

## **ROCKS AND STONES**

### **ROCKS:**

Rocks are a combination of minerals that are bonded together formed from minerals. They can be

1. Monomineralic- contain one mineral
2. Polymineralic- contain more than one mineral

### **CLASSIFICATION OF ROCKS:**

Rocks from which stones are obtained for civil engineering works may be classified in the following three ways:

1. Geological classification
2. Physical classification
3. Chemical classification

***Geological Classification:*** It is based on the materials of which rocks are made, the structure of the materials and the formation of the rocks. The rocks are classified as:

- Igneous rocks
- Sedimentary rocks
- Metamorphic rocks

### ***IGNEOUS ROCKS***

The earth's interior has extremely high temperature. The rocks are in molten state and are known as magma. The rocks formed by cooling and solidifying of magma are known as igneous rocks. Generally, igneous rocks are strong and durable. These rocks may be further classified as:

- Volcanic rocks
- Hyperbyssal rocks
- Plutonic rocks

**Volcanic rocks** are formed at the earth's surface due to the cooling of magma spewed out by volcanoes. As the cooling process is fast these rocks are extremely fine-grained and glossy. Basalt and trap are examples of volcanic rocks.

**Hyperbyssal rocks** are formed due to the cooling of magma at a shallow depth in the earth's surface. Cooling is relatively slow. Hence these rocks have a fine-grained crystalline structure. Quartz, dolerite and gneiss are examples of such rocks.

**Plutonic rocks** are formed due to the slow cooling of magma at a considerable depth from the earth's surface. These rocks are very strong and have a crystalline structure. Granite and diorite are examples of plutonic rocks.

### ***SEDIMENTARY ROCKS***

Rocks disintegrate due to the weathering action of water, wind and frost. The disintegrated material is carried away by wind and flowing water, water being the most powerful medium of transport. When flowing water encounters obstacles, the suspended materials are deposited. The deposited material gets consolidated under pressure and heat. Chemical action in the deposited materials also contributes to cementing of deposited material. Year after year, fresh layers of materials are formed. The rocks formed in this manner are known as sedimentary rocks. These rocks are more uniform and fine grained. They have bedded or stratified structure. Sandstone, limestone and mudstone (shale) are examples of sedimentary rocks.

### ***METAMORPHIC ROCKS***

Igneous rocks and sedimentary rocks undergo changes due to metamorphic action of pressure, internal heat and chemical action of water. For example, granite becomes gneiss, while trap building materials. Stones and basalt change into schist and laterite. Similarly, limestone changes to marble and mudstone becomes slate

### **STONES:**

Stone is a solid non-metallic mineral matter, which has been used as a building material from the early age of civilization. Stones are nothing but cut pieces of rock, the hard material of the earth's crust exposed on the surface or under the soil. Stones have been used in construction—from small residential buildings to large palaces, places of worship and forts—all over the world. The pyramids in Egypt, the Taj Mahal in Agra, Red Fort and India Gate in Delhi, Vidhan Soudha in Bangalore, and the Lord Gomateshwar statue in Shravanbelagola are some famous stone structures.

### ***USES OF STONES***

- ✓ Stones are extensively used for the construction of foundations, walls, columns and arches in buildings.

- ✓ They are ideally suited for the construction of retaining walls, forts, piers of bridges and dams.
- ✓ Polished granite and marble are used for the face works of important buildings.
- ✓ Stone slabs are used for flooring, damp-proof course, lintels, roofing and pavers round the buildings, as well as for footpaths.
- ✓ Crushed stones are used as a basic inert material in concrete, for making artificial building blocks, such as railway ballast and to provide base course for roads.

### **Characteristics of Good Building Stones**

Every building stone which is used for construction, cannot satisfy all the ideal requirements. For example, when the stone satisfies the requirement of strength and durability, it may not do the same with other necessities such as ease of dressing. Hence it is the job of the site engineer to look into the properties which are required for the specific work and select the stone accordingly.



A good building stone should have the following qualities:

**Appearance:** Building Stones used for the face work of the building should have fine, compact texture. Light coloured stone is usually preferred as dark colours are prone to fade out with time. They should be free from clay holes, bands or spots of colour.

**Structure:** A stone when broken, should not be dull in appearance and should show uniformity of texture. It should be free from cavities, cracks, and patches of loose or soft material. Stratifications, which are usually found in sedimentary rocks should not be visible to naked eye.

**Strength:** Stones used in construction should be strong and durable to withstand the disintegrating action of weather. Generally the stones can withstand the forces they encounter

in usual constructions but in case of constructions where the forces encountered are unusual, they should be tested for its strength. Stones with compact fine crystalline texture are stronger. Compressive strength of building stones in practice, range between 60 to 200 N/mm<sup>2</sup>.

**Specific gravity:** The specific gravity of Building stone is directly proportional to its weight and strength. Hence the stones having higher specific gravity should not be used for dams, retaining walls, docks and harbours. Specific gravity of a good building stone lies between 2.4 to 2.8.

**Hardness:** When stones are utilized for floors, pavements, aprons of bridges and weirs of rivers, the stones are subjected to abrasive forces which are caused by the wear and friction. Hence the stones which are to be used in such places should be tested for hardness.

**Toughness:** It is the measure of impact that a stone can withstand. When the stones are supposed to undergo vibrations of machinery and moving loads, they should be tough.

**Porosity and Absorption:** The porous building stones are not suitable in construction especially for exposed surfaces of structures. The rain water which comes down carry some acidic gases forming light acids which gets soaked on the surface. Acids react with the constituents of stones causing them to crumble. In cold regions water freezes in the pores of stones. This water causes the disintegration of stones because of its increase in volume on freezing. Stones should be tested for porosity and porous stones should be used only at places where they don't encounter frost, rain or moisture in any form.

Water absorption is directly proportional to the porosity of the rock. The more porous the rock is, the more water it will absorb and leads to the damaging of stone.

The types of some of the stones and their maximum limit of water absorption (%) is as follows:

- Sandstone : 10
- Limestone : 10
- Granite : 1
- Trap : 6
- Shale : 10
- Gneiss : 1
- Slate : 1
- Quartzite : 3

**Weathering:** It is the extent to which the face of a stone resists the action of weather. Stones with good weathering properties only should be used in the construction of important buildings.

**Workability:** Stones are said to be workable if the work which is involved in their cutting, dressing and shaping is considered as economical and easy to conduct. Know the Current House construction cost

**Fire Resistance:** Building Stones should be free from calcium carbonate, oxides of iron, and minerals having different coefficients of thermal expansion. Igneous rock undergo major disintegration because of quartz which disintegrates into small particles at a temperature of about 575 °C. Limestone, however, can withstand a little higher temperature; i.e. up to 800 °C after which they disintegrate.