

Aggregate

Aggregates can be of many types based on the different parameters. These parameters can be shape, size, strength, etc. Based on the size of the aggregates, they can broadly be classified as fine aggregate and coarse aggregate. These aggregate types essential for the GATE exam are explained below.

- **Fine aggregate:** This is the aggregate for which its size ranges between 4.75 mm to 0.075 mm. These are also called sand. These are the natural particles that the mining process can generate. It consists of the particle of the crushed stone or the sandy material.
- **Coarse aggregate:** These aggregates have a size of more than 4.75 mm. These aggregates are used in the construction of concrete structures. Such aggregates include river gravel and stone particles made from rock stratum.

Uses of Aggregate

Aggregates have many uses in the construction of various structures. Its use depends on the aggregates' size, shape and strength parameters. Aggregates are used to construct buildings, railway bridges, dams and other concrete structures. Using aggregates in concrete structures helps to bind the other ingredients in the concrete structures.

Aggregate enhances the strength of the concrete structures. Uses of aggregates are also explicitly mentioned in the GATE CE syllabus. The crushing strength of concrete is enhanced by using aggregate material. It increases the compactness of the aggregate. Its uses in concrete structures reduce the cement quantity in the concrete. Aggregates are used in different sizes in the concrete mix based on the required strength and compactness.

Classification of Aggregate

Aggregates can be classified into different types based on their origin, size, shape and other characteristics. The classification of aggregates essential for the [GATE question paper](#) is mentioned below.

1. **Based on origin:** Natural and artificial
2. **Based on size:** According to size, aggregates are classified as coarse aggregate, fine aggregate and all-in-aggregate
The aggregate retained on the 4.75 mm sieve is identified as coarse aggregate. Aggregate passing through a 4.75 mm sieve is defined as fine aggregate. Naturally available aggregates of different fractions of fine and coarse sizes are known as all-in-aggregate.

3. **Based on shape:** Aggregates are classified as rounded, irregular, angular, and flaky.
 - a. **Rounded aggregate:** These are generally obtained from rivers or sea shore and produce minimum voids (about 32 per cent) in the concrete.
 - b. **Irregular aggregate:** They have about 36 per cent voids and require more cement paste than the rounded aggregate. Because of their irregular shapes, they develop a good bond and are suitable for making ordinary concrete.
 - c. **Angular aggregate:** They have sharp, angular and rough particles having maximum voids (about 40 per cent). Angular aggregate provides a very good bond than the earlier two, are most suitable for high-strength concrete and pavements; the requirement of cement paste is relatively more.
 - d. **Flaky aggregate:** The least lateral dimension of flaky aggregate (thickness) should be less than 0.6 times the mean dimension.

Advantages of Aggregate in Concrete structures

Aggregate in civil engineering is hard structures made from the disintegration of rocks. It can be used in the designing of concrete structures and other structures. It is a durable and high-strength material. It has many advantages in the construction of concrete structures. Here are some advantages based on various [aggregate properties](#) in concrete structures.

- Aggregates provide more strength to the concrete.
- The use of aggregates in concrete structures increases the compactness of the structures.
- The use of aggregate reduces the quantity of cement in the concrete mix.
- It also reduces the water requirement in the concrete mix.
- It reduces the shrinkage of concrete in the dry mix.
- It reduces the voids in the concrete.

Different Tests on Aggregate

Different types of tests are carried out on the aggregate to determine its properties like strength, durability, corrosion resistance, hardness, etc. Here are some [tests on aggregates](#) mentioned below:

- **Crushing test:** This test is carried out to determine the aggregate's crushing strength according to IS code 2386 (part IV) 1963. The crushing value of an aggregate indicates the resistance against the crushing of the aggregates. If the crushing value of the aggregate is on or above 35, it will be considered a weak aggregate.
- **Abrasion test:** Los angles abrasion test is carried out to know the abrasion resistance of the coarse aggregate. It determines the percentage wear of the

aggregate due to relative rubbing. It also indicates the hardness property of the aggregates.

- **Impact test:** Aggregate may be supposed to impact load during its life cycle, so it's important to get the impact strength of the aggregate. It measures the strength of the aggregate against the impact load acting over the aggregate. It indicates the toughness of the aggregate.
- **Soundness test:** This test indicates the durability of the aggregate. It also indicates the aggregate's resistance property against adverse weather conditions.
- **Shape test:** This test is carried out to know the shape of the aggregate. The flakiness index and elongation index are the main important parameters to define the shape of the aggregates.

