

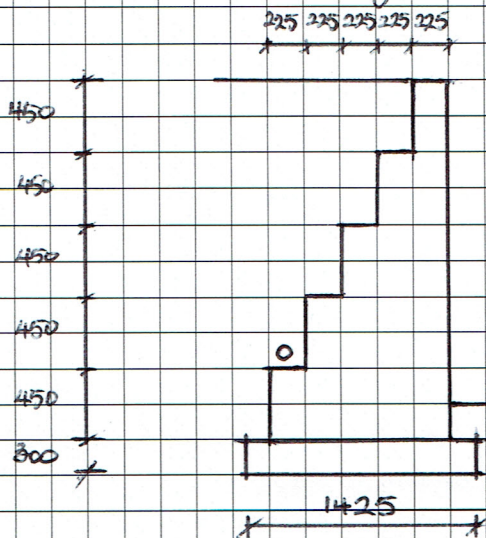
PROPOSED RETAINING WALL

48, DINAS BAKELAN ROAD.

Ref: Drg N^o: 48 DBR 02

Proposal is to use a Dense Mass Concrete Block Wall.

Max^m Retained Height 2000mm. Blocks 10.5 N/mm².



$$\phi = 35^\circ \quad K_a = 0.27$$

$$\rho_{\text{block}} = 20 \text{ kN/m}^3$$

$$\rho_{\text{conc}} = 24 \text{ kN/m}^3$$

$$\rho_{\text{backfill}} = 18 \text{ kN/m}^3$$

$$\mu = 0.5$$

• Check Wall above E

$$\text{Horizontal Thrust} = \frac{1}{2} \omega h^2 K_a = 0.49 \text{ kN}$$

$$\text{o/T Moment} = 0.49 \cdot \frac{h}{3} = 0.074 \text{ kN.m}$$

$$\text{Restoring Moment} = 0.45 \times 0.225 \times 20 = \frac{2.025 \times 0.225}{2} = 0.23 \text{ kN.m}$$

$$\text{Resultant} = \frac{0.23 - 0.074}{2.025} = 0.077 \text{ m from E.}$$

(ie) within Middle 3rd ✓ OK.

• Check Wall above D

$$\text{Horizontal Thrust} = \frac{1}{2} \omega h^2 K_a = 1.97 \text{ kN}$$

$$\text{o/T Moment} = 1.97 \cdot \frac{h}{3} = 0.59 \text{ kN.m}$$

Restoring Moment's

$$0.45 \times 0.45 \times 20 = 4.05 \times 0.225 = 0.911$$

$$0.225 \times 0.45 \times 18 = 1.82 \times 0.337 = 0.613$$

$$\frac{2.025}{2} \quad \frac{0.23}{2}$$

$$\Sigma \quad 7.895 \text{ kN} \quad \Sigma \quad 1.754 \text{ kN.m}$$

$$\text{Resultant} = \frac{1.754 - 0.59}{7.895} = 0.147 \text{ from D.}$$

(ie) 3mm o/s Middle 3rd - OK ✓

• Check Wall above C

$$\text{Hor. Thrust} = \frac{1}{2} w h^2 K_a = 443 \text{ kN}$$

$$\text{o/T Moment} = 443 \times \frac{h}{3} = 1.99 \text{ kNm}$$

Restoring Moments	$0.45 \times 0.675 \times 20 = 6.075 \times 0.3375 = 2.05$
	$0.225 \times 0.9 \times 18 = 3.645 \times 0.562 = 2.05$
	<u>7.895</u> <u>1.754</u>
	$\Sigma = 17.615 \text{ kN} \quad \Sigma = 5.854 \text{ kNm}$

$$\text{Resultant} = \frac{5.854 - 1.99}{17.615} = 0.219 \text{ m}$$

(ie) 6mm o/s Middle 3rd - ✓ OK.

• Check Wall above B

$$\text{Hor. Thrust} = \frac{1}{2} w h^2 K_a = 7.87 \text{ kN}$$

$$\text{o/T Moment} = 7.87 \times \frac{h}{3} = 4.722 \text{ kNm}$$

Restoring Moments	$0.9 \times 0.45 \times 20 = 8.10 \times 0.45 = 3.645$
	$0.225 \times 1.35 \times 18 = 5.46 \times 0.787 = 4.30$
	<u>17.615</u> <u>5.854</u>
	$\Sigma = 31.175 \text{ kN} \quad \Sigma = 13.80 \text{ kNm}$

$$\text{Resultant} = \frac{13.80 - 4.722}{31.175} = 0.291 \text{ m from B}$$

(ie) 9mm o/s Middle 3rd ✓ OK.

• Check Wall above A

$$\text{Hor. Thrust} = \frac{1}{2} w h^2 K_a = 12.30 \text{ kN}$$

$$\text{O/T Moment} = 12.30 \times \frac{h}{3} = 9.22 \text{ kNm}$$

Restoring Moments

$$1.125 \times 0.45 \times 20 = 10.125 \times 0.5625 = 5.695$$

$$0.225 \times 1.80 \times 18 = 7.29 \times 1.0125 = 7.381$$

$$\Sigma = \frac{31.75}{49.165} \text{ kN} \quad \Sigma = \frac{13.80}{26.876} \text{ kNm}$$

$$\text{Resultant} = \frac{26.876 - 9.22}{49.165} = 0.359 \text{ m from A}$$

14mm o/s Middle 3rd ✓ OK

Consider Whole Wall (including base)

$$\text{Hor. Thrust} = \frac{1}{2} w h^2 K_a = 15.80 \text{ kN}$$

$$\text{O/T Moment} = 15.80 \times \frac{h}{3} = 13.43 \text{ kNm}$$

Restoring Moments

$$1.425 \times 0.30 \times 24 = 10.20 \times 0.7125 = 7.31$$

$$2.25 \times 0.225 \times 20 = 10.125 \times 0.2625 = 2.66$$

$$1.80 \times 0.225 \times 20 = 8.10 \times 0.4875 = 3.95$$

$$1.35 \times 0.225 \times 20 = 6.075 \times 0.7125 = 4.33$$

$$0.90 \times 0.225 \times 20 = 4.05 \times 0.9375 = 3.80$$

$$0.45 \times 0.225 \times 20 = 2.025 \times 1.1625 = 2.35$$

$$0.45 \times 0.225 \times 18 = 1.823 \times 0.4875 = 0.89$$

$$0.90 \times 0.225 \times 18 = 3.645 \times 0.7125 = 2.60$$

$$1.35 \times 0.225 \times 18 = 5.468 \times 0.9375 = 5.13$$

$$1.80 \times 0.225 \times 18 = 7.29 \times 1.1625 = 8.47$$

$$2.25 \times 0.15 \times 18 = 6.075 \times 1.350 = 8.20$$

$$\Sigma = \frac{64.94}{49.165} \text{ kN} \quad \Sigma = \frac{49.69}{26.876} \text{ kNm}$$

$$\text{Resultant} = \frac{49.69 - 13.43}{64.94} = 0.522 \text{ m along base}$$

(ie) within Middle 3rd ✓ OK

• Check Sliding

$$\frac{64.94 \times \mu(0.5)}{15.8} = 2.06 (F.o.S) \checkmark \text{OK.}$$

Bearing Pressure

$$\frac{P}{A} + \frac{P_e}{Z}$$

$$Z = \frac{bd^2}{6}$$

$$k = 0.7175 - 0.522$$

$$k = 0.190$$

$$B.P. = \frac{64.94}{1.425} + \frac{64.94 \times 0.19}{Z}$$

$$Z = \frac{1.0 \times 1.425^2}{6} = 0.338$$

$$B.P. = \frac{64.94}{1.425} + \frac{64.94 \times 0.19}{0.338} =$$

$$B.P. = 82.07 \text{ kN/m}^2 \text{ or } 9.06 \text{ kN/m}^2$$

Take Allowable as 100 kN/m² > 82.07 kN/m².

$$\text{Average Pressure on u/s of Base} = \frac{64.94}{1.425} = 45.57 \text{ kN/m}^2$$

Take Cover = 50 mm

$$\frac{M}{bd^2} = ?$$

$$BM_{\text{max}} = \frac{45.57 \times 1.425^2}{2} = 46.27$$

$$\frac{M}{bd^2} = \frac{46.27 \times 10^6}{10^3 \times 250^2} = 0.74$$

$$\text{From Charts } \frac{100 A_s}{bd} = 0.2$$

$$\therefore A_s = 0.2 \times 10^3 \times \frac{250}{100} = 500 \text{ mm}^2/\text{m}$$

$\therefore$ Use B503 Mesh Ref⁺ to Base (2 layers - top & btm).

END.