

# An Experimental Study on Partial Replacement of River Sand by Crushed Sand for M20 Grade of Concrete

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DOI: 10.5281/zenodo.16165608

## ABSTRACT

*Concrete is a dominant part of construction industry. In India, ordinary concrete contains natural sand obtained from riverbeds as fine aggregates. In recent times with a boost in construction activities, there is a significant increase in the consumption of concrete causing the scarcity of natural sand. Because of several environmental issues thereby government imposing a ban on the uncontrolled use of natural sand. This has resulted in the significant rise in cost of natural sand. Therefore, to find a substitute to river sand has become the necessary in last two decades. The progressive use of crushed sand will conserve the natural resources for the sustainable development of the concrete in construction industry. In the experimental study of strength characteristics of concrete using crushed sand as fine aggregate it is found that replacement of crushed sand can be very much helpful.*

**Keyword – River Sand, Crushed Sand and Building materials**

## 1. INTRODUCTION:

Cement concrete is a mixture of coarse aggregates, fine aggregates, cement and water in certain proportion so as to make a concrete of desired quality. In India, the natural sand which excavated from river bed is used to produce conventional concrete. Conventionally concrete is mixture of cement, sand and aggregate. Properties of aggregate affect the durability and performance of concrete, so fine aggregate is an essential component of concrete. Depletion of natural sand causes the environmental problem and hence sand excavating is restricted by government which resulted in shortage and drastically increase in its cost. The use of manufactured sand as an effort towards viable development in India. It will help to find a viable solution to the diminishing availability of natural sand to make eco-balance. The M sand is obtained by crushing the rocks. Environmental concerns are also being rising against uncontrolled extraction of natural sand. The argument is mostly in regards of protecting the natural river bed against erosion and importance of having natural sand as a filter for ground water.

## Material Used

Various materials that have been used for the purpose of this project can be mainly enlisted in the following manner.

- Cement
- Coarse Aggregate
- Fine Aggregate
- Crushed Sand
- Water

## 2. Testing on Material

### Standard Consistency Test Procedure

Table 2.1 : Observation Table of Standard Consistency Test

Sr. No.	Wt. of cement (gm)	Percentage Water of dry cement (%)	Amount of water added (ml)	Penetration (mm)
1	500	28	140	13
2	500	30	150	10
3	500	32	160	6

**Result :** The normal consistency of a given sample of cement is 32%.

1. Weight of given sample of cement is 500 gm.
2. The normal consistency of a given sample of cement is 32%.

**Table 2.2: Observation Table of Setting Time Test**

Type of setting	Setting Time Test	Penetration from Top (mm)
Initial	30	5
Final	600	0

**Result**

1. The initial setting time of the cement sample is found to be 45 min.
2. The final setting time of cement sample is found to be 390 min.

**Particle Size Distribution****Table 2.3 : Observation Table of Fine Aggregate**

IS Sieve	Wt. Retained on sieve (gm)	Cumulative Weight retained	Cumulative Weight passing (%)	Cumulative Percentage Of passing (%)	IS-383:1970 % Passing for grading zone-I <sup>st</sup>
4.75mm	0	0	0	100	90-100
2.36mm	126	126	12.6	87.4	60-95
1.18mm	458	584	58.4	41.6	30-70
600micron	142	726	72.6	27.4	15-34
300micron	154	880	88	12	5-30
150micron	55	935	93.5	6.5	0-10
Pan	65	1000	100	0	-

**Result**

1. Fineness modulus of a given sample of Fine Aggregate is 3.2 that indicate coarse sand.
2. The given sample of fine aggregate is belonging to Grading zone 1.

**Performance Analysis****Compressive Strength Test**

Below Table As we observed compressive strength in concrete on cube the % of crushed sand represent, and curing period of 7 days and 28 days, the compressive strength are mentioned table.

**Compressive Strength Test**

Mix	% Crushed Sand	7 days	28 Days
M1	0	21.75	27.52
M2	20	17.54	19.83
M3	30	18.08	26.15
M4	40	22.44	29.52
M5	50	20.48	23.42

**Split Tensile Test**

Below Table represents the split tensile strength of concrete mixes where the test for determining split tensile strength employs a cylinder specimen of size 300mm length and 150mm diameter which is subjected to compression in compression testing machine and. shows the graphical representations of split tensile strength of mixes M1 and M2 for 7 and 28 days

Table represents the split tensile strength of concrete mixes M1 & M2 for 7 and 28 days as given below.

Mix	% Crushed sand	7 days	28 days
M1	0	7.30	8.93
M2	40	6.42	9.26

**4. CONCLUSIONS**

Following are the major conclusions drawn from the study: -

- It is observed that the compressive strength of concrete is improved by partial replacement of 40% of crushed sand.
- It is observed that the flexural strength and split tensile strength of concrete is also improved by partial replacement of 40% of crushed sand.
- It is observed that 20% of replacement of crushed sand compressive strength is minimum.
- At 20% replacement compressive strength is reduced by 48%.
- Crushed sand has potential to provide alternative natural river sand and helps in maintaining the environment as well as economical balanced.
- We can replace around 40% crushed sand to reduce the use of natural river sand.

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