

14 September 2021

70655/lt02

John O'Hare
The Edgerton (Property) Partnership Ltd
Lancaster House,
70-76 Blackburn Street,
Radcliffe,
Manchester,
M26 2JW

Dear John,

23 Crimsworth Avenue, Chorlton: Foundation and Slope Advice

1. Background and Proposals

It is proposed to develop the garden at 23 Crimsworth Avenue, Chorlton. The proposals construct a three storey (including roof space) detached house. It is understood that line loads will not exceed 100kN/m. Floor slab loads are unlikely to exceed 10kN/m². The scope of this work is to report on the ground investigation and provide outline advice on slope stability and foundation design.

2. Location, Topography and Geology

The site is located in Chorlton at approximate grid reference SJ 81730 94733. The existing property is a (assumed) 1930s semi detached two storey house. Being a corner plot there is a large garden to the side and rear. A survey of the plot and cutting was carried out by 3D-BS. The land is generally flat at an elevation of 28m AOD. The garden and proposed development plot is adjacent to the Metrolink Line. The Metrolink line is in cutting with the line level being at around 24.3m AOD, with an average slope angle of the cutting of approximately 23° to the horizontal (1v: 2.35h).

The published geology suggests that the site is underlain by Glaciofluvial sheet sand and gravel deposits of Devensian age. This is underlain by Wilmslow Sandstone of Olenekian (Triassic) Age. Nearby BGS borehole data suggests that the superficial deposits are thick and include Glacial Till at depth. Drawings showing the proposals and topographical surveys are included as Appendix A.

3. Ground Investigation

One cable percussive borehole to 8m bgl was drilled at the approximate location shown in the factual report. Laboratory testing was carried out which comprised one shear box, an atterberg

limit/moisture content and one determination of particle size distribution. The factual report including borehole log and laboratory test results is included as Appendix B. The primary purpose of the borehole was to provide a ground profile and engineering parameters for the assessment of slope stability of the Metrolink cutting. Ground and Project Consultants Ltd (GPCL) have been asked to provide ground-related advice on foundation and floor slab loads.

Beneath a cover of Topsoil, the borehole encountered a medium dense brown slightly gravelly silty medium to coarse Sand to 1.7m, overlying a medium dense brown very sandy Gravel to 3.2m bgl (Glaciofluvial Deposits). Beneath this was a firm brown slightly gravelly sandy Clay (Glacial Till), which became stiff from 5m bgl. The base of this latter stratum was not proven at 8m. A standpipe was installed at the lower part of the hole screened from 5 to 7m bgl. Groundwater was struck at 1.7m and rose to 1.5m bgl. Monitoring visits showed levels at 3.85 and 3.90m bgl in the monitoring standpipe.

4. Ground Model

A ground model has been developed from the Ground Investigation and published data.

Stratum	Bulk Unit Weight (γ) kN/m ³	Saturated Unit Weight (γ') kN/m ³	Plasticity Index (PI) %	Undrained Shear Strength (S_u) kN/m ²	Effective Cohesion (c') kN/m ²	Angle of internal Friction (ϕ') degrees	Oedometric Modulus (E_{oed}) MPa
Upper Sand	18	19	n/a	n/a	0	32	15
Middle Gravel	19	20	n/a	n/a	0	34	25
Glacial Till	20	21	16	70	0	26	7

The effective shear strength parameters for the Glacial Till are conservative given its low plasticity index, which are suggestive of $\phi' = 30^\circ$.

5. Foundations

Assuming a 450mm wide strip foundation with a 100kN/m line load at 1m depth, the bearing capacity of the soils is assessed as adequate. Predicted settlements are calculated as less than 25mm.

The ground should be capable of supporting a normally loaded residential ground bearing slab. Any Topsoil or other deleterious materials should be removed and replaced with suitably compacted granular fill. Similarly, any cohesive material should be removed and replaced with granular material. Output from the foundation analysis is included in Appendix C.

6. Slope Assessment

Slope Stability analysis has been carried using GEO5 Slope Stability 2021. Parameters have been assigned as Section 4 above and the soil profile developed from the borehole. The analysis has been carried out in accordance with EC7 Design Approach 1.

Conservative loadings have been used which include a line load of 100kN/m in addition to a floor slab on 10kN/m². The analysis shows that the utilisation of soil strength is acceptable both in the current situation and with the proposed building with line and slab loads. The calculated utilisation increases from 82% to 93%. This suggests that the proposed development will not adversely affect the stability of the cutting.

Output from the slope stability analysis is included in Appendix D.

Please do not hesitate to contact myself if you require any further information.

Yours sincerely



Jon Smithson, BSc, MSc, CGeol, FGS

Director

Appendix A: Drawings

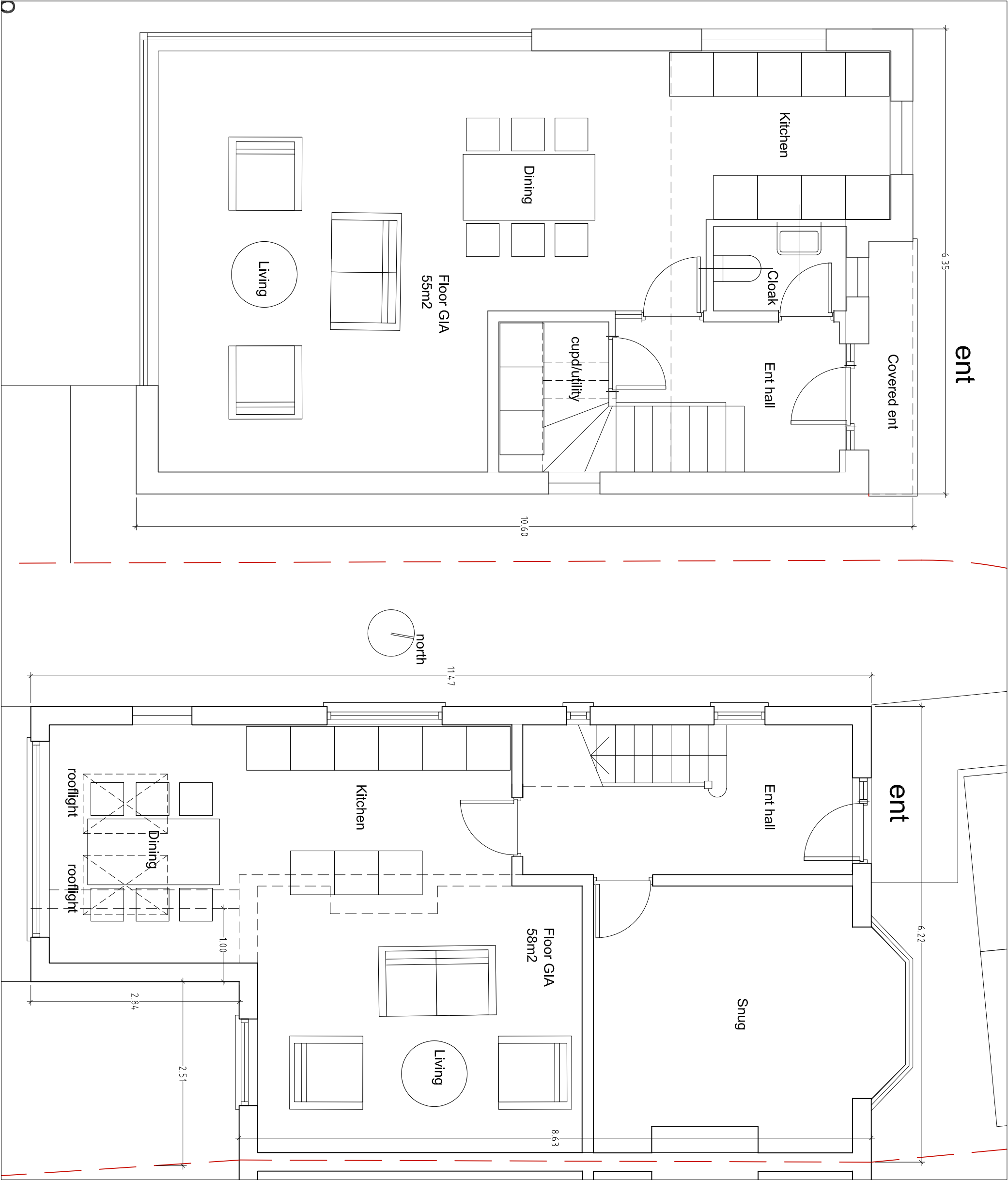
Appendix B: Ground Investigation Report

Appendix C: Foundation Analysis

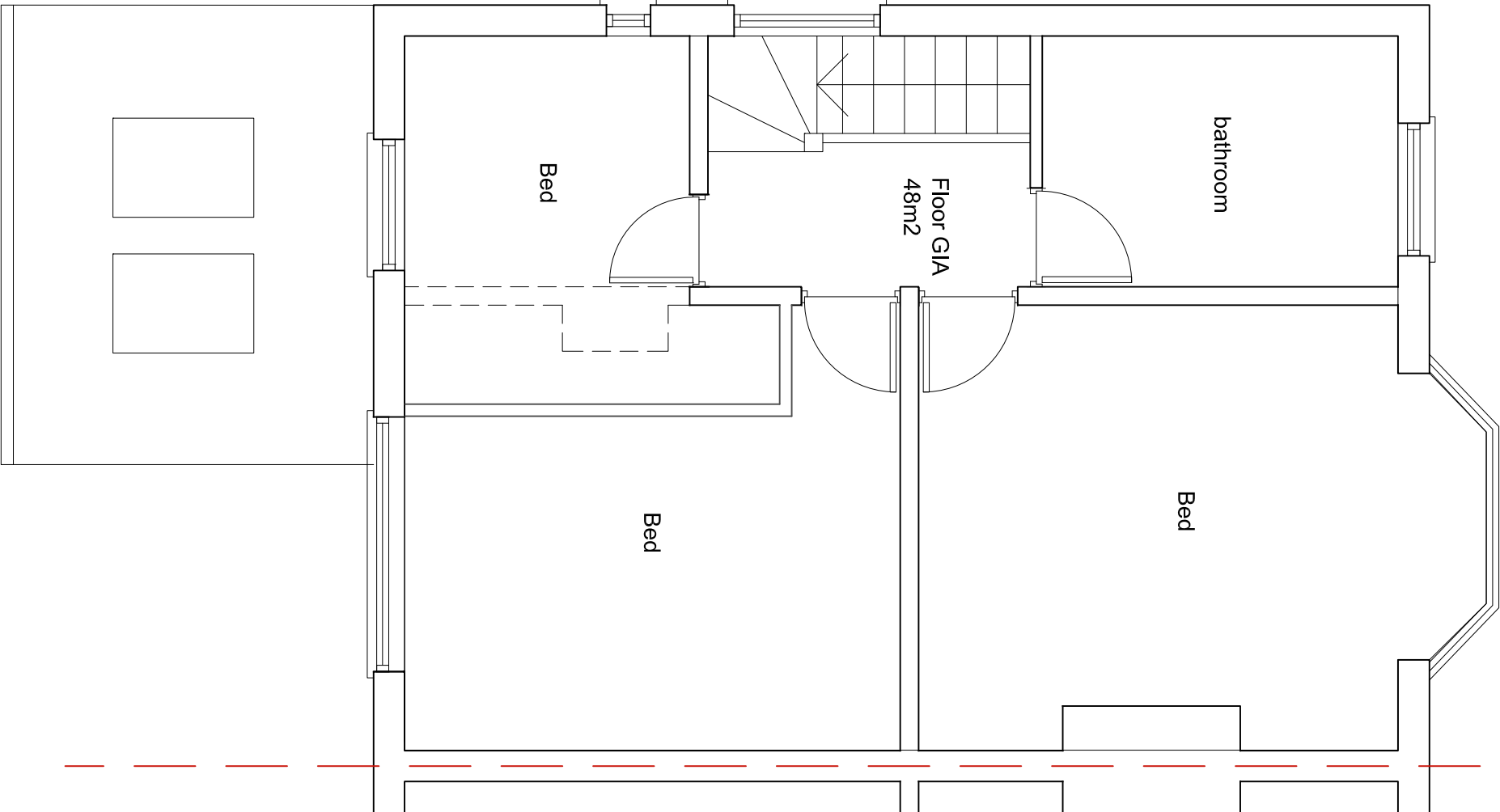
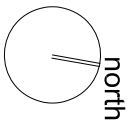
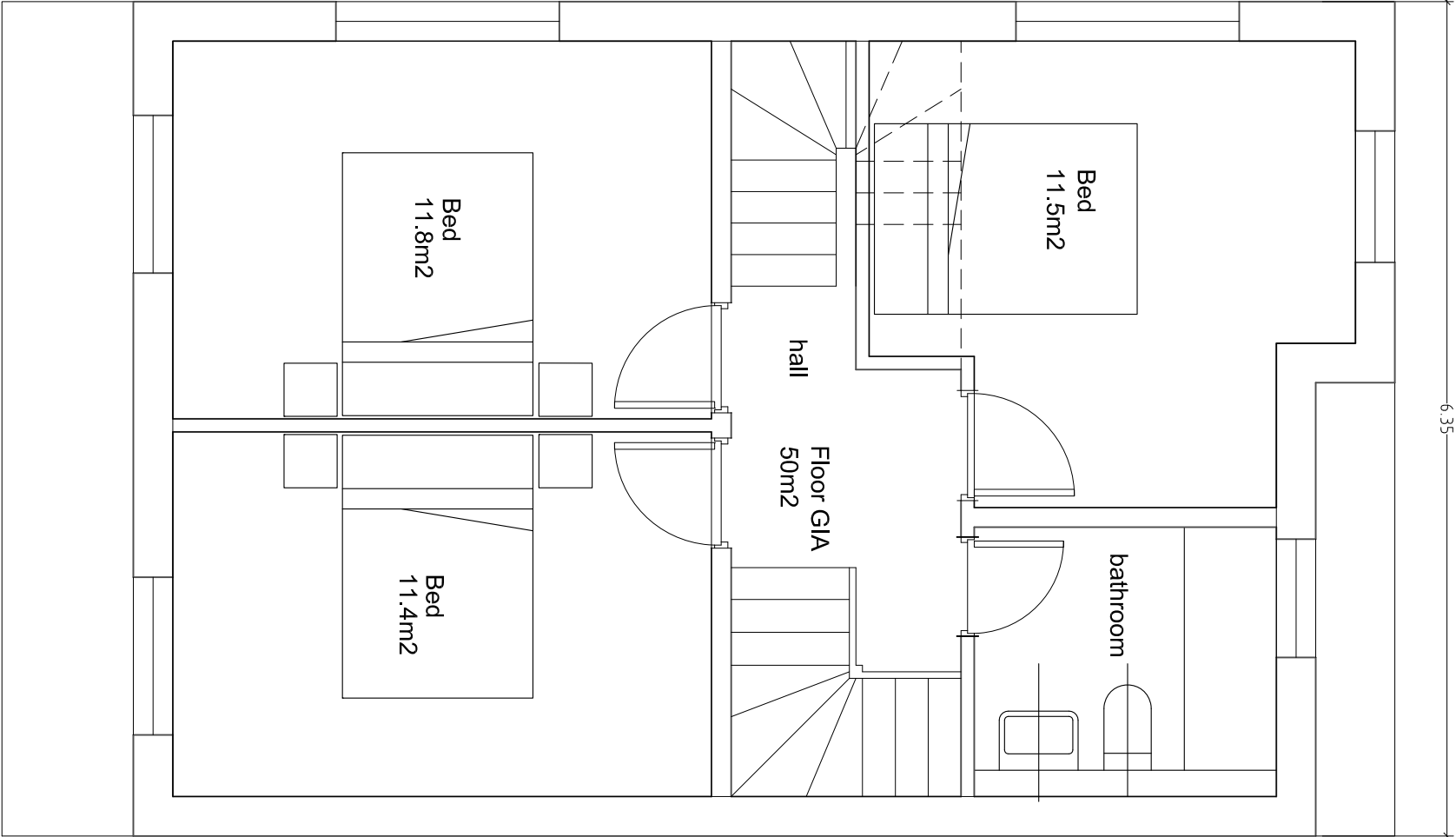
Appendix D: Slope Analysis

Appendix A

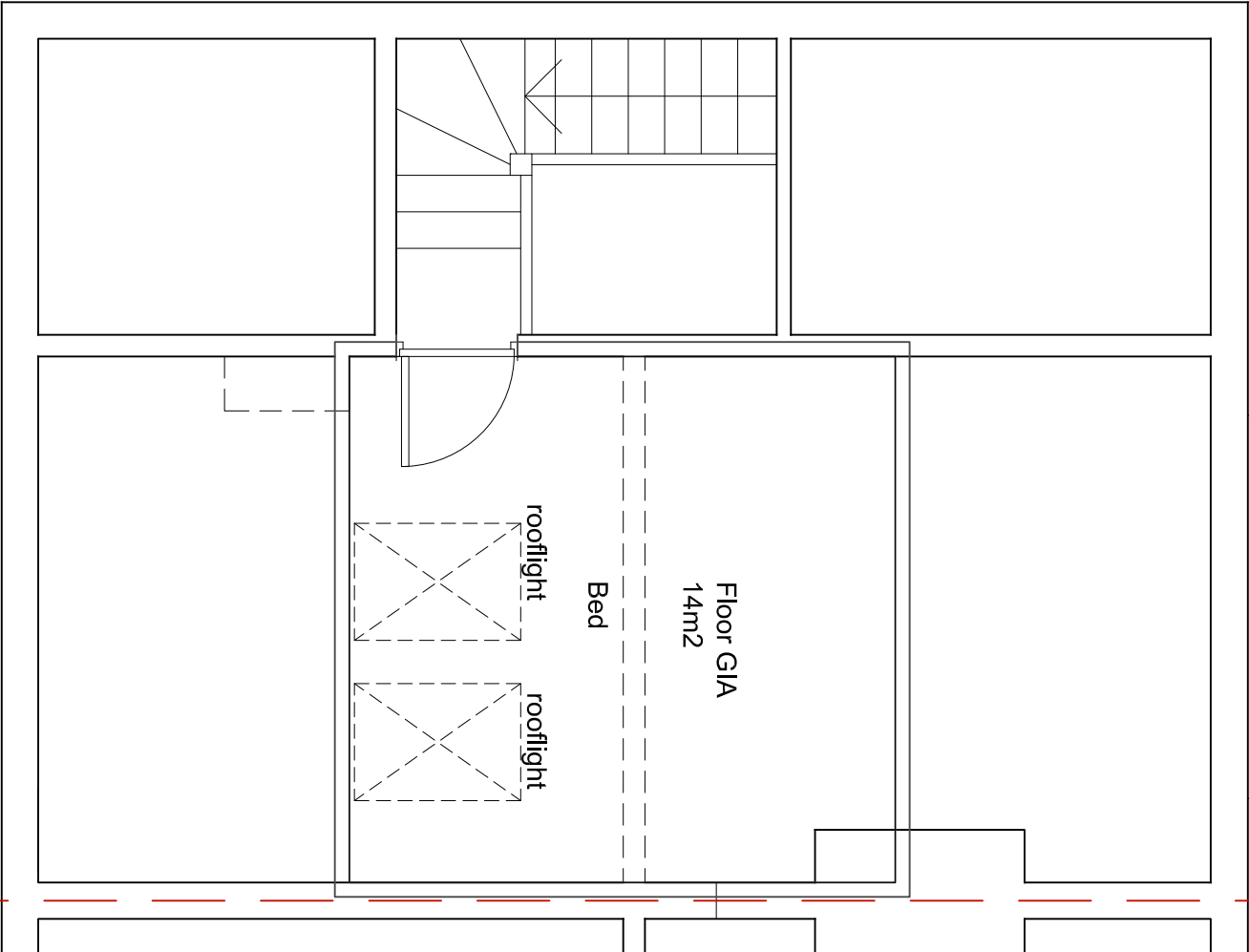
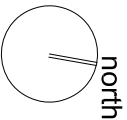
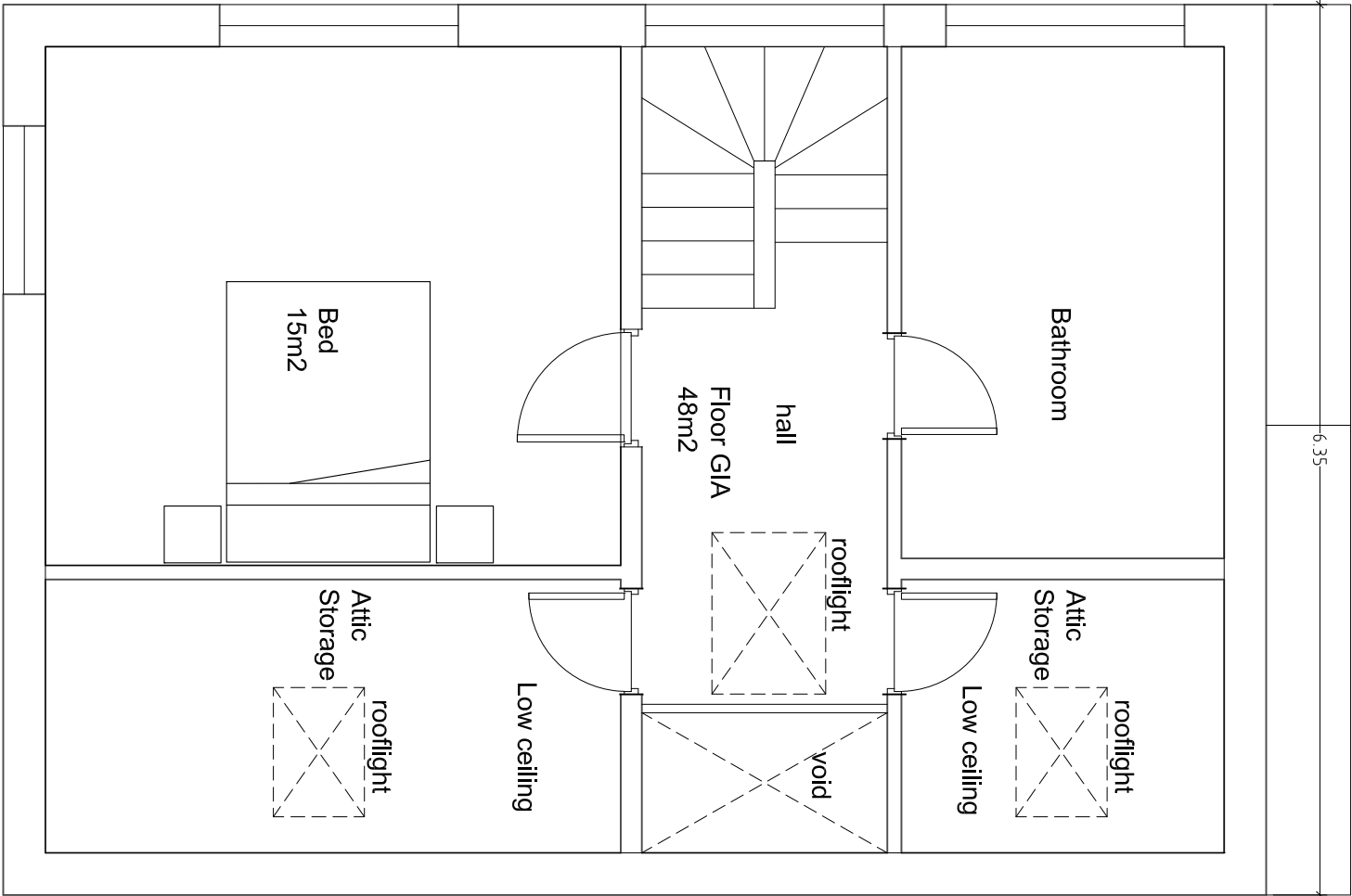
Drawings



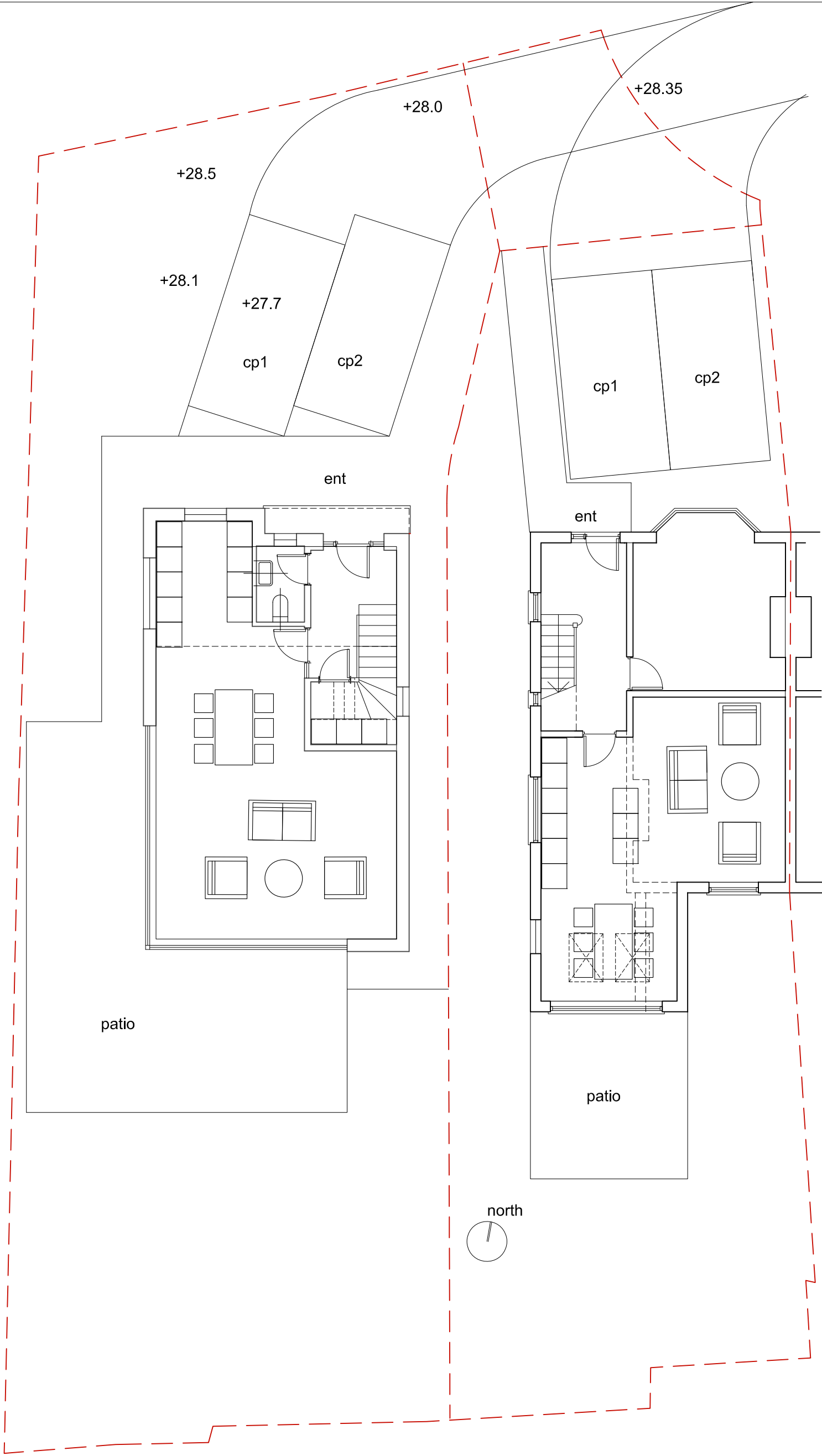
PROJECT 23a Crimsworth Av., Chorlton.				DRAFT			
SCALE 1:50 @A3		CLIENT John O'Hare.					
DRAWING NUMBER 155-PL-GA1		DRAWING TITLE Proposed plan: GROUND					
CONTRACT NO/ STAGE CODE 155 planning		REV/ -					
25/01/21							
ISSUED							



PROJECT 23a Crimsworth Av., Chorlton.				DRAFT			
SCALE 1:50 @A3		CLIENT John O'Hare.					
DRAWING NUMBER 155-PL-GA2		DRAWING TITLE Proposed plan: FIRST					
CONTRACT NO/STAGE CODE 155		REV/ planning					
25/01/21							
ISSUED							



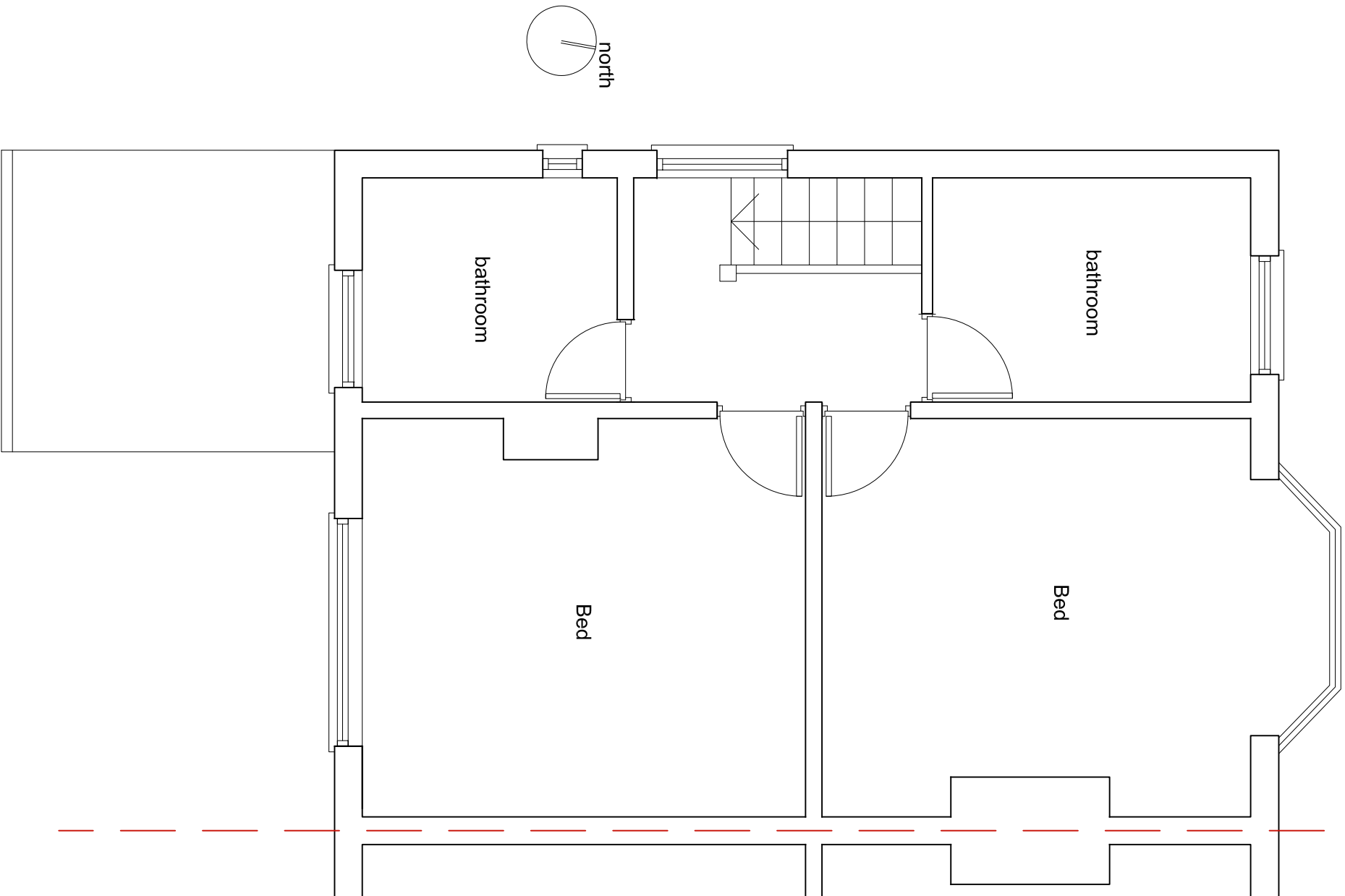
PROJECT 23a Crimsworth Av., Chorlton.				DRAFT			
SCALE 1:50 @A3		CLIENT John O'Hare.					
DRAWING NUMBER 155-PL-GA3		DRAWING TITLE Proposed plan: SECOND					
CONTRACT NO / STAGE CODE 155 / planning		REV / -					
25/01/21							
ISSUED							



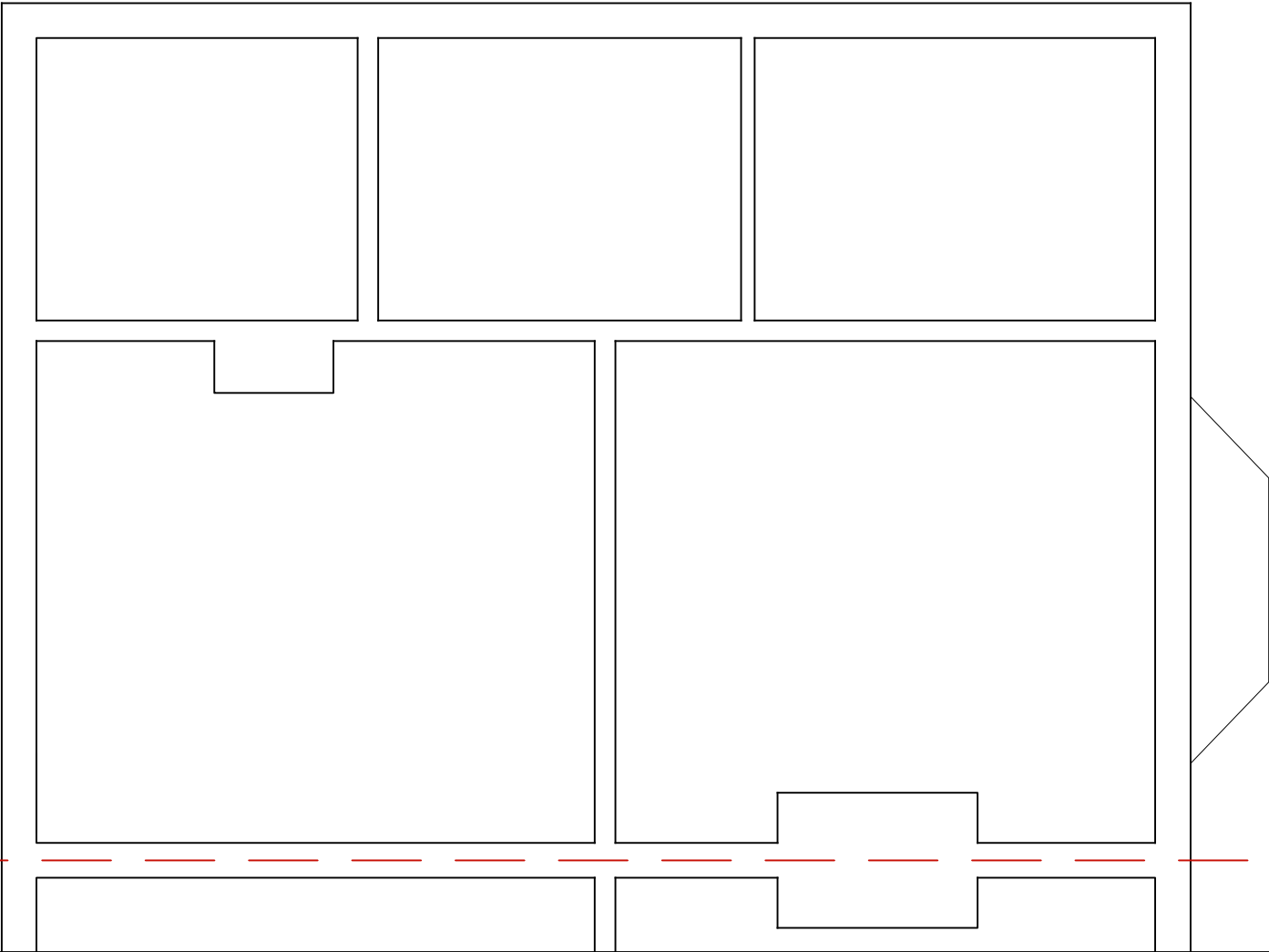
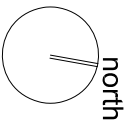
PROJECT 23a Crimsworth Av, Chorlton.			DRAFT	
SCALE 1:100 @A3		CLIENT John O' Hare.		
DRAWING NUMBER 155-PL- GL1				
CONTRACT NO: 155		STAGE CODE planning	REV. •	DRAWING TITLE Proposed plan: SITE PLAN
ISSUED	25/01/21	sj simon james arq ltd/architects UK: 120 Grosvenor st, Al Sakh, Manchester, M1 7HL, Spain:Enrique Lameiro 1, 4B, Chamartin, Madrid, 28036		



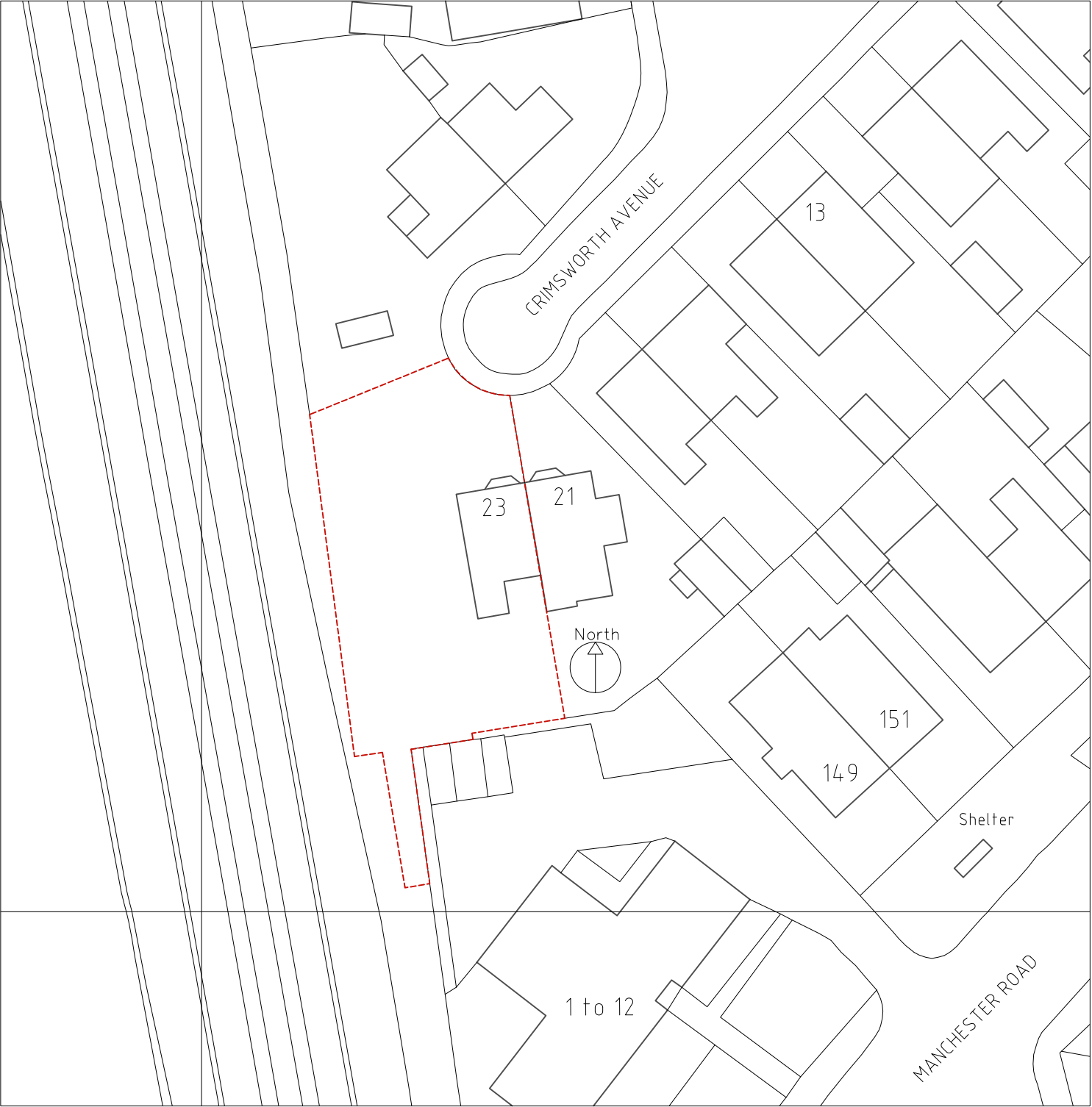
PROJECT 23a Crimsworth Av, Chorlton.			DRAFT	
SCALE 1:100 @A3		CLIENT John O' Hare.		
DRAWING NUMBER 155-PL- GLS1				
CONTRACT NO: 155		STAGE CODE planning		REV. •
		DRAWING TITLE Existing plan: SITE PLAN		
ISSUED	25/01/21		sj simon james arq ltd/architects UK: 120 Grosvenor st, Al Seikh, Manchester, M1 7PL, Spain: Enrique Llaneta 1, 4B, Chamartin, Madrid, 28039	



PROJECT 23a Crimsworth Av., Chorlton.				DRAFT			
SCALE 1:50 @A3		CLIENT John O'Hare.					
DRAWING NUMBER 155-PL-GS2				DRAWING TITLE Existing plan: FIRST			
CONTRACT NO/STAGE CODE 155		REV/ planning		-			
		25/01/21					
ISSUED							

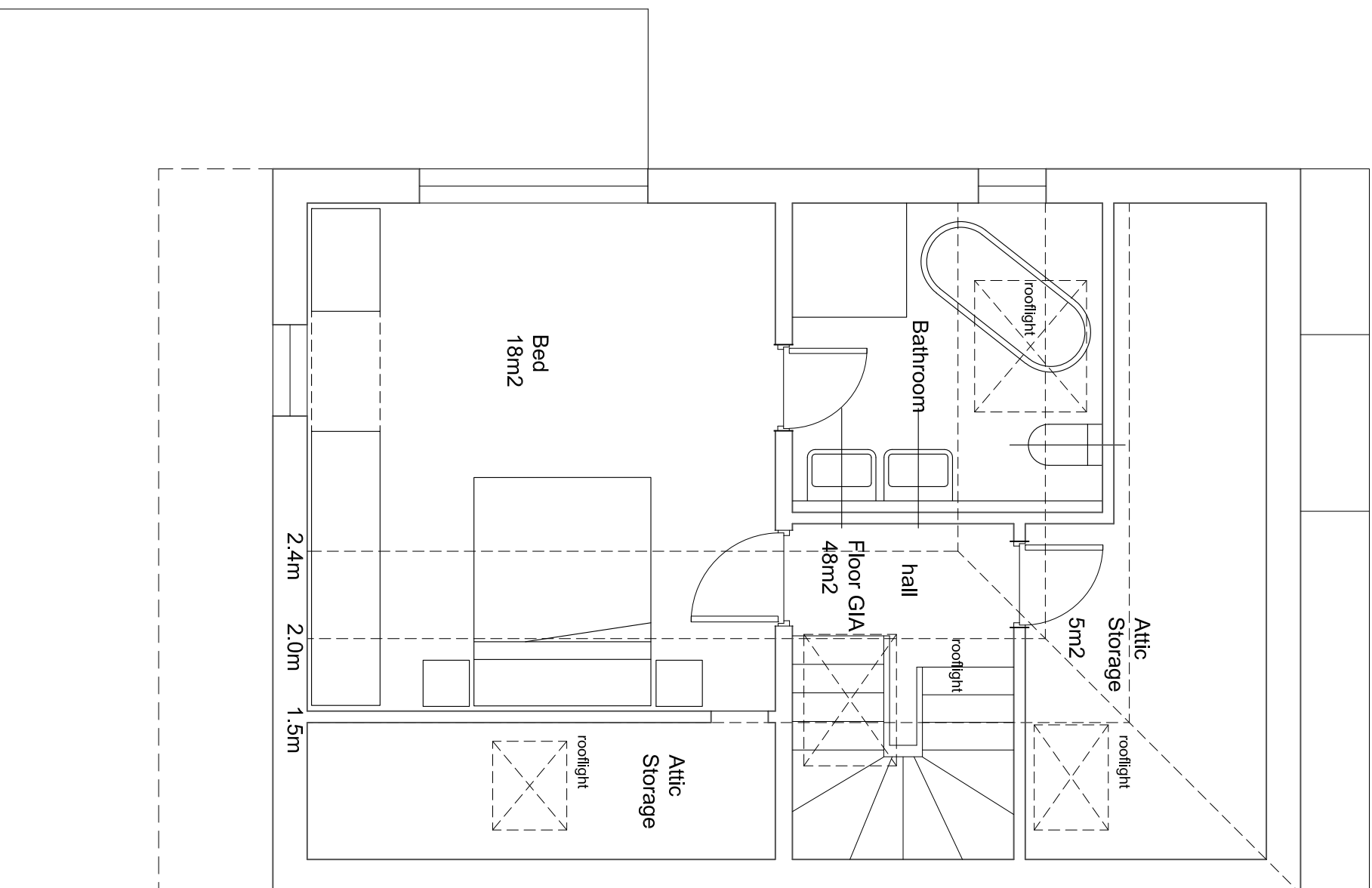


PROJECT 23a Crimsworth Av., Chorlton.				DRAFT			
SCALE 1:50 @A3		CLIENT John O'Hare.					
DRAWING NUMBER 155-PL-GS3				DRAWING TITLE Existing plan: ATTIC LEVEL			
CONTRACT NO/ STAGE CODE 155		planning		REV -			
		25/01/21					
ISSUED							

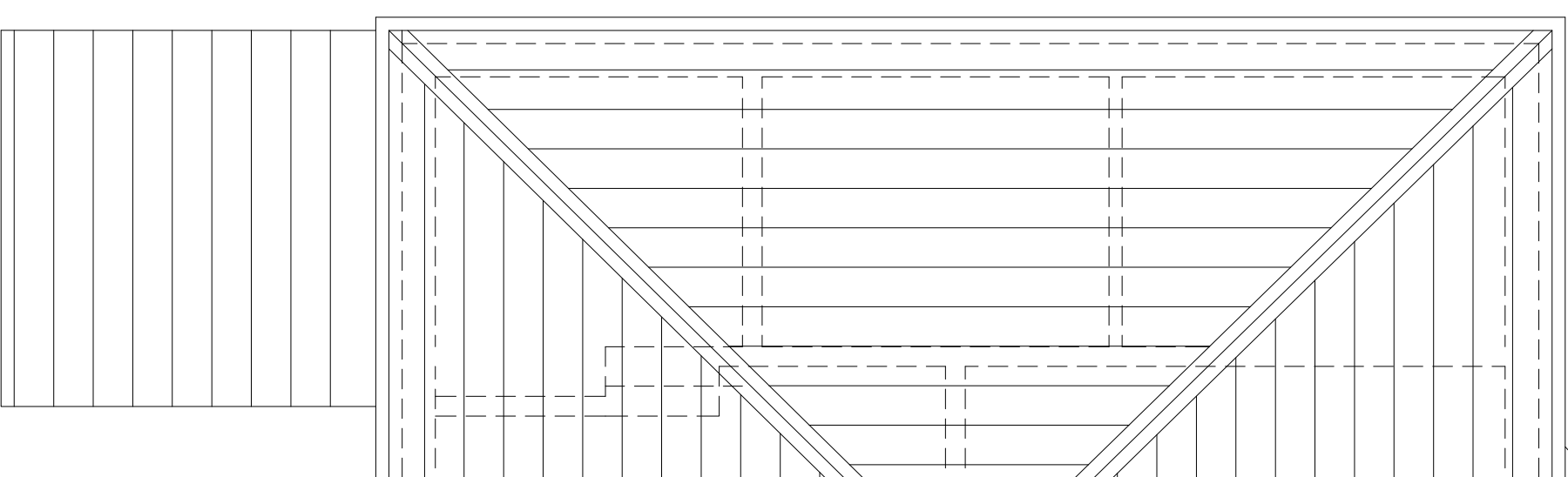


PROJECT 23a Crimsworth Av, Chorlton.			DRAFT		
SCALE 1to 500 @A4		CLIENT John O' Hare.			
DRAWING NUMBER 155-PL-0S1					
CONTRACT NO. 155		STAGE CODE planning	REV. .	DRAWING TITLE Location plan	
ISSUED	25/01/21		sj simon james arq ltd/architects UK: 120 Grosvenor st, All Saints, Manchester, M1 7HL Spain:Enrique Larrero 1, 4b, Chamartín, Madrid, 28038		

23a Crimsworth Av



23 Crimsworth Av



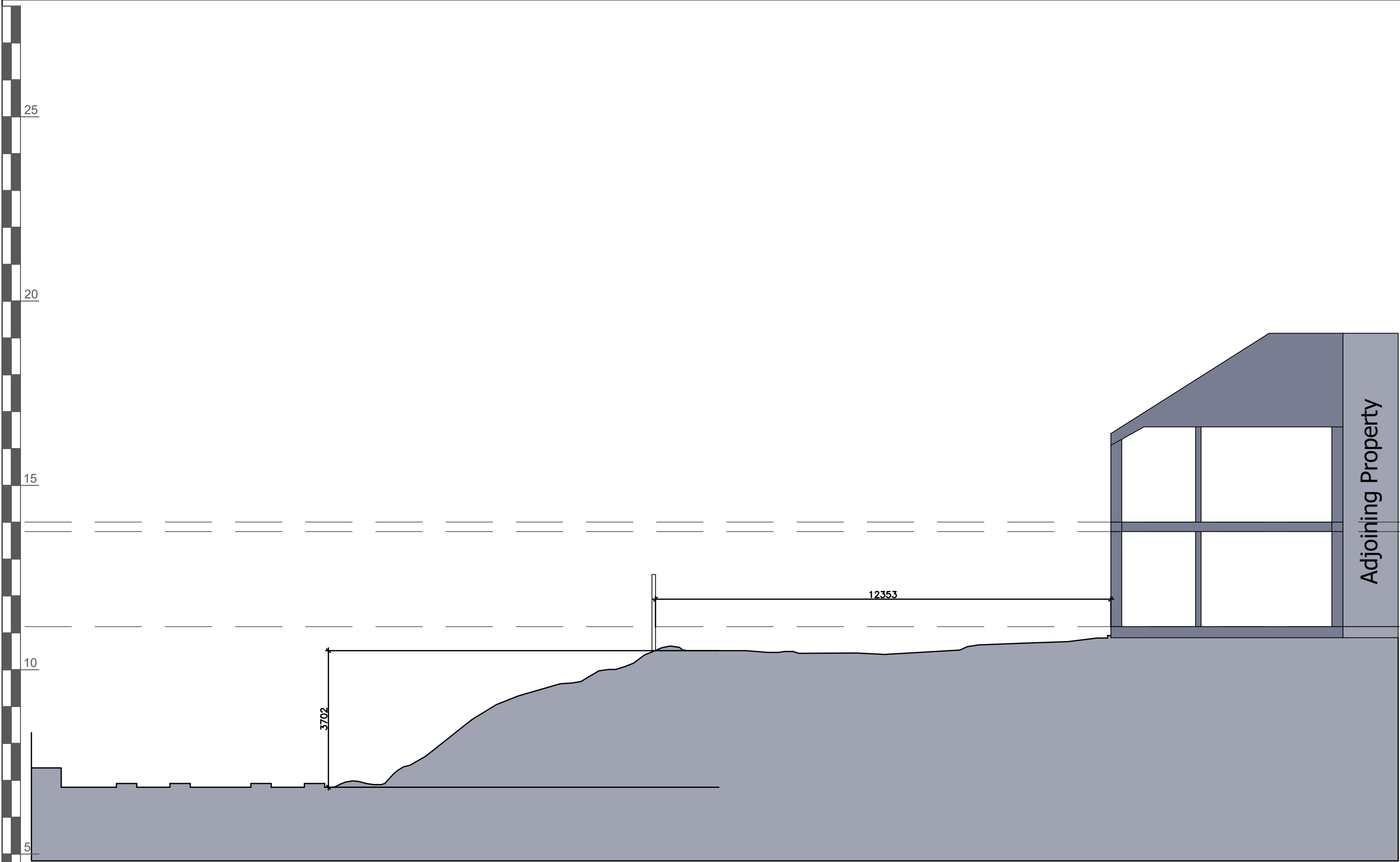
DRAFT

PROJECT		23a Crimsworth Av. Chorlton.	
SCALE	1:50 @A3	CLIENT John O' Hare.	DRAWING TITLE Proposed plan: SECOND
DRAWING NUMBER	155-PL- GA3		
CONTRACT NO	155	STAGE CODE	REV.
	planning		1
ISSUED	22/03/21		



simon james and kid/architects

UK: 120 Grosvenor St, 4th Floor, Manchester, M1 7PL



SITE SECTION

- Do not scale from this drawing for the purpose of construction - Work to figured dimensions only. All dimensions to be checked on site prior to the execution of any work.
- Where any discrepancy is found to exist within or between drawings and/or documents it should be reported to the architect immediately.
- Point Cloud Surveys shall not be liable for any use of drawings, CAD files & documents for any purpose other than for which the same were prepared by or on behalf of the client.

Rev. * Date In

Description

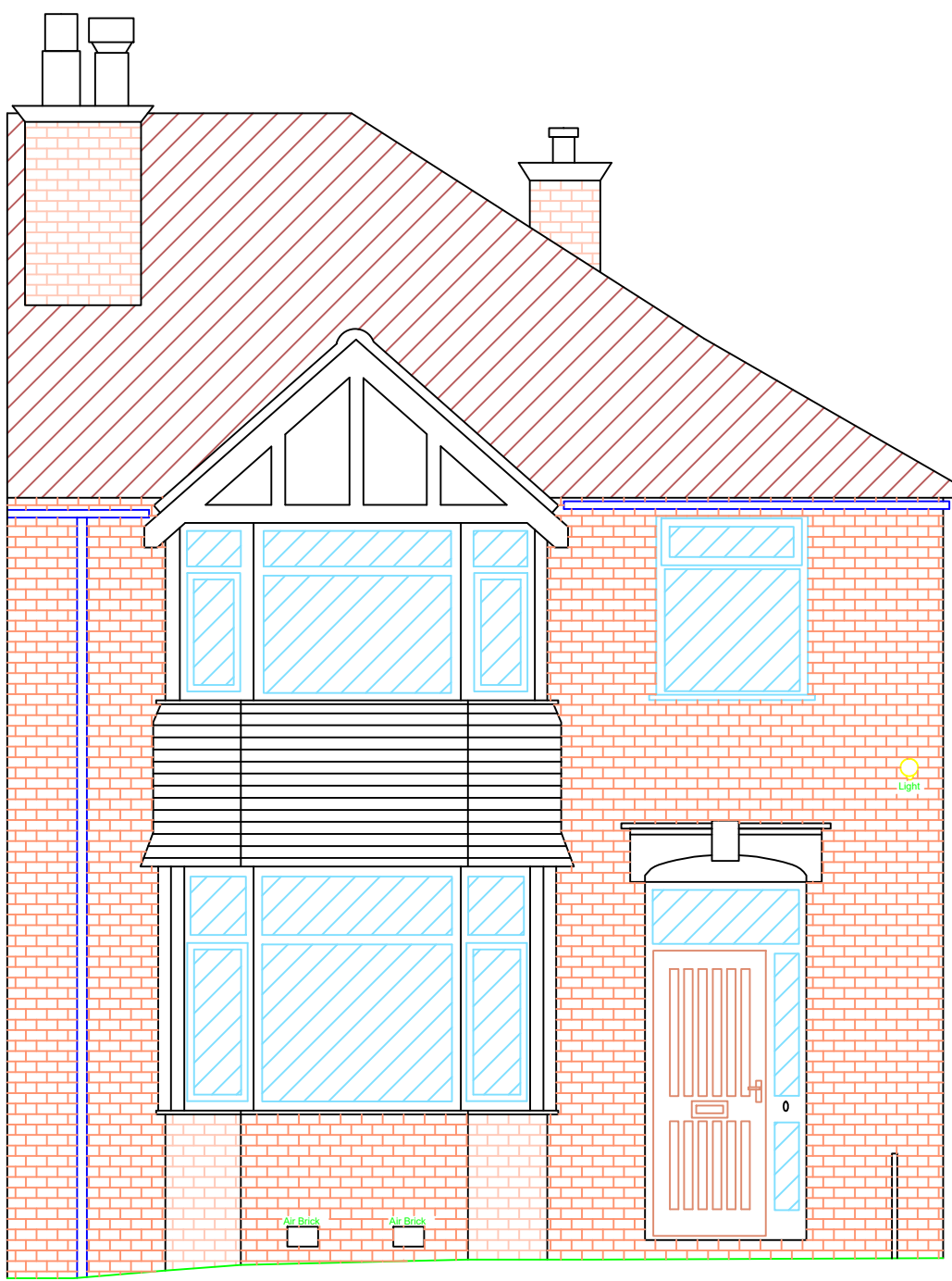

3D BUILDING SCANS

Jonathan Hayes
23 Crimsworth Avenue, Stretford M16 0EB

EXISTING SITE SECTION
July 2021 By CQ Scale 1:100@A3 [L]

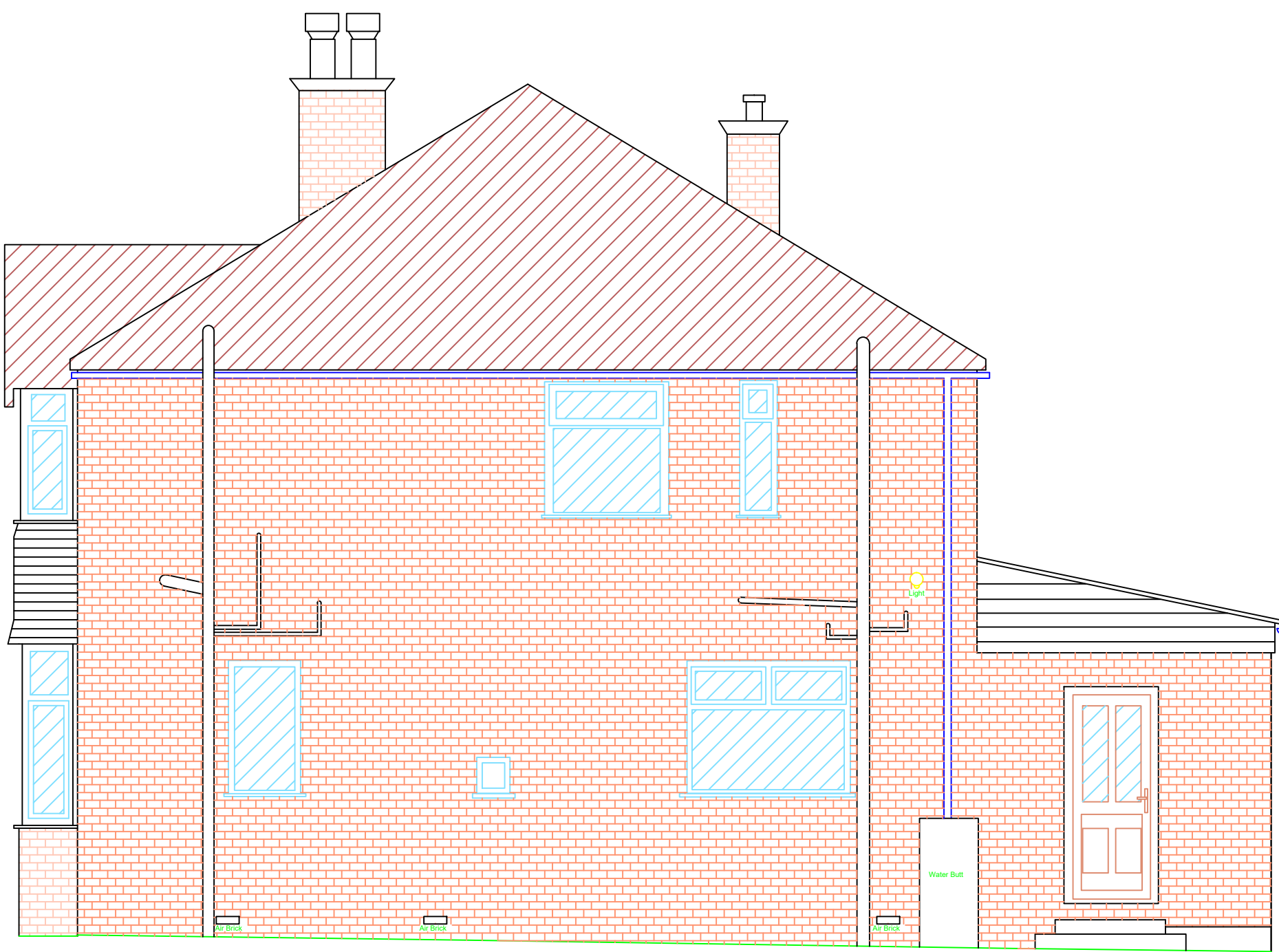
21-127 (EXT)20 Rev *

3D Building Scans
11 BRADSHAW LANE
GRAPPENHALL
CHESHIRE
WA4 2NU
0161 302 2304
www.3d-bs.co.uk



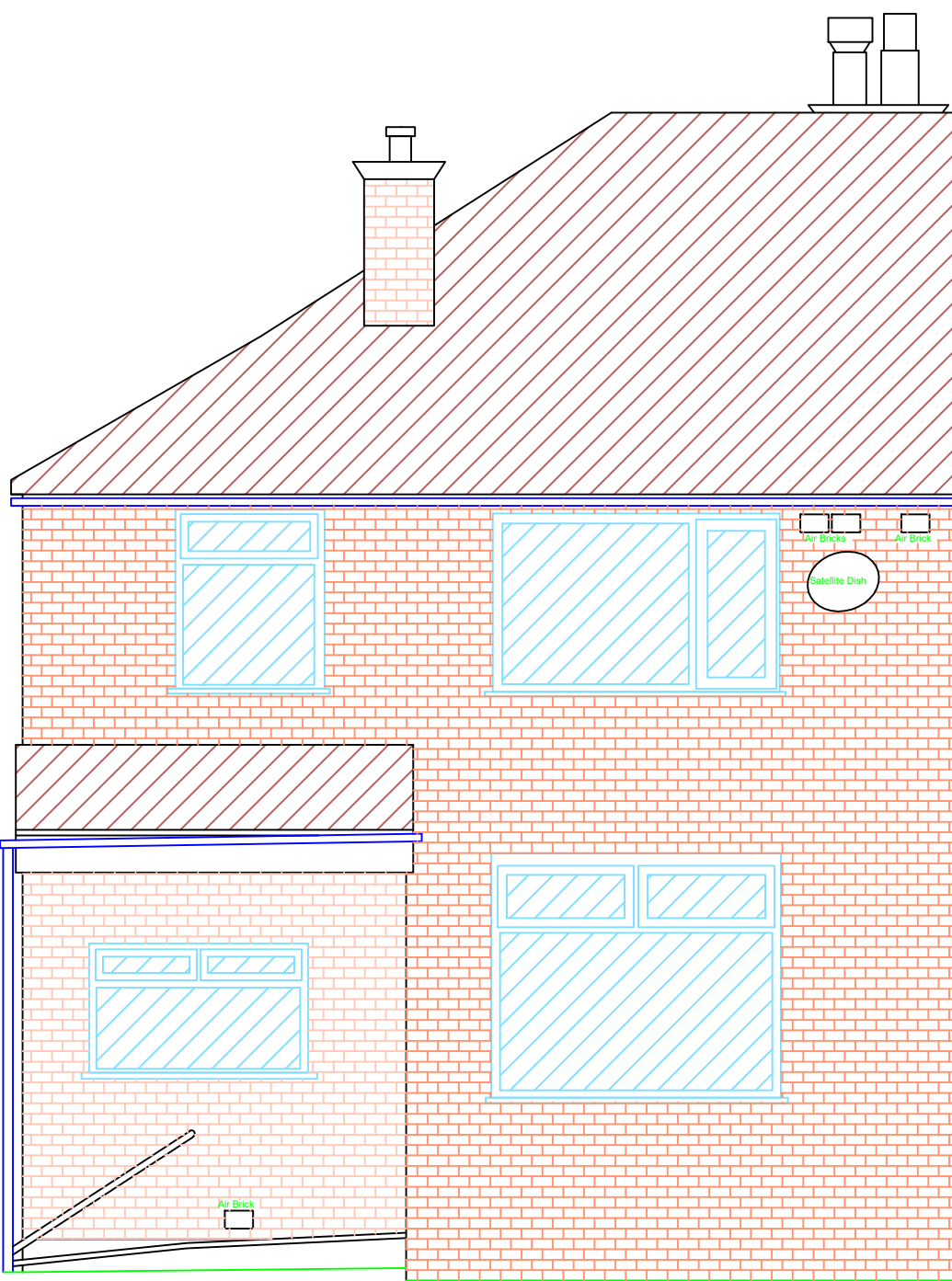
Datum 2=00m

Elevation 1



Datum 2=00m

Elevation 2



Datum 2=00m

Elevation 3

Disclaimer
All dimensions to be checked on site prior to any works commencing.
Any discrepancies must be reported back to Geomatic Surveys Limited immediately.
Although every effort has been made to ensure the accuracy of the information contained within the drawing, Geomatic Surveys Limited are not responsible for inaccurate or missing information which may have an impact on the development of the site.

REV	DATE	DESCRIPTION	BY	APP
-----	------	-------------	----	-----

Sheet Layout		Sheet 1		
--------------	--	---------	--	--

Survey Information
All levels are related to Ordnance Survey Datum.
Refer to Topographical Survey for details.

Geomatic Surveys Ltd
LAND SURVEYORS AND CONSULTING ENGINEERS
Bank House, The Paddock
Wimslow Road
Handforth
Cheshire
SK9 3HQ
Tel/Fax: - 01625 521405
Email: info@geomaticsurveys.co.uk
Web: www.geomaticsurveys.co.uk

Client
EGERTON DESIGNS

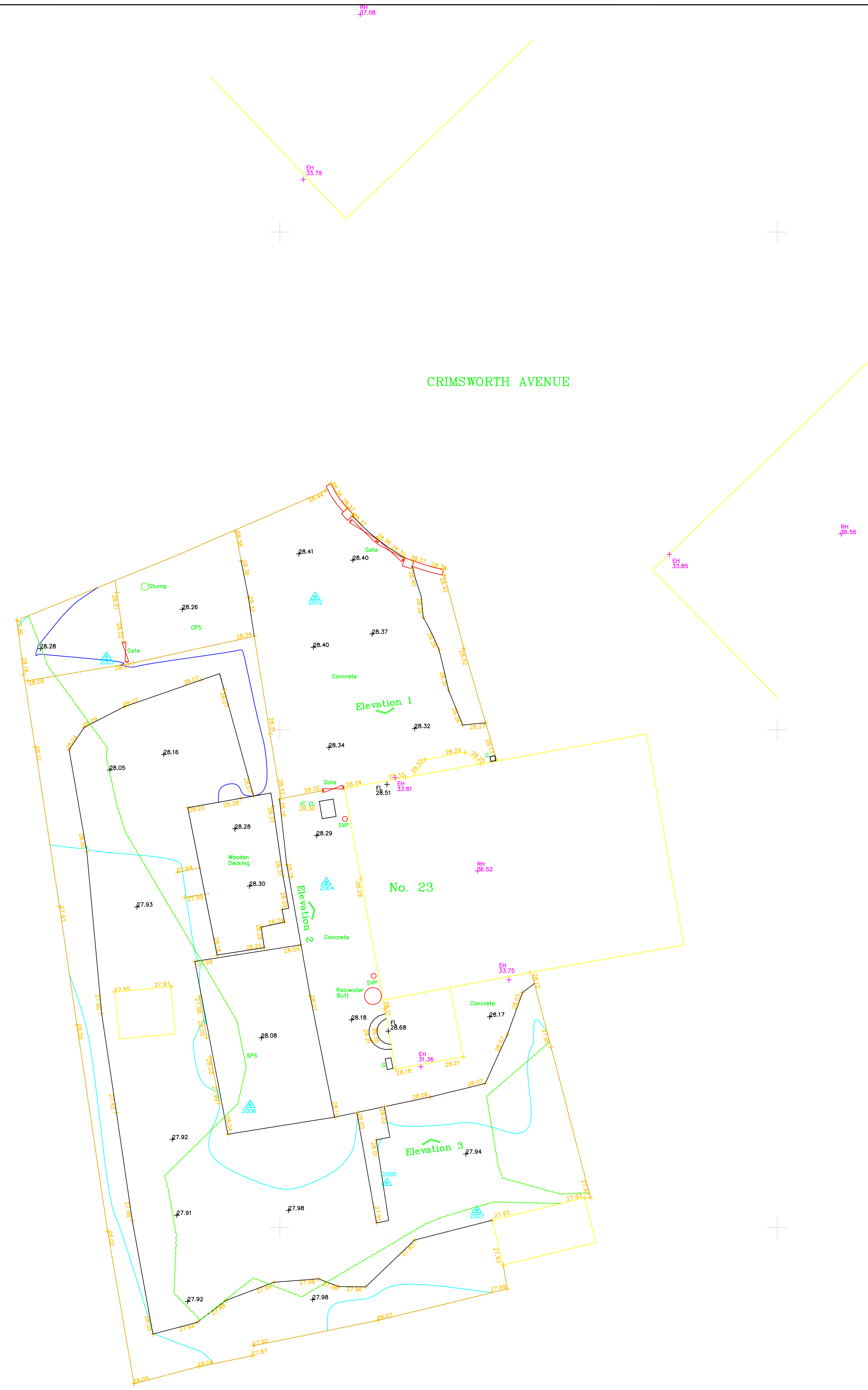
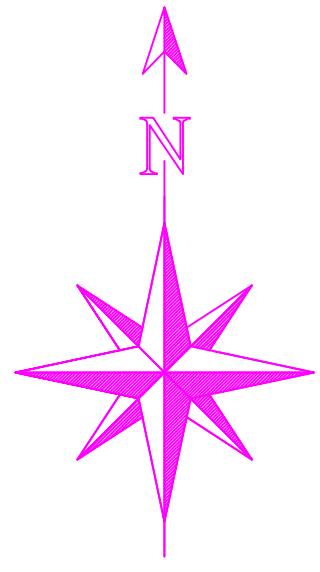
Project Title
**No. 23
CRIMSWORTH AVENUE
WHALLEY RANGE**

Drawing Title
ELEVATIONS

Drawn	Checked	Surveyed Date
GD	IRH	02/09/2020
Date	Scale	Sheet No.
04/09/2020	1:50 @ A1	SHEET 1 OF 1

Dwg No.	Rev
2492/Elevations	

Copyright©Geomatic Surveys Limited 2020



SURVEY CONTROL STATIONS			
STN	EASTING	NORTHING	HEIGHT
2001	381740.406	394771.290	26.219
2002	381721.453	394743.340	26.411
2003	381713.024	394742.901	26.267
2004	381721.676	394753.873	26.246
2005	381724.303	394721.751	27.928

LEGEND

- CONTROL STATIONS
- MANHOLE
- BUSH
- TREE
- DROP KERB
- EMBANKMENT
- OVERHEAD ELECTRICITY LINE
- OVERHEAD TELEPHONE LINE
- FOOTPATH
- FENCE
- HEDGE
- FOLIAGE
- DITCH
- VERGE
- EXISTING BUILDING
- MAIN CONTOUR
- CONTOUR
- SW SEWER
- FW SEWER

- AV Air Valve
- BD Borehole
- BS Bench Mark
- BT BT Inspection Chamber
- CL Cover Level
- CATV Cable TV Cover
- C/L Chain Link Fence
- CP Catch Pit
- CPS Concrete Paving Slab
- ECB Electricity Control Box
- ER Earthing Rod
- FR Fire Hydrant
- FL Fire Line
- GH Greenhouse
- GP Gate Post
- GR Grate
- GV Gas Valve
- G Gully
- IC Inspection Chamber
- IL Invert Level
- KD Kerb Duct
- JB Junction Box
- LP Lamp Post
- MH Man Hole
- MC Marker Post
- MS Mile Stone Marker
- NP Street Name Plate
- O/H Overhead
- P Post
- PB Post Box
- PI Pipe
- PM Parking Meter
- P/B Post & Rail Fence
- P/W Post & Wire Fence
- PE Electricity Pole
- RE Ridding Eye
- RH Reinforced Steel Joist
- R/SJ Reinforced Steel Joist
- R/W Retaining Wall
- RWP Rainwater Pipe
- SPS Stone Paving Slab
- SL Soffit Level
- SP Sign Post
- ST Stop Tap
- SV Stop Valve
- SY Slay Wire
- TC Tactile Crossing
- TGB Telephone Call Box
- TH Trial Hole
- TL Threshold Level
- TOW Top of Wall Level
- UPL Telegraph Pole
- UFL Upper Floor Level
- WM Water Meter
- WL Water Level
- WH Building Valley Level

Disclaimer:
Man Entry to sewers has not been undertaken. Depths, Pipe sizes etc are measured from the ground. All sewers and inverts to be checked prior to any works commencing on site. Geomatic Surveys Limited are not responsible for mistakes, omissions, information not surveyed which may have an impact on site development.
Boundaries shown are physical and may not represent legally conveyed ownership.

REV	DATE	DESCRIPTION	BY	APP.
1	04/09/2020	Sheet Layout		

Sheet 1

Survey Information
The survey has been orientated to Ordnance Survey National Grid and datum using one central control station. No Scale Factor has been applied to the coordinates meaning that the survey is arbitrary and not true Ordnance Survey Coordinates.

Geomatic Surveys Ltd
LAND SURVEYORS AND CONSULTING ENGINEERS
Bank House, The paddock
Wilmslow Road
Handforth
Cheshire
SK9 3HQ
Tel/Fax: - 01625 521405
Email: info@geomaticsurveys.co.uk
Web: www.geomaticsurveys.co.uk

Client
EGERTON DESIGNS

Project Title
**No. 23
CRIMSWORTH AVENUE
WHALLEY RANGE**

Drawing Title		
TOPOGRAPHICAL SURVEY		
Drawn	GD	Checked
IRH	02/09/2020	Surveyed Date
Date	04/09/2020	Scale
1:100 @ A1	Sheet No.	SHEET 1 OF 1
Dwg. No.	02492/01	Rev
Copyright © Geomatic Surveys Limited 2020		

Appendix B

Ground Investigation Report

**FACTUAL REPORT ON
GROUND INVESTIGATION
AT
23A CRIMSWORTH AVENUE,
CHORLTON**



REPORT STATUS SHEET

Client:	The Egerton (Property) Partnership Ltd
Report Title:	Factual Report on Ground Investigation at 23a Crimsworth Avenue, Chorlton
Report Number:	AG3278-21-AM89
Report Status:	Validated Issue 1
Date:	August 2021



		Date	Signed for and on behalf of Applied Geology Limited
Report Author	C Sellers MGeol (Hons) FGS MEnvSc Lead Project Geologist	13/08/2021	<i>C. Sellers</i>
Checked	P Gabrielle BSc (Hons) FGS Regional Manager	13/08/2021	<i>P. Gabrielle</i>
Authorised	S Day BSc (Hons) MSc CGeol FGS SiLC Director 	13/08/2021	<i>S. Day</i>

CONTENTS

1.0	INTRODUCTION.....	1
2.0	SITE LOCATION, DESCRIPTION AND GEOLOGY	1
2.1	Location and Description	1
2.2	Published Geology	1
3.0	FIELDWORK AND LABORATORY TESTING.....	1
3.1	Fieldwork	1
3.2	Instrumentation and Monitoring	2
3.3	Laboratory Testing.....	2

GENERAL NOTES

APPENDICES

APPENDIX A	DRAWINGS & FIGURES
	• Site Location Plan, Dwg No AG3278-21-01 • Exploratory Hole Location Plan, Dwg No AG3278-21-02
APPENDIX B	EXPLORATORY HOLE LOGS
APPENDIX C	FIELD MONITORING RESULTS
APPENDIX D	LABORATORY TEST RESULTS

1.0 INTRODUCTION

An area of private garden associated with 23 Crimsworth Avenue, Chorlton (the site) is being proposed for development. A slope stability assessment has been commissioned by The Egerton (Property) Partnership Ltd (the Client), which is being undertaken by Ground Project Consultants Ltd (the Consultant). This report presents the factual results of a ground investigation undertaken at the site to assist with this slope stability assessment.

The scope of the ground investigation was specified by Ground and Project Consultants Ltd and is outlined in our proposal (ref AG21-7659let001) and estimate (ref AG21-7659-01), dated 28th April 2021.

2.0 SITE LOCATION, DESCRIPTION AND GEOLOGY

2.1 Location and Description

The site is located in a private garden adjacent to 23 Crimsworth Avenue, Chorlton, approximately 4km southwest of Manchester city centre. The Ordnance Survey grid reference for the approximate centre of the site is 381731 394738 as shown on the Site Location Plan in Appendix A.

An existing cutting associated with a railway line is present on the eastern boundary.

At the time of the fieldwork, the garden was scattered with building materials and rubble associated with an adjacent renovation.

2.2 Published Geology

Published BGS data indicates that the site is underlain by Superficial strata comprising Glaciofluvial Deposits and Glacial Till, over Solid strata of the Wilmslow Sandstone Formation.

3.0 FIELDWORK AND LABORATORY TESTING

3.1 Fieldwork

A single 150mm diameter Cable Percussion borehole (ref. BH1) was undertaken to 8.0m bgl.

Fieldwork was generally carried out (where relevant) in accordance with BS5930 (2015) "Code of Practice for Site Investigations" and was supervised by an experienced Engineering Geologist.

The location of the exploratory hole was selected by Ground and Project Consultants Ltd and set out on site by Applied Geology. The sampling strategy was also specified by Ground and Project Consultants Ltd. The borehole record is included in Appendix B.

The exploratory hole location was cleared of services by trained personnel using a calibrated CAT & Genny in addition to consultation of statutory service plans. The positions of the exploratory hole was defined by taping from identifiable features on

a topographical survey Drawing ref: 02492/01 produced by Geomatic Surveys Ltd, dated September 2020. The location is shown on Drawing No. AG3278-21-02 in Appendix A, which is based on this topographical survey drawing.

3.2 Instrumentation and Monitoring

On completion of boring, a 19mm diameter standpipe piezometer was installed with the piezometer tip placed at 7.7m bgl in the Glacial Till, as instructed by Ground and Project Consultants Ltd. Graded sand was used as the filter medium below and around the piezometer tip and the installation was finished with a flush metal cover concreted in place. Details are included on the borehole log in Appendix B.

Groundwater monitoring visits were undertaken on 2 occasions, on 18th June and 25th June 2021. The monitoring results are included in Appendix C.

3.3 Laboratory Testing

Geotechnical laboratory testing was undertaken on selected samples as directed by Ground and Project Consultants Ltd and comprised the following:

- 2 No natural moisture content tests;
- 2 No Atterberg limit tests;
- 1 No particle size distribution test;
- 1 No 60mm Shearbox test.

Geotechnical testing was undertaken in accordance with BS17892 and BS1377 (where applicable) by UKAS accredited laboratory PSL Ltd.

Laboratory classification test results are included in Appendix D. The shearbox test result is to be issued separately once the result becomes available.

Applied Geology Limited
First Floor Lowton Business Park
Newton Road
Warrington
WA3 2AN

Tel: 01925 738599

GENERAL NOTES

- A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.
- B) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.
- C) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.
- D) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.
- E) The copyright of this report and other plans and documents prepared by Applied Geology is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.
- F) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.
- G) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.
- H) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.
- I) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.
- J) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.
- K) Applied Geology operates as a Consultancy and does not operate its own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

APPENDIX A



Reproduced from the Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office, Crown Copyright* LICENCE No: 100055022

APPLIED GEOLOGY

First Floor, Lowton Business Park
Newton Road
Lowton St. Mary's Warrington
WA3 2AN
Tel: 01925 738599
email: admin@appliedgeology.co.uk

Client:

THE EGERTON (PROPERTY) PARTNERSHIP LTD

Project:

23A CRIMSWORTH AVENUE, CHORLTON

Drawn By:

FD

Checked By:

CS

Paper Size:

A4

Scale:

NTS

Date:

09.08.2021

NGR:

381731 394738

Title:

SITE LOCATION PLAN

Drawing No:

AG3278-21-01

Revision:

0

APPENDIX B

BOREHOLE LOG - CABLE PERCUSSION

BH1

Project 23A Crimsworth Avenue, Chorlton, Manchester

Project No.

AG3278-21

Client The Egerton (Property) Partnership Ltd

Sheet

1 of 1

Start 09/06/2021

Coordinates

Scale

1:50

End 09/06/2021

Ground Level

Total Depth

8.00m

Sample / Test Type	Depth (m)	Result	Casing Depth (m)	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
B	0.50				(0.40) 0.40	Grass over dark brown silty slightly gravelly SAND. Gravel is fine subrounded to rounded quartzite. (TOPSOIL)			
B D S	1.20 1.20 1.20	N = 13			(1.30) 1.70	Dark brown to brown slightly gravelly silty medium to coarse SAND. Gravel is fine to medium subrounded to rounded quartzite. (GLACIOFLUVIAL DEPOSITS) From 1.20m bgl: medium dense.			
B C	2.00 2.00	N = 20			(1.50)	Medium dense brown very sandy GRAVEL. Gravel is fine to coarse subrounded to rounded quartzite. (GLACIOFLUVIAL DEPOSITS)			
C	3.00	N = 5			3.20	Firm brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular to rounded quartzite, sandstone and coal. (GLACIAL TILL)			
UT	4.00	(37)							
D	4.60								
D S	5.00 5.00	N = 19			(4.80)	From 5.00m bgl: stiff.			
D	6.00								
UT	6.60	(52)							
D	7.00								
D S	7.50 7.50	N = 22			8.00	End of Borehole at 8.00m			

Chiselling			Groundwater Strikes					Drilled: Lundy Site Investigation Logged: CS Checked: PG
From	To	Duration (hh:mm)	Depth Strike	Rose to	Remarks	Cased	Sealed	
			1.70	1.50		1.70	3.20	

Remarks: Hand dug service inspection pit excavated to 1.20m bgl. Water added to aid drilling from 1.60m bgl to 3.20m bgl.

Installation: 19mm diameter standpipe installed to 7.70m bgl.

Diameter: 150mm to 8.00m

Exploratory hole logs should be read in conjunction with key sheets

APPLIED GEOLOGY

SPT SUMMARY SHEET

Project: 23A Crimsworth Avenue, Chorlton, Manchester
Client: The Egerton (Property) Partnership Ltd
Project No: AG3278-21

Borehole No.	Borehole depth (m)	Bottom depth (m)	Casing depth (m)	Water Level (m)	Equipment ref.	Seating Drive		Test Drive							Test Type	N Value
						Blows	Pen (mm)	Blows				Pen (mm)				
BH1	1.20	1.65			LSI1	2 3	75 75	4 2 3 4	75 75 75 75	300	S	13				
BH1	2.00	2.45			LSI1	2 4	75 75	5 4 5 6	75 75 75 75	300	C	20				
BH1	3.00	3.45			LSI1	3 4	75 75	1 1 1 2	75 75 75 75	300	C	5				
BH1	5.00	5.45			LSI1	2 3	75 75	4 5 5 5	75 75 75 75	300	S	19				
BH1	7.50	7.95			LSI1	3 3	75 75	4 5 6 7	75 75 75 75	300	S	22				

Notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, or solid cone C.

SPT Hammer Energy Test Report

in accordance with BS EN ISO 22476-3:2005

ARCHWAY ENGINEERING
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: LS11
Test Date: 12/09/2020
Report Date: 12/09/2020
File Name: LS11.spt
Test Operator: RM

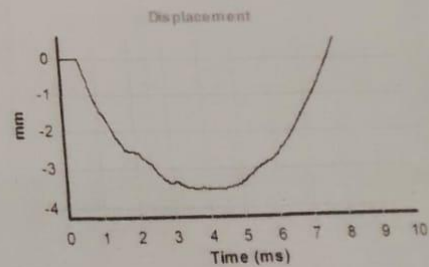
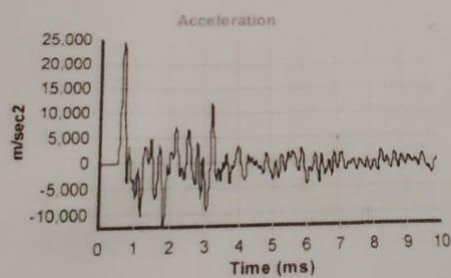
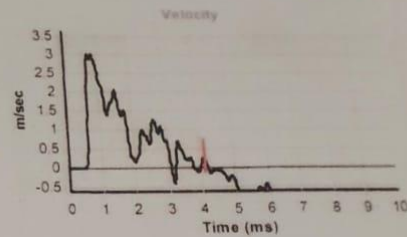
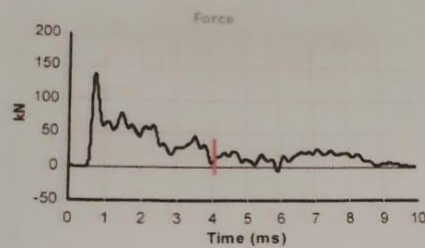
Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.3
Assumed Modulus E_a (GPa): 200
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location



Calculations

Area of Rod A (mm^2): 944
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 258

Energy Ratio E_r (%):

55

Signed: M.GARDNER
Title: FITTER

The recommended calibration interval is 12 months

Exploratory Hole Log Key Sheet					
Sample Notation		Backfill Symbols		Legend Symbols	
D	Small Disturbed sample		Sand		Topsoil
B	Bulk Disturbed sample		Gravel		Made Ground
ES	Environmental sample		Concrete		Concrete
U	Undisturbed U100 sample		Bentonite		Clay
UT	Undisturbed UT100 sample		Arisings		Silt
C	Core sample		Grout		Sand
W	Water sample				Gravel
In Situ Test Notation		Installation Symbols			Peat
S	Standard Penetration Test		Plain Standpipe		Cobbles
S (C)	Standard Penetration Test (cone)		Slotted Standpipe		Boulders
HV	Hand Shear Vane Test		Piezometer		Mudstone
PID	Photoionization Detector Test		Vibrating Wire Piezometer		Siltstone
MEXE	Mexecone Cone Penetrometer Test		Inclinometer		Sandstone
PP	Pocket Penetrometer Test		Extensometer (with magnet locations)		Limestone
K	Permeability Test				Chalk
Results Notation		Groundwater (GW)			Coal
Cu	Shear Strength				Breccia
N	SPT N Value				Conglomerate
PID	VOC Concentration				Shale
()	U/UT Blow Count				Igenous Rock
Rotary Core Notation					Metamorphic Rock
TCR	Total Core Recovery		Rise	NR	No Recovery
SCR	Solid Core Recovery		Groundwater Strike - with Recorded Rise	NR	No Recovery
RQD	Rock Quality Designation		Strike		
FI	Fracture Index		Groundwater Strike - No Recorded Rise		
If	Fracture Spacing				
NI	Non Intact				
NR	No Recovery				
NA	Not Applicable				
Ease of Dig					
VE	Very Easy				
E	Easy				
M	Moderate				
H	Hard				
VH	Very Hard				
General Notes					
1. Details of the standpipe/piezometer are given on the log. The 'Install' column shows a graphical representation of the installed including depth of instruments including slotted section or piezometer depth, and backfill details. 2. Standard Penetration Test is defined in BS EN ISO 17892. Total N value is shown on the logs, full details of the test increments, equipment references, water and casing levels shown on the SPT Summary Sheet.				Note: Most soils comprise a mixture of particle sizes. The soil type is graphically represented on the log and may be a combination of these symbols.	

APPENDIX C

Groundwater Monitoring Results

Project Number: AG3278-21
Project Name: 23a Crimsworth Avenue, Chorlton

Date of Monitoring				18/06/2021		25/06/2021	
BH No.	Installed Depth (m bgl)	Ground Level (m AOD)	Diameter of installation (mm)	Water level (m bgl)	Water level (m AOD)	Water level (m bgl)	Water level (m AOD)
CP1	7.70	27.93	19	3.85	24.08	3.80	24.13

Site Data

Monitoring Personnel	Hannah Hadwin
----------------------	---------------

General Notes:

Gas Monitoring Equipment Specification and Accuracy Details

Instrument Specifications

Instrument	Atmospheric Pressure Range	Temperature Range	Flow Range	Flow Resolution	Borehole Pressure Range
GA5000	500-1500 mb +/- 5 mb	-10°C to + 50°C	0-20 lt/hr +/- 0.3 l/hr	0.1l/hr	.+500/-500 mbar +/- 4 mbar
Phocheck Tiger	-	-20 to + 60°C (Certified to -15 to + 45°C)	-	-	-

Instrument Accuracy

Instrument		Methane	Lower Explosive Limit	Carbon Dioxide	Oxygen	Volatile Organic Compounds	Hydrogen Sulphide	Carbon Monoxide
GA5000	Detection Range	0-100%	-	0 -100%	0-25%	NA	0 -50ppm response <30 secs	0 - 1000ppm response <30 Secs
	Detection Accuracy	./- 0.5% @ 0 to 70%, ./-1.5% @ 70 to 100% Response < 10 secs	N/A	./- 0.5% @ 0 to 60%, ./-1.5% @ 60 to 100% Response < 10 secs	./- 1.0% @ 0 to 25%, Response < 20 secs	NA	./- 1.5% FS	./- 2% of FS
Phocheck Tiger	Detection Range	N/A	N/A	N/A	N/A	1 ppb - 10,000 ppm	N/A	N/A
	Detection Accuracy	N/A	N/A	N/A	N/A	+/- 1ppb +/- 5% of actual displayed accuracy +/- One digit Response < 2sec	N/A	N/A

Calibration Frequency

Equipment Serial Numbers

Instruments are calibrated annually. Details of the instrument calibration certificates and service records are available if required.		
	GA5000 (G503948, G505383, G505737)	
	Phocheck Tiger - (T-108308, T-109597, T-109598, T-110423)	

APPENDIX D



LABORATORY REPORT



4043

Contract Number: PSL21/5273

Report Date: 26 July 2021
Client's Reference: 17037
Client Name: Applied Geology Limited
Unit 23, Abbey Park
Stareton
Kenilworth
Warwickshire
CV8 2LY

For the attention of: Hannah Hadwin

Contract Title: 23A Crimsworth Avenue, Chorlton, Manchester
Date Received: 29/6/2021
Date Commenced: 29/6/2021
Date Completed: 26/7/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

M Fennell
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

23A Crimsworth Avenue, Chorlton, Manchester

Contract No:

PSL21/5273

Client Ref:

17037

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL

Professional Soils Laboratory

23A Crimsworth Avenue, Chorlton, Manchester

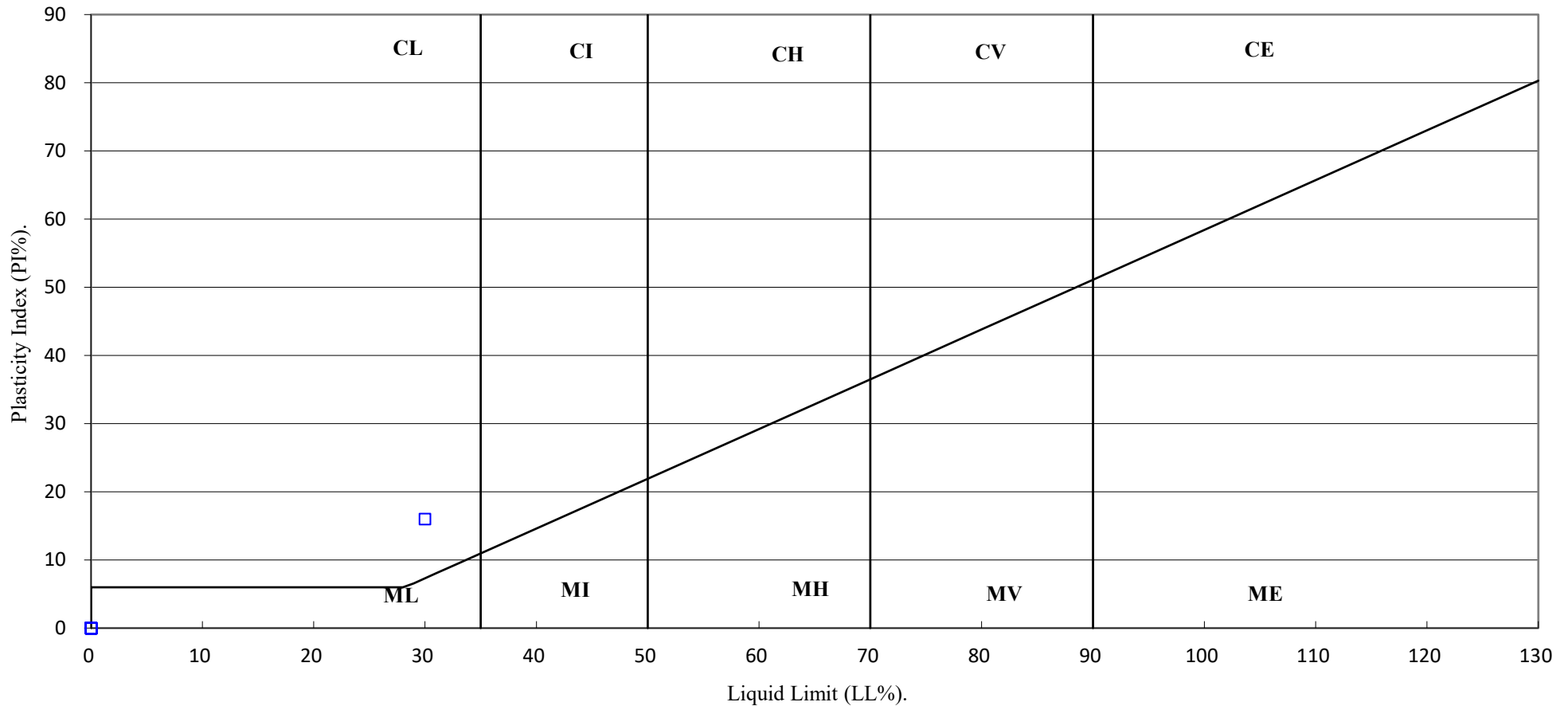
Contract No:

PSL21/5273

Client Ref:

17037

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

23A Crimsworth Avenue, Chorlton, Manchester

Contract No:

PSL21/5273

Client Ref:

17037

PARTICLE SIZE DISTRIBUTION TEST

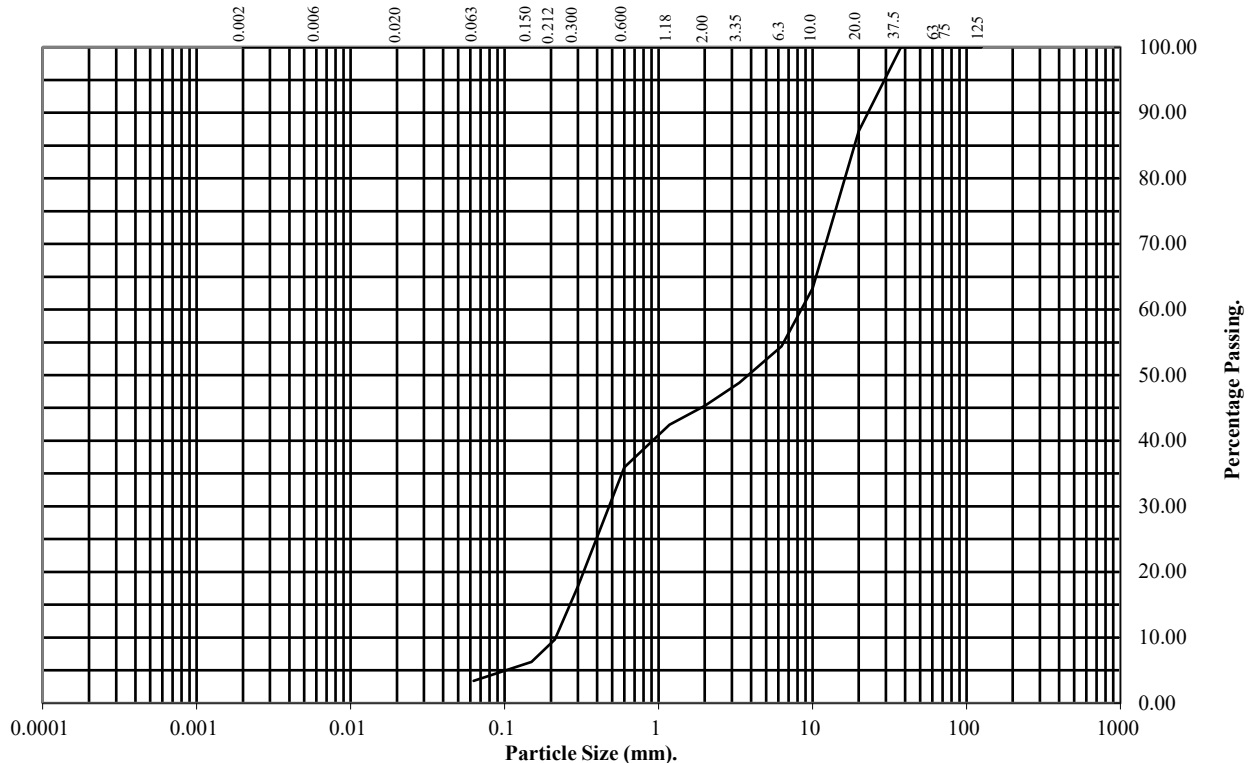
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: BH1 Top Depth (m): 2.00

Sample Number: Base Depth(m): 2.45

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	87
10	63
6.3	54
3.35	49
2	45
1.18	42
0.6	36
0.3	18
0.212	10
0.15	6
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	55
Sand	42
Silt/Clay	3

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

23A Crimsworth Avenue, Chorlton,
Manchester

Contract No:
PSL21/5273
Client Ref:
17037

Applied Geology Ltd

Unit 23 Abbey Park

Stareton

Kenilworth

Warwickshire

CV8 2LY

For the attention of Carl Sellers

Report No: B27231

Issue No 01

LABORATORY TEST REPORT

Project Name		23A CRIMSWORTH AVENUE, CHORLTON, MANCHESTER	
Project Number	B27231	Date samples received	20/08/2021
Your Ref		Date written instructions received	20/08/2021
Purchase Order	17259	Date testing commenced	20/08/2021
Please find enclosed the results as summarised below			
Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	1	Shear Strength by Direct Shear (small shearbox)	Yes
Remarks :			
Issued by : Stephen Langman		Date of Issue : 08/09/2021	Key to symbols used in this report S/C : Testing was sub-contracted
Approved Signatories :  08/09/2021 S Langman (Laboratory Coordinator), D Bowen (Production Manager)			
Unless we are notified to the contrary, samples will be disposed after a period of one month from this date. The results reported relate to samples received in the laboratory only. All results contained in this report are provisional unless signed by an approved signatory This report should not be reproduced except in full without the written approval of the laboratory. Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory. The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw our report if we have not received cleared funds in accordance with our standard terms and conditions Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation. Feedback on the this report may be left via our website www.terratek.co.uk/contact-us			



Moor Lane, Witton, Birmingham, B6 7HG

Tel: +44 (0)121 344 4838

birmingham@terratek.co.uk

www.terratek.co.uk

Terra Tek Ltd is registered in Scotland No. 121594
Offices in Airdrie, Birmingham, Belfast and Aston Clinton

Head Office : 62 Rochsolloch Road, Airdrie, ML6 9BG

 TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES		Site 23A CRIMSWORTH AVENUE, CHORLTON, MANCHESTER		Contract No B27231	
		Client		Hole BH01	
		Engineer		Sample Ref Depth (m) 0.50-1.00 Sample Type B	

Specimen Details

Depth within original sample

N/A

Orientation within original sample

N/A

Test condition

Submerged

Non Engineering Description

Dark brown SAND with some gravel. Gravel is fine to medium.

Preparation

Material < 2mm removed (95.5% passing). Remoulded at natural moisture content to wet density by using 2.5kg compaction efforts.

Specimen Number		1	2	3
Length	mm	60.0	60.0	60.0
Width	mm	60.0	60.0	60.0
Height	mm	21.0	21.0	21.0
Initial moisture content	%	9.3	9.4	9.4
Initial wet density	Mg/m ³	1.86	1.86	1.86
Initial dry density	Mg/m ³	1.70	1.70	1.70
Particle Density (assumed)	Mg/m ³	2.68	2.68	2.68

Consolidation Stage

Normal stress

kPa

60

120

240

Height change

mm

-0.3

-0.4

-0.6

Duration

day(s)

—

—

—

Shearing Stage

Normal stress

kPa

60

120

240

Peak Conditions:

Rate of horizontal displacement

mm/min

1.2

1.2

1.2

Maximum shear stress

kPa

38

78

150

Horizontal displacement

mm

1.2

2.0

2.0

Height change

mm

0.1

-0.1

0.0

Final Conditions

Final moisture content

%

17

17

18

Duration

day(s)

—

—

—

Shear Strength Parameters

Maximum Condition: (linear tangent interpretation)

Effective Cohesion

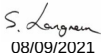
kPa

0

Effective Angle of Shearing Resistance

degrees

32.5

Originator	Checked & Approved	Shear Strength by Direct Shear (small shearbox) BS1377:Part 7:1990 Clause 4	 Figure 1 Sheet 1 of 5
AF	 08/09/2021		

Site 23A CRIMSWORTH AVENUE, CHORLTON, MANCHESTER

Client

Engineer

Contract No **B27231**

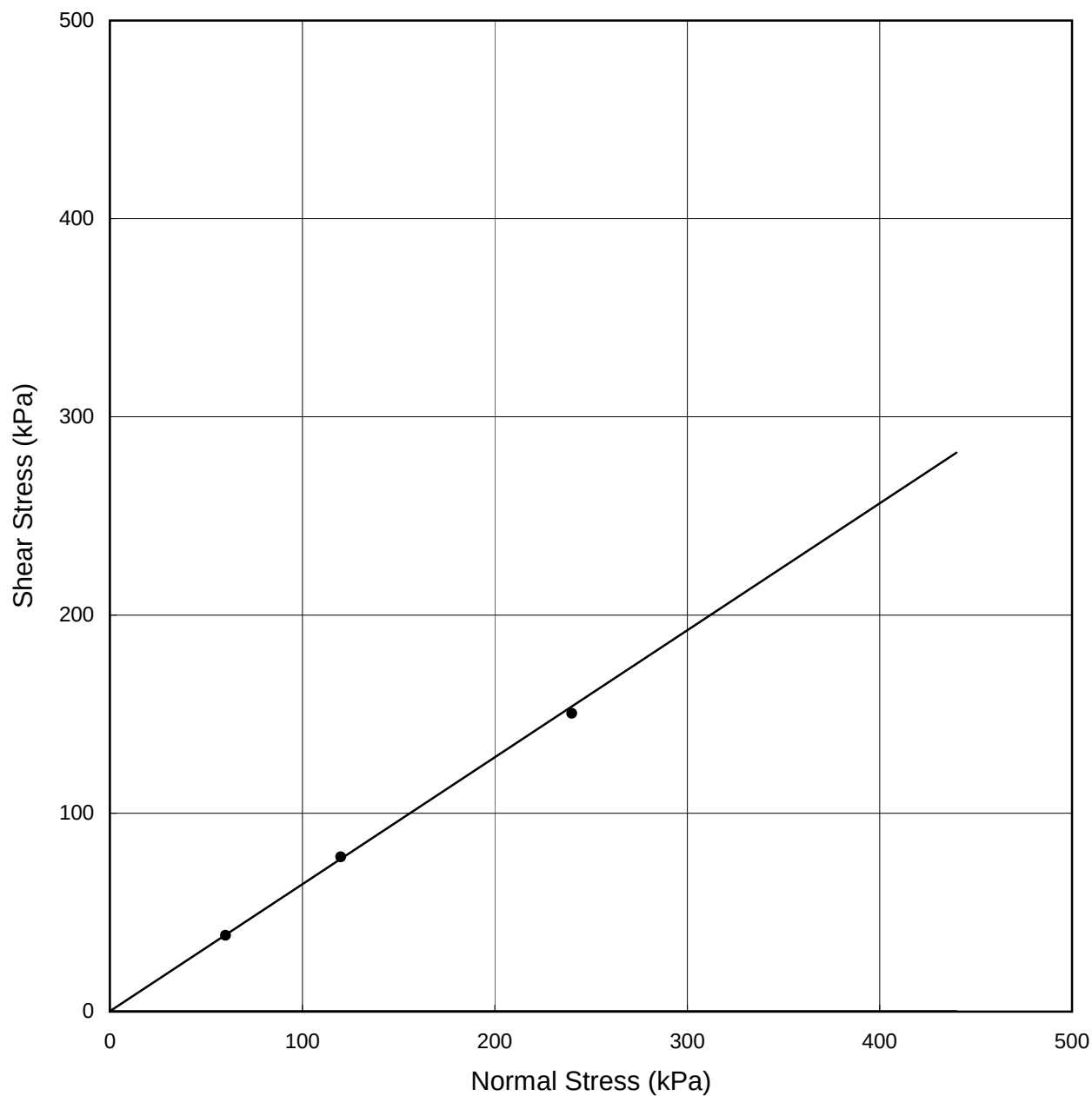
Hole BH01

Sample Ref

Depth (m) 0.50-1.00

Sample Type B

Shear Stress v Normal Stress



Shear Strength Parameters

 $c' = 0$ kPa $\phi' = 32.5^\circ$

Originator

AF

Checked &
Approved

 08/09/2021

Shear Strength by Direct Shear (small shearbox)

BS1377:Part 7:1990 Clause 4



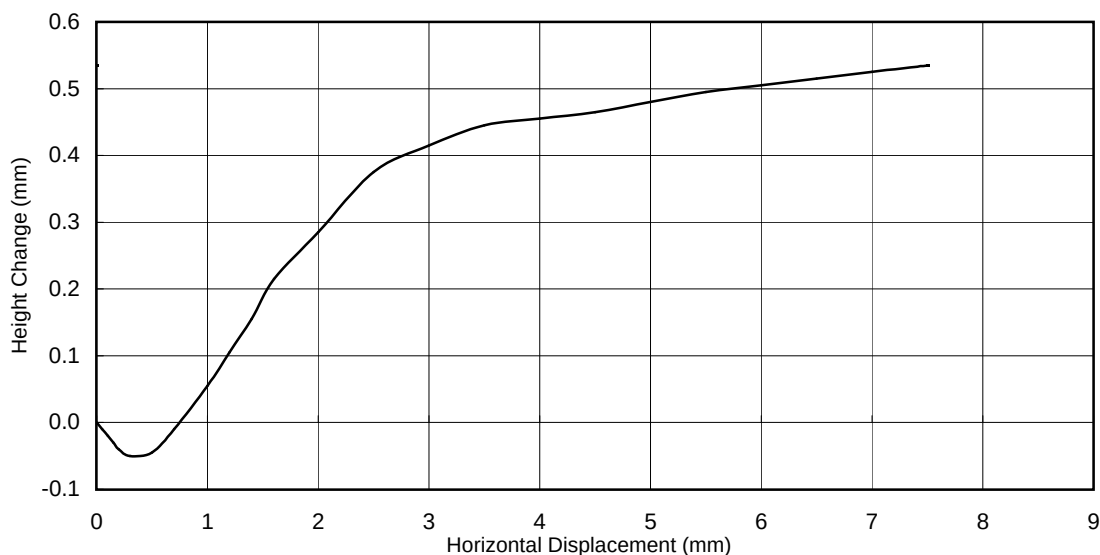
Figure 1

Sheet 2 of 5

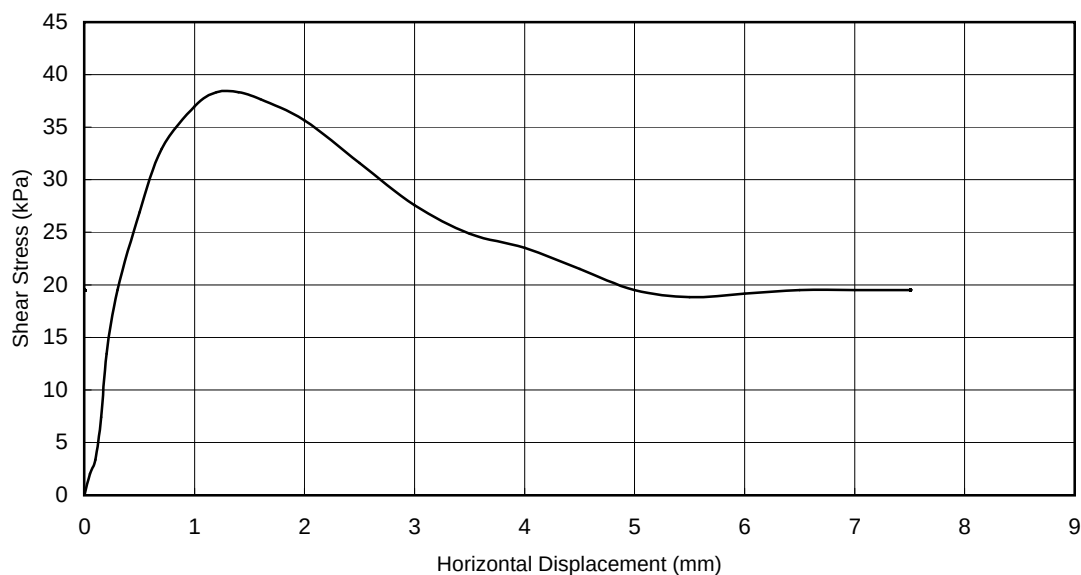
Specimen No. 1

Normal Pressure = 60 kPa

Height Change v Horizontal Displacement



Shear Stress v Horizontal Displacement



Originator

AF

Checked & Approved

S. Langren
 08/09/2021
Shear Strength by Direct Shear (small shearbox)

BS1377:Part 7:1990 Clause 4

TK

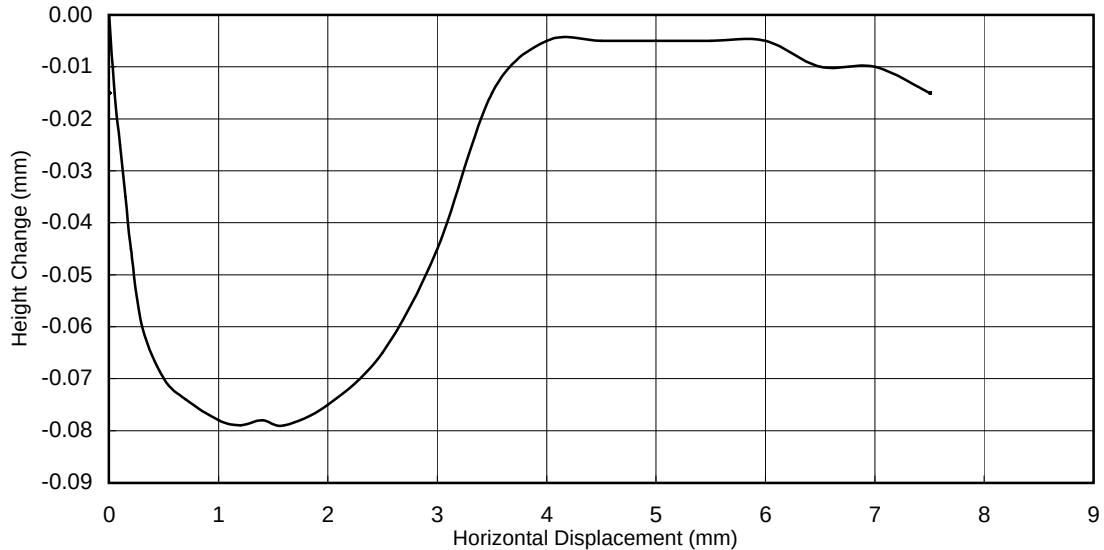
Figure 1

Sheet 3 of 5

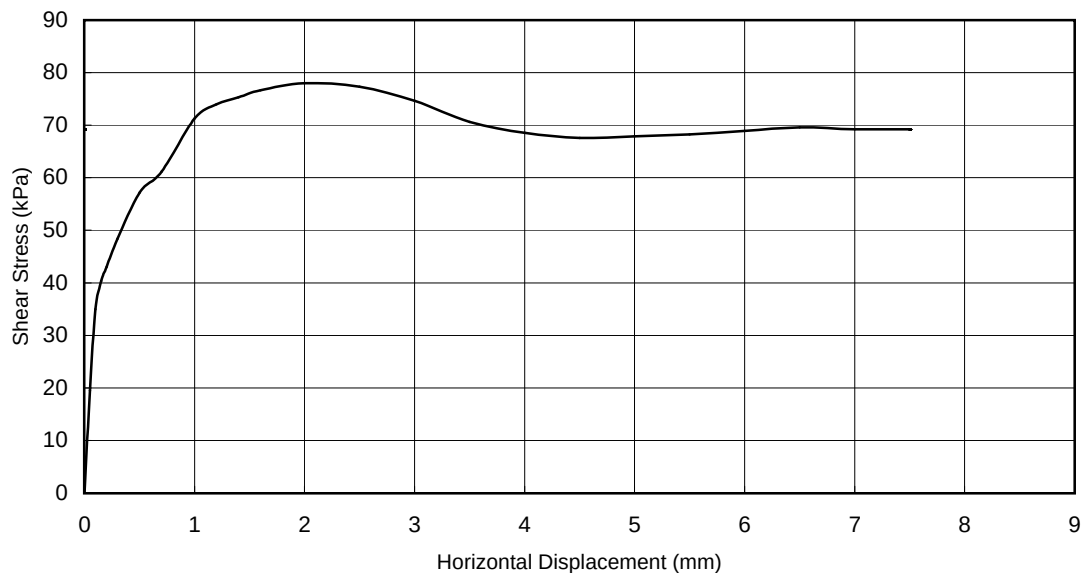
Specimen No. 2

Normal Pressure = 120 kPa

Height Change v Horizontal Displacement



Shear Stress v Horizontal Displacement



Originator

AF

Checked & Approved

S. Langren
 08/09/2021
Shear Strength by Direct Shear (small shearbox)

BS1377:Part 7:1990 Clause 4



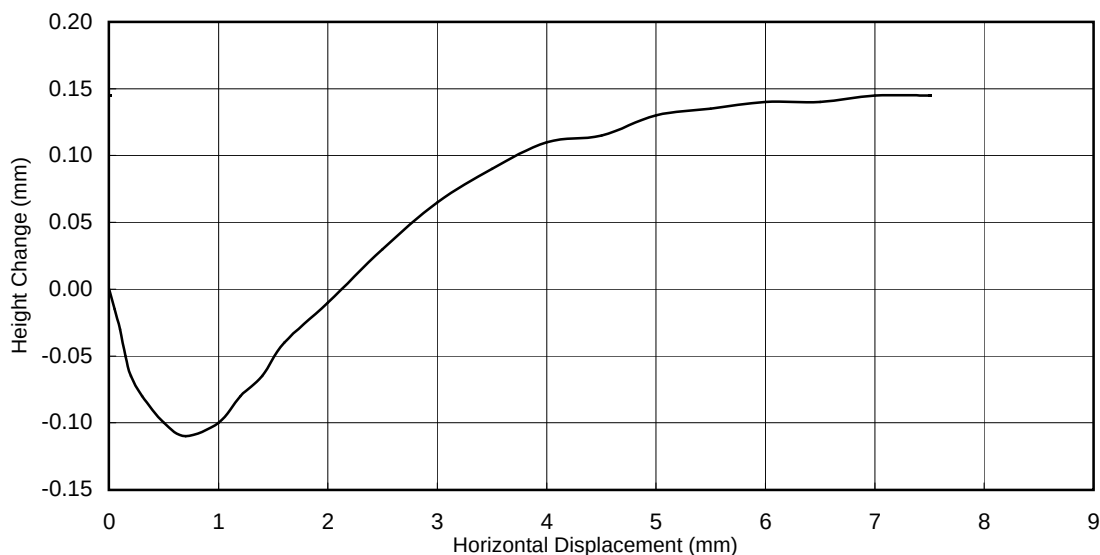
Figure 1

Sheet 4 of 5

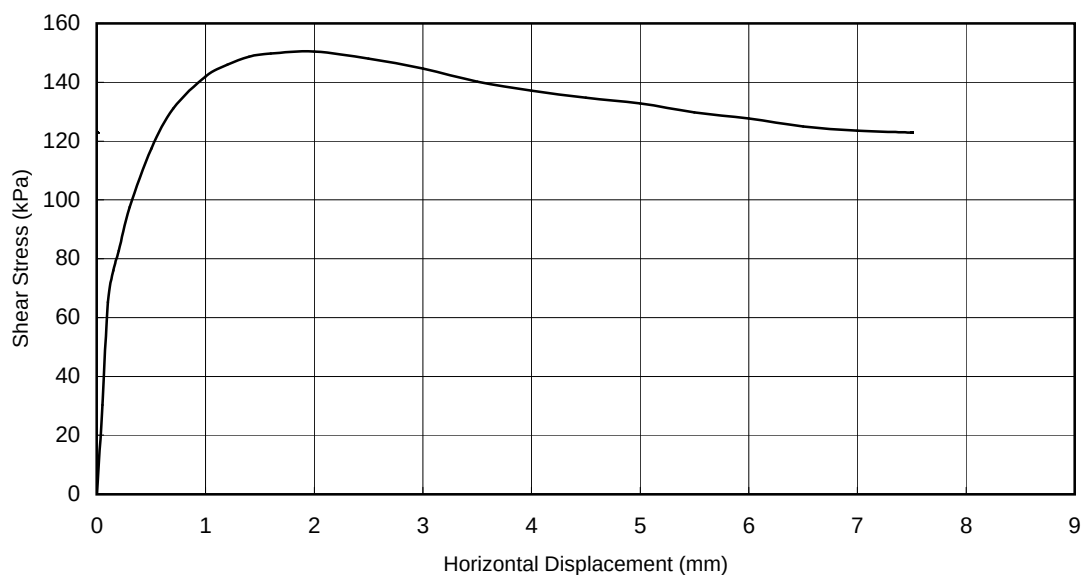
Specimen No. 3

Normal Pressure = 240 kPa

Height Change v Horizontal Displacement



Shear Stress v Horizontal Displacement



Originator

AF

Checked & Approved

S. Langren
 08/09/2021
Shear Strength by Direct Shear (small shearbox)

BS1377:Part 7:1990 Clause 4

Tk

Figure 1

Sheet 5 of 5

Appendix C

Foundation Analysis

Spread footing verification

Input data

Project

Task : Foundations
 Customer : John O'Hare
 Author : JS
 Date : 22/07/2021
 Project ID : Chorlton, Crimsworth Ave
 Project number : 70639

Settings

United Kingdom - EN 1997

Materials and standards

Concrete structures : EN 1992-1-1 (EC2)
 Coefficients EN 1992-1-1 : standard

Settlement

Analysis method : Analysis using oedometric modulus
 Restriction of influence zone : by percentage of Sigma, Or
 Coeff. of restriction of influence zone : 10.0 [%]

Spread Footing

Analysis for drained conditions : EC 7-1 (EN 1997-1:2003)
 Analysis of uplift : Standard
 Allowable eccentricity : 0.333
 Verification methodology : according to EN 1997
 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 :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]

Partial factors for soil parameters (M)				
Permanent design situation				
		Combination 1		Combination 2
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]
Partial factor on unconfined strength :	$\gamma_v =$	1.00 [-]		1.40 [-]

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m ³]	γ_{su} [kN/m ³]	δ [°]
1	Upper Sand		32.00	0.00	18.00	9.00	
2	Middle Gravel		34.00	0.00	19.00	10.00	
3	Till		26.00	0.00	20.00	11.00	

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Upper Sand

Unit weight :	γ	=	18.00 kN/m ³
Angle of internal friction :	ϕ_{ef}	=	32.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Oedometric modulus :	E_{oed}	=	15.00 MPa
Saturated unit weight :	γ_{sat}	=	19.00 kN/m ³

Middle Gravel

Unit weight :	γ	=	19.00 kN/m ³
Angle of internal friction :	ϕ_{ef}	=	34.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Oedometric modulus :	E_{oed}	=	25.00 MPa
Saturated unit weight :	γ_{sat}	=	20.00 kN/m ³

Till

Unit weight :	γ	=	20.00 kN/m ³
Angle of internal friction :	ϕ_{ef}	=	26.00 °
Cohesion of soil :	c_{ef}	=	0.00 kPa
Oedometric modulus :	E_{oed}	=	7.00 MPa
Saturated unit weight :	γ_{sat}	=	21.00 kN/m ³

Foundation

Foundation type: strip footing

Depth from original ground surface	h_z	=	1.00 m
Depth of footing bottom	d	=	1.00 m
Foundation thickness	t	=	0.40 m
Incl. of finished grade	s_1	=	0.00 °
Incl. of footing bottom	s_2	=	0.00 °

Overburden

Type: input unit weight

Unit weight of soil above foundation = 20.00 kN/m³

Geometry of structure

Foundation type: strip footing

Overall strip footing length	=	10.00 m
Strip footing width (x)	=	0.45 m
Column width in the direction of x	=	0.30 m

Inserted loading is considered per unit length of continuous footing span.

Volume of strip footing	=	0.18 m ³ /m
Volume of excavation	=	0.45 m ³ /m
Volume of fill	=	0.09 m ³ /m

Material of structure

Unit weight γ = 23.00 kN/m³

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2).

Concrete: C 20/25

Cylinder compressive strength	f_{ck}	=	20.00 MPa
Tensile strength	f_{ctm}	=	2.20 MPa
Elasticity modulus	E_{cm}	=	30000.00 MPa

Longitudinal steel: B500B

Yield strength	f_{yk}	=	500.00 MPa
----------------	----------	---	------------

Transverse steel: B500B

Yield strength

$f_{yk} = 500.00 \text{ MPa}$

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	1.70	0.00 .. 1.70	Upper Sand	
2	1.50	1.70 .. 3.20	Middle Gravel	
3	6.80	3.20 .. 10.00	Till	
4	5.00	10.00 .. 15.00	Upper Sand	
5	-	15.00 .. ∞	Upper Sand	

Load

No.	Load		Name	Type	N [kN/m]	M _y [kNm/m]	H _x [kN/m]
	new	change					
1	Yes		Load No. 1	Design	130.00	0.00	0.00
2	Yes		Load No. 1 - service	Service	92.86	0.00	0.00

GWT + incompressible subsoil

The ground water table is at a depth of 1.50 m from the original terrain.

Incompressible subsoil is at a depth of 25.00 m from the original terrain.

Global settings

Type of analysis : analysis for drained conditions

Settings of the stage of construction

Design situation : permanent

Verification No. 1**Load case verification**

Name	Self w. in favor	e _x [m]	e _y [m]	σ [kPa]	R _d [kPa]	Utilization [%]	Is satisfactory
Load No. 1	Yes	0.00	0.00	302.09	546.91	55.24	Yes
Load No. 1	No	0.00	0.00	306.71	546.91	56.08	Yes
Load No. 1 - service	Yes	0.00	0.00	219.55	281.28	78.05	Yes
Load No. 1 - service	No	0.00	0.00	219.55	281.28	78.05	Yes

Analysis carried out with automatic selection of the most unfavourable load cases.

Computed self weight of strip foundation $G = 4.14 \text{ kN/m}$ Computed weight of overburden $Z = 1.80 \text{ kN/m}$ **Vertical bearing capacity check**

Shape of contact stress : rectangle

Most unfavorable load case No. 2. (Load No. 1 - service)

Parameters of slip surface below foundation:

Depth of slip surface $z_{sp} = 0.77 \text{ m}$ Length of slip surface $l_{sp} = 2.42 \text{ m}$ Design bearing capacity of found.soil $R_d = 281.28 \text{ kPa}$

Extreme contact stress $\sigma = 219.55 \text{ kPa}$

Bearing capacity in the vertical direction is SATISFACTORY

Verification of load eccentricity

Max. eccentricity in direction of base length $e_x = 0.000 < 0.333$

Max. eccentricity in direction of base width $e_y = 0.000 < 0.333$

Max. overall eccentricity $e_t = 0.000 < 0.333$

Eccentricity of load is SATISFACTORY

Horizontal bearing capacity check

Most unfavorable load case No. 1. (Load No. 1)

Earth resistance: at rest

Design magnitude of earth resistance $S_{pd} = 1.22 \text{ kN}$

Horizontal bearing capacity $R_{dh} = 86.16 \text{ kN}$

Extreme horizontal force $H = 0.00 \text{ kN}$

Bearing capacity in the horizontal direction is SATISFACTORY

Bearing capacity of foundation is SATISFACTORY

Verification No. 1

Settlement and rotation of foundation - input data

Analysis carried out with automatic selection of the most unfavourable load cases.

Analysis carried out with accounting for coefficient κ_1 (influence of foundation depth).

Analysis carried out with accounting for coefficient κ_2 (influence of incompressible subsoil).

Stress at the footing bottom considered from the finished grade.

Computed self weight of strip foundation $G = 4.14 \text{ kN/m}$

Computed weight of overburden $Z = 1.80 \text{ kN/m}$

Settlement of mid point of longitudinal edge = 5.3 mm

Settlement of mid point of transverse edge 1 = 11.0 mm

Settlement of mid point of transverse edge 2 = 11.0 mm

(1-max.compressed edge; 2-min.compressed edge)

Settlement and rotation of foundation - results

Foundation stiffness:

Computed weighted average modulus of deformation $E_{def} = 11.94 \text{ MPa}$

Foundation in the longitudinal direction is rigid ($k=1764.88$)

Foundation in the direction of width is rigid ($k=160.83$)

Verification of load eccentricity

Max. eccentricity in direction of base length $e_x = 0.000 < 0.333$

Max. eccentricity in direction of base width $e_y = 0.000 < 0.333$

Max. overall eccentricity $e_t = 0.000 < 0.333$

Eccentricity of load is SATISFACTORY

Overall settlement and rotation of foundation:

Foundation settlement = 9.5 mm

Depth of influence zone = 4.72 m

Rotation in direction of width = 0.000 ($\tan^*1000$); (0.0E+00 °)

Dimensioning No. 1

Analysis carried out with automatic selection of the most unfavourable load cases.

Verification of longitudinal reinforcement of foundation in the direction of x

$0.07 \text{ m} \leq 0.20 \text{ m}$

Maximum offset of the foundation is smaller than $0.50 \cdot \text{thickness of foundation}$. Reinforcement is not required.

Spread footing for punching shear failure check

Column normal force = 130.00 kN

Maximum resistance at the column perimeter

Force transferred into found. soil		=	86.67	kN
Force transferred by shear strength of foundation		=	43.33	kN
Considered column perimeter	u_0	=	2.00	m
Shear resistance at the column perimeter	$V_{Ed,max}$	=	0.06	MPa
Resistance at the column perimeter	$V_{Rd,max}$	=	2.94	MPa

Spread footing for punching shear is SATISFACTORY

Appendix D

Slope Stability Analysis

Slope stability analysis

Input data

Project

Task : Existing Slope and proposed development
 Part : Line loads
 Customer : John O'Hare
 Author : JS
 Date : 07/09/2021
 Project ID : Crimsworth Avenue
 Project number : 70639

Settings

Standard - EN 1997 - DA1

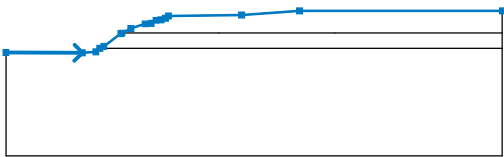
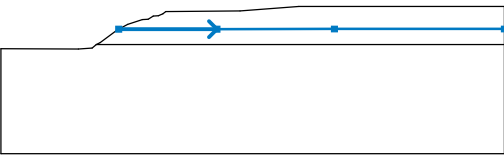
Stability analysis

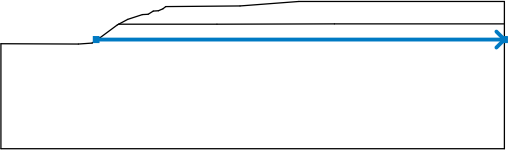
Earthquake analysis : Standard
 Verification methodology : according to EN 1997
 Design approach : 1 - reduction of actions and soil parameters

Partial factors on actions (A)					
Permanent design situation					
		Combination 1		Combination 2	
		Unfavourable	Favourable	Unfavourable	Favourable
Permanent actions :	$\gamma_G =$	1.35 [-]	1.00 [-]	1.00 [-]	1.00 [-]
Variable actions :	$\gamma_Q =$	1.50 [-]	0.00 [-]	1.30 [-]	0.00 [-]
Water load :	$\gamma_w =$	1.35 [-]		1.00 [-]	

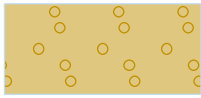
Partial factors for soil parameters (M)					
Permanent design situation					
		Combination 1		Combination 2	
Partial factor on internal friction :	$\gamma_\phi =$	1.00 [-]		1.25 [-]	
Partial factor on effective cohesion :	$\gamma_c =$	1.00 [-]		1.25 [-]	
Partial factor on undrained shear strength :	$\gamma_{cu} =$	1.00 [-]		1.40 [-]	

Interface

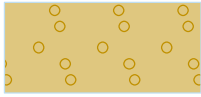
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		1.85	7.48	9.27	7.46	10.57	7.55
		10.96	7.90	11.35	8.08	12.99	9.31
		13.12	9.37	13.96	9.82	15.37	10.27
		15.94	10.32	16.41	10.61	16.90	10.66
		17.33	10.82	17.62	11.03	24.71	11.12
		30.34	11.53	50.00	11.53		
2		13.12	9.37	22.51	9.37	33.75	9.38
		50.00	9.38				

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
3		10.96	7.90	50.00	7.90		

Soil parameters - effective stress state

No.	Name	Pattern	Φ_{ef} [°]	C_{ef} [kPa]	γ [kN/m ³]
1	Sand		32.00	2.00	18.00
2	Gravel		33.00	2.00	20.00
3	Clay		26.00	2.00	20.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m ³]	γ_s [kN/m ³]	n [-]
1	Sand		19.00		
2	Gravel		21.00		
3	Clay		21.00		

Soil parameters**Sand**

Unit weight : $\gamma = 18.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\Phi_{ef} = 32.00^\circ$
 Cohesion of soil : $C_{ef} = 2.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 19.00 \text{ kN/m}^3$

Gravel

Unit weight : $\gamma = 20.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\Phi_{ef} = 33.00^\circ$
 Cohesion of soil : $C_{ef} = 2.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 21.00 \text{ kN/m}^3$

Clay

Unit weight : $\gamma = 20.00 \text{ kN/m}^3$
 Stress-state : effective
 Angle of internal friction : $\phi_{ef} = 26.00^\circ$
 Cohesion of soil : $c_{ef} = 2.00 \text{ kPa}$
 Saturated unit weight : $\gamma_{sat} = 21.00 \text{ kN/m}^3$

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		22.51	9.37	33.75	9.38	Sand
		50.00	9.38	50.00	11.53	
		30.34	11.53	24.71	11.12	
		17.62	11.03	17.33	10.82	
		16.90	10.66	16.41	10.61	
		15.94	10.32	15.37	10.27	
		13.96	9.82	13.12	9.37	
2		50.00	7.90	50.00	9.38	Gravel
		33.75	9.38	22.51	9.37	
		13.12	9.37	12.99	9.31	
		11.35	8.08	10.96	7.90	
3		10.96	7.90	10.57	7.55	Clay
		9.27	7.46	1.85	7.48	
		1.85	-2.54	50.00	-2.54	
		50.00	7.90			

Surcharge

No.	Type	Type of action	Location z [m]	Origin x [m]	Length l [m]	Width b [m]	Slope α [°]	Magnitude		
								q, q ₁ , f, F, x	q ₂ , z	unit
1	strip	permanent	on terrain	x = 30.34	l = 10.00		0.00	10.00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		1.85	6.86	11.80	7.00	16.77	9.45
		21.71	10.11	30.96	10.00	50.00	10.11

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1 (stage 1)

Circular slip surface

Slip surface parameters					
Center :	x =	11.11 [m]	Angles :	α_1 =	-9.22 [°]
	z =	11.14 [m]		α_2 =	72.00 [°]
Radius :	R =	3.64 [m]			
Slip surface after grid search.					

Slope stability verification (Bishop)

Combination 1

Sum of active forces : $F_a = 127.25$ kN/m

Sum of passive forces : $F_p = 176.78$ kN/m

Sliding moment : $M_a = 717.68$ kNm/m

Resisting moment : $M_p = 997.06$ kNm/m

Utilization : 72.0 %

Slope stability ACCEPTABLE

Combination 2

Sum of active forces : $F_a = 29.74$ kN/m

Sum of passive forces : $F_p = 36.24$ kN/m

Sliding moment : $M_a = 108.26$ kNm/m

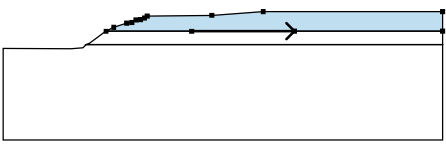
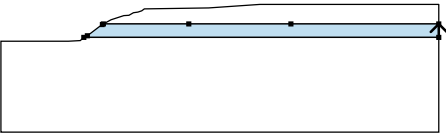
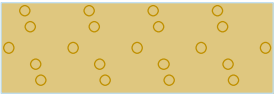
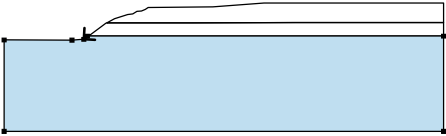
Resisting moment : $M_p = 131.92$ kNm/m

Utilization : 82.1 %

Slope stability ACCEPTABLE

Input data (Stage of construction 2)

Assigning and surfaces

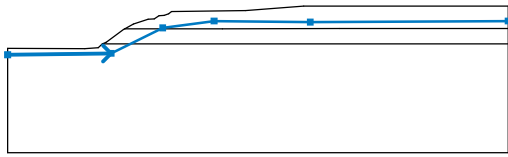
No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		22.51	9.37	33.75	9.38	Sand 
		50.00	9.38	50.00	11.53	
		30.34	11.53	24.71	11.12	
		17.62	11.03	17.33	10.82	
		16.90	10.66	16.41	10.61	
		15.94	10.32	15.37	10.27	
		13.96	9.82	13.12	9.37	
2		50.00	7.90	50.00	9.38	Gravel 
		33.75	9.38	22.51	9.37	
		13.12	9.37	12.99	9.31	
		11.35	8.08	10.96	7.90	
3		10.96	7.90	10.57	7.55	Clay 
		9.27	7.46	1.85	7.48	
		1.85	-2.54	50.00	-2.54	
		50.00	7.90			

Surcharge

No.	Surcharge		Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
	new	change			z [m]	x [m]	l [m]	b [m]	α [°]	q, q ₁ , f, F, x	q ₂ , z	unit
1	No	No	strip	permanent	on terrain	x = 30.34	l = 10.00		0.00	10.00		kN/m ²
2	Yes		line	permanent	on terrain	x = 20.00			0.00	100.00		kN/m
3	Yes		line	permanent	on terrain	x = 26.00			0.00	100.00		kN/m
4	Yes		strip	permanent	on terrain	x = 20.00	l = 6.00		0.00	10.00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		1.85	6.86	11.80	7.00	16.77	9.45
		21.71	10.11	30.96	10.00	50.00	10.11

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 2)

Analysis 1 (stage 2)

Circular slip surface

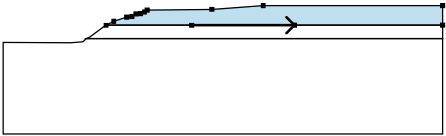
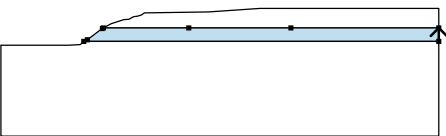
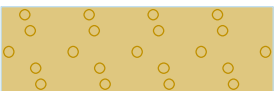
Slip surface parameters					
Center :	x =	12.81 [m]	Angles :	α_1 =	-17.05 [°]
	z =	15.79 [m]		α_2 =	56.82 [°]
Radius :	R =	8.64 [m]			
Specified slip surface.					

Slope stability verification (Bishop)

Analysis has not been performed.

Input data (Stage of construction 3)

Assigning and surfaces

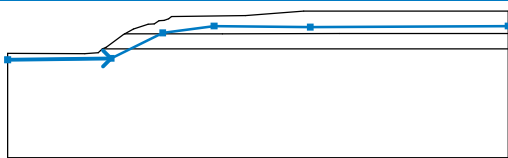
No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		22.51	9.37	33.75	9.38	Sand 
		50.00	9.38	50.00	11.53	
		30.34	11.53	24.71	11.12	
		17.62	11.03	17.33	10.82	
		16.90	10.66	16.41	10.61	
		15.94	10.32	15.37	10.27	
		13.96	9.82	13.12	9.37	
2		50.00	7.90	50.00	9.38	Gravel 
		33.75	9.38	22.51	9.37	
		13.12	9.37	12.99	9.31	
		11.35	8.08	10.96	7.90	
3		10.96	7.90	10.57	7.55	Clay 
		9.27	7.46	1.85	7.48	
		1.85	-2.54	50.00	-2.54	
		50.00	7.90			

Surcharge

No.	Surcharge		Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
	new	change			z [m]	x [m]	l [m]	b [m]	α [°]	q, q ₁ , f, F, x	q ₂ , z	unit
1	No	No	strip	permanent	on terrain	x = 30.34	l = 10.00		0.00	10.00		kN/m ²
2	No	No	line	permanent	on terrain	x = 20.00			0.00	100.00		kN/m
3	No	No	line	permanent	on terrain	x = 26.00			0.00	100.00		kN/m
4	No	No	strip	permanent	on terrain	x = 20.00	l = 6.00		0.00	10.00		kN/m ²

Water

Water type : GWT

No.	GWT location	Coordinates of GWT points [m]					
		x	z	x	z	x	z
1		1.85	6.86	11.80	7.00	16.77	9.45
		21.71	10.11	30.96	10.00	50.00	10.11

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 3)**Analysis 1 (stage 3)****Circular slip surface**

Slip surface parameters					
Center :	x =	13.44 [m]	Angles :	α_1 =	-25.27 [°]
	z =	14.43 [m]		α_2 =	63.84 [°]
Radius :	R =	7.64 [m]			
Slip surface after grid search.					

Slope stability verification (Bishop)**Combination 1**Sum of active forces : $F_a = 127.25$ kN/mSum of passive forces : $F_p = 176.78$ kN/mSliding moment : $M_a = 717.68$ kNm/mResisting moment : $M_p = 997.06$ kNm/m

Utilization : 72.0 %

Slope stability ACCEPTABLE**Combination 2**Sum of active forces : $F_a = 205.69$ kN/mSum of passive forces : $F_p = 221.18$ kN/mSliding moment : $M_a = 1571.44$ kNm/mResisting moment : $M_p = 1689.82$ kNm/m

Utilization : 93.0 %

Slope stability ACCEPTABLE