



Geotechnical Ground Investigation Report

**Jaguar Landrover
Halewood
L24 9BJ**

Date: 23rd May 2024

Version 1

ENVIROSOLUTION LTD

Suite 53
3a Bridgewater Street
Liverpool
L1 0AB



EnviroSolution Ltd

Document Verification

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Prepared by	Tom Craig	Signature	
Checked by	Angel Arantegui	Signature	

Disclaimer

This report has been prepared by EnviroSolution Ltd who has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant experienced in preparing reports of a similar scope.

However, to the extent that the report is based on or relies upon information contained in records, reports or other materials provided to EnviroSolution Ltd, which have not been independently produced or verified, EnviroSolution Ltd, gives no warranty, representation or assurance as to the accuracy or completeness of such information.

The scope of this report is restricted to potential ground contamination and its environmental impact; it does not cover above-ground hazards (e.g., asbestos in buildings), ecological sensitivities (e.g., bats), biological or horticultural hazards (e.g., Japanese Knotweed) or structural hazards (e.g., building stability) unless specifically referred to in the text of this report.



Executive Summary

EnviroSolution Ltd was commissioned to undertake a Geotechnical Ground Investigation to inform development plans for a JEA tent at Jaguar Landrover, Haewood.

The recent intrusive ground investigation has shown that the site is underlain by up to 0.60m of Made Ground overlying firm to stiff brown slightly gravelly clay diamicton. No organic soils or peat were recorded within the boreholes.

Uncorrected SPT N values for this unit range between 5 and in excess of 18 which indicates a low, becoming high strength clay with an approximate undrained shear strength range of between 25kN/m² and 90kN/m².

No groundwater inflows were recorded during the investigation.

Concrete core compressive strength for the concrete slab ranged between 40.9N/mm² and 50.3N/mm².

Specialist advice should be sought with regards to the design sulphate class.

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1 Introduction

1.1 Background

EnviroSolution Ltd was commissioned to undertake a Geotechnical Site Investigation at Jaguar Landrover in Halewood. This work was required to inform development plans for a new JEA tent.

1.2 Objectives

The objectives of the ground investigation were:

1. To develop a ground model of the site, summarising the ground conditions.
2. To obtain information to inform foundation design.
3. To identify the requirements for any additional works prior to site development (e.g. further ground investigation or remedial works).

1.3 Scope of Work

- An intrusive ground investigation in order to obtain information on the ground conditions beneath the site.
- Geotechnical testing.
- Concrete core testing.
- A geotechnical appraisal of the ground conditions to inform foundation design.

The scope of work for the assessment was developed in accordance with the following documents:

1. British Standard BS 5930:2015: Code of Practice for Site Investigations. British Standards Institute (2015).
2. BS EN ISO 14688-1:2002+A1:2013: Geotechnical Investigation and Testing. Identification and Classification of Soil. Identification and Description.

2 The Site

2.1 Site Location

The site is located at Jaguar Landrover, Halewood, Liverpool, L24 9BJ. The National Grid Reference at the approximate site centre is NGR: 344840 384300.

The site location is shown on **Figure 1** in **Appendix A**.

2.2 Site Description

The site lies in the north-eastern corner of the JLR compound and is currently used as a transport yard/ depot.

The entire site area is covered in concrete hardstanding.

The topography of the site is relatively flat with little change in elevation laying at approximately 24m aOD.

The existing site plan is shown on **Figure 2** which is included in **Appendix A**.

2.3 Development Proposals

It is understood that the proposed development is for the construction of a new JEA tent.

The proposed site plan is shown on **Figure 3** which is included in **Appendix A**.

3 Ground Investigation Methodology

3.1 Intrusive Field Works

The intrusive investigation works were undertaken by EnviroSolution Ltd on the 29th and 30th of May 2024. The work comprised the following:

- The drilling of 6 no. window sample boreholes (designated as WS1 – WS6) to depths of 5.45m bgl.
- Geotechnical logging of ground conditions.
- Collection of concrete cores for subsequent compressive strength testing.
- Collection of representative soil samples from the boreholes for subsequent geotechnical laboratory analysis.

The exploratory hole locations are shown on **Figure 4** in **Appendix A**.

3.2 Soil Sampling Methodology

The exploratory holes were logged in accordance with the requirements of BS 5930: 2015+A1:2020 and BS EN 14688 Pts 1&2. Soil samples were collected at distinct changes in lithology, or on the basis of field observations.

Samples were collected with a clean trowel or by hand (using dedicated nitrile gloves for each sampling location). Samples were placed immediately into laboratory supplied sampling containers, specific to the type of analyses required. All sample containers were sealed and labelled with a unique location identity, depth and date of sampling.

3.3 Laboratory Analysis

3.3.1 Geotechnical Analysis

A programme of laboratory testing was undertaken in accordance with BS:1377 (1990) 'Methods of Test for Soils for Civil Engineering Purposes'. The following tests being carried out:

Table 1: BS:1377 Testing

BS Test No.	Description
Part 2: 3.2.3.3	Moisture Content
Part 3: 5.2	Sulphate Content, pH Value
Part 2: 5,4	Plasticity Index

The following in-situ and laboratory testing outside the scope of BS:1377 was also undertaken:

Table 2: Non-BS:1377 Testing

Standard or Methodology	Test Description
BRE Special Digest 1	Total Sulphate, Aqueous Extract Sulphate, Total Sulphur, pH

4 Ground Conditions

4.1 Made Ground

Made Ground was encountered in all exploratory hole locations at the site with a recorded thickness of between 0.30m and 0.60m.

The Made Ground typically consists of a reinforced concrete slab (0.15m – 0.23m thick) overlying a grey sandy coarse gravel with occasional brick fragments.

4.2 Diamicton

Diamicton deposits were encountered in all of the exploratory boreholes at the site, beneath the Made Ground. The diamicton generally consists of firm to stiff brown slightly gravelly clay with occasional thin layers (0.10m) of fine to coarse gravel.

Uncorrected SPT N values recorded in the diamicton generally ranged between 5 and 18 which indicates a low, becoming high strength clay with an approximate undrained shear strength range of between 25kN/m² and 90kN/m² using the general approximation of:

Undrained shear strength = $N \times 5$ (after Stroud, 1974).

4.3 Bedrock

Bedrock deposits of the Kinnerton Sandstone were not encountered during the investigation.

4.4 Groundwater

Groundwater inflows were not recorded during the drilling works.

A copy of the borehole logs is included in **Appendix C**.

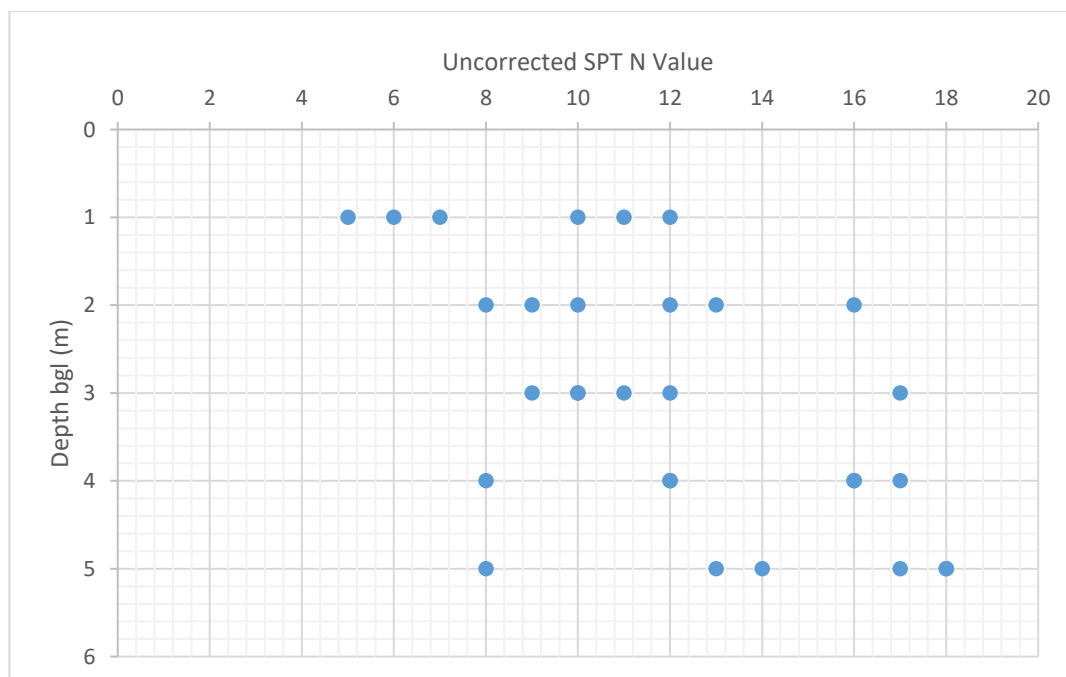
5 Geotechnical Test Results

5.1 Geotechnical Model

Table 3: Geotechnical Model

Stratum	Depth to Base (m bgl)	Parameters/ Comments	
		Strength Parameters	Other Parameters/ Notes
Made Ground	0.30m – 0.60m	Not recorded	Reinforced concrete slab overlying grey sandy coarse gravel with occasional brick fragments.
Diamicton	Not proven	SPT N values 5 - 18	Firm to stiff brown slightly gravelly clay with occasional thin layers (0.10m) of fine to coarse gravel.

A total of 30 no. Standard Penetration Tests (SPTs) were performed during the drilling works. The results are recorded on the borehole logs at the appropriate depths and are displayed on the graph below.



5.2 Geotechnical Laboratory Test Results

5.2.1 Sulphate Testing

The results of chemical testing carried out in accordance with BRE Special Digest 1:2005 Concrete in Aggressive Ground are summarised as follows (See **Appendix D**):

Table 4: BRE Special Digest 1:2005 Test Results

Material	Property	No. of Tests	Range of Results	Characteristic Values (BRE Special Digest 1)	Design Sulphate Class and ACEC Class
Made Ground	Sulphate (SO ₄) by 2:1 water soil extract (mg/l)	2	276 – 1630	1630	Specialist advice should be sought
	pH	2	9.6 – 10.5	9.6	
	Total Sulphur %	2	0.11 – 0.28	0.28	
Natural Ground	Sulphate (SO ₄) by 2:1 water soil extract (mg/l)	3	<10 – 68	68	DS-1 AC-1
	pH	3	8.2	8.2	
	Total Sulphur %	3	<0.02	0.02	

5.2.2 Plasticity Testing

The results of the plasticity testing are summarised below. A copy of the laboratory testing results is included in **Appendix D**.

Table 5: Plasticity Results

Sample	Plasticity Index	Modified Plasticity Index	Volume Change Potential
WS1 at 1.0m	15	13	Low
WS2 at 3.0m	13	12	Low
WS3 at 3.0m	15	13	Low

Sample	Plasticity Index	Modified Plasticity Index	Volume Change Potential
WS4 at 3.50m	14	13	Low

* Modified Plasticity Index for % passing 425µm sieve in accordance with NHBC Standards Chapter 4.2

The results show a low plasticity clay soil with a low volume change potential.

5.2.3 Natural Moisture Content

Natural moisture content testing was carried out on a total of 4 no. soil samples. The results of the natural moisture content testing are shown in **Appendix D**.

The results show a range in natural moisture content of between 13.3% and 14.9%.

5.3 Concrete Core Compressive Strength Results

The results of the concrete core compressive strength testing are summarised below. A copy of the laboratory test certificates is included in **Appendix D**.

Table 6: Concrete Core Compressive Strength Testing

Sample	Core Compressive Strength (N/mm ²)
CC-1	42.2
CC-2	40.7
CC-3	50.3
CC-4	40.9
CC-5	43.9
CC-6	41.5

6 Conclusions and Recommendations

The recent intrusive ground investigation has shown that the site is underlain by up to 0.60m of Made Ground overlying firm to stiff brown slightly gravelly clay diamicton. No organic soils or peat were recorded within the boreholes.

Uncorrected SPT N values for this unit range between 5 and in excess of 18 which indicates a low, becoming high strength clay with an approximate undrained shear strength range of between 25kN/m² and 90kN/m².

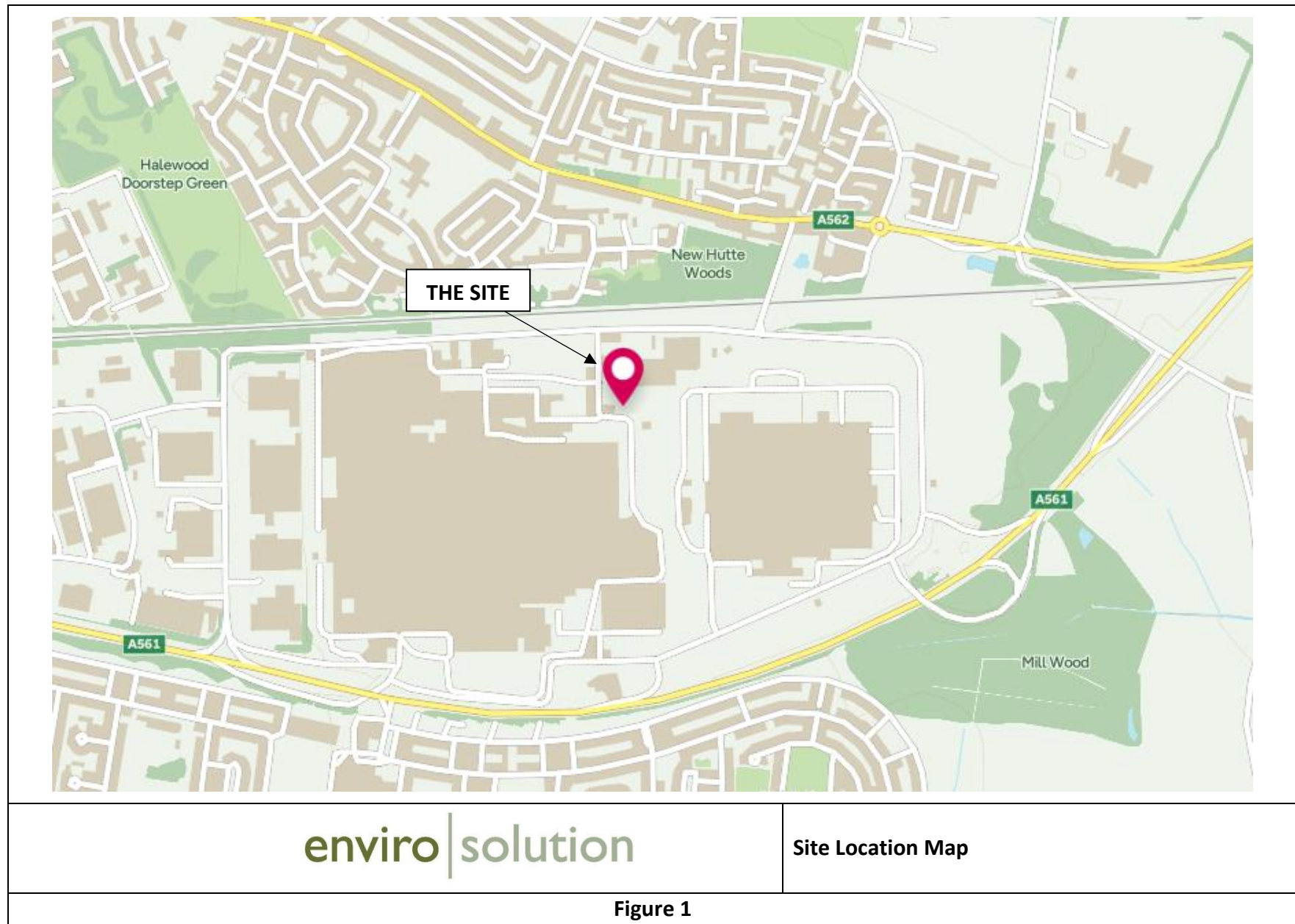
No groundwater inflows were recorded during the investigation.

Concrete core compressive strength for the concrete slab ranged between 40.9N/mm² and 50.3N/mm².

Specialist advice should be sought with regards to the design sulphate class.

APPENDICES

Appendix A – Site Location and Site Plan





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Existing Site Plan

Figure 2



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Exploratory Holes Location Plan

Figure 3

Appendix B – Site Photographs



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WS1



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WS2



enviro|solution

WS3



enviro|solution

WS4



enviro|solution

Borehole WS5



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Borehole WS6

Appendix C – Window Sample Borehole Logs

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Appendix D – Laboratory Data

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



Report No: **XTE 77860 - 863**
Page 1 of 1

TEST REPORT OF MOISTURE CONTENT OF SOILS

Method: BS 1377-2:1990, Method 3.2.3.3. Oven Drying

XTRATEC SAMPLE REF | *Remarks
CUSTOMER/SITE SAMPLE REF | **Remarks

CLIENT | DETS Ltd
SITE | JLR BIW
SPECIFICATION | For Classification
SUPPLIER/SOURCE | Insitu
SAMPLING METHOD | Unknown
SAMPLED BY | Client
TYPE OF SAMPLE | Bulk
DATE SAMPLED | Unknown
DATE RECEIVED | 02 May 2024
DATE TESTED | 03 May 2024
PREPARATION METHOD | BS 1377-1. 7.3.5.2 (Sub dividing)

Sample Reference	Sample Description	Location	Moisture Content (%)
XTE 77860	Red sandy Clay with gravel	1.00m	14.9
XTE 77861	Red sandy Clay with gravel	3.00m	13.9
XTE 77862	Red sandy Clay with gravel	3.00m	13.3
XTE 77863	Red sandy Clay with gravel	3.50m	13.3

REMARKS: *XTE 77860 - 863
**712897 - 900

ISSUE TO: DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 14 May 2024

AUTHORISED BY: R Hemmings Laboratory
Manager

The results reported represents only the material tested supplied to the laboratory or if the material has been sampled by Xtratec the quantity of the material represented by the sample. This report shall not be reproduced except in full without approval of the laboratory

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



Report No: **XTE 77860**
Page 1 of 1

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 77860
CUSTOMER/SITE SAMPLE REF | 712897

CLIENT	DETS Ltd
SITE	JLR BIW
SOIL DESCRIPTION	Red sandy Clay with gravel
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	1.00m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	02 May 2024
DATE TESTED	03 May 2024
PREPARATION METHOD	Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	11
Liquid Limit	30
Plastic Limit	15
Plasticity Index	15

REMARKS:

ISSUE TO: DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 14 May 2024

AUTHORISED BY: R Hemmings Laboratory
Manager

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Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



Report No: **XTE 77861**
Page 1 of 1

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 77861
CUSTOMER/SITE SAMPLE REF | 712898

CLIENT	DETS Ltd
SITE	JLR BIW
SOIL DESCRIPTION	Red sandy Clay with gravel
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	3.00m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	02 May 2024
DATE TESTED	03 May 2024
PREPARATION METHOD	Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	11
Liquid Limit	27
Plastic Limit	14
Plasticity Index	13

REMARKS:

ISSUE TO: DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 14 May 2024

AUTHORISED BY: R Hemmings Laboratory
Manager

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Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



Report No: **XTE 77862**
Page 1 of 1

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 77862
CUSTOMER/SITE SAMPLE REF | 712899

CLIENT	DETS Ltd
SITE	JLR BIW
SOIL DESCRIPTION	Red sandy Clay with gravel
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	3.00m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	02 May 2024
DATE TESTED	03 May 2024
PREPARATION METHOD	Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	14
Liquid Limit	29
Plastic Limit	14
Plasticity Index	15

REMARKS:

ISSUE TO: DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 14 May 2024

AUTHORISED BY: R Hemmings Laboratory
Manager

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Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176



Report No: **XTE 77863**
Page 1 of 1

TEST REPORT OF PLASTICITY INDEX

Method: BS 1377-2:1990 Method 4.4 Liquid Limit One Point
Method: BS 1377-2:1990 Method 5.3 Plastic Limit
Method: BS 1377-2:1990 Method 5.4 Plasticity Index

XTRATEC SAMPLE REF | XTE 77863
CUSTOMER/SITE SAMPLE REF | 712900

CLIENT	DETS Ltd
SITE	JLR BIW
SOIL DESCRIPTION	Red sandy Clay with gravel
SUPPLIER/SOURCE	Insitu
SAMPLING LOCATION	3.50m
SAMPLING METHOD	Unknown
SAMPLED BY	Client
TYPE OF SAMPLE	Bulk
DATE SAMPLED	Unknown
DATE RECEIVED	02 May 2024
DATE TESTED	03 May 2024
PREPARATION METHOD	Tested by Wet Sieving

TEST RESULTS	
Percentage Retained 425um (%)	9.7
Liquid Limit	28
Plastic Limit	14
Plasticity Index	14

REMARKS:

ISSUE TO: DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane, Lenham Heath
Maidstone
ME17 2JN

DATE: 14 May 2024

AUTHORISED BY: R Hemmings Laboratory
Manager

The results reported represents only the material tested supplied to the laboratory or if the material has been sampled by Xtratec the quantity of the material represented by the sample. This report shall not be reproduced except in full without approval of the laboratory



Tom Craig
Envirosolution Ltd
Suite 5
The Quay
No. 12 Princes Dock
Liverpool Waters
Liverpool
L3 1DL

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-04786

Site Reference: JLR BIW

Project / Job Ref: JLR BIW

Order No: ES020524A

Sample Receipt Date: 02/05/2024

Sample Scheduled Date: 02/05/2024

Report Issue Number: 1

Reporting Date: 15/05/2024

Authorised by:

Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 24-04786	~Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Envirosolution Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: JLR BIW	~TP / BH No	WS1	WS2	WS3	WS4	
~Project / Job Ref: JLR BIW	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
~Order No: ES020524A	~Depth (m)	1.00	3.00	3.00	3.50	
Reporting Date: 15/05/2024	DETS Sample No	712897	712898	712899	712900	

Determinand	Unit	RL	Accreditation				
Natural Moisture Content ^(S)	%	N / a	ISO17025	Create PDF	Create PDF	Create PDF	Create PDF

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

~Sample details provided by customer section and can affect the validity of results



Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04786

Envirosolution Ltd

~Site Reference: JLR BIW

~Project / Job Ref: JLR BIW

~Order No: ES020524A

Reporting Date: 15/05/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

~Sample details provided by customer section and can affect the validity of results



Tom Craig
Envirosolution Ltd
Suite 5
The Quay
No. 12 Princes Dock
Liverpool Waters
Liverpool
L3 1DL

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-04785

Site Reference: JLR BIW
Project / Job Ref: JLR BIW
Order No: ES020524A
Sample Receipt Date: 02/05/2024
Sample Scheduled Date: 02/05/2024
Report Issue Number: 1
Reporting Date: 09/05/2024

Authorised by:

Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 24-04785	~Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Envirosolution Ltd	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: JLR BIW	~TP / BH No	WS1	WS2	WS3	WS4	WS6
~Project / Job Ref: JLR BIW	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: ES020524A	~Depth (m)	2.00	0.30	0.30	2.10	1.80
Reporting Date: 09/05/2024	DETS Sample No	712892	712893	712894	712895	712896

Determinand	Unit	RL	Accreditation	(n)				
pH	pH Units	N/a	MCERTS	8.2	9.6	10.5	8.2	8.2
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	216	7462	2559	281	208
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.02	0.75	0.26	0.03	0.02
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	1630	276	68	52
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	1.63	0.28	0.07	0.05
Total Sulphur	%	< 0.02	NONE	< 0.02	0.28	0.11	< 0.02	< 0.02
W/S Magnesium	mg/l	< 0.1	NONE		2.9			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

~ Sample details provided by the customer

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-04785	
Envirosolution Ltd	
~Site Reference: JLR BIW	
~Project / Job Ref: JLR BIW	
~Order No: ES020524A	
Reporting Date: 09/05/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 712892	WS1	None Supplied	2.00	10.2	Light brown sandy clay
^ 712893	WS2	None Supplied	0.30	11.5	Brown concrete with brick
^ 712894	WS3	None Supplied	0.30	11	Brown sandy clay with brick and concrete
^ 712895	WS4	None Supplied	2.10	11.9	Light brown sandy clay
^ 712896	WS6	None Supplied	1.80	13.6	Light brown sandy clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}

~ Sample details provided by the customer

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04785

Envirosolution Ltd

~Site Reference: JLR BIW

~Project / Job Ref: JLR BIW

~Order No: ES020524A

Reporting Date: 09/05/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (all: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (all: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried

AR As Received

~ Sample details provided by the customer

LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project :	Jaguar Land Rover	Job No.:	W20239
Client :	Enviro Solution	Lab Ref No.:	W20239
		Date Received:	29/04/2024
		Date Reported:	12/05/2023
		Material:	Concrete
		Date Cored:	Na
Originator:	Tom	Sampled by	Enviro / Solution

As Received Sample Details		
Laboratory Ref.		W20239
Client Ref.		Core CC6
Sample Location		Slab
Direction		Vertical
Length (mm)	Max.	180
	Min.	180
Maximum Nominal Aggregate Size (mm)		5-20
Visual Inspection		Minimum Voids. 0.5%.
Reinforcement		2*8mm Ø bar 65mm, 55mm. 2*12mm Ø bar 50mm, 55mm. From top of core. 2*8mm Ø bar 49mm 57mm. From nearest end of final test specimen.
Test Section (mm)		10-180
Before End Preparation/After Grinding		
Measured Sample Length (mm)		170.0
Measured Sample Diameter (mm)		191.0
Sample Mass (g)		10957
Type Of Density Determined (Saturated, As Rec'd Or Dried)		As Received
Density (kg/m³)		2400
Method Of Volume Determination		Displacement
Test Results		
Date Cast		N/K
Date Tested		07/05/2024
Age At Test (days)		N/A
Method Of End Preparation		Grinding
Storage Condition		Sealed Container
Length Of Time Cured After Preparation		N/A
Length Of Specimen As Tested (mm)		160.0
Length/Diameter Ratio		0.84
Max. Load (kN)		1189
Compressive Strength (N/mm²)		41.5
Remarks		None

Cores cured since receipt at 20+/- 2°C
 Compressive Strength - Tested in accordance with BS EN 12504-1:2019
 Density - Tested in accordance with BS EN 12390-7:2019
 The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature **D Wain**
 CMTL Limited
 David Wain, Concrete Section.



LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project :	Jaguar Land Rover	Job No.:	W20239
Client :	Enviro Solution	Lab Ref No.:	W20239
		Date Received:	29/04/2024
		Date Reported:	12/05/2023
		Material:	Concrete
		Date Cored:	Na
Originator:	Tom	Sampled by	Enviro / Solution

As Received Sample Details		
Laboratory Ref.		W20239
Client Ref.		Core CC5
Sample Location		Slab
Direction		Vertical
Length (mm)	Max.	175
	Min.	140
Maximum Nominal Aggregate Size (mm)		5-20
Visual Inspection		Minimum Voids. 0.5%. Crack full length of core.
Reinforcement		3*8mm Ø bar 71mm, 78mm, 86mm. From top of core. 3*8mm Ø bar 64mm, 73mm, 81mm. From nearest end of final test specimen.
Test Section (mm)		0-140
Before End Preparation/After Grinding		
Measured Sample Length (mm)		133.0
Measured Sample Diameter (mm)		191.0
Sample Mass (g)		8300
Type Of Density Determined (Saturated, As Rec'd Or Dried)		As Received
Density (kg/m³)		2300
Method Of Volume Determination		Displacement
Test Results		
Date Cast		N/K
Date Tested		07/05/2024
Age At Test (days)		N/A
Method Of End Preparation		Grinding
Storage Condition		Sealed Container
Length Of Time Cured After Preparation		N/A
Length Of Specimen As Tested (mm)		125.0
Length/Diameter Ratio		0.65
Max. Load (kN)		1258
Compressive Strength (N/mm²)		43.9
Remarks		None

Cores cured since receipt at 20+/- 2°C

Compressive Strength - Tested in accordance with BS EN 12504-1:2019

Density - Tested in accordance with BS EN 12390-7:2019

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Approved Signature
 CMTL Limited
 David Wain, Concrete Section.

D Wain



LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project :	Jaguar Land Rover	Job No.:	W20239
Client :	Enviro Solution	Lab Ref No.:	W20239
		Date Received:	29/04/2024
		Date Reported:	12/05/2023
		Material:	Concrete
		Date Cored:	Na
Originator:	Tom	Sampled by	Enviro / Solution

As Received Sample Details		
Laboratory Ref.		W20239
Client Ref.		Core CC4
Sample Location		Slab
Direction		Vertical
Length (mm) Max.		230
Min.		215
Maximum Nominal Aggregate Size (mm)		5-20
Visual Inspection		Minimum Voids. 0.5%
Reinforcement		2*8mm Ø bar 200mm, 193mm. From top of core. None present in final test specimen
Test Section (mm)		20-215
Before End Preparation/After Grinding		
Measured Sample Length (mm)		185.0
Measured Sample Diameter (mm)		191.0
Sample Mass (g)		11814
Type Of Density Determined (Saturated, As Rec'd Or Dried)		As Received
Density (kg/m³)		2360
Method Of Volume Determination		Displacement
Test Results		
Date Cast		N/K
Date Tested		07/05/2024
Age At Test (days)		N/A
Method Of End Preparation		Grinding
Storage Condition		Sealed Container
Length Of Time Cured After Preparation		N/A
Length Of Specimen As Tested (mm)		180.0
Length/Diameter Ratio		0.94
Max. Load (kN)		1173
Compressive Strength (N/mm²)		40.9
Remarks		None

Cores cured since receipt at 20+/- 2°C
 Compressive Strength - Tested in accordance with BS EN 12504-1:2019
 Density - Tested in accordance with BS EN 12390-7:2019
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Approved Signature **D Wain**
 CMTL Limited
 David Wain, Concrete Section.



LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project :	Jaguar Land Rover	Job No.:	W20239
Client :	Enviro Solution	Lab Ref No.:	W20239
		Date Received:	29/04/2024
		Date Reported:	12/05/2023
		Material:	Concrete
		Date Cored:	Na
Originator:	Tom	Sampled by	Enviro / Solution

As Received Sample Details		
Laboratory Ref.		W20239
Client Ref.		Core CC3
Sample Location		Slab
Direction		Vertical
Length (mm)	Max.	180
	Min.	180
Maximum Nominal Aggregate Size (mm)		5-20
Visual Inspection		Minimum Voids. 0.5%.
Reinforcement		2*6mm Ø bar 101mm, 95mm. From top of core. 2*6mm Ø bar 91mm, 84mm. From nearest end of final test specimen.
Test Section (mm)		10-180
Before End Preparation/After Grinding		
Measured Sample Length (mm)		170.0
Measured Sample Diameter (mm)		191.0
Sample Mass (g)		10977
Type Of Density Determined (Saturated, As Rec'd Or Dried)		As Received
Density (kg/m³)		2380
Method Of Volume Determination		Displacement
Test Results		
Date Cast		N/K
Date Tested		07/05/2024
Age At Test (days)		N/A
Method Of End Preparation		Grinding
Storage Condition		Sealed Container
Length Of Time Cured After Preparation		N/A
Length Of Specimen As Tested (mm)		163.0
Length/Diameter Ratio		0.85
Max. Load (kN)		1441
Compressive Strength (N/mm²)		50.3
Remarks		None

Cores cured since receipt at 20+/- 2°C
 Compressive Strength - Tested in accordance with BS EN 12504-1:2019
 Density - Tested in accordance with BS EN 12390-7:2019
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Approved Signature **D Wain**
 CMTL Limited
 David Wain, Concrete Section.



LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project :	Jaguar Land Rover	Job No.:	W20239
Client :	Enviro Solution	Lab Ref No.:	W20239
		Date Received:	29/04/2024
		Date Reported:	12/05/2023
		Material:	Concrete
		Date Cored:	Na
Originator:	Tom	Sampled by	Enviro / Solution

As Received Sample Details		
Laboratory Ref.		W20239
Client Ref.		Core CC2
Sample Location		Slab
Direction		Vertical
Length (mm) Max.		227
Min.		177
Maximum Nominal Aggregate Size (mm)		5-20
Visual Inspection		Minimum Voids. 0.5%
Reinforcement		None present
Test Section (mm)		0-170
Before End Preparation/After Grinding		
Measured Sample Length (mm)		170.0
Measured Sample Diameter (mm)		191.0
Sample Mass (g)		11313
Type Of Density Determined (Saturated, As Rec'd Or Dried)		As Received
Density (kg/m³)		2420
Method Of Volume Determination		Displacement
Test Results		
Date Cast		N/K
Date Tested		07/05/2024
Age At Test (days)		N/A
Method Of End Preparation		Grinding
Storage Condition		Sealed Container
Length Of Time Cured After Preparation		N/A
Length Of Specimen As Tested (mm)		165.0
Length/Diameter Ratio		0.86
Max. Load (kN)		1167
Compressive Strength (N/mm²)		40.7
Remarks		None

Cores cured since receipt at 20+/- 2°C
 Compressive Strength - Tested in accordance with BS EN 12504-1:2019
 Density - Tested in accordance with BS EN 12390-7:2019
 The stated result only relates to the item/location tested, this report shall not be reproduced except in full.

Approved Signature **D Wain**
 CMTL Limited
 David Wain, Concrete Section.



1740

LABORATORY TEST REPORT
CONCRETE CORE COMPRESSIVE STRENGTH - BS EN 12504-1:2019

Project : Jaguar Land Rover	Job No.: W20239
Client : Enviro Solution	Lab Ref No.: W20239
	Date Received: 29/04/2024
	Date Reported: 12/05/2023
	Material: Concrete
	Date Cored: Na
Originator: Tom	Sampled by: Enviro / Solution

As Received Sample Details	
Laboratory Ref.	W20239
Client Ref.	Core CC1
Sample Location	Slab
Direction	Vertical
Length (mm) Max.	160
Min.	145
Maximum Nominal Aggregate Size (mm)	5-20
Visual Inspection	Minimum Voids. 0.5%.
Reinforcement	2*6mm Ø bar 130mm, 125. From top of core. 2*6mm Ø bar 20mm, 15mm From nearest end of final test specimen.
Test Section (mm)	0-145
Before End Preparation/After Grinding	
Measured Sample Length (mm)	145.0
Measured Sample Diameter (mm)	191.0
Sample Mass (g)	9714
Type Of Density Determined (Saturated, As Rec'd Or Dried)	As Received
Density (kg/m³)	2420
Method Of Volume Determination	Displacement
Test Results	
Date Cast	N/K
Date Tested	07/05/2024
Age At Test (days)	N/A
Method Of End Preparation	Grinding
Storage Condition	Sealed Container
Length Of Time Cured After Preparation	N/A
Length Of Specimen As Tested (mm)	140.0
Length/Diameter Ratio	0.73
Max. Load (kN)	1208
Compressive Strength (N/mm²)	42.2
Remarks	None

Cores cured since receipt at 20+/- 2°C

Compressive Strength - Tested in accordance with BS EN 12504-1:2019

Density - Tested in accordance with BS EN 12390-7:2019

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Approved Signature
CMTL Limited
David Wain, Concrete Section.

D Wain



1740