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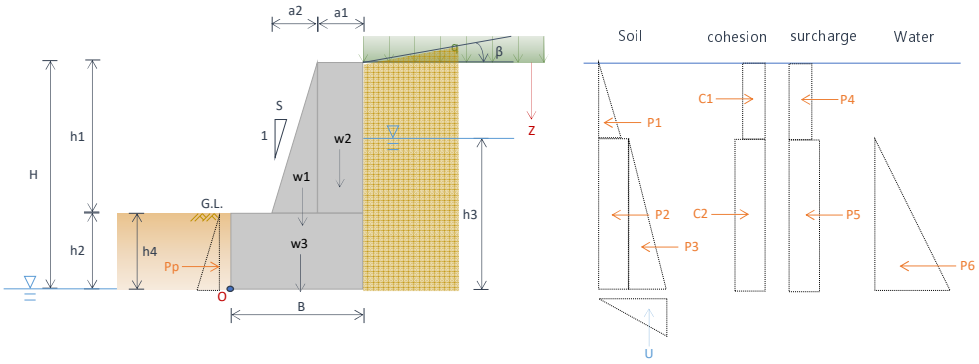

I. Design Parameters

Item	Value	Unit	Remark
Geometry of Retaining wall			
Wall height (H)	3	m	
Width of top(a1)	0.6	m	
Slope of wall, 1 : S	0.3	m	
h1	2	m	
a2	0.6	m	
Width of bottom (B)	1.8	m	
Thickness of bottom (h2)	1	m	
Embedment depth (h4)	1	m	
Unit weight of Concrete (γ_c)	2.3	t/m^3	

Item	Value	Unit	Remark
Engineering properties of Backfill			
Traffic surcharges (q)	0	t/m^2	
surcharge slope (β)	0	°	
Gross unit weight (γ_m)	2	t/m^3	
Cohesion (c)	0	t/m^3	
Intermal angle of friction (φ)	30	°	
Saturated unit weight (γ_{sat})	2.2	t/m^3	
Effective cohesion (c')	0	t/m^3	
Effective intermal angle of friction (φ')	26	°	
Eepth of waterground from point O(h3)	0.5		
Unit weight of water(γ_w)	1	t/m^3	

Others			
Type of design	static		
Whether to consider the influence of passive earth pressure in the calculation?	No		
Whether the water pressure on both sides of the wall is the same or not?	different		
Whether to set the Shear Key?	Yes		
Angle of wall friction (δ)	33	°	
The Friction Coefficient with Foundation and soil(u)	0.649		u = tanδ

Engineering properties of Foundation Soil		
Unit weight(γ)	1.96	t/m^3
Cohesion(c)	0	t/m^3
Intermal angle of friction (φ)	33	°

II. Safety Factor

Item (faulure mode)		for Static	for Seismic	Unit	Remark
Overturning (FSo)	≧	2	1.5		
Sliding (FSs)	≧	1.5	1.2		
Allowable bearing capacity	≦	60		t/m²	Only consider the β = 0

The chosen performance criteria should reflect site conditions and agency or Internaction code requirements, like ISO, BS, AASHTO..., ect.

III. Stability Analysis

A.

Soil Properties	Unit	Gross soil	Saturated soil	Base Soil
Surcharge slope (β)	°	0	0	0
Unit weight (γ)	t/m^3	2	2.2	1.96
Cohesion(c)	t/m^3	0	0	0
Intermal angle of friction (φ)	°	30	26	33

Coefficient of active earth pressure (K_a)	0.333	0.390	$K_a = \tan^2\left(45° - \frac{\phi}{2}\right)$
Coefficient of passive earth pressure (K_p)		3.39	$K_p = \tan^2\left(45° + \frac{\phi}{2}\right)$

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B. Lading check

Retaining Wall	Vertical force (V) t/m	Moment arm to point O ($\bar{y}$) m	Torque/Moment to point O (Mr) t-m/m
Wall weight(w1)	1.38	1.00	1.38
Wall weight(w2)	2.76	1.50	4.14
Wall weight(w3)	4.14	0.90	3.73
Total(ΣV)	8.28		9.25

Effective pressure	Force under different z t/m	Moment arm to point O (y) m	Torque/Moment to point O (Md) t-m/m	Stress under different z, σ t/m^2	P t/m
Lateral earth pressure above z =2.5m (P1)	2.08	1.33	2.78	1.67	2.08
Lateral earth pressure below z =2.5m (P2)	0.98	0.25	0.24	1.95	0.98
Lateral earth pressure at z=3m (P3)	0.06	0.17	0.01	2.19	0.06
Lateral earth pressure caused by surcharges (P4)	0.00			0.00	0.00
Lateral earth pressure caused by surcharges (P5)	0.00			0.00	0.00
Lateral earth pressure caused by pore water (P6)	0.13	0.17	0.02	0.50	0.13
Total active earth pressure (P_a)	3.24		3.05		
The increment of horizontal stress (Ph)	--	--	--		
The increment of vertical stress (Pv)	--	--	--		
Total passive earth pressure (P_p)	--	--	--		
Uplift pressure(U)	0.45	1.20	0.54		

C. Overall Stability Check

Don't consider the influence of uplift pressure:

Overturning Moment	$M_d = \sum P_i \cdot y_i$	3.05	t-m/m	
Restoring Moment	$M_r = \sum W_i \cdot \overline{y_i}$	9.25	t-m/m	
∴	$FS_o = \frac{M_r}{M_d}$	3.03	>2	OK

Consider the influence of uplift pressure:

Overturning Moment	$M_d + U$	3.59	t-m/m	
Restoring Moment	$M_r = \sum W_i \cdot \overline{y_i}$	9.25	t-m/m	
∴	$FS_o = \frac{M_r}{M_d}$	2.57	>2	OK

D. Sliding Stability Check

If the angle of wall friction (δ) is known, use the recommended calculation method of the MOTC:

Horzontal driving forces	$F_d = P_a$	3.24	t	
Horizontal resisting forces	$F_r = \sum V_i \cdot tan\delta + C_a B$	5.37	t	
∴	$FS_s = \frac{F_r}{F_d}$	1.66	>1.5	OK

Consider the influence of uplift pressure:

Horzontal driving forces	$F_d = P_a$	3.24	t	
Horizontal resisting forces	$F_r = (\sum V_i - U) \cdot tan\delta + C_a B$	5.08	t	
∴	$FS_s = \frac{F_r}{F_d}$	1.57	>1.5	OK

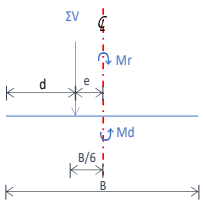
E. Bearing Capacity Failure

Don't consider the influence of uplift pressure:

Distance from center of resultant to point O	$d = \frac{\sum Mr - \sum Md}{\sum V}$	0.75	m	
Eccentricity	e = $\frac{B}{2}$ - d	0.15	m (< B/6)	OK
Maximum footing pressure	$q_{max} = \frac{V}{B}(1 + \frac{6e}{B})$	6.93	<60 t-m	OK
Minimum footing pressure	$q_{min} = \frac{V-U}{B}(1 - \frac{6e}{B})$	2.27		
∴	$FS_b = \frac{q_{ult}}{q_{mxx}}$	8.66	>2.5	OK

Consider the influence of uplift pressure:

Distance from center of resultant to point O	$d = \frac{\sum Mr - \sum Md}{\sum V - U}$	0.72	m	
Eccentricity	e = $\frac{B}{2}$ - d	0.18	m (< B/6)	OK
Maximum footing pressure	$q_{max} = \frac{V}{B}(1 + \frac{6e}{B})$	6.93	<60 t-m	OK
Minimum footing pressure	$q_{min} = \frac{V-U}{B}(1 - \frac{6e}{B})$	1.77		
∴	$FS_b = \frac{q_{ult}}{q_{mxx}}$	8.66	>2.5	OK



IV.Result

Don't consider the influence of uplift pressure:

Item	Result	Check
Overturnin, FSo	3.03>2	OK
Sliding, FSs	1.66>1.5	OK
Allowable bearing capacity	6.93<60 t-m	OK

Consider the influence of uplift pressure:

Item	Result	Check
Overturnin, FSo	2.57>2	OK
Sliding, FSs	1.57>1.5	OK
Allowable bearing capacity	6.93<60 t-m	OK

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