

LOWER GROUND FLOOR

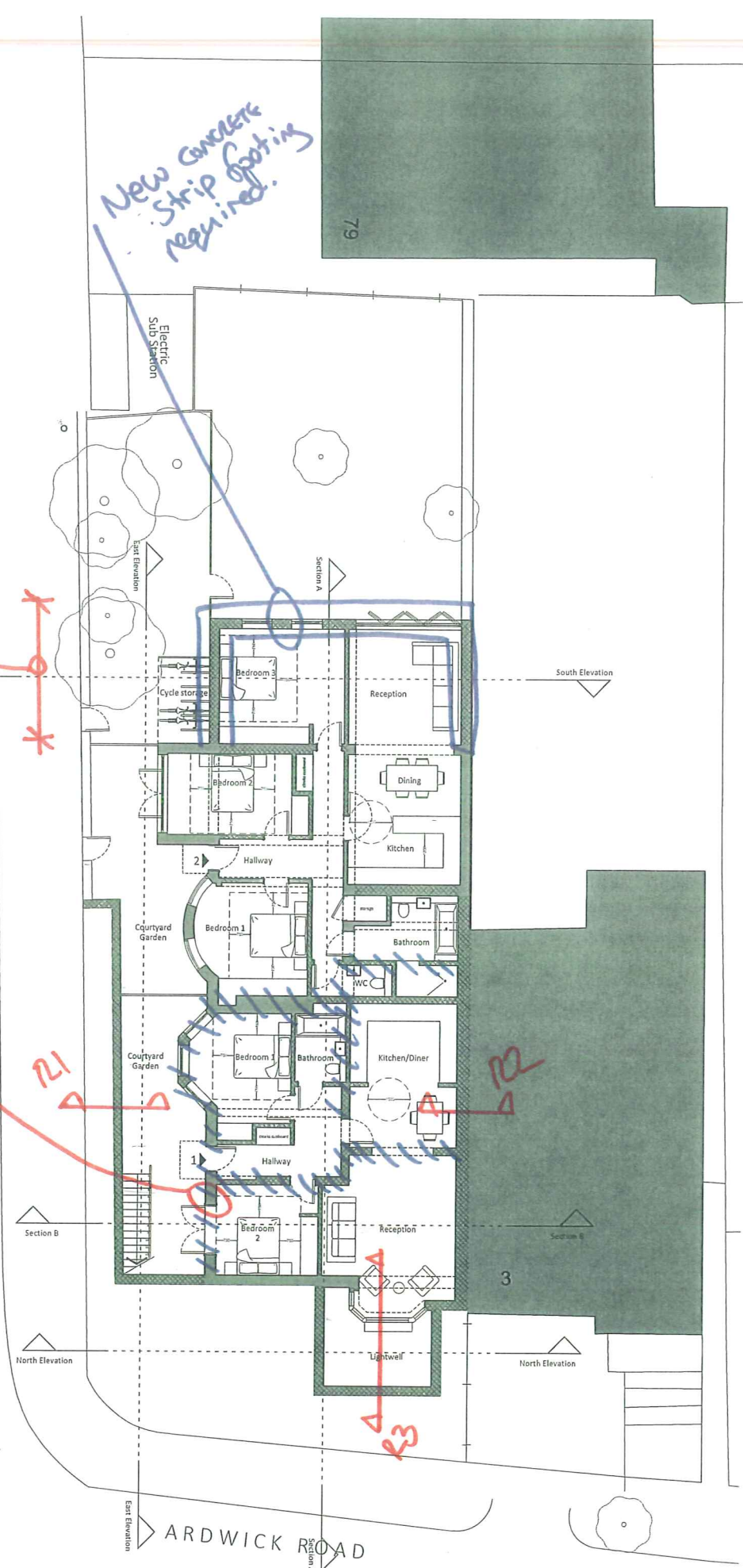
EXTENT OF LG FLOOR EXTENSION


New concrete strip footing required.

ASS CONCRETE REDEPIN EXISTING WALLS. DOWN: (|||||)

FORTUNE GREEN ROAD

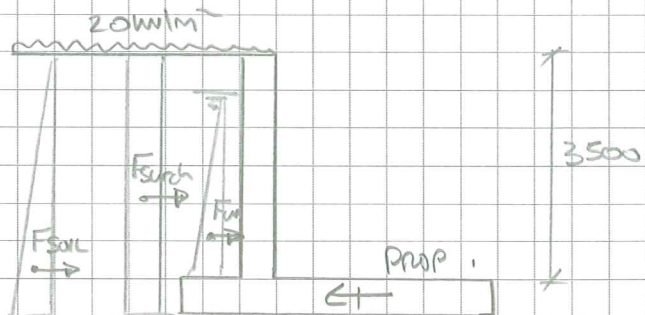
ARDWICK ROAD



	Project		Job Ref	
	1 Ardwick Road, NW2 2BX		12693	
	Drawing Ref	Calculations by	Checked by	Sheet of
	JC	BC		
Part of Structure			Date	
R1 - LG. Floor.			April '15	

Assumptions :

- Bearing onto London clay. SBP = 150kPa.
- Retained height = 3500mm
- Water table taken 1m below G.L.
- Surcharge of 20kN/m^2 applies (highway surcharge)
- LG. slab will act as a permanent prop.
- No vertical loading.



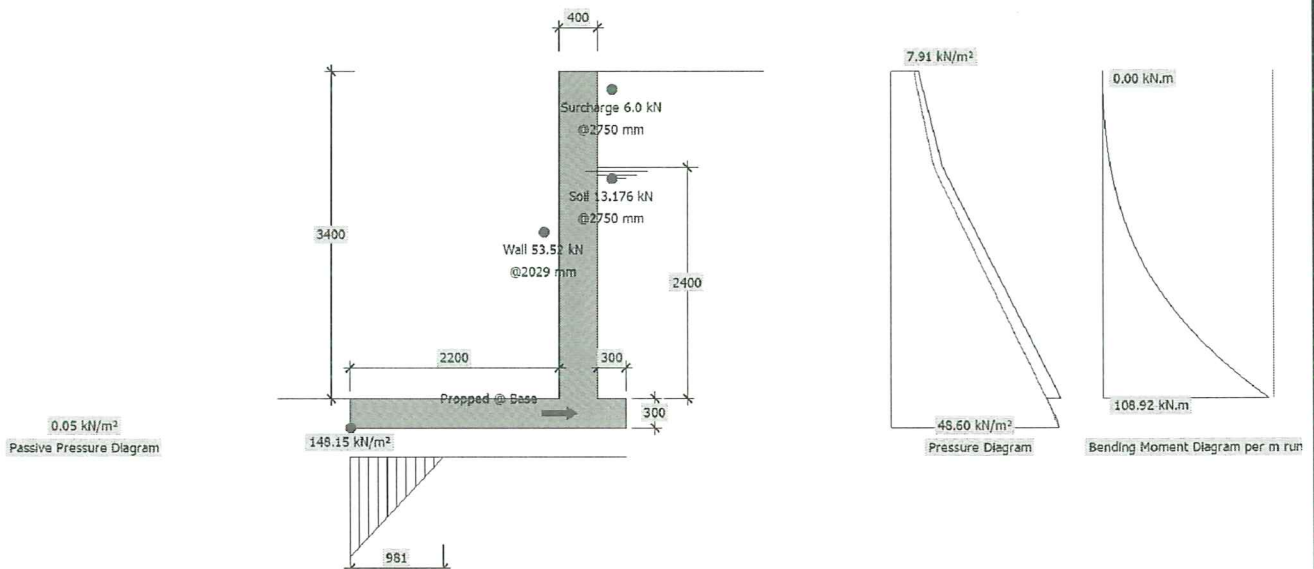


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Job ref : 12693
 Sheet :
 Made By : JC
 Date : March '15
 Checked : BC
 Approved :

R1 – LG FLOOR – PERMANENT CASE

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 AND BS 8110 : 1997
Basic RC Retaining Wall
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes All dimensions are in mm and all forces are per metre run
 Material Densities (kN/m³) Dry Soil 18.00, Saturated Soil 20.80, Submerged Soil 10.80, Concrete 24.00
 Concrete grade fcu 35 N/mm², Permissible tensile stress 0.250 N/mm²
 Concrete covers (mm) Wall inner cover 50 mm, Wall outer cover 30 mm, Base cover 50 mm
 Reinforcement design fy 500 N/mm² designed to BS 8110: 1997
 Surcharge and Water Table Surcharge 20.00 kN/m², Water table level 2400 mm
 † The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Additional Loads

Wall Propped at Base Level Therefore no sliding check is required
 † Dimensions

Soil Properties

Soil bearing pressure Allowable pressure @ front 150.00 kN/m², @ back 150.00 kN/m²
 Back Soil Friction and Cohesion $\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$
 Base Friction and Cohesion $\delta = \text{Atn}(0.75 \times \text{Tan}(\text{Atn}(\text{Tan}(30)/1.2))) = 19.84^\circ$
 Front Soil Friction and Cohesion $\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, F_{VHeel}- Vertical Loads over Heel,
 P_a- Active Earth Pressure, P_{surcharge}- Earth pressure from surcharge
 Case 1: Geotechnical Design 1.00 G_{Soil}+1.00 G_{Wall}+1.00 F_{VHeel}+1.00 P_a+1.00 P_{surcharge}
 Case 2: Structural Ultimate Design 1.40 G_{Soil}+1.40 G_{Wall}+1.60 F_{VHeel}+1.00 P_a+1.00 P_{surcharge}

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 120.107/161.346 0.744 OK



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Wall Sliding - Virtual Back Pressure

Fx/(RX_{Friction}+ RX_{Passive}) 0.000/(26.232+0.000) 0.000 OK
Prop Reaction Case 2 (Serviceability) 92.5 kN @ Base

Soil Pressure

Virtual Back 85.432/150 kN/m², Length under pressure 1.702 m 0.570 OK
Wall Back 148.145/150 kN/m², Length under pressure 0.981 m 0.988 OK
Note: Length under pressure is less than 75% of the base width Warning

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate) 102.5 kN @ Base

Wall Design (Inner Steel)

Critical Section Critical @ 0 mm from base, Case 2
Steel Provided (Cover) Main H10@100 (50 mm) Dist. H10@150 (60 mm) 785 mm² OK
Compression Steel Provided (Cover) Main H10@300 (30 mm) Dist. H10@300 (40 mm) 262 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 345 mm, 1000 mm, 785 mm², 500 N/mm², 35.0 N/mm² 328 mm
Mr=fn(above,As',d',x,x/d) 262 mm², 35 mm, 24 mm, 0.07 112.0 kN.m
Moment Capacity Check (M/Mr) M 108.9 kN.m, Mr 112.0 kN.m 0.973 OK
Shear Capacity Check F 88.5 kN, vc 0.448 N/mm², Fvr 154.5 kN 0.57 OK

Base Top Steel Design

Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm² OK
Compression Steel Provided (Cover) Main H16@150 (50 mm) Dist. H10@200 (66 mm) 1340 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 245 mm, 1000 mm, 393 mm², 500 N/mm², 35 N/mm² 233 mm
Mr=fn(above,As',d',x,x/d) 1340 mm², 58 mm, 12 mm, 0.05 39.8 kN.m
Moment Capacity Check (M/Mr) M 4.5 kN.m, Mr 39.8 kN.m 0.114 OK
Shear Capacity Check F 29.9 kN, vc 0.434 N/mm², Fvr 106.4 kN 0.28 OK

Base Bottom Steel Design

Steel Provided (Cover) Main H16@150 (50 mm) Dist. H10@200 (66 mm) 1340 mm² OK
Compression Steel Provided (Cover) Main H10@200 (50 mm) Dist. H10@200 (60 mm) 393 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 242 mm, 1000 mm, 1340 mm², 500 N/mm², 35 N/mm² 223 mm
Mr=fn(above,As',d',x,x/d) 393 mm², 55 mm, 42 mm, 0.17 130.2 kN.m
Moment Capacity Check (M/Mr) M 115.1 kN.m, Mr 130.2 kN.m 0.884 OK
Shear Capacity Check F 83.2 kN, vc 0.658 N/mm², Fvr 159.3 kN 0.52 OK

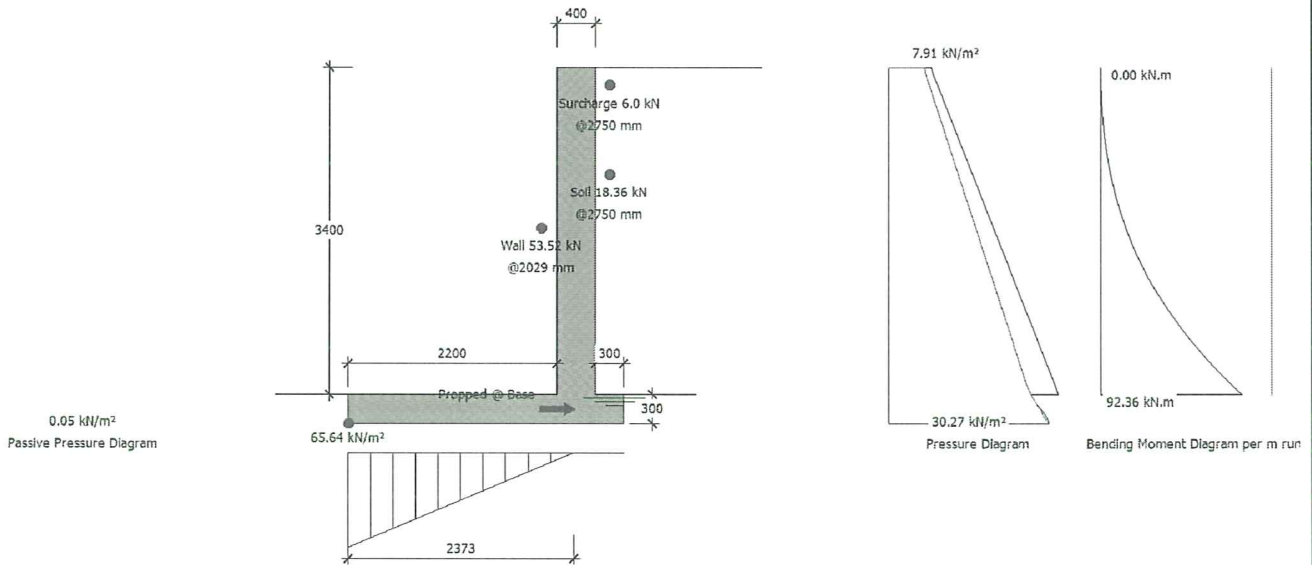


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R1 – LG FLOOR – TEMPORARY CASE

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 AND BS 8110 : 1997
Basic RC Retaining Wall
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes All dimensions are in mm and all forces are per metre run
 Material Densities (kN/m³) Dry Soil 18.00, Saturated Soil 20.80, Submerged Soil 10.80, Concrete 24.00
 Concrete grade fcu 35 N/mm², Permissible tensile stress 0.250 N/mm²
 Concrete covers (mm) Wall inner cover 50 mm, Wall outer cover 30 mm, Base cover 50 mm
 Reinforcement design fy 500 N/mm² designed to BS 8110: 1997
 Surcharge and Water Table Surcharge 20.00 kN/m², Water table level 0 mm
 † The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Additional Loads

Wall Propped at Base Level Therefore no sliding check is required
 † Dimensions

Soil Properties

Soil bearing pressure Allowable pressure @ front 150.00 kN/m², @ back 150.00 kN/m²
 Back Soil Friction and Cohesion $\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$
 Base Friction and Cohesion $\delta = \text{Atn}(0.75 \times \text{Tan}(\text{Atn}(\text{Tan}(30)/1.2))) = 19.84^\circ$
 Front Soil Friction and Cohesion $\phi = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$

Loading Cases

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, F_{VHeel}- Vertical Loads over Heel,
 P_a- Active Earth Pressure, P_{surcharge}- Earth pressure from surcharge
 Case 1: Geotechnical Design 1.00 G_{Soil}+1.00 G_{Wall}+1.00 F_{VHeel}+1.00 P_a+1.00 P_{surcharge}
 Case 2: Structural Ultimate Design 1.40 G_{Soil}+1.40 G_{Wall}+1.60 F_{VHeel}+1.00 P_a+1.00 P_{surcharge}

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 94.951/175.602 0.541 OK

Wall Sliding - Virtual Back Pressure

F_x/(R_{XFriction}+ R_{XPassive}) 0.000/(28.103+0.000) 0.000 OK
 Prop Reaction Case 2 (Serviceability) 65.0 kN @ Base



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Soil Pressure

Virtual Back (No uplift)	Max(49.881/150, 3.829/150) kN/m ²	0.333	OK
Wall Back	65.642/150 kN/m ² , Length under pressure 2.373 m	0.438	OK

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate) 76.5 kN @ Base

Wall Design (Inner Steel)


Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H10@100 (50 mm) Dist. H10@150 (60 mm)	785 mm ²	OK
Compression Steel Provided (Cover)	Main H10@300 (30 mm) Dist. H10@300 (40 mm)	262 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	345 mm, 1000 mm, 785 mm ² , 500 N/mm ² , 35.0 N/mm ²	328 mm	
Mr=fn(above,As',d',x,x/d)	262 mm ² , 35 mm, 24 mm, 0.07	112.0 kN.m	
Moment Capacity Check (M/Mr)	M 92.4 kN.m, Mr 112.0 kN.m	0.825	OK
Shear Capacity Check	F 67.9 kN, vc 0.448 N/mm ² , Fvr 154.5 kN	0.44	OK

Base Top Steel Design

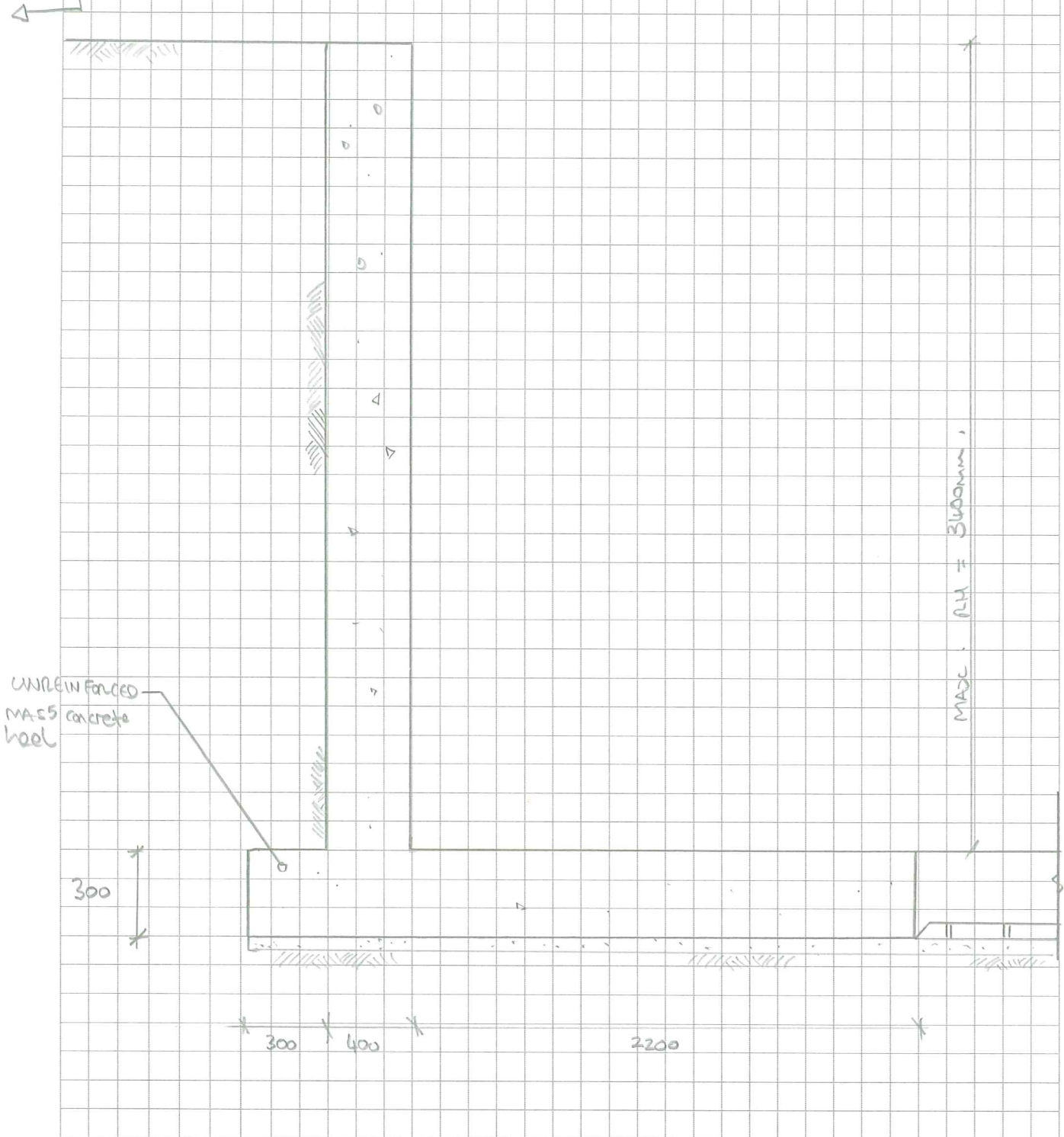
Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H10@200 (66 mm)	1340 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 35 N/mm ²	233 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm ² , 58 mm, 12 mm, 0.05	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 4.8 kN.m, Mr 39.8 kN.m	0.120	OK
Shear Capacity Check	F 31.7 kN, vc 0.434 N/mm ² , Fvr 106.4 kN	0.30	OK


Base Bottom Steel Design

Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H10@200 (66 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 35 N/mm ²	223 mm	
Mr=fn(above,As',d',x,x/d)	393 mm ² , 55 mm, 42 mm, 0.17	130.2 kN.m	
Moment Capacity Check (M/Mr)	M 88.7 kN.m, Mr 130.2 kN.m	0.681	OK
Shear Capacity Check	F 70.8 kN, vc 0.658 N/mm ² , Fvr 159.3 kN	0.44	OK

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	Drawing Ref	Calculations by	Checked by	Sheet of
		JC	BC	
Part of Structure		Date		
R1 - LG. Floor		April '15		

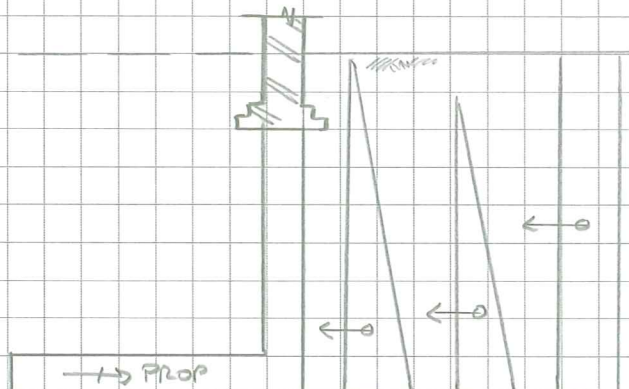
FORTUNE GREEN RD




	Project		Job Ref	
	1 Ardwick Road, NW2 2BX		12693	
	Drawing Ref	Calculations by	Checked by	Sheet of
	JC	BC		
Part of Structure			Date	
R1 - Basement.			April '15	

Assumptions :

- #1 and #3 Ardwick RD have separate external walls along boundary line.
- External wall @ #3 will be underpinned with mass concrete to formation level at #1.
- An 'L'-shaped RC underpin will transfer the loadings from #1 external wall down to formation.
- A SBP of 150kPa will be assumed.
- A low level permanent prop will be provided by the new ground bearing RC slab.



	Project 1 Ardwick Road, NW2 2BX		Job Ref 12693	
	Drawing Ref	Calculations by JC	Checked by BC	Sheet of
	Part of Structure R2 - LG FLOOR		Date April '15	

Loadings :

Gr: (Dead)

				kN/m
330 Brick	: 7.4 kN/m ² x 3m	=	22.2	
215 Brick	: 5.3 kN/m ² x 6m	=	31.8	
LG Floor	: 0.8 kN/m ² x 0.2m	=	0.16	
G Floor	: 0.8 kN/m ² x 3m/2	=	1.2	
1 st Floor	: 0.8 kN/m ² x 0.2m	=	0.16	
2 nd Floor	: 0.8 kN/m ² x 0.2m	=	0.16	
Roof	: 1 kN/m ² x 1m	=	1	
				<u>56.7 kN/m</u>

Gr: (Live)

Floors	: 2.1 kN/m ² x 0.2m x 3	=	1.26
G Floor	: 2.1 kN/m ² x 1.5m	=	3.15
Roof	: 1 kN/m ² x 1m	=	1
			<u>5.41 kN/m</u>



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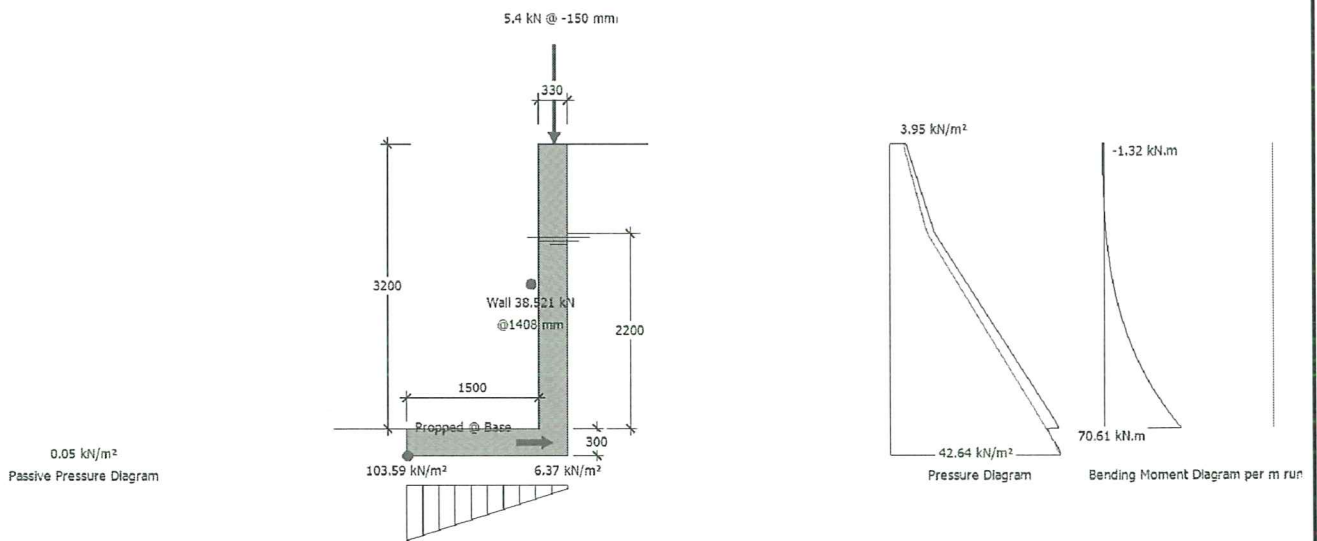
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R2 – LOWER GROUND FLOOR – PERMANENT CASE

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 AND BS 8110 : 1997

Basic RC Retaining Wall

Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m ³)	Dry Soil 18.00, Saturated Soil 20.80, Submerged Soil 10.80, Concrete 24.00
Concrete grade	fcu 35 N/mm ² , Permissible tensile stress 0.250 N/mm ²
Concrete covers (mm)	Wall inner cover 35 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm ² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 10.00 kN/m ² , Water table level 2200 mm
† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice	

Additional Loads

Wall Propped at Base Level	Therefore no sliding check is required
Vertical Line Loads	56.7 kN/m @ X -150 mm and Y 0 mm - Load type Dead 5.4 kN/m @ X -150 mm and Y 0 mm - Load type Live
† Dimensions	Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Soil bearing pressure	Allowable pressure @ front 150.00 kN/m ² , @ back 150.00 kN/m ²
Back Soil Friction and Cohesion	f = Atn(Tan(30)/1.2) = 25.69°
Base Friction and Cohesion	δ = Atn(0.75xTan(Atn(Tan(30)/1.2))) = 19.84°
Front Soil Friction and Cohesion	f = Atn(Tan(30)/1.2) = 25.69°

Loading Cases

G _{Wall} - Wall & Base Self Weight, F _{VHeel} - Vertical Loads over Heel, P _a - Active Earth Pressure, P _{surcharge} - Earth pressure from surcharge	
Case 1: Geotechnical Design	1.00 G _{Wall} +1.00 F _{VHeel} +1.00 P _a +1.00 P _{surcharge}
Case 2: Structural Ultimate Design	1.40 G _{Wall} +1.60 F _{VHeel} +1.00 P _a +1.00 P _{surcharge}



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Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 82.414/158.581 0.520 OK

Wall Sliding - Virtual Back Pressure

Fx/(R_XFriction+ R_XPassive) 0.000/(36.308+0.000) 0.000 OK
Prop Reaction Case 2 (Serviceability) 71.5 kN @ Base

Soil Pressure

Virtual Back (No uplift) Max(83.474/150, 26.487/150) kN/m² 0.556 OK
Wall Back (No uplift) Max(103.592/150, 6.370/150) kN/m² 0.691 OK

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate) 78.6 kN @ Base

Wall Design (Inner Steel)

Critical Section Critical @ 0 mm from base, Case 2
Steel Provided (Cover) Main H16@150 (35 mm) Dist. H12@175 (51 mm) 1340 mm² OK
Compression Steel Provided (Cover) Main H12@250 (30 mm) Dist. H12@175 (42 mm) 452 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 287 mm, 1000 mm, 1340 mm², 500 N/mm², 35.0 N/mm² 268 mm
Mr=fn(above,As',d',x,x/d) 452 mm², 36 mm, 42 mm, 0.15 156.5 kN.m
Moment Capacity Check (M/Mr) M 70.6 kN.m, Mr 156.5 kN.m 0.451 OK
Wall Axial Design (N/Ncap) N 123.5 kN, Ncap 4620.0 kN 0.027 OK
Wall Slenderness λ Leff/tk = 1.60x3200.0/330.0 15.5 OK
Kmin = (Nuz-N)/(Nuz-Nbal) Min(1.0, 5133.3 - 123.5)/(5133.3 - 1895.0) 1.0
M_{add} = N.Kmin.h.λ²/2000 123.5x1.0x330.0x15.5²/2000 4.9kN.m
(M+Madd)/M_{rAxial} M+Madd 75.5 kN, M_{rAxial} 171.9 kN.m 0.439 OK
Shear Capacity Check F 66.3 kN, vc 0.596 N/mm², Fvr 171.1 kN 0.39 OK

Wall Design (Outer Steel)

Critical Section Critical @ 3200 mm from base, Case 2
Steel Provided (Cover) Main H12@250 (30 mm) Dist. H12@175 (42 mm) 452 mm² OK
Compression Steel Provided (Cover) Main H16@150 (35 mm) Dist. H12@175 (51 mm) 1340 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 294 mm, 1000 mm, 452 mm², 500 N/mm², 35.0 N/mm² 279 mm
Mr=fn(above,As',d',x,x/d) 1340 mm², 43 mm, 14 mm, 0.05 55.0 kN.m
Moment Capacity Check (M/Mr) M 1.3 kN.m, Mr 55.0 kN.m 0.024 OK
Shear Capacity Check F 0.0 kN, vc 0.409 N/mm², Fvr 120.3 kN 0.00 OK

Base Top Steel Design

Steel Provided (Cover) Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm² OK
Compression Steel Provided (Cover) Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 242 mm, 1000 mm, 1340 mm², 500 N/mm², 35 N/mm² 223 mm
Mr=fn(above,As',d',x,x/d) 754 mm², 56 mm, 42 mm, 0.17 130.2 kN.m
Moment Capacity Check (M/Mr) M 0.0 kN.m, Mr 130.2 kN.m 0.000 OK
Shear Capacity Check F 0.0 kN, vc 0.658 N/mm², Fvr 159.3 kN 0.00 OK

Base Bottom Steel Design

Steel Provided (Cover) Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm² OK
Compression Steel Provided (Cover) Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm²
Leverarm z=fn(d,b,As,fy,Fcu) 244 mm, 1000 mm, 754 mm², 500 N/mm², 35 N/mm² 232 mm
Mr=fn(above,As',d',x,x/d) 1340 mm², 58 mm, 23 mm, 0.10 76.0 kN.m
Moment Capacity Check (M/Mr) M 75.6 kN.m, Mr 76.0 kN.m 0.995 OK
Shear Capacity Check F 101.1 kN, vc 0.541 N/mm², Fvr 132.0 kN 0.77 OK



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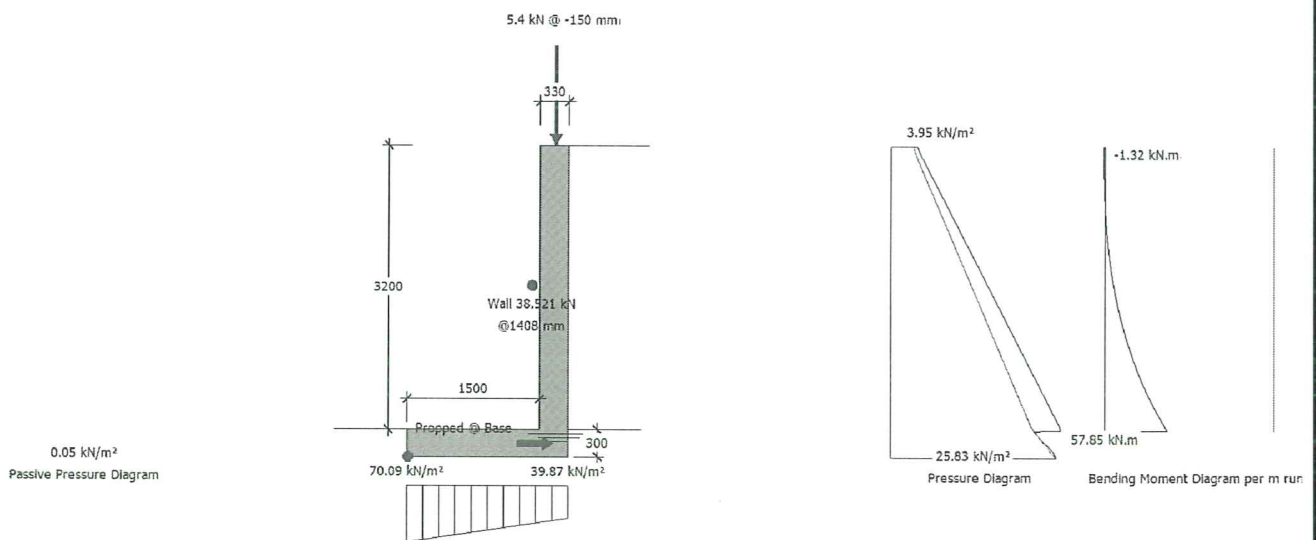
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R2 – LOWER GROUND FLOOR – TEMPORARY CASE

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 AND BS 8110 : 1997

Basic RC Retaining Wall

Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes
 All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)
 Dry Soil 18.00, Saturated Soil 20.80, Submerged Soil 10.80, Concrete 24.00
Concrete grade
 fcu 35 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)
 Wall inner cover 35 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design
 fy 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table
 Surcharge 10.00 kN/m², Water table level 0 mm
 † The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Additional Loads

Wall Propped at Base Level
 Therefore no sliding check is required
Vertical Line Loads
 56.7 kN/m @ X -150 mm and Y 0 mm - Load type Dead
 5.4 kN/m @ X -150 mm and Y 0 mm - Load type Live
 † Dimensions
 Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Soil bearing pressure
 Allowable pressure @ front 150.00 kN/m², @ back 150.00 kN/m²
Back Soil Friction and Cohesion
 $f = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$
Base Friction and Cohesion
 $\delta = \text{Atn}(0.75 \times \text{Tan}(\text{Atn}(\text{Tan}(30)/1.2))) = 19.84^\circ$
Front Soil Friction and Cohesion
 $f = \text{Atn}(\text{Tan}(30)/1.2) = 25.69^\circ$

Loading Cases

G_{Wall} - Wall & Base Self Weight, $F_{V_{\text{Heel}}}$ - Vertical Loads over Heel, P_a - Active Earth Pressure,
 $P_{\text{surcharge}}$ - Earth pressure from surcharge
 Case 1: Geotechnical Design 1.00 G_{Wall} +1.00 $F_{V_{\text{Heel}}}$ +1.00 P_a +1.00 $P_{\text{surcharge}}$
 Case 2: Structural Ultimate Design 1.40 G_{Wall} +1.60 $F_{V_{\text{Heel}}}$ +1.00 P_a +1.00 $P_{\text{surcharge}}$

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 62.445/158.581 0.394 OK



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Wall Sliding - Virtual Back Pressure

$F_x / (R_x \text{Friction} + R_x \text{Passive})$	0.000 / (36.308 + 0.000)	0.000	OK
Prop Reaction Case 2 (Serviceability)	48.0 kN @ Base		

Soil Pressure

Virtual Back (No uplift)	Max(47.701/150, 62.261/150) kN/m ²	0.415	OK
Wall Back (No uplift)	Max(70.086/150, 39.875/150) kN/m ²	0.467	OK

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate) 56.2 kN @ Base

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (35 mm) Dist. H12@175 (51 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H12@250 (30 mm) Dist. H12@175 (42 mm)	452 mm ²	
Leverarm $z = \text{fn}(d, b, A_s, f_y, F_{cu})$	287 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 35.0 N/mm ²	268 mm	
$M_r = \text{fn}(\text{above}, A_s', d', x, x/d)$	452 mm ² , 36 mm, 42 mm, 0.15	156.5 kN.m	
Moment Capacity Check (M/M _r)	M 57.8 kN.m, M _r 156.5 kN.m	0.370	OK
Wall Axial Design (N/N _{cap})	N 123.5 kN, N _{cap} 4620.0 kN	0.027	OK
Wall Slenderness λ	$L_{eff}/t_k = 1.60 \times 3200.0 / 330.0$	15.5	OK
$K_{min} = (Nuz - N) / (Nuz - N_{bal})$	$\text{Min}(1.0, 5133.3 - 123.5) / (5133.3 - 1895.0)$	1.0	
$M_{add} = N \cdot K_{min} \cdot h \cdot \lambda^2 / 2000$	$123.5 \times 1.0 \times 330.0 \times 15.5^2 / 2000$	4.9 kN.m	
$(M + M_{add}) / M_{r_{Axial}}$	M + Madd 62.7 kN, M _{r_{Axial}}} 171.9 kN.m	0.365	OK
Shear Capacity Check	F 49.0 kN, v_c 0.596 N/mm ² , F _v 171.1 kN	0.29	OK

Wall Design (Outer Steel)

Critical Section	Critical @ 3200 mm from base, Case 2		
Steel Provided (Cover)	Main H12@250 (30 mm) Dist. H12@175 (42 mm)	452 mm ²	OK
Compression Steel Provided (Cover)	Main H16@150 (35 mm) Dist. H12@175 (51 mm)	1340 mm ²	
Leverarm $z = \text{fn}(d, b, A_s, f_y, F_{cu})$	294 mm, 1000 mm, 452 mm ² , 500 N/mm ² , 35.0 N/mm ²	279 mm	
$M_r = \text{fn}(\text{above}, A_s', d', x, x/d)$	1340 mm ² , 43 mm, 14 mm, 0.05	55.0 kN.m	
Moment Capacity Check (M/M _r)	M 1.3 kN.m, M _r 55.0 kN.m	0.024	OK
Shear Capacity Check	F 0.0 kN, v_c 0.409 N/mm ² , F _v 120.3 kN	0.00	OK

Base Top Steel Design

Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H12@175 (66 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H12@150 (50 mm) Dist. H12@175 (62 mm)	754 mm ²	
Leverarm $z = \text{fn}(d, b, A_s, f_y, F_{cu})$	242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 35 N/mm ²	223 mm	
$M_r = \text{fn}(\text{above}, A_s', d', x, x/d)$	754 mm ² , 56 mm, 42 mm, 0.17	130.2 kN.m	
Moment Capacity Check (M/M _r)	M 0.0 kN.m, M _r 130.2 kN.m	0.000	OK
Shear Capacity Check	F 0.0 kN, v_c 0.658 N/mm ² , F _v 159.3 kN	0.00	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H12@150 (50 mm) Dist. H12@175 (62 mm)	754 mm ²	OK
Compression Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H12@175 (66 mm)	1340 mm ²	
Leverarm $z = \text{fn}(d, b, A_s, f_y, F_{cu})$	244 mm, 1000 mm, 754 mm ² , 500 N/mm ² , 35 N/mm ²	232 mm	
$M_r = \text{fn}(\text{above}, A_s', d', x, x/d)$	1340 mm ² , 58 mm, 23 mm, 0.10	76.0 kN.m	
Moment Capacity Check (M/M _r)	M 58.6 kN.m, M _r 76.0 kN.m	0.770	OK
Shear Capacity Check	F 92.0 kN, v_c 0.541 N/mm ² , F _v 132.0 kN	0.70	OK