**Module 4 : Design of Shallow Foundations**

**Lecture 16 : Introduction [ Section16.1 : Introduction ]**

## Objectives

**In this section you will learn the following**

- Introduction
- Different types of footings

## 16 Introduction

A foundation is a integral part of the structure which transfer the load of the superstructure to the soil. A foundation is that member which provides support for the structure and it's loads. It includes the soil and rock of earth's crust and any special part of structure that serves to transmit the load into the rock or soil. The different types of the foundations are given in fig. 4.1

**Different types of footings**

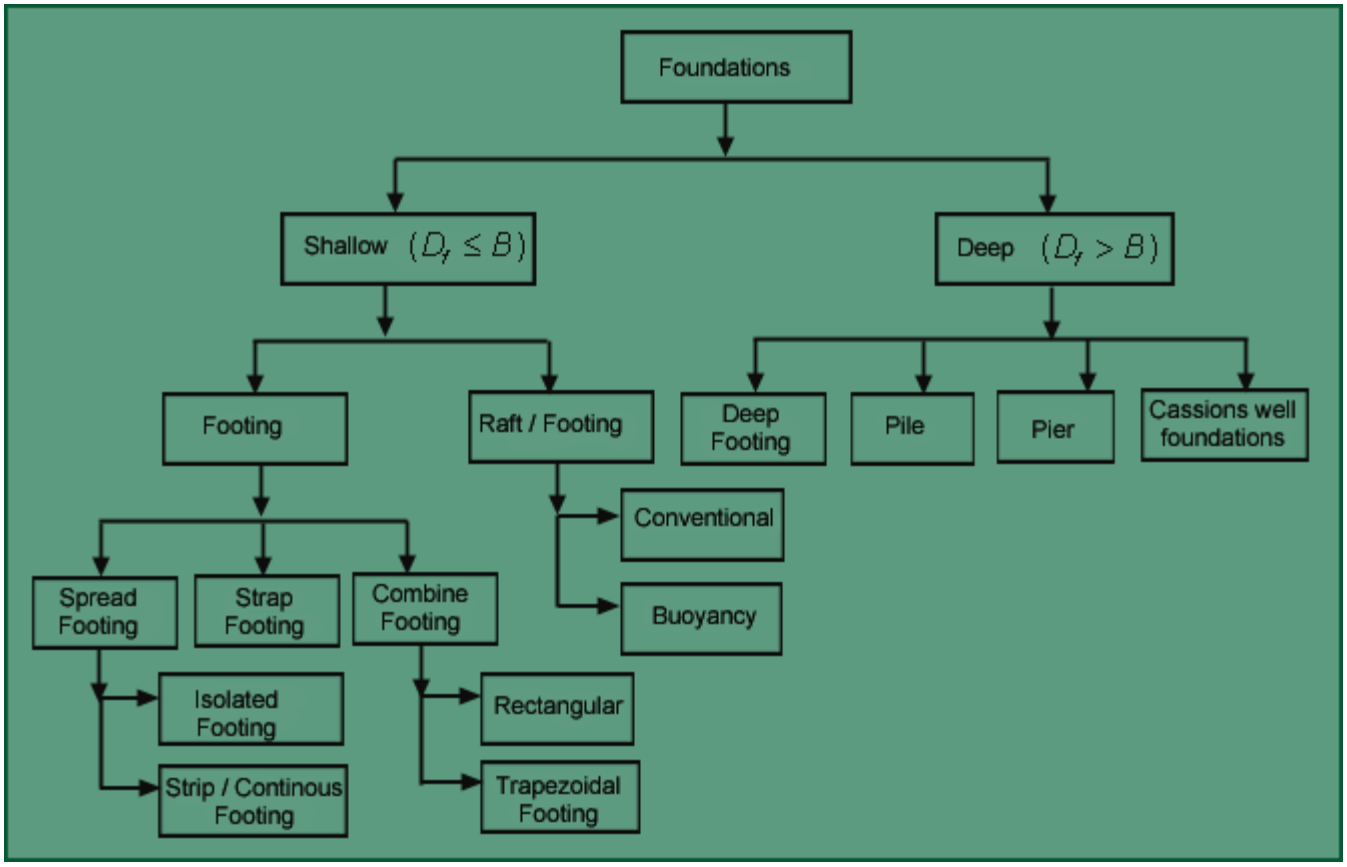


**Fig. 4.1 Different types of footings**

**Module 4 : Design of Shallow Foundations**

**Lecture 16 : Introduction [ Section16.1 : Introduction ]**

If the soil conditions immediately below the structure are sufficiently strong and capable of supporting the required load, then shallow spread footings can be used to transmit the load. On the other hand, if the soil conditions are weak, then piles or piers are used to carry the loads into deeper, more suitable soil.

**Design Considerations:**

- Must not settle excessively.
- Must be placed at depth sufficient to prevent damage from surface environmental effects (frost, swelling and shrinkage, erosion and scour).
- Must not cause failure of supporting soil (Bearing Capacity criteria).

**Advantages of using shallow foundation**

- Cost (affordable)
- Construction Procedure (simple)
- Materials (mostly concrete)
- Labor (does not need expertise)

**Disadvantages of using shallow foundation**

- Settlement
- Irregular ground surface (slope, retaining wall)
- Foundation subjected to pullout, torsion, moment.

Shallow foundations are foundations where the depth of the footing ( $D_f$ ) is generally less than the width (B) of the footing. Deep foundations are foundations where the depth of the footing ( $D_f$ ) is greater than the width (B) of the footing.

**Module 4 : Design of Shallow Foundations**

**Lecture 16 : Introduction [ Section16.1 : Introduction ]**

**Recap**

**In this section you have learnt the following**

- Introduction
- Different types of footings

**Objectives**

**In this section you will learn the following**

- Spread Footing
- Strap Footing
- Strip/continuous footings
- Combined Footing
- Mat or Raft footings

**Footings :**

**1. Spread Footing:**

It is circular, square or rectangular slab of uniform thickness. Sometimes, it is stepped or haunched to spread the load over a larger area. When spread footing is provided to support an individual column, it is called "Isolated footing" as shown in fig.4.2.

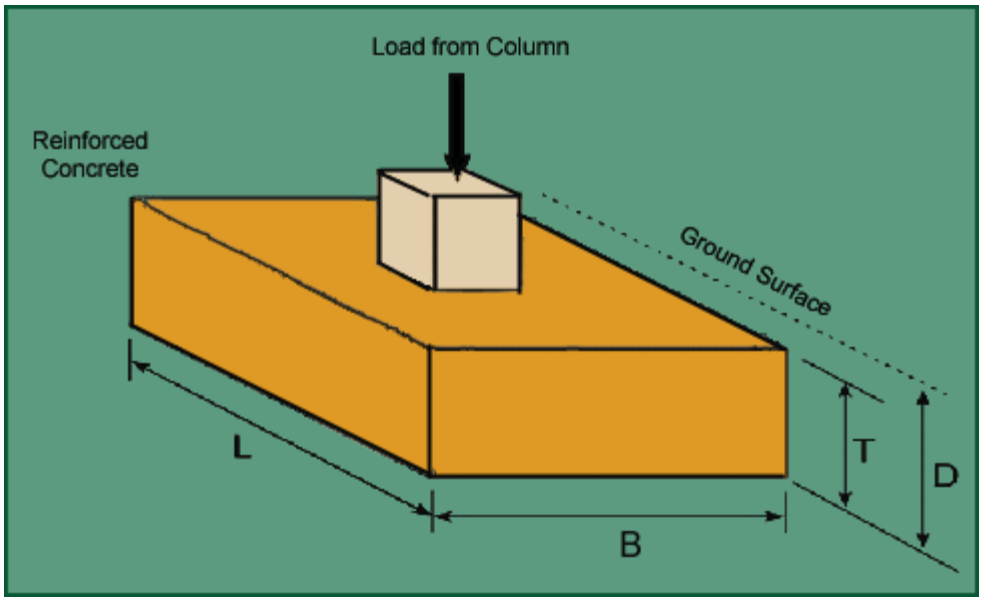


**Fig. 4.2 Isolated (spread) footing**

## 2. Strap Footing:

It consists of two isolated footings connected with a structural strap or a lever, as shown in fig. 4.3. The strap connects the footing such that they behave as one unit. The strap simply acts as a connecting beam. A strap footing is more economical than a combined footing when the allowable soil pressure is relatively high and distance between the columns is large.

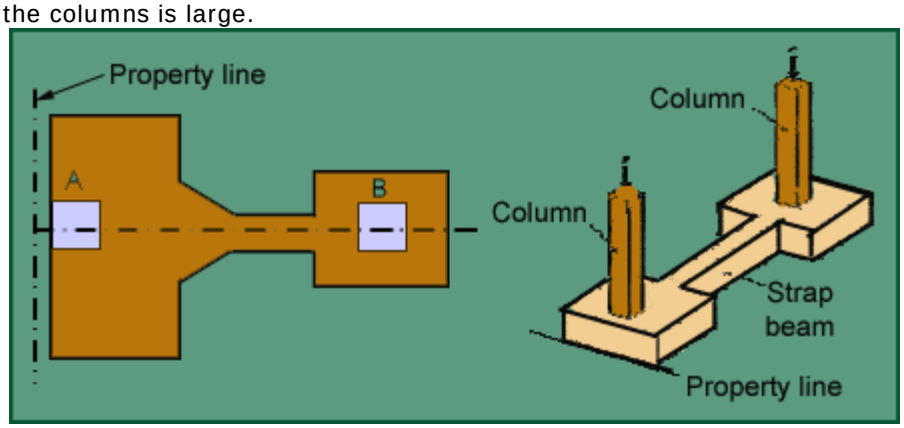


**Fig. 4.3 Strap footing**

### 3. Combined Footing:

It supports two columns as shown in fig. 4.4. It is used when the two columns are so close to each other that their individual footings would overlap. A combined footing is also provided when the property line is so close to one column that a spread footing would be eccentrically loaded when kept entirely within the property line. By combining it with that of an interior column, the load is evenly distributed. A combine footing may be rectangular or trapezoidal in plan. Trapezoidal footing is provided when the load on one of the columns is larger than the other column.

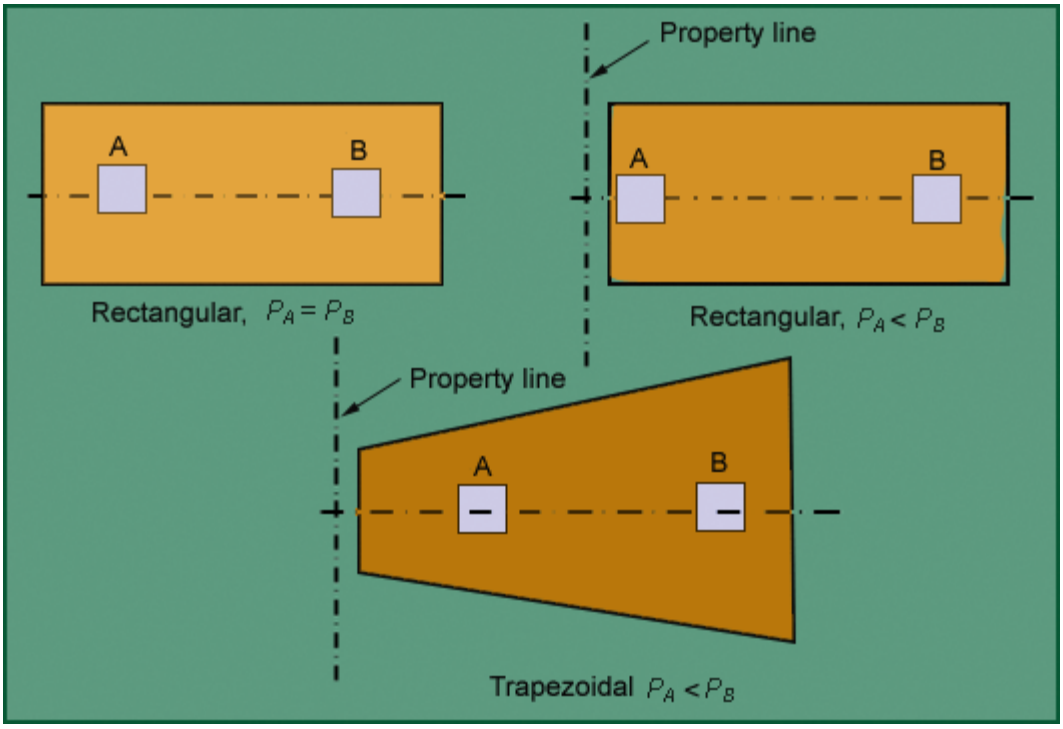


**Fig. 4.4 Combined footing**

### 4. Strip / continuous footings

A strip footing is another type of spread footing which is provided for a load bearing wall. A strip footing can also be provided for a row of columns which are so closely spaced that their spread footings overlap or nearly touch each other. In such a cases, it is more economical to provide a strip footing than to provide a number of spread footings in one line. A strip footing is also known as “continuous footing”. Refer fig. 4.5

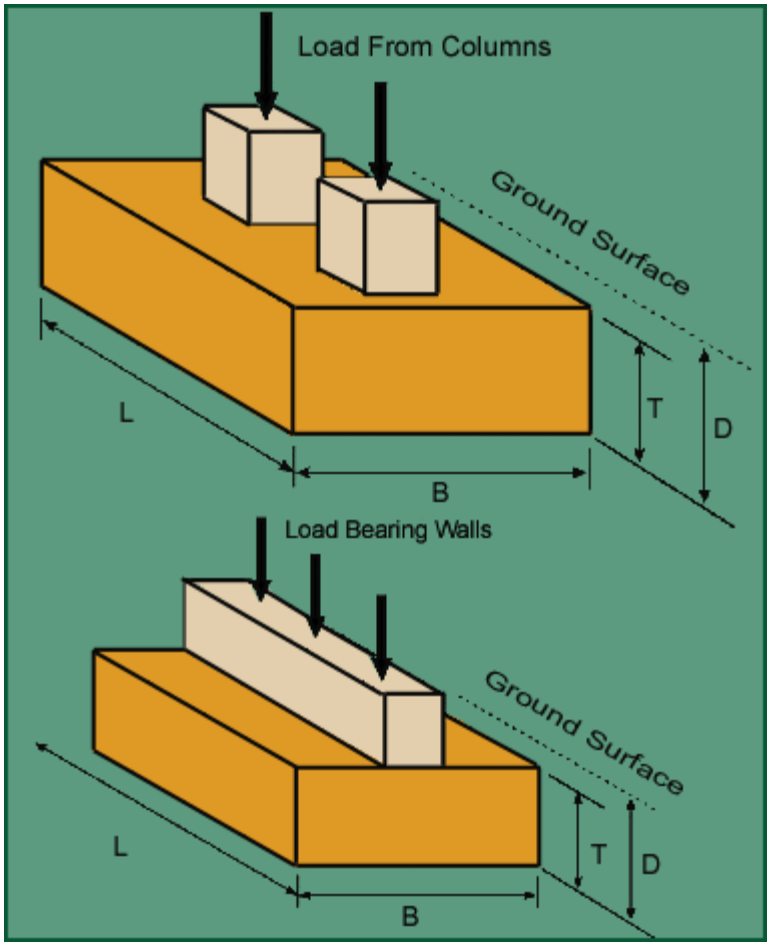


**Fig. 4.5 Strip footing**

**4. Mat or Raft footings:**

It is a large slab supporting a number of columns and walls under entire structure or a large part of the structure. A mat is required when the allowable soil pressure is low or where the columns and walls are so close that individual footings would overlap or nearly touch each other. Mat foundations are useful in reducing the differential settlements on non-homogeneous soils or where there is large variation in the loads on individual columns. In this there are two types:

**Conventional method**

In this excavation is done upto depth $D_f$ and then the concreting is done upto ground level. Then refilling is done with soil upto ground level. Refer fig. 4.6

$$q_{ulti} = q_{exc} + \gamma D_f$$

**Buoyancy type**

In this excavation is done upto depth $D_f$ and then the concreting of slab and beam is done to tie up the columns. Here, refilling with soil is not done. The void space is used as basement. Here the concept of floating footing is used.

Floating footing: Let density of soil be 1.8t/m $^3$ and height of first floor is 3m. But, there is void space below ground level upto 3m, soil is not refilled upto ground surface.

$$\gamma D_f = 5.4\ t/m^2$$

$q_{ulti} = q_{exc}$ due to buoyancy. So, we can put extra superstructure load of 5.4 t/m $^2$ to balance the loads. Then,

$$q_{ulti} = q_{exc} + (extra\ load\ equal\ to\ \gamma D_f)$$

So, no footing is required. This is a theoretical case.

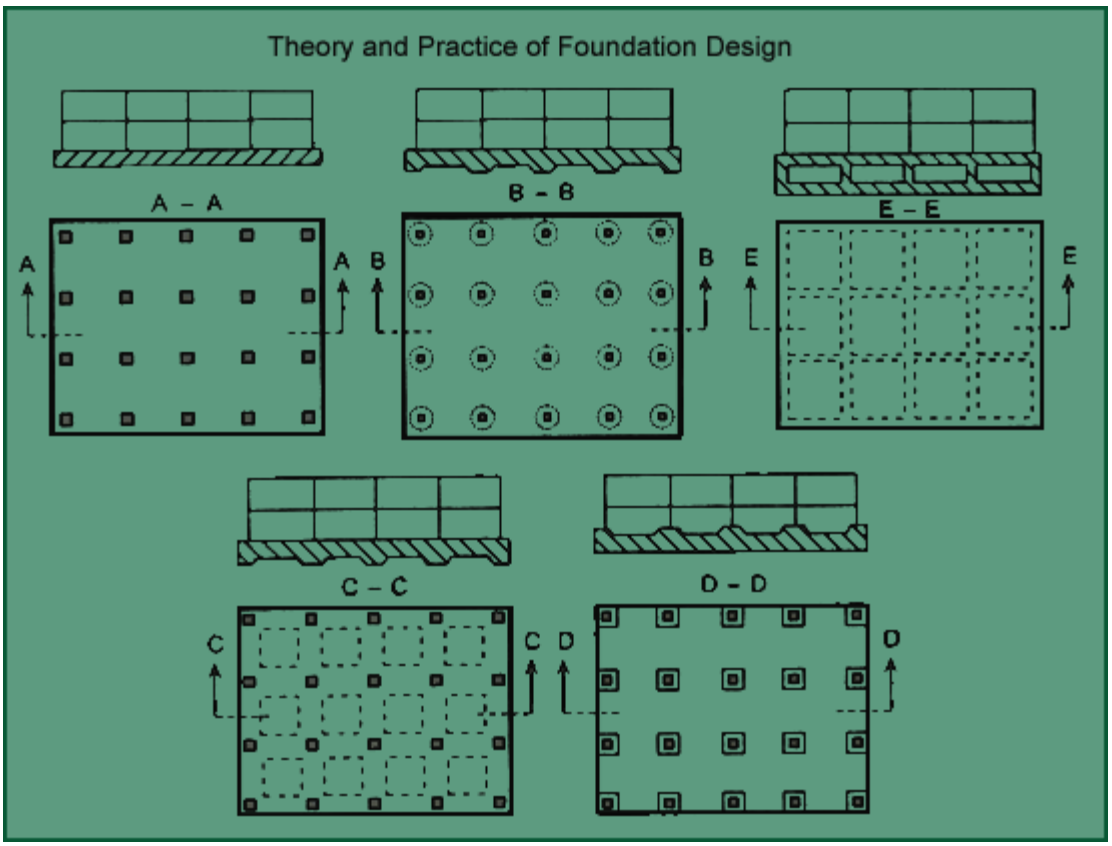


**Fig. 4.6 Typical Raft Foundation**

**Recap**

**In this section you have learnt the following**

- Spread Footing
- Strap Footing
- Strip/continuous footings
- Combined Footing
- Mat or Raft footings

**Congratulations, you have finished Lecture 16. To view the next lecture select it from the left hand side menu of the page**