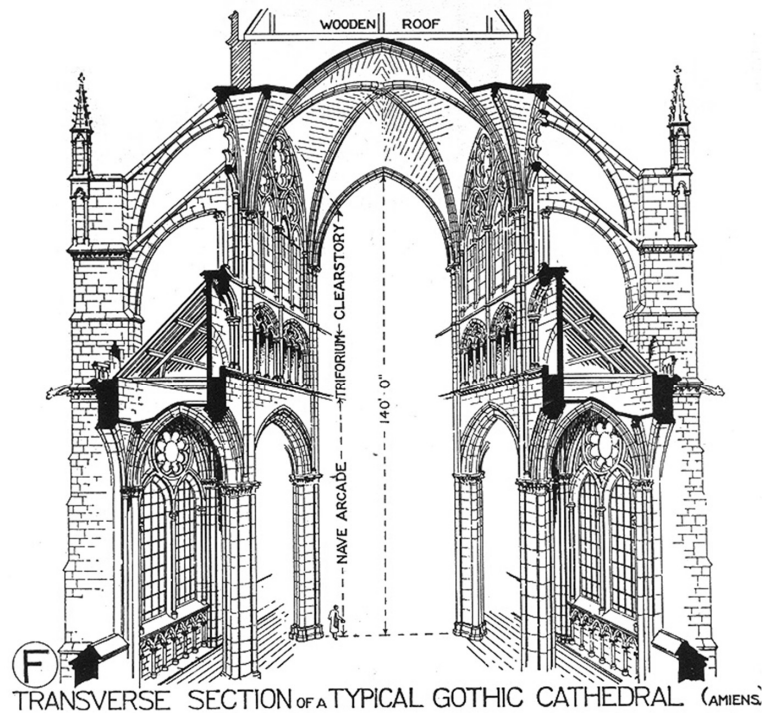


Masonry Vaults and Shells

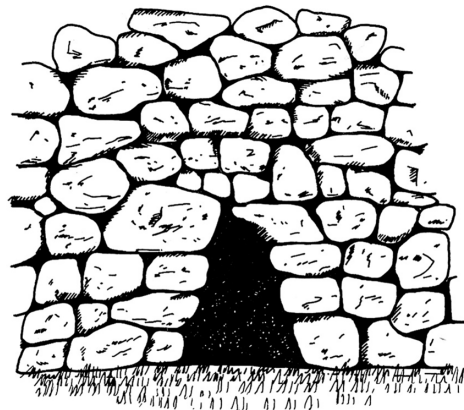
Roman Domes
Byzantine Domes
Renaissance Domes
Gothic Vaults
Catalonian Shells



Amiens Cathedral

Corbeled Dome

Greek
Corbels (not a true arch)



Corbelled arch in
wall, Tiryns, Greece (c. 600 B.C.).

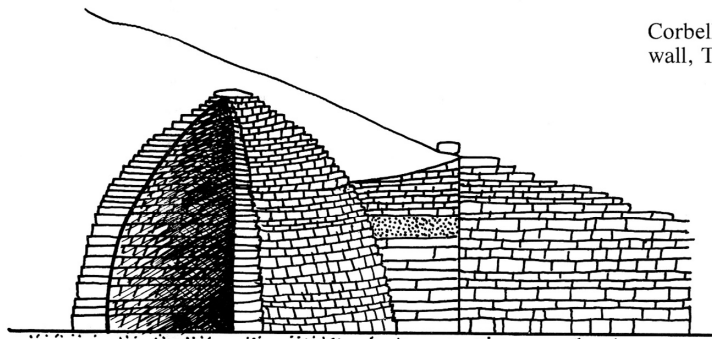


Figure 1.21 Tomb of Agamemnon (c. 1325 B.C.).

Pantheon

Roman

Pantheon 125 AD

- First to use
- Spherical form
- Braced sides
- 43.6 m

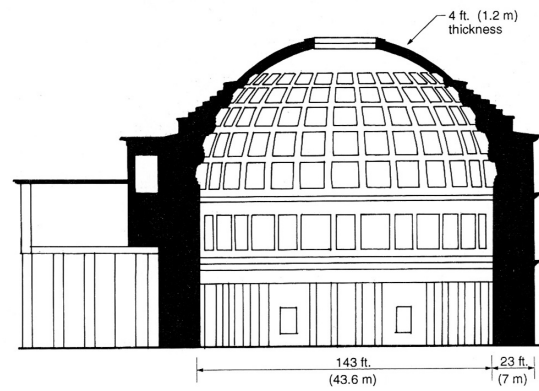
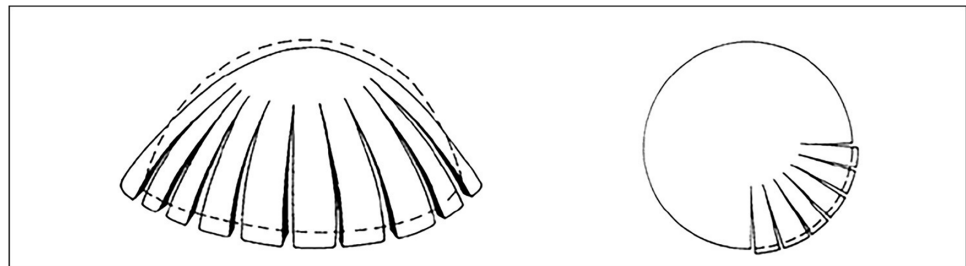


Figure 1.23 The Pantheon in Rome (A.D. 123). (Redrawn from Ref. 1.9)

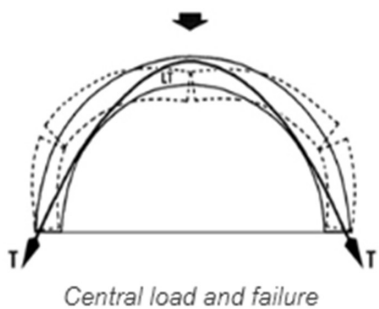


Pantheon

Roman Arches

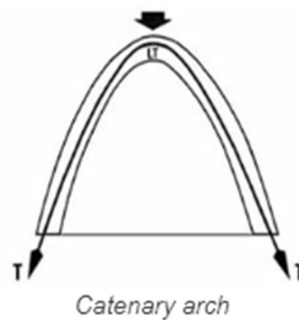


Example 1



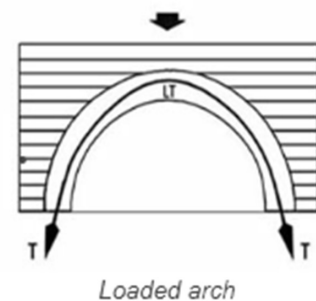
Remedy 1 to Example 1

Change the shape of the arch.



Remedy 2 to Example 1

Keep the shape and load the haunches.



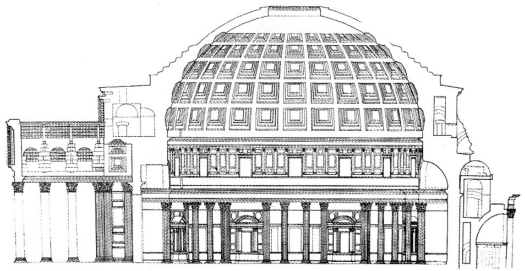
Historic Masonry

Roman

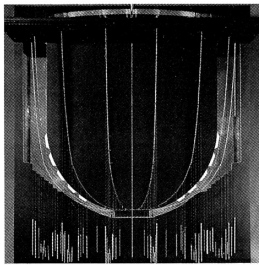
Pantheon

- Thrust line
- Catenary models

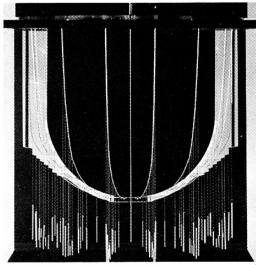
Institute for Lightweight
Structures (IL)



3



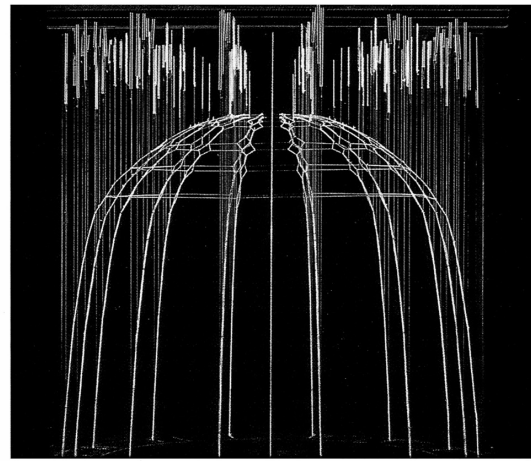
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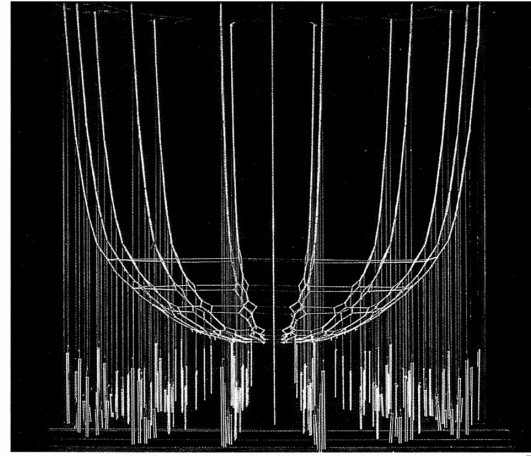
5

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Masonry



6



7

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Domes



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Masonry

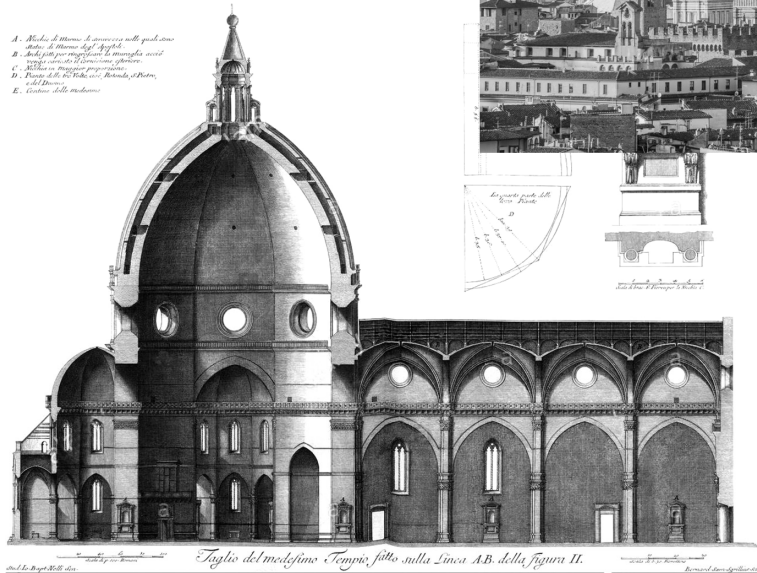
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Florence Dome

Gothic/Renaissance

Santa Maria del Fiore

- Brunelleschi
- 1296-1436
- 43 or 45 m span ?
- Largest brick dome



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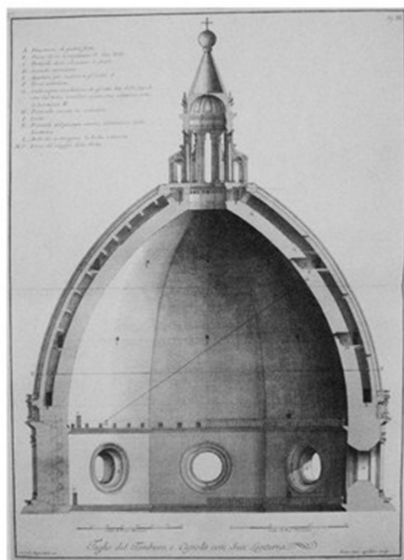
Slide 7 of 32

Florence Dome

Gothic/Renaissance

Santa Maria del Fiore

- Brunelleschi
- 1296-1436
- 43 or 45 m span ?
- Largest brick dome



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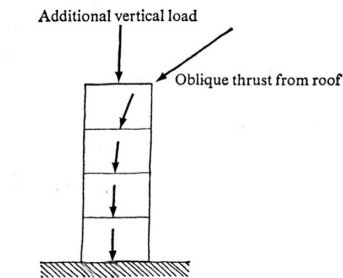
Masonry

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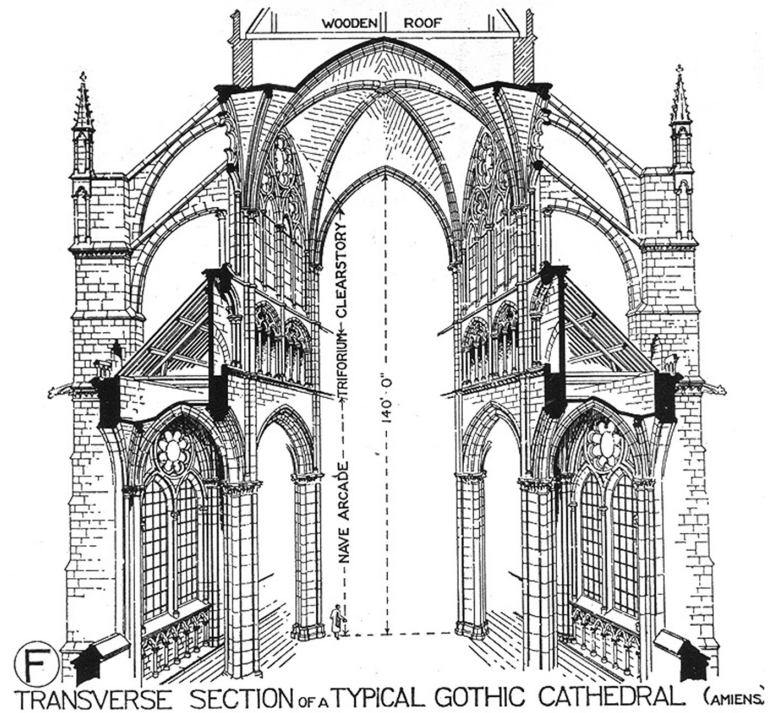
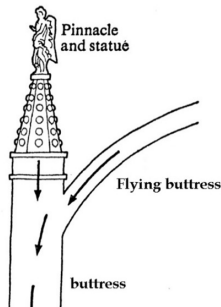
Gothic Vaulting

Gothic vaults and buttressing

- Amiens
- 1220-1225



The effect of an additional load at the top of the buttress is to *reduce* the eccentricity of the thrust line.



Gothic Vaulting

Gothic vaults

- Amiens
- 1220-1225



Gothic Vaulting



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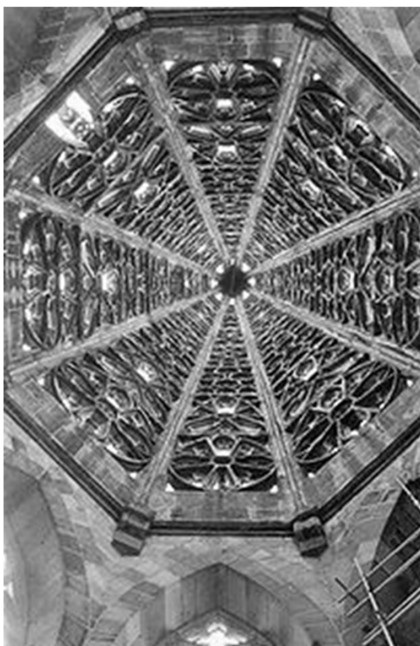
Masonry

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Gothic Vaulting

Gothic vaults

- Freiburg
- 1260



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Masonry

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Gothic Vaulting

Gothic vaults

- Freiburg
- 1260



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Masonry

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Gothic Vaulting

Gothic vaults

- Chartres
- 1194



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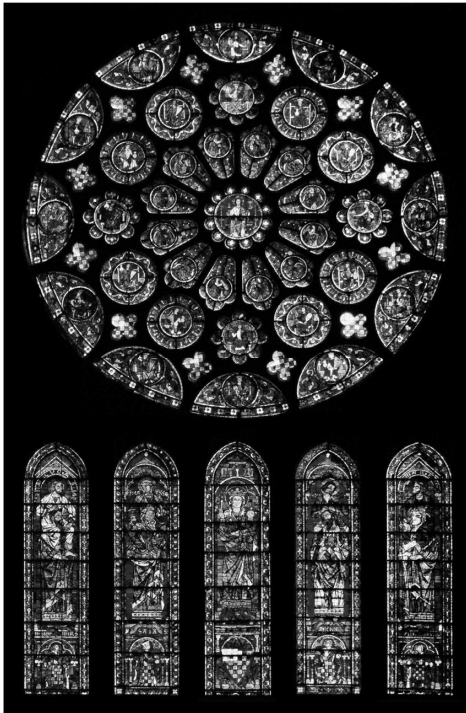
Masonry

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Gothic Vaulting

Gothic vaults

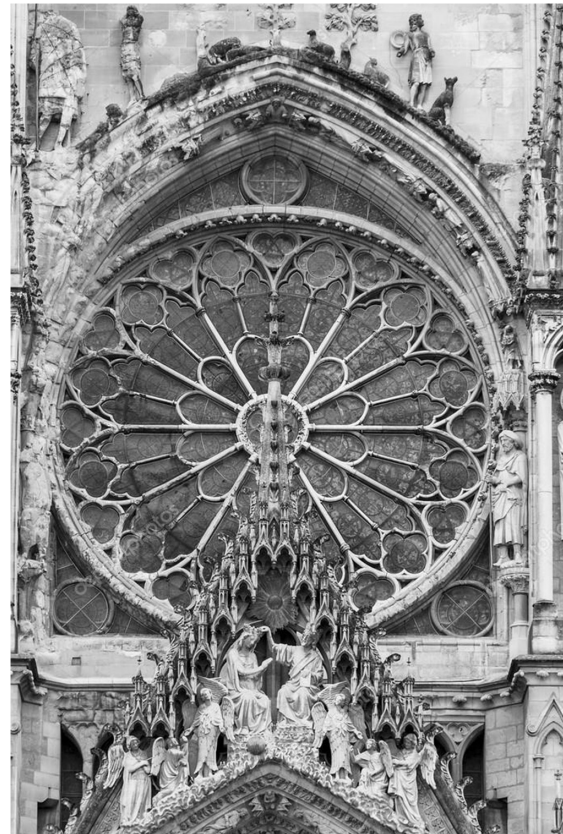
- Chartres
- 1194



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Masonry

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Gothic Vaulting

Gothic vaults

- Kölner Dom (Cologne) 1248 -1880
- Spire height 157 m (515 ft)



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Masonry

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Gothic Vaulting

Gothic vaults

- Kölner Dom (Cologne) 1248 -1880
- Spire height 157 m (515 ft)



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Masonry

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German Expressionism



Grundtvig Church, Copenhagen
Jensen Klimt

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Chilehaus, Hamburg
Fritz Höger



Masonry

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German Expressionism



Einstein Tower, Potsdam
Erich Mendelsohn



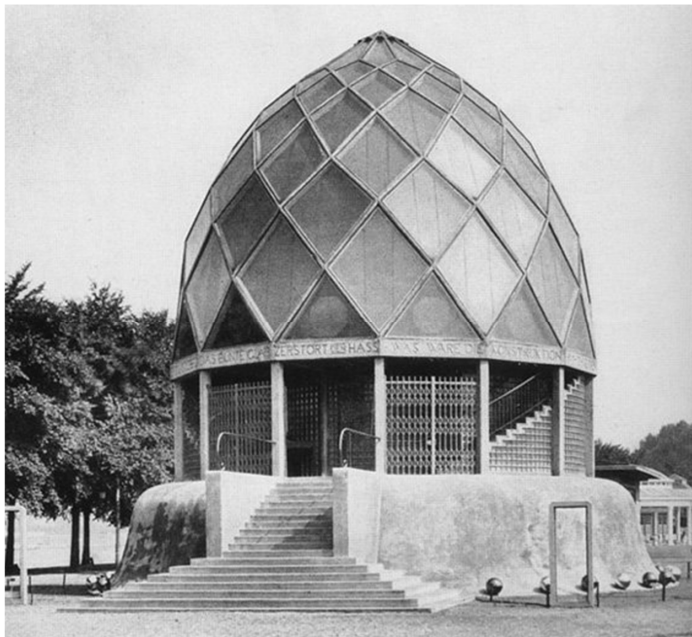
Goetheanum, Dornach CH
Rudolf Steiner

University of Michigan, TCAUP

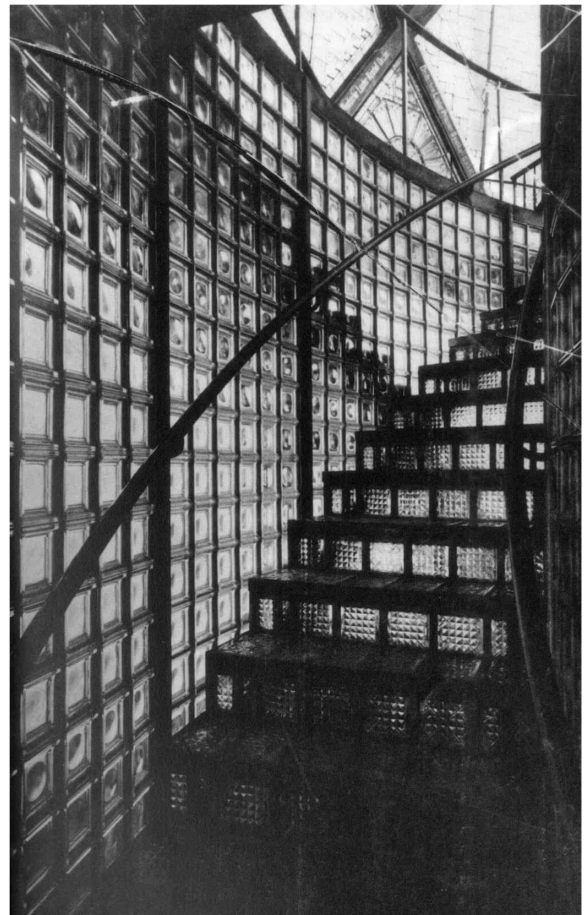
Masonry

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German Expressionism



Glass Pavilion, Bruno Taut



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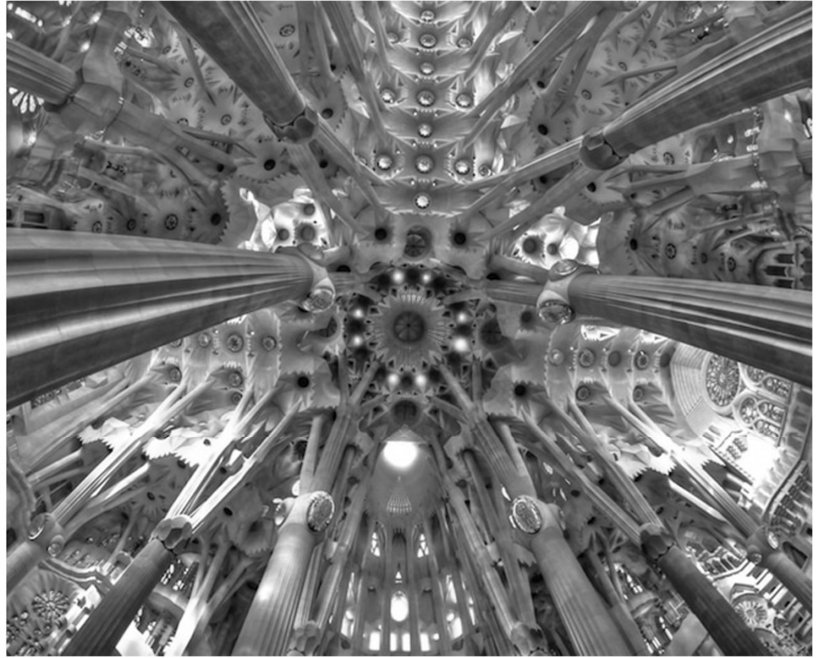
Masonry

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Art Nueveau

Catalonian

- Antonio Gaudi 1852 - 1926
- Catalonian Art Nouveau
- La Sagrada Familia



Art Nouveau

Catalonian

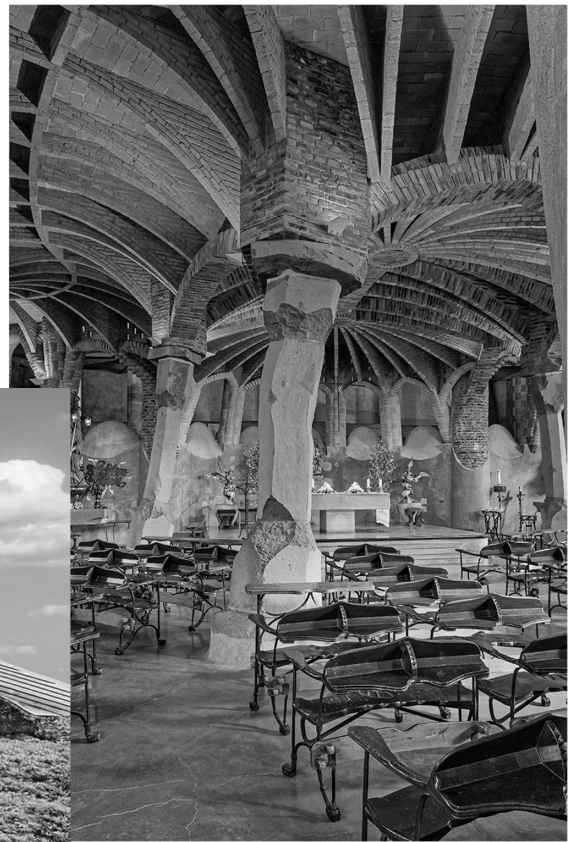
- Antonio Gaudi 1852 - 1926
- Catalonian Art Nouveau
- Park Güell



Art Nouveau

Catalonian

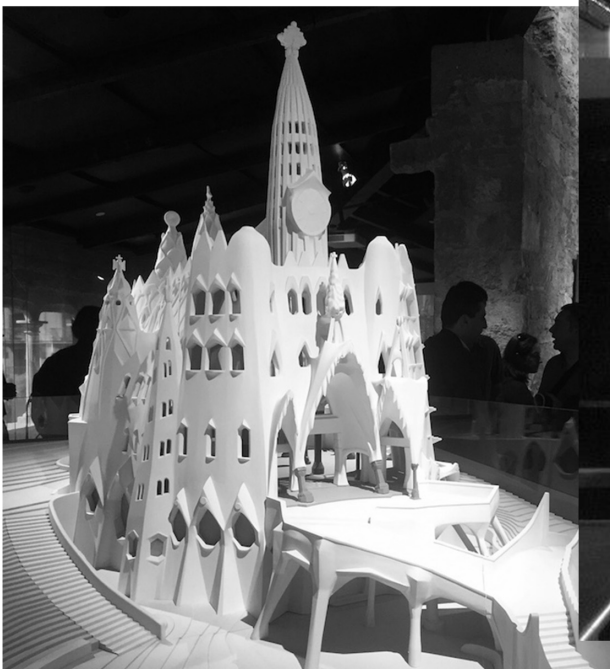
- Antonio Gaudi 1852 - 1926
- Catalonian Art Nouveau
- Crypt at Colonia Guell



Art Nouveau

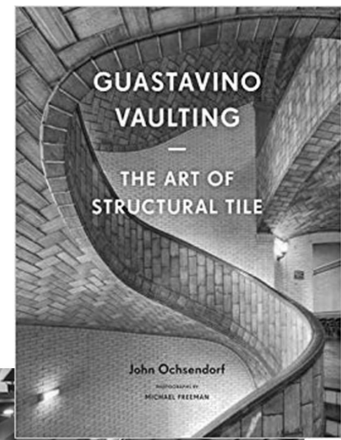
Catalonian

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



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



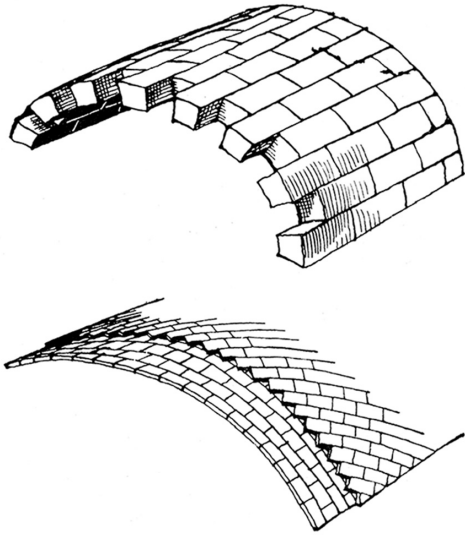
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Masonry

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Guastavino Vaulting

- Guastavino Co. 1885 – 1962
- Started in Boston



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Masonry

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Guastavino Vaulting

- Other examples



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Masonry

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High Rise

Walls – thrust line calculation

- Sum moments at sections to find axis

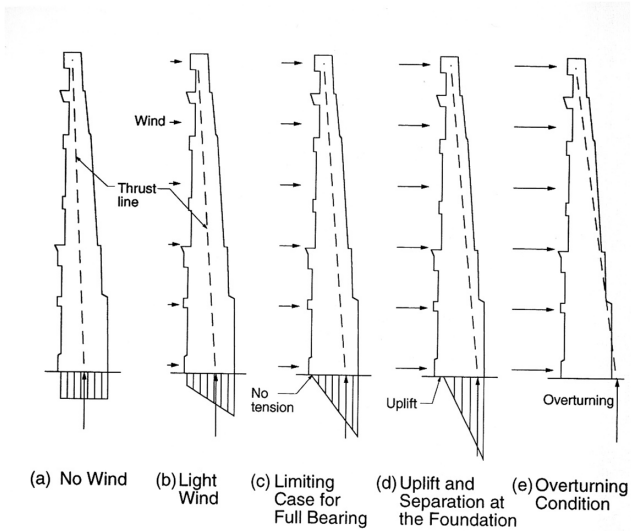


Figure 1.9 Stability of wall under increasing wind force.

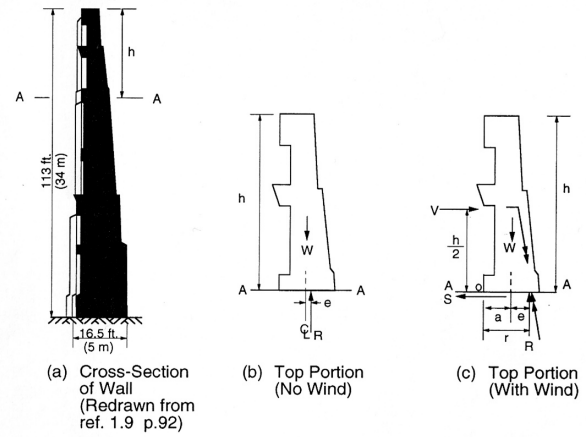


Figure 1.8 Equilibrium of mud brick wall at Palace of Ctesiphon (c. A.D. 550).

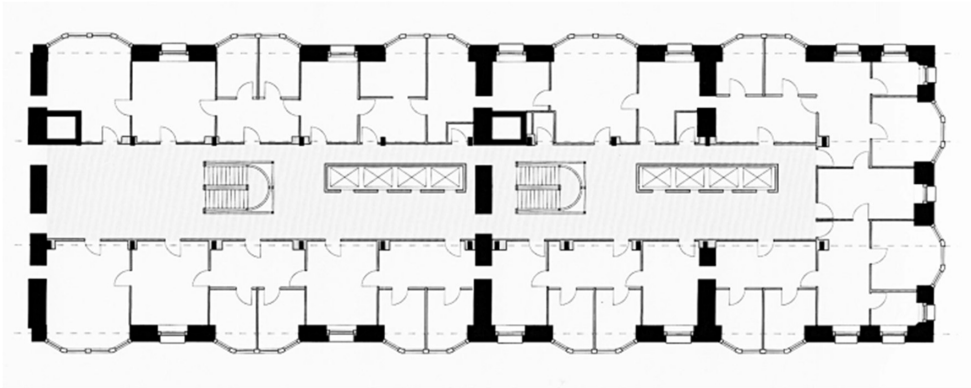
High Rise

Monadnock Building
Burnham & Root
1892, Chicago
215 ft., 16 stories



High Rise

Monadnock Building
Burnham & Root
1892, Chicago
215 ft., 16 stories



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Masonry

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Modern Multistory Masonry

- Reinforced cavity
- Tied to slab
- Diaphragm action

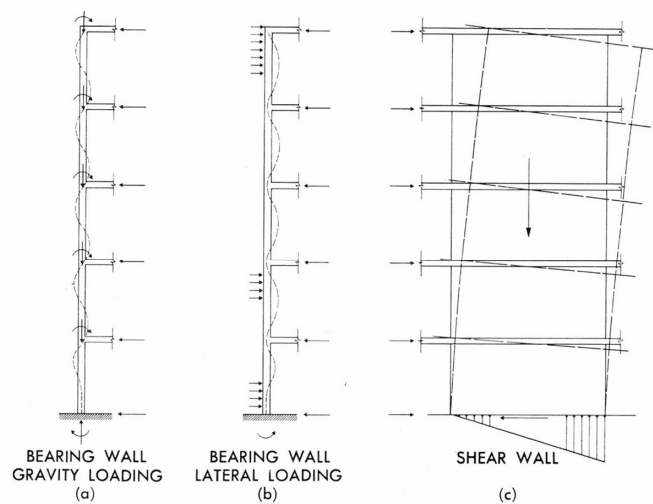


Figure 17.1 16-story loadbearing brick masonry building, Biel, Switzerland. (Courtesy of Brick Institute of America.)

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Masonry

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