



# Effect of Mechanical Properties on Marble Dust as Partial Replacement of Cement

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## Abstract—

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 beams & cylinders were casted and experimentally tested and compared in terms of strength of the conventional cement concrete mixes at 28 days for 500x100x100mm beams & 300x150mm cylinder.

**Keywords:** Marble Dust, water cement ratio, Flexural Strength, Split Tensile 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.

## 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 Flexural Test:

The mould is prepared for beams used in the bending test having a size of 0.10mX0.10mX0.50m. After preparing beams rest on the flexural testing machine and load is applied. After applying load the value noted from the dial gauge. Bending strength determine at 28 days

#### 3.2 Split Tensile Strength:

The mould is prepared for cylinder used in the tensile test having a size of 0.15m diameter and 0.30m height. After preparing cylinder rest on the compression testing machine and load is applied. After applying load the value noted from the dial gauge. Tensile strength determine at 28 days

### 4. TEST RESULTS

#### 4.1 Flexural Strength Results:

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

**Table 4.1: Flexural Strength Result after 28 days**

S. NO.	MD (%)	28 days Flexural Strength (M-20)	28 days Flexural Strength (M-25)	28 days Flexural Strength (M-30)
1	0	2.28 MPa	3.96 MPa	5.34 MPa
2	5	2.75 MPa	4.10 MPa	5.56 MPa
3	10	3.05 MPa	4.85 MPa	6.54 MPa
4	15	3.25 MPa	4.62 MPa	5.96 MPa
5	20	2.62 MPa	4.35 MPa	5.60 MPa

#### 4.2 Split Tensile Strength;

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

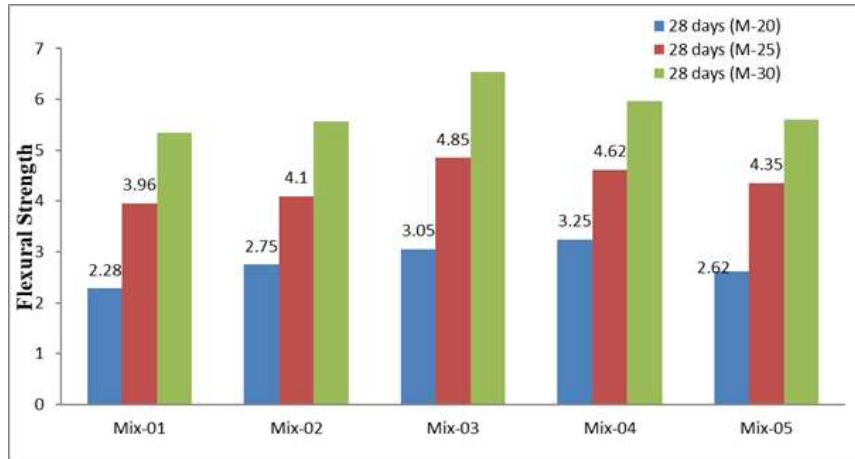
**Table 4.2 Split Tensile Strength Result**

Mix Design	% MD	28 days Tensile Strength (M-20)	28 days Tensile Strength (M-25)	28 days Tensile Strength (M-30)
Mix-01	0	5.10	4.95	5.35
Mix-02	5	5.26	5.35	5.65
Mix-03	10	5.64	5.84	6.64
Mix-04	15	4.70	5.64	6.01
Mix-05	20	5.60	5.52	5.51

### 5. DISCUSSION ON TEST RESULTS

#### 5.1 Flexural Strength:

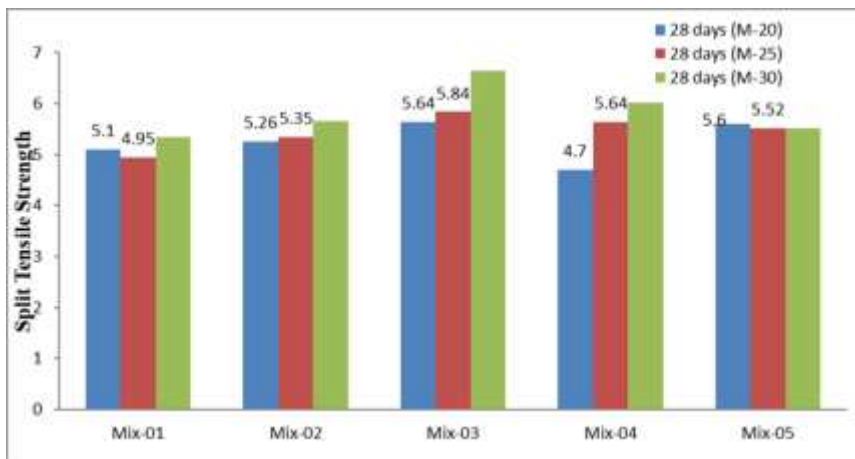
From the graph 1 it is conclude that 28 days flexural strength 42.54% increases for M-20 concrete when percentage upto 15%. After that strength decreases when percentage of MD increases. From the graph 1 it is conclude that 28 days compressive strength 22.47% increases for M-25 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases. From the graph 1 it is conclude that 28 days compressive strength 22.01% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.



Graph: 1. Flexural Strength in N/mm<sup>2</sup>

### 5.2 Split Tensile Strength Test:

From the graph 2 it is conclude that 28 days split tensile strength 10.58% increases for M-20 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases. From the graph 2 it is conclude that 28 days split tensile strength 17.97% 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 split tensile strength 24.12% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.



Graph: 2. Split Tensile 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 28 days flexural strength 42.54% increases for M-20 concrete when percentage upto 15%. After that strength decreases when percentage of MD increases.
2. It is conclude that 28 days compressive strength 22.47% increases for M-25 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.
3. It is conclude that 28 days compressive strength 22.01% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.
4. It is conclude that 28 days split tensile strength 10.58% increases for M-20 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.
5. It is conclude that 28 days split tensile strength 17.97% increases for M-25 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.
6. It is conclude that 28 split tensile strength 24.12% increases for M-30 concrete when percentage upto 10%. After that strength decreases when percentage of MD increases.

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