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ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

WEST LONDON COMPOSTING

PERMIT VARIATION WEST LONDON

CQA REPORT

SEPTEMBER 2025

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JOB NUMBER:	**ST21061**
REPORT NUMBER:	**0005**
VERSION:	**V3.0**
STATUS:	**FINAL**

WEST LONDON COMPOSTING

PERMIT VARIATION WEST LONDON

CQA REPORT

SEPTEMBER 2025

PREPARED BY:

Luke Imber Civil Engineer

APPROVED BY:

Drew Bennett Technical Director

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ST21061-140-D	General Arrangement Plan (8.5 x 6m Bays)	1:500
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BM12515-S-RC02	Reinforcement Details-Protection Slab S2	N/A

1 INTRODUCTION

1.1.1 Envar Composting Limited (Client) have commissioned Wardell Armstrong LLP (WA) to prepare a CQA Report for the site at West London Composting, High View Farm, New Years Green Lane, Harefield, Uxbridge.

1.1.2 The site is located on an industrial estate North of Uxbridge, in an agricultural area. To the east of the site is Ruislip on the edge of Greater London. To the north and south of the site are extensive cuttings, embankment and workings related to High Speed Rail 2 (HS2) development.

1.1.3 WA were previously commissioned to undertake the detailed design for a slab extension to the composting site, increasing the area of the existing slab from approximately 1.6ha to approximately 4.0ha. WA carried out the detailed design of the external works and levels, drainage strategy, structural design of the concrete slabs and tie in details. At the time of writing the report, construction is in progress.

1.1.4 To allow for the completion of the CQA report, a site inspection was undertaken by Luke Imber (Civil Engineer) and Drew Bennett (Technical Director) on 14th May 2025.

1.1.5 This report provides a summary of the site inspection, in relation to the construction of the slab extension and containment systems present on site.

2 SITE INSPECTION

2.1.1 Whilst carrying out the site inspection, WA Engineers completed various measurements across the site to ensure that the construction of the slab is in line with the details which were designed by WA.

2.1.2 In addition to the site inspection undertaken by WA Engineers, the Client provided the following information, included in Appendices A and B:

- Photographs taken on site;
- 21 Day concrete strength tests.

2.2 Concrete Slab Thickness

2.2.1 As per WA Drawing No ST21061-120-B, the concrete slab thickness is designed to be 215mm. Upon inspection, it was observed that the thickness of the slab is 215mm in the areas that were available to be inspected. Figure 1 below was provided by the Client to indicate the thickness of the concrete slab.

Figure 1 - Concrete thickness measurement

2.3 Reinforcement

2.3.1 As per Drawing No ST21061-120-B the reinforcement for the external yard slab is specified as two layers of A393 mesh. During the inspection, WA Engineers confirmed that A393 had been delivered to site and witnessed this being installed during the concreting process. Figure 2 is a photograph taken by WA Engineers of the mesh stockpiles, confirming A393 mesh was used on site.

Figure 2 - Steel Mesh Specification

2.4 Slab Joints and Dowel Bars

2.4.1 The distance between the contraction joints was measured on site as compliant with WA's design, in accordance with WA Drawing ST21061-140.

2.4.2 The client confirmed that the concrete joints have been sealed using Sikaflex Pro-3 SL, which is a watertight sealant (including resistance against wastewater), ensuring that the joints in the slab are impermeable. Sikaflex Pro-3 SL also has a high level of mechanical and chemical resistance, rendering it a suitable sealant for this application.

2.4.3 The dowel bars were specified as being 25mm diameter in Wardell Armstrong's design, at 300mm spacing; the areas inspected during the site visit were compliant with this, as shown in Figure 3.

Figure 3 - Dowel Bar Measurements

2.5 Gas Main Protection Slab

2.5.1 In Wardell Armstrong Drawing No BM12515-S-2000 the concrete strength was specified as RC40/50. Wardell Armstrong received the results of the concrete strength after 21 days on 5 June 2025 (contained in Appendix B), and the results are compliant with the design. On site WA Engineers also confirmed that the thickness of the polystyrene was compliant with the detailed design in the locations that were inspected, as well as the steel reinforcement dimensions. It is important to note that the gas main protection slab has been signed off by Cadent gas.

2.6 Leachate Tank Foundation Slab

2.6.1 Wardell Armstrong carried out structural calculations to design the foundation of the proposed leachate tank slab. The calculations for the tank foundation are included in Appendix C.

3 SITE CONTAINMENT

3.1.1 CIRIA C736: Containment systems for the prevention of pollution (C736) provides a method to look at the risk category for a site and therefore determine whether class 1, 2 or 3 containment would be appropriate (with class 3 being the most robust, designed for high-risk sites).

3.1.2 The risk is assessed based on the source pathways and receptors to determine whether the site has an overall low, medium or high risk to the environment should there be a loss of liquid from the tank.

3.1.3 Following the Source-pathway-receptor model in C736, the source is considered first. The primary containment vessels on this site are two efusion epoxy coated steel tanks, which are suitable for a wide range of applications, leachate being one of them. These are highly resistant tanks, with a high durability. The water contained within the primary containment is rainwater and runoff from a composting site. The worst-case scenario on site is that there are aggressive chemicals contained within the compost/organic material, that are carried through the surface water runoff into the containment. Using this rationale, the source could be categorised as low risk.

3.1.4 The next item to consider is the pathway. The main pathway if the primary containment were to fail would be overland flow into the adjacent agricultural land. The ground is impermeable around this location, therefore overland flow is the main pathway to be considered. The slab is impermeable, and is designed so that the fall is towards the existing slab area (See WA Drawing ST21061-140), and the low spot of the site is where the primary containment is located, therefore if failure of the primary containment were to occur, it is highly unlikely that the water from this would flow off site due to the topography in this area, therefore the pathway can be categorised as a low risk.

3.1.5 Finally, any nearby receptors are considered. Throughout the design process it has been identified that there are two sensitive receptors nearby: Ruislip Woods and an aquifer buried deep below the site. Ruislip Woods is comprised of several woodland areas; Bayhurst Wood is one of these areas that is adjacent to the site at the northern boundary. The aquifer runs underneath the site, some 20m below the finished ground level. The ground conditions located between the slab and the aquifer are cohesive in nature and is therefore considered to be impermeable. The receptors are classed as medium risk.

3.1.6 Considering all the above, it has been determined that the site is low risk. Assessing the events that could cause a failure of the primary containment, it has been determined that the risk is very low. The primary containment is leachate tanks, which are located separately to the main composting area, therefore the risk of vehicle impact is minimised due to the installation of blocks, and there is very little risk in the operation of the leachate tanks. It is very unlikely that there will be any operation that could in any way compromise the structure of the tanks. The finished ground levels on site ensure that the direction of any flow is towards the leachate tanks, therefore the risk of any flow off-site is extremely low.

3.1.7 C736 suggests that along with the primary containment, there should be secondary containment, in the case of this site this is provided in the form of earthworks bunding around the areas in which water would be conveyed in the event of a tank failure. It is important to note that the bunds are to be constructed from impermeable cohesive material, meaning seepage through the earthworks will not be an issue on site.

3.1.8 The cohesive material to be used to construct the bunds has been subject to various testing, including permeability testing and a variety of classification tests, included in Appendix D. C736 states that soil used to construct earthworks bunds should be of a permeability less than $1 \times 10^{-9} m/s$. There are 67 soil samples taken from the clay that is to be used to construct the bunds that have previously been tested for permeability, and all of them show a permeability of less than $1 \times 10^{-10} m/s$, so the soil is within the permeability limit specified in C736.

3.1.9 The bunds have also been subject to a geotechnical design utilising the Geo5 Slope Stability Software in accordance with BSEN1997-1, which allowed the Bishop Circle Method to be applied across the cross sections finding the critical slip circle. This model has been created encompassing the overdesign factor approach which includes partial factors applied to the soil parameters and loads as required by the Eurocodes. The utilisation was shown to be less than 100% for the proposed bunds at a 1 in 2.5 slope, and are considered to be stable. The results of which are included in Appendix E.

3.1.10 Whilst outlining the surface water management design, it was determined that the site would flood in the event of a 1 in 100-year storm plus a 40% allowance for climate change, due to the size of the tanks not being large enough to accommodate the runoff from this type of storm event. Whilst this will not be the usual operation, the site was designed to accommodate this rainfall event. During normal operation, there

will be no flooding, and it is highly unlikely that the event of a tank failure would occur simultaneously to this type of storm event, therefore this scenario will be considered when assessing the extent of the secondary containment required on site.

3.1.11 WA Drawing ST21061-140 shows the extent of the bunding, and it has been determined through modelling that if one of the tanks were to fail and the entire volume of water from within this tank was to be displaced, the surface water would not reach the North of the site and would be contained within the bunding along the west of the site. Even with an additional 9 days of rainfall, which equates to around 100mm of water, this would still be the case. Drawing ST21061-115 shows the site with a 2174m^3 flood applied to it, which is vastly larger than the volume that would be required in the secondary containment under C736. In accordance with C736, the bunds have been designed to have a minimum of 750mm freeboard.

3.1.12 Due to the site being categorised as low risk, there is no requirement for tertiary containment.

3.1.13 The item being stored is water, therefore there is no need for firewater in relation to the liquid stored in the containment.

4 CONCLUSION

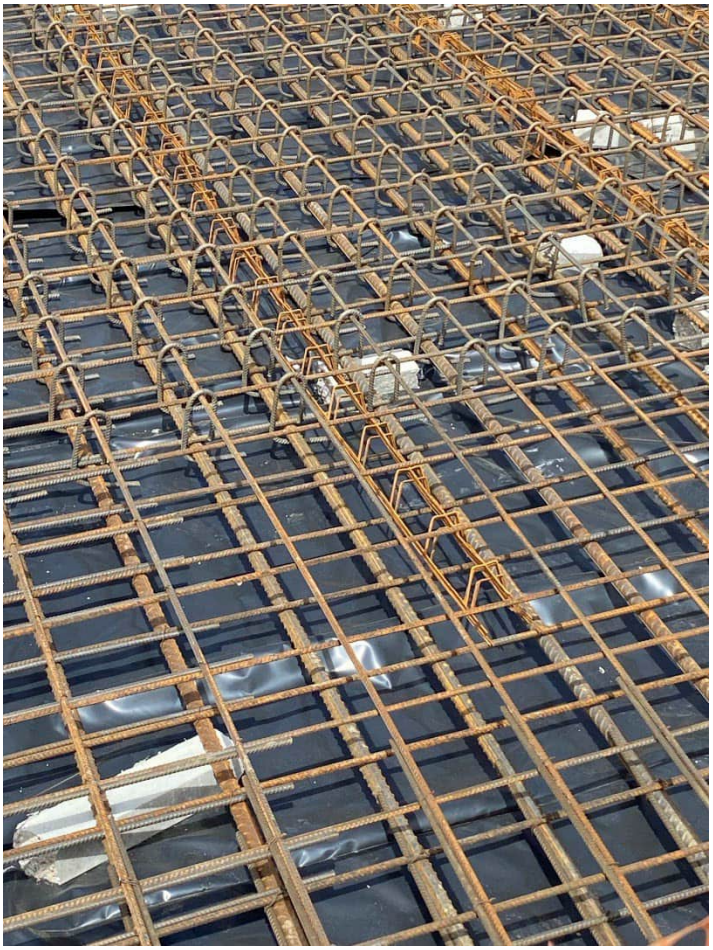
4.1 The on-site inspection undertaken by WA Engineers identified that the construction witnessed on site, at that time, has been constructed in accordance with the detailed design, and construction drawings included within this report.

4.2 In addition, the site is deemed to be compliant with C736, as detailed in this report.

APPENDICES

APPENDIX A

Client Supplied Photographs



APPENDIX B

Concrete Strength Test Results

TESTING SOLUTIONS LTD.
Unit 9 Precision4 Business Park, Bingham Road, Sittingbourne, ME10 3FZ

TEST CERTIFICATE FOR DETERMINATION OF COMPRESSIVE STRENGTH AND DENSITY OF CONCRETE CUBES

Samples Tested At:	**Client:**	**Site:**	UKAS TESTING
Unit 9	ATBone and Sons Ltd	Envar Composting	
Precision 4 Buisness Park	Clements Farm, Brickdon Lane	Newyears Green Lane	
Bingham Road	Hertford, Hertfordshire	Harefield	
Sittingbourne ME10 3FZ	SG13 8NS	Uxbridge, UB9 6LX	10183

Concrete Location: Gas Slab

TEST METHOD

BS EN 12390-1: 2021 SHAPES & DIMENSIONS (Accredited)
BS EN 12390-3: 2019 COMPRESSIVE STRENGTH (Accredited)
BS EN 12390-7: 2019 DENSITY/INCORP CORRIGENDUM 2020 (Accredited)

Cert Issue Date:	27/05/2025
Lab Site Ref:	CR3226
Set:	7
Version:	1

DATE CAST	16/05/2025	TIME SAMPLED	08:35	
MIX DETAILS	C40/50	POINT OF SAMPLING:	SITE	
TICKET NO:	31123485	COMPACTION METHOD:	HAND	
SUPPLIER	Capital	LOCATION CAST:	SITE	
DATE RECEIVED	16/05/2025	LOCATION CURED:	LAB	

LAB REF.:	HB386	HB387	HB388	HB389		
CLIENT REF.:	A	B	C	D		
TEST AGE (DAYS)	7	28	28	SP		
TEST DATE	23/05/2025	13/06/2025	13/06/2025	16/05/2025		
COND. ON RECEIPT:	A L-H-W mm					
NOMINAL SIZE:	**100x100x100**					
CONDITION AT TEST:	**Sat;d**					
MASS IN AIR SAT'D (KG/m3)	**2326**					
DENSITY SAT'D (KG/m3)	**2330**					
MAX LOAD: (kN)	**433.4**					
COMP. STRENGTH (N/mm2)	**43.3**					
MODE OF FAILURE:	**N**					
Laboratory Temperature:	**20.6**					
Flatness & Perpendicularity:	✓ ✓					

Cubes Made By:	**W.Turner**	**Certificate Issued By:**	**Ryan Lilliott**	
A = SATISFACTORY	**D** = SURFACE AIR VOIDS	**G** = CHIPPED EDGES	**N** = NORMAL	
B = HONEYCOMBED	**E** = ROUGH FACES	**H** = EXPOSED AGGREGATES	**E** = EXPLOSIVE	
C = POOR COMPOSITION	**F** = CHIPPED CORNERS	**J** = BAD DIMENSIONS		

CHECKED BY: (Jack Dunk: Managing Director)
Remarks:

TESTING SOLUTIONS LTD.
Unit 9 Precision4 Business Park, Bingham Road, Sittingbourne, ME10 3FZ

TEST CERTIFICATE FOR DETERMINATION OF COMPRESSIVE STRENGTH AND DENSITY OF CONCRETE CUBES

Samples Tested At:	**Client:**	**Site:**	UKAS TESTING
Unit 9	ATBone and Sons Ltd	Envar Composting	
Precision 4 Buisness Park	Clements Farm, Brickdon Lane	Newyears Green Lane	
Bingham Road	Hertford, Hertfordshire	Harefield	
Sittingbourne ME10 3FZ	SG13 8NS	Uxbridge, UB9 6LX	10183

Concrete Location: Main Slab

TEST METHOD

BS EN 12390-1: 2021 SHAPES & DIMENSIONS (Accredited)
BS EN 12390-3: 2019 COMPRESSIVE STRENGTH (Accredited)
BS EN 12390-7: 2019 DENSITY/INCORP CORRIGENDUM 2020 (Accredited)

Cert Issue Date:	28/05/2025
Lab Site Ref:	CR3226
Set:	9
Version:	1

DATE CAST	20/05/2025	TIME SAMPLED	N/A
MIX DETAILS	C32/40	POINT OF SAMPLING:	SITE
TICKET NO:	No Ticket	COMPACTION METHOD:	HAND
SUPPLIER	Brett	LOCATION CAST:	SITE
DATE RECEIVED	20/05/2025	LOCATION CURED:	LAB

LAB REF.:	HB528	HB529	HB530	HB531		
CLIENT REF.:	A	B	C	D		
TEST AGE (DAYS)	7	28	28	SP		
TEST DATE	27/05/2025	17/06/2025	17/06/2025	20/05/2025		
COND. ON RECEIPT:	A L-H-W mm					
NOMINAL SIZE:	**100x100x100**					
CONDITION AT TEST:	**Sat;d**					
MASS IN AIR SAT'D (KG/m3)	**2185**					
DENSITY SAT'D (KG/m3)	**2190**					
MAX LOAD: (kN)	**234.6**					
COMP. STRENGTH (N/mm2)	**23.4**					
MODE OF FAILURE:	**N**					
Laboratory Temperature:	**20.1**					
Flatness & Perpendicularity:	✓ ✓					

Cubes Made By:	**B.Shirley**	**Certificate Issued By:**	**Ryan Lilliott**	
A = SATISFACTORY	**D** = SURFACE AIR VOIDS	**G** = CHIPPED EDGES	**N** = NORMAL	
B = HONEYCOMBED	**E** = ROUGH FACES	**H** = EXPOSED AGGREGATES	**E** = EXPLOSIVE	
C = POOR COMPOSITION	**F** = CHIPPED CORNERS	**J** = BAD DIMENSIONS		

CHECKED BY: (Jack Dunk: Managing Director)
Remarks:

TESTING SOLUTIONS LTD.
Unit 9 Precision4 Business Park, Bingham Road, Sittingbourne, ME10 3FZ

TEST CERTIFICATE FOR DETERMINATION OF COMPRESSIVE STRENGTH AND DENSITY OF CONCRETE CUBES

Samples Tested At:	**Client:**	**Site:**	UKAS TESTING
Unit 9	ATBone and Sons Ltd	Envar Composting	
Precision 4 Buisness Park	Clements Farm, Brickdon Lane	Newyears Green Lane	
Bingham Road	Hertford, Hertfordshire	Harefield	
Sittingbourne ME10 3FZ	SG13 8NS	Uxbridge, UB9 6LX	10183

Concrete Location: Gas Main

TEST METHOD

BS EN 12390-1: 2021 SHAPES & DIMENSIONS (Accredited)

BS EN 12390-3: 2019 COMPRESSIVE STRENGTH (Accredited)

BS EN 12390-7: 2019 DENSITY/INCORP CORRIGENDUM 2020 (Accredited)

Cert Issue Date:	28/05/2025
Lab Site Ref:	CR3226
Set:	10
Version:	1

DATE CAST	20/05/2025	TIME SAMPLED	09:55	
MIX DETAILS	C40/50	POINT OF SAMPLING:	SITE	
TICKET NO:	31123646	COMPACTION METHOD:	HAND	
SUPPLIER	Brett	LOCATION CAST:	SITE	
DATE RECEIVED	20/05/2025	LOCATION CURED:	LAB	

LAB REF.:	HB532	HB533	HB534	HB535		
CLIENT REF.:	A	B	C	D		
TEST AGE (DAYS)	7	28	28	SP		
TEST DATE	27/05/2025	17/06/2025	17/06/2025	20/05/2025		
COND. ON RECEIPT:	A L-H-W mm					
NOMINAL SIZE:	**100x100x100**					
CONDITION AT TEST:	**Sat;d**					
MASS IN AIR SAT'D (KG/m3)	**2287**					
DENSITY SAT'D (KG/m3)	**2290**					
MAX LOAD: (kN)	**408.7**					
COMP. STRENGTH (N/mm2)	**40.8**					
MODE OF FAILURE:	**N**					
Laboratory Temperature:	**20.1**					
Flatness & Perpendicularity:	✓ ✓					

Cubes Made By:	**B.Shirley**	**Certificate Issued By:**	**Ryan Lilliott**	
A = SATISFACTORY	**D** = SURFACE AIR VOIDS	**G** = CHIPPED EDGES	**N** = NORMAL	
B = HONEYCOMBED	**E** = ROUGH FACES	**H** = EXPOSED AGGREGATES	**E** = EXPLOSIVE	
C = POOR COMPOSITION	**F** = CHIPPED CORNERS	**J** = BAD DIMENSIONS		

CHECKED BY: (Jack Dunk: Managing Director)

Remarks:

APPENDIX C

Tank Foundation Structural Calculations

Structural Calculations for Proposed Ground Bearing Tank Foundation Slab

At

PERMIT VARIATION WEST LONDON.

For

WEST LONDON COMPOSTING

CALCULATIONS REVIEW

Project Title:	**Job No:**
Permit variation west London.	ST21061
Calculations Prepared by:	Position:
Akalanka Chandrasiri	Principal Structural Engineer
Signature: 	Date: 05/09/2025

Calculations Sheets and Sketches Reviewed:

Reviewed by:	Job Title:
Daniel Bamford	Structural Engineer
Signature: 	Date: 05/09/2025

CONTENTS

DESIGN PHILOSOPHY STATEMENT

SLR Consulting Engineers were instructed to carry out the structural design for the new ground-bearing reinforced concrete slab supporting two cylindrical fluid storage tanks.

IMPORTANT NOTE

Dimensions in these calculations are only approximate and the contractor must check the latest architectural drawings and measure up on site before ordering any materials. Ensure length includes for bearing.

STRUCTURAL SPECIFICATION

Ensure a copy of these calculations and supporting drawings and details are provided to the Contractor in advance of the works commencing.

Actual set-out dimensions are to be measured on site. DO NOT use any nominal plan dimensions quoted in design notes without verification. Ensure lengths include for bearings as required by the drawings and details.

Where deflection, settlement or shrinkage may cause minor cracking, this is to be anticipated and made good in finishes as required.

1 General

The contractor shall notify the Engineer should there be any incorrect information contained within these calculations, any details that are unclear or conflicts with the existing construction and services. The condition of the formation/subgrade and any existing adjacent slabs/foundations is to be verified on site before ordering of materials. Any irregularities or discrepancies are to be reported to the Engineer. The structural design and enclosed calculations are based on the sketch layout and information provided by the Client; where no drawings have been received, measurements from site visits are used. The structural information provided in this specification is in addition to that provided by others (e.g., tank vendor, civil/MEP).

2 Dimensions:

Prior to ordering materials all dimensions are to be checked on site. Co-ordinate slab extents, levels, falls and set-out of hold-downs/anchor points with the latest drawings and tank vendor requirements.

3 Reinforcement Arrangement:

Reinforcement grade & standards: High-yield deformed B500 to BS 4449. Detailing and scheduling to BS 8666; design to Eurocode 2.

5 Proprietary Products:

All proprietary manufacturers' items (e.g., joint systems, membranes, fixing anchors) are to be installed in accordance with the manufacturer's latest requirements and instructions

6 Materials:

All materials and installation to comply with current Eurocodes, British Standards, Building Regulations and Codes of Practice.

7 CDM Regulations:

In accordance with The Construction (Design and Management) Regulations 2015, the designer has eliminated any foreseeable health and safety risks based upon the information provided.

Where residual risks remain, these are highlighted on the supporting drawings and details so that appropriate control measures can be implemented.

If a domestic client does not have a written agreement with the Engineer to confirm they are taking on the client duties, those duties automatically pass to the principal contractor.

Temporary works and propping of the existing structure shall consider the existing building loads and ensure stability is always maintained.

Installation of steel beams and heavy materials shall use mechanical handling in accordance with The Manual Handling Operations Regulations, 1992.

The contractor is to have a co-ordinated construction plan, risk assessment and method statement for non-traditional works.

The contractor is to inform the designer should there be any changes to the construction that may impact on the design and CDM regulations.

<u>All projects to have:</u>

All workers with the right skills, knowledge, training and experience.

Contractors providing appropriate supervision, instruction and information.

A written construction phase plan.

<u>Projects where more than one contractor involved</u>

Principal designer and principle contractor must be appointed.

Need a health and safety file.

<u>Client must notify project to HSE</u>

If construction programme is longer than 30 working days and have more than 20 workers working simultaneously at any point or exceeds 500-person days.

LOADINGS AND ASSUMPTIONS

PARTIAL FACTORS OF SAFETY

Permanent action; $\gamma_G = 1.35$

Variable action; $\gamma_Q = 1.50$

LOADING ON SLAB

Permanent load

; Weight of the per tank with fluid; $g_{k\_tank(s\&f)} = 2755$ kN

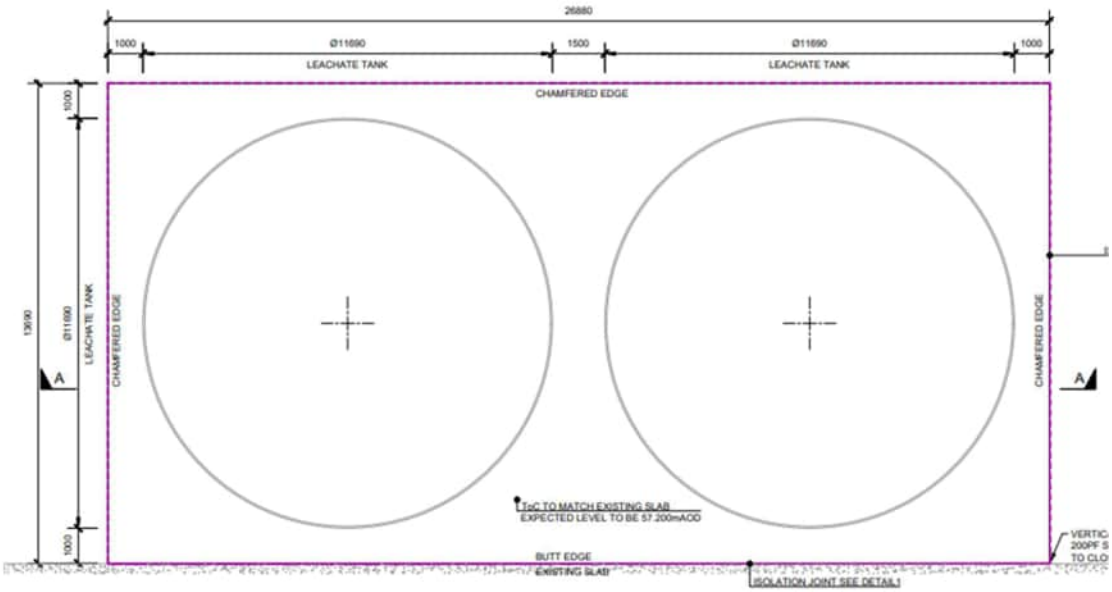
; Self weight of slab; $g_{k\_slabs} = 0.8m \times 24kN/m^3 =$ **19.200** kN/m^2

; Services on slab; $g_{k\_ser(slab)} = 0.01\ kN/m^2$

Variable load

; Veriable load on slab ; $q_{k\_slab} = 1.5\ kN/m^2$

GENERAL ARRANGEMENT OF THE SLAB



DESIGN CALCULATIONS

CONSIDER BEARING PRESSURE UNDERNEATH FOUNDATION SLAB - BP01

Maximum bearing pressure is applied beneath the tank (With two tanks and a 1.5m gap there is no geometric overlab).

Radius of the tank; R_{tank} = **5.8m**

Area of the tank; $A_{Area} = \pi \times R_{tank}^2 =$ **105.683** m^2

Weight of the tank; W_{tank} = **2755kN**

Bearing pressure due to weight of tank; $P_{tank} = W_{tank} / A_{Area} =$ **26.068** kN/m^2

Self-weight of slab; g_{k_slabs} = **19.200** kN/m^2

Total bearing pressure due to weight of tank and self-weight of slab; $P_{total\_SLS} = P_{tank} + g_{k\_slabs} =$ **45.268** kN/m^2 ;< (50kN/m^2)

Allowable bearing pressure. Hence satisfied.

CONSIDER GROUND BEARING SLAB FOUNDATION - SF01

Foundation transfers the load from tank with fluid into ground.

Allowable bearing capacity of soil; $P_{k\_ALLOWABLE}$ = 50.0 kN/m²

Radius of the tank; **R_w = 5.8m**

SLS Permanent load from a tank with fluid; $Roof_{gk}$=2755kN

Self-weight of slab; g_{k_slabs} = **19.200** kN/m²

Total load on slab SLS; P_{total_SLS} = **45.268** kN/m²

Total load on slab ULS; P_{total_ULS} = $P_{total\_SLS} \times 1.5$ = **67.903** kN/m²

CONCRETE INDUSTRIAL GROUND FLOOR SLAB DESIGN (TR34)

CONCRETE INDUSTRIAL GROUND FLOOR SLAB DESIGN

In accordance with TR34, 4th Edition 2013

Tedds calculation version 2.0.04

Design summary

Load 1 -UDL 45 kN/m²

Description	Unit	Provided	Required	Utilisation	Result
Slab capacity in flexure	kN/m²	60.7	45.0	0.742	PASS

Slab details

Reinforcement type; Fabric

Concrete class; C32/40

Slab thickness; h = **800** mm

Characteristic strength of reinforcement; f_{yk} = **500** N/mm²

Diameter of reinforcement; ϕ_s = **16** mm

Spacing of reinforcement; s_s = **175** mm

Area of top steel provided; $A_{s,prov}$ = **1149** mm²/m

Nominal cover; c_{nom_b} = **50** mm

Effective depth of reinforcement; d = 0.75 × h = **600** mm

Partial safety factors

Concrete (with or without fibre); γ_c = **1.50**

Reinforcement (bar or fabric); γ_s = **1.15**

Permanent; γ_G = **1.40**

Variable; γ_Q = **1.60**

Dynamic loads; γ_D = **1.60**

Subgrade reaction

Modulus of subgrade reaction; k = **0.020** N/mm³

Concrete details - Table 6.1. Strength properties for concrete

Characteristic compressive cylinder strength; f_{ck} = **32** N/mm²

Characteristic compressive cube strength; f_{cu} = **40** N/mm²

Mean value of compressive cylinder strength; f_{cm} = f_{ck} + 8 N/mm² = **40** N/mm²

Mean value of axial tensile strength; f_{ctm} = 0.3 N/mm² × (f_{ck}/ 1 N/mm²)$^{2/3}$ = **3.0** N/mm²

Flexural tensile strength; $f_{ctd,fl}$ = f_{ctm} × (1.6 - h / 1m) / γ_c = **1.6** N/mm²

Design concrete compressive strength (cylinder); $f_{cd} = f_{ck} / \gamma_c =$ **21.3** N/mm^2

Secant modulus of elasticity of concrete; $E_{cm} = 22$ kN/mm$^2 \times [f_{cm}/ 10$ N/mm$^2]^{0.3} =$ **33** kN/mm^2

Poisons ratio; $\nu =$ **0.2**

Radius of relative stiffness (Eqn. 20); $l = [E_{cm} \times h^3 / (12 \times (1 - \nu^2) \times k)]^{0.25} =$ **2934** mm

Characteristic of system (Eqn. 33); $\lambda = (3 \times k / (E_{cm} \times h^3))^{0.25} =$ **0.243** m^{-1}

Moment capacity

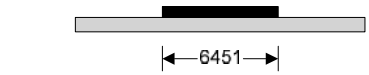
Negative moment capacity (Eqn. 2); $M_n = M_{un} = f_{ctd,fl} \times (h^2 / 6) =$ **172.0** kNm/m

Positive moment capacity (Eqn. 2); $M_p = M_{un} =$ **172.0** kNm/m

Ratio of cracked to uncracked mnt of resist (cl.7.4); $M_p / M_n =$ **1.000**

PASS - Ratio of cracked to uncracked moment of resistance is greater or equal to 0.5

Load 1 - UDL 45 kN/m^2



Maximum positive bending moment loading pattern

Maximum negative bending moment loading pattern

Working load capacity of UDL

UDL; $U_k =$ **45.0** kN/m^2

Critical aisle width; $l_{crit} = \pi / (2 \times \lambda) =$ **6451** mm

Loaded width of single UDL (max positive moment); $l_{load\_p} = \pi / (2 \times \lambda) =$ **6451** mm

Loaded width of dual UDL (max nagative moment); $l_{load\_n} = \pi / \lambda =$ **12903** mm

Working load capcity of slab; $q = 5.95 \times \lambda^2 \times M_n =$ **60.7** kN/m^2

Utilisation; $U_k / q =$ **0.742**

PASS - Total slab capacity exceeds applied load

USE 800mm THICK C32/40 REINFORCE CONCRETE SLAB WITH H16@ 175mm BOTH DIRECTION TOP AND BOTTOM.

SKETCH -01

REFER THE DRAWING NO.ST21061-150 REV.A

APPENDIX D

Geotechnical Laboratory Test Results

Construction Testing Solutions

CHECKED

BY:

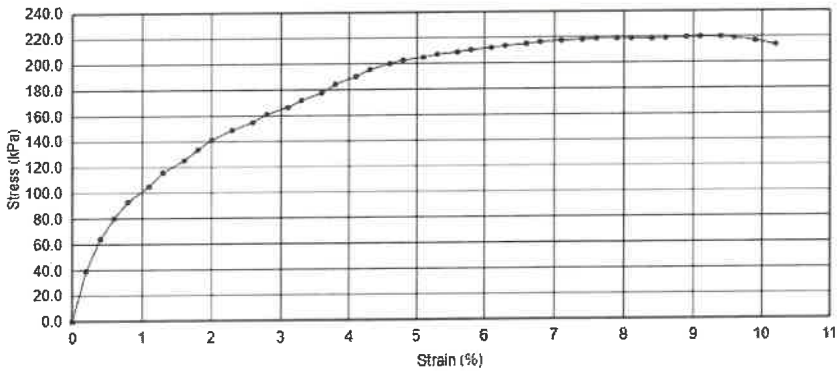
TEST REPORT:	**DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT** BS 1377 : Part 7 : 1990 Clause 8		
REPORT NUMBER:	C1050095 / 179546.2.1.1		
SAMPLE NUMBER:	278525	CLIENT:	SCS Railways
CLIENT REF:	M06577	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	05/04/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	06/04/2022	MATERIAL:	Brown Clay
DATE COMPLETED:	13/04/2022	LOCATION:	Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 4
TESTED BY:	Jacob Tindall	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE IF REMOULDED:	Remoulded 4.5kg	ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SPECIMEN: N/A	

RESULTS: **Test Location: Harrietsham Lab**

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height:	200.3 mm
Initial specimen diameter:	100.4 mm
Initial bulk density:	1.99 Mg/m^3
Initial moisture content:	26.2 %
Initial dry density:	1.57 Mg/m^3
Rate of strain applied:	1 %/min
Membrane thickness (latex):	0.2 mm
Membrane correction:	0.4 kPa
Cell pressure:	200 kPa
Corrected maximum deviator stress at failure:	219.6 kPa
Strain at failure:	9.4 %
Mode of failure:	Plastic
Undrained Shear Strength, cu:	109.8 kPa

Stress V Strain



Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Chris Davidson - Southern Laboratories Manager

Approved Signatory
Report date 19-Apr-22

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

LABORATORY TESTING OF SOIL - CONSTANT HEAD PERMEABILITY USING FLEXIBLE WALL PERMEAMETER
Test Report Certificate (Tested in accordance with BS EN ISO 17892-11:2019)

Contract No	CH22-009	Sample Details:	Sample Number	CH22-009-1 PERM	
Job Name	West Ruislip		Sample Reference	CH22-009-1	
			Sample No	278525	Type C
			Date Sampled	05/04/2022	
			Date Received	07/04/2022	
			Client Ref	M06577	

CHECKED 20 APR 2022 BY:

Specimen Details

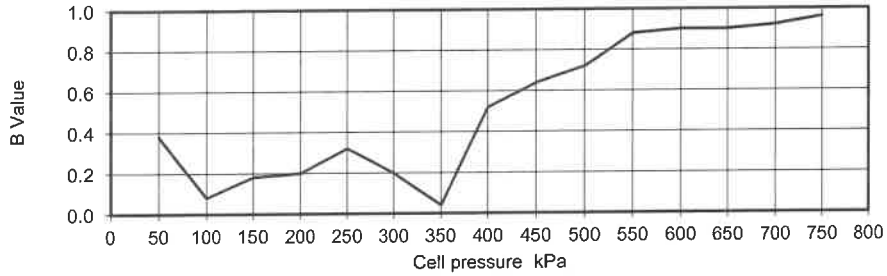
Soil Description: Stiff brown slightly sandy slightly gravelly CLAY (BROWN CLAY)

Preparation Details: UNDISTURBED

Length	100.9	mm	
Diameter	101.9	mm	
Particle density	2.65	Mg/m³	Measured

	Initial	Final	
Bulk Density	1.94	1.97	Mg/m³
Water Content	27.1	29.2	%
Dry density	1.53	1.53	Mg/m³
Voids ratio	0.74	0.74	
Degree of saturation	98	105	%

Saturation Stage

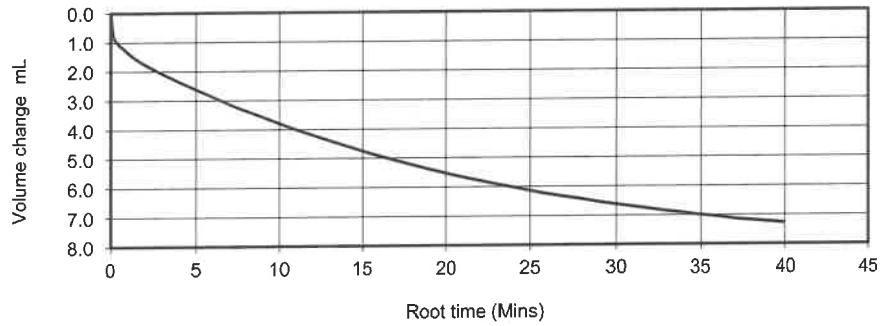


Date: Start of Test: 07/04/2022

Method used during saturation: Increments of cell and back pressure

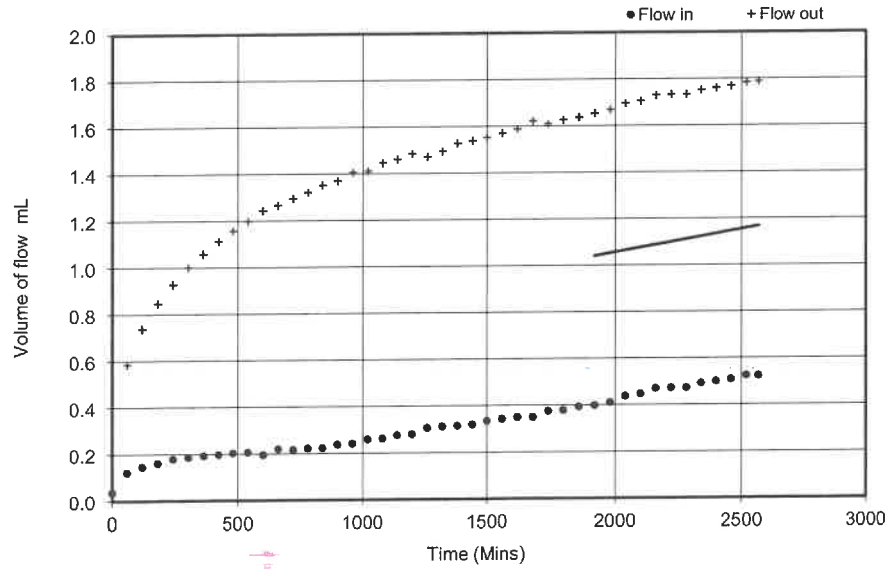
Cell pressure increments	50	kPa
Differential pressure	10	kPa
Final cell pressure	750	kPa
Final pore water pressure	737	kPa
Final B value	0.96	

Consolidation Stage



Drainage condition	to one end only	
Cell pressure applied	800	kPa
Back pressure applied	700	kPa
Effective stress	100	kPa

Permeability Stage



Date: Start of Flow: 18/04/2022

Cell pressure	800	kPa
Top pressure	715	kPa
Base pressure	685	kPa
Mean effective stress	100	kPa
Differential pressure	30	kPa
Hydraulic gradient	30	
Mean rate of flow	0.00019	ml/min
Average temperature during test	20	°C

Average Permeability, k_V

(at 20°C) 1.3×10^{-11} m/s

Notes Source: Copthall North
Supplier: SCS Railways
Location: Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 4

UKAS TESTING 4161

Construction Testing Solutions

Checked/Date		21/04/2022
Approved/Date		21/04/2022
Date Reported	21/04/2022	END OF REPORT

LABORATORY TESTING OF SOIL - CONSTANT HEAD PERMEABILITY USING FLEXIBLE WALL PERMEAMETER
Test Report Certificate (Tested in accordance with BS EN ISO 17892-11:2019)

Contract No	CH22-009
Job Name	West Ruislip

CHECKED 27 APR 22 BY:

Sample Details:

Sample Number	CH22-009-2 PERM		
Sample Reference	CH22-009-2		
Sample No	278527	Type	C
Date Sampled	05/04/2022		
Date Received	07/04/2022		
Client Ref	M06577		

Specimen Details

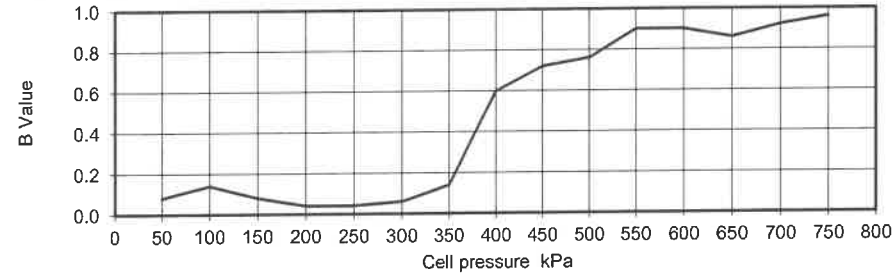
Soil Description: Stiff brown slightly sandy slightly gravelly CLAY (BROWN CLAY)

Preparation Details: UNDISTURBED

Length	100.9	mm	
Diameter	101.2	mm	
Particle density	2.70	Mg/m³	Measured

	Initial	Final	
Bulk Density	2.01	2.05	Mg/m³
Water Content	22.8	24.9	%
Dry density	1.64	1.64	Mg/m³
Voids ratio	0.65	0.65	
Degree of saturation	95	104	%

Saturation Stage

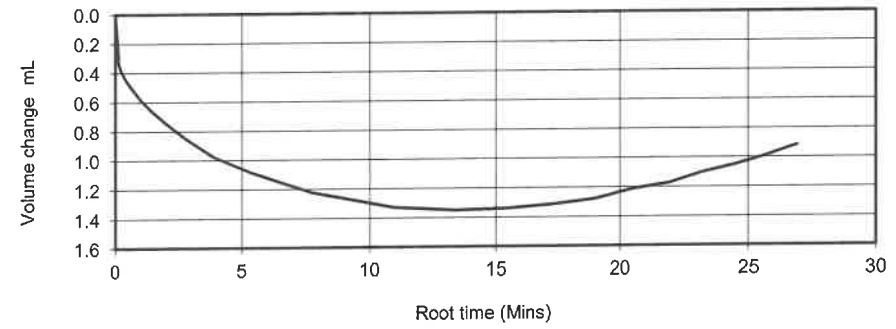


Date: Start of Test: 07/04/2022

Method used during saturation: Increments of cell and back pressure

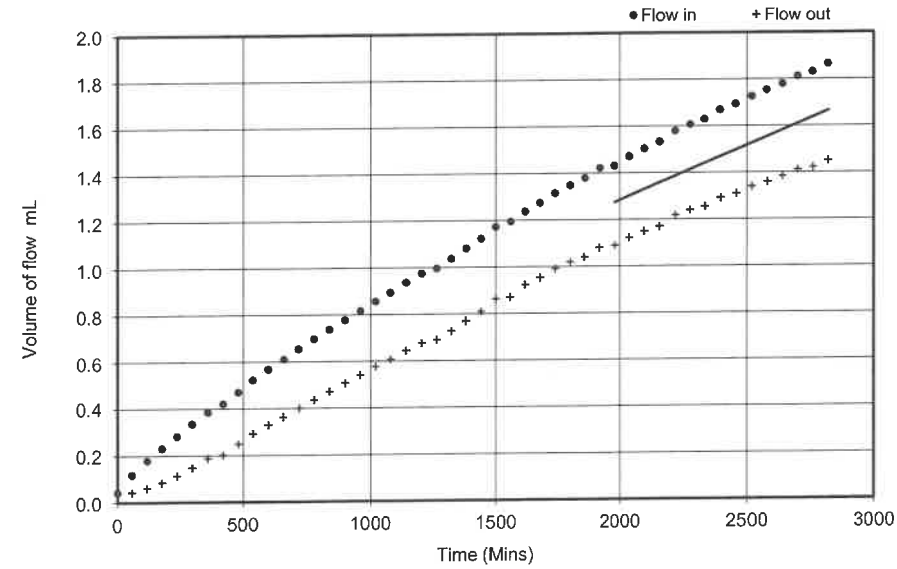
Cell pressure increments	50	kPa
Differential pressure	10	kPa
Final cell pressure	750	kPa
Final pore water pressure	737	kPa
Final B value	0.96	

Consolidation Stage



Drainage condition	to one end only	
Cell pressure applied	800	kPa
Back pressure applied	700	kPa
Effective stress	100	kPa

Permeability Stage



Date: Start of Flow: 18/04/2022

Cell pressure	800	kPa
Top pressure	715	kPa
Base pressure	685	kPa
Mean effective stress	100	kPa
Differential pressure	30	kPa
Hydraulic gradient	30	
Mean rate of flow	0.00046	ml/min
Average temperature during test	20	°C

Average Permeability, k_V

(at 20°C) 3.2×10^{-11} m/s

Notes

Source: Copthall North

Supplier: SCS Railways

Location: Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 4

UKAS TESTING 4161

Construction Testing Solutions

Checked/Date		21/04/2022
Approved/Date		21/04/2022
Date Reported	21/04/2022	END OF REPORT

Construction Testing Solutions

CHECKED
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050090 / 168678.2.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	21/01/2022	SITE:	Copthall Tunnel
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	25/01/2022	MATERIAL:	Brown Clay 2G
DATE COMPLETED:	04/02/2022	LOCATION:	NWSPA Mound 2, Strip 1-Layer 1
TESTED BY:	RH, KJ		
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
262257	M05976	Brown Clay 2G	2.68

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 04-Feb-22

UKAS TESTING
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861167

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**262257.2 (M05976)**
Date and Time of Sampling:	**21/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 1, Layer 1**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Brown Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.2 mm	N/A
Height:	98.8 mm	N/A
Moisture Content:	23 %	24 %
Bulk density:	2.02 Mg/m^3	2.09 Mg/m^3
Dry density:	1.65 Mg/m^3	1.69 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.32
Final pore pressure coefficient,B:	0.98
Duration of stage:	5 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days

Coefficient of Permeability (k_v) at 20°C = 2.6×10^{-11} m/s

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861166

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**262257.1 (M05976)**
Date and Time of Sampling:	**21/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 1 - Layer 1**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Brown Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	100.9 mm	N/A
Height:	102.6 mm	N/A
Moisture Content:	26 %	29 %
Bulk density:	1.96 Mg/m^3	2.02 Mg/m^3
Dry density:	1.56 Mg/m^3	1.56 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.10
Final pore pressure coefficient,B:	0.96
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	4.5×10^{-11} m/s

Construction Testing Solutions

CHECKED
14 FEB 22
BY:

TEST REPORT:	**DETERMINATION OF THE PLASTICITY INDEX OF SOIL** BS 1377:Part 2:1990 clause 5.4		
REPORT NUMBER:	C1050090 / 168678.1.1.1		
SAMPLE NUMBER:	262257	CLIENT:	SCS Railways
CLIENT REF:	M05976	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	21/01/2022	SITE:	Copthall Tunnel
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	25/01/2022	MATERIAL:	Brown Clay
DATE COMPLETED:	03/02/2022	LOCATION:	NWSPA Mound 2, Strip 1-Layer 1,
TESTED BY:	SM, ND	PREPARATION METHOD:	BS 1377:Part 1:1990 cl 7.3 & 7.4.3
TYPE OF SAMPLE:	Disturbed	VARIATIONS:	None
WITHIN ORIGINAL SAMPLE:	N/A		

RESULTS:

TEST DETAILS	TEST RESULT	SPECIFICATION LIMITS	
		Lower Limit	Upper Limit
THE LIQUID LIMIT OF THE SAMPLE:	52%	N/A	N/A
THE PLASTIC LIMIT OF THE SAMPLE:	21%	N/A	N/A
THE PLASTICITY INDEX OF THE SAMPLE:	31%		
THE PERCENTAGE PASSING 425µm TEST SIEVE:	100%		
Sample History:	The material was tested in the natural state		

Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Sasha Mahon - Laboratory Supervisor

Approved Signatory
Report date 03-Feb-22

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0927

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END OF REPORT

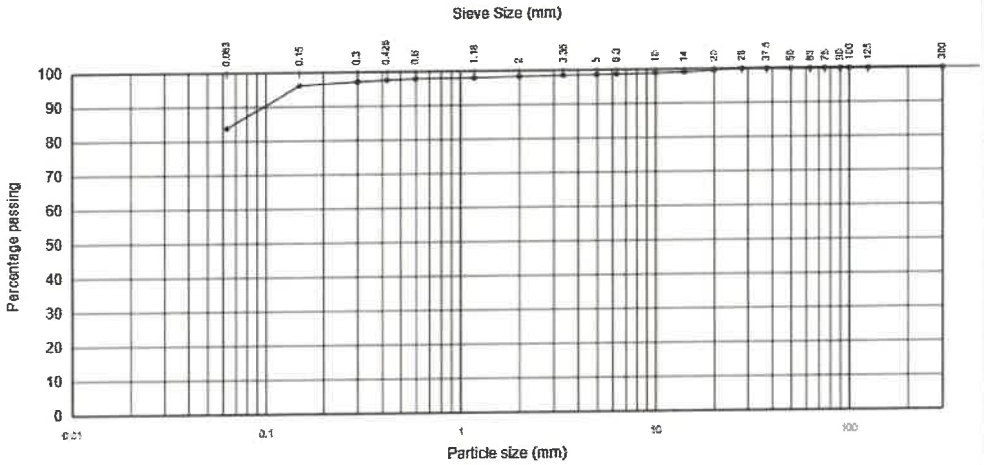
Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions

CHECKED
BY:

TEST REPORT:	**TEST REPORT: DETERMINATION OF PARTICLE SIZE DISTRIBUTION & MOISTURE CONTENT** BS 1377 - 2 : 1990, Method 9.2 Washing & Dry Sieving and BS 1377 2 : 1990, Method 3.2		
REPORT NUMBER:	C1050090 / 168678.3.1.1		
SAMPLE NUMBER:	262257	CLIENT:	SCS Railways
CLIENT REF:	M05976	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	21/01/2022	SITE:	Copthall Tunnel
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	25/01/2022	MATERIAL:	Brown Clay
DATE COMPLETED:	29/01/2022	CLASSIFICATION:	Class 2A
TESTED BY:	SK, HM	LOCATION:	NWSPA Mound 2, Strip 1-Layer 1
WITHIN ORIGINAL SPECIMEN:	N/A	PREPARATION METHOD:	BS 1377:Part 1:1990 clause 7.3 & 7.4.5
TYPE OF SAMPLE:	Disturbed	VARIATIONS:	No variations

RESULT



Class 2A - Specification for Highway Works (2016) Table 6/2 Earthworks Materials - Class 2A

Uniformity Coefficient (D60/D10) N/A

Percentage passing 63µm > 10% therefore uniformity coefficient is estimated minimum.

Sample complies with the grading specification

Moisture content: 25%

SIEVE ANALYSYS

Particle Diameter mm	Passing %	Specification Limits
500	100	
300	100	
125	100	100 - 100
100	100	
90	100	
75	100	
63	100	
50	100	
37.5	100	
28	100	
20	100	
14	99	
10	99	
6.3	99	
5	99	
3.35	99	
2	98	80 - 100
1.18	98	
0.6	98	
0.425	98	
0.3	97	
0.15	96	
0.063	84	15 - 100

Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Sasha Mahon - Laboratory Supervisor

Approved Signatory
Report date 31-Jan-22

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0927

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

CHECKED

21 FEB 22

BY:

Construction Testing Solutions

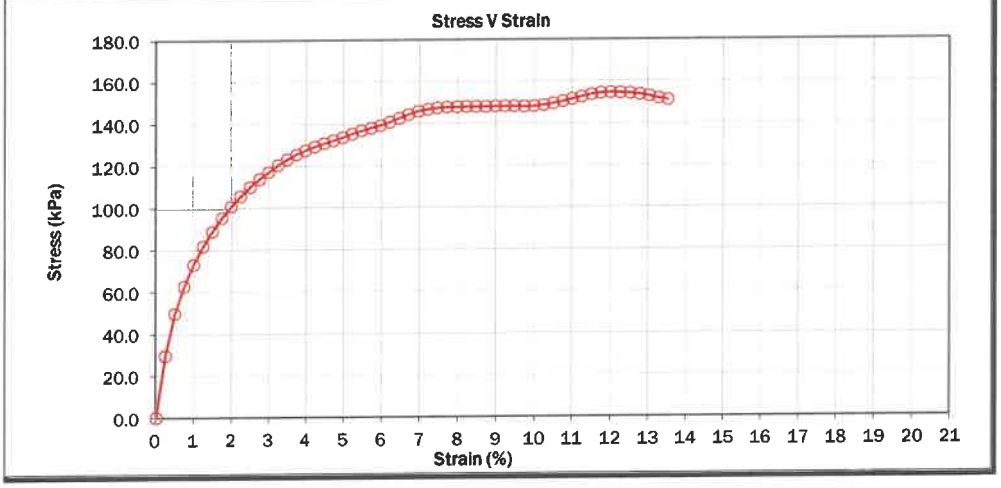
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050090 / 168678.6.1.1	CLIENT:	SCS Railways
SAMPLE No.:	262257	ADDRESS:	Black Arrow House
CLIENT REF:	M05976	SITE:	Copthall Tunnel
DATE SAMPLED:	21/01/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Brown Clay
DATE RECEIVED:	25/01/2022	LOCATION:	NWSPA Mound 2, Strip 1-Layer 1
DATE TEST COMPLETED:	16/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	2.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 2.5kg rammer at as received moisture content.

Initial specimen height	200.3	mm
Initial specimen diameter	100.1	mm
Initial bulk density	1.98	Mg/m³
Initial moisture content	28	%
Initial dry density	1.54	Mg/m³
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.5	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	154	kPa
Strain at failure	12.0	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**77**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

This report shall not be reproduced except in full without approval of the laboratory.

For and on behalf of CTS

16-Feb-22

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06012**
Client Sample No: **JM01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 1 Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **25/01/2022**
Date Received: **25/01/2022**
Date Tested: **26/01/2022**
Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	2	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.16	2.15	-	-	-
In-Situ Dry Density (Mg/m^3)	1.77	1.76	-	-	-
Moisture Content (%)	22.4	22.3	-	-	-
Relative Compaction (%)	98.8	98.4	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **25-Feb-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06012		
Sample Certificate:	Yes		
Site Reference:	JM01	Date Tested:	25/01/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 1 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	25/01/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1723	1710				
Moisture Content - %	22.5	22.2				
Relative Compaction - %	96.3	95.5				

Average Relative Compaction - %	95.9
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06012

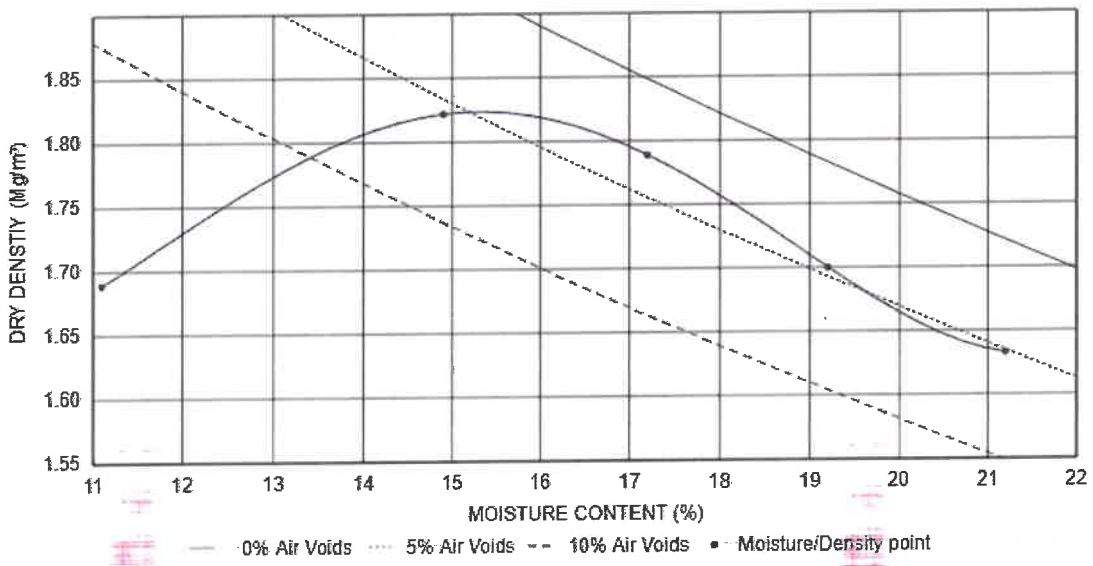
Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 168831.2.1.1		
SAMPLE NUMBER:	262446	CLIENT:	SCS Railways
CLIENT REF:	M06012	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	25/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	26/01/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	03/02/2022	LOCATION:	NWSPA, Mound 2 Strip 1 Layer 2
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None		

RESULT:

MAXIMUM DRY DENSITY:	1.82 Mg/m^3
OPTIMUM MOISTURE CONTENT:	15 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.71 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 04-Feb-22

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Harrietsham, Nr Maidstone
Kent ME17 1QW

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enquiries@constructiontesting.co.uk
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions

CHECKED
17 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 168831.8.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	25/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	26/01/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	04/02/2022	LOCATION:	NWSPA, Mound 2 Strip 1 Layer 2
TESTED BY:	RH, KJ		
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
262446	M06012	Grey Clay 2A	2.71

Remarks:
Test results reported relate only to the items tested.
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Dan Gay - Laboratory Manager

Approved Signatory
Report date 04-Feb-22

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861168

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**262446.1 (M06012)**
Date and Time of Sampling:	**25/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 1, Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	mm	N/A
Height:	mm	N/A
Moisture Content:	29 %	31 %
Bulk density:	1.92 Mg/m^3	1.98 Mg/m^3
Dry density:	1.50 Mg/m^3	1.52 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.30
Final pore pressure coefficient,B:	0.96
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	4.7×10^{-11} m/s

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861169

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**262446.2 (M06012)**
Date and Time of Sampling:	**25/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 1, Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	mm	N/A
Height:	mm	N/A
Moisture Content:	23 %	24 %
Bulk density:	2.03 Mg/m^3	2.09 Mg/m^3
Dry density:	1.65 Mg/m^3	1.68 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.22
Final pore pressure coefficient,B:	0.98
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	4.6×10^{-11} m/s

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06012**	Date Sampled:	**25/01/2022**
Client Sample No:	**JM01**	Date Received:	**25/01/2022**
Sample Certificate:	**Yes**	Date Tested:	**27/01/2022**
Sample Location:	**NWSPA Mound 2 Strip 1 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**62.6**
Plastic Limit	**21.5**
Plasticity Index	**41.1**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **18-Feb-22**

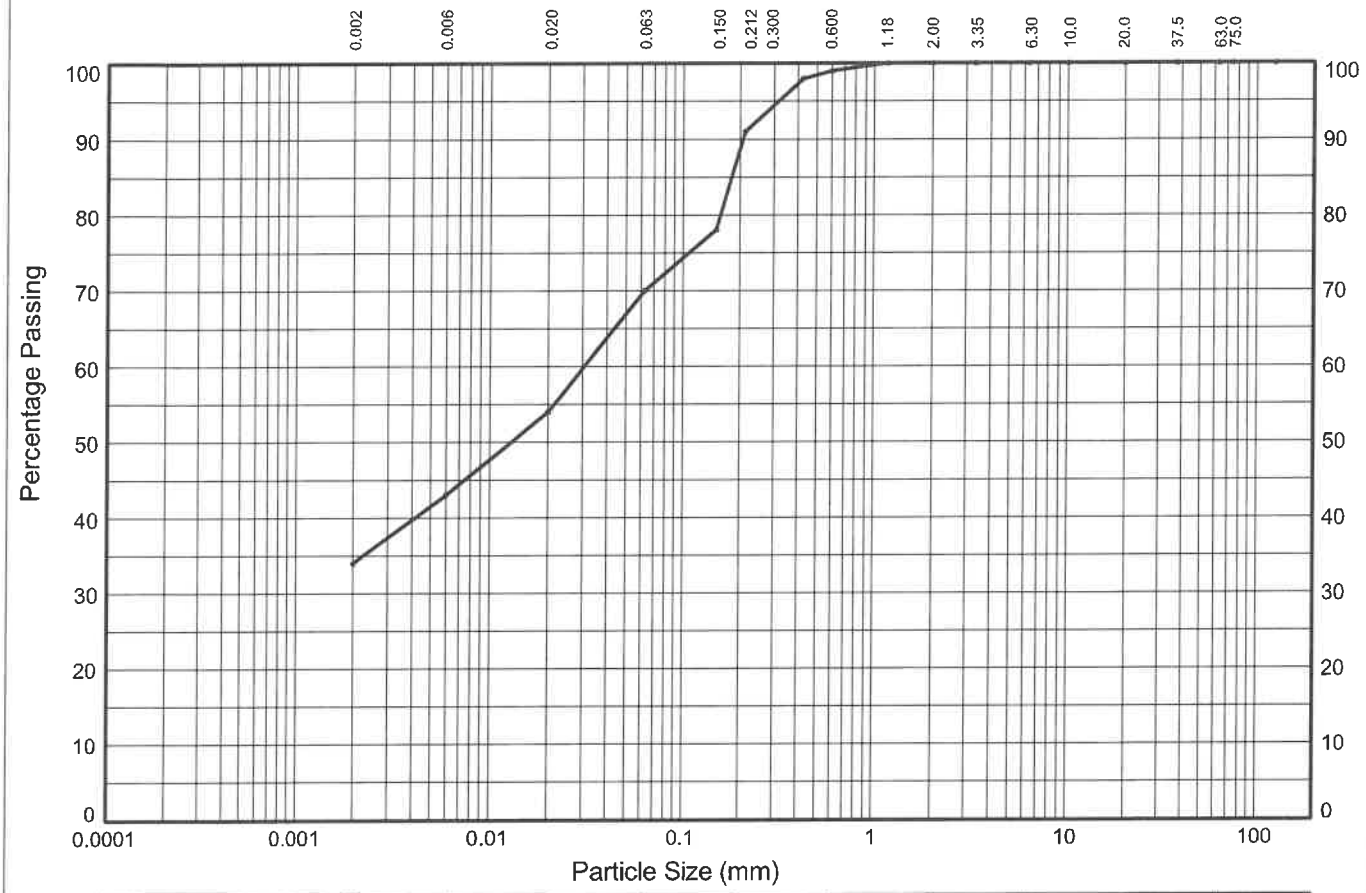
Lab Manager - Satish Ahlawat

CHECKED
10 MAY 2022
BY:

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06012 - NWSPA Mound 2 Strip 1 Layer 2**
Sample Ref: **262446** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	9%	11%	16%	18%	11%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
34%	36%			30%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**98**
0.212	**91**
0.150	**78**
0.063	**70**

Particle Diameter (mm)	Percent Passing (%)
0.02	**54**
0.006	**43**
0.002	**34**
Sedimentation sample was not pre-treated	

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.013**
D_{60} (mm)	**0.031**
D_{85} (mm)	**0.181**
D_{90} (mm)	**0.206**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
D. Richards	DAISY RICHARDS	11/04/22

Contract	Contract Ref:
West Ruislip	**750601**

AGS

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No: **M06012**
Client Sample No: **JM01**
Sample Certificate: **Yes**
Sample Location: **NWSPA, Mound 2, Strip 1, Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **Copthall Tunnel/ SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **25-Jan-22**
Date Received: **25-Jan-22**
Date Tested: **26-Jan-22**
Sample Type: **Disturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.10	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.71	-	-	-	-
Moisture Content (%)	22.4	-	-	-	-
Relative Compaction (%)	96	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06039**
Client Sample No: **JM01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 3 Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **27/01/2022**
Date Received: **27/01/2022**
Date Tested: **28/01/2022**
Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	2	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.07	2.07	-	-	-
In-Situ Dry Density (Mg/m^3)	1.68	1.68	-	-	-
Moisture Content (%)	22.8	22.8	-	-	-
Relative Compaction (%)	94.0	93.9	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06039		
Sample Certificate:	Yes		
Site Reference:	JM01	Date Tested:	27/01/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 3 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	27/01/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1769	1727				
Moisture Content - %	22.9	22.7				
Relative Compaction - %	98.8	96.5				

Average Relative Compaction - %	97.7
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06039

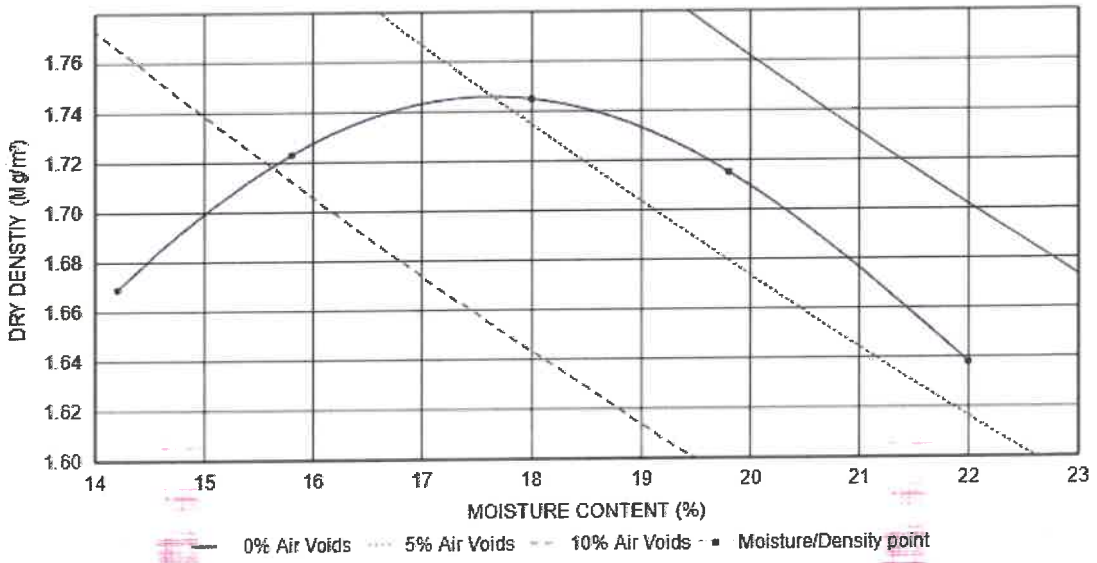
Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 170004.3.1.1		
SAMPLE NUMBER:	264084	CLIENT:	SCS Railways
CLIENT REF:	M06039	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	27/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	03/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	16/02/2022	LOCATION:	Ruislip Sustainable Placements A.V 08-02 NWSPA Mound 2 Strip 3 Layer 2
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Provided

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.75 Mg/m^3
OPTIMUM MOISTURE CONTENT:	18 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.72 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 17-Feb-22

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 170004.2.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	27/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	03/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	10/02/2022	LOCATION:	West Ruislip Retrained Embankment, NWSPA Mound 2 Strip 3 Layers 2
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Provided
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
264084	M06039	Grey Clay 2A	2.72

Remarks:
Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 17-Feb-22

UKAS TESTING
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Kent ME17 1QW

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 863733

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100870**
Client Ref. No:	**264084.1**
Date and Time of Sampling:	**27/01/2022 AM**
Date of Receipt at Lab:	**15/02/2022**
Date of Start of Test:	**24/02/2022**
Sampling Location:	**West Ruislip Retained Embankment, NWSPA Mound 2 Strip 3 Layer 2**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.2 mm	N/A
Height:	105.2 mm	N/A
Moisture Content:	24 %	31 %
Bulk density:	1.91 Mg/m^3	2.11 Mg/m^3
Dry density:	1.54 Mg/m^3	1.62 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.12
Final pore pressure coefficient,B:	1.00
Duration of stage:	7 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**6.1×10^{-11} m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 863734

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100870**
Client Ref. No:	**264084.2**
Date and Time of Sampling:	**27/01/2022 AM**
Date of Receipt at Lab:	**15/02/2022**
Date of Start of Test:	**24/02/2022**
Sampling Location:	**West Ruislip Retained Embankment, NWSPA Mound 2 Strip 3 Layer 2**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.0 mm	N/A
Height:	104.0 mm	N/A
Moisture Content:	26 %	30 %
Bulk density:	1.98 Mg/m^3	2.14 Mg/m^3
Dry density:	1.57 Mg/m^3	1.65 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.34
Final pore pressure coefficient,B:	1.00
Duration of stage:	9 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	4.5×10^{-11} m/s

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06039**	Date Sampled:	**27/01/2022**
Client Sample No:	**JM01**	Date Received:	**27/01/2022**
Sample Certificate:	**Yes**	Date Tested:	**01/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 3 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**64.2**
Plastic Limit	**24.5**
Plasticity Index	**39.7**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **18-Feb-22**

Lab Manager - Satish Ahlawat

STRUCTURAL SOILS LTD

TEST REPORT

Report No. 750601R.01(00) 1774

Date 12-April-2022 Contract West Ruislip

Client Construction Testing Solutions Limited
Address Bootham Lane Industrial Estate
Dunscroft
Doncaster
DN7 4JU

For the Attention of Sasha Mahon

Samples submitted by client	26-January-2022	Client Reference	None
Testing Started	26-January-2022	Client Order No.	None
Testing Completed	11-April-2022	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

Particle Size Distribution sedimentation pipette method BS1377:Part 2: 1990,clause 9.4 (superseded)*

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 1a Princess Street Bedminster Bristol BS3 4AG Tel.0117 9471000. e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **11/04/2022 07:16:58**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Alan Frost (Data Quality Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

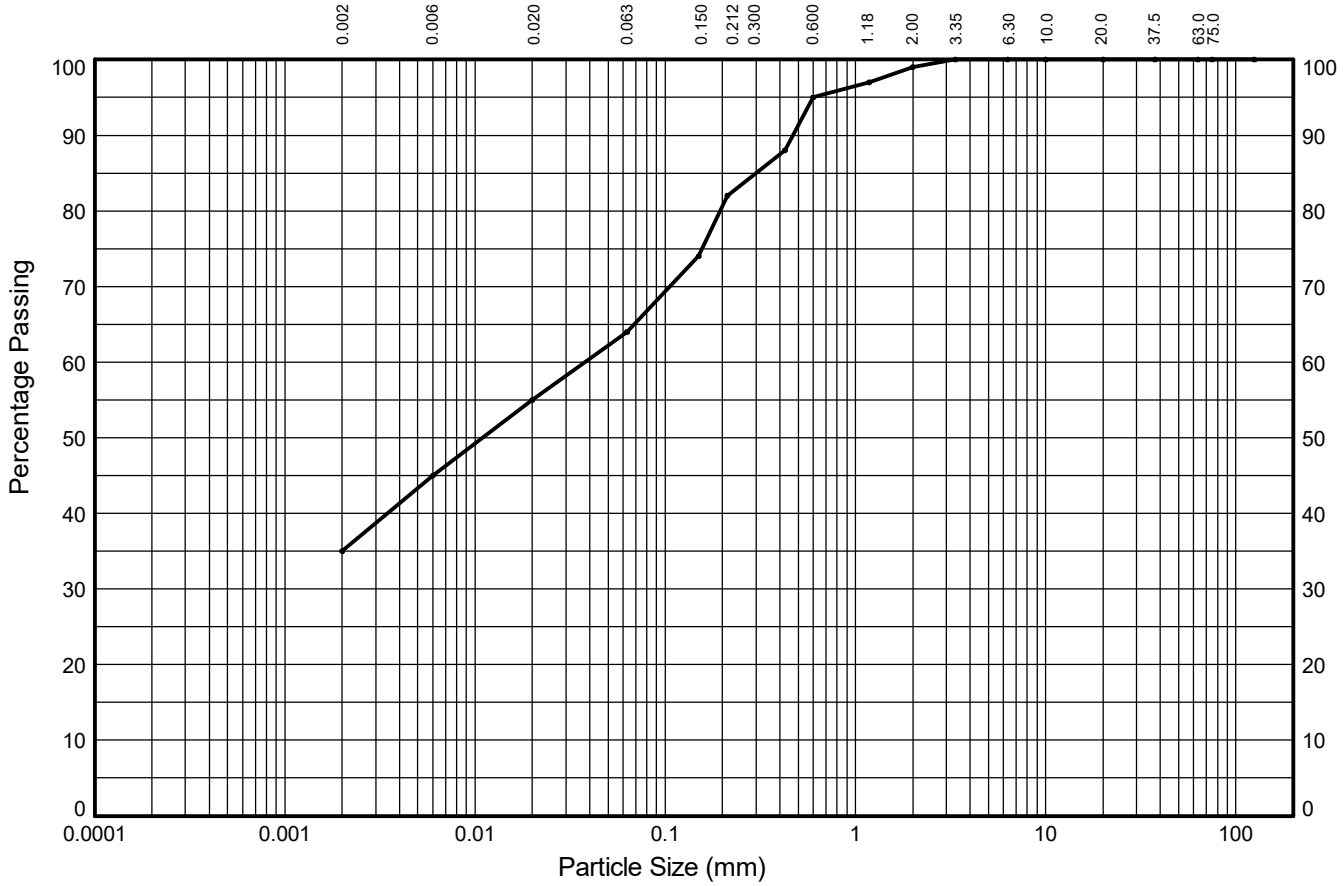
Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

STRUCTURAL SOILS LTD	Contract: **West Ruislip**	Job No: **750601**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06039 - Ruislip Sustainable Placements A. V 08-02 NWSPA Mound 2 Strip 3 Layer 2**
Sample Ref: **264084** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	10%	10%	9%	16%	15%	4%	1%	0%	0%	
	SILT			SAND			GRAVEL			
35%	29%			35%			1%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**99**
1.18	**97**
0.600	**95**
0.425	**88**
0.212	**82**
0.150	**74**
0.063	**64**

Particle Diameter (mm)	Percent Passing (%)
0.02	**55**
0.006	**45**
0.002	**35**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.011**
D_{60} (mm)	**0.038**
D_{85} (mm)	**0.300**
D_{90} (mm)	**0.469**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey sandy slightly gravelly CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
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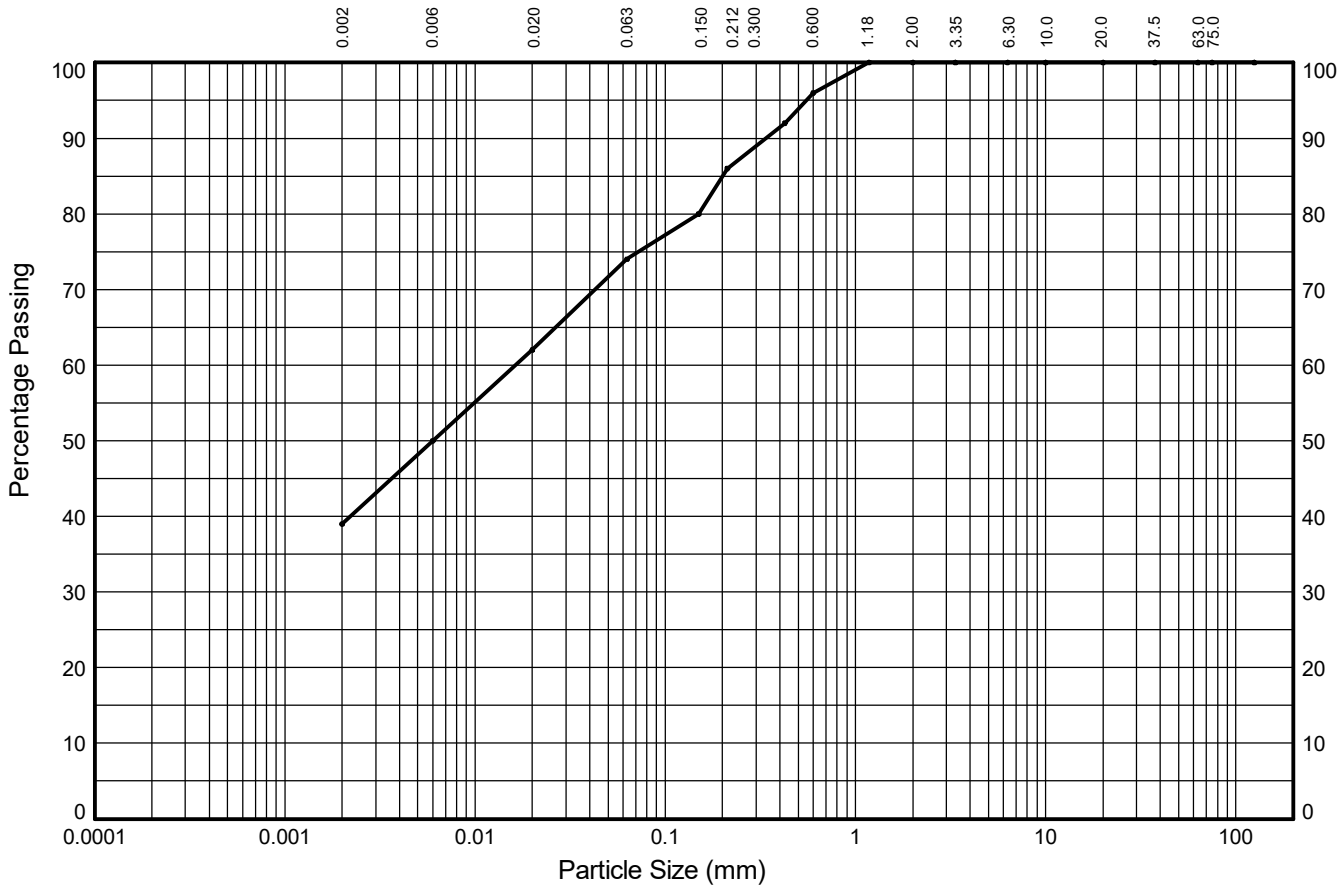
Compiled By		Date
Francesca Bennett	**FRANCESCA BENNETT**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06045 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 3 Layer 3**
Sample Ref: **263520** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	12%	12%	11%	11%	4%	0%	0%	0%	
	SILT			SAND			GRAVEL			
39%	35%			26%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**96**
0.425	**92**
0.212	**86**
0.150	**80**
0.063	**74**

Particle Diameter (mm)	Percent Passing (%)
0.02	**62**
0.006	**50**
0.002	**39**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.006**
D_{60} (mm)	**0.016**
D_{85} (mm)	**0.200**
D_{90} (mm)	**0.337**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

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Compiled By	Date
D. Richards	11/04/22

Contract: **West Ruislip**
Contract Ref: **750601**

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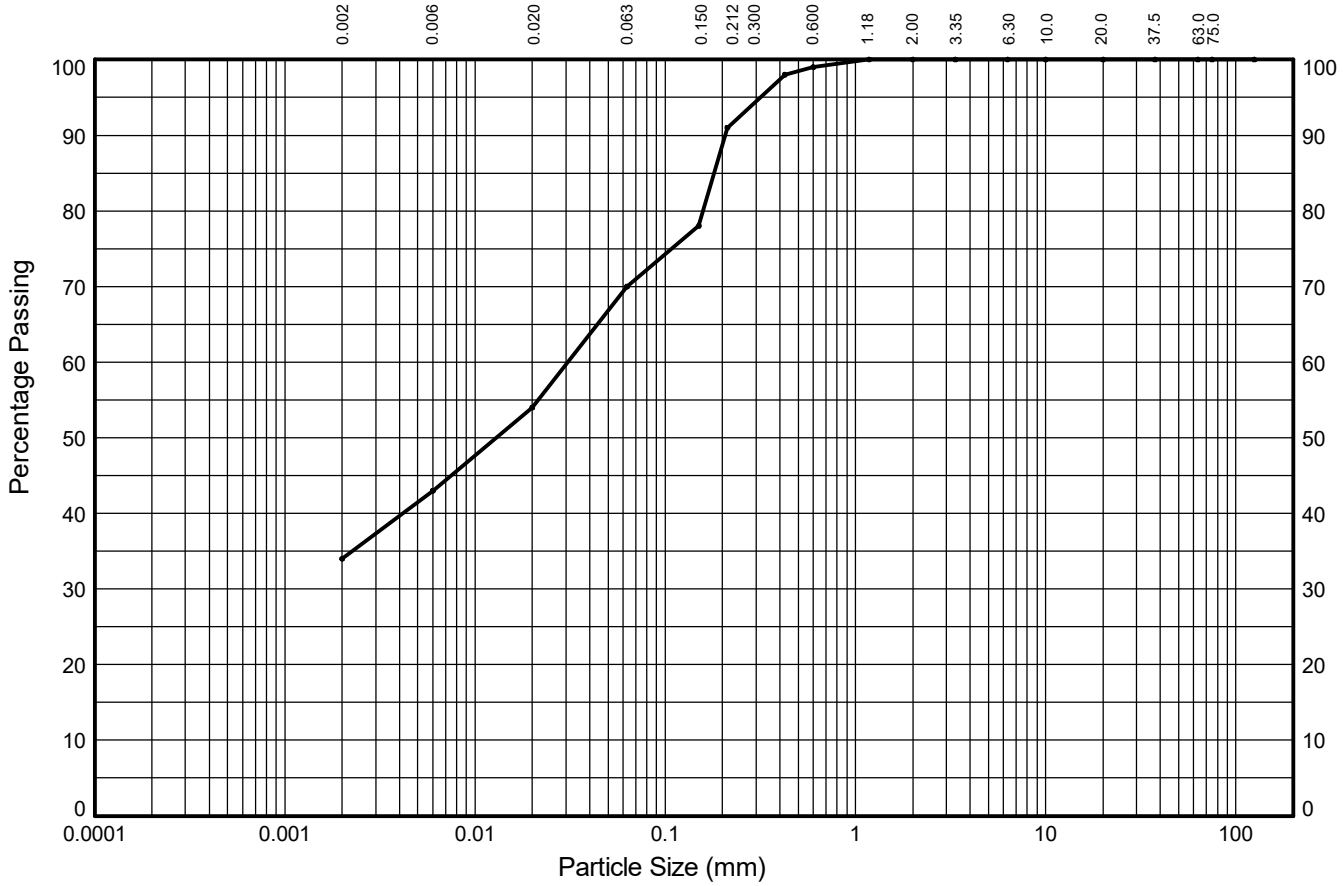
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06012 - NWSPA Mound 2 Strip 1 Layer 2**
Sample Ref: **262446** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	9%	11%	16%	18%	11%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
34%	36%			30%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**98**
0.212	**91**
0.150	**78**
0.063	**70**

Particle Diameter (mm)	Percent Passing (%)
0.02	**54**
0.006	**43**
0.002	**34**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.013**
D_{60} (mm)	**0.031**
D_{85} (mm)	**0.181**
D_{90} (mm)	**0.206**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

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D. Richards	11/04/22
DAISY RICHARDS	

Contract	Contract Ref:
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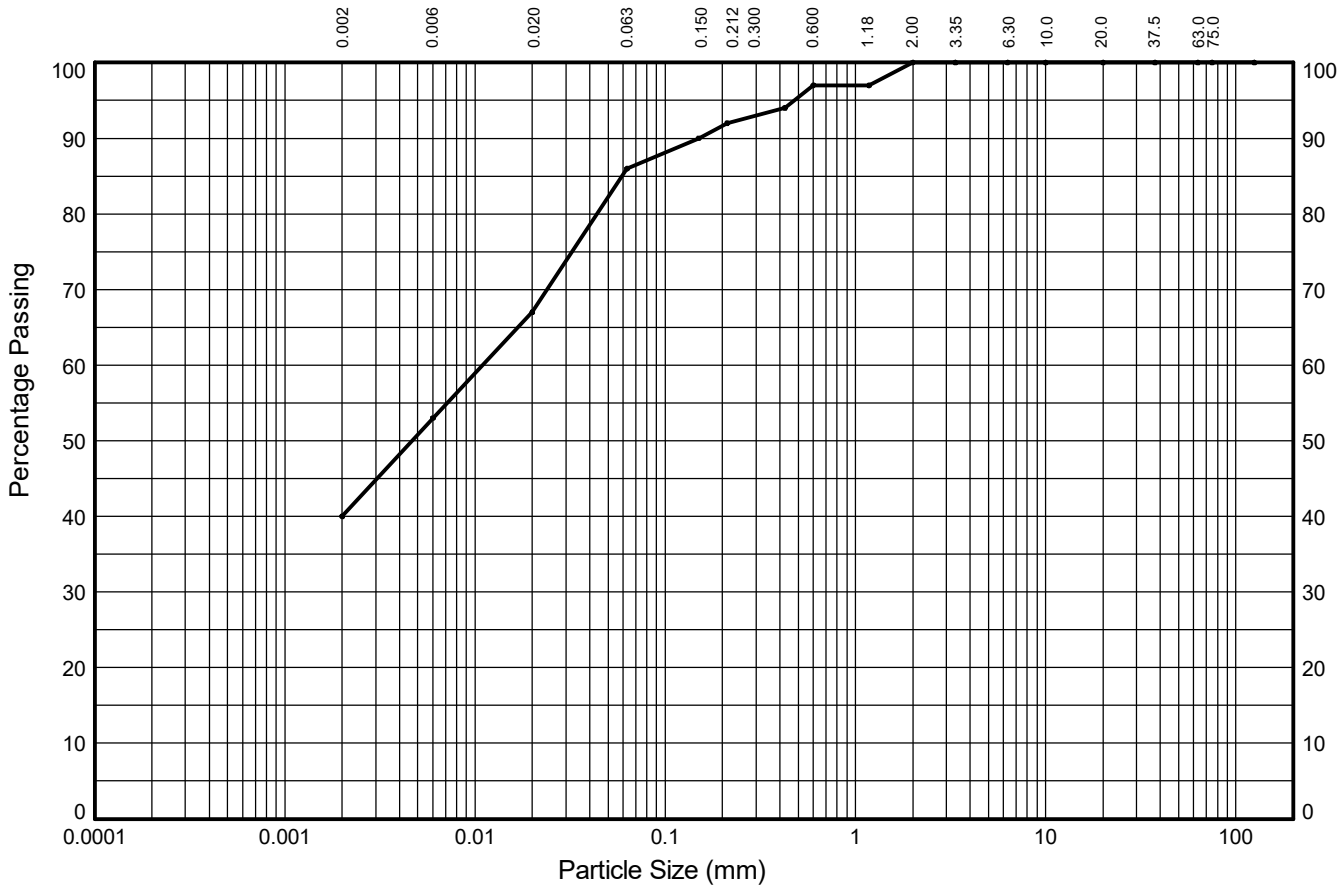
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06064 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 3 Layer 4**
Sample Ref: **263521** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	13%	14%	19%	6%	5%	3%	0%	0%	0%	
	SILT			SAND			GRAVEL			
40%	46%			14%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**97**
0.600	**97**
0.425	**94**
0.212	**92**
0.150	**90**
0.063	**86**

Particle Diameter (mm)	Percent Passing (%)
0.02	**67**
0.006	**53**
0.002	**40**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.005**
D_{60} (mm)	**0.011**
D_{85} (mm)	**0.059**
D_{90} (mm)	**0.150**
C_U	**NA**
C_C	**NA**

Soil Description:
Greyish brown silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

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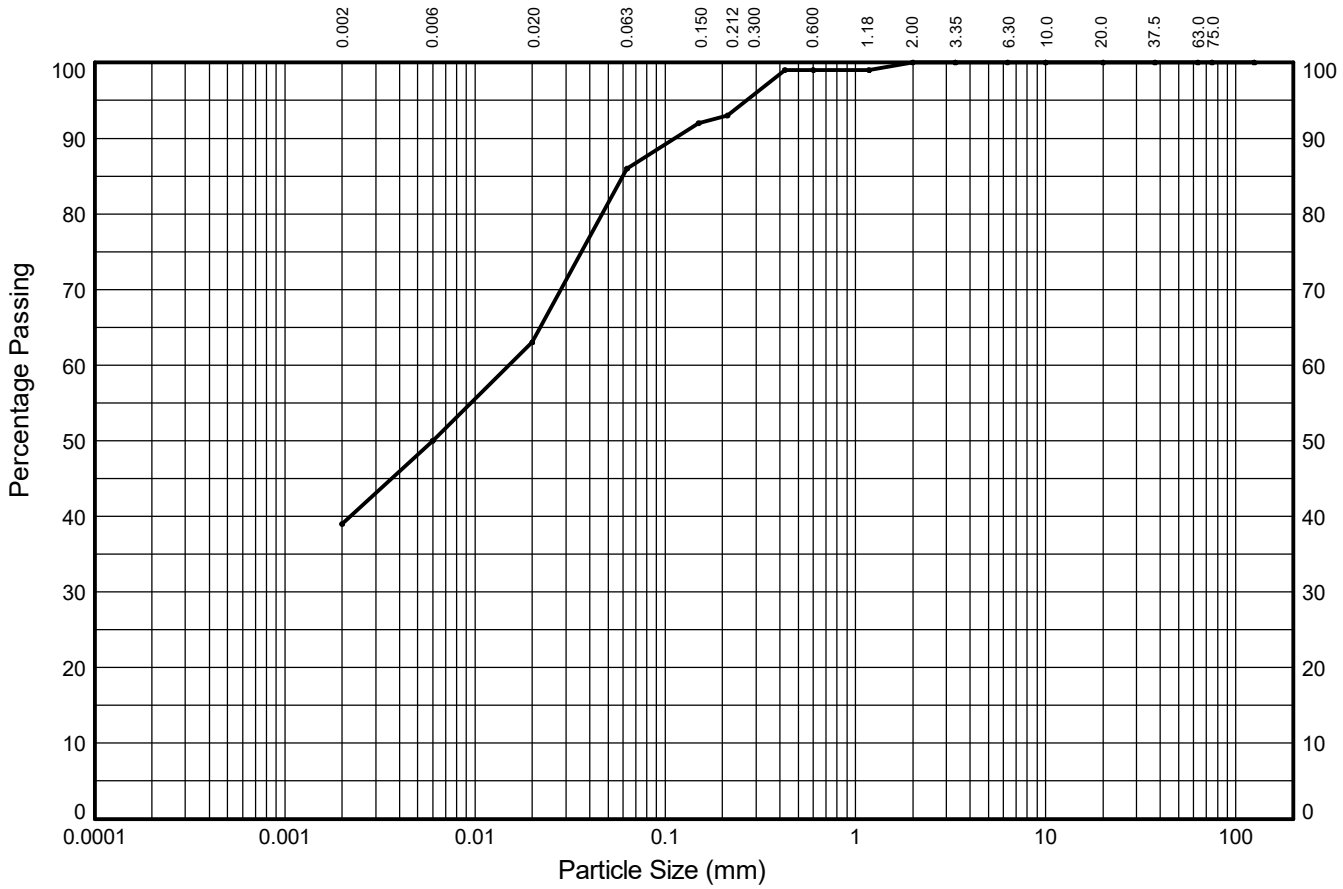
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06065 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 2 Layer 2**
Sample Ref: **263522** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	13%	23%	7%	6%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
39%	47%			14%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**99**
0.600	**99**
0.425	**99**
0.212	**93**
0.150	**92**
0.063	**86**

Particle Diameter (mm)	Percent Passing (%)
0.02	**63**
0.006	**50**
0.002	**39**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.006**
D_{60} (mm)	**0.015**
D_{85} (mm)	**0.060**
D_{90} (mm)	**0.112**
C_U	**NA**
C_C	**NA**

Soil Description:
Brown silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

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Contract	Contract Ref:
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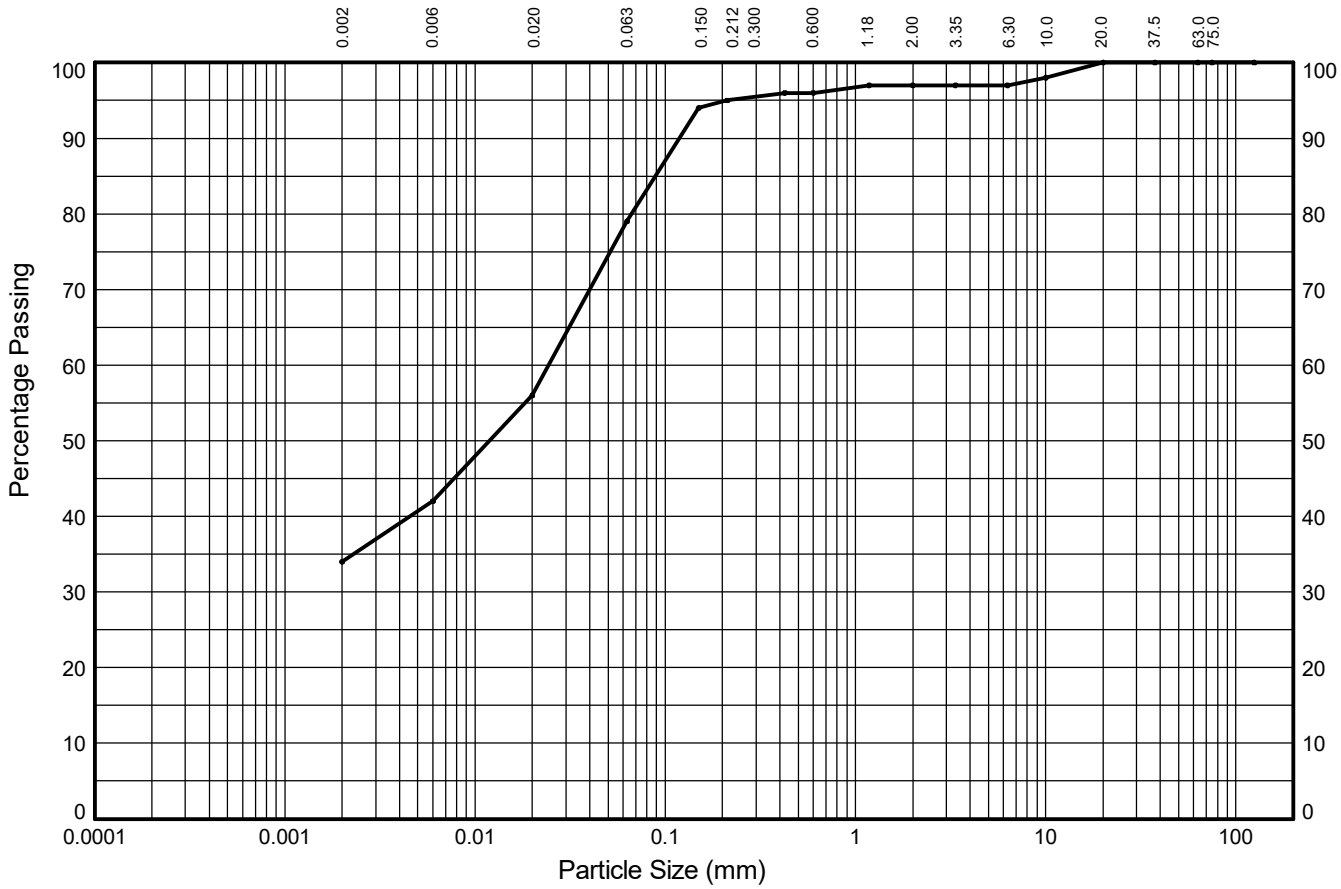
PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06086 - Ruislip Sustainable Placement - NWSAP Mound 2 Strip 2 Layer 4**
Sample Ref: **264085** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	8%	14%	23%	16%	1%	1%	0%	3%	0%	
	SILT			SAND			GRAVEL			
34%	45%			18%			3%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**98**
6.30	**97**
3.35	**97**
2.00	**97**
1.18	**97**
0.600	**96**
0.425	**96**
0.212	**95**
0.150	**94**
0.063	**79**

Particle Diameter (mm)	Percent Passing (%)
0.02	**56**
0.006	**42**
0.002	**34**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.012**
D_{60} (mm)	**0.024**
D_{85} (mm)	**0.089**
D_{90} (mm)	**0.119**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey silty slightly sandy slightly gravelly CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
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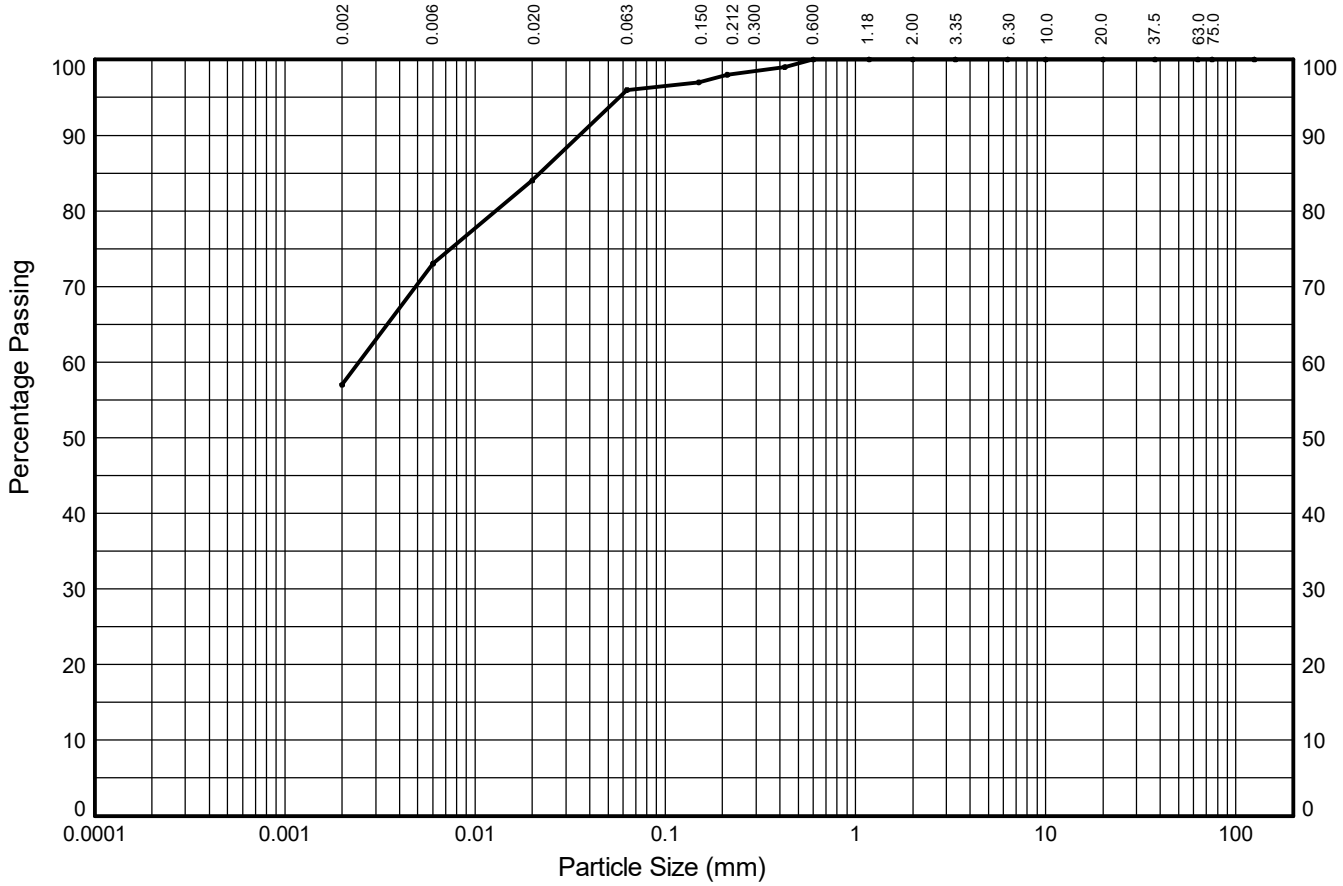
Compiled By		Date
Francesca Bennett	**FRANCESCA BENNETT**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06234 Copthall Tunnel - C1A Excavation**
Sample Ref: **268156** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	16%	11%	12%	2%	2%	0%	0%	0%	0%	
	SILT			SAND			GRAVEL			
57%	39%			4%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**100**
0.425	**99**
0.212	**98**
0.150	**97**
0.063	**96**

Particle Diameter (mm)	Percent Passing (%)
0.02	**84**
0.006	**73**
0.002	**57**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**NA**
D_{60} (mm)	**0.002**
D_{85} (mm)	**0.022**
D_{90} (mm)	**0.035**
C_U	**NA**
C_C	**NA**

Soil Description:
Greenish grey slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
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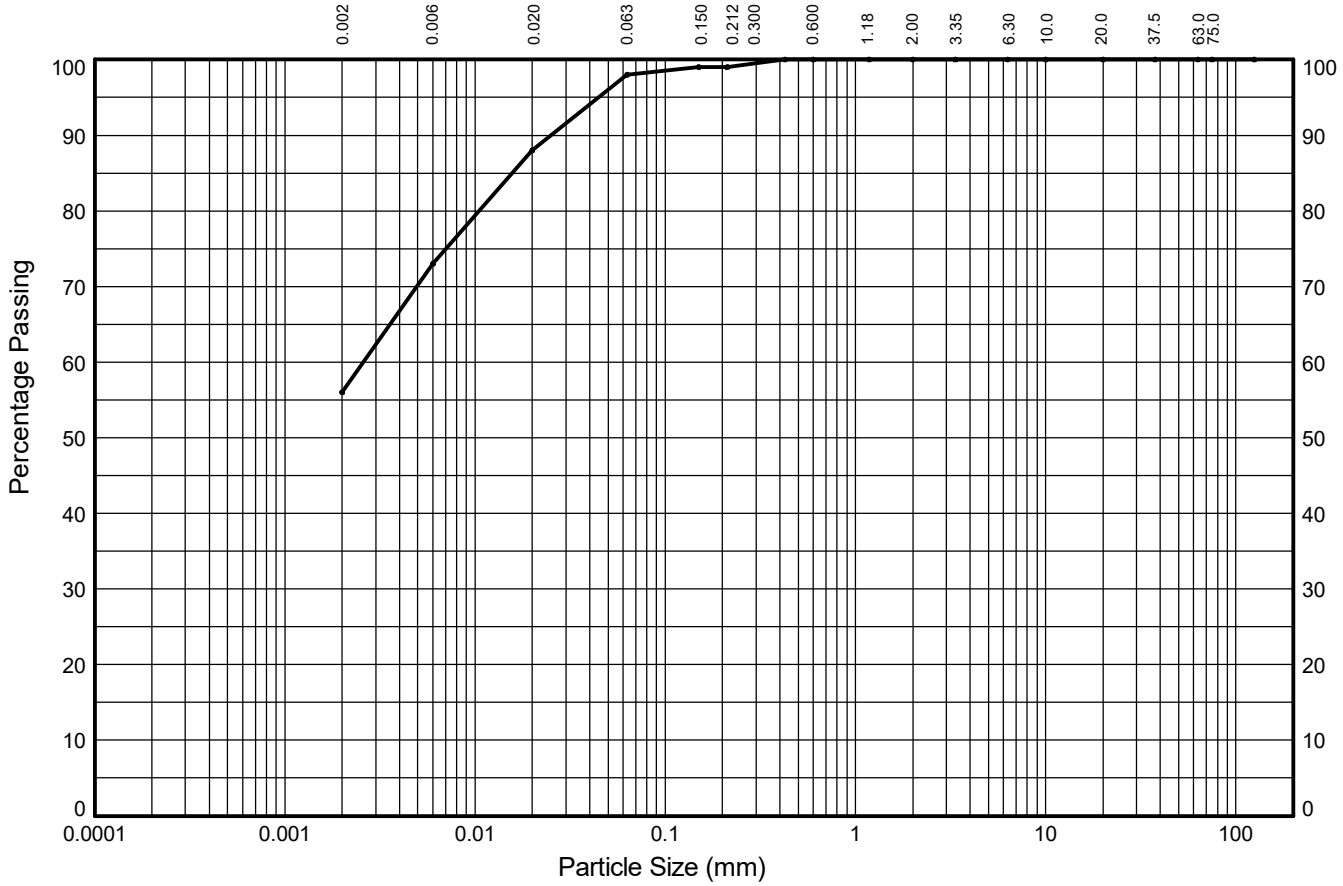
Compiled By		Date
Francesca Bennett	**FRANCESCA BENNETT**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06234 Copthall Tunnel - C1A Excavation**
Sample Ref: **268158** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	17%	15%	10%	1%	1%	0%	0%	0%	0%	
	SILT			SAND			GRAVEL			
56%	42%			2%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**100**
0.425	**100**
0.212	**99**
0.150	**99**
0.063	**98**

Particle Diameter (mm)	Percent Passing (%)
0.02	**88**
0.006	**73**
0.002	**56**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**NA**
D_{60} (mm)	**0.003**
D_{85} (mm)	**0.016**
D_{90} (mm)	**0.025**
C_U	**NA**
C_C	**NA**

Soil Description:
Dark brown slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
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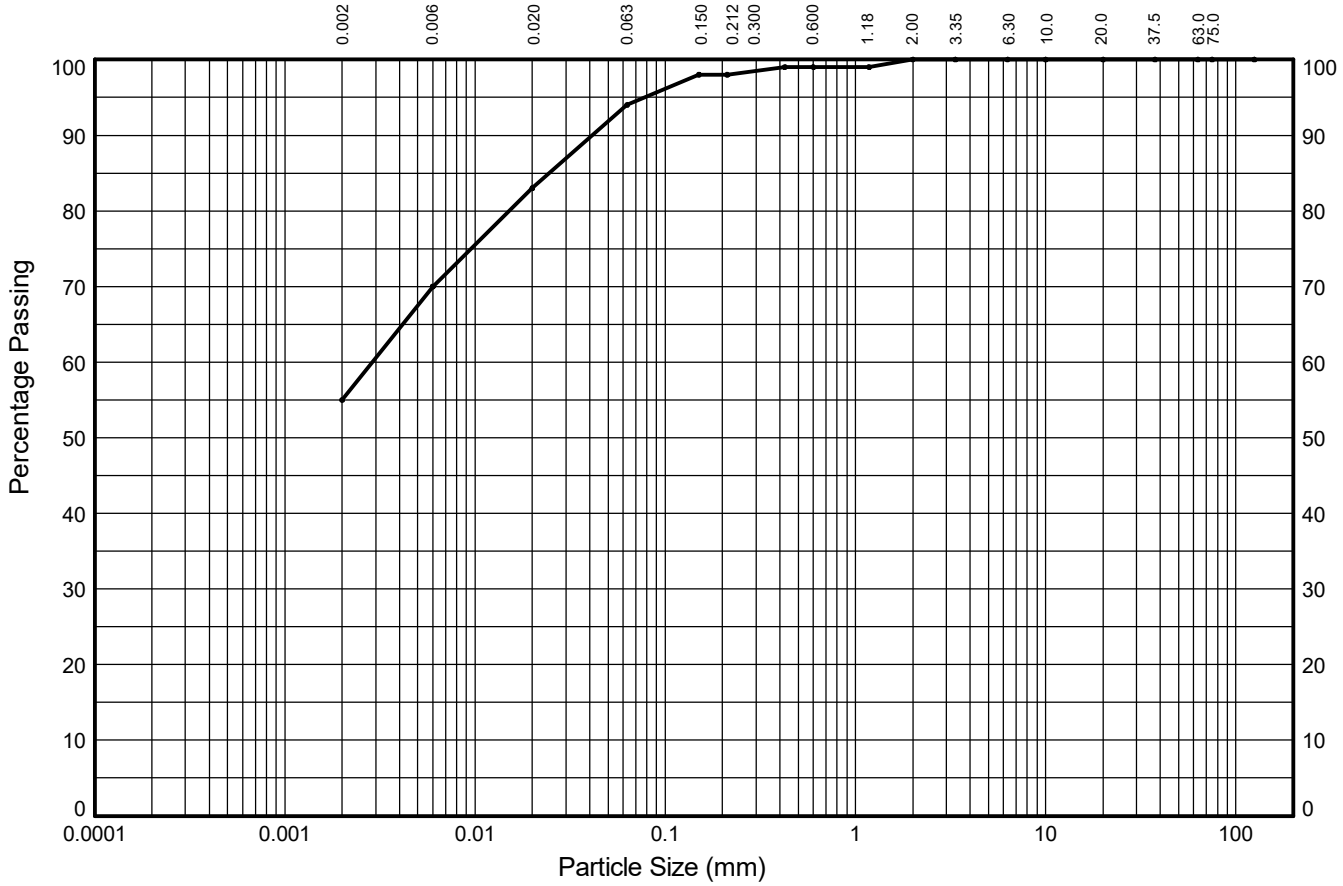
Compiled By		Date
Francesca Bennett	**FRANCESCA BENNETT**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06275 Copthall Tunnel - C1A Excavation**
Sample Ref: **270745** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	15%	13%	11%	4%	1%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
55%	39%			6%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**99**
0.600	**99**
0.425	**99**
0.212	**98**
0.150	**98**
0.063	**94**

Particle Diameter (mm)	Percent Passing (%)
0.02	**83**
0.006	**70**
0.002	**55**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**NA**
D_{60} (mm)	**0.003**
D_{85} (mm)	**0.025**
D_{90} (mm)	**0.042**
C_U	**NA**
C_C	**NA**

Soil Description:
Brown slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
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Compiled By	Date
DAISY RICHARDS	11/04/22

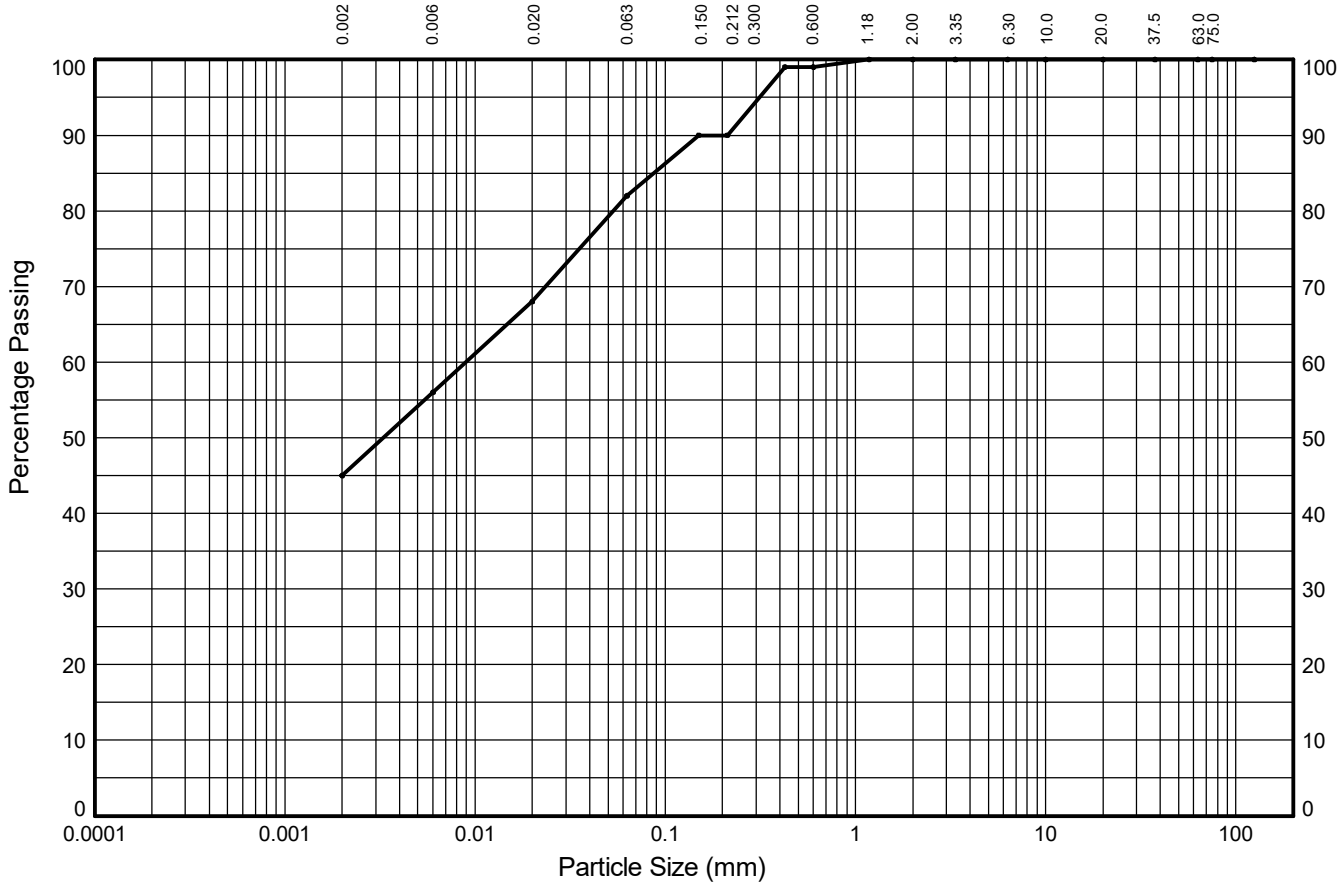
Contract	Contract Ref:
West Ruislip	**750601**

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M05966 North West SPA Attention Lagoon**
Sample Ref: **260784** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	12%	14%	8%	9%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
45%	37%			18%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**99**
0.212	**90**
0.150	**90**
0.063	**82**

Particle Diameter (mm)	Percent Passing (%)
0.02	**68**
0.006	**56**
0.002	**45**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.003**
D_{60} (mm)	**0.009**
D_{85} (mm)	**0.087**
D_{90} (mm)	**0.150**
C_U	**NA**
C_C	**NA**

Soil Description:
Greyish brown slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By	Date
DAISY RICHARDS	11/04/22

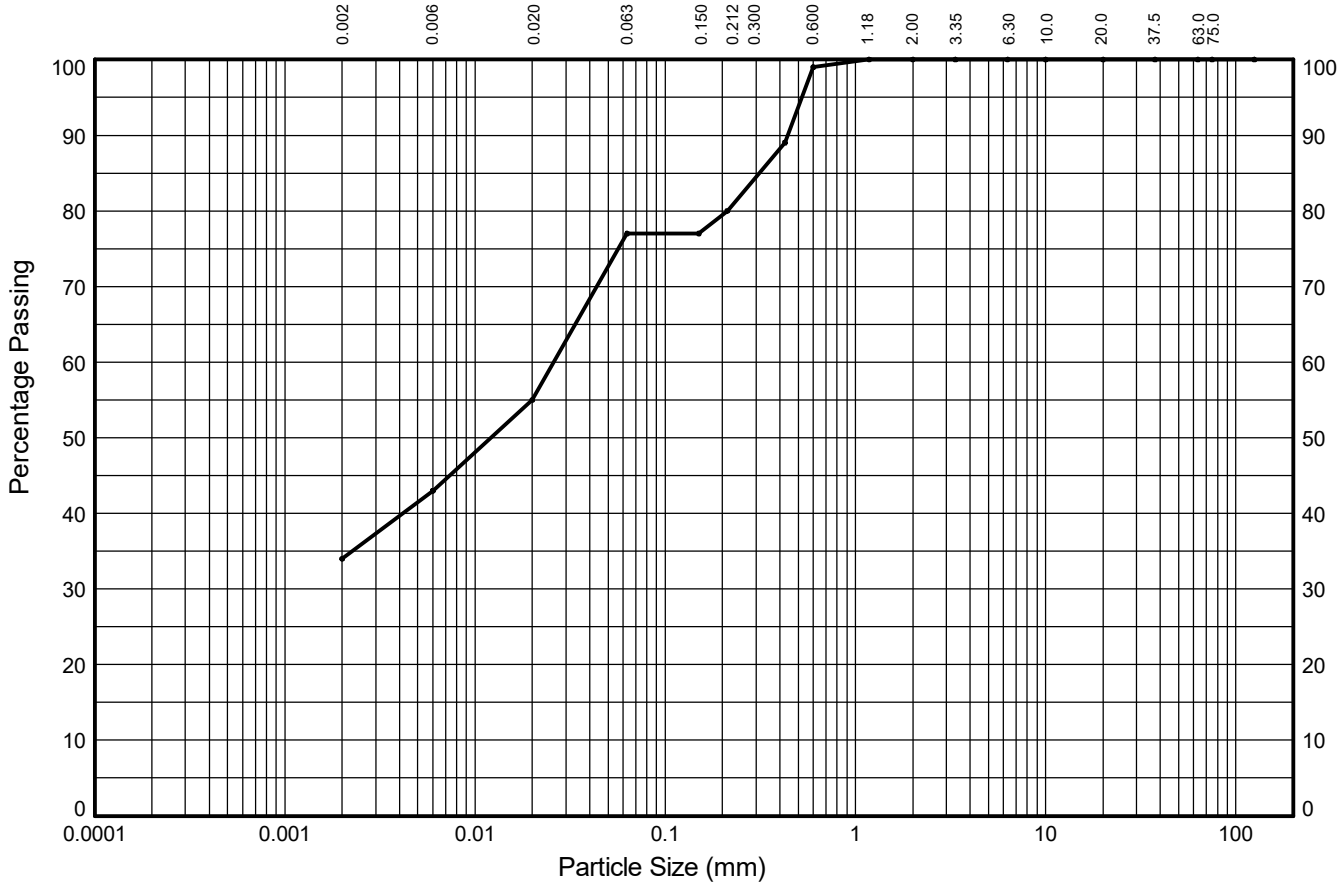
Contract	Contract Ref:
West Ruislip	**750601**

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M05976 NWSPA Mound 2 Strip 1 Layer 1**
Sample Ref: **262257** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	9%	12%	22%	2%	20%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
34%	43%			23%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**89**
0.212	**80**
0.150	**77**
0.063	**77**

Particle Diameter (mm)	Percent Passing (%)
0.02	**55**
0.006	**43**
0.002	**34**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.012**
D_{60} (mm)	**0.026**
D_{85} (mm)	**0.312**
D_{90} (mm)	**0.440**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By	Date
DAISY RICHARDS	**11/04/22**

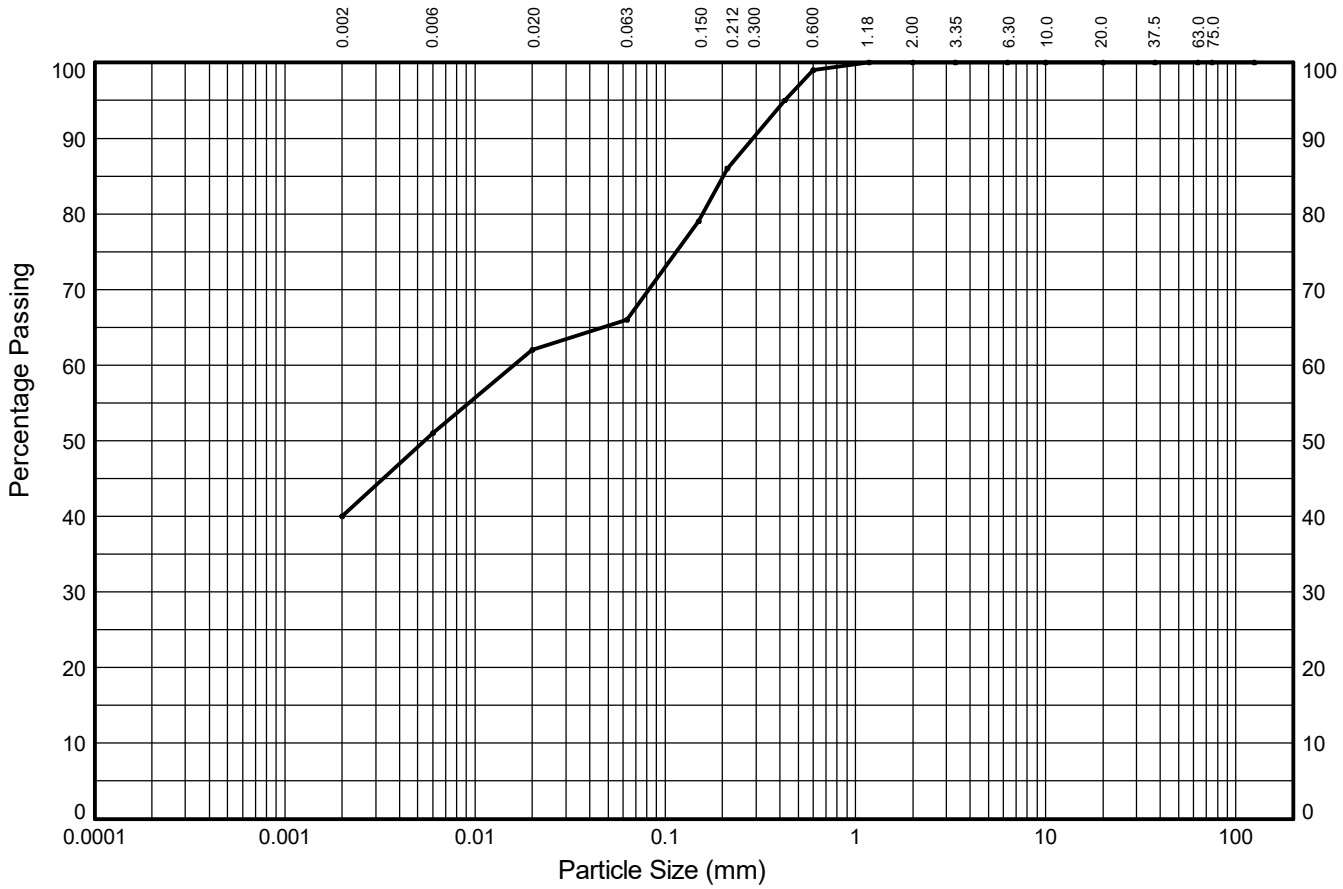
Contract	Contract Ref:
West Ruislip	**750601**

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06163 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 4 Layer 4**
Sample Ref: **266049** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	11%	4%	19%	14%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
40%	26%			34%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**95**
0.212	**86**
0.150	**79**
0.063	**66**

Particle Diameter (mm)	Percent Passing (%)
0.02	**62**
0.006	**51**
0.002	**40**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.005**
D_{60} (mm)	**0.016**
D_{85} (mm)	**0.202**
D_{90} (mm)	**0.289**
C_U	**NA**
C_C	**NA**

Soil Description:
Dark grey slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
Francesca Bennett	**FRANCESCA BENNETT**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No: **M06039**
Client Sample No: **JM01**
Sample Certificate: **Yes**
Sample Location: **NWSPA, Mound 2, Strip 3, Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **Copthall Tunnel/ SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **27-Jan-22**
Date Received: **27-Jan-22**
Date Tested: **28-Jan-22**
Sample Type: **Disturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	1	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.12	2.12	-	-	-
In-Situ Dry Density (Mg/m^3)	1.72	1.72	-	-	-
Moisture Content (%)	23.2	23.0	-	-	-
Relative Compaction (%)	96	96.2	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

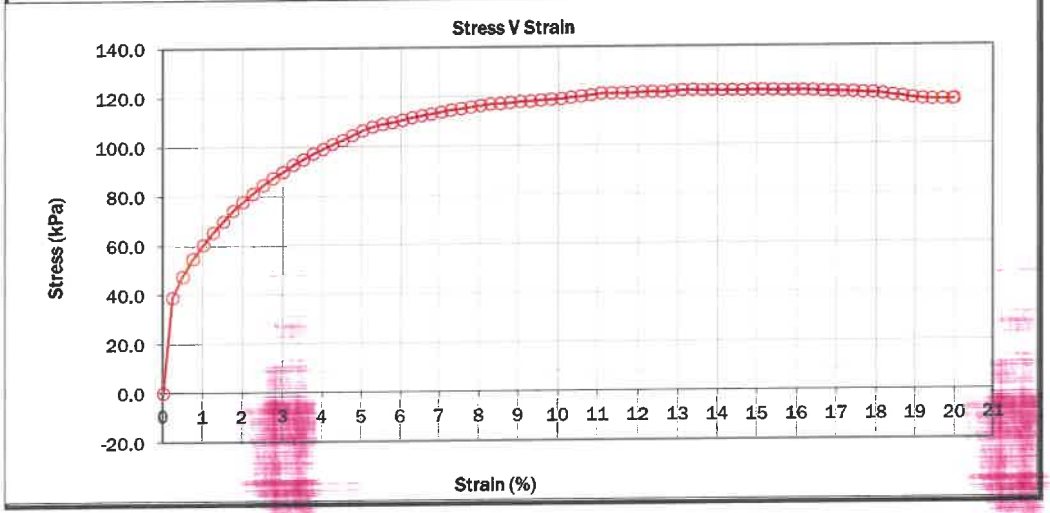
Construction Testing Solutions

DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 170004.7.1.1	CLIENT:	SCS Railways
SAMPLE No.:	264084	ADDRESS:	Black Arrow House
CLIENT REF:	M06039	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	27/01/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay
		LOCATION:	Ruislip Sustainable Placements A.V 09-02 NWSPA Mound 2 Strip 3 Layer 2
DATE RECEIVED:	03/02/2022		
DATE TEST COMPLETED:	17/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	2.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 2.5kg rammer at as received moisture content.		
Initial specimen height	200.1	mm
Initial specimen diameter	100.2	mm
Initial bulk density	1.96	Mg/m^3
Initial moisture content	31	%
Initial dry density	1.50	Mg/m^3
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.6	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	122	kPa
Strain at failure	13.3	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**61**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

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For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor

17-Feb-22

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Report Format: L/Rep UDSS/rev.1

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06045**
Client Sample No: **JM01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 3 Layer 3**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **28/01/2022**
Date Received: **28/01/2022**
Date Tested: **28/01/2022**
Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	2	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.15	2.16	-	-	-
In-Situ Dry Density (Mg/m^3)	1.74	1.75	-	-	-
Moisture Content (%)	23.6	23.5	-	-	-
Relative Compaction (%)	97.1	97.8	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06045		
Sample Certificate:	Yes		
Site Reference:	JM01	Date Tested:	28/01/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 3 Layer 3		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	28/01/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1729	1738				
Moisture Content - %	22.5	22.8				
Relative Compaction - %	96.6	97.1				

Average Relative Compaction - %	96.8
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06045

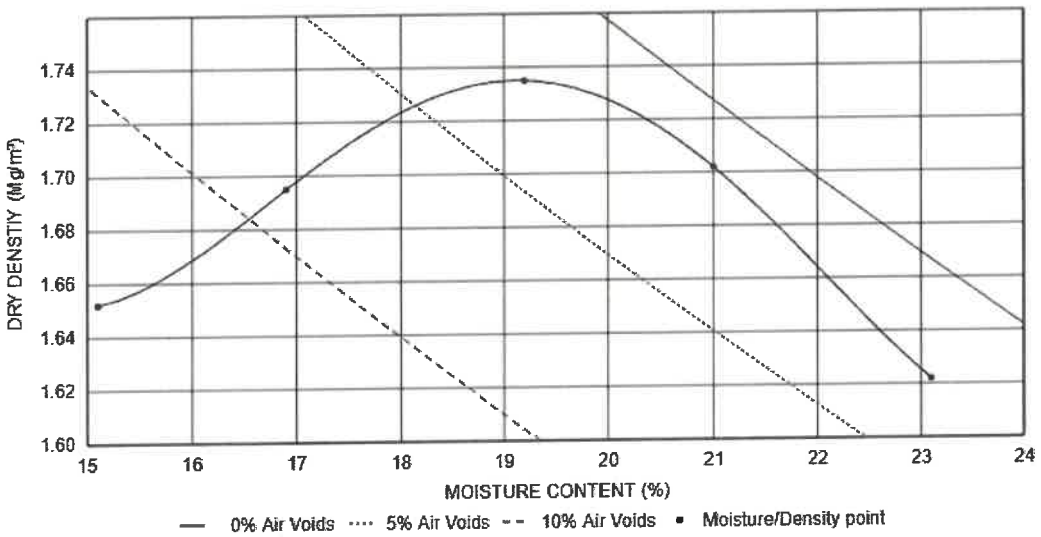
Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 169657.2.1.1		
SAMPLE NUMBER:	263520	CLIENT:	SCS Railways
CLIENT REF:	M06045	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	28/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	21/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 3 Layer 3
TESTED BY:	James Gough	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Provided

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.74 Mg/m^3
OPTIMUM MOISTURE CONTENT:	19 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.71 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 21-Feb-22

UKAS TESTING
0927

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

0343 227 8545
enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 169657.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	28/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	09/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 3 Layer 3
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Provided
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
263520	M06045	Grey Clay 2A	2.71

Remarks:
Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 21-Feb-22

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Harrietsham, Nr Maidstone
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06045**	Date Sampled:	**28/01/2022**
Client Sample No:	**JM01**	Date Received:	**28/01/2022**
Sample Certificate:	**Yes**	Date Tested:	**02/02/2022**
Sample Location:	**Ruislip Sustainable Placements,NWSPA Mound 2 Strip 3 Layer 3**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**63**
Plastic Limit	**23.7**
Plasticity Index	**39.3**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

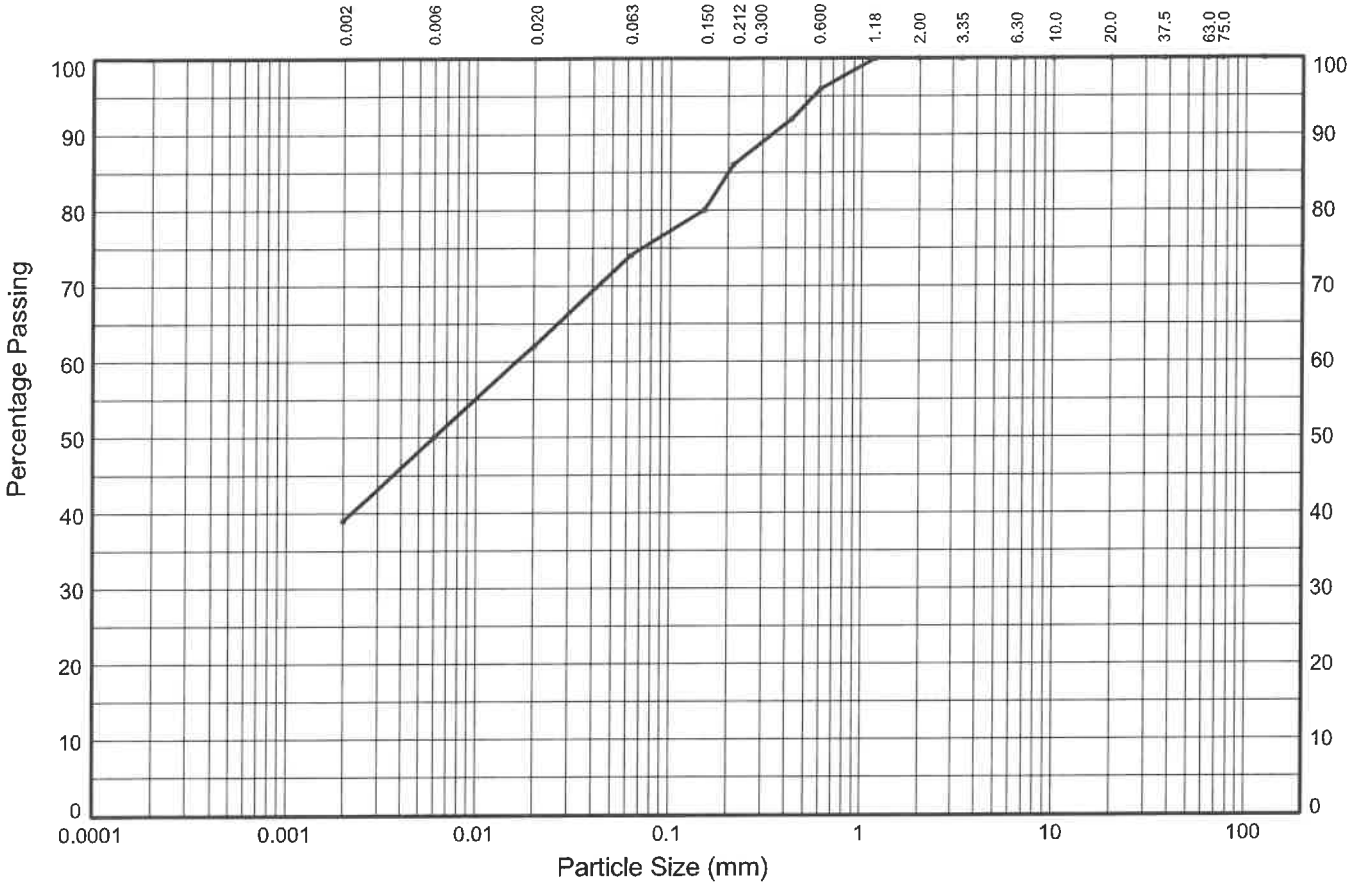
Dated: **01-Mar-22**

Lab Manager - Satish Ahlawat

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06045 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 3 Layer 3**
Sample Ref: **263520** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	12%	12%	11%	11%	4%	0%	0%	0%	
	SILT			SAND			GRAVEL			
39%	35%			26%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**96**
0.425	**92**
0.212	**86**
0.150	**80**
0.063	**74**

Particle Diameter (mm)	Percent Passing (%)
0.02	**62**
0.006	**50**
0.002	**39**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.006**
D_{60} (mm)	**0.016**
D_{85} (mm)	**0.200**
D_{90} (mm)	**0.337**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
D. Richards	DAISY RICHARDS	11/04/22

Contract	Contract Ref:
West Ruislip	**750601**

AGS

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, Chandos Road, NW10 6NF**
Contract Name:	**High Speed 2 - Main Works**

Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06045**	Date Sampled:	**28-Jan-22**
Client Sample No:	**JM01**	Date Received:	**28-Jan-22**
Sample Certificate:	**Yes**	Date Tested:	**29-Jan-22**
Sample Location:	**NWSPA, Mound 2, Strip 3, Layer 3**		
Material Description:	**Grey Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Disturbed**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	1	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.11	2.13	-	-	-
In-Situ Dry Density (Mg/m^3)	1.71	1.72	-	-	-
Moisture Content (%)	23.4	23.5	-	-	-
Relative Compaction (%)	96	96.3	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager - Satish Ahlawat

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Construction Testing Solutions

CHECKED
BY:

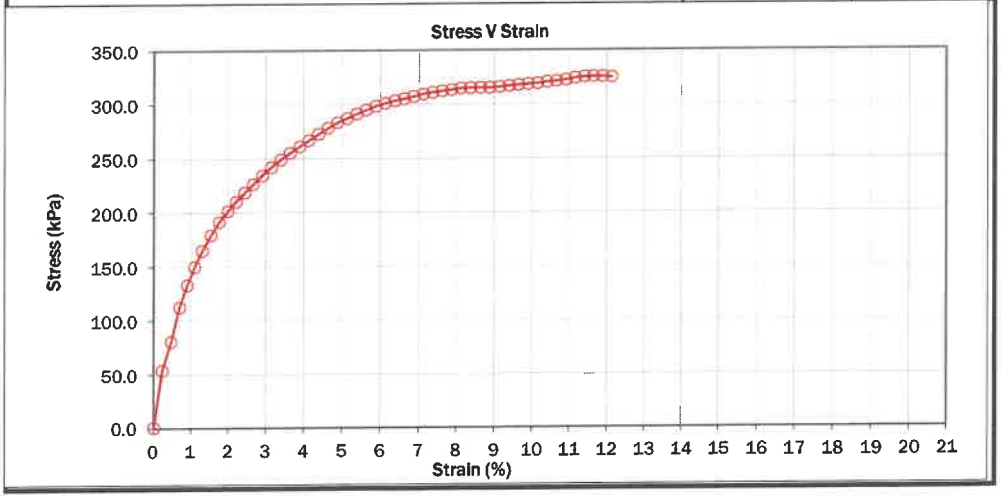
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 169657.5.1.1	CLIENT:	SCS Railways
SAMPLE No.:	263520	ADDRESS:	Black Arrow House
CLIENT REF:	M06045	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	28/01/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay
DATE RECEIVED:	02/02/2022	LOCATION:	Sustainable Placement, NWSPA Mound 2 Strip 3 Layer 3
DATE TEST COMPLETED:	16/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	4.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height	200.4	mm
Initial specimen diameter	100.2	mm
Initial bulk density	2.05	Mg/m³
Initial moisture content	24	%
Initial dry density	1.65	Mg/m³
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.5	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	325	kPa
Strain at failure	11.6	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**162**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

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For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor
Mike Gray - Senior Technician

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Report Format: L/Rep UDSS/rev.1

17-Feb-22

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06064**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 3 Layer 4**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **31/01/2022**
Date Received: **31/01/2022**
Date Tested: **01/02/2022**

Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	2	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.11	2.11	-	-	-
In-Situ Dry Density (Mg/m^3)	1.71	1.71	-	-	-
Moisture Content (%)	23.0	23.2	-	-	-
Relative Compaction (%)	95.6	95.5	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06064		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	31/01/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 3 Layer 4		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	31/01/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1726	1721				
Moisture Content - %	22.5	22				
Relative Compaction - %	96.4	96.1				

Average Relative Compaction - %	96.3
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06064

Construction Testing Solutions

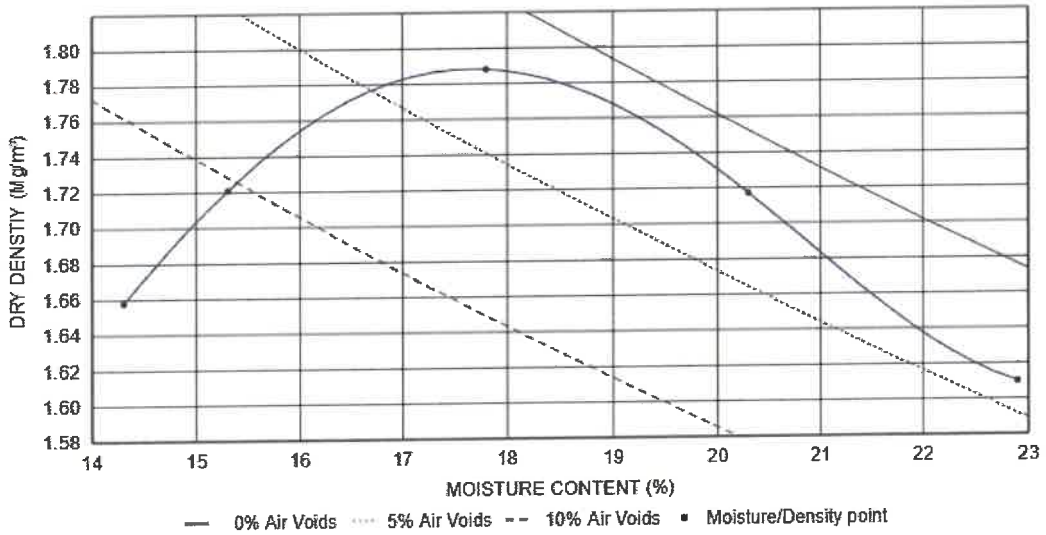
CHECKED
BY:

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 169657.7.1.1		
SAMPLE NUMBER:	263521	CLIENT:	SCS Railways
CLIENT REF:	M06064	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	31/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	08/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 3 Layer 4
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None		

RESULT:

MAXIMUM DRY DENSITY:	1.79 Mg/m^3
OPTIMUM MOISTURE CONTENT:	18 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.72 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 09-Feb-22

UKAS TESTING
0927

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

CHECKED
11 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 169657.6.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	31/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	09/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 3 Layer 4
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Provided
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
263521	M06064	Grey Clay 2A	2.72

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Mike Gray - Laboratory Supervisor

Approved Signatory
Report date 11-Feb-22

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END OF REPORT

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Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861170

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**263521.1 (M06064)**
Date and Time of Sampling:	**31/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 3, Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	mm	N/A
Height:	mm	N/A
Moisture Content:	21 %	24 %
Bulk density:	2.04 Mg/m^3	2.10 Mg/m^3
Dry density:	1.69 Mg/m^3	1.70 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.26
Final pore pressure coefficient,B:	0.96
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**2.6×10^{-11} m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861171

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**263521.2 (M06064)**
Date and Time of Sampling:	**31/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 3, Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

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18 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	100.8 mm	N/A
Height:	103.0 mm	N/A
Moisture Content:	20 %	23 %
Bulk density:	2.05 Mg/m^3	2.16 Mg/m^3
Dry density:	1.71 Mg/m^3	1.74 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.18
Final pore pressure coefficient,B:	0.96
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**2.0×10^{-11} m/s**

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06064**	Date Sampled:	**31/01/2022**
Client Sample No:	**AV01**	Date Received:	**31/01/2022**
Sample Certificate:	**Yes**	Date Tested:	**10/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 3 Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**68.40**
Plastic Limit	**24.2**
Plasticity Index	**44.2**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

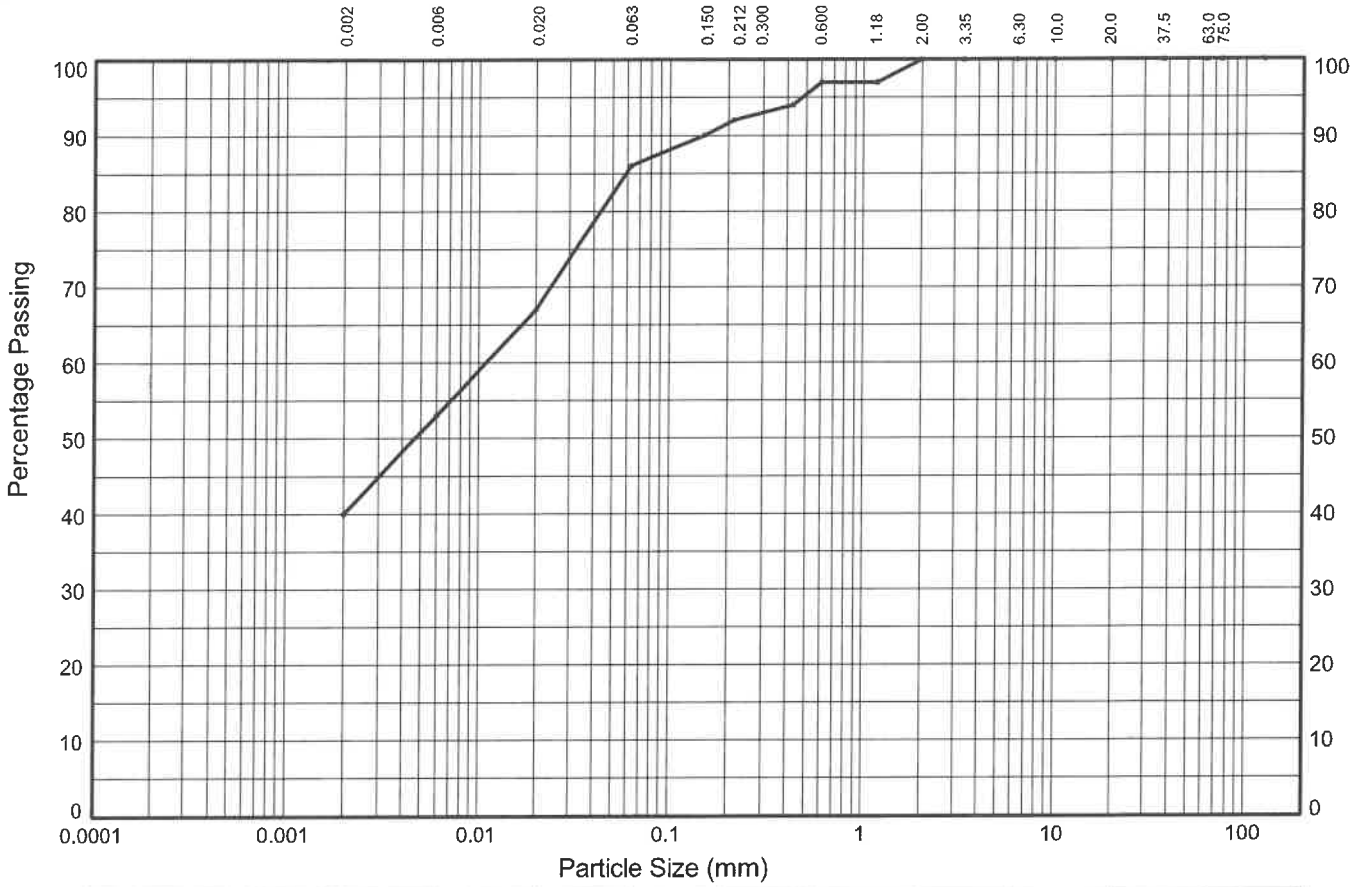
Dated: **18-Feb-22**

Lab Manager - Satish Ahlawat

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06064 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 3 Layer 4**
Sample Ref: **263521** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	13%	14%	19%	6%	5%	3%	0%	0%	0%	
	SILT			SAND			GRAVEL			
40%	46%			14%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**97**
0.600	**97**
0.425	**94**
0.212	**92**
0.150	**90**
0.063	**86**

Particle Diameter (mm)	Percent Passing (%)
0.02	**67**
0.006	**53**
0.002	**40**
Sedimentation sample was not pre-treated	

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.005**
D_{60} (mm)	**0.011**
D_{85} (mm)	**0.059**
D_{90} (mm)	**0.150**
C_U	**NA**
C_C	**NA**

Soil Description:
Greyish brown silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By	Date
DAISY RICHARDS	11/04/22

Contract	Contract Ref:
West Ruislip	**750601**

AGS

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No: **M06064**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **NWSPA, Mound 2, Strip 3, Layer 4**
Material Description: **Grey Clay**
Source/Supplier: **Copthall Tunnel/ SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **31-Jan-22**
Date Received: **31-Jan-22**
Date Tested: **01-Feb-22**
Sample Type: **Disturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.10	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.72	-	-	-	-
Moisture Content (%)	22.3	-	-	-	-
Relative Compaction (%)	96	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

CHECKED
BY:

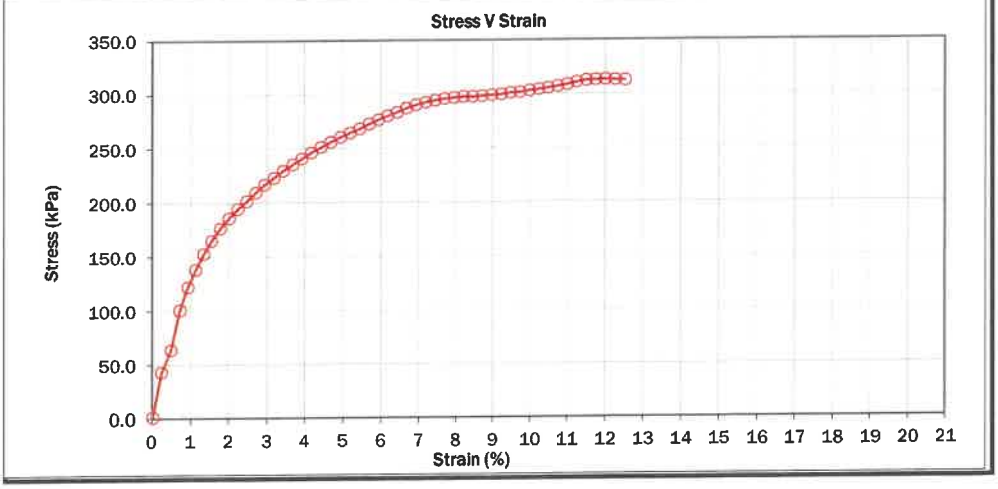
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 169657.11.1.1	CLIENT:	SCS Railways
SAMPLE No.:	263521	ADDRESS:	Black Arrow House
CLIENT REF:	M06064	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	31/01/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay
		LOCATION:	Ruislip Sustainable Placement,NWSPA Mound 2 Strip 3 Layer 4
DATE RECEIVED:	02/02/2022		
DATE TEST COMPLETED:	16/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	4.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height	200.3	mm
Initial specimen diameter	100.2	mm
Initial bulk density	2.03	Mg/m³
Initial moisture content	25	%
Initial dry density	1.63	Mg/m³
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.5	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	312	kPa
Strain at failure	12.0	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**156**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

This report shall not be reproduced except in full without approval of the laboratory.

For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor
Mike Gray - Senior Technician

UKAS TESTING

Report Format: L/Rep UDSS/rev.1

17-Feb-22

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06065**
Client Sample No: **AV02**
Sample Certificate: **Yes**
Sample Location: **NWSPA, Mound 2, Strip 2, Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **31/01/2022**
Date Received: **31/01/2022**
Date Tested: **01/02/2022**
Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	2	-	-	-
Test Location	1	2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.09	2.09	-	-	-
In-Situ Dry Density (Mg/m^3)	1.68	1.67	-	-	-
Moisture Content (%)	24.5	25.2	-	-	-
Relative Compaction (%)	95.8	95.2	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.75 Mg/m^3

Remarks:

Signed:

Dated: **17-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06065		
Sample Certificate:	Yes		
Site Reference:	AV02	Date Tested:	31/01/2021
Test/ Sample Location:	NWSPA, Mound 2 Strip 2 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	31/01/2022

Maximum Dry Density of the Material - kg/m³	1750

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1816	1804				
Moisture Content - %	23.4	23.3				
Relative Compaction - %	103.8	103.1				

Average Relative Compaction - %	103.4
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06065

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06065**	Date Sampled:	**31-Jan-22**
Client Sample No:	**AV02**	Date Received:	**31-Jan-22**
Sample Certificate:	**Yes**	Date Tested:	**01-Feb-22**
Sample Location:	**NWSPA Mound 2 Strip 2 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Bulk**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	1	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.09	2.09	-	-	-
In-Situ Dry Density (Mg/m^3)	1.66	1.67	-	-	-
Moisture Content (%)	25.9	25.3	-	-	-
Relative Compaction (%)	95	95.3	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.75 Mg/m^3

Remarks:

Signed:

Dated: **17-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

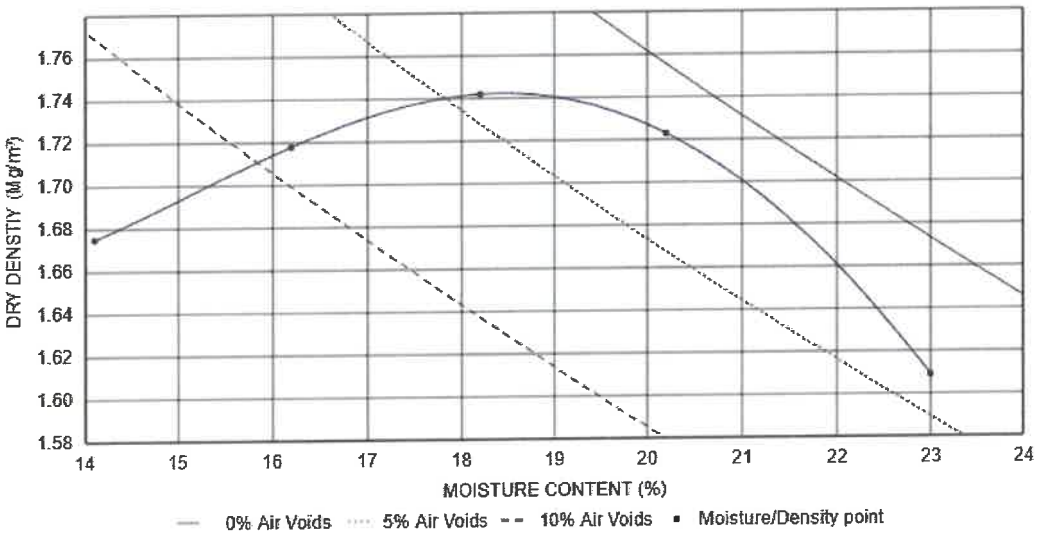
CHECKED
15 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 169657.13.1.1		
SAMPLE NUMBER:	263522	CLIENT:	SCS Railways
CLIENT REF:	M06065	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	31/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	10/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 Layer 2
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Provided

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.74 Mg/m^3
OPTIMUM MOISTURE CONTENT:	18 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.72 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 11-Feb-22

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

CHECKED
11 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 169657.12.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	31/01/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	02/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	09/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 Layer 2
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Provided
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
263522	M06065	Grey Clay 2A	2.72

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 11-Feb-22

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Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861172

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**263522.1 (M06065)**
Date and Time of Sampling:	**31/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 2, Layer 2**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	100.7 mm	N/A
Height:	105.2 mm	N/A
Moisture Content:	27 %	29 %
Bulk density:	1.95 Mg/m^3	2.00 Mg/m^3
Dry density:	1.54 Mg/m^3	1.56 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.32
Final pore pressure coefficient,B:	0.98
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**5.2×10^{-11} m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 25 February 2022
Test Report Ref: TR 861173

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100585**
Client Ref. No:	**263522.2 (M06065)**
Date and Time of Sampling:	**31/01/2022**
Date of Receipt at Lab:	**03/02/2022**
Date of Start of Test:	**08/02/2022**
Sampling Location:	**NWSPA Mound 2, Strip 2, Layer 2**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay - 2A (2G)**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
13 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.0 mm	N/A
Height:	105.2 mm	N/A
Moisture Content:	27 %	29 %
Bulk density:	1.93 Mg/m^3	2.01 Mg/m^3
Dry density:	1.52 Mg/m^3	1.56 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.30
Final pore pressure coefficient,B:	1.00
Duration of stage:	6 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	9.6×10^{-11} m/s

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06065**	Date Sampled:	**31/01/2022**
Client Sample No:	**AV02**	Date Received:	**31/01/2022**
Sample Certificate:	**Yes**	Date Tested:	**02/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 2 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**64.9**
Plastic Limit	**23.8**
Plasticity Index	**41.1**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **18-Feb-22**

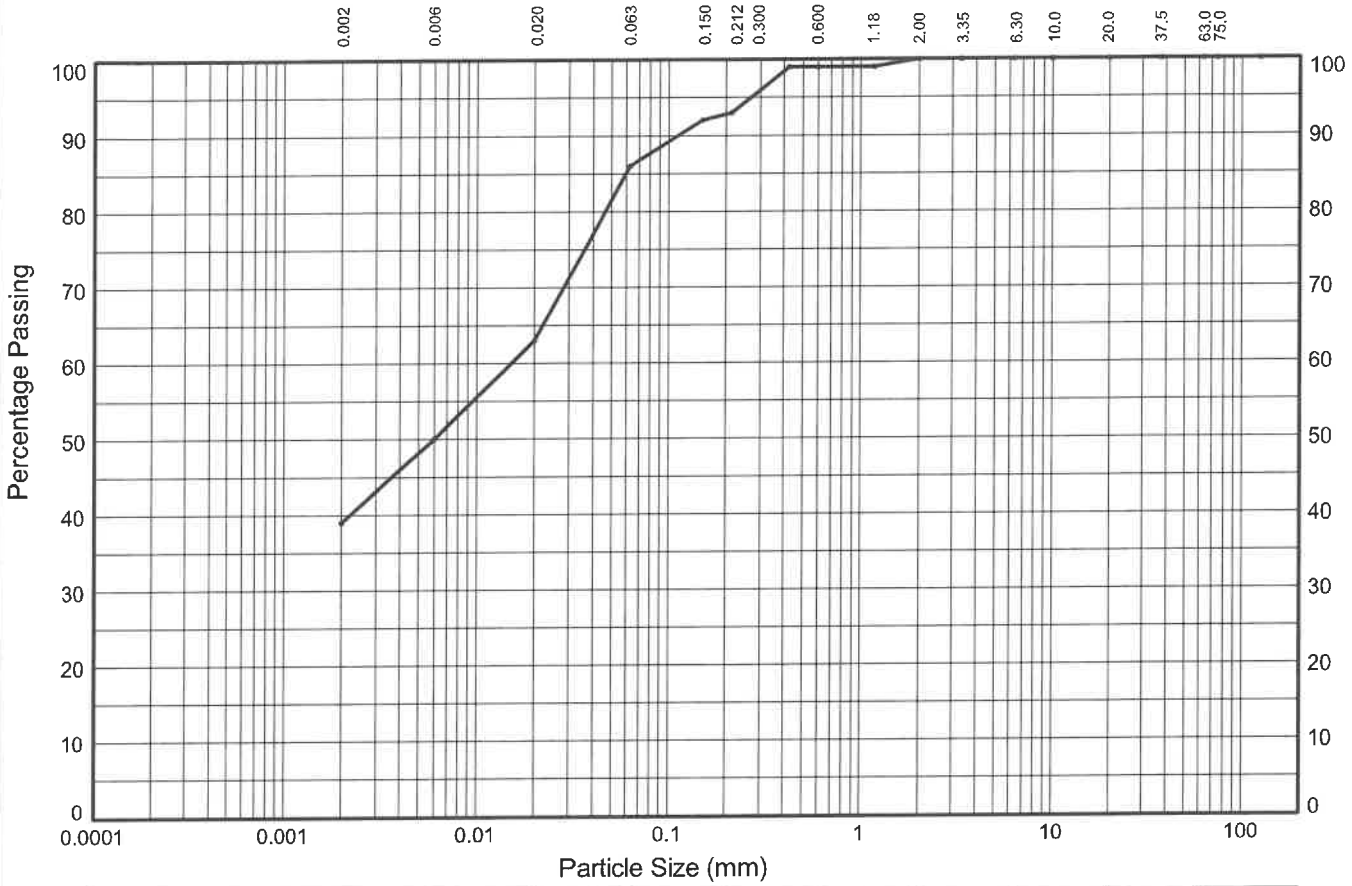
Lab Manager - Satish Ahlawat

Site Address

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06065 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 2 Layer 2**
Sample Ref: **263522** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	13%	23%	7%	6%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
39%	47%			14%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**99**
0.600	**99**
0.425	**99**
0.212	**93**
0.150	**92**
0.063	**86**

Particle Diameter (mm)	Percent Passing (%)
0.02	**63**
0.006	**50**
0.002	**39**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.006**
D_{60} (mm)	**0.015**
D_{85} (mm)	**0.060**
D_{90} (mm)	**0.112**
C_U	**NA**
C_C	**NA**

Soil Description:
Brown silty slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
D. Richards	**DAISY RICHARDS**	**11/04/22**

Contract	Contract Ref:
West Ruislip	**750601**

AGS

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06065		
Sample Certificate:	Yes		
Site Reference:	AV02	Date Tested:	31/01/2021
Test/ Sample Location:	NWSPA, Mound 2 Strip 2 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	31/01/2022

Maximum Dry Density of the Material - kg/m³	1750

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1816	1804				
Moisture Content - %	23.4	23.3				
Relative Compaction - %	103.8	103.1				

Average Relative Compaction - %	103.4

Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06065

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06065**	Date Sampled:	**31-Jan-22**
Client Sample No:	**AV02**	Date Received:	**31-Jan-22**
Sample Certificate:	**Yes**	Date Tested:	**01-Feb-22**
Sample Location:	**NWSPA Mound 2 Strip 2 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Bulk**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	1	-	-	-
Test Location	T1	T2	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.09	2.09	-	-	-
In-Situ Dry Density (Mg/m^3)	1.66	1.67	-	-	-
Moisture Content (%)	25.9	25.3	-	-	-
Relative Compaction (%)	95	95.3	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.75 Mg/m^3

Remarks:

Signed:

Dated: **17-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

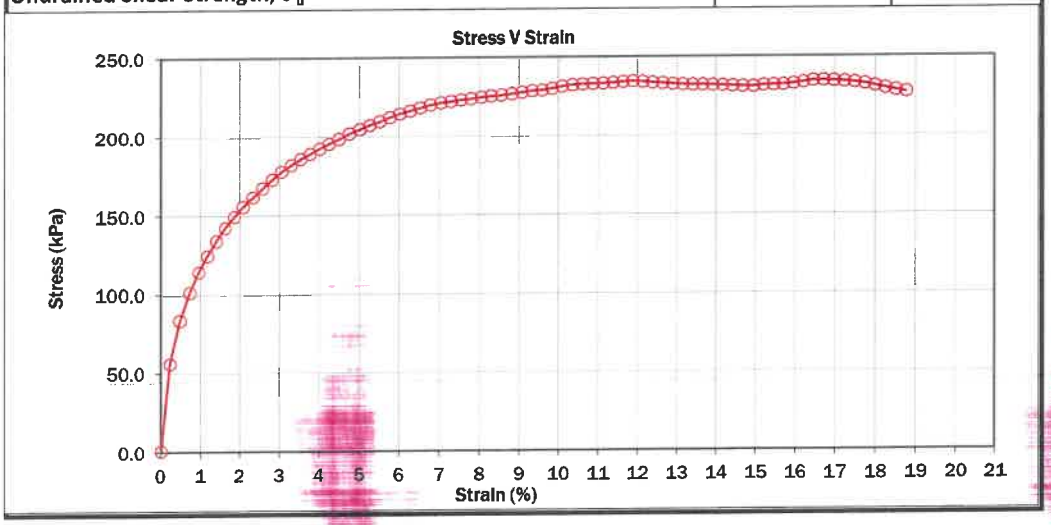
Construction Testing Solutions

DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 169657.17.1.1	CLIENT:	SCS Railways
SAMPLE No.:	263522	ADDRESS:	Black Arrow House
CLIENT REF:	M06065	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	31/01/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay 2A
DATE RECEIVED:	02/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 Layer 2
DATE TEST COMPLETED:	17/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	4.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.		
Initial specimen height	200.1	mm
Initial specimen diameter	100.2	mm
Initial bulk density	1.98	Mg/m³
Initial moisture content	27	%
Initial dry density	1.57	Mg/m³
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.7	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	234	kPa
Strain at failure	16.7	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**117**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

This report shall not be reproduced except in full without approval of the laboratory.

For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

04-Mar-22

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06086**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 2 Layer 4**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **02/02/2022**
Date Received: **02/02/2022**
Date Tested: **02/02/2022**
Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.13	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.73	-	-	-	-
Moisture Content (%)	22.7	-	-	-	-
Relative Compaction (%)	96.8	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP INS 011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06086		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	02/02/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 2 Layer 4		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	02/02/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1744	1740				
Moisture Content - %	22.8	22.6				
Relative Compaction - %	97.4	97.2				

Average Relative Compaction - %	97.3
Specification Limits - %	95.0

Remarks

UKAS TESTING 1489

Signed:

Laboratory Manager - Satish Ahlawat

Report No. SDG-M06086

Construction Testing Solutions

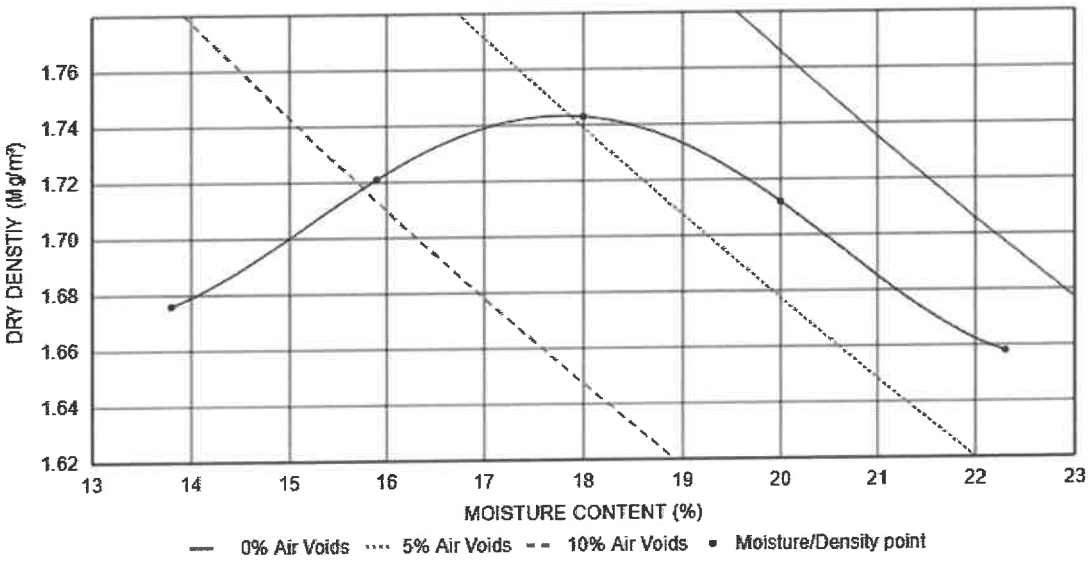
CHECKED
BY:

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:2016 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 170009.2.1.1		
SAMPLE NUMBER:	264085	CLIENT:	SCS Railways
CLIENT REF:	M06086	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	02/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	03/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	11/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 Layer 4
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:2016 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Specification

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.74 Mg/m^3
OPTIMUM MOISTURE CONTENT:	18 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 2016:part 2)	2.73 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Test results reported relate only to the items tested.
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Amended report. This test report supersedes test report version 1 - Location updated

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 31-Mar-22

UKAS TESTING
0927

Report Format: L/Rep S11-S14a/Rev 10

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

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enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 2

Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 170009.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	02/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	03/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	10/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 Layer 4
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:2016 clauses 8.3 and 8.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None
		METHOD OF PREPARATION:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
264085	M06086	Grey Clay 2A	2.73

CHECKED

BY:

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.
Amended report. This test report supersedes test report version 1 - .

For and on behalf of CTS
Mike Gray - Laboratory Supervisor

Approved Signatory
Report date 23-Mar-22

UKAS TESTING
0927

Report Format: L/Rep S7A/Rev 5

Northdown House, Ashford Road
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 863722

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100869**
Client Ref. No:	**264085.1 (M06086)**
Date and Time of Sampling:	**02/02/2022 AM**
Date of Receipt at Lab:	**15/02/2022**
Date of Start of Test:	**21/02/2022**
Sampling Location:	**Ruislip Sustainable Placement, NWSPA, Mound 2, Strip 2 Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
08 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	100.8 mm	N/A
Height:	104.5 mm	N/A
Moisture Content:	23 %	25 %
Bulk density:	2.00 Mg/m^3	2.11 Mg/m^3
Dry density:	1.62 Mg/m^3	1.69 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.20
Final pore pressure coefficient,B:	0.96
Duration of stage:	9 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**4.0×10^{-11} m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 863723

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100869**
Client Ref. No:	**264085.2 (M06086)**
Date and Time of Sampling:	**02/02/2022 AM**
Date of Receipt at Lab:	**15/02/2022**
Date of Start of Test:	**21/02/2022**
Sampling Location:	**Ruislip Sustainable Placement, NWSPA, Mound 2, Strip 2 Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

UKAS TESTING 0494

CHECKED
08 APR 2022
BY:

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.4 mm	N/A
Height:	104.8 mm	N/A
Moisture Content:	23 %	26 %
Bulk density:	1.98 Mg/m^3	2.12 Mg/m^3
Dry density:	1.61 Mg/m^3	1.69 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.32
Final pore pressure coefficient,B:	0.96
Duration of stage:	9 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	4.6×10^{-11} m/s

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06086**	Date Sampled:	**02/02/2022**
Client Sample No:	**AV01**	Date Received:	**02/02/2022**
Sample Certificate:	**Yes**	Date Tested:	**04/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 2 Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**62.90**
Plastic Limit	**23.2**
Plasticity Index	**39.7**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

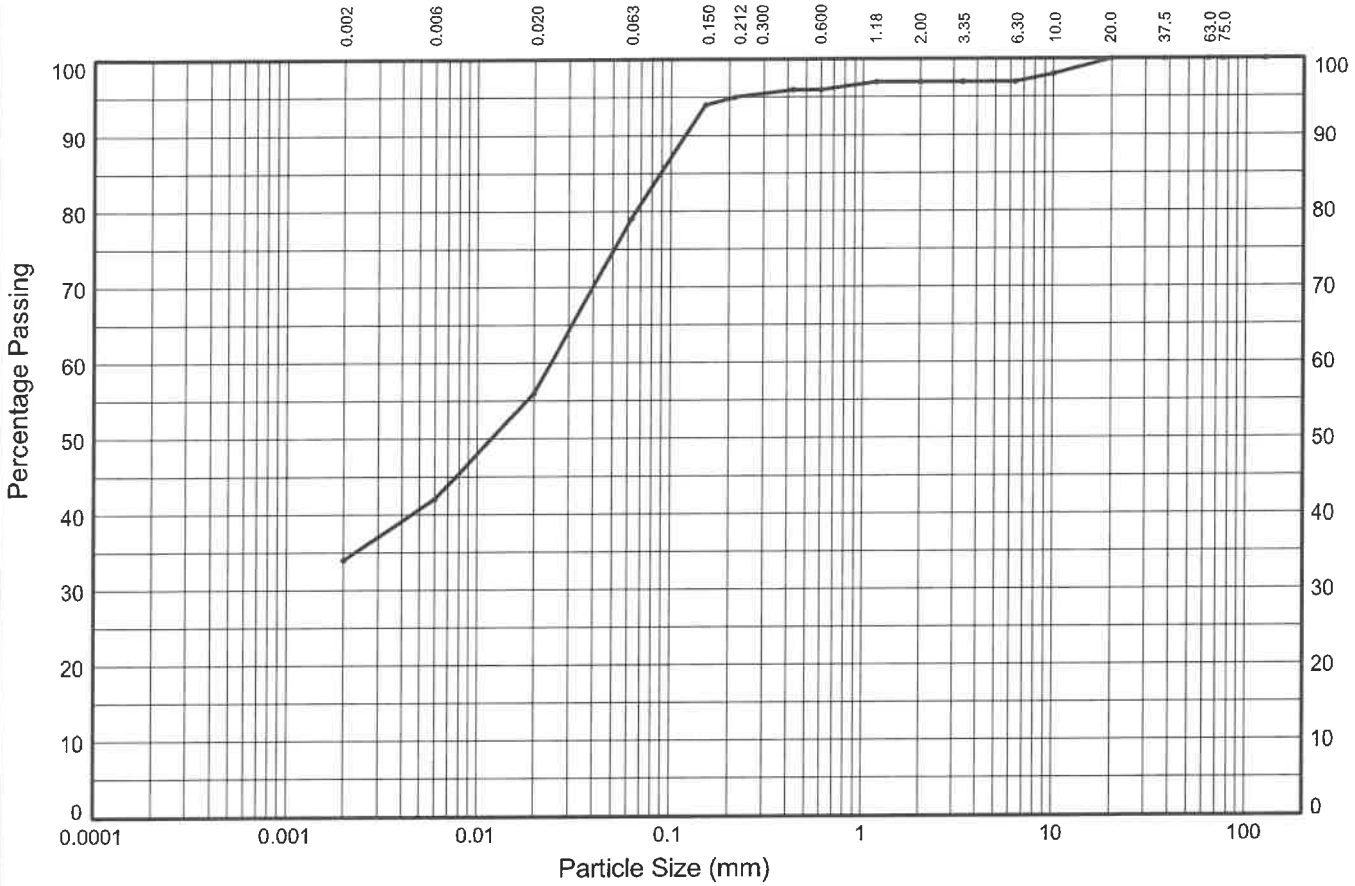
Dated: **18-Feb-22**

Lab Manager - Satish Ahlawat

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06086 - Ruislip Sustainable Placement - NWSAP Mound 2 Strip 2 Layer 4**
Sample Ref: **264085** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	8%	14%	23%	16%	1%	1%	0%	3%	0%	
	SILT			SAND			GRAVEL			
34%	45%			18%			3%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**98**
6.30	**97**
3.35	**97**
2.00	**97**
1.18	**97**
0.600	**96**
0.425	**96**
0.212	**95**
0.150	**94**
0.063	**79**

Particle Diameter (mm)	Percent Passing (%)
0.02	**56**
0.006	**42**
0.002	**34**
Sedimentation sample was not pre-treated	

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.012**
D_{60} (mm)	**0.024**
D_{85} (mm)	**0.089**
D_{90} (mm)	**0.119**
C_U	**NA**
C_C	**NA**

Soil Description:
Grey silty slightly sandy slightly gravelly CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
Francesca Bennett	FRANCESCA BENNETT	11/04/22
Contract: **West Ruislip**	Contract Ref: **750601**	

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, Chandos Road, NW10 6NF**
Contract Name:	**High Speed 2 - Main Works**

Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06086**	Date Sampled:	**02-Feb-22**
Client Sample No:	**AV01**	Date Received:	**02-Feb-22**
Sample Certificate:	**Yes**	Date Tested:	**03-Feb-22**
Sample Location:	**NWSPA, Mound 2, Strip 2, Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Disturbed**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.14	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.74	-	-	-	-
Moisture Content (%)	22.7	-	-	-	-
Relative Compaction (%)	97	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

CHECKED
13 APR 2022
BY:

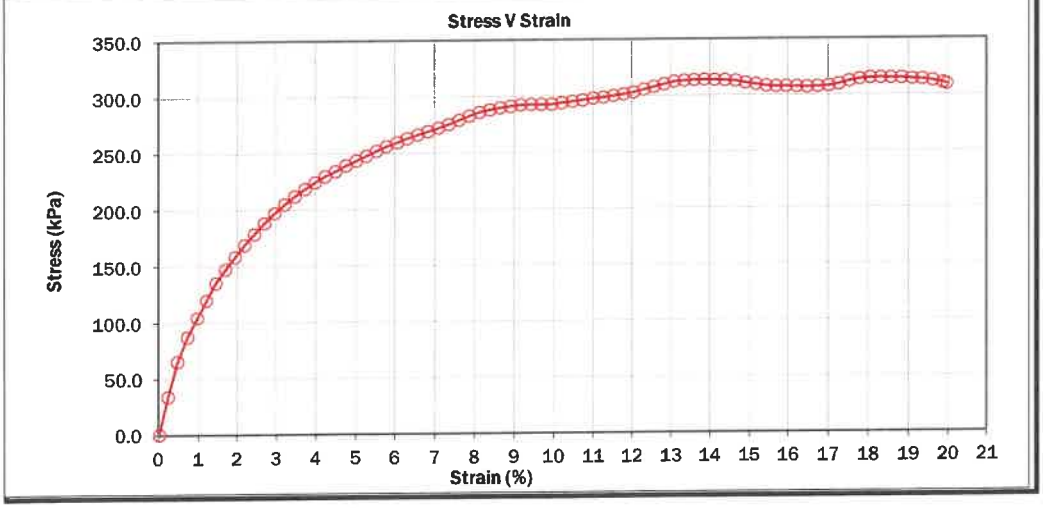
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 170009.6.1.1	CLIENT:	SCS Railways
SAMPLE No.:	264085	ADDRESS:	Black Arrow House
CLIENT REF:	M06086	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	02/02/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay
DATE RECEIVED:	03/02/2022		
		LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 2 layer 4
DATE TEST COMPLETED:	17/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	4.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height	200.4	mm
Initial specimen diameter	100.2	mm
Initial bulk density	2.07	Mg/m^3
Initial moisture content	24	%
Initial dry density	1.67	Mg/m^3
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.7	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	314	kPa
Strain at failure	18.3	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**157**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

This report shall not be reproduced except in full without approval of the laboratory.

For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor
Mike Gray - Senior Technician

UKAS TESTING

Report Format: L/Rep UDSS/rev.1

31-Mar-22

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06108**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 1 Layer 4**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **04/02/2022**
Date Received: **04/02/2022**
Date Tested: **05/02/2022**

Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.17	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.77	-	-	-	-
Moisture Content (%)	23.1	-	-	-	-
Relative Compaction (%)	98.6	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06108		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	04/02/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 1 Layer 4		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	04/02/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1741	1781				
Moisture Content - %	22.8	22.6				
Relative Compaction - %	97.3	99.5				

Average Relative Compaction - %	98.4
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06108

Construction Testing Solutions

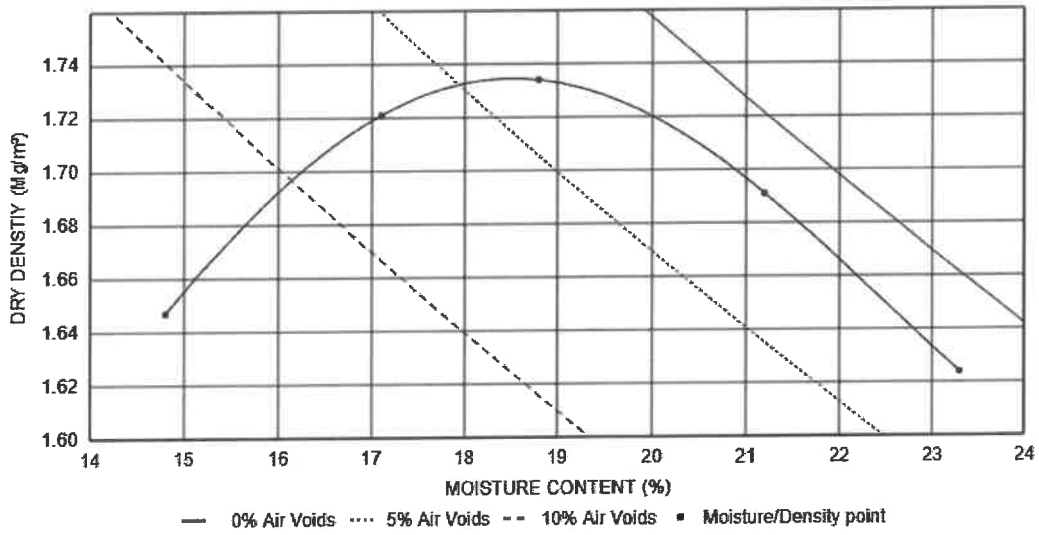
CHECKED
BY:

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.6 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 170412.2.1.1		
SAMPLE NUMBER:	264696	CLIENT:	SCS Railways
CLIENT REF:	M06108	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	04/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	04/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	16/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 1 Layer 4
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	CBR Mould (BS1377:Pt1:1990 Cl7.6.3) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Provided

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.73 Mg/m^3
OPTIMUM MOISTURE CONTENT:	19 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.71 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 17-Feb-22

UKAS TESTING
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enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk
END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

CHECKED
24 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 170412.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	04/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	04/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	16/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 1 Layer 4
TESTED BY:	MW, KJ	SAMPLING PLAN:	Client Provided
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
264696	M06108	Grey Clay 2A	2.71

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 17-Feb-22

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 864974

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100968**
Client Ref. No:	**264696.1**
Date and Time of Sampling:	**04/02/2022 AM**
Date of Receipt at Lab:	**17/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainability Placement, NWSPA Mound 2, Strip 1 Layer 4**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.3 mm	N/A
Height:	103.5 mm	N/A
Moisture Content:	25 %	28 %
Bulk density:	1.96 Mg/m^3	2.10 Mg/m^3
Dry density:	1.57 Mg/m^3	1.64 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.60
Final pore pressure coefficient,B:	1.00
Duration of stage:	8 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**8.0×10^{-11} m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 864975

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100968**
Client Ref. No:	**264696.2**
Date and Time of Sampling:	**04/02/22 AM**
Date of Receipt at Lab:	**17/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainability Placement, NWSPA Mound 2, Strip 1 Layer 4**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.4 mm	N/A
Height:	102.3 mm	N/A
Moisture Content:	25 %	28 %
Bulk density:	1.95 Mg/m^3	2.10 Mg/m^3
Dry density:	1.56 Mg/m^3	1.64 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.70
Final pore pressure coefficient,B:	0.96
Duration of stage:	8 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	5.7×10^{-11} m/s

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06108**	Date Sampled:	**04/02/2022**
Client Sample No:	**AV01**	Date Received:	**04/02/2022**
Sample Certificate:	**Yes**	Date Tested:	**08/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 1 Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**63.3**
Plastic Limit	**25.5**
Plasticity Index	**37.8**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **18-Feb-22**

Lab Manager - Satish Ahlawat

CHECKED
31 MAR 2022
BY:

celtest
INDEPENDENT MATERIALS TESTING | DIAMOND DRILLING & SAWING

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 24 February 2022
Test Report Ref: TR 863109

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Particle Size Distribution (PSD) of a soil sample- washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2** Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100838**
Client Ref. No:	**264696 (M06108)**
Date and Time of Sampling:	**04/02/2022**
Date of Receipt at Lab:	**14/02/2022**
Date of Start of Test:	**16/02/2022**
Sampling Location:	**Ruislip Sustainability Placement, NWSPA Mound 2, Strip 1, Layer 4**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Disturbed Bulk Sample**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**SR**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

SEE ATTACHED

These results relate only to the items tested.

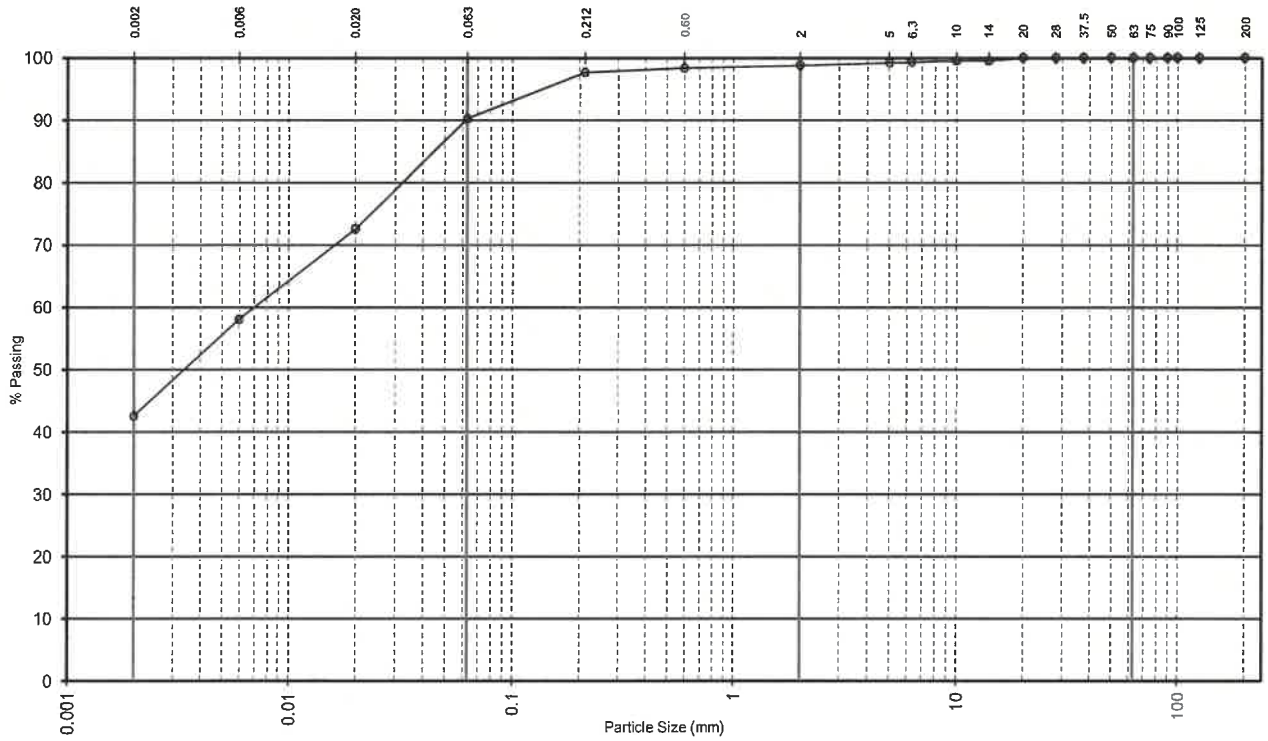
Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

MATERIAL DESCRIPTION
Grey Clay

Method of pre-treatment: N/A

Sieve Size mm	% Passing	Sieve Size mm	% Passing
200	100	2.0	99
125	100	0.600	98
100	100	0.212	98
90	100	0.063	90
75	100	0.020	73
63	100	0.006	58
50	100	0.002	42.6
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5.0	99		

Cobbles	0.0
Gravel	1.2
Sand	8.5
Silt	47.7
Clay	42.6



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002	0.006	0.02	0.063	0.2	0.63	2.0	6.3	20	63 200
	SILT			SAND			GRAVEL			

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No: **M06108**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **NWSPA Mound 2 Strip 1 Layer 4**
Material Description: **Grey Clay**
Source/Supplier: **Copthall Tunnel/ SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **04-Feb-22**
Date Received: **04-Feb-22**
Date Tested: **05-Feb-22**
Sample Type: **Bulk**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.13	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.73	-	-	-	-
Moisture Content (%)	23.1	-	-	-	-
Relative Compaction (%)	96	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **28-Feb-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

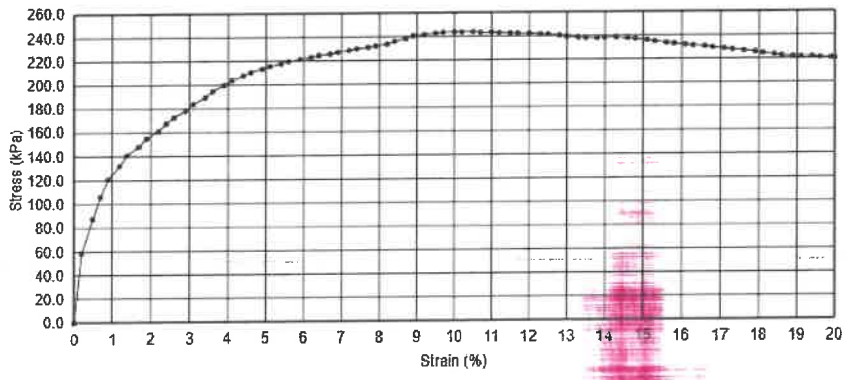
TEST REPORT:	**DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT** BS 1377 : Part 7 : 1990 Clause 8		
REPORT NUMBER:	C1050095 / 170412.4.1.1		
SAMPLE NUMBER:	264696	CLIENT:	SCS Railways
CLIENT REF:	M06108	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	04/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	04/02/2022	MATERIAL:	Grey Clay
DATE COMPLETED:	24/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 1 Layer 4
TESTED BY:	AP, JT	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE IF REMOULDED:	Remoulded 4.5kg	ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SPECIMEN: N/A	

RESULTS: **Test Location: Harrietsham Lab**

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height:	200.1 mm
Initial specimen diameter:	100.0 mm
Initial bulk density:	2.00 Mg/m^3
Initial moisture content:	27.2 %
Initial dry density:	1.57 Mg/m^3
Rate of strain applied:	1 %/min
Membrane thickness (latex):	0.3 mm
Membrane correction:	0.7 kPa
Cell pressure:	200 kPa
Corrected maximum deviator stress at failure:	243.0 kPa
Strain at failure:	10.0 %
Mode of failure:	Plastic
Undrained Shear Strength, cu:	121.5 kPa

Stress V Strain



Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.
Amended report. This test report supersedes test report version 1 - Location updated

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 07-Mar-22

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06113**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 4 Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **07/02/2022**
Date Received: **27/02/2022**
Date Tested: **08/02/2022**

Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.12	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.73	-	-	-	-
Moisture Content (%)	22.8	-	-	-	-
Relative Compaction (%)	96.5	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06113		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	07/02/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 4 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	07/02/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1745	1732				
Moisture Content - %	22.8	22.6				
Relative Compaction - %	97.5	96.8				

Average Relative Compaction - %	97.1
Specification Limits - %	95.0

Remarks

UKAS TESTING 1489

Signed:

Laboratory Manager - Satish Ahlawat

Report No. SDG-M06113

Construction Testing Solutions

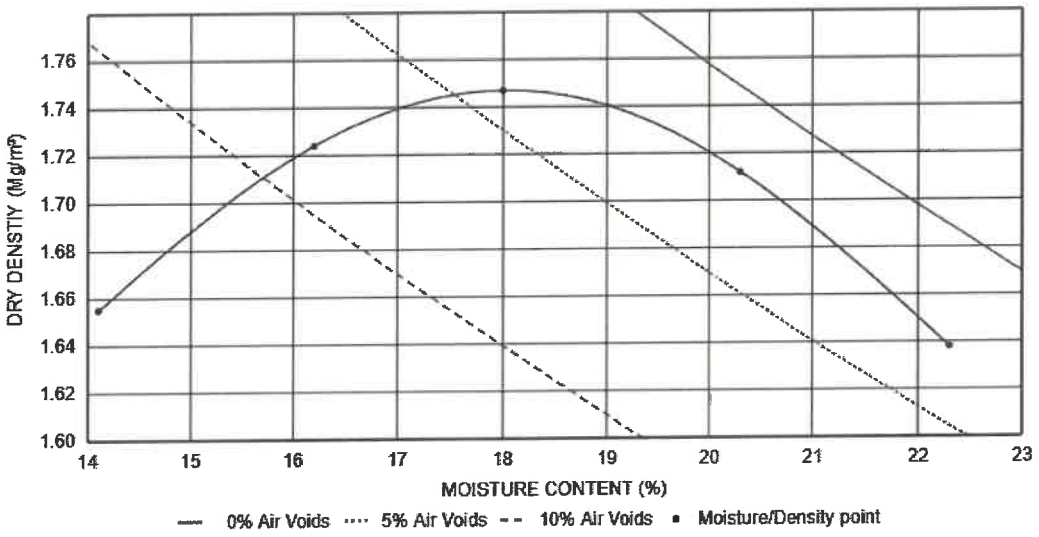
CHECKED
BY:

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 170653.2.1.1		
SAMPLE NUMBER:	265081	CLIENT:	SCS Railways
CLIENT REF:	M06113	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	07/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	08/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	17/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 2
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Specification

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.75 Mg/m^3
OPTIMUM MOISTURE CONTENT:	18 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.71 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 18-Feb-22

UKAS TESTING
0927

Northdown House, Ashford Road
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

CHECKED
25 FEB 2022
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 170653.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	07/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	08/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	18/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 2
TESTED BY:	KJ, JF	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
265081	M06113	Grey Clay 2A	2.71

Remarks:
Test results reported relate only to the items tested.
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For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 18-Feb-22

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 864959

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100967**
Client Ref. No:	**265081.1**
Date and Time of Sampling:	**07/02/2022 AM**
Date of Receipt at Lab:	**17/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainable Placements, NWSPA Mound 2, Strip 4 Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	100.8 mm	N/A
Height:	103.2 mm	N/A
Moisture Content:	22 %	25 %
Bulk density:	1.99 Mg/m^3	2.08 Mg/m^3
Dry density:	1.62 Mg/m^3	1.66 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.32
Final pore pressure coefficient,B:	1.00
Duration of stage:	9 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	9.2×10^{-11} m/s

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 864960

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100967**
Client Ref. No:	**265081.2**
Date and Time of Sampling:	**07/02/2022**
Date of Receipt at Lab:	**17/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainable Placements, NWSPA Mound 2, Strip 4 Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:
Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.2 mm	N/A
Height:	104.7 mm	N/A
Moisture Content:	26 %	28 %
Bulk density:	1.98 Mg/m^3	2.05 Mg/m^3
Dry density:	1.57 Mg/m^3	1.60 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.48
Final pore pressure coefficient,B:	0.96
Duration of stage:	8 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	3 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**8.4×10^{-11} m/s**

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 Main Works** Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06113**	Date Sampled:	**07/02/2022**
Client Sample No:	**AV01**	Date Received:	**07/02/2022**
Sample Certificate:	**Yes**	Date Tested:	**09/02/2022**
Sample Location:	**Ruislip Sustainable Placements,NWSPA Mound 2 Strip 4 Layer 2**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**63.6**
Plastic Limit	**21.6**
Plasticity Index	**42**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager - Satish Ahlawat

CHECKED
31 MAR 2022
BY:

celtest
INDEPENDENT MATERIALS TESTING | DIAMOND DRILLING & SAWING

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 24 February 2022
Test Report Ref: TR 863117

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Particle Size Distribution (PSD) of a soil sample-
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S100839**
Client Ref. No:	**265081 (M06113)**
Date and Time of Sampling:	**07/02/2022**
Date of Receipt at Lab:	**14/02/2022**
Date of Start of Test:	**16/02/2022**
Sampling Location:	**Ruislip Sustainable Placements, NWSPA Mound 2, Strip 4, Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Disturbed Bulk Sample**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**SR**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

SEE ATTACHED

These results relate only to the items tested.

Comments:	Report checked and approved by:
None	Meical Owen Soils Team Manager

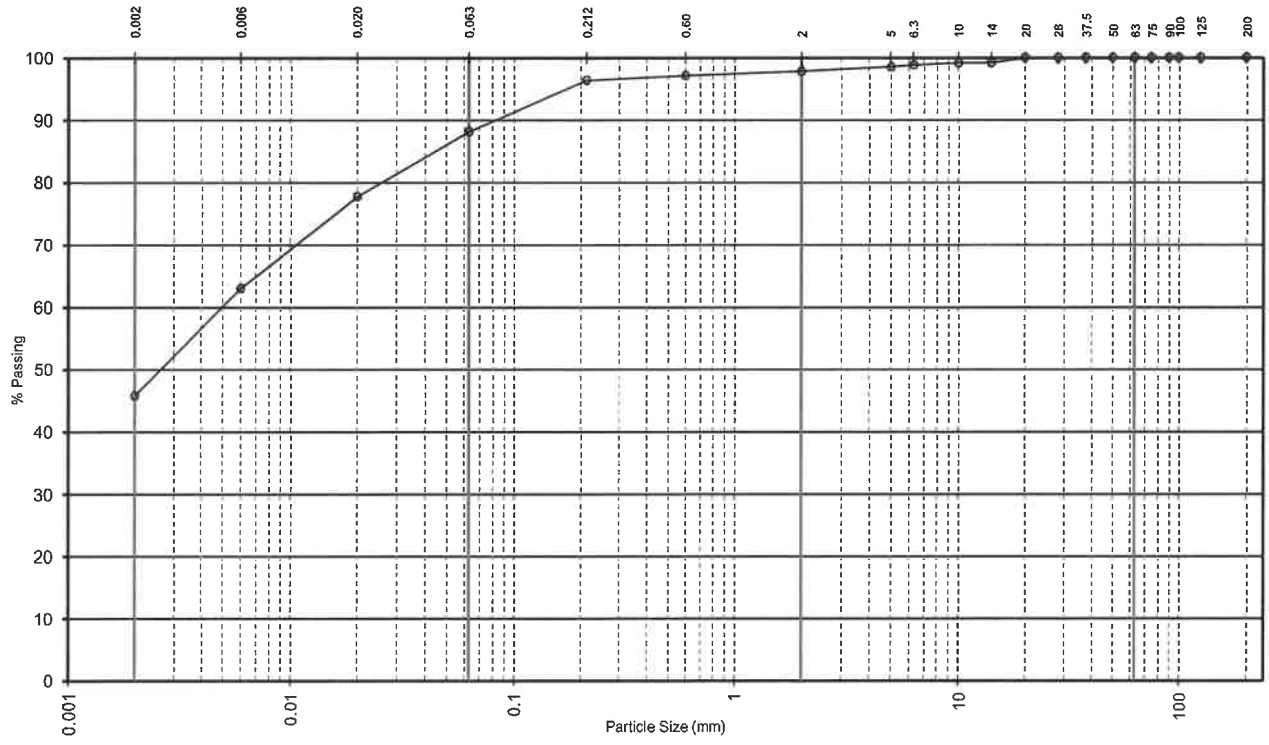
MATERIAL DESCRIPTION

Grey Clay

Method of pre-treatment: N/A

Sieve Size mm	% Passing	Sieve Size mm	% Passing
200	100	2.0	98
125	100	0.600	97
100	100	0.212	96
90	100	0.063	88
75	100	0.020	78
63	100	0.006	63
50	100	0.002	45.8
37.5	100		
28	100		
20	100		
14	99		
10	99		
6.3	99		
5.0	99		

Cobbles	0.0
Gravel	2.1
Sand	9.7
Silt	42.4
Clay	45.8



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002 0.006 0.02			0.063 0.2 0.63			2.0 6.3 20			63 200
	SILT			SAND			GRAVEL			

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No: **M06113**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA, Mound 2, Strip 4, Layer 2**
Material Description: **Grey Clay**
Source/Supplier: **Copthall Tunnel/ SCS Railways**
Specification as Ordered: **2A (2G)**

Date Sampled: **07-Feb-22**
Date Received: **07-Feb-22**
Date Tested: **08-Feb-22**
Sample Type: **Disturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.11	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.72	-	-	-	-
Moisture Content (%)	22.7	-	-	-	-
Relative Compaction (%)	96	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

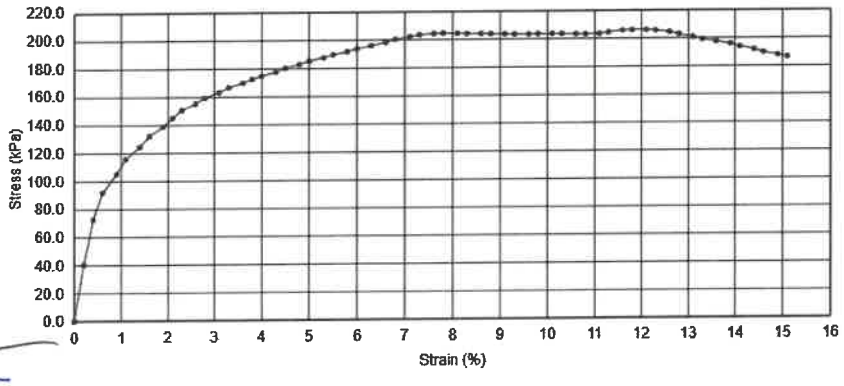
TEST REPORT:	**DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT** BS 1377 : Part 7 : 1990 Clause 8		
REPORT NUMBER:	C1050095 / 170653.4.1.1		
SAMPLE NUMBER:	265081	CLIENT:	SCS Railways
CLIENT REF:	M06113	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	07/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	08/02/2022	MATERIAL:	Grey Clay 2A
DATE COMPLETED:	24/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 2
TESTED BY:	AP, JT	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE IF REMOULDED:	Remoulded 4.5kg	ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SPECIMEN: N/A	

RESULTS: **Test Location: Harrietsham Lab**

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height:	200.2 mm
Initial specimen diameter:	100.1 mm
Initial bulk density:	1.96 Mg/m^3
Initial moisture content:	31.3 %
Initial dry density:	1.50 Mg/m^3
Rate of strain applied:	1 %/min
Membrane thickness (latex):	0.3 mm
Membrane correction:	0.8 kPa
Cell pressure:	200 kPa
Corrected maximum deviator stress at failure:	205.4 kPa
Strain at failure:	12.1 %
Mode of failure:	Plastic
Undrained Shear Strength, cu:	102.7 kPa

Stress V Strain



CHECKED
08 APR 2022
BY:

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.
Amended report. This test report supersedes test report version 1 - Material updated

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 21-Mar-22

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 2

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 - Main Works**
Contract No:	**2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No:	**M06163**	Date Sampled:	**09/02/2022**
Client Sample No:	**JM01**	Date Received:	**09/02/2022**
Sample Certificate:	**Yes**	Date Tested:	**09/02/2022**
Sample Location:	**RSP,NWSPA Mound 2 Strip 4 Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways**	Sample Type:	**Undisturbed**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.13	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.73	-	-	-	-
Moisture Content (%)	23.2	-	-	-	-
Relative Compaction (%)	96.4	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06163		
Sample Certificate:	Yes		
Site Reference:	JM01	Date Tested:	09/02/2022
Test/ Sample Location:	RSP,NWSPA, Mound 2 Strip 4 Layer 4		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Grey Clay		
Specification as Ordered:	2A	Date report issued:	09/02/2022

Maximum Dry Density of the Material - kg/m³	1790

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1729	1722				
Moisture Content - %	23.1	23.2				
Relative Compaction - %	96.6	96.2				

Average Relative Compaction - %	96.4
Specification Limits - %	95.0

Remarks

UKAS TESTING 1489

Signed:

Laboratory Manager - Satish Ahlawat

Report No. SDG-M06163

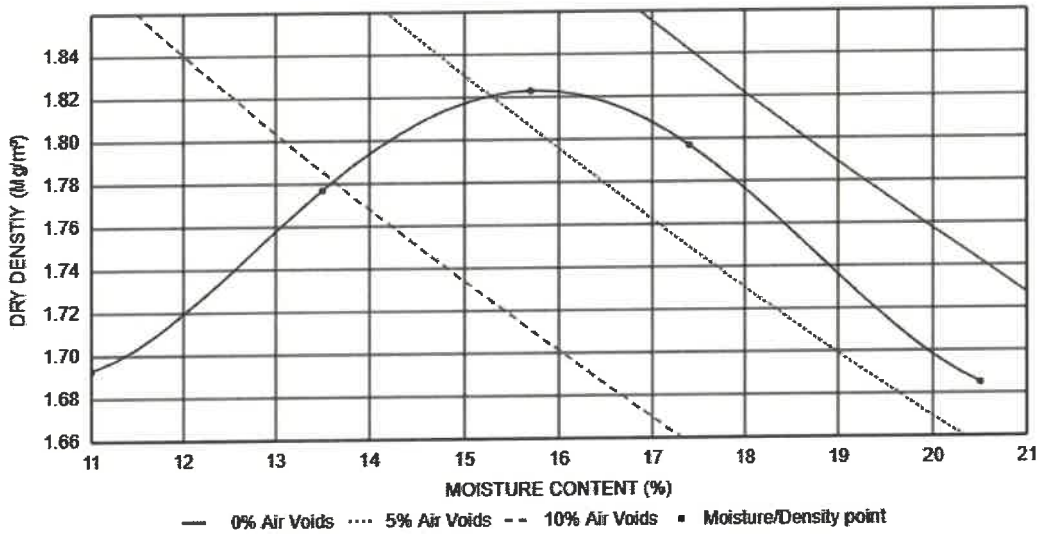
Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF DRY DENSITY/MOISTURE CONTENT RELATIONSHIP** BS 1377:Part 4:1990 clause 3.5 4.5kg Rammer method		
REPORT NUMBER:	C1050095 / 171131.2.1.1		
SAMPLE NUMBER:	266049	CLIENT:	SCS Railways
CLIENT REF:	M06163	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	09/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	10/02/2022	MATERIAL:	Grey Clay
DATE COMPLETED:	28/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 4
TESTED BY:	Colin Gourlay	PREPARATION METHOD:	1 Ltr Mould (BS1377:Pt1:1990 Cl7.6.2) : Material chopped to <20mm, for cohesive soil.
TYPE OF SAMPLE:	Disturbed	COMPACTION SAMPLE:	Separate samples
VARIATIONS:	None	SAMPLING PLAN:	Client Specification

RESULT **Test Location: Harrietsham Lab**

MAXIMUM DRY DENSITY:	1.82 Mg/m^3
OPTIMUM MOISTURE CONTENT:	16 %
AMOUNT (By Dry Mass) RETAINED ON >20mm TEST SIEVE:	0 %
AMOUNT (By Dry Mass) RETAINED ON >37.5mm TEST SIEVE:	0 %
MEASURED PARTICLE DENSITY USED TO PLOT AIR VOIDS: (measured in accordance with BS 1377: 1990:part 2)	2.71 Mg/m^3

MOISTURE CONTENT / DRY DENSITY RELATIONSHIP



Remarks:
Remaining sample will be retained for a minimum of 28 days from date of report. Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 01-Mar-22

UKAS TESTING
0927

Report Format: L/Rep S11-S14a/Rev 9

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 171131.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	09/02/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	10/02/2022	MATERIAL:	Grey Clay
DATE COMPLETED:	21/02/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 4
TESTED BY:	RH, KJ	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:1990 clauses 7.3 and 7.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None
		METHOD OF PREPARATION:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
266049	M06163	Grey Clay	2.71

Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Dan Gay - Laboratory Manager

Approved Signatory
Report date 01-Mar-22

UKAS TESTING
0927

Report Format: L/Rep S7A/Rev 4

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END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 865776

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S101005**
Client Ref. No:	**266049.1**
Date and Time of Sampling:	**09/02/22 PM**
Date of Receipt at Lab:	**18/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainable Placement, NWSPA Mound 2, Strip 4 Layer 4**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.6 mm	N/A
Height:	101.1 mm	N/A
Moisture Content:	23 %	26 %
Bulk density:	1.96 Mg/m^3	2.07 Mg/m^3
Dry density:	1.59 Mg/m^3	1.65 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B: **0.34**

Final pore pressure coefficient,B: **1.00**

Duration of stage: **8 days**

Consolidation stage:

Effective pressure: **100 kPa**

Duration of stage: **3 days**

Permeability stage:

Pressure difference across specimen: **20 kPa**

Mean effective stress: **90 kPa**

Duration of stage **2 days**

Coefficient of Permeability (k_v) at 20°C = 4.2×10^{-11} **m/s**

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 18 March 2022
Test Report Ref: TR 865777

Contract: West Ruislip

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Coefficient of Permeability under constant head conditions in a Triaxial Cell in accordance with **BS 1377: Part 6 : 1990 : Clause 6.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S101005**
Client Ref. No:	**266049.2**
Date and Time of Sampling:	**09/02/2022 PM**
Date of Receipt at Lab:	**18/02/2022**
Date of Start of Test:	**27/02/2022**
Sampling Location:	**Ruislip Sustainable Placement, NWSPA Mound 2, Strip 4 Layer 4**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Core Cutter**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**CH**
Material Description:	**Grey Clay**
Target Specification:	**N/A**

RESULTS:

See attached

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

TEST RESULTS

Sample condition: **Undisturbed**

Method of Remoulding (If applicable): **N/A**

Specimen Details:	Initial:	Final:
Diameter:	101.2 mm	N/A
Height:	100.3 mm	N/A
Moisture Content:	22 %	25 %
Bulk density:	1.99 Mg/m^3	2.12 Mg/m^3
Dry density:	1.63 Mg/m^3	1.70 Mg/m^3

Saturation stage: **Performed in accordance with clause 5.4.3 - Saturation by increments of cell pressure and back pressure.**

Initial pore pressure coefficient,B:	0.30
Final pore pressure coefficient,B:	1.00
Duration of stage:	9 days

Consolidation stage:

Effective pressure:	100 kPa
Duration of stage:	4 days

Permeability stage:

Pressure difference across specimen:	20 kPa
Mean effective stress:	90 kPa
Duration of stage	2 days
Coefficient of Permeability (k_v) at 20°C =	**7.2×10^{-11} m/s**

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06163**	Date Sampled:	**09/02/2022**
Client Sample No:	**JM01**	Date Received:	**09/02/2022**
Sample Certificate:	**Yes**	Date Tested:	**11/02/2022**
Sample Location:	**NWSPA Mound 2 Strip 4 Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**SCS Railways/Copthall North**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**62.5**
Plastic Limit	**26.5**
Plasticity Index	**36**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **18-Feb-22**

Lab Manager - Satish Ahlawat

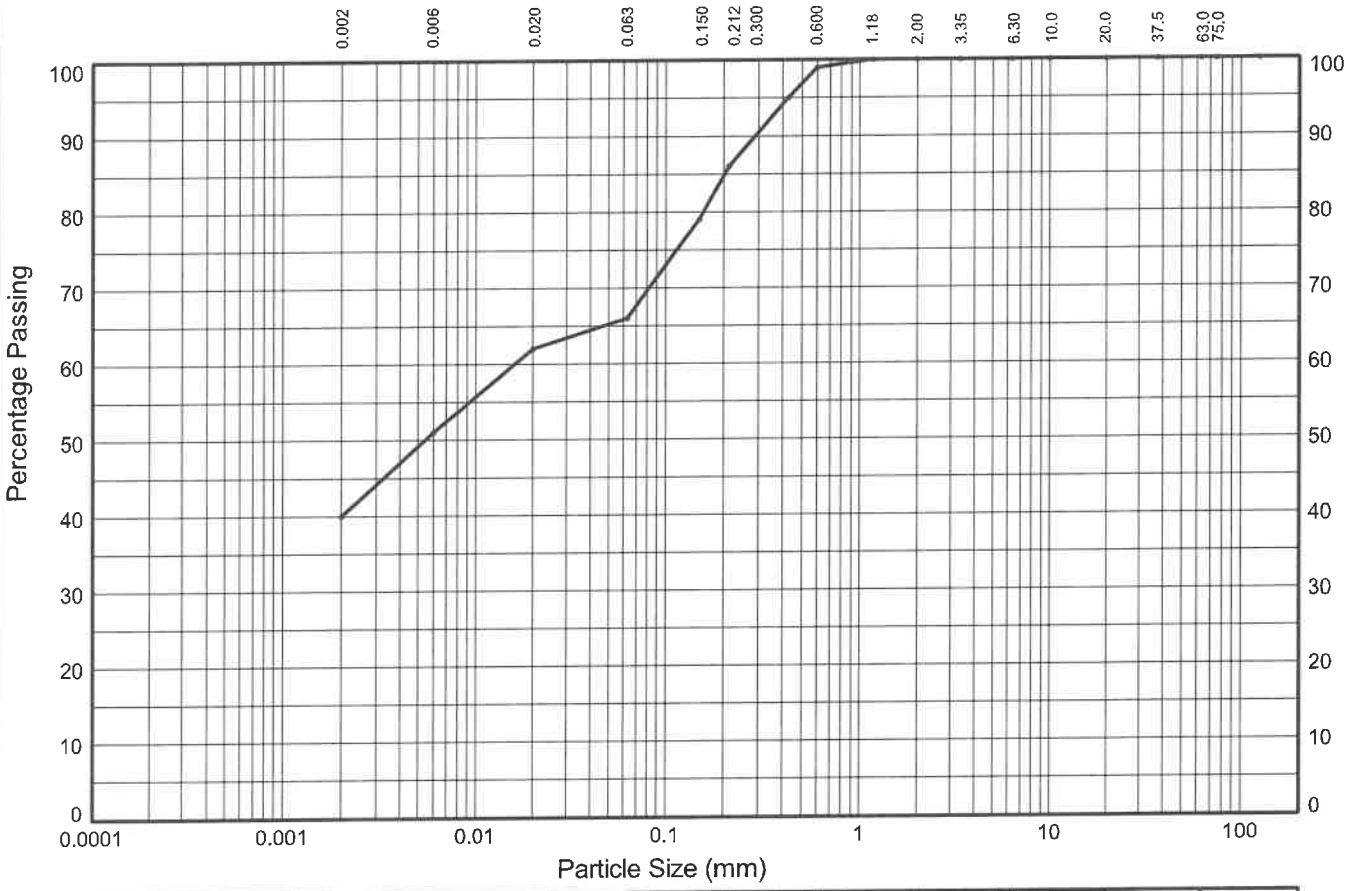
Site Address

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2, 9.4 of BS1377:Part 2:1990

Position ID: **M06163 - Ruislip Sustainable Placement - NWSPA Mound 2 Strip 4 Layer 4**

Sample Ref: **266049** Sample Type: **B** Depth (m): **-**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	11%	11%	4%	19%	14%	1%	0%	0%	0%	
	SILT			SAND			GRAVEL			
40%	26%			34%			0%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**100**
10.0	**100**
6.30	**100**
3.35	**100**
2.00	**100**
1.18	**100**
0.600	**99**
0.425	**95**
0.212	**86**
0.150	**79**
0.063	**66**

Particle Diameter (mm)	Percent Passing (%)
0.02	**62**
0.006	**51**
0.002	**40**

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**NA**
D_{30} (mm)	**NA**
D_{50} (mm)	**0.005**
D_{60} (mm)	**0.016**
D_{85} (mm)	**0.202**
D_{90} (mm)	**0.289**
C_U	**NA**
C_C	**NA**

Soil Description:

Dark grey slightly sandy CLAY

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2:2018

STRUCTURAL SOILS
1a Princess Street
Bedminster
Bristol
BS3 4AG

Compiled By		Date
Francesca Bennett	FRANCESCA BENNETT	11/04/22
Contract: **West Ruislip**	Contract Ref: **750601**	

AGS

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, Chandos Road, NW10 6NF**
Contract Name:	**High Speed 2 - Main Works**

Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06163**	Date Sampled:	**09-Feb-22**
Client Sample No:	**JM01**	Date Received:	**09-Feb-22**
Sample Certificate:	**Yes**	Date Tested:	**10-Feb-22**
Sample Location:	**RSP,NWSPA, Mound 2, Strip 4, Layer 4**		
Material Description:	**Grey Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Disturbed**
Specification as Ordered:	**2A (2G)**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.12	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.72	-	-	-	-
Moisture Content (%)	23.2	-	-	-	-
Relative Compaction (%)	96	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.79 Mg/m^3

Remarks:

Signed:

Dated: **01-Mar-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

CHECKED

07 MAR 2022

BY:

Construction Testing Solutions

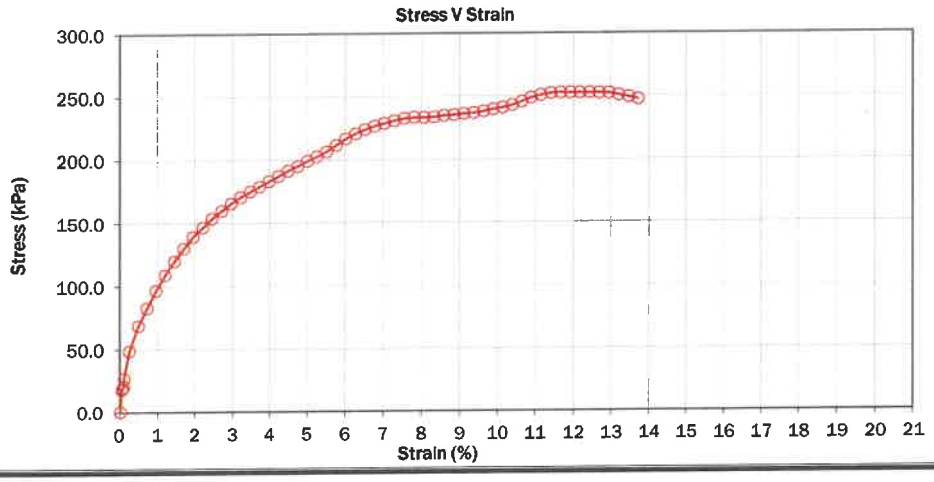
DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT

BS 1377 : Part 7 : 1990 Clause 8

REPORT No.:	1050095 / 171131.7.1.1	CLIENT:	SCS Railways
SAMPLE No.:	266049	ADDRESS:	Black Arrow House
CLIENT REF:	M06163	SITE:	Ruislip Sustainable Placements
DATE SAMPLED:	09/02/2022	SUPPLIER:	SCS Railways
SAMPLED BY:	Client	MATERIAL:	Grey Clay
		LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2 Strip 4 Layer 4
DATE RECEIVED:	10/02/2022		
DATE TEST COMPLETED:	24/02/2022	ACCEPT STD:	Contract Specification
TESTED BY:	JT	ORIENTATION OF TEST SPECIMEN	
TYPE OF SAMPLE:	Remoulded	WITHIN ORIGINAL SPECIMEN: N/A	
IF REMOULDED; METHOD OF COMPACTION:	4.5kg rammer		

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height	200.2	mm
Initial specimen diameter	100.3	mm
Initial bulk density	2.05	Mg/m³
Initial moisture content	22	%
Initial dry density	1.68	Mg/m³
Rate of strain applied	1.00	%/min
Membrane thickness (latex)	0.2	mm
Membrane correction	0.5	kPa
Cell pressure	200	kPa
Corrected maximum deviator stress at failure	252	kPa
Strain at failure	11.6	%
Mode of failure	Plastic	
Undrained Shear Strength, c_u	**126**	kPa



REMARKS:

Bulk sample will be kept for a minimum 28 days from date of test.

Test results reported relate only to the items tested.

This report shall not be reproduced except in full without approval of the laboratory.

For and on behalf of CTS

Chris Davidson - Laboratory Manager
Dan Gay - Laboratory Supervisor
Mike Gray - Senior Technician

Determination of Correlation of Soils Density Gauge (Dielectric) Versus Calibration Box for Gauge Offsets to Documented In-House Method SP_INS_011 and Manufacturers Instruction Manual

Laboratory Sample No. M06557 **Date Tested:** 01/04/2022
Material Description: Brown Clay
Supplier: SCS Railways
Source: Copthall Tunnel

Volume of Calibration Box: m^3	**0.0875**
Mass of Compacted Material in Calibration Box: kg	**168**
Calculated Bulk Density of Material in Calibration Box: kg/m^3	**1915**
Moisture Content of Material in Calibration Box: %	**26.4**
Gauge Bulk Density : kg/m^3	**2899.4**
Moisture Content of Material in Calibration Box: %	**12.3**

Offset to apply to Insitu Bulk Density Readings to Dieletric Gauge:	**-984.8857**

Offset to apply to Insitu Moisture Contents Readings to Dieletric Gauge:	**14.1**

Maximum Dry Density of the Material: kg/m^3	**1660**

Remarks:

Signed: 

Date: 07/04/2022

Laboratory Manager -Satish Ahlawat

Determination of Correlation of Soils Density Gauge (Dielectric) Versus Calibration Box for Gauge Offsets to Documented In-House Method SP_INS_011 and Manufacturers Instruction Manual

Laboratory Sample No. M06557 **Date Tested:** 01/04/2022
Material Description: Brown Clay
Supplier: SCS Railways
Source: Copthall Tunnel

Volume of Calibration Box: m^3	**0.0875**
Mass of Compacted Material in Calibration Box: kg	**168**
Calculated Bulk Density of Material in Calibration Box: kg/m^3	**1915**
Moisture Content of Material in Calibration Box: %	**26.4**
Gauge Bulk Density : kg/m^3	**2899.4**
Moisture Content of Material in Calibration Box: %	**12.3**

Offset to apply to Insitu Bulk Density Readings to Dieletric Gauge:	**-984.8857**

Offset to apply to Insitu Moisture Contents Readings to Dieletric Gauge:	**14.1**

Maximum Dry Density of the Material: kg/m^3	**1660**

Remarks:

Signed: 

Date: 07/04/2022

Laboratory Manager -Satish Ahlawat

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 - Main Works** Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No: **M06557**
Client Sample No: **AV01**
Sample Certificate: **Yes**
Sample Location: **RSP,NWSPA Mound 2 Strip 5 Layer 2**
Material Description: **Brown Clay**
Source/Supplier: **SCS Railways**
Specification as Ordered: **2A**

Date Sampled: **01/04/2022**
Date Received: **01/04/2022**
Date Tested: **01/04/2022**

Sample Type: **Undisturbed**

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	1.98	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.56	-	-	-	-
Moisture Content (%)	26.9	-	-	-	-
Relative Compaction (%)	93.8	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.66 Mg/m^3

Remarks:

Signed:

Dated: **04-Apr-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Site Address

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06557		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	04/04/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 5 Layer 2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	BrownClay		
Specification as Ordered:	2A	Date report issued:	01/04/2022

Maximum Dry Density of the Material - kg/m³	1660

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1514	1582				
Moisture Content - %	26.4	26.7				
Relative Compaction - %	91.2	95.3				

Average Relative Compaction - %	93.3
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06557

Report on the Determination of Moisture Content in accordance with BS 1377-2: 1990 Cl 3.2

Sample Certificate: **Yes**
Source/Supplier: **Copthall Tunnel/SCS Railways**

Specification as Ordered: **2A/2B**

Date Sampled: **01-Apr-22**
Date Received: **01-Apr-22**
Date Tested: **01-Apr-22**

Test results relate only to the sample numbers shown below.

Lab Sample No:	Site Reference	Sample Type	Sample Location	Material Description	Moisture Content %
M06557	**AV01**	**Disturbed**	**Ruislip Sustainable Placement,NWSPA Mound 2,Strip 5,Layer 2**	**Brown Clay**	**22.8**

Remarks:

Signed:

Dated: **20-Apr-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Site Address: Black Arrow House, London NW10 6NF

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on determination of Moisture Condition Value of Materials at Natural Moisture Content in accordance with BS 1377: PART 4: 1990: Clause 5.4 and Moisture content in accordance with BS 1377: Part 2: 1990: Clause 3.2

Laboratory Sample No.	**M06557**	Date Sampled:	**01-Apr-22**
Client Sample No.	**AV01**	Date Received:	**01-Apr-22**
Sample Certificate:	**Yes**	Date Tested:	**06-Apr-22**
Site Reference:	**AV01**	Sample Type:	**Bulk**
Sample Location:	**Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 2**		
Material Description:	**Brown Clay**		
Supplier:	**SCS Railways**		
Source:	**Copthall Tunnel**		
Specification as Ordered:	**2A**		

Test results relate only to the Laboratory Sample number shown above.

			Specification Limits	
			Lower	Upper
Percentage Retained on 20mm Sieve - %	**0**	**(DRY)**		
Method of Interpretation SSL	**SSL**			
Natural Moisture Content - %	**25.7**			
Moisture Condition Value	**14.2**		**N/A**	**N/A**

SSL - Steepest straight line / BFL - Best Fit Line

Remarks:

Signed:

Date: **14-Apr-22**

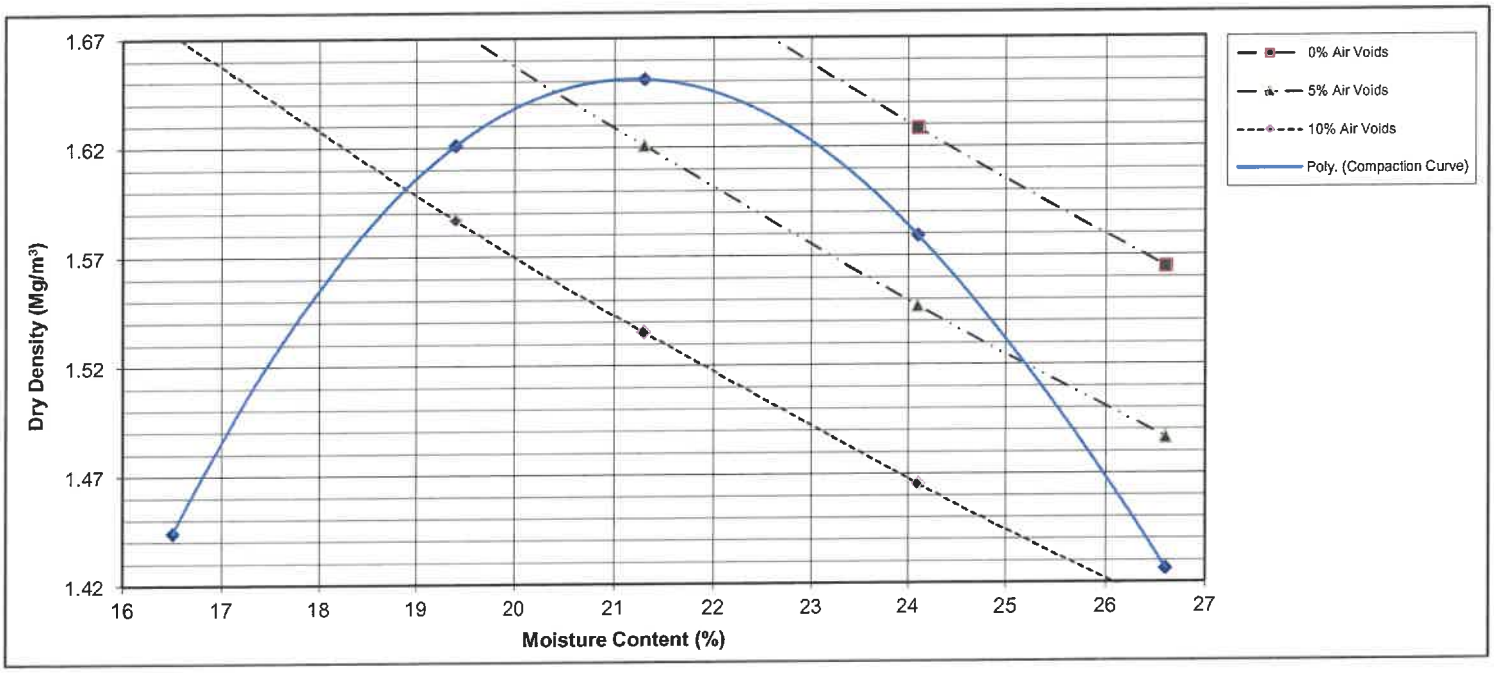
Laboratory Manager- Satish Ahlawat

UKAS TESTING 1489

RS-007 Rev002

Report on the Determination of Dry Density/Moisture Content Relationship in Accordance with BS 1377-4: 1990 Cl 3 and Moisture Content in Accordance with BS 1377-2: 1990 Cl 3.2 (Oven-Drying Method)

Laboratory Sample No:	M06557	Date Sampled:	01/04/2022
Sample Certificate:	Yes	Date Received:	01/04/2022
Site Reference:	AV01	Date Tested:	21/02/2022
Test/ Sample Location:	Ruislip Sustainable Placements NWSPA Mound 2, Strip 5, Layer2		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	Brown Clay		
Specification as Ordered:	2A	Date report issued:	19/04/2022
Sample Type:	Bulk		
Test Method:	Cl.3.5.4.2, 4.5 kg Rammer, Separate Batches 1L Mould		
Sample Preparation:	Cl.3.2.6.1		
Particle Density (Mg/m^3):	2.68 Assumed		
NMC	26.6%		
Percentage Retained:	20/37.5 mm sieve 0 / 0 %		



Optimum Moisture Content:	21.3%
Maximum Dry Density:	1.651Mg\m³

Remarks

UKAS TESTING 1489

Signed:

Laboratory Manager - Satish Ahlawat

Report No. MDD-M06557

Construction Testing Solutions

CHECKED
BY:

TEST REPORT:	**DETERMINATION OF PARTICLE DENSITY** BS 1377:Part 2:1990 Gas Jar Method		
REPORT NUMBER:	C1050095 / 179391.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	01/04/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	05/04/2022	MATERIAL:	Brown Clay 2A
DATE COMPLETED:	14/04/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2, Strip 5, Layer 2
TESTED BY:	WH, KJ	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:2016 clauses 8.3 and 8.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None
		METHOD OF PREPARATION:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
278335	M06557	Brown Clay 2A	2.70

Remarks:
Test results reported relate only to the items tested.
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For and on behalf of CTS
Mike Gray - Laboratory Supervisor

Approved Signatory
Report date 14-Apr-22

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0927

Report Format: L/Rep S7A/Rev 5

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

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www.constructiontesting.co.uk

Construction Testing Solutions Ltd.
Registered in England No. 05998333

END OF REPORT

LABORATORY TESTING OF SOIL - CONSTANT HEAD PERMEABILITY USING FLEXIBLE WALL PERMEAMETER
Test Report Certificate (Tested in accordance with BS EN ISO 17892-11:2019)

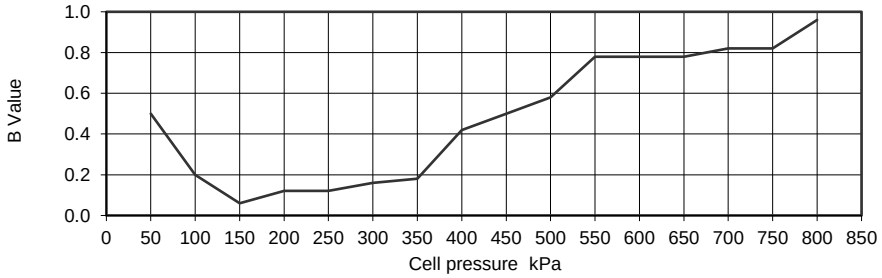
Contract No	CH22-008	Sample Details:	Sample Number	CH22-008-1 PERM		
Job Name	West Ruislip		Sample Reference	CH22-008-1		
			Sample No	278335	Type	C
			Date Sampled	01/04/2022		
			Date Received	07/04/2022		
			Client Ref	M06577		

Specimen Details

Soil Description	Stiff brown slightly sandy slightly gravelly CLAY (BROWN CLAY)		
Preparation Details	UNDISTURBED		
Length	101.3	mm	
Diameter	101.2	mm	
Particle density	2.70	Mg/m³	Measured

	Initial	Final	
Bulk Density	1.98	2.02	Mg/m³
Water Content	23.9	26.3	%
Dry density	1.60	1.60	Mg/m³
Voids ratio	0.69	0.69	
Degree of saturation	94	103	%

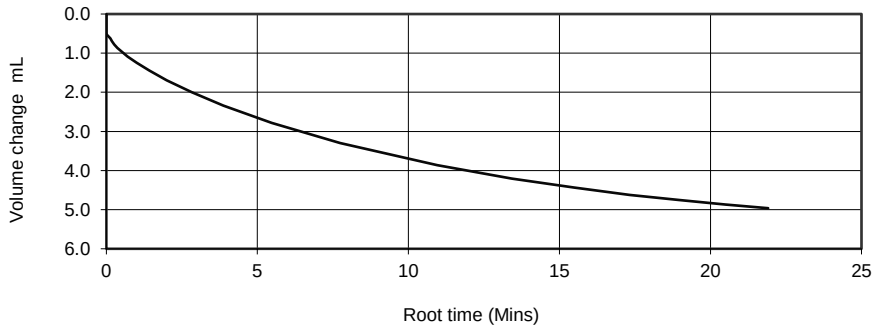
Saturation Stage



Date: Start of Test: 07/04/2022
Method used during saturation:
Increments of cell and back pressure

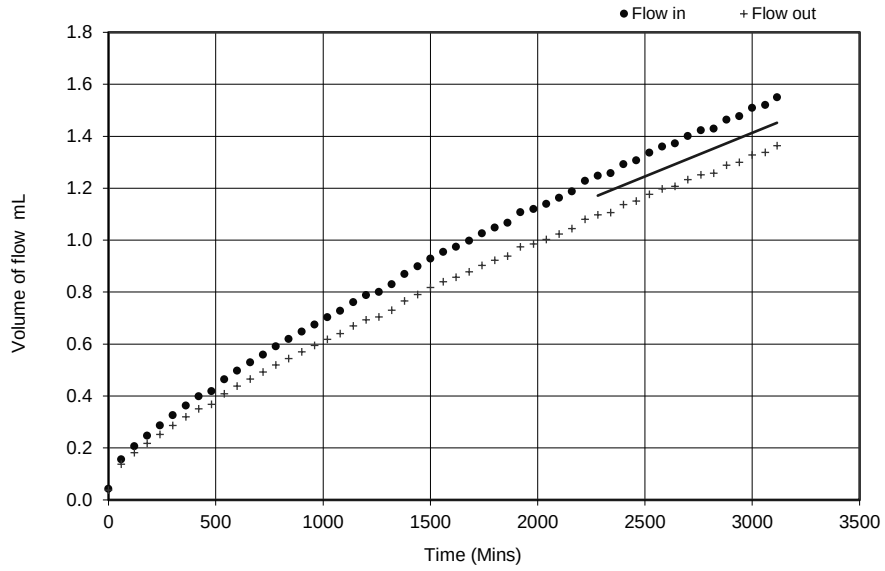
Cell pressure increments	50	kPa
Differential pressure	10	kPa
Final cell pressure	800	kPa
Final pore water pressure	788	kPa
Final B value	0.96	

Consolidation Stage



Drainage condition	to one end only	
Cell pressure applied	850	kPa
Back pressure applied	750	kPa
Effective stress	100	kPa

Permeability Stage



Date: Start of Flow: 18/04/2022

Cell pressure	850	kPa
Top pressure	765	kPa
Base pressure	735	kPa
Mean effective stress	100	kPa
Differential pressure	30	kPa
Hydraulic gradient	30	
Mean rate of flow	0.00034	ml/min
Average temperature during test	20	°C

Average Permeability, *kv*

(at 20°C) **2.3×10^{-11} m/s**

Notes Source: Copthall Tunnel
Supplier: SCS Railways
Location: Ruislip Sustainable Placement, NWSPA Mound 2, Strip 5, Layer 2

UKAS TESTING 4161

Construction Testing Solutions

Checked/Date		21/04/2022
Approved/Date		21/04/2022
Date Reported	21/04/2022	END OF REPORT

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, London, NW10 6NF**

Contract Name: **HS2 Main Works** Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No: **M06557** Date Sampled: **01/04/2022**

Client Sample No: **AV01** Date Received: **01/04/2022**

Sample Certificate: **Yes** Date Tested: **04/04/2022**

Sample Location: **Ruislip Sustainable Placements, NWSPA Mound 2,Strip 5,Layaer 2**

Material Description: **Brown Clay**

Source/Supplier: **Copthall Tunnel / SCS Railways** Sample Type: **Bulk**

Specification as Ordered: **2A**

Test results relate only to the sample numbers shown above.

Liquid Limit	**71.6**
Plastic Limit	**27.8**
Plasticity Index	**43.8**
Liquidity Index	**-0.15**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **12-Apr-22**

Laboratory Manager- Satish Ahlawat

CHECKED
BY:

celtest
INDEPENDENT MATERIALS TESTING | DIAMOND DRILLING & SAWING

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 19 April 2022
Test Report Ref: TR 875782

Contract: West Ruislip, Uxbridge Breakspear Road

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Particle Size Distribution (PSD) of a soil sample- washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2** Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S102115**
Client Ref. No:	**278335 (M06557)**
Date and Time of Sampling:	**01/04/2022**
Date of Receipt at Lab:	**07/04/2022**
Date of Start of Test:	**08/04/2022**
Sampling Location:	**Ruislip Sustainable Placement, NWSPA Mound 2, Strip 5, Layer 2**
Name of Source:	**Copthall Tunnel**
Method of Sampling:	**Disturbed Bulk Sample**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**VY**
Material Description:	**Brown Clay**
Target Specification:	**N/A**

RESULTS:

SEE ATTACHED

These results relate only to the items tested.

Comments:
None

Report checked and approved by:

Meical Owen
Soils Team Manager

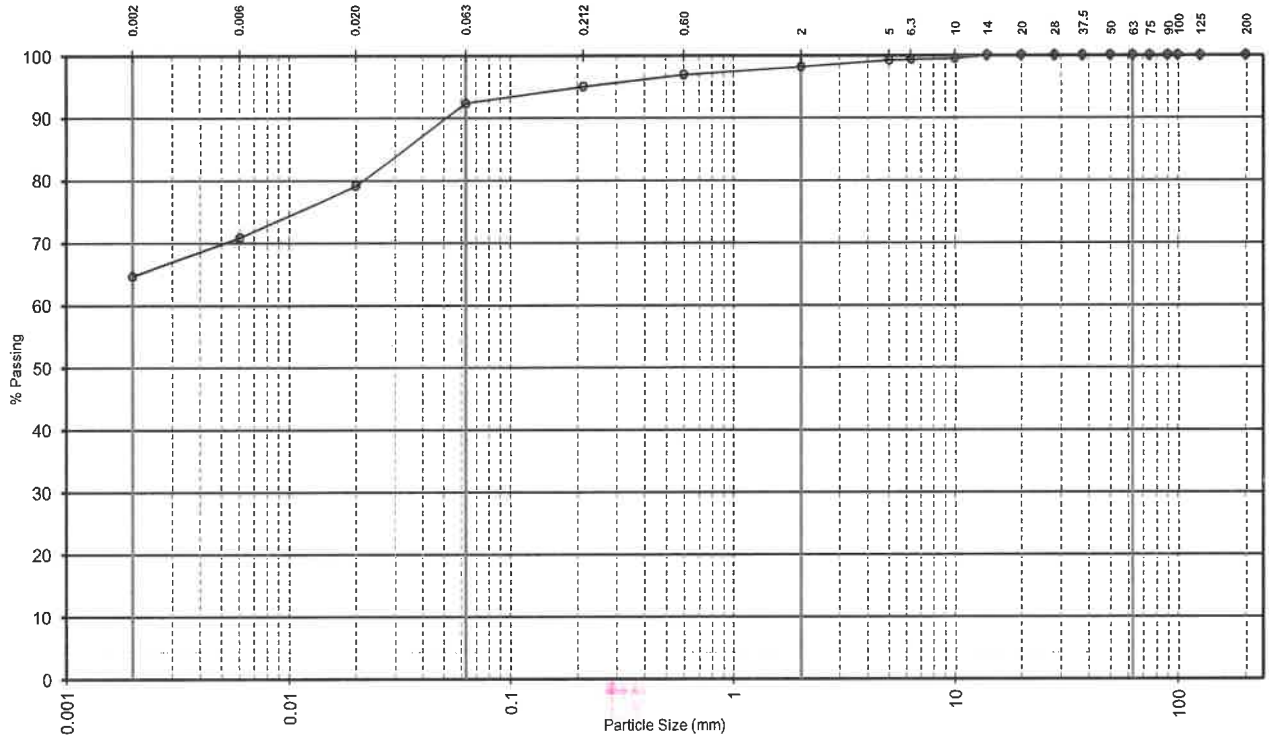
UKAS TESTING
0494

MATERIAL DESCRIPTION

Brown Clay

Method of pre-treatment:		N/A	
Sieve Size mm	% Passing	Sieve Size mm	% Passing
200	100	2.0	98
125	100	0.600	97
100	100	0.212	95
90	100	0.063	92.4
75	100	0.020	79.1
63	100	0.006	70.8
50	100	0.002	64.7
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5.0	99		

Cobbles	0.0
Gravel	1.8
Sand	5.8
Silt	27.7
Clay	64.7



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002 0.006		0.02	0.063 0.2		0.63	2.0 6.3		20	63 200
	SILT			SAND			GRAVEL			

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, Chandos Road, NW10 6NF**
Contract Name:	**High Speed 2 - Main Works**

Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06557**	Date Sampled:	**01-Apr-22**
Client Sample No:	**AV01**	Date Received:	**01-Apr-22**
Sample Certificate:	**Yes**	Date Tested:	**01-Apr-22**
Sample Location:	**NWSPA, Mound 2, Strip 5,Layer 2**		
Material Description:	**Brown Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Disturbed**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	1.92	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.52	-	-	-	-
Moisture Content (%)	26.4	-	-	-	-
Relative Compaction (%)	91	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.66 Mg/m^3

Remarks:

Signed:

Dated: **04-Apr-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Construction Testing Solutions

CHECKED
BY:

TEST REPORT: **DETERMINATION OF UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT PORE PRESURE MEASUREMENT**
BS 1377 : Part 7 : 1990 Clause 8

REPORT NUMBER: C1050095 / 179391.2.1.1

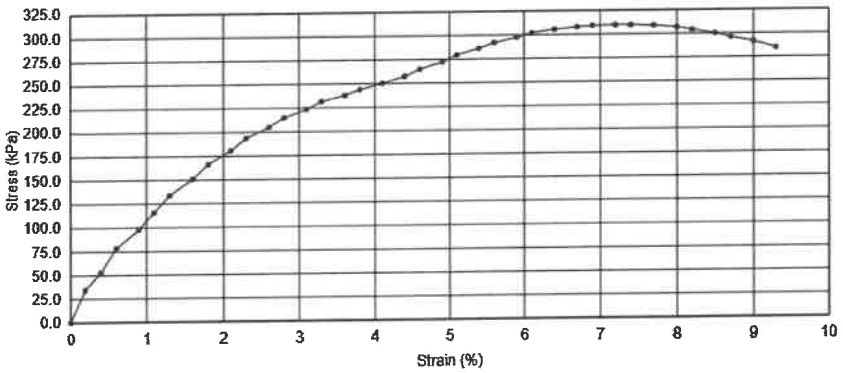
SAMPLE NUMBER:	278335	CLIENT:	SCS Railways
CLIENT REF:	M06557	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	01/04/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall Tunnel
DATE RECEIVED:	05/04/2022	MATERIAL:	Brown Clay
DATE COMPLETED:	13/04/2022	LOCATION:	Ruislip Sustainable Placement, NWSPA Mound 2, Strip 5, Layer 2
TESTED BY:	JW, JT	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE IF REMOULDED:	Remoulded 4.5kg	ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SPECIMEN: N/A	

RESULTS: **Test Location: Harrietsham Lab**

Tests were conducted on a disturbed sample, recompacted using a 4.5kg rammer at as received moisture content.

Initial specimen height:	200.3 mm
Initial specimen diameter:	100.4 mm
Initial bulk density:	2.03 Mg/m^3
Initial moisture content:	23.7 %
Initial dry density:	1.64 Mg/m^3
Rate of strain applied:	1 %/min
Membrane thickness (latex):	0.2 mm
Membrane correction:	0.4 kPa
Cell pressure:	200 kPa
Corrected maximum deviator stress at failure:	309.3 kPa
Strain at failure:	7.2 %
Mode of failure:	Plastic
Undrained Shear Strength, cu:	154.6 kPa

Stress V Strain



Remarks:
Test results reported relate only to the items tested.
This report shall not be reproduced except in full without approval of the Laboratory.

For and on behalf of CTS
Chris Davidson - Southern Laboratories Manager

Approved Signatory
Report date 19-Apr-22

UKAS TESTING
0927

Report Format: L/Rep UDSS/rev.1

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

0343 227 8545
enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

COSTAIN

Client Name:	**SCS Railways**		
Client Address:	**Black Arrow House, London, NW10 6NF**		
Contract Name:	**HS2 - Main Works**	Contract No:	**2500377**

Report on the Determination of the Insitu Density of Soil in accordance with BS 1377-9:1990 Cl 2.4 Core Cutter Method

Lab Sample No:	**M06577**	Date Sampled:	**05/04/2022**
Client Sample No:	**AV01**	Date Received:	**05/04/2022**
Sample Certificate:	**Yes**	Date Tested:	**05/04/2022**
Sample Location:	**RSP,NWSPA Mound 2 Strip 5 Layer 4**		
Material Description:	**Brown Clay**		
Source/Supplier:	**SCS Railways**	Sample Type:	**Undisturbed**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	T1	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	2.00	-	-	-	-
In-Situ Dry Density (Mg/m^3)	1.57	-	-	-	-
Moisture Content (%)	26.9	-	-	-	-
Relative Compaction (%)	94.9	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.66 Mg/m^3

Remarks:

Signed:

Dated: **06-Apr-22**

Lab Manager -Satish Ahlawat

UKAS TESTING 1489

Determination of Insitu Densities of Earthwork Materials using a Soil Density Gauge (Dieletric) to BS 1377: Part 9: 1990 and Documented In-House Method SP_INS_011, Air Voids Determination to Construction of Highway Earthworks HA79/94 Appendix A

Laboratory Sample No:	M06577		
Sample Certificate:	Yes		
Site Reference:	AV01	Date Tested:	05/04/2022
Test/ Sample Location:	NWSPA, Mound 2 Strip 5 Layer 4		
Supplier:	SCS Railways	Source:	Copthall Tunnel
Material Description:	BrownClay		
Specification as Ordered:	2A	Date report issued:	05/04/2022

Maximum Dry Density of the Material - kg/m³	1660

Laboratory Test Number	1	2	3	4	5	6
Test Location:	T1	T2				
Gauge Readings						
Dry Density - kg/m³	1580	1562				
Moisture Content - %	26.6	26.6				
Relative Compaction - %	95.2	94.1				

Average Relative Compaction - %	94.6
Specification Limits - %	95.0

Remarks

Signed:

Laboratory Manager - Satish Ahlawat

UKAS TESTING 1489

Report No. SDG-M06577

COSTAIN	**Costain Ltd** Costain House, Vanwall Business Park, Maidenhead SL6 4UB	RS-004-Moisture Content to BS1377 (Oven Drying Method) - Rev002
	Laboratory: Skanska Costain Strabag Joint Venture - Area West	
	Customer: High Speed 2	Page: 1 of 1

Report on the Determination of Moisture Content in accordance with BS 1377-2: 1990 Cl 3.2

Sample Certificate: **Yes**
Source/Supplier: **Copthall Tunnel/SCS Railways**

Specification as Ordered: **2A/2B**

Date Sampled: **05-Apr-22**
Date Received: **05-Apr-22**

Date Tested: **06-Apr-22**

Test results relate only to the sample numbers shown below.

Lab Sample No:	Site Reference	Sample Type	Sample Location	Material Description	Moisture Content %
M06577	**AV01**	**Disturbed**	**Ruislip Sustainable Placement,NWSPA Mound 2,Strip 5,Layer 4**	**Brown Clay**	**26.6**

Remarks:

Signed:

Dated: **20-Apr-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

Site Address: Black Arrow House, London NW10 6NF

COSTAIN

Client Name: **SCS Railways**

Client Address: **Black Arrow House, Chandos Road, NW10 6NF**

Contract Name: **High Speed 2 - Main Works** Contract No: **2500377**

Report on determination of Moisture Condition Value of Materials at Natural Moisture Content in accordance with BS 1377: PART 4: 1990: Clause 5.4 and Moisture content in accordance with BS 1377: Part 2: 1990: Clause 3.2

Laboratory Sample No.	**M06577**	Date Sampled:	**05-Apr-22**
Client Sample No.	**AV01**	Date Received:	**05-Apr-22**
Sample Certificate:	**Yes**	Date Tested:	**07-Apr-22**
Site Reference:	**AV01**	Sample Type:	**Bulk**
Sample Location:	**Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 4**		
Material Description:	**Brown Clay**		
Supplier:	**SCS Railways**		
Source:	**Copthall Tunnel**		
Specification as Ordered:	**2A**		

Test results relate only to the Laboratory Sample number shown above.

			Specification Limits	
			Lower	Upper
Percentage Retained on 20mm Sieve - %	**0**	**(DRY)**		
Method of Interpretation SSL	**SSL**			
Natural Moisture Content - %	**26.8**			
Moisture Condition Value	**13.2**		**N/A**	**N/A**

SSL - Steepest straight line / BFL - Best Fit Line

Remarks:

Signed:

Date: **14-Apr-22**

Laboratory Manager- Satish Ahlawat

UKAS TESTING 1489

RS-007 Rev002

Construction Testing Solutions

CHECKED
21 APR 2022
BY:

TEST REPORT: **DETERMINATION OF PARTICLE DENSITY**
BS 1377:Part 2:1990 Gas Jar Method

REPORT NUMBER:	C1050095 / 179546.1.1.1		
SAMPLE NUMBER:	See Below	CLIENT:	SCS Railways
CLIENT REF:	See Below	ADDRESS:	Black Arrow House, 2 Chandos Road, London, NW10 6NF
DATE SAMPLED:	05/04/2022	SITE:	Ruislip Sustainable Placements
SAMPLED BY:	Client	SUPPLIER:	SCS Railways, Copthall North
DATE RECEIVED:	06/04/2022	MATERIAL:	Brown Clay 2A
DATE COMPLETED:	14/04/2022	LOCATION:	Ruislip Sustainable Placement, Mound 2, Strip 5, Layer 4
TESTED BY:	WH, KJ	SAMPLING PLAN:	Client Specification
TYPE OF SAMPLE:	Disturbed	PREPARATION METHOD: :	BS1377:Part1:2016 clauses 8.3 and 8.4.2
ORIENTATION OF TEST SPECIMEN WITHIN ORIGINAL SAMPLE:	N/A	VARIATIONS:	None
		METHOD OF PREPARATION:	None

RESULT **Test Location: Harrietsham Lab**

SAMPLE NO	CLIENT SAMPLE REF	MATERIAL	PARTICLE DENSITY Mg.m^3
278525	M06577	Brown Clay 2A	2.75

Remarks:
Test results reported relate only to the items tested.
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For and on behalf of CTS
Mike Gray - Laboratory Supervisor

Approved Signatory
Report date 14-Apr-22

UKAS TESTING
0927

Report Format: L/Rep S7A/Rev 5

Northdown House, Ashford Road
Harrietsham, Nr Maidstone
Kent ME17 1QW

0343 227 8545
enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

Report version 1

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, London, NW10 6NF**
Contract Name:	**HS2 Main Works**

Contract No: **2500377**

Report on the Determination of Liquid Limit (Cone Penetrometer Method), Plastic Limit & Plasticity Index in accordance with BS 1377-2:1990 Cl 4 & 5

Lab Sample No:	**M06577**	Date Sampled:	**05/04/2022**
Client Sample No:	**AV01**	Date Received:	**05/04/2022**
Sample Certificate:	**Yes**	Date Tested:	**12/04/2022**
Sample Location:	**Ruislip Sustainable Placement, Mound 2 Strip 5 Layer 4**		
Material Description:	**Brown Clay**		
Source/Supplier:	**Copthall North/ SCS Railways**	Sample Type:	**Bulk**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Liquid Limit	**68.6**
Plastic Limit	**26.3**
Plasticity Index	**42.3**
Liquidity Index	**#VALUE!**
Percentage of Material <425µm	**N/A**
Sample History	**Tested in the natural state**
Test Method	**Single Point**

Remarks:

Signed:

Dated: **20-Apr-22**

Lab Manager - Satish Ahlawat

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 29 April 2022
Test Report Ref: TR 876456

Contract: West Ruislip, Uxbridge Breakspear Road

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Particle Size Distribution (PSD) of a soil sample-
washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2**
Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S102197**
Client Ref. No:	**278527 (M06577)**
Date and Time of Sampling:	**05/04/2022**
Date of Receipt at Lab:	**11/04/2022**
Date of Start of Test:	**21/04/2022**
Sampling Location:	**Ruislip sustainable placement, Mound 2, Strip 5, Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Disturbed Bulk Sample**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**VY**
Material Description:	**Brown Clay**
Target Specification:	**N/A**

RESULTS:

SEE ATTACHED

These results relate only to the items tested.

Comments:
None

CHECKED
04 MAY 2022
BY:

Report checked and approved by:

Meical Owen
Soils Team Manager

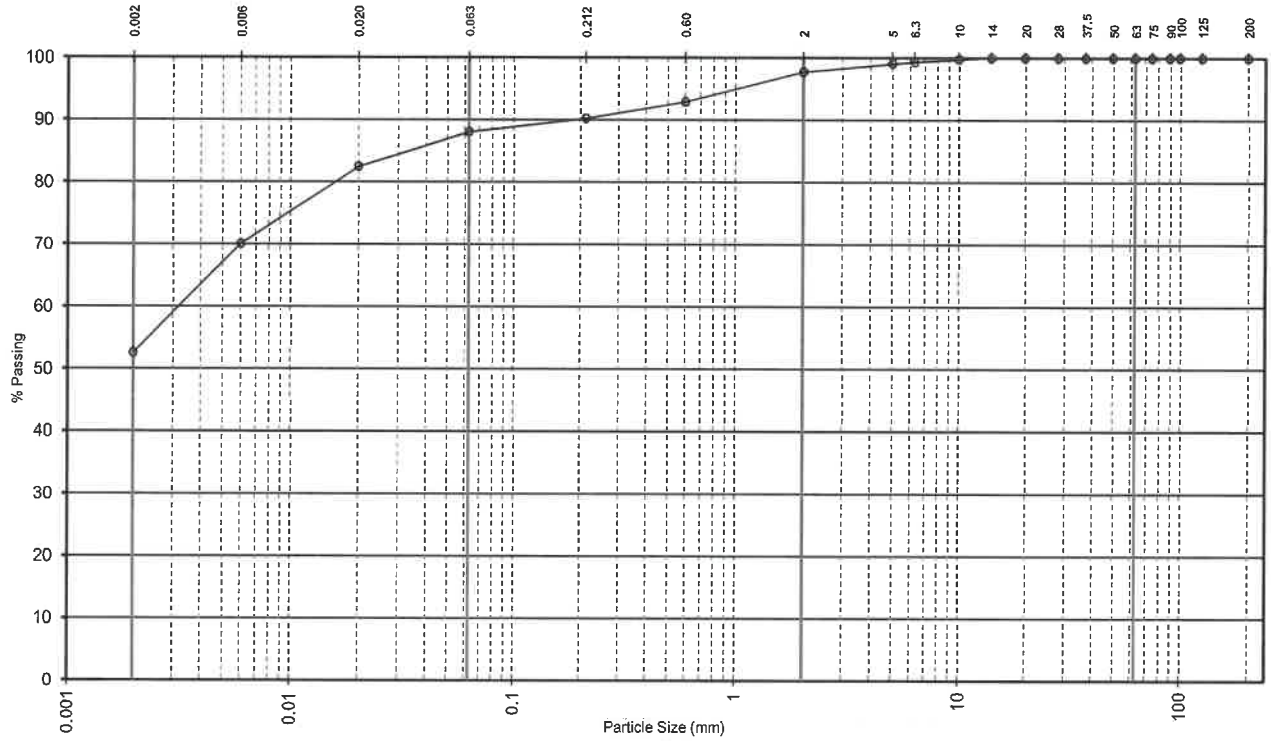
MATERIAL DESCRIPTION

Brown Clay

Method of pre-treatment: N/A

Sieve Size mm	% Passing	Sieve Size mm	% Passing
200	100	2.0	98
125	100	0.600	93
100	100	0.212	90
90	100	0.063	88.0
75	100	0.020	82.4
63	100	0.006	70.0
50	100	0.002	52.6
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5.0	99		

Cobbles	0.0
Gravel	2.3
Sand	9.7
Silt	35.4
Clay	52.6



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002	0.006	0.02	0.063	0.2	0.63	2.0	6.3	20	63 200
	SILT			SAND			GRAVEL			

Construction Testing Solutions Ltd
Heathrow Unit 12
Brittania Industrial Estate
Poyle Road
SL3 0BH

Date: 29 April 2022
Test Report Ref: TR 876457

Contract: West Ruislip, Uxbridge Breakspear Road

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Particle Size Distribution (PSD) of a soil sample- washing and sieving method in accordance with **BS1377-Part2-1990 Clause 9.2** Sedimentation by pipette method to **BS 1377: Part 2: 1990: clause 9.4.**

SAMPLE DETAILS:

Certificate of sampling received:	**Yes**
Laboratory Ref. No:	**S102197**
Client Ref. No:	**278525 (M06577)**
Date and Time of Sampling:	**05/04/2022**
Date of Receipt at Lab:	**11/04/2022**
Date of Start of Test:	**21/04/2022**
Sampling Location:	**Ruislip sustainable placement, Mound 2, Strip 5, Layer 4**
Name of Source:	**Copthall North**
Method of Sampling:	**Disturbed Bulk Sample**
Sampled By:	**Client (Test results apply to sample as received)**
Tested By:	**VY**
Material Description:	**Brown Clay**
Target Specification:	**N/A**

RESULTS:

SEE ATTACHED

These results relate only to the items tested.

Comments:
None

CHECKED
04 MAY 2022
BY:

Report checked and approved by:

Meical Owen
Soils Team Manager

Test Report Ref: TR 876457: Page 2 of 2

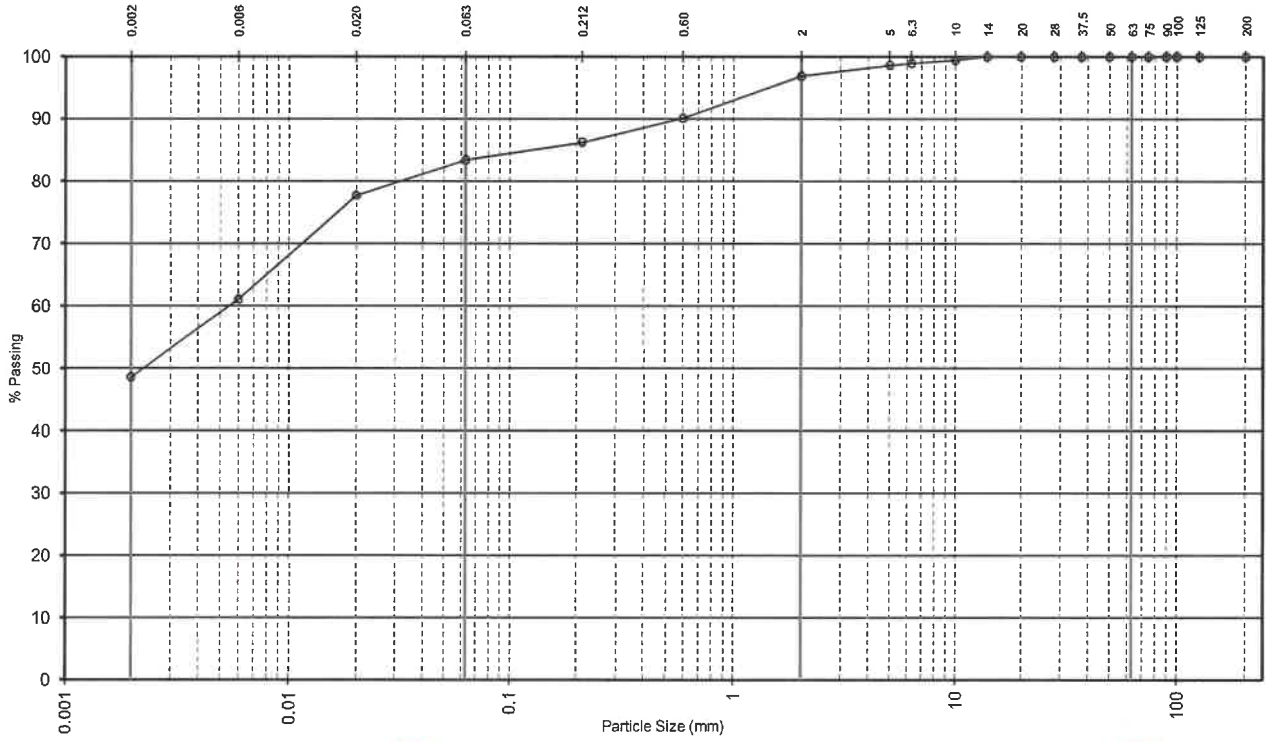
MATERIAL DESCRIPTION

Brown Clay

Method of pre-treatment: N/A

Sieve Size mm	% Passing	Sieve Size mm	% Passing
200	100	2.0	97
125	100	0.600	90
100	100	0.212	86
90	100	0.063	83.4
75	100	0.020	77.7
63	100	0.006	61.0
50	100	0.002	48.5
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5.0	99		

Cobbles	0.0
Gravel	3.1
Sand	13.5
Silt	34.9
Clay	48.5



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	0.002	0.006	0.02	0.063	0.2	0.63	2.0	6.3	20	63 200
	SILT			SAND			GRAVEL			

Client Name:	**SCS Railways**
Client Address:	**Black Arrow House, Chandos Road, NW10 6NF**
Contract Name:	**High Speed 2 - Main Works**

Contract No: **2500377**

Report on the Determination of the Insitu Density of Soil in Accordance with BS 1377-9:1990 Cl 2.2

Lab Sample No:	**M06577**	Date Sampled:	**05-Apr-22**
Client Sample No:	**AV01**	Date Received:	**05-Apr-22**
Sample Certificate:	**Yes**	Date Tested:	**05-Apr-22**
Sample Location:	**NWSPA, Mound 2, Strip 5,Layer 4**		
Material Description:	**Brown Clay**		
Source/Supplier:	**Copthall Tunnel/ SCS Railways**	Sample Type:	**Disturbed**
Specification as Ordered:	**2A**		

Test results relate only to the sample numbers shown above.

Test No.	1	-	-	-	-
Test Location	**T1**	-	-	-	-
In-Situ Bulk Density (Mg/m^3)	**1.98**	-	-	-	-
In-Situ Dry Density (Mg/m^3)	**1.56**	-	-	-	-
Moisture Content (%)	**26.5**	-	-	-	-
Relative Compaction (%)	**94**	-	-	-	-

Note: Relative Compaction based on a Maximum Dry Density of 1.66 Mg/m^3

Remarks:

Signed:

Dated: **06-Apr-22**

Lab Manager - Satish Ahlawat

UKAS TESTING 1489

APPENDIX E

Geotechnical Design Output

Slope stability analysis

Input data (Construction stage 1)

Project

Project : West London Composting
Part : Bund
Description : Geotechnical Design
Customer : Envar
Author : Drew Bennett
Date : 27/08/2025
Project ID : ST21061

Settings

United Kingdom - EN 1997

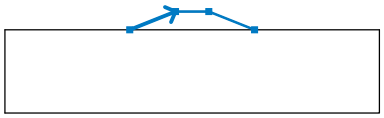
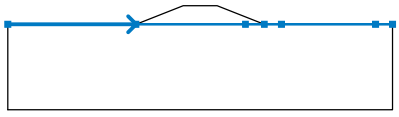
Stability analysis

Verification methodology : according to EN 1997
Earthquake analysis : Standard
Design approach : 1 - reduction of actions and soil parameters

Partial factors on actions (A)								
Permanent design situation								
		Combination 1				Combination 2			
		Unfavourable		Favourable		Unfavourable		Favourable	
Permanent actions :	γ_G =	1.35	[–]	1.00	[–]	1.00	[–]	1.00	[–]
Variable actions :	γ_Q =	1.50	[–]	0.00	[–]	1.30	[–]	0.00	[–]
Water load :	γ_w =	1.35	[–]			1.00	[–]		

Partial factors for soil parameters (M)					
Permanent design situation					
		Combination 1		Combination 2	
Partial factor on internal friction :	γ_ϕ =	1.00	[–]	1.25	[–]
Partial factor on effective cohesion :	γ_c =	1.00	[–]	1.25	[–]
Partial factor on undrained shear strength :	γ_{cu} =	1.00	[–]	1.40	[–]

Interface

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	2.75	1.10	4.75	1.10
		7.50	0.00				
2		-7.50	0.00	0.00	0.00	6.40	0.00
		7.50	0.00	8.50	0.00	14.00	0.00
		15.00	0.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Bund		21.00	0.50	20.00
2	Natural Clay		25.00	0.00	20.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Bund		20.00		
2	Natural Clay		20.00		

Soil parameters

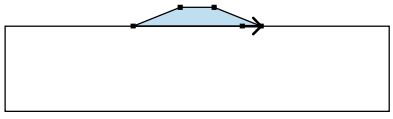
Bund

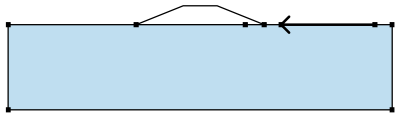
Unit weight :	γ = 20.00 kN/m^3
Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 21.00 °
Cohesion of soil :	c_{ef} = 0.50 kPa
Saturated unit weight :	γ_{sat} = 20.00 kN/m^3

Natural Clay

Unit weight :	γ = 20.00 kN/m^3
Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 25.00 °
Cohesion of soil :	c_{ef} = 0.00 kPa
Saturated unit weight :	γ_{sat} = 20.00 kN/m^3

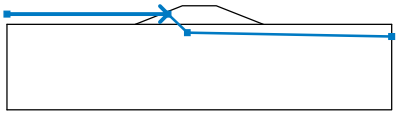
Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		6.40	0.00	7.50	0.00	Bund
		4.75	1.10	2.75	1.10	
		0.00	0.00			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
2		14.00	0.00	8.50	0.00	Natural Clay
		7.50	0.00	6.40	0.00	
		0.00	0.00	-7.50	0.00	
		-7.50	-5.00	15.00	-5.00	
		15.00	0.00			

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		-7.50	0.60	1.91	0.60	3.05	-0.48
		15.00	-0.71				

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	0.44	[m]	Angles :	α_1 =	-10.21	[°]
	z =	3.11	[m]		α_2 =	50.50	[°]
Radius :	R =	3.16	[m]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 18.68 kN/m

Slope stability verification (Bishop)

Combination 1

Sum of active forces : F_a = 6.53 kN/m
Sum of passive forces : F_p = 6.75 kN/m

Sliding moment : M_a = 17.04 kNm/m
Resisting moment : M_p = 17.62 kNm/m
Utilization : 96.7 %

Slope stability ACCEPTABLE

Combination 2

Sum of active forces : F_a = 4.64 kN/m
Sum of passive forces : F_p = 4.68 kN/m

Sliding moment : M_a = 14.67 kNm/m
Resisting moment : M_p = 14.80 kNm/m

Utilization : 99.1 %

Slope stability ACCEPTABLE

Optimized slip surface for : Combination 2

APPENDIX F

BUND CAPACITY CALCULATION SHEET

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
West London Composting	Permit Variation, West London	ST21061	PAGE: 1 OF 1
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Bund Capacity Calculation	Luke Imber	AP	AP
	DATE: 29/08/2025	DATE: 08/09/2025	DATE: 08/09/2025

Storage Tanks On Site	Storage Volume (m³)
Ad Blue Tank	1.4
Diesel Tank 1	20
Diesel Tank 2	14
Diesel Tank 3	5
2 x Existing leachate tanks (total)	980
2 x New leachate tanks (total)	1000
TOTAL	**2020.4**

From Ciria document 736, page 38:

> Where two or more tanks are installed within the same bund, the recommended capacity of the bund is the greater of:
>
> 1 110 per cent of the capacity of the largest tank within the bund.
>
> 2 25 per cent of the total capacity of all of the tanks within the bund, except where tanks are hydraulically linked in which case they should be treated as if they were a single tank

1. 110% Capacity of the largest tank

Largest tank present in the bunded area is 500m³. 110% of 500m³ = 550m³

1 (alt). Treating the leachate tanks as one single unit-110% capacity of the tanks.

Total volume of the tanks = 1980m³. 110% of 1980 =2178m³

2. 25% of the total capacity.

Total capacity = 2020.4m³. 25% of 2020.4m³ = 505.1m³.

Therefore the capacity of the bund should be 550m³ as a minimum.

The bund has been designed to accommodate the storm water that would occur during a 1 in 100 year storm event + 40% allowance for climate change. The total storage available underneath the freeboard of the bunds is 2200m³

Drawing ST21061-115-B Demonstrates a flood volume of 2200m³ applied to the site. The maximum flood depth around the storage tank area is 0.3m. With a 750mm allowance for freeboard, the bund height has been designed to be 1.05m high.