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Job ref Sheet : Sheet Ref / 6 -

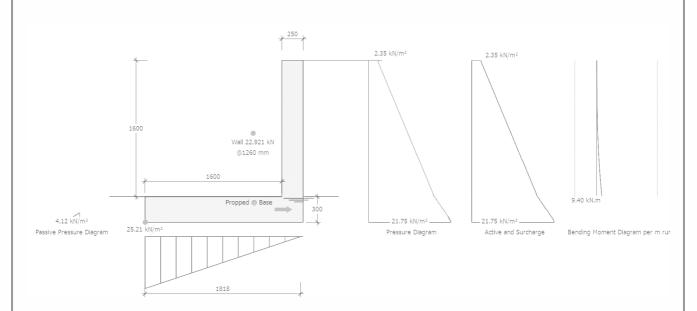
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Date : 22 Nov 2023/ Version 2015.04

Checked Approved

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997

RW2 (LC1)-Temp Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

All dimensions are in mm and all forces are per metre run

Material Densities (kN/m³) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm Concrete covers (mm)

Reinforcement design fy 500 N/mm² designed to BS 8110: 1997 Surcharge and Water Table Surcharge 5.00 kN/m², Water table level 0 mm

Unplanned excavation depth Front of wall 190 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 Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

P_p- Passive Earth Pressure

1.00 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp Case 1: Geotechnical Design Case 2: Structural Ultimate Design 1.40 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 14.990/28.882 0.519 OK

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Job ref : Job Ref
Sheet : Sheet Ref / 7 -

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Wall Sliding - Virtual Ba		0.000	01/
Fx/(Rx _{Friction} + Rx _{Passive}) Prop Reaction Case 2 (Service)	0.000/(6.680+0.229) 21.6 kN @ Base	0.000	OK
Soil Pressure			
Virtual Back Wall Back	25.211/95 kN/m², Length under pressure 1.818 25.143/95 kN/m², Length under pressure 1.823		OK OK
	Structural Design		
Prop Reaction			
Maximum Prop Reaction (Ultimate)	21.6 kN @ Base		
Wall Design (Inner Stee	el)		
Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@175 (46 m		OK
Compression Steel Provided (Cover) Leverarm z=fn(d,b,As,fy,Fcu)	Main H12@250 (30 mm) Dist. H12@175 (42 m 212 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30.		
Mr=fn(above,As',d',x,x/d)	452 mm ² , 36 mm, 48 mm, 0.23	110.9 kN.m	
Moment Capacity Check (M/Mr)	M 9.4 kN.m, Mr 110.9 kN.m	0.085	OK
Shear Capacity Check	F 15.7 kN, vc 0.676 N/mm ² , Fvr 143.2 kN	0.11	OK
Base Top Steel Design			
Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H12@175 (66 m		OK
Compression Steel Provided (Cover)	Main H12@150 (50 mm) Dist. H12@175 (62 m	,	
Leverarm z=fn(d,b,As,fy,Fcu) Mr=fn(above,As',d',x,x/d)	242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30 754 mm ² , 56 mm, 48 mm, 0.20	N/mm ² 220 mm 128.4 kN.m	
Moment Capacity Check (M/Mr)	M 0.0 kN,m, Mr 128,4 kN,m	0,000	OK
Shear Capacity Check	F 0.0 kN, vc 0.625 N/mm ² , Fvr 151.3 kN	0.00	OK
Base Bottom Steel Desi	gn		
Steel Provided (Cover)	Main H12@150 (50 mm) Dist. H12@175 (62 m		OK
Compression Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H12@175 (66 m		
Leverarm z=fn(d,b,As,fy,Fcu) Mr=fn(above,As',d',x,x/d)	244 mm, 1000 mm, 754 mm ² , 500 N/mm ² , 30 N 1340 mm ² , 58 mm, 27 mm, 0.11	N/mm ² 232 mm 76.0 kN.m	
Moment Capacity Check (M/Mr)	M 13.3 kN.m, Mr 76.0 kN.m	0.175	OK
Shear Capacity Check	F 13.2 kN, vc 0.514 N/mm², Fvr 125.4 kN	0.11	OK

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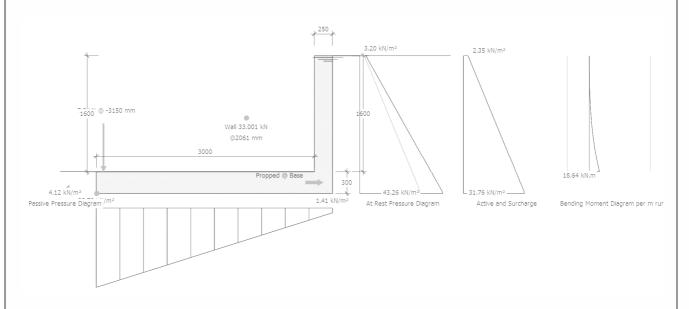
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Checked

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997
RW2 (LC2)-Perm

Fax: (028) 9036 5102

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) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 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 5.00 kN/m², Water table level 1600 mm

Unplanned excavation depth Front of wall 190 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 Load 7.8 kN/m @ X -3150 mm and Y 1600 mm - Load type Live

† Dimensions Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(20)/1.2))) = 12.82^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, FvHeel- Vertical Loads over Heel, Pa- Active Earth Pressure,

P_{surcharge}- Earth pressure from surcharge, P_p- Passive Earth Pressure

Case 1: Geotechnical Design 1.00 Gwall+1.00 FvHeel+1.00 Pa+1.00 Psurcharge+1.00 Pp Case 2: Structural Ultimate Design 1.40 Gwall+1.60 FvHeel+1.00 Pa+1.00 Psurcharge+1.00 Pp

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 22.129/68.807 0.322 OK

Wall Sliding - Virtual Back Pressure

 $Fx/(Rx_{Friction} + Rx_{Passive})$ 0.000/(9.281+0.229) 0.000 OK

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Job ref : Job Ref
Sheet : Sheet Ref / 9 -

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Prop Reaction Case 2 (Service)	32.6 kN @ Base		
Soil Pressure			
Virtual Back (No uplift)	Max(23.701/95, 1.407/95) kN/m ²	0.249	OK
Wall Back (No uplift)	Max(23.675/95, 1.433/95) kN/m ²	0.249	OK
	Structural Design		
At Rest Earth Pressure			
At rest earth pressures magnification	$(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24)) \times \sqrt{1}$		1.36
Prop Reaction			
Maximum Prop Reaction (Ultimate)	44.3 kN @ Base		
Wall Design (Inner Stee			
Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@175 (46 mm)	1340 mm ²	OK
Compression Steel Provided (Cover) Leverarm z=fn(d,b,As,fy,Fcu)	Main H12@250 (30 mm) Dist. H12@175 (42 mm) 212 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30.0 N/mm ²	452 mm² 190 mm	
Mr=fn(above,As',d',x,x/d)	452 mm ² , 36 mm, 48 mm, 0.23	110.9 kN.m	
Moment Capacity Check (M/Mr)	M 18.6 kN.m, Mr 110.9 kN.m	0.168	OK
Shear Capacity Check	F 32.3 kN, vc 0.676 N/mm², Fvr 143.2 kN	0.23	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) Leverarm z=fn(d,b,As,fy,Fcu)	Main H12@150 (50 mm) Dist. H12@175 (62 mm) 242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30 N/mm ²	754 mm² 220 mm	
Mr=fn(above,As',d',x,x/d)	754 mm ² , 56 mm, 48 mm, 0.20	128.4 kN.m	
Moment Capacity Check (M/Mr)	M 2.2 kN.m, Mr 128.4 kN.m	0.017	OK
Shear Capacity Check	F 8.9 kN, vc 0.625 N/mm², Fvr 151.3 kN	0.06	OK
Base Bottom Steel Desi	gn		
Steel Provided (Cover)	Main H12@150 (50 mm) Dist. H12@175 (62 mm)	754 mm ²	OK
Compression Steel Provided (Cover) Leverarm z=fn(d,b,As,fy,Fcu)	Main H16@150 (50 mm) Dist. H12@175 (66 mm) 244 mm, 1000 mm, 754 mm ² , 500 N/mm ² , 30 N/mm ²	1340 mm² 232 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm ² , 58 mm, 27 mm, 0.11	76.0 kN.m	
Moment Capacity Check (M/Mr)	M 28.2 kN.m, Mr 76.0 kN.m	0.371	OK
Shear Capacity Check	F 17.0 kN, vc 0.514 N/mm², Fvr 125.4 kN	0.14	OK

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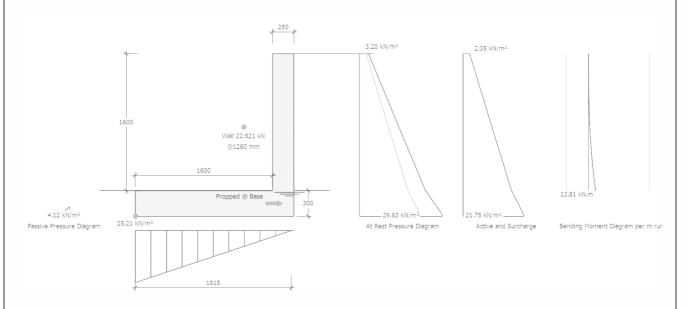
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Date : 22 Nov 2023/ Version 2015.04

Checked : Approved :

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997 RW2 (LC2)-Temp 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) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 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 5.00 kN/m², Water table level 0 mm

Unplanned excavation depth Front of wall 190 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 Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 14.990/28.882 0.519 OK

Wall Sliding - Virtual Back Pressure

Fx/(Rx_{Friction}+ Rx_{Passive}) 0.000/(6.680+0.229) 0.000
Prop Reaction Case 2 (Service) 21.6 kN @ Base

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Job ref : Job Ref Sheet : Sheet Ref / 11 -

Made By :

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Soil Pressure			
Virtual Back Wall Back	25.211/95 kN/m², Length under pressure 1.818 m 25.143/95 kN/m², Length under pressure 1.823 m	0.265 0.265	OK OK
Wall back		0.205	OK
	Structural Design		
At Rest Earth Pressure			
At rest earth pressures magnification	$(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24)) \times \sqrt{1}$		1.36
Prop Reaction			
Maximum Prop Reaction (Ultimate)	29.4 kN @ Base		
Wall Design (Inner Stee			
Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@175 (46 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H12@250 (30 mm) Dist. H12@175 (42 mm)	452 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	212 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30.0 N/mm ²	190 mm	
Mr=fn(above,As',d',x,x/d)	452 mm ² , 36 mm, 48 mm, 0.23	110.9 kN.m	OV
Moment Capacity Check (M/Mr) Shear Capacity Check	M 12.8 kN.m, Mr 110.9 kN.m F 21.4 kN, vc 0.676 N/mm², Fvr 143.2 kN	0.115 0.15	OK OK
Base Top Steel Design	7 21.1 KW, VC 0.070 W/HHHT , 1 VI 113.2 KW	0.15	OK
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	OK
Leverarm z=fn(d,b,As,fy,Fcu)	242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30 N/mm ²	220 mm	
Mr=fn(above,As',d',x,x/d)	754 mm ² , 56 mm, 48 mm, 0,20	128,4 kN,m	
Moment Capacity Check (M/Mr)	M 0.0 kN.m, Mr 128.4 kN.m	0.000	OK
Shear Capacity Check	F 0.0 kN, vc 0.625 N/mm ² , Fvr 151.3 kN	0.00	OK
Base Bottom Steel Desi	gn		
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=fn(d,b,As,fy,Fcu)	244 mm, 1000 mm, 754 mm², 500 N/mm², 30 N/mm²	232 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm², 58 mm, 27 mm, 0.11	76.0 kN.m	
Moment Capacity Check (M/Mr)	M 18.4 kN.m, Mr 76.0 kN.m	0.243	OK
Shear Capacity Check	F 16.0 kN, vc 0.514 N/mm ² , Fvr 125.4 kN	0.13	OK

	Project 28 Parliament I	Hill	Job Ref. 20230153	
G GREEN STRUCTURA TING NITTRIK	Drawing Ref.	Calculations by AS	Checked by	Sheet
	Part of Structure Retaining wall F retaining wall	R-1 - with column C1mov	ved on top of the	Date Sep-23

h = 1.6 m

The retaining walls will be designed for one load case:

- Case 1 Minimum vertical forces and maximum horizontal forces: This is the most onerous case for bearing pressures on the toe and overturning. For these the live loads will be removed.
- Permanent case –empty pool, surcharge, water at ground level
- Temporary case –empty pool, surcharge, no water

Assumptions:

- Total retained height 1600mm
- Accidental water level assumed at 1mBGL
- Surcharge of 5kN/m2 has been considered for the area underneath existing floor
- 125Pa safe bearing pressure

Ltoe = 1.6 m Lheel = m

9.158

0.00

Loading (w)					
Dead Load (G_k) :			kN/m^2	m	kN/m
	ST12;ST21 - Column 1 Reaction (LGF)	146.7		3.8	38.61
	TOTAL LC1				38.61
	TOTAL LC2				34.74
Live Load (Q_k) :			kN/m ²	m	kN/m
	surcharge considered		10.00		
	ST12;ST21 - Column 1 Reaction (LGF)	34.8		3.8	9.16

TOTAL LC1

TOTAL LC2

	Project 28 Parliament I	Hill	Job Ref. 20230153	
G CRLIN STRUCTURAL INGNITRIN	Drawing Ref.	Calculations by	Checked by	Sheet
	Part of Structure Retaining wall I	R-1	'	Date Sep-23

h = 1.6 m

The retaining walls will be designed for one load case:

- Case 1 Minimum vertical forces and maximum horizontal forces: This is the most onerous case for bearing pressures on the toe and overturning. For these the live loads will be removed.
- Permanent case –empty pool, surcharge, water at ground level
- Temporary case –empty pool, surcharge, no water

Assumptions:

- Total retained height 1600mm
- Accidental water level assumed at 1mBGL
- Surcharge of 5kN/m2 has been considered for the area underneath existing floor
- 125Pa safe bearing pressure

Ltoe = 1.6 m Lheel = m

0.00

Loading (w)

Dead Load (G_k) :		kN/m ²	m	kN/m
	No vertical load considered			
	TOTAL LC1			0.00
	TOTAL LC2			0.00
Live Load (Q_k) :		kN/m ²	m	kN/m
	surcharge considered	10.00		
	No vertical load considered			
	TOTAL LC1			0.000

TOTAL LC2

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Sheet : Sheet Ref / 12 -

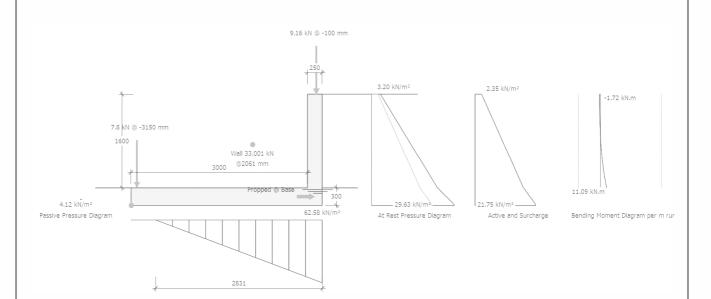
Made By :

Date : 22 Nov 2023/ Version 2015.04

Checked : Approved :

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997 RW1 (LC1)-Perm

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) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 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 5.00 kN/m², Water table level 0 mm

Unplanned excavation depth Front of wall 190 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 $38.61 \text{ kN/m} @ X - 100 \text{ mm} \text{ and Y 0 mm} - \text{Load type Dead} \\ 9.16 \text{ kN/m} @ X - 100 \text{ mm} \text{ and Y 0 mm} - \text{Load type Live} \\ 7.8 \text{ kN/m} @ X - 3150 \text{ mm} \text{ and Y 1600 mm} - \text{Load type Dead} \\$

† Dimensions Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, FvHeel- Vertical Loads over Heel, Pa- Active Earth Pressure,

 $P_{\text{surcharge}}\text{-}$ Earth pressure from surcharge, $P_{\text{p}}\text{-}$ Passive Earth Pressure

OK

OK

OΚ

OK

OK

OK

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OK

OK

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Made By

Date : 22 Nov 2023/ Version 2015.04

0.068

0.000

Approved

Checked

Geotechnical Design

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Wall	Stability	-	Virtual	Back	Pressure
Case 1	. Overturning/S	tak	oilising	14.99	0/219.283

Wall Sliding - Virtual Back Pressure

0.000/(25.813+0.229) Fx/(Rx_{Friction}+ Rx_{Passive}) Prop Reaction Case 2 (Service) 21.6 kN @ Base

Soil Pressure

Virtual Back 62.579/95 kN/m², Length under pressure 2.831 m 0.659 $\bigcirc K$ Wall Back 62.608/95 kN/m², Length under pressure 2.829 m 0.659 OK

Structural Design

At Rest Earth Pressure

At rest earth pressures magnification $(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24)) \times \sqrt{1}$ 1.36

Prop Reaction

Maximum Prop Reaction (Ultimate) 29.4 kN @ Base

Wall Design (Inner Steel)

Critical Section Critical @ 0 mm from base, Case 2 Steel Provided (Cover) Main H16@150 (30 mm) Dist. H12@175 (46 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) 212 mm, 1000 mm, 1340 mm², 500 N/mm², 30.0 N/mm² 190 mm 452 mm², 36 mm, 48 mm, 0.23 110,9 kN,m Mr=fn(above,As',d',x,x/d)Moment Capacity Check (M/Mr) M 11.1 kN.m, Mr 110.9 kN.m 0.100 OK Wall Axial Design (N/Ncap) N 82.1 kN, Ncap 3000.0 kN OKWall Slenderness λ $Leff/tk = 1.09 \times 1600.0 / 250.0$ 7.0 OK Wall Axial-Mom Design (M/Mr_{Axial}) M 11.1 kN, Mr_{Axial}117.5 kN.m 0.094 OK Shear Capacity Check F 21.4 kN, vc 0.676 N/mm², Fvr 143.2 kN 0.15 OK

Wall Design (Outer Steel)

Critical Section Critical @ 1599 mm from base, Case 2 Steel Provided (Cover) Main H12@250 (30 mm) Dist. H12@175 (42 mm) 452 mm² Compression Steel Provided (Cover) Main H16@150 (30 mm) Dist. H12@175 (46 mm) 1340 mm² Leverarm z=fn(d,b,As,fy,Fcu) 214 mm, 1000 mm, 452 mm², 500 N/mm², 30.0 N/mm² 203 mm 1340 mm², 38 mm, 16 mm, 0.08 40.0 kN.m Mr=fn(above,As',d',x,x/d)Moment Capacity Check (M/Mr) M 1.7 kN.m, Mr 40.0 kN.m 0.043 Shear Capacity Check F 0.0 kN, vc 0.468 N/mm², Fvr 100.1 kN 0.00

Base Top Steel Design

Steel Provided (Cover) Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm² 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, 30 N/mm² 220 mm 128.4 kN.m Mr=fn(above,As',d',x,x/d) 754 mm², 56 mm, 48 mm, 0.20 M 22.1 kN.m, Mr 128.4 kN.m Moment Capacity Check (M/Mr) 0.172 F 42.8 kN, vc 0.625 N/mm², Fvr 151.3 kN 0.28 Shear Capacity Check

Base Bottom Steel Design

Steel Provided (Cover) Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm² Compression Steel Provided (Cover) Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm² 244 mm, 1000 mm, 754 mm², 500 N/mm², 30 N/mm² 232 mm Leverarm z=fn(d,b,As,fy,Fcu) Mr=fn(above,As',d',x,x/d) 1340 mm², 58 mm, 27 mm, 0.11 76.0 kN.m Moment Capacity Check (M/Mr) M 10.8 kN.m, Mr 76.0 kN.m 0.142 Shear Capacity Check F 63.0 kN, vc 0.514 N/mm², Fvr 125.4 kN 0.50

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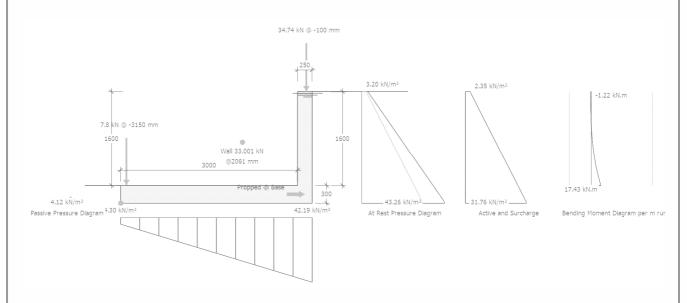
Made By : Date :

Date : 22 Nov 2023/ Version 2015.04
Checked :

Approved :

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997

RW1 (LC2)-Perm
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) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 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 5.00 kN/m², Water table level 1600 mm

Unplanned excavation depth Front of wall 190 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 34.74 kN/m @ X -100 mm and Y 0 mm - Load type Dead 7.8 kN/m @ X -3150 mm and Y 1600 mm - Load type Dead

† Dimensions Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

P_p- Passive Earth Pressure

Case 1: Geotechnical Design 1.00 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp Case 2: Structural Ultimate Design 1.40 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 22,129/178,239 0,124 OK

OK

MasterSeries User Company

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Job ref : Job Ref Sheet : Sheet Ref / 15 -

Made By :

Date : 22 Nov 2023/ Version 2015.04
Checked :

0.000

Approved :

Wall	Slidina	_	Virtual	Back	Pressure
*****	Silaing		VIIICACI	Duck	i i Coodii C

 $\begin{array}{ll} Fx/(Rx_{Friction} + Rx_{Passive}) & 0.000/(22.016 + 0.229) \\ Prop \ Reaction \ Case \ 2 \ (Service) & 32.6 \ kN \ @ \ Base \\ \end{array}$

Soil Pressure

 Virtual Back (No uplift)
 Max(4.298/95, 42.187/95) kN/m²
 0.444
 OK

 Wall Back (No uplift)
 Max(4.272/95, 42.213/95) kN/m²
 0.444
 OK

Structural Design

Fax: (028) 9036 5102

At Rest Earth Pressure

At rest earth pressures magnification $(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24) \times \sqrt{1}$ 1.36

Prop Reaction

Maximum Prop Reaction (Ultimate) 44.3 kN @ Base

Wall Design (Inner Steel)

Critical Section Critical @ 0 mm from base, Case 2 Steel Provided (Cover) Main H16@150 (30 mm) Dist. H12@175 (46 mm) 1340 mm² OK Main H12@250 (30 mm) Dist. H12@175 (42 mm) Compression Steel Provided (Cover) 452 mm² Leverarm z=fn(d,b,As,fy,Fcu) 212 mm, 1000 mm, 1340 mm², 500 N/mm², 30.0 N/mm² 190 mm 452 mm², 36 mm, 48 mm, 0.23 110.9 kN.m Mr=fn(above,As',d',x,x/d)Moment Capacity Check (M/Mr) M 17.4 kN.m, Mr 110.9 kN.m 0.157 OK F 32.3 kN, vc 0.676 N/mm², Fvr 143.2 kN Shear Capacity Check 0.23 OK

Wall Design (Outer Steel)

Critical Section Critical @ 1600 mm from base, Case 2 Main H12@250 (30 mm) Dist. H12@175 (42 mm) 452 mm² Steel Provided (Cover) OKCompression Steel Provided (Cover) Main H16@150 (30 mm) Dist. H12@175 (46 mm) 1340 mm² Leverarm z=fn(d,b,As,fy,Fcu) 214 mm, 1000 mm, 452 mm², 500 N/mm², 30.0 N/mm² 203 mm Mr=fn(above,As',d',x,x/d) 1340 mm², 38 mm, 16 mm, 0.08 40.0 kN.m Moment Capacity Check (M/Mr) M 1.2 kN.m, Mr 40.0 kN.m 0.030 OK Shear Capacity Check F 0.0 kN, vc 0.468 N/mm², Fvr 100.1 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 242 mm, 1000 mm, 1340 mm², 500 N/mm², 30 N/mm² Leverarm z=fn(d,b,As,fy,Fcu)220 mm Mr=fn(above,As',d',x,x/d)754 mm², 56 mm, 48 mm, 0.20 128.4 kN.m M 11.1 kN.m, Mr 128.4 kN.m Moment Capacity Check (M/Mr) 0.086 $\bigcirc K$ Shear Capacity Check F 20.9 kN, vc 0.625 N/mm², Fvr 151.3 kN 0.14 OK

Base Bottom Steel Design

Steel Provided (Cover) Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm² OK Main H16@150 (50 mm) Dist. H12@175 (66 mm) Compression Steel Provided (Cover) 1340 mm² Leverarm z=fn(d,b,As,fy,Fcu) 244 mm, 1000 mm, 754 mm², 500 N/mm², 30 N/mm² 232 mm Mr=fn(above,As',d',x,x/d) 1340 mm², 58 mm, 27 mm, 0.11 76.0 kN.m Moment Capacity Check (M/Mr) M 22.6 kN.m, Mr 76.0 kN.m 0.298 $\bigcirc K$ F 50.2 kN, vc 0.514 N/mm², Fvr 125.4 kN Shear Capacity Check 0.40 OK

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Job ref Sheet : Sheet Ref / 16 -

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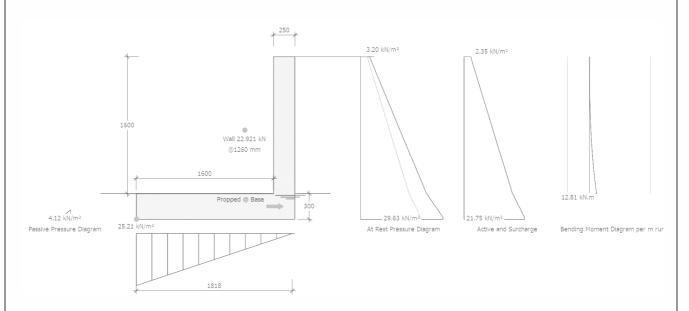
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Checked

Fax: (028) 9036 5102

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997 RW1 (LC2)-Temp Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

All dimensions are in mm and all forces are per metre run Material Densities (kN/m³) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

fcu 30 N/mm², Permissible tensile stress 0.250 N/mm² Concrete grade

Concrete covers (mm) Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm

Reinforcement design fy 500 N/mm² designed to BS 8110: 1997 Surcharge 5.00 kN/m², Water table level 0 mm Surcharge and Water Table

Unplanned excavation depth Front of wall 190 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 Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

P_p- Passive Earth Pressure $1.00 \; G_{Wall} + 1.00 \; P_a + 1.00 \; P_{surcharge} + 1.00 \; P_p$ Case 1: Geotechnical Design 1.40 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp Case 2: Structural Ultimate Design

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising 14.990/28.882 0.519 OK

Wall Sliding - Virtual Back Pressure

Fx/(Rx_{Friction}+ Rx_{Passive}) 0.000/(6.680+0.229)0.000 OK Prop Reaction Case 2 (Service) 21.6 kN @ Base

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Job ref : Job Ref Sheet : Sheet Ref / 17 -

Made By :

Date : 22 Nov 2023/ Version 2015.04

Checked : Approved :

Soil Pressure			
Virtual Back Wall Back	25.211/95 kN/m², Length under pressure 1.818 m 25.143/95 kN/m², Length under pressure 1.823 m	0.265 0.265	OK OK
Wall back		0.205	OK
	Structural Design		
At Rest Earth Pressure			
At rest earth pressures magnification	$(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24)) \times \sqrt{1}$		1.36
Prop Reaction			
Maximum Prop Reaction (Ultimate)	29.4 kN @ Base		
Wall Design (Inner Stee			
Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@175 (46 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H12@250 (30 mm) Dist. H12@175 (42 mm)	452 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	212 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30.0 N/mm ²	190 mm	
Mr=fn(above,As',d',x,x/d)	452 mm ² , 36 mm, 48 mm, 0.23	110.9 kN.m	OV
Moment Capacity Check (M/Mr) Shear Capacity Check	M 12.8 kN.m, Mr 110.9 kN.m F 21.4 kN, vc 0.676 N/mm², Fvr 143.2 kN	0.115 0.15	OK OK
Base Top Steel Design	7 21.1 KW, VC 0.070 W/HHHT , T VI 113.2 KW	0.15	OK
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	OK
Leverarm z=fn(d,b,As,fy,Fcu)	242 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30 N/mm ²	220 mm	
Mr=fn(above,As',d',x,x/d)	754 mm ² , 56 mm, 48 mm, 0,20	128,4 kN,m	
Moment Capacity Check (M/Mr)	M 0.0 kN.m, Mr 128.4 kN.m	0.000	OK
Shear Capacity Check	F 0.0 kN, vc 0.625 N/mm ² , Fvr 151.3 kN	0.00	OK
Base Bottom Steel Desi	gn		
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=fn(d,b,As,fy,Fcu)	244 mm, 1000 mm, 754 mm², 500 N/mm², 30 N/mm²	232 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm², 58 mm, 27 mm, 0.11	76.0 kN.m	
Moment Capacity Check (M/Mr)	M 18.4 kN.m, Mr 76.0 kN.m	0.243	OK
Shear Capacity Check	F 16.0 kN, vc 0.514 N/mm ² , Fvr 125.4 kN	0.13	OK

	Project 28 Parliament H	lill	Job Ref. 20230153	
G CREEN STRUCTURAL FING NITTRING	Drawing Ref.	Calculations by	Checked by	Sheet
	Part of Structure Retaining wall R	i-3	'	Date Sep-23

h = 1.6 m

The retaining walls will be designed for one load case:

- Case 1 Minimum vertical forces and maximum horizontal forces: This is the most onerous case for bearing pressures on the toe and overturning. For these the live loads will be removed.
- Permanent case –empty pool, surcharge, water at ground level
- Temporary case –empty pool, surcharge, no water

Assumptions:

- Total retained height 1600mm
- Accidental water level assumed at 1mBGL
- Surcharge of 5kN/m2 has been considered for the area underneath existing floor
- 125Pa safe bearing pressure

Ltoe = 1.6 m Lheel = m

0.00

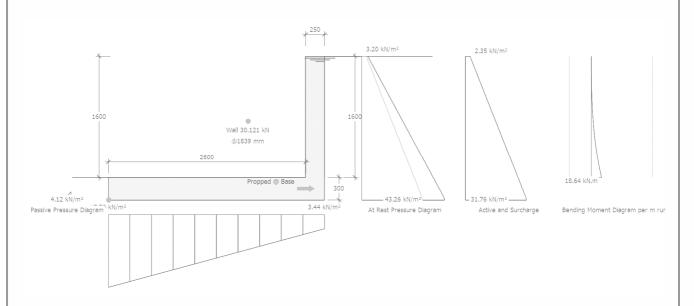
Loading (w)

Dead Load (G_k) :		kN/m^2	m	kN/m
	No vertical load considered			
	TOTAL LC1			0.00
	TOTAL LC2			0.00
Live Load (Q_k) :		kN/m ²	m	kN/m
	surpharma considered	10.00	1	
	surcharge considered	10.00		
	No vertical load considered			
	TOTAL LC1			0.000

TOTAL LC2

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MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997 RW3 (LC2)-Perm 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) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Concrete grade fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 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 5.00 kN/m², Water table level 1600 mm

Unplanned excavation depth Front of wall 190 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 Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

Base Friction and Cohesion $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

Geotechnical Design

Wall Stability - Virtual Back Pressure

ı	Case 1 Overturning/Stabilising	22.129/55.403	0.399	OK
	Wall Sliding - Virtual I	Back Pressure		
ı	Fx/(Rx _{Friction} + Rx _{Passive})	0.000/(8.778+0.229)	0.000	OK
ı	Prop Reaction Case 2 (Service)	32.6 kN @ Base		
	Soil Pressure			
ı	Virtual Back (No uplift)	Max(17.696/95, 3.441/95) kN/m ²	0.186	OK
ı	Wall Back (No uplift)	Max(17.662/95, 3.475/95) kN/m ²	0.186	OK
ı				

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Job ref Job Ref Sheet : Sheet Ref / 2 -

Made By

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Structural Design

At Rest Earth Pressure

At rest earth pressures magnification $(1+Sin(\phi)) \times \sqrt{OCR} = (1+Sin(21.24)x\sqrt{1})$ 1.36

OK

OK

OK

 $\bigcirc K$

OK

Prop Reaction

Maximum Prop Reaction (Ultimate) 44.3 kN @ Base

Wall Design (Inner Steel)

Critical Section	Cri
Steel Provided (Cover)	Ма
Compression Steel Provided (Cover)	Ма
Leverarm z=fn(d,b,As,fy,Fcu)	21
Mr=fn(above,As',d',x,x/d)	45
Moment Capacity Check (M/Mr)	M
Shear Capacity Check	F 3

itical @ 0 mm from base, Case 2 ain H16@150 (30 mm) Dist. H12@175 (46 mm) ain H12@250 (30 mm) Dist. H12@175 (42 mm)

.2 mm, 1000 mm, 1340 mm², 500 N/mm², 30.0 N/mm² 52 mm², 36 mm, 48 mm, 0.23 18.6 kN.m, Mr 110.9 kN.m

1340 mm² OK 452 mm² 190 mm 110.9 kN.m

0.168

0.23

32.3 kN, vc 0.676 N/mm², Fvr 143.2 kN

Base Top Steel Design

Steel Provided (Cover)
Compression Steel Provided (Cove
Leverarm z=fn(d,b,As,fy,Fcu)
Mr=fn(above,As',d',x,x/d)
Moment Capacity Check (M/Mr)
Shear Capacity Check

Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm² OK Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm² 242 mm, 1000 mm, 1340 mm², 500 N/mm², 30 N/mm² 220 mm 754 mm², 56 mm, 48 mm, 0.20 128,4 kN,m M 0.0 kN.m, Mr 128.4 kN.m 0.000 $\bigcirc K$ F 0.0 kN, vc 0.625 N/mm², Fvr 151.3 kN 0.00 OK

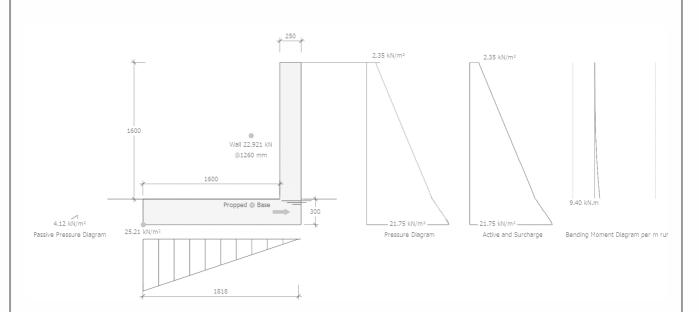
Base Bottom Steel Design

Steel Provided (Cover)
Compression Steel Provided (Cove
Leverarm z=fn(d,b,As,fy,Fcu)
Mr=fn(above,As',d',x,x/d)
Moment Capacity Check (M/Mr)
Shear Capacity Check

Main H12@150 (50 mm) Dist. H12@175 (62 mm) 754 mm² Main H16@150 (50 mm) Dist. H12@175 (66 mm) 1340 mm² 244 mm, 1000 mm, 754 mm², 500 N/mm², 30 N/mm² 232 mm 1340 mm², 58 mm, 27 mm, 0.11 76.0 kN.m M 28.3 kN.m, Mr 76.0 kN.m 0.372 F 15.0 kN, vc 0.514 N/mm², Fvr 125.4 kN 0.12

MASTERKEY: RETAINING WALL DESIGN TO BS 8002: 1994 AND BS 8110: 1997

RW3 (LC2)-Temp Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes All dimensions are in mm and all forces are per metre run

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Job ref : Job Ref Sheet : Sheet Ref / 3 -

Made By

Date : 22 Nov 2023/ Version 2015.04 Checked

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Material Densities (kN/m³) Back Soil - Dry 20.00, Saturated 22.00, Submerged 12.00

Front Soil - Dry 18.00, Saturated 20.80, Submerged 10.80, Concrete 24.00

Fax: (028) 9036 5102

fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²

Concrete covers (mm) Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm

fy 500 N/mm² designed to BS 8110: 1997 Reinforcement design Surcharge and Water Table Surcharge 5.00 kN/m², Water table level 0 mm

Front of wall 190 mm Unplanned excavation depth

† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice

Additional Loads

Concrete grade

Wall Propped at Base Level Therefore no sliding check is required

† Dimensions Ties, line loads and partial loads are measured from the inner top edge of the wall

Soil Properties

Bearing pressure Premissable service pressure @ front 95.00 kN/m², @ back 95.00 kN/m²

Back Soil Friction and Cohesion $\phi = Atn(Tan(25)/1.2) = 21.24^{\circ}$

 $\delta = Atn(0.75xTan(Atn(Tan(25)/1.2))) = 16.25^{\circ}$ Base Friction and Cohesion

Front Soil Friction and Cohesion $\phi = Atn(Tan(30)/1.2) = 25.69^{\circ}$

Loading Cases

Gwall- Wall & Base Self Weight, Pa- Active Earth Pressure, Psurcharge- Earth pressure from surcharge,

P_p- Passive Earth Pressure

Case 1: Geotechnical Design 1.00 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp Case 2: Structural Ultimate Design 1.40 Gwall+1.00 Pa+1.00 Psurcharge+1.00 Pp

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	14.990/28.882	0.519	OK
Wall Sliding - Virtual Ba	ck Pressure		

0.000/(6.680+0.229) Fx/(Rx_{Friction}+ Rx_{Passive})

Prop Reaction Case 2 (Service) 21.6 kN @ Base

Soil Pressure

Virtual Back	25.211/95 kN/m ² , Length under pressure 1.818 m	0.265	OK
Wall Back	25.143/95 kN/m ² , Length under pressure 1.823 m	0.265	OK

Structural Design

Prop Reaction

Maximum Prop Reaction (Ultimate) 21.6 kN @ Base

Wall Design (Inner Steel)

3 ()	/		
Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@150 (30 mm) Dist. H12@175 (46 mm)	1340 mm ²	OK
Compression Steel Provided (Cover)	Main H12@250 (30 mm) Dist. H12@175 (42 mm)	452 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	212 mm, 1000 mm, 1340 mm ² , 500 N/mm ² , 30.0 N/mm ²	190 mm	
Mr=fn(above,As',d',x,x/d)	452 mm ² , 36 mm, 48 mm, 0.23	110.9 kN.m	
Moment Capacity Check (M/Mr)	M 9.4 kN.m, Mr 110.9 kN.m	0.085	OK
Shear Capacity Check	F 15.7 kN, vc 0.676 N/mm ² , Fvr 143.2 kN	0.11	OK
Base Top Steel Design			

Steel Provided (Cover) Compression Steel Provided (Cover)	Main H16@150 (50 mm) Dist. H12@175 (66 mm) Main H12@150 (50 mm) Dist. H12@175 (62 mm)	1340 mm² 754 mm²	OK
Leverarm z=fn(d,b,As,fy,Fcu)	242 mm, 1000 mm, 1340 mm², 500 N/mm², 30 N/mm²	220 mm	
Mr=fn(above,As',d',x,x/d)	754 mm², 56 mm, 48 mm, 0.20	128.4 kN.m	01/
Moment Capacity Check (M/Mr)	M 0.0 kN.m, Mr 128.4 kN.m	0.000	OK
Shear Capacity Check	F 0.0 kN, vc 0.625 N/mm², Fvr 151.3 kN	0.00	OK

Base Bottom Steel Design

	5)		
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 mm ²	
Leverarm z=fn(d,b,As,fy,Fcu)	244 mm, 1000 mm, 754 mm ² , 500 N/mm ² , 30 N/mm ²	232 mm	
Mr=fn(above,As',d',x,x/d)	1340 mm ² , 58 mm, 27 mm, 0.11	76.0 kN.m	
Moment Capacity Check (M/Mr)	M 13.3 kN.m, Mr 76.0 kN.m	0.175	OK
Shear Capacity Check	F 13.2 kN, vc 0.514 N/mm ² , Fvr 125.4 kN	0.11	OK

	Project	Project		Job Ref.	
	28 Parliament Hi	28 Parliament Hill		20230153	
G _r	Drawing Ref.	Calculations by	Checked by Sheet		
	Part of Structure	AS	Date		
		Uplift and Buoyancy check		Sep-25	

BUOYANCY CHECK

TOTAL WEIGHT OF THE BUILDING

 $F_{weight\ total} = w_{slab\ self-weight+screed} * Aslab + underpin\ weight + party\ wall\ load$

Aslab = 33 m2

wslab (sw+screed)= 5.23 kN/m2

underpin weight= 322.56 kN

party wall load= 0 kN

= 495 kN

445.6 x0.9 factor

TOTAL UPLIFT DUE TO GROUNDWATER

 $F_{uplift\ total} = w_{H20} * Hw * Aslab =$ 939 kN x1.0 factor

(where Aslab = 33 m2)

EQUILIBRIUM $F_{weight total factored} > F_{uplift total}$

446 > 939

(CONSIDERS 0.9 FACTOR ON DEAD LOAD)

EQUILIBRIUM NOT SATISFIED UR 0.47

=> Provide 4No. Piles