



PROJECT SWANSEA ROAD, MERTHYR			PREPARED BY JEU	DATE FEB '24
JOB No. S.7810	DRG No. Ro1.	PAGE No. RW10FRWS	CHECKED BY 	DATE 11

REF

CALCULATIONS

1. INTRODUCTION.

THESE CALCULATIONS ARE FOR THE RETAINING WALL DESIGN FOR WALLS GREATER THAN 1M IN HEIGHT (AS REQUESTED/REQUIRED TO SATISFY PLANNING CONDITION N: 2).

THERE IS ONLY ONE LOCATION ON THE SITE WHERE WALLS ARE IN EXCESS OF 1M, THIS IS TO THE REAR OF PLOT N: 40. THE HEIGHT OF THE WALL HERE DOES NOT EXCEED 1.2M.

ALL WALLS ARE MASONRY CONSTRUCTION.

2. OVERALL STABILITY.

2.1. ACTIVE PRESSURE & SURCHARGE.

CONSERVATIVELY TAKE 1:2 BATTER TO REAR.

$P_w = 0 \text{ kN/m}^2$ (FREE-DRAINING BACKFILL + WEEPHOLES).

SURCHARGE = 2.5 kN/m^2 (GARDENS).

LIGHT PLANT ONLY PERMITTED TO REAR OF WALLS DURING CONSTRUCTION. $\Rightarrow 2.5 \text{ kN/m}^2$ SURCHARGE.

NO FRICTION TAKEN TO REAR OF WALL.

$$K = \left(\frac{\cos \theta}{2 + 1} \right)^2 \quad \alpha = \sqrt{\left[\sin^2 \theta - \frac{1}{2} \tan \phi \sin 2\theta \right]}$$

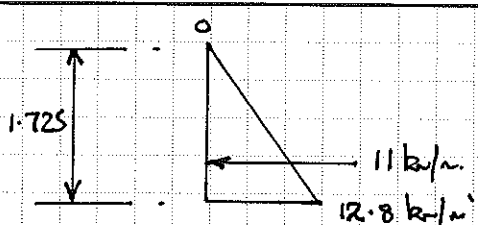
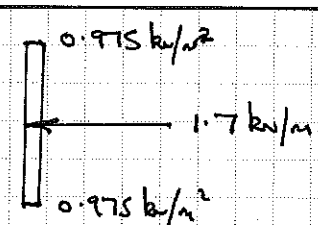
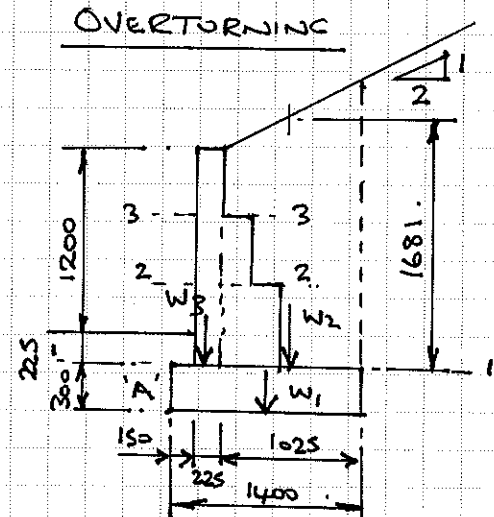
$$\phi = 26.56^\circ \text{ (BATTER ANGLE)} \quad \theta = 35^\circ \text{ (INT. FRICTION ANGLE)}$$

$$\therefore K = \underline{0.39}$$

$$\gamma = 19 \text{ kN/m}^3 \text{ (BACKFILL & MASONRY)}$$



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2.1. (CONTD)	 <u>ACTIVE PRESSURE</u>  <u>SURCHARGE</u> $p_w = 0 \text{ kN/m}^2$ $\therefore \text{OVERTURNING MOMENT} = 11 \times \frac{1.725}{3} + 1.7 \times \frac{1.725}{2} = 7.8 \text{ kNm/m.}$ (6.3 PERMANENT) $\text{THRUST} = 11 + 1.7 = 12.7 \text{ kN/m. (11 PERMANENT).}$
2.2.	<u>OVERTURNING</u>  $W_1 = \text{S/WT BASE} = 1.4 \times 0.3 \times 23.4 \text{ kN/m}^2 = 9.8$ $W_2 = \text{BACKFILL} + \text{MASONRY} + \text{SURCHARGE}$ $= 1.681 \times 1.025 \times 19 \text{ kN/m}^2 + 1.025(25) = 35.3$ $W_3 = \text{MASONRY} = 1.425 \times 0.225 \times 19 \text{ kN/m}^2 = 6.1$ $W = 51$ $(W = 48 \text{ kN/m PERMANENT; 51 TEMP})$ $\text{RESTORING MOMENT} = 9.8 \times \frac{1.4}{2} + 35.3 \times 0.888 + 6.1 \times 0.263 = 40$ (TEMP) $\text{PERMANENT RM} = 38 \text{ kNm/m.}$ $\therefore F_d \text{ S o/T} = 40 / 7.8 = 5.1 \text{ (TEMP); 6 (PERMANENT).}$ $F_d \text{ S} > 3 \therefore \text{OK.}$ <u>WALL O.K. FOR OVERTURNING.</u>
2.3.	<u>SLIDING.</u> $\text{TEMP CASE: } F_R = W \mu = 51 \times 0.4 = 20.4 \text{ kN/m.}$ $\text{THRUST} = 12.7 \text{ kN/m} \therefore F_d \text{ S SLIDING (TEMP)} = 1.6 > 1.5 \therefore \text{OK.}$ (FRICTION ALONE) $\text{PERMANENT CASE: } F_R = 48 \times 0.4 = 19.2 \text{ kN/m THRUST} = 11 \text{ kN/m}$ $\therefore F_d \text{ S SLIDING (FRICTION ONLY)} = 1.75 > 1.5.$



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2.3
(CONTD)

$$\text{PASSIVE RESISTANCE} = \frac{1}{2} \times 19 \times 0.3^2 \times \frac{1}{0.3} = 2.9 \text{ kN/m}$$

$$\therefore F \text{ of } S \text{ SLIDING (PERMANENT)} = 2.0 \therefore \text{OK}$$

WALL O.K. FOR SLIDING.

2.4.

BEARING PRESSURE.

TAKING MNTS ABOUT 'A' TO FIND POSITION OF RESULTANT :-

$$40 - 7.8 = 51x \therefore x = 0.631 \text{ m TO RIGHT OF 'A'}$$

$$\therefore e = 0.069 \text{ m}$$

$$\therefore p_{b \text{ max}} = \frac{51}{1.4} \left(1 + \frac{6 \times 0.069}{1.4} \right) = 47 \text{ kN/m}^2$$

$$\text{PERMANENT CASE : } 38 - 6.3 = 48x \therefore x = 0.660$$

$$\therefore e = 0.040 \text{ m}$$

$$\therefore p_{b \text{ max}} = \frac{48}{1.4} \left(1 + \frac{6 \times 0.040}{1.4} \right) = 40 \text{ kN/m}^2$$

ALLOWABLE BEARING PRESSURE (FROM S.I. REPORT) = 50 > 47. $\therefore$ OK

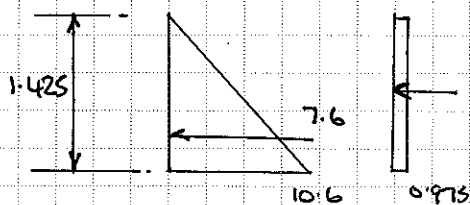
WALL O.K FOR BEARING PRESSURE.

3.

STEM CHECKS.

3.1.

AT 1-1. (WALL THICKNESS O/ALL = 675 mm)



$$M_o = 1.4 \left(7.6 \times \frac{1.425}{3} + 1.4 \times \frac{1.425}{2} \right) = 6.5 \text{ kNm}$$

$$Z_{xx} = 75.94 \times 10^6 \text{ mm}^3$$

$$q_d = 0.9 \left(\frac{1.425 \times 0.675 \times 19 \times 10^3}{1.0 \times 675} \right) = 0.024 \text{ N/mm}^2$$

$$M_R = \left(\frac{f_{lex}}{f_m} + q_d \right) Z$$

$$f_{lex} = 10.5 \text{ N/mm}^2 = 0.25 \text{ N/mm}^2$$

$$f_m = 3.0$$



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3.1. (CONT'D)	$\therefore M_R = \left(\frac{0.25}{3.0} + 0.024 \right) 75.94 : 8.15 > 6.5 \therefore \text{OK.}$ WITH 7 u/m² BLOCKS, LOWER WALL SECTION WOULD NEED TO BE MIN OF 775mm WIDE ($M_R = 7.4 \text{ kNm} > 6.5$).
3.2.	<u>AT 2-2</u> (WALL THICKNESS o/w = 450mm) $p_a = 19 \times 0.875 \times 0.39 = 6.5 \text{ k/m}^2$ $\therefore P_a = \frac{1}{2} \times 6.5 \times 0.875 = 2.8 \text{ k/m}$ $p_s = 2.5 \times 0.39 = 0.975 \text{ k/m} \therefore P_s = 0.975 \times 0.875 = 0.85 \text{ k/m}$ $\therefore M_0 = 1.4 \left(2.8 \times \frac{0.875}{3} + 0.85 \times \frac{0.875}{2} \right) = 1.66 \text{ kNm/m}$ $q_d = 0.9 \left(\frac{0.875 \times 0.45 \times 19 \times 10^3}{10^3 \times 450} \right) = 0.015 \text{ N/mm}^2$ $Z_{xx} = 33.75 \times 10^6 \text{ mm}^3$ $M_R = \left(\frac{0.25}{3.0} + 0.015 \right) 33.75 = 3.3 \text{ kNm} > 1.66 \therefore \text{OK.}$ (OK AS WELL AT 7.3 u/m² BLOCK, $M_R = 2.19 \text{ kNm}$)
3.3	<u>AT 3-3</u> (WALL THICKNESS o/w = 225mm) $p_a = 19 \times 0.45 \times 0.39 = 3.3 \text{ k/m}^2 \quad P_a = \frac{1}{2} \times 3.3 \times 0.45 = 0.74$ $p_s = 0.975 \text{ k/m} \quad P_s = 0.975 \times 0.45 = 0.44 \text{ k/m}$ $\therefore M_0 = \left(0.74 \times \frac{0.45}{3} + 0.44 \times \frac{0.45}{2} \right) 1.4 = 0.29 \text{ kNm}$ $Z_x = 8.44 \times 10^6 \text{ mm}^3$ $M_R \text{ EVEN WITHOUT } q_d = 0.42 \text{ kNm (FOR 7.3 u/m}^2) > 0.29 \therefore \text{OK}$
3.4	<u>SHEAR CHECKS.</u> $\text{SHEAR STRENGTH} = \frac{0.35}{2.5} + q_A = 0.14 \text{ N/mm}^2 + q_A$ <u>AT 1-1.</u> $\sigma_h = 0.013 \text{ N/mm}^2$ <u>AT 2-2.</u> $\sigma_h = 0.011 \text{ N/mm}^2$ <u>AT 3-3.</u> $\sigma_h = 0.007 \text{ N/mm}^2$ ALL $\ll 0.14 \text{ N/mm}^2 \therefore \text{OK.}$



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3.5.	<u>CONCLUSION.</u> TO AVOID USING INCORRECT BLOCKS ON SITE, USE 7.3N/mm² BLOCKS THROUGHOUT & THICKEN BOTTOM OF WALL TO 1200 HIGH WALL AS FOLLOWS:- 7.3N/mm² BLOCKS (FULLY BONDED). 225 325 450 225 225 900
4.	<u>BASE CHECKS.</u> 350 26 kN/m 47 kN/m 45 kN/m 33 kN/m $M_o \max = 1.4 \left(26 \times \frac{0.35^2}{2} + \frac{1}{2} \times 7 \times \frac{0.35^2}{3} \right)$ $= 3 \text{ kNm}$ $V_o \max = \left[\left(\frac{47 + 45}{2} \right) 0.15 \right] 1.4 = 10 \text{ kN/m}$ BY INSPECTION, ALL VERY LOW & NOT SIGNIFICANT, HOWEVER GROUND IS POOR & A393 MESH FABRIC WILL BE USED T & B. <u>300 RC 32/40 BASE WITH A393 MESH TOP & BOTTOM MORE THAN ADEQUATE.</u>