

Proposed Steel Beam at:
Ty Ffynon
Dan y Ffynon
Port Talbot

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Moment due to earth pressure	$me = sfe \cdot od / 3 = 8.804 \cdot 1.9 / 3 = 5.576 \text{ kNm}$
Surcharge horizontal force	$sfs = ws \cdot ce \cdot od = 0 \cdot 0.271 \cdot 1.9 = 0 \text{ kN}$
Moment due to surcharge	$ms = sfs \cdot od / 2 = 0 \cdot 1.9 / 2 = 0 \text{ kNm}$
Wall shear	
Horizontal shear force	$usf = (sfe \cdot \gamma_{mae}) + (sfs \cdot \gamma_{mas})$ $= (8.804 \cdot 1.4) + (0 \cdot 1.6)$ $= 12.33 \text{ kN}$
Shear stress at bottom of wall	$uss = usf / (t(\text{steps}) \cdot 1000)$ $= 12.33 / (0.65 \cdot 1000)$ $= 0.01896 \text{ N/mm}^2$
Weight at bottom of step 1	$uwt = t(a) \cdot we \cdot h(a) \cdot \gamma_{maf} = 0.45 \cdot 18 \cdot 1 \cdot 0.9 = 7.29 \text{ kN}$
Weight at bottom of step 2	$uwt = uwt + (t(a) \cdot we \cdot h(a) \cdot \gamma_{maf})$ $= 7.29 + (0.65 \cdot 18 \cdot 1.6 \cdot 0.9)$ $= 24.14 \text{ kN}$
Weight per. unit area	$ga = uwt / (t(\text{steps}) \cdot 1000)$ $= 24.14 / (0.65 \cdot 1000)$ $= 0.03714 \text{ N/mm}^2$
Permissible shear stress	$fv = 0.15 + 0.6 \cdot ga = 0.15 + 0.6 \cdot 0.03714$ $= 0.1723 \text{ N/mm}^2$
Applied shear less than shear resistance ($0.01896 \leq 0.1723$) therefore section is satisfactory.	
<u>Overturning</u>	
Overturning moment about A	$om = me + ms + (xm + xv \cdot od) = 5.576 + 0 + (0 + 0 \cdot 1.9) = 5.576 \text{ kNm}$
Restoring moment abt A fill/wall	$rmf = wf \cdot ef = 23.04 \cdot 0.55 = 12.67 \text{ kNm}$
base	$rmb = wb \cdot tb / 2 = 6.84 \cdot 0.95 / 2 = 3.249 \text{ kNm}$
surcharge	$rms = ws \cdot (t + th) \cdot ef = 0 \cdot (0.65 + 0.15) \cdot 0.55 = 0$
total	$rm = rmf + rmb + rms = 12.67 + 3.249 + 0 = 15.92$
Factor of safety	$fso = rm / om = 15.92 / 5.576 = 2.855$