Topics covered in Lecture-01 of this series:

- What is Foundation ?
- Functions of Foundation
- Classifications of Foundation
- What is Footing ?
- Difference between Foundation & Footing
- Types of Footings

R.C.C. Footings:

- Reinforced concrete is most admirably suitable material and most commonly used.
- Footings are used to transfer the loads and moments from the column to the soil.
- Neither soil should fail nor the footing should fail.
- They should remain compatible with each other.

Design of foundation cover two aspects;

(1) Soil design

(2) Structural design

Soil design includes:

- Determination of depth of foundation
- Determination of allowable bearing pressure
- Determination of plan dimensions
- Determination of upward soil pressure on footing

Structural design includes the design of footing, i.e., concrete and reinforcement.

Aspects of soil design:

1. Depth of foundation
2. Modes of soil failure
3. Safe bearing capacity of soil
4. Safe bearing pressure on soil
5. Allowable bearing pressure on soil
6. Plan dimensions
7. Upward soil pressure

1. Depth of foundation:

- In addition to vertical loads, footing also have to resist moment and horizontal forces.
- Should check for sliding and overturning.
- Settlement shall not be excessive.
- Footing should be placed at a sufficient depth.
- Minimum depth of foundation should be such that;
  - Should not affected by erosion, roots of plants, frost, etc. this usually requires minimum depth of 0.9m.
  - Good hard soil should available and designer should know ABP at that hard strata.

Other practical considerations:

- Existing foundation level of nearby building
- Possible influence of future expansion
- Height of building
- If the height of the building is more, the horizontal forces on the building such as wind forces are large.

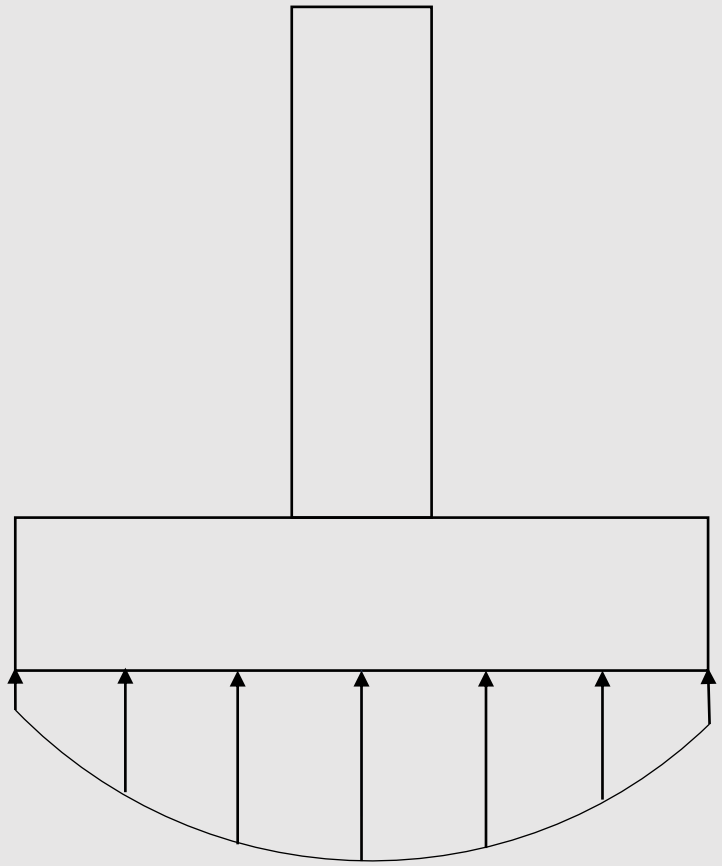
As a thumb rule, minimum depth of foundation may be selected as 5% to 10% of the height of the building.

2. Modes of soil failure:

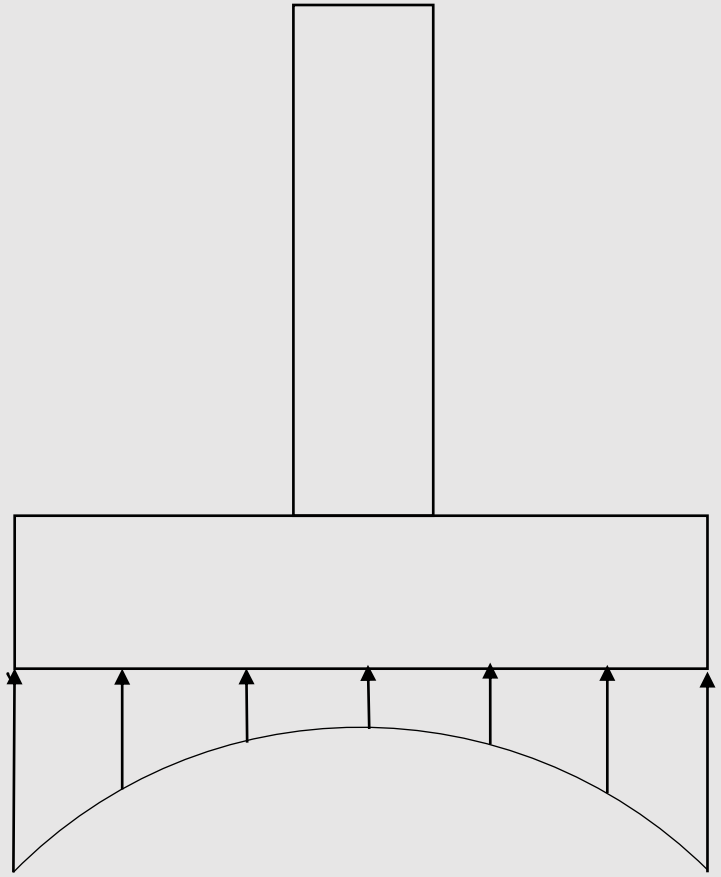
- *Catastrophic collapse* of soil underneath the foundation
  - If the shear strength is inadequate to support the applied load.
  - Bearing capacity of soil is associated with shear failure.
  - This type of failure is not very common.
  - But if occurred, the they may lead to large movements and distortion of the structure.
- *Excessive settlement* of the soil
  - Partly due to distortion of soil mass (due to applied stresses)
  - Partly due to consolidation of soil (results in increase of normal stresses)
  - Safe bearing pressure is associated with settlement failure of soil

*Resistance to shear failure and settlement depends on the shape, size and depth of foundation and properties of soil.

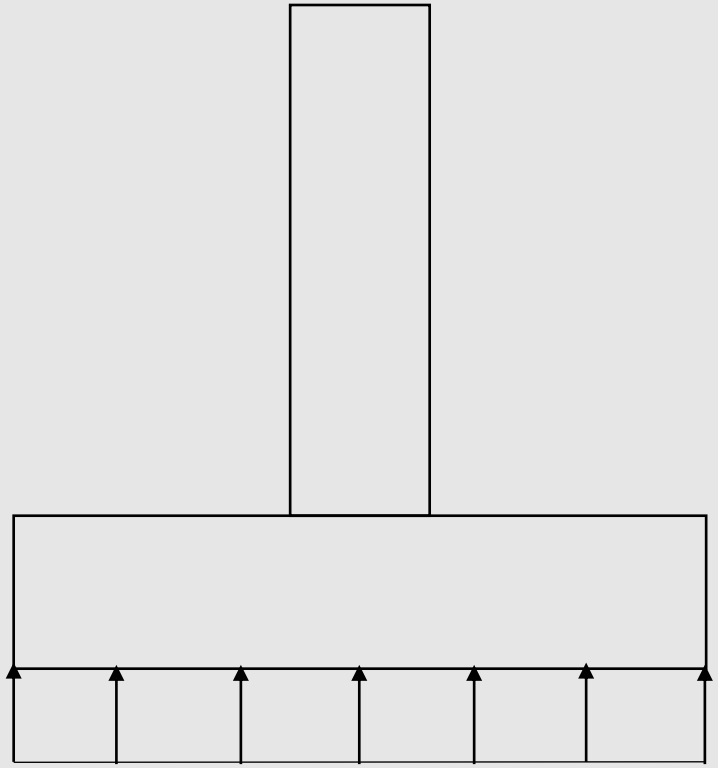
3. Safe bearing capacity (S.B.C.) of soil:



(a) Sandy soil
(variable pressure)



(b) Clayey soil
(variable pressure)



(c) Assumed condition
(uniform pressure)

Bearing capacity:

- The supportive power of a soil is referred to as its bearing capacity.

Ultimate bearing capacity:

- Minimum gross pressure intensity at the base of foundation at which the soil fails in shear.

Net ultimate bearing capacity:

- The minimum net pressure intensity causing shear failure of soil.

Safe bearing capacity:

- Net ultimate bearing capacity divided by F.O.S. (A value of 3 is generally adopted)

4. Safe bearing pressure (S.B.P.) on soil:

- Associated with settlement failure of soil.
- It is the net pressure which soil can carry without exceeding allowable settlement.
- Maximum allowable settlement varies from 25mm to 50mm.

Total settlement;

i. Immediate elastic settlement

ii. Consolidated settlement

iii. Settlement due to secondary consolidation of clay

5. Allowable bearing pressure (A.B.P.) on soil:

- Pressure on soil which can be applied without causing excessive settlement.
- Depends on shear strength of soil.

  A.B.P. = Minimum of S.B.C. and S.B.P.

- Various soil properties have to be studied for determination.
- If good soil available at footing level, designer may assume A.B.P. on his/her past experience.
- If not, then proper investigation is desired.