



# **Chapter IV: Footings**

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# *Objectives*



- Identify the types of footings
- Design the different types of footings

# 1. Footings (Foundations)



## A. Definition



### *Definition*

Footings and other foundation units transfer loads from the structure to the soil or rock supporting the structure. Because the soil is generally much weaker than the concrete columns and walls that must be supported, the contact area between the soil and the footing is much larger than that between the supported member and the footing.

## B. 2. Types of footings

The type of foundation used will depend on a number of factors, including the type of structure, the soil conditions, and the load-bearing capacity of the soil.

Here are the following considerations for foundations:

- **Type of structure:** The type of structure will have a big impact on the type of foundation that is needed. For example, a small shed will not need as strong of a foundation as a large office building.
- **Soil conditions:** The soil conditions at the site will also play a role in determining the type of foundation that is needed. For example, if the soil is weak and unstable, then a deep foundation will be needed.
- **Load-bearing capacity of the soil:** The load-bearing capacity of the soil is the amount of weight that the soil can support without settling or failing. The load-bearing capacity of the soil will be determined by a geotechnical engineer.
- **Environmental impact:** The environmental impact of the foundation should also be considered. For example, some foundations may require the removal of trees or other vegetation.

Foundations may be broadly classified into two main categories, namely:

1. **Shallow foundation**

## 1. Footings (Foundations)

### 2. Deep foundation

#### 1. Shallow foundation:

If the depth of the foundation ( $D$ ) is equal to or less than its width ( $B$ ), then the foundation is said to be a shallow foundation.

These foundations are typically used when the soil near the ground surface has sufficient bearing capacity to support the structure.

They are commonly used for low-rise buildings, load-bearing structures, and structures with relatively lower weights.

Some of the common types of shallow foundations are listed below:

- **Isolated footing:**

Isolated footing, also known as individual footing, is used to support the individual columns of the structure. These footings have a square or rectangular pad at the base to distribute loads from the column to the underlying soil. Steel reinforcement is provided along both directions in the concrete pad.

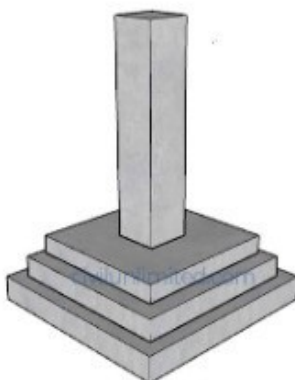
There are various types available in the isolated footing. They are,

- Isolated Pad footing
- Isolated Stepped footing
- Isolated tapered footing

Isolated footings are designed as one of the above footings based on varying factors like the load-bearing capacity of the soil, the weight of the column, the weight distribution of footing, etc.



Isolated Pad footing



Isolated Stepped footing



Isolated tapered footing

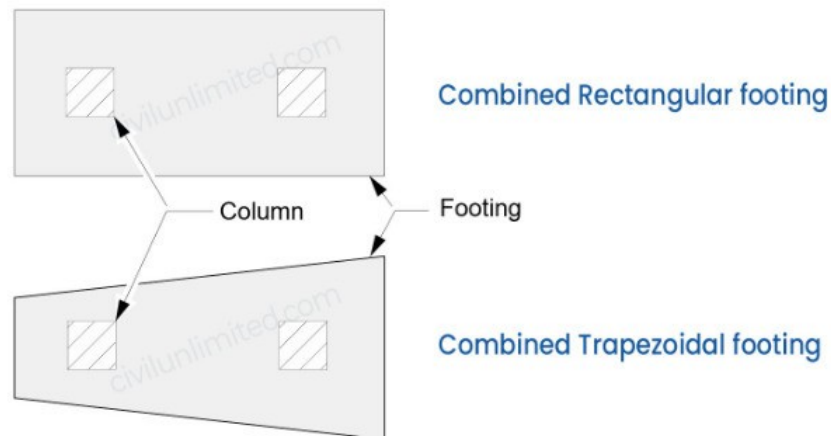
- **Combined footing:**

The footing that is commonly provided for two or more columns is known as a combined footing. This type of footing is provided when the required area for adjacent footings overlaps each other.

A combined footing is also provided when a dimension of footing is restricted when there is a property line nearby the footing. In that case, the restricted footing is connected to the adjacent internal column footing.

There are two types of combined footing available. They are,

- Combined rectangular footing
- Combined Trapezoidal footing



Combined rectangular footing is adopted when the load on the two columns which are connected by a footing are the same.

Combined trapezoidal footing is adopted when the load on one of the columns is less than the other one.

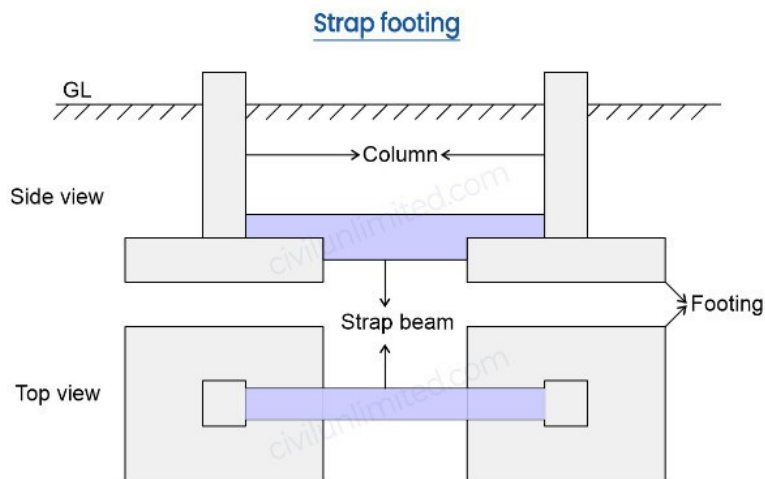
- **Strap footing:**

Strap footing, also known as connecting footing or cantilever footing, is a variation of combined footing that is used to connect two or more footing with a connecting beam called a strap beam.

The strap beam is used to distribute the load evenly to the two footings and provide additional stability to the footing.

We know that the combined footing is provided when a footing is located near the boundary line. But when the adjacent column is too far, we can't provide a narrow combined footing to a larger extent, because it creates an excessive bending moment.

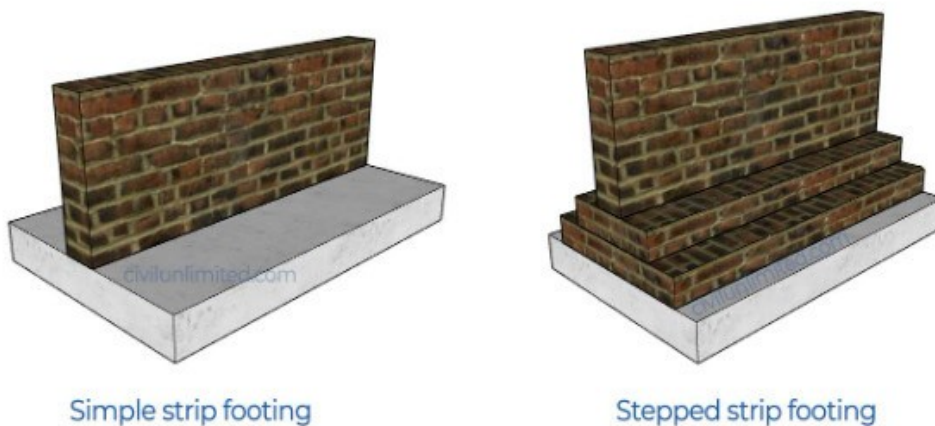
In that case, a strap beam is connected to two footing columns. This strap beam simply acts as a connecting beam and doesn't take any soil reaction. It simply transfers the load from a heavily loaded column to another one.



- **Spread footing:**

Spread footing is a common type of footing provided in buildings with low loads on walls.

A spread is given at the base of the foundation so that the load of the structure is distributed on a larger area of soil in such a way that the developed stress is within the safe bearing capacity of the soil. Spread footing is also known as strip footing, wall footing, or continuous footing because it contains a strip of concrete that supports the load-bearing wall. The spread footing may be either simple or stepped.



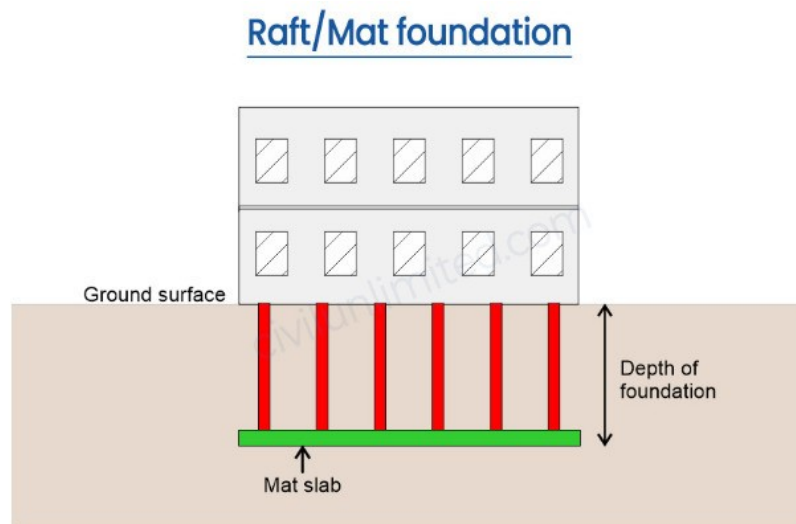
- **Raft footing:**

Raft / Mat footing consists of a large, continuous slab that connects all the columns and covers the entire area beneath the structure.

The mat footing distributes the load of the structure to a larger area, thus reducing the pressure on the soil and minimizing the settlement.







## 2. Deep foundation:

If the depth of the foundation ( $D$ ) is greater than its width ( $B$ ), then the foundation is said to be a deep foundation.

These foundations are typically used when the soil near the ground surface is loose and has a low bearing capacity, hence a need arises to go to a greater depth to reach the soil or rock with sufficient bearing capacity.

They are commonly used for high-rise buildings with relatively higher loads. The deep foundation is much more expensive than the shallow foundation so it must be used only when the shallow foundation is not feasible.

Some of the common types of deep foundations are listed below:

- Pile foundation
- Pier foundation
- Caisson foundation

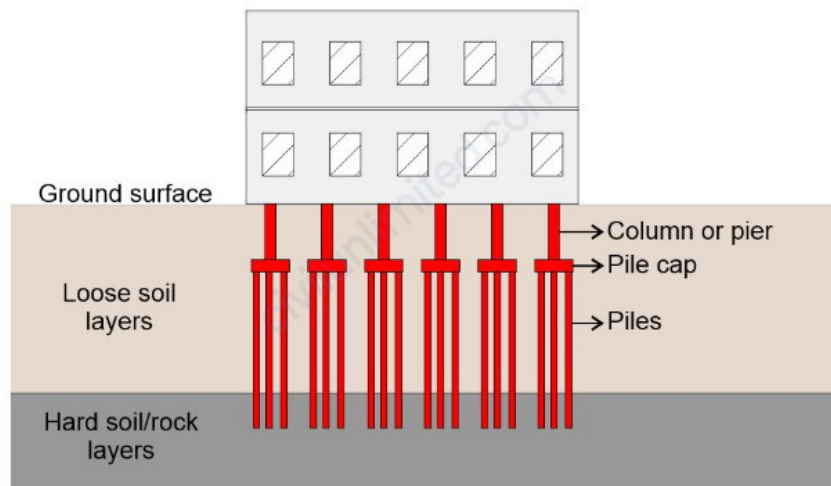
- **Pile foundation:**

Piles are long, slender structural elements resembling columns and can be constructed from materials such as concrete, steel, wood, and others.

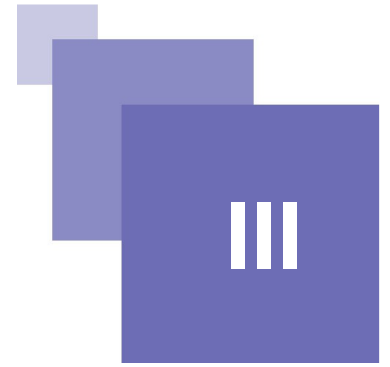
They are inserted into the ground to bear the load of the superstructure and transfer it to the solid rock or firm soil layers below.

Piles can either be premanufactured and driven into the ground or cast on-site. Typically, the piles are driven into the ground until they reach the firm strata.

## Pile foundation



# Bibliography



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Pearson Education Inc

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<https://civilunlimited.com/important-types-of-foundation-in-construction/>