



# A Study On The Use of Marble Dust Powder To Improve The Property Of Cement Concrete

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## Abstract

Increment in populace goes connected at the hip with increment in contamination. The wastage that we endure today is from the expansion sought after of the populace itself. Waste management is an endeavour to reduce and recycle wastes to any modern and fabricating activity. Though a segment of this waste might be used, for example, excavation pit fill up. Waste produced at quarries and creation units are very alike. Generally scrap stone should be moderated and overseen, yet consideration must be distributed to different sorts of wastes, also. These incorporate marble dust/slurry as well. Marble sawing powder wastes is boundless side-effect of mechanical procedure in India. Reuse of Marble waste as a development material is a significant natural administration device for accomplishing practical turn of events. Marble powder is utilized as an admixture in concrete, so that quality of the solid could be expanded. The creation of less expensive and progressively solid utilizing this waste can tackle somewhat the natural and ecological issues. Then again, without proper logical idea of innovative work of re-usage can launch natural problems more prominent than the waste itself.

**Keywords:** Contamination, wastes, marble waste, re-use, ecological issues.

## I. INTRODUCTION

The natural corruption i.e. the ecological degradation, during extraction of marble is a family to any opencast mining exercises, like debasement or expulsion of crown soil, mined out pits upsetting nearby natural habitats and water table of the zone. What's more, the rejected blocks, uneven sized rubbles and blocks created from mining and from overload, when discarded in unhygienic manner causing genuine hazards. The wastes produced during and after processing of marble blocks in marble cutting plants come as 'Marble Slurry'. The slurries are discarded by the handling units by the side of the closest region accessible or in the advised zones set apart for dumping close to the plants.

## II. OBJECTIVES

The objective is to study the influence of replacement of fine aggregates and cement (to some extent) with Marble Dust Powder on conventional concrete.

- i. To obtain and compare the compressive strength of a standard grade concrete Vs concrete with partial replacement of cement to certain extent by MDP i.e., 5, 10, 15 and 20% by weight.
- ii. To obtain and compare the compressive strength of a standard grade concrete Vs concrete with partial replacement of fine aggregates by MDP by 25, 50 and 100 % by weight.

- iii. To study the influence of incorporation of Marble dust powder in concrete.

### III. MATERIALS AND METHODS.

#### 3.1 MATERIALS REQUIRED FOR CONCRETE MIX

- i. Cement: It should convince the standard specifications under *IS 455(1989)*. This standard covers the manufacture, chemical and physical requirement of Portland slag cement.
- ii. Aggregates: It includes fine aggregate i.e. sand grains passing 4.750 mm sieve, coarse aggregate i.e. grains retaining at 4.75 mm sieve. The aggregated used should satisfy the standard specifications under *IS 383(1970)*.
- iii. Portable water is appropriate for incorporation and curing.

#### 3.2 TESTS FOR CONCRETE BLOCKS

##### 3.2.1 STRENGTH OF CONCRETE

Concrete grade is designated in expressions of numbers, represents its compressive strength (of 15 cm cube @ 28 days), unit is MPa (equal to N/sq. mm).

##### 3.2.2 COMPRESSIVE STRENGTH TEST

- Cement, fine and coarse aggregate are major ingredients of concrete and weigh in the relative amount to be used for the purpose and is machine mixed or hand mixed.
- Now the entire batch is mixed with the addition of water until the concrete appear to be homogenous and has the required consistency. Test specimens recommended are 15 x 15 x 15 cm cubes or cylinders of 15 cm diameter and 30 cm height.
- Assorted mix is poured in layers of 50 mm into the mould and every layer is tamped 35 times with bar of 1.6 cm in diameter and 60 cm length or with a vibrator.
- Moulds are stored at temperature of  $27 \pm 3^{\circ} \text{C}$  at 90% humidity for  $24 \pm \frac{1}{2}$  hour starting at moment when water is added to dry ingredients.
- Following that duration the specimens are taken off the moulds and placed in water bath and rested, until taken out right before the test.
- Usually specimens are tested for 7 and 28 day strength but IS code only suggests 28 day strength only.
- 7 days strength should be at least  $\frac{2}{3}$  of 28 day strength of concrete.
- Specimen is tested using compression testing machine, where they are placed between the plates of CTM with the centre of thrust plate and specimen's axis aligned properly.
- Compression testing machine applies load gradually at 14 N/sq mm/minute, till the specimen is compressed/fails.
- Mean of three values is considered as compressive strength of concrete, given the single variation is always less than  $\pm 15\%$  on an average.

##### 3.2.3 WORKABILITY

Generally referred as ease of transporting, placing and 100% compaction of concrete with no unnecessary segregation and bleeding. For maximum strength in concrete, full compaction is required. It means a higher water to cement ratio than theoretical requirements. This is because workability can also be known as the inner work done in overcoming the frictional forces between concrete ingredients for full compaction. So, water functions as a lubricant so the concrete can be compacted to a maximum possible extent. The optimal workability of concrete will depend upon the given job hence will vary from situation to situation.

### 3.2.4 MEASUREMENT OF WORKABILITY

#### SLUMP TEST

- This is used for in-situ determination of workability. Slump test measure consistency and is very helpful in detecting how variably uniform the mix is.
- Moulds dimension- height = 30 cm, top dia = 10cm and bottom dia = 20 cm.
- 1.6 cm diameter and 0.6m long bullet end steel tamping is used.
- On a flat, even, horizontal, firm and non absorbing surface, the mould is placed.
- Layer of 4 and every layer of about  $\frac{1}{4}$  of height of mould. Every layer is tampered 25 times.
- Once final layer is poured, the concrete is levelled with a towel and tamping rod. The mould is taken off right away by lifting it vertically cautiously.
- The concrete will then subside and the subsidence is known as slump of concrete.
- The difference amid the uppermost point of subsided concrete and the height of mould in mm is considered as slump of concrete.
- The pattern of slump also displays characteristic of concrete.
- True slump is an even slump and shear slump is one which has one half of concrete sliding down. In case the concrete is very wet it will collapse.
- The slump value measured as difference between average of substance and the height of mould is shear slump.
- Shear slump indicates non cohesive concrete and may lead to segregation.

## IV. RESULTS AND DISCUSSION

### 4.1 Introduction of replacement of marble dust powder

The effect of introduction of marble dust powder in concrete mix can be derived by performing compression test on the concrete mix for acquiring the compressive strength of the sample.

#### 4.1.1 Partial replacement of Cement by varying percentage of marble dust

To test the influence of marble powder on the compressive strength and characteristics of concrete with the partial substitution of cement by varying percentage of MDP by 0%, 5%, 10%, 15% and 20%, we compared the results of the compression test on both mixes i.e. conventional and modified.

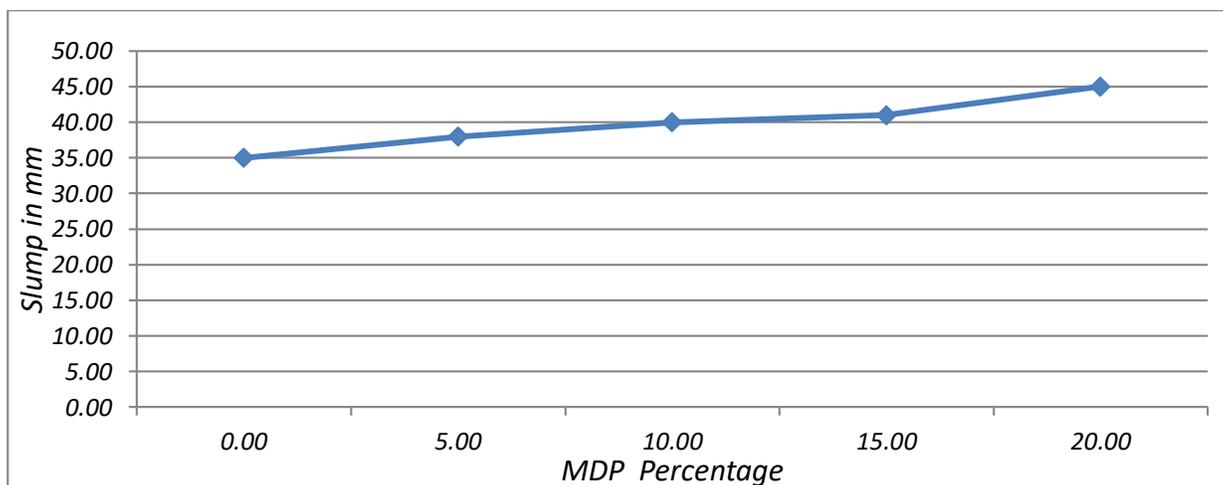


Figure 1: Slump of cement concrete mixes

Workability: Slump test tells us the workability of the concrete. Along the raise in the percent of MDP we observed that there was increase in the slump.

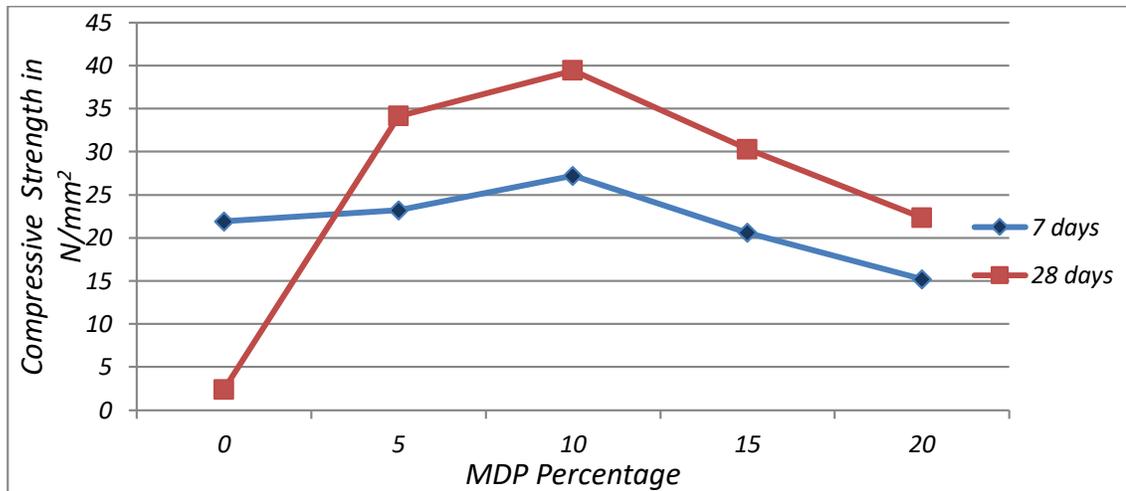


Figure 2: Compressive strength of concrete at 7 days and 28 days

Compressive strength: On 7 days we can notice increase in compressive strength from 0-10% substitution but the strength decreases with the raise in the percentage of MDP. Similarly on 28 days we can notice rise in the compressive strength but eventually compressive strength decreases along the raise in the percentage of MDP.

#### 4.1.2 Partial replacement of fine aggregate by varying percentage of marble dust powder

We shall see the outcome of partial substitution of fine aggregate by changing percentage 0%, 25%, 50% and 100% of MDP on the concrete. We shall compare the results achieved by the compression test.

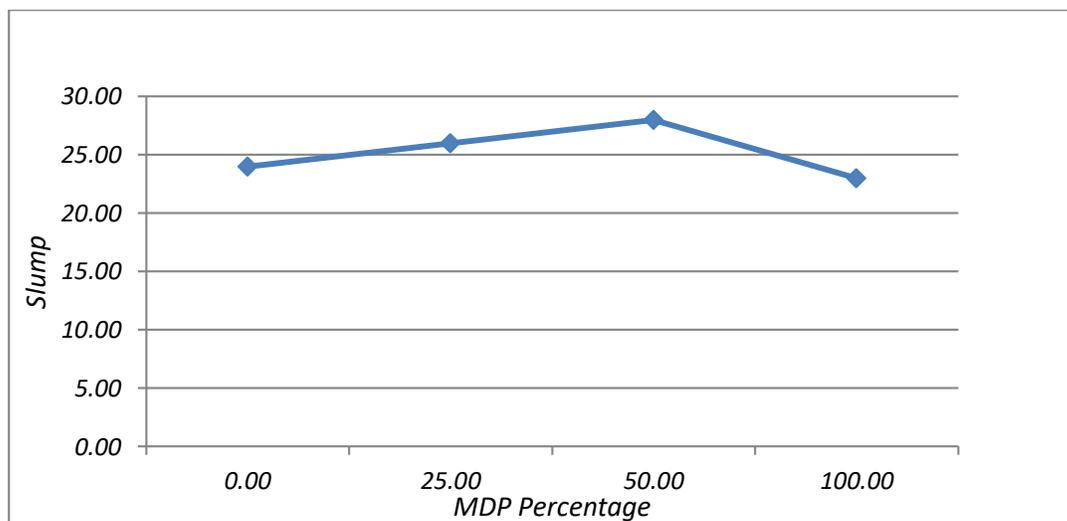


Figure 3: Slump cone test displaying workability

Workability: With the raise in the percentage of MDP we can notice an increase in the slump but eventually decreases after increase of more than 50%.

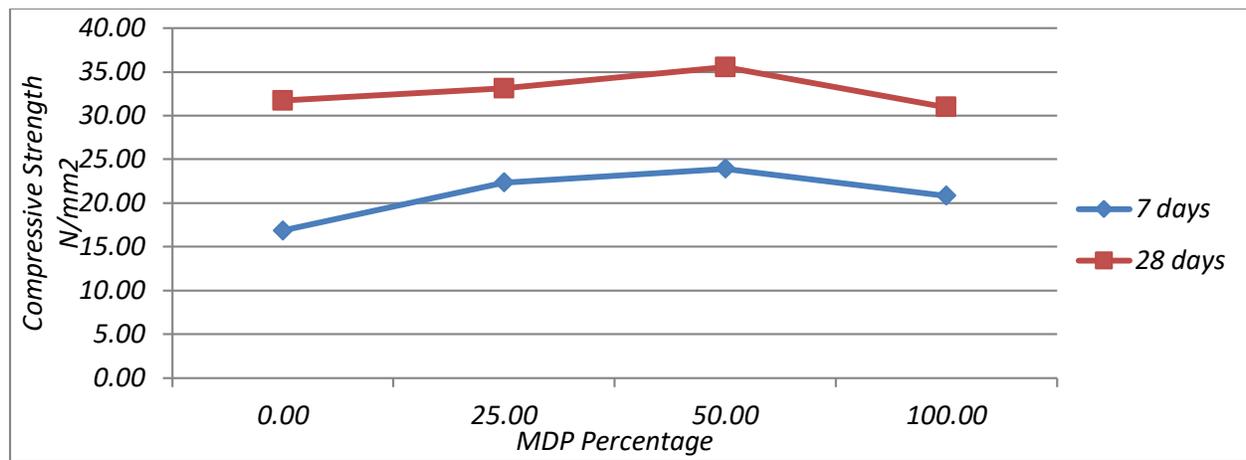


Figure 4: Compressive strength of 7 days and 28 days.

Compressive strength: From the above graph shows, rise in the compressive strength of modified concrete mixes with raise in the percentage of the MDP. But we can notice a decline in the lines in the graph after 50% of MDP.

## V. CONCLUSION

1. It is observed that introduction of marble dust in the concrete mixes as substitution of cement in varying percentage did display some amount of appreciable improvement.

The experimental result shows that 10% marble dust powder can work as substitution of cement. It shows increase of compressive strength of M 25 grade concrete cube after 7 and 28 days both i.e. 27.2% and 39.41% respectively. Whereas percentages considered above 10% has shown reduce in compressive strength.

The workability of the concrete on basis of slump improves with raise in the percentage of marble powder. The result gives a strong recommendation of application of marble dust powder in and as building material replacing the cement in concrete but of course limiting its amount. And thus, saving the atmosphere from dust pollution to some extent and saving the expenditure of the manufacturers as the marble powder is cost free.

2. It is also observed that swap of fine aggregate by MDP in concrete has shown some positive results. The partial swap of fine aggregate by marble dust powder in varying percentages that are 25%, 50% and 100% has displayed rise in the compressive strength and workability of concrete.

The maximum compressive strength is acquired at substitution of fine aggregate by 50%. The M25 concrete with 50% replaced fine aggregate acquires compressive strength of 23.91 MPa in 7 days and 35.54 MPa in 28 days. Adding up of marble dust powder above 50% reduces the compressive strength.

Though the slump test results in rise in the workability of the raised quantity of marble dust powder infused in the concrete, no more than 50 percentage of marble dust powder is recommended as a substitution of fine aggregates.

3. The infusion of marble dust powder will help in recycling and reducing the marble dust which is one of the pollutant in our environment. Therefore substitution of natural sand in brick mortar by marble dust for 80% and 90% does not only rises in compressive strength but also is very price effective. Marble dust powder not only replaces the raw materials of concrete without harming the values of the materials rather improves the characteristic of the concrete. It is seen that not all varying percentages that has been added has elevated the strength but neither had it reduced the strength to the very less. With increase in the pollution and environmental degradation, if and only if we can Reduce, Reuse and Recycle (3R), this way of utilizing the marble waste is a very acceptable and practical help to bring down the pollution.

## REFERENCES

1. Indian minerals yearbook 2016 [part III: Mineral reviews] 55<sup>th</sup> edition; [govt. Of India Ministry of mines Indian Bureau of Mines]
2. Concrete technology theory and practice; M. S.SHETTY
3. The Indian standard adopted by the Bureau of Indian standards: IS 456: 2000; IS 10262: 2009; IS 455: 1989; IS 383: 1970; IS 516: 1959
4. **Manju Pawar et.al**, “Feasibility and need of use of waste marble powder in concrete production”, ISSN No. 2349-943435.PP 1-6.
5. **V.M.Sounthararajan and A. Sivakumar et.al**, “Effect of the lime content in marble powder for producing high strength concrete” .ISSN 1819-6608.PP 260-264. **Corinaldesi V, Moriconi G, Naik TR et.al**, “Characterization of marble powder for its use in mortar and concrete”, Const. Build. Mat., 24, pp 113-117.
6. **Ranjan Kumar et.al**, “Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 5, Issue 8, (Part - 4) August 2015, pp.106-114
7. **G V Vigneshpandian et.al**, “Utilisation of Waste Marble Dust as Fine Aggregate inConcrete”, School of Civil Engineering, SASTRA University, Thanjavur -613401. India.
8. **Veena G. Pathan et.al** , “ 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, www.iosrjournals.org
9. **Erhan Gu'neyisi et.al** , “Effects of marble powder and slag on the properties of self compacting mortars”, Department of Civil Engineering, Gaziantep University, 27310 Gaziantep, Turkey
10. **Ronak Malpani et.al**, “Effect of Marble Sludge Powder and Quarry Rock Dust as Partial Replacement for Fine Aggregates on Properties of Concrete”, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-4, Issue-1, June 2014
11. **Asokan Pappu et.al et.al**, “ Solid wastes generation in India and their recycling potential in building materials”, Semanticscholarship.org
12. **Gurucharan Singh et.al**, “An experimental investigation on utilization of marble dust as partial replacement of cement in concrete”, nbm&cw.com
13. **Dr. M. Vijaya sekhar Reddy et.al**, “Effects of replacement of various level marble dust in plce of fine aggregate to study the fresh and hardened properties of concrete”, Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 5, Issue 12, (Part - 4) December 2015, pp.73-77
14. **Manpreet Singh et.al**, “Low cost concrete bricks using marble slurry as a raw material”, BITS PILANI, Department of civil engineering
15. **Kapil Katuwal et.al**, “ comparative study of M 35 concrete using marble dust as partial replacement of fine aggregate and cement”, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Website: www.ijirset.com Vol. 6, Issue 5, May 2017
16. **Anshuman Srivastava et.al**, “Potential applications of marble dust in industrial use by characterization techniques – a review”, BRCORP, International Journal of Advanced Structures and Geotechnical Engineering ISSN 2319-5347, Vol. 05, No. 03, July 2016
17. **Mohamad Atiyeh et.al**, “Data for bottom ash and marble powder utilization as an alternative binder for sustainable concrete construction”, Department of Civil Engineering, European University of Lefke, TR-10, Northern Cyprus Turkey, journal homepage: www.elsevier.com/locate/dib
18. **Pooja.J.Chavhan et.al**, “To Study the Behaviour of Marble Powder as Supplementary Cementitious Material in Concrete”, Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 4, Issue 4( Version 1), April 2014, pp.377-381.