A Critical Literature Review on Properties of Concrete Incorporating Marble Powder

Parth.D.Joshi1[1], Prof. A.D.Raval[2], Dr. J.R.Pitroda[3]
[1]*PG Student, M.Tech, CE&M Engg, BVM Engineering College, V. V. Nagar– 388120*
[2] *lecturer, Civil Engg. Dept., BVM Engineering College, V. V. Nagar– 388120*
[3] *prof, Civil Engg. Dept., BVM Engineering College, V. V. Nagar – 388120*

***Abstract*- History of concrete dates back to 1,200 BC, when reactions between limestone and oil shale during spontaneous combustion occurred in Israel to form a natural deposit of cement compounds. In ancient era cement was not discovered, so Lime was used as an adhesive, to harden and strengthen the construction, was used to construct concrete floors. In modern times, researchers have experimented with the addition of other materials, like water-based cross linking polymers, to create concrete with improved properties, such as higher strength, electrical conductivity, or resistance to damages through spillage. Concrete is a composite material composed of water, coarse granular material embedded in a hard matrix of material (the cement or binder) that fills the space among the aggregate particles and glues them together. In addition, the marble cutting industry generates a high volume of wastes. Recent studies showed that marble waste can be used as construction materials.**

***Index Terms*- Marble powder, Compressive strength, Concrete.**

I. INTRODUCTION

Concrete is the most important engineering material in construction industry because of its inherent strength properties. However, the addition of some other materials may change the properties of concrete. In addition, the marble cutting industry generates a high volume of wastes. Recent studies showed that marble waste can be used as construction materials.

The productive use of waste marble powder is one of the ways to alleviate some of the problems of solid waste management. There are several benefits of using waste marble powder.

A review of earlier research shows that industrial wastes were used in concrete to improve the properties of concrete and reduce the costs. Some alternate or supplementary marble waste materials like Marble powder can be used for cement as partial replacement in concrete and should lead to global sustainable development and lowest possible environmental impact and energy saving.

II. LITERATURE REVIEW

Pathan & Pathan et al. (2014) Use of waste & byproducts as aggregates has greater potential because 75% of concrete is composed of aggregates. The physical and chemical properties of marble dust are suitable for its proposed use. None of the mineral constituents in waste is in undesirable concentration.

Chaid , Perrot & Ghernouti et al. (2015) The partial replacement of cement by marble powder does not contribute to the formation of a significant volume of hydrated products capable of reducing porosity, however the compressive strength may beimproved to a greater or lesser extent.The marble powder can efficiently supplement cement in concrete; this structural contribution manifests itself by the reduction of porosity and consequently a greater resistance to chemical attack.The concrete with the addition of marble powder with a specific surface of 12,000 cm2/g offers interesting advantages over the conventional control concrete: higher strength, improved durability against physico-chemical absorption.

Shelke, Pawde & Shrivastava et al. (2012) The workability of concrete is decreases, with addition of silica fume & silica fume with marble powder by the replacement of cement. The compressive strength of cube & cylinder is marginally decreases, by using 8%, 12% & 16% replacement of OPC cement with marble powder in concrete.

Chavhan & Bhole et al. (2014) Compressive strength increases with increase of marble powder.Compressive strength increases with 30%

replacement and also 45%,50% replacement by sand. The maximum 28 days split tensile strength was obtained with 45%marble powder replaced with fine aggregate.

D , S , M & E et al. (2016) In this experimental investigation, a comparative study on conventional concrete with green concrete quarry dust as fine aggregate replacement of 25% and replacement of marble powder 0%, 2.5%, 5%, 7.5%, 10%, 12.5% and 15% by cement have been studied and the results were presented and analyzed in the previous chapter.

Kushwah , Sharma , & Chaurasia et al. (2015) AS per results of Practical examination this material Marble slurry shows a good and acceptable strength when added in Cement Mortar and Cement Concrete Both (replacing sand). It can be used as a filler material (upto 30% replacing sand) showing same strength as of controll.

Sharma & Kumar et al. (2015) Industrial wastes are capable of improving the physical and chemical properties. Use of marble waste powder shows a great performance due to the efficient micro filling ability.As per the study it, marble powder when replacing with sand upto certain percentage shows almost same strength.

Lal , Kumar & Sharma et al. (2015) The results obtained in the present study indicates that it is feasible to replace the fine aggregates by waste marble powder for improving the strength characteristics of concrete, thus the WMP can be used as an alternative material for the production of concrete to address the waste disposal problems and to minimize the cost of construction with usages of WMP which is almost freely available.

Talah , Kharchi & Chaid et al. (2015) Marble powder could be used as partial replacement of Portland cement up to 15% in composite cement. Additionally to this, an improvement in durability characteristics is observed; without decreasing the compressive strength of concrete.

N , R & Khrusi et al. (2017) At 5% replacement of cement with marble powder the compressive strength decreased to 70.2 N/mm2 and at 10% replacement of cement with marble powder the compressive strength increased to 71.9 N/mm2 while at 15% replacement of cement with marble powder the compressive strength decreased to 64.8 N/mm2.

Meena et al. (2015) In present study experimental investigation conducted on optimum marble dust replacement with sand. After cutting and sawing marbles, in large amount of marble slurry produce.

Binici , Kaplan & Yilmaz et al. (2007) Based on the experimental investigation reported in the paper, the following conclusions are drawn: 1- MD concrete group MD3 specimens have higher compressive strength than any of the other specimens. 2- Greater resistances of concrete against sodium sulphate were achieved with greater dusts additive ratios. The resistance of concretes compared to the sodium sulphate of the MD concrete was greater than the LD specimens.

Demirel et al. (2010) The concrete series that employed WMD as the substitute for the very fine aggregate passing through 0.25 mm sieve performed better than the series without any addition of marble dust in terms of compressive strength. As a matter of fact marble dust had a filler effect (particularly important at early ages) and played a noticeable role in the hydration process.

Kumar et al. (2016) The flexural strength of beam increase upto 15% replacement of fine aggregate by marble waste powder and further decreasing on the percentage of 20% marble waste powder leads to reduce in flexural strength of beam.Marble sludge can produces less porous concrete with normal concrete.

Priyatham , Chaitanya & Dash et al. (2017) The split tensile strength of concrete increases up to 10% replacement of cement by marble powder and further increase of percentage of marble powder leads to decrease in split tensile strength of concrete. The addition of marble powder (10% by weight of cement) into the concrete improved its split tensile strength by 13.17 % when compared with conventional mix.

Kalchari , Chandak & Yadav et al. (2015) The compressive strength of concrete is increased when the percentage of marble powder waste is increased up to 20% and by further increasing the percentage of marble powder waste compressive strength gets reduced.

Kumar & Kumar et al. (2015) The MDP can be used as a replacement material of cement, and 10% replacement of cement with MDP gives an excellent result in strength, as compared to the normal concrete.

Singh , Bhutani & Syal et al. (2015) Compressive Strength of concrete increases upto 10% of partial

replacement of Cement with waste Marble Powder and upto 30 % of partial replacement of coarse aggregates with tile aggregate.

Singh & Bansal et al. (2015) Considering the all of the results in this study, using of waste marble in the conventional concrete as binder or fine/coarse aggregate was positively affected on properties of hardened concrete. Whereas in self-compacting concrete, increasing of waste marble replacement ratios in the concrete were decreased the mechanical properties of concrete. Same declining trend of hardened properties of concrete was also determined in the polymer concrete.

Ulubeyli & Artir et al. (2015) Up to 12% replacement of cement with waste marble there is a increase in all mechanical properties.The replacement of 12% of cement with waste marble powder attains maximum compressive and tensile strength.

III. CONCLUSIONS

From the above literature review,we can conclude the following things:

1. In present study experimental investigation conducted on optimum marble powder replacement with sand.
2. Compressive strength increases with increase of marble powder.
3. The addition of marble powder (10% by weight of cement) into the concrete improved its compressive strength by 7.16 % when compared with conventional mix.
4. The Compressive strength of Concrete increases up to 10% replacement of cement by Marble Powder and further increasing of percentage of Marble Powder leads to decrease in compressive strength of concrete.
5. The compressive strength of concrete is increased when the percentage of marble powder waste is increased up to 20% and by further increasing the percentage of marble powder waste compressive strength gets reduced.
6. When marble powder is partially replaced in cement by weight, there is a marked reduction in compressive strength values of mortar mix with increasing marble powder content when compared with control sample at each curing age.
7. Up to 15% replacement of fine aggregate with waste marble powder there is an increase in all compressive strength of cube.

IV. ACKNOWLEDGEMENT

The authors thankfully acknowledge to Dr. C. L. Patel, Chairman C.V.M., Er. V. M. Patel, Hon. Jt. Secretary C.V.M., Prof. (Dr.) I. N. Patel, Principal, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar and Prof. (Dr.) L. B. Zala, Head Civil Engineering, Birla Vishvakarma Mahavidyalaya Engineering College, PROF. A. D. Raval, Lecturer ,Civil Engineering Department, B&B Institute of Engineering College,Vallabh Vidyanagar, Dr. Jayeshkumar Pitroda, Assistant Professor, Civil Engineering Department, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar for his extreme constructive support, constant encouragement, guidance and challenging my efforts in the right direction.

REFERENCES

[1] Vaidevi C, Study on marble dust as partial replacement of cement in concrete, Indian journal of engineering, 2013, 4(9), 14-16.

[2] Baboo Rai 1 , Khan Naushad H 2 , Abhishek Kr 3 , Tabin Rushad S 4 , Duggal S.K 5, Influence of Marble powder/granules in Concrete mix, International Journal of civil and Structural Engineering, Volume 1, No 4, 2011, ISSN 09764399.

[3] Characterization of Marble Powder for Use in Mortar and Concrete, http://www.4. uwm. edu /cbu/abstracts/05-09.pdf

[4] Bouziani Tayeb*1,2, Benmounah Abdelbaki1, Bederina Madani2 and Lamara Mohamed2, Effect of Marble Powder on the Properties of Self-Compacting Sand Concrete, The Open Construction and Building Technology Journal, 2011, 5, 25-29.

[5] Abrar Awol, Using Marble Waste Powder in Cement and Concrete Production, ADDIS ABABA UNIVERSITY SCHOOL OF GRADUATE STUDIES

[6] Bahar Demirel, The effect of the using waste marble dust as fine sand on the mechanical properties of the concrete, International Journal

of the Physical Sciences Vol. 5(9), pp. 1372-1380, 18 August, 2010, ISSN 1992 – 1950.

[7] Animesh Mishra, Abhishek Pandey, Prateek Maheshwari, Abhishek Chouhan, S. Suresh*, Shaktinath Das, Green Cement For Sustainable Concrete Using Marble Dust, International Journal of ChemTech Research CODEN(USA): IJCRGG ISSN : 0974-4290, Vol.5, No.2, pp 616-622, April-June 2013 ICGSEE-2013[14th – 16th March 2013] International Conference on Global Scenario in Environment and Energy.

[8] 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 E-ISSN2249–8974, IJAERS/Vol. I/ Issue III/April-June, 2012/175-177.

[9] F. J. Aukour, Feasibility study of manufacturing concrete eco-blocks using marble sludge powder as raw materials, Sustainable Development and Planning IV, Vol. 2 845, ISSN 1743-3541.

[10] A.A. Sammy. Mechanical properties for composite cement materials with different fiber. M. Sc faculty of engineering, materials engineering dept. Zagazig University 2007

[11] B. Demirel, The effect of the using waste marble dust as fine sand on the mechanical properties of the concrete. Turkey, International Journal of the Physical Sciences 5 (9) (2010) 1372– 1380.

[12] T. Celik, K. Marar, Effects of crushed stone dust on some properties of concrete Turkey, Cement and Concrete Research. 26 (7) (1996) 1121–1130.

[13] V. Corinaldesi, G. Moriconi, T.R. Naik, Characterization of marble powder for its use in mortar and concrete. United States, Construction and Building Materials 24 (2009) 113–117.

[14] A. Ergu ı n, Effects of the usage of diatomite and waste marble powder as partial replacement of cement on the mechanical properties of concrete. Turkey, Construction and Building Materials 25 (2010) 806–812.

[15] Chavhan J and Bhole S.D.(2014) " To Study the Behaviour of Marble Powder as Supplementry Cementitious Material in Concrete" Journal of Engineering Research and Applications, Vol.4, Issue 4, pp.377-381

[16] Dhanalaxmi C and Nirmalkumar K.(2015) "Study on the Properties of Concrete Incorporated With Various Mineral Admixtures Limestone Powder and Marblen Powder" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 1, pp.18511-18515

[17] Gulden C.U. and Recep A.(2015) "Properties of Hardened Concrete Produced by Waste Marble Powder" Science Direct, pp.2181-2190

[18] Lohe M.M., Makarande S.G. and Shende N.P.(2015) "Utility Of Marble Dust & Fly Ash In Different Grades Of Concrete" International Journal Of Engineering Research, Vol.3, pp.270-273

[19] Manju P.(2014) "The Significance of Partial Replacement of Cement With Waste Marble Powder" Periodic Research UPBIL, Vol.3, pp.1-6

[20] Raminder S., Manish B and Tarun S.(2015) "Strength evaluation of concrete using Marble Powder and Waste Crushed Tile Aggregates" International Journal for Science and Emerging Technologies with Latest Trends

[21] Ronak M., Sachith K.J., Rashmi S., Kiran H.N. and Veena K(2014) "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, Vol-4, Issue-1, pp.39-42

[22] Sakthivel B.P., Ramya C. and Raja M(2013) "An Innovative Method of Replacing River Sand by Quarry Dust Waste in Concrete for Sustainability" International Journal of Scientific & Engineering Research, Vol. 4, Issue 5, pp.246-249