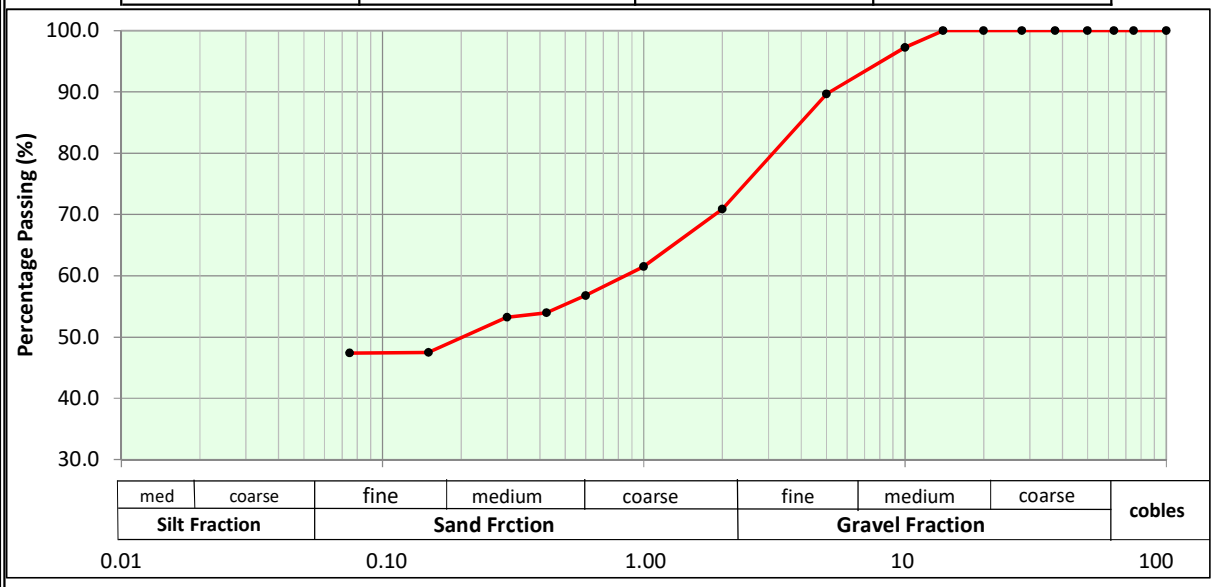
GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S242	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	km1+500(TP3)		
Weight before washing (g):	250	**Riffled weight (g):**	250
Weight After washing (g):	137	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	0	0.0	100.0
10	7	2.8	97.2
5	19	7.6	89.7
2	47	18.8	70.9
1	23	9.4	61.5
0.600	12	4.8	56.8
0.425	7	2.8	54.0
0.300	2	0.7	53.2
0.150	14	5.8	47.5
0.075	6	2.4	45.1
<0.075	0	47.4	
	137	102.3	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

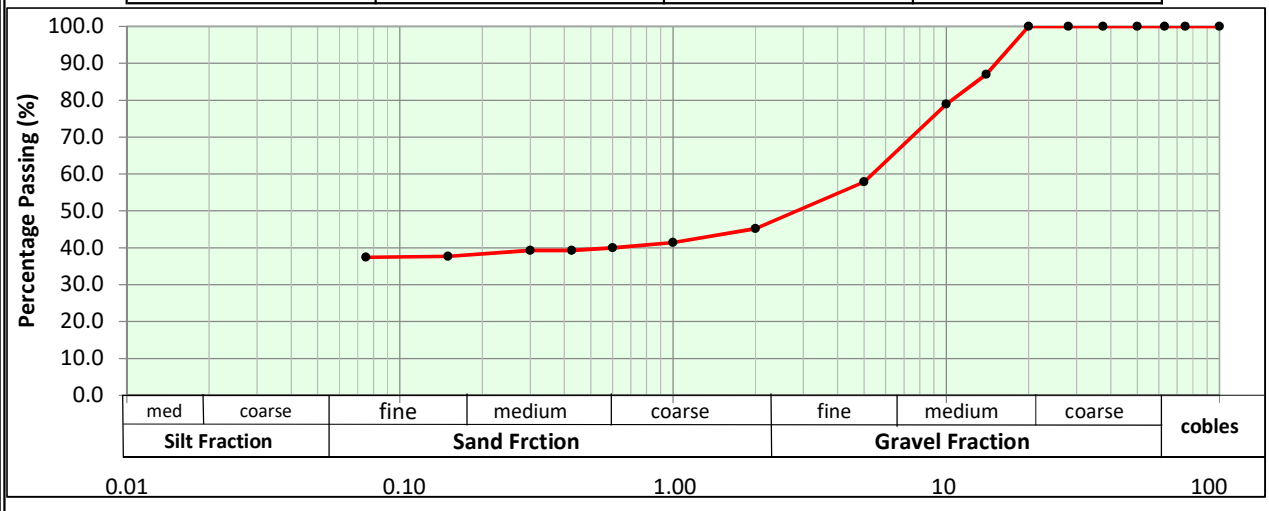
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION

(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S43	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	km 2+200 (tp4)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	127	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	26	13.0	87.0
10	16	8.1	79.0
5	42	21.1	57.9
2	25	12.7	45.2
1	8	3.8	41.4
0.600	3	1.4	40.0
0.425	1	0.7	39.3
0.300	0	0.0	39.3
0.150	3	1.7	37.7
0.075	2	0.8	36.9
<0.075	1	37.4	
	127	100.6	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

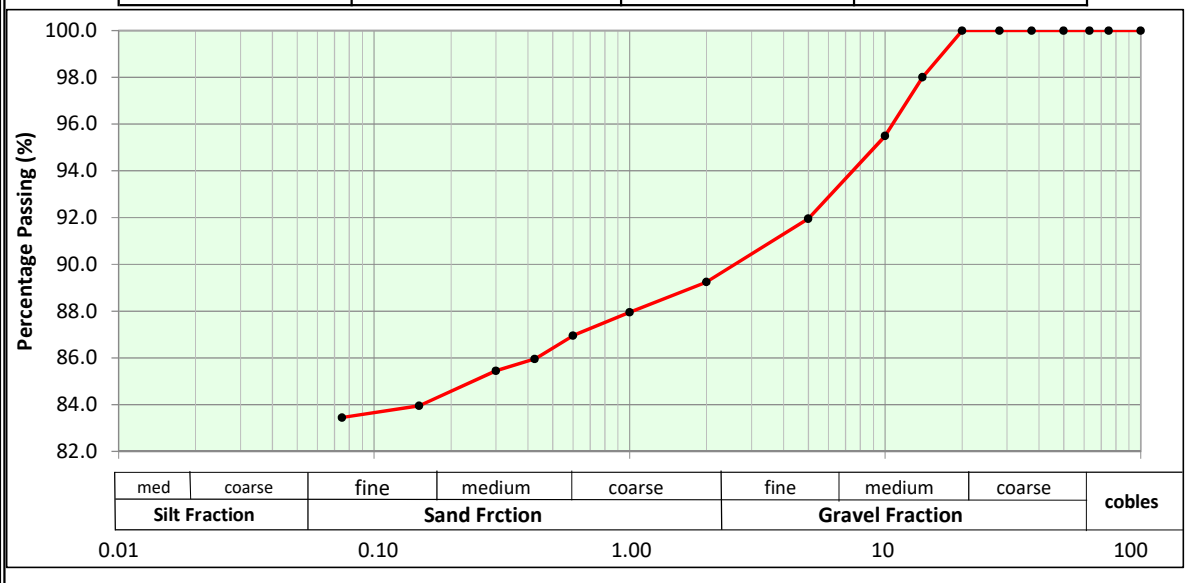
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION

(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S244	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	km 3+000(TP5)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	36	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	0	0.0	100.0
14	4	2.0	98.0
10	5	2.5	95.5
5	7	3.6	92.0
2	5	2.7	89.3
1	3	1.3	88.0
0.600	2	1.0	87.0
0.425	2	1.0	86.0
0.300	1	0.5	85.5
0.150	3	1.5	84.0
0.075	4	1.8	82.2
<0.075	1	83.5	
	37	101.3	



Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

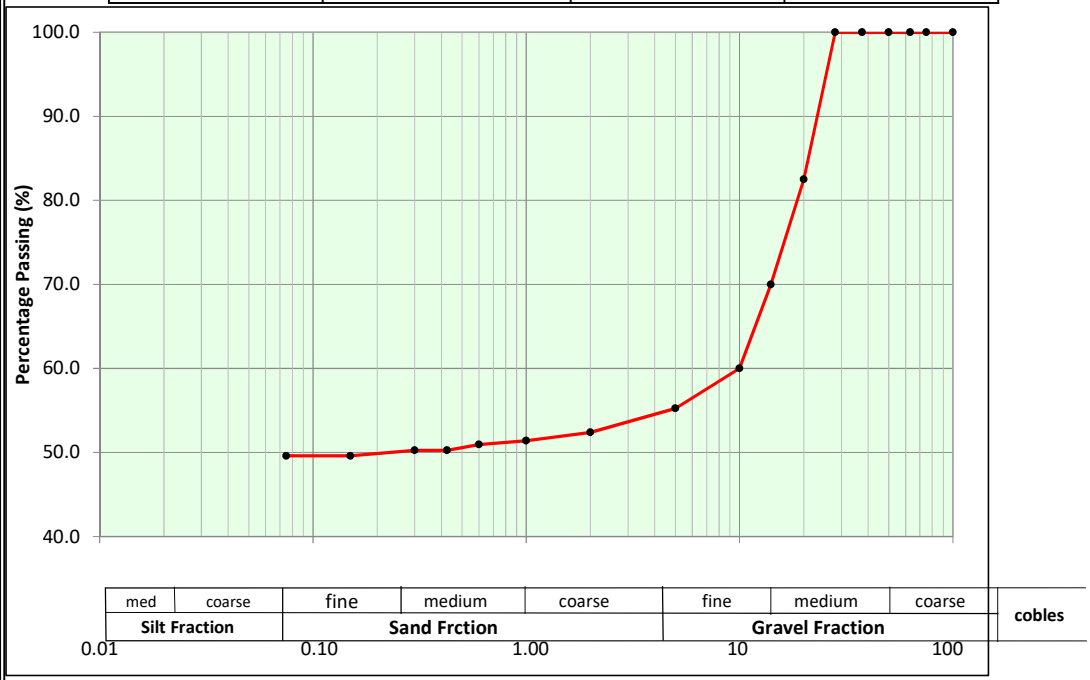
GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PARTICLE SIZE DISRIBUTION
(According to BS 1377:1990)

Source:	JKIA RUNWAY	**Date Sampled:**	24-4-2026
sample No.:	S245	**Date Tested:**	10-4-2026
Description:		**Operator:**	JACK
	km 4+200(TP6)		
Weight before washing (g):	200	**Riffled weight (g):**	200
Weight After washing (g):	101	**NMC (%):**	0

Sieve (mm)	Wt. Retained (g)	Wt. Retained (%)	% Passing
50	0	0.0	100.0
37.5	0	0.0	100.0
28	0	0.0	100.0
20	35	17.5	82.5
14	25	12.5	70.0
10	20	10.0	60.0
5	10	4.8	55.3
2	6	2.9	52.4
1	2	1.0	51.4
0.600	1	0.5	51.0
0.425	1	0.7	50.3
0.300	0	0.0	50.3
0.150	1	0.7	49.6
0.075	0	0.0	49.6
<0.075	0	49.6	
	101	100.0	

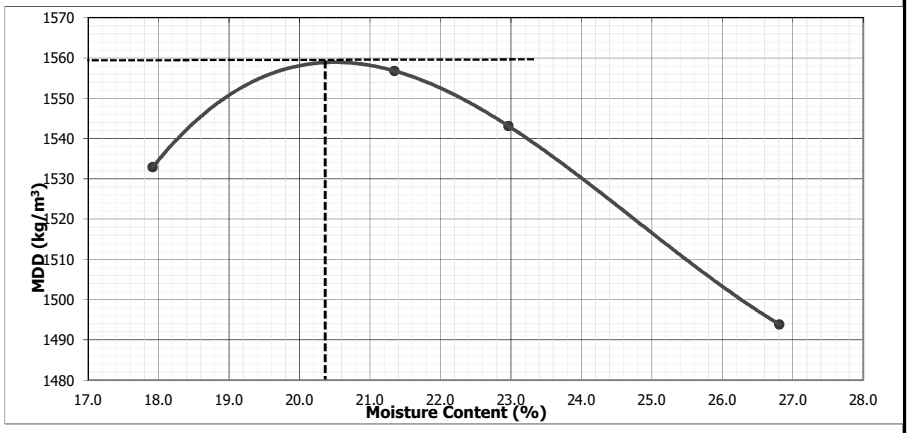


Material Technologist	**Snr. Material Technologist**	**Materials Engineer.**
Sign:	**Sign:**	**Sign:** .....
Date:	**Date:**	**Date:** .....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST				AASHTO T99 :1990			
Road:	JKIA			**Sample Date:**	29/03/2026		
Sampled from:	Trial Pit			**Sampled By:**	Caroline		
Location:	JKIA STOCKPILE			**Test date:**	8/4/2026		
Purpose	Geotechnical Investigations			**Tested By:**	Jimmy		
CONTRACT No.							
Wt of Mould (g)	**3202**		**Volume of Mould (l)**		**0.956**		
Water				300	400	500	600
Wt of mould + wet material (g)				4930	5008	5016	5013
Wt wet material (g)				1728	1806	1814	1811
Wet density (kg/m^3)				1808	1889	1897	1894
	NMC			**Moisture content**			
Container No	E6	Q1		D1	D11	B12	B5
Wt of container + wet material (g)	103.40	131.60		104.20	107.40	110.20	145.80
Wt of container (g)	21.00	22.20		19.30	22.70	34.70	31.80
Wt of container + dry material (g)	95.90	121.60		91.30	92.50	96.10	121.70
Wt dry material (g)	74.90	99.40		72.00	69.80	61.40	89.90
Wt of moisture (g)	7.50	10.00		12.90	14.90	14.10	24.10
Moisture content (%)	10.01	10.06		17.92	21.35	22.96	26.81
Average Moisture content (%)	10.0			17.9	21.3	23.0	26.8
Dry density (kg/m^3)				1533	1557	1543	1494



Optimum Moisture Content (%)	20.4
Maximum Dry Density (kg/m3)	1328

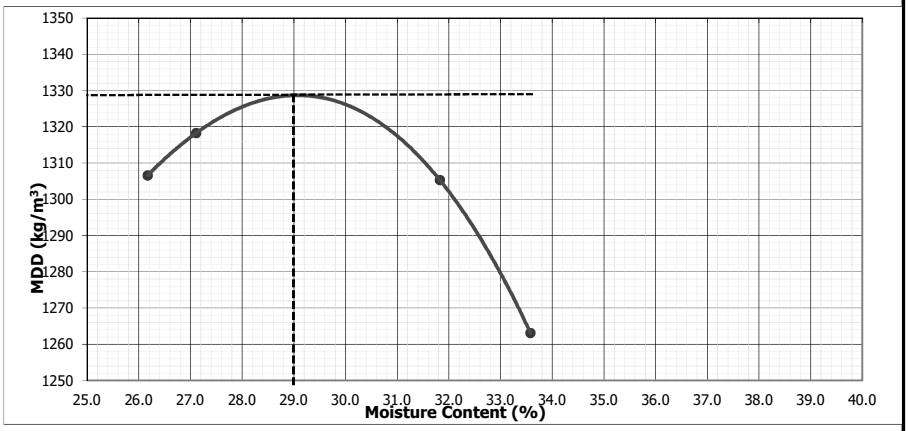
Mat. Technologist	**Snr. Mat Technologist**	**Technician**
Sign: ….....	**Sign:** ….....	**Sign;**….....
Date: ….....	**Date:** ….....	**Date;**….....

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990	
Road:	JKIA		**Sample Date:**	29/03/2026
Sampled from:	Trial Pit		**Sampled By:**	Caroline
Location:	JKIA TERMINAL TP1		**Test date:**	8/4/2026
Purpose	Preliminary and Detailed Design		**Tested By:**	Jimmy
CONTRACT No.				
Wt of Mould (g)	**3202**	**Volume of Mould (l)**	**0.956**	

Water			400	500	600	700
Wt of mould + wet material (g)			4778	4804	4847	4815
Wt wet material (g)			1576	1602	1645	1613
Wet density (kg/m^3)			1649	1676	1721	1687
	NMC		**Moisture content**			
Container No	A40	A65	C15	A62	A52	C103
Wt of container + wet material (g)	109.40	140.80	100.60	115.90	107.60	116.10
Wt of container (g)	36.50	35.60	17.20	36.20	34.70	25.40
Wt of container + dry material (g)	101.80	130.20	83.30	98.90	90.00	93.30
Wt dry material (g)	65.30	94.60	66.10	62.70	55.30	67.90
Wt of moisture (g)	7.60	10.60	17.30	17.00	17.60	22.80
Moisture content (%)	11.64	11.21	26.17	27.11	31.83	33.58
Average Moisture content (%)	11.4		26.2	27.1	31.8	33.6
Dry density (kg/m^3)			1307	1318	1305	1263

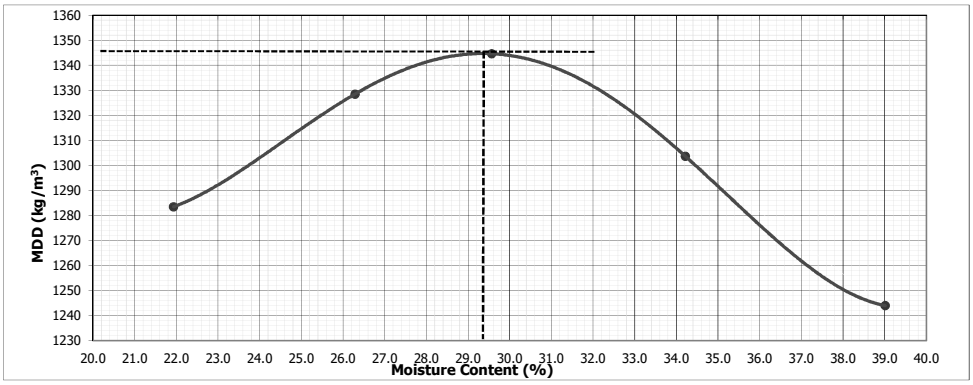


Optimum Moisture Content (%)	29
Maximum Dry Density (kg/m3)	1328

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST				AASHTO T99 :1990				
Road:	JKIA			**Sample Date:**	29/03/2026			
Sampled from:	Trial Pit			**Sampled By:**	Caroline			
Location:	JKIA TERMINAL TP 2			**Test date:**	8/4/2026			
Purpose	Preliminary and Detailed Design			**Tested By:**	Jimmy			
CONTRACT No.								
Wt of Mould (g)	**3202**		**Volume of Mould (l)**	**0.931**			**1**	
Water				400	500	600	700	800
Wt of mould + wet material (g)				4659	4764	4824	4831	4812
Wt wet material (g)				1457	1562	1622	1629	1610
Wet density (kg/m^3)				1565	1678	1742	1750	1729
	NMC			**Moisture content**				
Container No	Z4	Q17		RC1	B104	Q2	E11	K21
Wt of container + wet material (g)	97.30	102.60		91.40	94.70	99.40	100.70	96.30
Wt of container (g)	20.40	22.10		20.80	21.20	21.40	19.50	20.40
Wt of container + dry material (g)	91.40	96.30		78.70	79.40	81.60	80.00	75.00
Wt dry material (g)	71.00	74.20		57.90	58.20	60.20	60.50	54.60
Wt of moisture (g)	5.90	6.30		12.70	15.30	17.80	20.70	21.30
Moisture content (%)	8.31	8.49		21.93	26.29	29.57	34.21	39.01
Average Moisture content (%)	8.4			21.9	26.3	29.6	34.2	39.0
Dry density (kg/m^3)				1283	1329	1345	1304	1244

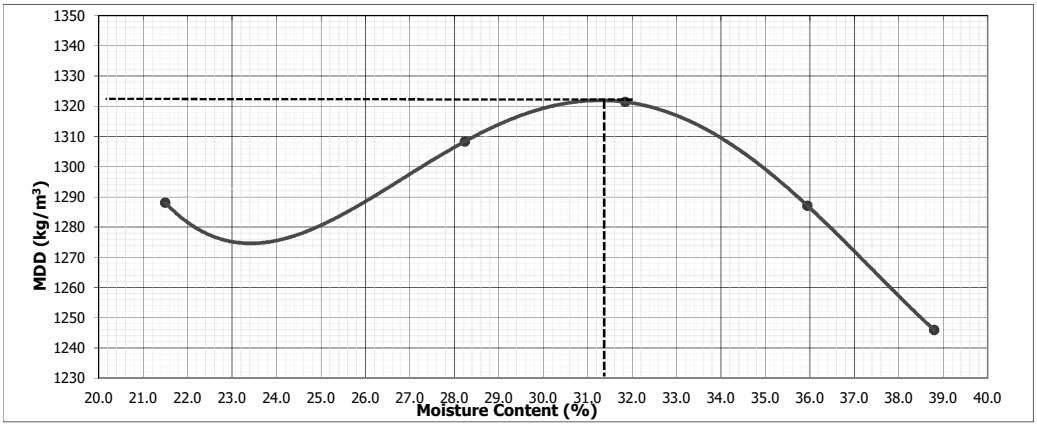


Optimum Moisture Content (%)	29.4
Maximum Dry Density (kg/m3)	1346

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990				
Road:	JKIA		**Sample Date:**	29/03/2026			
Sampled from:	Trial Pit		**Sampled By:**	Caroline			
Location:	JKIA TERMINAL TP 3		**Test date:**	8/4/2026			
Purpose	Preliminary and Detailed Design		**Tested By:**	Jimmy			
CONTRACT No.							
Wt of Mould (g)	**3202**	**Volume of Mould (l)**	**0.931**				**1**
Water		400	500	600	700	800	
Wt of mould + wet material (g)		4659	4764	4824	4831	4812	
Wt wet material (g)		1457	1562	1622	1629	1610	
Wet density (kg/m^3)		1565	1678	1742	1750	1729	
	NMC		**Moisture content**				
Container No	D5	I	Q12	B106	D15	B8	Q49
Wt of container + wet material (g)	134.10	113.80	90.50	100.30	91.90	110.70	107.10
Wt of container (g)	21.20	18.40	23.80	24.00	21.10	22.20	24.10
Wt of container + dry material (g)	123.60	104.90	78.70	83.50	74.80	87.30	83.90
Wt dry material (g)	102.40	86.50	54.90	59.50	53.70	65.10	59.80
Wt of moisture (g)	10.50	8.90	11.80	16.80	17.10	23.40	23.20
Moisture content (%)	10.25	10.29	21.49	28.24	31.84	35.94	38.80
Average Moisture content (%)	10.3		21.5	28.2	31.8	35.9	38.8
Dry density (kg/m^3)			1288	1308	1321	1287	1246



Optimum Moisture Content (%)	31.2
Maximum Dry Density (kg/m3)	1324

Mat. Technologist	**Snr. Mat Technologist**	**TECHNICIAN**
Sign: ……	**Sign:** ……	**Sign:**……
Date: ……	**Date:** ……	**Date:**……

GALLCONS ENGINEERING TECHNOLOGY LIMITED

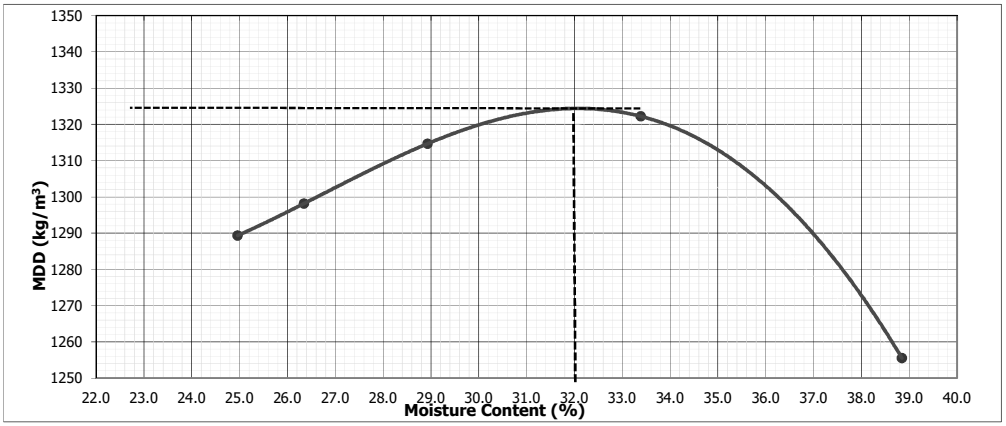
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990	
Road:	JKIA	**Sample Date:**	29/03/2026	
Sampled from:	Trial Pit	**Sampled By:**	Caroline	
Location:	JKIA TERMINAL TP 4	**Test date:**	8/4/2026	
Purpose	Preliminary and Detailed Design	**Tested By:**	Jimmy	

CONTRACT No.

Wt of Mould (g)	**3202**	**Volume of Mould (l)**	**0.931**			**1**
Water		400	500	600	700	800
Wt of mould + wet material (g)		4702	4729	4780	4844	4825
Wt wet material (g)		1500	1527	1578	1642	1623
Wet density (kg/m^3)		1611	1640	1695	1764	1743

	NMC		**Moisture content**				
Container No	Q50	Q33	10	Q27	B18	Q7	Z13
Wt of container + wet material (g)	112.80	119.70	97.60	85.30	87.50	103.00	100.00
Wt of container (g)	22.20	19.80	19.50	19.60	20.20	21.90	25.30
Wt of container + dry material (g)	103.50	109.10	82.00	71.60	72.40	82.70	79.10
Wt dry material (g)	81.30	89.30	62.50	52.00	52.20	60.80	53.80
Wt of moisture (g)	9.30	10.60	15.60	13.70	15.10	20.30	20.90
Moisture content (%)	11.44	11.87	24.96	26.35	28.93	33.39	38.85
Average Moisture content (%)	11.7		25.0	26.3	28.9	33.4	38.8
Dry density (kg/m^3)			1289	1298	1315	1322	1256



Optimum Moisture Content (%)	32
Maximum Dry Density (kg/m3)	1324

Mat. Technologist	**Snr. Mat Technologist**	
Sign: ……	**Sign:** ……	
Date: ……	**Date:** ……	

GALLCONS ENGINEERING TECHNOLOGY LIMITED

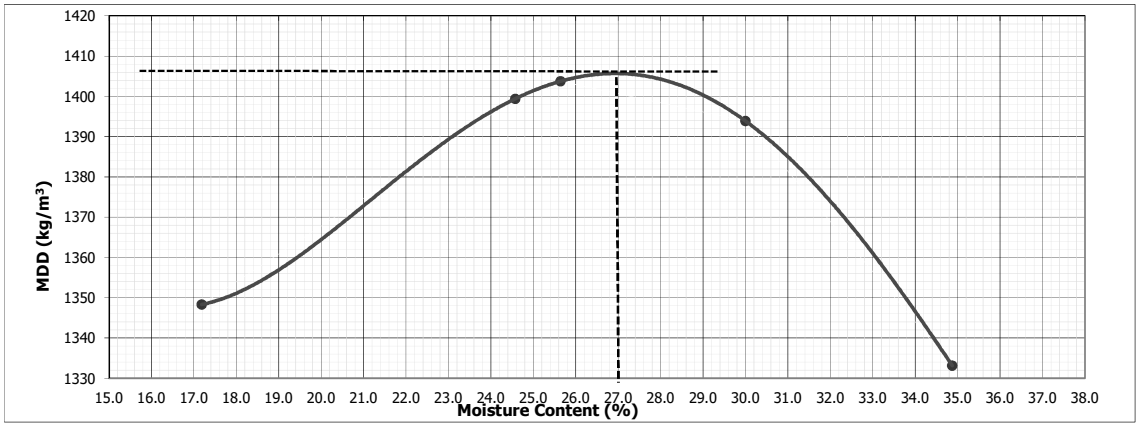
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990
Road:	JKIA	**Sample Date:**	29/03/2026
Sampled from:	Trial Pit	**Sampled By:**	Caroline
Location:	km 0+600 TP 1	**Test date:**	6/4/2026
Purpose	Geotechnical Investigations	**Tested By:**	Jimmy

CONTRACT No.

Wt of Mould (g)	**3202**	**Volume of Mould (l)**		**0.931**		
Water		200	300	400	500	600
Wt of mould + wet material (g)		4673	4825	4844	4889	4876
Wt wet material (g)		1471	1623	1642	1687	1674
Wet density (kg/m^3)		1580	1743	1764	1812	1798

	NMC		**Moisture content**				
Container No	C21	B11	10	D4	Q27	B4	K21
Wt of container + wet material (g)	113.90	111.70	129.30	90.00	93.10	108.30	105.10
Wt of container (g)	17.00	20.80	19.50	17.00	19.60	22.50	20.40
Wt of container + dry material (g)	105.50	102.70	113.20	75.60	78.10	88.50	83.20
Wt dry material (g)	88.50	81.90	93.70	58.60	58.50	66.00	62.80
Wt of moisture (g)	8.40	9.00	16.10	14.40	15.00	19.80	21.90
Moisture content (%)	9.49	10.99	17.18	24.57	25.64	30.00	34.87
Average Moisture content (%)	10.2		17.2	24.6	25.6	30.0	34.9
Dry density (kg/m^3)			1348	1399	1404	1394	1333

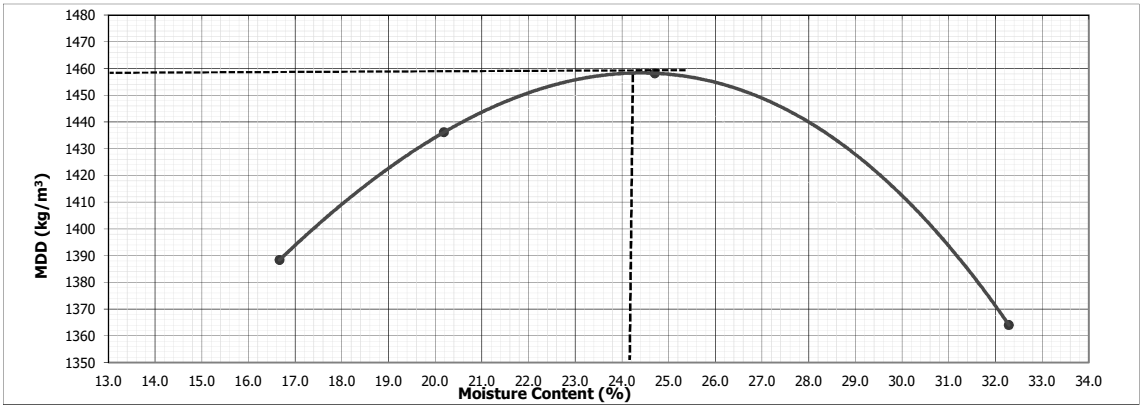


Optimum Moisture Content (%)	27
Maximum Dry Density (kg/m3)	1404

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST				AASHTO T99 :1990				
Road:	JKIA			**Sample Date:**				
Sampled from:	Trial Pit			**Sampled By:**				
Location:	km 0+800 TP 2			**Test date:**	3/4/2026			
Purpose	Preliminary and Detailed Design			**Tested By:**	Jimmy			
CONTRACT No.								
Wt of Mould (g)	**3202**	**Volume of Mould (l)**		**0.931**	**Mould No.**		**1**	
Water				250	350	450	550	650
Wt of mould + wet material (g)				4657	4710	4809	4895	4882
Wt wet material (g)				1455	1508	1607	1693	1680
Wet density (kg/m^3)				1563	1620	1726	1818	1805
		NMC		**Moisture content**				
Container No		A	B	58	37	66	21	61
Wt of container + wet material (g)		89.00	99.10	114.80	114.70	122.50	93.00	104.00
Wt of container (g)		21.50	25.40	18.10	20.90	33.20	18.80	19.60
Wt of container + dry material (g)		85.00	95.60	102.30	101.30	107.50	78.30	83.40
Wt dry material (g)		63.50	70.20	84.20	80.40	74.30	59.50	63.80
Wt of moisture (g)		4.00	3.50	12.50	13.40	15.00	14.70	20.60
Moisture content (%)		6.30	4.99	14.85	16.67	20.19	24.71	32.29
Average Moisture content (%)		5.6		14.8	16.7	20.2	24.7	32.3
Dry density (kg/m^3)				1361	1388	1436	1458	1364



Optimum Moisture Content (%)	24.2
Maximum Dry Density (kg/m3)	1458

Mat. Technologist	**Snr. Mat Technologist**	**TECHNICIAN**
Sign: ….....	**Sign:** ….....	**Sign:**….....
Date: ….....	**Date:** ….....	**Date:**….....

GALLCONS
ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST				AASHTO T99 :1990			
Road:	JKIA			**Sample Date:**	29/03/2026		
Sampled from:	Trial Pit			**Sampled By:**	Caroline		
Location:	km 1+500 TP 3			**Test date:**	7/4/2026		
Purpose	Preliminary and Detailed Design			**Tested By:**	Jimmy		
CONTRACT No.							
Wt of Mould (g)	**3202**	**Volume of Mould (l)**		**0.931**			
Water				300	400	500	600
Wt of mould + wet material (g)				4777	4879	4946	4931
Wt wet material (g)				1575	1677	1744	1729
Wet density (kg/m^3)				1692	1801	1873	1857
	NMC			**Moisture content**			
Container No	B102	B9		B109	B11	Z2	D5
Wt of container + wet material (g)	134.40	121.00		96.30	90.60	103.40	94.80
Wt of container (g)	18.10	22.40		21.30	20.70	19.40	21.10
Wt of container + dry material (g)	128.30	116.00		86.00	79.90	89.50	79.00
Wt dry material (g)	110.20	93.60		64.70	59.20	70.10	57.90
Wt of moisture (g)	6.10	5.00		10.30	10.70	13.90	15.80
Moisture content (%)	5.54	5.34		15.92	18.07	19.83	27.29
Average Moisture content (%)	5.4			15.9	18.1	19.8	27.3
Dry density (kg/m^3)				1459	1526	1563	1459

Optimum Moisture Content (%)	22.2	
Maximum Dry Density (kg/m3)	1584	

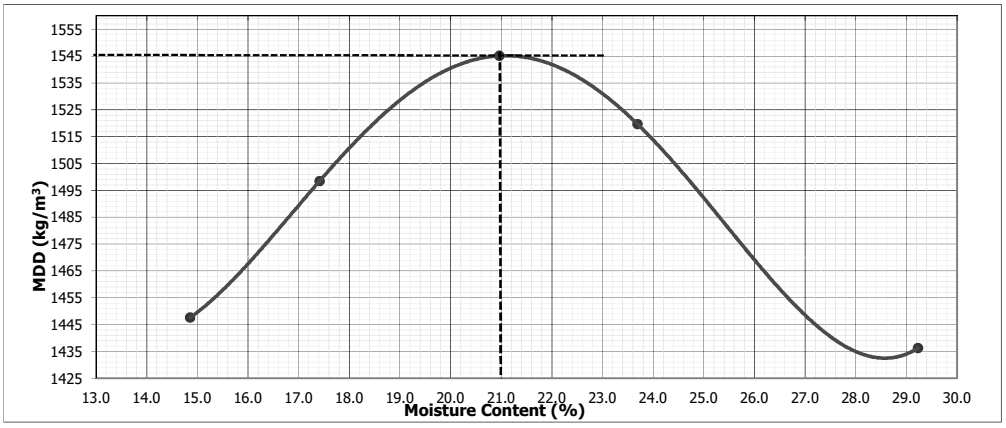
GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990	
Road:	JKIA	**Sample Date:**	29/03/2026	
Sampled from:	Trial Pit	**Sampled By:**	Caroline	
Location:	km 2+200 TP 4	**Test date:**	3/4/2026	
Purpose	Preliminary and Detailed Design	**Tested By:**	Jimmy	

CONTRACT No.

Wt of Mould (g)	**3202**	**Volume of Mould (l)**	**0.931**	**Mould No.**		**1**
Water		250	350	450	550	650
Wt of mould + wet material (g)		4750	4840	4942	4952	4930
Wt wet material (g)		1548	1638	1740	1750	1728
Wet density (kg/m^3)		1663	1759	1869	1880	1856
	NMC		**Moisture content**			
Container No	C	D	TR	B109	Q41	D3	E2
Wt of container + wet material (g)	125.40	94.60	110.90	115.70	95.20	88.90	93.90
Wt of container (g)	19.00	21.90	22.00	21.30	19.60	20.50	23.60
Wt of container + dry material (g)	119.40	91.00	99.40	101.70	82.10	75.80	78.00
Wt dry material (g)	100.40	69.10	77.40	80.40	62.50	55.30	54.40
Wt of moisture (g)	6.00	3.60	11.50	14.00	13.10	13.10	15.90
Moisture content (%)	5.98	5.21	14.86	17.41	20.96	23.69	29.23
Average Moisture content (%)	5.6		14.9	17.4	21.0	23.7	29.2
Dry density (kg/m^3)			1448	1498	1545	1520	1436



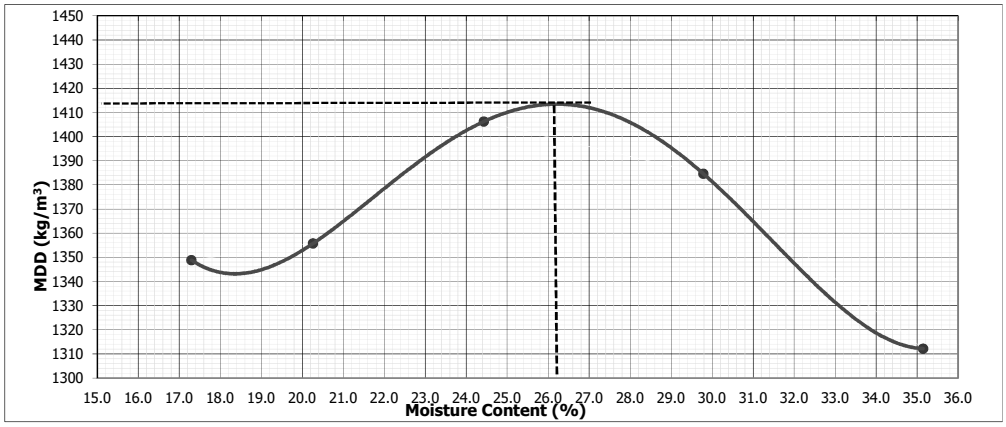
Optimum Moisture Content (%)	21
Maximum Dry Density (kg/m3)	1545

Mat. Technologist	**Snr. Mat Technologist**	**TECHNICIAN**
Sign: ……	**Sign:** ……	**Sign:**……
Date: ……	**Date:** ……	**Date:**……

GALLCONS ENGINEERING TECHNOLOGY LIMITED

GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST				AASHTO T99 :1990				
Road:	JKIA RUNWAY			**Sample Date:**	29/03/2026			
Sampled from:	Trial Pit			**Sampled By:**	Caroline			
Location:	km 3+000 TP 5			**Test date:**	6/4/2026			
Purpose	Preliminary and Detailed Design			**Tested By:**	Jimmy			
CONTRACT No.								
Wt of Mould (g)	**3202**		**Volume of Mould (l)**	**0.931**			**1**	
Water			300	400	500	600	700	
Wt of mould + wet material (g)			4675	4720	4831	4875	4853	
Wt wet material (g)			1473	1518	1629	1673	1651	
Wet density (kg/m^3)			1582	1631	1750	1797	1773	
	NMC		**Moisture content**					
Container No	B104	T53	Z6	A29C	Z5	Q26	D4	
Wt of container + wet material (g)	108.60	117.80	107.60	102.40	107.20	85.80	81.80	
Wt of container (g)	21.20	23.20	20.80	20.50	20.10	18.70	17.20	
Wt of container + dry material (g)	102.30	111.30	94.80	88.60	90.10	70.40	65.00	
Wt dry material (g)	81.10	88.10	74.00	68.10	70.00	51.70	47.80	
Wt of moisture (g)	6.30	6.50	12.80	13.80	17.10	15.40	16.80	
Moisture content (%)	7.77	7.38	17.30	20.26	24.43	29.79	35.15	
Average Moisture content (%)	7.6		17.3	20.3	24.4	29.8	35.1	
Dry density (kg/m^3)			1349	1356	1406	1385	1312	



Optimum Moisture Content (%)	26.2
Maximum Dry Density (kg/m3)	1414

GALLCONS ENGINEERING TECHNOLOGY LIMITED

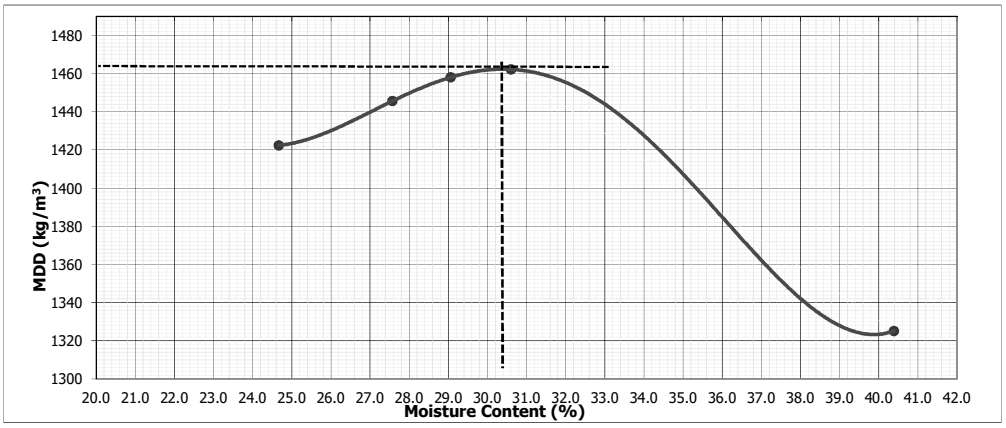
GEOTECHNICAL INVESTIGATIONS & MATERIALS TESTING

PROCTOR TEST			AASHTO T99 :1990	
Road:	JKIA	**Sample Date:**	29/03/2026	
Sampled from:	Trial Pit	**Sampled By:**	Caroline	
Location:	km 4+200 TP 6	**Test date:**	7/4/2026	
Purpose	Preliminary and Detailed Design	**Tested By:**	Jimmy	

CONTRACT No.

Wt of Mould (g)	**3202**	**Volume of Mould (l)**	**0.931**			**1**
Water		400	500	600	700	800
Wt of mould + wet material (g)		4853	4919	4954	4980	4934
Wt wet material (g)		1651	1717	1752	1778	1732
Wet density (kg/m^3)		1773	1844	1882	1910	1860

	NMC		**Moisture content**				
Container No	Q14	B34	C15	B4	D4	B37	C18
Wt of container + wet material (g)	127.20	117.20	92.50	115.50	103.70	124.80	129.30
Wt of container (g)	21.30	19.20	17.20	22.50	17.10	27.50	21.20
Wt of container + dry material (g)	117.50	107.80	77.60	95.40	84.20	102.00	98.20
Wt dry material (g)	96.20	88.60	60.40	72.90	67.10	74.50	77.00
Wt of moisture (g)	9.70	9.40	14.90	20.10	19.50	22.80	31.10
Moisture content (%)	10.08	10.61	24.67	27.57	29.06	30.60	40.39
Average Moisture content (%)	10.3		24.7	27.6	29.1	30.6	40.4
Dry density (kg/m^3)			1422	1446	1458	1462	1325



Optimum Moisture Content (%)	30.4
Maximum Dry Density (kg/m3)	1462

Mat. Technologist	**Snr. Mat Technologist**	**TECHNICIAN**
Sign: ……	**Sign:** ……	**Sign:**……
Date: ……	**Date:** ……	**Date:**……

Head office and Laboratories, Highpoint off Thika Superhighway
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Independent Materials Testing Laboratories
"Balance of Time, Quality and Cost"

POINT LOAD TEST OF NATURAL ROCK CORES (ACCORDING TO ASTM D7012-8)

PROJECT:	**CONSULTANCY SERVICES FOR PROPOSED DESIGN DEVELOPMENT AND MODERNISATION OF JKIA NAIROBI.**		
CLIENT:	**KENYA AIRPORT AUTHORITY.**		
SAMPLED BY:	**NOITECH ENG LTD**	TESTING DATE	**04/04/2026**
SAMPLING DATE:	**21/03/2026**	SITE LOCATION	**NAIROBI COUNTY**

BH NO	Depth (m) From	Depth (m) To	Height of Specimen (mm)	Diameter (mm)	Weight (Kg)	Cross section Area (m^2)	Volume (m^3)	Density (Kg/m^3)	Proving Ring Reading (kN)	$I_s = P/De^2$	Corrected I_s (50) (Mpa)
1	3.20	3.33	78	82	0.783	0.0053	0.00041	1901	2.3	282	353
	5.10	5.12	80	82	0.829	0.0053	0.00042	1962	2.1	251	314
	10.00	10.15	68	70	0.500	0.0038	0.00026	1911	2.0	330	384
	13.00	13.11	40	70	0.321	0.0038	0.00015	2085	8.2	2300	2676
	16.90	17.00	65	70	0.567	0.0038	0.00025	2267	19.2	3280	3816
	19.90	20.00	63	70	0.543	0.0038	0.00024	2240	18.5	3295	3834
	21.35	21.50	67	70	0.612	0.0038	0.00026	2374	23.2	3885	4520
	23.50	23.60	68	70	0.603	0.0038	0.00026	2304	9.0	1485	1728

Head office and Laboratories, Highpoint off Thika Superhighway
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	24.90	25.00	70	70	0.625	0.0038	0.00027	2320	11.5	1843	2144
2	2.90	3.00	80	82	0.745	0.0053	0.00042	1763	2.2	263	329
	4.70	4.85	80	82	0.818	0.0053	0.00042	1936	2.5	299	374
	7.00	7.15	70	82	0.745	0.0053	0.00037	2015	2.0	274	342
	9.00	9.14	78	82	0.901	0.0053	0.00041	2187	11.0	1351	1688
	10.90	11.00	67	70	0.605	0.0038	0.00026	2346	12.0	2010	2339
	14.00	14.15	67	70	0.440	0.0038	0.00026	1706	7.0	1172	1364
	16.80	16.90	65	70	0.584	0.0038	0.00025	2335	25.0	4315	5020
	19.00	19.10	69	70	0.623	0.0038	0.00027	2346	22.0	3577	4162
	22.90	23.00	66	70	0.587	0.0038	0.00025	2311	20.0	3400	3956
	24.80	24.90	67	70	0.445	0.0038	0.00026	1726	13.4	2244	2611
	26.00	26.12	70	70	0.540	0.0038	0.00027	2005	14.3	2292	2667
	28.00	28.10	68	70	0.603	0.0038	0.00026	2304	26.0	4290	4991
3	4.00	4.10	55	70	0.410	0.0038	0.00021	1937	12.6	2570	2991
	5.50	5.60	47	70	0.355	0.0038	0.00018	1963	8.1	1934	2250
	10.00	10.10	65	82	0.669	0.0053	0.00034	1949	12.7	1871	2338
	13.40	13.50	65	82	0.665	0.0053	0.00034	1937	14.3	2107	2633
	14.00	14.10	60	82	0.555	0.0053	0.00032	1752	14.0	2235	2792
	15.50	15.60	55	70	0.475	0.0038	0.00021	2244	13.1	2672	3109
	16.50	16.60	65	70	0.565	0.0038	0.00025	2259	7.5	1295	1506
	18.40	18.50	60	70	0.410	0.0038	0.00023	1776	5.0	935	1088
	20.00	20.10	68	70	0.535	0.0038	0.00026	2044	12.0	1980	2304
	21.80	21.90	50	70	0.440	0.0038	0.00019	2287	7.0	1571	1828
	23.50	23.60	65	70	0.550	0.0038	0.00025	2199	8.7	1502	1747
	25.00	25.10	70	70	0.642	0.0038	0.00027	2383	17.0	2725	3170
	29.80	29.90	65	70	0.582	0.0038	0.00025	2327	16.5	2848	3314

Notes: *Tests results are specific to samples tested*

Tested By: D.O

Date Reported: 15-04-2026

Checked By: Eng. J.R.O. Ogallo

Head office and Laboratories, Highpoint off Thika Superhighway
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Independent Materials Testing Laboratories

"Balance of Time, Quality and Cost

MATERIAL TESTING SUMMARY
(ACCORDING TO BS 812)
(WATER ABSORPTION)

PROJECT:	**CONSULTANCY SERVICES FOR PROPOSED DESIGN DEVELOPMENT AND MODERNISATION OF JKIA NAIROBI.**		
CLIENT:	**KENYA AIRPORT AUTHORITY.**		
SAMPLED BY:	**NOITECH ENG LTD**	TESTING DATE	**04/04/2026**
SAMPLING DATE:	**21/03/2026**	SITE LOCATION	**NAIROBI COUNTY**

BH No.	Depth (m)		x-sectional area (mm2)	Volume (mm3)	Mass of natural sample, A (kg)	Mass of oven dried sample, A (kg)	Mass of Saturated Surface Dried Sample D, (kg)	Rock density (dry) (kg/m3)	Rock density (natural) (kg/m3)	Rock density (saturated) (kg/m3)	Water Absorption Rate (%)
1	6.20	6.40	0.00503	0.00060	1.295	1.298	1.314	2152	2147	2178	1.233
	16.00	16.20	0.00385	0.00042	0.954	0.958	0.959	2263	2254	2265	0.104
	23.00	23.20	0.00385	0.00046	1.094	1.096	1.097	2373	2369	2375	0.091
	24.40	24.60	0.00385	0.00054	1.324	1.324	1.325	2457	2457	2459	0.076
	25.40	25.60	0.00385	0.00050	1.097	1.099	1.101	2197	2193	2201	0.182
	26.40	26.60	0.00385	0.00042	1.341	1.342	1.343	3170	3168	3172	0.075
	27.65	27.85	0.00385	0.00054	1.38	1.381	1.383	2563	2561	2567	0.145
	28.80	29.00	0.00385	0.00054	1.396	1.397	1.399	2593	2591	2597	0.143
	29.80	30.00	0.00385	0.00054	1.318	1.319	1.320	2448	2446	2450	0.076

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BH No.	Depth (m)		x-sectional area (mm2)	Volume (mm3)	Mass of natural sample, A (kg)	Mass of oven dried sample, A (kg)	Mass of Saturated Surface Dried Sample D, (kg)	Rock density (dry) (kg/m3)	Rock density (natural) (kg/m3)	Rock density (saturated) (kg/m3)	Water Absorption Rate (%)
2	5.80	6.00	0.00385	0.00062	1.750	1.784	1.797	2897	2842	2918	0.729
	7.60	7.80	0.00528	0.00058	1.173	1.255	1.261	2160	2019	2171	0.478
	8.00	8.20	0.00528	0.00074	1.657	1.703	1.710	2303	2241	2313	0.411
	10.40	10.60	0.00528	0.00087	2.206	2.207	2.209	2548	2547	2551	0.091
	12.00	12.20	0.00528	0.00074	1.25	1.254	1.256	1696	1691	1699	0.159
	13.00	13.20	0.00385	0.00054	1.294	1.297	1.299	2407	2402	2411	0.154
	15.90	16.10	0.00385	0.00038	0.921	0.922	0.923	2396	2393	2398	0.108
	17.10	17.30	0.00385	0.00050	1.202	1.204	1.205	2407	2403	2409	0.083
	20.70	20.90	0.00385	0.00050	1.045	1.048	1.05	2095	2089	2099	0.191
	23.10	23.30	0.00385	0.00050	1.109	1.112	1.113	2223	2217	2225	0.090
	26.80	27.00	0.00385	0.00042	0.852	0.863	0.864	2039	2013	2041	0.116
	27.70	27.90	0.00385	0.00054	1.3	1.300	1.301	2413	2413	2415	0.077
	28.80	29.00	0.00385	0.00054	1.227	1.230	1.232	2283	2277	2287	0.163
	28.80	29.00	0.00385	0.00050	0.971	0.985	0.987	1969	1941	1973	0.203

BH No.	Depth (m)		x-sectional area (mm2)	Volume (mm3)	Mass of natural sample, A (kg)	Mass of oven dried sample, A (kg)	Mass of Saturated Surface Dried Sample D, (kg)	Rock density (dry) (kg/m3)	Rock density (natural) (kg/m3)	Rock density (saturated) (kg/m3)	Water Absorption Rate (%)
3	5.00	5.17	0.00385	0.00038	0.641	0.643	0.646	1671	1666	1679	0.467
	16.00	16.18	0.00385	0.00050	1.094	1.094	1.095	2187	2187	2189	0.091
	18.00	18.20	0.00385	0.00035	0.537	0.581	0.586	1677	1550	1692	0.861
	19.80	19.90	0.00385	0.00042	0.754	0.757	0.759	1788	1781	1793	0.264
	22.50	22.70	0.00385	0.00038	0.974	0.976	0.977	2536	2531	2539	0.102
	25.70	25.90	0.00385	0.00050	1.186	1.188	1.191	2375	2371	2381	0.253
	27.80	28.00	0.00385	0.00050	1.28	1.290	1.291	2578	2558	2580	0.078
	28.50	28.70	0.00385	0.00054	1.41	1.412	1.413	2621	2617	2621	0.071

Notes: *Tests results are specific to samples tested*

Tested By: Noitech Labs Date Reported: 15-04-2026 Checked By: Eng. J.R.O.

NOITECH ENGINEERING LIMITED

Photographs

Appendix 4-1: Photographs

SELECTES SITE PHOTOGRAPHS

ASSORTED PHOTOGRAPHS

Photo A: *TP 06*

Photo B: *Samples for TP01*

Photo C: *TP05*

Photo D: *Samples for TP04*

Photo E: *TP02*

Photo F: *TP01*

Borehole Samples

BH1 Samples

Borehole 1 depth 0.00m-1.50m

Borehole 1 depth 1.50m-17.00m

Borehole 1 depth 17.00m-26.00m

Borehole 1 depth 17.00m-26.00m

BH2 Samples

Borehole 2 depth 0.00m-1.50m

Borehole 2 depth 1.50m-11.00m

Borehole 1 depth 11.00m-21.00m

Borehole 2 depth 21.00m-29.00m

Borehole 2 depth 29.00m-30.00m

BH3 Samples

Borehole 3 depth 0.00m-1.50m

Borehole3 depth 1.50m-21.00m

Borehole 3 depth 21.00m-30.00m