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Experimental Analysis on Concrete with Partially Replacement of Cement and Sand with Marble Powder and Crusher Sand

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Abstract: Utilization of marble powder and different is Crusher sand as incomplete substitution of concrete and stable creation. Right now ruin down the excellent of cement made with utilizing these waste substances one is marble powder and different is Crusher sand. The marble powder is utilized as 16% supplant by means of weight of concrete and Crusher sand as the incomplete substitution of Fine Aggregate from 0%, 6%, 12%, 18%, 24%, 30% and 36%. The comparison of the strong right here is M-30, M-35 and M-40 evaluation. It has been utilized as a substitution of nice totals in severa writing works but this paper famous the practicality of the substitution of marble powder for concrete to accomplish financial system and circumstance sparing. Droop Test was once performed for the crisp cement whilst Flexure Strength Tests have been conveyed for the Hardened cement. All exams are carried out at 7-day, 14 - day, and 28 days with zero to 36% substitution of sand at a meantime of 6%. Investigation, for example, express gravity trial of Crusher sand and sand by means of pycnometer strategy, dampness substance of sand and Crusher sand with the aid of range drying technique, normal consistency of concrete, and beginning placing time of concrete, have been carried out to determine the bodily property of cement.

Keywords—marble powder, Crusher sand, Mix Design, slump and Flexure Test

1. INTRODUCTION

The improvement enterprise is not simply utilized in constructing development but in addition in specific territories like extensions, streets, harbors, dam, Railways and some more. It is highly prudent, easy to make gives congruity robustness and absolutely it lays the job of developing and enhancing or existing day life. It is a composite cloth which is comprised of sand, concrete, whole and water. The new concrete can be structure into any craving shape. The lifestyles of the stable is excessive so it tends to be utilized as adaptable material. In the strong the concrete is utilized as the folio cloth which has the coupling inclination. Because of increment in workouts for a variety of locales and utilities terrifying of the usually on hand property is being restricted due to the fact of it is over abuse. This is the hazard to the earth. Additionally the utilization of everyday fabric turns out to be high-priced step through step. Subsequently safety of the typically on hand fabric is tremendous take a look at for the structural specialists. By using the optional substances which diminished halfway, there is nice way to seem to be via substances which can absolutely or incompletely supplanted generally reachable fabric in the improvement field. The one-of-a-kind optionally available substances are utilized as fractional for definitely substitution of normal fabric for instance Rice husk debris, fly-debris, sugarcane bagasse's debris, coconut shell, squashed sand, reused whole and so on. Here we make use of the two waste substances which is efficaciously accessible. The Crusher sand delivered from stone pounding zones appears as a difficulty for compelling removal. Which is utilized right here as partly substitution as high-quality total. Additionally the glass powder created from companies is likewise a waste fabric which can be utilized as fractional substitution as concrete. Sand is a cloth utilized in concrete as high-quality aggregate.

2. OBJECTIVE

1. The objective of this study is to search alternatives material which can fully or partially replaced naturally available material in construction
2. The main purpose of this study is to reduce the use of conventional material for making the concrete.
3. Substitution of normal sand by crusher sand will serve both solid waste minimization and waste recovery.
4. To check the workability of the concrete by adding marble Powder and crusher sand
5. To find out the Flexure strength Test of concrete by adding marble Powder and crusher sand.

6. To determine the optimum percentage of Marble Powder is 16% and crusher sand in concrete by replacing 0%, 6%, 12%, 18%, 24%, 30% and 36% of fine aggregate for M-40, Grade of concrete.

3. LITERATURE REVIEW

Numerous works have been due to investigate the advantages of utilizing different waste materials, for example, rock dust, marble dust, Crusher sand and glass powder in making and improving the properties of cement. The accompanying works have done by the creators as portray beneath

Utilization of Crusher sand as a fine total in solid draws genuine consideration of analysts and specialists. The most extreme compressive and flexural qualities were watched for examples containing a 6% squander muck when contrasted and control and it was likewise discovered that waste slop up to 9% could successfully be utilized as an added substance material in concrete could adequately be utilized as an added substance material in concrete. With the consideration of Marble powder the quality of cement progressively increments up to a specific cutoff yet the bit by bit diminishes. With the incorporation of Marble powder upto10% the underlying quality increase in concrete is high. At 10% there is 27.4% expansion in starting Split Tensile quality for 7 days. At 10% there is 11.5% expansion in introductory Split Tensile quality for 28 days. The underlying quality slowly diminishes from 15%. It was discovered that the ideal rate for supplanting of marble powder with concrete and it is practically 10% concrete for the two 3D shapes and chambers,

P. Aggarwal et al [5] completed the trial examinations on the impact of utilization of that material of debris as a substitution of fine totals. The quality advancement for an assortment of rates (0-half) supplanting of fine totals with base debris can without much of a stretch be likened the quality improvement of ostensible cement at various ages. Dr. Lalit Kumar, Er. Arvinder Singh. Have research the plausibility of utilizing squashed stone residue as fine total incompletely or completely with various evaluations of solid composites. The appropriateness of squashed stone residue squander as a fine total for concrete has been evaluated by contrasting its essential properties and that of traditional cement. Two fundamental blends were picked for common sand to accomplish M25 and M30 grade concrete. The equal blends were gotten by supplanting common sand by stone residue halfway and completely. The test outcomes shows the squashed stone residue can be utilized successfully to supplant regular sand in concrete. In the exploratory investigation of solidarity qualities of solid utilizing squashed stone residue as fine total it is discovered that there is increment in compressive quality, flexure quality and rigidity.

III. Materials Uses

1. Cement

In the present work locally available Portland Pozzolana Cement (fly ash based) brand name Birla Gold confirming to IS: 1489 (Part 1) -1991 was used. Having specific gravity 3.12 and normal consistency 33%

Table 1 Composition of Ordinary Cement

Ingredients	Desired Range of Percentage
Lime (Cao)	62 to 67
Silica (SiO_2)	17 to 25
Alumina (Al_2O_3)	3 to 8
Calcium Sulphate ($CaSO_4$)	3 to 4
Iron Oxide (Fe_2O_3)	3 to 4
Magnesia (MgO)	0.1 to 3
Sulphur (S)	1 to 3
Alkalies	0.2 to 1

2. Fine Aggregate

The fine aggregate in this research work are used from locally available and confirms to zone II of IS 383:1970. Having specific gravity 2.67 and fineness modulus 2.87

Fig.2: Sand Sample

Table 2. Sieve Analysis of Fine aggregate

Sieve Size	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative Percentage weight retained	% Passing
4.75 mm	-	-	-	100
2.36 mm	55	55	5.5	94.5
1.18 mm	228	283	28.3	71.7

600 µ	348	631	63.1	36.9
300 µ	285	916	91.6	8.4
150 µ	75	991	99.1	0.9
Pan	5	996	100	0
Total 1 Kg	Fineness Modulus = 287.6/100 = 2.87			

3. Coarse Aggregate

Two aggregate of sizes 20 mm and 10 mm were used from local available in this work. The specific gravity of coarse aggregate was 2.72 for both the fractions. The sieve analysis of 10 mm and 20 mm coarse aggregate is given is table below. The 20 mm and 10 mm aggregate were mixed in the ratio of 60:40. The coarse aggregates are confirms to IS 383:1970 and having specific gravity 2.84 and fineness modulus 6.026

Table 3. Sieve analysis for coarse aggregate of 20 mm size

Sieve size	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative Percentage weight retained	% passing
40 mm	-	-	-	100
20 mm	484	484	9.68	90.32
10 mm	4165	4649	92.98	7.02
4.75 mm	345	4994	100	-
1.18 mm	0	4994	100	-
600 µ	0	4994	100	-
300 µ	0	4994	100	-
150 µ	0	4994	100	-
Total = 5 Kg	Fineness modulus = 602.66/100 = 6.026			

Table 4. Sieve analysis for coarse aggregate of 10 mm size.

Sieve size	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative % weight retained	% passing
20 mm	-	-	-	100
10 mm	2856	2856	57.12	42.88
4.75 mm	1394	4250	85	15
2.36 mm	744	4992	100	-
1.18 mm	0	4992	100	-
600 µ	0	4992	100	-
300 µ	0	4992	100	-
150 µ	0		100	-
Total = 5 Kg	Fineness modulus = 642.12/100 = 6.42			

4. Crusher sand

Crusher sand produced from stone crushing zones appears as a problem for effective disposal. Hence in this work stone dust is used in the concrete as partial replacement of the sand. The main purpose of this work is to waste minimization. The study focuses to determine the relative performance of concrete by using stone dust. Stone dust was collected from local stone crushing units.

Table 5. Sieve analysis for Crusher sand

Sieve size	Weight retained (gm)	Cumulative weight retained	Cumulative percentage weight retained	% passing
4.75 mm	-	-	-	100
2.36 mm	24	24	2.4	97.6
1.18 mm	158	182	18.2	81.8
600 µ	185	367	36.7	63.3
300 µ	385	752	75.2	24.8
150 µ	197	949	94.9	5.1
Pan	46	995	100	0
Total = 1 kg	Fineness modulus = 227.40/100 = 2.27			

5. Marble Powder

Waste Marble Powder in this study was used from locally available market. Marble Powder waste is very hard material. The Marble Powder if ball pulverized and particles size are less than 150 µm and sieved through 75 µm.

6. Water

The clean portable water is used in this experimental work without any visible impurities.

IV Experimental Details

1. Mix design

In this experiment we select the two grades of concrete M-30. The mix design was carried out as per IS: 10262-2009. The trials have been prepared and. M-40 grade was

design for this experiment having the mix proportion 1:1.32:2.85 and the water cement ratio are 0.43. All locally available materials are used during the preparation of the mix proportion.

2. Mixing and casting of samples

The mixing and casting were done with proper care and all materials were weighted properly and mixed in laboratory concrete mixer. The water is added after all materials are feed into in mixer in proper order. The cubes were filled and compacted by using table vibrating machine and the cylinder and beams were compacted using the tamping rod for around 25 times. The moulds were leveled properly. The specimens were kept for 24 hours andthen it is removed from mould and kept in curing tank till the testing days. All specimens are tested at 7, 14, and 28 days.

Fig. 3 mixing of concrete

V. Results

4. Flexure Strength Tests

The flexure strength also known as modulus of rupture, bends strength, or fracture strength. The value of modulus of rupture depends on the dimensions of the beam and manner of loading. The value of the flexural strength is about 10 to 20 percent of compressive strength depending on the type, size and volume of coarse aggregate used. In these tests the beams were casted having the size 150x150x700 mm. For this the moulds of the same sizes are taken which are confirming to the IS specification. During the casting it is compacted by using the tamping rod of around 25 times the diameter of the tamping rod is 16 mm. The flexure strength was tested at the age of 7, 14 and 28 days curing.

Fig. 6 Flexure Strength Tests

Table 6 Flexural strength of Different Mix of M-30 Concrete

Designation	Flexure Strength in N/mm^2 M30		
	7 Days	14 Days	28 Days
MP1-30-00	2.12	3.41	4.48
MP1-30-06	2.65	3.37	4.75
MP1-30-12	3.30	4.28	5.36
MP1-30-18	3.97	4.96	5.92
MP1-30-24	4.24	5.12	6.18
MP1-30-30	3.58	4.84	5.66
MP1-30-36	3.18	4.46	5.14

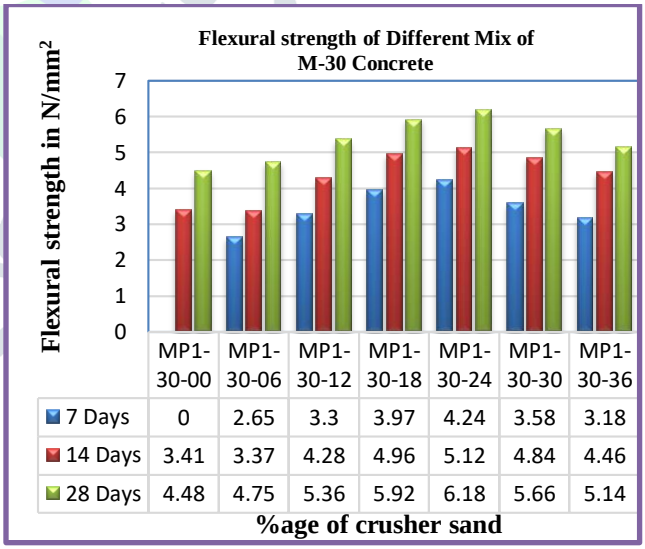

Figure 7. Flexural strength of Different Mix of M-30 Concrete

Table 7 Flexural strength of Different Mix of M-35 Concrete

Designation	Flexure Strength in N/mm² M30		
	7 Days	14 Days	28 Days
MP1-30-00	3.25	4.40	5.06
MP1-30-06	3.96	4.84	5.65
MP1-30-12	4.10	5.20	5.96
MP1-30-18	4.34	5.58	6.10
MP1-30-24	4.51	6.34	7.24
MP1-30-30	4.33	6.08	7.11
MP1-30-36	4.12	5.80	6.85

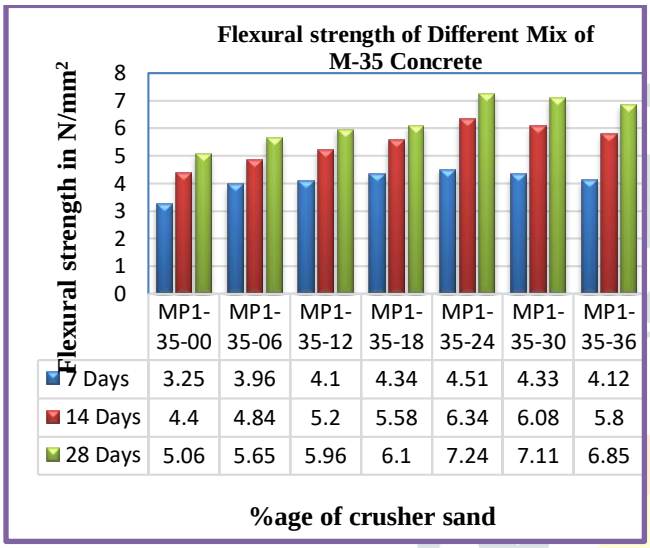

Figure 8. Flexural strength of Different Mix of M-35 Concrete

Table 8 Flexural strength of Different Mix of M-40 Concrete

Designation	Flexure Strength in N/mm² M40		
	7 Days	14 Days	28 Days
MP1-30-00	3.46	4.28	5.12
MP1-30-06	4.46	5.30	5.89
MP1-30-12	4.50	5.50	6.31
MP1-30-18	4.74	6.24	7.21
MP1-30-24	5.26	6.84	7.76
MP1-30-30	5.04	6.70	7.38
MP1-30-36	4.76	6.47	7.04

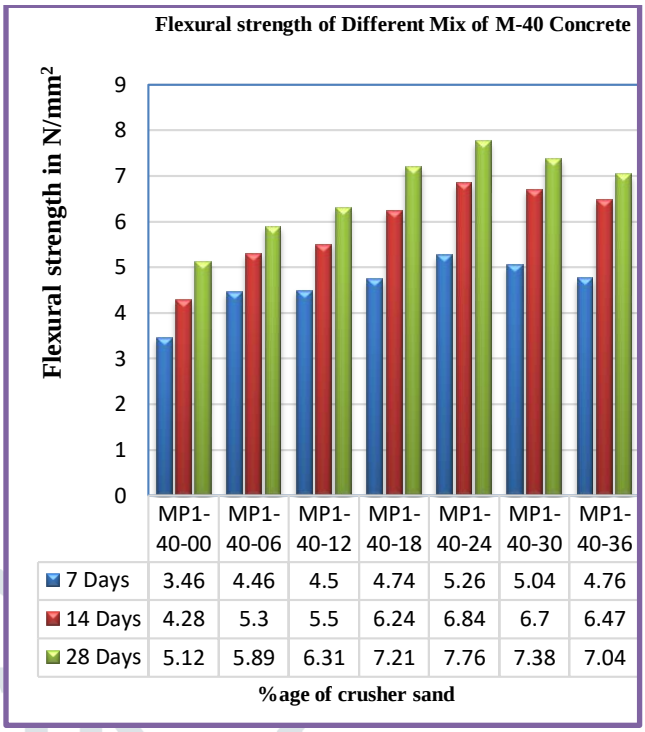

Figure 9. Flexural strength of Different Mix of M-40 Concrete

VI. Conclusion

From the above table is seen that the Flexural strength with 16% Marble powder and 84% cement in M-30 grade of concrete at 7, 14 and 28 days gradually increases from 2.12N/mm² to 4.24 N/mm², from 3.41N/mm² to 5.12 N/mm² and from 4.48 N/mm² to 6.18 N/mm² respectively, for M-35 grade of concrete at 7, 14 and 28 days gradually increases from 3.25 N/mm² to 4.51 N/mm², from 4.40 N/mm² to 6.34 N/mm² and from 5.06 N/mm² to 7.24 N/mm² respectively and for M-40 grade of concrete at 7, 14 and 28 days gradually increases from 3.46 N/mm² to 5.26 N/mm², from 4.28 N/mm² to 6.84 N/mm² and from 5.12 N/mm² to 7.76 N/mm² respectively when the percentage of the crusher sand increase from 0% to 24% and decreases for from 4.24 N/mm² to 3.18 N/mm², from 5.12 N/mm² to 4.46 N/mm² and from 6.18 N/mm² to 5.14 N/mm² respectively for M-30 grade of concrete, for M-35 grade of concrete at 7, 14 and 28 days decreases from 4.51 N/mm² to 4.12 N/mm², from 6.34 N/mm² to 5.80 N/mm² and from 7.24 N/mm² to 6.85 N/mm² respectively and for M-40 grade of concrete at 7, 14 and 28 days decreases from 5.26 N/mm² to 4.76 N/mm², from 6.84 N/mm² to 6.47 N/mm² and from 7.76 N/mm² to 7.04 N/mm² respectively when the percentage of the crusher sand increase from 24% to 36%

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