Job Number: 141002
27th October 2014

CROFT STRUCTURAL ENGINEERS

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Basement Structural Method Statement – Structural Calculations & drawings

231 Goldhurst Terrace
NW6 3EP London

Frances Bennett
Bridge Mills,
Huddersfield Rd, Holmfirth,
West Yorkshire HD9 3TW

Structural Design Reviewed by
Chris Tomlin
MEng CEng MIStructE

Revision	Date	Comment
-	27/10/14	First Issue
1	05/11/14	Minor alterations to structural drawings
2	17/11/14	Designer's reference added

Job Number: 141002
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1. Design Information - Structural

Structural Summary

231 Goldhurst Terrace is a single occupancy Victorian Property Located in the borough of Camden. The structure of the property is load bearing masonry external walls, internal load bearing masonry walls on the ground floor and masonry & stud walls on the first floor. Timber floors on each floor and timber roof.

Figure 1: 231 Goldhurst Terrace: Front

Proposed works

The proposed works require the insertion of a new basement under the property.

Croft Structural Engineers Ltd Structural Engineers has extensive knowledge of inserting new basements. Over the last 4 years we have completed over 150 basements in and around the local area. The method developed is:

1. Excavate front to allow for conveyor to be inserted.

2. Form lightwell with cantilevered retaining walls

3. Slowly work from the front to the rear inserting 1200 long cantilevered retaining walls sequentially.

4. Cast ground slab

5. Waterproof internal space with a drained cavity system.

Structural Defects Noted

No defects were noted during the Chartered Engineers first visit.

Progressive Collapse

Family/domestic use

	UDL kN/m²	Concentrated Loads kN
Domestic Single Dwellings	1.5	1.4

4

Is Live Load Reduction included in design No

Reinforced concrete cantilevered retaining walls

The designs for the retaining walls have been calculated using Finite element software TEDDS. The software is specifically designed for retaining walls and ensures the design is kept to a limit to prevent damage to the adjacent property.

Results can be found in appendix B.

The overall stability of the walls are design using K_a & K_p values, while the design of the wall uses K_o values. This approach minimise the level of movement from the concrete affecting the adjacent properties.

The Investigations have highlight that water is a present. The walls are designed to cope with the hydrostatic pressure. The water table was low. The design of the walls however considers the long term items. It is possible that a water main may break causing local high water table. To account for this the wall is designed for water 1m from the top of the wall.

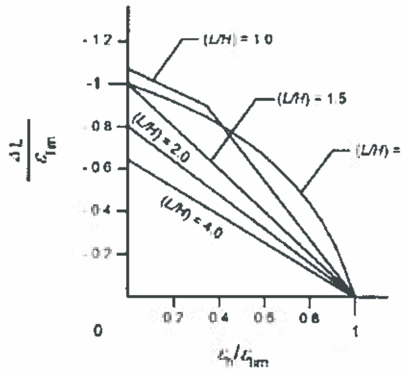
The Design also considers floatation as a risk. The design of has considered the weight of the building and the uplift forces from the water. The weight of the building is greater than the uplift resulting in a stable structure.

The building does not undermine the highway, but car parking is present to the front of the property. It is possible for heavier goods vehicles to

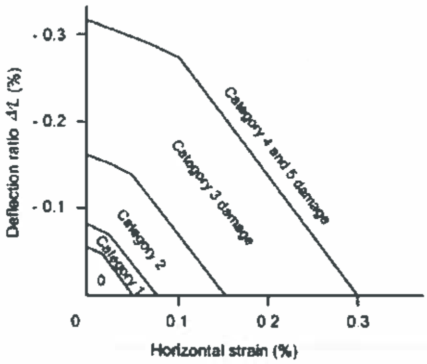
	reverse on to the property to allow for this risk loadings are to be taken from the Highways loading code. 5kN/m² to front light well Garden Surcharge 2.5kN/m² Surcharge for adjacent property 1.5kN/m² + 4kN/m² for concrete ground bearing slab
Is the Building Multi Occupancy?	No
Lateral Stability	EN 1991-1-7:1996 Table A1 Class 1 — Single occupancy houses not exceeding 4 storeys Class1 – Design to satisfy EN 1990 to EN 1999 stability requirements
Exposure and wind loading conditions	Basic wind speed Vb = 21 m/s to EC1-2 Site level +75.000 m above sea level. Topography not considered significant.
Stability Design	The cantilevered walls are suitable to carry the lateral loading applied from above
Lateral Actions	The soil loads apply a lateral load on the retaining walls. Hydrostatic pressure will be applied to the wall Imposed loading will surcharge the wall.

Adjacent Properties	***Any ground works pose an elevated risk to adjacent properties. The proposed works undermines the adjacent property along the party wall line:*** The party wall is to be underpinned. Underpinning the party wall will remove the risk of the movement to the adjacent property. The works must be carried out in accordance with the party wall act and condition surveys will be necessary at the beginning and end of the works. The method statement provided at the end of this report has been formulated with our experience of over 120 basements completed without error. The design of the retaining walls is completed to K_O lateral design stress values. This increases the design stresses on the concrete retaining walls and limits the overall deflection of the retaining wall. It is not expected that any cracking will occurring during the works. However our experience informs us that there is a risk of movement to the neighbours. To reduce the risk the development: • Employ a reputable firm for extensive knowledge of basement works. • Employ suitably qualified consultants. Croft Structural engineer has completed over 120 basements in the last 4 years. • Design the underpins to the stable without the need for elaborate temporary propping or needing the floor slab to be present. • Provide method statements for the contractors to follow • Investigate the ground, now completed. • Record and monitor the external properties. This is completed by a condition survey on under the Party Wall Act before and after the works are completed. See end of method statement. • Allow for unforeseen ground conditions: Loose ground is always a concern. The method statement and drawings show the use of precast lintels to areas of soft ground; this follows the guidance by the underpinning association.

With the above the maximum level of cracking anticipated is Hairline cracking which can be repaired with decorative cracking and can be repaired with decorative repairs. Under the party wall Act damage is allowed (although unwanted) to occur to a neighbouring property as long as repairs are suitability undertaken to rectify this. To mitigate this risk The Party Wall Act is to be followed and a Party Wall Surveyor will be appointed.



(b) Influence of horizontal strain on $\Delta L / \varepsilon_{lim}$ (after Burland, 2001)



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (L/H) = 1.0 (after Burland, 2001)

Extract from The Institution of Structural Engineers "Subsidence of Low-Rise Buildings"

Table 6.2 Classification of visible damage to walls with particular reference to type of repair, and rectification consideration

Category of Damage	Approximate crack width	Limiting Tensile strain	Definitions of cracks and repair types/considerations
0	**Up to 0.1**	0.0-0.05	**<u>HAIRLINE</u> – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks rarely visible and remedial works rarely justified.**
1	0.2 to 2	0.05-0.075	FINE – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks may be visible, sometimes repairs required for weather tightness or aesthetics. NOTE: Plaster cracks may, in time, become visible again if not covered by a wall covering.
2	2 to 5	0.075-0.015	MODERATE – Internal cracks are likely to need raking out and repairing to a recognised specification. May need to be chopped back, and repaired with expanded metal/plaster, then redecorated. The crack will inevitably become visible again in time if these measures are not carried out. External cracks will require raking out and repointing, cracked bricks may require replacement.

3	5 to 15	0.15-0.3	SERIOUS – Internal cracks repaired as for MODERATE, plus perhaps reconstruction if seriously cracked. Rebonding will be required. External cracks may require reconstruction perhaps of panels of brickwork. Alternatively, specialist resin bonding techniques may need to be employed and/or joint reinforcement.
4	15 to 25	0.3	SEVERE Major reconstruction works to both internal and external wall skins are likely to be required. Realignment of windows and doors may be necessary.
5	Greater than 25		VERY SEVERE –Major reconstruction works, plus possibly structural lifting or sectional demolition and rebuild may need to be considered. Replacement of windows and doors, plus other structural elements, possibly necessary. NOTE – Building & CDM Regulations will probably apply to this category of work, see sections 10.4, 10.6 and Appendix F.

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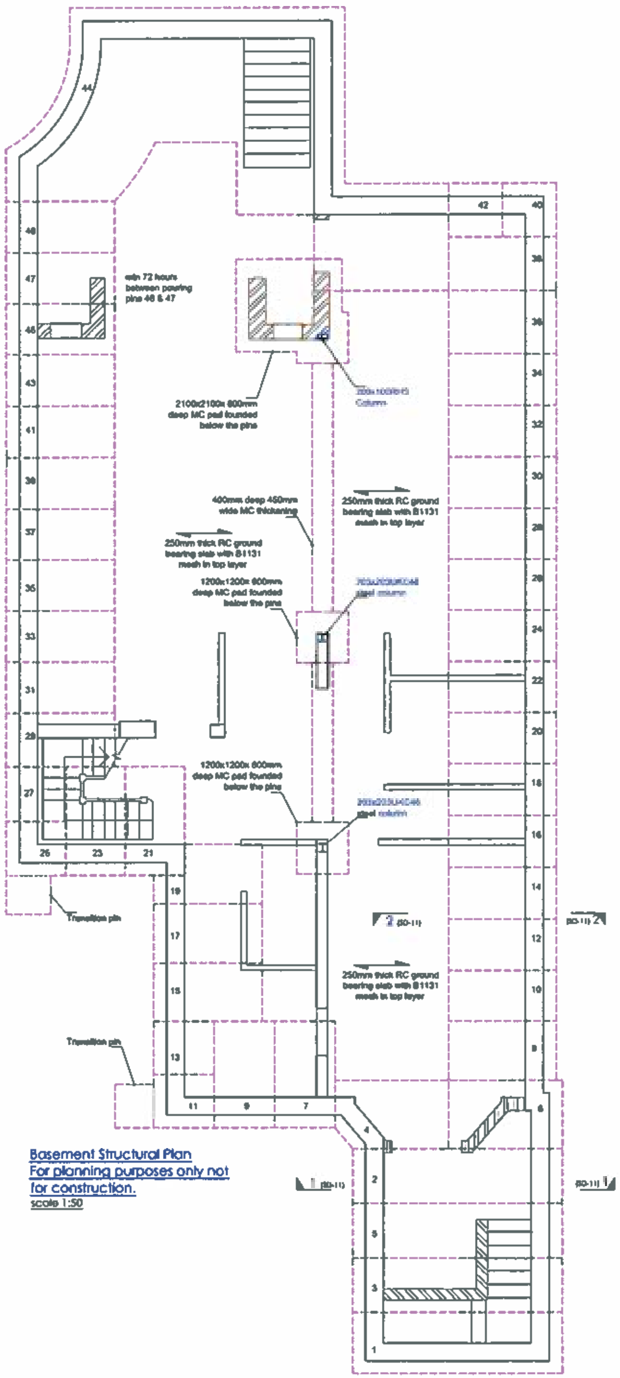
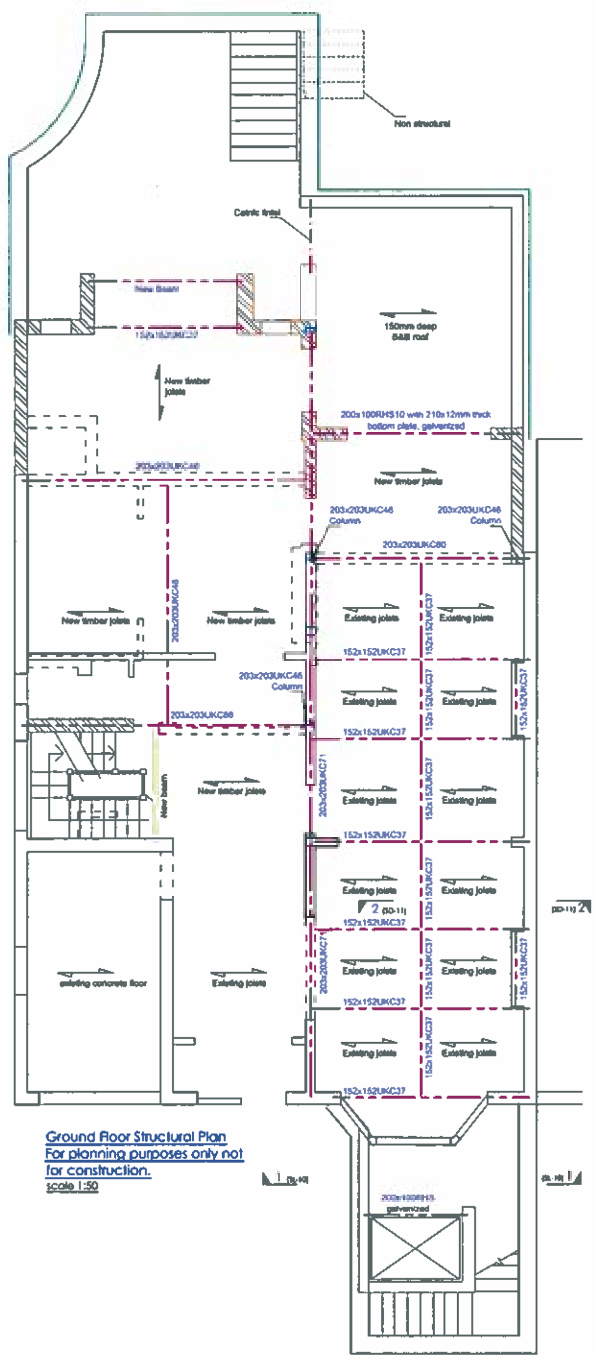
Appendix A

Structural Scheme Drawings

This information is provided for Planning use only and is not to be used for Building control submissions



Basement Structural Plan
For planning purposes only not for construction.
scale 1:50



Ground Floor Structural Plan
For planning purposes only not for construction.
scale 1:50

For Planning Purposes only not for construction

Rev	Date	Amendments
2	05/11/14	Minor alteration to ground floor plan
1	04/11/14	Altered to architect's drawings.
-	27/10/14	First issue for comment

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Client: Francis Bennett
Project: 231 Goldhurst Terrace
Title : Basement and ground floor Plans

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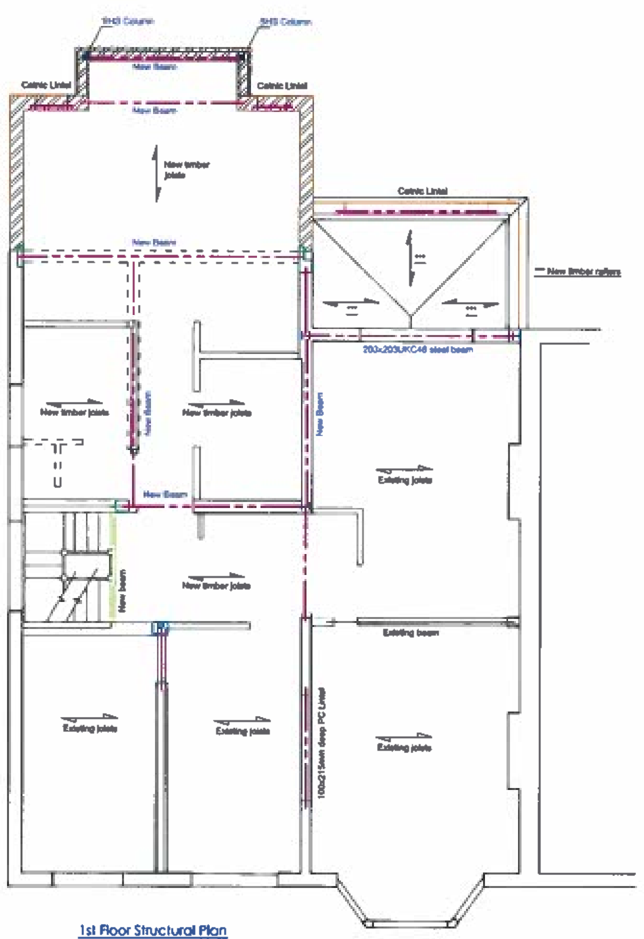
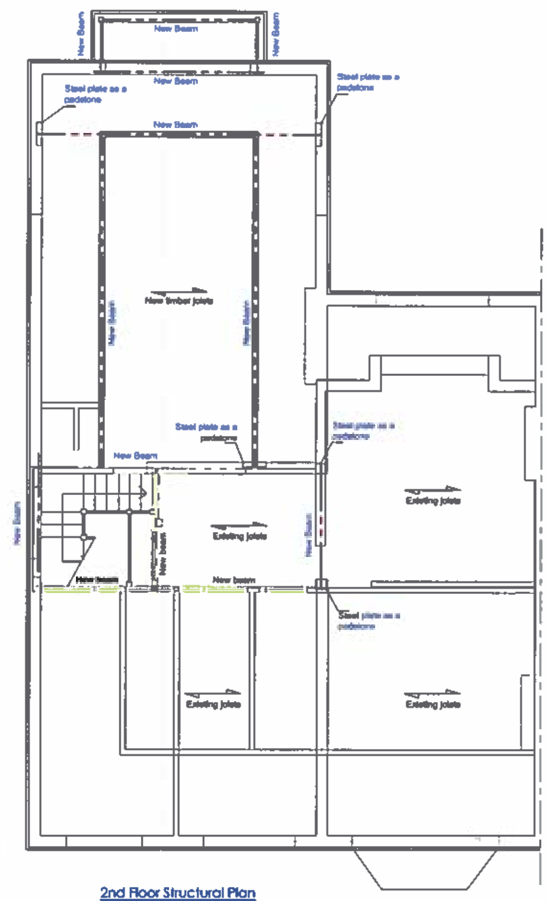
SL-10	2	OCT 14



1st Floor Structural Plan
For planning purposes only not for construction.
scale 1:50



2nd Floor Structural Plan
For planning purposes only not for construction.
scale 1:50

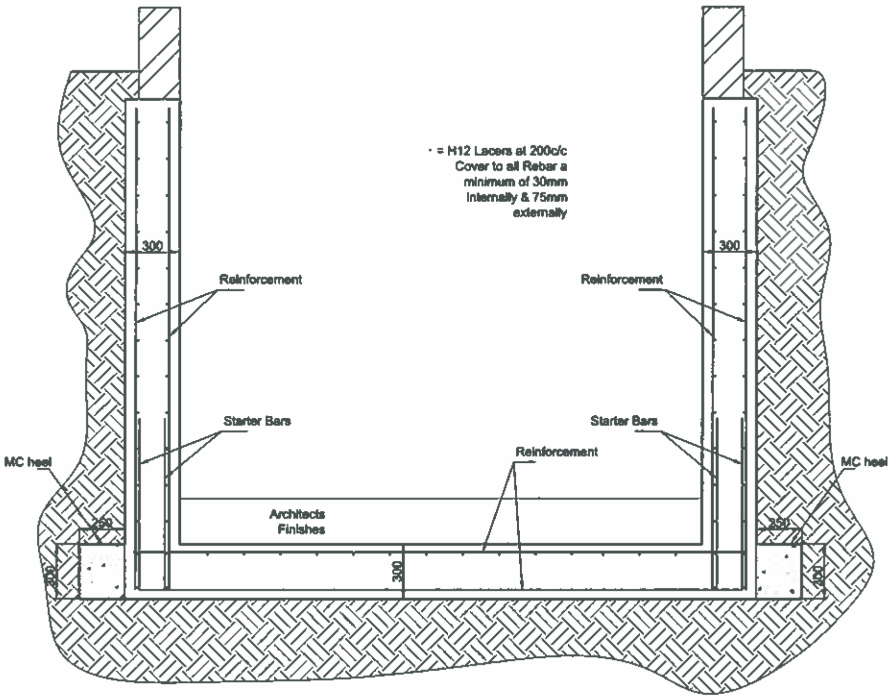
For Planning Purposes only not for construction

Rev	Date	Amendments
-	27/10/14	First issue for comment

Croft Structural Engineers

Client: Francis Bennett
Project: 231 Goldhurst Terrace
Title : 2nd & 1st Floor Plans

141002 | CT | 1:50 (u.n.o.)
SL-20 | - | OCT 14



Section 1-1
For planning purposes only,
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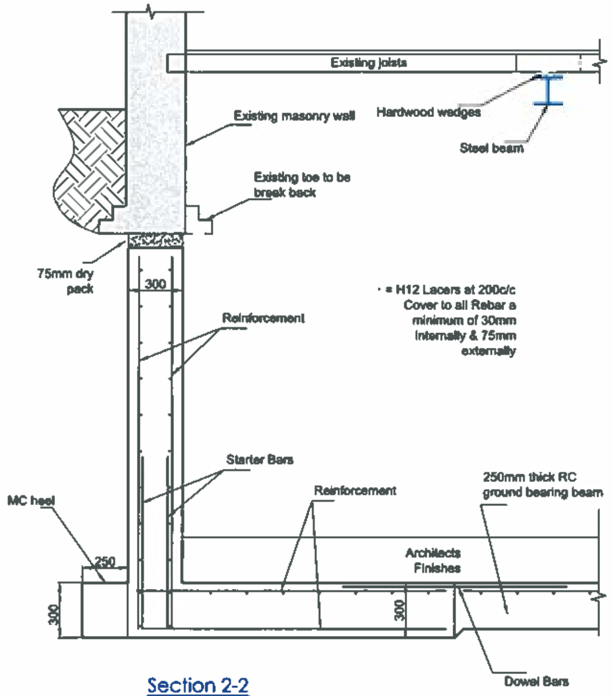
scale 1:20



Section 2-2
For planning purposes only,
not for construction
scale 1:20

For Planning Purposes
only not for construction

Rev	Date	Amendments
1	05/11/14	Section 2-2 altered
-	27/10/14	First Issue for comments

Client: Francis Bennett
Project: 231 Goldhurst Terrace
Title : Structural Sections 1-1 & 2-2

Job nos	date
141002	Oct 14
Dwg Nos SD-11	Rev 1
drawn pr	Chkd CT
Scale 1:50 @ A2	

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Appendix B

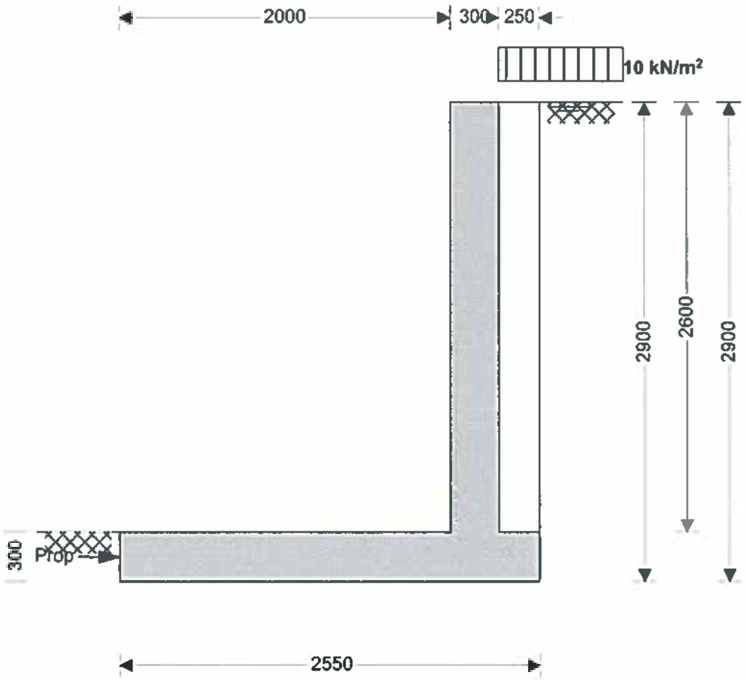
Structural Basement Calculations

This information is provided for Planning use only and is not to be used for Building control submissions

RC retaining wall 1 design

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2600** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **2000** mm	Length of heel	l_{heel} = **250** mm
Overall length of base	l_{base} = **2550** mm	Base thickness	t_{base} = **300** mm
Height of retaining wall	h_{wall} = **2900** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **1650** 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} = **2900** 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} = **2900** mm
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **120** kN/m^2

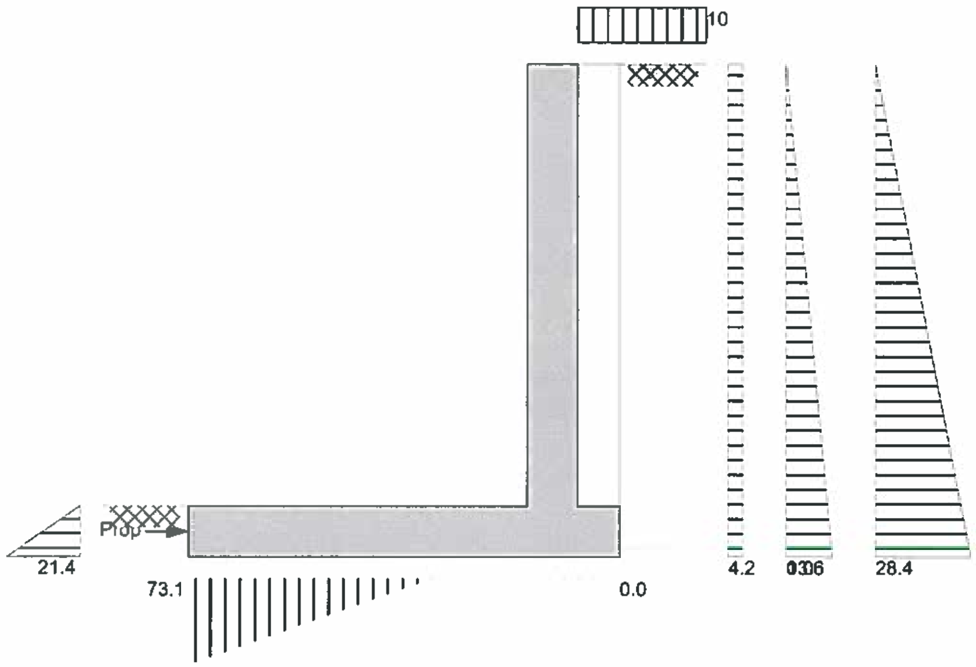
Using Coulomb theory

Active pressure	K_a =**0.419**	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/m²

Calculate propping force

Propping force — F_{prop} = **53.0** kN/m

Check bearing pressure

Total vertical reaction	R = **52.6** kN/m	Distance to reaction	x_{bar} = **480** mm
Eccentricity of reaction	e = **795** mm		

Reaction acts outside middle third of base

Bearing pressure at toe	p_{toe} = **73.1** kN/m²	Bearing pressure at heel	p_{heel} = **0.0** kN/m²

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor	γ_{f_d} = **1.4**	Live load factor	γ_{f_l} = **1.6**
Earth pressure factor	γ_{f_e} = **1.4**		

Calculate propping force

Propping force — F_{prop} = **53.0** kN/m

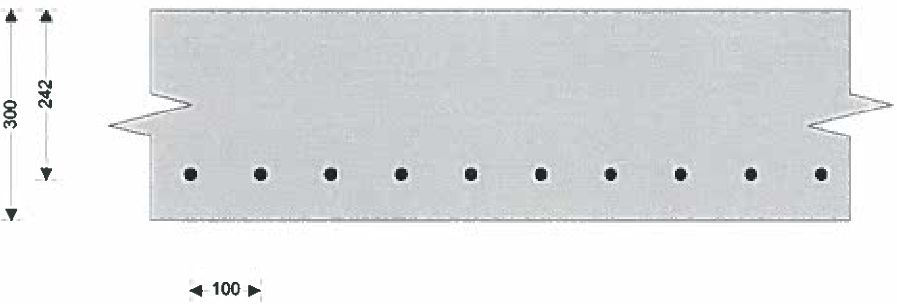
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete	f_{cu} = **35** N/mm²	Strength of reinforcement	f_y = **500** N/mm²

Base details

Minimum reinforcement	k = **0.13** %	Cover in toe	c_{toe} = **50** mm



Design of retaining wall toe

Shear at heel V_{toe} = **54.3 kN/m** Moment at heel M_{toe} = **126.0 kNm/m**

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $A_{s\_toe\_req}$ = **1291.7 mm²/m** Area provided $A_{s\_toe\_prov}$ = **2011** mm²/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.225 N/mm²** Allowable shear stress v_{adm} = **4.733 N/mm²**

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_toe} = **0.754 N/mm²**

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

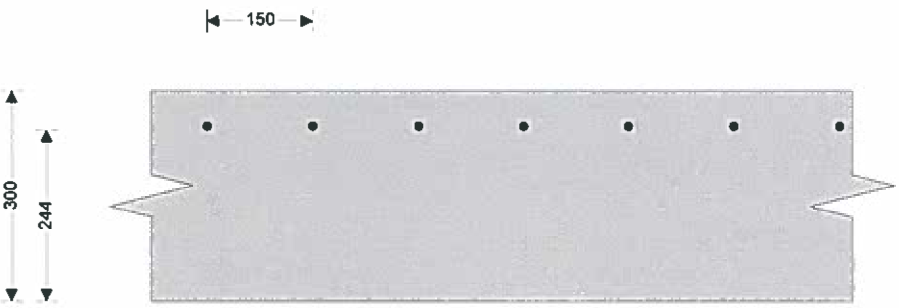
Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Strength of concrete f_{cu} = **35 N/mm²** Strength of reinforcement f_y = **500 N/mm²**

Base details

Minimum reinforcement k = **0.13 %** Cover in heel c_{heel} = **50 mm**



Design of retaining wall heel

Shear at heel V_{heel} = **25.6 kN/m** Moment at heel M_{heel} = **7.1 kNm/m**

Compression reinforcement is not required

Check heel in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required $A_{s\_heel\_req}$ = **390.0 mm²/m** Area provided $A_{s\_heel\_prov}$ = **754** mm²/m

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress v_{heel} = **0.105 N/mm²** Allowable shear stress v_{adm} = **4.733 N/mm²**

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_heel} = **0.541 N/mm²**

v_{heel} < v_{c_heel} - No shear reinforcement required

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

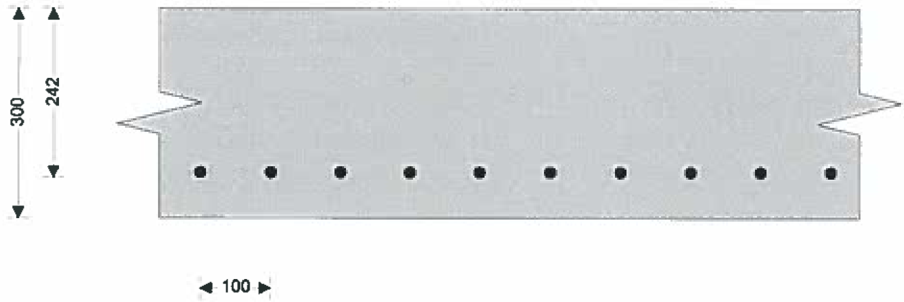
Material properties

Strength of concrete f_{cu} = **35** N/mm² Strength of reinforcement f_y = **500** N/mm²

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **50** mm Cover in wall c_{wall} = **50** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **6.3** kN/m Moment at base of stem M_{stem} = **102.9** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**

Area required $As_{\_stem\_req}$ = **1039.1** mm²/m Area provided $As_{\_stem\_prov}$ = **2011** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

Design shear stress v_{stem} = **0.026** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.754** N/mm²

v_{stem} < v_{c_stem} - No shear reinforcement required

RC retaining wall 2 design

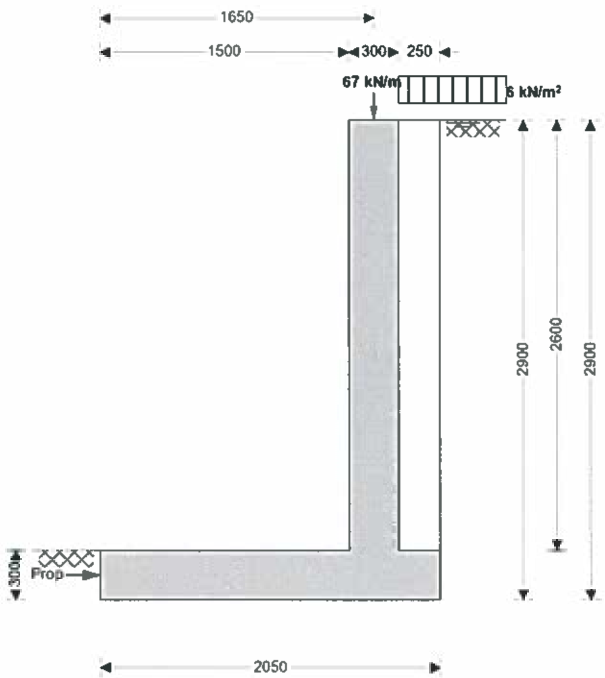
Floor & roof loads doubled to allow for load from neighbouring property.

Loading:

Masonry wall	DLmasonry = 5kN/m^2 × 6.5m = **32.500**kN/m
Timber joists (2nd, 1st, ground floor) DL	DLfloor = 3 × 0.7kN/m^2 × 4.1m / 2 × 2 = **8.610**kN/m
Roof Load DL	DLroof = 1.1kN/m^2 × 4.1m / 2 × 2 = **4.510**kN/m
Total Dead Load	DL = DLmasonry + DLfloor + DLroof = **45.620**kN/m
Timber joists (2nd, 1st, ground floor) LL	LLfloor = 3 × 1.5kN/m^2 × 4.1m / 2 × 2 = **18.450**kN/m
Roof Load DL	LLroof = 0.6kN/m^2 × 4.1m / 2 × 2 = **2.460**kN/m
Total Dead Load	LL = LLfloor + LLroof = **20.910**kN/m

RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



Wall details

Retaining wall type	**Cantilever**		
Height of wall stem	h_{stem} = **2600** mm	Wall stem thickness	t_{wall} = **300** mm
Length of toe	l_{toe} = **1500** mm	Length of heel	l_{heel} = **250** mm
Overall length of base	l_{base} = **2050** mm	Base thickness	t_{base} = **300** mm
Height of retaining wall	h_{wall} = **2900** mm		
Depth of downstand	d_{ds} = **0** mm	Thickness of downstand	t_{ds} = **300** mm
Position of downstand	l_{ds} = **1650** 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} = **2900** 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} = **2900** mm

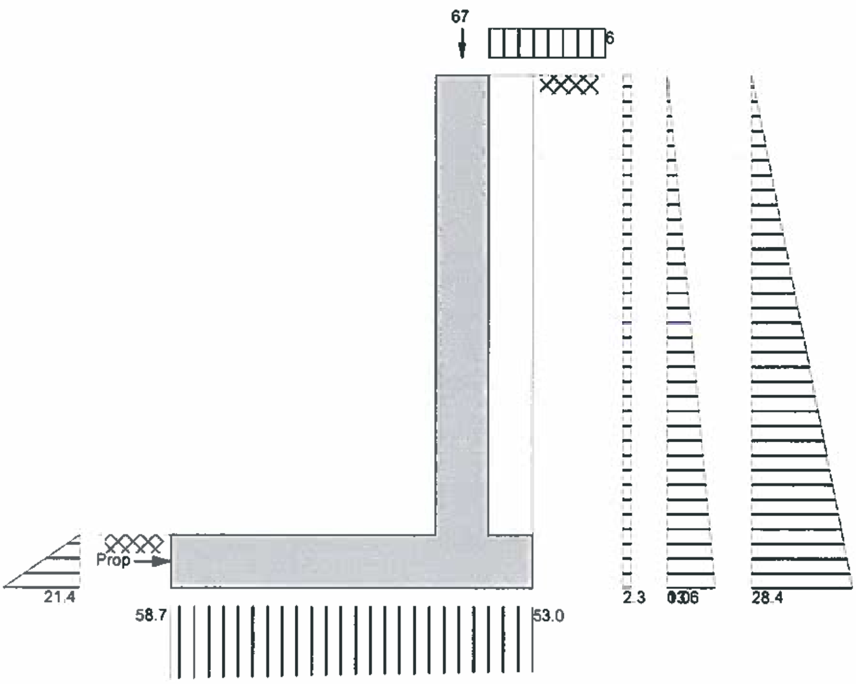
Mobilisation factor	M = **1.5**		
Moist density	γ_m = **18.0** kN/m^3	Saturated density	γ_s = **21.0** kN/m^3
Design shear strength	ϕ' = **24.2** deg	Angle of wall friction	δ = **0.0** deg
Design shear strength	ϕ'_b = **24.2** deg	Design base friction	δ_b = **18.6** deg
Moist density	γ_{mb} = **18.0** kN/m^3	Allowable bearing	$P_{bearing}$ = **120** kN/m^2

Using Coulomb theory

Active pressure	K_a =**0.419**	Passive pressure	K_p = **4.187**
At-rest pressure	K_0 = **0.590**		

Loading details

Surcharge load	Surcharge = **5.5** kN/m^2		
Vertical dead load	W_{dead} = **45.6** kN/m	Vertical live load	W_{live} = **20.9** 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} = **1650** mm	Height of horizontal load	h_{load} = **0** mm



Loads shown in kN/m, pressures shown in kN/m²

Calculate propping force

Propping force	F_{prop} = **33.4** kN/m		

Check bearing pressure

Total vertical reaction	R = **114.5** kN/m	Distance to reaction	x_{bar} = **1008** mm
Eccentricity of reaction	e = **17** mm		

Reaction acts within middle third of base

Bearing pressure at toe	p_{toe} = **58.7** kN/m^2	Bearing pressure at heel	p_{heel} = **53.0** kN/m^2

PASS - Maximum bearing pressure is less than allowable bearing pressure

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor	γ_{f_d} = **1.4**	Live load factor	γ_{f_l} = **1.6**
Earth pressure factor	γ_{f_e} = **1.4**		

(Library item: ULS load factors summary)

Calculate propping force

Propping force F_{prop} = **33.4** kN/m

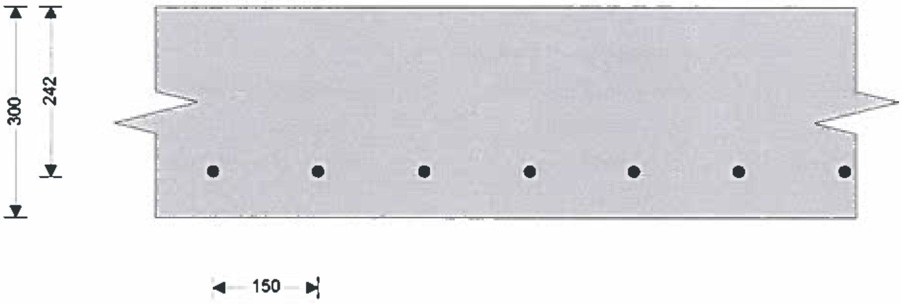
Design of reinforced concrete retaining wall toe (BS 8002:1994)

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} = **50** mm



Design of retaining wall toe

Shear at heel V_{toe} = **116.7** kN/m Moment at heel M_{toe} = **113.1** kNm/m

Compression reinforcement is not required

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required $As_{\_toe\_req}$ = **1150.0** mm^2/m Area provided $As_{\_toe\_prov}$ = **1340** mm^2/m

PASS - Reinforcement provided at the retaining wall toe is adequate

Check shear resistance at toe

Design shear stress v_{toe} = **0.482** 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} = **0.658** N/mm^2

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

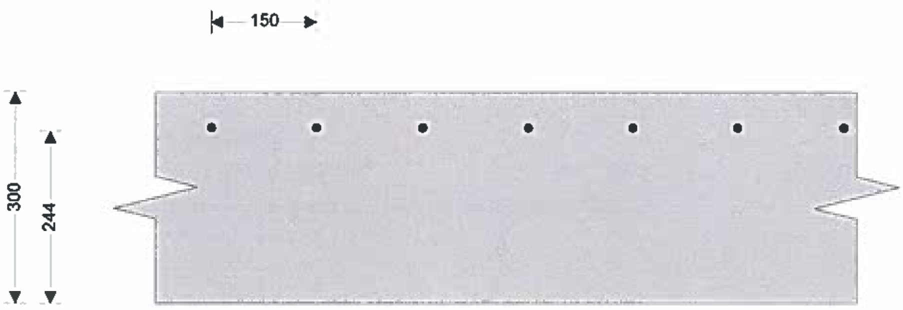
Design of reinforced concrete retaining wall heel (BS 8002:1994)

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 heel c_{heel} = **50** mm



Design of retaining wall heel

Shear at heel V_{heel} = **9.7** kN/m Moment at heel M_{heel} = **2.1** kNm/m

Compression reinforcement is not required

Check heel in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**

Area required As_{heel_req} = **390.0** mm²/m Area provided As_{heel_prov} = **754** mm²/m

PASS - Reinforcement provided at the retaining wall heel is adequate

Check shear resistance at heel

Design shear stress v_{heel} = **0.040** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_heel} = **0.541** N/mm²

$v_{heel} < v_{c\_heel}$ - No shear reinforcement required

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

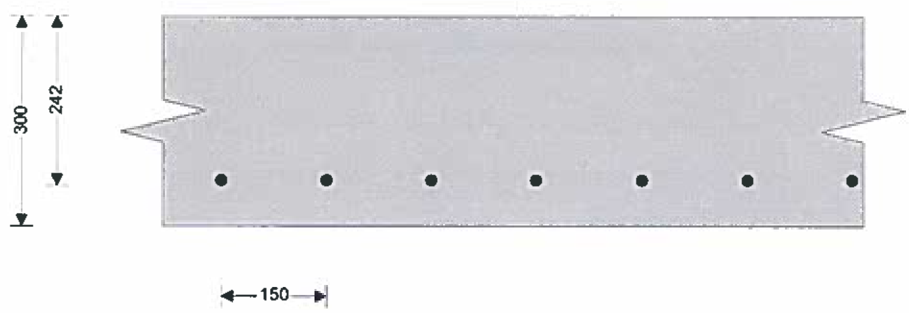
Material properties

Strength of concrete f_{cu} = **35** N/mm² Strength of reinforcement f_y = **500** N/mm²

Wall details

Minimum reinforcement k = **0.13** %

Cover in stem c_{stem} = **50** mm Cover in wall c_{wall} = **50** mm



Design of retaining wall stem

Shear at base of stem V_{stem} = **27.4** kN/m Moment at base of stem M_{stem} = **86.9** kNm/m

Compression reinforcement is not required

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**

Area required As_{stem_req} = **868.8** mm²/m Area provided As_{stem_prov} = **1340** mm²/m

PASS - Reinforcement provided at the retaining wall stem is adequate

Check shear resistance at wall stem

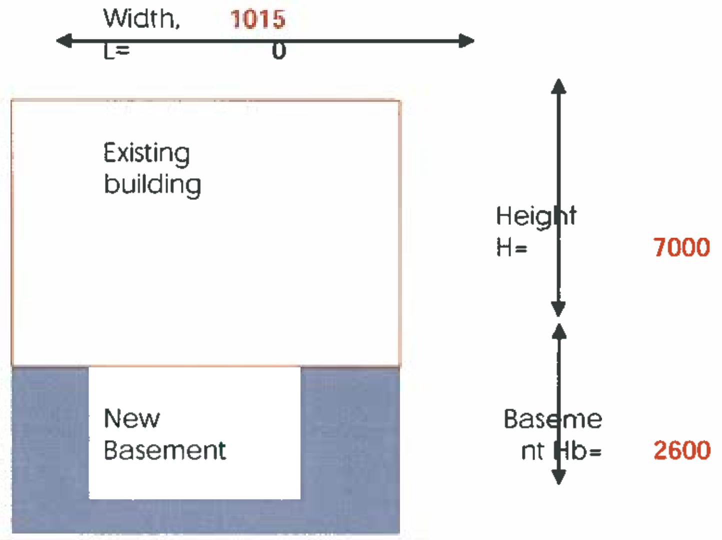
Design shear stress v_{stem} = **0.113** N/mm² Allowable shear stress v_{adm} = **4.733** N/mm²

PASS - Design shear stress is less than maximum shear stress

Concrete shear stress v_{c_stem} = **0.658** N/mm²

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

Horizontal Movement Assessment



L/H = 1.45

Horizontal movement Assessment CIRIA C580: Embedded Retaining walls - Guide to Ecomonic Design

Potential Movement Due to wall installation

Horizontal surface movement = 0.05%

Delta H = 0.05% x 2600 = 1.3 mm

Vertical Surface Movement = 0.05% 1.3

Delta V = 0.05% x 2600 = 1.3 mm = 0.33333 mm/m

Distance behind wall wall to neglibible movement

lh = 2600 x 1.5 = 3900 mm

Potential Movement Due to wall Excavation

Horizontal surface movement = 0.15% 3.9

Delta H = 0.15% x 2600 = 3.9 mm

= 0.375 mm/m

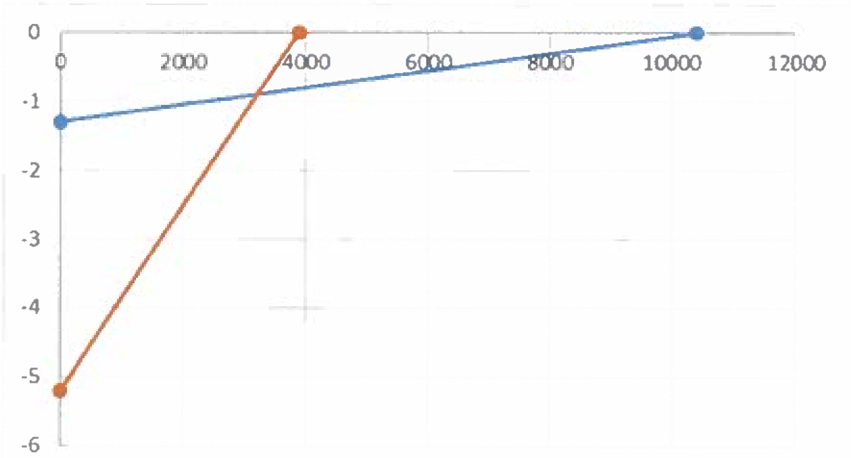
Vertical Surface Movement = 0.10%

Delta V = 0.10% x 2600 = 2.6 mm

Distance behind wall wall to neglibible movement

lh = 2600 x 4 = 10400 mm

	Excavation movement		Installation movement	
	Distance	delta V	Distance	delta V
Nodes x	10400	0	3900	0
y	0	-1.3	0	-5.2



Determine Horizontal Movement

delta l = 5.2 mm / 10400 mm = 0.05%

Table 2.4 CIRIA C580

Category of Damage	Normal Degree	Limiting Tensile Strain %		
0	Negligible	0.00%	-	0.05%
1	Very slight	0.05%	-	0.075 %
2	Slight	0.075%	-	0.15%
3	Moderate	0.15%	-	0.30%
4 to 5	Severe to Very Server		>	0.30%
5				

Anticipated Damage May be Categorised as **"Negligible to Slight Category 0-1"**

CROFT STRUCTURAL ENGINEERS

Appendix C

Method Statement

Job Number: 141002
Date: 27th October 2014

CROFT STRUCTURAL ENGINEERS

231 Goldhurst Terrace

Revision	Date	Comments
-	27/10/14	First Issue for Comment

1. Basement Formation Suggested Method Statement.

1.1. This method statement provides an approach which will allow the basement design to be correctly considered during construction, and the temporary support to be provided during the works. The contractor is responsible for the works on site and the final temporary works methodology and design on this site and any adjacent sites.

1.2. This method statement 231 Goldhurst Terrace has been written by a Chartered Engineer and in accordance with the recommendations stated in the Royal Borough of Kensington and Chelsea Town Planning policy on Subterranean Development & Camden New Basement Development Guidance Notes. The sequencing has been developed considering guidance from ASUC.

1.3. This method has been produced to allow for improved costings and for inclusion in the party wall Award. Should the contractor provide alternative methodology the changes shall be at their own costs, and an Addendum to the Party Wall Award will be required.

1.4. Contact party wall surveyors to inform them of any changes to this method statement.

1.5. The approach followed in this design is; to remove load from above and place loads onto supporting steelwork, then to cast cantilever retaining walls in underpin sections at the new basement level.

1.6. The cantilever pins are designed to be inherently stable during the construction stage without temporary propping to the head. The base benefits from propping, this is provided in the final condition by the ground slab. In the temporary condition the edge of the slab is buttressed against the soil in the middle of the property, also the skin friction between the concrete base and the soil provides further resistance. The central slab is to be poured in a maximum of a 1/3 of the floor area.

1.7. A soil investigation has been undertaken. The soil conditions are London clays.

1.8. The bearing pressures have been limited to 120kN/m^2. This is standard loadings for local ground conditions and acceptable to building control and their approvals.

2. Enabling works

2.1. The site is to be hoarded with ply sheet to 2.2m to prevent unauthorised public access.

2.2. Licenses for Skips and conveyors to be posted on hoarding

3. Basement Sequencing

3.1. Excavate Light well to front of property down to 600mm below external ground level.

3.2. Excavate first front corner of light well. (Follow methodology in section 4)

3.3. Excavate second front corner of light well. (Follow methodology in section 4)

3.4. Continue excavating section pins to form front light well. (Follow methodology in section 4)

3.5. Place cantilevered retaining wall to the left side of front opening. After 72 hours place cantilevered retaining wall to the right side of front opening.

3.6. Needle and prop bay/front wall. Insert support

3.7. Excavate out first 1.2m around front opening prop floor and erect conveyor.

3.8. Continue cantilevered wall formation around perimeter of basement following the numbering sequence on the drawings.

3.8.1. Excavation for the next numbered sections of underpinning shall not commence until at least 8 hours after drypacking of previous works. Excavation of adjacent pin to not commence until 24 hours after drypacking. (24hours possible due to inclusion of Conbextra 100 cement accelerator to dry pack mix)

3.8.2. Floor over to be propped as excavations progress. Steelwork to support Floor to be inserted as works progress.

3.9. Excavate a maximum of a 1/3 of the middle section of basement floor. Place reinforcement to central section of ground bearing slab and pour concrete. Excavate next third and cast slab. Excavate and cast final third and cast.

3.10. Provide structure to ground floor and water proofing to retaining walls as required.

4. Underpinning - Cantilevered Wall Creation

4.1. Excavate first section of retaining wall (no more than 1200mm wide). Where excavation is greater than 1.2m deep provide temporary propping to sides of excavation to prevent earth collapse (Health and Safety). A 1200mm width wall has a lower risk of collapse to the heel face.

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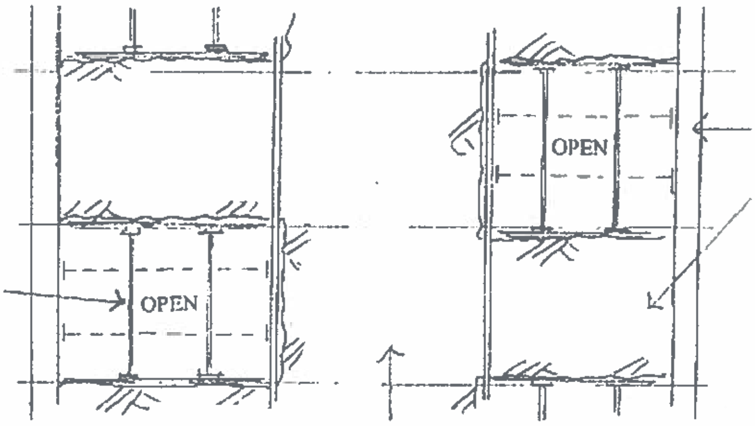
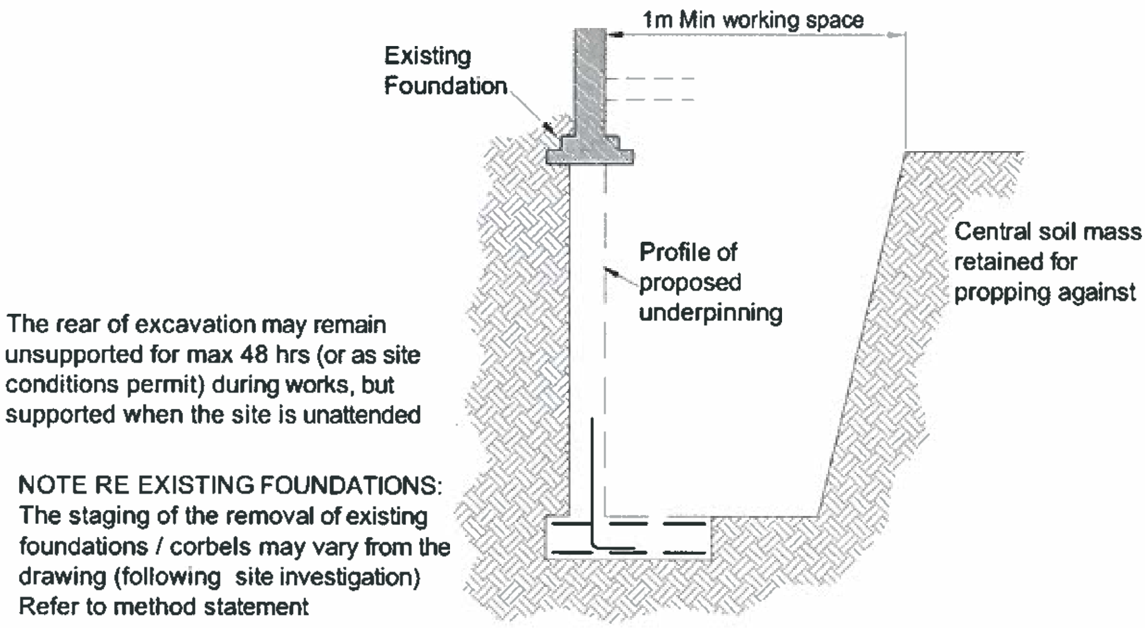


Figure 2 – Schematic Plan view of Soil Propping

Figure 3 Propping



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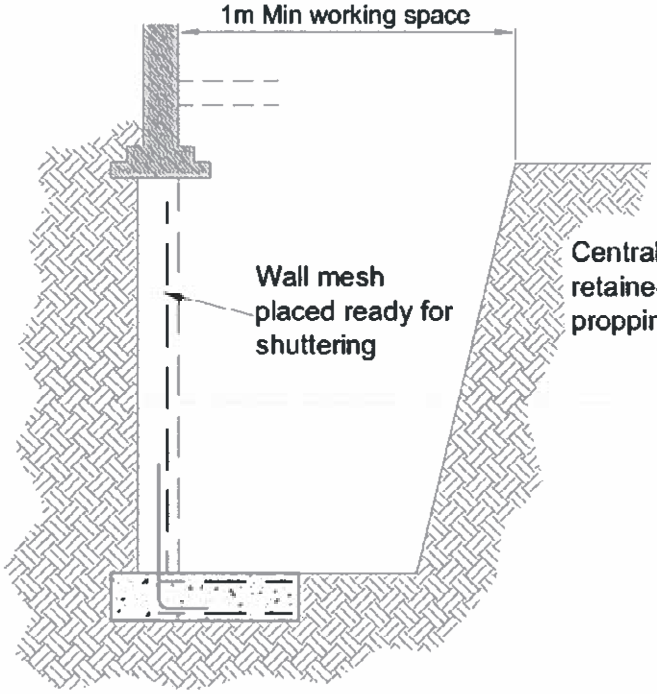
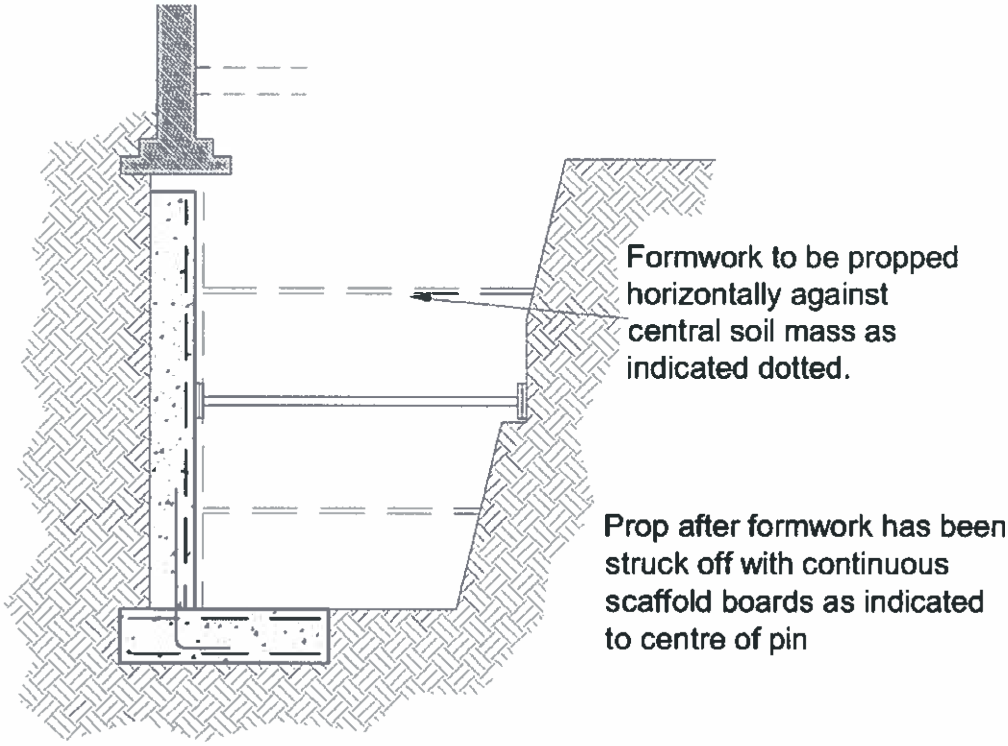
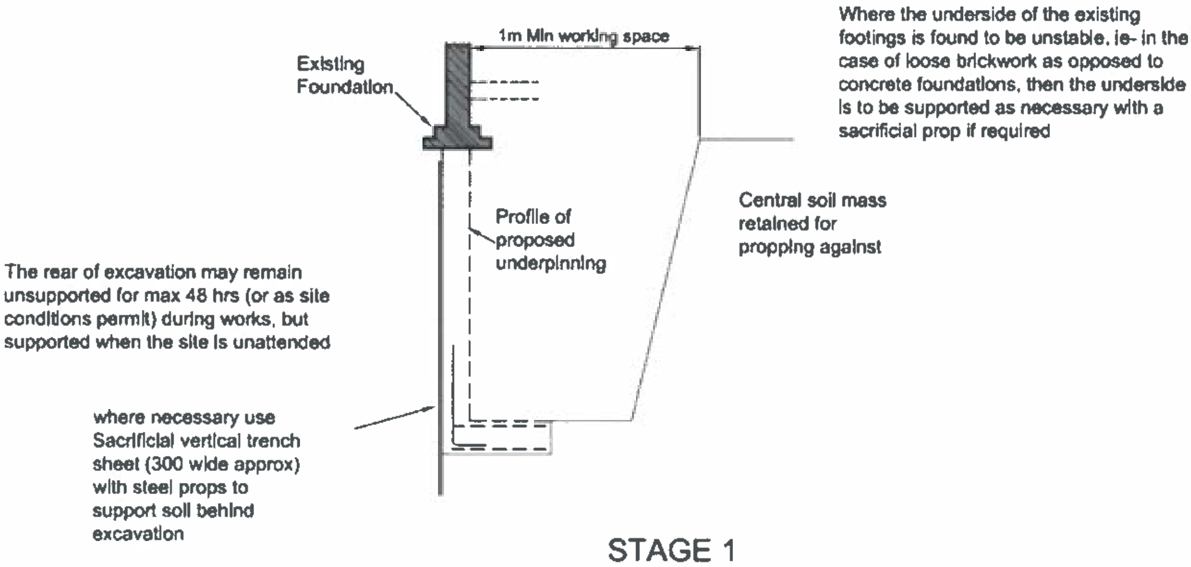
Where the underside of the existing footings is found to be unstable. ie- in the case of loose brickwork as opposed to concrete foundations, then the underside is to be supported as necessary with a sacrificial prop if required



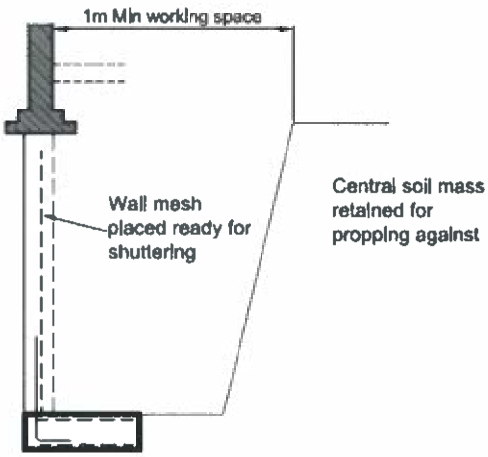


CLAY SOILS - STAGE 3

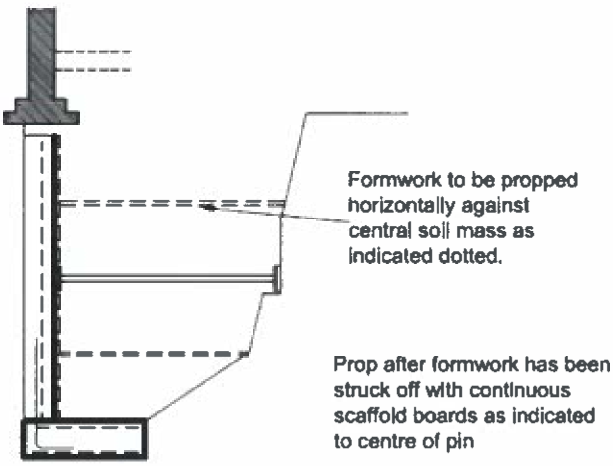
Granular soils:



STAGE 1

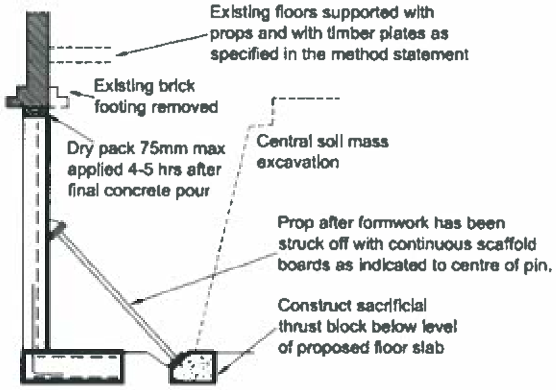


STAGE 2



STAGE 3

Image of Stage 3 on Site



STAGE 4

4.1.1. Where soft spots are encountered back prop with Precast lintels or trench sheeting. Where voids are present behind the lintels (or trench sheeting) grout behind. Prior to casting place layer of DPM between PC lintels (or trench sheeting) and new concrete. The lintels are to be cut into the soil by 150mm either side of the pin. A site stock of a minimum of 10 lintels to be present for to prevent delays due to ordering. . .

4.1.2. If the soil support to the ends of the lintels is insufficient then brace the ends of the PC lintels with 150x150 C24 Timbers and prop with Acrows diagonally back to the floor.

4.2. Visually inspect the footings and provide propping to local brickwork, if necessary props to be sacrificial and cast into the retaining wall.

4.3. Provide propping to floor where necessary.

4.4. Excavate base. Mass concrete heels to be excavated. If soil over unstable prop top with PC lintel and sacrificial prop.

4.5. Clear underside of existing footing.

4.6. Local authority inspection to be carried for approval of excavation base.

4.7. Place blinding.

4.8. Place reinforcement for retaining wall base & toe. Site supervisor to inspect and sign off works for proceeding to next stage.

4.9. Cast base. (on short stems it is possible to cast base and wall at same time)

4.10. Take 2 cubes of concrete and store for testing. Test one at 28 days if result is low test second cube. Provide results to client and design team on request or if values are below those required.

4.11. Horizontal temporary prop to base of wall to be inserted. Alternatively cast base against soil.

4.12. Place reinforcement for retaining wall stem. Site supervisor to inspect and sign off works for proceeding to next stage.

4.13. Drive H16 Bars UBars into soil along centre line of stem to act as shear ties to adjacent wall.

4.14. Place shuttering & pour concrete for retaining wall. Stop a minimum of 75mm from the underside of existing footing. Take 2 cubes of concrete and store for testing

4.15. Ram in drypack between retaining wall and existing masonry. (24 hours after pouring the concrete pin the gap shall be filled using a dry pack mortar.)

4.16. Trim back existing masonry corbel and concrete on internal face.

4.17. Site supervisor to inspect and sign off for proceeding to the next stage.

5. Approval

5.1. Building control officer/approved inspector to inspect pin bases and reinforcement prior to casting concrete.

5.2. Contractor to keep list of dates pins inspected & cast

5.3. One month after work completed the contractor is to contact adjacent party wall surveyor to attend site and complete final condition survey and to sign off works.

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This calcualtion has been provided for the trench sheet and prop design of standard underpins in the temporary condition. There are gaps left between the sheeting and as such no water pressure will occur. Any water present will flow through the gaps betweenthe sheeting and will be required to pump out.

Trecnh sheets should be placed at centers to deal with the ground. It is expected that the soil between the trench sheeting will arch. Looser soil will required tighter centers. It is typical for udnerpins to be placed at 1200c/c, in this condition the highest load on a trench sheet is when 2 nos trench sheets are used. It is for this design that these calculations have been provided.

Soil and ground conditions are variable. Typically one finds that in the temporary condition clays are more stable and the C_u (cohesive) values in clay reduce the risk of collapse. It is this cohesive nature that allows clays to be cut into a vertical slope. For these calculations weak snad and gravels have been assummed The soil properties are:

Surcharge	sur = **10.** kN/m^2	
Soil density	δ = **20** kN/m^3	
Angle of friction	ϕ = **25** °	
Soil depth	Dsoil = **3000.000** mm	
	$k_a = (1 - \sin(\phi)) / (1 + \sin(\phi))$	= **0.406**
	$k_p = 1 / k_a$	= **2.464**
Soil Pressure bottom	soil = $k_a * \delta *$ Dsoil	= **21.916**kN/m^2
Surcharge pressure	surcharge = sur * k_a	= **4.059** kN/m^2

Standard Lap Trench Sheeting

STANDARD LAP

The overlapping trench sheeting profile is designed primarily for construction work and also temporary deployment.

Technical Information

Effective width per sheet (mm)	330
Thickness (mm)	3.4
Depth (mm)	35
Weight per linear metre (kg/m)	10.8
Weight per m² (kg)	32.9
Section modulus per metre width (cm³)	48.3
Section modulus per sheet (cm³)	15.9
I value per metre width (cm⁴)	81.7
I value per sheet (cm⁴)	26.9
Total rolled metres per tonne	92.1

Sxx = 15.9 cm^3
py = 275N/mm^2
Ixx = 26.9cm^4
A = (1m^2 * 32.9kg/m^2) / (330mm * 7750kg/m^3) = **12864.125**mm^2

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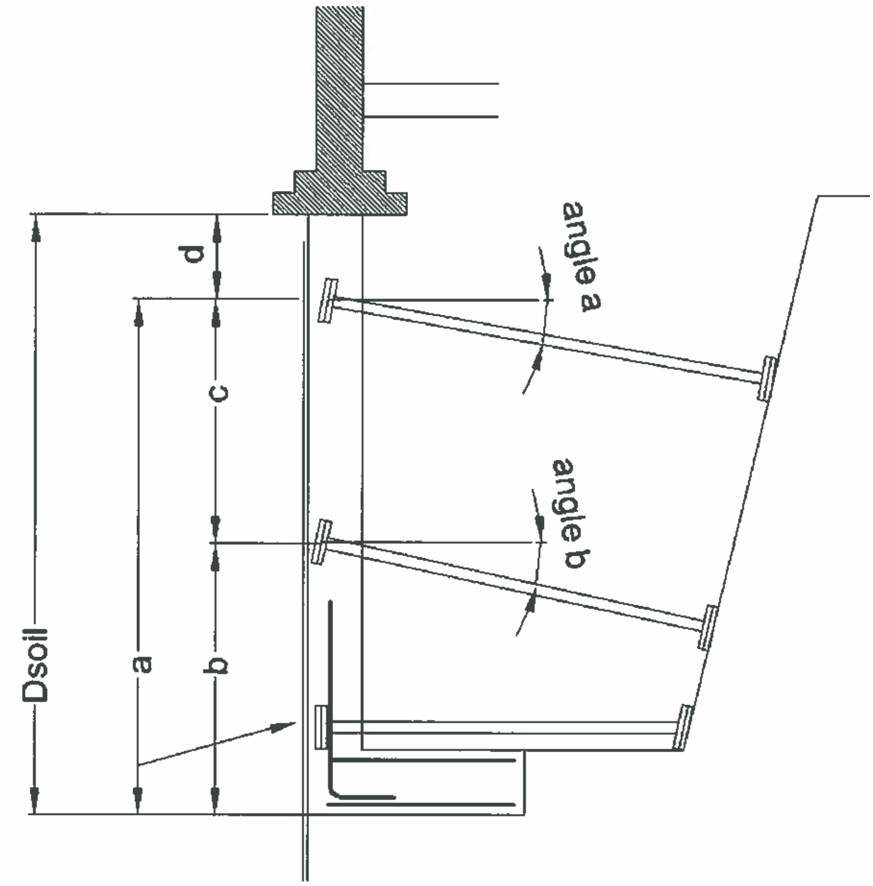
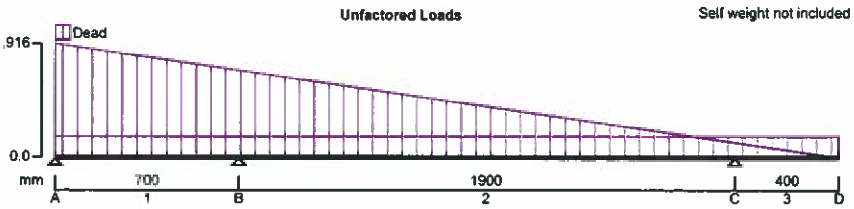


Length a — a = **2.600** m

Length b bottom — b = **0.700** m

Length c Middle — c = a – b = **1.900**m

Length d top — d = Dsoil – a = **0.400**m



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **3**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 — Material density = **7860** kg/m^3

Support Conditions:

Support A	Vertically **"Restrained"**	Rotationally **"Free"**
Support B	Vertically **"Restrained"**	Rotationally **"Free"**
Support C	Vertically **"Restrained"**	Rotationally **"Free"**

Support D	Vertically **"Free"**		Rotationally **"Free"**

Span Definitions:

Span 1	Length = **700** mm	Cross-sectional area = **12864** mm^2	Moment of inertia = **269.×10^3** mm^4
Span 2	Length = **1900** mm	Cross-sectional area = **12864** mm^2	Moment of inertia = **269.×10^3** mm^4
Span 3	Length = **400** mm	Cross-sectional area = **12864** mm^2	Moment of inertia = **269.×10^3** mm^4

LOADING DETAILS

Beam Loads:

Load 1 UDL Dead load **4.1** kN/m

Load 2 VDL Dead load **21.9** kN/m to **0.0** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1×Dead

Span 2 1×Dead

Span 3 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Unfactored support reactions

	Dead (kN)							
Support A	**-1.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Support B	**-32.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Support C	**-10.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Support D	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Support Reactions - Combination Summary

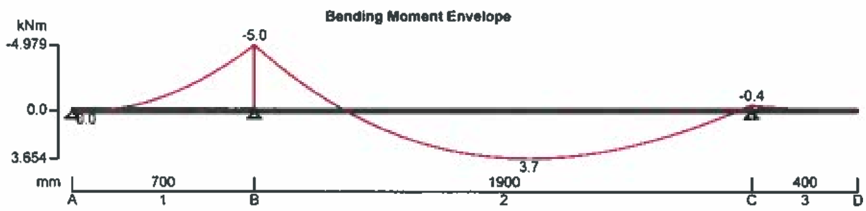
Support A	Max react = **-1.4** kN	Min react = **-1.4** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support B	Max react = **-32.8** kN	Min react = **-32.8** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support C	Max react = **-10.8** kN	Min react = **-10.8** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support D	Max react = **0.0** kN	Min react = **0.0** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm

Beam Max/Min results - Combination Summary

Maximum shear = **17.8** kN — Minimum shearF_{min} = **-15.0** kN

Maximum moment = **3.7** kNm — Minimum moment = **-5.0** kNm

Maximum deflection = **21.0** mm — Minimum deflection = **-14.3** mm



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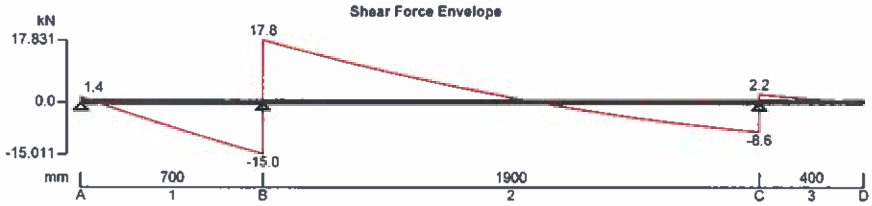


Number of sheets Nos = 2

Mallowable = Sxx * py * Nos = **8.745**kNm

SRU 4-0

Safe working loads for Acrow Props — loads given in kN

For normal purposes 1 kilo Newton (kN) = 100 kg	Height m / ft	2.0 / 6.6	2.25 / 7.4	2.5 / 8.2	2.75 / 9.0	3.0 / 9.8	3.25 / 10.7	3.5 / 11.5	3.75 / 12.3	4.0 / 13.1	4.25 / 13.9	4.5 / 14.8	4.75 / 15.6
TABLE A Props loaded concentrically and erected vertically	Prop size 1 or 2	35	35	35	34	27	23						
	Prop size 3				34	27	23	21	19	17			
	Prop size 4						32	25	21	18	16	14	12
TABLE B Props loaded concentrically and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	35	32	26	23	19	17	15	13	12			
	Prop size 4						24	19	15	12	11	10	9
TABLE C Props loaded 25 mm eccentricity and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	17	17	17	17	15	13	11	10	9			
	Prop size 4						17	14	11	10	9	8	7
TABLE D Props loaded concentrically and erected 1½° out of vertical and laced with scaffold tubes and fittings	Prop size 3				35	33	32	28	24	20			
	Prop size 4						35	35	35	35	27	25	21

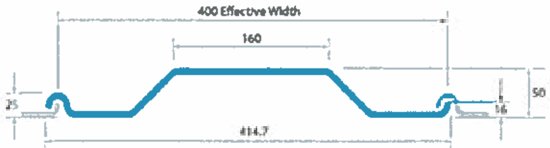
Shear V = (14.6kN + 13.4kN) /2 = 14.000kN

Any Acro Prop is accetpable

KD4 sheets

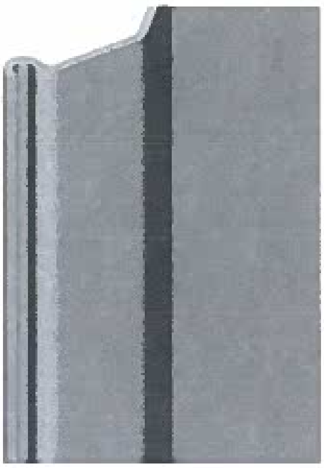
KD4

The overlapping trench sheeting profile is a heavier version of the Standard Lap, with a wider gauge and width coverage, designed in large for construction work.



Technical Information

Effective width per sheet (mm)	400
Thickness (mm)	6.0
Depth (mm)	50
Weights per linear metre (kg/m)	21.90
Weights per m² (kg)	55.2
Section modulus per metre width (cm³)	101
Section modulus per sheet (cm³)	40.34
I value per metre width (cm⁴)	250
I value per sheet (cm⁴)	101
Total rolled metres per tonne	45.659



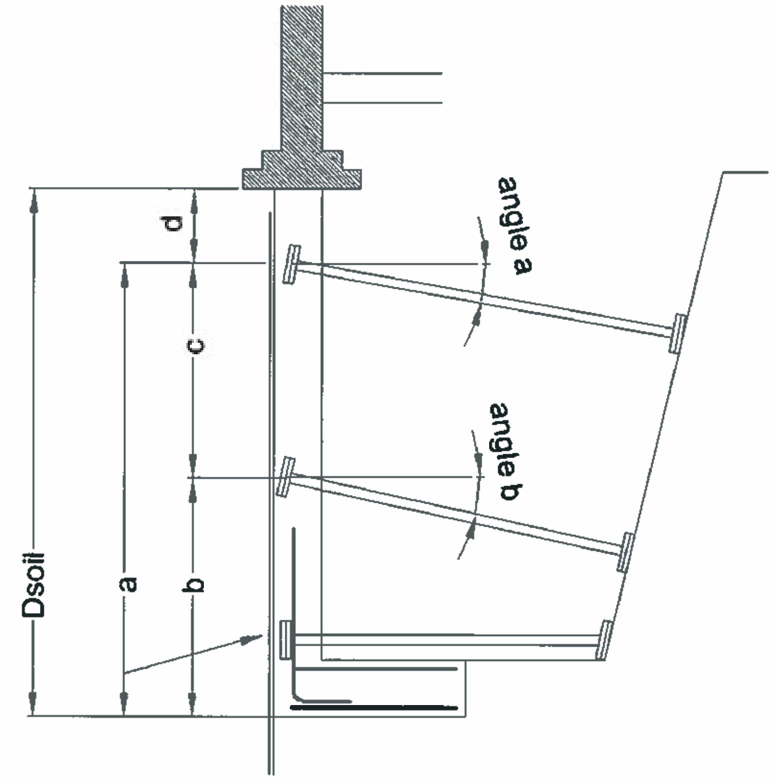
$Sxx = 48.3cm^3$

$py = 275N/mm^2$

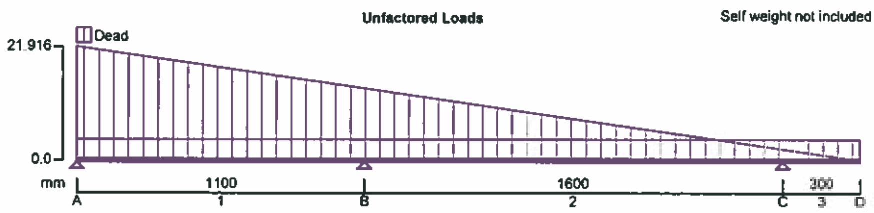
$Ixx = 26.9cm^4$

$A = (1m^2 * 55.2kg/m^2) / (400mm * 7750kg/m^3) =$ **17806.452**mm^2

CROFT STRUCTURAL ENGINEERS



Length a	a = **2.700** m
Length b bottom	b = **1.100** m
Length c Middle	c = a – b = **1.600**m
Length d top	d = Dsoil – a = **0.300**m



CONTINUOUS BEAM ANALYSIS - INPUT

BEAM DETAILS

Number of spans = **3**

Material Properties:

Modulus of elasticity = **205** kN/mm^2 Material density = **7860** kg/m^3

Support Conditions:

Support A	Vertically **"Restrained"**	Rotationally **"Free"**
Support B	Vertically **"Restrained"**	Rotationally **"Free"**
Support C	Vertically **"Restrained"**	Rotationally **"Free"**
Support D	Vertically **"Free"**	Rotationally **"Free"**

Span Definitions:

Span 1	Length = **1100** mm	Cross-sectional area = **17806** mm^2	Moment of inertia = **269.×10^3** mm^4
Span 2	Length = **1600** mm	Cross-sectional area = **17806** mm^2	Moment of inertia = **269.×10^3** mm^4

Span 3 Length = **300** mm Cross-sectional area = **17806** mm^2 Moment of inertia = **269.×10^3** mm^4

LOADING DETAILS

Beam Loads:

Load 1 VDL Dead load **21.9** kN/m to **0.0** kN/m

Load 2 UDL Dead load **4.1** kN/m

LOAD COMBINATIONS

Load combination 1

Span 1 1×Dead

Span 2 1×Dead

Span 3 1×Dead

CONTINUOUS BEAM ANALYSIS - RESULTS

Support Reactions - Combination Summary

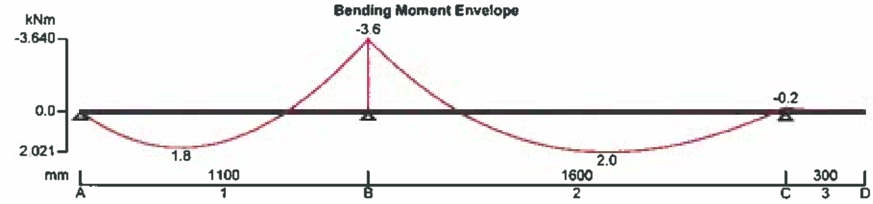
Support A	Max react = **-9.5** kN	Min react = **-9.5** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support B	Max react = **-28.0** kN	Min react = **-28.0** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support C	Max react = **-7.5** kN	Min react = **-7.5** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm
Support D	Max react = **0.0** kN	Min react = **0.0** kN	Max mom = **0.0** kNm	Min mom = **0.0** kNm

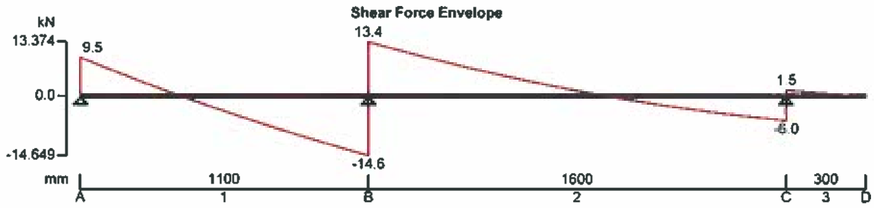
Beam Max/Min results - Combination Summary

Maximum shear = **13.4** kN Minimum shearF_{min} = **-14.6** kN

Maximum moment = **2.0** kNm Minimum moment = **-3.6** kNm

Maximum deflection = **7.7** mm Minimum deflection = **-4.9** mm





Number of sheets Nos = 2

Mallowable = Sxx * py * Nos = **26.565**kNm

SRU 4.0

Safe working loads for Acrow Props — loads given in kN

For normal purposes 1 kilo Newton (kN) = 100 kg	Height m / ft	2.0 / 6.6	2.25 / 7.4	2.5 / 8.2	2.75 / 9.0	3.0 / 9.8	3.25 / 10.7	3.5 / 11.5	3.75 / 12.3	4.0 / 13.1	4.25 / 13.9	4.5 / 14.8	4.75 / 15.6
TABLE A Props loaded concentrically and erected vertically	Prop size 1 or 2	35	35	35	34	27	23						
	Prop size 3				34	27	23	21	19	17			
	Prop size 4						32	25	21	18	16	14	12
TABLE B Props loaded concentrically and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	35	32	26	23	19	17	15	13	12			
	Prop size 4						24	19	15	12	11	10	9
TABLE C Props loaded 25 mm eccentricity and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	17	17	17	17	15	13	11	10	9			
	Prop size 4						17	14	11	10	9	8	7
TABLE D Props loaded concentrically and erected 1½° out of vertical and laced with scaffold tubes and fittings	Prop size 3				35	33	32	28	24	20			
	Prop size 4						35	35	35	35	27	25	21

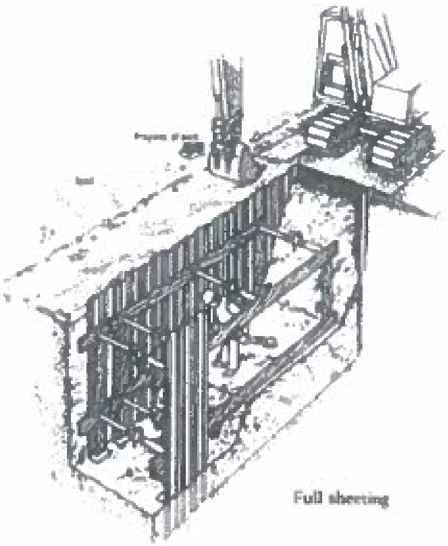
Shear V = (14.6kN + 13.4kN) /2 = 14.000kN

Any Acro Prop is accetpable

Sheeting requirements

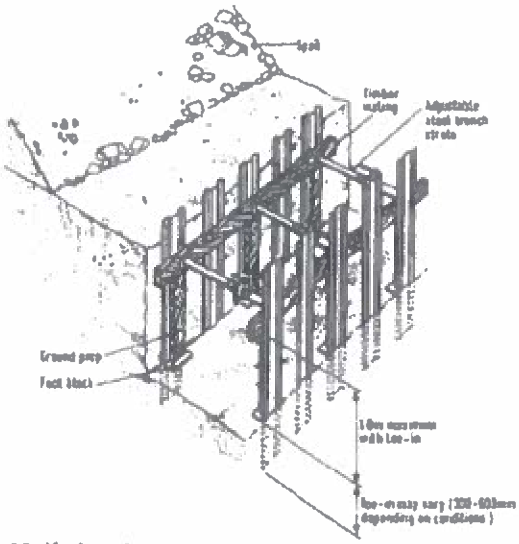
Ground Type	Trench Depth, D: less than 1.2m(1)	1.2 to 3m	3 to 4.5m	4.5 to 6m
Sands and gravels Silt Soft Clay High compressibility Peat	Close, ½, ¼, ⅛ or nil	Close	Close	Close
Firm/stiff Clay Low compressibility Peat	¼, ⅛ or nil	½ or ¼	½ or ¼	Close or ½
Rock(2)	From ½ for incompetent rock to nil for competent rock(3)			

Sheeting requirements



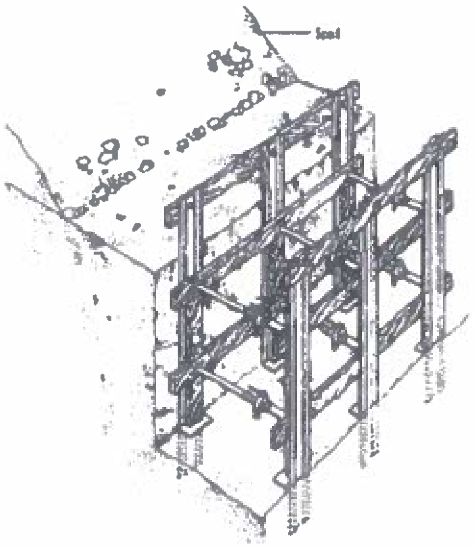
Full sheeting

Sheeting requirements



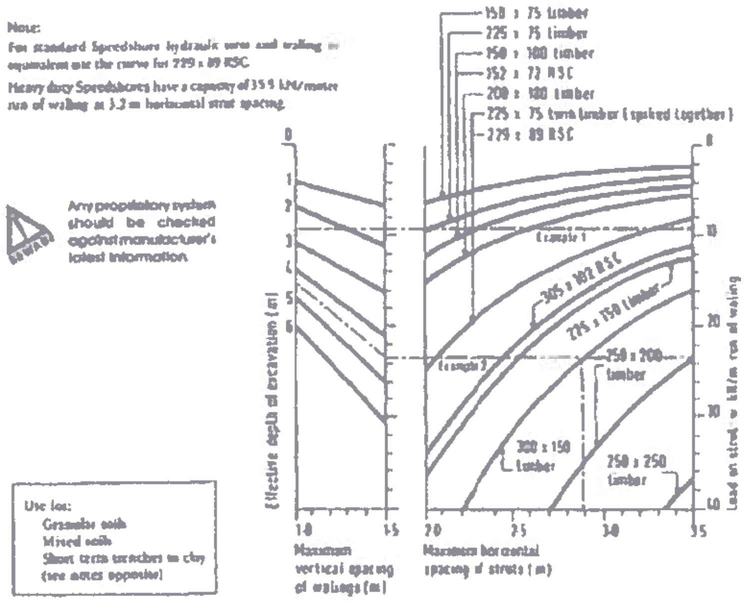
Half sheeting
shown for 1.5 m deep trench

Sheeting requirements



Quarter sheeting

Design to CIRIA 97



CROFT STRUCTURAL ENGINEERS

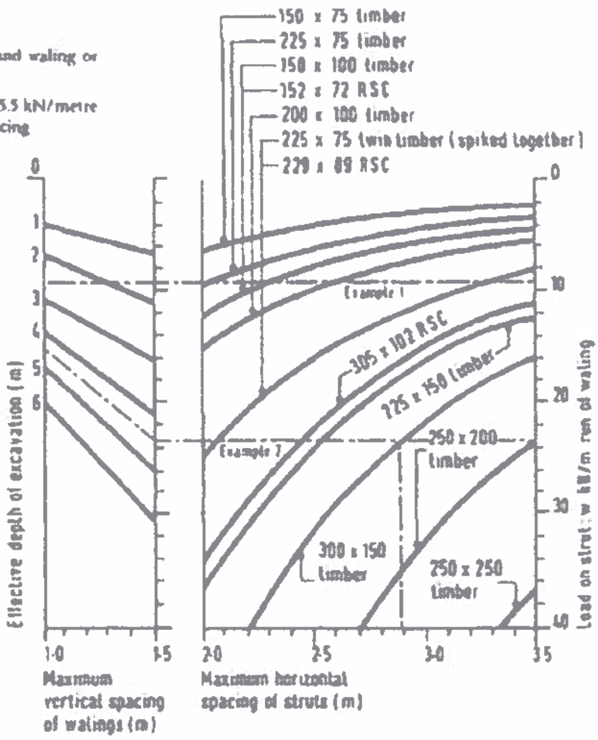
Note:

For standard Speedshore hydraulic strut and waling or equivalent use the curve for 229 x 89 RSC

Heavy duty Speedshores have a capacity of 35.5 kN/metre run of waling at 3.2 m horizontal strut spacing

BEWARE

Any proprietary system should be checked against manufacturer's latest information



Use for:
- Granular soils
- Mixed soils
- Short term trenches in clay (see notes opposite)