An Experimental Evaluation on Potency Attributes of Concrete with Marble Dirt Powder

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Abstract: This research is embraced to assess the impact of fractional supplanting of bond with waste residue of marble in cement. Test program will be directed utilizing 0%, 10%, 20% and 30% halfway supplanting of bond with waste marble residue will be taken for cement with 0.45 w/c ratio. Furthermore, I am looking for some data from different prestigious specialists and following their exploration papers important to our research study. In this present research, solid blend will have arranged according to IS and ASTM and preliminary examinations would be completed to research the strength variations of M30 grade of concrete with MDP as a halfway supplementation for Cement.

Index Terms – Marble waste, Marble dirt powder, M30 grade of concrete.

I. INTRODUCTION

The material which is widely used in construction technology throughout the globe is concrete which consists of cement paste and aggregates. The glue involves water and concrete and the total segment is made out of sand and totals. The bond is delivered in an enormous amount. The creation of concrete is relied upon to cross 51 million tons by 2018. In the creation of concrete huge measure of CO2 is radiated which produces antagonistic consequences for the earth. Per analysts, each 1 ton of bond production discharges 0.5 tons of CO2 that enormously add to the dangerous atmospheric deviation.

In recent times, huge consideration is given to the utilization of either mechanical or farming waste as strengthening concrete substitution materials. Mechanical squanders comprise of waste marble dust, impact heater slag, fly cinder and silica smoke and rural waste comprise of rice husk fiery remains, wheat straw powder, coconut waste and sugarcane bagasse slag and so forth., which are utilized as bond substitution in cement. The use of such waste materials as bond substitution lessens the expense of concrete as well as limits the negative natural effects that are related with the transfer of these waste materials and outflow of carbon dioxide gas by the solid.

Marble dust is the result of Marble plants; the slime or wet residue is gotten from the cleaning, dressing and cutting of the marble stones and the fine marble dust which is left subsequent to dressing cleaning and cutting of the marble, is dumped into the landfills, water sheds, waterways, daze wells and the regular streams which is then completed by the downpour water to the horticultures lands consequently causing unfriendly consequences for the dirt and lessening the richness of soil, along these lines by diminishing the yearly harvests generation.

The marble dust predominantly comprises of rocks which are utilized as totals relying on the sizes, and the fine residue which isn't utilized by locally and dumped legitimately into the streams, wells and watersheds which is then washed away by the Down pour water. It was inferred that out of 50 tones crude stone of marble the 20 tones is transformed into waste while the 30 tones is transformed into completed item.

The MDP is a waste material whose disposition is a big problem and can cause serious problems to the environment so by dumping it directly to the landfills, blind wells and seasonal rivers so then utilizing this fine waste marble dust as the substitution of cement not only encounters the environmental problem due to bagasse but also the CO2 which is emitted during the production of cement.

II. BIBLIOGRAPHY

A Study has been conducted by V. M. Sounthararajan et.al(2016) He have done their exploration on Lime Content effect in MDP for Producing High potency Concrete. The Dirt marble residue up to 10 percent by weight of bond was studied for parameters of soli. Besides, the effect of various rate substitution of marble dust on the compressive, rigidity and flexural potency was examined. It was found that effect of fine to coarse in total mix and concrete to-add up to total proportion affected

the imploration in potency properties. A marvelous increment in the compressive strength of 46 MPa at 7 days for 10 percent supplementary of MDP in bond substance was noted.

A Study has been conducted by Vaidevi C (2014) Have done their exploration on Study on the marble dust as halfway substitution of bond in cement. They found that the marble dust from marble handling is a waste used. In this examination, the utilization of marble residue gathered during the forming procedure of marble squares has been explored in the solid blends as cementations material. The investigation demonstrated that marble squanders, which are in the residue structure, could be utilized as cementations material in solid blends where they are accessible and the expense of development is lower than standard solid materials. The solid is readied containing 5, 10, 15 and 20% misuse of marble dust with bond contrasted with the all out amount of ordinary cement. The readied blends were then concentrated as far as their properties both in new and in solidified state. In this specific, tests they led and relieved at various occasions to discover compressive potency and rigidity with and without partial substitution of MDP in bond concrete and for mortar additionally decided for 14 and 28 days.10% substitution gives the best outcome and for each 10 sacks of concrete, the option of 10 percent of MDP spares 1bag of bond and 1 pack expense.

Pooja J. Chavhan et al., 2011 studied on "To consider the conduct of marble powder as valuable cementitious material in cement" and presumed that compressive strength increments with increment of marble powder. The maximum 28 days spilt elasticity was gotten with 45% marble powder supplanted with fine total where as if there should arise an occurrence of compressive strength the strength was picked up by substitution of 30% along withreplacementofsandby45-50%.Themarbleslurryutilization in dark cotton soil is perhaps the most ideal approaches to improve soil properties and to ensure the earth up somewhat from the unsafe impacts of transfer of marble slurry in land and water.

Abdullah Anwar et al., 2010 studied on "Investigation of compressive Strength of cement by incomplete supplanting of concrete with MDP" and reasoned that MDP can possibly give a choice to bond and aides in keeping up the surroundings each piece well as efficient parity. The compressive strength properties of cement containing MDP at 0%, 5%, 10%, 15%, 20% and 25% of Portland bond. The examination was fundamentally to decide a goals to the transfer issue of marble dust by making utilization of it in solid generation for maintainable development advancement. The outcome got for multi day compressive strength affirms that the ideal rate for supplanting of concrete with MDP is about 10%. This will post less on the generation of carbon dioxide and comprehending the natural contamination by bond creation, in this manner upgrades the urban surroundings.

Veena G. Pathan et al.,2011 studied on "Attainability and need of utilization of waste marble powder in solid generation" and presumed that the examination uncovered that supplanting of bond with marble waste powder up to 20% lessens the drop of cement blends, though substitution of sand by marble waste powder up to 20% upgrades the drop of the solid blends. In solid creation substitution of 5% bond by marble waste powder gives practically identical compressive and flexural strength as of marble waste free solid examples, however expanding the substitution go past 5% brings about strength decrease. In solid creation, supplanting of sand up to 20% by marble waste powder gives comparable strength as of cement blends with 100% sand both at right on time and last ages. Based on the before experimental ponders the unit weight of the solid expanded because of the high explicit gravity of WMD and furthermore filler impact of marble dust since it has better particles than fine sand total. Indeed marble residue had a filler impact and assumed a detectable job in the hydration procedure. Bond being kept steady it is a normal result that an improvement in the mechanical and physical properties has occurred by ideals of the marble residue's commitment to the hydration procedure.

Aalok D et al., 2009 studied on "Exploratory investigation on utilization of marble dust in cement" and presumed that for M 25 evaluation cement the compressive strength of 3D squares is expanded when half of marble powder is included and further any expansion of waste marble powder the strength continuously diminishes. The split elasticity of chambers are expanded with expansion of waste marble powder up to 25% and diminishes on further expansion. The flexural strength is acquired at half of marble powder mix.

Rakesh Gupta et al., 2009 studied on "Halfway supplanting of bond with marble powder" and inferred that for M 20 evaluation cement the compressive strength of 3D squares are expanded with expansion of waste marble powder up to 10% supplant by weight of concrete and further any expansion of waste marble powder the compressive strength reductions. The split rigidity of chambers are expanded with expansion of waste marble powder up to 10% supplant by weight of concrete and further any expansion of waste marble powder the split malleable strength decreases.

III. MATERIALS USED

Cement: In the present research OPC of 53 Grade is utilized. Making sure that OPC is made from single source and of same grade a distorted in an air-tight container to prevent it from the atmospheric moisture and humidity. The cement thus produced was tested for physical properties in accordance with IS code.

Coarse Aggregate: The Crushed coarse aggregate of 20 mm maximum size used and tested in accordance with I.S-.2386.

Fine Aggregate: In the present research, fine aggregate of naturals and obtained from local market is used.

Marble Dirt Powder: In Stone Industry, One of the huge wastes outcome in the stone industry during cutting, shaping, and polishing of marbles is the MDP. During this procedure, about 20- 25 percent of the shaped marble is turn into the form of a powder. One of the top seed of marble exporter in world is India being the third (about 10 percent) every year million tons of marble waste form processing plants are released. Due to the availability of abundant quantity project has been implemented.

Figure 1: Marble Dirt Powder

Table 1: Physical Properties of MDP

S.No	Properties	Test Result
1	Specific Gravity	2.63
2	Colour	white
3	Form	Powder
4	Odour	Odourless
5	Moisture Content (%)	0.6
6	sieve	0.90mm
7	hardness	3 on Mohr's scale
8	Water absorption	0.97%

Table 2: Chemical Parameters of MDP

S.No	Chemical compound	Test value of MDP in %	Standard of Natural cement Content (%)
1	Calcium oxide (CaO)	55.09	31-57
2	Silica dioxide (SiO_2)	0.48	22-29
3	Magnesium oxide (MgO)	0.4	1.5-2.2
4	Iron oxide (Fe_2O_3)	0.12	1.5-3.2
5	Aluminum dioxide (Al_2O_3)	0.17	5.2-8.8
6	Sodium oxide(Na_2O)	0.2	-
7	Potassium oxide (K_2O)	0.06	
8	Sulfur trioxide (SO_3)		
9	Lost on ignition in %	43.48	-
10	Total amount	100	-

Table 3: Details of Mix Proportion

Cement	Fine Aggregate	Coarse Aggregate	Water
437.77 Kg/m3	657.02 Kg/m3	1187.42 Kg/m3	197 ltrs
1	1.5	2.7	0.45

IV. METHODOLOGY

As per the IS code (IS: 10262-2009), mix design for M30 grade of concrete was done. In that mix cement was partially replaced with 5 different percentages of MDP (0%, 10%, 20% and 30%) by weight. For varying %'s of MDP, the mix proportions of the concrete is stated in the following table along with test results of slump cone test which had been conducted for workability of concrete.

Table 4: Values of Slump with various %'s of MDP

S.No	Cement (Kg)	%of Marble Dust	Replace marble dust (kg)	Sand (Kg)	Coarse Agg (Kg)	Water (Litres)	Slump (mm)
1	12.8	0	0	17	35.6	5.1	62
2	12.2	5	0.6	17	35.6	5.1	54
3	11.7	10	1.3	17	35.6	5.1	47
4	10.9	15	1.9	17	35.6	5.1	43
5	10.2	20	2.6	17	35.6	5.1	40

The concrete mix was prepared as per the required proportions. Cubes (150mm*150mm), cylinders (300mm*150mm) and beams (100mm*100mm*500mm) were also casted accordingly for different % of marble dust powder. After casting, the curing was done for 28 days. The casted and cured concrete specimens are show in figures.

Figure 2: Casted Specimens

Figure 3: Curing of Casted Specimens

TEST PROCEDURE:

Compressive Strength Test:

Concrete has relatively higher compressive strength, but very poor in tensile strength. The different mix of concrete gives various strength, according to the IS 10262: 1982 gives the characteristic and design strength values for various grades of concrete. Compressive strength test is done as Per IS 516- 1959. The test is conducted on Compression testing machine of capacity 2000 KN as shown in Figure.

Figure 4: Testing of Cube Specimen

Compressive strength of the example can be determined by utilizing following articulation:

Compressive strength = Load at failure (N) / Area of the specimen

Split Tensile Strength Test:

Testing for split tensile strength of concrete is done as Specimen details of the work at Split tensile strength is done as per IS 5816- 1999. The test is conducted on Compression testing machine of capacity 2000 KN as shown in Fig. The cylinder is placed horizontally between the loading surfaces of compression testing machine and the load is applied till failure of the cylinder. Packing material such as plywood is used to avoid any sudden loading. During the test the platens of the testing machine should not be allowed to rotate in a plane perpendicular to the axis of cylinder.

Figure 5: Testing of Cylindrical Specimen

The Split tensile strength is computed from the following formula

$$T = 2P/\pi LD$$

Where; T:Tensile Strength P: Maximum load in Newton's applied to the Specimen, L: length of the specimen in mm D: C/S dimension of the specimen in mm.

Flexural Strength Test:

Flexural strength test is done according to Seems to be: 516-1959. The bearing surfaces of the supporting and stacking rollers are cleaned off before stacking. The crystals are put in the machine in such a way, that the heap is connected to the upper most surface along the two lines divided 13.30 cm separated. The hub of the example is lined up with the pivot of the stacking gadget. The heap is connected at a pace of 180 kg/min without stun on the example till it comes up short and the most extreme burden is noted.

Figure 6: Testing of Beam Specimen

The following expression is used for estimation of modulus of rupture:

$$MR = \frac{3PL}{2bd^2}$$

Where, P = maximum load at failure in N, and L = length of the beam specimen (400mm) b = Width of the beam specimen in mm, d = Depth of beam specimen.

V RESULTS AND DISCUSSIONS:

This part manages the perception of the outcomes from the different tests would lead on concrete for use as diminishing the amounts concrete. The outcomes are then would be contrasted and the control of various Concrete blends for the different rate supplanting levels of bond with marble residue and Fine total with Stone total. The strength attributes of concrete containing marble residue would be think about. Tests will be performed on hard cement relieved under Standard lab conditions, and compressive and spilt rigid qualities will be seen at Curing ages of 7 ,14, 28 days. In this test we would get the most extreme pressure strength at 20% or substitution of marble residue powder by expanding the solidarity to 28.44mpa.

Table 5.5 : Compressive Strength Values for Different %'s of MDP

S.No	% of MDP	7 days strength N/mm2	14 days strength N/mm2	28 days strength N/mm2
1	0	25.25	30.55	39
2	10	35.7	42.65	45
3	20	27.4	36.55	47.38
4	30	18.5	25	32.3

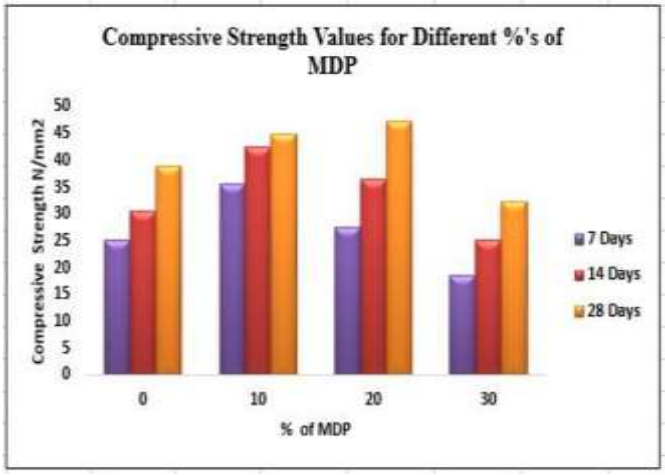


Table 5.6 : Tensile Strength Values for Different %'s of MDP				
S.No	% of MDP Added	7 Days	14 Days	28 Days
1	0%	3.02	3.49	4.65
2	10%	2.83	3.27	4.36
3	20%	3.18	3.67	4.89
4	30%	2.55	2.95	3.93

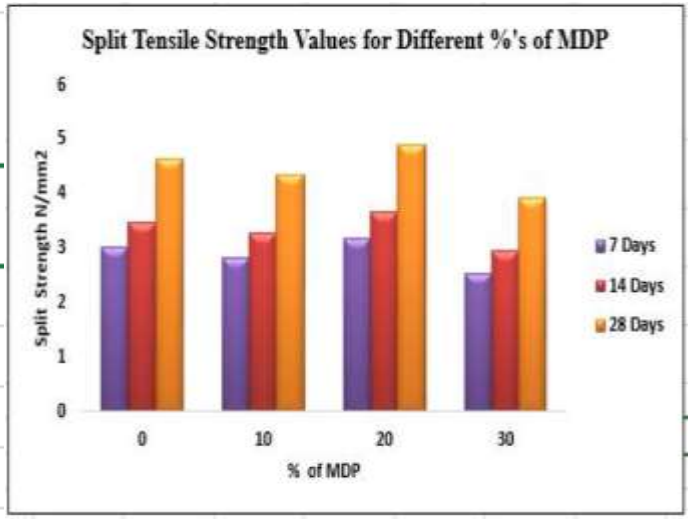
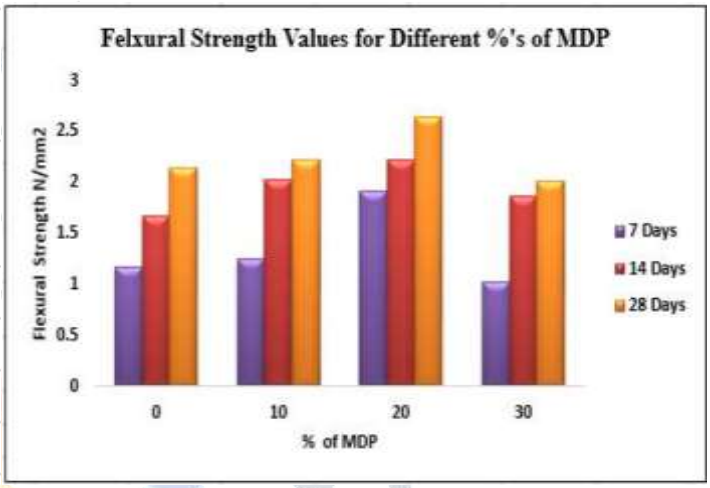


Table 5.7 : Flexural Strength Values for Different %'s of MDP				
S.No	% of MDP Added	7 Days	14 Days	28 Days
1	0%	1.17	1.67	2.15
2	10%	1.28	2.03	2.23
3	20%	1.92	2.23	2.65
4	30%	1.03	1.87	2.01



VI.CONCLUSIONS:

Based on the study the following conclusions are drawn:

1. The slump values are decreased as the % addition MDP is increased.

2. For the designed mix proportion the target mean strength was achieved at 28 days.

3. Compressive, Split and Flexural potency values for conventional Concrete (0% replacement of MDP) are 39 N/mm2, 4.65 N/mm2 and 2.15 N/mm2.

4. For 10%, 20% and 30% MDP Replacement, the compressive potency values at 28 days are obtained as 45 N/mm2, 47.38 N/mm2 and 32.3 N/mm2.

5. At 28 days ,the split tensile potency values for 10%, 20% and 30% MDP replacement are 4.36 N/mm2,4,89 N/mm2 and 3.93 N/mm2.

6. The flexural potency values are 2.23 N/mm2, 2.65 N/mm2 and 2.01 N/mm2 obtained with 10%,20% and 30% replacement of MDP at 28 days.

7. At 20% replacement of MDP all strength values are increased.

8. Based on the results, when all the potency attributes are considered, the optimum % replacement of MDP may be taken as 20%.

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