

# Introduction to Infrastructural Engineering

## Introduction to Foundation Engineering

by

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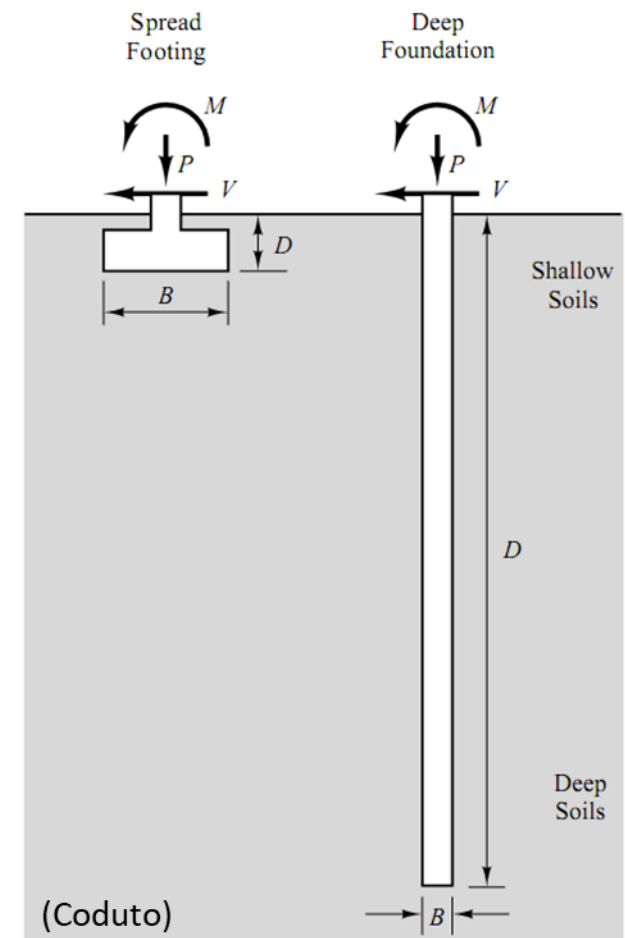
# Key Terms

- Foundation: structure that transmits loads to underlying soils.

Shallow Foundations  
( $D_f/B < 2.5-4.0$ )

Deep Foundations  
( $D_f/B > 4.0$ )

$D_f$  = Embedment Depth  
 $B$  = Characteristic Length



# Key Terms

- **Bearing Capacity ( $q$ ):** Pressure that a soil can support (soil property)
- **Ultimate bearing capacity ( $q_{ult}$ ):** Max. pressure soil can support (determined by analysis)
- **Net bearing capacity ( $q_{net}$ ):** Max. pressure soil can support above current overburden pressure (account for embedment effect)
- **Allowable bearing capacity ( $q_{all}$ ):** Design soil bearing pressure
$$q_{all} = \frac{q_{net}}{F.S.}$$
- **F.S. = Factor of Safety (2.5 – 3.5) (Allowable Stress Design)**

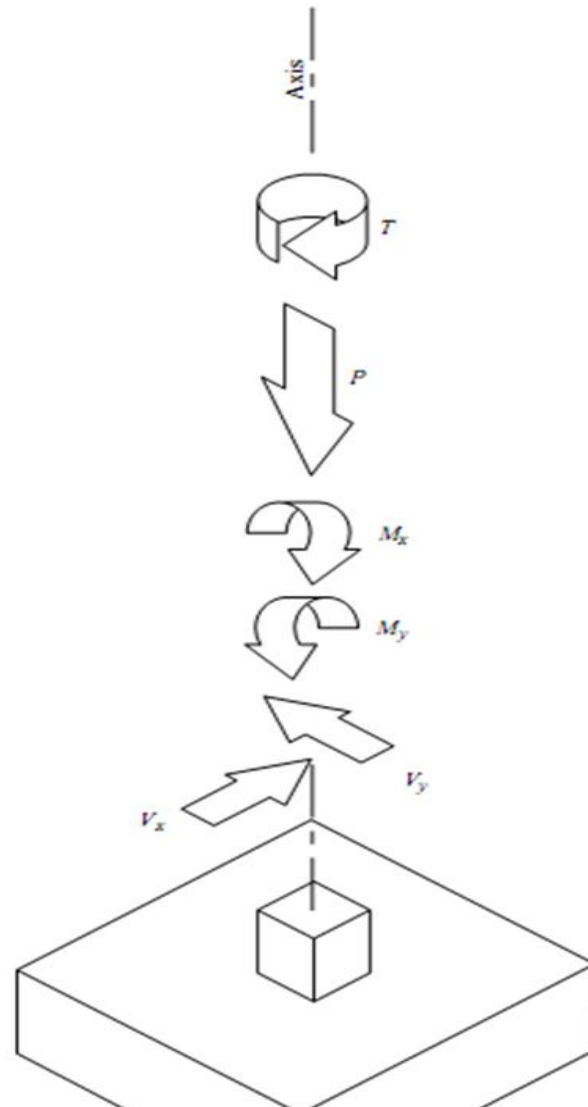


# Types of Foundation Loads

- 1) Normal Loads
- 2) Shear Loads
- 3) Moment Loads
- 4) Torsion Loads

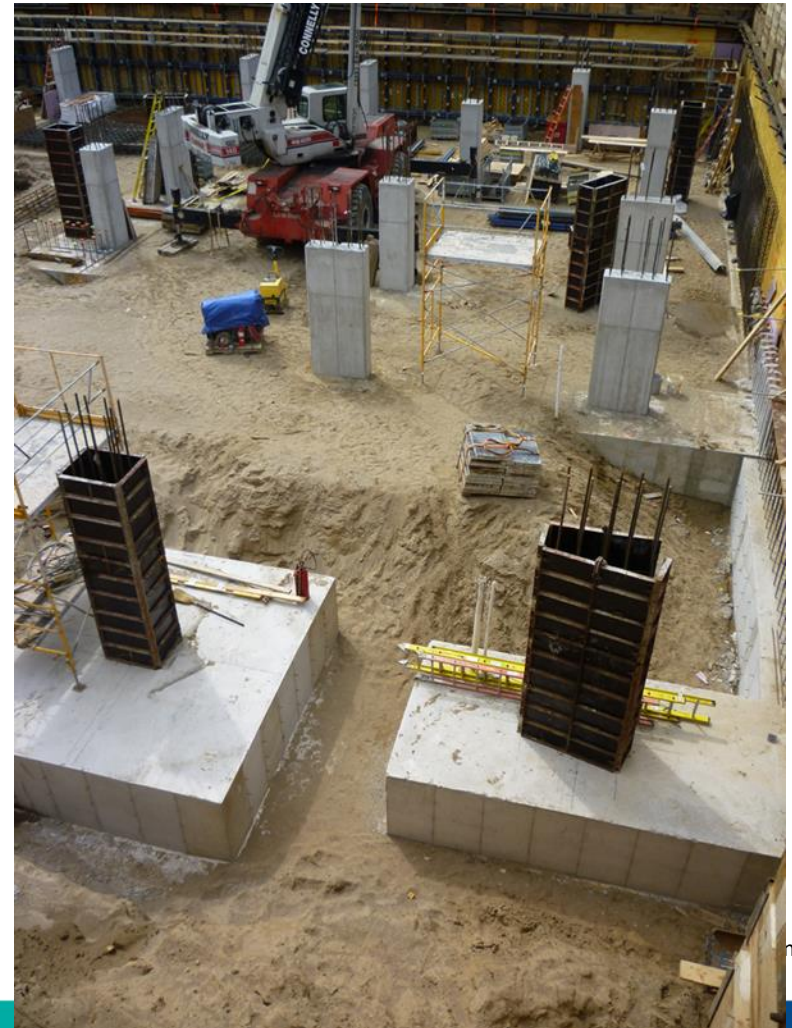
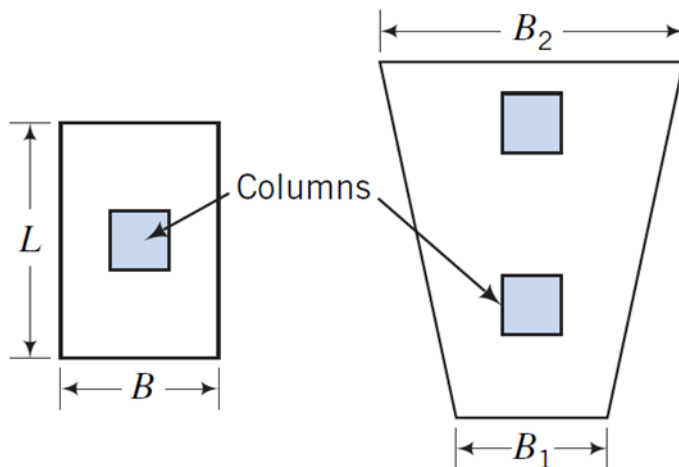
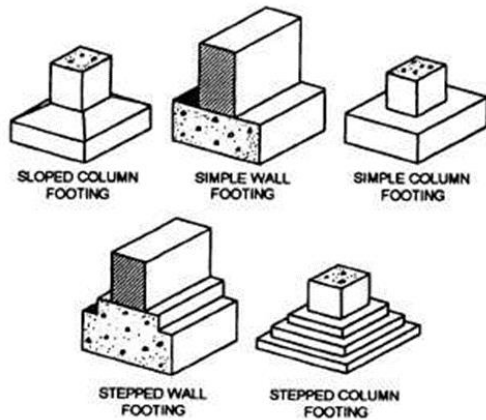
Load Sources:

- |                     |                              |
|---------------------|------------------------------|
| 1) Dead Loads       | 8) Impact Loads              |
| 2) Snow Loads       | 9) Temperature Induced Loads |
| 3) Earth Pressure   | 10) Stream/Ice Loads         |
| 4) Fluid Loads      | 11) Centrifugal/Braking      |
| 5) Earthquake Loads | 12) Shear Loads              |
| 6) Wind Loads       |                              |



# Shallow Foundation Types

## Spread Footing (column loads)



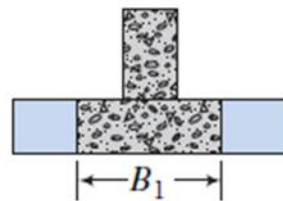
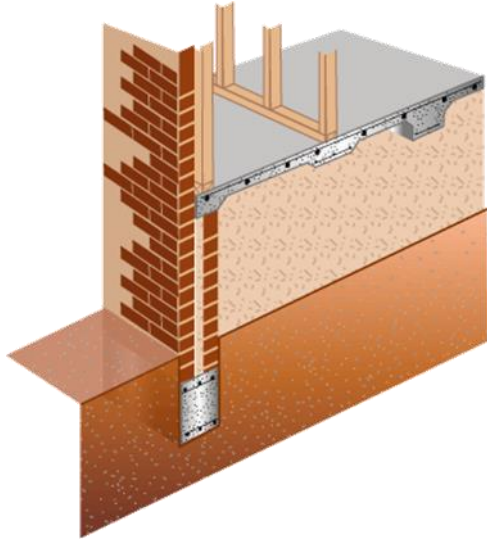
# Shallow Foundation

- 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](#).
- A [spread footing](#) foundation, which is typical in residential building, has a wider bottom portion than the load-bearing foundation walls it supports. This wider part "spreads" the weight of the structure over more area for greater stability.

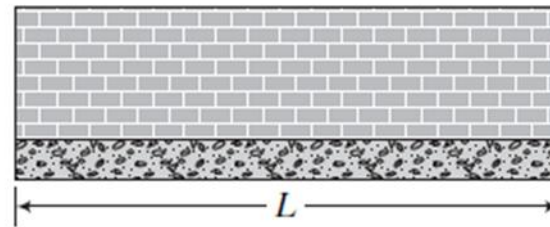


# Shallow Foundation Types

Strip Footing (wall loads)



(b) Combined



(c) Strip →

# Strip footing

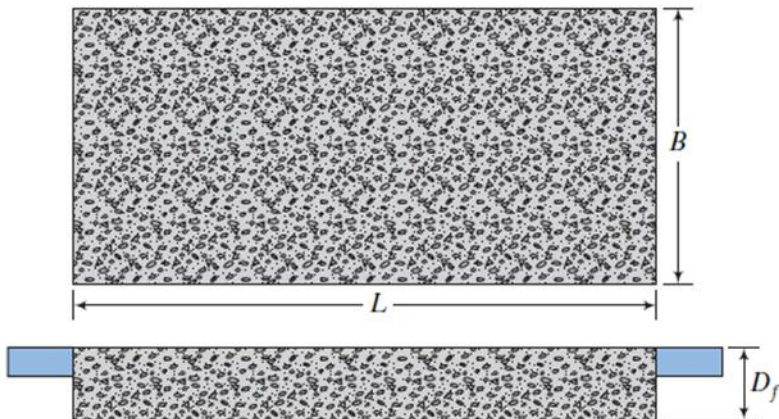
- A wall **footing** or **strip footing** is a continuous **strip** of concrete that serves to spread the weight of a load-bearing wall across an area of soil. It is the component of a shallow **foundation**. **Wall Footing.**





# Shallow Foundation Types

## Mat (Raft) Foundation (floor loads)



(d) Mat or Raft



# Mat Foundation

- Mat-slab foundations, are used to distribute heavy column and wall loads across the entire building area, to lower the contact pressure compared to conventional spread footings.



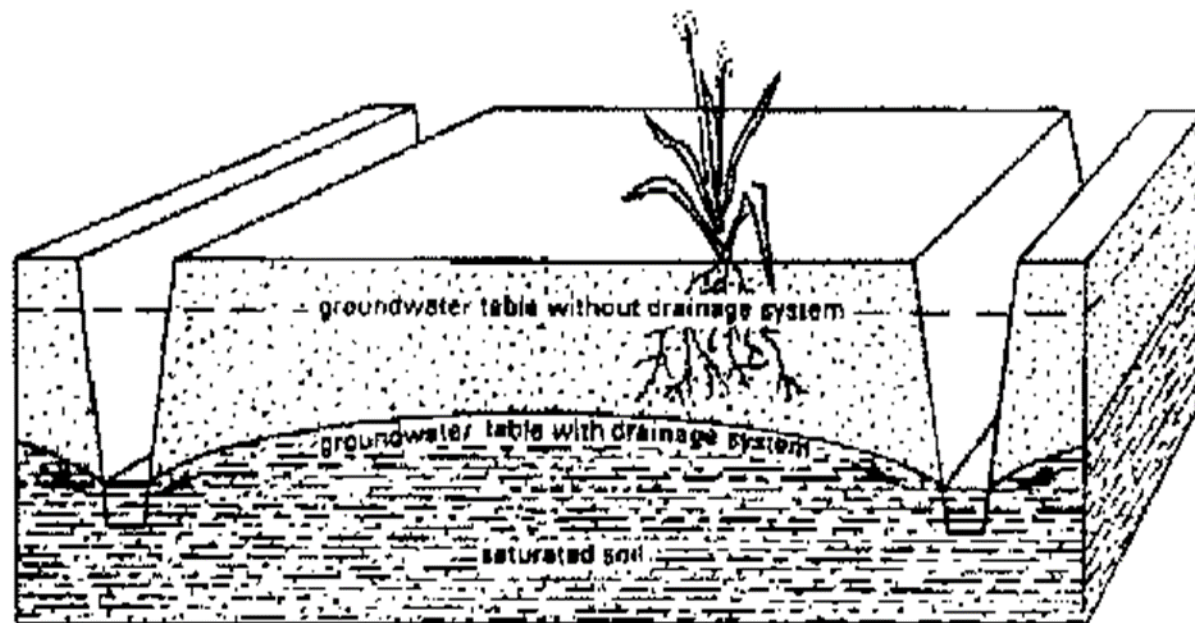
# Deep Foundations

A **pile** is a vertical structural element of a deep **foundation**, driven deep into the ground at the building site.

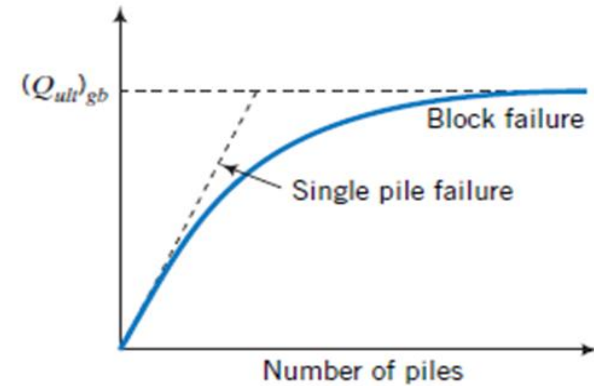
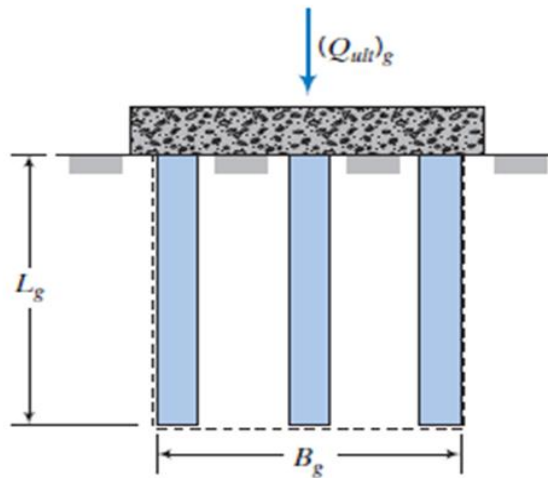
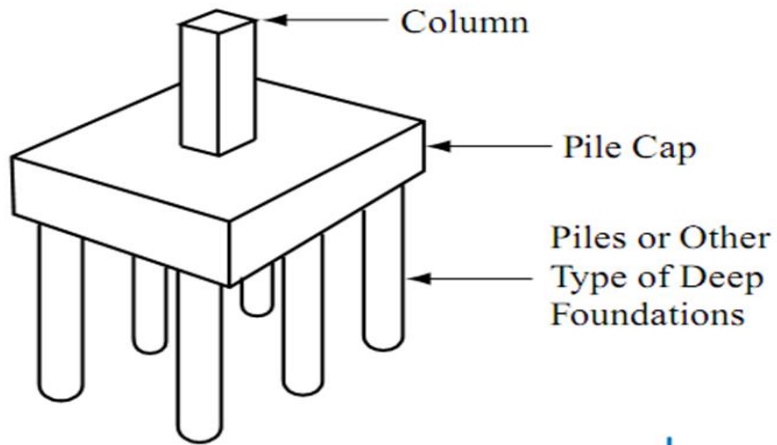


# Sub-Surface Drainage Using Ditches

Fig. 99. Control of the groundwater table by means of deep open drains



# Pile Groups



**FIGURE 10.12** Block failure mode.