Kurdistan Region - Iraq
University of Cihan – Sulaymaniyah
Department of Architectural Engineering

Building Elements
(Foundations)

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Introduction of Building Elements

- The basic components of a building structure are the **foundation**, **floors**, **walls**, **beams**, **columns**, **roof**, **stair**, etc. These elements serve the purpose of supporting, enclosing and protecting the building structure.

Introduction of Building Elements

Figure.1: Basic components of building

- There Mentioned below are the 12 basic elements a building structure.

1. Foundation
2. Plinth
3. Plinth Beam
4. Stairs
5. Floor
6. Walls
7. Damp proof course (DPC)
8. Columns
9. Beams
10. Lintels
11. Parapet
12. Roof

1.Building structure:

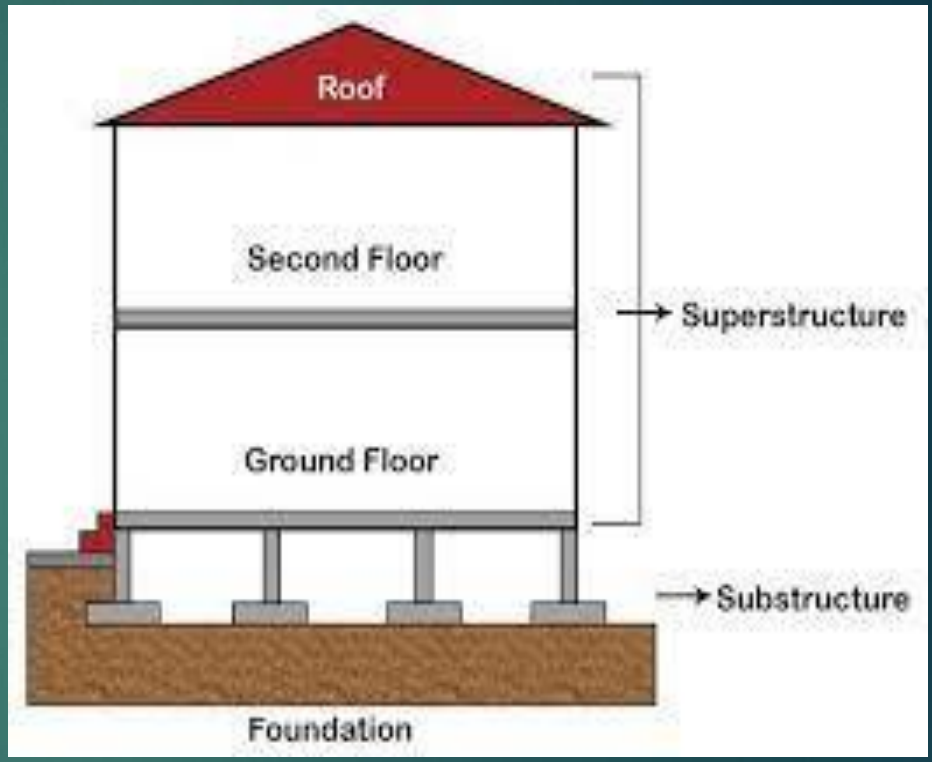


Figure.2: Types of the Building structure.

1.Foundation:

The Foundation is a structural unit that uniformly distributes the load from the superstructure to the underlying soil. This is the first structural unit to be constructed for any building construction. A good foundation prevents settlement of the building.

• The basic function of foundation • To Transmit the load from building to the subsoil, in such a way that • settlement are within permissible limit • the soil does not fail in shear Reduce the load intensity • Even distribution of load Provide level surface

2. The FACTORS AFFECT THE CHOICE OF A FOUNDATION

a- Primary Factors affect the choice of a foundation type for a building are:

- Subsurface soil and groundwater conditions.
- Structural requirements, including foundation loads, building configurations, and depth.

b-Secondary factors that may be important include:

- Construction methods, including access and working space.
- Environmental factors, including noise, traffic, and disposal of earth and water.
- Building codes and regulations.
- Time available for construction.
- Construction risks.

3.Types of Foundations

A. Shallow foundations

- Strip footing (Wall footing)
- Single Column footing (Isolated footing)
- Combined footing
- Strap footing
- Mat foundation

B. Deep foundations

- Pile
- Well or caissons

Shallow VS Deep foundations:

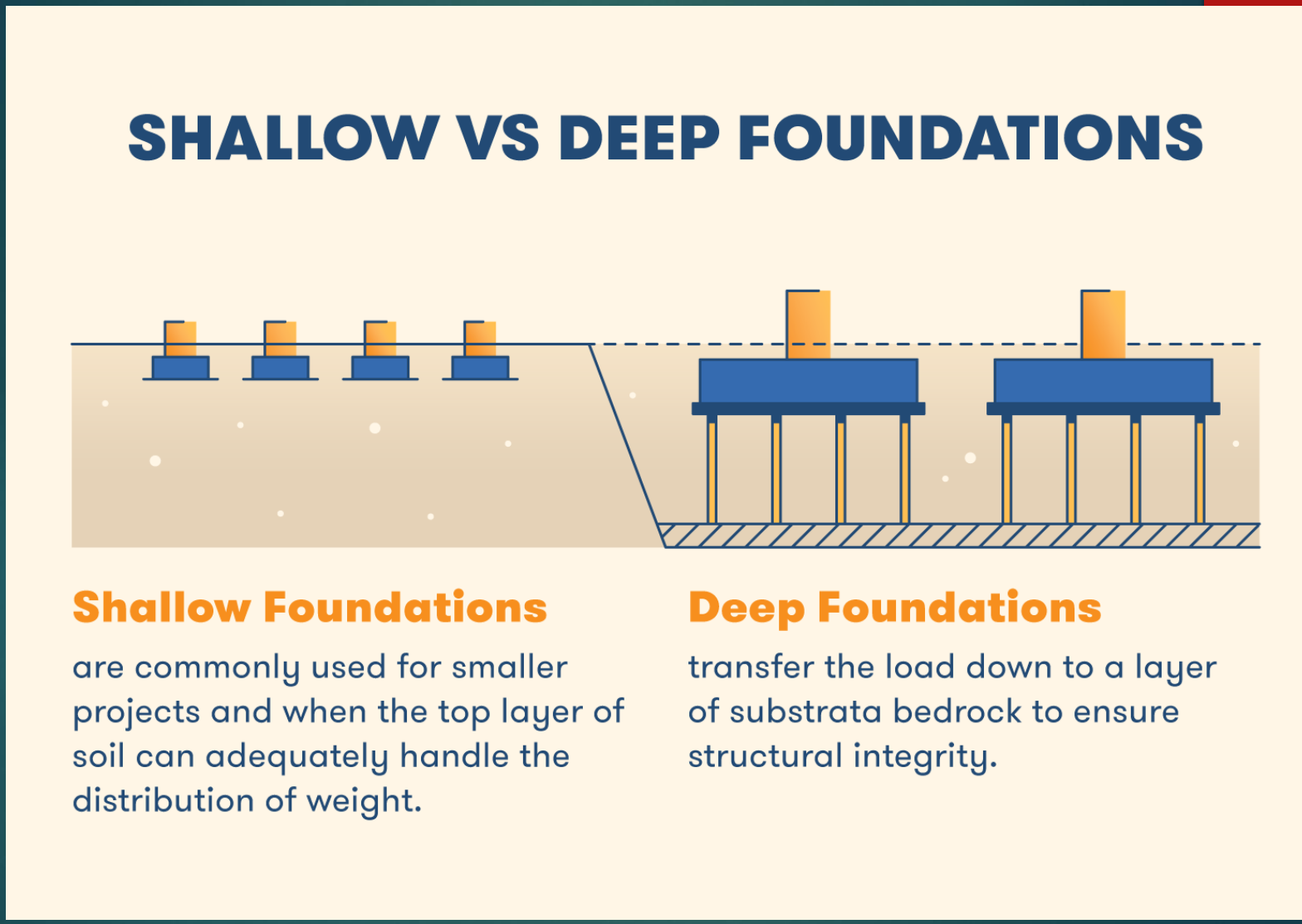


Figure.3: comparison between Shallow & Deep foundations.

A. Shallow foundations:

- A **shallow foundation** is a type of building **foundation** that transfers **structural load** to the earth very near to the surface, rather than to a subsurface layer or a range of depths, as does a **deep foundation**. Usually, a shallow foundation is considered as such when the **width** of the entire foundation is **greater than** its **depth**.

- In comparison to **deep foundations**, **shallow foundations** are **less technical**, thus making them more **economical** and generally used for relatively **light structures**.

- **Shallow foundations:**

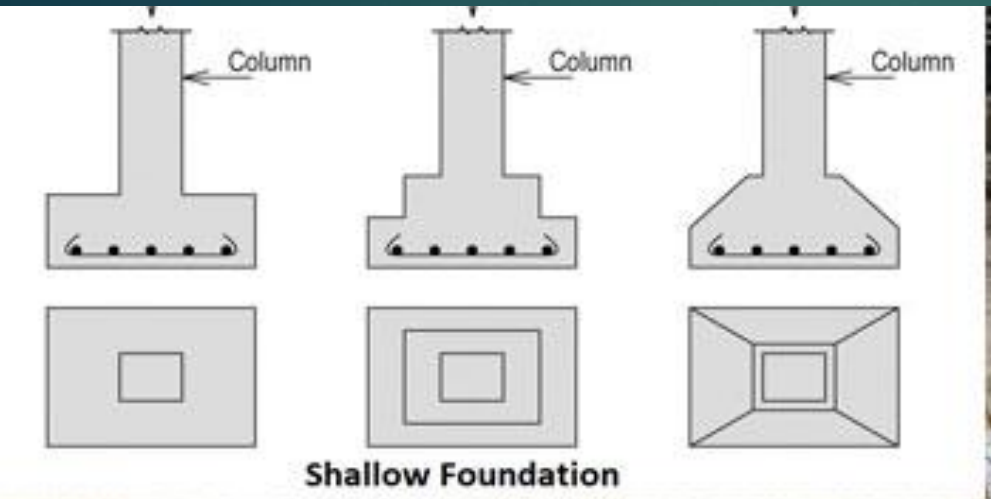
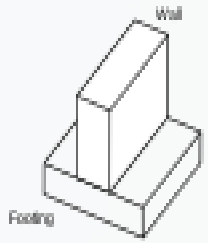


Figure.4: Shallow foundations.

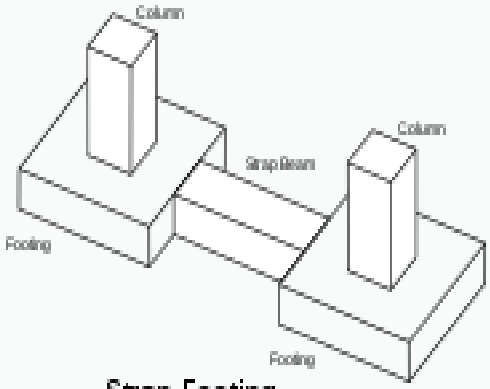
- **Types of Shallow foundations:**

- Strip footing (Wall footing)
- Single Column footing (Isolated footing)
- Combined footing
- Strap footing
- Raft / Mat foundation

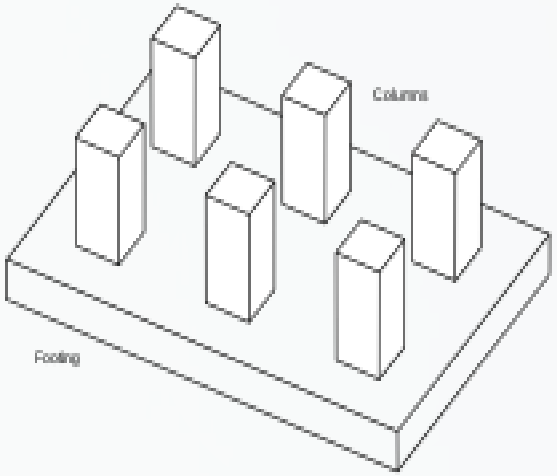
- **Types of Shallow foundations:**



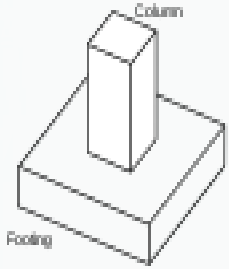
Wall Footing



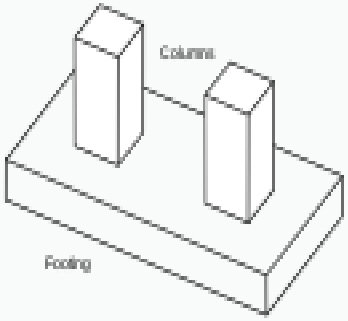
Strap Footing



Mat Foundation



Isolated Footing



Combined Footing

Figure.5: Types of Shallow foundations.

- **Strip footing (Wall footing):**

This footing is a **continuous strip** that supports structural and non-structural load bearing walls. Found **directly under the wall**, Its width is commonly **2-3 times** wider than **the wall** above it.

Figure.6: Strip footing.

- **Single Column footing (Isolated footing)**

It is a **square, rectangular, or circular slab** that supports the structural members individually and also, it is an **economic** type. Sometimes, an isolated footing can be **sloped or stepped** at the base to spread greater loads. This type of footing is used when the **structural load** is **relatively low**, columns are widely spaced, and the soil's bearing capacity is adequate at a shallow depth.

Figure.7: Single column footing.

- **Combined footing:**

It Used when the **spacing of the columns** is too **restricted**, that if isolated footing were used, they would overlap one another.

When the **load** among the columns is **equal**, the combined footing may be **rectangular**. In opposition, when the load among the columns is **unequal**, the combined footing should be **trapezoidal**.

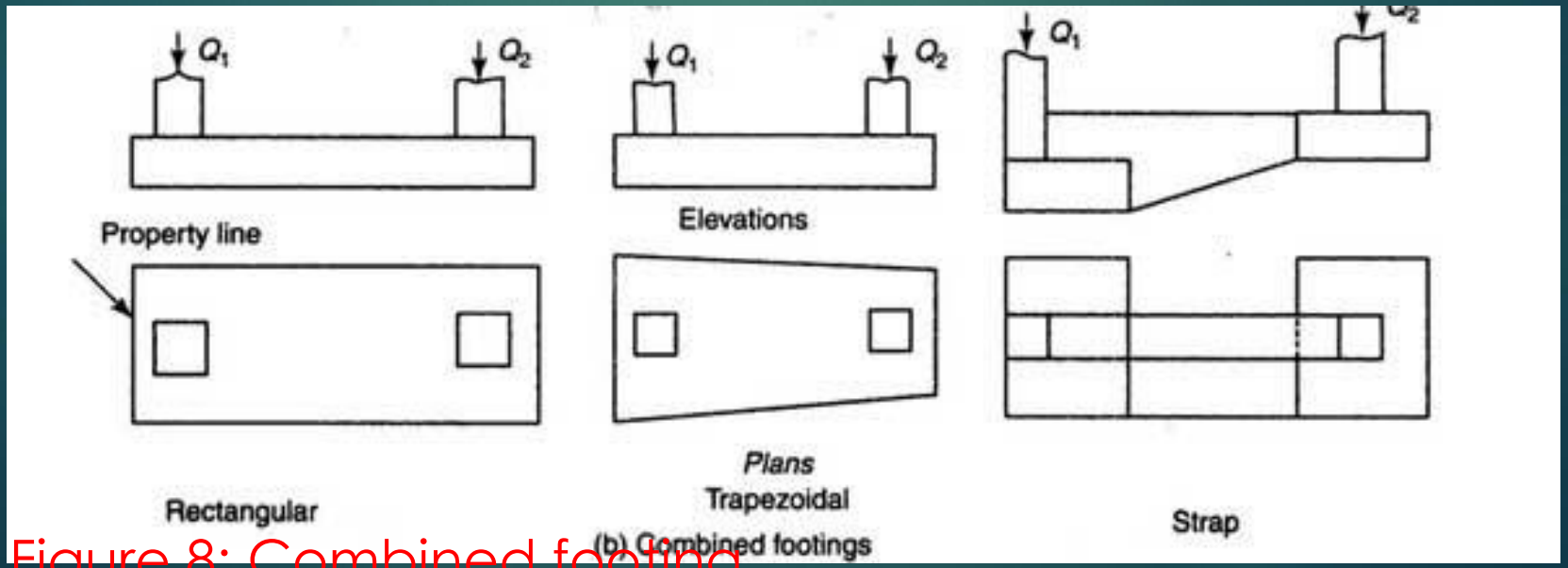


Figure.8: Combined footing.

- **Combined foundation:**

Figure.9: Combined footing.

- **Strap footing:**

A strap footing is when **individual columns** are connected to one another with the use of **a strap beam**. The general purpose of a strap footing is alike to those of a combined footing, where **the spacing is possibly limited** and/or the columns are adjacent to the property lines.

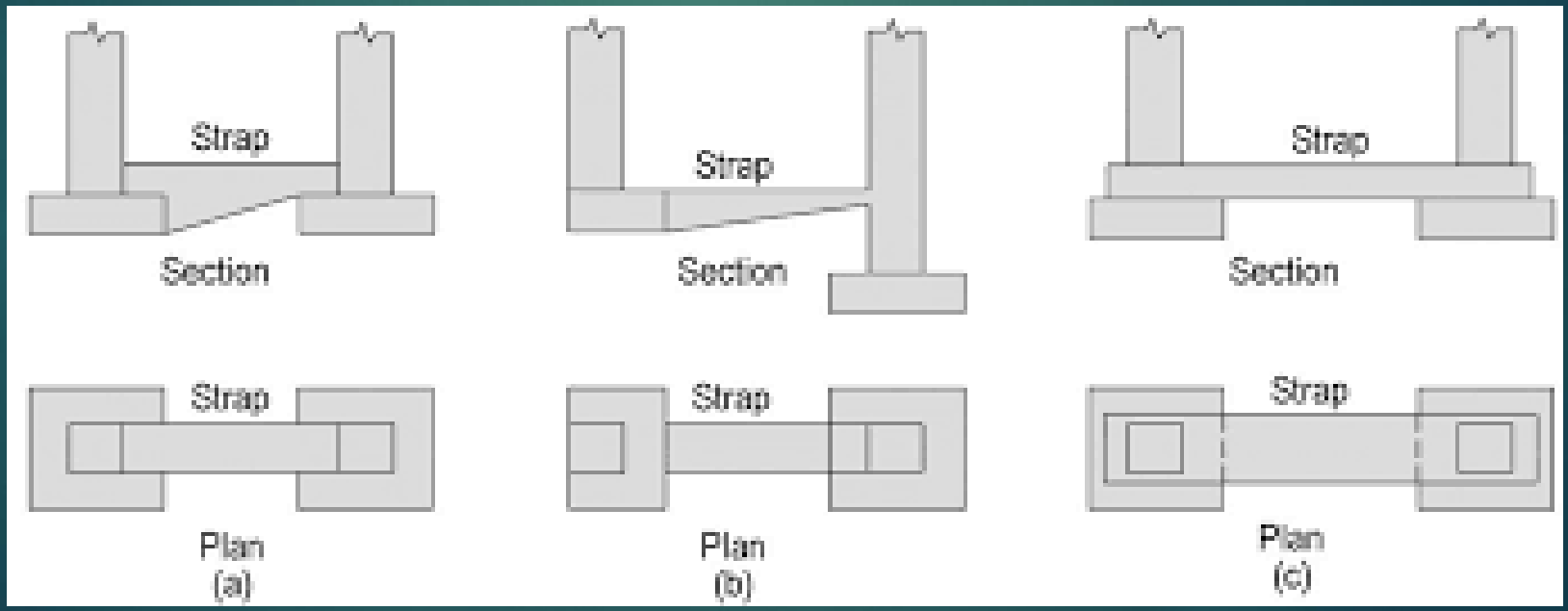


Figure.10: strap footing.

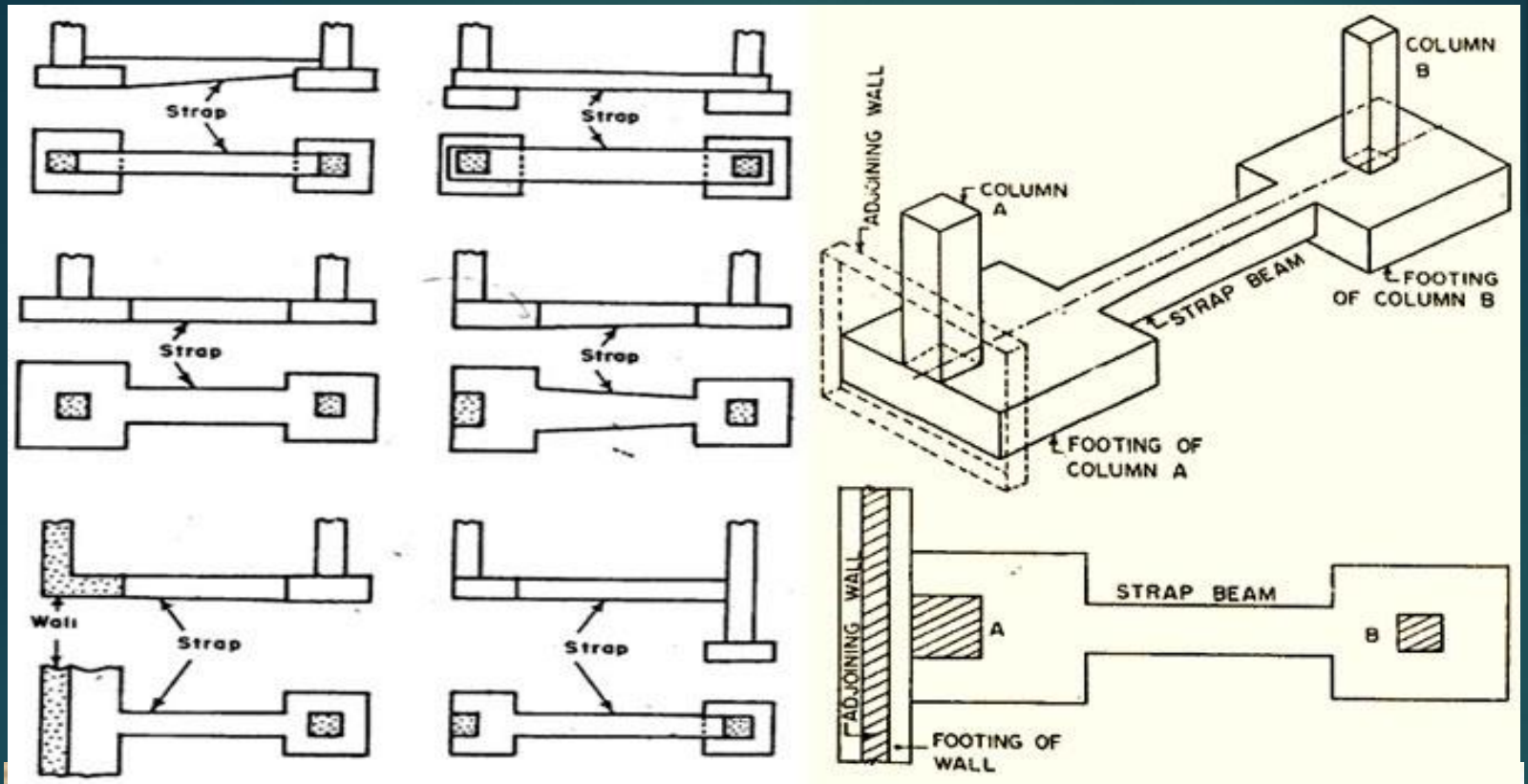


Figure.11: strap footing.

- **Raft / Mat foundation:**

A it is a **single continuous slab** that covers the whole of the base of a building. Mat foundations **support all the loads of the structure** and transmit them to the ground evenly. Soil conditions may prevent other footings from being used. Since this type of foundation **distributes the load** coming from the building **uniformly** over a considerably large area, it is favored when individual footings are unworkable due to the **low bearing capacity of the soil.**

Mat (Raft) Foundations types

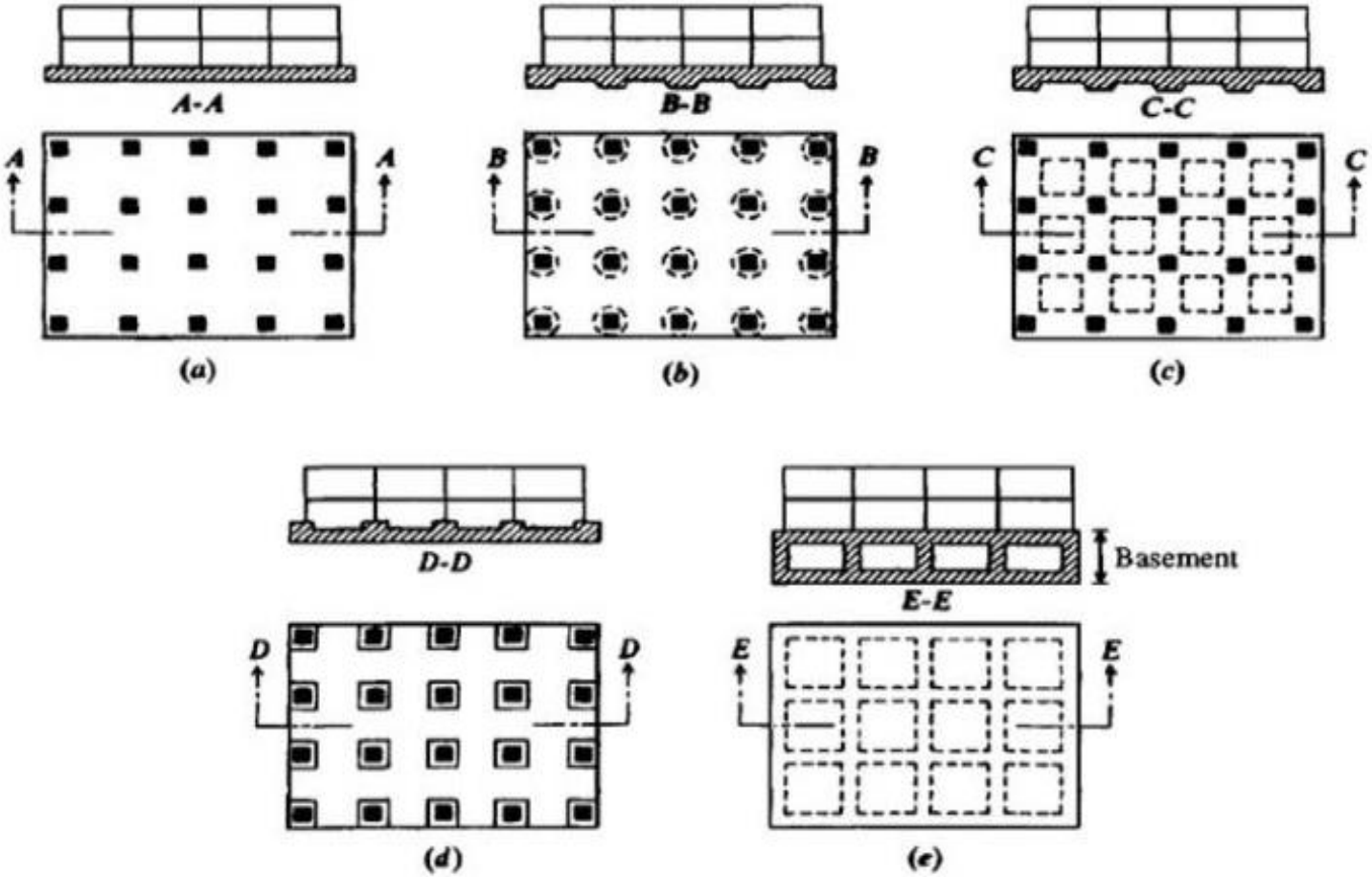


Figure.12: (a) flat plate; (b) plate thickened under columns; (c) waffle slab; (d) plate with pedestals; € basement walls as part of mat.

Figure.13: Raft foundation.

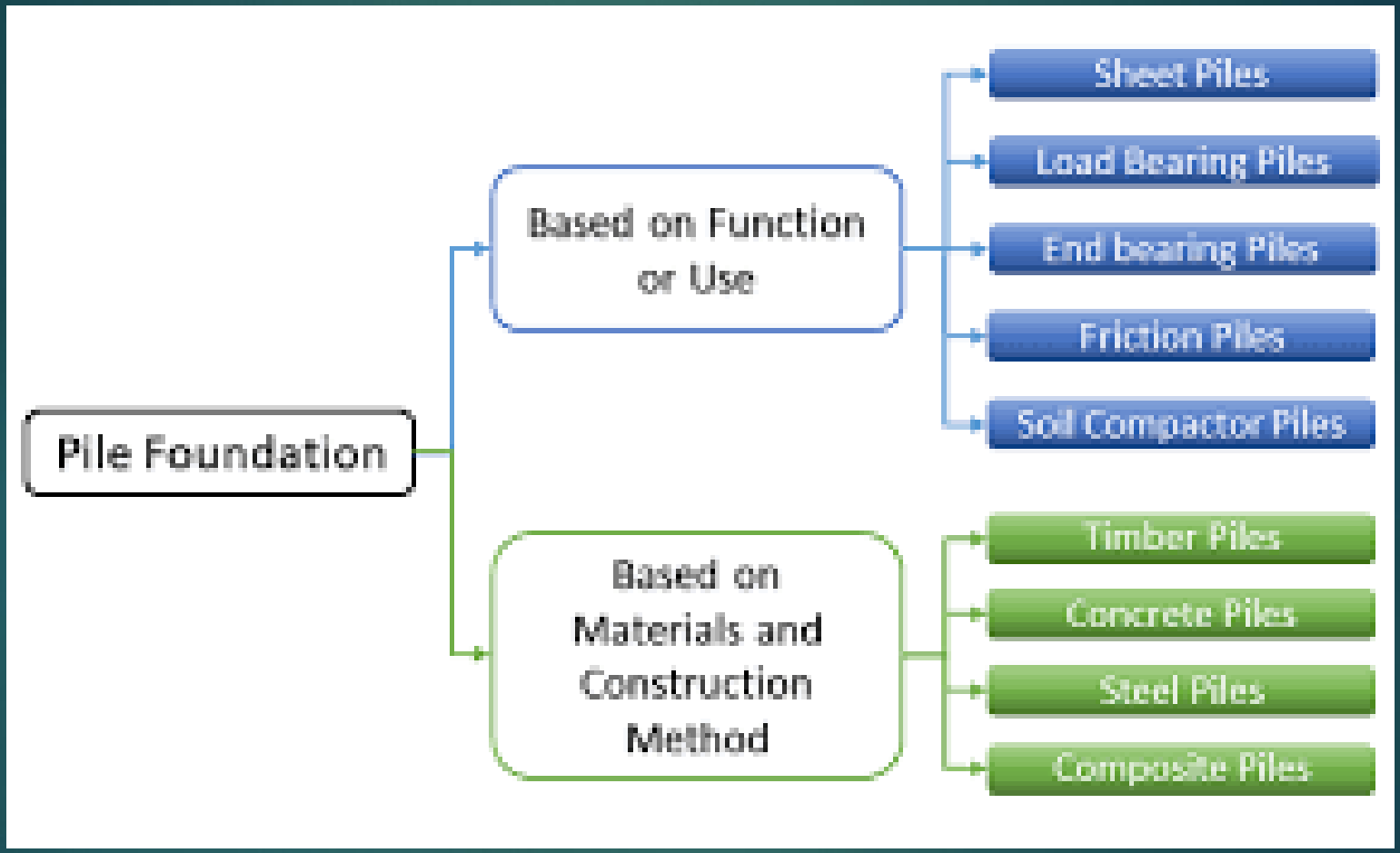
B. Deep foundations:

- A **deep foundation** is a type of foundation that transfers building loads to the earth farther down from the surface than a **shallow foundation** does to a subsurface layer or a range of depths. A pile or piling is a vertical structural element of a deep foundation, driven or drilled deep into the ground at the building site.
- There are many reasons that a geotechnical engineer would recommend a deep foundation over a shallow foundation, such as for a **skyscraper**. Some of the common reasons are very **large design loads**, a **poor soil** at shallow depth, or site constraints like property lines. Deep foundations can be made out of timber, steel, reinforced concrete or prestressed concrete.

- **Pile foundation:**
  - It is a long (slender) vertical load transferring member made of timber, steel or concrete.

Figure.14: Pile foundation.

- **Types of Pile foundation:**



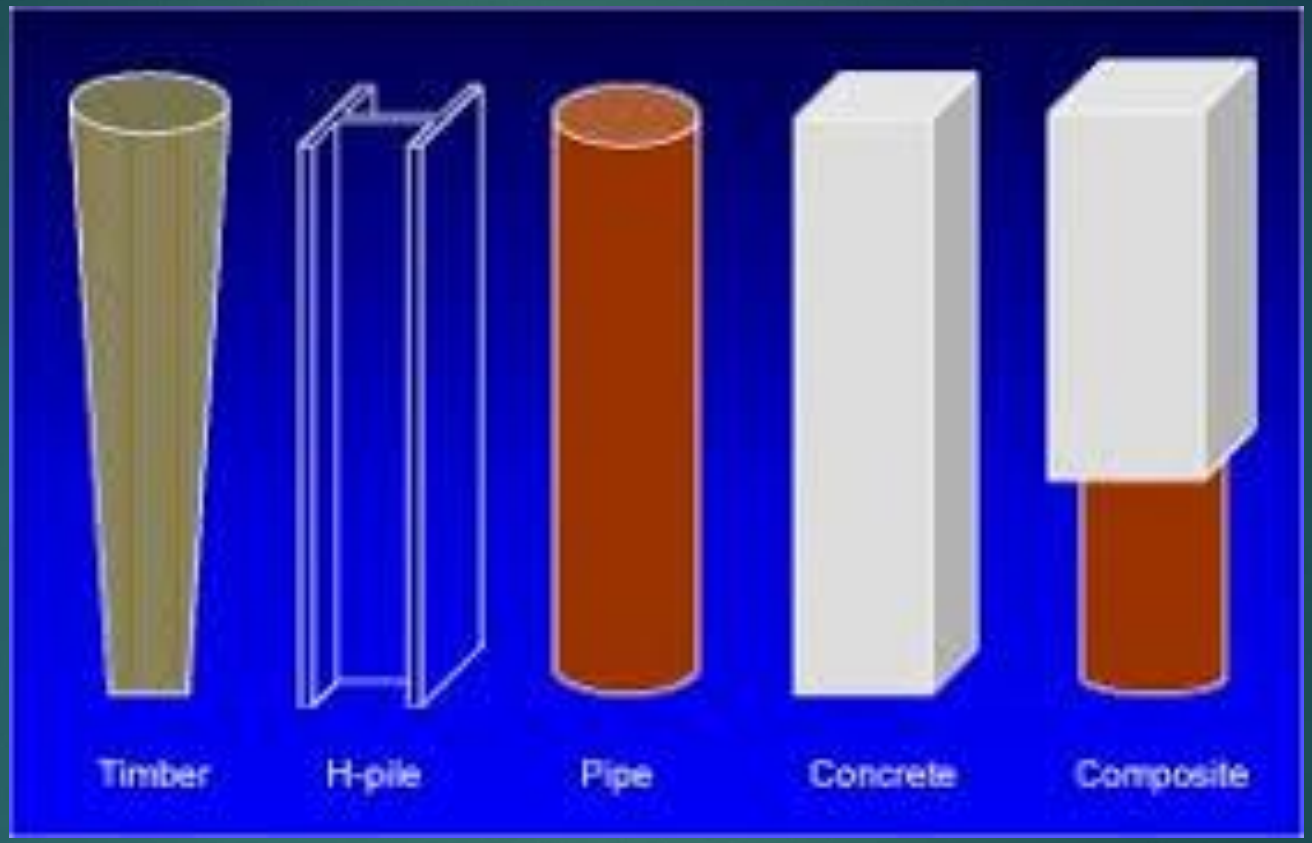
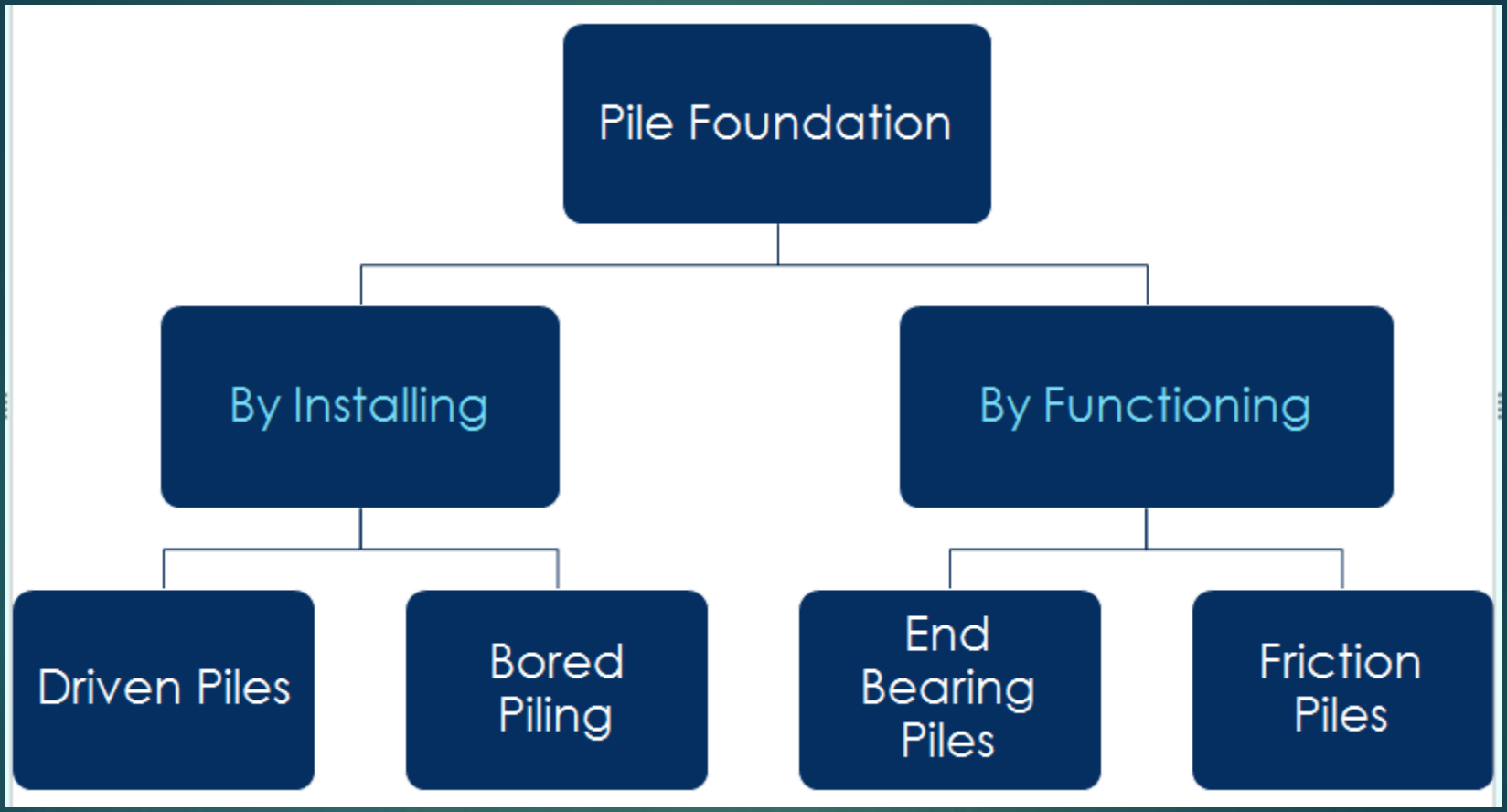


Figure.15: Types of Pile foundation according to the materials .


Pile Foundation
By Installing
By Functioning
Driven Piles
Bored Piling
End Bearing Piles
Friction Piles

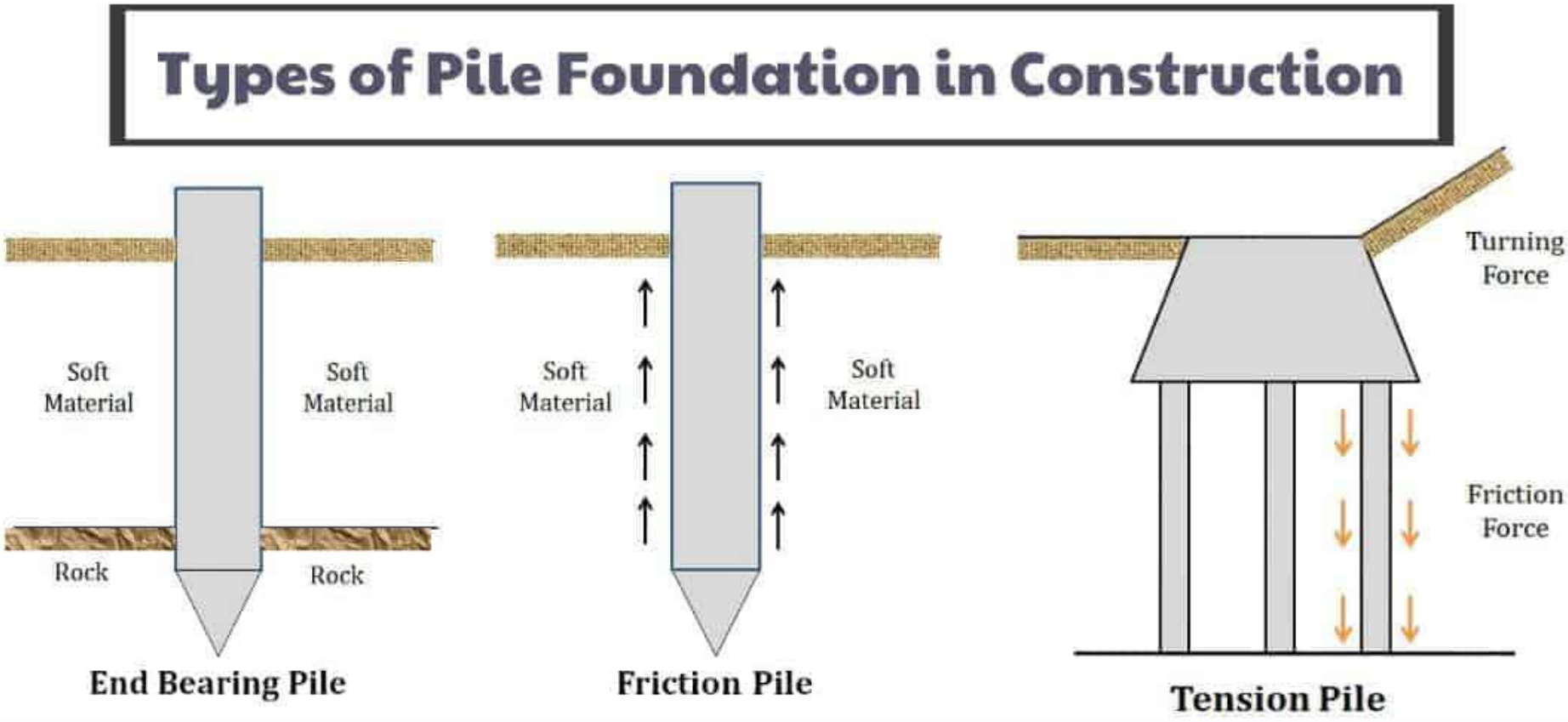
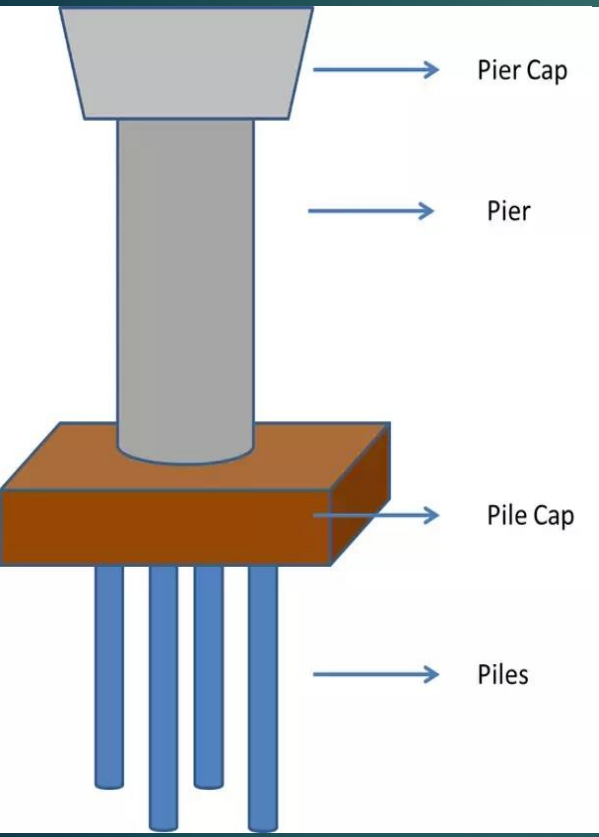


Figure.16: Types of Pile foundation according to the functions .

- **Pier foundation:**
  - A pier is a vertical column of relatively large cross-section than a pile.



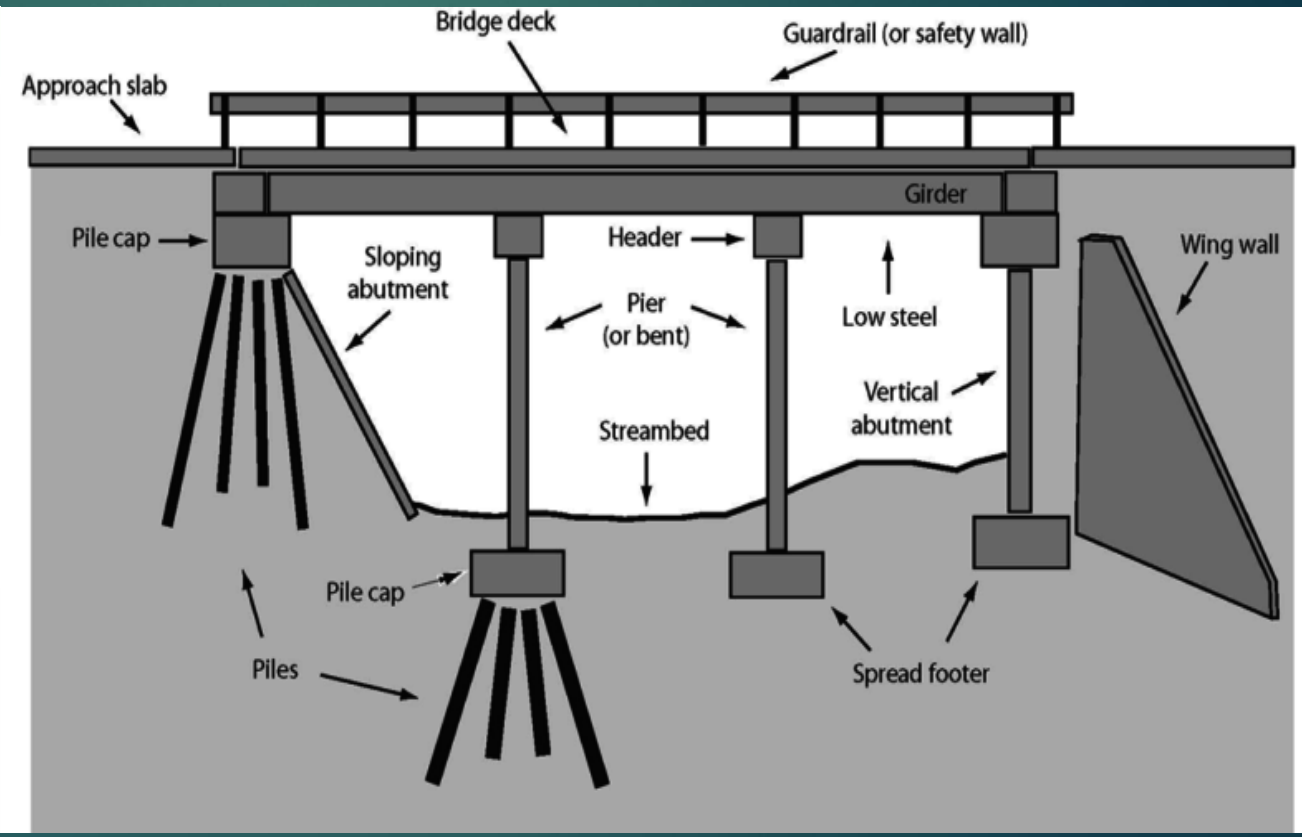


Figure.17: Pier foundation .

- **Caisson foundation:**

- A caisson is a type of foundation of the shape of hollow prismatic box, which is built above the ground and then sunk to the required depth as a single unit.
- • Economics • Minimizes pile cap needs • Slightly less noise and reduced vibrations • Easily adaptable to varying site conditions • High axial and lateral loading capacity.
- Disadvantages of Caissons: • Extremely sensitive to construction procedures • Not good for contaminated sites • Lack of construction expertise • Lack of Qualified Inspectors

- **Caissons (well) foundation:**

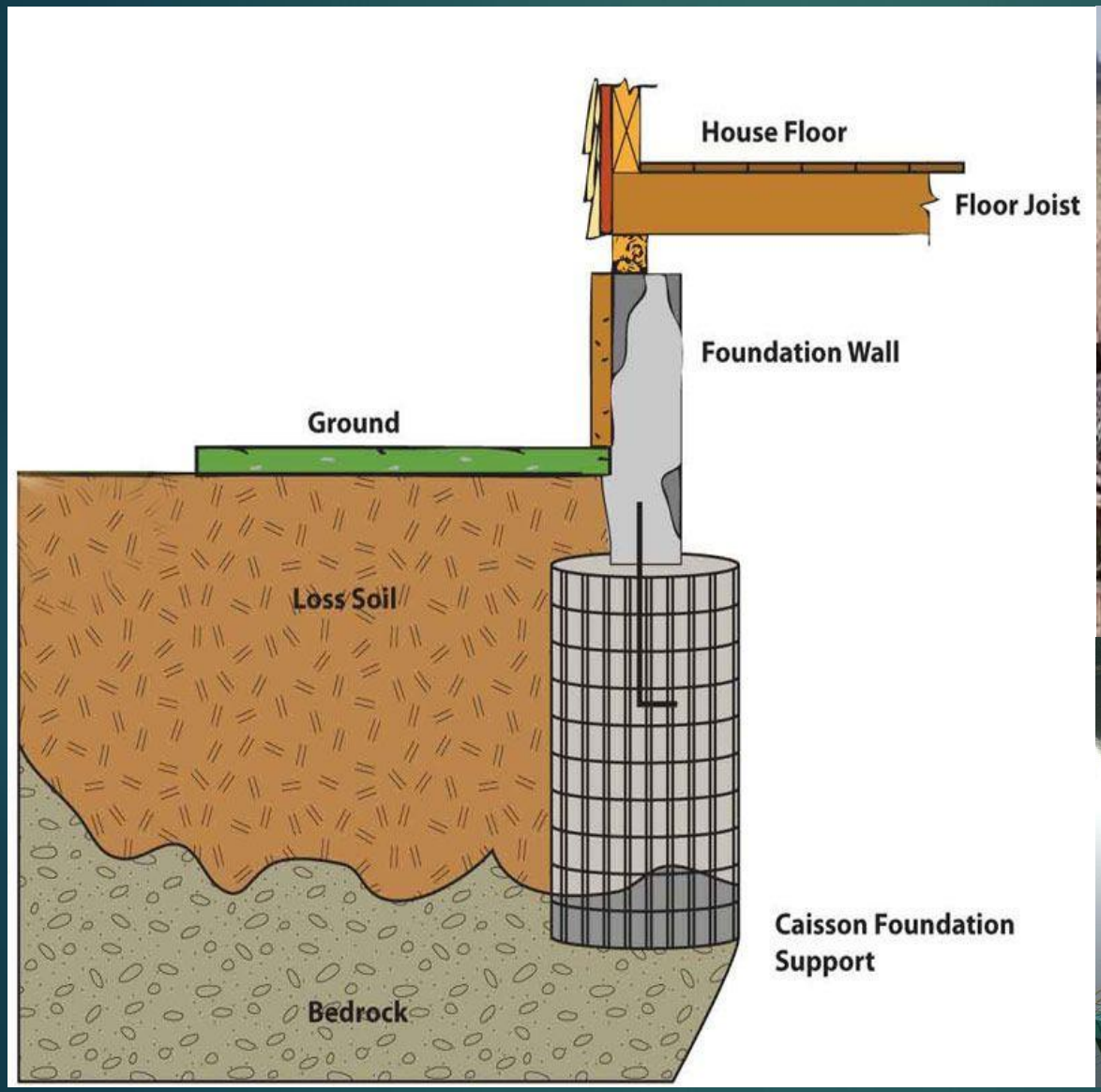


Figure.18: Well foundation .

- **Caissons (well) foundation:**

Figure.19: Caissons foundation .

Thank You

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