FOUNDATION

The lowest part of the structure providing a base to transmit load from the ~~sub~~ building to the sub-soil.

A structure is provided with a foundation to:

i) Distribute the load of building over large area.
ii) Limiting the magnitude and unequal settlements.
iii) To provide a levelled surface.
iv) To take structure deep into the ground and prevent overturn.

(*): Loads in building foundation:

They are.

i) Dead load
ii) Live load
iii) wind load
iv) Seismic load.

It must be done in following ways:

→ Settlements within permissible limits.
→ within soil bearing capacity.
→ Load path must be proper to subsoil.

*) Requirement of Good foundation:

i) It must sustain dead load and live load and transmit to the subsoil such that no settlement or soil failures occur.

ii) Foundation base should be rigid such that differential settlements are limited when unequal load distribution occurs.

iii) No distress due to swelling or shrinkage of subsoil.

iv) Should be stable and safe against overturning.

v) Should be located in such a way that its performance is unaffected due to unexpected future influences.

Bearing Capacity of soil:

The capacity of soil to support the loads applied to the ground is called soil bearing capacity.

It is the measure of maximum average contact pressure between foundation and soil where by it doesn't produce soil failure.

(*): Foundation Soil and Safe Bearing classification.

S.No	Safe Bearing Capacity (kN/m²)	Foundation type	Soil / Foundation material.
1	> 200	Hard	Rock, Gravel
2	150 - 200	Medium	Sand
3	100 - 150	Soft	Clay
4	50 - 100	Weak	Loose clay.

Types of Foundation:

1) Shallow Foundation: Depth (D) <= Breadth (B)

2) Deep Foundation: Depth (D) > Breadth (B).

Shallow Foundation	Deep Foundation
Spread Foundation.	– Pile Foundation.
Combined Foundation	– Pier / Drilled Caisson Foundation
Strap Foundation	– Well / Caisson Foundation.
Mat foundation.	–

Shallow Foundation: A) Spread Foundation.

It has three types:

i) Conventional spread footing / Wall-footing
ii) RCC spread ~~fotting~~ footing.
iii) Grillage foundation.

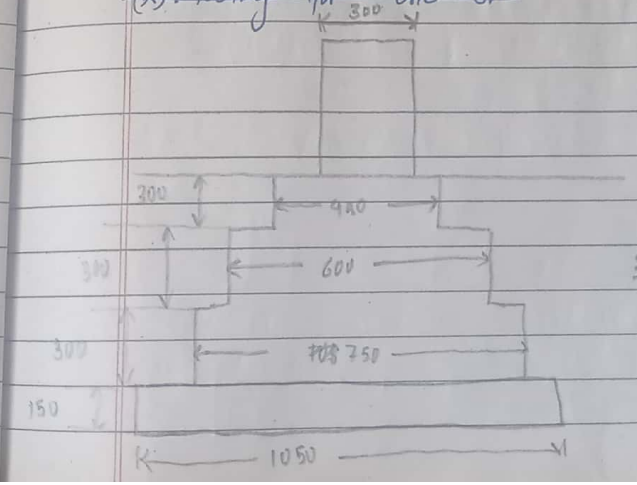
i) Convential Spread Footing:

→ Commonly used for walls and masonry columns.
→ Built after digging trenches to required depth.
→ Economical upto 3m maximum depth.

~~Concrete~~ Plain Cement concrete ⇒ 1:4:8
Concrete thickness ⇒ 150 - 200 mm

→ Built in ~~coar~~ course such that each course projects 50 - 75 mm from course lying above it.

~~(*): Footing for One Sh~~



3-stepped wall footing.

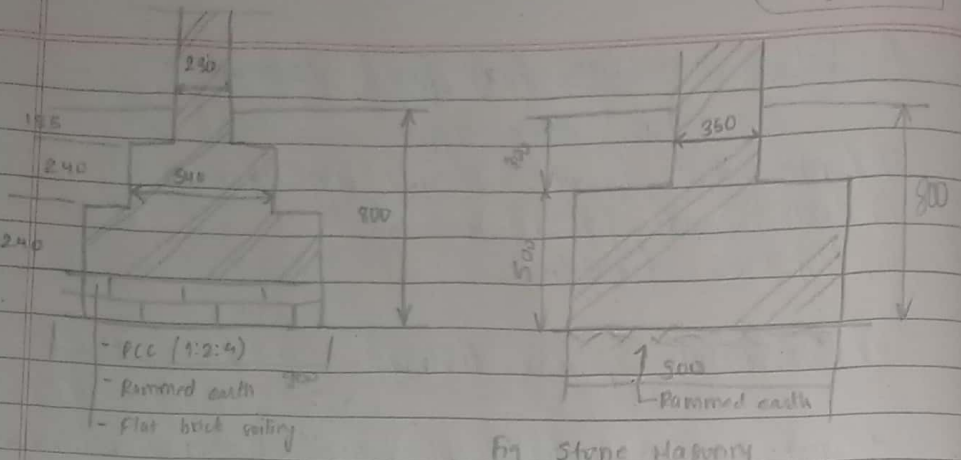
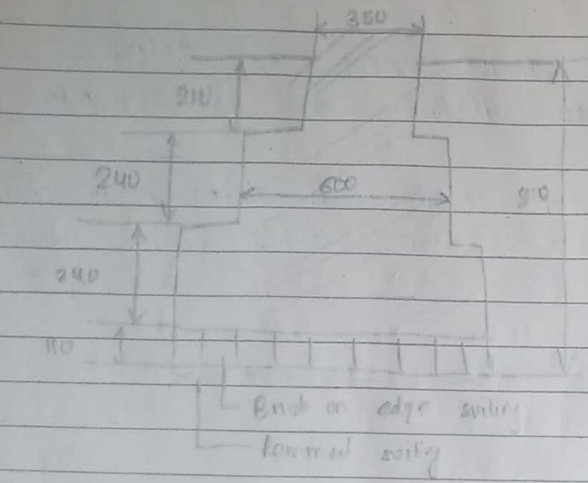


Fig Brick masonry
cement mortar (1:6)

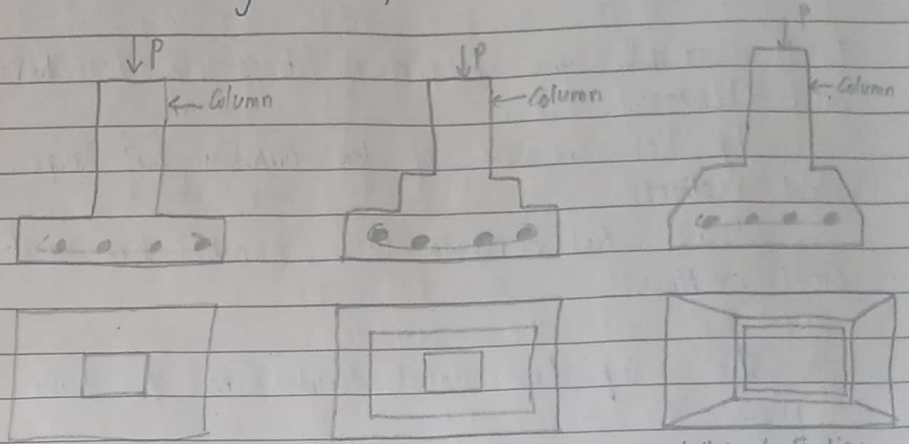
Fig Stone Masonry
Cement Mortar (1:6)



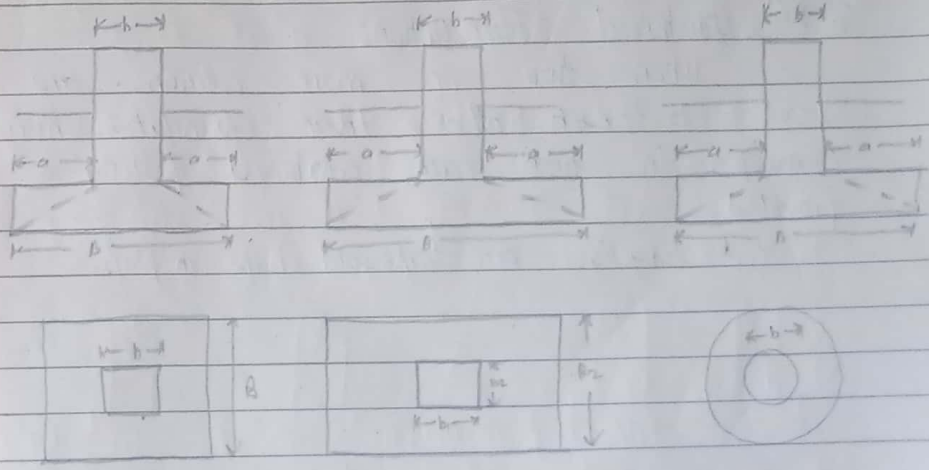
(ii): ~~RCC spread Footing~~ spread Footing:

It is used for smaller load on column.

- It may be sloped or not sloped.
- It may be square, rectangular or circular.



a) Pad Footing b) Stepped Footing. c) Sloped Footing.



a) Square footing. b) Rectangular footing c) Circular footing

(iii) Grillage Foundation:

→ It is used when the load on foundation is too heavy and bearing capacity of soil is low.

→ It consists one or more ties of I-sections steel beams.

Top tier consists of less number but large steel section.

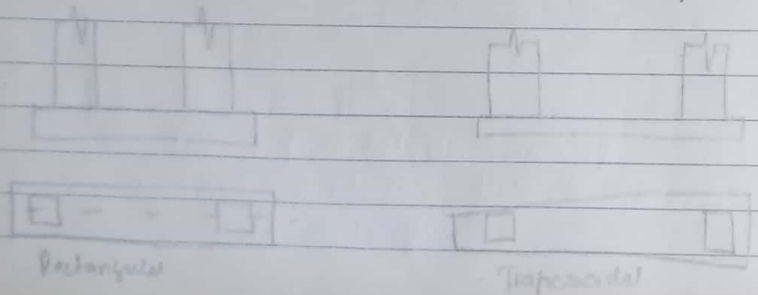
Lower ties consists large number but smaller steel sections.

→ The top tier takes load from the base plate.

D): Combined Foundations:

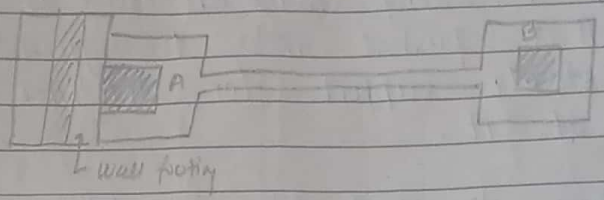
When two or more columns are close to each other, their foundation may overlap. In such case, combined footing is provided.

→ Rectangular or trapezoid shape in plan.



c) Strap Foundation:

If two isolated footings are joined by beam, strap beam, it is called strap foundation.



D) Mat Footing

If load on the columns is quite high, isolated columns overlap each other. In this situation, we give a common footing to several columns known as raft footing.

If beams are provided in both directions over the footing slab for connecting columns, the raft foundation is called as grid.

This footing has uniform settlement.

Deep Foundation:

i) Pile Foundation:

A pile is a ~~strong material~~ long cylinder of a strong material such as concrete that pushes into the ground to act as steady support for structures built on top of it.

*) Situations to used Pile foundation:

a): When there is layers of weak solid ~~under the~~ at the surface.:

The given layer ~~doesn't~~ cannot support the weight of the building, so the loads are bypasses from this layer and transferred to the layes of stronger soil or rock beyond the weak layer.

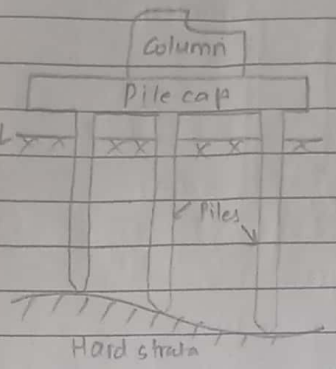
(b) When the building has very heavy concentrated loads and its distribution is uneven, such as in high rise structure, bridge, water tank.

*) Types:

Pile foundations are of two types: bearing and friction pile.

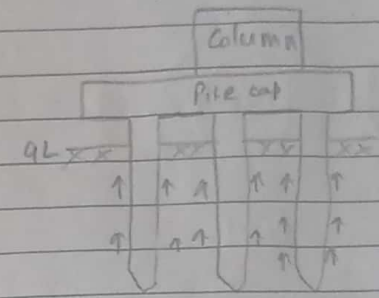
(1): Bearing pile

→ ~~of~~ pile driven into the ground until hard ground stratum reached.



(2) Friction pile:

→ Transfers load by friction between surrounding soil and pile surface area.



(ii) Pier Foundation:

A pier foundation is a collection of large diameter cylindrical columns to support the superstructure and transfer large super-imposed ~~load~~ loads to firm strata below.

Also called post foundation.

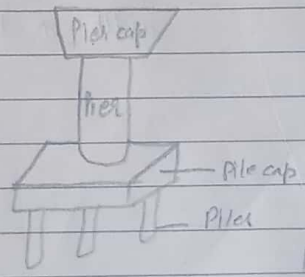
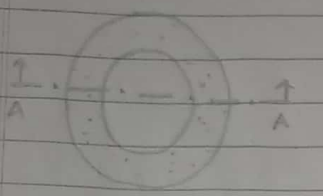


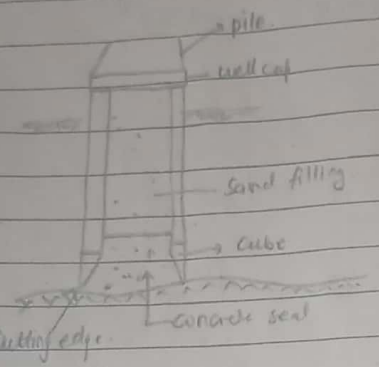
Fig: Pier foundation

(iii) Well foundations:

The deep foundation which is provided below water level for bridges.



PLAN



RCC footing:

a) One-way reinforced footing:

→ Footings used for walls

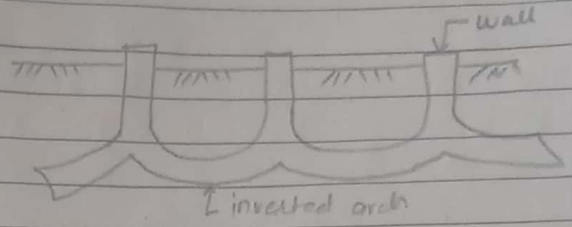
→ reinforcement in transverse direction g way.

b) Two-way reinforced footing:

→ Used for columns.

→ reinforcement across width in both directions.

(*): Arch footing:



→ Used where SBC is very poor and load of structure is through walls.

→ Arch effect: End walls must be sufficiently thick and strong to withstand outward horizontal thrust.

(*): Factors considered during choosing foundation:

i) Soil strata
ii) Soil bearing capacity
iii) Type of structure
iv) Type and amount of loading
v) ~~Eco~~ Economy
vi) Permissible differential settlement.

(*) Causes for failure of foundation

i) Lateral pressure tend to overturn the structure
ii) Roots & Vegetation
iii) Atmospheric effects
iv) Sub-soil moisture movement
v) Unequal subsoil settlement
vi) Poor building site & ground penetration.