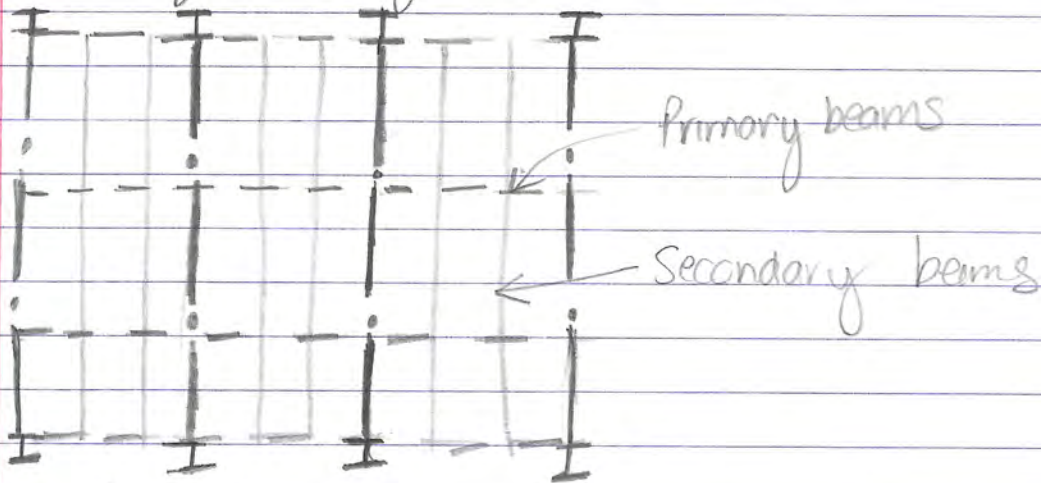


# Two-way Beam System



• When a large column-free space is needed long spanning plate girders can be used to carry the primary beam, which it could support the secondary beam

L4x3x 3/8

4x3 → nominal depth of each leg

3/8 → thickness of leg.

long-spanning beams

## Steel Beams

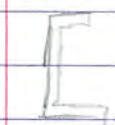


• S shape



• wider flange

• W shape Channel



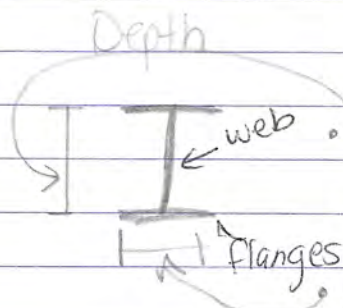
• C shape



• Structural tubing



• WT shape



• Steel shape / size

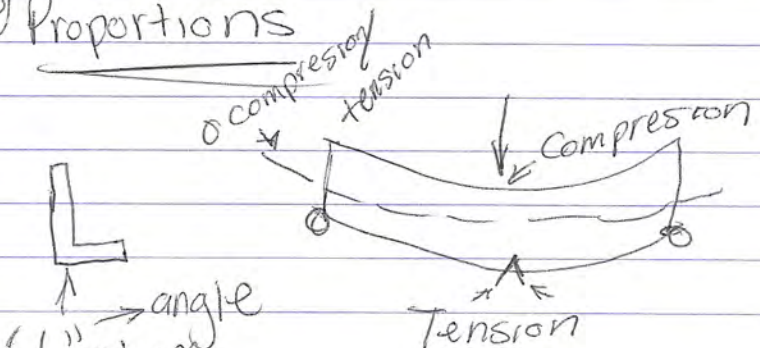
W21 x 83  
↑ nominal dept

beams / 20  
girder / 15

lbs / foot of Length

width 1/3 to 1/2 of dept

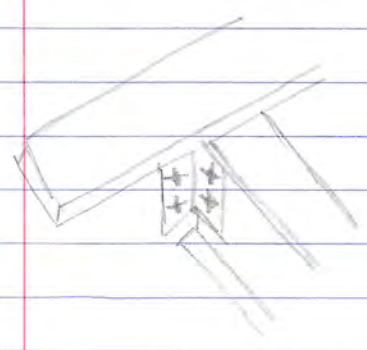
## Proportions





Box girders are built up from shapes and have a hollow rectangular section.

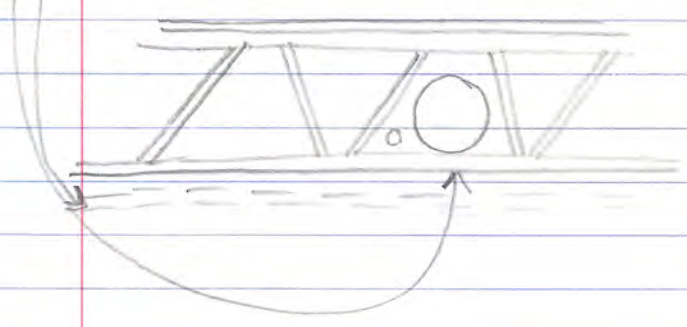
### Steel Beam Connections



- rivet
- high strength bolt
- weld / weld symbols
- shear connections
- moment connections.

### Open web joist framing

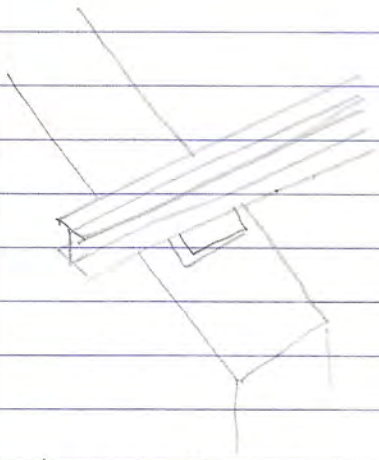
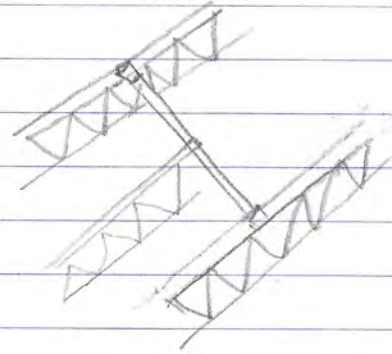
- open web steel joists may be supported by a bearing wall
- open web permit the passage of mechanical services
- Ceiling may be attached to the bottom chords / suspended.



- floor deck may consist of
- Metal decking w/ concrete
  - Precast concrete planks
  - Plywood panels or wood planking required a nailable top chord

- 2' to 10' spacing
- 4' spacing common in large buildings
- Joist span should not exceed  $24 \times$  joist depth.

- Small openings may be framed with steel angle headers. Large openings require steel framing.



- there is a limited overhang. It may extend 5'-6" with a load of 300psf.

### Lateral Resistance

- brace frame

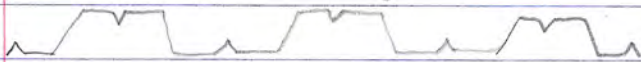
### Metal decking

- Form Decking



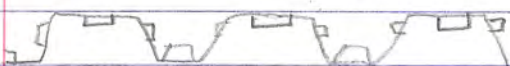
reinforced concrete slab until the slab can support itself

- Composite decking



Composite action between concrete slab and floor beams or joists.

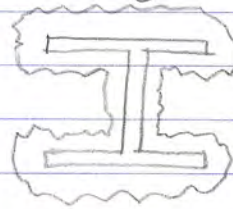
- Cellular decking



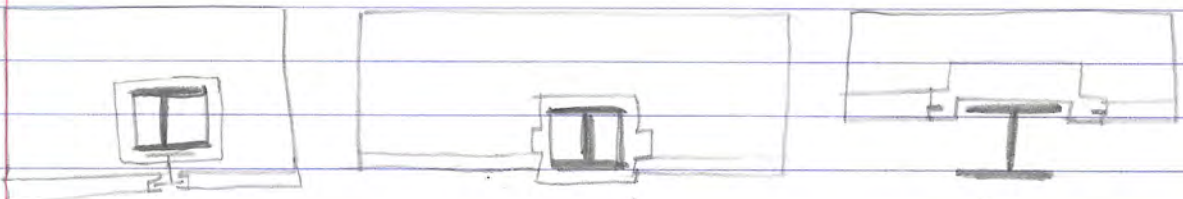
special cut outs are available for floor outlets.

# Steel framing

resistance to lateral wind and seismic forces requires the use of shear planes, DIAGONAL BRACING or rigid framing with moment resisting connection



steel can lose strength rapidly in a fire, coating is required.

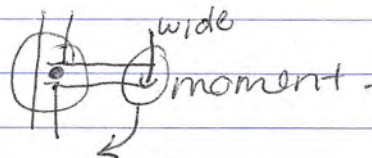


There are 3 basic relationships between structural steel frame & curtain wall

- column in front of the wall plane
- Column within the wall plane
- Column behind the wall plane

## Lateral Resistance

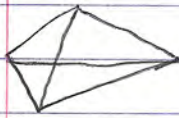
- brace frame
- shear wall
- moment frame



fabrication

Shop drawing  
Iron workers  
pumping up  
drift pin.

## Space frames



Triangular Grid



Square Grid



Hexagonal grid

These are 3 or many diff patterns.

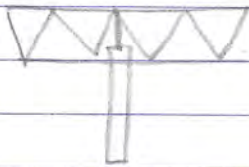
A space frame is a long-spanning 3D plate based of triangles, only to axial tension or compression.

3 diff fabricated connectors

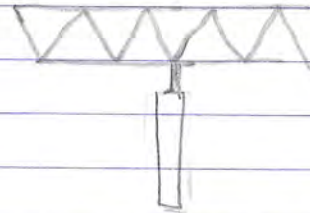
- Welded connection
- Bolted connection
- Threaded connection

- The supporting bay for a space frame should be square to make sure that it acts as a two way structure.

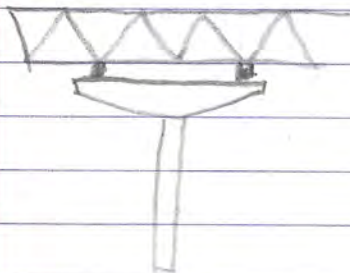
• top chord supported



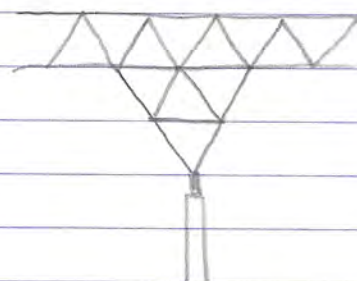
• Bottom-chord supported



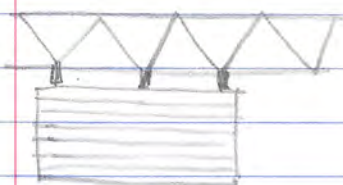
• Four point cruciform



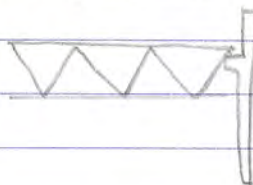
• frame capital



• Interior wall



• Exterior wall



Open web steel joists

→ to resist uplifting wind forces, every joist is anchored to the supporting structure

→ horizontal bridging angles for K Series joists are welded to the top and bottom chords.

- the diagonal bridging angles are also welded or bolted to clip angles.

- Top and Bottom Chords parallel require a Slope rafter so in order to obtain it the joist can be shortened or taper with the insulating layer of Roof decking



- Bearing Walls : Parapet
- Secure every roof joist to a steel bearing plate
- Double treated wood plate w 1/2 anchor bolts

→ Flush edge : end wall

- Structural Steel frame
- has 2 1/8" fillet welds

→ Metal Roof decking

Parapet wall:

- Precast concrete or stone veneer
- Angle cast into cast edge of concrete slab
- Metal slab closure
- Steel beam
- Fire proofing as required

## - Metal Roof Decking

is corrugated to increase its stiffness & ability to span across open-web steel joists

- decking panels are puddle-welded or mechanically fastened to the supporting steel

- it is commonly used w/o a concrete topping

- to provide max surface area, the top flange should be wide and flat

## ① Ribbed Roof Decking

## ② Cellular Roof Decking

New material - that can be used in construction

- Carbon fiber

- plastic (recycled)

- Steel gives more strength; lets in more light gives a high level of transparency.

alone.

~~alone~~ - metal that has other material added on.

\* Cross bracing - is used for high structure for lateral loads.

melted bronze early greeks.

\* Cast iron: stronger iron.

wrought iron: weaker metal

- Steel highly recyclable.

Cast iron

wrought iron

puddle iron

bessemer process

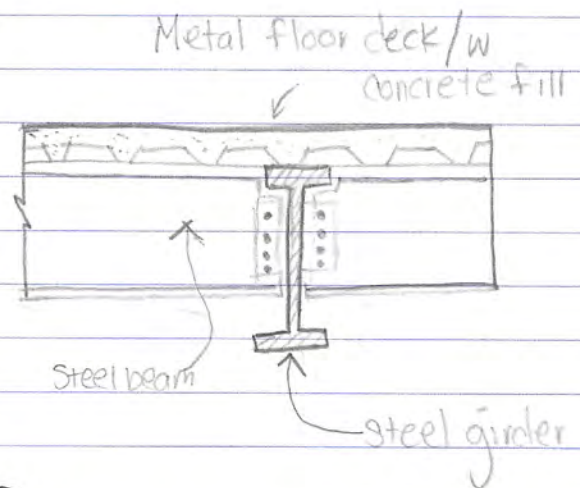
open hearth method

3/10/17

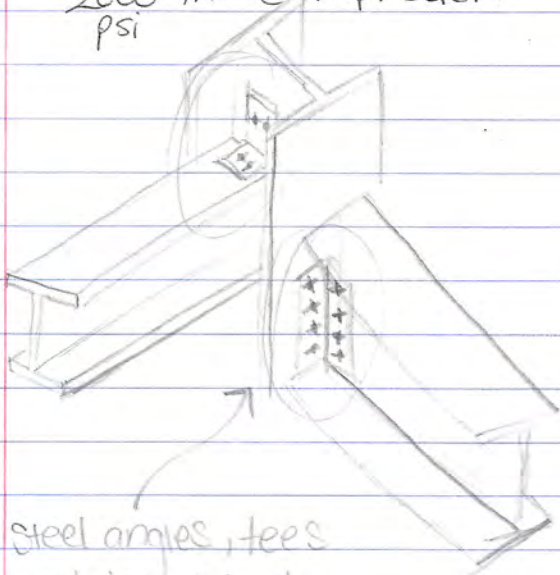
# Read about Steel

## Structural Steel Framing

- steel girders, beams & columns are used to construct a skeleton frame for structures ranging from one-story to skyscrapers.
- steel isn't resistant against heat b/c the fire melts it.
- Steel framing work better when girder & beam supports are laid out along a regular grid.



\* Concrete 0 in tension  
2000 in Compression -  
psi



- (A) One way Beam System
- Span range for beams is 20' to 36' - which reduces weight.
  - Beams are spaced 6' to 15'
  - Framing beams into girders minimizes floor depth.

Some mechanical service can pass through holes cut on the beam webs but long lines may have to be as suspended ceiling space below.

Psi of steel  
Strength in tension  
24,000 - 43,000 psi

