

Review on the study of compressive strength of concrete using marble dust as partial replacement of cement

Disha Singh¹, Mohd. Afaque Khan², Abhishek Kumar³

¹PG student (Structural Engineering), BBDU, Lucknow, Uttar Pradesh, India

²Astt. Professor, Dept. of Civil Engineering, BBDU, Lucknow, Uttar Pradesh, India

³Astt. Professor, Dept. of Civil Engineering, BBDU, Lucknow, Uttar Pradesh, India

Abstract - In this research work marble dust powder (MDP) has replaced the cement in various percentages. The purpose of the investigation is to analyse the compressive strength of concrete while replacing the marble dust powder with different proportions in concrete.

Key Words: Marble dust powder, Marble, Cement, Compressive strength, Concrete.

1. INTRODUCTION

Marble is a metamorphic rock produced from limestone from pressure and heat in the earth's crust due to geological process. Marble dust powder is an industrial waste produced from cutting of marble stone. In India, the marble processing is one of the most flourishing industry. Marble industries in India grow more than 3500 metric tons of marble powder slurry per day. The cement industry releases carbon dioxide, a major green house gas 5-10%. Marble stone industry generates both solid waste and stone slurry. Whereas solid waste results from the rejects at the mine sites liquid substance consisting of particles originating from the sawing and the polishing processes and water used to cool and lubricate the sawing and polishing machines. Marble stone slurry generated during processing corresponds to around 40% of the final product from stone industry. This is relevant because the stone industry presents an annual output of 68 million tonnes of processed products. Hence, the scientific and industrial community must commit towards more sustainable patterns.

In India, marble dust is settled by sedimentation and then dumped away which results in environmental pollution, in addition to forming dust in summer and threatening both agriculture and public health. Therefore utilization of the marble dust in various industrial sectors especially the construction, agriculture, glass and paper industries would help to protect the environment. Waste can be used to produced new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits. There are several reuse and recycling solutions for this industrial by

product. It is estimated that the Rajasthan marble processing enterprise produces 1800m³ (4500 tons) marble waste annually, which implies that using marble waste of the Rajasthan marble processing enterprise as cement replacing material can indirectly reduce CO₂ emission to the atmosphere by 4500 tons annually. Marble dust is not only the economical material but also improves the properties of the concrete so by varying marble dust contents the physical and mechanical properties of fresh and hardened concrete can be improved.

2. LITERATURE REVIEW

Baboo Rai et.al [1], studied the effect of waste marble powder as partial replacement of cement by varying percentage of waste marble powder. It was observed that with the increase of WMP (replacing cement) the strength falls remarkably upto 10 N/mm² when the WMP is 15% or 20%. The rate of fall being uniform upto 15%. When marble waste granules were partially replaced in fine aggregate by weight then there was increase in compressive strength at each curing age on increasing the percentage replacement beyond 10%, there was a slight reduction in the compressive strength value.

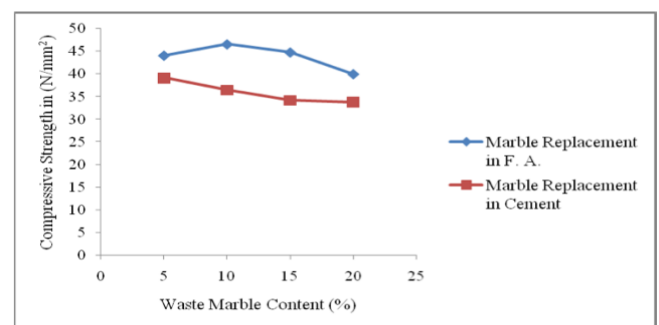


Figure 1: 28 days compressive strength of mortar mix with partial replacement of marble

Vaidevi C. [2], studied the possibilities of using waste materials from different manufacturing activities in the preparation of mortar and concrete. The concrete (M20)

was prepared containing 5, 10, 15 and 20% waste of marble dust with cement. The compressive strength and tensile strength of concrete were calculated with and without partial replacement with marble dust at 14 and 28 days. Test result indicated that 10% of marble dust in cement concrete give best result and increase in curing days will increased the strength when compared from 14 to 28 days.

N. Gurumoorthy[3], studied the performance of concrete contained marble dust as a partial of cement, 10%, 20%, 25% and 30%. The compressive strength was increased with addition of waste marble dust upto 25% replace by weight of cement. Further any addition of waste marble dust the compressive strength decreases. Therefore it was concluded that the most suitable percentage replacement of marble dust in concrete is 25%.

Prof. VeenaG. Pathan and Prof. Md Gulfam Pathan [4], studied the need to use waste marble powder in concrete production. The investigation revealed that replacing cement with marble waste powder up to 20% reduces the slump of concrete mixes. In concrete production, replacement of 5% cement by marble waste powder gives comparable compressive and flexural strength as of marble free concrete specimens; but increasing the replacement range beyond 5% that leads to strength reduction.

Abdullah Anwar et.al [5], in this research work, marble dust powder as replaced the (OPC & PPC) cement accordingly in the reach of 0%, 5%, 10%, 15%, 20%, 25%, by weight of M-20 grade concrete. Concrete mixtures were developed, tested and compared in terms of compressive strength to the conventional concrete. The result obtained for 28-days compressive strength confirms that the optimal percentage for replacement of cement with marble dust powder was about 10%

Jashandeep Singh and Er. R S Bansal [6], studied the compressive strength of concrete by partial replacement of cement with WMP and M25 grade is used for which marble powder is replaced by (0%, 4%, 8%, 12%, 16%, 20%). The standard cubic specimens of size 150mm and cylindrical moulds for size 150 x 300mm were casted. Concrete cubes were casted and compressive strength of concrete was tested at 7, 14, & 28 days of age. Slump values were taken which decreased with increased percentage of marble powder. It was concluded that replacement of nearly 12% of cement with waste marble powder attains maximum compressive strength.

Table 1: Test value of slump value

% Replacement	Slump Value (mm)
0	28
4	27
8	27
10	27
12	26
16	25

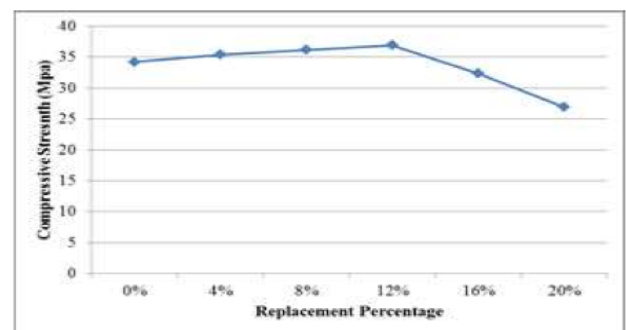


Figure 2: Test result of compressive strength of 28 days

G. Latha[7], his study investigated the fresh and hardened properties of concrete when cement was partially replaced by waste marble powder. The work was focused on M20, M30, M40 grades of concrete. The percentage of WMP that replaced cement in this investigation are 0%, 5%, 10%, 15% and 20%. Result shows that the workability and compressive strength was increased with partial replacement of cement by waste marble powder between 10% to 15%.

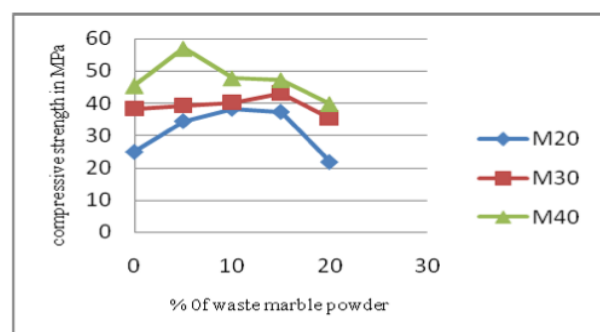


Figure 3: Compressive strength at 28 days of curing for various percentages replacement of cement with WMP

3. CONCLUSIONS

- 1) With the inclusion of marble powder, the compressive strength of concrete gradually increases up to a certain limit but then gradually decreases.
- 2) Increase in curing days will increase the strength of marble dust concrete when compared from 14 days to 28 days.
- 3) To minimize the costs of construction with usage of marble powder, which is freely or cheaply available
- 4) It is essential to find out the specific areas where this mix can be used.
- 5) To realm of saving the environmental pollution by cement production; being our main objective as civil engineers.

ACKNOWLEDGEMENT

Author acknowledge the immense help received from the scholars whose articles are mentioned and included in references of this review paper. The author is also grateful to authors/editors/publishers of all those journals and articles from where the literature of this article has been reviewed and discussed.

REFERENCES

- 1) Baboo Rai, Khan Naushad H, Abhishek Kumar, Tabin Rushad S and Duggal S.K , "Influence of marble powder/granules in concrete mix", IJCSE, Volume 1, No 4, 2011. ISSN:0976-4399, PP. 827-834.
- 2) Vaidevi C., "Study on marble dust as partial replacement of cement in concrete." IJE, Volume 4, No 9, July 2013. ISSN:2319-7757, PP. 14-16.
- 3) N.Gurumoorthy, "Influence of marble dust as partial replacement of cement in concrete", IJERT, Volume 3, Issue 3, March-2014. ISSN:2278-0181, PP. 740-749.
- 4) Prof. Veena G. Pathan and Prof. Md Gulfam Pathan, "Feasibility and need of use of marble powder in concrete production", (IOSR-JMCE), 2014, e-ISSN:2278-1684, p-ISSN:2320-334X, PP. 23-26.
- 5) Abdullah Anwar, Juned Ahmad, Meraj Ahmad Khan, Sabih Ahmad and Syed Aqeel Ahmad, "Study of compressive strength of concrete by partial replacement of cement with marble dust powder", IJMERE, 2014, ISSN(Print):2321-5747, Volume-2, Issue-3, PP. 1-4.
- 6) Jashandeep Singh and Er. R S Bansal, "Partial replacement of cement with waste marble powder with M25 grade", IJTRA, e-ISSN:2320-8163, Volume 3, Issue 2, (Mar-Apr 2015), PP. 202-205.
- 7) G. Latha, A. Suchith Reddy and K. Mounika (2015), "Experimental investigation on strength characteristic of concrete using WMP as cementitious material", IJIRSET, e-ISSN:2319-8753, p-ISSN:2347-6710, Volume 4, Issue 12, December 2015, PP. 12691-12698.
- 8) Concrete Technology-M.S Shetty, S.Chand.

- 9) IS: 383-1970, "Specification for coarse and fine aggregate from natural resources for concrete", BIS, New Delhi, India.
- 10) IS: 10262-2009, "Concrete mix proportioning-guidelines", BIS, New Delhi, India.

BIOGRAPHIES



Ms. Disha Singh was born in 1992 in Lucknow city. She received his Bachelor of Technology degree in Civil Engineering from Babu Banarasi Das National Institute of Technology and Management, Lucknow in 2014. She is right now pursuing her Master of Technology in Structural Engineering from School of Engineering (BBDU) Lucknow.

E-mail: 19dishasingh@gmail.com



Mr. Mohd. Afaque Khan was born in 1982 in Gonda city. He received his Bachelor of Technology degree in Civil Engineering from ZHCET, AMU, Aligarh in 2009. In 2012 he received his Master's degree in Structural Engineering from ZHCET, AMU, Aligarh. He joined BBDU, Lucknow in 2012 as a faculty. He worked as Head of the Department in Babu Banarasi Das Engineering College, Lucknow and is now working as an Assistant Professor in BBDU, Lucknow (Department of Civil Engineering) with a total of 4 years of experience.

E-mail: afaque15amu@gmail.com



Mr. Abhishek Kumar was born in 1986 in Patna city. He received his Bachelor of Technology degree in Civil Engineering from School of Engineering (CUSAT) Kochi, Kerala in 2009. In 2011 he received his Master's degree in Structural Engineering from MNNIT, Allahbad. He joined Babu Banarasi Das Engineering College, Lucknow in 2011 as a faculty. He was Head of the Department in BBDU, Lucknow and is now working as an Assistant Professor in BBDU, Lucknow (Department of Civil Engineering) with a total of 5 years of experience.

E-mail: rajaabhis@gmail.com