"REPLACEMENT ON NATURAL SAND BY STONE DUST"

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Abstract

In concrete, generally natural sand is used as a fine aggregate. Owing to increased construction activities and scarcity of natural resources, depletion of natural resources has become a great threat. The only way is to use alternative materials. So STONE DUST (M sand) is such an alternative material which can be effectively used in construction as a replacement of natural sand. The purpose of the study is to explore the eventuality of using M Sand as substitute of natural sand. M35 concrete mix is used in the present investigation. The outcomes will indicate that M Sand can be effectively used in reserve of natural sand in concrete. Substitution of the natural sand by M Sand was investigated. It observed that stone dust can be use as replace of natural sand by increasing certain amount of cement. With substitution of M Sand, demand of earth surface can be degraded and able to figure out the challenges of natural sand inadequacy. It has become very costly to construct a house in Maharashtra due to the presence of illegal natural sand market and that is the cause to find out for an alternative material.

Keywords: STONE DUST, M sand, replacement of natural river sand, waste material, workability, compressive strength, sieve analysis.

Introduction: Concrete is an agglomerate of coarse aggregate, fine aggregate and water. Due to its low cost, concrete widely used on sites. As development activities are increasing rapidly, due to this consumption of concrete also increase. Due to rapid construction activities requires production of more and more quantity of concrete in construction industry, which needs more natural sand and coarse aggregate. Due to ban on natural sand, illegal mining increases. According to the news, the rate of one brass of sand, which stood Rs 8000. Businessman face difficulties while running their business. Due to this, we need another fine aggregate as replacement of natural sand. While production of coarse aggregate in plants, a huge amount of M Sand is produced. This M Sand being a unproductive material can be used as fine aggregate in construction industry. This will result in conservation of natural resources, besides helping in environment protection and disposal of stone dust in abundance.

Objective:

>To analyze the effect of 100% of substitution of natural sand by M Sand.

>To prepare cubes of different cement proportions.

>To conduct the compressive strength test and compare the observed result with standard values.

>To study the effect on workability and improve it by using suitable plasticizers.

>Today also there is a lack of awareness among common peoples and many construction officials.

Scope:

As shortage of natural sand increasing after a ban imposed by Supreme Court. Many builder, developers and many government organization have started finding an alternate . Stone dust to be used for construction in upcoming projects. The stone dust is not only the alternate but is superior in different ways.

Literature Review:

1. Stone Dust in Concrete: Effect on Compressive Strength:

Stone dust is a waste material obtained from crusher plants. It has potential to be used as partial replacement of natural river sand in concrete. Use of stone dust in concrete not only improve the quality of concrete but also conserve the natural river sand for future generations. In the present investigation, an experiment program was carried out to study the workability and compressive strength of concrete made using stone dust as partial replacement of fine aggregate in the

range of 10% - 100%. M25 grade of concrete was designed using Portland pozzolana cement (PPC) for referral concrete. Workability and Compressive strength were determined at different replacement level of fine aggregate viz a viz referral concrete and optimum replacement level was determined based on compressive strength. Results showed that by replacing 60% of fine aggregate with stone dust concrete of maximum compressive strength can be made as compared to all other

replacement levels. Slump(mm) of concrete made using stone dust decreases abruptly with increase in replacement level of river sand.

2. Influence of stone dust as fine aggregate replacement on concrete compressive strength using an analysis of variance (ANOVA)

The use of stone dust in concrete provides environmental benefits by reducing the impacts produced by the extraction of natural sand. The use of this material can also offer economic advantages, since the product is less costly than natural sand. In this way, the present work evaluated the compressive strength of concretes made with stone dust in different replacement levels (30% and 100%) compared to the use of natural sand. The results were analyzed statistically using the Analysis of Variance

(ANOVA) in order to verify the statistical influence of replacement levels and the mix proportioning in the resulting compressive strength. It was found that the compressive strength of concrete with 30% of replacement level presented similar behavior to reference concrete, showing that the use in structural concrete is feasible.

3. Crushed stone waste as fine aggregate for concrete

It can be concluded that if 40 percent sand is replaced by stone dust in concrete, it will not only reduce the cost of concrete but at the same time will save large quantity of natural sand and will also reduce the pollution created due to the disposal of this stone dust on valuable fertile land.

4. Review on Use of Stone Dust as a Partial Replacement of Fine Aggregates in concrete as a Rigid Pavement

Currently India has taken a major initiative on developing the infrastructures such as express highways, power projects, ports and harbors, to meet the requirements of globalization, in the construction of pavements and other structures concrete plays the key role and a large quantum of concrete is being utilized in every construction practices. River sand, which is one of the constituents used in the production of conventional concrete, has become very expensive and also becoming scarce due to depletion of river bed. In view of this, there is a need to identify suitable alternative material from waste in place of river sand. Today researches all over the world are focusing on ways of utilizing either industrial or agricultural wastes as a source of raw materials for the construction industry. These wastes utilization would not only be economical, but may also help to create a sustainable and pollution free environment. The main problem in the world is now or future existing is the downstream of the natural resources for building and constructing purpose. Basically, Countries like India should concern with these developments to undergone by replacing the materials of the industrial by products and waste products to minimize the use of the natural sources in the building and construction. Concrete is the material mostly used in the construction field for building and pavement construction. Natural sand is a very fine material which can contribute for a concrete to solidify to give the necessary strength for a certain structure. Natural sand fill up the pores or voids inside concrete which is also a contributing factor for the strength of the concrete.

Methodology:

In order to study effect of mixing stone dust and sikaplast with concrete under compression 30 cube work casted the experimental program was divided onto 4 mixes each mix consist of 6 cube of 15cm*15cm*15 cm .

Mix design - M35 grade concrete

Mix designing is a method of selecting appropriate constituents for concreteand find its properties. Designing is done in a way to maximize the strength and durability. Concrete is designed to satisfy the requirements and produce economical concrete.
Designing was done as per IS 10262-2009 and water cement ratio was taken as 0.45.

Details of specimens :

Mix	Composition
Trial mix 1	Cement = 350 kg , Water = 157.7kg, Fine aggregate = 764.9 kg, Coarse aggregate = 1112.8kg (20mm = 667.7kg, 10mm=445.12kg) Admixture=3.15kg, Water cement ratio =0.45
Trial mix 2	Cement = 370kg, Water = 166.5kg, Fine Aggregate = 748.3kg, Coarse Aggregate = 1088.7kg (20mm = 653.2kg, 10mm =435.5kg), Admixture = 3.33kg , Water cement ratio =0.45
Trial mix 3	Cement = 390kg, Water =175.5kg, Fine aggregate = 731.7kg, Coarse aggregate = 1064.7kg (20mm = 638.82kg, 10mm = 425.88kg), Admixture = 3.51kg, Water cement ratio = 0.45

Trial mix 4	Cement = 410kg, Water = 184.5kg, Fine aggregate = 715.4kg, Coarse aggregate = 1040.8kg (20mm = 624.48kg, 10mm = 416.32kg), Admixture = 3.69kg, Water cement ratio = 0.45

Stipulations for testing:

1) Grade - M35
2) Class of aggregate- crushed angular aggregate
3) Method of placing concrete- Pumping
4) Class of cement- OPC 53
5) Max. Nominal size of aggregate- 20mm
6) Mini. Cement content-300 kg
7) Max. water cement ratio- 0.5
8) Workability -100 mm
9) Exposure type-Moderate
10) Max. cement content-410kg/m3

Data for material:

1) Cement - OPC 53
2) S.G. of cement-3.1
3) Chemical admixture- Super plasticizer [Sikaplast 4202NS SG-1.1]
4) 4) S.G (i) C A -2.7
   (ii) F A -2.43(Stone dust)

5) H20 absorption (i) C A -0.5%

(ii) F A -1.0%

Tests and Results : 1) Sieve Analysis: To determine the particle size distribution of fine aggregate and whether it is suitable to use in concrete mixing.

Sieve analysis of fine aggregate

Sieve Size		Weight Retain		Average Wt Retaining	% Wt Retaining	Cum. Wt Retaining	Percent Passing
	A	B	C				
10 mm	0	0	0	0	0	0	100
4.75mm	0	0	0	0	0	0	100
2.36mm	55	53	42	50	5	5	95
1.18mm	311	326	319	319	31.9	36.9	63.1
600 u	188	193	208	196	19.6	56.5	43.5
300 u	226	235	237	233	23.3	79.8	20.2
150 u	143	135	131	136	13.6	93.4	6.6

PAN	76	58	63	66	6.6	100	0

It was found that the fineness modulus was 2.71

Coarse aggregate size 10mm

Sieve size	**Wt. retained**	**Cum wt retaining**	**Cum %retaining**	**Passing %**	**IS 383-1970**
80mm	0	0	0	100	100
40mm	0	0	0	100	90-100
20mm	0	0	0	100	85-100
10mm	2192	2192	43.84	56.16	55-90
4.75mm	2728	4920	98.4	1.6	0-10
2.36mm	80	5000	100	0	0
1.18mm	0	5000	100	0	0
0.6mm	0	5000	100	0	0
0.3mm	0	5000	100	0	0
0.15mm	0	5000	100	0	0
Total	5000		642.24		

Fineness modulus = 642.24/100 = 6.42

Coarse aggregate size 20mm

Sieve size	**Wt retaining**	**Cumwt retaining**	**Cum % wt retaining**	**% Passing**	**IS 383-1970**
80mm	0	0	0	100	100
40mm	0	0	0	100	100
20mm	0	0	0	100	85-100
10mm	3476	3476	69.52	30.48	25-55
4.75mm	1524	5000	100	0	0-10
2.36mm	0	5000	100	0	0
1.18mm	0	5000	100	0	0
0.6mm	0	5000	100	0	0
0.3mm	0	5000	100	0	0
0.15mm	0	5000	100	0	0
Total	5000		669.52		

Fineness modulus = 669.52/100 = 6.69

2) Slump Test: Slump is generally used to find out the workability of freshly made concrete in the labs or on the construction site throughout the progress of the construction work.

The slump was found out to be 100mm .

3) Compressive Strength Test :

To find out compressive strength values of concrete cubes this test is used.

Observations -

7 days comp strength

Mix	**Age in days**	**Failure load(KN)**	**Comp strength (MPa)**	**Avg comp strength (MPa)**
Trial mix 1	7	457 567 527	20.3 25.2 23.4	22.9
Trial mix 2	7	648 587 619	28.8 26.1 27.5	27.4
Trial mix 3	7	716 689 648	31.8 30.6 28.8	30.3
Trial mix 4	7	745 738 747	33.1 32.8 33.2	33.03
Standard Mix 1(with sand)	7	570	23.2	23.2

Standard Mix 2(with sand)	**7**	632	28.1	28.1
Standard Mix 3 (with sand)	**7**	705	31.5	31.5
Standard Mix 4 (with sand)	**7**	740	33.01	33.01

28 days comp strength

Mix	**Age in days**	**Failure load(KN)**	**Comp strength (MPa)**	**Avg comp strength (Mpa)**
Trial mix 1	28	727 783 805	32.3 34.8 35.6	34.25

Trial mix 2	28	941 866 887	41.8 38.5 39.4	39.9
Trial mix 3	28	981 1028 997	43.6 45.7 44.3	44.53
Trial mix 4	28	1098 1105 1086	48.8 49.1 48.2	48.7
Standard Mix 1(with sand)	28	780	35.1	35.1
Standard Mix 2 (with sand)	28	973	43.25	43.25
Standard Mix 3 (with sand)	28	998	46.02	46.02

Standard Mix 4 (with sand)	28	1100	49.7	49.7

Conclusions:

1) Slump Results

The slump value of concrete decreases with the addition of stone dust as it has a higher water absorption capacity as compared to natural sand. Slump loss is not of much importance as super plasticizer is used for increasing the workability.

2) Compressive strength test

It is observed that the compressive strength of concrete decreases when stone dust is used in place of sand for a same mix proportion.

Compressive strength is affected directly by water cement ratio and cement content.

Compressive strength was observed to be increasing as cement content was increased.

Stone dust can be satisfactorily used as replacement of sand with certain modifications in the composition of concrete.

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