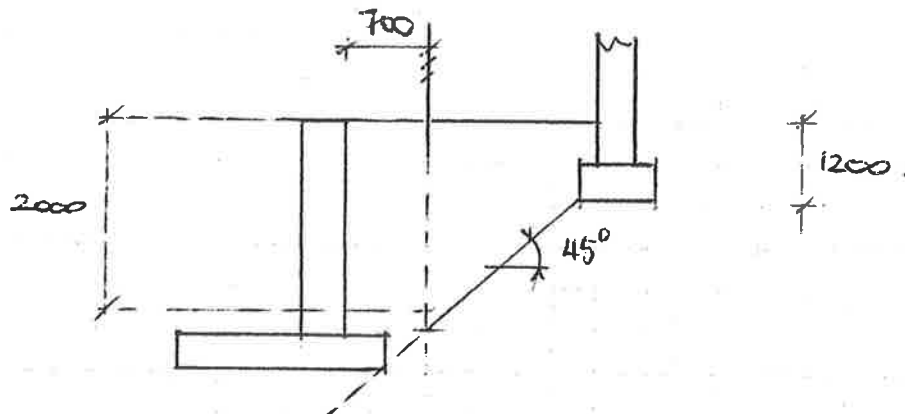


DESIGN OF RETAINING WALL Plot 24

- The proposed position of the wall takes into account the location and depth of the foundations of the adjacent property.



- The proposed construction is to be Reinforced Blockwork.
- Design to be to BS 8002 and BS 5268
- The maximum retained height will be 2.400 m
- The existing ground material is assumed to be boulder clay or gravels with an expected density of 18 kN/m^3 - this should be established on site prior to works commencing.
- The proposed backfill material to be 40 mm clean stone to BS 882, with a land drain provided to the rear of the wall to prevent the build up of water pressure.

For the purposes of this design the following criteria will be used:

$$P_{\text{soil}} = 18 \text{ kN/m}^3 \quad \phi = 35^\circ \text{ giving } K_a = 0.271$$

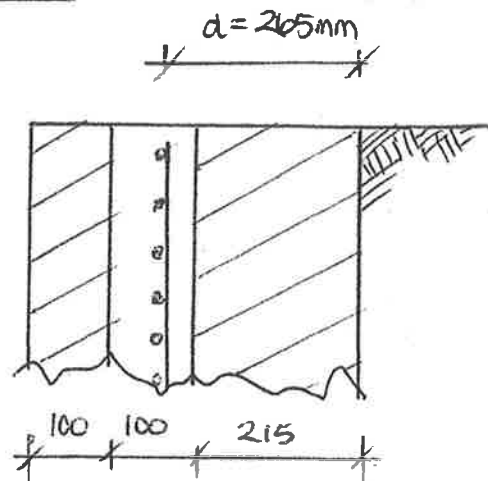
$$\delta_f = 1.4 \text{ kN and } 1.6 \text{ kN} \quad \delta_{\text{mm}} = 2.0 \quad \text{Surcharge} = 0$$

$$P = 0.271 \times 18 \times 2.4 = 11.71 \text{ kN/m}^2$$

$$F = \frac{1}{2} \times 11.71 \times 2.4 \times 1.4 = 19.67 \text{ kN/m run.}$$

$$\text{Design Ultimate Moment } M_u = 19.67 \times \frac{2.4}{3} = \underline{15.73 \text{ kN-m}}$$

Assumed Construction



Grouted cavity - C25 Conc

Mesh B503

Main Steel T8 @ 100 c/c
 $A_s = 503 \text{ mm}^2/\text{m}$

Cross Steel T8 @ 200 c/c
 $A_s = 252 \text{ mm}^2/\text{m}$

• Check Bending

$$Z = d \left[1 - \frac{0.5 \cdot A_s \cdot f_y \cdot \gamma_{ms}}{b \cdot d \cdot f_k \cdot \gamma_{ms}} \right] \quad \text{where } \gamma_{ms} = 1.15$$

$$f_k = 7.0$$

$$Z = 265 \left[1 - \frac{0.5 \times 503 \times 460 \times 2.0}{1000 \times 265 \times 7.0 \times 1.15} \right]$$

$$Z = 265 \times 0.892 = 236 \text{ mm (i.e.) } Z < 0.95d.$$

∴ Moment of Resistance (M_d) based on steel = $\frac{f_y \cdot A_s \cdot Z}{\gamma_{ms}}$

$$M_d = \frac{460 \times 503 \times 236}{1.15 \times 10^6} = 47.53 \text{ kN.m}$$

$$\therefore \underline{M_d > M \quad \checkmark \quad \text{OK}}$$

• Check Moment Capacity based on Blockwork in compression.

$$M_d = \frac{0.4 f_k \cdot b \cdot d^2}{\gamma_{ms}} = \frac{0.4 \times 7.0 \times 1000 \times 265^2 \times 10^{-6}}{2.0}$$

$$\underline{M_d = 77.97 \text{ kN.m} > M \quad \checkmark \quad \text{OK}}$$

• Check Secondary Steel Requirement

$$A_s = \frac{0.05}{100} \times 1000 \times 236 = 118 \text{ mm}^2/\text{m}$$

B503 Mesh gives $A_s = 252 \text{ mm}^2/\text{m}$ ✓ OK.

• Check Shear

$$v = \frac{V}{bd} = \frac{19.67 \times 10^3}{10^3 \times 236} = 0.083 \text{ N/mm}^2$$

$$v < \frac{f_v}{\gamma_{mv}} = \left[0.35 + 17.5 \frac{A_s}{bd} \right] \cdot \left[2.5 - 0.25 \frac{M}{vd} \right]$$

$$\frac{f_v}{\gamma_{mv}} = \left[0.35 + \frac{17.5 \times 503}{1000 \times 236} \right] \cdot \left[2.5 - \frac{0.25 \times 15.73}{19.67 \times 10^3 \times 236} \right]$$

$$\frac{f_v}{\gamma_{mv}} = 0.97 > v (0.083) \quad \checkmark \quad \text{OK.}$$

Anchorage

$$\text{Anchorage length}(l) = \frac{A_s \cdot f_y \cdot \gamma_{mb}}{f_b \cdot \gamma_{ms} \cdot \pi d}$$

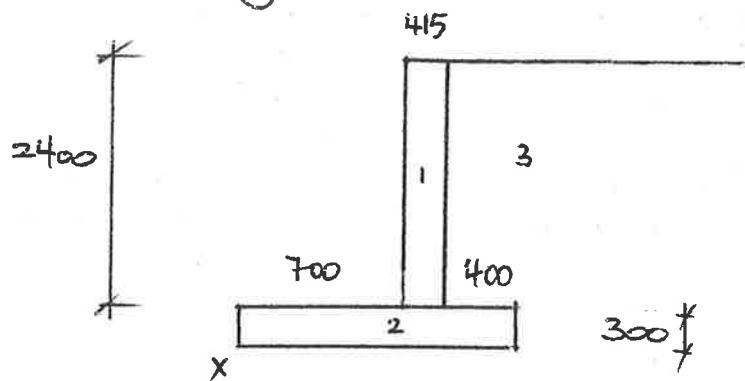
γ_{mb} = partial safety factor = 1.5

f_b = characteristic strength = 1.8

$$\hat{L} = \frac{\pi \times (4^2) \times 460 \times 1.5}{1.8 \times 1.15 \times \pi \times 8}$$

$l = 667 \text{ mm}$

Overall Stability to CP 2



$$w/F \text{ o/T Moment} = 11.23 \text{ kNm}$$

$$w/F \text{ Force} = 14.05 \text{ kN}$$

Restoring Moment @ x

Element

$$1 \quad 2.4 \times 0.415 \times 20 = 19.92 \times 0.9075 = 18.08$$

$$2 \quad 1.515 \times 0.3 \times 24 = 10.91 \times 0.758 = 8.27$$

$$3 \quad 2.4 \times 0.4 \times 18 = 17.28 \times 1.315 = 22.72$$

$$\Sigma \quad 48.11 \text{ kN} \quad \Sigma \quad 49.07 \text{ kN.m}$$

$$FoS (o/T) = \frac{49.07}{11.23} = 4.37 \checkmark \text{ OK}$$

$$FoS (\text{Sliding}) \quad \text{take } \mu = 0.5$$

$$= \frac{48.11 \times 0.5}{14.05} = 1.71 \checkmark \text{ OK.}$$

Bearing Pressure

$$\frac{M}{R_v} = \frac{49.07 - 11.23}{48.11} = 0.786 \text{ m}$$

$$e = \frac{1.515}{2} - 0.786 = -0.029 \text{ m}$$

$$P_1, P_2 = \frac{W}{B} \left(1 \pm \frac{6e}{B} \right)$$

$$P_1, P_2 = \frac{48.11}{1.515} \left(1 \pm \frac{6 \times 0.029}{1.515} \right)$$

$$\therefore P_1, P_2 = 32.845 \text{ \& } 30.875 \text{ kN/m}^2 < 75 \text{ kN/m}^2 \checkmark$$

$$\text{Average pressure on w/s of base} = \frac{48.11}{1.515} = 31.76 \text{ kN/m}^2$$

$$\text{Take cover} = 50 \text{ mm}$$

$$\frac{M}{bd^2} = \frac{31.76 \times 10^6}{10^3 \times 250^2} = 0.508$$

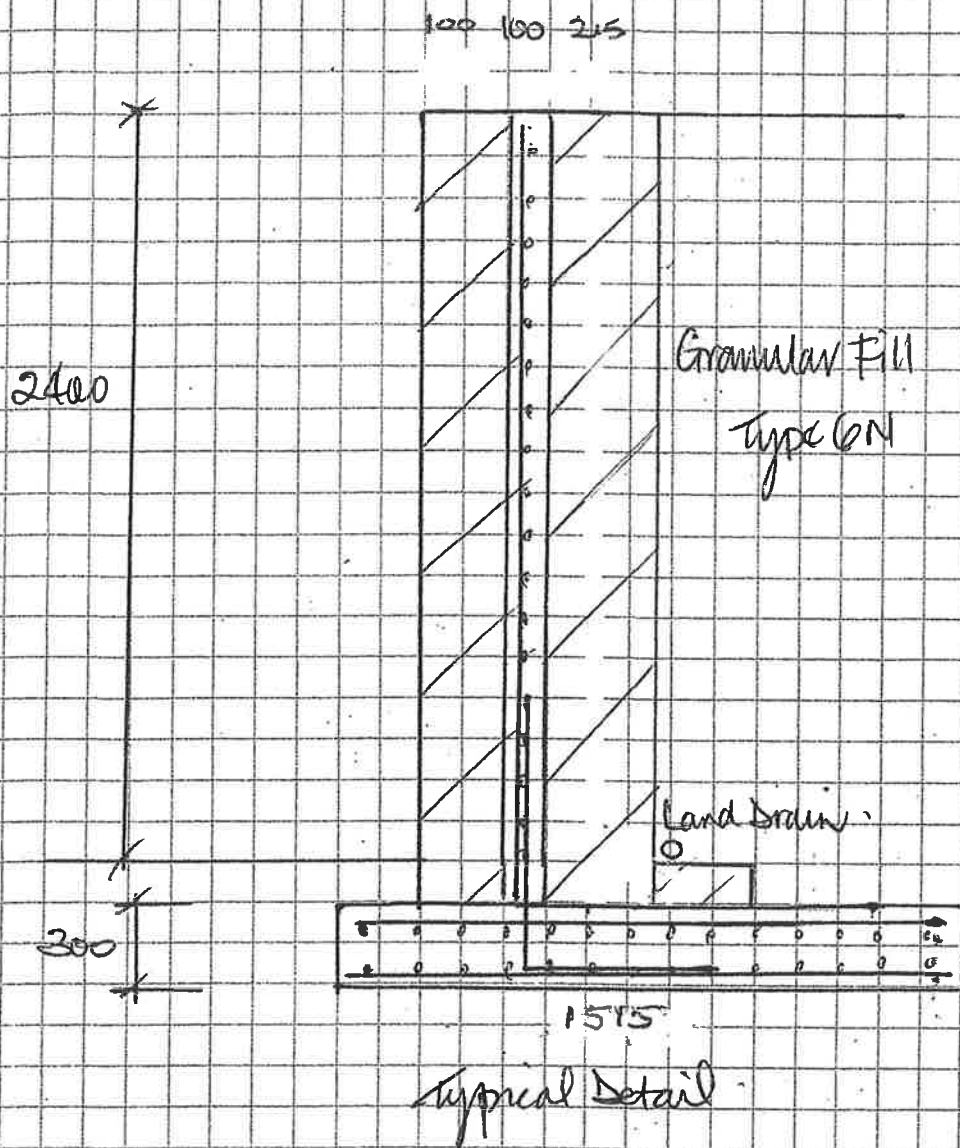
From Design Charts

$$\frac{100 A_s}{bd} = 0.14$$

$$\therefore A_s = 0.14 \times 10^3 \times \frac{250}{100} = 350 \text{ mm}^2/\text{m}$$

$\therefore$ use A393 Mesh Ref⁺ to base - 2 N^o layers

(end)



End

6/6