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61A CANFIELD GARDENS				...	
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Structural Engineering Report for Planning Application				1	
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Structural Engineering Report

For Planning Application

61a Canfield Gardens

Report Prepared by Robert Cichon
M.Sc. of Civil Engineering

EXISTING STRUCTURE

The property is a large terraced residential property constructed around 1860.

Generally the construction is typical of similar properties in London. The main walls are 9" masonry on spread brickwork foundations formed approximately 0.5m below external ground level.

The floors are timber joists supported on external walls and steel beams.

STRUCTURAL DESIGN PRINCIPLES

Retaining Walls

Basement walls are designed as propped cantilevers in reinforced concrete, the basement slab acting as the prop at base level. The walls are designed using parameters relevant to the Code. Even though no water table was found the walls will be designed for a water table 1.75m above the base of the stem in accordance with the relevant Code

The surcharge load allowed on the external walls of the property will be

10 kN/m2 - for the party wall

10 kN/m2 - for walls adjoining to public pavement

DESIGN CRITERIA.

Basement walls and bases are designed using the program TEDDS parameters for the retained walls.
The design is in accordance with BS 8002:1994.

The wall and base in designed for the following

1. The design adopts a water head behind the wall to 75 % the height of the wall below ground.
2. Retaining wall will be designed for a surcharge load of 10.0KN/m2.

Bearing capacity will be 100 KN/m2 to limit settlements.

Concrete will generally be grade C35 and Class 1 to BRE Digest 363.

Reinforcement will be grade 500N/mm2.

RELEVANT CODES OF PRACTICE AND BRITISH STANDARDS

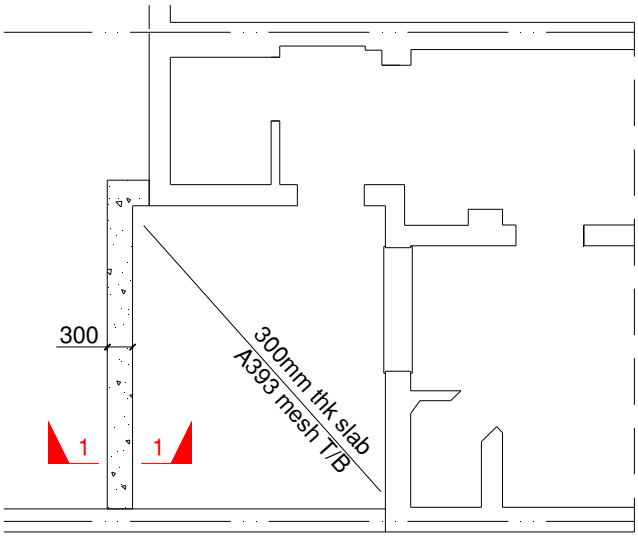
B.S. 8004 Code of Practice For Foundations

B.S. 6031 Code of Practice For Earthworks

B.S. 8110 Structural Use of Concrete

B.S. 5750 Structural Use of Steelwork in Buildings

RETAINING WALL DESIGN



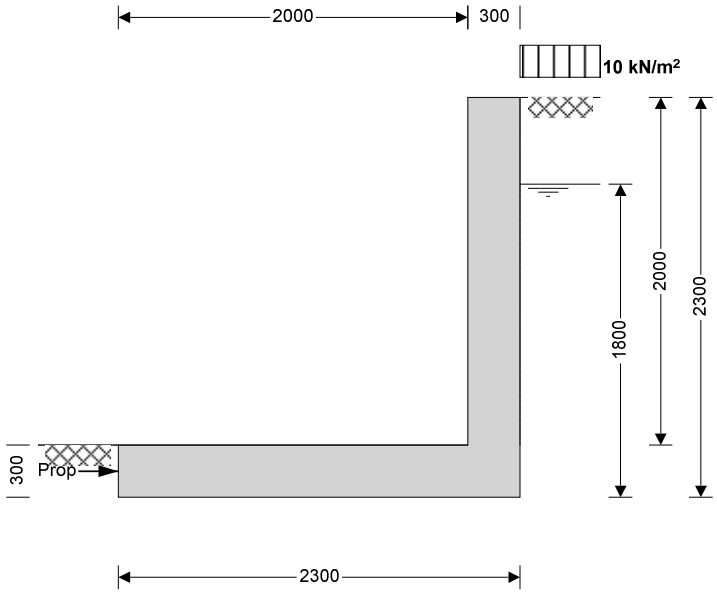
Load

Surcharge –10 kN/m^2

RETAINING WALL ANALYSIS & DESIGN (BS8002:1994)

RETAINING WALL ANALYSIS (BS 8002:1994)

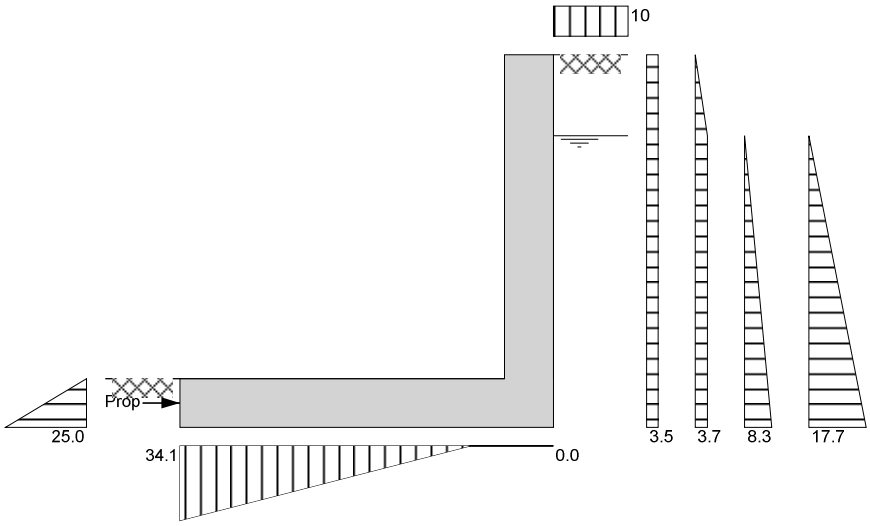
TEDDS calculation version 1.2.01.02



Wall details

Retaining wall type	Cantilever		
Height of wall stem	h_{stem} = 2000 mm	Wall stem thickness	t_{wall} = 300 mm
Length of toe	l_{toe} = 2000 mm	Length of heel	l_{heel} = 0 mm

Overall length of base	l_{base} = 2300 mm	Base thickness	t_{base} = 300 mm
Height of retaining wall	h_{wall} = 2300 mm		
Depth of downstand	d_{ds} = 0 mm	Thickness of downstand	t_{ds} = 300 mm
Position of downstand	l_{ds} = 850 mm		
Depth of cover in front of wall	d_{cover} = 0 mm	Unplanned excavation depth	d_{exc} = 0 mm
Height of ground water	h_{water} = 1800 mm	Density of water	γ_{water} = 9.81 kN/m^3
Density of wall construction	γ_{wall} = 23.6 kN/m^3	Density of base construction	γ_{base} = 23.6 kN/m^3
Angle of soil surface	β = 0.0 deg	Effective height at back of wall	h_{eff} = 2300 mm
Mobilisation factor	M = 1.5		
Moist density	γ_m = 21.0 kN/m^3	Saturated density	γ_s = 23.0 kN/m^3
Design shear strength	ϕ' = 24.2 deg	Angle of wall friction	δ = 18.6 deg
Design shear strength	ϕ'_b = 24.2 deg	Design base friction	δ_b = 18.6 deg
Moist density	γ_{mb} = 21.0 kN/m^3	Allowable bearing	$P_{bearing}$ = 100 kN/m^2
Using Coulomb theory			
Active pressure	K_a =0.369	Passive pressure	K_p = 4.187
At-rest pressure	K_0 = 0.590		
Loading details			
Surcharge load	Surcharge = 10.0 kN/m^2		
Vertical dead load	W_{dead} = 0.0 kN/m	Vertical live load	W_{live} = 0.0 kN/m
Horizontal dead load	F_{dead} = 0.0 kN/m	Horizontal live load	F_{live} = 0.0 kN/m
Position of vertical load	l_{load} = 0 mm	Height of horizontal load	h_{load} = 0 mm



Loads shown in kN/m, pressures shown in kN/m^2

Calculate propping force			
Propping force	F_{prop} = 24.9 kN/m		
Check bearing pressure			
Total vertical reaction	R = 30.4 kN/m	Total moment	M_{total} = 18.1 kNm/m
Distance to reaction	x_{bar} = 596 mm	Eccentricity of reaction	e = 554 mm
		Reaction acts outside middle third of base	
Bearing pressure at toe	p_{toe} = 34.1 kN/m^2	Bearing pressure at heel	p_{heel} = 0.0 kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.02

Ultimate limit state load factors

Dead load factor $\gamma_{f\_d} = 1.4$ Live load factor $\gamma_{f\_l} = 1.6$

Earth pressure factor $\gamma_{f\_e} = 1.4$

Calculate propping force

Propping force $F_{prop} = 24.9$ kN/m

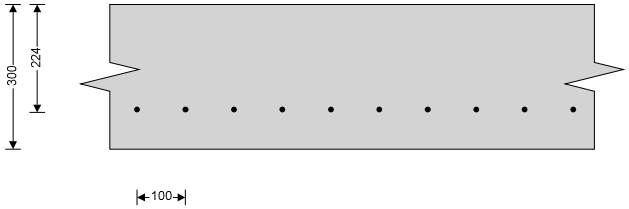
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete $f_{cu} = 35$ N/mm^2 Strength of reinforcement $f_y = 500$ N/mm^2

Base details

Minimum reinforcement k = 0.13 % Cover in toe $c_{toe} = 70$ mm



Design of retaining wall toe

Shear at heel $V_{toe} = 22.8$ kN/m Moment at heel $M_{toe} = 67.1$ kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided 12 mm dia.bars @ 100 mm centres

Area required $A_{s\_toe\_req} = 725.1$ mm^2/m Area provided $A_{s\_toe\_prov} = 1131$ mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress $v_{toe} = 0.102$ N/mm^2 Allowable shear stress $v_{adm} = 4.733$ N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress $v_{c\_toe} = 0.651$ N/mm^2

$v_{toe} < v_{c\_toe}$ - No shear reinforcement required

Design of reinforced concrete retaining wall stem (BS 8002:1994)

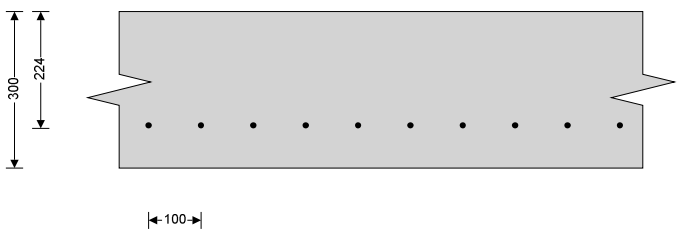
Material properties

Strength of concrete $f_{cu} = 35$ N/mm^2 Strength of reinforcement $f_y = 500$ N/mm^2

Wall details

Minimum reinforcement k = 0.13 %

Cover in stem $c_{stem} = 70$ mm Cover in wall $c_{wall} = 70$ mm



Design of retaining wall stem

Shear at base of stem $V_{stem} = 2.0$ kN/m Moment at base of stem $M_{stem} = 49.3$ kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided 12 mm dia.bars @ 100 mm centres

Area required $A_{s\_stem\_req} = 532.2$ mm^2/m Area provided $A_{s\_stem\_prov} = 1131$ mm^2/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress $v_{stem} = 0.009$ N/mm^2 Allowable shear stress $v_{adm} = 4.733$ N/mm^2

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress $v_{c\_stem} = 0.651$ N/mm^2

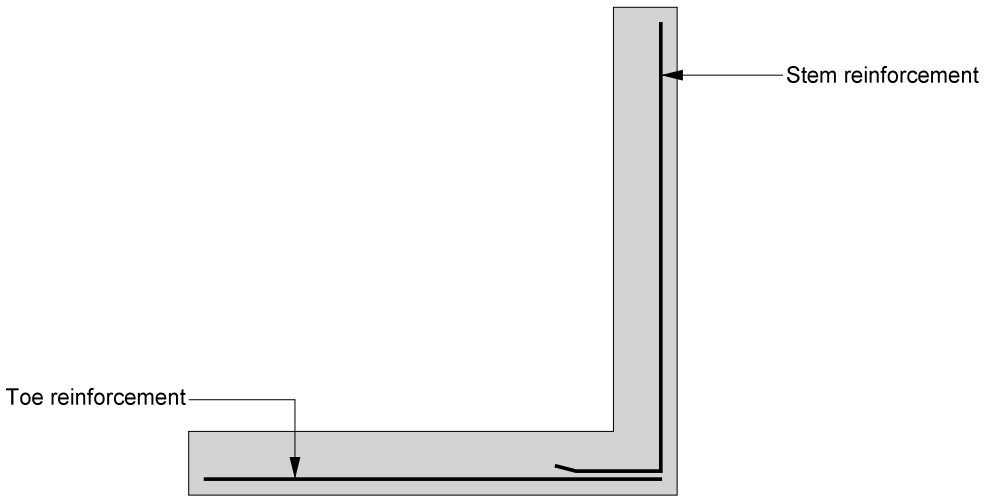
$v_{stem} < v_{c\_stem}$ - No shear reinforcement required

Check retaining wall deflection

Max span/depth ratio $ratio_{max} = 13.77$ Actual span/depth ratio $ratio_{act} = 8.93$

PASS - Span to depth ratio is acceptable

Indicative retaining wall reinforcement diagram



Toe bars - 12 mm dia.@ 100 mm centres - (1131 mm^2/m)

Stem bars - 12 mm dia.@ 100 mm centres - (1131 mm^2/m)

GENERAL BRIEF METHOD STATEMENT FOR CONSTRUCTION OF THE RETAINING WALL

Site Set-Up

1 Access will be available at existing ground floor level from 61a Canfield Gardens

2 Work area will be enclosed with secure timber hoarding.

3 A skip will be placed to the front of the property in the road (position of the skip is a subject to Local Authority approval)

4 Excavations will be carried out by hand and with hand tools powered by compressed air.

5 Spoil will be removed and deposited into the skip.

6 The skip will be emptied using a grab lorry when it is full, or alternatively the skip will be exchanged.

7 **Sequence of work - new retaining wall**

a. Sequence for new retaining wall to be 1,2,3,4,5; maximum bay length to be 1.0m.
b. Excavate to the agreed formation level and remove spoil.
c. Provide planking and strutting to sides of excavations
d. Arrange for Engineer and Building Control Inspector to inspect and approve steel reinforcement prior to placing concrete. (Please see section SE drawings for details of reinforcement)
e. Fill bay excavation with C30 Grade concrete
f. After the new RC walls have cured, the cross propping can be removed.

PRINCIPAL HEALTH AND SAFETY ISSUES

8 All work is to be carried out within the curtilage of the boundaries all boundaries must be protected and maintained and safe access is provided for adjoining owners'.

9 Access to the site area is from the main road and particular attention will be required to the means of removing excavation arising and import of construction materials and components. All reasonable precautions against nuisance and injury to workers and others arising from noise, dust and vibration are to be implemented.

10 The Contractor must ensure that suitable measures are taken to adequately mark and protect at all times the existing drainage.

11 All work at height shall be carried out using suitable access equipment and personal protection.

12 The Contractor shall notify the Engineer immediately in the event of any variations of the proposals from that anticipated or any intention to modify any aspect of the works from that shown on the structural drawings. Where appropriate the Engineer will issue revised drawings

Summary

The above description and methodology will ensure any risks due to the excavations are minimised and managed to create a safe basement both during construction and in the finished state.