

## **Building Stone**

### **Introduction**

The stones are derived from rock, which form the earth's crust and have no definite shape or chemical composition but are mixture of two or more minerals. The mineral is a substance which is formed by the natural inorganic process and possesses a definite chemical composition and molecular structure.

### **Classification of Rocks**

The rocks from which stones are obtained are classified in the following four ways:

- 1- **Geological** : geologically the rocks are classified into three different types:
  - **Igneous rock** : are formed by cooling the molten lava on or inside the earth's surface during the volcanic eruption. The portion of lava, which comes outside the surface, cools quickly and forms the rock of non-crystalline nature called as trap or basalt. The rest of the portion which remains inside the earth undergoes cooling at a slow rate and results in formation of rock of crystalline variety known as Granite.
  - **Sedimentary rocks**: are formed by gradual deposition of disintegrated rocks (due to the atmospheric action such as rain and wind), vegetable matter and clay at the bottom of rivers, lakes or sea. These are also called stratified because these rocks are formed in layers. Lime stone and sand stone belong to this category of rocks.
  - When sedimentary or even igneous rock are subjected to great heat and pressure inside the earth, a new variety of rock is formed which known as metamorphic rock. This

change of structure is called metamorphism. For example lime stone changes to marble, slate changes to gneiss, etc.

2- **Physical:** the basis of the classification are physical properties of rocks, the manner and arrangement of different particles and mass forming a stone. Physically the rocks are classified as:

- **Stratified rocks:** are those which exhibit distinct layers which can be separated. The plane along which separation of the layers can be carried out is called cleavage plane. Lime stone, slate and sand stone are the examples.
- **Unstratified rocks:** do not show any sign of strata and cannot be easily split into slabs. Examples are granite, trap, marble, etc.

3- **Chemical :** the chemical constituents (in the rocks) are the basis of this classification. Chemically the rocks are classified as:

- **Siliceous:** In case of siliceous rocks, silica is the main constituent. The silica in free state is called sand and in combined state silicate. The rocks containing silica in free form are harder, while those having silica in combined form are likely to be disintegrated. Examples are sand stone, quartzite, etc.
- **Argillaceous rocks:** In clay or alumina is the main constituent. Slate, laterite, kaolin, etc., belong to this category.
- **Calcareous rocks :** have calcium carbonate or lime as their leading constituent. These rocks are readily acted upon by even dilute hydrochloric acid, Limestone and the marble are the important examples.

4- **Practical :** is based on the usage. Practically stones have been classed as: Granites, basalts, lacerates, marbles, lime stones, sandstones, slates.

## Characteristics of Good Building Stones

Stones find their applications in the construction of heavy structures such as dams, docks and harbours, weirs, bridge piers, buildings, etc. To find the suitability of stones under different conditions, the following characteristics should be considered:

- 1- **Appearance and colour:** The stones which are to be employed for decoration work should have uniform and appealing colour and should be free from flaws and clay holes. The use of stones which contain much iron should be discouraged as the formation of iron oxide disfigures them and brings about disintegration. The stones should also have the ability to receive good polish.
- 2- **Weight:** The specific gravity hence the weight of the good building stone should be high as heavier stones can resist the force of bigger magnitude. A heavy stone possesses more compactness and less porosity.
- 3- **Porosity and absorption:** Porosity (which is decided by the number of pores) exists in all the stones but if it is present in greater extent it makes the stone unsuitable for building construction because during rain, water seeping into pores contains acids and fumes (absorbed from atmosphere) which destroy the stone. When the climate is cold, water entering the pores may even freeze and split the stone.
- 4- **Fineness of grain:** The stones which are fine grained are suitable for moulding works. If the stones are non-crystalline they are likely to disintegrate under the action of natural agencies.
- 5- **Compactness:** Stone's durability is decided by their compactness or density of composition. A compact stone can withstand the effects of external agencies effectively.

- 6- **Resistance to fire:** For resistance against fire, the stone (i) should have homogeneous composition and (ii) should be free from calcium carbonate or oxide of iron.
- 7- **Electrical resistance:** The electrical resistance of stone decreases when it gets wet. Thus to have steady and high electrical resistance, the stone must be non-absorbent like slate.
- 8- **Hardness and toughness:** The stones must be adequately hard and tough so that they may resist wear and tear. Hardness may be tested by scratching with a penknife, which should not be able to produce an impression on hard stone like granite. Toughness of the stone can be tested by subjecting it to a hammer action.
- 9- **Strength:** Stones used in the structures are usually subjected to compression; so they should have sufficient strength to cope with the requirements. Generally all the stones possess a reasonable degree of strength as far as their use in building work is concerned, but for heavy structures only those stones are suitable which have high strength comparatively.
- 10- **Durability:** A stone is more durable in case it is (i) compact. (ii) homogeneous and (iii) free from any material affected by dilute hydrochloric and sulphuric acids. It should also have negligible water absorption.
- 11- **Dressing:** The art of shaping a stone is known as dressing. Stones should possess uniform texture and softness so that they may be easily dressed, if it is too hard, finish will be poor and dressing uneconomical.
- 12- **Cost:** The cost is an important consideration in the selection of building stone. Other things being equal the cost of a stone depends upon the ease with which it can be quarried out, the proximity of the quarry to the place of use, and the transportation facilities available. The

subsequent cost of dressing a stone, before it is placed directly in the structure, should also be low.

- 13- **Seasoning:** Good stone must also be free from quarry sap. To ensure this, the stones after quarrying and dressing should be left for a period of 6 to 12 months for proper seasoning, before using in construction work.

### **Deterioration of Stones**

The various agencies which bring about the deterioration of stones are as follows:

- 1- **Rain:** A stone gets wet due to rain and becomes dry due to sun; this alternate wetting and drying go a long way in deteriorating the stone. The harmful gases and acids contained in rain water also exercise a damaging effect on the stone.
- 2- **Temperature:** The stone also gets deteriorated due to frequent changes of temperature of atmosphere (due to these changes expansion and contraction take place frequently, which result in the production of cracks).
- 3- **Wind:** A strong wind carrying with it grits and dust strikes the stones and brings about the wear of the stones. Also the water particles in the wind penetrate into the pores of the stones and cause dampness which results in deterioration.
- 4- **Frost:** When the stone is used in the cold climatic conditions, the water in the pores freezes; consequently it expands and thereby splits the stone. Therefore, porous stones should not be used in very cold places.
- 5- **Atmospheric impurities:** In an industrial town, the presence of acids and fumes adversely affect the stones containing carbonate of lime.

- 6- **Vegetable growth:** Certain acids secreted by the roots of certain plants and trees in the joints of the stone, attack it. The vegetable growth also keep the stone in wet condition; this constant dampness decays the stone.
- 7- **Living organism:** In the stones, sometimes holes are bored by certain insects due to which they become weak. These insects, are found in sea and thus stones near shores are effected by them.
- 8- **Movements of chemicals:** If stones of different varieties, such as limestone and sandstone, are used side by side in the same structure, the chemicals formed by the action of atmospheric agencies on one variety may move on the other and cause deterioration of the other.