THEORY AND ACTIVITIES MODULE 3

(3th week)

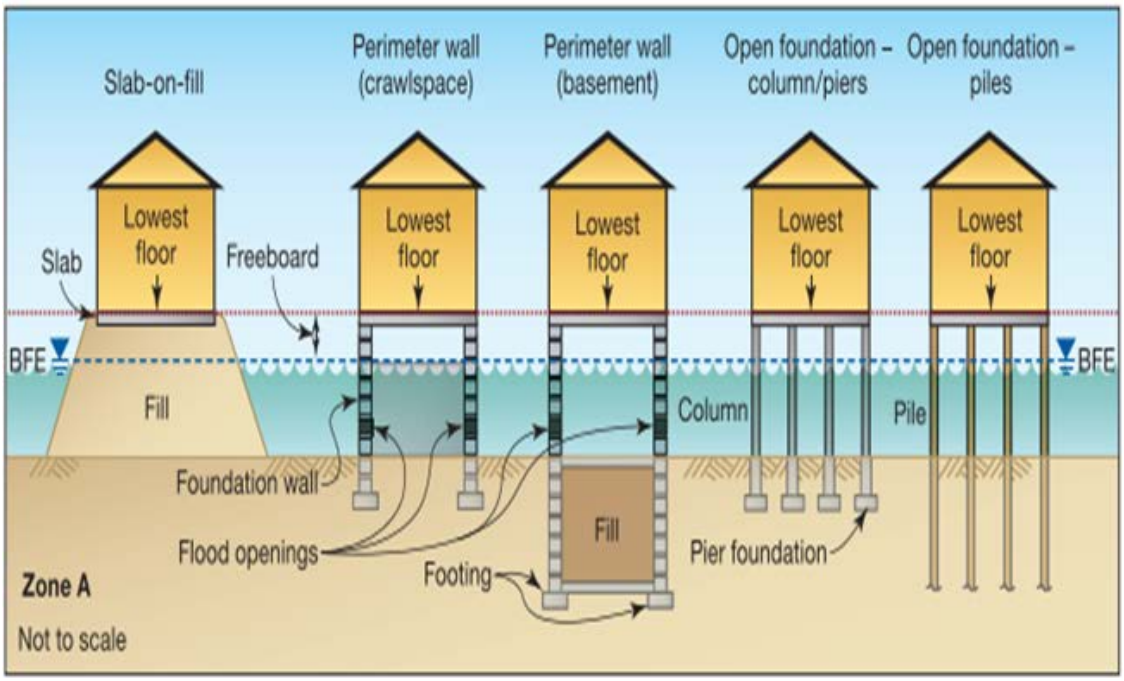
CONTENTS:

ACTIVITIES:

A. **Read the text below once to understand the general meaning.**
B. **Read the text again out loud, checking the audio of terms. Repeat the text (or chunks of texts) when you find yourself stumbling over words. Do it several times until you can read it fluently.**

3.1. INTRODUCTION

This module covers terms related to foundations and structures. We will explore what foundations and structures are for, and the most common types of each.



3.2. FOUNDATIONS AND TYPES OF FOUNDATIONS

A **foundation** is the lowest part of a construction, partly or wholly below the surface of the ground, designed to support and anchor the **superstructure** and transmit its **loads** directly to the earth.

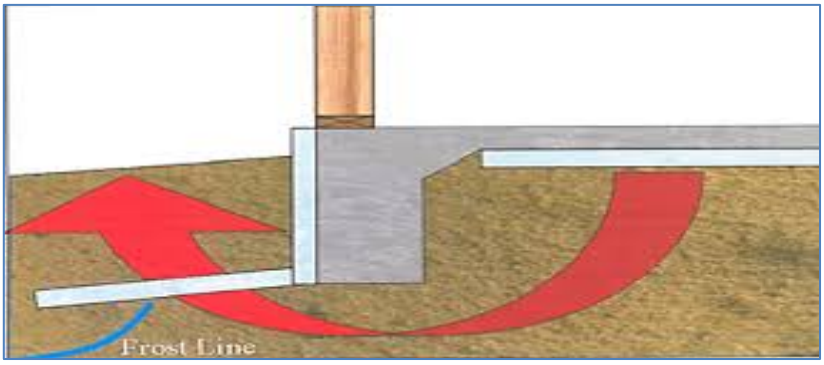
TYPES OF FOUNDATIONS

There are different types of foundations in building construction and their uses depend on **soil** condition and loads from the structure.

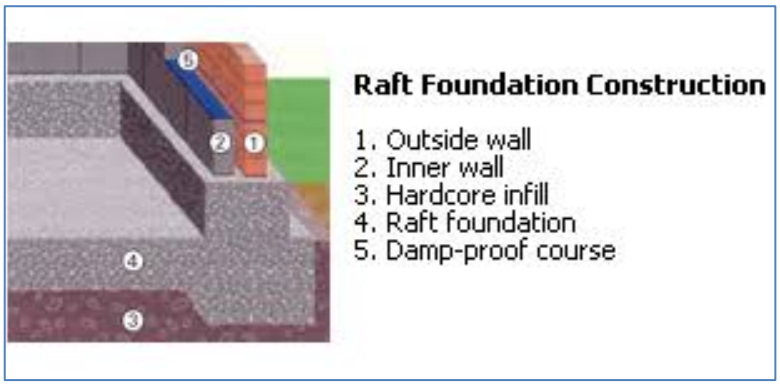
Low-rise buildings and houses generally have **shallow foundations**, while **medium-rise buildings** may need **pad footings** or a **raft foundation**. However, **high-rise buildings** on clay are often constructed on **deep foundations** such as **piles**.

The most common ones are shallow and deep foundations:

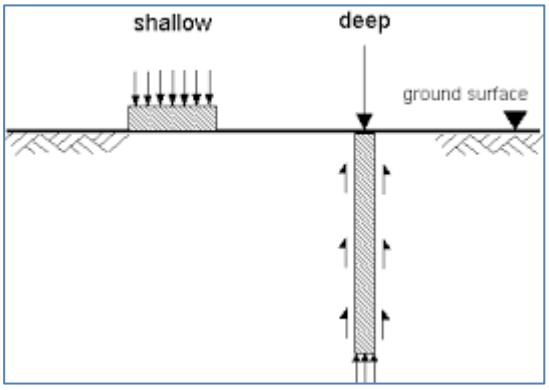
3.2.1. Shallow foundations transfer building loads directly to the supporting soil by vertical pressure. They are placed directly below the lowest part of a substructure. The most common types are: wall footing, pad footing, and mat/raft footing.



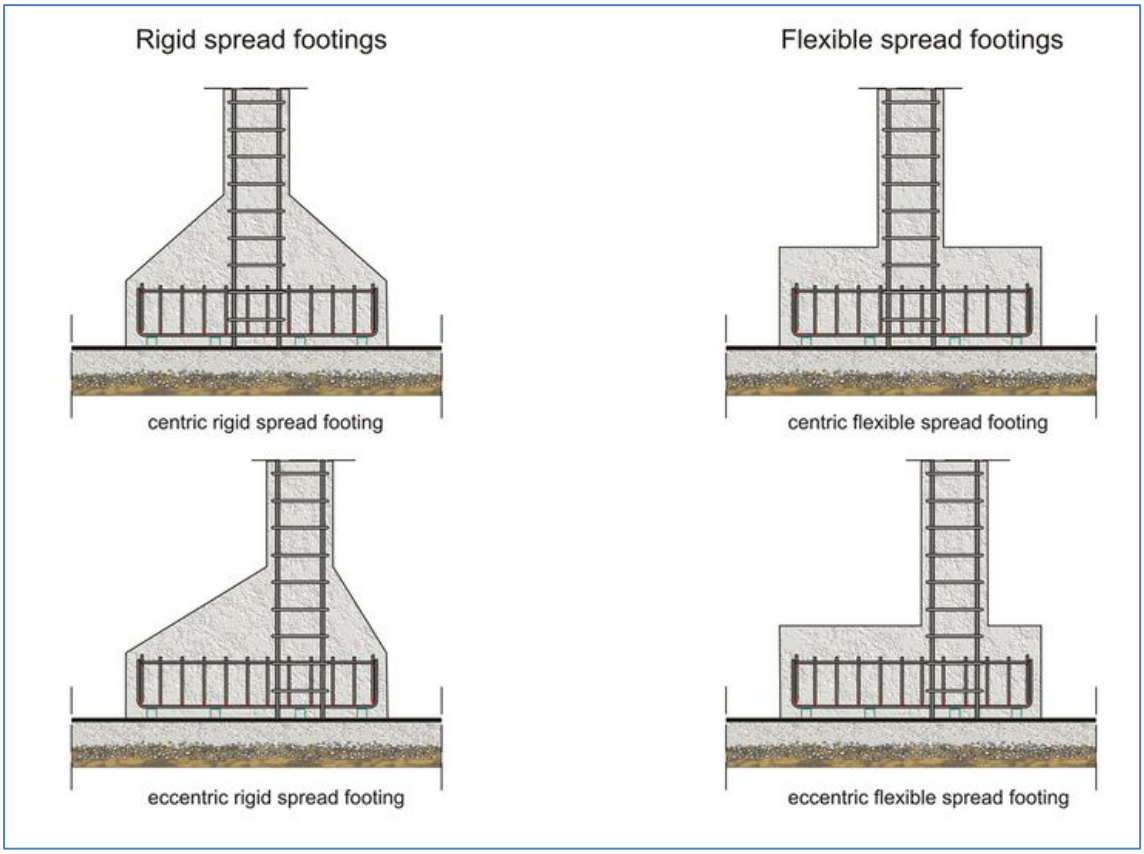
Raft foundations are a type of shallow foundation. They consist of a continuous structural concrete slab that extends over the whole base of a structure and sometimes beyond.

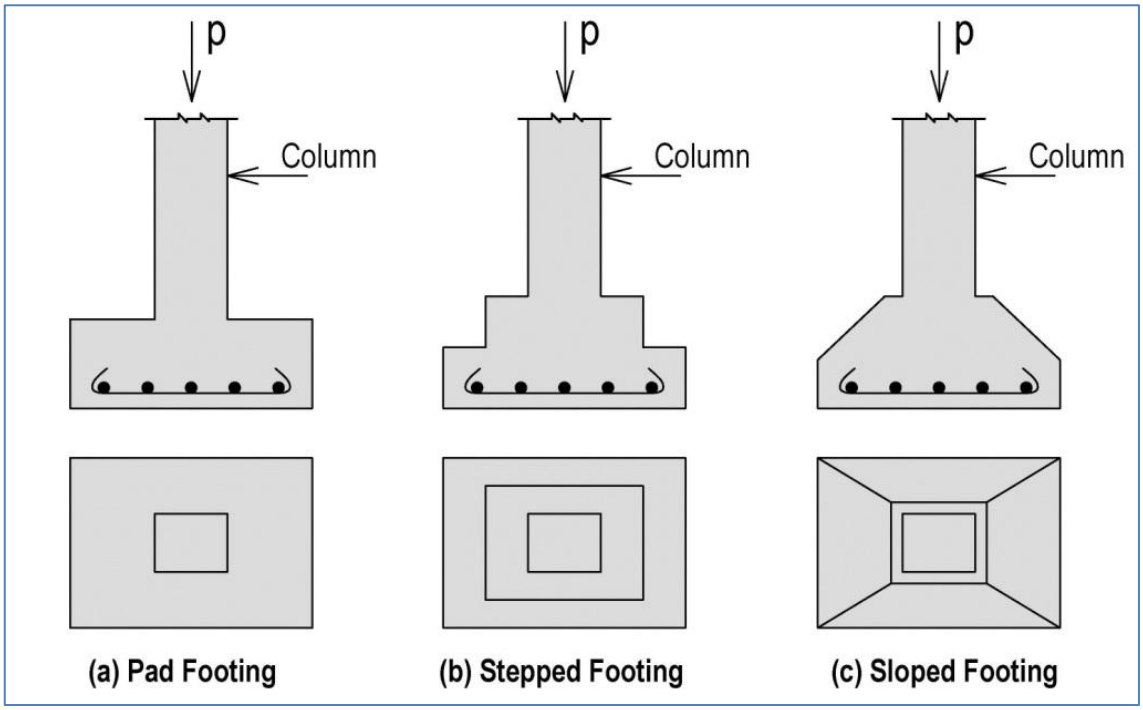


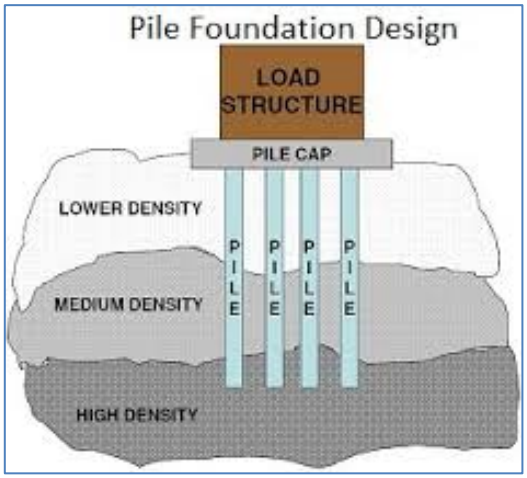
3.2.2. Deep foundations are continuous foundations which provide a **footing** by filling a deep trench with concrete. The most common types are **pile** and **pier foundations**. See illustration below of shallow and deep foundations.



The part of a foundation bearing directly upon the supporting soil set below the frostline is called **footing.** See below different types of footings. Among them is **pad footing**, which is an insulated footing, usually square and made of **reinforced concrete**, cast directly in an excavation.


Rigid spread footings
Flexible spread footings
centric rigid spread footing
centric flexible spread footing
eccentric rigid spread footing
eccentric flexible spread footing


p
Column
p
Column
p
Column
(a) Pad Footing
(b) Stepped Footing
(c) Sloped Footing



Pile foundations are a common type of deep foundations. They consist of a system of piles, pile caps, and **tie beams** for transferring building loads down to a suitable building **stratum**. Piles are long, thin members that have a high **bearing** capacity. They are used when it is desirable to transmit loads to **strata** beyond the practical reach of shallow foundations.

Piles are used to anchor structures against uplift forces and to assist them in resisting lateral and overturning forces.

To tie a group of piles together, thick **slabs** are used in order to support and transmit **column loads** to the piles.

3.2.3. Eco foundations

In modern construction eco foundation systems are very important. They utilize green technologies with innovative anchoring such as **ground screws,** which replace traditional concrete pier footings and have also been used to support **multi-story buildings**. As they do not require soil removal or disposal, cost is reduced significantly. Like traditional wood screws, ground screws are installed using readily available equipment. They are fast, strong and green.

3.3. STRUCTURES AND TYPES OF STRUCTURES

A structure is an organized combination of connected structural elements designed to provide some measure of rigidity. Structural elements form a stable assembly designed to function as a whole. Structures applied to a building are **loadbearing frames**, **walls**, **floors**, and **roofs**, except for **finishings** or **joinery**.

TYPES OF STRUCTURES

There are several classifications of structures depending on usage, such as civil or military structures, or depending on form and function.

The structural members **joined** together by structural connections form the structural system. These include **trusses,** cables, **arches**, **frames**, etc. The most common types of structures are:

3.3.1. Mass structures

Built with large quantities of material, these structures respond well to **compression.** They are solid structures that rely on their own weight to resist **loads**.

3.3.2. Vaulted structures

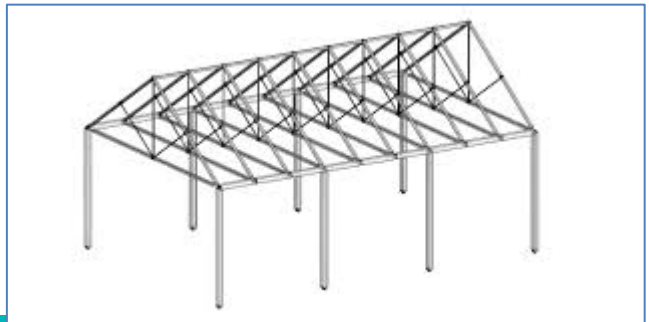
They are based on arches and vaults to increase the size of the openings.

3.3.3. Frame structures

These are common structures held up by l**oadbearing** walls. They are designed to span between supports and rely on fixed **joints** resisting capacity where vertical supports connect to horizontal **beams** or **trusses**.

3.3.4. Truss structures

This type of structure is formed by members in a triangular form. A **truss** is a structural frame based on the geometric rigidity of the triangle and composed of linear members subject only to axial **tension** or **compression**.

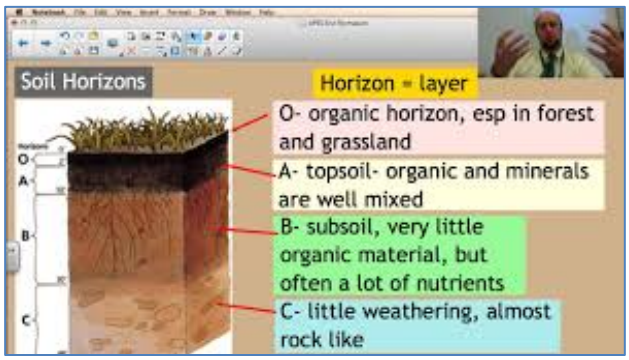


3.3.5. Suspension structures

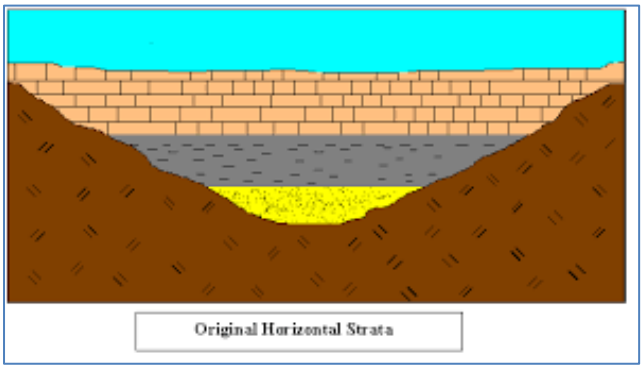
These structures use **cables**, and are also called **cable structures**. They are used in bridges and to cover stadiums and pavilions.

3.4. OTHER TERMS

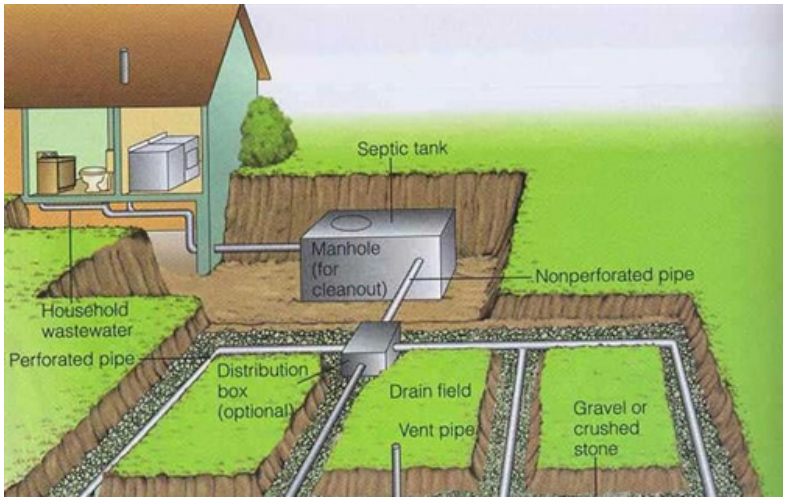
Soil: a portion of the earth's surface made up of sediments of solid particles.



Stratum: a single layer of sedimentary rock or soil. The plural of 'stratum' is 'strata'.

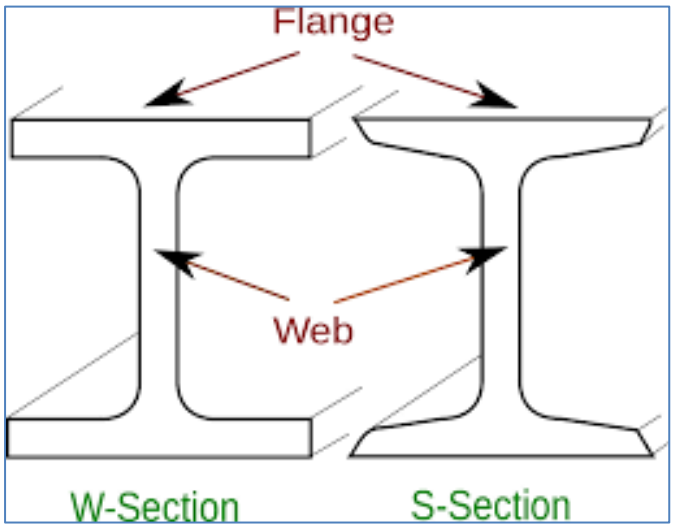


Disposal field: a system of trenches containing **coarse aggregate** and **pipes** through which the liquid waste in the septic tank may flow into the surrounding **soil**. It is also called **absorption field**.

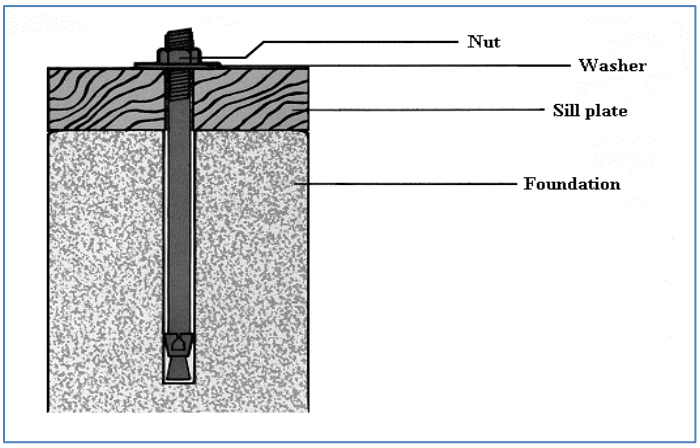


Beam: a structural member whose function is to carry transverse loads. The most common beams according to location are:

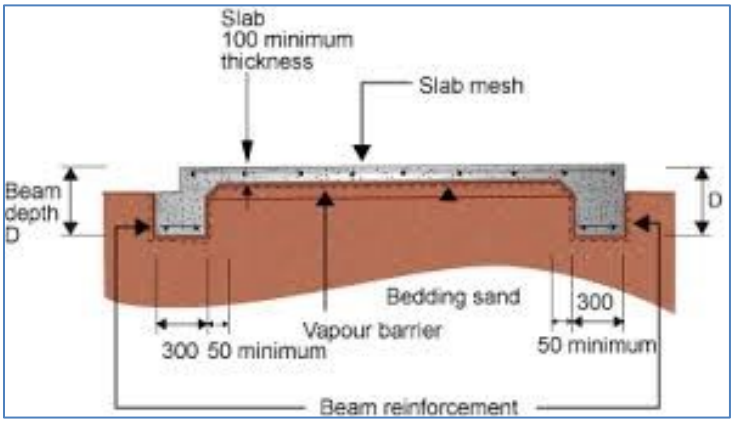
- **Joist:** parallel beam to support floor and ceiling loads
- **Rafter:** a sloping roof beam
- **Purlin**: horizontal roof beam
- **Girder:** principal beam to support concentrated loads



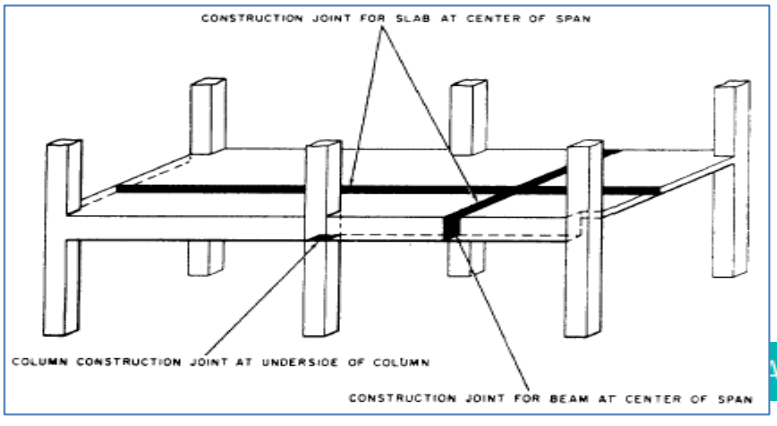
Anchor: a fixing device, such as a **metal rod**, **wire**, or **strap** that serves to hold components.



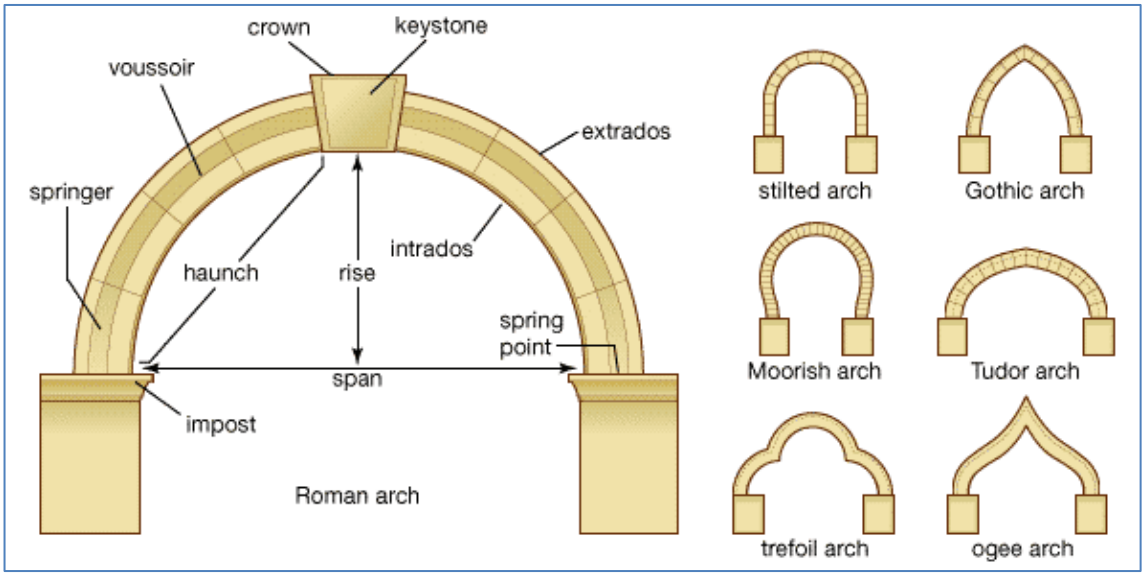
Slab: a thick flat or shaped component of a **reinforced concrete** floor that is carried on beams below.



Joint: a connection between two components that are joined together by **nails**, **fasteners**, **cement**, **mortar**, etc.



Arch: a construction that spans an opening, usually a curved beam of stones or brick that works in compression.



Span: the interval between two terminals of a construction.