



# Experimental Investigation on Marble Dust as Partial Replacement of Cement

<sup>1</sup>Shravan Goud, <sup>2</sup>Dr.J.N.Vyas

<sup>1</sup>M. Tech Scholar, Department of Civil Engineering, Mahakal institute of Technology & Management Ujjain, M.P.

<sup>2</sup>Professor, Department of Civil Engineering, Mahakal institute of Technology & Management Ujjain, M.P.

## Abstract—

Marble is a metamorphic rock resulting from the transformation of a pure limestone. Marble dust contains high calcium oxide content of more than 50%. To avoid adverse environmental circumstances, the content of cement is reduced in concrete and replaced by marble dust which increases strength of concrete. The marble dust was replaced with cement at 0%, 5%, 10%, 15%, 20% by weight for M20, M25 & M30 grade concrete. Concrete mixes for cubes were casted and experimentally tested and compared in terms of strength of the conventional cement concrete mixes at 28 days for 150x150mm cubes.

**Keywords:** Marble Dust, water cement ratio, Workability, compressive strength

## 1. INTRODUCTION

Marble has been usually used as a building material, sculpture since the ancient times. The marble industries dispose the marble powder material, consisting of very fine powder which finally results in constitutes that causes diverse environmental issues. Marble blocks are cut into smaller blocks so as to give them the specified class form. Throughout the cutting method regarding twenty fifth the initial marble mass is lost within the type of dust. Currently a day's marble waste is one in all the causes of environmental issues round the world. Therefore, most consumption of marble waste in numerous industrial sectors, significantly the development, agriculture, glass and paper industries would facilitate to shield the surroundings. Concrete is that the principally normally used construction material within the civil construction work as a result of its high structural strength and stability. Concrete may be a varied mixture of cement, coarse mixture, fine mixture and water. Mixture cannot simply sure the strength of concrete however additionally have an effect on the durability and performance of concrete. The event of concrete technology will cut back the consumption of natural resources and energy sources that in turn further decrease the weight of pollutants on the surroundings. One in all the cheap suggests that for reduction of the waste marble plenty is by utilizing them in building construction. Waste Marble powder is often used to get better the mechanical and physical properties of the traditional concrete. The chance of utilize waste marble powder as building material within the production of concrete also will create a relief on waste disposal problems. Currently days they need for cement is kind of high in developing countries because of fast infrastructural growth which ends up in offer scarceness and increase within the price of fabric. If the stuff is employed within the manufacture of the concrete the development value decrease. Additionally to marble powder, Marble mud, ash and ground coarse furnace dross are wide utilized in the development sector as mineral admixtures rather than cement.

## 2. MATERIAL USED

### 2.1 Cement:

Portland Pozzolana cement (PPC) is used in this research work.

### 2.2 Sand:

Sand is available near Narmada River. This sand is used for the above research work.

### 2.3 Natural aggregate:

20 mm natural coarse aggregate is used having a specific gravity of 2.72.

### 2.4 Marble Dust:

Marble has been commonly used for various purposes like tiles, shell etc., as a building material since the ancient times. The industry's removal of the marble powder material, consisting of extremely fine powder, today constitutes one of the environmental problems around the world. Therefore, utilization of the marble dust in various industrial sectors especially the construction, agriculture, glass and paper industries would help to protect the environment. Some attempts have been made to find and assess the possibilities of using waste marble powder in mortars and concretes and results about strength and workability were compared with control samples of conventional concrete. The use of the replacement materials offer cost decrease, energy reserves, arguably superior products, and smaller amount hazards in the environment. These materials contribute in the hydraulic reactions, contributing significantly to the composition and microstructure of hydrated product.

## 3. EXPERIMENTAL WORK AND TEST

### 3.1 Workability Test:

This test is conducted to determine workability of fresh concrete. Slump test gives an idea about consistency of concrete mix and indirectly measures the workability of the concrete mix taken. This test is conducted only when nominal size of aggregate does not exceed 20mm as per IS 456:2000.

### 3.2 Compressive Strength Test:

The mould is prepared for cubes used in the compression test having a size of 0.15mX0.15mX0.15m. After preparing cubes rest on the compression testing machine and load is applied. After applying load the value noted from the dial gauge. Compressive strength determine at 28 days.

## 4. TEST RESULTS

### 4.1 Workability Results:

The below table shows the slump cone test results for different percentage of MD which is vary from 0%-20% for M-20, M-25 & M-30 Concrete.

**Table 4.1: Result of Workability for different % of MD for M-20, M-25 & M-30 Concrete**

S. NO.	MD (%)	SLUMP (mm) (M-20)	SLUMP (mm) (M-25)	SLUMP (mm) (M-30)
1	0	65	110	140
2	5	60	95	125
3	10	55	87	110
4	15	52	82	100
5	20	45	75	95

### 4.2 Compressive Strength

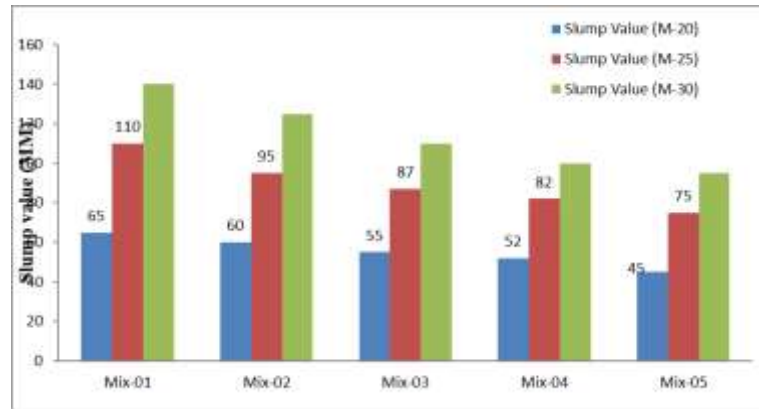
The below table shows the compressive strength for different percentage of MD which is vary from 0%-20% for M-20, M-25 & M-30 Concrete.

**Table 4.2 : Compressive Strength Result**

Mix Design	% MD	28 days Compressive Strength (M-20)	28 days Compressive Strength (M-25)	28 days Compressive Strength (M-30)
Mix-01	0	18.50	24.13	31.47
Mix-02	5	20.06	25.16	32.62
Mix-03	10	22.30	28.67	36.51
Mix-04	15	23.20	28.17	34.17
Mix-05	20	21.75	27.36	33.95

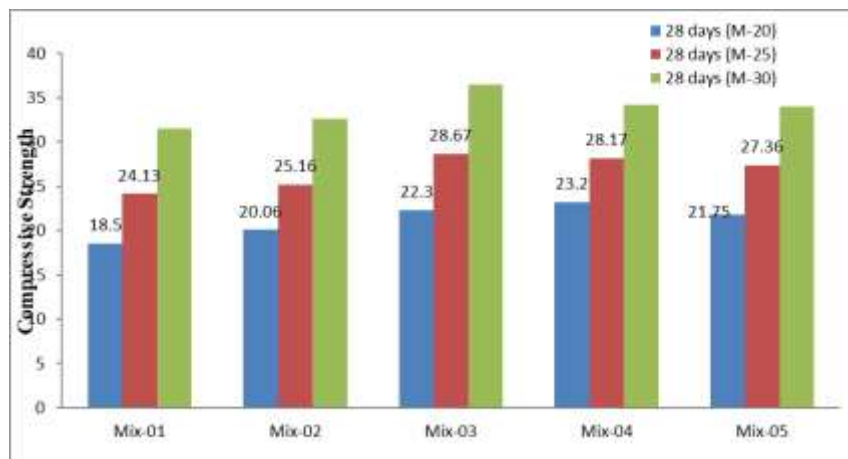
## 5. DISCUSSION ON TEST RESULTS

**5.1 Workability Results:** From the graph 1 it is conclude that value of slump decreases when percentage of marble dust increases for M-20, M-25 & M-30 concrete.



Graph: 1. Slump Value in mm

**5.1 Compressive Strength Test:** From the graph 2 it is conclude that 28 days compressive strength 25.40% increases for M-20 concrete when percentage upto 15%. After that strength decreases when percentage of MD increases. From the graph 2 it is conclude that 28 days compressive strength 18.81% increases for M-25 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases. From the graph 2 it is conclude that 28 days compressive strength 16.01% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.



Graph: 2. Compressive Strength in N/mm<sup>2</sup>

## 6. CONCLUSIONS:

Based on the various tests conducted on concrete with varying proportion of MD the results were obtained and discussed in previous chapter from which the following conclusions are drawn.

1. It is conclude that value of slump decreases when percentage of marble dust increases for M-20, M-25 & M-30 concrete. .
2. It is conclude that 28 days compressive strength 25.40% increases for M-20 concrete when percentage upto 15%. After that strength decreases when percentage of MD increases.
3. It is conclude that 28 days compressive strength 18.81% increases for M-25 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.
4. It is conclude that 28 days compressive strength 16.01% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases2.

## REFERENCES

1. T Naga Sai Sree Saran, T Venkat Das Experimental Investigation on Concrete with Partial Replacement of Fine Aggregate by Marble Dust Powder International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-7, Issue-6C2, April 2018
2. Vinodhini Ellappan, V. Amudhan, Prathik. E and Ebenezer Stephen. A EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF CEMENT WITH MARBLE POWDER International Journal of Civil Engineering and Technology (IJCIET) Volume 9, Issue 5, May 2018, pp. 741–750, Article ID: IJCIET\_09\_05\_082 Available online at <http://iaeme.com/Home/issue/IJCIET?Volume=9&Issue=5> ISSN Print: 0976-6308 and ISSN Online: 0976-6316.

3. Shanu Sharma; Siddharth Pastariya; Gajendra Kumar Verma Experimental Investigation on Partial Replacement of Cement with Marble Dust Powder on Properties of Concrete IJournals: International Journal of Software & Hardware Research in Engineering ISSN-2347-4890 Volume 5 Issue 9 September, 2017
4. Surajmal Patidar Experimental Investigation in Concrete by Partial Replacement of Sand with Marble Dust International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 05 | May 2019
5. Sameer Khan1 , Sagar Jamle2 , M.P. Verma3 Experimental Investigation with Marble Dust Powder as a Partial Substitution of Cement for M20 Grade Concrete IJSART - Volume 3 Issue 6 – JUNE 2017 ISSN [ONLINE]: 2395-1052
6. Vijaya Kumar YM, Shruti D, Tharan SN, Sanjay SR, Sricharan PM: Partial Replacement of Cement to Concrete by Marble Dust Powder Volume: 2 | Issue: 05 | May 2016 | ISSN: 2455-3778 IJMTST
7. Devesh Meena: A STUDY ON BEHAVIOR OF MARBLE DUST IN CONCRETE PAVEMENT International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 05 | Aug- 2015 sp-ISSN: 2395-0072
8. Mr. Ranjan Kumar, Shyam Kishor Kumar: “Partial Replacement of Cement with Marble Dust Powder” Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 8, (Part - 4) August 2015, pp.106-114.
9. Abdullah Anwar, Sabih Ahmad, Syed Mohd. Ashraf Husain and Syed Aqeel Ahmad: Replacement Of Cement By Marble Dust And Ceramic Waste In Concrete For Sustainable Development IJISSET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 6, June 2015 ISSN 2348 – 7968.
10. Prof. Veena G. Pathan, Prof. Md. Gulfam Pathan: Feasibility and Need of use of Waste Marble Powder in Concrete Production IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 23-26 International Conference on Advances in Engineering & Technology – 2014 (ICAET-2014)