

Introduction to Masonry

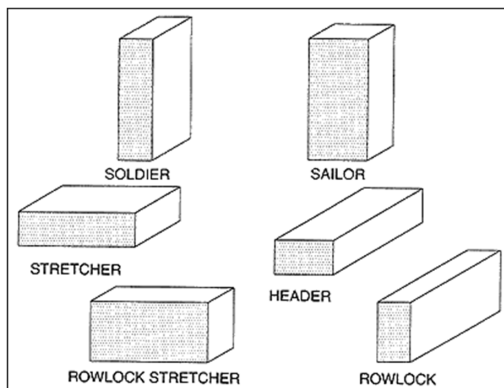
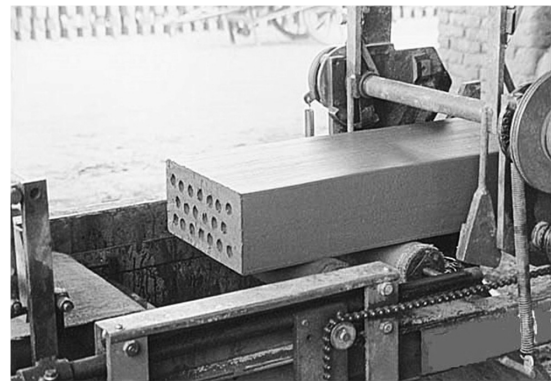
- Clay Masonry
- Concrete Masonry
- Autoclaved Aerated Concrete (AAC)

Höchst Entrance Hall, Frankfurt
Arch: Peter Behrens, 1920-24
Photo: Eva Kröcher



Clay Brick

- Molded
or
- Extruded
- Cored – adds stability, strength
cored < 25% > hollow
- Fired (2000° F)
- Sizes – use 3/8" mortar bed
- Six ways to position in wall:



3/8" Mortar Joint Between Bricks (Most Common)

BRICK TYPE	SPECIFIED SIZE D X H X L (INCHES)	NOMINAL SIZE D X H X L	VERTICAL COURSE
Standard	3 5/8 x 2 1/4 x 8	Not modular	3 courses = 8"
Modular	3 5/8 x 2 1/4 x 7 5/8	4 x 2 2/3 x 8	3 courses = 8"
Norman	3 5/8 x 2 1/4 x 11 5/8	4 x 2 2/3 x 12	3 courses = 8"
Roman	3 5/8 x 1 5/8 x 11 5/8	4 x 2 x 12	1 course = 2"
Jumbo	3 5/8 x 2 3/4 x 8	4 x 3 x 8	1 course = 3"
Economy	3 5/8 x 3 5/8 x 7 5/8	4 x 4 x 8	1 course = 4"
Engineer	3 5/8 x 2 13/16 x 7 5/8	4 x 3 1/5 x 8	5 courses = 16"
King	2 3/4 x 2 5/8 x 9 5/8	Not modular	5 courses = 16"
Queen	2 3/4 x 2 3/4 x 7 5/8	Not modular	5 courses = 16"
Utility	3 5/8 x 3 5/8 x 11 5/8	4 x 4 x 12	1 course = 4"

Clay Brick

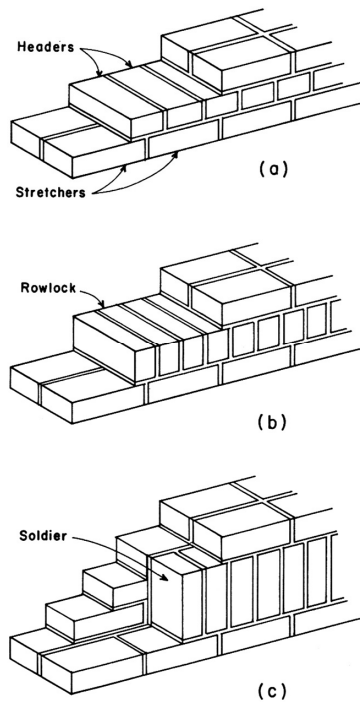
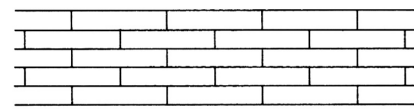
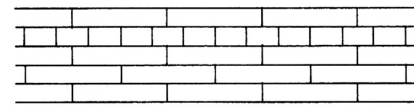


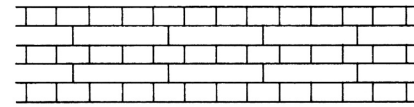
FIGURE 4.2. Ordinary positions for bricks.



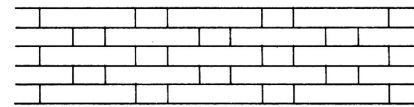
running bond



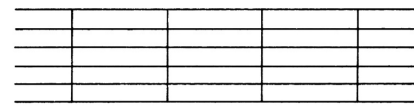
common bond



English bond

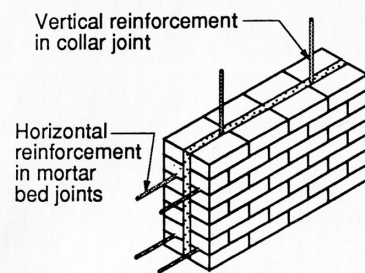


Flemish bond

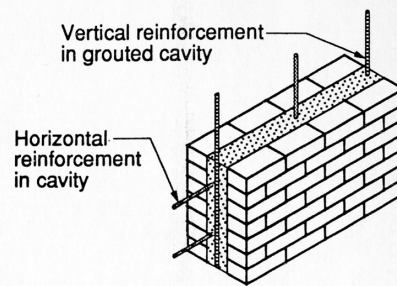


stack bond

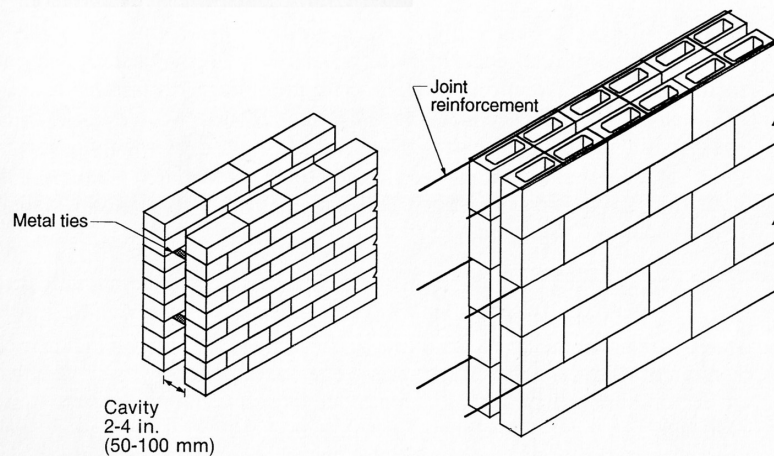
Cavity Walls



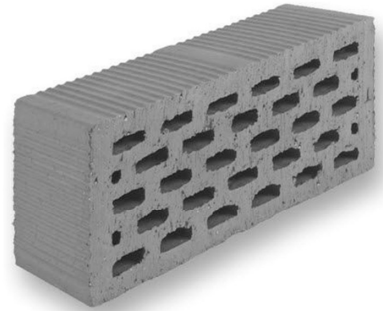
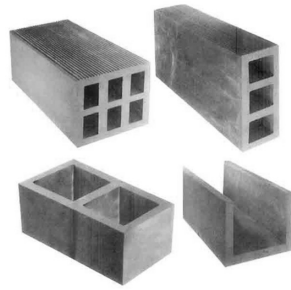
(a) Reinforcement in Joints



(b) Reinforcement in Cavity



Clay Tile

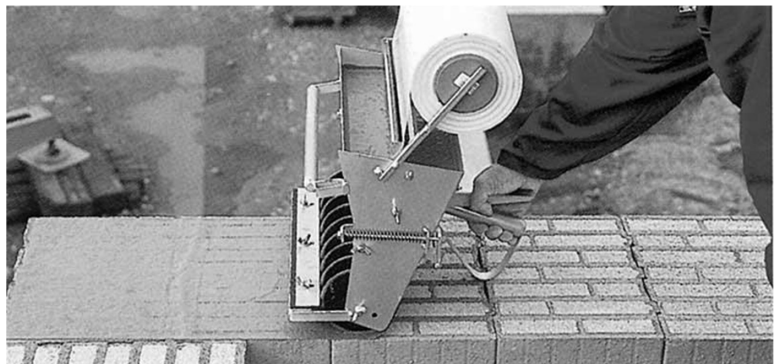
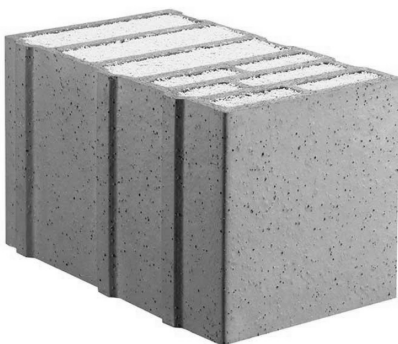
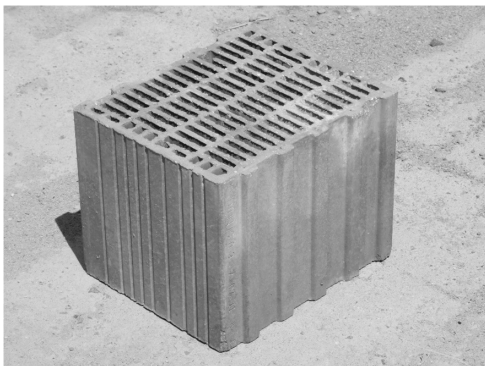


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Structures II

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Insulated Clay Tile



Ziegelindustrie International <https://www.zi-online.info/en/index.html>

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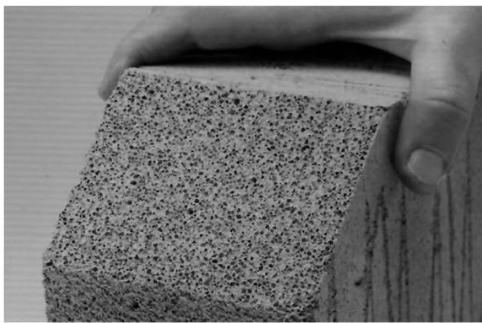
Structures II

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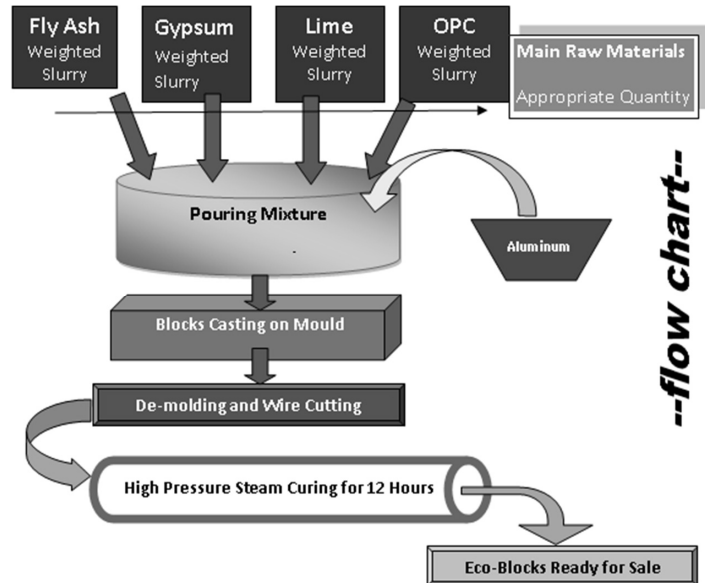
Autoclaved Aeriated Concrete (AAC)

Used predominately in Europe
 Developed by Dr. Johan Axel Eriksson in mid- 1920s in Sweden as "Ytong"
 since 1943, Hebel blocks in Germany
 Current largest production in China

Lighter weight
 Better insulation value
 Better fire resistance
 Better moisture transmission
 Larger blocks for faster erection
 Can be shaped on site



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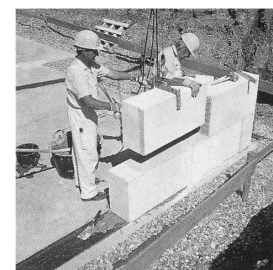
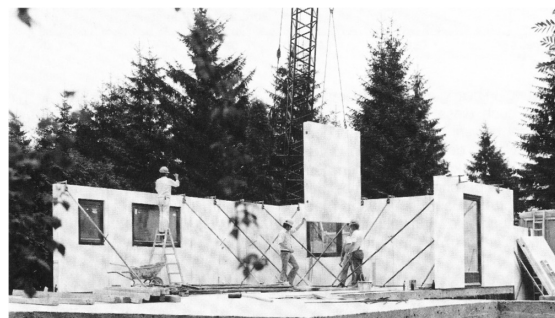
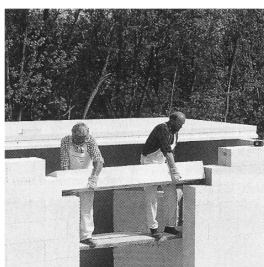


Structures II

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Autoclaved Aeriated Concrete (AAC)

Density – 20 to 50 PCF (floats)
 Compressive strength – 300 to 900 PSI
 Allowable Shear Stress – 8 to 22 PSI
 Thermal Resistance - 0.8 to 1.25 R/ IN



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Structures II

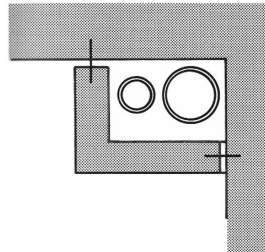
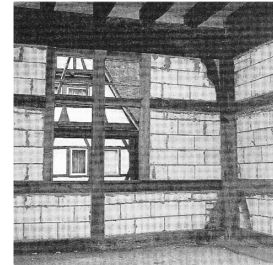
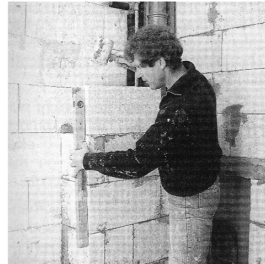
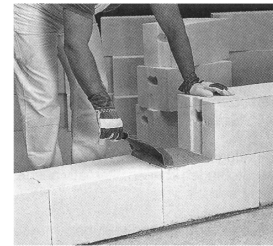
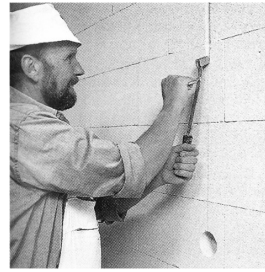
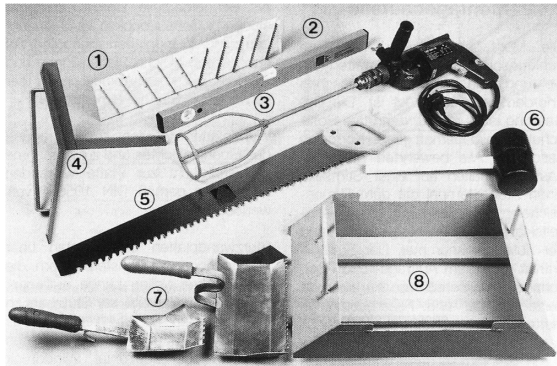
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Autoclaved Aeriated Concrete (AAC)

Easily shaped on site

Thin mortar bed – 1/8" (1mm to 3mm)

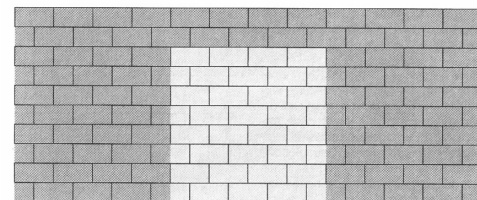
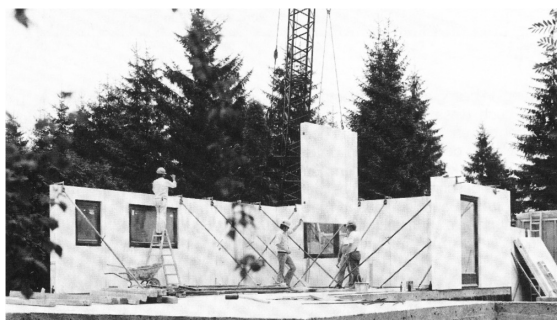
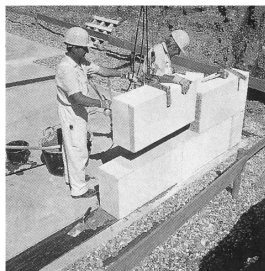
Tools for placement (below)



Autoclaved Aeriated Concrete (AAC)

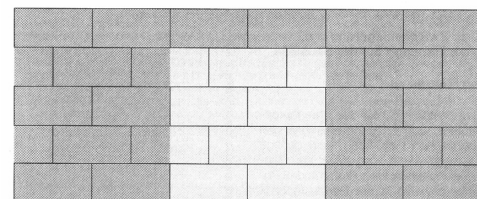
Larger blocks so faster layup – e.g. 8"x8"x24"

Panel layup with onsite crane



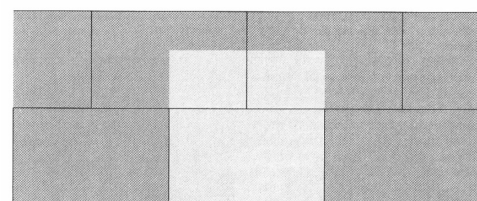
Clay block
32 blocks / m²
9.4" x 4.4"

Konventionelles Mauerwerk:
32 Steine 2 DF/3 DF für 1 m² Wand;
Steinmaß 240 mm x 113 mm x d



AAC block
8 blocks / m²
19.6" x 9.8"

Porenbeton-Plansteine:
16 Steine pro 1 m² Wand;
Steinmaß 499 mm x 249 mm x d



AAC panel
1.6 panels / m²
39.3" x 24.5"

Porenbeton-Planelemente:
1.6 Steine pro 1 m² Wand;
Steinmaß 999 mm x 623 mm x d

Autoclaved Aeriated Concrete (AAC)

Finish with stucco

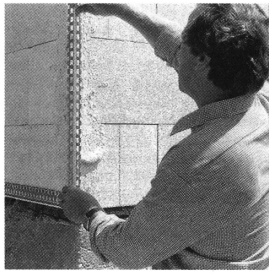


Abb. 2.4.4-1
Anbringen der Sockelabschluß- und Eckschutzschiene zur Sicherung der Mauerwerkskanten



Abb. 2.4.4-2
Auftrag des Grundputzes von Hand

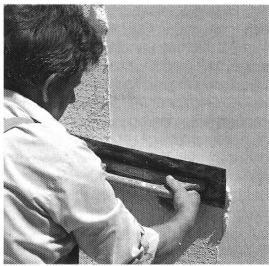


Abb. 2.4.4-3
Auftrag der Deckschicht

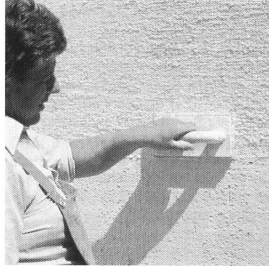


Abb. 2.4.4-4
Verreiben der Putzoberfläche mit Filzbrett oder Schwammscheibe



Member Types

Compression members based on proportions.

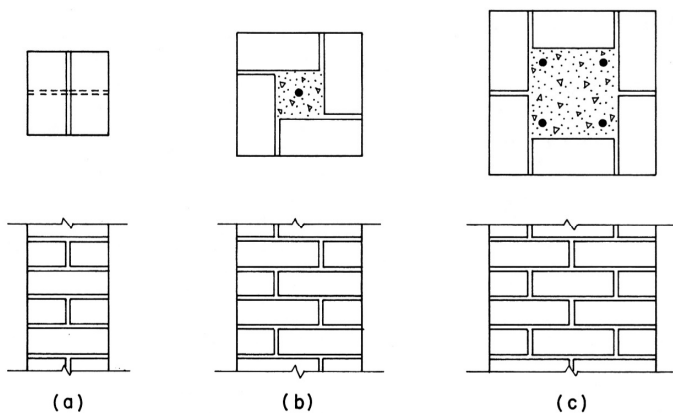
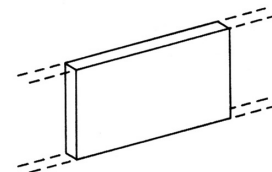
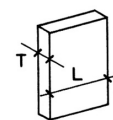


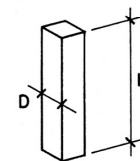
FIGURE 4.12. Forms of brick columns.



(a) Wall



(b) Pier
 $3T < L \leq 6T$



(c) Column
 $H/D \geq 3$



(d) Pedestal
 $H/D < 3$

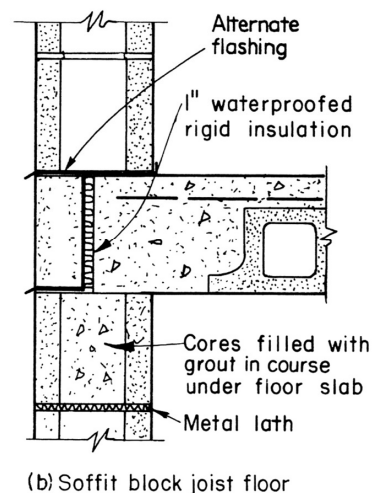
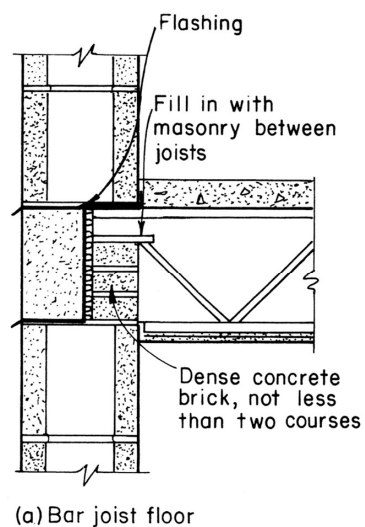
FIGURE 4.6. Classification of vertical compression members.

Concrete Masonry Units (CMU) wall construction



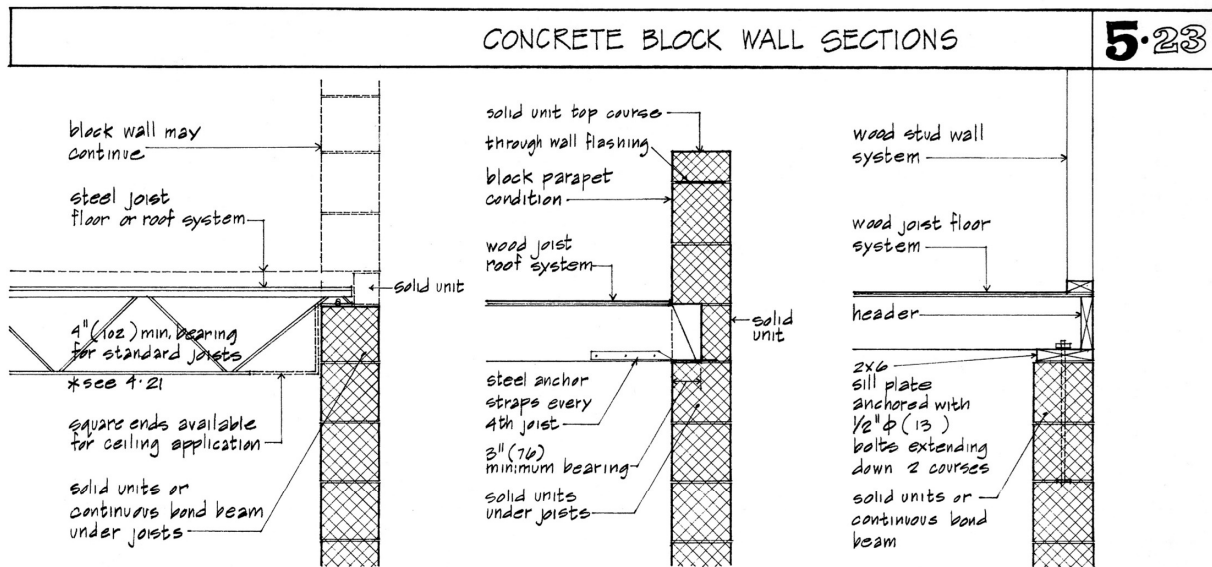
Member Details

Floor / Column details.



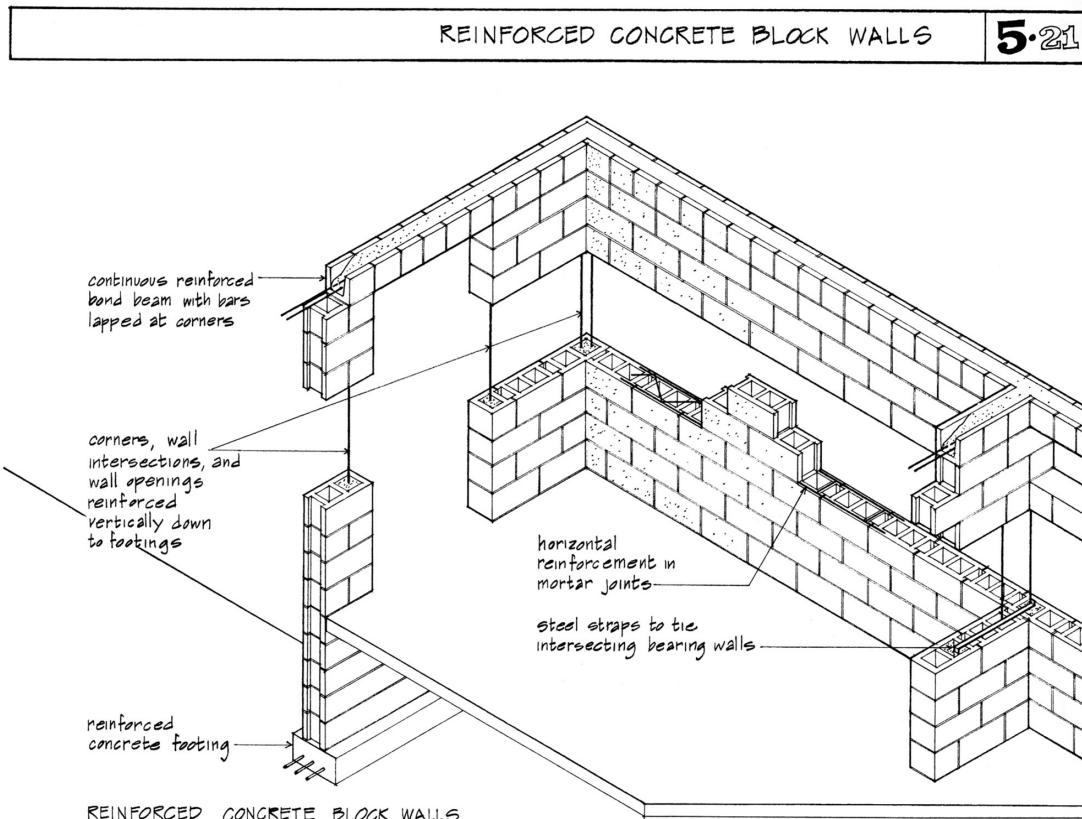
Concrete Masonry Units (CMU)

- wall sections



These wall sections are not intended to be complete. They exclude floor, wall, and ceiling finishes, trim, etc. They attempt to illustrate how various floor and roof systems are supported by a concrete block bearing wall. The above-grade wall is literally an extension of the concrete block foundation wall system. Note that the edges of floor and roof planes are not visible from the exterior except at the top of the concrete block wall. All vertical dimensions should be modular, especially if the block is left exposed as the wall finish.

Concrete Masonry Units (CMU)



When concrete block walls are subjected to lateral forces such as caused by wind, earth pressure below grade, and earthquakes, they may be reinforced as illustrated above.

Concrete Masonry Units (CMU)

- Cast (molds)
- Dried
- Autoclaved

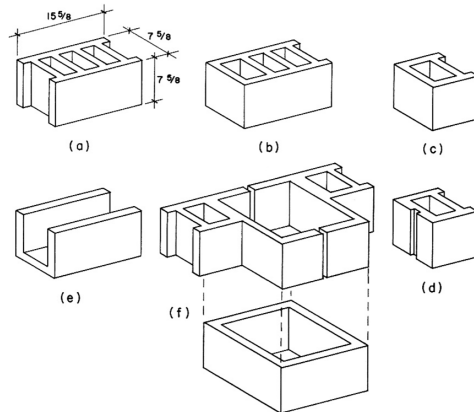
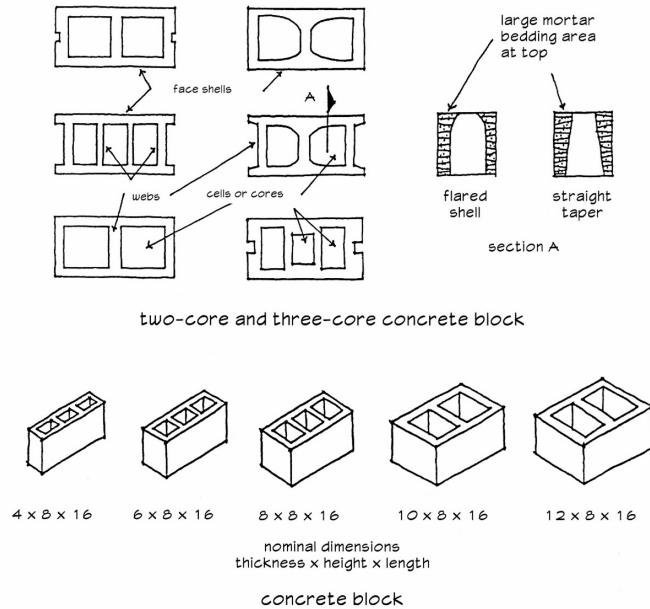


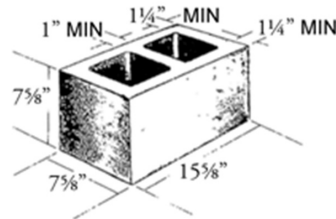
FIGURE 5.1. Forms of CMUs for unreinforced construction.

1.9.1 Standard Concrete Masonry Unit (CMU) Stretchers and Unit Coring



Concrete Masonry Units (CMU)

- Geometric Properties
- NCMA TEK 14-1B
- Radius of gyration, $r = \sqrt{\frac{I}{A}}$



8-inch (203-mm) Single Wythe Walls, 1 1/4 in. (32 mm) Face Shells (standard)

Horizontal Section Properties (Masonry Spanning Vertically)					
Unit	Grout spacing (in.)	Mortar bedding	Net cross-sectional properties ^A		
			A_n (in. ² /ft)	I_n (in. ⁴ /ft)	S_n (in. ³ /ft)
Hollow	No grout	Face shell	30.0	308.7	81.0
Hollow	No grout	Full	41.5	334.0	87.6
100% solid/solidly grouted			91.5	443.3	116.3
Hollow	16	Face shell	62.0	378.6	99.3
Hollow	24	Face shell	51.3	355.3	93.2
Hollow	32	Face shell	46.0	343.7	90.1
Hollow	40	Face shell	42.8	336.7	88.3
Hollow	48	Face shell	40.7	332.0	87.1
Hollow	72	Face shell	37.1	324.3	85.0
Hollow	96	Face shell	35.3	320.4	84.0
Hollow	120	Face shell	34.3	318.0	83.4

Concrete Masonry Units (CMU)

- Reinforcing

Joint Reinforcing



Truss Type



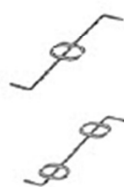
Ladder Type

4.5 Horizontal reinforcement required for masonry not laid in running bond of $0.00028A_g$, placed at a maximum spacing of 48 in. o.c. in horizontal mortar joints or in bond beams.

$$0.00028(7.625)(16) = 0.034\text{in}^2 \quad \text{Use 9 gage (W1.7) at 16 in. o.c.}$$

W1.7 wire
dia. = 0.147 in
area = 0.017 in²
2x wire = 0.034 in²

Rebar Positioners



Placed in mortar joints



Concrete Masonry Units

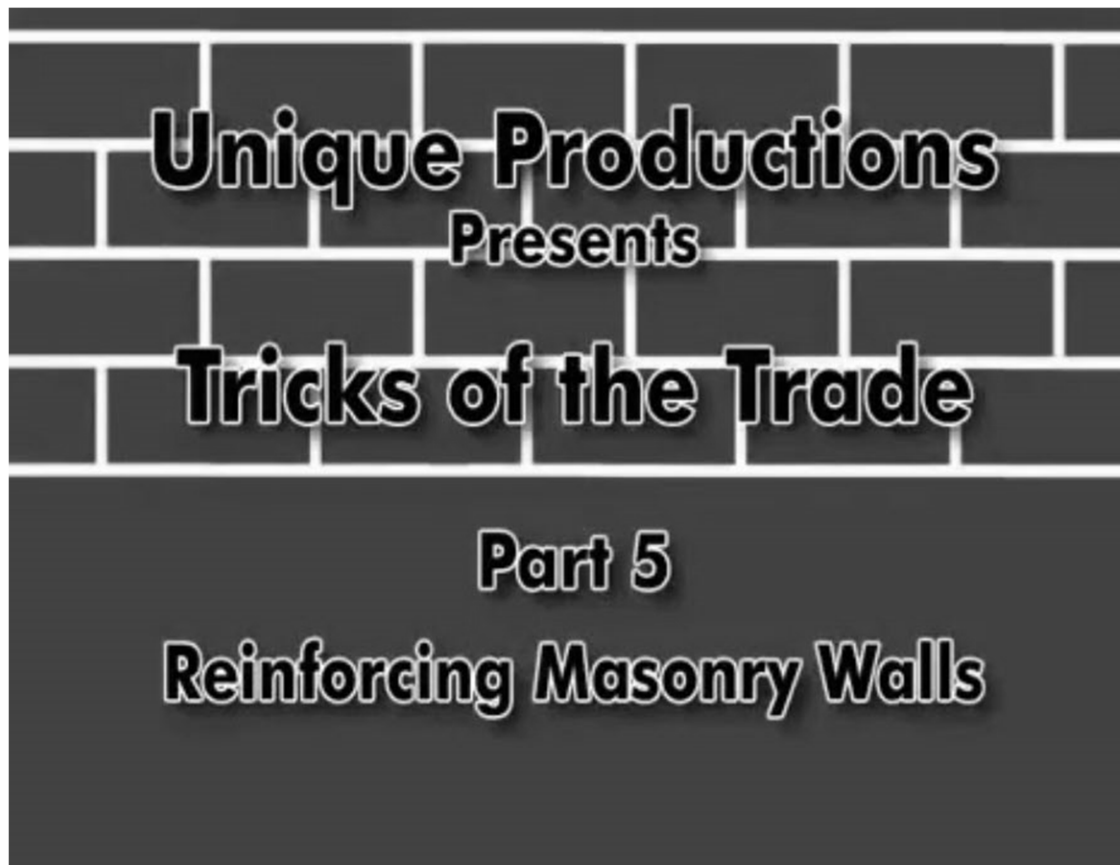


Placed in cells



8

Concrete Masonry Construction



Art Nueveau

Catalonian

- Antonio Gaudi 1852 - 1926
- Catalonian Art Nouveau
- Park Guell



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Masonry

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Art Nueveau

Catalonian

- Antonio Gaudi 1852 - 1926
- Catalonian Art Nouveau
- Crypt at Colonia Guell



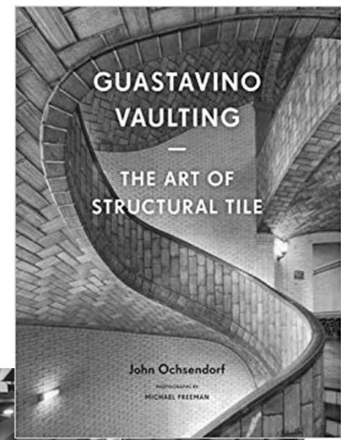
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Masonry

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Guastavino Vaulting

- Guastavino Co. 1885 – 1962
- Started in Boston



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Masonry

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Guastavino Vaulting

- Guastavino Co. 1885 – 1962
- Detroit Train Station



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Masonry

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