CMS SUPPLEMENTARY CALCULATIONS

143a Gloucester Avenue, NW1 8LA

Project Number: 2746

Revision A

Prepared by Tommaso Pascucci
19 January 2016

Checked By James Sharp

Blue Structural Engineering LLP
Third Floor 16–28 Tabernacle St London EC2A 4DD
T +44 (0) 20 7247 3811 E info@blueengineering.co.uk
www.blueengineering.co.uk

Registered Office: 911 Green Lanes London N21 2QP United Kingdom
Partnership No: OC366872 – Registered in England | VAT No: 119 413 233

BLUE ENGINEERING

GROUND PRESSURE CALCULATIONS:

A desk study was carried out using the BGS borehole log database which indicated that below the top substrate of made ground the strata is firm London Clay. Typical internal angle of shearing resistance for the strata is between 18-24°. For the purpose of these calculations the conservative value of 20° has been taken.

Active Pressure:

K_a = 1-sin Φ/1+sin Φ: 1-sin20/1+sin20 = 0.49

Passive pressure:

$K_p = 1/K_a = 2.0$

Ground Pressures Acting on New Reinforced Concrete Wall:

From trial holes, ground is not cohesive

Φ = 20° K_a = 0.49 K_p = 2.0 c = 0 kN/m² Surcharge = 10.0 kN/m³

γ = 20 kN/m³ γ′ = 10 kN/m³ γ_w = 10 kN/m³

The above values are estimated and are considered conservative. Water level has been taken at ground level

Pressure at 0.0m depth:

Surcharge: 10*0.49	= 4.9 kN/m²

Pressure at 4.0m depth:

Surcharge: 10*0.49	= 4.90 kN/m²
Active pressure Ground (Water Level below basement level): 20*0.49*4	= 39.2 kN/m²
Active pressure Ground (below water): 10*0.49*4	= 19.6 kN/m²
Passive pressure Ground (Water Level below basement level): 20*2*4	= 160 kN/m²
Passive pressure Ground (below water): 10*2*4	= 80.0 kN/m²
Water pressure: 10*4	= 40.0 kN/m²

PERMANENT GLOBAL ANALYSIS

Applied Sliding Force:

Load from surcharge: 4.9 kN/m *4m	= 19.6 kN
Load from Ground (below water): 0.5*19.6 kN/m*4	= 39.2 kN
Water: 0.5*40 kN/m*4	= 80 kN
Total Force Unfactored	**= 138.8 kN**

Retaining Wall Checks:

The calculations below check the global stability of 1 metre of the retaining wall. This will include both the global stability against sliding and overturning.

The basement structure will be designed to be sufficiently stiff as to enable any lateral forces to be transferred from one side to the other where passive pressure will be mobilised to prevent any movement. The force on each side of the basement will be equal and opposite. Therefore the basement is in equilibrium and sliding cannot occur.

Sliding Equilibrium Check:

Reinforcement in retaining structure to be sized accordingly to allow mobilisation of ground on opposite side of property.

Sliding force to be resisted = 138.8*1.5 = 208.2 kN

Resistance to sliding due to passive pressure: 20 kN/m³ *3.5m *2*3.5m*0.5*0.9 = 221 kN (factor of safety of 0.9)

First 500mm of ground has not been considered to allow for the potential for the ground level to be reduced.

Uplift Check:

There will be an upwards vertical force acting on the property due the ground water being displaced by the proposed basement construction.

Water displaced by basement construction:
4.0m *(deep)**64.3m^2 *(area)**10.0 kN/m^3

Total uplift force	= 2572 kN
Total factored uplift force (*1.1)	= **2829 kN**

Permanent loading resisting uplift:

Reinforced concrete slab @ 25.0 kN/m^3 @ 400mm thick @ 64.3m^2 total area	= 643 kN
Reinforced concrete walls @ 25.0 kN/m^3 @ 40m length @ 1.6m^2 total area	= 1600 kN
Ground floor @ 25.0 kN/m^2 @ 200mm thick @ 64.3m^2 total area	= 320 kN
Front façade @ 19.0 kN/m^3 @ 14m height	= 408.5 kN
Garden wall @ 19.0 kN/m^3 @ 40m length @ 500 mm height	= 123.5 kN
Total force resisting uplift	= 3095 kN
Total factored force resisting uplift	= 2856 **kN**

PERMANEND LOCAL ANALYSIS

The calculations below calculate the reinforcement in the retaining structures able to resist the bending moment along the stem and allow transfer of forces and moment into the ground bearing slab.

Use: **325mm thick Reinforced Concrete retaining wall constructed from RC40.**

Estimated Bending Moment applied along the stem of the retaining wall will be: 23 kNm/m (Factored)
As,request = 203 mm^2/m
Therefore use: **H12 @ 200mm c/c in both faces. (565mm^2/m). Laps to be a minimum 480mm**

Estimated Bending Moment applied at the base of the stem and toe will be: 195 kNm/m (Factored)
As,request = 1520 mm^2/m
Therefore use: **H20 @ 200mm c/c. (1571mm^2/m). Laps to be a minimum 800mm**

TEMPORARY LOCAL ANALYSIS

The calculations below calculate horizontal load on the retaining wall to define the temporary load in the props.
Ground Water Table shows the water level lower than the depth of the basement, therefore the water pressure will be ignored to define the force in the props for temporary works.

The worst scenario of the temporary works has been identified in the Stage no.3 of the Sequence of works. Follow it has been shown the calculations to evaluate the lateral load in the props.

Applied Horizontal force:

Load from surcharge: 4.9 kN/m *4m		= 19.6 kN
Load from Ground: 0.5*39.2 kN/m*4		= 78.4 kN
	Total Horizontal load (Unfactored)	**= 98.0 kN**
	Total Horizontal load (Factored)	**= 147 kN**

Overturning Moment:

Moment from surcharge: 19.6 kN*4/2		= 39.2 kNm
Moment from Ground: 78.4*4/3		= 104.5 kNm
	Total Moment (Unfactored)	**= 143.7 kNm**
	Total Moment (Factored)	**= 215.6 kNm**

It is assumed the top props are located at 1 meter deep from the ground level.

Load applied per metre in the props to stop the overturning: 215.6/3 = 71.9 kN

Therefore Use: **No.1 System 160 Prop per metre (Capacity @ L = 4.8m = 120 kN). Refer to attached document "System 160 Propping and Needling"** Therefore OK