

10 Chorlton Green Calculations 1 Load Appraisal

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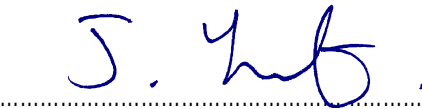
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1 Introduction

1.1 Overview

The following calculations have been completed with respect to two proposed extensions to 10 Chorlton Green, Chorlton-cum-Hardy, Manchester, M21 9HS. The first of which being a single storey lean-to extension forming a new boot room, this will utilise existing foundations which will be underpinned as well as adopting new strip foundations. The second proposed extension is to house a new kitchen, also single storey, which will also require underpinning to the existing foundations of the house.

These calculations provide a load appraisal to consider whether the existing foundations can support an increase in load.

2 Ground data

2.1 British Geological Survey records

A review of publicly available British Geological Survey records has been undertaken. The records indicate:

- Superficial deposits: Glaciofluvial Sheet Deposits, Devensian
- Bedrock: Wilmslow Sandstone Formation

2.2 Site investigations

A site investigation has been completed. The site investigation indicated that below made ground (500mm) only dense orange sand was recorded, indicating that the strata on site is granular in nature.

Trial Hole 1A

Site investigations concluded paving slabs below ground level to a depth of 70mm, overlying made ground (soft soil and clay fill with brick rubble) to a depth of 470mm, overlying medium dense dry orange brown SAND to a depth of 940mm. Foundations were formed as brickwork projected 200mm from the face of the building at ground level.

Trial Hole 1B

Site investigations concluded paving slabs below ground level to a depth of 70mm, overlying made ground to a depth of 470mm, overlying medium dense orange brown SAND to a depth of 940mm. Foundations were formed as a stone slab protruding 40mm from the face of the building at ground level.

Trial Hole 2

Site investigations concluded paving slabs below ground level to a depth of 40mm, overlying made ground (mixed soil and clay fill with brick rubble) to a depth of 400mm, overlying dense

dry orange brown SAND to a depth of 600mm. Foundations were formed as a rough concrete footing projected 70mm from the face of the building at a depth of 550mm.

Trial Hole 3A

Site investigations concluded topsoil (with abundant roots) below ground level to a depth of 200mm, overlying made ground (sandy clay fill with brick rubble) to a depth of 500mm, overlying dense dry orange brown SAND to a depth of 1300mm. Foundations were formed as brickwork projected 50mm from the face of the building at a depth of 500mm.

Trial Hole 3B

Site investigations concluded topsoil below ground level to a depth of 200mm, overlying made ground (sandy clay fill with brick rubble) to a depth of 500mm, overlying dense dry orange brown SAND to a depth of 1300mm. Foundations were formed as brickwork projected 80mm from the face of the building at a depth of 1.25m.

2.3 Ground characterisation

Based on the above information, the ground can be characterised as granular around the proposed extensions.

A presumed bearing resistance (PBR) of 100 kN/m^2 has been adopted within the design for the proposed extensions. This PBR will limit ground settlement to within acceptable limits.

The ground conditions should be verified on site by building control. Should this assumption be contradicted on site, contact DYSE immediately.

3 Structural Analysis and Design

Part	Part	Page
A	Loading	A1
B	Foundations Design	B1
C	Underpinning	C1

Element	Description	Load	t, (m)	Total
Element 1	Cavity wall (brick and brick)			
	Brick Density (kN/m3) Brick, clay	20.00	0.10	2.00 kN/m ²
	Insulation Density (kN/m3) Insulation, expanded board	0.50	0.10	0.05 kN/m ²
	Brick Density (kN/m3) Brick, clay	20.00	0.10	2.00 kN/m ²
	Services Area (kN/m2) Services	0.05	-	0.05 kN/m ²
	Wallboard & Skimcoat Area (kN/m2) Plaster, 13mm wallboard and skim coat	0.12	-	0.12 kN/m ²
		-	-	0.00 kN/m ²
				4.22 kN/m ²
Element 2	Cut roof (slate tiles)			
	Roof Tiles Area (kN/m2) Roofing tiles, slate	0.63	-	0.63 kN/m ²
	Battens & Felt Area (kN/m2) Battens and felt	0.05	-	0.05 kN/m ²
	Rafters Area (kN/m2) Rafters	0.15	-	0.15 kN/m ²
	Services Area (kN/m2) Services	0.05	-	0.05 kN/m ²
		-	-	0.00 kN/m ²
		-	-	0.00 kN/m ²
				0.88 kN/m ²
Element 3	Vaulted roof (slate tiles)			
	Roof Tiles Area (kN/m2) Roofing tiles, slate	0.63	-	0.63 kN/m ²
	Battens & Felt Area (kN/m2) Battens and felt	0.05	-	0.05 kN/m ²
	Rafters Area (kN/m2) Rafters	0.15	-	0.15 kN/m ²
	Insulation Density (kN/m3) Insulation, Rockwool	1.50	0.15	0.23 kN/m ²
	Services Area (kN/m2) Services	0.05	-	0.05 kN/m ²
	Ceiling Area (kN/m2) Plaster, 13mm wallboard and skim coat	0.12	-	0.12 kN/m ²
				1.23 kN/m ²
Element 4	Timber floor			
	Finishes Area (kN/m2) Finishes, general	0.25	-	0.25 kN/m ²
	Chipboard Density (kN/m3) Chipboard	7.00	0.01	0.07 kN/m ²
	Floor Joists Area (kN/m2) Joists, floor	0.15	-	0.15 kN/m ²
	Services Area (kN/m2) Services	0.05	-	0.05 kN/m ²
	Insulation Density (kN/m3) Insulation, expanded board	0.50	0.10	0.05 kN/m ²
	Ceiling Area (kN/m2) Plaster, 13mm wallboard and skim coat	0.12	-	0.12 kN/m ²
				0.69 kN/m ²
Element 5	External timber stud (timber clad)			
	Timber cladding Density (kN/m3) Timber, softwood	4.00	0.03	0.10 kN/m ²
	Battens & Felt Area (kN/m2) Battens and felt	0.05	-	0.05 kN/m ²
	Waterproofing Area (kN/m2) Waterproofing	0.10	-	0.10 kN/m ²
	Stud & Insulation Area (kN/m2) Studs, 600mm c/c with insulation	0.40	-	0.40 kN/m ²
	Chipboard Density (kN/m3) Chipboard	7.00	0.02	0.11 kN/m ²
	Plaster Area (kN/m2) Plaster, 13mm wallboard and skim coat	0.12	-	0.12 kN/m ²
				0.90 kN/m ²

Element 1	Single Leaf Exterior Blockwork Wall			Load	t, (m)	Total	
	Plaster	Area (kN/m2)	Plaster, 13mm wallboard and skim coat	0.12	-	0.12	kN/m ²
	Blockwork	Density (kN/m3)	Blockwork, mediumweight, 1800kg/m3	18.00	0.22	3.87	kN/m ²
	Exterior Finishes	Area (kN/m2)	Finishes, general	0.25	-	0.25	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						4.30	kN/m ²
Element 2	Title			Load	t, (m)	Total	
						0.12	kN/m ²
						3.87	kN/m ²
						0.25	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						4.30	kN/m ²
Element 3	Title			Load	t, (m)	Total	
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
Element 4	Title			Load	t, (m)	Total	
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
Element 5	Title			Load	t, (m)	Total	
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²
						0.00	kN/m ²

BOOT ROOM STRIP FOUNDATION DESIGN

LOADING

- PROPOSED BOOT ROOM SLATE CUT ROOF,
 $g_k = 0.9 \text{ kN.m}^{-2}$, $q_k = 0.6 \text{ kN.m}^{-2}$

$$\text{ROOF TRIB} = 1.8 \text{ m} / 2 = 0.9 \text{ m}$$

$$\text{PERMANENT} = (0.9 \text{ kN.m}^{-2})(0.9 \text{ m}) = 0.81 \text{ kN.m}^{-1}$$

$$\text{VARIABLE} = (0.6 \text{ kN.m}^{-2})(0.9 \text{ m}) = 0.5 \text{ kN.m}^{-1}$$

- SINGLE LEAF BLOCKWORK WALL, $g_k = 4.3 \text{ kN.m}^{-2}$

$$\text{HEIGHT} = 1.9 \text{ m} + 0.3 \text{ m} = 2.2 \text{ m}$$

$$\text{PERMANENT} = (4.3 \text{ kN.m}^{-2})(2.2 \text{ m}) = 9.5 \text{ kN.m}^{-1}$$

- GROUND BEARING SLAB, $g_k = 7.7 \text{ kN.m}^{-2}$, $q_k = 1.5 \text{ kN.m}^{-2}$

$$\text{TRIB} = 1.6 \text{ m} / 2 = 0.8 \text{ m}$$

$$\text{PERMANENT} = (7.7 \text{ kN.m}^{-2})(0.8 \text{ m}) = 6.2 \text{ kN.m}^{-1}$$

$$\text{VARIABLE} = (1.5 \text{ kN.m}^{-2})(0.8 \text{ m}) = 1.2 \text{ kN.m}^{-1}$$

SELF WEIGHT OF CONCRETE STRIP FOUNDATION:

$$\text{PRELIM SIZE} = 600 \text{ mm} \times 300 \text{ mm}$$

$$\bullet \rho = 25 \text{ kN.m}^{-3}$$

$$\bullet \text{TAKING NOMINAL STRIP WIDTH OF } 600 \text{ mm}$$

$$\bullet \text{TAKING NOMINAL STRIP DEPTH OF } 300 \text{ mm}$$

$$\Rightarrow (25 \text{ kN.m}^{-3})(0.6 \text{ m})(0.3 \text{ m}) = 4.5 \text{ kN.m}^{-1}$$

$$\Sigma \text{ LINE LOADS (SLS)} = 22.7 \text{ kN.m}^{-1}$$

TAKING A 1m STRIP OF FOUNDATIONS:

$$(22.7 \text{ kN.m}^{-1})(1 \text{ m}) = 22.7 \text{ kN} = F$$

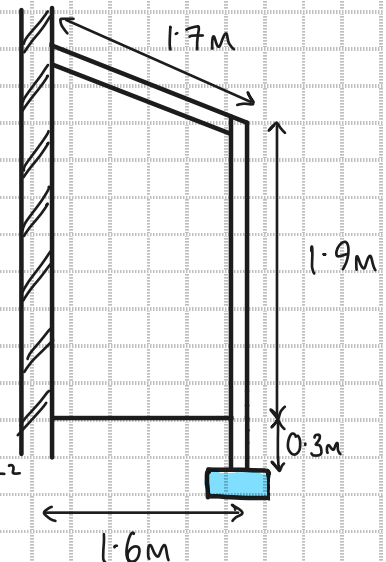
$$\text{PBR} = 100 - 300 \text{ kN.m}^{-2} \rightarrow \text{TAKE AS } 100 \text{ kN.m}^{-2}$$

$$\text{AREA} = \frac{F}{\text{PBR}} = \frac{22.7 \text{ kN}}{100 \text{ kN.m}^{-2}} = 0.23 \text{ m}^2$$

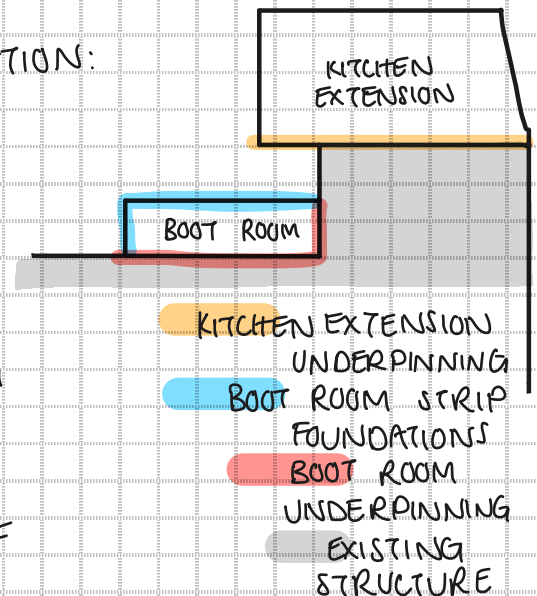
$$\text{WIDTH OF STRIP FOUNDATIONS} = \sqrt{0.23 \text{ m}^2} = 0.48 \text{ m}$$

THEREFORE ADOPT 600mm WIDE STRIP FOUNDATIONS

SECTION VIEW:



PLAN VIEW:



KITCHEN EXTENSION UNDERPINNING

LOADING

- EXISTING SLATE CUT ROOF, $g_k = 0.9 \text{ kN.m}^{-2}$, $q_k = 0.6 \text{ kN.m}^{-2}$
 $\text{TRIB} = 2.8\text{m} / 2 = 1.4\text{m}$

$$\text{PERMANENT} = (0.9 \text{ kN.m}^{-2})(1.4\text{m}) = 1.3 \text{ kN.m}^{-1}$$

$$\text{VARIABLE} = (0.6 \text{ kN.m}^{-2})(1.4\text{m}) = 0.8 \text{ kN.m}^{-1}$$

- 1st FLOOR - TIMBER JOISTED FLOOR, $g_k = 0.7 \text{ kN.m}^{-2}$, $q_k = 1.5 \text{ kN.m}^{-2}$
 $\text{TRIB} = 4.3\text{m} / 2 = 2.15\text{m}$

$$\text{PERMANENT} = (0.7 \text{ kN.m}^{-2})(2.15\text{m}) = 1.5 \text{ kN.m}^{-1}$$

$$\text{VARIABLE} = (1.5 \text{ kN.m}^{-2})(2.15\text{m}) = 3.2 \text{ kN.m}^{-1}$$

- EXISTING SOLID BRICK WALL, $g_k = 4.2 \text{ kN.m}^{-2}$
 $\text{HEIGHT} = 4.6\text{m}$

$$\text{PERMANENT} = (4.2 \text{ kN.m}^{-2})(4.6\text{m}) = 19.3 \text{ kN.m}^{-1}$$

- GLAZING LINK $g_k = 0.8 \text{ kN.m}^{-2}$, $q_k = 0.6 \text{ kN.m}^{-2}$
 $\text{TRIB} = 0.6\text{m} / 2 = 0.3\text{m}$

$$\text{PERMANENT} = (0.8 \text{ kN.m}^{-2})(0.3\text{m}) = 0.2 \text{ kN.m}^{-1}$$

$$\text{VARIABLE} = (0.6 \text{ kN.m}^{-2})(0.3\text{m}) = 0.2 \text{ kN.m}^{-1}$$

- GROUND BEARING SLAB, $g_k = 7.7 \text{ kN.m}^{-2}$, $q_k = 1.5 \text{ kN.m}^{-2}$
 $\text{TRIB} = 4.4\text{m} / 2 = 2.2\text{m}$

$$\text{PERMANENT} = (7.7 \text{ kN.m}^{-2})(2.2\text{m}) = 16.9 \text{ kN.m}^{-1}$$

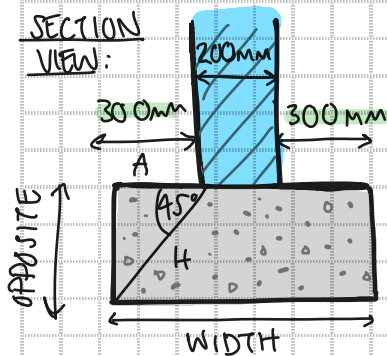
$$\text{VARIABLE} = (1.5 \text{ kN.m}^{-2})(2.2\text{m}) = 3.3 \text{ kN.m}^{-1}$$

- BLOCKWORK UNDERPINNING, $g_u = 3.6 \text{ kN.m}^{-2}$
HEIGHT, $h = 300 \text{ mm} - 90 \text{ mm} = 210 \text{ mm} = 0.21 \text{ m}$

$$\text{PERMANENT} = (g_u)(\text{HEIGHT})$$

$$\text{PERMANENT} = (3.6 \text{ kN.m}^{-2})(0.21 \text{ m}) = 0.76 \text{ kN.m}^{-1}$$

- UNDERPINNING DEPTH (PRELIMINARY WIDTH = 600 mm)



$$\tan \theta = \frac{\text{OPPOSITE}}{\text{ADJACENT}}$$

$$\tan 45^\circ = \frac{\text{OPPOSITE}}{300 \text{ mm}}$$

$$(\tan 45^\circ)(300 \text{ mm}) = 300 \text{ mm}$$

$$300 + 300 + 200 = 800 \text{ mm} \rightarrow \text{NEW WIDTH OF UNDERPINNING BLOCKS}$$

- SELF-WEIGHT OF NEW UNDERPINNING
CONCRETE SELF-WEIGHT, DENSITY = 25 kN.m^{-3}
DEPTH OF UNDERPINNING = $300 \text{ mm} = 0.3 \text{ m}$
WIDTH OF UNDERPINNING = $800 \text{ mm} = 0.8 \text{ m}$

$$\text{PERMANENT LINE LOAD} = (25 \text{ kN.m}^{-3})(0.3 \text{ m})(0.8 \text{ m}) = 6.0 \text{ kN.m}^{-1}$$

$$\Sigma \text{ LOAD (SLS)} = 53.5 \text{ kN.m}^{-1}$$

TAKING A 1m LONG STRIP OF FOUNDATION:

$$(50.5 \text{ kN.m}^{-1})(1.0 \text{ m}) = 50.5 \text{ kN} = \Sigma F$$

$$\text{PBR} = 100 \text{ kN.m}^{-2}$$

$$\text{AREA OF UNDERPINNING BLOCK, A} = \frac{\Sigma F}{\text{PBR}} = \frac{50.5 \text{ kN}}{100 \text{ kN.m}^{-2}} = 0.505 \text{ m}^2$$

$$\text{WIDTH OF UNDERPINNING BLOCK} = \sqrt{0.505 \text{ m}^2} = 0.71 \text{ m}$$

THEREFORE, ADOPT 800 mm WIDE UNDERPINNING BLOCKS

SECTION VIEW

