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Saturday, August 24, 2024 For [redacted] (The Property Owner),

Our Ref. 379/2024

Foundation assessment report for proposed re-use of previous conservatory Foundation + Soil type at formation etc.

Building Control Ref. [redacted]

PRELIMINARIES

Please note that this Report is solely for your use and your professional advisers, and no liability to anyone else is accepted. The extent of the advice in this report is based on & limited to the observable substrate, and the associated field tests contained within this report.

Having visited the site, and then subsequently performing Rapid Assessment Feild tests – **Appendix D** on the soil excavated from current formation. The findings demonstrate this site to be challenging for the proposed scheme, exposing the following risks – expressed as Engineers concerns that will feed into advise later in the report.

Engineers concerns

1. **Appendices C – D** Presence of Shrinkable clays found within the samples
2. **Appendix C & 2.1** - Excavation depth not currently sufficient for such shrinkable clays
3. **Appendix E & C – Photos 5-8** - Formation not kept dry and rain contaminated, very soft digging at this location at time of last visit, this affecting sample consistency and strength predictions.
4. **Appendix E & F** - Limited bearing capacity achievable in the substrate v's that required of the currently submitted scheme.

INTRODUCTION

The property owner we understand at the request of his BC Officer has requested an opinion as to the suitability of the possible re-use of the existing conservatory strip foundation.

To assist with this S J Johnson Associates Ltd have offered to Visit undertake the following checks in order to provide an opinion.

The following numbering aligns with our offer dated 20-8-2024.

2.1 Assess the soil type and depth
2.2 Assess the concrete strength by impact
2.3 Assess the concrete strength by Schmitt hammer
2.4 Assess any effects of planting.

Note Sampling & Chemical analysis is not within the agreed scope of this appointment.

FINDINGS

2.1 Soil Type and Formation depth.

SOIL TYPE
As one would expect from the Geological Mapping – **Appendix A**, the soil observed was in part sandy in places – **Photos 3,9,10,11** the BGS map showing the legend extent of the Cheltenham Sand and Gravel very close but to the East of the property. Being outside of the defined map legend extent, places the site within the area of mixed superficial deposits and samples taken towards the Northern boundary (within the triangular excavation) confirm this appearing darker and to contain much (fine grain material) like clay or silt – **Photo 5 (Sample 1)** and **Photos (6-8)** the sampling location.

Post visit, to avoid the cost of laboratory testing due to the size of the project the following Rapid Assessment Tests for Plasticity where undertaken as specified in **Ref. [1]** to assess the soils "Volume Change Potential" **Ref. [4]**.

The Rapid test procedures and results are shown in **Appendix D**, but summarised in the table below.

Rapid / Field Test	**Result**
(1) Dry Strength Test	High Strength, indicating much inorganic clay at high liquid limit
(2) Toughness Test	Low plasticity & cohesion
(3) Dilatancy	No reaction, so a Clay with an absence of very fine sand / silts

Insitu Soil Description and Classification.

Very Clayey Sand – est. 15-35% Clay
Loose can be excavated with a spade(*) etc. see section 2.2 below for further strength comment
Field Test (2) Low plasticity at the in-situ water content, Field Test (1) indicating a High Liquid limit, the upper limit of plastic behaviour – in laymen's terms a large heave potential range before loosing soil structure & strength effectively becoming a liquid.

Formation Depth
Existing / currently proposed formation was circa 700mm – **Photo's 4, 11, 29** Ground water was not observed within the excavation, the nearest water well (within the same superficial deposits) being several hundred meters away at New Court Road, the water there recorded at some 9.6m depth. Ground water is therefore not likely to be close to the proposed foundation formation level.

(*) It was noted however that the trial pits had been left open for at least several days, and with the recent rain this may account for the ease of spade digging & peg driving – (see next section). The client is advised to cover them to let them dry out, removing any soggy material.

The further advice however is that the NHBC Standards require the following **minimum foundation depths for low plasticity soils.** Therefore the current excavation should be increased to 750mm – as tables extracted from the NHBC guidance – see over.

Minimum foundation depths outside of the zone of influence of trees can be determined from Tables 4 and 5.

Table 4: Minimum foundation depths

Volume change potential	A) Minimum foundation depth (m) (allowing for restricted new planting)	B) Minimum foundation depth (m) (where planting is outside the zone of influence of trees)
High	1.50	1.0
Medium	1.25	0.9
Low	1.0	0.75

Table 5: Where foundation depths are in accordance with column A or column B in Table 4, tree planting should be restricted to:

Water demand	No tree planting zone for column A in Table 4	No tree planting zone / zone of influence for column B in Table 4
High	1.0 x mature height	1.25 x mature height
Moderate	0.5 x mature height	0.75 x mature height
Low	0.2 x mature height	0.50 x mature height

Foundation depths related to new shrub planting

Shrubs have considerable potential to cause changes in soil moisture content. The foundation design should consider shrub planting in accordance with Table 6.

Table 6: Shrub planting current situatuation if shrubs reduced to 1.8m

Volume change potential	A) Minimum foundation depth (m)	B) Minimum foundation depth (m)
High	1.50	1.0
Medium	1.25	0.9
Low	1.0	0.75

The foundation design should consider shrub planting as follows:

Shrubs that have a maximum mature height of 1.8m	Use foundation depth from column **B**.
Climbing shrubs which require wall support and have a maximum mature height of 5.0m	Use foundation depth from column **B**.
Pyracantha and cotoneaster whose mature height exceeds 1.8m	Use foundation depth from column **B** and plant at least 1.0 x mature height from foundation, or use foundation depth from column **A** and plant at least 0.5 x mature height from foundation.
All others	Use foundation depth from column **B** and plant at least 0.75 x mature height from foundation, or use foundation depth from column **A** with no restriction on minimum distance from foundation.

4.2

Soil Strength

Field Tests as **Ref [1] & [7]** – Table 1.2 Firmness – **Appendix E**

- Soil at formation **Ref. Photos 6-9** could be easily excavated with a spade, suggesting [LOOSE] firmness.
- The 50mm square peg driven with a lump hammer to refusal at about 10cm penetration suggesting (even with rain ingress – previous section) a higher-end strength in the firmness category range. **Ref [2]** – Table (c) 50-150kN/m^2

Strength assessment – based on the above peg result & the matter **that the immediate formation had been rain contaminated** at the time of the visit. **It is likely that if foundations are deepened as required above for Plasticity by NHBC then firm clay might be found which should support up to 100Kpa.** The Client and inspector should assure themselves of this, the client deepening as required until consistent substrate is found that requires "**Strong Finger Pressure to mould it**" - **Appendix E Ref [1].** The client then covering and protecting that formation level until the BC Officer inspects & the concrete arrives. The engineer should be asked to visit again with the BC officer if there is any question over the consistency / any of the above.

It should be further appreciated **Ref. Appendix E** that even at 100Kpa presumed allowable bearing capacity , an extension of masonry construction – **Ref Appendix F** - with large openings, and thus load concentration at bearings may be challenging. A rough load take down **Appendix F** showing 67% Utilisation without such proposed large openings. This constraint / issues won't be fully realised until the final plans & materiality have been confirmed & a detailed design & final load take down undertaken.

2.2 & 2.3 Concrete Strength

Our offer allowed for two strength testing options 2.2 – Basic Impact Testing, & should that be non-conclusive, 2.3 Quantitive testing by Schmitt Hammer.

Strength testing undertaken today with the chisel end of a 10kg five foot breaking bar failed to make much of an impression on the concrete. The concrete where it could be tested once the latence had come off resisting well and refusing to breakdown or split, indicating **Ref [8]** a strength of at least that of GEN1 / ST2

and therefore from a strength aspect suitable for foundations - **Photos 1 & 2**.

However in view of the soils clay content and anticipated plasticity, its formation level is not sufficient at 700mm and will require deepening as follows.

1. Min 750mm to suit the anticipated plasticity – from the Field Test – **Appendix D**
2. Further as required to yield formation level samples that are at least firm clays – **Appendix E**

2.4 Planting

No significant planting was observed other than shrubs, this has been logged in **Appendices B & C**, and the NHBC foundation depths required for shrubs & the management of those shrubs relayed in **Section 2.1** above.

SYNOPSIS

This survey / assessment, unfortunately took place after the formation had been left open to the rain, this compounded by visual observations suggesting the presence of a clay component, the Field Tests post visit **Appendix D** confirming this.

Both of the above have lead to a very low estimated presumed allowable bearing value circa 100Kpa - **Appendix E** which is very close to the likely bearing values for the scheme as drawn **Appendix F**.

The presence of clay, the presence of shrubs and the likely Plasticity level – **Appendix D** also requiring the formation to be deepened to a minimum of 750mm which unfortunately means that the existing footing will need to come out.

CONCLUSIONS / RECOMENDATIONS

To progress you will need to:

1. **Foundation Depth - Ref Section 2.1** - Whilst keeping the excavation dry, excavate to a minimum formation level of 750mm(*) below external ground level, this to allow for the assessed soils plasticity and your adjacent shrubs, which will need management as **NHBC Table 6** contained within this report. **(*) It is appreciated Ref Photos 3,4 & 27 that if the neighbours foundations are found to be above this level then party walls matters may apply and careful management will be required.**
2. **Soil Strength - Ref Appendix E (Ref. 1) Table 1.2** - Having reached - 750mm check the consistency of the arisings – you will need minimum stiffness of samples that require **"Strong Finger Pressure to mould them"**.
3. **Existing Concrete – Section 2.2** - As the existing footing is only at a formation level of -700mm, this will need removing. Recognising that the strength of its concrete is very good – you will likely need to hire a Pneumatic breaker.
4. **Building Control** - When you have achieved both you should invite your Building Control Officer and myself if required back to site to ensure the requirements have been met / agreed.
5. **Ground Pressure from current planning proposdals - Ref App F** - Finally I would point out that with the plans as drawn @ CBC, and with a 400mm wide footing that you are sailing very close to the allowable bearing capacity of the soil as observed / predicted below the current rain damaged substrate – **Photo 5** looking much softer than the samples taken away that although kept in plastic much of the time have had time to dry & definitely **Ref [1]** "***require strong finger pressure to mould them***".

I trust the above clearly explains the assessment processes thus far, the issues and concerns listed above and the proposals to remedy them for your proposed scheme.

We need now to address / mitigate those concerns, therefore as above please start to lower the formation, keep the excavation dry and (5) consider widening the foundation due to the tight utilisationratio noticed

between ground bearing capacity and induced loads from the scheme as currently drawn assuming a block inner leaf.

Finally please circulate this report & covering email to your Building Control Officer / all interested parties to demonstrate that you have taken professional advise and to assist in taking this matter forwards.

Should further clarification be required on any matters discussed in this report then again please do come back to me.

Sincerely,

Steve Johnson MIstructE CEng

Managing Director

References

1 Soil Mechanics – R.F. Craig 4th Ed. ISBN 0-278-00019-3
2 Foundation Design & Construction 5th Ed. ISBN 0-582-28642-5
3 British Geological Survey - Mapping
4 NHBC Chapter 4.2
5 The Woodlands Trust App.
6 Collins Trees – ISBN – 0-00-458803-7
7 ATT-29/95, Soils Identification, Hand Method
8 BS 8500-1:2002 Method of specifying & Guidance for the specifier (BS EN 206-1)

APPENDICES

A – BGS – Soils Desk Study

B – Visit - Photo & Tree Locations

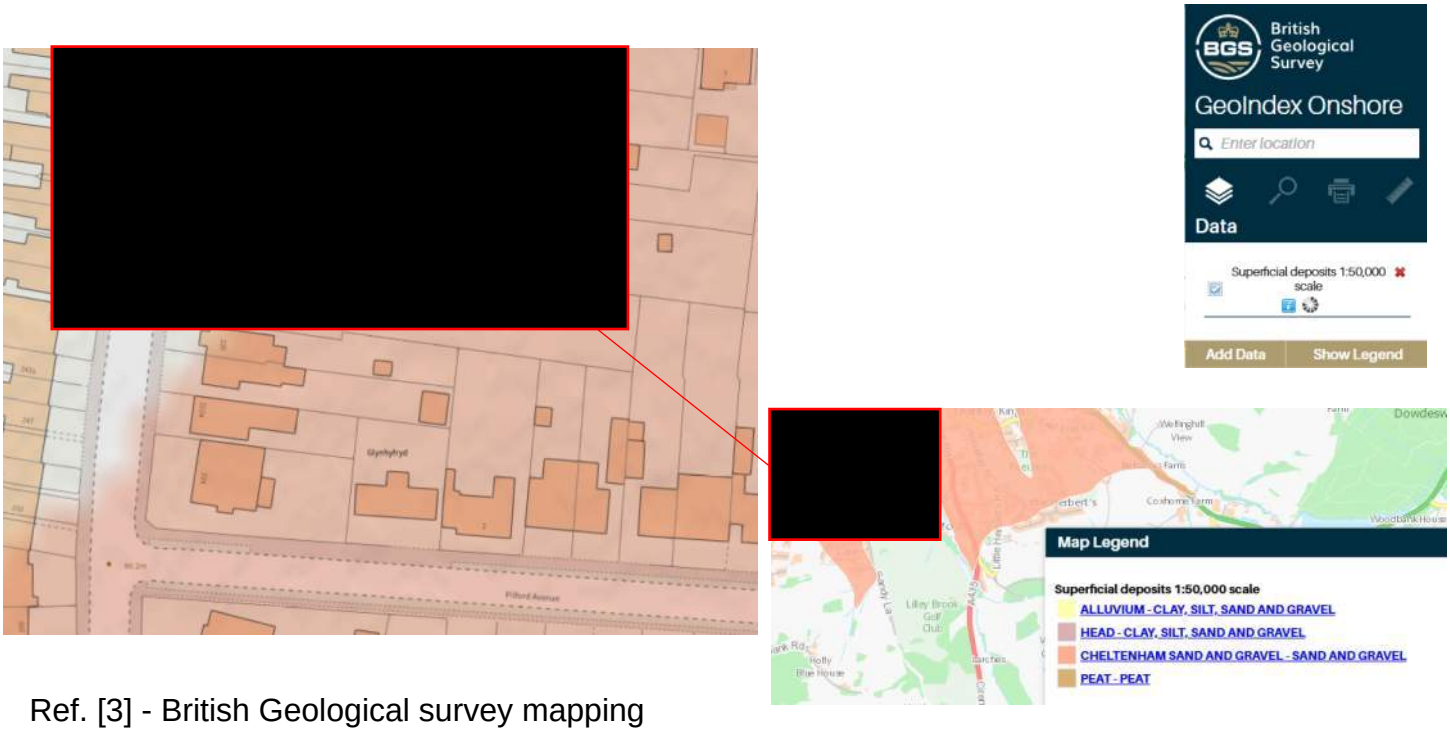
C - Visit Photos - Tree / Shrub features

D – Soils Field Tests

E – Presumed bearing Capacity v Load Take Down

********** END *********

APPENDIX A - BRITISH GEOLOGICAL SURVEY
DESK STUDY SOILS



Ref. [3] - British Geological survey mapping

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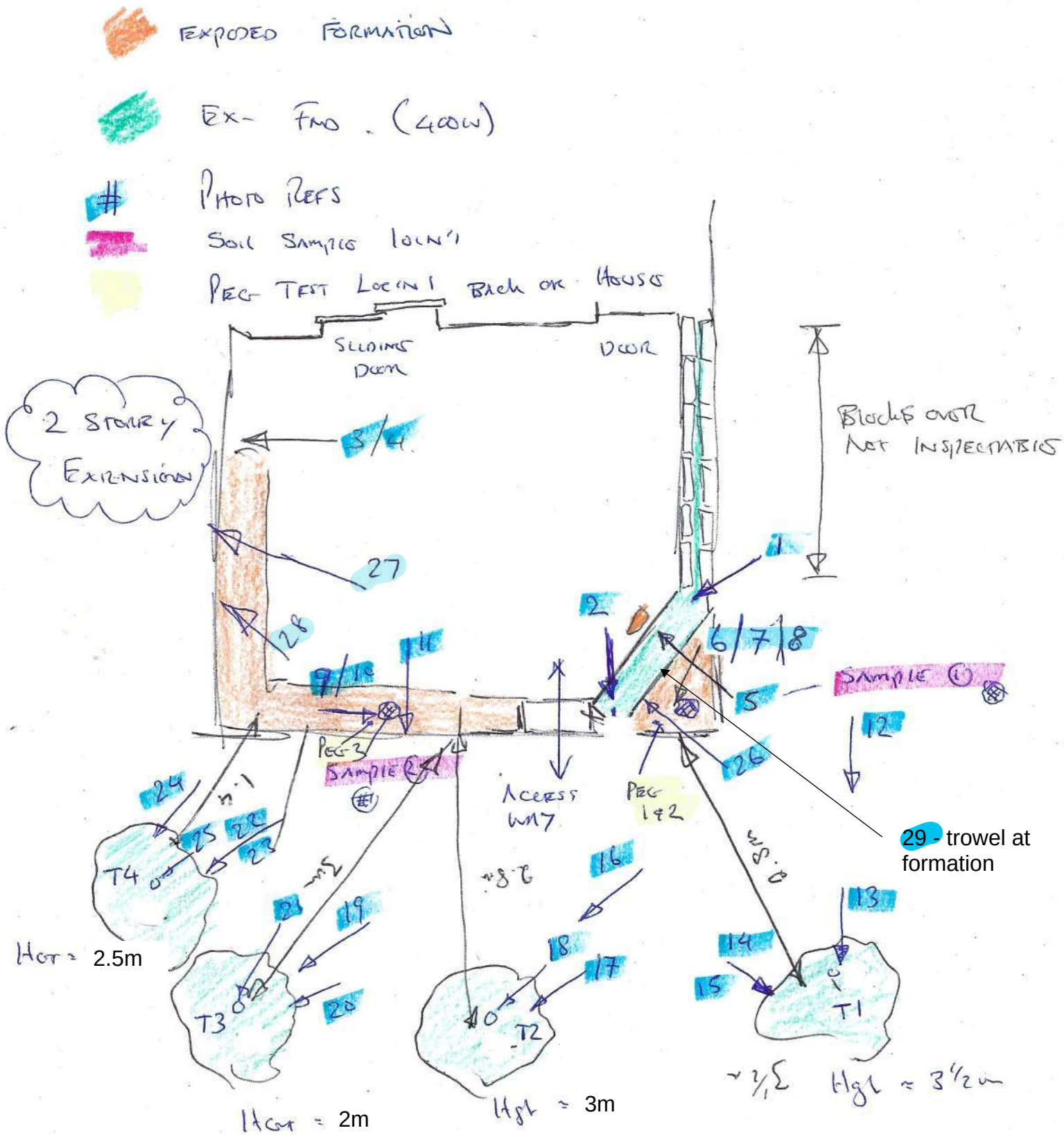
APPENDIX B
VISIT NOTES , PHOTO, SAMPLES AND PLANTING LOCATIONS

212 - OLD BATH ROAD
Visit (1) 22/8/24



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APPENDIX C

VISIT VISIT PHOTOS - SEE APP B FOR LOCATIONS

01 - EX FND AT EDGE OF LOW LVL BLOCK WORK

02 - EX FND AT ACCESS WAY - EMBEDDED SHUTTER - BUT OTHERWISE AS 01

03 - EX FND UNDER TWO STOREYNEIGHBOURS EXTENSION

27 - EX FND UNDER TWO STOREY NEIGHBOURS EXTENSION

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APPENDIX D

FEILD TESTS - RAPID ASSESSMENT
PROCEEDURES AS REF [1]

Summary result - high strength - indicating the presence of much inorganic clay of high liquid limit.

FEILD TEST 1 - DRY STRENGTH [1]

Dry Strength Test. A pat of soil about 6 mm thick is allowed to dry completely either naturally or in an oven. The strength of the dry soil is then assessed by breaking and crumbling between the fingers. Inorganic clays have relatively high dry strength, the greater the strength the higher the liquid limit. Inorganic silts of low liquid limit have little or no dry strength, crumbling easily between the fingers.

Test Sample - plan

REF [7]

3.3 **Interpretation of Results**

3.3.1 **Dry Strength**

a) **slight** dry strength - friable, sample crumbles into powder with some finger pressure.

b) **medium** dry strength - considerable pressure required to powder the sample; and

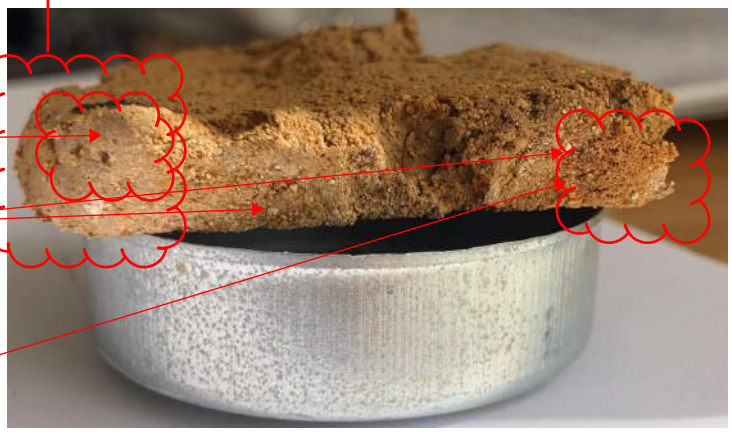
c) **high** dry strength - the dried sample cannot be powdered with finger pressure.

circa 6mm thick

Paste like, particles <0.06mm Clay or Silt

Medium Sand sized particles circa 0.5mm

Fine Sand sized particles circa <0.1mm



Test Sample - elevation - with thickness (Shows a comples arrangement of

BRITISH STANDARDS PARTICLE SIZE RANGES

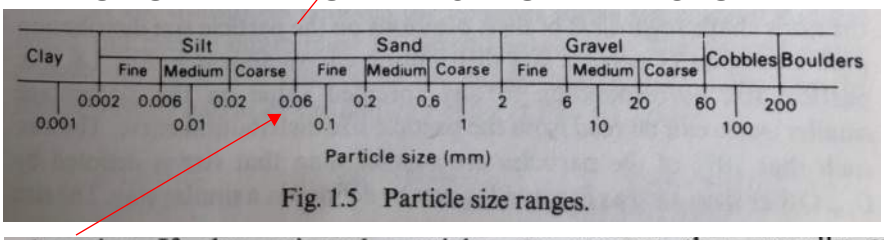


Fig. 1.5 Particle size ranges.

clay size. If clay mineral particles are present they usually exert a considerable influence on the properties of a soil, an influence out of all proportion to their percentage by weight in the soil.

Test 1 - Considerable Finger Pressure - No Effect.

Test 2 - Took pliers to break the sample, the finger pressure in effective on smaller pieces.

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APPENDIX E

LIKLEY SOIL STRENGTH BASED ON
SAMPLE OBSERVATIONS

Observations appear to show **that below the imediate surface** (that hadbeen exposed to the rain at the time of the visit, that the soil type is that of Ref 2 a Loose Clayey Sand, & Ref 1 by handling samples a Firm Clay requiring strong finger pressure to mold it. With the formation level carefully prepared, blinded / protected a 100Kpa presumed bearing value should be achievable.

REF. [2]

Description of soil	*N-value in standard penetration test*	*Presumed bearing value (kN/m^2 or $kgf/cm^2 \times 100$) for foundation of width*		
		1 m	2 m	4 m
Very dense sands and gravels	>50	600	500	400
Dense sands and gravels	30–50	350–600	300–500	250–400
Medium-dense sands and gravels	10–30	150–350	100–300	100–250
Loose sands and gravels	5–10	50–150	50–100	50–100

Notes: (1) Corrections to *N*-values to be applied to observed *N*-value before using this table (*see* Section 2.4.2). (2) The water table is assumed not to be close to base of foundation. If the water table is at the base of the foundation or within a depth equal to the width of the foundation then these presumed bearing values should be halved.

With the refusal at 100mm Peg penatration, allowing for the rain ingress likely - 100 Kpa

REF. [1]

Basic Characteristics of Soils 13

Table 1.2

Soil type	Term	Field test
Sands, gravels	Loose	Can be excavated with a spade; 50 mm wooden peg can be easily driven
	Dense	Requires a pick for excavation; 50 mm wooden peg is hard to drive
	Slightly cemented	Visual examination; pick removes soil in lumps which can be abraded
Silts	Soft or loose	Easily moulded or crushed in the fingers
	Firm or dense	Can be moulded or crushed by strong pressure in the fingers
Clays	Very soft	Exudes between the fingers when squeezed in the hand
	Soft	Moulded by light finger pressure
	Firm	Can be moulded by strong finger pressure
	Stiff	Cannot be moulded by the fingers; can be indented by the thumb
	Very stiff	Can be indented by the thumb nail
Organic, peats	Firm	Fibres already compressed together
	Spongy	Very compressible and open structure
	Plastic	Can be moulded in the hand and smears the fingers

Table 8.1 Presumed Bearing Values (BS 8004:1986)

Soil type	Bearing value (kN/m^2)	Remarks
Dense gravel or dense sand and gravel	> 600	Width of foundation (B) not less than 1 m. Water table at least B below base of foundation
Medium dense gravel or medium dense sand and gravel	200–600	
Loose gravel or loose sand and gravel	< 200	
Compact sand	> 300	
Medium dense sand	100–300	
Loose sand	< 100	
Very stiff boulder clays and hard clays	300–600	Susceptible to long-term consolidation settlement
Stiff clays	150–300	
Firm clays	75–150	
Soft clays and silts	< 75	
Very soft clays and silts	—	

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