SUPERSTRUCTURE:

The portion above the ground level and below the ground floor level is called plinth.

The portion above the ground floor level is known as superstructure.

(*) Types: Based on Method of Load Transfer.

Loading Bearing structures	Framed structures
- Load on the structure is transfered vertically downward through walls.	- Load transfered through frame work of columns, beam, floors.
- Cost is less.	- Cost is more.
- Suitable upto three storeys.	Suitable for any stories.
- Thicker walls so floor area is reduced.	- Thinner walls more floor area available.
- Poor resistance to earthquake	- Resistive to earthquake.

WALLS

Walls are the structural members that divide living area into different parts.

a) Load Bearing walls	b) Partition walls:
- When beams and columns not used, load is transfered to foundation by walls.	- It divides living floor into different utilities in framed structures.
- They carry loads from floor and roof.	- They don't carry loads from floor and roof
- Minimum thickness is 200mm	- They are generally thin.
- Stones & bricks are used to built them.	- Stones are not used to built them.
- They typically lie above line of beam.	- They don't have to lie upon line of beam.

Masonry

Construction of buildings using building blocks, like stone, bricks, concrete blocks is called masonry.

They are: Stone & brick masonry.

A): Stone masonry:

It is of two types: rubbiet rubble and ashlar:

a) Rubble masonry are of two types: uncoursed and coursed.

Uncoursed rubbles masonry	Coursed Rubble masonry.
- stones are either undressed or comparatively roughly dressed.	- stones are dressed and have uniform heights.
- joints are wide due to irregularity.	- joints are uniform since rubble is regular.
- cheapest form.	expenstun than uncoursed.
- Used for construction of foundations, compound walls, garages, etc.	- Used for constructing public & residential buildings.

b) Ashlar Masonry:

Masonry stones are dressed to get suitable shapes and sizes.

- Length shouldn't exceed three times the height.

Height: 250 - 300 mm

(*) Supervision:

i) Used of hard and durable stone
ii) No flaws or cavities.
iii) Must be properly wet before to avoid moisture sucking from mortar.
iv) Laid on natural bed.
v) Avoid thick mortar joints.
vi) Check perpendicularity of wall plumb bob.

B) Brick masonry Bonds:

a) Stretcher Bond:

- Commonly used in UK.
- Not particular strong.
- The pattern where the joints on each course is centered above and below by half a brick.

b): Headers Bond:

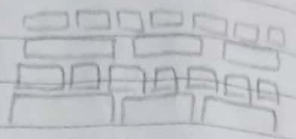
Header: Shortest face of brick.

- All bricks are constructed in header course.

In this bond, the overlap is performed corresponding to half-width brick. of header.

c) English Bonds:

Fig: English bonds

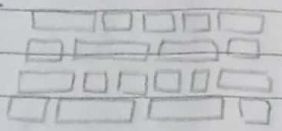


Bond comprises of alternating course of headers and stretchers.

Headers are laid centered over the stretchers and below and each row alternate row is vertically aligned.

(d): Flemish Bond:

Fig: Flemish bond



Each course is made up of alternate ~~and~~ headers and stretchers.

Each header is centered on stretcher above and below and every alternate course begins with header in the corner.

(e): Rat trap bond:

In this bond, the bricks are laid on edge, placed in vertical position instead of conventional horizontal position.

This creates a cavity with the wall and helps in keeping enhanced thermal comfort.

Consists of smaller numbers of materials.

→ Skilled labour and extra care needed.

(*) Supervision:

i) Uniform colour bricks
ii) Well-burnt, proper shape and size.
iii) Brick soaked in water before use.
iv) Bricks courses must be ~~bef~~ perfectly horizontal.
v) Follow mortar specification.
vi) Check perpendicularity by plumb bob.

(C) PLASTERING

The application of mortar coats on wall surface, column, ceiling to get smooth surface finish is called plastering.

Lime mortar: 1:3 or 1:4 Cement mortar: 1:4 or 1:6

*) Reasons for Plastering:

i) To conceal defective workmanship.
ii) To give smooth surface
iii) For good looks.
iv) Protection from rain.

*) Requirement of Good Plaster:

i) Should stick to background easily
ii) Hard and durable
iii) Less permeability
iv) Cost effective.

(D): Flooring:

Flooring is done to get good, hard, levelled and beautiful surface.
It must be damp resistive.

*) Types:

a) Mud / Moorum Flooring:

→ Low cost housing
→ Floor needs thin wash of cow dunk, once every week

b) Brick flooring:

→ cheap floor construction.
→ Brick layer is provided on sand bed or lean concrete.

c) Timber flooring:

→ Placed on concrete bed
- Used for dancing halls, auditoriums.

d): Cement concrete flooring:

→ Base course and wearing coat
→ Base course is laid over well compact soil. (75-100mm thickness)
→ Panels of (1x1)m, (2x2)m wearing coat of 40mm is laid.

(E): Roofing:

Roofing is of three types: Flat, Pitched, Folded.

a): Flat roofs

They are generally flat.
- they have slight slope (not more than 10°) to drain out rainwater.

(*): Advantages:

i) Suitable for complex buildings.
ii) Easiness to build and maintain.
iii) Better light and ventilation.

(*): Disadvantage: Not suitable for heavy rain or snow.

(b): Pitched roofs:

Sloping roofs having slope ~~upt~~ more than 90° and upto 45°-60°.

(*): Advantages

→ Traditional, aesthetic use
→ Easiness in water evacuation.
→ Economical.

(*) Disadvantages

→ Not durable
→ Leakage problem
→ Mostly iron sheets are used.

<E): Lintels:

The horizontal flexural member running over the opening of wall, door, window, ventilators.

(*) End bearing = 200mm.

(*): Types:

(a): Wood lintel: oldest type of lintel.
commonly used in hills where timber is cheaply available in abundance.
→ They are susceptible to catch fire and decay.

(b): Stone Lintel: recommended where stones are in abundance.
- made up of slabs of stones of sufficient length without flaws in single piece or combination of more pieces.

(c): Brick lintel: used to span small openings.
- constructed over temporary wood support.
- bridges are laid on end and occasionally on edge

When brick lintels have to be used over large spans, they are reinforced with steel bars.

(d): Concrete lintels:

(a): Plain concrete lintels:
- devoid of steel bars.
- dont take heavy load.
- used for shortes span.

(*) Reinforced concrete lintels:
- fireproof, durable, strong, economical.
- easier to construct.

Bridges:

The structure providing passage over an obstacle without closing way beneath.

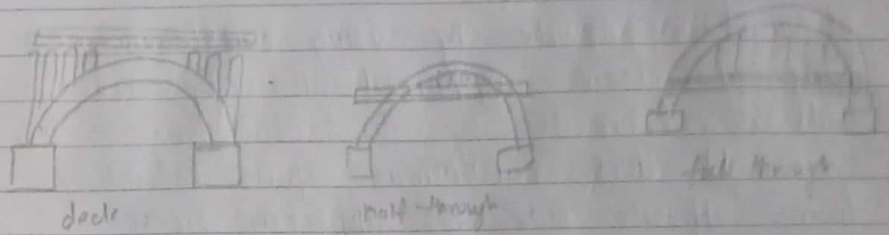
If >6 m, bridge If <6m, culvert.

*) Characteristics of ideal bridge:

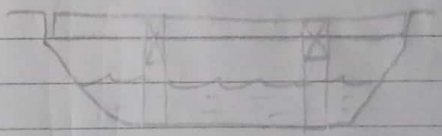
i): Bridge's line should not have serious deviation from line of approach road.
ii) Should be in level.
iii) Width of bridge sufficient to incorporate future traffic.
iv) Must be economical
v) Foundation must be in firm ground at sufficient depth.
vi) Bridge shouldn't obstruct stream, must provide adequate waterway.

(*): Types:

a) Arch bridge:
→ Has arc as main component and generally located below bridge.
The load of the arc bridge is carried outward along the curve of the arch towards the support at each end.



b) Beam bridge:
→ Most common bridge.
→ Beam bridge are supported by several beams of various shapes and sizes of steel or wood.
→ They are horizontal supported by substructure.



(C): Truss bridge:

It uses truss as main load bearing supes structure.

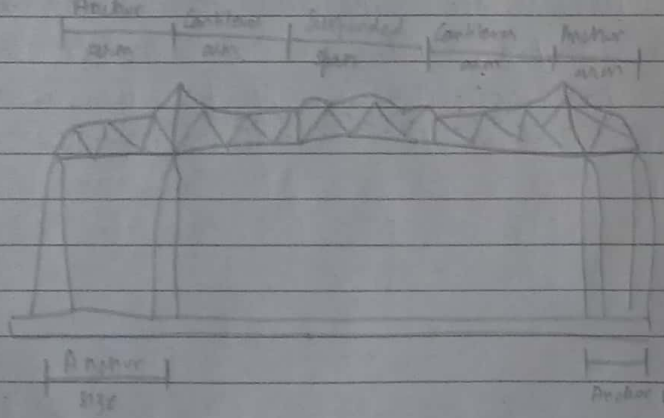
Truss is the structure of connected units forming triangular units.

(D): Cantilever Bridge:

It is made by using cantilevers - horizontal beam supported on only one end.

It used continuous spans extending from opposite side of supporting piers.

for small foot, simple beam.
for large foot, truss is used.



(E) SUSPENSION BRIDGES:

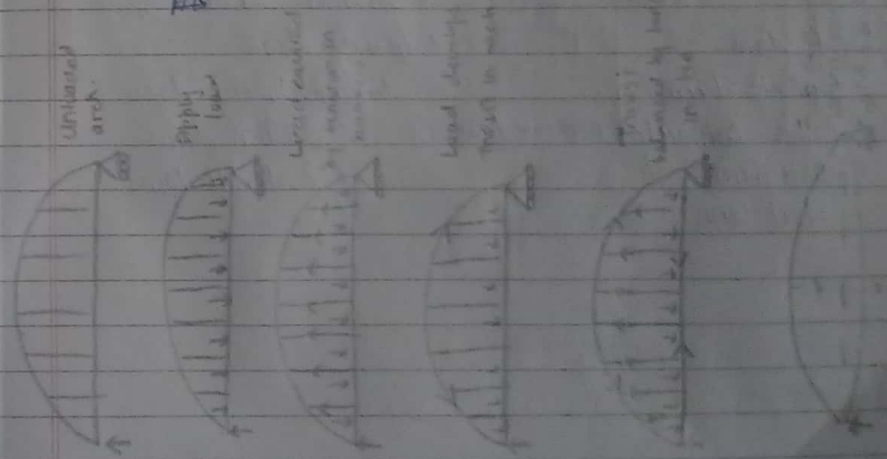
Uses rope and cables from vertical suspender to hold weight of bridge deck and traffic.

(F): Cable Stayed bridge:

Uses deck cables connected directly to one or more vertical columns.

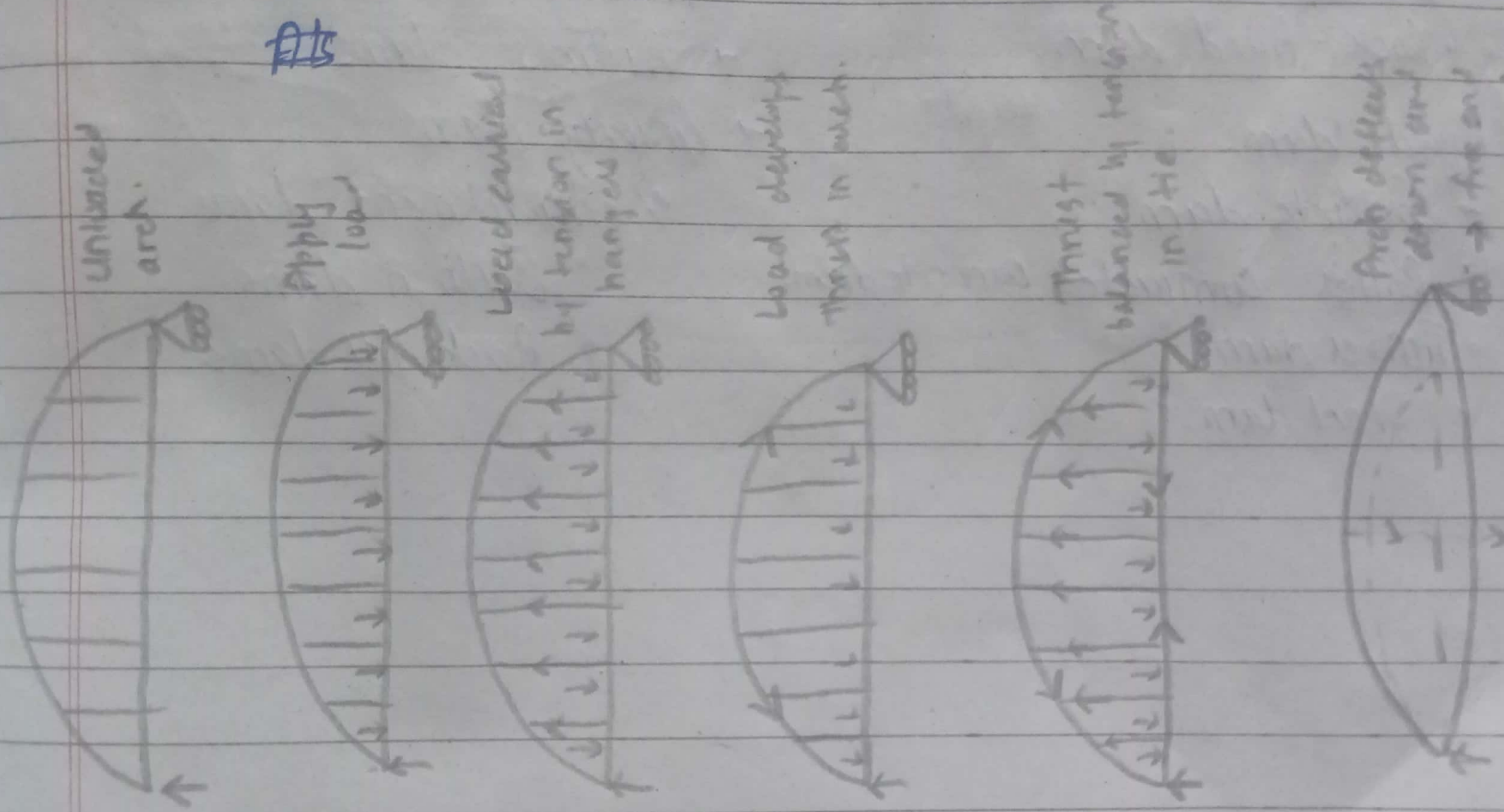
(G): Tied Arch bridge: (Bowstring Arches):

They have arch shaped superstructure. Instead of transferring weight to abutments, the ends are restrained by tension in bottom chord.



Tied arch bridge (Bowstring arches):

They have arch shaped superstructure. Instead of transferring weight to abutments, the ends are restrained by tension in bottom chord.



DAMS

It is a hydraulic structure constructed across a river that raises the water level behind it to form a reservoir for us of any ~~hydrological~~ water-related functions.

(*): Classification:

A) Based on purpose:
- → Storage dam
- → Detention dam
- → Diversion dam

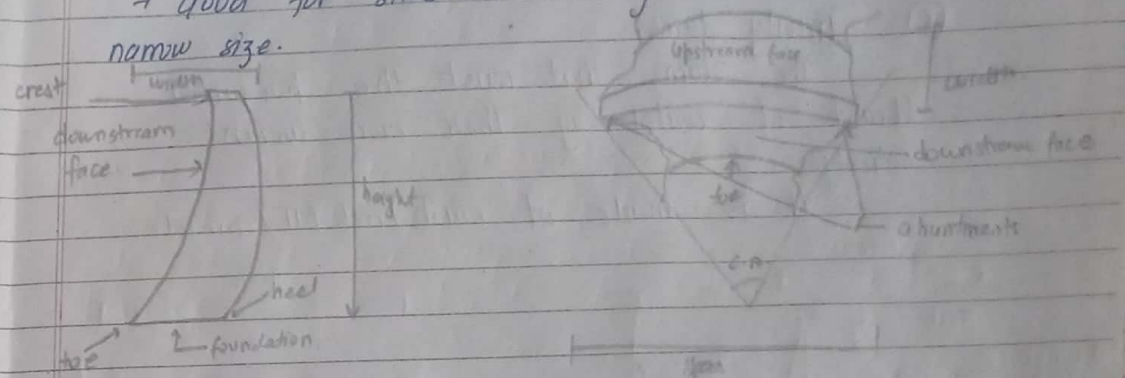
B) Based on material:
- → Non-rigid dams:
  - Earthen embankment dam
  - Rock-filled dam.
- → Rigid dam:
  - Concrete dam
  - Roller compacted concrete dam.
  - Timber dam
  - Steel dam.

(c): Based on height.
- → High head: > 100 m
- → Medium Head: 50-100 m
- → Low head < 50 m.

(D): Based on structure:
- → ~~Gravity dams~~. Arch dams
- → Buttress dams
- → Gravity dams
  - * Embankment dams
    - × Earthen dams
    - × Rock fill dams.

(D): Based on structure:

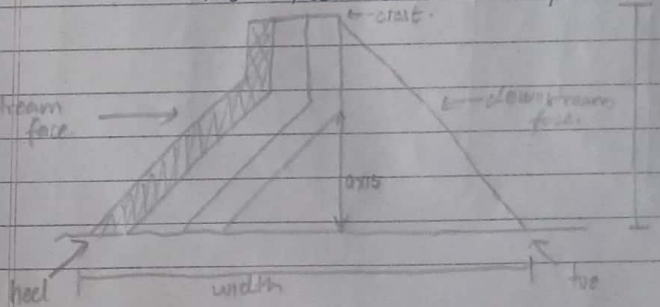
(a): Arch dams:
- → Curved dam dependent upon arch action for its length.
- → Transmits most of horizontal water thrust behind them to ~~abandat~~ abutments by arch action.
- → Thinner dams.
- → Good for sites with strong abutments and narrow size.

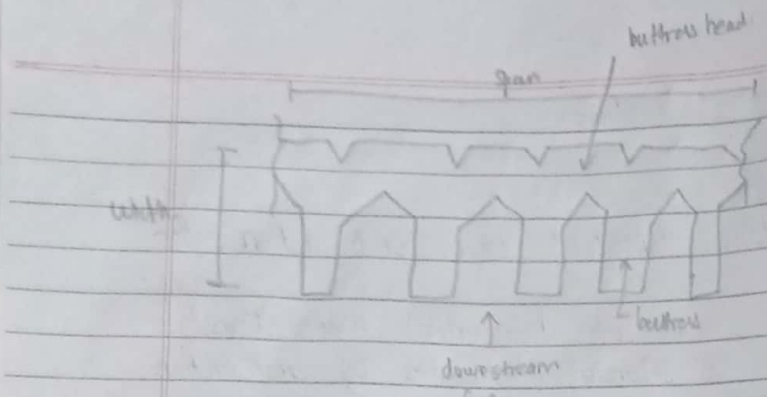


(b): Buttress dam:

The dam in which the face is held up by a series of supports.

The face can be flat or curved.

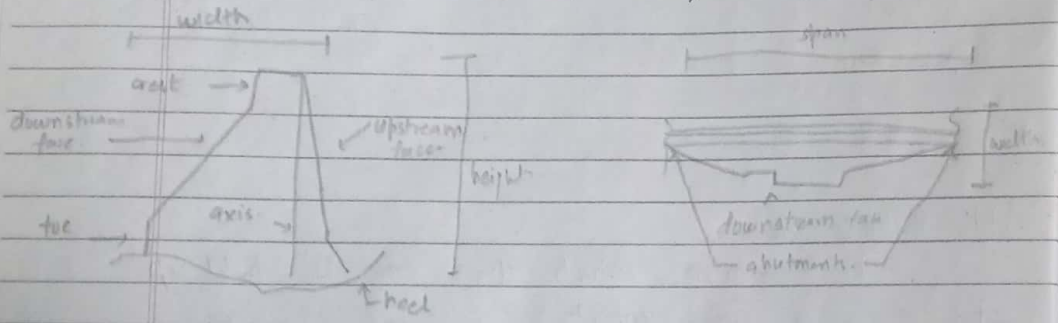




(c): Gravity dams:

The dams that resist the horizontal thrust of water by their own weight entirely.

It is made of earth / rock fill / concrete.



(d): Embankment dams:

Made up of compacted Earth or rock fill without any cementing agents.

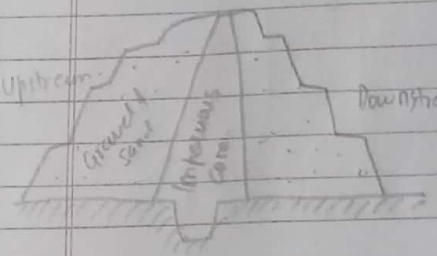
→ rely on their own weight to hold water.

Earthen dam

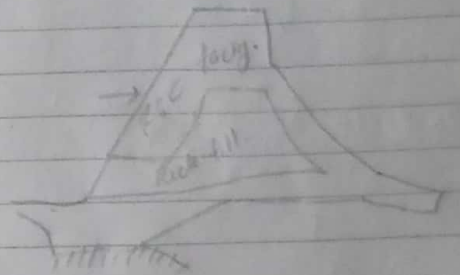
Compacted soil accounts for more than 50% of placed volume of material.

Rock fill dam:

- If 50% of the fill materials are rocks.



Earthen dam



Rockfill dam with RCC facing

(*) Advantages

→ using naturally available materials.
→ Less costly
→ can accomodate to board range of foundation ranging from good to permeable rock.

(*) Disadvantages

→ more susceptible to damage
→ problem of seepage is higher.