ARCH 324 STRUCTURE II

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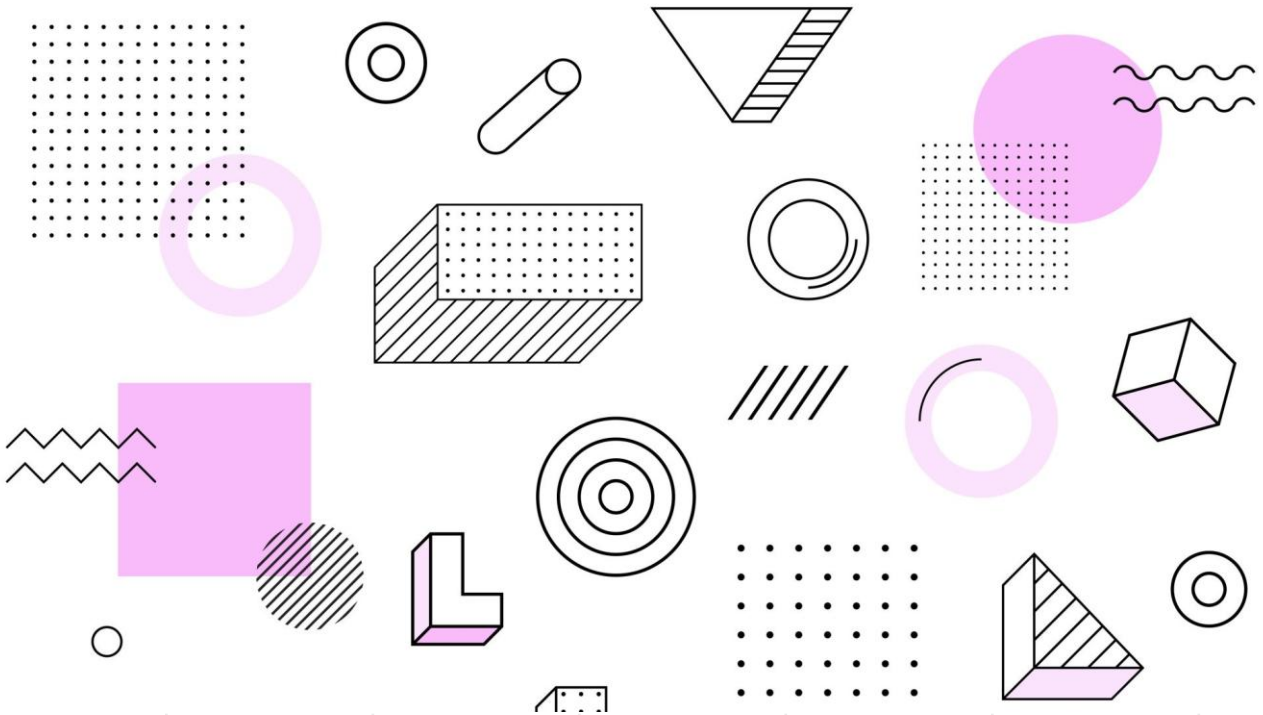
Recitation

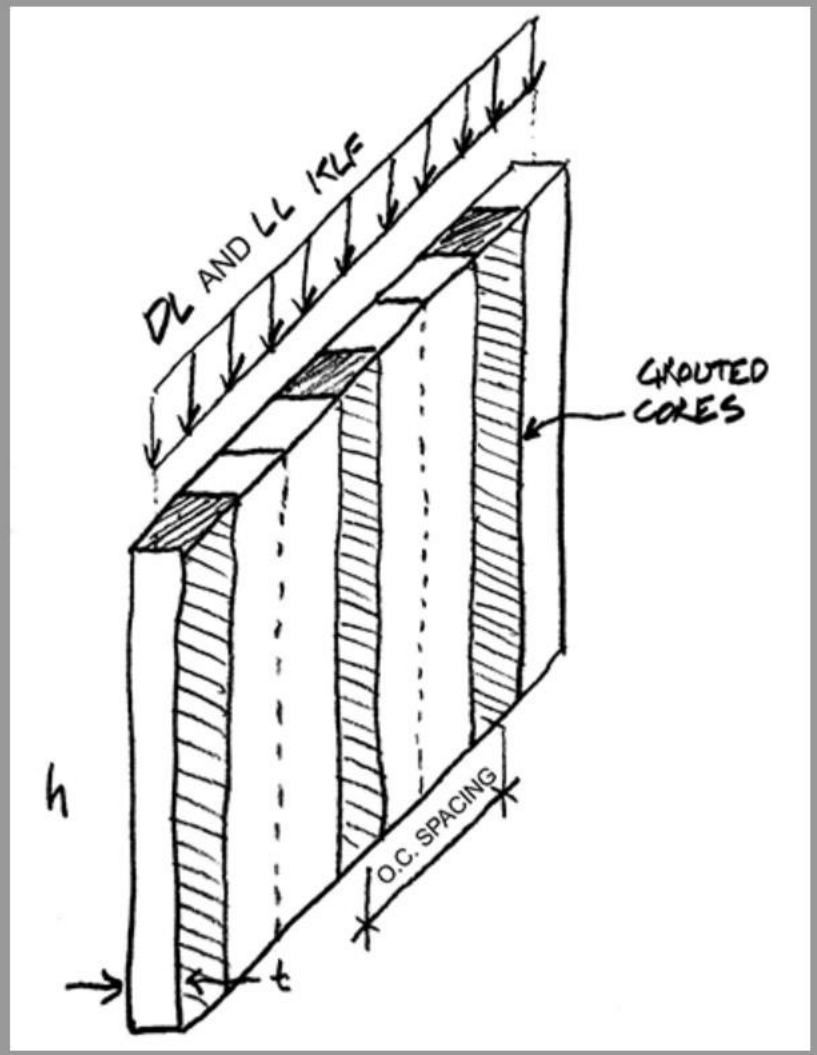


11. Masonry Walls

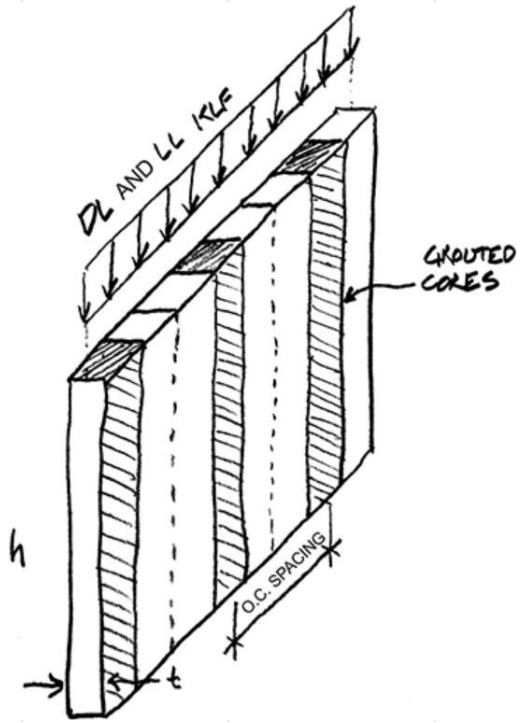
Using the strength method for axial compression (masonry spanning vertically) described in TMS 402, determine the safety of the given concrete masonry wall (pass or fail). Calculate the factored nominal axial strength, phi_Pn and compare it to the required strength, Pu for the given loads. (loads are given without factors)

DATASET: 1 -2- -3-

Height of wall, h	15 FT
Nominal thickness of wall	10 IN
grouted cells o.c. spacing	32 IN
Masonry compressive strength, f'm	3000 PSI
The wall DL	28 KLF
The wall LL	21 KLF



#	Question	Your Response		Correct Answer
1	Actual wall thickness, t (see TEK 14-1B)		IN	SUBMIT
2	Net area per foot of wall, An		IN2	SUBMIT
3	Net moment of inertia per foot of wall, In		IN^4	SUBMIT
4	Radius of gyration per foot of wall, r		IN	SUBMIT
5	Ratio of h/r			SUBMIT
6	Which TMS equation used? (11 or 12)			SUBMIT
7	Nominal axial strength, Pn		KLF	SUBMIT
8	Factored nominal axial strength, phi_Pn		KLF	SUBMIT
9	Axial strength required by loads, Pu		KLF	SUBMIT
10	Does the wall pass or fail? (1=pass 0=fail)			SUBMIT



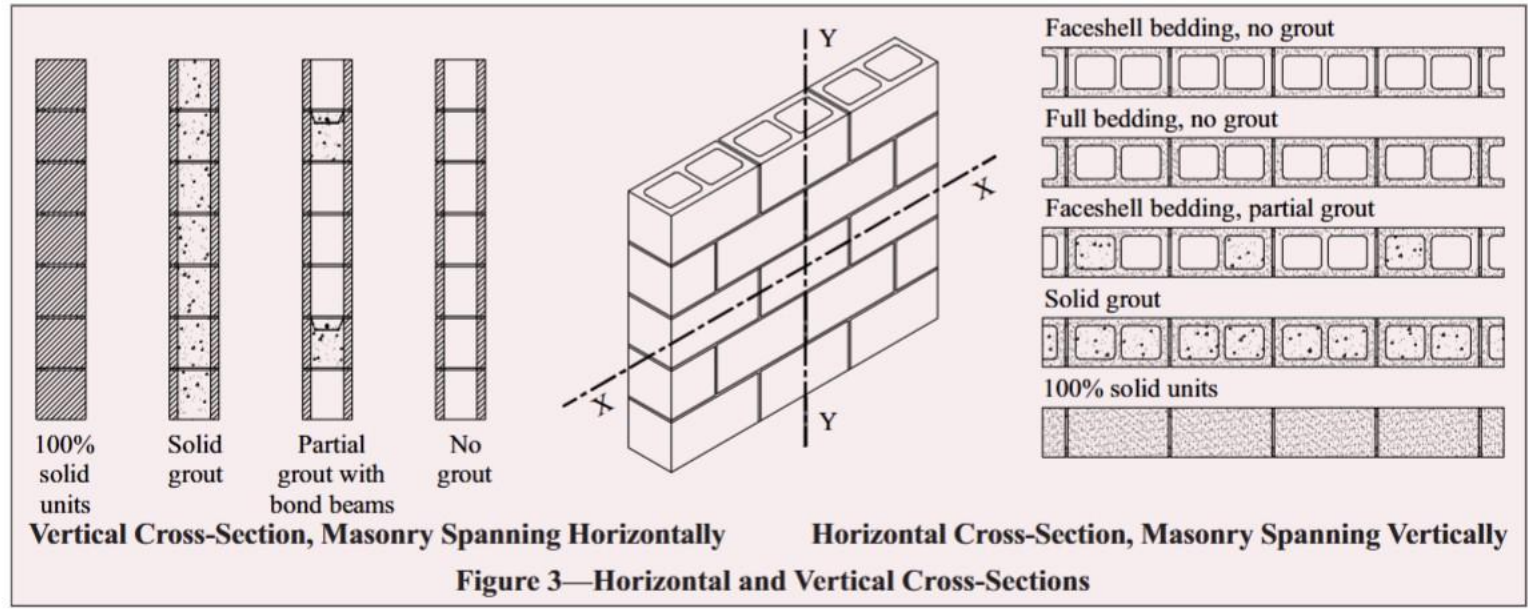


Figure 3—Horizontal and Vertical Cross-Sections

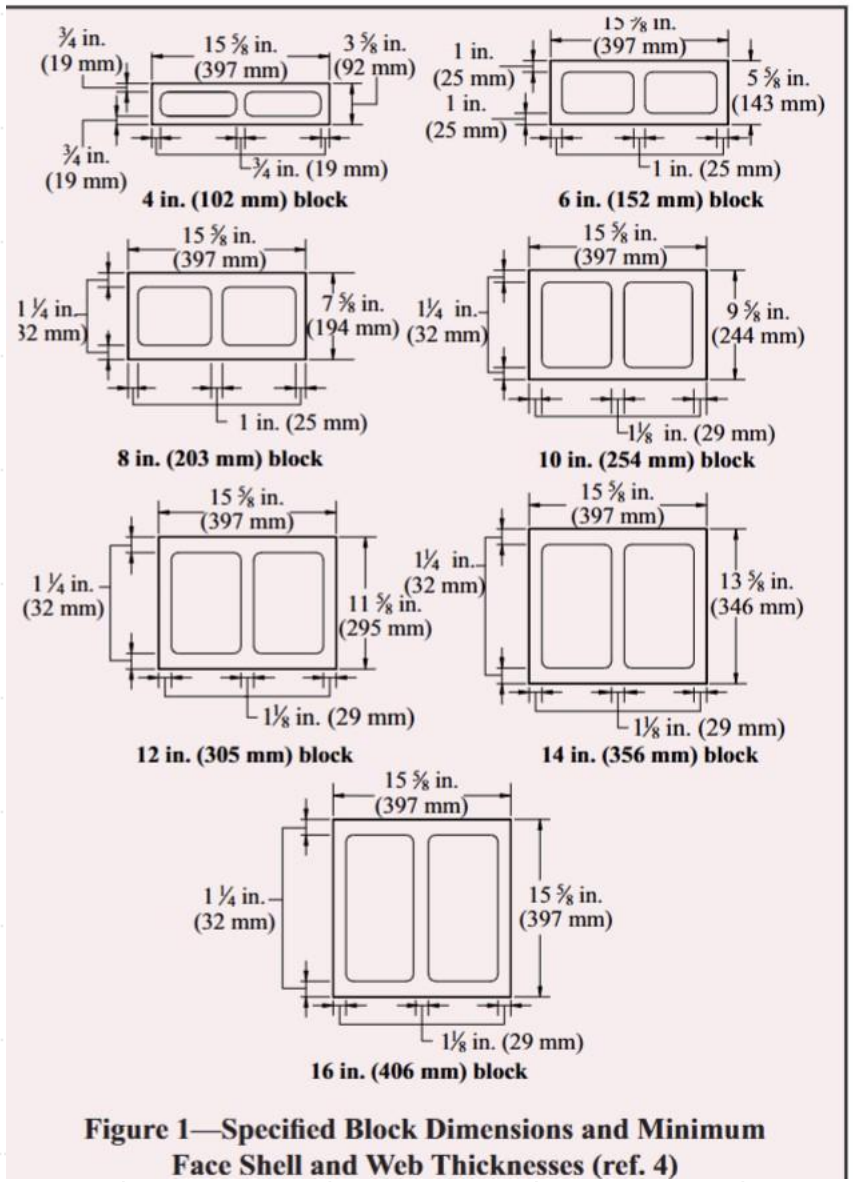
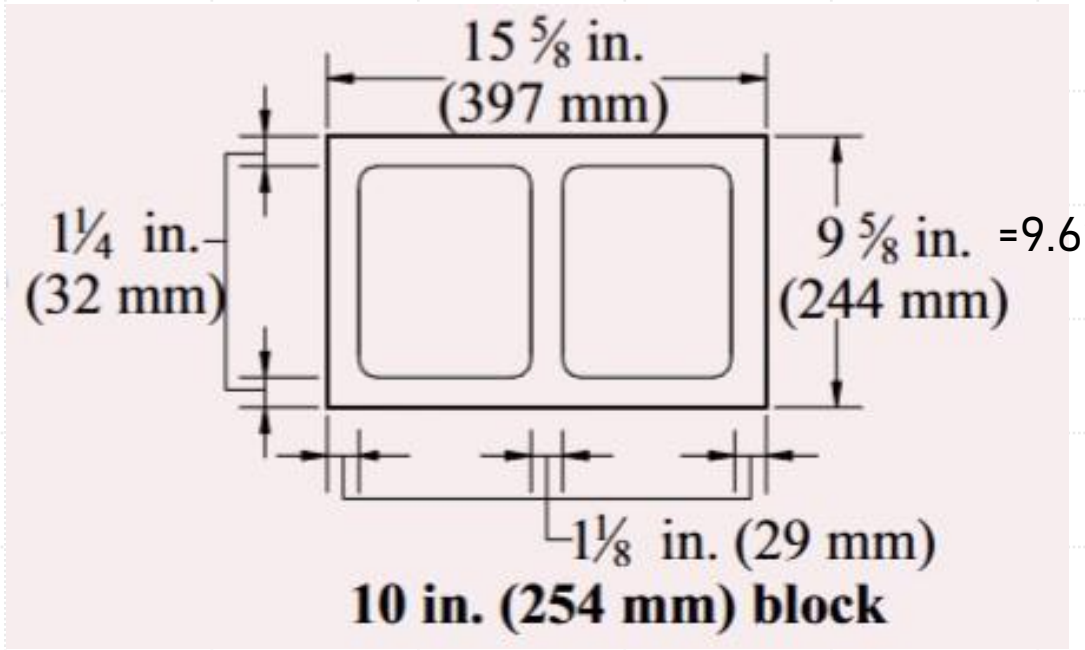


Figure 1—Specified Block Dimensions and Minimum Face Shell and Web Thicknesses (ref. 4)



=9.625

Table 4—10-inch (254-mm) Single Wythe Walls, $1^1/_4$ in. (32 mm) Face Shells (standard)

4a: Horizontal Section Properties (Masonry Spanning Vertically)

Unit	Grout spacing (in.)	Mortar bedding	Net cross-sectional properties[A]			Average cross-sectional properties[B]			
			A_n (in.^{2}/ft)	I_n (in.^{4}/ft)	S_n (in.^{3}/ft)	A_{avg} (in.^{2}/ft)	I_{avg} (in.^{4}/ft)	S_{avg} (in.^{3}/ft)	r_{avg} (in.)
Hollow	No grout	Face shell	30.0	530.0	110.1	48.0	606.3	126.0	3.55
Hollow	No grout	Full	48.0	606.3	126.0	48.0	606.3	126.0	3.55
100% solid/solidly grouted		Full	115.5	891.7	185.3	115.5	891.7	185.3	2.78
Hollow	16	Face shell	74.8	719.3	149.5	80.8	744.7	154.7	3.04
Hollow	24	Face shell	59.8	656.2	136.3	69.9	698.6	145.2	3.16
Hollow	32	Face shell	52.4	624.6	129.8	64.4	675.5	140.4	3.24
Hollow	40	Face shell	47.9	605.7	125.9	61.1	661.6	137.5	3.29
Hollow	48	Face shell	44.9	593.1	123.2	58.9	652.4	135.6	3.33
Hollow	72	Face shell	39.9	572.0	118.9	55.3	637.0	132.4	3.39
Hollow	96	Face shell	37.5	561.5	116.7	53.5	629.3	130.8	3.43
Hollow	120	Face shell	36.0	555.2	115.4	52.4	624.7	129.8	3.45

4b: Vertical Section Properties (Masonry Spanning Horizontally)

Hollow	No grout	Face shell	30.0	530.0	110.1	46.3	597.4	124.1	3.59
Hollow	No grout	Full	30.0	530.0	110.1	48.0	606.3	126.0	3.55
100% solid/solidly grouted		Full	115.5	891.7	185.3	115.5	891.7	185.3	2.78
Hollow	16	Face shell	72.8	710.8	147.7	89.1	778.3	161.7	2.96
Hollow	24	Face shell	58.5	650.5	135.2	74.8	718.0	149.2	3.10
Hollow	32	Face shell	51.4	620.4	128.9	67.7	687.9	142.9	3.19
Hollow	40	Face shell	47.1	602.3	125.2	63.4	669.8	139.2	3.25
Hollow	48	Face shell	44.3	590.2	122.6	60.6	657.7	136.7	3.29
Hollow	96	Face shell	37.1	560.1	116.4	53.5	627.6	130.4	3.43
Hollow	120	Face shell	35.7	554.1	115.1	52.0	621.6	129.2	3.46

Radius of gyration

$$r = \sqrt{\frac{I}{A}} = \sqrt{\frac{624.6}{52.4}} = 3.45$$

Ratio of h/r

h: Height of wall $\quad \frac{15\,FT \times 12}{3.45} = 52.17 < 99$

Nominal axial Strength (P_n)

$$P_n = 0.80\left\{0.80\,A_n f'_m\left[1-\left(\frac{h}{140r}\right)^2\right]\right\}$$

$$P_n = 0.8\left\{0.8(52.4)(3000)\left[1-\left(\frac{15\times12}{140(3.45)}\right)^2\right]\right\}$$

$$= 86724.09 \times \frac{1}{1000} = 86172 \text{ Klf}$$

$\emptyset P_n = 0.9(86,72) = 78,048$ → Max load wall withstand

$P_u = 1.2(DL) + 1.6(LL) = 1.2(28) + 1.6(21) = 67.2$ kLf $< \emptyset P_n$

- Thanks for your attention ☺