Iron & Bronze

Structure: Steel

use of metals in early history

Vocabulary

Rebars - a steel reinforcing rod in concrete

Transparency - The condition of being transparent. (clarity)

alloy - a mixture of metals or a mixture of a metal and another element. defined by (metallic bonding character).

Arch works well in compression

↓

The reduction in volume causing an increase in pressure!

Masonry - Stonework

Ancient Greeks and Romans used Molten bronze (metal) as clamp to secure stones at joints.

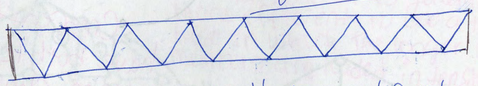
Cast iron:

wrought iron:

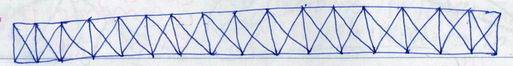
Space Frames

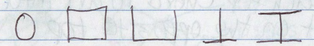
Triangular Grid

Square Grid



Hexagonal Grid

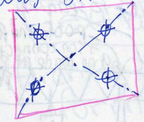




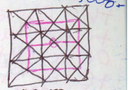
- Space frames may be constructed of structural steel pipe, tubing, channels, tees, or W-shapes.

A space frame is a long-spanning three-dimensional plate structure based on the rigidity of the triangle and composed of linear elements subject only to axial tension or compression.

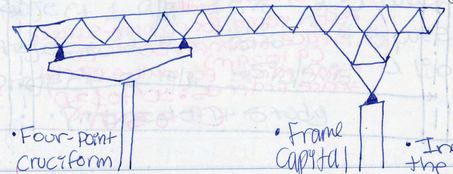
- As with other constant-depth plate structures, the supporting bay for a space frame should be square or nearly square to ensure that it acts as a two-way structure.



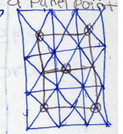
- Top-chord supported
- Bottom-chord supported



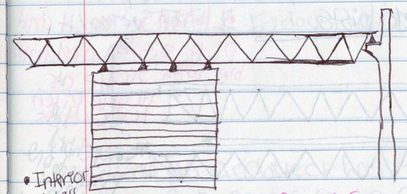
- A space frame should always be supported at a panel point



- Four-point cruciform
- Frame capital

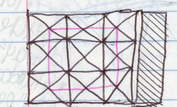


- Increasing the bearing area of the supports increases the number of members into which shear is transferred and reduces the forces in the members.



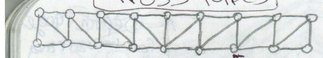
- Interior wall

- Exterior wall

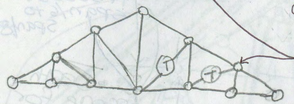


- A reinforced concrete or masonry bearing wall distributes its support points along a line.
- steel bearing plates anchored into concrete or bond beam.

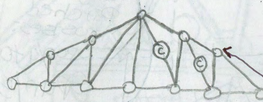
Truss Types



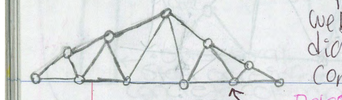
• Flat trusses have parallel top and bottom chords. Flat trusses are generally not as efficient as pitched or bowstring trusses.



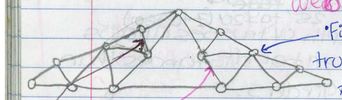
• Pratt trusses have vertical web members in compression and diagonal web members in tension. It is generally more efficient to use a truss type in which the longer web members are loaded in tension.



• Howe trusses have vertical web members in tension and diagonal web members in compression.



• Belgian trusses have only inclined web members.



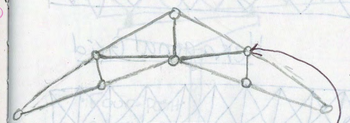
• Fink trusses are Belgian trusses having subdiagonals to reduce the length of compression web members toward the center line of the span.

Diagonals connect a top to a bottom chord.

• subdiagonals join a chord with a main diagonal.

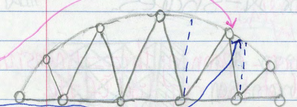
• Warren trusses have inclined web members forming a series of equilateral triangles. Vertical web members are sometimes introduced to reduce the panel lengths of the top chord, which is in compression.

• Raised-chord trusses have a bottom chord raised substantially above the level of the supports.



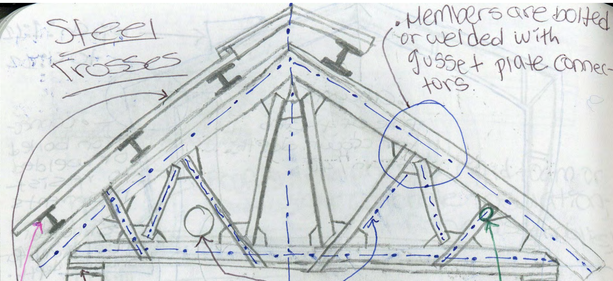
• Crescent trusses have both top and bottom chords curving upward from a common point at each side.

• Scissors ~~stoe~~ ~~each~~ trusses have tension members extending from the foot of each top chord to an intermediate point on the opposite top chord.



• Bowstring trusses have a curved top chord meeting a straight bottom chord at each end.

Steel Trusses



• Members are bolted or welded with gusset plate connectors.

• Steel bearing plate.

• Structural steel or reinforced concrete column support.

• Mechanical services such as piping, conduit, and ductwork may pass through the web spaces.

• Web components ~~that~~ (steel construction may be left exposed if at least 20' (codes) above the finish floor. Consult the building code for requirements.)

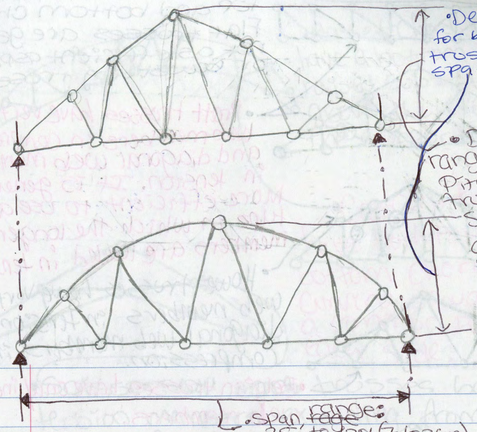
• Metal or cementitious roof decking or panels span purlin spaces.

• Channel or W-shape purlins span the truss spacing.

• If not bearing at a panel point, purlins subject top chord to local bending.

• Trusses require lateral bracing in a direction perpendicular to their planes.

• To prevent secondary shear and bending stresses from developing, the centroidal axes of truss members and the load at a point should pass through a common point.



• Depth range for bowstring trusses: span/6 to span/8

• Depth range for pitched trusses: span/4 to span/5

• Span range: 25' to 120' (7 to 36 m)

• The increased depth of trusses allows them to span greater distances than steel beams and girders.

Steel trusses are generally fabricated by welding or bolting structural angles and tees together to form the triangulated framework.