

# Use of Mount Crushed Rock as Replacement of Fine Aggregate in Concrete

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**Abstract** - Concrete is a significant structure material which is utilized in development all through the world. It is very flexible and is utilized for a wide range of structures. Because of quick development in development action, the utilization of cement is expanding each year. This outcomes in over the top extraction of regular totals. The utilization of these materials is being obliged by urbanization, zoning guidelines, expanded expense and ecological concern. Accordingly, it is getting inescapable to utilize elective materials for totals in solid which incorporate reused totals, fly debris, made sand, squashed stone powder and so on. The utilization of such materials brings about protection of normal assets as well as aides in keeping up great ecological conditions. The present examination points in the investigation of properties of mortar and cement in which Crushed Rock Powder (CRP) is utilized as a fractional and full swap for common sand. For mortar, CRP is supplanted 100%. The fundamental quality properties of cement were examined by supplanting regular sand by CRP at substitution levels of 20%, 30% and 40%.

**Index Terms** - Crushed Rock Powder (CRP), Alternate building materials (Aggregate & Sand).

## I. INTRODUCTION

Concrete is a generally utilized development material comprising of establishing material, fine total, coarse total and required amount of water, where in the fine total is typically common sand. The utilization of sand in development brings about unnecessary sand mining which is questionable. Because of fast development in development action, the accessible wellsprings of Sakthivel sand may must be shipped from long separation, which adds to the expense of development. Sometimes, the characteristic sand may not be of acceptable quality. Thus, regular sand concreting is required to some extent or entirely by alternative

materials without taking the form of cement. CRP is a material that can be used for total sand extraction. The present investigation is planned for using Crushed Rock Powder as fine total in concrete mortar and concrete solid, supplanting characteristic sand. Currently, India has taken a major initiative on developing the infrastructures such as express highways, power projects and industrial structures etc., to meet the requirements of globalization. To meet this demand of construction industry excessive quarrying of sand from riverbeds is taking place causing the depletion of sand resources. Natural sand is excavated from riverbed impacts on environment in many ways. Due to digging of the sand from riverbed reduces the water head, so less percolation of rainwater in ground, which result in lower ground water level. There is erosion of nearby land due to excess sand lifting as well as it destroys the flora & fauna in surrounding areas. Natural or river sand are weathered and worn out particles of rock and are of various grade or size depending upon wearing. Natural sand is mainly excavated from riverbeds and always contains high percentages of inorganic materials, chlorides, sulphates, silt, and clay that adversely affecting the strength & durability of concrete & reinforcing steel there by reducing the life of structure. Digging sand, from riverbed, in excess quantity is hazardous to environment and causing bank slides, loss of vegetation on the bank of rivers.

The cheapest and the easiest way of getting substitute for natural sand is by crushing natural stone to get artificial sand of desired size and grade which would be free from all impurities. Use of crushed sand has become a good substitute for natural sand and it has become essential keeping in view of technical, commercial & environmental requirements. Crushed sand is manufactured by crushing larger stones of

quarry to particular size of sand. Its chemical & physical properties such as color, size & shape, surface texture up particles depend upon types of stone & its source the artificial sand produce by machine can be a better substitute to natural river sand. The sand must be of proper gradation (it should have particle from 150 micron to 4.75 mm in proper proportion) Fine and coarse aggregate constitute about 75% of total volume. It is, therefore, important to obtain right type and good quality aggregate at site, because the aggregate form the main matrix of concrete or mortar. When fine particle is in proper proportion, the sand will have fewer voids. In this situation research began for inexpensive and easily available alternative material to natural sand. Under these circumstances use of natural sand is inevitable. For the purpose of experimentation, we are going design concrete mixes of M20 grades by different replacement of natural sand to artificial sand. Its mechanical properties namely cube compressive strength; flexural strength and split tensile strength are studied in this experiment.



I.

## II.PROCEDURE

### A. Material Used

In our experiment we used Ordinary Portland Cement of 53 grades available in local market of standard brand. We used fine aggregate as locally available natural Sand and mount crushed rock sand. We used water in preparation of mortar which is least expensive but most important ingredient of concrete. The water which is used for making concrete should be clean and free from harmful impurities such as Oil, Alkalis, Acids, etc. In general, the water which was fit for drinking, used for making concrete and crushed rock sand used in that of size less than 4.75m.

### B. Curing & Casting

For the casting, the cast iron moulds are cleaned of dust particles and applied with oil on all sides before concrete is poured in the moulds. The moulds are placed on a level platform. The well mixed concrete is filled, allowed to flow, and settle itself in the moulds. Excess concrete is removed with trowel and top surface is kept level and smooth. In this total number of 9 cubes are casted. In that from 80%, 90%, 100% replacement of natural sand with mount crushed rock sand. It means that we prepared 9 blocks for compression test. After that the specimens are cured in mould for 24 hours. After 24 hours, all samples are removed from the mold and kept in the healing tank for 28 days. After days all weight samples are kept in the environment for 1 day for continuous weighting. And then the test is taken.

### C. Slump Cone Testing

Slump cone is used to find the slump of the concrete as per the requirement of IS11991959.



Fig. Slump cone testing

Oil is applied on the base plate and interior surface of the slump cone. The slump cone is kept on a leveled surface and filled with fresh concrete in three layers, approximately one-third of height of the cone. Each Layer is tamped 25 times with a tamping rod. After compacting the top layer, the concrete surface is struck off. The slump cone is removed by rising it slowly in vertical direction. The slump is recorded as the height to which concrete settle from the height at the highest point of the concrete.

**D. Specific Gravity of Mount Crushed Rock Sand**

In concrete technology, specific gravity of mount crushed rock sand is made use of in design calculation of concrete mixes. Specific gravity of mount crushed rock sand is necessary to be taken when we are dealing with light weight and heavy weight concrete. The average specific gravity of the rocks lies between 2.6 to 2.8. Make the pycnometer dry & weight it with its cap & ring unscrew the cap & rut 200gms of aggregate & weight it adds water to the top of brass cap. Removed all the trap dry by pouring additional water. Dry the pycnometer & filled it to the top & weight it repeats the procedure. Find the average specific gravity by using formula.



Table No. 3.1.3: Grading limits of fine aggregates I S: 3831970

IS Sieve Designation	Grading Zone A	Grading Zone B	Grading Zone C	Grading Zone D
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600micron	15-34	35-59	60-79	80-100
300micron	5-20	8-30	12-40	15-50
150micron	0-10	0-10	0-10	0-15

Table No. 3.1.4: Grading limit of all in aggregate:

IS Sieve Designation	40mm nominal size	20mm nominal size
80mm	100	-
40mm	95-100	100

20mm	45-75	95-100
4.75mm	25-45	30-50
600micron	8-30	10-35
150micron	0-6	0-6

**E. Compression Strength Testing**

Out of many tests applied to the solid, this is the significant test which gives a thought regarding all the attributes of cement. By this single test one adjudicator that in the case of cementing has been done appropriately or not. For solid shape test examples blocks of 15 cm X 15 cm X 15 cm are readied. This solid is poured in the form and tempered appropriately so as not to have any voids. Following 24 hours these molds are eliminated and test examples are placed in water for relieving. The top surface of this example ought to be made even and smooth. These specimens are tested by compression testing machine after 28 days curing. Also split tensile strength is tested.



Table 1: Compressive Strength of Concrete

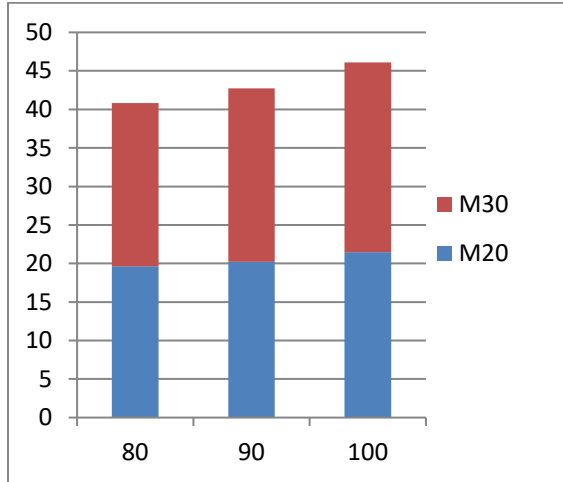
Grade of concrete	% of Mount Crushed Rock Sand	28 Days Strength N/mm <sup>2</sup>
M20	80	19.26
	90	20.21
	100	21.46
M30	80	21.22
	90	22.52
	100	24.62

Table 2: Split Tensile Strength of Concrete

Grade of concrete	% of Mount Crushed Rock Sand	28 days Strength N/mm <sup>2</sup>
M20	80	1.60
	90	1.68
	100	1.71
M30	80	2.17
	90	2.21
	100	2.26

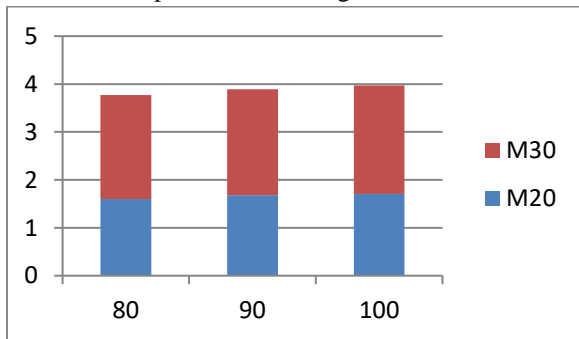
III.RESULTS AND DISCUSSION

Chart No. 1: Compressive Strength of Concrete



% of Mount Crushed Rock Sand

Chart No.2: Split Tensile Strength of Concrete



% of Mount Crushed Rock Sand

As we can see in the charts the actual compressive strength and split tensile strength of concrete is near about same and little decrease in the reading of 28 days strength are allowed. So, from our results it is proved that we can use mount crushed rock sand as a substitute of fine aggregates or sand.

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V. CONCLUSION

A survey of various trial contemplates performed by different analysts have been completed to look at different operational boundaries like workability, compressive strength, strength with squashed sand as substitution to the characteristic sand in that all out examination. I feel that following ends are made.

1. The concrete with mount crushed rock sand performed better than concrete with natural sand as the property of mount crushed rock sand is better than that of natural sand.
2. The maximum tensile strength of concrete is obtained at 70% and 80% replacement of natural sand with mount crushed rock sand.
3. From our study it is concluded that the mount crushed rock sand is budget friendly.

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