Review on Utilization of Waste Marble Powder in Self-Compacting Concrete

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Abstract *— Self-Compacting concrete (SCC) is defined as a highly flowable, non-segregating concrete mix that can be placed even in the most congested reinforcement by means of its own weight, with little or no vibrations. With the increasing use of marble stones, the waste marble powder (WMP) is also increasing in the same way. As per the experiment, about 45% of the marble block will be wasted during its cutting in the form of powder. As we all know, the waste marble powder decreases the fertility of the soil and also pollute the environment. Therefore, as a solution for these problems and also to get some benefits from the wastage materials; we tried replacing the fine aggregates with waste marble powder (WMP). The fine aggregate is being replaced by the powder's slurry in the form of marble powder. By the use of this waste marble powder in the concrete, we can increase or change various properties of the concrete mix; also the concrete can be used as self compacting concrete.*

Keywords *— Self-compacting concrete (SCC), Waste marble powder (WMP), non-segregating, congested reinforcement, flowable, slurry*

I. INTRODUCTION

Self Compacting Concrete is also known as Self-Consolidating Concrete or High-Performance Concrete or Super-Workable Concrete. SCC has been developed for the use in situations where vibration is difficult and reinforcing steel is highly congested as in the case of typical pre-stressed beam. Self-Compacting concrete (SCC) technology is based on increasing amount of fine material like marble powder, fly ash, lime stone filler, etc., without changing the water content compares to the conventional concrete. The self-compacting or super-workable concrete or also referred to as self-consolidating concrete is a highly flowable or self-levelling cohesive concrete that can spread readily into low viscous place through and around dense reinforcement under its own weight. It adequately fills formwork without segregation or bleeding, and without any significant vibrations. SCC mix has low yield stress and an increased plastic viscosity. This mix requires minimal force to initiate flow but also have adequate cohesion to resist aggregate segregation and excessive bleeding. It is estimated that SCC may result in up to 40% faster construction than using normal concrete and the elastic modulus and shrinkage of SCC didn't differ significantly from the corresponding properties of normal concrete.

Marble cutting industry produces large amount of wastes in the powder form. Marble powder is one of the waste produces in marble industry. While cutting marble, slurry is formed which replaces fine aggregate. It is obtained during the processes of dressing, cutting and polishing. The marble waste during quarrying by mechanized processes can be estimated at 30% to 40% of the total production. The waste generated during the quarrying operation is mainly in the form of rock fragments. The marble waste generated during the processing of marble like dressing, cutting and polishing processes. The slurry generated during processing can be estimated at about 10% of the total stone quarried and during polishing processes 5% to 7%.

The Waste marble powder can be utilized in concrete in different ways. Waste marble powder can be used as filler in concrete and helps to reduce the total void content in concrete. Waste marble powder can be used as an admixture in concrete, so that the strength can be altered

II. LITERATURE REVIEW

Gulden CaginUlubeyli and RecepArtir(2015), showed that, replaced waste marble with cement or aggregate in typical concrete was improved properties of hardened concrete. But, using of waste marble in self-compacting or polymer concrete wasn't affected absolutely on the properties of hardened concrete.[1]

Kishan P. Pala and Krunal J Dhandha(2015), studied, fresh property like Filling ability and passing ability is increase by use of 10% waste Marble Powder and 25% fly ash by replacement by cement in binder material. In Hardened property like Flexural strength, Compressive strength and Split strength would be taken into consideration, Marble powder may be use up to 10% and fly ash 25%.[2]

Ranjodh Singh et.al, (2013), showed that smart hardened properties were achieved for the concretes with 25% marble powder which may be considered because the optimum content for prime compressive strength. try has been created to replace fine

aggregate with brick dust and marble powder. both brick kiln dust and marble powder are waste products and are dumped as waste, inflicting land deficiency and environmental pollution. using these kinds of waste product for concrete may be a larger step towards sustainable infrastructure development.[3]

M. SahulHameed et.al, (2012), showed that it's attainable to utilize each marble sludge powder(MSP) and crushed rock dust(CRD) wastes within the producing of Self compacting concrete(SCC). This utilization of wastes improves the physical and mechanical properties. recycling and using waste to produce a SCC might then be the most effective choice to sustain future economy. it's suggested that the replacement of natural sand with 85% CRD (Crushed Rock Dust) and 15% marble sludge powder (MSP), as replacement in SCC. [4]

Omar et.al, (2012), studied the compressive strength is also because of that the active SiO2 in waste marble powder will react with the Ca (OH)2 in concrete to form secondary calcium silicate hydrate and build it chemically stable and structurally dense.[5]

Bouzianiet. al.(2011), showed that the rise of Marble powder(MP) dose in self compacting sand concrete(SCSC) will increase each of the mini-slump flow and also the V-funnel flow time. SCSC have the highest values of consistency index and lowest values of flow index with 250 kg/m3 of MP. This dose is appropriate for SCSC, due to it permits to the mixture to possess good fluidness throughout the flow (up to 30 rpm) while presenting a enough viscousness at the end of the flow that permits to avoid the segregation.[6]

Ergun (2011), used the waste marble powder in concrete show as a filler impact. the reason may be said as that the filler is an inert addition and it will be assumed as ultrafine aggregates filling voids in concrete. The usage of waste marble powder reduces the porousness in concrete mix physically, and has a very important binding property that is formed by hydration of calcite and C3A chemically. The concrete containing 5-hitter waste marble powder as partial replacement by weight for cement with a brilliant plasticizing admixture had higher compressive strength than that of the control concrete samples. Consequently, the replacement of cement with diatomite and waste marble powder individually or along may be used to improve the mechanical properties of the conventional concrete mixtures.[7]

ZoranGrdić, et.al(2008), found that the addition of fly ash to the mixture containing hydraulic lime is quite useful, bringing a considerable improvement of the behavior of SCCFAHL (SCC with a mix of ash and hydraulic lime concrete). Also, this mixture has smaller filling capability and fluidness than different mixtures. The silica fume, a costlier additive, imparts within the SCC the same behaviour to the one of normal concrete compacted by vibrations. it's caused by an incompatibility between silica fume and super-plasticizer requiring a rise of water-cement ratio for constant concrete workability.[8]

III. DISCUSSION

The waste marble powder cab be used as fine aggregates. Sand is replaced by the waste marble powder. With the use of the waste marble powder, wasted materials are utilized as well as the strength and quality of the concrete is increased. Cost, when using marble powder is less than the cost when using sand. SCC can be made using the marble powder. Good quality and good strength SCC can be produced using the wastage produced by marble industry.

IV. CONCLUSIONS

Marble wastage are able for improving the fresh and hardened properties of self compacting concrete (SCC). Marble powder has some cementitious properties. As per the previous studies, it concludes that use of waste marble powder as the replacement of fine aggregate as well as cement had a good prospective

REFERENCES (SIZE 10 & BOLD)

[1] Gulden Cagin Ulubeyli, Recep Artir (2015). "Properties of Hardened Concrete Produced by Waste Marble Powder." , www.sciencedirect.com

[2] Kishan P Pala et.al (2015). "*Use of Marble Powder and Fly Ash in Self Compacting Concrete",* IJIRST – International Journal for Innovative Research in Science & Technology ISSN (online): 2349-6010S.

[3] Er.Ranjodh Singh, et.al., "Study of Self Compacting Concrete Using Brick Dust and Marble Powder". International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 *www.ijera.com*

[4] *M. Shahul Hameed, et.al(2012). "Self-Compacting Concrete Using Marble Sludge Powder and Crushed Rock Dust".* KSCE Journal of Civil Engineering (2012) 16(6):980-988 DOI 10.1007/s12205-012-1171-y

[5] Omar, et.al (2012). "Influence of limestone waste as partial replacement material for sand and marble powder in concrete properties".

[6] Bouziani Tayeb et. al, (2011) "Effect of Marble Powder on the Properties of Self-Compacting Sand Concrete", The Open Construction and Building Technology Journal, 2011,5,25-29

[7] Ergun, A. (2011), "Effects of the usage of diatomite and waste marble powder as partial replacement of cement on the mechanical properties of concrete". *Construction and Building Materials, 25, 806–812.*

[8] *Zoran Grdić, et.al,(2008) "Properties of Self Compacting Concrete with different types of Additives", Architecture and Civil Engineering Vol. 6, No 2, 2008*

[9] H.J.H. Brouwers, H.J. Radix(2005).“Self-Compacting Concrete: Theoretical and Experimental Study”, Cement and Concrete Research 35 (2005) 2116 – 2136

[10] “*Status report on commercial utilization of marble slurry in Rajasthan”* MSME- Development Institute, Govt. of India, Ministry of micro, small and medium enterprises

[11] Nitisha Sharma and Ravi kumar (2015), “Review on Use of Waste Marble Powder as Partial Replacement in Concrete Mix” SSRG International Journal of Civil Engineering (SSRG-IJCE) EFES April 2015, ISSN: 2348 – 8352

[12] Ankit nileshchandra patel and Prof. Jayeshkumar Pitroda (2013), ‘‘STONE WASTE AS A GROUNDBREAKING CONCEPTION FOR THE LOW COST CONCRETE” International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013, ISSN: 2231-5381