

# Concrete

Concrete is a composite material with Coarse aggregate, Fine aggregate, Cement, Water and Admixtures. These ingredients are mixed in a fixed proportion based on strength. This proportion governs the characteristics compressive strength of concrete. Concrete and its properties are important for the [GATE exam](#). Nowadays, concrete structures are widely used worldwide. It is the second most used material in the world after water.

Concrete is a material that can be said that hardened rock material. Due to its non-homogenous [property of concrete](#), its properties in different directions will be different. Using aggregates in concrete enhances its strength and makes it more durable. The setting time of concrete mix is short range; that's why concrete production generally happens at the site.

## Use of Concrete Material

Concrete is a non-homogenous material that can resist compressive loads. Its use depends on its ingredients. Based on the ingredients, it can be of two types: plain cement or reinforced cement concrete. In plain cement concrete, no reinforcing material is used, but steel is used as a reinforcing material in the case of reinforced cement concrete.

Concrete use depends upon these types; as there is no reinforcing material in plain cement concrete, it can only resist the compressive load and will be weak in tension. Concretes are also used in forming the question in the [GATE question paper](#). But in the case of reinforced cement concrete, steel is used as reinforcing material to resist the tensile loads along with the compressive load. Concrete material can be used to construct dams, bridges, buildings, etc.

## What is the Meaning of the Grade of Concrete?

The grade of concrete represents the compressive strength of the concrete mix. The compressive strength of concrete governs by the many parameters like ingredients used, amount of water and types of cement used, etc. Based on the strength of different mixes, it can be classified as M10, M15, M20, M25 etc., grade of concrete. Here 'M' represents the mix and these digits represent the compressive strength characteristics in MPa. Depending on the different grades of concrete, the use of concrete varies. A fixed proportion of ingredients are used in the concrete mix for the different grades of concrete. These proportions are shown below:

Grade	Proportion
M5	1 : 5 : 10
M7.5	1 : 4 : 8
M10	1 : 3 : 6
M15	1 : 2 : 4
M20	1 : 1.5 : 3
M25	1 : 1 : 2
M30	1 : 1 : 3

## Compressive Strength of Concrete

The compressive strength of concrete is the strength of concrete that can be resisted in terms of compressive load. Compressive strength can be determined in the laboratory as well as in the field by different methods. In the laboratory, compressive strength is determined in the universal testing machine. Some non-destructive testing of concrete is also available that is used after constructing the concrete structures.

The compressive strength of concrete is reported in terms of its characteristics compressive strength. It is the value of compressive strength for which only 5% of test results are expected to be below this strength. It can be related as follows:

$$f_{ck} = f_m - 1.65 \sigma$$

Where

- $f_{ck}$  = characteristics compressive strength
- $f_m$  = Mean compressive strength, and sigma is the standard deviation.

Mean compressive strength is the average compressive strength of all samples of concrete.

## What is Prestressed Concrete?

Prestress concrete is a type of concrete that is stressed before its use. Prestressing of concrete can be done before the casting of concrete or after the casting of concrete. Based on this, it is classified as pre-tensioned and post-tensioned,

respectively. These two types of prestressing have some advantages and disadvantages; based on those, it is used in constructing structures.

[Prestress concrete](#) is constructed before its use in construction. The minimum grade of concrete is M40 for the construction of prestressed concrete. Such type of concrete mix is having high strength than the normal mix. These are used for the high amount of stress transfer. For example, these are used in the case of concrete pavement, railway sleepers, etc.

## Workability of Concrete

The workability of concrete measures its ability to place the concrete and its setting. The workability of concrete depends upon many factors like ingredients used, water content, water-cement ratio and use of admixtures. Good workable concrete takes more time, and less workable concrete sets early. So, workability should be optimum so that concrete can be placed in sets accordingly.

Many methods are available to determine the workability of concrete: the slump method, compaction factor test, vee bee consistometer test, and flow table test. This test works for different ranges of workability. Like the [vee-bee consistometer](#) test is only used for low-workable concrete.

For more information about the concrete material, like its properties, ingredients and other related concepts, you can refer to the following video on the **Byjus Exam Prep's** official youtube channel.

## Benefits of Using Concrete in Construction

Concrete has various uses in the construction world. It is the most commonly used material for construction works. Concrete is a brittle material that can take the compressive load and tensile strength of concrete. Here are some benefits of concrete are listed below:

- Concrete structures are environment friendly.
- These structures are cost-effective.
- Concrete structures are durable and fire-resistant.
- Ingredients of concrete are easily available.