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Review on, the Behavior of Concrete Including Marble Waste as Coarse Aggregate

Heshamuddin[1], Mithun Kumar Rana[2] , Pushpendra Kushwaha[3]

[1]M. Tech. Research Scholar, Civil Department, RKDF College of Engineering, Bhopal (M. P.), 462026 India
[2]Assistant Professor, Civil Department, RKDF College of Engineering, Bhopal (M. P.), 462026 India
[3]Assistant Professor, Civil Department, RKDF College of Engineering, Bhopal (M. P.), 462026 India

ABSTRACT

This research paper review ,A huge amount of waste is generated during quarrying and processing of marble stone. It has been reported that, approximately 50% of waste is generated during mining operation and about 15% during processing work. Majority of this waste is in the form of pieces stones of irregular shape and sizes dumped on open land and along roads, which create a lot of environmental as well as health problems. Management of huge quantity of waste to prevent such adversities is a major challenge to the society. In the present study the marble waste obtained from nearby area was crushed into crusher to obtain the desired gradation suitable for coarse aggregate. A detailed characterization of marble waste was carried out in this study. Mechanical and durability properties of concrete with marble waste as coarse aggregate were investigated. Overall the product becomes sustainable with saving of 14% in overall cost of concrete .From the study it was observed vii that, it has a good potential for bulk consumption of marble waste in construction industry in an environmental friendly manner. The utilization of this waste not only solves the problem associated with disposal of marble waste but also conserve the natural resources.

Key word -Marble Waste,Workability,Compressive Strength, Mechanical and Durability

1.Introduction & Literature Review

A huge amount of waste is generated during quarrying and processing of marble stone. Approximately 50% of waste is generated during mining operation and around 15% during processing (Status Report ,2009). This waste is in the form of stones of irregular shape and size and slurry that are dumped on open land and along roads, which create a lot of environmental as well as health problems.

1.1 Use of Marble Powder as a partial replacement for cement in concrete

Manpreet Singh *et al*.(2017**)** represented the waste marble suspension from Makrana locus of Rajasthan in India for various physiochemical properties and accustomed replace bond partly by weight in concrete. Drying shrinkage was found to decrease and quality of mortar increased for a selected rate substitution. They watched that the mechanical properties of cement concrete upgraded with change of integrity of became dried marble slurry for scarce to fifteen percent substitution.

Ismail Sedat Buyuksagis*et al*.(2017**)**studied the the accessibility of marble powder (MP) additional substance at numerous proportions instead of dolomite, that is that the crude material in glue mortars of insulation board. The employment of marble powder with dolomite was additionally investigated economically and it had been observed that it had been additional advantageous to form price calculations and in accordance with the relevant EN standards

Chetan Thakur and Jagdeep Singh Gahir2018 ,studied the Effect of Micro-Silica and Marble Dust on Mechanical Properties of Concrete. Experimetal work is done on the marble dust which is in the form of solid waste and stone slurry. The experiment is performed on marble dust which is used to make the bricks. After making the bricks their performance is tested on compressive strength, water absorption test and flexure strength. The results are noted on adding 9%, 10%, 11% of marble dust for cube specimen and 14%,15%,16% for beam specimen along with different proportions of micro silica.

Arun Kumaret al 2018 , Experimental investigation on Strength Behaviour of Concrete Produced with Marble Dust Powder, marble natural stone industry generates both solid and stone slurry and according to prior survey solid waste materials generation is even more in marble natural stone industry, in and about 40% of waste materials is formed, that's around 68 million tonnes. So, have an effect on the fertility of the soil. Experimental programme was carried out using 0%, 7.5%, 15%, 22.5%, 30% by wt. partial replacement of cement with marble dust powder for making of cement concrete with 0.40 water cement ratio.

Ergün (2011) reported that, replacement of cement by marble powder in different percentages 5%, 7.5% and 10% enhances the mechanical properties of concrete mixes. It was reported that, compressive strength increased by 11.29%, 12.72% at 5% and 7.5% replacement but at 10% replacement it

decreased by 13.82% as compared to that of control mixes. On the contrary flexural strength decreased by 3.92% and 6.07% at replacement level of 7.5% and 10%, respectively. However at 5% replacement flexural strength, was found to be equal to that of control concrete.

Another study carried out by Shirule et al. (2012) used marble powder as a partial replacement for cement in concrete mixes with a constant water-cement ratio of 0.5. They reported that, compressive strength of concrete mixes increased by 13.2% and 17.7% at 5% and 10% replacement levels whereas at 15% and 20% replacement compressive strength decreased by 13.3% and 17.8%, respectively.

Mishra et al. (2013) used marble dust as partial replacement for Portland cement in concrete mixes with a constant water-cement ratio of 0.46 in different percentages 0% to 10% by weight. Marble dust was ground together with Portland cement clinker. They reported that, compressive strength of the resulting blended cement concrete mixes increased by 19% at10% replacement level as compared to that of control concrete.

Rana et al. (2015) reported that, marble sludge can be used as a partial replacement for ordinary Portland cement up to 10% in concrete mixes. The dense microstructure of concrete formed due to the inclusion of marble, enhanced the concrete mixes' durability properties namely resistance to permeation, chloride migration and corrosion, but at the expense of reduced workability. Large surface area of marble powder was attributed to the cause of this reduction in workability of the concrete mixes. It was also reported that, 10% marble sludge as partial replacement of cement does not affect the formation of hydration products.

1.2 Use of marble waste as a partial replacement for fine aggregate

Hameed et al (2009) in their study reported that, replacement of natural sand by marble powder and quarry rock dust in equal proportion (50% quarry rock dust and 50% marble powder) in concrete mixes showed improvement in compressive and split tensile strengths by 9.5% and 8.65%, respectively. The permeability of concrete reduced by 19% as compared to that of control specimens.

Hebhoub et al. (2011) conducted studies on concrete mixes with crushed marble waste as a partial replacement for sand. They reported here that, workability of concrete mix decreased as the percentage of replacement increased due to higher water absorption of natural aggregates. The compressive strength of concrete mix increased by 17.2%, 23.65% and 16.1% at 25%, 50% and 75% replacements, respectively but at 100% replacement level the compressive strength was reduced by 23.29%.

Rai et al. (2011) also prepared concrete mixes by replacing fine aggregate using marble waste in proportions from 0% to 20% with a constant water-cement ratio of 0.44. They reaffirmed that, compressive and flexural strength of all mixes was 5% to 10% higher than that of control mixes.

Gencel et al. (2012) carried out a study to evaluate the potential use of crushed marble waste as a partial replacement for conventional fine aggregates in different percentages 0% to 40% for production of concrete paving blocks. They reported that, compressive strength, density and water absorption decreased by 22%, 5% and 28% as compared to that of control concrete at 10% to 40% replacements of fine aggregate by marble powder. It was also reported that, resistance to abrasion increased by 20.14% and relative strength loss after freeze –thaw resistance decreased by 4.43% at 40% replacement

Gameiro et al (2013) investigated the effect of partial replacement of conventional fine aggregate by marble mining waste 20%, 50%, and 100% on the physical and mechanical properties of concrete with a constant water-cement ratio 0.55. They concluded that, replacement of sand by marble mining waste up to 20% in concrete mixes improved the mechanical and durability properties.

Silva et al. (2014) investigated the influence of replacement of fine aggregate by marble mining waste on concrete mixes. The replacement level of fine aggregate by marble powder was kept at 20%, 50% and 100% without changing the water-cement ratio of 0.43. They reported that, workability of concrete mixes decreased as replacement level for fine aggregate by marble mining waste increased and this can be maintained by adjusting the water-cement ratio. The same study reports that, the compressive strength decreased by 2.5% to 10.2%, split tensile strength increased by 1.5% to 3.6%, modulus of elasticity increased by 1.9% to 3.5%, abrasion resistance decreased by 10.1% to 31.9% as replacement level for fine aggregate by marble mining waste increased from 20% to 100%, respectively. The cause behind marginal decrease in properties of concrete mixes was, increase in water-cement ratio and poor wear resistance of fine aggregate from marble mining waste.

1.3 Use of marble waste as a partial replacement for conventional coarse aggregate

In a study by Sadek M. et al. (2002), conventional coarse aggregate were replaced by marble waste in different proportions 0% to 100% by weight in manufacturing of cement concrete bricks. It was reported that, 75% replacement of coarse aggregate 17 obtained from marble waste increases the compressive strength by 27.7%, flexural strength by 11.7% and water absorption of concrete reduced by 53.7% as compared to that of control concrete. They also reported that, the solid concrete bricks produced by using marble waste as coarse aggregate satisfy the required criteria of Egyptian standards.

Binici et al. (2008) investigated the influence of 100 % replacement of natural coarse aggregates by marble waste, in concrete mixes with a constant water-cement ratio of 0.4. River sand and ground blast furnace slag (GBFS) were used as fine aggregate. They reported that, concrete mixes prepared with marble waste were more workable than that of control mixes due to low water absorption and smooth surface texture of marble waste. The average compressive strength, flexural strength and split tensile strength of concrete mixes increased by 27%, 7.25% and 3.75%, respectively when compared to that of control concrete. It was also reported that, these concrete mixes showed considerably better performance under chemical attack. The concrete mixes containing marble aggregate showed nearly about 30% reduction in compressive strength as compared to 50% in control concrete when immersed in 10% sodium sulphate solution. The depth of chloride penetration was also reduced by 70% as compared to that of control concrete.

Hebhoub et al. (2011) conducted studies on use of marble waste as partial and complete replacement (0 to 100%) in the form of fine aggregate and coarse aggregate in concrete with 0.5 as water-cement ratio. It was reported that, workability decreased as replacement level increased and insignificant change in density of concrete mix was observed. Compressive strength of all concrete mixes increased as percentage for replacement of conventional coarse aggregate by marble aggregate increased.

Gencel et al. (2012) described the potential use of aggregate produced from marble waste as a partial replacement for conventional coarse aggregate in different percentages 0%, 10%, 20% and 40% for preparation of concrete paving blocks. It was reported that, for all the concrete mixes density and water absorption decreased by 3.9% and 20%, respectively for 40% replacement.

Martins et al. (2014) reported that, coarse aggregate from marble waste can be used as a partial replacement for conventional coarse aggregate to improve the mechanical properties of concrete. They also reported that, the workability of all concrete mixes increased by 4.16% to 9.34% and density marginally decreased by 0.28% to 4.21% at 20% to 100% replacement level. With regard to compressive and tensile strength, marginal reduction by 5.2% to 6.2% and 1% to 10.4%, at replacement of 20% to 100%, respectively was reported.

2 CONCLUSION

From the above study it can be concluded that, the use of aggregate produced from marble waste can be used as replacement of conventional coarse aggregate in concrete mixes. The increase in resistance against abrasion and significant reduction in depth of chloride penetration are added benefits ensuring enhanced life of concrete structure without sacrificing strength

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