Sliding

Horizontal pressure force per *metre* run of the wall $= P = C_p \dfrac{wH^2}{2} = \dfrac{1}{3} \times 18000 \times \dfrac{5.4^2}{2} = 87480 \ N$

$\mu = 0.65,$

Limiting friction $= \mu W = 0.65 \times 211500 = 137475 \ N$

Factor of safety against sliding $= \dfrac{\mu W}{P} = \dfrac{137475}{87480} = 1.57$

1.3 *A contilever type retaining wall has a 5.5 m tall stem. It retains earth level with its top. The soil weighs 18.5 and has an angle of repose of 30°. The safe bearing capacity of the soil is 200 kN/m². Design the wall. Use M 20 & Fe 250 steel.*

Dimensions

Width of the stem at the top = 200 *mm*

Width of the stem at the bottom

Weight of one *metre* run of the wall

Maximum bending moment per *metre* run of the wall $= M$

$= \dfrac{1}{3} \times 18500 \times \dfrac{5.5^3}{6} = 170996.53 \ Nm$

Ultimate moment $M_u = 1.5 \times 170996.53 = 256494.79 \ Nm$

$0.149 \, f_{ck} \, bd^2 = 0.149 \times 20 \times 1000 \, d^2 = 256494.79 \times 10^3$

$d = 293.4 \ mm$

Cover to stem reinforcement = 40 *mm*

Thickness of the stem = 293.4 + 40 = 333.4 *mm*

This may be increased by 30% to 35% for an economical design.

Provide thickness of 450 *mm* at the bottom of the stem.

The base also will be made 450 *mm* thick.

Height of the wall = H = 5.5 + 0.45 = 5.95 *m*

Width of the base slab $b = 0.5H$ to $0.6H$

$0.5 \ H = 0.5 \times 5.95 = 2.975 \ m$

$0.6 \ H = 0.6 \times 5.95 = 3.570 \ m$

Provide base width of 3.50 *m*

Toe projection = About one – third the base width

$= \dfrac{3.50}{3} = 1.17 \ m$

Provide toe projection of 1 *m*

Fig. 29.26

Stability Calculations
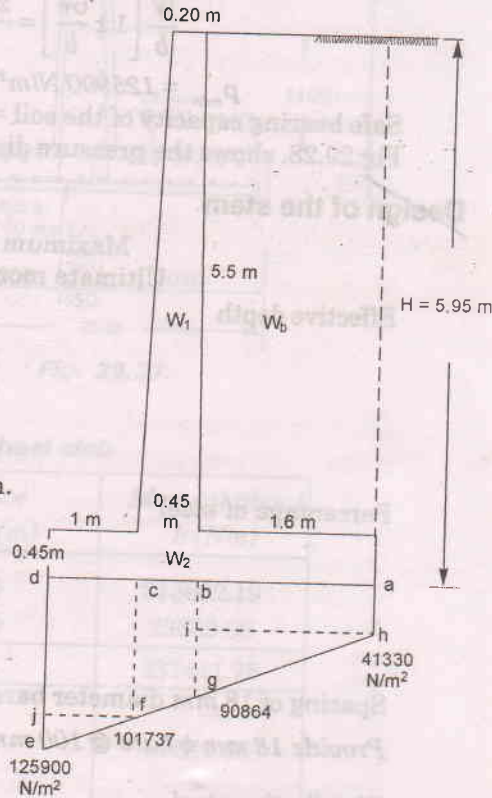
See table below for Stability Calculations

Load due to	Magnitude of the load (N)	Distance from a (m)	Moment about a (Nm)
$W_1 \quad 0.2 \times 5.5 \times 25000$	27500	2.15	59125
$W_2 \quad \dfrac{1}{2} \times 0.25 \times 5.5 \times 25000$	17187.5	$\dfrac{7}{3}$	40104.17
$W_3 \quad 3.5 \times 0.45 \times 25000$	39375	1.75	68906.25
$W_4 \quad 2.05 \times 5.5 \times 18500$	208587.5	1.025	213802.19
Moment of lateral pressure			
$C_p \dfrac{wH^3}{6} = \dfrac{1}{3} \times 18500 \times \dfrac{5.95^3}{6}$			216496.12
Total	292650		598433.73