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Determining Mix Proportion For The Marble Slurry Powder Recovered From Marble Slurry Replacing Fine Aggregate Of Concrete Used In Residential Construction Project In Udaipur, India

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ABSTRACT
The use of recycle materials as concrete ingredients has gained popularity because of increasingly stringent environmental legislation. it is find out that marble powder recover from Marble slurry can be replaced fine aggregate or cement content of concrete used for construction work. This investigation check the possibility of replacement of sand (Fine aggregate) by marble powder recovered from marble slurry waste of marble processing units from 0% - 20 % ranges, in production of concrete used in residential projects .The study work Investigate the performance of M20 grade concrete Mix replacing fine aggregate by Marble Powder recovered from marble slurry in different proportion ranging 0 - 20 % (by weight) . For that Marble slurry waste is collected from marble processing units situated in Udaipur region of India .M20 Concrete Mix is designed and prepared M20 grade concrete from materials locally available in Udaipur of India.
Keywords– Water Cement ratio , Cement Content , Gradation of the Aggregate , Consistency.

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I. INTRODUCTION

The concrete produced is in green concrete helps in sustainable developments in India , as it reuse and minimize hazardous. Waste materials creating environment problems and also saves continuously depleting natural resources of our country. Practice of using Recovered Marble powder is beneficial both to marble Slurry generating industry for environment point of view and economically to the construction Industry which uses this waste. Ultra fine calcium carbonate dust recovered from marble sawing and processing slurry, have interesting application of economically feasible industrial uses. Hence the reuse of waste material has been emphasized. In addition to loss, disposal of this waste material will cause the following environmental problems:

II. MATERIALS

The main ingredients of Concrete are cement, aggregates and water. Some times admixture is added to get desired quality of concrete. Therefore, preparing designed M20 Grade concrete Test specimens 53 Grade Ordinary Portland Cement ,Natural sand and recovered Marble Powder from Marble Slurry as Fine aggregates, 20mm downward size Coarse aggregates , and potable Water are required and experiments are performed on Them for detail investigation**.**

2. Cement

Cement is one of the binding materials in this project. Cement is the important building material in today's construction world and 53 grade Ordinary Portland Cement (OPC) conforming to IS: 12269-1987 is wide spread in use now a day.

2.1Aggregate:

Aggregates are the important constituents in concrete.They give body to the concrete, reduce shrinkage and effect economy. On the bases of size aggregate can be classified as fine aggregate and coarse aggregate.

2.2.1. Fine Aggregate

The aggregate fraction 4.75 mm to 150 micron is termed as fine aggregate. IS: 383-1970 grades the fine aggregate in to four zones viz. zone I, zone II, zone III and zone IV as shown in Table 1.1 given below.

Table 1.1 Grading limits of fine aggregates (IS: 383-1970)

I.S.Sieve Designation	Percentage passing by weight for			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 Micron	5-20	8-30	12-40	15-50
150 Micron	0-10	0-10	0-10	0-15

(a) Natural River sand:
Natural river sand, confirming to Grading Zone I to IV, table 4 0f IS 385-1970. is required as fine aggregate for preparing M20 grade design Mix concrete test specimens of for detailed study.

(b) Marble powder :
Marble Powder recovered from Marble Slurry produced as waste from marble processing Units , in dry form generates during Cutting of marble slabs into strips and sizes is required for percentage replacement of Fine aggregates for preparing designed M20 Grade Test specimens for testing and investigations

2.2.2 Coarse Aggregate
The aggregate fraction 80 mm to 4.75 mm is termed as coarse aggregate. For coarse aggregate (20 mm and 10 mm) required to prepare Design Mix M20 grade concrete specimens.Grading limits of coarse aggregates (20mm and 10 mm) as per IS: 2386-Part 1 is mentioned in Table 1.2.

Table 2.2 Grading limits of coarse aggregates (IS: 2386- Part 1)

IS Sieve Size	**Required % Passing As per IS. Specification**	**IS Sieve Size**	**Required % Passing As per IS. Specification**
40 mm	100%	12.5 mm	12.5 mm
20 mm	85-100%	10 mm	85-100 mm
10 mm	0-20%	4.75 mm	0-20%
4.75 mm	0-5%	2.36 mm	0-5%

III. EXPERIMENTAL PROGRAMME

This study mainly focused on feasibility study and effect on strength of concrete by replacing sand by Marble powder recovered from marble slurry, generally of M20 grade concrete widely used in construction of structural member in residential Apartments, Flats having up to four story height, by replacing sand with Marble slurry recovered powder. The Experimental Program working plan is shown in **Figure 3.1.**

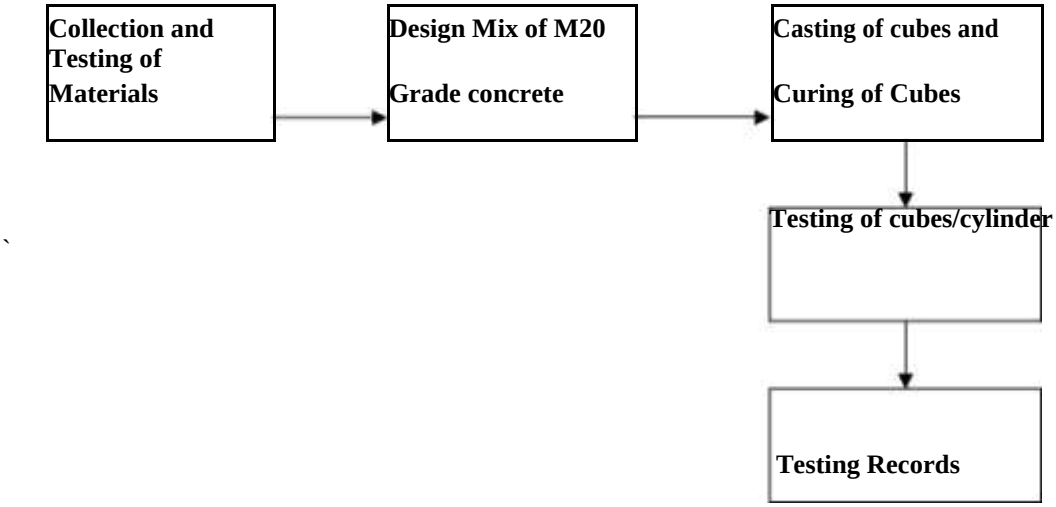

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Figure 3.1 experimental program Working Plan

3.1 Collection and Testing on Materials.

Concrete is the mixture of cement, water, fine aggregate and coarse aggregate. It also contain air and sometime admixture is added to get desired property of concrete as per requirement.

In this study ,Experiment is performed on concrete of M20 grade concrete designed Mix containing 53 Grade Binani cement received from retailer, natural sand of river Sabarmati and Marble Powder recovered from Marble slurry waste received from Laxmi stone, one of the marble Tiling unit are used as fine aggregate and angular 20 mm down size machine cut coarse aggregates are used as coarse aggregate received from nearby quarry.

The following materials were used for preparing test specimens as per design Mix of grade M20.Required Tests were performed on them to check their suitability confirming standard of practices.

3.2 Binani Cement (53 grade OPC)

53 Grade Binani cement received from retailer for preparing test specimens.**Table3.1**confirms the properties of OPC 53 Grade cement shown in **Figure 3.1**is used for preparation of Test Specimens with IS -12269-.1989.

Table 3.1 Physical Characteristics of OPC 53 Grade Binani Cement

Sr.No.	Discription	Values	Binani cement
		IS 12269-1989	53 Grade OPC
1	Fineness (m^2/kg) Min.	225	327
2	Soundness by Le chatilier (mm) Max.	10	1.0
3	Setting time Initial (mts) min.		

		30	105
	Final (mts) max.	600	165
4	Compressive strength		
	3 Days Min. MPa	27	39
	7 Days Min. MPa	37	47
	28 Days Min. MPa	53	60

3.3 M20 Grade Concrete Mix Design:

For utilization of marble slurry as a alternate Fine aggregate in concrete used in residential construction projects like Apartments and Flats of four to five story heights, in the vicinity of waste generating area ,on the bases of use of recovered materials for sustainable development and minimizing pollution .In the present study Design Mix of M20 grade is Prepared as per IS 10262-1982 as M20 grade mix is preferable for RCC work in residential projects performing in mild environment (concrete surfaces protected against weather or aggressive conditions, except those situated in costal area.) according to IS 456-2000 .(Clauses 6.1.2,8.2.4.1, and 9.1.2).

3.4 M20 Design Mix proportion

Table 4.11 Final Design Mix (M20) Concrete proportion

Water	Cement	Fine Aggregate (F.A)	Coarse aggregate (C.A)	
			20 mm (60%)	10mm (40 %)
25.641 Kg	50 kg (1 Bag)	75.36 kg	96.18 kg	64.12 kg
			Total= 160.30 kg	

IV. RESULTS AND DISCUSSION

4.1 Tests Results

Test results obtained after performing Slump Test on fresh concrete to know workability, Compressive strength of concrete cubes at 7 day and 28 day and also Split Tensile strength on cylinders are Tabled bellow for Discussion.

4.1.1 Tests Results of Slump For workability

he Slump value of all tested specimens are Written in following Table 4.1

Table 4.1 Slump value of Designed M20Concretes

Marble Powder Content	**Slump Value**
0%	40
10%	38
15%	37
20%	35

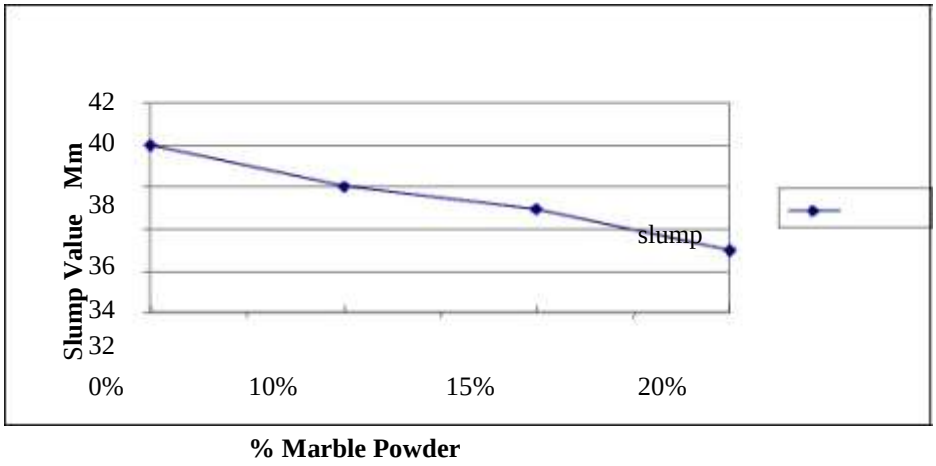

Figure 4.1 Slump Value of M20 Design Mix Concrete

4.2 Tests Results of Compressive strength of Concrete Cube

The test results for all samples are presented on the Appendix A. But for the purpose of discussion the summarized test results are presented in Tables 5.2 according to the type of the specimens.

Table 5.2 Test results of Compressive Strength of Designed M20 grade Concrete Cubes(150mm)

Concrete Grade	Code	Test cube Containing recovered Marble Powder	Compressive Strength (7 days) N/mm²	Compressive Strength (28 days) N/mm²
M20	MP0	0%	16.67	23.53
	MP10	10%	17.04	25.89
	MP15	15%	17.098	27.365
	MP20	20%	21.09	28.84

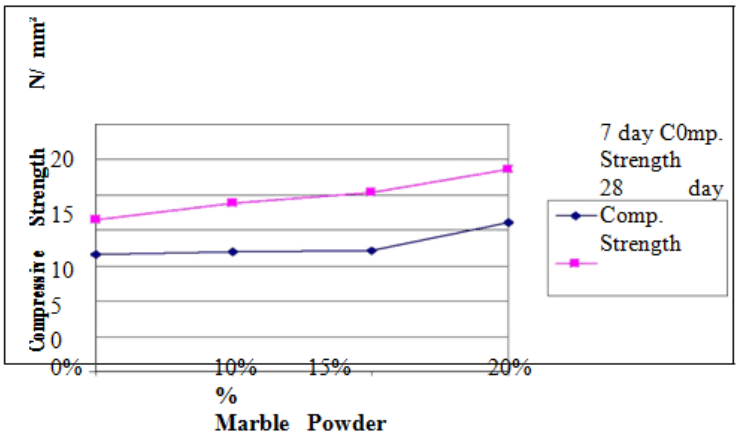

Figure 4.2 Average Compressive strength of M20 Grade Design Mix concrete cubes at 7 days and 28 days

V. CONCLUSION

5.1 Conclusion of the Study

In this thesis, recycling of marble waste powder for the production of concrete has
been studied and the following conclusions are made:

1. In concrete production, replacing of sand up to 20% by marble waste powder gives almost similar strength as of concrete mixes with 100% sand both at early and latter
ages. It can be used as sand replacement material used in construction of residential Apartments and Flats, which is economical with compare to normal concrete.

2. Recycling of Marble slurry wastes by producing concrete, a common and versatile construction material widely used in all type of constructions is one of the best solutions for environmental protection . It is also economical alternative of sand and helps in sustainable construction in Udaipur region of India.

5.2 Economical Benefits

In this Thesis, detailed cost break down and economical analysis is not workout in detail as the cost of sand depends on location of site. But Comparison of average price of sand and recovered Marble powder in study area is given in **Table 5.1.**

Table 5.1 Average Price of sand and recovered marble powder in Udaipur (Udaipur)

Sr.No.	Type of Material	Average price
1	Sand	Rs. 330 / ton
2	Recovered Marble Powder	Rs. 00 / ton

Table 5.1 clearly show that use of marble slurry waste in concrete production can definitely reduce the cost of Concrete production in Udaipur region of India.

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