

CE-200

Details of Construction

Lecture-2

“Shallow Foundation”



Definition

- ◆ A **foundation** is a structure that transfers loads to the ground. Foundations are generally broken into two categories:
 - ◆ shallow foundation
 - &
 - ◆ deep foundation



- ◆ A **shallow foundation** is a type of foundation which transfers building loads to the earth very near the surface, rather than to a subsurface layer or a range of depths as does a deep foundation.
- ◆ **Deep foundations** are used to transfer a load from a structure through an upper weak layer of soil to a stronger deeper layer of soil. Deep foundations are distinguished from shallow foundations by the depth they are embedded into the ground.

Foundation Depth

- ◆ foundation design depends on various factors, e.g. type of building, type of construction/materials used, ground conditions, site slope, natural hazards etc.
- ◆ designer/engineer will consider these factors when determining the design of a buildings foundation.

Objectives of Foundation

- ◆ To distribute the load of the structure on large area.
- ◆ To distribute the load on underlying soil evenly.
- ◆ To provide a levelled and hard surface for the super-structure to be built over it.
- ◆ To increase the stability as a whole against sliding, overturning or other distribution forces like wind, rain etc.
- ◆ To prevent lateral movement of the supporting materials so that safety of the structure is not endangered.

Types of Shallow Foundation

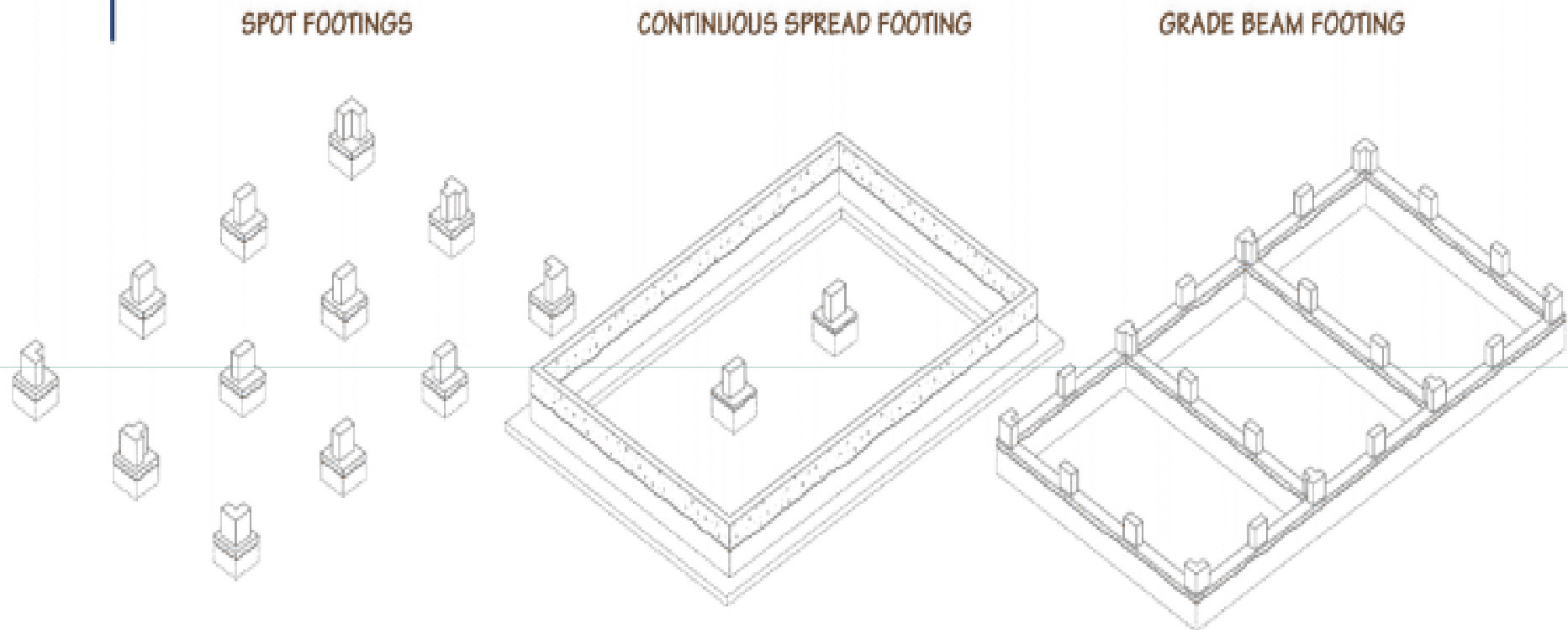
- ◆ Spread footings
- ◆ Grillage footings
- ◆ Eccentrically loaded footings
- ◆ Combined footings
- ◆ Mat or raft foundation


Spread footing is further classified as:

- ◆ Wall footings
- ◆ Reinforced concrete footings
- ◆ Inverted arch footings
- ◆ Column footings

Different footings

Figure 9 Typical Footings – Types and Layouts



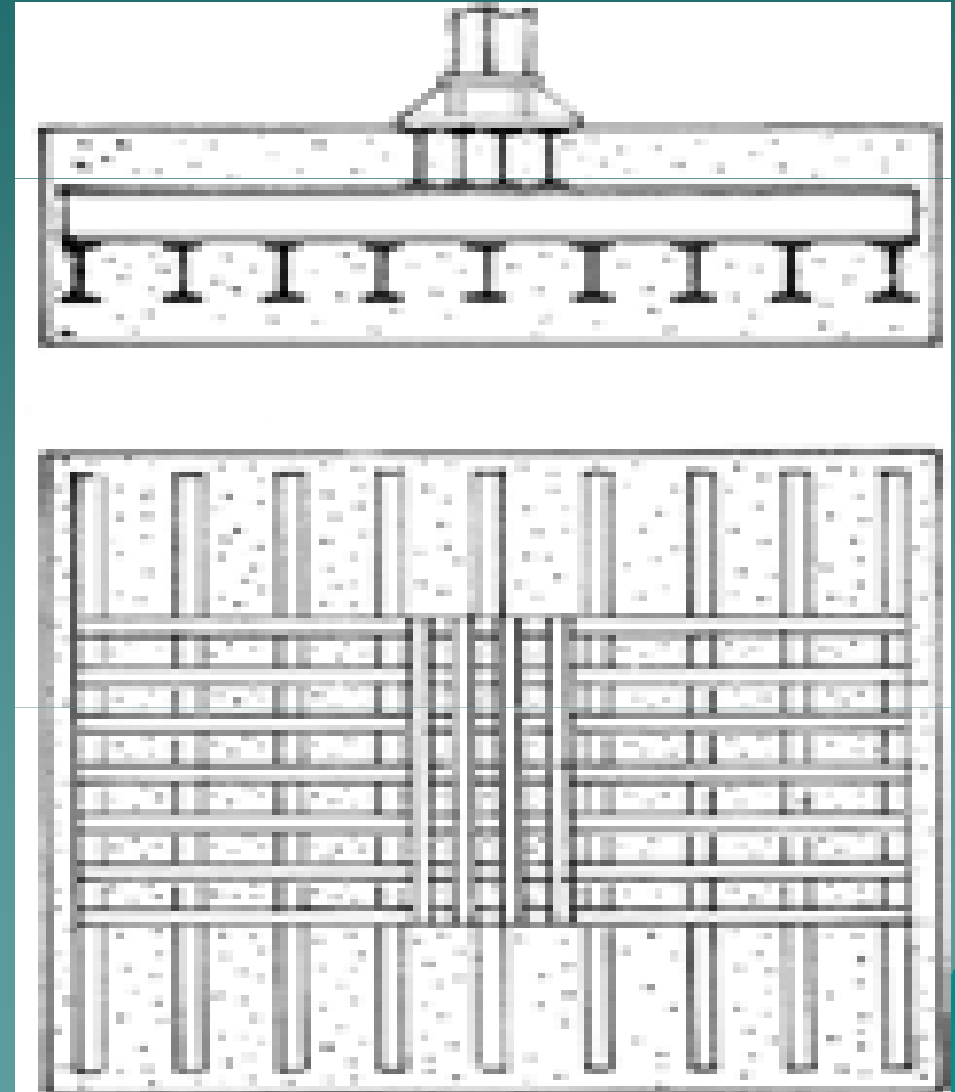
- ◆ Wall foundation
 - ◆ Reinforced Cement Concrete (R.C.C.) foundation
 - ◆ Inverted Arch footing
 - ◆ Column footing
- 
- A decorative graphic at the bottom right of the slide, consisting of a silhouette of a mountain range in various shades of teal and blue.

Grillage Foundation

- ◆ A network or frame of timber or steel serving as a foundation, usually on ground that is wet or soft.
- ◆ A framework of heavy timbers, steel, or reinforced concrete beams laid longitudinally and crossed by similar members laid upon them to spread a heavy load over a larger area, esp. for use where the ground is not firm.

Grillage Foundation

- ◆ A series of steel beams, bolted together and placed over a footing; used to distribute a concentrated column load over the top of the footing.



RAFT FOUNDATION

- ◆ Raft foundation are required on soil of low bearing capacity, or where structural column or other loads areas are so close in both direction that individual pad will nearly touch each other. The function of raft foundation are to spread the load over as wide an area as possible, and to give a measure of rigidity to the sub-structure to enable it to bridge over local areas of weaker or more compressible soil. The degree of rigidity given to the raft also reduces differential settlement. It is useful in reducing different settlement on variable soils or there is a wide variation in loading and adjacent column or other applied loads.

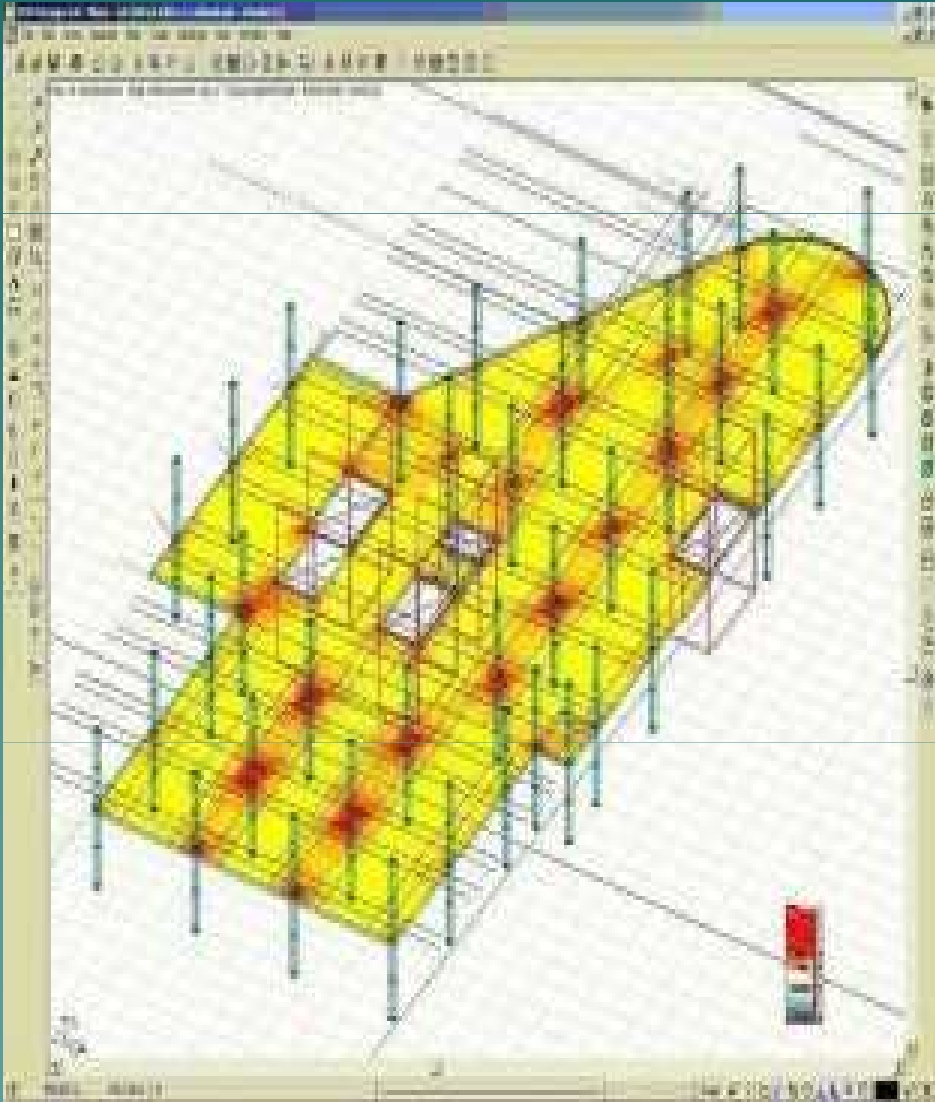
- ◆ **Typical use :**

- ◆ Rafts are used to bridge over soft spots if the spots are very localized and to reduce the average pressure applied to the soil. Raft foundation can be used as a matter of constructional convenience in structure supported by a grid of fairly closed spaced columns.
- ◆ In such case, an overall raft will avoid obstruction of the site by a number of individual excavation with their associated heaps of spoil.

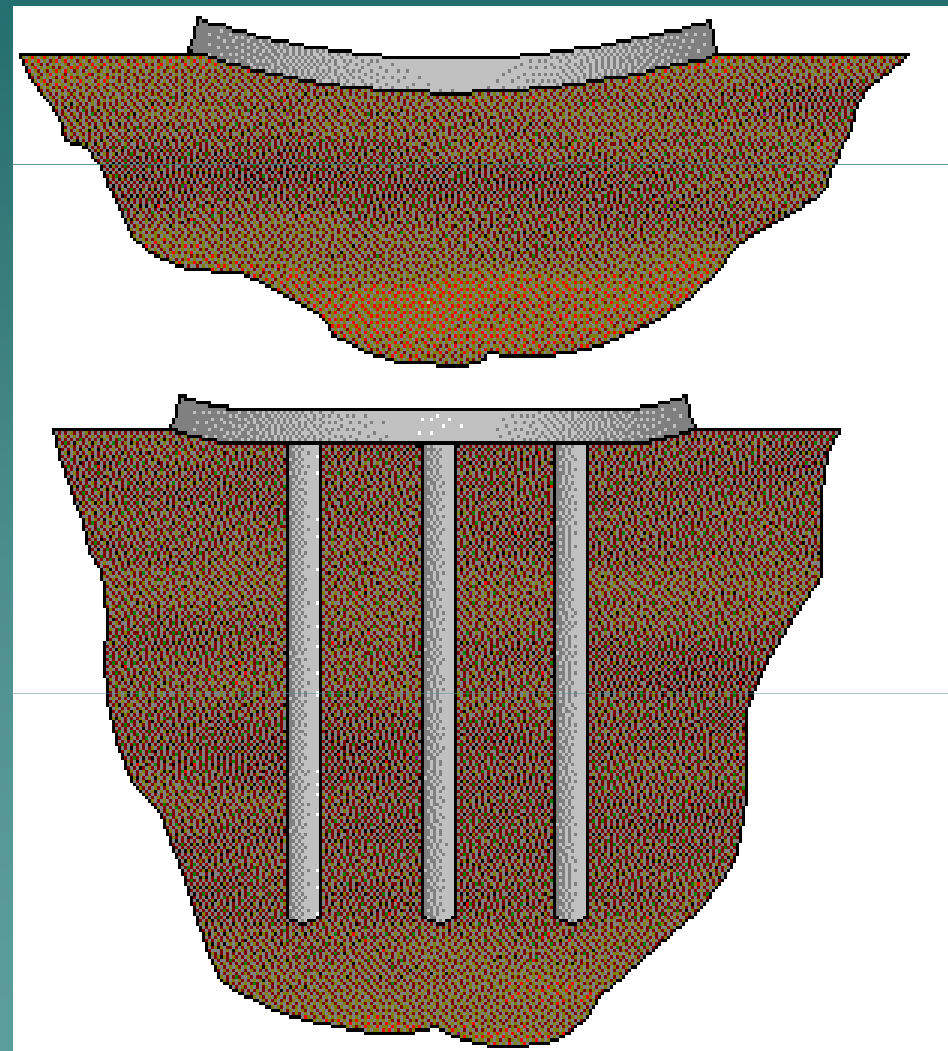
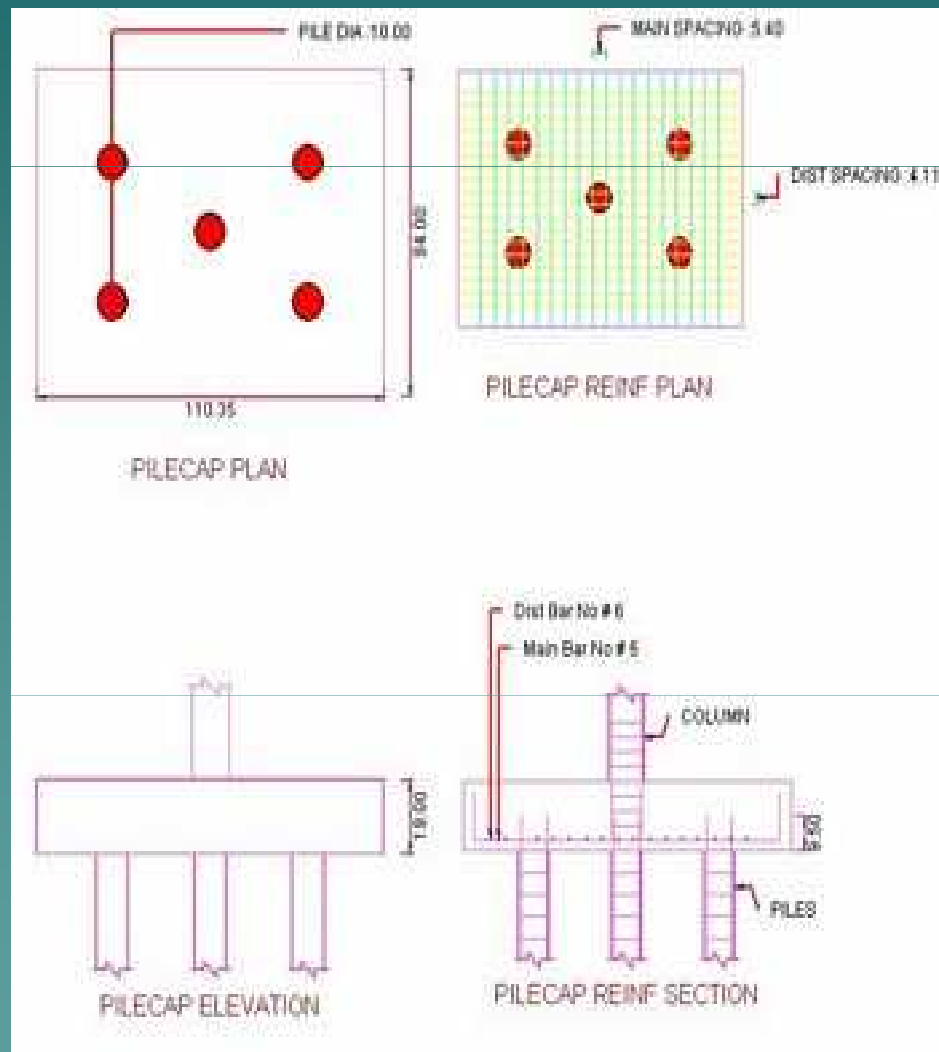
- ◆ Some designer work on the rule that if more than 50% of the area of the structure is occupied by individual strip foundation it will be more economical.
- ◆ Normally built at for support construction at low bearing capacity such as abandon at the slopping site which are refilled or not.

- ◆ Where constructed:
- ◆ In made-up ground
- ◆ Soft clay
- ◆ Marshy areas
- ◆ Uncertain behavior of subsoil water condition
- ◆ Pile foundation cannot be used advantageously.
- ◆ Independent column footing is impracticable.

Raft Foundation

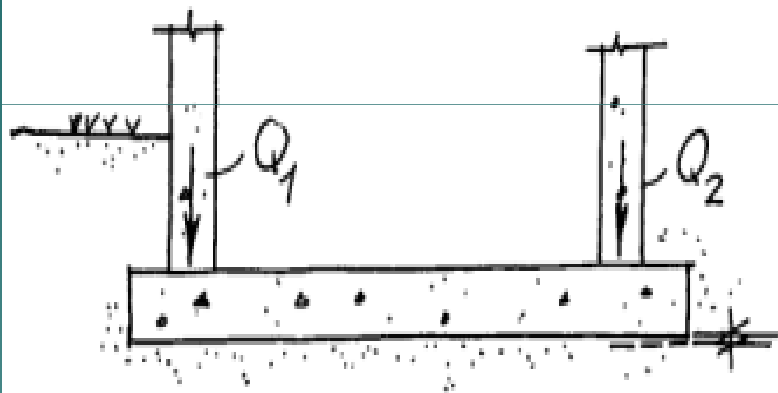


Raft with piles (pile cap)

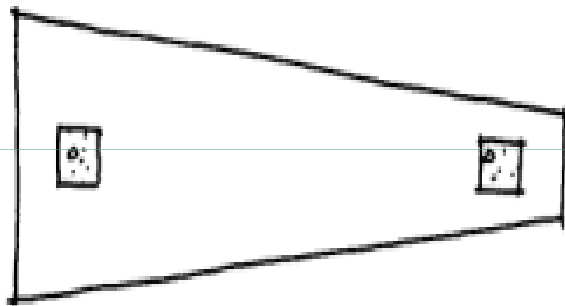


Combined Footing

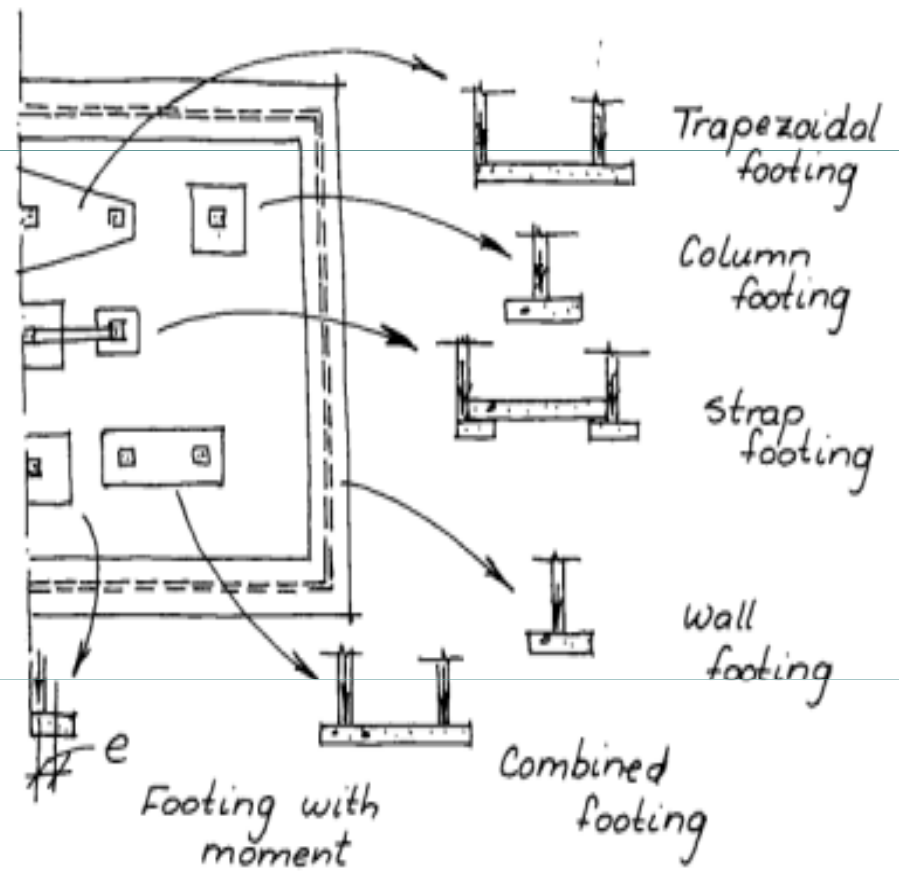
- ◆ This type of footing is provided under the following circumstances:
- ◆ When columns are very near to each other and their individual footings overlap.
- ◆ When bearing capacity of the soil is less, requiring more area under individual footing.
- ◆ When the end column is located at or near the property line and its footing can not be extended on the side of the property line.



Elevation



Plan



Trapezoidal footing

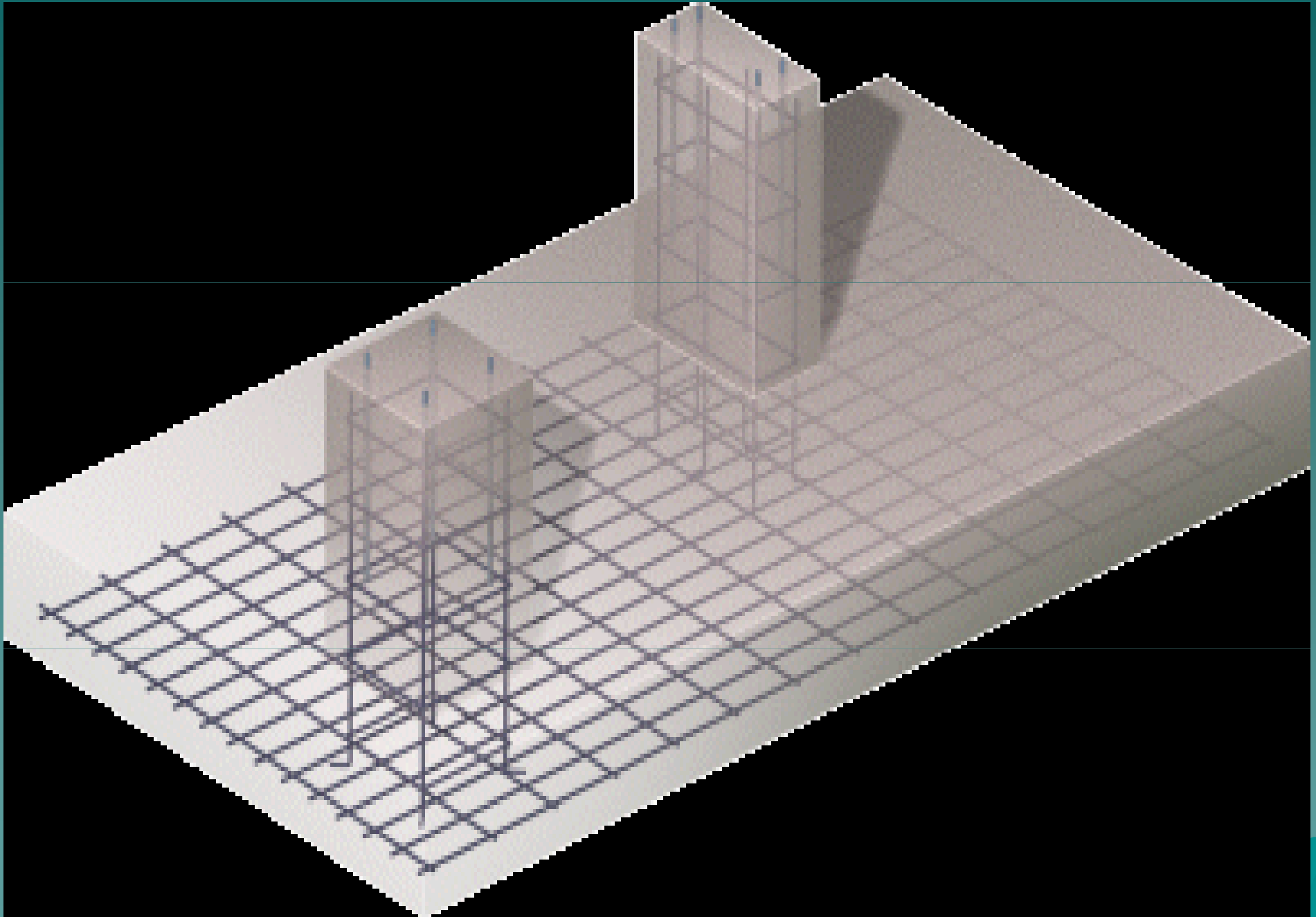
Column footing

Strap footing

Wall footing

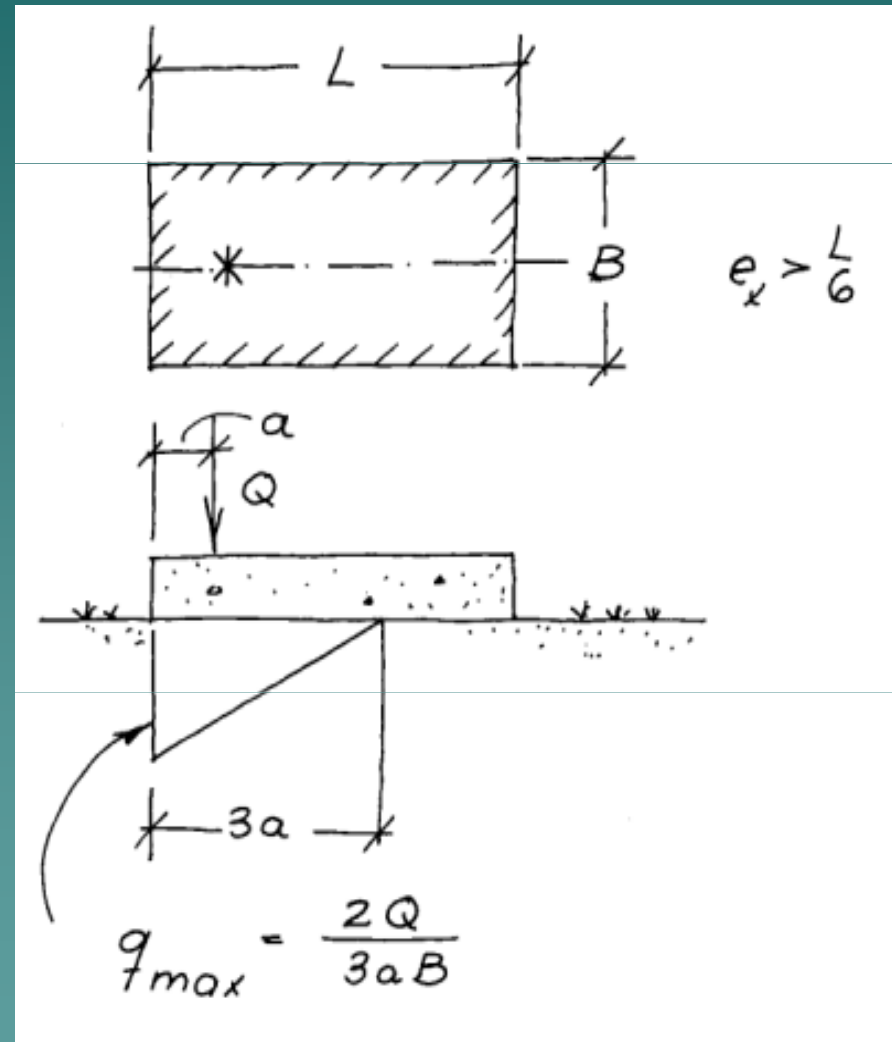
Footing with moment

Combined footing



Eccentrically loaded foundation

- ◆ The foundation (wall or column) should be so shaped and proportional that the c.g. of the imposed loads coincide with the c.g. of the supporting area of base. Thus, the distribution of pressure on the soil remains uniform.



- ◆ Eccentrically loaded foundation has got two categories:
- ◆ Offsetting the footings
- ◆ By providing strap footing

Conclusion

- ◆ Buildings are built for a purpose: schools for education, offices for work, theatres for culture. Each building is a blend of form and function - to be aesthetically pleasing as well as to fulfill the purpose for which it was created.



Conclusion

- ◆ Foundations do not typically contribute to the architectural aesthetics of a building. Yet, without suitable foundations, a building will not function effectively, will be unsafe and its architectural merits will rapidly fade.

