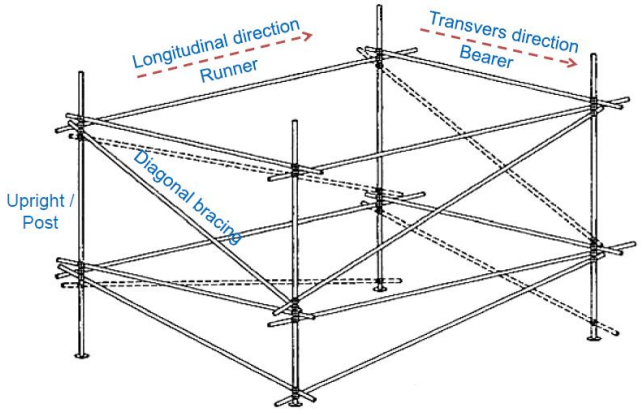
Lecture 3: Scaffolding

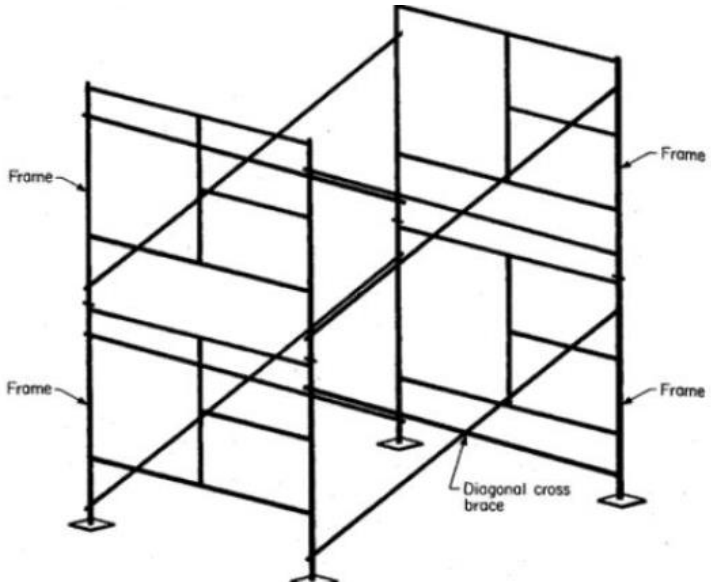
- Scaffold is a temporary structure erected to support access or working platform
- Scaffolding is the individual components used to assemble the scaffold
- Scaffolding work is the erecting, altering or dismantling of a temporary structure erected to support a platform and from which a person or object could fall more than 4m
- **Properties:** made of low cost material, easy to fabricate, fast to assemble, light weight, reliably strong and spatially adaptable
- Two classification of scaffold: **"Built Up" and Hanging/Suspended**
- **Built Up:** Elevated platform that start from the ground
- **Hanging:** Scaffold platform suspended by cabled from overhead structural components
- Scaffolds and their components shall be capable of carrying 4 times the maximum intended load **(Factor of Safety of 4)**

- **Bamboo Scaffolding**
- Can be erected 6 times fasters and dismantled 12 times faster than metal scaffold
- Needs to be 2-5 year old and air dried for 3 months

- **Tube and Coupler Scaffolding**
- Three basic components: Upright, bearer and runner
- **Uprights:** Members that rises from the ground
- **Bearer:** Transverse horizontal connection
- **Runner:** Attached below bearer and longitudinal connection (along the length of scaffold)
- Elements are connected together by standard or fixed coupler
- Diagonal bracing is used to stiffen the structural (used in longitudinal directions)
  Attached to the posts closely possible to "node" points
- Scaffold is attached to the building through wall ties and anchors
- If there is a gap, a reveal tube with screw leg is put in gap and attached to the scaffold
- **Advantages:** Flexible in any dimensions in horizontal and vertical planes, easy to assemble, can be used in irregular dimensions
- **Disadvantages:** Labour intensives

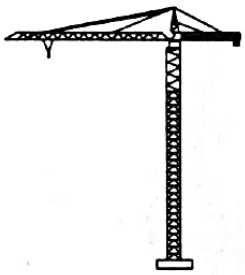


- **Tubular Frame Scaffold**
- Replace couplers and clamps with welded joints and tight coupling pins
- Rigidity of engineering frames reduce making mistakes
- Creates standard elements that will fit into frames
- There are no runners in the system and only diagonal cross bracing

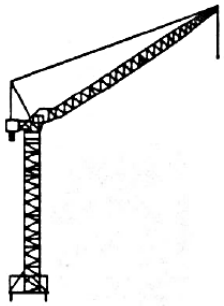


- Cranes are used for lifting, lowering and transporting loads
- Two types of cranes: **Tower** and **Mobile**

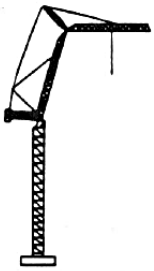
- **Tower Crane**
- High lifting height
- Good working radius
- Low impact area
- Low carrying capacity



Horizontal Jib

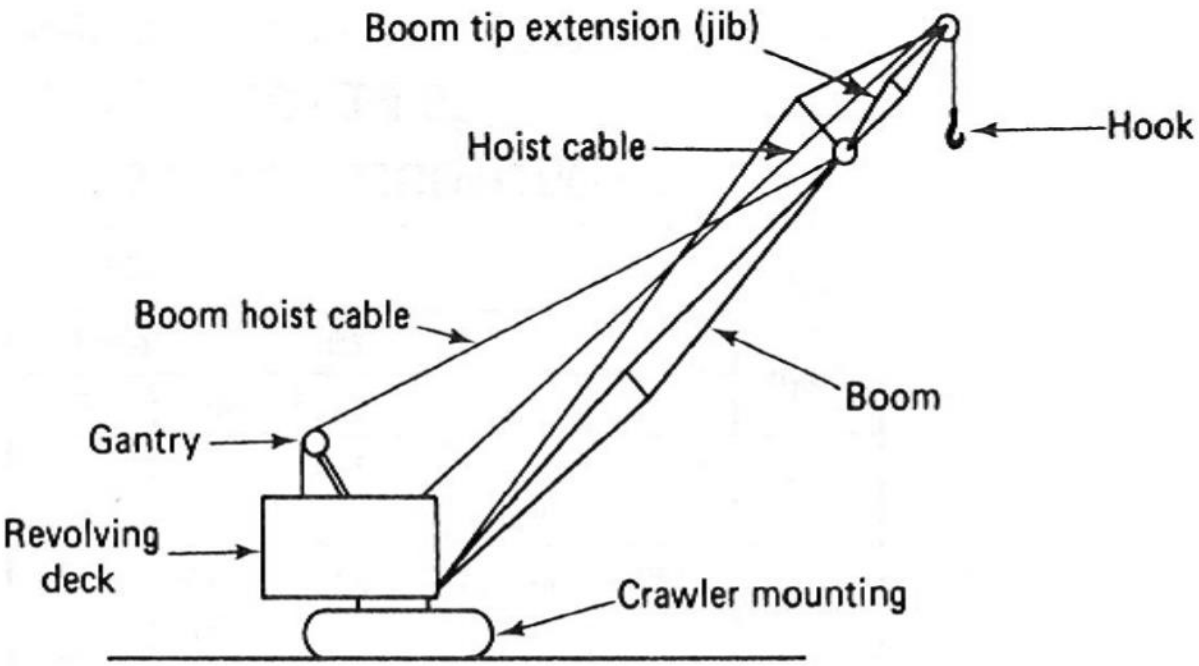


Luffing Boom



Articulated Jib

- **Mobile Cranes**
- **Types of Cranes**: Crawler, telescoping boom truck mounted, lattice boom truck mounted, rough terrain, all terrain, modified crane for heavy lifting
- Able to lift heavy loads
- Boom length is different for each manufacturer
  (it may include boom extension or not)



Components of A Mobile Crane

- **Crawler**:
- Crawler has tracks
- The tracks provide larger contact on the ground
- Greater capacities
- Longer boom
- Ability to travel with loads
- Cannot travel on the road so needs to be transported by other means

- **Rougher Terrain Crane**
- Boom is permanent part of superstructure
- Mounted on two axle base with large wheels
- Good performance over rough terrain
- Limited travel and lifting
- Hydraulically operated boom
- Versatile and highly manoeuvrable
- Equip with outriggers

- **All Terrain Crane**
- Boom is permanent part of superstructure
- Equip with outriggers

- **Lattice Boom Truck Crane**
- Lighter weight therefore more lifting capacity
- Lattice boom not permanent part of super structure
- Must be transported

Modes of Failure

- Cranes can fail either: structurally or tipping
- **Structural:** Occurs in boom or house
  Parts are detached or broken
- Side loading can cause structural failure
  Booms can take loading on one plane only
- **Tipping:** Occurs when crane is not balance
  Crane appears to be intact

- Cranes travelling with load must have plan routes
- If not crane cause crane to be out of level, side loading of boom, contact with electrical power lines

- **Environmental Factors:** Out of level, soft/uneven ground, excavation, wind loading, overheard power lines
- **Out of Level**: Ground is on an angle making crane not in balance causing tipping
  Slope cannot exceed 1/500
  Crane should operate within reduced manufacture chart levels
- **Soft/Uneven Ground:** Soft ground causes crane to be out of balance causing tipping
  Conditions more apparent when load is in air
  Need to use geotechnical reports
- **Excavation:** Can cause ground to fail nearby therefore crane can be out of balance and tip
  Need to check area for nearby excavation and avoid placing crane near excavations
- **Wind Loading:** Wind exerts force on boom and load thus causing side loading therefore structural failure
  Manufacturer do not take into account of wind load
- **Overhead Power lines:** Current can build up in the boom without touching power line
  Safe working distance is related to the voltage of the power line stated in the standards

- **Other Considerations**
- **Human Factors:** Experience of operator, supervisor, crew, lift engineer
- Rigging can handle loads
- Tag lines strong enough to secure load
- Close of area where lifting is occurring
- Boom and load block clearance
- Clearance from obstruction and power lines
- Clearance from underground utilities