

Kirklees Council
Huddersfield Bus Station Canopy
Huddersfield

Geotechnical Design Report

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Geotechnical Design Report

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APPENDICES

Appendix 1: Geotechnical Factual Report

1. INTRODUCTION

Instruction

- 1.1 BWB Consulting Ltd (BWB) was instructed by Kirklees Council (the Client) to undertake a geotechnical assessment and design and present this in a report format for the proposed Huddersfield Bus Station Canopy, Huddersfield West Yorkshire. Original details of the instruction are given in the proposal *Huddersfield Bus Station Canopy*, Ref: 231101/R2/GS/221692/RS/LC

Objectives

- 1.2 The objectives of the geotechnical assessment and design are to:
- Summarise the ground and groundwater conditions at the site, based on the results of ground investigation, in situ and laboratory testing;
 - Select and define appropriate representative geotechnical parameters (Characteristic Values) for the site, in relation to the proposed development;
 - Undertake a geotechnical assessment for the development; and
 - Present the foregoing in a geotechnical design report (this document).
- 1.3 Reference should also be made to the Phase 2 report which presents and summarises factual data obtained during the ground investigation, completed between 12th and 18th June 2025, see details below in Section 1.7.
- 1.4 This report has been prepared in accordance with BS EN 1997-1:2004 and BS EN 1997-2:2007.

Geotechnical Category

- 1.5 The **Geotechnical Category** has been determined in accordance with Eurocode 7 BS EN 1997: Part 1: General rules. At this stage, in consideration of the known site ground conditions and with reference to the proposed development, the Geotechnical Category is assessed as being 2.
- 1.6 Category 2 is applicable for projects where conventional types of structures and foundation are proposed with no exceptional geotechnical risk or difficult ground or loading conditions.

Other Documents

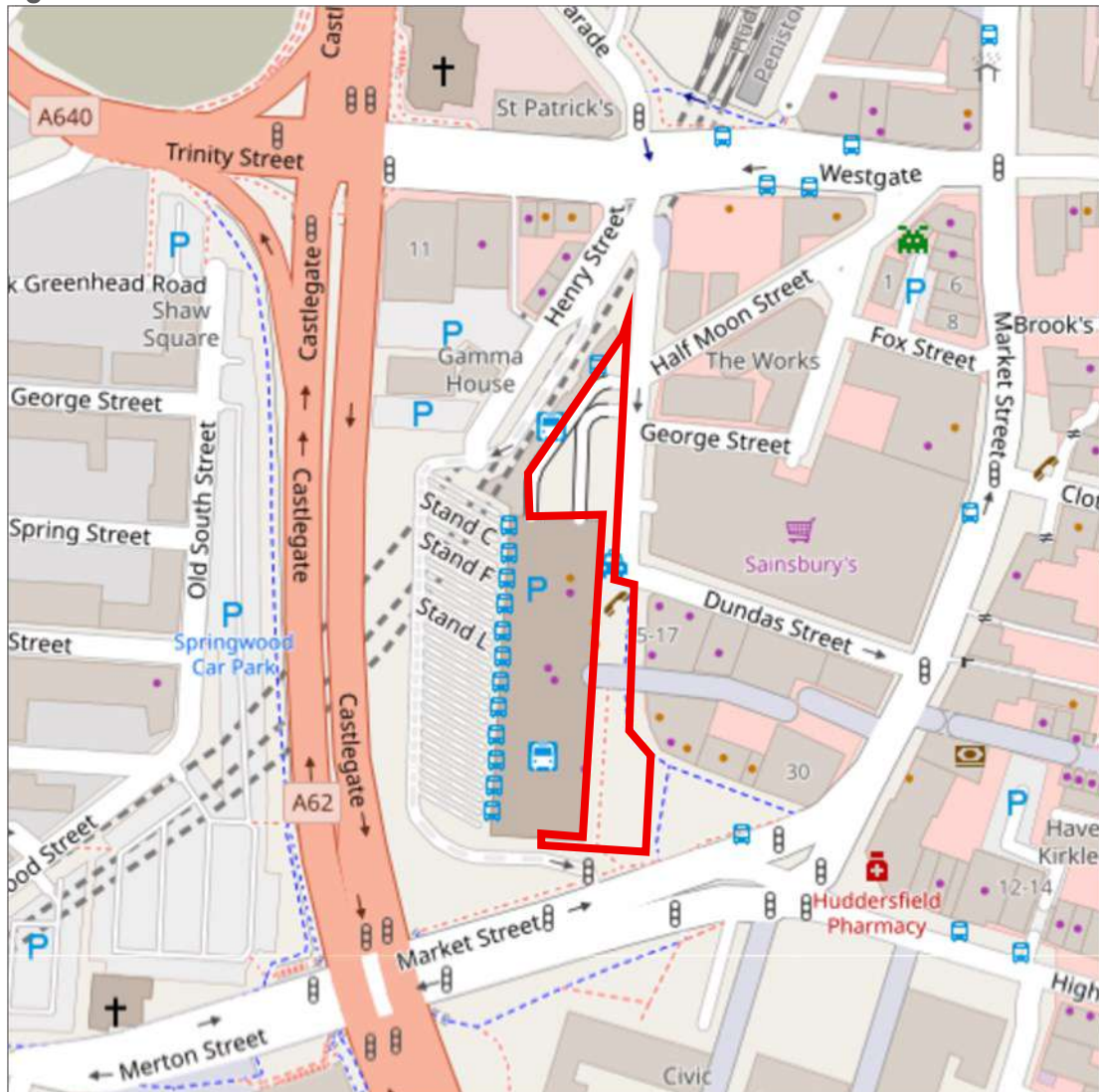
- 1.7 This report should be read in conjunction with the following documents:
- Phase 2 Geo-Environmental Assessment Report Ref HBS-BWB-XX-XX-T-G-000X_Ph2 dated August 2025
 - Huddersfield Bus Station Canopy - Mining Risk Assessment ELR: MVL3SBF, 205mls 1430yds to 206mls 0300yds March 2025221692-HBS-XXX-BWB-EGT-XX-RP-LE-0001_TN P0201

2. THE SITE AND PROPOSED DEVELOPMENT

Site Location

- 2.1 The site is located at Huddersfield Bus Station, Upperhead Row in Huddersfield, located at National Grid Reference 414230, 416590. The location of the site is shown in **Figure 2-1** below.

Figure 2-1 : Site Location Plan



Site Description

- 2.2 The site is along the eastern side of the bus station building comprising a multi-storey structure, the ground floor level being the bus station and the upper levels a car park. Currently the ground surface lies at around 98m to 100m above ordnance datum (AOD). The area of the proposed canopy is currently a block paved pedestrian area adjacent to the bus station main (pedestrian) entrance on Upperhead Row.

Proposed Development

- 2.3 The proposed development is to comprise the construction of a new glass canopy extension, with light weight green roof (0.8kN/m^2), new pedestrian paving zone, and landscaping, along the eastern side of the bus station building. A development Masterplan, reference, 202335-SGP-ZZ-ZZ-DR-A-131000-P08-Proposed Site Plan is presented as **Drawing 1**. The works are indicated to include formation of shallow ($2.4 \times 2.4\text{m}$) and ($3.4 \times 3.4\text{m}$) pad footings carrying columns with pressures of 100kN/m^2 (Foundation Plan Drawing, HBS-BWB-ZZ-FN-DR-S1001) **Drawing 2**.
- 2.4 In order to enable construction of this development, the following geotechnical aspects/constraints need to be addressed, as covered in this report:
- Mining risks;
 - Foundations – bearing capacity and settlement;
 - Roads and external hardstanding – pavement design;
 - Ground aggressivity to buried concrete.

3. GEOTECHNICAL INVESTIGATION

3.1 Intrusive ground investigation works were undertaken between 12th and 18th June 2025, and comprised the following:

- Clearance of investigation locations by a specialist buried services tracing company.
- Collection of coordinates and elevations of exploratory hole locations.
- The formation of 2 rotary boreholes (BH01 and BH03) to depths of up to 25 metres below ground level (m bgl) with representative soil and rock sampling and in situ standard penetration testing (SPTs) together with installations of gas/groundwater monitoring wells.
- Collection of large and small disturbed and 'undisturbed' soil/rock samples for geotechnical testing at a UKAS accredited laboratory.

3.2 An exploratory hole location plan is presented as **Drawing 3**. The factual ground investigation data, on which this assessment and design is based, are presented in the following report(s):

- Phase 2 Geo-Environmental Assessment Report Ref HBS-BWB-XX-XX-T-G-000X_Ph2.

3.3 The ground investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations'.

Geotechnical Investigation Strategy

3.4 Boreholes were positioned to investigate the ground conditions below the canopy structure. Hand dug pits were formed to 1.2m depths followed by dynamic sampling of Superficial deposits to rock head. Boring was then extended through rock by rotary open hole and core drilling techniques to investigate the rock strata, with particular reference to underlying coal seams and any associated workings/collapsed ground, known to be present in the site area. Standard penetration testing was undertaken to determine the shear strength and in-situ density of the soils. Soil samples were recovered for laboratory classification testing. Rock coring was undertaken to allow description and laboratory testing of the rock strength and rock mass characteristics.

Limitations and Uncertainty

3.5 The investigation was constrained by location of services and access in a busy pedestrian town centre location. Time was a further constraint which only allowed two of the originally proposed three boreholes (not BH02) to be completed.

3.6 Interpretations have been based on widely used empirical relations and are therefore subject to the uncertainty of the universal application of these to a specific site without confirmatory evidence.

3.7 Rock discontinuities have been described on the borehole records as "closely spaced closed to open" which appears to be inconsistent with the given core indices which predominantly indicate zero solid core recovery (SCR).

4. GROUND AND GROUNDWATER CONDITIONS

Introduction

- 4.1 The site ground and groundwater conditions, as derived from published geological records and from the ground investigations, are described in detail in the Mining Risk Assessment and Phase 2 reports to which reference should be made.
- 4.2 The ground conditions encountered during ground investigations confirmed the published geology comprising Made Ground over Head Deposits, underlain by Middle Band Rock (a named unit within the Lower Pennine Coal Measures formation) over Pennine Lower Coal Measures, with evidence of both intact coal and coal mining.

Ground Conditions - Summary

- 4.3 The recorded ground conditions are summarised in **Table 4-1** below; **Figure 5-1** presents a geological cross section through the site. SPT results, in terms of uncorrected N-values are presented on the exploratory borehole records presented in the Factual Ground Investigation Report (**Appendix 1**).

Table 4-1: Summary of Ground Conditions

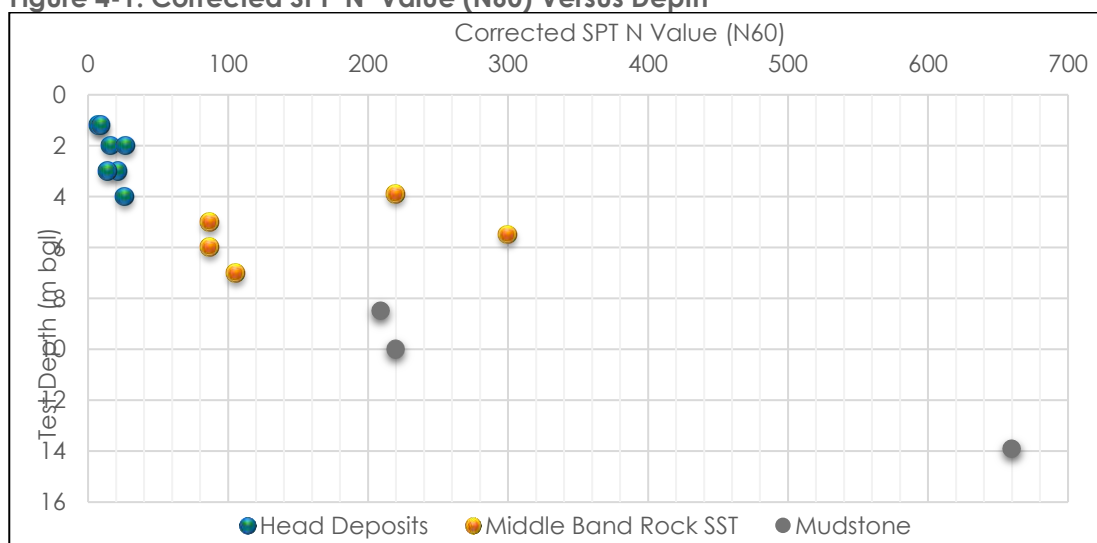
Lithological Unit	Base Depth (m)		Thickness (m)		Description
	Min	Max	Min	Max	
Made Ground	1.20	1.40	1.20	1.40	Modern block paving over sandstone cobbles, with bedding sands/concrete/ Sandy Clay with ash and clinker.
Head Deposits (stoney Clays)	3.80	5.00	2.60	3.60	Soft/firm becoming stiff yellowish brown slightly sandy slightly gravelly Clay, Gravel is angular to subangular of sandstone.
Middle Band Rock Sandstone	6.40	8.50	1.40	4.70	Medium Strong yellowish brown thickly cross laminated sandstone.
Mudstone	20.20	21.20	11.70	14.80	Weak thinly laminated Dark grey Mudstone
Coal (Soft Bed)	20.40	21.50	0.20	0.30	Coal
Void	23.00	23.0	0.80	0.80	Void
Mudstone	23.50	24.0	0.50	3.80	Dark grey Mudstone
Mustone/Siltstone (Soft bed Flags)	>25.00	NP	>1.00	NP	Light grey Mustone/siltstone
NP not proven					

In Situ and Laboratory Geotechnical Test Results

In Situ Testing

- 4.4 From in situ SPTs, corrected 'N₆₀' values have been derived, and a plot of N₆₀ value vs. depth (in m bgl) is presented as **Figure 4-1** below. N₆₀ values within the cohesive Head Deposits were recorded ranging from 8 to 28 blows. N₆₀ values with the rock recorded >50blows before the full 300mm penetration. These blow counts have been extrapolated to estimate the number of blows for the full 300mm test. These are conservative values based on the penetration rate for 50 blows. There is a general increase in N values with depth. Estimated blow counts within the sandstone range from 87 to 300 blows, the deeper mudstones range from 209 to 660 blows.

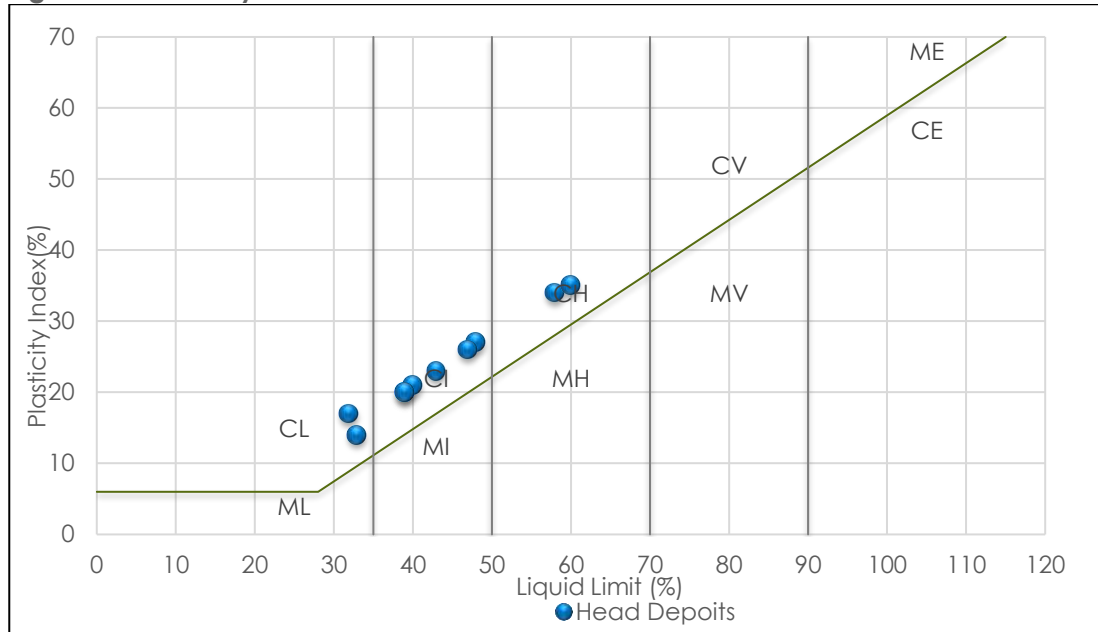
Figure 4-1: Corrected SPT 'N' Value (N₆₀) Versus Depth



Geotechnical Laboratory Test Results

- 4.5 Where cohesive soils were encountered and sampled, geotechnical laboratory testing included the determination of Atterberg Limits and Plasticity Index (PI) values. A Plasticity Chart is presented as **Figure 4-2**. This indicates PI values for the Head deposits to be in the range 15% to 26% (low to high plasticity).

Figure 4-2 Plasticity Chart



4.6 The results of the in-situ and geotechnical laboratory testing undertaken are summarised in **Table 4-2**.

Table 4-2: Summary of Laboratory and In-situ Geotechnical Test Results

Lithology / Parameter (Units)	Made Ground	Head Deposits	Weathered Middle band rock	Middle Band Rock Sandstone	PLCM Mudstone
Moisture Content (%)	19%	14-26%	20%	NR	NR
Plasticity Index (%)	17%	14-35%	19%	NR	NR
Atterberg Classification	intermediate	Low to high	Low	NR	NR
PSD:					
Cobbles (%)			0		
Gravel (%)	NR	NR	46	NR	NR
Sand (%)			31		
Silt (%)			11		
Clay (%)			12		
Particle Density (Mg/m ³)	NR	NR	NR	NR	NR
Organic Matter (%)	5.5-1.0%	0.9-0.8%	NR	NR	NR
SPN N60 Values	NR	8-28	24	87-300	NR
pH conditions	8.4-10.8	8.4-5.8	NR	NR	NR
Total Sulphur (%)	0.16-0.02	0.02	NR	NR	NR
Total Sulphate (%)	0.034-0.073	NR	NR	NR	NR
Soluble Sulphate (mg/l)	448-28	77	NR	NR	NR

Lithology / Parameter (Units)	Made Ground	Head Deposits	Weathered Middle band rock	Middle Band Rock Sandstone	PLCM Mudstone
UCS (MPa)	NR	NR	NR	NR	NR
Point Load Index Is50 (MPa)					
Diametral	NR	NR	NR	1.0-2.4	0.3
Axial	NR	NR	NR	2.5-3.9	NR
Notes: NR = NO TEST RESULTS OMC = Optimum Moisture Content; MDD = Maximum Dry Density. #1 values at effective pressure + 100kPa UCS = Unconfined Effective Strength					

Groundwater and Hydrogeology

- 4.7 Groundwater entries were not encountered during hole formation.
- 4.8 During subsequent monitoring of wells with response zones at depths of 2.50-4.00m and 3.00-6.00m bgl, groundwater levels were recorded as dry.

Contamination Observations

- 4.9 Slight exceedances of several PAHs in Made Ground have been attributed to the bituminous material present in former pavement layers. Appropriate PPE/hygiene during construction and the anticipated hardstanding cover will limit the risk to construction workers and commercial end site users, respectively.

5. GEOTECHNICAL PARAMETERS FOR DESIGN

Introduction

5.1 From the information derived from the ground investigation and summarised in the previous section, a series of Characteristic Values have been determined for the various lithological units. These are presented in this report Section, which also provides a summary of their derivation.

Derivation of Characteristic Values

5.2 Derivation of geotechnical design Characteristic Values is based on the site-specific ground investigation information referenced in the previous Section.

5.3 Unit weights, both dry and saturated, are derived from suggested values for various soils and particle size distributions in British Standard BS8002:2015 [Figures 1 & 2]. Unit weight of rock has been derived from published values from values published by F.G. Bell Engineering geology 2nd Edition Tables 5.30 and 5.31.

5.4 Effective angle of friction in granular soils is estimated from SPT N values, after Peck, Hansen & Thornburn, and compared with the empirical estimating tables presented in British Standard BS8002:2015 [Table 1].

5.5 Undrained shear strength values in cohesive soils are estimated from correlation with SPT N values, using the relationship $c_u = f_1 \times N$ and an f_1 value of 5, based on characteristic PI values for each lithology, following Stroud and Butler (1975).

5.6 Effective angle of friction of cohesive soils is estimated from plasticity using the relationship presented in British Standard BS8002:2015 [Table 2] and PD6694-2020.

5.7 Drained elastic modulus (E') values in granular soils are estimated from correlation with SPT N values, using the relationship $E' = N60$ as presented in CIRIA143.

5.8 Drained elastic modulus (E') values in cohesive soils are estimated from correlations with SPT N values, using the relationship $E' = 0.9 \times N60$ as presented in CIRIA143, and checked against the relationship $E' = f_2 \times N$ with f_2 values of 0.5 for the Head Deposits, following Stroud and Butler (1975).

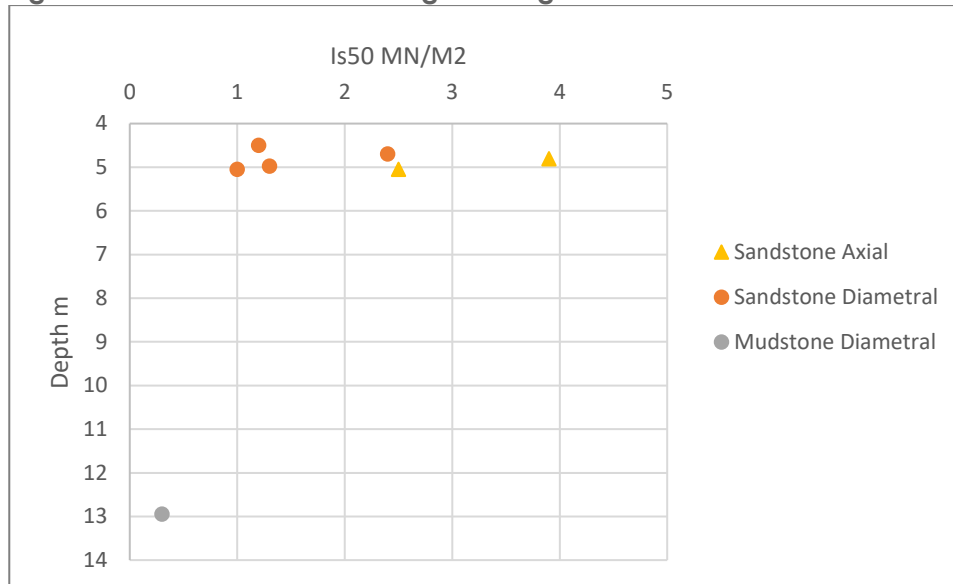
5.9 The coefficient of volume compressibility (m_v) values of cohesive soils are taken as the reciprocal of E' .

5.10 Undrained elastic modulus (E_u) values of cohesive soils are estimated from SPT N-values using the correlation of $E_u/N = 1.0$ to 1.2 , taken from CIRIA 143.

5.11 The unconfined compressive strength of the rock mass is estimated from correlation with SPT N values, extrapolated to the full 300mm and using an average value of $F1 = 5kNm^2$ relating the N60 value to the undrained shear strength as for clays and taking the compressive strength as $2C_u$ where N values are less than 200. Stroud 1989.

5.12 The unconfined compressive strength of the intact rock has been derived from the correlation with point load test results (see **Figure 5-1**). Due to poor core recoveries, it has not been possible to establish a site-specific correlation, and the relationship “UCS = $I_s (50) \times k$ ”, where k is taken as 20 after Norbury, has been adopted as a cautious estimate from the available point load I_{s50} data.

Figure 5-1 Point load Index strength testing



5.13 Estimate of the drained modulus (E') values in rock are estimated from point load strength index testing and core indices RQD and log descriptions following Bieniawski's Rock Mass Rating (RMR) system and its relationship with rock mass modulus by Serafim & Pereira 1983.

Summary of Characteristic Values

5.14 The following table presents the Characteristic Values typically adopted for design. Where site or geometry specific changes have been made for the purposes of particular analyses, these are discussed in the relevant report sections.

Table 5-1: Characteristic Values

Lithological Unit	Depth	Bulk unit weight	Undrained cohesion	Intact Unconfined compressive strength	Unconfined compressive mass strength	Effective Angle of friction	Effective cohesion	Undrained modulus	Drained modulus	Coefficient of volume compressibility
	(m)	γ (kN/m ³)	c_u (kN/m ²)	UCS (MPa)	UCS (MPa)	ϕ' ($^\circ$)	c' (kN/m ²)	E_u (MPa)	E' (MPa)	m_v (m ² /MN)
Head Deposits (stoney clay)	1.5m	20	40	-	-	24	-0	8	4	0.26
	2.0m	20	82	-	-			16	8	0.12
Completely Weathered Sandstone (PLCM)	4.0m-5.0m	19.5	-	-	-	30	-	-	24	-
Pennine Lower Coal Measures Sandstone (PLCM)	4.5m – 8.5m	22.7	-	50	1.6	25	-	-	2000	-
Pennine Lower Coal Measures Mudstone (PLCM)	6.4m – 13.9m	24.6	-	6	3.6	25	-	-	>2000	-

6. GEOTECHNICAL ASSESSMENT

Introduction

- 6.1 This section of the report provides a summary of the geotechnical assessment undertaken as part of the design for the proposed development, based on the ground and groundwater conditions encountered and Characteristic Values derived for these (summarised in previous report sections).

Earthworks/Enabling works

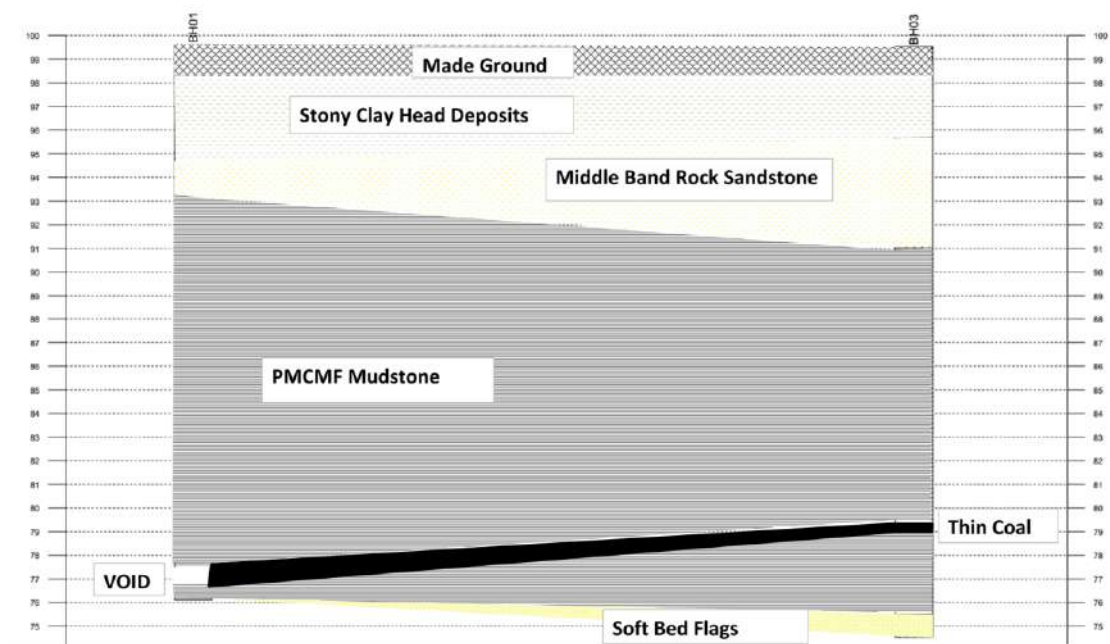
- 6.2 No significant alternations of site levels are proposed.

Foundations

Ground Model

- 6.3 The ground model below has been adopted for this geotechnical assessment:

Figure 6-1 Ground Model



- 6.4 Monitoring indicates that summer groundwater levels were below 6.0m bgl, i.e. within the Middle Band Rock.

Spread Foundations (pads/strips)

- 6.5 The Made Ground in its current untreated state is unsuitable for the support of shallow spread foundations owing to variability/poor competence and the potential risk of excessive total and/or differential settlements.
- 6.6 Consequently, foundations will need to be taken through the Made Ground and founded in the "competent", i.e. firm to stiff or stronger Head deposits, as encountered at the site at/below depths of 1.50m to 2.00m m bgl.
- 6.7 Bearing capacity calculations indicate that the proposed 2.2m x 2.2m and 3.3m x 3.3m pad foundations supported on the competent Head Deposits at depths of about 2.0m below current ground level with a uniform vertical load of 100KN/m² would be feasible and would not be at risk of bearing capacity failure.
- 6.8 Checks of the serviceability limit state (SLS) indicate settlements at these pressures and dimensions will be within tolerable limits (<25mm).
- 6.9 If higher bearing pressures or larger foundations are required, further detailed assessment will need to be undertaken. However, if such further assessment indicates unacceptable foundation performance, then an alternative foundation solution may be needed.
- 6.10 Alternative to shallow pad foundations (not considered further here) include:
- Ground improvement, to provide strengthened elements within the soil to the depths of competent natural ground. At this site, options include vibro stone columns and rigid inclusions.
 - Deep foundations, comprising piles to competent underlying soils.

Mining Risk Considerations

- 6.11 From the information gathered from the ground investigation presented herein, the only coal seam underlying the proposed canopy structure is the Soft Bed coal, the base of which was inferred to have been encountered at depths of between 20.40m and 23.30m bgl (the latter based on "hard ground" recorded below collapsed workings in BH01). The intact thickness of this coal seam is indicated, in the local area, to vary between 0.45m and 1.50m, but more typically less than 1.0m thick. Allowing for a typical worked seam thickness of, say, 1.20m; and applying the "10 times seam thickness" rule-of thumb, it can be demonstrated that and collapse of workings associated with the Soft Bed coal seam beneath the proposed canopy would choke before attaining rockhead, and therefore would not pose a risk of mining subsidence to the proposed pad foundations at depths of ca. 2.0m bgl.
- 6.12 Therefore, the risk from shallow mine workings upon the proposed structure and its pad foundations is deemed to be negligible, therefore stabilisation works are not considered to be necessary.

Pavement design

- 6.13 It is understood pavements are to be reconstructed as part of the overall redevelopment of Upper Head Row pedestrian area. The design of the pavement reconstruction should consider appropriate design (i.e. long-term) subgrade California Bearing Ratio (CBR) or Surface Subgrade Modulus (SSM) values. It maybe that the existing Made Ground could be used as a capping layer upon which the new sub-base can be placed.
- 6.14 From the ground investigation, the groundwater levels at the site are at depth (indicated to be at least 6.0m). Laboratory testing of natural subgrade materials (Head Deposits) gave plasticity index values of 17% to 34% at 1.2m to 1.6m. From Table C1 of TRRL 1132 (Structural Design of Bituminous Roads) according to guidance in National Highways document CD225, "Design for New Pavement Foundations" a long term CBR value of 3.0% should be used for preliminary design purposes. This equates to an SSM value of 30MPa.
- 6.15 It is recommended that in situ CBR tests at formation level should be carried out to confirm the strength and stiffness of sub-grade.

Excavations

- 6.16 Excavations into the underlying natural soils should be readily achievable using standard plant, noting that the potential for soft ground (and buried obstructions) should be considered by the contractor in selection of plant. Depending on weather conditions and timing of works, tracked plant and other access interventions may be necessary.
- 6.17 Where personnel entry is required for inspection, excavations should be sufficiently enlarged, and an assessment of safe temporary angles should be made by the contractor/temporary works designer.
- 6.18 It is recommended that no excavations should be entered without appropriate support, and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented if necessary.
- 6.19 Temporary shoring of the excavations is likely to be necessary to assist deeper excavations into the Head Deposits, and an assessment/design should be undertaken by the temporary works designer/contractor.
- 6.20 If excavation below the water table were required during construction (unlikely) or if perched groundwater were encountered within Made Ground underlain by lower permeability Head Deposits, it is recommended that such excavations should be undertaken in sections/limited areas, rather than excavating in a single phase. This should limit the volume of groundwater that would need to be managed in each excavation.
- 6.21 Management of groundwater, including the anticipated requirement for localised dewatering, should be considered/implemented by the temporary works designer / contractor.

Groundwater and Constraints/Implications

- 6.22 Groundwater has not been recorded during the ground investigation and is not considered to be a problem. However, the potential for perched groundwater to be encountered within Made Ground underlain by lower permeability Head Deposits, cannot be discounted and due allowance for such should be made.

Ground aggressivity to buried concrete

- 6.23 The classification of concrete in aggressive ground has been undertaken in accordance with BRE Special Digest 1: Concrete in Aggressive Ground (2005).
- 6.24 From the available GI information, concrete to be cast in contact with the near-surface soils at the site should be designed for Design Sulphate (DS) and Aggressive Chemical Environment for Soils (ACEC) classes DS-2, AC-2.

8. CONCLUSIONS AND RECOMMENDATIONS

Summary of Ground and Groundwater Conditions

- 8.1 Ground conditions at the site have been found to comprise up to 1.4m of Made Ground over Head Deposits (stoney clays of low to high plasticity) over sandstone bedrock at/below depths of 3.80-5.00m bgl.
- 8.2 Characteristic values for the various strata have been derived for assessment and design purposes.
- 8.3 Monitoring indicated site groundwater levels to be low (greater than 6.0m bgl); however, there is a potential for localised perched groundwater at shallower depths, e.g. within Made Ground underlain by lower permeability head Deposits.

Summary Of Geotechnical Assessment

- 8.4 Given the depths and intact thickness of the coal seam beneath the site and the thickness of overlying rock strata, the risk of mining instability (subsidence) attaining the ground surface or impacting upon the proposed pad foundations is considered as negligible.
- 8.5 The proposed development can be constructed utilising the proposed 3x3m and 2.2x2.2m spread (pad) foundations supporting uniform vertical pressures of 100kN/m² founded within the competent (firm or stronger) Head Deposits at depths in the order of 1.5-2.0m bgl.
- 8.6 New pavement hardstanding can be designed based on an equilibrium design CBR value of 3.0%.
- 8.7 New concrete to be cast in contact with the near-surface soils at the site should be designed in accordance with design class DS-2 and ACEC class AC-2

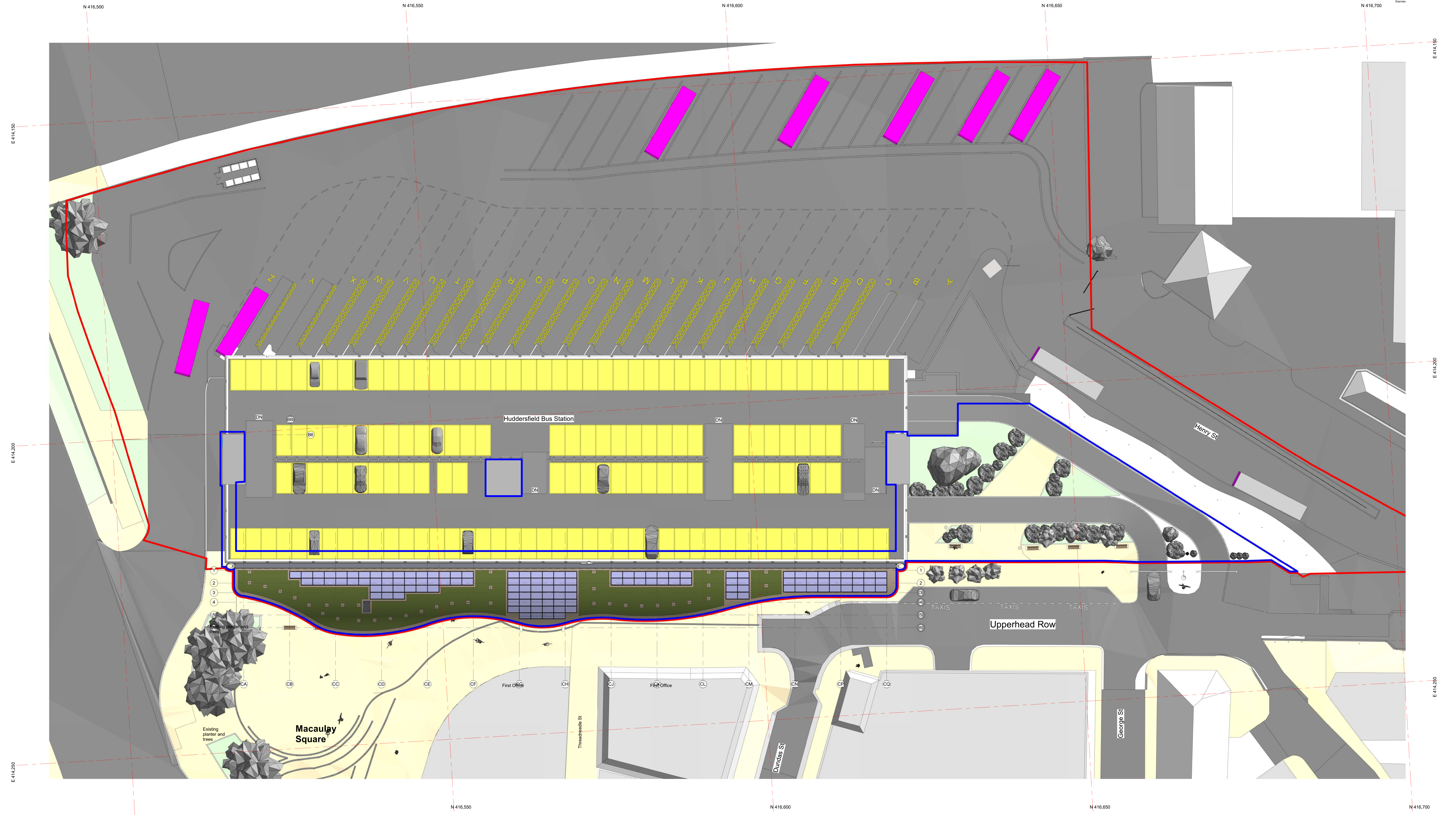
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DRAWINGS

Drawing 1 - 202335-SGP-ZZ-ZZ-DR-A-131000-P08 Proposed Development Plan

Rev	Date	By	Description
P01	18/02/23	MB	Initial design for information and coordination
P02	18/02/23	MB	Shaded 3D model for information and coordination
P03	18/02/23	MB	Shaded 3D model for information and coordination
P04	30/04/24	MB	Change issued as Draft Planning Submission for information and coordination. Includes works at site to be completed before works at site.
P05	13/06/24	MB	Planning issued for approval purposes. Includes amendments following EC review.
P06	01/07/24	MB	Planning issued for approval purposes. Red/Blue boundary line amended to 50% coverage.
P07	04/07/24	MB	Change issued for information purposes as part of V&E exercise.
P08	10/12/23	MB	



Proposed Site Plan
1 : 200

— Notional Canopy Scheme Boundary
— Notional Application Site Boundary

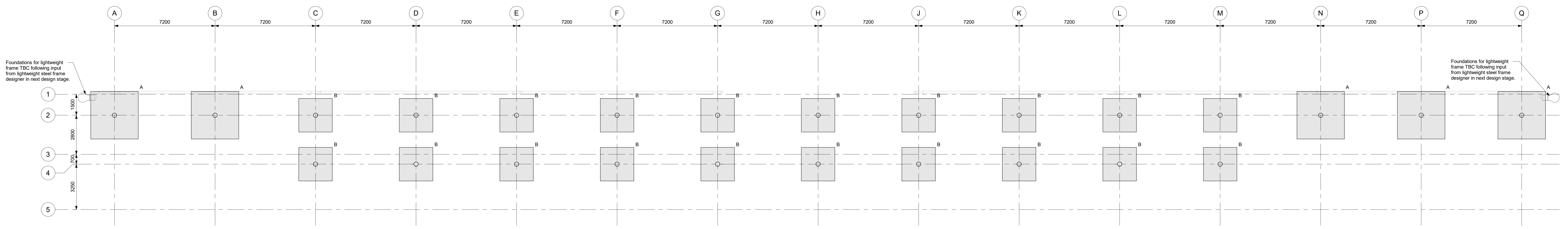
Title: "Scan to BIM Survey Model"
 Ref: "Huddersfield Bus Station 07-10-21.rvt"
 Reason: "010"
 Date: "10/10/2021"
 Author: "MB"
 Title: "Topographical Survey of Land at Huddersfield Town Centre"
 Ref: "0107.rvt.dwg"
 Reason: "010"
 Date: "01/07/2017"
 Author: "The 3D Survey Operations Ltd"
 Title: "Existing Layout"
 Ref: "1815-SP18-00-ZZ-M3-G-0001-Existing Site 2D Model.dwg"
 Reason: "1"
 Date: "10/11/2023"
 Author: "MB"
 This information has not been verified by Stephen George + Partners LLP and no liability is accepted for its accuracy.

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**Drawing 2: Drawing 2 HBS-BWB-ZZ-FN-DR-S-1001-Foundation General
Arrangement_P05**

FOUNDATION SCHEDULE						
Type Mark	Width	Length	Depth	Volume	Count	Reinforcement
A	3400	3400	1000	11.56m³	5	2 layers A393 mesh bottom, 1 layer A393 mesh top
B	2400	2400	500	2.88m³	20	1 layer A393 mesh top & bottom

- Notes**
- Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
 - This drawing is to be read in conjunction with all relevant architects, engineers and specialist drawings and specifications.
 - All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
 - Any discrepancies noted on site are to be reported to the engineer immediately.
- FOUNDATION PHILOSOPHY NOTES**
- For general notes drawing refer to BWB drawing ref S-0001.
 - The information on this drawing is for preliminary purpose only and is not suitable for construction.
 - The main Contractor is to make due allowances for design development at detailed design stage.
 - Refer to Architects information for setting out and finishes.
 - The base specification for foundation works shall be BS EN 1997-1 Eurocode 7 'Geotechnical Design, General Rules'.
 - Foundations have been designed assuming net allowable bearing pressure of 100kN/m². piling may still be required. To be confirmed in intrusive ground investigation.
 - Columns to be central on foundation.
 - Column bases assumed to be fixed.
 - It is assumed that all existing services below the proposed canopy will be diverted outside of the proposed footprint.



Foundation GA
1 : 100

Date	By	Description	Checked
11.05.25	JH	Issued to suit latest Architects model	JH
21.05.24	JH	Detail updated	JH
20.04.24	JH	Notes updated and mark added	JH
02.03.24	JH	Final updates to suit Architects design	JH
20.12.23	JH	Issued for review and comment	JH
		Details of Issue / Revision	DTN / CHJ

REVISION HISTORY

Drawn By	Signed	Date
J. Crossley		

Checked	Signed	Date
L. Stevens		

Approved	Signed	Date
J. Hackwell		

CURRENT REVISION

Birmingham | 0121 233 3322
Leeds | 0113 233 8000
London | 020 7407 3819
Manchester | 0161 233 4290
Nottingham | 0115 924 1100
www.bwbconsulting.com

Client

Contractor

Project Title
**Huddersfield Bus Station
Canopy
Upperhead Row**

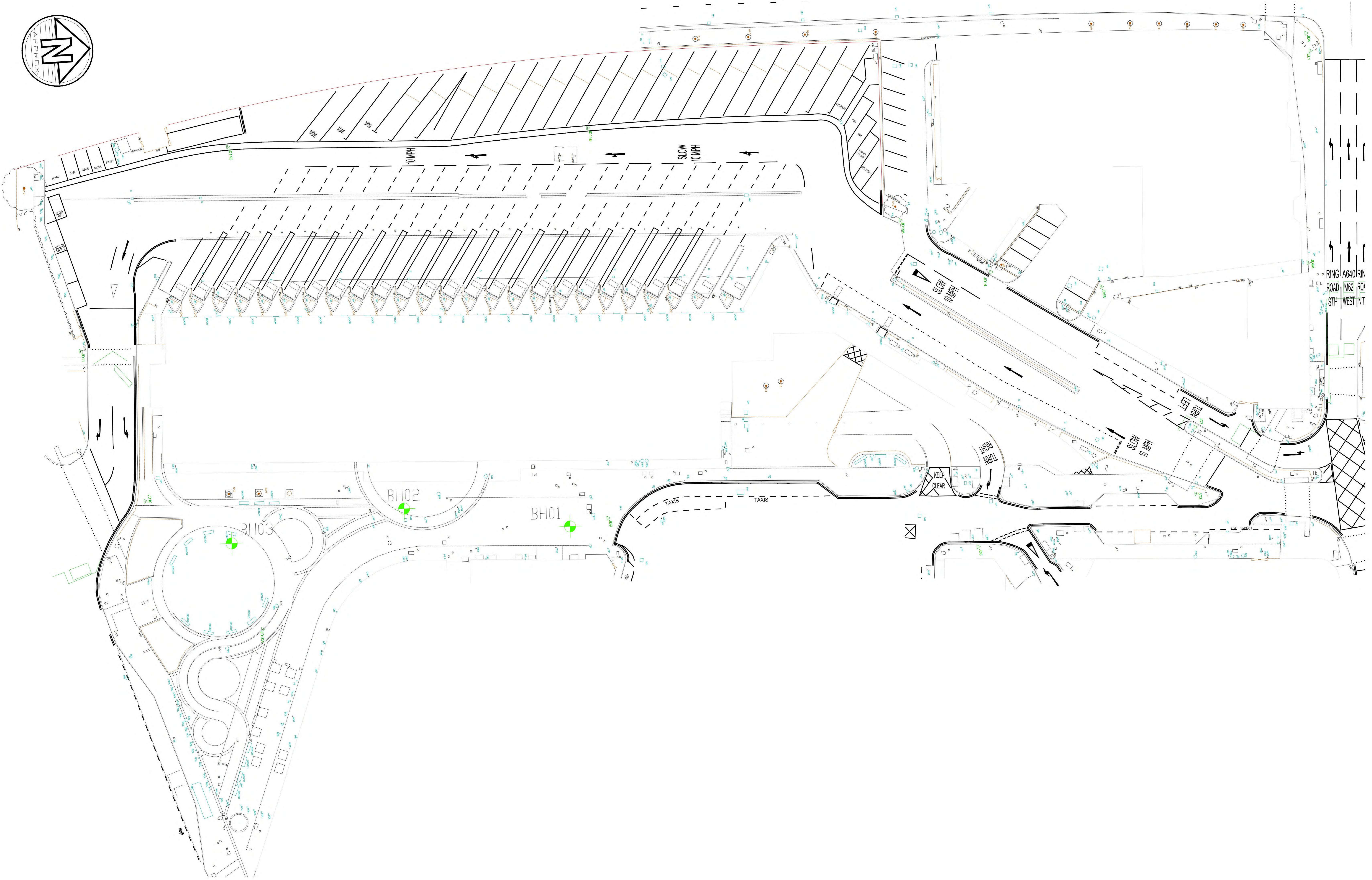
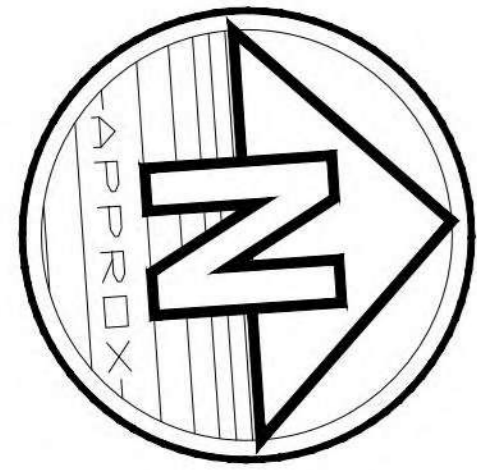
Drawing Title
**Foundation General
Arrangement**

Drawing Originator	L.Norris	First issued	20.12.23
BWB Ref	221692	Scale	A0 1 : 100

Project Originator-Functional-Spatial-Form-Description-Number
HBS-BWB-ZZ-FN-DR-S-1001

Drawing Status	Rev.
S2 - Issue for Information	P05

Drawing 3: HBS-BWB-00-XX-DR-G-0003-S2-P03-EHLP



Notes

1. Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialist drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.



ISSUES & REVISIONS		Drw	Rev
Rev	Date	Details of issue / revision	
PI1	29.05.25	For Information	RT LC
PI2	05.08.25	BH01 & BH03 Location Updated	RT LV
PI3	05.08.25	FINAL ISSUE	RT LV



Client
KIRKLEES COUNCIL

Project Title
HUDDERSFIELD BUS STATION
NEW CANOPY WORKS

Drawing Title
PROPOSED EXPLORATORY HOLE LOCATION PLAN

Drawing Status
FINAL

Project - Originator - Zone - Level - Type - Role - Number
HBS-BWB-00-XX-DR-G-0003

Status Rev
S2 P03

APPENDICES

Appendix 1: Geotechnical Factual Report



< ENVIRONMENTAL > < GEOTECHNICAL >

GEOTECHNICAL TESTING RESULTS



Please consider the environment before printing this report.



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< ENVIRONMENTAL > < GEOTECHNICAL >

Blank Page



Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



Rogers Geotechnical Services Ltd.
 Offices 1&2,
 Barncliffe Business Park,
 Near Bank, Shelley,
 Huddersfield,
 HD8 8LU

Classification of Index Properties

C5244/25/E/8058

Project Name: Huddersfield Bus Station

BS EN ISO 17892-12 2018+A2:2022

Fig. 2
 Sheet. 1

Location:

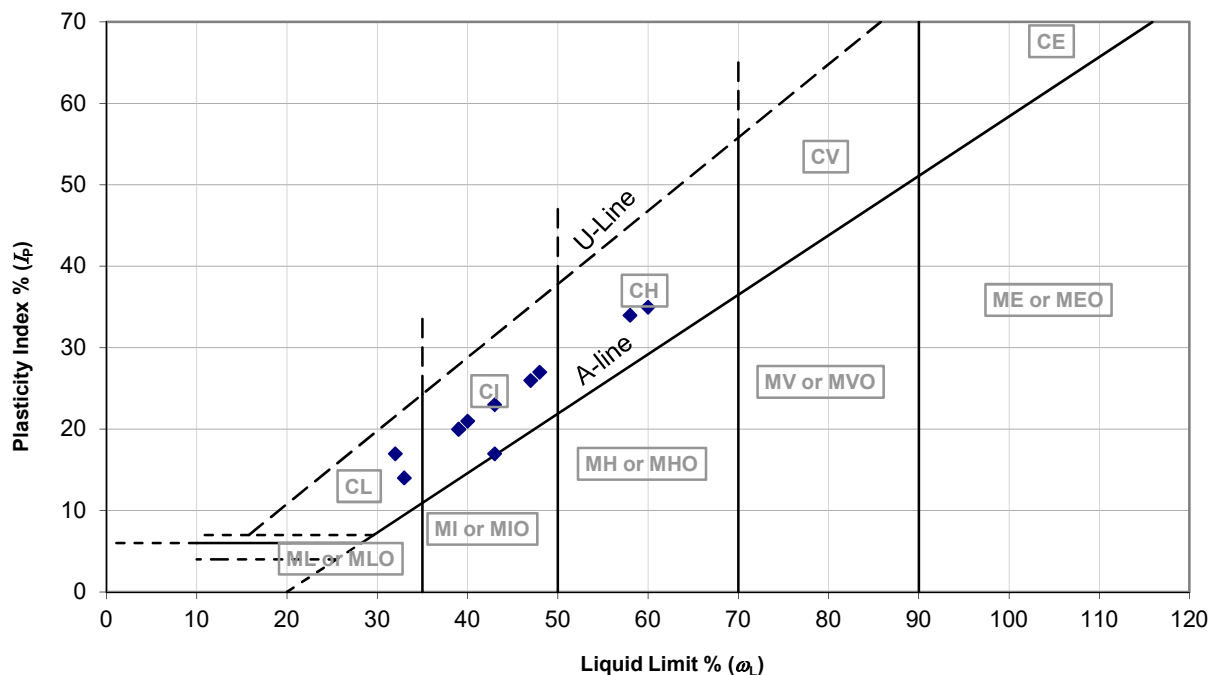
Input By: Harry

Client: BWB Consulting Limited

Check By: EC

Location	Depth (m)	Water Content (ω) (%)	Liquid Limit (ω_L) (%)	Plastic Limit (ω_P) (%)	Plasticity Index (I_P) (%)	Retained by 0.425mm (%)	Modified (ω) (ω') (%)	Modified (I_P) (I_P') (%)	Liquidity/ Consistency		Casagrande Class	N.H.B.C Class (%)
									(I_L) (%)	(I_C) (%)		
BH01	1.20	19	43	26	17	19	23	14	-0.4	1.4	C I	LOW
BH01	1.60	26	58	24	34	3	27	33	0.1	0.9	C H	MEDIUM
BH01	1.80	24	60	25	35	9	26	32	0.0	1.0	C H	MEDIUM
BH01	2.50	19	48	21	27	18	23	22	-0.1	1.1	C I	MEDIUM
BH01	2.80	19	47	21	26	23	25	20	-0.1	1.1	C I	MEDIUM
BH01	3.50	17	39	19	20	45	31	11	-0.1	1.1	C I	LOW
BH01	3.80	16	40	19	21	25	21	16	-0.1	1.1	C I	LOW
BH01	4.60	20	33	19	14	8	22	13	0.1	0.9	C L	LOW
BH03	1.70	16	39	19	20	4	17	19	-0.2	1.2	C I	LOW
BH03	2.50	14	32	15	17	9	15	15	-0.1	1.1	C L	LOW
BH03	2.80	17	43	20	23	35	26	15	-0.1	1.1	C I	LOW

Interpretation graph based on BS EN ISO 14688-2:2018 any interpretations are expressed outside of our UKAS Accreditation.





PARTICLE SIZE DISTRIBUTION

Job Ref **C5244/25/E/8058**

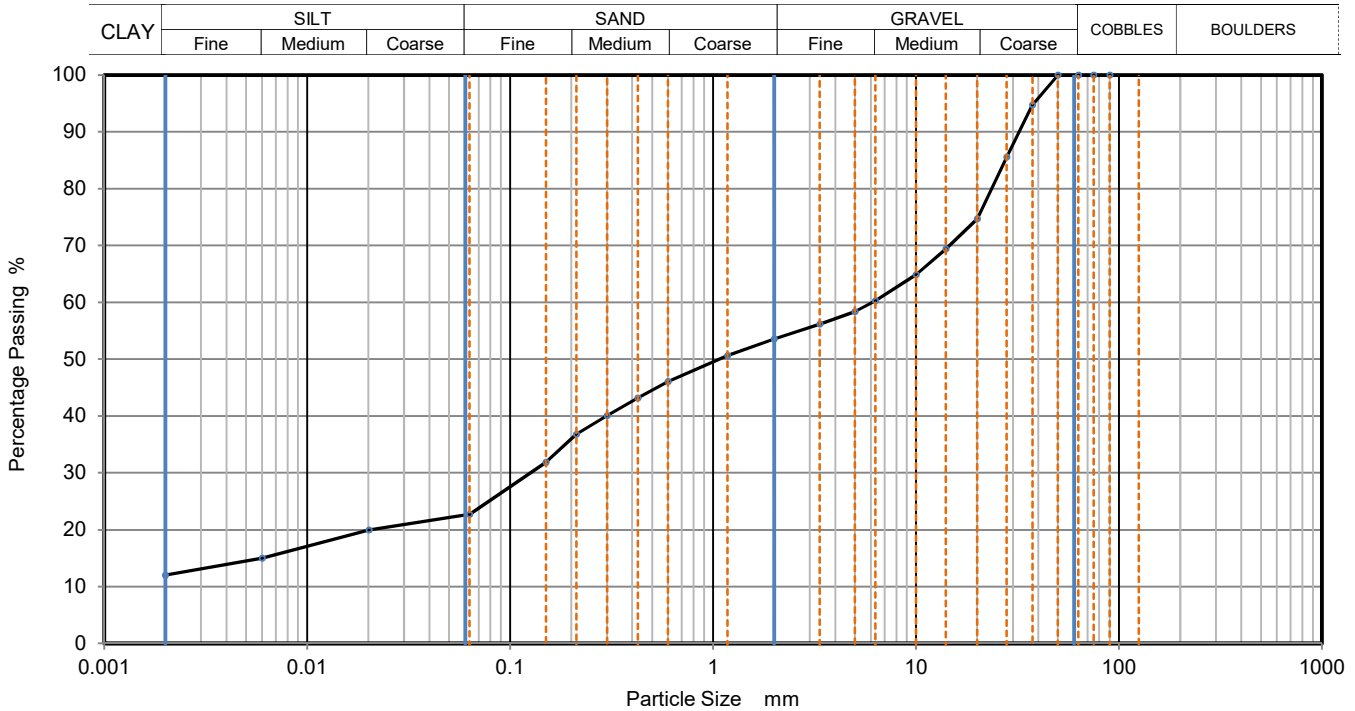
Borehole/Pit No. **BH01**

Site Name **Huddersfield Bus Station** Sample No. **11**

Soil Description **Yellowish brown, silty, very gravelly SAND.** Depth, m **4.40**

Specimen Reference **11** Specimen Depth **4.4** m Sample Type **C**

Test Method **ISO 17892 -4, by sieving and pipette sedimentation** KeyLAB ID **RGS_2025062413**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0201	20
90	100	0.0060	15
75	100	0.0020	12
63	100		
50	100		
37.5	95		
28	86		
20	75		
14	69		
10	65		
6.3	60		
5	58		
3.35	56		
2	54		
1.18	51		
0.6	46		
0.425	43	Particle density (assumed) 2.65 Mg/m ³	
0.3	40		
0.212	37		
0.15	32		
0.063	23		

Dry Mass of sample, g **1729**

Sample Proportions	% dry mass
Very coarse	0
Gravel	46
Sand	31
Silt	11
Clay	12

Grading Analysis		
D ₁₀₀	mm	50
D ₆₀	mm	6.05
D ₃₀	mm	0.125
D ₁₀	mm	

Remarks
Preparation and testing in accordance with BS EN ISO 17892 - 4, unless noted below

Test performance date: 01/07/2025

Operator	Checked	Approved
HJL	EC	Harry

Sheet printed
03/07/2025

Fig 3
Sheet 1



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