Strength Evaluation in three different grades of Concrete Using Marble Waste

Ms. Khushbuben K. Mewada[1], Dr. P. J. Patel[2]
[1, 2] Department of Civil Engineering
[1] M.I.T. Piludara
[2] Ganpat University, Kherva

Abstract- *In this experimental work, the effects of using marble waste as a fine material on the harden properties of the concrete have been looked into. Compare to M20, M25, M30 grades of concrete-mixtures were prepared by replacing 40% sand using marble waste with control concrete. In order to compare the three grades of concrete on the compressive strength, flexural strength and split tensile strength at the curing age of 28 days.*

Keywords- Waste marble, sand, comparison, concrete, compressive strength, flexure strength, split-tensile strength.

I. INTRODUCTION

The waste generated during the cutting and polishing Process of Marble is called Marble Waste. Marble waste use as a material is a very important environmental management tool for achieving sustainable growth. Marble waste from quarry operations can be unsafe and environmentally damaging. Many researchers recently were interested in studying the possibility of re-use of waste marble dust in useful industries especially with regard to the building and construction materials such as sand.

The technological importance of using waste marble waste in concrete production is expressed by performance improvement of concrete. The economic benefit is generally attributed to the decrease of the amount of expensive and or scarce ingredients with cheap materials. Environmentally, when waste marble dusts are recycled, less material is dumped as landfill and more natural resources are delivered.

According to the study, marble waste is used in 40% replacement in sand in M20, M25, and M30 grades and compare to each other with control concrete.

II. MATERIALS

Cement:

Portland Pozzolona cement conforming to IS 1489 (part-1) 1991was adopted in this work.

Coarse aggregate:

The aggregate used in this project are locally available. 40% of the aggregate used are of 10 mm size and remaining 60% are of 20mm size.

Sand:

Natural sand which is easily available was used in the workplace. It has a cubical or rounded shape with a smooth surface texture.

Marble waste:

Marble waste was collected from the near of the work place It was initially in wet form (i.e. slurry); after that it is dried by exposing in the sun and finally sieved by IS-4.75 mm sieve before mixing in concrete.

III. MIX DESIGN

In the present study, M20, M25, M30 grades with nominal mix as per IS 456-2000 and IS 10262- 2009 was used.

IV. CASTING AND TESTING DETAIL

For M20, M25, and M30 grades of concrete total 18 cubes, 18 cylinders and 18 beams were casted. Marble waste was added in concrete at 40% replacement of sand. Compare the value of compressive test, flexural test, and split tensile test at 28 days for three grades with control concrete.

1. Compressive test

The uniaxial compression test on cube specimens was performed with reference to IS-516 (Load increasing (@ 14 MPa/min.). Compressive loading was applied to the cube specimens 150 X 150 X 150. Three cubes were tested at each stage of curing for each type of mix design. In this paper the compressive strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

CHART I
COMPRESSIVE TEST AT 28DAYS

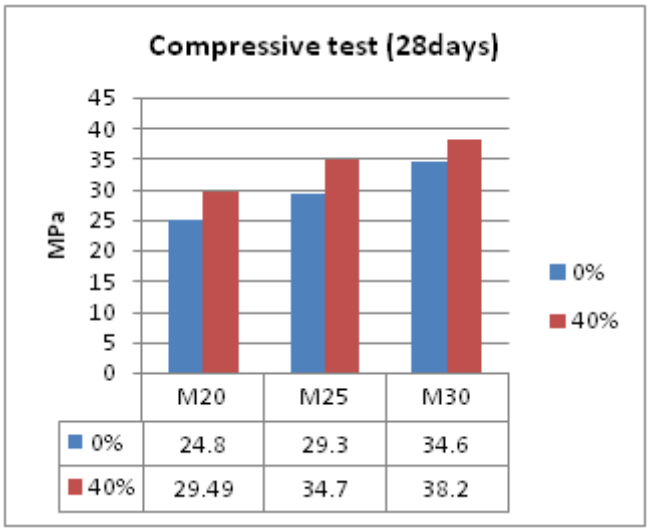
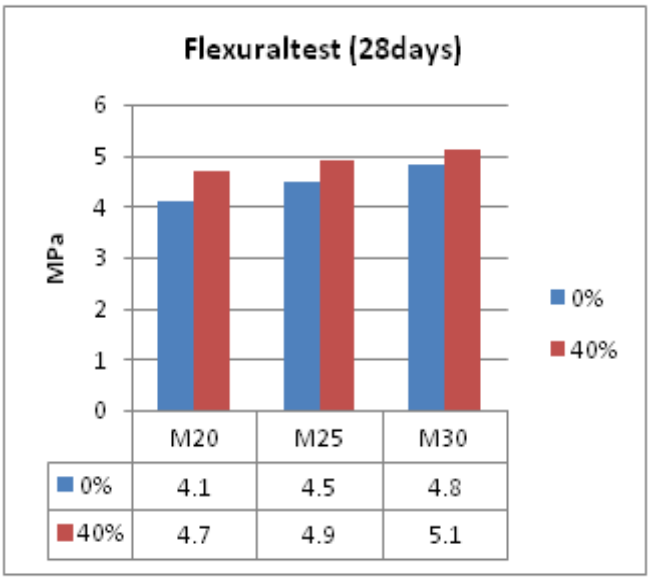


CHART II
FLEXURAL TEST AT 28DAYS



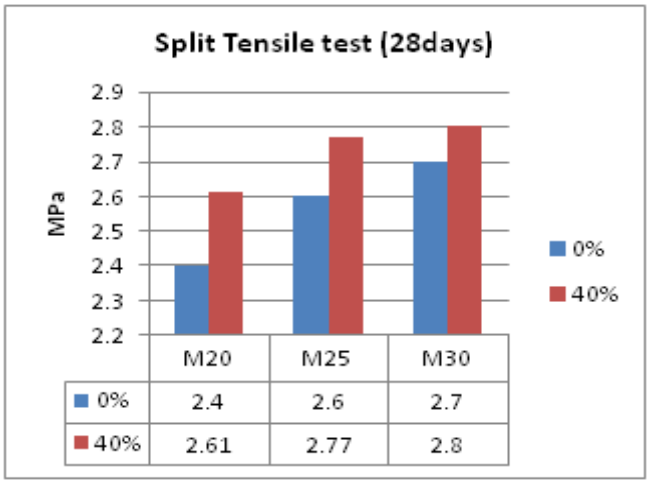
2. Flexural test

Beams of dimensions (15x15x70 cm) were prepared and tested under monotonic increasing loading to determine the flexural tensile strength. The rate of load application was 1.0 MPa/min in all cases. The flexural strength can be determined as PL/BD2 , where P is the maximum node applied (N), L is the span length (mm) that is the distance between the line of fracture and the nearest support measured from the center line of the tensile side of specimen, B is the width of the specimen (mm), d is the depth of specimen (mm). (When L is greater than 200mm for 150mm specimen or greater than 133mm for 100mm specimen). In this paper the flexural strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

3. Split tensile test

Cylinders of 15 cm diameter and 30 cm length were prepared and tested under increasing loading @14 MPa/min. Three cylinders were tested at each stage of curing for each type of mix design. The Split Tensile Strength is determined by $2P/\pi ld$ Where P= Load at which sample fails, L= length of the specimen cylinder, D= diameter of the specimen cylinder. In this paper the flexural strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

CHART III
SPLIT TENSILE TEST AT 28DAYS



	M20	M25	M30
0%	2.4	2.6	2.7
40%	2.61	2.77	2.8

V. DISCUSSION

Today we live in the world full of development and enthusiastic for still more comfort and facilities. This leads to innovations and revolutions in each and every field, but on contrary it has negative impact on environment as resources get depleted and pollution to different natural sources are occurred. Marble powder as a waste has properties which has bad impact on the environment but when mix with concrete constituents in some proportion it helps in enhancing the properties of concrete mix specially its strength. By adding marble powder it can reduce the environmental pollutions and save natural resources. According to the researches, it shows that marble powder is give good impact in construction line. In this paper results show 40% we achieve high compressive strength compare to ordinary (0%) and other replacement in M20, M25, M30 grades.

VI. CONCLUSIONS

1. The study was conducted to compare the properties like compressive, split tensile and flexure strength. M20, M25, M30 grades were selected.
2. Mechanical properties (compressive, flexural, split tensile strength) of marble waste used concrete have higher results compare to the ordinary mix in M20, M25, M30 grade.
3. All mechanical properties in marble waste concrete have higher results compared to the same grade as well as consequently grade also.

REFERENCES

[1] Aalok D. Sakalkale, G. D. Dhawale, R. S. Kedar "Experimental Study on Use of Waste Marble Dust in Concrete" International Journal of Engineering Research and Applications, October 2014

[2] António André, Jorge de Brito*, Alexandra Rosa, Diogo Pedro "Durability performance of concrete incorporating coarse aggregates from marble industry waste" Journal of Cleaner Production (ELSEVIER),1 October 2013

[3] Bhupendra Singh Kalchuri, Dr. Rajeev Chandak, R.K.Yadav "Study on concrete using marble powder waste as partial replacement of sand" International Journal of Engineering Research and Application, April 2015

[4] Diogo Silva, Filipe Gameiro, Jorge de Brito "Mechanical properties of structural concrete containing fine aggregate from waste generated by the marble quarrying industry" American Society of Civil Engineers. (ASCE), 2014

[5] Emmanuel K. Attiogbe and Sami H. Rizkalla "Response of Concrete to Sulfuric Acid Attack" ACI Materials Journal I November-December 1988

[6] F. Gameiro, J. de Brito, D. Correia da Silva "Durability performance of structural concrete containing fine aggregates from waste generated by marble quarrying industry" Engineering Structures (ELSEVIER), 24 December 2013

[7] Kür at Esat Alyamaç and Alp Bu ra Aydin "Concrete Properties Containing Fine Aggregate Marble Powder" KSCE Journal of Civil Engineering (SPRINGER), 17 February , 2015

[8] Olutoge, F. Adeyemi and Amusan and G. Modupeola "The Effect of Sea Water on Compressive Strength of Concrete" International Journal of Engineering Science Invention, July 2014

[9] Pooja J. CHavhan, Prof. S. D. Bhole "To Study the Behavior of Marble Powder as Supplementary Cementations Material in Concrete" International Journal of Engineering Research and ApplicationsApril 2014.

[10] Prof. P.A. Shirulea, Ataur Rahmanb, Rakesh D. Guptac "Partial Replacement of Cement with Marble Dust Powder" International Journal of Advanced Engineering Research and Studies, April-June, 2012

[11] Rishi, Dr. Vanita Aggarwal "Effect on partial Replacement of Fine Aggregate and Cement by Waste Marble Powder/ Granules on flexural and Split tensile strength" IOSR Journal of mechanical and civil Engineering, Jul-Aug. 2014

[12] R. Rodrigues, J. de Brito , M. Sardinha "Mechanical properties of structural concrete containing very fine aggregates from marble cutting sludge" Construction and Building Materials (ELSEVIER), 12 January 2015

[13] IS: 456-2000, Indian Standard code of practice for plain and reinforced concrete. Bureau of Indian Standard, New Delhi.

[14] IS: 10262-2009, Indian Standard code of practice for recommended guidelines Concrete Mix Design. Bureau of Indian Standard, New Delhi.

[15] IS: 383-1997, Specification for coarse and fine aggregates from natural sources for concrete. Bureau of Indian Standard, New Delhi.

[16] IS 1489 (Part 1) : 1991, Portland-Pozzolana cement Specification. Bureau of Indian Standard, New Delhi.

[17] Concrete Technology by M.S. Shetty.

[18] Concrete technology by M. L. Ghambhir.