Basement Foundation Wall

STRUTTED BASEMENT WALL V5.04 — Engineering Building & Infrastructure Pty Ltd

Piers: **(Basement Foundation Wall) 600mm dia. piers at 1450mm cts, 40MPa, 10000mm excavation depth**
25kPa surcharge, Ks =0.6, Ka.γ = 6
Refer analysis for pier design

Wall: **100% pressure allowance on wall for arching**
RL1018 (main wires in horizontal direction) to spray wall, N16-400 cts to wall interface

M* = 8.8kNm < øMuo = 22.7kNm	**OK (0.39)**
V* = 41.4kN < øVuc = 42.8kN (Unreinforced shear)	**OK (0.97)**
V* = 41.4kN < øVu = 562.0kN (Interface shear)	**OK (0.07)**

Pier Geometry (Strutted - Not Cantilevered)

Excavation depth (H) =	10000	mm
Pier centres (cts) =	1450	mm
Pier diameter (dia) =	600	mm
Concrete strength (f'c) =	40	MPa
Cover to steel =	60	mm
Effective cover (Cover - 20mm) =	40	mm - Cl 4.10.3.5
Exposure classification =	B1	Table 4.10.3.2 (Standard formwork)

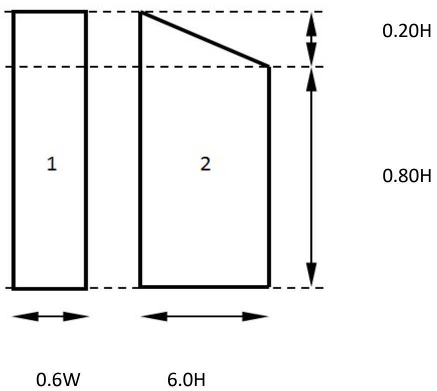
Geotechnical

Geotechnical report =		
Lateral surchage coeff (Ks) =	0.6	
Surcharge (W) =	25	kPa
Lateral earth pressure (Ka.γ) =	6	x H uniform
Anchor friction =	100	kPa
Lateral socket bearing =	1000	kPa
Socket side friction =	300	kPa
Top proportion =	0.2	(Proportion to full lateral pressure - refer diagram)
% pressure for infill walls =	100	% (50% - 100%)

Soldier pier pressure distribution (free draining) (Not for cantilever distribution)

Working

Surcharge p1 = Ks*W =	15.00	kPa
Earth pressure p2 = (Ka.γ)*H =	60.00	kPa
Total pressure pt = p1 + p2 =	75.00	kPa
Surcharge f1 = p1 * cts =	21.75	kN/m
Earth pressure f2 = p2 * cts =	87.00	kN/m
Total ft = pt * cts =	108.75	kN/m



Ultimate

Earth factor (elf) =	1.25	AS 4678 - Cl 4.1
Live load factor (llf) =	1.5	AS 4678 - Cl 4.1
Surcharge f1* = llf * f1 =	32.63	kN/m
Earth pressure f2* = elf * f2 =	108.75	kN/m
Total ft* = f1* + f2* =	141.38	kN/m
Load factor (LF = Ult*/Working) =	1.30	

	Surcharge	Earth	Total	
	0.6W	6H		
Working	15.00	60.00	75.00	kPa
	21.75	87.00	108.75	kN/m
Ultimate	32.63	108.75	141.38	kN/m

Analysis for moment and deflection using other methods.

Spray wall

Concrete strength (f'c) =	32	MPa		
Wall thickness (t) =	150	mm		
Bending reinforcement =	**RL1018 (main wires in horizontal direction)**			
Bar size =	9.5	mm		
Bar cts/No/mm² =	100	mm		
Yield strength (fsy) =	500	MPa		
Reinf't ductility class =	L	(N)ormal,(L)ow		
Cover from basement face =	40	mm		
Steel area (Ast) =	709	mm²/m		
Depth to tensile steel from soil face (dsw) =	105	mm		
No. bars =	10.0			
Bar centres =	100	mm		
Exposure classification =	B1	Table 4.10.3.2 (Standard formwork)		
Design moment and shear				
Horizontal wall span (L) =	850	mm		
p.max = % pressure * lateral pressure =	75	kPa		
M* = p*.*L²/8 =	8.8	kNm/m		
Reaction (R*) =	41.4	kN/m		
p* = p.max * LF =	97.5	kPa		
Bending capacity - Cl 8.1				
Minimum steel (Ast.min) =	290	mm²/m	Cl 9.1.1 & Cl 8.1.6.1	
alpha (α2 = 0.85-0.0015*f'c) =	0.802	(α2 ≥ 0.67)	Eq 8.1.3(1)	
gamma (γ = 0.97-0.0025*f'c) =	0.890	(γ ≥ 0.67)	Eq 8.1.3(2)	
kuo = fsy*Ast/(α2*f'cw*γ*dsw*bw) =	0.147			
ø = 0.65 =	0.650		Table 2.2.2(b)(ii) for L Class	
Design capacity (øMuo) =	22.66	kNm/m	Cl 9.1.1 & Cl 8.1.6.1	OK (0.39)
Dowels =	**N16-400 cts**			
Diameter =	16	mm		
Centres (cts) =	400	mm		
Yield strength (fsys) =	500	MPa (Class N)		
Steel area (Ast) =	503	mm²/m		
	Min. aggregate size of 10mm for simplified shear - Cl 8.2.4.1			
Unreinforced shear capacity - Cl 8.2.4				
Strength reduction factor ø =	0.70		Table 2.2.2(e)	
do = t/2 =	75	mm		
Effective shear depth dv = max(0.72*D,0.9*do) =	108	mm	Cl 8.2.1.9	
Asv < Asv.min, kvo = 200/(1000+1.3*dv) =	0.175			
Asv < Asv.min, kv = min(kvo, 0.10) =	0.100		Cl 8.2.4.3	
√f'c =	5.66	MPa		
Vuc = kv*1000*dv*min(√f'c, 8.0) =	61.1	kN/m	Eq 8.2.4.1	
øVuc =	42.8	kN/m	Cl 8.2.1.6	OK (0.97)
Shear stress capacity - Cl 8.4.3				
Strength reduction factor (øv) =	0.75		Table 2.2.2	
Horizontal steel area (Asf) =	503	mm²		
Frictional constant (μ) =	0.7		Table 8.4.3 (Deliberately roughened)	
Cohesion coeff. (kco) =	0.4		Table 8.4.3 (Deliberately roughened)	
f'ct = 0.36*√f'c =	2.04	MPa	Cl 3.1.1.3	
Permanant load normal to shear interface (gp) =	0	kN/m		
τu = μ*[Asf*fsys/(cts*t+gp/t]+kco*f'ct =	3.75	MPa	Cl 8.4.3	
τu.max = 0.2*f'c =	8.00	MPa	Cl 8.4.3	
τu = min(0.2*f'c, 10, τu) =	3.75	MPa		
øVus = τu*Ac =	562.0	kN/m		OK (0.07)

Socket resistance

Working reaction (R) =	250	kN horizontal reaction at toe
Socket depth (d) =	1000	mm
Wedge calculation method =	W	(W)edge,(A)ngle,(C)ustom
Wedge area of plane (A = 4.5*d²+2.25*d*dia) =	3.20	m² (Approx. 1 to 2, or 27°, failure wedge angle)

				Adopt A =	3.20 m²		Trimmed
Case 1 (Shear across coated plane) = R/A =	78.0	kPa	≤	80	kPa	OK (0.98)	
Case 2 (Shear across 50% jointed rock plane) = 2*R/A =	156.0	kPa	≤	160	kPa	OK (0.98)	
Case 3 (Lateral Bearing) = R/(dia*sd) =	416.7	kPa	≤	1000	kPa	OK (0.42)	
Vertical load resistance =	848.2	kN (End bearing and side friction)					

Anchors

Anchor friction =	100	kPa
Anchor reaction (T) =	500	kN (horizontal - working)
Anchor declination to horz. (horz) =	15	° (0° ≤ angle ≤ 45°)
Anchor diameter (adia) =	100	mm
Anchor capacity =	31	kN/m
Required pullout =	518	kN
Estimated anchor length =	16.5	m