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STRUCTURAL CALCULATIONS

DCE IRL

PROJECT NO: 4560

21/11/2021

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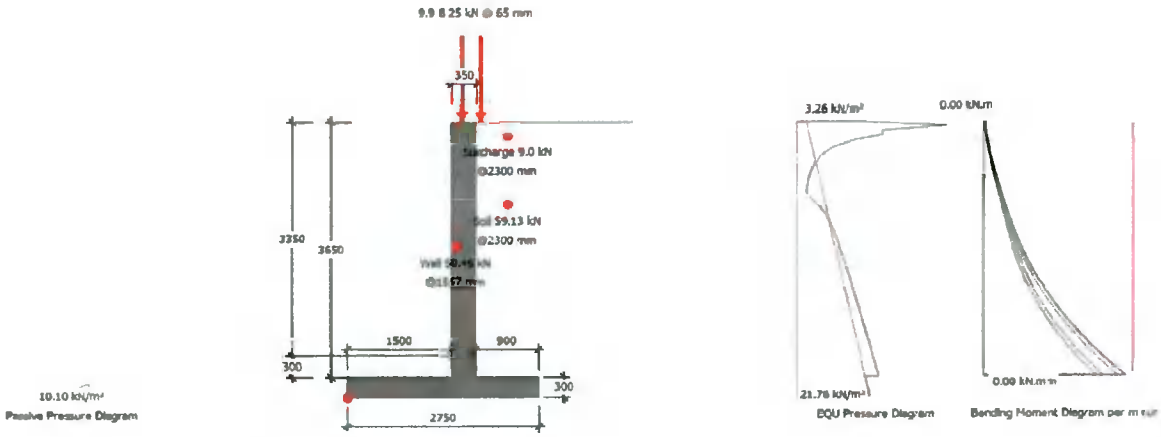
MasterKey : Retaining Wall Design to EC 7 : 2004 and EC 2 : 2004
RW1 (carrying 1st floor extension)
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Soil 18.00, Concrete 24.00
Concrete grade	C28/35 N/mm², Permissible tensile stress 1.033 N/mm²
Concrete covers (mm)	Wall inner cover 45 mm, Wall outer cover 45 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to EC 2: 2004
Surcharge and Water Table	Surcharge 10.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 395 mm

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

Additional Loads

Vertical Line Loads	40 kN/m @ X -200 mm and Y 0 mm - Load type Dead 9.9 kN/m @ X -200 mm and Y 0 mm - Load type Live 8.25 kN/m @ X 65 mm and Y 0 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	Ultimate resistance M1 @ front 100.00 kN/m², @ back 100.00 kN/m² Ultimate resistance M2 @ front 100.00 kN/m², @ back 100.00 kN/m²
EC7 EQU - Wall Stability	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.1) = 30.56°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.1))) = 27.69°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.1) = 27.69°
EC7 GEO/STR - M1	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1) = 33°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1))) = 30°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1) = 30°
EC7 GEO/STR - M2	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.25) = 27.45°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.25))) = 24.79°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.25) = 24.79°

Loading Cases EQU and GEO/STR - Design Approach 1

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge,
P_{surch}(fav) - Earth pressure from surcharge (no load over heel), P_p- Passive Earth Pressure

Case 1: EQU Wall Stability	0.90 G_{Soil}+0.90 G_{Wall}+1.10 P_a+1.50 $P_{surcharge}$+0.90 P_p
Case 2: GEO/STR A1+M1 I	1.00 G_{Soil}+1.00 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$
Case 3: GEO/STR A2+M2 I	1.00 G_{Soil}+1.00 G_{Wall}+1.30 Fv_{Heel}+1.00 P_a+1.30 $P_{surcharge}$
Case 4: GEO/STR A1+M1 II	1.00 G_{Soil}+1.00 G_{Wall}+1.35 P_a+1.50 P_{surch}(fav)
Case 5: GEO/STR A2+M2 II	1.00 G_{Soil}+1.00 G_{Wall}+1.00 P_a+1.30 P_{surch}(fav)
Case 6: GEO/STR A1+M1 III	1.35 G_{Soil}+1.35 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$

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Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	86.766/266.733	0.325	OK

Wall Sliding - Virtual Back Pressure

Case 2 $Fx/(Rx_{Friction}+ Rx_{Passive})$	60.329/(107.497+1.140)	0.555	OK
Case 3 $Fx/(Rx_{Friction}+ Rx_{Passive})$	59.345/(84.252+0.929)	0.697	OK
Case 4 $Fx/(Rx_{Friction}+ Rx_{Passive})$	60.329/(91.129+1.140)	0.654	OK
Case 5 $Fx/(Rx_{Friction}+ Rx_{Passive})$	59.345/(72.903+0.929)	0.804	OK
Case 6 $Fx/(Rx_{Friction}+ Rx_{Passive})$	60.329/(139.392+1.140)	0.429	OK

Soil Pressure

Case 2 - Virtual Back	69.588/100 kN/m², Length under pressure 2.676 m	0.696	OK
Case 3 - Virtual Back	67.679/100 kN/m², Length under pressure 2.695 m	0.677	OK
Case 4 - Virtual Back	60.066/100 kN/m², Length under pressure 2.628 m	0.601	OK
Case 5 - Virtual Back	59.986/100 kN/m², Length under pressure 2.631 m	0.600	OK
Case 6 - Virtual Back	98.042/100 kN/m², Length under pressure 2.463 m	0.980	OK
Case 2 - Wall Back	80.763/100 kN/m², Length under pressure 2.305 m	0.808	OK
Case 3 - Wall Back	77.595/100 kN/m², Length under pressure 2.351 m	0.776	OK
Case 4 - Wall Back	69.724/100 kN/m², Length under pressure 2.264 m	0.697	OK
Case 5 - Wall Back	67.102/100 kN/m², Length under pressure 2.352 m	0.671	OK
Case 6 - Wall Back	91.550/100 kN/m², Length under pressure 2.637 m	0.916	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 6		
Steel Provided (Cover)	Main H16@200 (45 mm) Dist. H12@200 (61 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (45 mm) Dist. H12@200 (61 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	297 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	282 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 53 mm, 34 mm, 0.12	123.3 kN.m	
Moment Capacity Check (M/Mr)	M 116.9 kN.m, Mr 123.3 kN.m	0.948	OK
Shear Capacity Check	F 70.1 kN, vc 0.462 N/mm², Fvr 137.3 kN	0.51	OK

Base Top Steel Design - Case 2

Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	242 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	228 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 58 mm, 34 mm, 0.14	99.8 kN.m	
Moment Capacity Check (M/Mr)	M 27.8 kN.m, Mr 99.8 kN.m	0.278	OK
Shear Capacity Check	F 50.6 kN, vc 0.519 N/mm², Fvr 125.6 kN	0.40	OK

Base Bottom Steel Design - Case 6

Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	242 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	228 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 58 mm, 34 mm, 0.14	99.8 kN.m	
Moment Capacity Check (M/Mr)	M 92.1 kN.m, Mr 99.8 kN.m	0.923	OK
Shear Capacity Check	F 122.7 kN, vc 0.519 N/mm², Fvr 125.6 kN	0.98	OK

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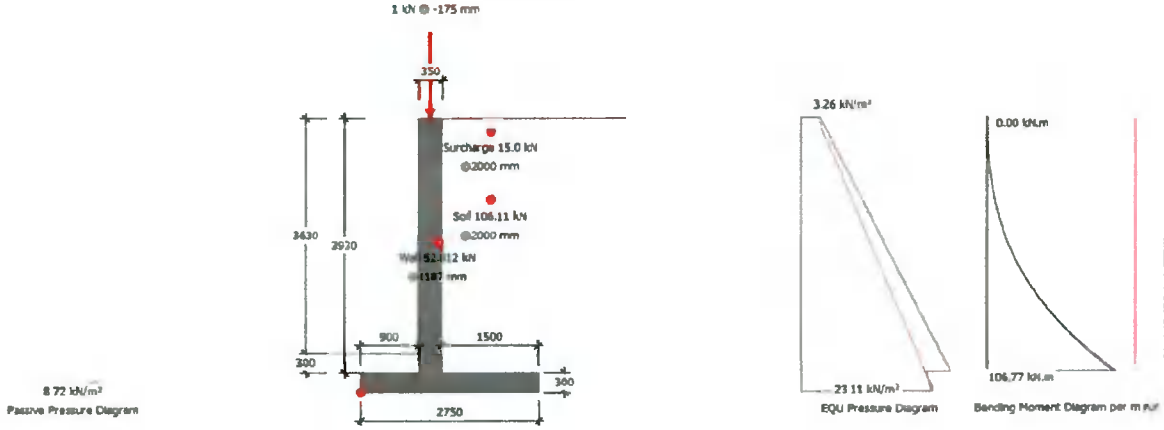
MASTERKEY : RETAINING WALL DESIGN TO EC 7 : 2004 AND EC 2 : 2004

RW2

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)	Soil 18.00, Concrete 24.00
Concrete grade	C28/35 N/mm², Permissible tensile stress 1.033 N/mm²
Concrete covers (mm)	Wall inner cover 45 mm, Wall outer cover 45 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm² designed to EC 2: 2004
Surcharge and Water Table	Surcharge 10.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 423 mm

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

Additional Loads

Vertical Line Load	1 kN/m @ X -175 mm and Y 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	Ultimate resistance M1 @ front 100.00 kN/m², @ back 100.00 kN/m² Ultimate resistance M2 @ front 100.00 kN/m², @ back 100.00 kN/m²
EC7 EQU - Wall Stability	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.1) = 30.56°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.1))) = 27.69°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.1) = 27.69°
EC7 GEO/STR - M1	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1) = 33°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1))) = 30°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1) = 30°
EC7 GEO/STR - M2	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.25) = 27.45°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.25))) = 24.79°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.25) = 24.79°

Loading Cases EQU and GEO/STR - Design Approach 1

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge,
P_{surch}(fav) - Earth pressure from surcharge (no load over heel), P_p- Passive Earth Pressure

Case 1: EQU Wall Stability	0.90 G_{Soil}+0.90 G_{Wall}+1.10 P_a+1.50 $P_{surcharge}$+0.90 P_p
Case 2: GEO/STR A1+M1 I	1.00 G_{Soil}+1.00 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$
Case 3: GEO/STR A2+M2 I	1.00 G_{Soil}+1.00 G_{Wall}+1.30 Fv_{Heel}+1.00 P_a+1.30 $P_{surcharge}$
Case 4: GEO/STR A1+M1 II	1.00 G_{Soil}+1.00 G_{Wall}+1.35 P_a+1.50 P_{surch}(fav)
Case 5: GEO/STR A2+M2 II	1.00 G_{Soil}+1.00 G_{Wall}+1.00 P_a+1.30 P_{surch}(fav)
Case 6: GEO/STR A1+M1 III	1.35 G_{Soil}+1.35 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$

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Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	103.996/247.435	0.420	OK

Wall Sliding - Virtual Back Pressure

Case 2 $Fx/(Rx_{Friction}+ Rx_{Passive})$	68.105/(105.610+0.851)	0.640	OK
Case 3 $Fx/(Rx_{Friction}+ Rx_{Passive})$	66.846/(83.010+0.693)	0.799	OK
Case 4 $Fx/(Rx_{Friction}+ Rx_{Passive})$	68.105/(91.754+0.851)	0.735	OK
Case 5 $Fx/(Rx_{Friction}+ Rx_{Passive})$	66.846/(73.403+0.693)	0.902	OK
Case 6 $Fx/(Rx_{Friction}+ Rx_{Passive})$	68.105/(137.724+0.851)	0.491	OK

Soil Pressure

Case 2 - Virtual Back	78.001/100 kN/m², Length under pressure 2.345 m	0.780	OK
Case 3 - Virtual Back	77.309/100 kN/m², Length under pressure 2.325 m	0.773	OK
Case 4 - Virtual Back	75.223/100 kN/m², Length under pressure 2.113 m	0.752	OK
Case 5 - Virtual Back	74.942/100 kN/m², Length under pressure 2.121 m	0.749	OK
Case 6 - Virtual Back	91.569/100 kN/m², Length under pressure 2.605 m	0.916	OK
Case 2 - Wall Back	87.230/100 kN/m², Length under pressure 2.097 m	0.872	OK
Case 3 - Wall Back	85.538/100 kN/m², Length under pressure 2.101 m	0.855	OK
Case 4 - Wall Back	86.981/100 kN/m², Length under pressure 1.827 m	0.870	OK
Case 5 - Wall Back	85.091/100 kN/m², Length under pressure 1.868 m	0.851	OK
Case 6 - Wall Back	98.784/100 kN/m², Length under pressure 2.415 m	0.988	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H16@200 (45 mm) Dist. H12@200 (61 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (45 mm) Dist. H12@200 (61 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	297 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	282 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 53 mm, 34 mm, 0.12	123.3 kN.m	
Moment Capacity Check (M/Mr)	M 106.8 kN.m, Mr 123.3 kN.m	0.866	OK
Shear Capacity Check	F 72.7 kN, vc 0.462 N/mm², Fvr 137.3 kN	0.53	OK

Base Top Steel Design - Case 2

Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	242 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	228 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 58 mm, 34 mm, 0.14	99.8 kN.m	
Moment Capacity Check (M/Mr)	M 73.3 kN.m, Mr 99.8 kN.m	0.734	OK
Shear Capacity Check	F 71.5 kN, vc 0.519 N/mm², Fvr 125.6 kN	0.57	OK

Base Bottom Steel Design - Case 6

Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	OK
Compression Steel Provided (Cover)	Main H16@200 (50 mm) Dist. H12@200 (66 mm)	1005 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	242 mm, 1000 mm, 1005 mm², 500 N/mm², 28 N/mm²	228 mm	
Mr=fn(above,As',d',x,x/d)	1005 mm², 58 mm, 34 mm, 0.14	99.8 kN.m	
Moment Capacity Check (M/Mr)	M 36.1 kN.m, Mr 99.8 kN.m	0.362	OK
Shear Capacity Check	F 80.2 kN, vc 0.519 N/mm², Fvr 125.6 kN	0.64	OK

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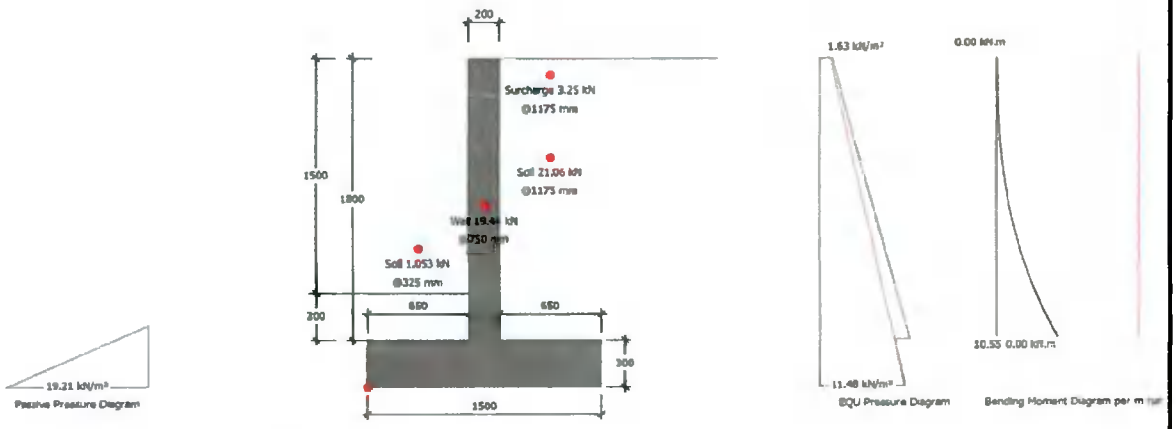
MASTERKEY : RETAINING WALL DESIGN TO EC 7 : 2004 AND EC 2 : 2004
RW3 Supporting Staircase
Reinforced Concrete Retaining Wall with Reinforced Base



Summary of Design Data

Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Soil 18.00, Concrete 24.00
Concrete grade	C28/35 N/mm², Permissible tensile stress 1.033 N/mm²
Concrete covers (mm)	Wall inner cover 45 mm, Wall outer cover 45 mm, Base cover 75 mm
Reinforcement design	fy 500 N/mm² designed to EC 2: 2004
Surcharge and Water Table	Surcharge 5.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 210 mm

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

Soil Properties

Bearing pressure	Ultimate resistance M1 @ front 100.00 kN/m², @ back 100.00 kN/m² Ultimate resistance M2 @ front 100.00 kN/m², @ back 100.00 kN/m²
EC7 EQU - Wall Stability	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.1) = 30.56°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.1))) = 27.69°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.1) = 27.69°
EC7 GEO/STR - M1	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1) = 33°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1))) = 30°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1) = 30°
EC7 GEO/STR - M2	
Back Soil Friction and Cohesion	ϕ = Atn(Tan(33)/1.25) = 27.45°
Base Friction and Cohesion	δ = Atn(1xTan(Atn(Tan(30)/1.25))) = 24.79°
Front Soil Friction and Cohesion	ϕ = Atn(Tan(30)/1.25) = 24.79°

Loading Cases EQU and GEO/STR - Design Approach 1

G_{Soil}- Soil Self Weight, G_{Wall}- Wall & Base Self Weight, Fv_{Heel}- Vertical Loads over Heel,
P_a- Active Earth Pressure, $P_{surcharge}$- Earth pressure from surcharge,
P_{surch}(fav) - Earth pressure from surcharge (no load over heel), P_p- Passive Earth Pressure

Case 1: EQU Wall Stability	0.90 G_{Soil}+0.90 G_{Wall}+1.10 P_a+1.50 $P_{surcharge}$+0.90 P_p
Case 2: GEO/STR A1+M1 I	1.00 G_{Soil}+1.00 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$
Case 3: GEO/STR A2+M2 I	1.00 G_{Soil}+1.00 G_{Wall}+1.30 Fv_{Heel}+1.00 P_a+1.30 $P_{surcharge}$
Case 4: GEO/STR A1+M1 II	1.00 G_{Soil}+1.00 G_{Wall}+1.35 P_a+1.50 P_{surch}(fav)
Case 5: GEO/STR A2+M2 II	1.00 G_{Soil}+1.00 G_{Wall}+1.00 P_a+1.30 P_{surch}(fav)
Case 6: GEO/STR A1+M1 III	1.35 G_{Soil}+1.35 G_{Wall}+1.50 Fv_{Heel}+1.35 P_a+1.50 $P_{surcharge}$
Case 7: Service Base Pressure Check	1.00 G_{Soil}+1.00 G_{Wall}+1.00 Fv_{Heel}+1.00 P_a+1.00 $P_{surcharge}$

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Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	12.756/35.652	0.358	OK

Wall Sliding - Virtual Back Pressure

Case 2 $Fx/(Rx_{Friction}+ Rx_{Passive})$	16.816/(26.805+4.117)	0.544	OK
Case 3 $Fx/(Rx_{Friction}+ Rx_{Passive})$	16.506/(21.144+3.354)	0.674	OK
Case 4 $Fx/(Rx_{Friction}+ Rx_{Passive})$	16.816/(23.991+4.117)	0.598	OK
Case 5 $Fx/(Rx_{Friction}+ Rx_{Passive})$	16.506/(19.193+3.354)	0.732	OK
Case 6 $Fx/(Rx_{Friction}+ Rx_{Passive})$	16.816/(35.202+4.117)	0.428	OK

Soil Pressure

Case 2 - Virtual Back	32.864/100 kN/m², Length under pressure 1.413 m	0.329	OK
Case 3 - Virtual Back	32.735/100 kN/m², Length under pressure 1.398 m	0.327	OK
Case 4 - Virtual Back	31.896/100 kN/m², Length under pressure 1.303 m	0.319	OK
Case 5 - Virtual Back	31.922/100 kN/m², Length under pressure 1.302 m	0.319	OK
Case 6 - Virtual Back	41.510/100 kN/m², Length under pressure 1.469 m	0.415	OK
Case 7 - Virtual Back SLS (No uplift)	Max(27.237 / (100 / 3), 32.500/ (100 / 3)) kN/m²	0.975	OK
Case 2 - Wall Back	35.777/100 kN/m², Length under pressure 1.298 m	0.358	OK
Case 3 - Wall Back	35.353/100 kN/m², Length under pressure 1.295 m	0.354	OK
Case 4 - Wall Back	35.387/100 kN/m², Length under pressure 1.174 m	0.354	OK
Case 5 - Wall Back	34.989/100 kN/m², Length under pressure 1.188 m	0.350	OK
Case 6 - Wall Back	42.237/100 kN/m², Length under pressure 1.444 m	0.422	OK
Case 7 - Wall Back SLS (No uplift)	Max(32.348 / (100 / 3), 27.389/ (100 / 3)) kN/m²	0.970	OK

Structural Design

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	Main H10@200 (45 mm) Dist. H10@200 (55 mm)	393 mm²	OK
Compression Steel Provided (Cover)	Main H10@200 (45 mm) Dist. H10@200 (55 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	150 mm, 1000 mm, 393 mm², 500 N/mm², 28 N/mm²	143 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 50 mm, 13 mm, 0.09	24.3 kN.m	
Moment Capacity Check (M/Mr)	M 10.5 kN.m, Mr 24.3 kN.m	0.433	OK
Shear Capacity Check	F 15.3 kN, vc 0.524 N/mm², Fvr 78.6 kN	0.20	OK

Base Top Steel Design - Case 4

Steel Provided (Cover)	Main H10@200 (75 mm) Dist. H10@200 (85 mm)	393 mm²	OK
Compression Steel Provided (Cover)	Main H10@200 (75 mm) Dist. H10@200 (85 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	220 mm, 1000 mm, 393 mm², 500 N/mm², 28 N/mm²	209 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 80 mm, 13 mm, 0.06	35.7 kN.m	
Moment Capacity Check (M/Mr)	M 6.5 kN.m, Mr 35.7 kN.m	0.182	OK
Shear Capacity Check	F 14.6 kN, vc 0.506 N/mm², Fvr 111.2 kN	0.13	OK

Base Bottom Steel Design - Case 6

Steel Provided (Cover)	Main H10@200 (75 mm) Dist. H10@200 (85 mm)	393 mm²	OK
Compression Steel Provided (Cover)	Main H10@200 (75 mm) Dist. H10@200 (85 mm)	393 mm²	
Leverarm z=fn(d,b,As,fy,Fck)	220 mm, 1000 mm, 393 mm², 500 N/mm², 28 N/mm²	209 mm	
Mr=fn(above,As',d',x,x/d)	393 mm², 80 mm, 13 mm, 0.06	35.7 kN.m	
Moment Capacity Check (M/Mr)	M 6.4 kN.m, Mr 35.7 kN.m	0.180	OK
Shear Capacity Check	F 19.7 kN, vc 0.506 N/mm², Fvr 111.2 kN	0.18	OK