Contemporary Masonry

- walls
- columns and pilasters
- beams and lintels

Monadnock Building
Chicago 1891 – 1893
Burnham & Root

Monadnock Building

- Chicago
- 1891 – 1893
- Burnham & Root

Modern Multistory Masonry

- Reinforced cavity
- Tied to slab
- Diaphragm action

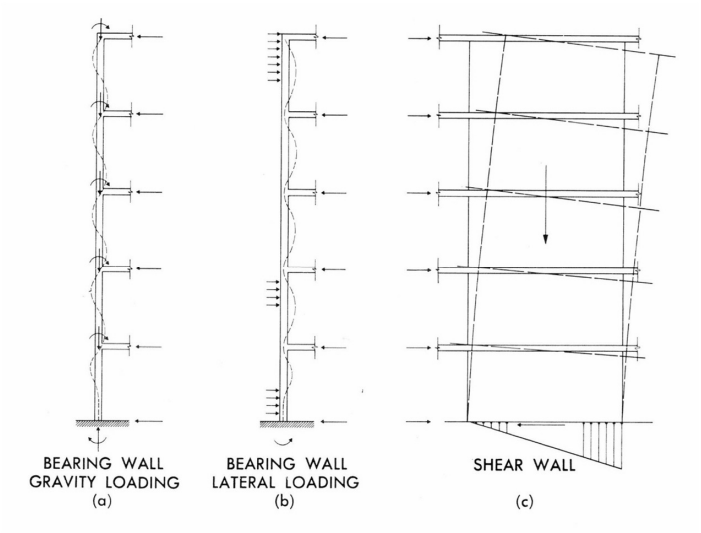


Figure 17.1 16-story loadbearing brick masonry building, Biel, Switzerland. (*Courtesy of Brick Institute of America.*)

Modern Multistory Masonry

- Reinforced cavity
- Tied to slab
- Diaphragm action

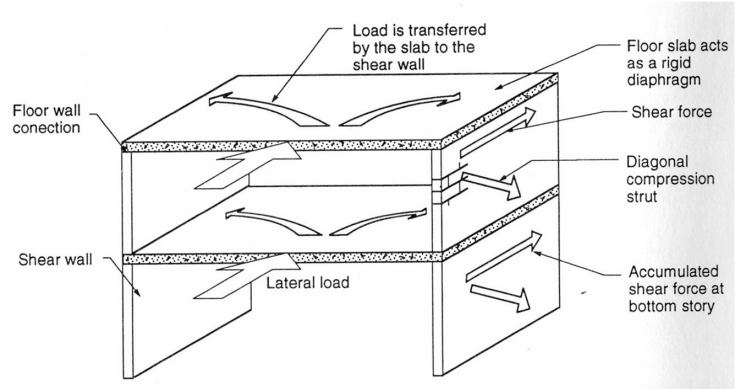
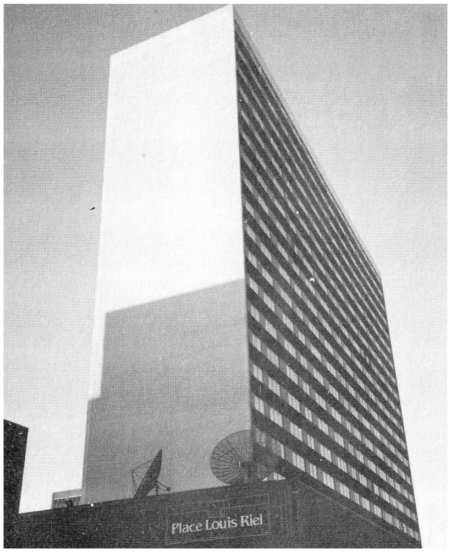
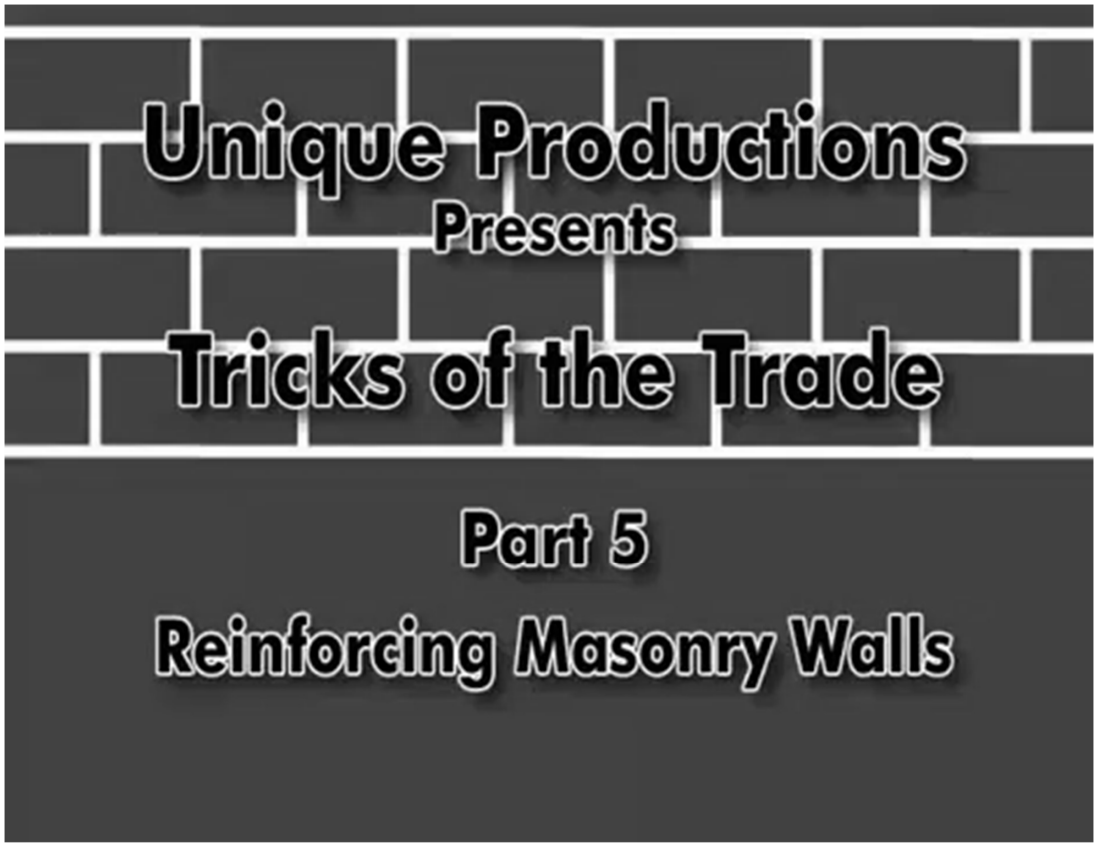


Figure 17.6 Lateral load transfer in multistory loadbearing masonry buildings.



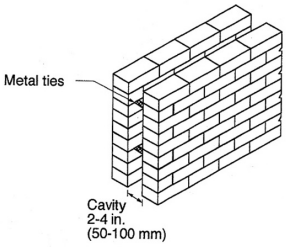
24 story loadbearing reinforced 8” block Apartment building. Winnipeg, Canada

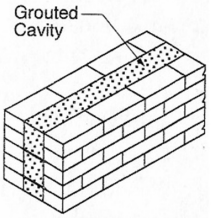
Modern Masonry Construction



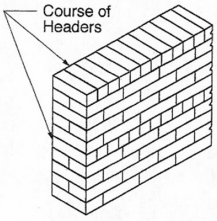
Wall Construction

- solid
- cavity
- composite

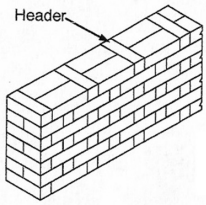




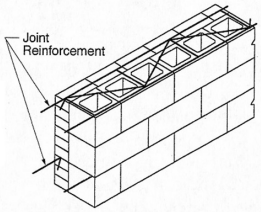
Grouted Cavity



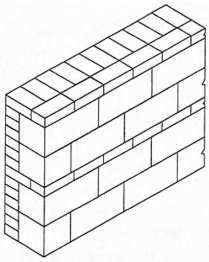
(a) Common Bond



(b) Flemish Bond



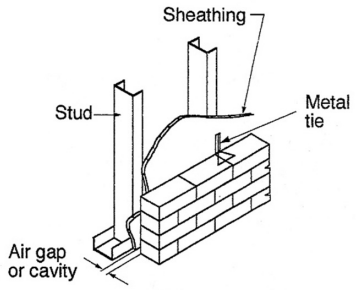
Composite Wall
(Metal Ties)



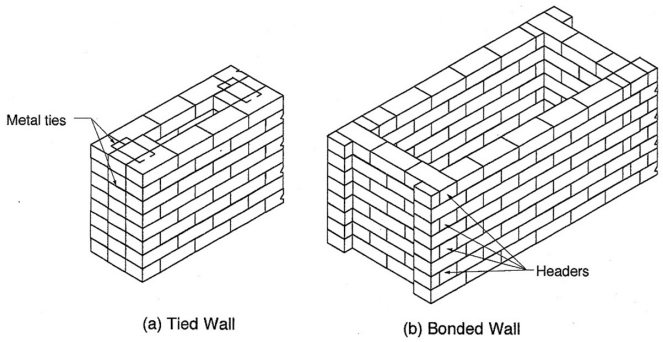
Composite Wall
(Headers)

Wall Construction

- veneer
- diaphragm



Anchored Veneer (Stud Backing)

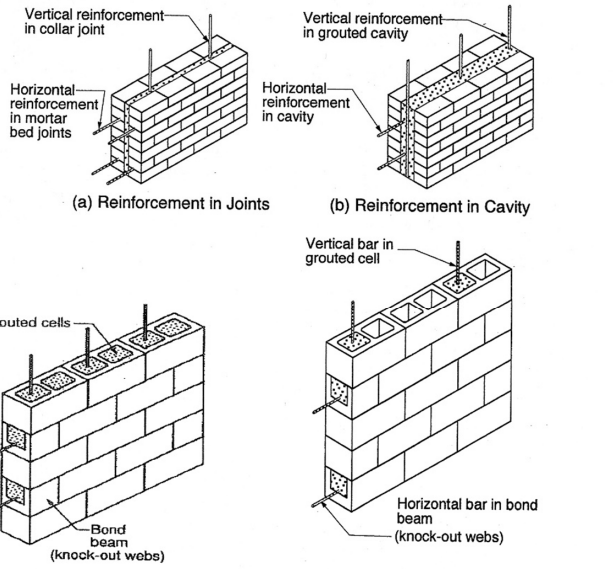


(a) Tied Wall (b) Bonded Wall

Figure 2.6 Diaphragm walls.

Wall Construction

- reinforced walls
- vertical
- horizontal



(a) Reinforcement in Joints (b) Reinforcement in Cavity

(c) Reinforcement in hollow units (fully and partially grouted masonry, L to R)

Figure 2.3 Examples of reinforced walls

Columns and Pilasters

(by TSM 402)

- lateral support spacing (h) = 99 r_{min}
  r = 0.288675 t (rectangle)
  h/r < 99
- t min = 8”
- fully grouted
- As min = 0.0025 An
- As max = 0.04 An
- min bars = 4

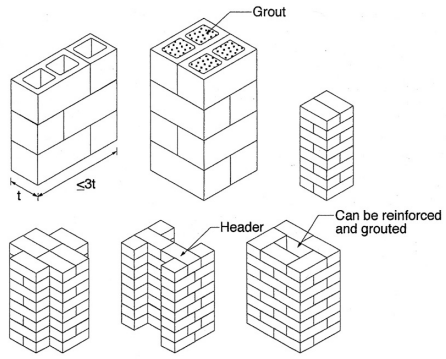
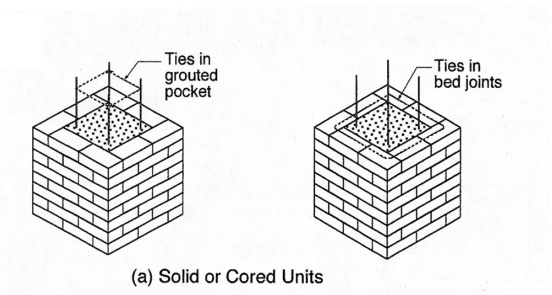


Figure 2.7 Columns.



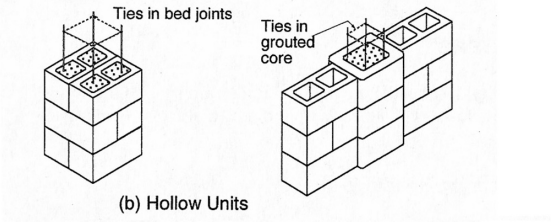


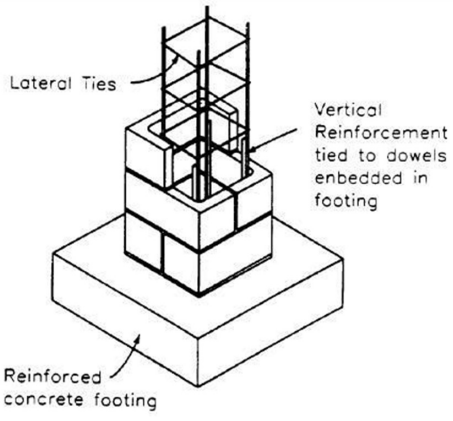
Figure 2.9 Column and pilaster reinforcement.

Columns and Pilasters

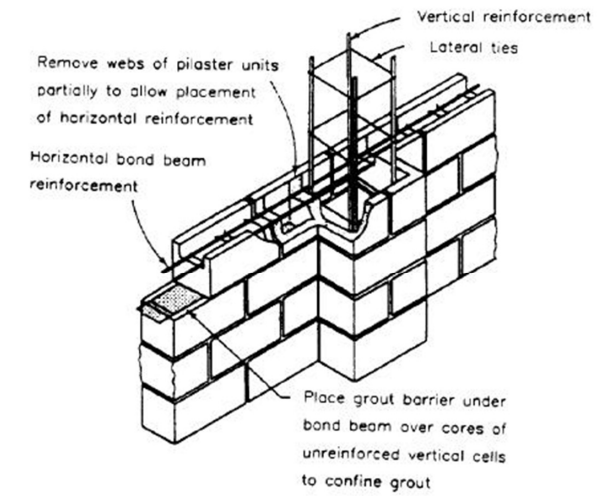
(by TSM 402)

Ties

- min. ¼” dia.
- vertical spacing
  - 16 x longitudinal bar dia.
  - 48 x tie dia.
  - least dim. of column



U. S. ARMY CORPS OF ENGINEERS



U. S. ARMY CORPS OF ENGINEERS

Columns and Pilasters

- pilasters
- project from one or both sides
- carry lateral and vertical loads

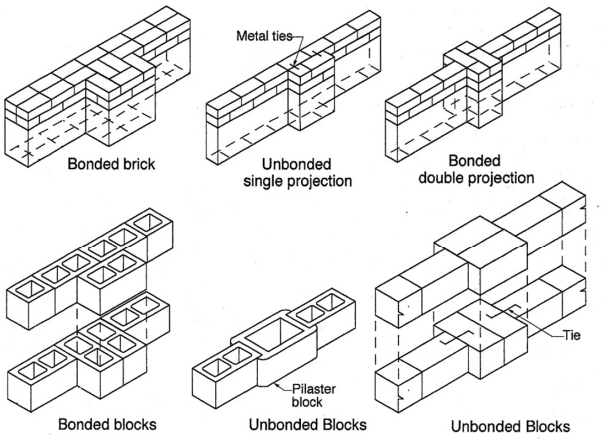


Figure 2.8 Pilasters.

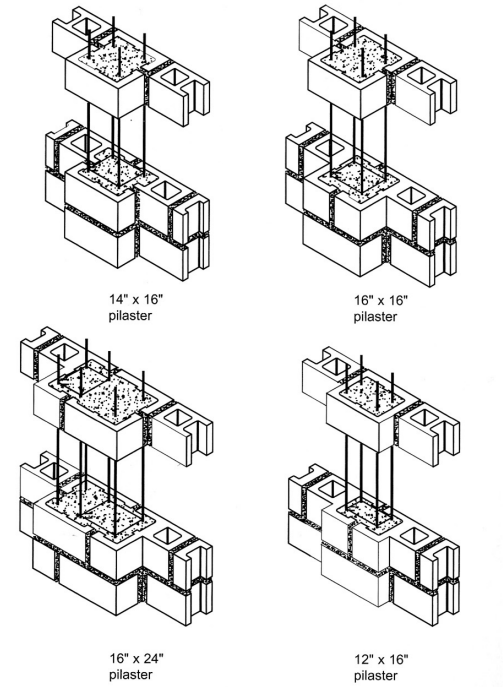


Figure 4.25 Pilaster details.

Beams and Lintels

- solid
- hollow

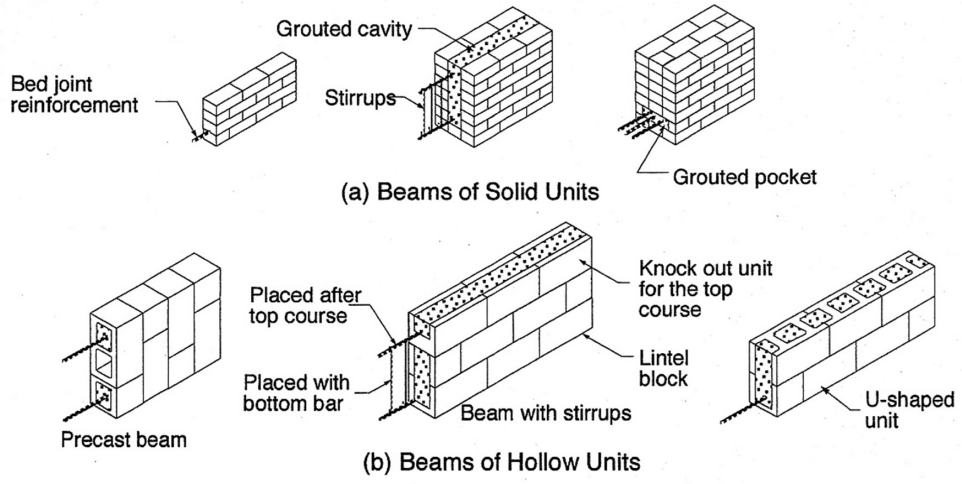


Figure 2.10 Reinforced masonry beams and lintels.

Single-Story Buildings

- compression
- bending
- shear

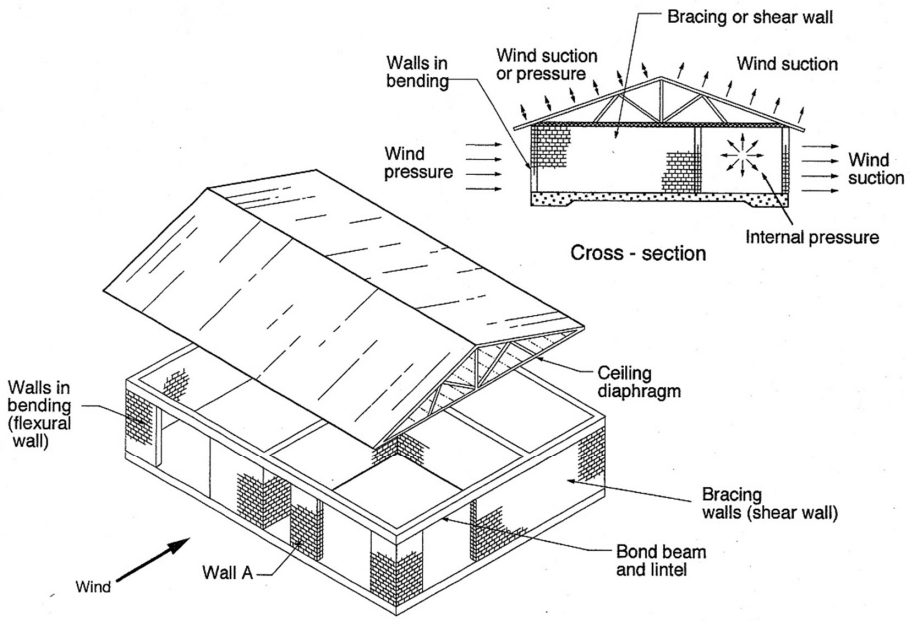


Figure 2.11 Structural action of a single-story structure.

Multi-Story Buildings

- compression
- bending
- shear

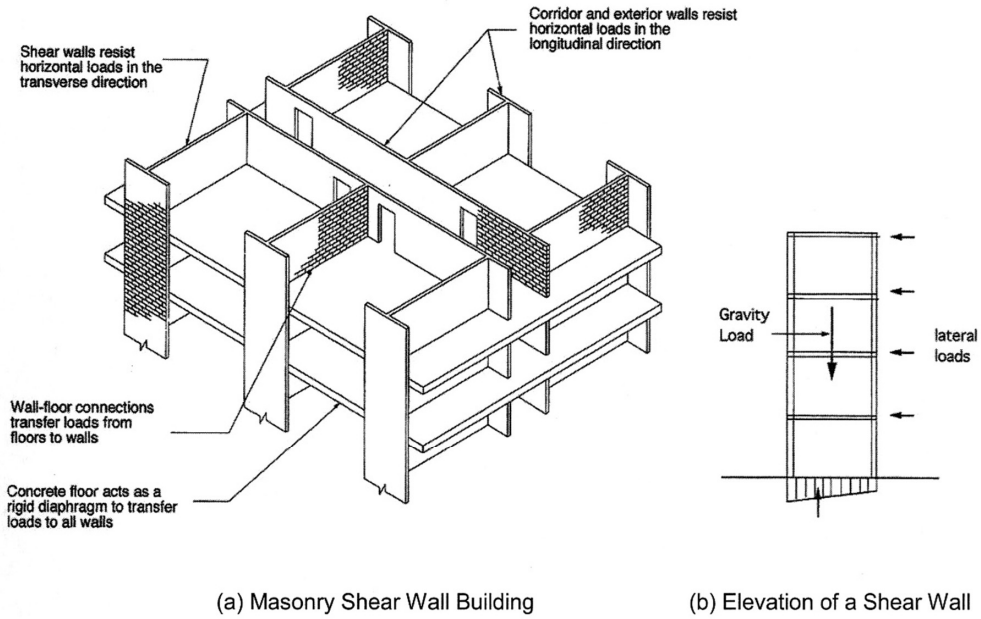


Figure 2.12 Lateral load resistance of masonry shear wall system.

Multi-Story Buildings

- thrust lines in walls
- unreinforced
- if center of force is outside of the kern, then tension occurs
- this is magnified by bending in thin walls

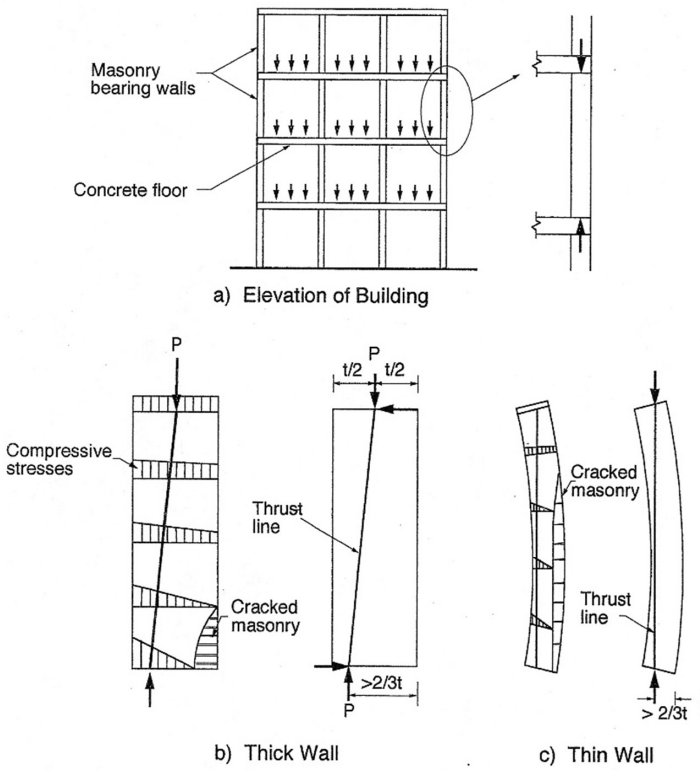


Figure 2.14 Thrust lines in unreinforced masonry walls.

Multi-Story Buildings

- thrust lines in walls
- finding thrust line at center
- sum moments at center c
- find e
- if e < width of wall then all is in compression
- this assumes minimal bending deformation

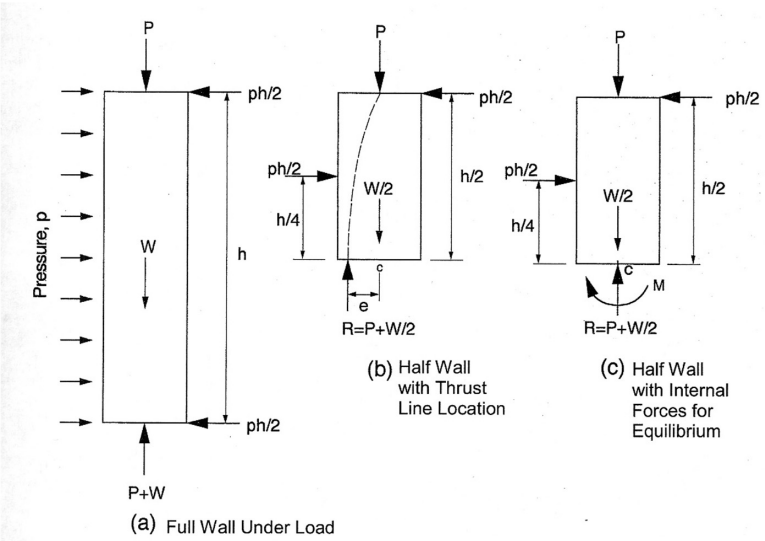


Figure 2.15 Masonry walls under axial load and lateral wind pressure.

$$R \cdot e = \frac{ph}{2} \cdot \frac{h}{2} - \frac{ph}{2} \cdot \frac{h}{4}$$

$$e = \frac{ph^2}{8R} = \frac{ph^2}{8}\left(\frac{1}{P + W/2}\right)$$

Multi-Story Buildings

Shear Walls

- failure modes
- compression
- tension
- shear

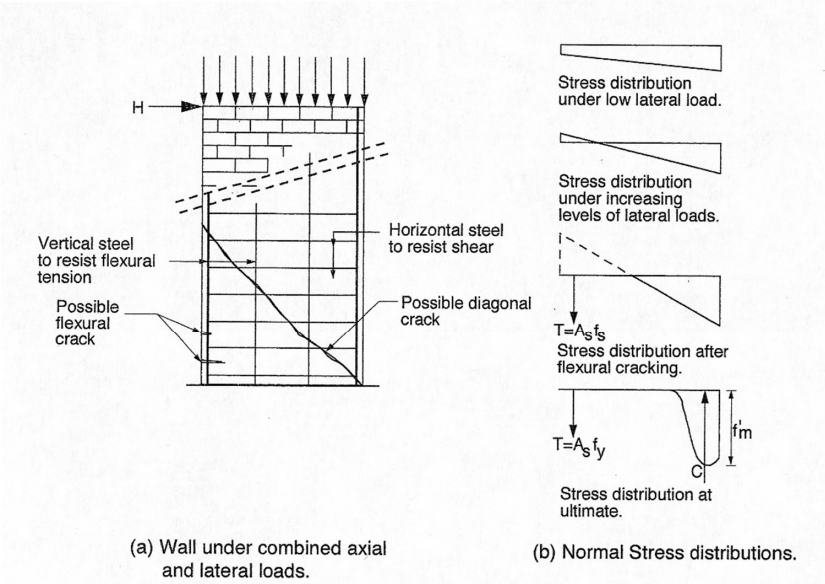


Figure 2.18 Reinforced masonry shear wall design.

Prestressed Masonry

- raises compressive stress
- used in Gothic (without steel)
- steel placed on centroid
- no need for grout
- creep ~ 2 to 3 times initial elastic deformation

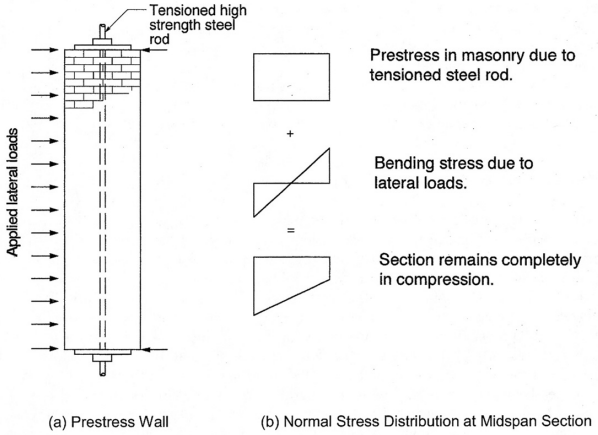


Figure 2.20 Principle of prestressing.

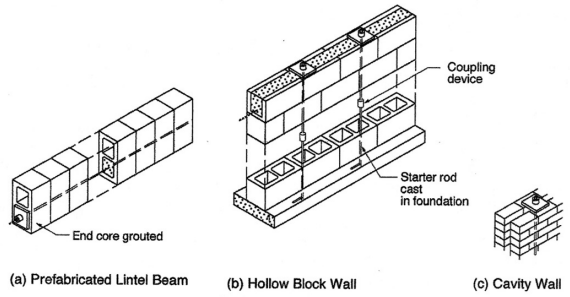


Figure 2.21 Examples of prestressed masonry elements.