



TYPICAL SIZES AND SHAPES OF CONCRETE MASONRY UNITS

TEK 2-1A

Unit Properties (2002)

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INTRODUCTION

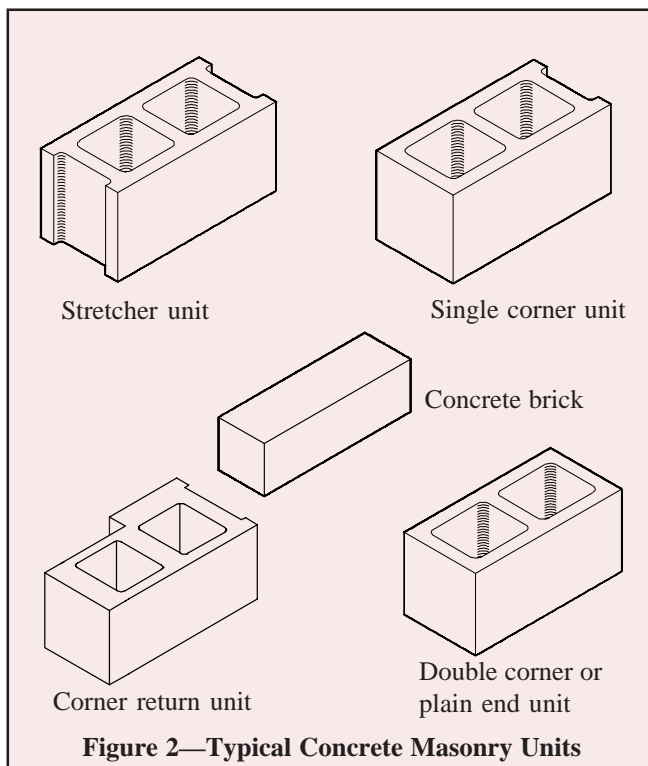
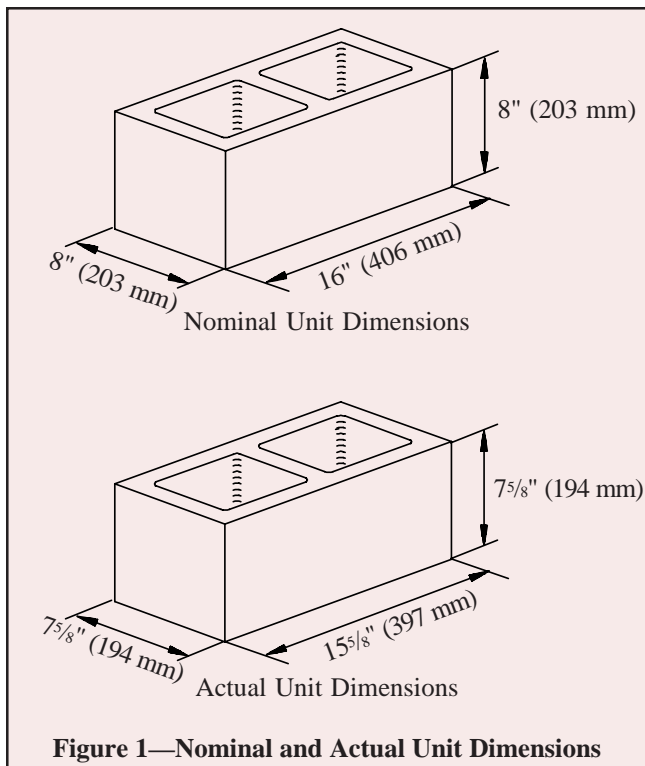
Concrete masonry is one of the most versatile building products available because of the wide variety of appearances that can be achieved using concrete masonry units. Concrete masonry units are manufactured in different sizes, shapes, colors, and textures to achieve a number of finishes and functions. In addition, because of its modular nature, different concrete masonry units can be combined within the same wall to achieve variations in texture, pattern, and color.

Certain concrete masonry sizes and shapes are considered standard, while others are popular only in certain regions. Local manufacturers can provide detailed information on specific products, or the feasibility of producing custom units. A more complete guide to concrete masonry units is the *Shapes and Sizes Directory* (ref. 2).

UNIT SIZES

Typically, concrete masonry units have nominal face dimensions of 8 in. (203 mm) by 16 in. (406 mm), available in nominal thicknesses of 4, 6, 8, 10, and 12 in. (102, 152, 203, 254, and 305 mm). Nominal dimensions refer to the module size for planning bond patterns and modular layout with respect to door and window openings. Actual dimensions of concrete masonry units are typically $\frac{3}{8}$ in. (9.5 mm) less than nominal dimensions, so that the 4 or 8 in. (102 or 203 mm) module is maintained with $\frac{3}{8}$ in. (9.5 mm) mortar joints. Figure 1 illustrates nominal and actual dimensions for a nominal 8 x 8 x 16 in. (203 x 203 x 406 mm) concrete masonry unit. In addition to these standard sizes, other unit heights, lengths, and thicknesses may be available from local concrete masonry producers.

Standard Specification for Load-Bearing Concrete Masonry Units, ASTM C 90 (ref. 5) is the most frequently referenced standard for concrete masonry units. ASTM C 90 includes minimum face shell and web thicknesses for



the different sizes of concrete masonry units as listed in Table 1. Overall unit dimensions (height, width, or length) are permitted to vary by $\pm 1/8$ in. (3.2 mm) from the dimensions specified by the manufacturer. Where required, units may be manufactured to closer tolerances than those permitted in ASTM C 90. ASTM C 90 also defines the difference between hollow and solid concrete masonry units. The net cross-sectional area of a solid unit is at least 75% of the gross cross-sectional area.

In addition to the “standard” sizes listed above, concrete brick is available in typical lengths of 8 and 16 in. (203 and 406 mm), nominal 4 in. (102 mm) width, and a wide range of heights. They may be 100% solid, or may have two or three cores. Like ASTM C 90, *Standard Specification for Concrete Building Brick*, ASTM C 55 (ref. 4), permits overall unit dimensions to vary $\pm 1/8$ in. (3.2 mm) from the dimensions specified by the manufacturer. Nominal dimensions of modular concrete brick equal the actual dimensions plus $3/8$ in. (9.5 mm), the thickness of one standard mortar joint. However, nominal dimensions of nonmodular sized concrete brick usually exceed the standard dimensions by $1/8$ to $1/4$ in. (3.2 to 6.4 mm).

Table 1—Minimum Thickness of Face Shells and Webs (ref. 5)

Nominal width of unit, in. (mm)	Face shell thickness ^a , in. (mm)	Web thickness	
		Webs ^a , in. (mm)	Equivalent web thickness, in./linear foot ^{b,c} (mm/m)
3 (76) and 4 (102)	3/4 (19)	3/4 (19)	1 5/8 (136)
6 (152)	1 (25) ^d	1 (25)	2 1/4 (188)
8 (203)	1 1/4 (32) ^d	1 (25)	2 1/4 (188)
10 (254)	1 3/8 (35) ^d	1 1/8 (29)	2 1/2 (209)
12 (305)	1 1/4 (32) ^{d,e}	1 1/8 (29)	2 1/2 (209)
	1 1/2 (38)		
	1 1/4 (32) ^{d,e}		

^a Average of measurements on 3 units taken at the thinnest point when measured as described in ASTM C 140 (ref. 3). When this standard is used for split face units, a maximum of 10% of a split face shell area is permitted to have thicknesses less than those shown, but not less than 3/4 in. (19.1 mm). When the units are solid grouted, the 10% limit does not apply.

^b Average of measurements on 3 units taken at the thinnest point when measured as described in ASTM C 140. The minimum web thickness for units with webs closer than 1 in. (25.4 mm) apart shall be 3/4 in. (19.1 mm).

^c Sum of the measured thickness of all webs in the unit, multiplied by 12 and divided by the length of the unit. Equivalent web thickness does not apply to the portion of the unit to be filled with grout. The length of that portion shall be deducted from the overall length of the unit for the calculation.

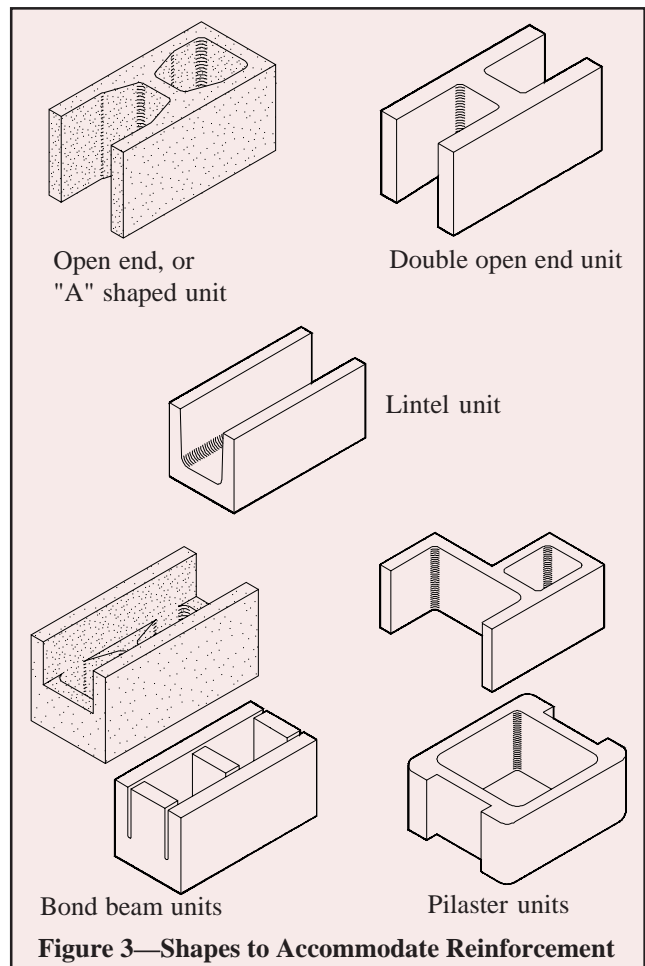
^d For solid grouted masonry construction, minimum face shell thickness not less than 5/8 in. (16 mm).

^e This face shell thickness is applicable where allowable design load is reduced in proportion to the reduction in thickness from basic face shell thicknesses shown, except that allowable design loads on solid grouted units shall not be reduced.

UNIT SHAPES

Concrete masonry unit shapes have been developed for a wide variety of applications. The most common shapes are shown in Figure 2. Typically, the face shells and webs are tapered on concrete masonry units. Depending on the core molds used in the manufacture of the units, face shells and webs may be tapered with a flare at one end, or may have a straight taper from top to bottom. The taper provides a wider surface for mortar and easier handling for the mason.

The shapes illustrated in Figure 3 have been developed specifically to accommodate reinforcement. **Open-ended units** allow the units to be threaded around reinforcing bars. This eliminates the need to lift units over the top of the reinforcing bar, or to thread the reinforcement through the masonry cores



after the wall is constructed. Bond beams in concrete masonry walls can be accommodated either by saw-cutting out of a standard unit, or by using **bond beam units**. Bond beam units are either manufactured with reduced webs or with “knock-out” webs, which are removed prior to placement in the wall. Horizontal bond beam reinforcement is easily accommodated in these units. **Lintel units** are similar to the U shaped bond beam units. Lintel units are available in various depths to carry appropriate lintel loads over door and window openings. The solid bottom confines grout to the lintel. **Pilaster and column units** are used to easily accommodate a wall-column or wall-pilaster interface, allowing space for vertical reinforcement in

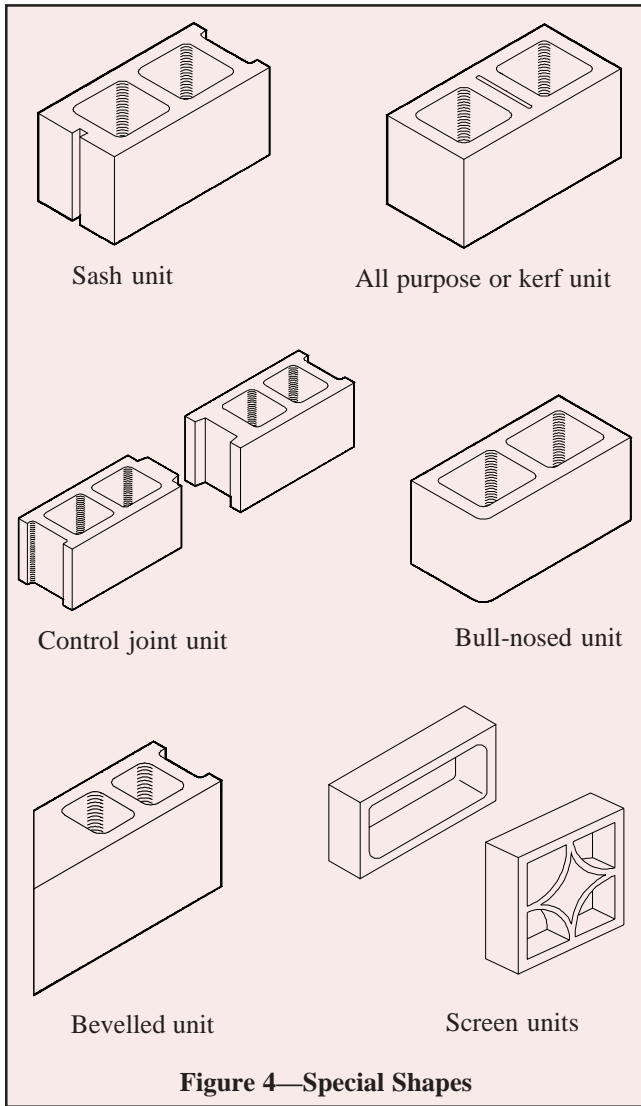


Figure 4—Special Shapes

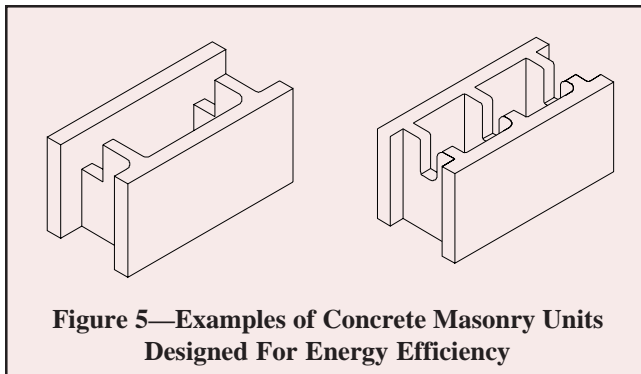


Figure 5—Examples of Concrete Masonry Units Designed For Energy Efficiency

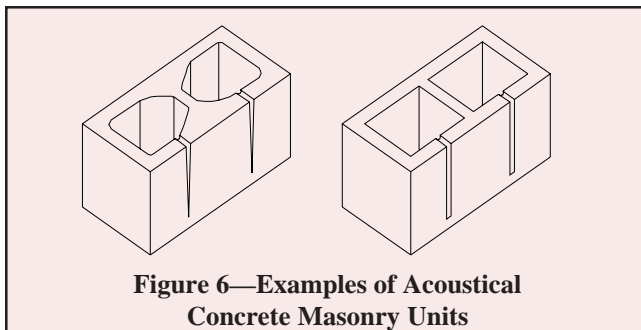


Figure 6—Examples of Acoustical Concrete Masonry Units

the hollow center.

Figure 4 shows units developed for specific wall applications. **Sash block** have a vertical groove molded into one end to accommodate a window sash. Sash block can be laid with the grooves adjacent to one another to accommodate a preformed control joint gasket. **Control joint units** are manufactured with one male and one female end to provide lateral load transfer across control joints. An **all-purpose or kerf unit** contains two closely spaced webs in the center, rather than the typical single web. This allows the unit to be easily split on the jobsite, producing two 8 in. (203 mm) long units, which are typically used adjacent to openings or at the ends or corner of a wall. **Bull-nosed units** are available with either a single or double bull nose, to soften corners. **Screen units** are available in many sizes and patterns. Typical applications include exterior fences, interior partitions, and openings within interior concrete masonry walls. **Bevelled-end units**, forming a 45° angle with the face of the unit, are used to form walls intersecting at 135° angles. Units in adjacent courses overlap to form a running bond pattern at the corner.

A variety of concrete masonry units are designed to increase energy efficiency. These units, examples of which are shown in Figure 5, may have reduced web areas to reduce heat loss through the webs. Web areas can be reduced by reducing the web height or thickness, reducing the number of webs, or both. In addition, the interior face shell of the unit can be made thicker than a typical face shell for increased thermal storage, and hence further increase energy efficiency. Insulating inserts can also be incorporated into standard concrete masonry units to increase energy efficiency.

Acoustical units (Figure 6) dampen sound, thus improving the noise reduction attributes of an interior space. Acoustical units are often used in schools, industrial plants, and churches, and to improve internal acoustics.

SURFACE FINISHES

The finished appearance of a concrete masonry wall can be varied with the size of units, shape of units, color of units and mortar, bond pattern, and surface finish of the units. The various shapes and sizes of concrete masonry units described above are often available in a choice of surface finishes. Some of the surfaces are molded into the units during the manufacturing process, while others are applied separately.

Figure 7 shows some of the more common surface textures available. Ribs, flutes, striations, offsets, and scores are accomplished by using a unit mold with the desired characteristics. Split-faced units are molded with two units face-to-face and then the units are mechanically split apart.

Glazed units are manufactured by bonding a permanent colored facing to a concrete masonry unit, providing a smooth impervious surface. Glazed units are often used for brightly-colored accent bands, and in gymnasiums, rest rooms, and indoor swimming pools where the stain and moisture resistant finish reduces maintenance. Glazed units comply to *Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units*, ASTM C 744 (ref. 6).

Ground-face units are ground to achieve a smooth finish which reveals the natural colors of the aggregates. Often, specific aggregates will be used to enhance the appearance.

For more information on surface finishes, see TEK 2-3A *Architectural Concrete Masonry Units* (ref. 1).



Figure 7—Examples of Surface Finishes Available For Concrete Masonry Units
 (clockwise from bottom left: split face with three scores; single score ground face; glazed corner unit; ground face; ground face; single score glazed ; split face; ground face; split face; center: eight-ribbed split face)

REFERENCES

1. *Architectural Concrete Masonry Units*, TEK 2-3A, National Concrete Masonry Association, 2001.
2. *Shapes and Sizes Directory*, National Concrete Masonry Association, 1995.
3. *Standard Methods of Sampling and Testing Concrete Masonry Units and Related Units*, ASTM C 140-01a^{e1}. American Society for Testing and Materials, 2001.
4. *Standard Specification for Concrete Building Brick*, ASTM C 55-01a. American Society for Testing and Materials, 2001.
5. *Standard Specification for Load-Bearing Concrete Masonry Units*, ASTM C 90-01a. American Society for Testing and Materials, 2001.
6. *Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units*, ASTM C 744-99. American Society for Testing and Materials, 1999.