Building materials

Introduction:

The engineering structures are composed of materials. These materials are known as the engineering materials or building materials or materials of construction. It is necessary for the civil engineer to become conversant with the properties of such materials. The service conditions of buildings demand a wide range of materials and various properties such as water resistance, strength, durability, temperature resistance, appearance, permeability, etc. are to be properly studied before making final selection of any building material for a particular use. There are different types of building materials used to construct buildings. Some of them have even existed for years, and are still in use.

Building materials are basically divided into **natural and synthetic** materials. The materials made from natural products like clay, twigs, sand, leaves and rocks are natural building materials.

Building materials used in industries, that have gone through human processing is called synthetic building material, like plastics.

Here are the 8 types of building materials:

1. **Rock** is one building material that has been used in building structures for centuries.

2. Another very old building material used today is **thatch**. It is very cheap, is a great insulator and is very easily harvested.

3. **Ice** is another famous building material which was once used only for building igloos. Today, it is also being used in building ice hotels for tourist attractions in cold places.

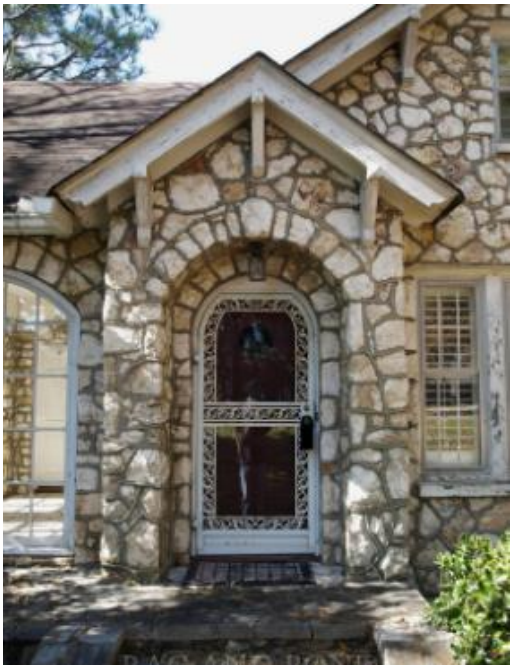
4. In some places, **earth is still used in creating walls**. These walls are made by tightly packing and compacting mud between planks. This was previously done by hand, but now machines are being used. These houses of rammed earth are warm in winter, and cool in summer. This is because soil and clay help at maintaining temperatures at constant levels.

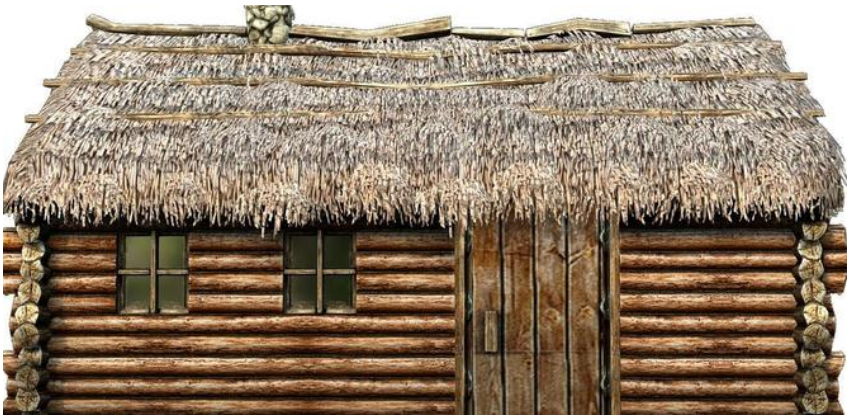
5. **Cement** is a common building material made from rock. Today, cement is used in constructing most buildings mainly because it is long lasting.

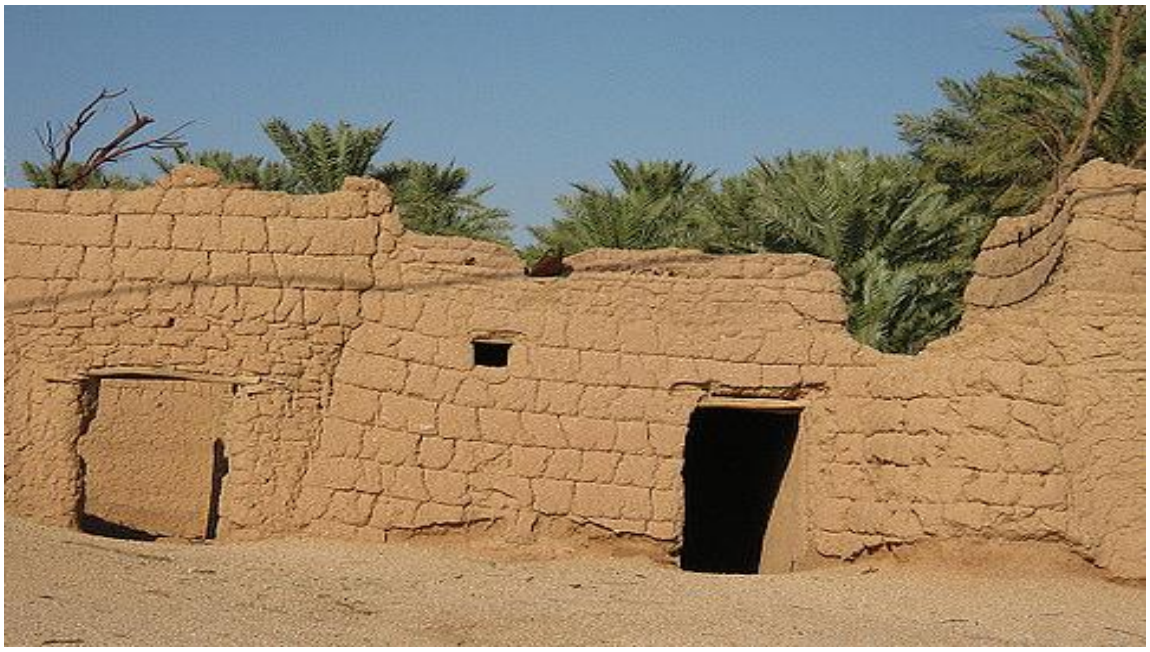
6. **Metal** is today popularly used for constructing a building's structural framework. Metals are used mainly because it is long lasting there are different types of metals you can use for building like steel, which is a metal alloy. Sometimes gold and silver are used for decorative purposes. However not many people can afford it, and moreover, it is not as hard as other metals.

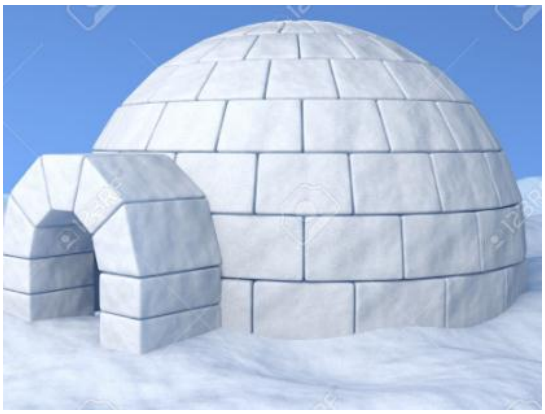
7. **Glass** is a building material used a lot nowadays in building structures because of its class and richness.

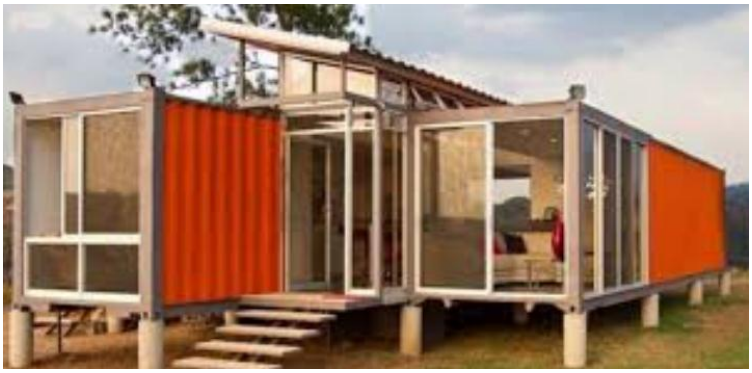
This variety of building materials is used for constructing all those beautiful structures found worldwide. The choice of usage is done based on personal preference and the climatic condition of the place.











Responsibilities of Materials Engineer

A material engineer must be familiar with a wide range of materials used in a wide range of structures and is responsible for the following jobs with certain limits of compromises to be made on site.

- **Selection of Materials**
- **Specification of Materials**
- **Quality Control of materials**

Factors Influencing Selection of a Building Materials

A wide range of construction materials is available. The proper selection of materials to be used in a particular construction project depends on the following factors

- Strength
- Availability
- Durability
- Workability
- Ease of Transportation
- Cost
- Aesthetics
- Resistance to Fire
- Ease of Cleaning

High Performance Materials

The increasing scope of civil engineering has brought many researches and advancement in materials and knowledge of molecular structure. These materials have shown better quality with much safety and economy. Such materials are known as High Performance Materials. In addition, improvements have been made to existing materials by changing their molecular structures or including additives to improve quality, economy, and performance.

Advantages of High Performance Materials

- **High strength concrete can be produced**
- **Elastomeric material are used in joints in highly active earthquake areas**
- **Light weight concrete and aggregate have made cross sections smaller**
- **Polymers have been mixed with asphalt, allowing pavements to last longer under the effect of vehicle loads and environmental conditions.**
- **Fiber-Reinforced Concrete has greater toughness than conventional Portland cement concrete**.

Mortar

Mortar is a mixture of cementitious material, aggregate generally with a grain size of less than 4 mm, water and possibly additives and/or admixtures. Mortar can be classified as cement-lime mortar, cement mortar, lime mortar or masonry cement mortar. Mortar is used for the **following functions:**

1- **To bind materials together (e. g. masonry mortar and tile adhesive mortar, either non reinforced or reinforced).**
2- **To serve as a seating and levelling material for the masonry units.**
3- **To provide aesthetic quality of the structure and a level or smooth finish (e. g. floor screed mortar, internal plastering).**
4- **To protect against weathering (e. g. external rendering).**
5- **To improve thermal insulation of walls (e. g. external thermal insulation composite systems, thermal insulation rendering mortar, lightweight masonry mortar)**
6- **To repair constructions (e. g. concrete repair mortar, damproofing mortar).**

CONCRETE CONSTITUENTS

The constituent materials of concrete should satisfy; **the durability, structural performance and safety requirements, taking into consideration the environment** to which it will be subjected. The common types of **cement used in concreting include**:

- Ordinary Portland cement OPC
- Sulphate-resisting Portland Cement
- Low heat Portland Cement

The exposure conditions of the concrete and whether there are other special requirements, should be considered in the selection of the cement type. For example, concrete made with Portland cement is not recommended for use in acidic conditions.

The various factors affecting the choice of concrete are:

1. Compressive strength of concrete:

It is one of the most important properties of concrete and influences many other describable properties of the hardened concrete. The mean compressive strength required at a specific age, usually 28 days, determines the nominal water-cement ratio of the mix.

2. Workability of concrete:

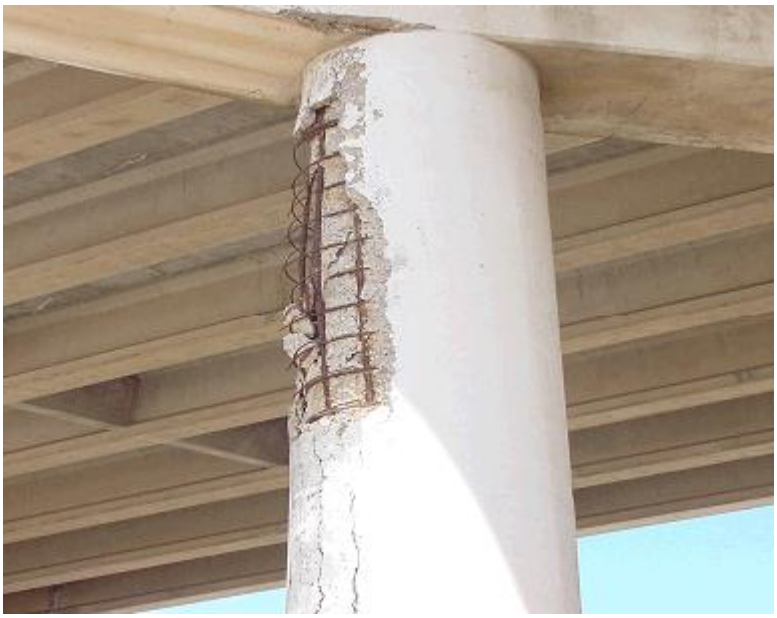
The degree of workability required depends on three factors. These are the size of the section to be concreted, the amount of reinforcement, and the method of compaction to be used.

3. Durability of concrete:

The durability of concrete is its resistance to the aggressive environmental conditions.

SELECTION OF CONCRETE REPAIR MATERIALS

Selection of concrete repair materials is based on evaluation of type of damage, types of materials to be used for repair and the local condition. Concrete repairing material must be compatible with the concrete being repaired. Variety of materials is available for repair of concrete structures.



The selection of concrete repair materials should be made based on following properties:

- Bond with concrete
- Strength development of material with concrete(compressive, flexural and tensile)
- Coefficient of thermal expansion of the material
- Coefficient of permeability of the material
- Stress development at interface whether on shrinkage, temperature change, alternative cycles of wetting and drying
- Corrosion resistance property of the material
- appearance of finished surface
- speed of concrete repair

Basically, the concrete repair materials can be grouped into:

i) Cementitious System

ii) Polymer Modified Cementitious System

iii) Polymer Concrete System , composite materials

iv) Reactive Thermosetting Resin System

Green building:

Green building (also known as **green construction** or **sustainable building**) refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition.

The common **objective** of green buildings is to : reduce the overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

Materials Replaced in Green Building

- The table bellow shows the materials used in Conventional & Green Home respectively for different items:

Sr. No.	Item	Conventional Material	Green Material
1	Windows and Openings	Aluminium Panelled Plain Glasses	Insulated Glass (IG Units)
2	Lighting Fixtures	Tube Lights & CFLs	Low Watt LED Tube Lights & Bulbs
3	Plumbing Fixtures	Conventional Fixtures	Special Green Fixtures
4	Flooring	Vitrified & Glazed Tiles and China Mosaic	PVC Flooring, Glazed Tiles and China Mosaic
5	Doors	Pine Wood	Engineering Wood

Water efficiency

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas, the demands on the supplying aquifer exceed its ability to replenish itself.

Materials efficiency

Building materials typically considered to be 'green' include lumber from forests that have been certified to a third-party forest standard, rapidly renewable plant materials like bamboo and straw, dimension stone, recycled stone, recycled metal

The End