

SECTION PROPERTIES OF CONCRETE MASONRY WALLS

TEK 14-1A
Structural (2003)

Keywords: allowable stress design, area (net vs. gross), moment of inertia, radius of gyration, reinforced concrete masonry, reinforced properties, section modulus, section properties, strength design, structural properties

INTRODUCTION

Engineered design of concrete masonry walls uses section properties to determine strength, stiffness and deflection characteristics. These design philosophies are summarized in *Allowable Stress Design of Concrete Masonry* and *Strength Design of Concrete Masonry* (refs. 3, 4).

SECTION PROPERTIES

Tables 1 through 10 summarize section properties of grouted and ungrouted 4, 6, 8, 10, 12, 14 and 16 in. (102, 152, 203, 254, 305, 356 and 406 mm) wide concrete masonry walls, based on the following assumptions:

- standard unit dimensions are based on the minimum face shell and web thickness requirements of *Standard Specification for Loadbearing Concrete Masonry Units*, ASTM C 90 (ref. 2) as shown in Figure 1 (except as noted in Tables 8, 9 and 10),
- each unit has square ends and two square cores,
- the nominal face dimensions of all units are 16 in. long by 8 in. high (406 by 203 mm),
- all units have a symmetrical cross-section,
- all mortar joints are $\frac{3}{8}$ in. (9.5 mm) thick, and
- all mortar joints are the same depth as the thickness of the face shell or web on which they are placed.

The tables include both net and average section properties. The net section properties (A_n , I_n and S_n) are calculated based on the minimum net cross-sectional area of an assemblage. These values are related to the critical section when determining stresses due to an applied load (ref. 1). Average section properties (A_{avg} , I_{avg} , S_{avg} and r_{avg}) correspond to an average cross-sectional area of an assemblage. Average section properties are used to determine stiffness or deflection due to applied loading (ref. 1).

The net and average horizontal section properties

are listed in Tables 1a, 2a, etc. while vertical section properties are listed in Tables 1b, 2b, etc. For vertically spanning walls, horizontal section properties are calculated along a horizontal axis parallel to the plane of the masonry (axis X-X in Figure 2). For horizontally spanning walls, vertical section properties are

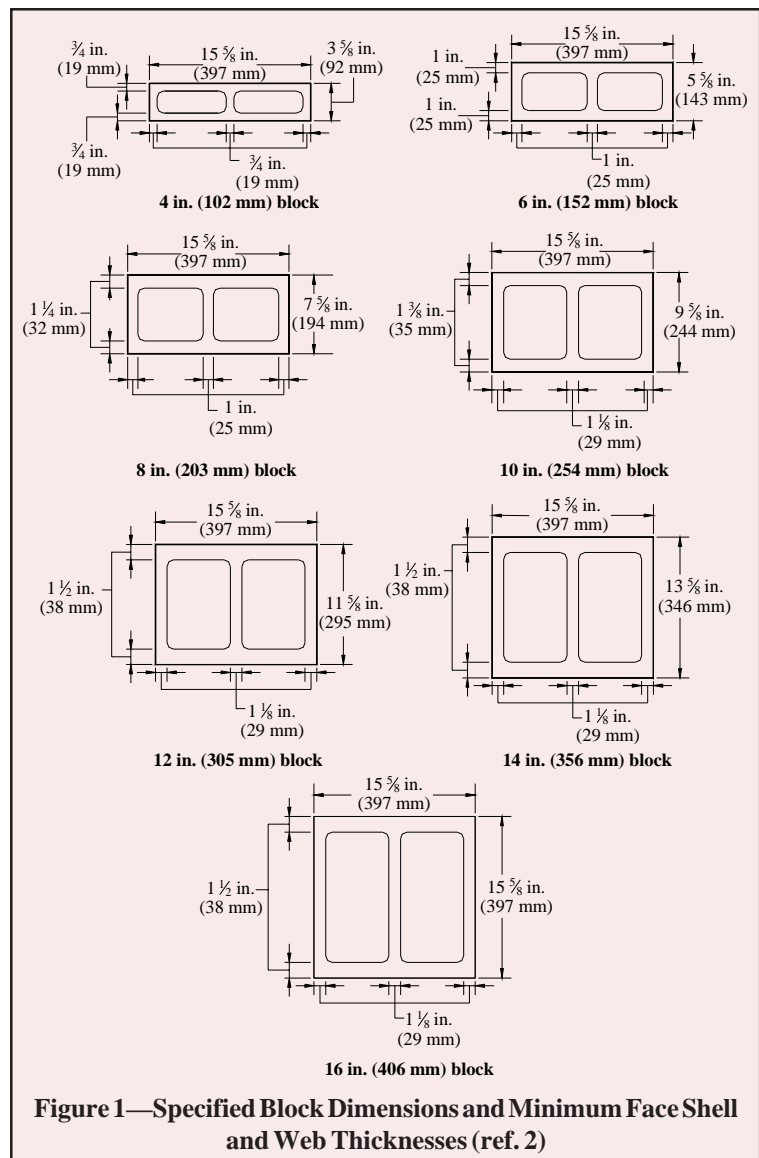


Table 1—4-Inch (102 mm) Single Wythe Walls, 3/4 in. (19 mm) Face Shells (standard)^C

1a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	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	18.0	38.0	21.0	21.6	39.4	21.7	1.35
Hollow	No grout	Full	21.6	39.4	21.7	21.6	39.4	21.7	1.35
100% Solid	No grout	Full	43.5	47.6	26.3	43.5	47.6	26.3	1.05

1b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	18.0	38.0	21.0	21.2	38.0	21.0	1.34
Hollow	No grout	Full	18.0	38.0	21.0	21.6	38.0	21.0	1.33
100% Solid	No grout	Full	43.5	47.6	26.3	43.5	47.6	26.3	1.05

Table 2—6-Inch (152 mm) Single Wythe Walls, 1 in. (25 mm) Face Shells (standard)

2a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	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	24.0	130.3	46.3	32.2	139.3	49.5	2.08
Hollow	No grout	Full	32.2	139.3	49.5	32.2	139.3	49.5	2.08
100% Solid/solid grouted		Full	67.5	178.0	63.3	67.5	178.0	63.3	1.62
Hollow	16 in. o.c.	Face shell	46.6	155.1	55.1	49.3	158.1	56.2	1.79
Hollow	24 in. o.c.	Face shell	39.1	146.8	52.2	43.6	151.8	54.0	1.87
Hollow	32 in. o.c.	Face shell	35.3	142.7	50.7	40.7	148.7	52.9	1.91
Hollow	40 in. o.c.	Face shell	33.0	140.2	49.9	39.0	146.8	52.2	1.94
Hollow	48 in. o.c.	Face shell	31.5	138.6	49.3	37.9	145.5	51.7	1.96
Hollow	72 in. o.c.	Face shell	29.0	135.8	48.3	36.0	143.5	51.0	2.00
Hollow	96 in. o.c.	Face shell	27.8	134.5	47.8	35.0	142.4	50.6	2.02
Hollow	120 in. o.c.	Face shell	27.0	133.6	47.5	34.4	141.8	50.4	2.03

2b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	24.0	130.3	46.3	31.4	137.7	49.0	2.09
Hollow	No grout	Full	24.0	130.3	46.3	32.2	139.3	49.5	2.08
100% Solid/solid grouted		Full	67.5	178.0	63.3	67.5	178.0	63.3	1.62
Bond beam	24 in. o.c.	Face shell	38.5	146.2	52.0	45.9	153.6	54.6	1.83
Bond beam	48 in. o.c.	Face shell	31.3	138.3	49.2	38.6	145.7	51.8	1.94
Bond beam	96 in. o.c.	Face shell	27.6	134.3	47.8	35.0	141.7	50.4	2.01
Bond beam	120 in. o.c.	Face shell	26.9	133.5	47.5	34.3	140.9	50.1	2.03

Table 3—8-Inch (203 mm) Single Wythe Walls, 1 1/4 in. (32 mm) Face Shells (standard)

3a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	308.7	81.0	41.5	334.0	87.6	2.84
Hollow	No grout	Full	41.5	334.0	87.6	41.5	334.0	87.6	2.84
100% Solid/solid grouted		Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Hollow	16 in. o.c.	Face shell	62.0	378.6	99.3	65.8	387.1	101.5	2.43
Hollow	24 in. o.c.	Face shell	51.3	355.3	93.2	57.7	369.4	96.9	2.53
Hollow	32 in. o.c.	Face shell	46.0	343.7	90.1	53.7	360.5	94.6	2.59
Hollow	40 in. o.c.	Face shell	42.8	336.7	88.3	51.2	355.2	93.2	2.63
Hollow	48 in. o.c.	Face shell	40.7	332.0	87.1	49.6	351.7	92.2	2.66
Hollow	72 in. o.c.	Face shell	37.1	324.3	85.0	46.9	345.8	90.7	2.71
Hollow	96 in. o.c.	Face shell	35.3	320.4	84.0	45.6	342.8	89.9	2.74
Hollow	120 in. o.c.	Face shell	34.3	318.0	83.4	44.8	341.0	89.5	2.76

3b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	30.0	308.7	81.0	40.5	330.1	86.6	2.86
Hollow	No grout	Full	30.0	308.7	81.0	41.5	334.0	87.6	2.84
100% Solid/solid grouted		Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Bond beam	24 in. o.c.	Face shell	50.5	353.6	92.7	61.0	374.9	98.3	2.48
Bond beam	48 in. o.c.	Face shell	40.3	331.1	86.9	50.7	352.5	92.5	2.64
Bond beam	96 in. o.c.	Face shell	35.1	319.9	83.9	45.6	341.3	89.5	2.74
Bond beam	120 in. o.c.	Face shell	34.1	317.7	83.3	44.6	339.0	88.9	2.76

Table 4—10-Inch (254 mm) Single Wythe Walls, 1³/₈ in. (35 mm) Face Shells (standard)

4a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	33.0	566.7	117.8	50.4	635.3	132.0	3.55
Hollow	No grout	Full	50.4	635.3	132.0	50.4	635.3	132.0	3.55
100% Solid/solid grouted		Full	115.5	891.7	185.3	115.5	891.7	185.3	2.78
Hollow	16 in. o.c.	Face shell	76.2	736.8	153.1	82.0	759.7	157.9	3.04
Hollow	24 in. o.c.	Face shell	61.8	680.1	141.3	71.5	718.2	149.2	3.17
Hollow	32 in. o.c.	Face shell	54.6	651.8	135.4	66.2	697.5	144.9	3.25
Hollow	40 in. o.c.	Face shell	50.3	634.8	131.9	63.0	685.0	142.3	3.30
Hollow	48 in. o.c.	Face shell	47.4	623.4	129.5	60.9	676.7	140.6	3.33
Hollow	56 in. o.c.	Face shell	45.3	615.3	127.9	59.4	670.8	139.4	3.36
Hollow	72 in. o.c.	Face shell	42.6	604.5	125.6	57.4	662.9	137.7	3.40
Hollow	96 in. o.c.	Face shell	40.2	595.1	123.6	55.7	656.0	136.3	3.43
Hollow	120 in. o.c.	Face shell	38.8	589.4	122.5	54.6	651.8	135.4	3.45
4b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	33.0	566.7	117.8	48.8	626.4	130.2	3.58
Hollow	No grout	Full	33.0	566.7	117.8	50.4	635.3	132.0	3.55
100% Solid/solid grouted		Full	115.5	891.7	185.3	115.5	891.7	185.3	2.78
Bond beam	24 in. o.c.	Face shell	60.5	675.0	140.3	76.3	734.8	152.7	3.10
Bond beam	48 in. o.c.	Face shell	46.8	620.9	129.0	62.5	680.6	141.4	3.30
Bond beam	96 in. o.c.	Face shell	39.9	593.8	123.4	55.6	653.5	135.8	3.43
Bond beam	120 in. o.c.	Face shell	38.5	588.4	122.3	54.3	648.1	134.7	3.46

Table 5—12-Inch (305 mm) Single Wythe Walls, 1¹/₂ in. (38 mm) Face Shells (standard)

5a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	36.0	929.4	159.9	57.8	1064.7	183.2	4.29
Hollow	No grout	Full	57.8	1064.7	183.2	57.8	1064.7	183.2	4.29
100% Solid/solid grouted		Full	139.5	1571.0	270.3	139.5	1571.0	270.3	3.36
Hollow	16 in. o.c.	Face shell	90.2	1265.2	217.7	97.5	1310.4	225.4	3.67
Hollow	24 in. o.c.	Face shell	72.1	1153.3	198.4	84.2	1228.5	211.4	3.82
Hollow	32 in. o.c.	Face shell	63.1	1097.3	188.8	77.6	1187.5	204.3	3.91
Hollow	40 in. o.c.	Face shell	57.7	1063.7	183.0	73.7	1163.0	200.1	3.97
Hollow	48 in. o.c.	Face shell	54.1	1041.3	179.2	71.0	1146.6	197.3	4.02
Hollow	56 in. o.c.	Face shell	51.5	1025.3	176.4	69.2	1134.9	195.3	4.05
Hollow	64 in. o.c.	Face shell	49.5	1013.4	174.3	67.7	1126.1	193.7	4.08
Hollow	72 in. o.c.	Face shell	48.0	1004.0	172.7	66.6	1119.3	192.6	4.10
Hollow	96 in. o.c.	Face shell	45.0	985.4	169.5	64.4	1105.7	190.2	4.14
Hollow	120 in. o.c.	Face shell	43.2	974.2	167.6	63.1	1097.5	188.8	4.17
5b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	36.0	929.4	159.9	55.8	1049.2	180.5	4.34
Hollow	No grout	Full	36.0	929.4	159.9	57.8	1064.7	183.2	4.29
100% Solid/solid grouted		Full	139.5	1571.0	270.3	139.5	1571.0	270.3	3.36
Bond beam	24 in. o.c.	Face shell	70.5	1143.3	196.7	90.3	1263.1	217.3	3.74
Bond beam	48 in. o.c.	Face shell	53.3	1036.3	178.3	73.0	1156.1	198.9	3.98
Bond beam	96 in. o.c.	Face shell	44.6	982.9	169.1	64.4	1102.7	189.7	4.14
Bond beam	120 in. o.c.	Face shell	42.9	972.2	167.3	62.7	1092.0	187.9	4.17

calculated along a vertical axis parallel to the plane of the masonry (axis Y-Y in Figure 2).

In addition to section properties based on the standard unit dimensions shown in Figure 1, Tables 8 and 9 list section properties of walls constructed using 8-inch (203-mm) units with thickened face shells. These units are often specified to achieve higher fire ratings. Table 10 lists section properties of walls constructed using 12-in. (305-mm) units with 1¹/₄ in. (32 mm) face shells. These units are permitted by ASTM C 90 (ref.

2) when allowable design loads are reduced in proportion to the reduction in face shell thickness.

FOOTNOTES:

- ^A Net cross-sectional properties are typically used to determine stress and strain from load application.
- ^B Average cross-sectional properties are typically used to determine stiffness and deflection of an element.
- ^C Because of the small core size and resulting difficulty consolidating grout, 4-in. (102-mm) units are rarely grouted.

Table 6—14-Inch (356 mm) Single Wythe Walls, 1½ in. (38 mm) Face Shells (standard)

6a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit		Mortar bedding	Net cross-sectional properties ^A			Average cross-sectional properties ^B			
configuration	Grout spacing		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	36.0	1329.9	195.2	62.9	1582.9	232.4	5.02
Hollow	No grout	Full	62.9	1582.9	232.4	62.9	1582.9	232.4	5.02
100% Solid/solid	grouted	Full	163.5	2529.4	371.3	163.5	2529.4	371.3	3.93
Hollow	16 in. o.c.	Face shell	102.7	1957.7	287.4	111.7	2042.1	299.8	4.28
Hollow	24 in. o.c.	Face shell	80.5	1748.5	256.7	95.4	1889.0	277.3	4.45
Hollow	32 in. o.c.	Face shell	69.4	1643.8	241.3	87.3	1812.5	266.1	4.56
Hollow	40 in. o.c.	Face shell	62.7	1581.0	232.1	82.4	1766.6	259.3	4.63
Hollow	48 in. o.c.	Face shell	58.2	1539.2	225.9	79.2	1736.0	254.8	4.68
Hollow	56 in. o.c.	Face shell	55.1	1509.3	221.5	76.8	1714.1	251.6	4.72
Hollow	64 in. o.c.	Face shell	52.7	1486.9	218.3	75.1	1697.7	249.2	4.75
Hollow	72 in. o.c.	Face shell	50.8	1469.4	215.7	73.7	1684.9	247.3	4.78
Hollow	80 in. o.c.	Face shell	49.3	1455.5	213.6	72.7	1674.7	245.8	4.80
Hollow	104 in. o.c.	Face shell	46.3	1426.5	209.4	70.4	1653.5	242.7	4.85
Hollow	120 in. o.c.	Face shell	44.9	1413.6	207.5	69.4	1644.1	241.3	4.87
6b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	36.0	1329.9	195.2	60.4	1557.9	228.7	5.08
Hollow	No grout	Full	36.0	1329.9	195.2	62.9	1582.9	232.4	5.02
100% Solid/solid	grouted	Full	163.5	2529.4	371.3	163.5	2529.4	371.3	3.93
Bond beam	24 in. o.c.	Face shell	78.5	1729.7	253.9	102.9	1957.7	287.4	4.36
Bond beam	48 in. o.c.	Face shell	57.3	1529.8	224.6	81.6	1757.8	258.0	4.64
Bond beam	96 in. o.c.	Face shell	46.6	1429.8	209.9	71.0	1657.8	243.4	4.83
Bond beam	120 in. o.c.	Face shell	44.5	1409.9	207.0	68.9	1637.9	240.4	4.88

Table 7—16-Inch (406 mm) Single Wythe Walls, 1½ in. (38 mm) Face Shells (standard)

7a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit		Mortar bedding	Net cross-sectional properties ^A			Average cross-sectional properties ^B			
configuration	Grout spacing		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	36.0	1802.4	230.7	68.0	2226.9	285.0	5.72
Hollow	No grout	Full	68.0	2226.9	285.0	68.0	2226.9	285.0	5.72
100% Solid/solid	grouted	Full	187.5	3814.7	488.3	187.5	3814.7	488.3	4.51
Hollow	16 in. o.c.	Face shell	115.3	2855.7	365.5	126.0	2997.2	383.6	4.88
Hollow	24 in. o.c.	Face shell	88.9	2504.6	320.6	106.6	2740.4	350.8	5.07
Hollow	32 in. o.c.	Face shell	75.7	2329.0	298.1	97.0	2612.0	334.3	5.19
Hollow	40 in. o.c.	Face shell	67.7	2223.7	284.6	91.2	2535.0	324.5	5.27
Hollow	48 in. o.c.	Face shell	62.4	2153.5	275.6	87.3	2483.6	317.9	5.33
Hollow	56 in. o.c.	Face shell	58.7	2103.3	269.2	84.5	2447.0	313.2	5.38
Hollow	64 in. o.c.	Face shell	55.8	2065.7	264.4	82.5	2419.4	309.7	5.42
Hollow	72 in. o.c.	Face shell	53.6	2036.5	260.7	80.8	2398.0	307.0	5.45
Hollow	80 in. o.c.	Face shell	51.9	2013.1	257.7	79.6	2380.9	304.8	5.47
Hollow	88 in. o.c.	Face shell	50.4	1993.9	255.2	78.5	2366.9	303.0	5.49
Hollow	96 in. o.c.	Face shell	49.2	1977.9	253.2	77.6	2355.3	301.5	5.51
Hollow	120 in. o.c.	Face shell	46.6	1942.8	248.7	75.7	2329.6	298.2	5.55
7b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	36.0	1802.4	230.7	65.0	2189.1	280.2	5.81
Hollow	No grout	Full	36.0	1802.4	230.7	68.0	2226.9	285.0	5.72
100% Solid/solid	grouted	Full	187.5	3814.7	488.3	187.5	3814.7	488.3	4.51
Bond beam	24 in. o.c.	Face shell	86.5	2473.2	316.6	115.5	2859.9	366.1	4.98
Bond beam	48 in. o.c.	Face shell	61.3	2137.8	273.6	90.2	2524.5	323.1	5.29
Bond beam	96 in. o.c.	Face shell	48.6	1970.1	252.2	77.6	2356.8	301.7	5.51
Bond beam	120 in. o.c.	Face shell	46.1	1936.5	247.9	75.1	2323.3	297.4	5.56

NOTATION:

- A_{avg} = average cross-sectional area of masonry, in.²(mm²).
- A_n = net cross-sectional area of masonry, in.²(mm²).
- I_{avg} = moment of inertia of average cross-sectional area of masonry, in.⁴(mm⁴).
- I_n = moment of inertia of net cross-sectional area of masonry, in.⁴(mm⁴).
- r_{avg} = radius of gyration of the average cross-sectional area of masonry, in. (mm).
- S_{avg} = section modulus of the average cross-sectional area of masonry, in.³(mm³).
- S_n = section modulus of the net cross-sectional area of masonry, in.³(mm³).

METRIC CONVERSIONS:

Multiply:	by:	to get:
in.	25.4	mm
in. ² /ft	2,117	mm ² /m
in. ³ /ft	53,763	mm ³ /m
in. ⁴ /ft	1,365,588	mm ⁴ /m

Table 8—8-Inch (203 mm) Single Wythe Walls, 2 in. (51 mm) Face Shells (nonstandard)

8a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	48.0	395.7	103.8	56.2	404.6	106.1	2.68
Hollow	No grout	Full	56.2	404.6	106.1	56.2	404.6	106.1	2.68
100% Solid/solid	grouted	Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Hollow	16 in. o.c.	Face shell	70.6	420.4	110.3	73.3	423.4	111.1	2.40
Hollow	24 in. o.c.	Face shell	63.1	412.2	108.1	67.6	417.1	109.4	2.48
Hollow	32 in. o.c.	Face shell	59.3	408.1	107.0	64.7	414.0	108.6	2.53
Hollow	40 in. o.c.	Face shell	57.0	405.6	106.4	63.0	412.1	108.1	2.56
Hollow	48 in. o.c.	Face shell	55.5	403.9	106.0	61.9	410.9	107.8	2.58
Hollow	72 in. o.c.	Face shell	53.0	401.2	105.2	60.0	408.8	107.2	2.61
Hollow	96 in. o.c.	Face shell	51.8	399.8	104.9	59.0	407.8	107.0	2.63
Hollow	120 in. o.c.	Face shell	51.0	399.0	104.7	58.4	407.1	106.8	2.64
8b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	48.0	395.7	103.8	55.4	400.7	105.1	2.69
Hollow	No grout	Full	48.0	395.7	103.8	56.2	404.6	106.1	2.68
100% Solid/solid	grouted	Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Bond beam	24 in. o.c.	Face shell	62.5	411.6	108.0	69.9	416.6	109.3	2.44
Bond beam	48 in. o.c.	Face shell	55.3	403.6	105.9	62.6	408.7	107.2	2.55
Bond beam	96 in. o.c.	Face shell	51.6	399.7	104.8	59.0	404.7	106.1	2.62
Bond beam	120 in. o.c.	Face shell	50.9	398.9	104.6	58.3	403.9	105.9	2.63

Table 9—8-Inch (203 mm) Single Wythe Walls, 1 3/8 in. (35 mm) Face Shells (nonstandard)

9a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	33.0	327.5	85.9	44.0	349.2	91.6	2.82
Hollow	No grout	Full	44.0	349.2	91.6	44.0	349.2	91.6	2.82
100% Solid/solid	grouted	Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Hollow	16 in. o.c.	Face shell	63.4	387.7	101.7	67.0	394.9	103.6	2.43
Hollow	24 in. o.c.	Face shell	53.3	367.6	96.4	59.4	379.7	99.6	2.53
Hollow	32 in. o.c.	Face shell	48.2	357.6	93.8	55.5	372.0	97.6	2.59
Hollow	40 in. o.c.	Face shell	45.2	351.5	92.2	53.2	367.5	96.4	2.63
Hollow	48 in. o.c.	Face shell	43.1	347.5	91.2	51.7	364.4	95.6	2.66
Hollow	72 in. o.c.	Face shell	39.8	340.8	89.4	49.1	359.3	94.3	2.71
Hollow	96 in. o.c.	Face shell	38.1	337.5	88.5	47.8	356.8	93.6	2.73
Hollow	120 in. o.c.	Face shell	37.1	335.5	88.0	47.0	355.3	93.2	2.75
9b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	33.0	327.5	85.9	42.9	345.3	90.6	2.84
Hollow	No grout	Full	33.0	327.5	85.9	44.0	349.2	91.6	2.82
100% Solid/solid	grouted	Full	91.5	443.3	116.3	91.5	443.3	116.3	2.20
Bond beam	24 in. o.c.	Face shell	52.5	366.1	96.0	62.4	383.9	100.7	2.48
Bond beam	48 in. o.c.	Face shell	42.8	346.8	91.0	52.7	364.6	95.6	2.63
Bond beam	96 in. o.c.	Face shell	37.9	337.1	88.4	47.8	354.9	93.1	2.72
Bond beam	120 in. o.c.	Face shell	36.9	335.2	87.9	46.8	353.0	92.6	2.75

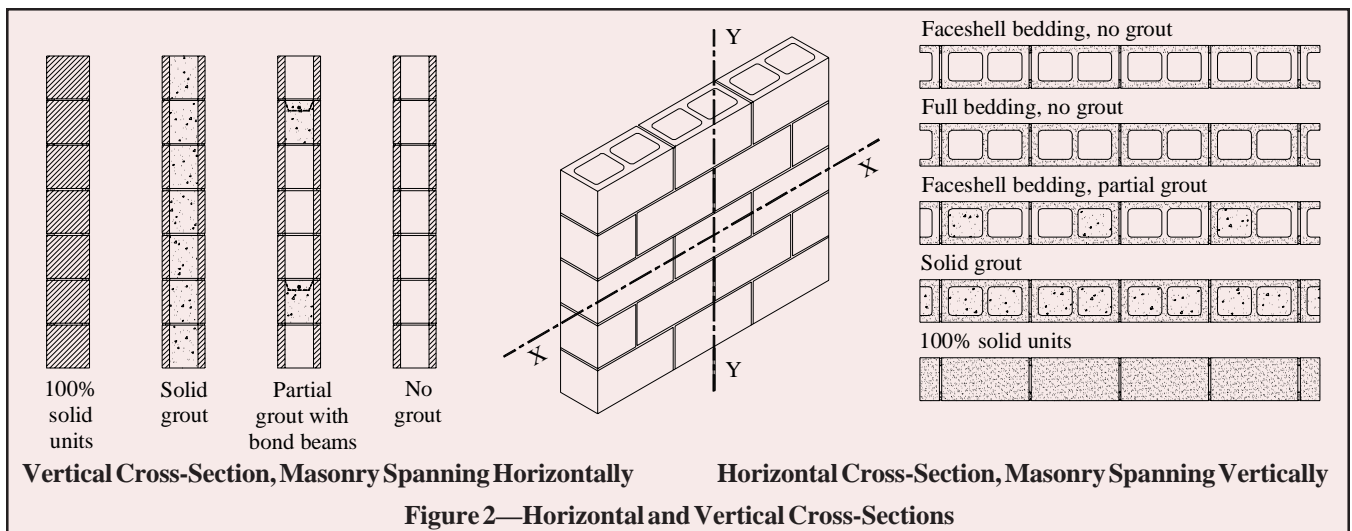


Table 10—12-Inch (305 mm) Single Wythe Walls, 1¼ in. (32 mm) Face Shells (nonstandard)

10a: Horizontal Section Properties (Masonry Spanning Vertically)									
Unit configuration	Grout spacing	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	811.2	139.6	53.1	971.5	167.1	4.28
Hollow	No grout	Full	53.1	971.5	167.1	53.1	971.5	167.1	4.28
100% Solid/solid	grouted	Full	139.5	1571.0	270.3	139.5	1571.0	270.3	3.36
Hollow	16 in. o.c.	Face shell	87.3	1208.9	208.0	95.0	1262.3	217.2	3.64
Hollow	24 in. o.c.	Face shell	68.2	1076.3	185.2	81.0	1165.4	200.5	3.79
Hollow	32 in. o.c.	Face shell	58.7	1010.1	173.8	74.1	1116.9	192.2	3.88
Hollow	40 in. o.c.	Face shell	52.9	970.3	166.9	69.9	1087.8	187.2	3.95
Hollow	48 in. o.c.	Face shell	49.1	943.8	162.4	67.1	1068.4	183.8	3.99
Hollow	56 in. o.c.	Face shell	46.4	924.8	159.1	65.1	1054.6	181.4	4.03
Hollow	64 in. o.c.	Face shell	44.3	910.6	156.7	63.6	1044.2	179.6	4.05
Hollow	72 in. o.c.	Face shell	42.7	899.6	154.8	62.4	1036.1	178.3	4.07
Hollow	96 in. o.c.	Face shell	39.6	877.5	151.0	60.1	1020.0	175.5	4.12
Hollow	120 in. o.c.	Face shell	37.6	864.2	148.7	58.7	1010.3	173.8	4.15
10b: Vertical Section Properties (Masonry Spanning Horizontally)									
Hollow	No grout	Face shell	30.0	811.2	139.6	50.9	955.9	164.5	4.33
Hollow	No grout	Full	30.0	811.2	139.6	53.1	971.5	167.1	4.28
100% Solid/solid	grouted	Full	139.5	1571.0	270.3	139.5	1571.0	270.3	3.36
Bond beam	24 in. o.c.	Face shell	66.5	1064.5	183.1	87.4	1209.2	208.0	3.72
Bond beam	48 in. o.c.	Face shell	48.3	937.8	161.3	69.2	1082.6	186.3	3.96
Bond beam	96 in. o.c.	Face shell	39.1	874.5	150.5	60.1	1019.3	175.4	4.12
Bond beam	120 in. o.c.	Face shell	37.3	861.9	148.3	58.2	1006.6	173.2	4.16

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