Sample of Excel Spreadsheet Analysis and Deign of Cantilever Retaining Walls

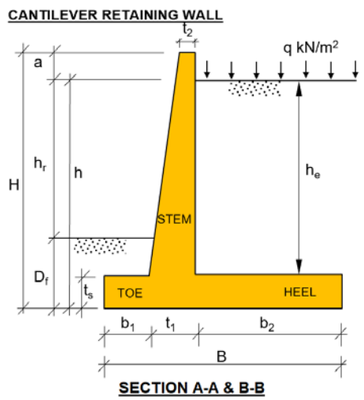
Note:
Assume the Bearing Capacity of the Foundation, q_{all} = 3000 psf

AN20

Name: | PROJECT TITLE: | SHEET No.
ID: | DESCRIPTION: Retaining Wall | DATE
 | LOCATION : | DATE

DESIGN OF CANTILEVER RETAINING WALL PER ACI318-05

CANTILEVER RETAINING WALL



SECTION A-A & B-B

b) Geometry input

B =	7.00 m	22.97 ft	
b_1 =	1.50 m	4.92 ft	
D_f =	2.50 m	8.20 ft	
t_s =	1.50 m	4.92 ft	
h_e =	11.10 m	36.42 ft	
a =	0.00 m	0.00 ft	
t_1 =	1.00 m	3.28 ft	
t_2 =	0.50 m	1.64 ft	
b_2 =	4.50 m	14.76 ft	
h =	12.60 m	41.34 ft	
H =	12.60 m	41.34 ft	

1) **Design Inputs**

a) Material

Concrete grade	f_c =	35	Mpa	5076.32	psi
Steel grade	f_y =	420	Mpa	60915.85	psi
Material factor	ϕ =	0.9			
Conrete density	γ_c =	24	kN/m^3	152.88	lb/ft^3
Soil density	γ_σ =	18	kN/m^3	114.66	lb/ft^3
Angle of repose for soil	θ =	30	degree	30	degree
Coefficient of active earth pressure ka = $\frac{1-\sin(\theta)}{1+\sin(\theta)}$	k_a =	0.33	redian	0.33	redian
Coefficient of passive earth pressure ka = $\frac{1-\sin(\theta)}{1+\sin(\theta)}$					
Safe Bearing Capacity	$f_{b.all}$ =	500	kPa	10442.736	lb/ft^2
Coeff of friction for Sliding	m =	0.5		0.5	

c) Loading

Surcharge pressure	q =	12	kN/m^2	250.62521	lb/ft^2

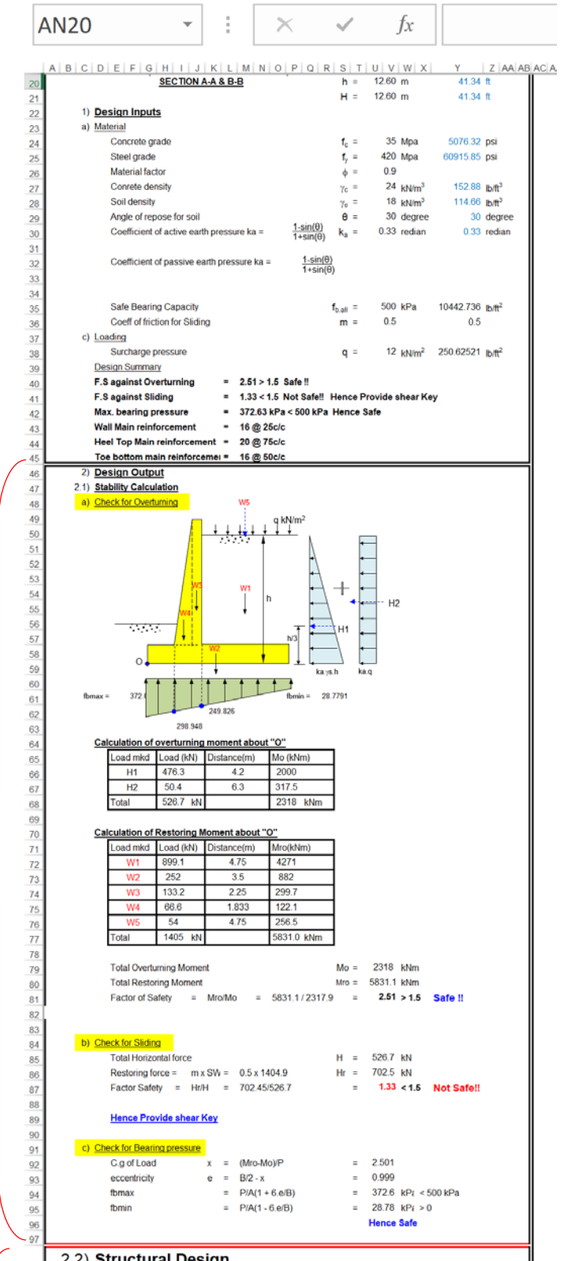
Design Summary

F.S against Overturning = 2.51 > 1.5 Safe !!
F.S against Sliding = 1.33 < 1.5 Not Safe!! Hence Provide shear Key
Max. bearing pressure = 372.63 kPa < 500 kPa Hence Safe
Wall Main reinforcement = 16 @ 25c/c
Heel Top Main reinforcement = 20 @ 75c/c
Toe bottom main reinforceme = 16 @ 50c/c

2) **Design Output**

Design | Ready

Page 1
Design Input


AN20

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2) Design Output

2.1) Stability Calculation

a) Check for Overturning

Calculation of overturning moment about "O"

Load mkd	Load (kN)	Distance(m)	Mo (kNm)
H1	476.3	4.2	2000
H2	50.4	6.3	317.5
Total	526.7 kN		2318 kNm

Calculation of Restoring Moment about "O"

Load mkd	Load (kN)	Distance(m)	Mro(kNm)
W1	899.1	4.75	4271
W2	252	3.5	882
W3	133.2	2.25	299.7
W4	66.6	1.833	122.1
W5	54	4.75	256.5
Total	1405 kN		5831.0 kNm

Total Overturning Moment Mo = 2318 kNm
Total Restoring Moment Mro = 5831.1 kNm
Factor of Safety = Mro/Mo = 5831.1 / 2317.9 = **2.51 > 1.5 Safe !!**

b) Check for Sliding

Total Horizontal force H = 526.7 kN
Restoring force = m x SW = 0.5 x 1404.9 Hr = 702.5 kN
Factor Safety = Hr/H = 702.45/526.7 = **1.33 < 1.5 Not Safe!!**

Hence Provide shear Key

c) Check for Bearing pressure

C.g of Load x = (Mro-Mo)/P = 2.501
eccentricity e = B/2 - x = 0.999
fbmax = P/A(1 + 6.e/B) = 372.6 kPa < 500 kPa
fbmin = P/A(1 - 6.e/B) = 28.78 kPa > 0
Hence Safe

2.2) Structural Design

a) Design of Stem (vertical reinforcement - inner face (1))

Design | Ready

Page 2
Design Output
(External Stability)
REQUIRED

Page 3
Design Output
(Internal Stability)
NOT REQUIRED
IN THIS PROPJECT