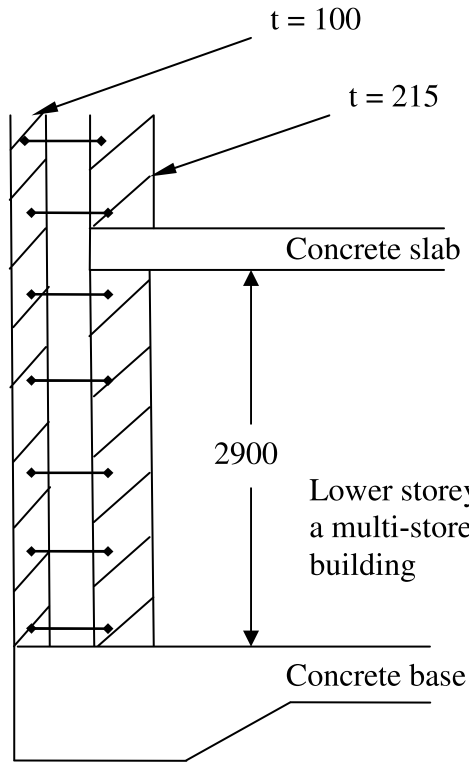
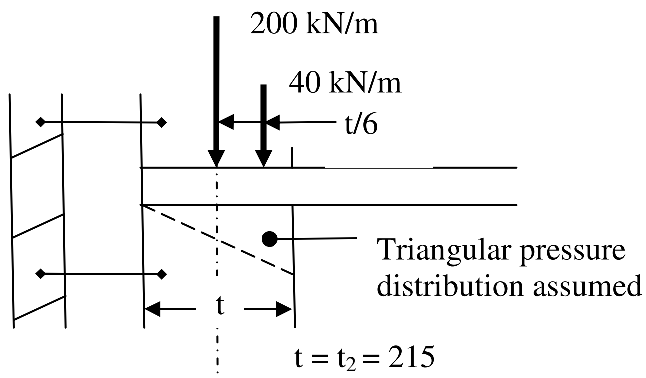
REFERENCE	CALCULATIONS	OUTPUT
	 440 x 100 x 215 Group 1 concrete block masonry units laid on edge for the outer leaf and on flat for the inner leaf. Cavity is 100 mm insulated and the wall ties are stainless steel. Manufacturing control of units is Category I M4 general purpose mortar – prescribed mix of 1:1:6 Class 5 (Normal) executive control will be used Design load on the lower storey = 240 kN/m run of which 40 kN/m run is applied at the first floor level. Neglect wind loading. Determine the strength of unit required for the lower storey and the vertical load carrying capacity of the wall, using this unit.	

REFERENCE	CALCULATIONS	OUTPUT
Cl 5.5.1.4	**Slenderness Ratio (SR)**	
5.5.1.2 (10)	Effective height, $h_{ef} = \rho_n h$ **E (5.2)**	
(11)(i)	$\rho = \rho_2 = 0.75$ **E (5.3)**	
	The concrete slab provides "enhanced" resistance to the wall	
	Then h_{ef} = (0.75)(2900) = 2175 mm	h_{ef} = 2175 mm
5.5.1.3 (3)	Effective thickness, t_{ef}	
	$t_{ef} = \sqrt[3]{(k_{tef} t_1^3 + t_2^3)}$ **E (5.11)**	
	where $k_{tef} = E_1/E_2$ where E_1 refers to the outer leaf	
Irish NA	$k_{tef} = 1$	
	Then $t_{ef} = = \sqrt[3]{(1)(100)^3 + (215)^3} = 222$ mm	t_{ef} = 222 mm
5.5.1.4 (1)P	SR = h_{ef}/t_{ef} = 2175/222 = 9.8	
(2)	9.8 < 27	SR √ OK
6.1.2.2	**Reduction factor for slenderness and eccentricity (Φ)** (based on rectangular stress block) **Eccentricity of first floor loading**	
		

REFERENCE	CALCULATIONS	OUTPUT
6.1.2.2 (1)(i)	$e_i = M_{id} / N_{id} + e_{he} + e_{init} \leq 0.05t$ **E (6.5)**	
F 6.1	$M_{id} / N_{id} = M_{1d} / N_{1d}$ (at top) = (40 x t/6)/240	
	= (40 x 215)/(240 x 6) = 5.97 mm	
	$e_{he} = 0$ (no horizontal loading)	
5.5.1.1 (4)	$e_{init} = h_{ef} /450$ = 2175/450 = 4.83 mm	e_{init} = 4.83 mm
	Then e_i = 5.97 + 0 + 4.83 = 10.8 mm = 10.8 t / 215	
	= 0.05 t ≤ 0.05 t (minimum value)	e_i = 0.05 t
6.1.2.2 (1)(i) E (6.4)	Then $\Phi_i = 1 - 2\, e_i /t = 1 - 2(0.05\, t\,)t = 0.9$	Φ_i = 0.9
	Eccentricity of design vertical load	
	$e_m = M_{md} / N_{md} + e_{hm} \pm e_{init}$ **E (6.7)**	
	$M_{md} / N_{md} = 0$ (point of contraflexure – double curvature strut)	
	$e_{hm} = 0$ (no horizontal loading)	
	From above e_{init} = 4.83 mm	
	Then e_m = 0 + 0 + 4.83 = 4.83 mm	
	Eccentricity at mid height	
	$e_{mk} = e_m + e_k \leq 0.05t$ **E (6.6)**	
6.1.2.2 (2) Irish NA	$e_k = 0$ since $\lambda_c < 27$ (< 15 EC 6)	
	e_{mk} = 4.83 + 0 = 4.83 mm = 4.83 t / 215	
	= 0.022 t < 0.05 t	e_{mk} = 0.05 t
	Design resistance per unit length	
6.1.2.1 (2)	$N_{Rd} = \Phi\, t\, f_d$ **E (6.2)**	
	For middle of wall $\Phi = \Phi_m$	

REFERENCE	CALCULATIONS	OUTPUT
	$\Phi_m = A_1\, e\{- u^2/2\}$ **E (G.1)**	
Annex G (1)	where e is the base of natural logarithms	
	$A_1 = 1 – 2\, e_{mk} /t$ **E (G.2)**	
	$= 1 – 2\,(0.05\,t)/t = 0.9$	$A_1 = 0.9$
3.7.2 (2) + Irish NA	$E = K_E f_k = 1000 f_k$	
	Then $u = (h_{ef}/t_{ef} - 2)/(23 - 37\, e_{mk}/t)$ **E (G.5)**	
	From above $h_{ef}/t_{ef} = 9.8$	
	Then $u = [9.8 – 2]/[23 – 37(0.05t/t) = 0.369$	
E (G.1)	Then $\Phi_m = (0.9)(2.718)\{- 0.369^2/2\} = 0.84$ Note: this value may also be obtained from Fig G.1 - **quicker**	$\Phi_m = 0.84$
E (6.2)	Then $N_{Rd} = (0.84)(215)\, f_d$	
2.4.1 (1)P + 3.6.1 + Ire NA Tab NA.1	$f_d = f_k /\gamma_M$ $\gamma_M = 2.7$	
	Then $N_{Rd} = (0.84)(215)(f_k/2.7) = 240$ kN/m run (design load) From which f_k required = 3.6 N/mm^2	f_k reqd. = 3.6 N/mm^2
3.6.1.2	$f_k = K\, f^{\alpha}_b\, f^{\beta}_m$ **E (3.1)**	
3.6.1.2 (2)	$= K\, f^{0.7}_b\, f^{0.3}_m$ (general purpose mortar) **E (3.2)**	
Ire NA Tab NA.3	K = 0.55 (general purpose mortar and Group 1 units)	
Ire NA Tab NA.2	$f_m = 4$ N/mm^2	
	Then $f^{0.7}_b = (3.6)/(0.55)(4)^{0.3} = 4.32$ N/mm^2	
	From which $f_b = {}^{0.7}\sqrt{4.32} = 8.09$ N/mm^2 $= f_b$ minimum	f_b min = 8.09 N/mm^2

REFERENCE	CALCULATIONS	OUTPUT
EC6 study for Ire NA	Blocks of mean strength 5N per IS 20 have a normalised compressive strength of 10 N per IS EN 772-1, when laid on flat	
	Then f_k achieved = $(0.55)(10)^{0.7}(4)^{0.3}$ = 4.2 N/mm^2 > 3.6 N/mm^2	√ OK
6.1.2.1 (2) E (6.2)	$N_{Rd} = \Phi\, t\, f_d$	
	$f_d = f_k / \gamma_M$	
	Then N_{Rd} = (0.84)(215)(4.2)/2.7 = 281 kN/m run > 240 kN/m run	√ OK