Building materials are materials used for construction purposes, it can be

- **Natural** like **clay, sand, wood, rocks, twigs, leaves, soil, aggregates, limestone, rock, thatch**
- **Manufactured** like **plastic, stone, mortar, cement, concrete, foam, ceramic, glass, bricks**

They are used for stuff like **carpentry, plumbing, roofing, insulation works, make-up of habitats and structures like houses**

STONE

Type of Stone	Definition	Examples
Igneous Rocks	Rocks formed through the cooling of molten rock	Granite, Basalt, Obsidian, Pumice
Sedimentary Rocks	Rocks formed by the accumulation and cementation of sediments	Sandstone, Limestone, Shale, Conglomerate
Metamorphic Rocks	Rocks formed through the alteration of existing rocks due to heat, pressure, or chemical processes	Marble, Slate, Schist, Quartzite
Stratified	Rocks formed in layers or strata	Sandstone, Limestone
Unstratified	Rocks lacking clear layering	Granite, Basalt
Foliated	Rocks exhibiting parallel layering or banding	Slate, Schist, Gneiss
Siliceous	Rocks rich in silica content	Quartzite, Flint, Chert
Argillaceous	Rocks rich in clay minerals	Shale, Mudstone
Calcareous	Rocks rich in calcium carbonate	

LIMESTONE

It's a rock made from **Calcium Carbonate (CaCO3)**, it's the most commonly used to make crushed stone, and it's a type of sedimentary rock

It's popular for many things

- Widely available
- Greater Diversty than other rocks
- Primary ingredient in cement
- Base material for structures like highways, rural roads, etc
- Used to make agricultural lime
- It neutralizes acid
- It's used in products in small volumes
- Aids digestion in poultry feed "**poultry grit**"
- It's a flooring material **"Terrazzo"**
- Glass production
- Absorbs pollutants from air
- Controls dust in mines
- Dietary supplements for animals
- Cosmetic products
- Blast furnace flux

uses of limestone:-

- It is used to manufacture glass, refractory, sand lime bricks and paints.
- it is used as lime mortar for masonry work of buildings.
- it is used for plastering and white washing of buildings.
- It is used as lime concrete to make water proof structures.

Crushed stone

It’s produced by crushing suitable rock deposits using crushers, it’s different from gravel because

1. It’s manufactured by breaking the rocks into desired sizes while gravel is produced by natural weathering and erosion
2. It has an angular shape while gravel is round

It’s highly accessible, and used in construction, agriculture, and various industries

It contributes to the economy massively despite low product value

And its demand correlates with construction activity levels

ROCKS USED FOR CRUSHED STONE

Rock Type	Definition	Gathering Process
1. Limestone	Sedimentary rock is primarily composed of calcium carbonate.	Quarrying, mining
2. Granite	Igneous rock with a granular texture, composed mostly of quartz, mica, and feldspar.	Quarrying, mining
3. Trap Rock	Dense, dark-colored igneous rock, is often used for construction.	Quarrying, mining
4. Sandstone	Sedimentary rock is composed mainly of sand-sized minerals or rock grains.	Quarrying, mining
5. Quartzite	Hard, metamorphic rock primarily composed of quartz grains.	Quarrying, mining
6. Dolomite	Sedimentary rock is composed of calcium magnesium carbonate.	Quarrying, mining
7. Marble	A metamorphic rock formed from limestone or dolomite, often featuring unique veining.	Quarrying, mining
8. Slate	Metamorphic rock with a fine-grained, foliated structure, commonly used for roofing.	Quarrying, mining
9. Shell	Composed of seashells and is often used as a decorative aggregate.	Gathering from natural sources
10. Calcareous	Contains a high percentage of calcium carbonate; and can include various rock types like limestone, marble, etc.	Quarrying, mining

Granite

It's a light-colored igneous rock used in construction

It includes various light-colored igneous rocks such as **granodiorite, diorite, and rhyolite**, and they are all referred to as granite

It's the second most used material for crushed stone

It is superior to limestone in acidic waters or soils

It can be a substitute for limestone in applications requiring durable aggregates

Trap rock

It's a dark-colored igneous rock used in construction

It includes various light-colored igneous rocks such as **basalt, peridotite, diabase, gabbro**

It's the third most used material for crushed stone

It is superior to limestone in acidic waters or soils

It can be a substitute for limestone in applications requiring durable aggregates

Dolomite

It's a similar rock to limestone, with it being magnesium calcium carbonate **$CaMg(CO3)_2$** While limestone is just calcium carbonate **CaCO3**

It's better at neutralizing acid than limestone

It's harder because of a mohs scale of 4 while limestone is 3

It's more durable to stuff like erosion and abrasion

It's similar to limestone in appearance, especially dolomitic limestone

Sandstone

It's a rock composed from sand grains cemented and bonded together by calcite, clay, or silicate minerals

It exhibits a porosity ranging between 5 and 30 percent because some fillings between sand grains are incomplete

This porosity allows water absorption, but in cold temperatures, this makes the sandstone break because water expands by 9% when freezing

Quartzite

It's a type of sandstone that has gone into a state of metamorphism, aka, changes in material due to pressure and heat, this welded the material and made it extermly durable

Because of the extra welding, it has resistance to the freeze-thaw concerns with sandstone

It has a hardness of 7 in the mohs scale, making it harder than crusher jaws, loader buckets, sizing screens, truck beds, and other equipment used to handle and process the stone. As a result, it can quickly put very expensive wear and tear on essential equipment.

Cement

Requirement of cement:

- Cement should not prosses of alumina which may reduce strength
- It should be in fine power
- It should find cool when touch by hand

Cement Type	Definition	Real-Life Uses
Sulphate Resisting Cement	Designed to resist sulphate attack, ensuring durability in environments prone to sulphate exposure.	Used in construction near seawater, sewage treatment plants, and areas with high sulphate content in soils.
White Cement	Produced from raw materials with low iron content, resulting in a white finish.	Ideal for decorative purposes, creating colored concrete, and in architectural designs.
Low Heat Cement	Generates less heat during hydration, reducing the risk of thermal cracking.	Suitable for massive concrete structures like dams, where excessive heat can cause cracking.
Blast Furnace Cement	Produced from a mixture of blast furnace slag and Portland cement clinker.	Used in marine structures, dams, and structures exposed to sulfate and chloride-containing waters.
Colored Cement	Contains pigments to produce a variety of colors, enhancing aesthetic appeal.	Used in decorative concrete works, pathways, and flooring where color differentiation is desired.
Quick Setting Cement	Sets quickly and gains strength rapidly, useful for immediate repairs or constructions requiring swift completion.	Utilized in road repairs, under water structures, and in situations demanding rapid setting and hardening.
Ordinary Portland Cement	The most common type, produced by grinding Portland cement clinker and gypsum.	Widely used in general construction, from residential buildings to bridges, pavements, and infrastructure.
Pozzolana Portland Cement	Contains volcanic ash (pozzolana) and Portland cement clinker, providing enhanced durability and workability.	Used in hydraulic structures, marine construction, and in situations requiring high resistance to chemicals.

Uses of cement:

- it’s used in making joints for drains, pipes
- it’s used in the construction of building, bridges, tanks, domes
- it’s used to prepare cement concrete for various construction works

Bricks

Requirements of bricks:

- the color of the brick should be red or copper and uniform
- it should be well burnt in kilns
- the edges should be sharp

Type of bricks:

- conventional /traditional bricks; size 23cm *11.4cm*7.6cm
- standard /modular; size 19cm*9cm* 9cm

Uses of brick:

- bricks are used in wall masonry construction of building
- used in brick lintal construction
- bats of brick are used in concrete in foundation work

Metal

Properties Required in Metals:

- **Strength and Load Bearing:** Metals used in construction must possess adequate strength to withstand the loads exerted upon them, ensuring the structural integrity of buildings and infrastructure.
- **Heat and Fire Resistance:** Resistance to high temperatures and fire is crucial, as it enhances safety and structural stability during unforeseen circumstances.
- **Compatibility with Concrete:** Good adhesion with cement concrete ensures a strong bond between metals and the construction materials, contributing to the overall solidity and stability of structures.

Types of Metals:

Ferrous Metals:

- **Pig Iron:** High-carbon-content iron used in steel production.
- **Cast Iron:** Known for its strength and casting abilities, often used in structural elements.
- **Wrought Iron:** Historically used for decorative purposes due to its malleability and corrosion resistance.
- **Steel:** Highly versatile due to its strength, durability, and adaptability, commonly used in various construction applications.

Non-Ferrous Metals:

- **Aluminum:** Lightweight, corrosion-resistant, and often used in facades, roofing, and structural elements.
- **Copper:** Known for its conductivity, corrosion resistance, and aesthetic appeal, used in roofing and electrical applications.
- **Magnesium:** Lightweight and durable, utilized in certain structural components and alloys.
- **Nickel:** Adds strength and corrosion resistance, often used in alloys and coatings.

Applications:

- **Construction:** Metals are integral in creating robust and long-lasting structures, including beams, columns, reinforcement bars, and frameworks.
- **Weather Resistance:** While bare metals might lack weather resistance, various coatings, treatments, and alloys are applied to enhance their ability to withstand environmental factors, ensuring longevity and durability.

Sand

Characteristics Required in Sand:

- **Cleanliness:** Quality sand should be free from impurities, debris, and organic matter, ensuring the integrity of construction materials.
- **Grading:** Well-graded sand ensures consistency in particle sizes, contributing to better compaction and stability in construction projects.
- **Grain Shape:** The presence of sharp, angular grains enhances the interlocking of particles, improving the strength and stability of the material.
- **Clay Content:** Ideally, sand should contain a minimal clay content, usually limited to 3 to 4%, to prevent adverse effects on construction materials.

Types of Sand:

Natural Sand:

- **Source:** Obtained from various natural sources such as pits, river beds, and sea beds, offering different qualities based on their origins.
- **Characteristics:** Natural sand often exhibits diverse grain shapes and sizes, influenced by its geological source.

Artificial Sand:

- **Formation:** Created through the breakdown of sandstone due to weathering effects, resulting in a manufactured alternative to natural sand.
- **Consistency:** Artificial sand can be controlled for specific grain shapes and sizes, providing uniformity in construction applications.

Uses:

- **Masonry:** Essential in mortar for bricklaying and block construction, contributing to the strength and stability of walls.
- **Plaster and Flooring:** Used in plastering applications and as a base material for flooring to enhance smoothness and stability.
- **Concrete Work:** A crucial component in concrete, sand acts as a filler, contributing to the strength and workability of the mixture.

Aggregates

Qualities Required in Aggregates:

- **Strength:** Adequate strength in aggregates ensures the structural integrity and durability of the resulting construction material.
- **Soundness:** Good soundness refers to the ability of aggregates to resist physical and chemical deterioration under varying conditions, maintaining their quality over time.
- **Adhesion with Binding Material:** Strong adhesion between aggregates and binding materials, such as cement or asphalt, is crucial for the overall strength and stability of the composite material.

Types of Aggregates:

Fine Aggregate:

- **Application:** Used in the preparation of cement mortar, lime mortar, and cement concrete.
- **Characteristics:** Consists of smaller particles, enhancing the workability and cohesiveness of the mixtures.

Coarse Aggregate:

- **Application:** Essential in preparing cement concrete for bituminous and rigid pavements.
- **Characteristics:** Comprises larger particles, contributing to the structural strength and stability of the construction material.

Applications:

- **Fine Aggregate Usage:** Vital in creating the right consistency and strength in cement mortar, lime mortar, and concrete mixes, ensuring proper binding and workability.
- **Coarse Aggregate Usage:** Essential for providing strength and stability in concrete used for pavements, beams, and columns, offering durability and load-bearing capacity.

Glass

Types of Glass:

Soda Lime Glass:

- **Composition:** Contains soda, lime, and silica as primary components, commonly used in windows, bottles, and common household items.
- **Characteristics:** Offers good clarity and durability for everyday applications.

Potash Lime Glass:

- **Composition:** Incorporates potash, lime, and silica, often utilized in specialty glassware and decorative items.
- **Characteristics:** Known for its higher refractive index and suitability for artistic creations.

Potash Lead Glass:

- **Composition:** Contains lead oxide along with potash, lime, and silica, used in fine crystal and high-end glassware.
- **Characteristics:** Exhibits exceptional brilliance, clarity, and refractive properties, ideal for luxury glass products.

Properties of Glass:

- **Rigidity:** Glass does not deform under normal conditions, maintaining its shape and structure over time.
- **Hardness:** It possesses a hard surface, providing resistance to abrasions and scratches, ensuring longevity.
- **Brittleness:** While hard, glass is also brittle, meaning it can break or shatter under significant impact or stress.
- **Chemical Inertness:** Glass demonstrates resistance to the effects of air and water, maintaining its integrity when exposed to these elements.
- **Translucency:** Depending on its composition, glass allows light transmission while maintaining varying levels of translucency or transparency.

Applications:

- **Construction:** Utilized in windows, facades, and architectural elements due to its transparency and versatility in design.
- **Household Items:** Used in bottles, containers, and tableware due to its inert nature and resistance to chemical reactions.
- **Specialty Industries:** Employed in specialized fields like optics, electronics, and medical devices owing to its unique optical and physical properties.

Plastic

Plastic, composed of natural or synthetic polymers, stands as a versatile material with a wide range of properties and applications. Here's a detailed exploration:

Properties of Plastic:

- **Lightweight:** One of the defining features of plastic is its low density, making it significantly lighter than many traditional materials.
- **Low Electrical Conductivity:** Plastics generally exhibit low electrical conductivity, making them useful in electrical insulation and various applications where conductivity needs to be minimized.
- **Low Thermal Conductivity:** With limited thermal conductivity, plastics are employed in situations where insulation from heat or cold is required.
- **Shock Absorption:** Certain types of plastics possess excellent shock-absorbing properties, making them suitable for protective gear and packaging materials.
- **Specific Gravity:** The specific gravity of plastic averages around 1.4, contributing to its lightweight nature.

Applications:

1. **Waterproof Products:** Plastic is extensively used in manufacturing waterproof doors, bags, and various packaging materials due to its impermeable nature.
2. **Furniture:** From chairs to tables and various household items, plastic is used in furniture manufacturing due to its durability, versatility, and ease of shaping.
3. **Optical Lenses:** Some high-performance plastics are employed in crafting optical lenses due to their optical clarity and lightweight properties.

Diverse Usage:

- **Packaging:** Widely used in packaging industries due to its versatility, durability, and ability to preserve products.
- **Construction:** Employed in pipes, insulation, and roofing materials due to its resistance to weathering and durability.
- **Automotive:** Used in vehicle interiors, exteriors, and various components due to its lightweight and customizable properties.