AN INVESTIGATION ON PROPERTIES OF S.C.C BY PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH WASTE MARBLE CHIPS: A REVIEW

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Abstract : In developing countries, the methods used to recycle and re-use waste materials should be investigated in order to benefit from natural resources effectively. Reuse of construction and demolition waste is one of the most important goals of the construction industry. Conversion of raw materials, used or waste materials provides significant energy savings by reducing the number of industrial processes in the production of materials. The advantages of the use of these SCCs, are mainly the combination of stability to segregation and great fluidity they offer in the fresh state. A high volume of marble production has generated a considerable amount of waste materials; almost 70% of this mineral gets wasted in the mining, processing and polishing stages which have a serious impact on the environment. The processing waste is dumped and threatening the aquifer. Therefore, it has become necessary to reuse these wastes particularly in the manufacture of concrete products for construction purposes. The main goal of this study is to demonstrate the possibility of using marble wastes as a substitute rather than natural aggregates in concrete production. It was observed that workability of concrete mixes containing marble aggregate was 14% more than that of control concrete. The average compressive strength of all the concrete mixes containing marble aggregate increased by 40% and 18% at 7 and 28 days, respectively.

Index Terms **-** Marble aggregate, self-compacting concrete, Compressive Strength, Fresh property

I. INTRODUCTION

Nowadays, due to an increase in marble and emerged wastes are disposed into open fields. This waste causes environment. The use of marble waste in the production of SCC was investigated. Concrete is an artificial material in which the aggregates (fine and course) are bounded together by the cement when mixed with water. Concrete has unlimited opportunities for innovative applications in construction field. Due to fast developing of infrastructure the availability of quality aggregates is depleting day to day and this is scaring to the construction industry. In this context it is required to think innovate or reuse of waste materials as alternate materials to available materials. The stone waste is generated from the stone polishing industries and it is converted in to use full aggregate and the same is used in concrete with different replacement levels of natural coarse aggregate (25,50,75 and 100%) with and without steel fibers. The marble extraction industry has a significant impact on Portugal's economy, but it is also responsible for important environmental impacts. Large amounts of waste are produced every year that can be as much as 80–90% of all the materials extracted. Therefore, solutions must be found that will satisfy the increasing production of this waste. Wastes from marbles and tiles factories as mineral additives to self-compacting concrete and to substitute at 100% the known additions. The use of these wastes can help produce economical self-compacting concretes and reduce the amount of wastes dumped into landfills.

Today we are faced with an important consumption and a growing need for aggregates because of the growth in industrial production, this situation has led to a fast decrease of available resources. On the other hand, a high volume of marble production has generated a considerable amount of waste materials; almost 70% of this mineral gets wasted in the mining, processing and polishing stages which have a serious impact on the environment. The self-compacting concrete is used even in the most complex shapes and can pass through the densest reinforcement without requiring the means of vibration that is to say, it is recommended concrete to use for works of the great projects. The structures of these projects require high mechanical performances and durability of the concrete used. The self-compacting concretes are considered a new family of concrete in the world. Initially, these SCCs were used only for big projects such as bridges, and thereafter, they were used even for the construction of buildings. The advantages of the use of these SCCs, are mainly the combination of stability to segregation and great fluidity they offer in the fresh state

II REVIEW OF LITERATURE

[1] Tayfun Uyguno glu **(2014)** had Use of waste marble and recycled aggregates in self-compacting concrete. They use of marble waste (MW) and recycled aggregate (RA) from crushed concrete in the production of SCC. Control series were produced with crushed limestone aggregate (LS) in different water to binder ratios. Then, LS was replaced with MW or RA in ratio of 100%. They had performed fresh concrete experiments such as slump-flow, the J-ring test, unit weight and air content. Furthermore, they had check compressive strength, splitting-tensile strength, stress- strain relationship, modulus of elasticity and ultrasonic pulse velocity experiments on the hardened specimens. They got results that the workability of SCC strongly depends on characteristic properties of aggregate such as unit weight (or bulk density), shape and surface texture. However, the significance of aggregate characteristics becomes less important as the w-b ratio increases. The marble wastes and recycled aggregates can be used in the production of self-consolidating concrete as aggregate, and thus an advantage can be provided.

[2] Mohsen Tennich, Abderrazek Kallel **(2018)** had use the marble & tiles fillers on self-compacting concrete & tried to find the thermal effect & behavior of concrete. The effect of industrial wastes of marble and tiles on setting of the cement is studied by testing different pastes. In a second part of this research, a study of the effect of these industrial wastes on the hydration reaction in early age is has done on different self-compacting concretes made with industrials wastes from marble and tiles factories. & they got result the setting of cement show that the marble and tiles wastes have a positive effect on the fresh concrete and the setting period by reducing the critical phase of concrete in the face of shrinkages. The marble and tiles wastes acted as a setting accelerator. The marble and tiles wastes are beneficial and they have a positive effect on the fresh state of the concrete by reducing plastic shrinkage, by decreasing the setting period of cement paste combined with these industrial wastes from **20% to 27%** relatively. The industrial wastes fillers reduce the release of heat in the exothermic hydration reactions of cement in self-compacting concrete up to **13%** and limit their cracking due to different shrinkages

[3] Mohsen Tennich, Mongi Ben Ouezdou **(2017)** had used waste marble tiles in self-compacting concrete & found behavior of concrete to external sulfate attack. The different samples of concretes were immersed in seawater, in a sodium sulfate solution (liquid form of sulfate attack) and potable water chosen as a reference. Other samples of these concretes were also placed in a vehicle battery charging hall to ensure their exposure to gaseous form in sulfate through the release of sulfur dioxide gas in the hall. They got result by doing this self-compacting concretes (SCCWs) incorporating industrial wastes have sufficient resistance to severe chemical degradation. The observed mass gain for the SCCWs was between **5% and 7%** for 20 months of exposure in comparison to the OVC. The SCCW1 samples showed the most resistance to external sulfate attack in liquid form while the OVC samples were completely degraded.

[4] H. Hebhoub, M. Belachia, H. Houari **(2011)** had used the waste marble as a aggregate in concrete. The characterization of waste marble aggregates and various practical formulations of concrete. This experimental investigation was carried out on three series of concrete mixtures: sand substitution mixture, gravel substitution mixture and a mixture of both aggregates (sand and gravel). The concrete formulations were produced with a constant water/cement ratio. They got result from this experiment that the mechanical properties of concrete specimens produced using the marble wastes were found to confirm with the concrete production standards and the substitution of natural aggregates by waste marble aggregates up to **75%**

[5] Sudarshan D. Kore, A.K. Vyas **(2016)** had used marble waste as a coarse aggregate in concreter & found impact of this material also found the properties of lean concrete. The feasibility of use of marble waste as a coarse aggregate in concrete. Conventional natural coarse aggregate was replaced by marble aggregate in different percentages **0–100%** by compressive strength of all the concrete mixes containing marble aggregate increased by **40%** and **18%** at **7** and **28** days respectively. The workability of all the concrete mix increases with increased percentage of replacement of natural coarse aggregate by marble aggregates.

[6] Hasan S¸ahan Arel **(2016)** had done recyclability of waste marble in concrete production. He had done replacement of cement with waste marble and the use of waste marble as aggregate in concrete production. When he replaced natural sand with marble dust at a ratio of **15-75%** the compressive strength increases by **20-26%.**coarse marble aggregates achieved the best results at a **100%** replacement ratio. Moreover, waste marble in coarse aggregate form improves the mechanical properties over the dust form. Marble powder that is replaced with cement in quantities of **20%** or more was determined to have adverse effects on the compressive strength and workability of concrete. Replacing cement with **5-10%** marble dust improves the mechanical properties of the concrete, while reducing the CO2 emissions of cement production by **12%**. Supplementing up to **75%** of the cement weight with marble dust as a filler material enhances the compressive strength by **42%** and the splitting tensile strength by **42%**. In coarse aggregate form, marble waste replacement exerts more positive impacts as the w/c ratio reduces.

[7] Mohsen Tennich, Abderrazek Kallel **(2015)** had used marble &tile waste as a filler in the composition of self-compacting e. influence of these wastes on the behavior of SCC in the fresh state is highlighted in comparison to a reference self-compacting concrete (SCCR) made with limestone filler while their effects on mechanical strength and ultrasonic testing are evaluated in the hardened state in comparison to the properties of both SCCR and an ordinary vibrated concrete. They carried out test on fresh concretes (slump flow test, V-funnel test, L-Box test and sieve stability test) show that the incorporation of wastes from marbles and tiles factories gives a satisfactory fluidity to the SCCW and their resistance to segregation, approaching those of SCCR. The mechanical properties of the tested concretes were evaluated by ultrasonic testing and by simple compressive testing and tensile splitting of cylindrical specimens at the curing ages of **3**, **7**, **14** and **28** days.& they got result like compressive and tensile strengths are clearly sufficient for the self-compacting concretes incorporating wastes from marbles and tiles factories compared to those of SCCR and OVC

[8] M. Sardinha, R. Rodrigues **(2015)** had used marble cutting sludge a fine aggregate in concrete & found the properties of this concrete. They found the mechanical performance of concrete with various incorporation ratios of sludge from the marble extraction industry as cement replacement **0%**, **5%**, **10%** and **20%**. By using this test they got result that replacement ratios of up to **10%**, thereby validating the use of this concrete in the construction sector. Regarding the use of plasticizers, it was observed that they improve the mechanical performance of concrete with marble sludge by offsetting the decline of its properties relative to conventional concrete. The bulk density slightly decreases with higher replacement ratios. The compressive strength decreases as the replacement ratio increases. But this decrease is not significant up to replacement ratios of **10%**. The ultrasonic pulse velocity decreases.

[9] G Reddy babu, U.Raghu Babu **(2016)** had used black stone as a waste aggregate concrete. They had test for compressive and bearing strength performance on steel fiber reinforced stone waste aggregate concrete. The stone waste is generated from the stone polishing industries and it is converted in to use full aggregate and the same is used in concrete with different replacement levels of natural coarse aggregate (**25**,**50**,**75** and **100%**) with and without steel fibers. After preforming this test they got that **50%** replacement of natural aggregate by stone waste aggregate is desirable for concrete works. Some regression models were deduced for estimating the bearing strength of concrete. The results of the experimental works were also compared with **IS 456. 2000** code provision. As the % of stone waste aggregate increases in the concrete mix the compressive and bearing strengths were decreased. The compressive strength at first crack and ultimate stages the % of decrease is about 8 to **42%** for **25** to **100%** stone waste aggregate when compared with natural aggregate concrete. The bearing strength at first crack and ultimate stages, the % of decreases about **15** to **61%** for **25** to **100%** stone waste aggregate when compared with natural aggregate concrete. The bearing strength regression model presented in this paper is well matched with the experimental results. From the present research work, it can be concluded that the utilization of stone waste aggregate can be used for concrete works up to **50%** of replacement of natural aggregate.

III CONCLUSION

A lighter SCC can be obtained the desired qualities for concrete made with recycled aggregates. Thus, formwork pressure would be decreased by use of SCC with lower unit weight than traditional concrete. The compressive strength of concrete with waste marble and recycled aggregate in the lowest water to binder ratio was lower the appropriate incorporation of marble waste aggregates can lead to interesting characteristics in terms of strength, indeed the use of marble aggregates resulted in a considerable increase in the compressive and tensile strength. The enhancement in resistance is very significant for 25%, 50% and 75% of substitution In terms of workability. There was no need to change the w/c ratio of the various mixes significantly to maintain the same levels. Plasticizers reduce the w/c ratio and this reduction is greater according to the water reduction power of the plasticizer

References

[1] TayfunUygunoglu, IlkerBekirTopçu, AtilaGürhanÇelik 2014, Use of waste marble and recycled aggregates in self-compacting concrete for environmental sustainability, Journal of Cleaner Production, Vol 3,10-15.

[2] Mohsen Tennicha, Mongi Ben Ouezdoua, AbderrazekKallela 2018, Thermal effect of marble and tile fillers on self-compacting concrete behavior in the fresh state and at early age, Journal of Building Engineering, 20, 1–7.

[3] Mohsen Tennich, Mongi Ben Ouezdou, AbderrazekKallel 2018, Behavior of self-compacting concrete made witmarble and tile wastes exposed to external sulfate attack, Construction and Building Materials 135, 335–342.

[4] H. Hebhoub, H. Aoun, M. Belachia, H. Houari, E. Ghorbel 2011, Use of waste marble aggregates in concrete, Construction and Building Materials 25, 1167–1171.

[5] Sudarshan D. Kore, A.K. Vyas 2016, Impact of marble waste as coarse aggregate on properties of lean cement concrete, Case Studies in Construction Materials 4, 85–92.

[6] Hasan S¸ahanArel 2016, Recyclability of waste marble in concrete production, Journal of Cleaner Production, 131, 179-188.

[7] Mohsen Tennich, AbderrazekKallel, Mongi Ben Ouezdou 2015, Incorporation of fillers from marble and tile wastes in the composition of self-compacting concretes, Construction and Building Materials, 91, 65–70.

[8] R. Rodrigues, J.de Brito, M. Sardinha 2015, Mechanical properties of structural concrete containing very fine aggregates from marble cutting sludge, Construction and Building Materials, 77, 349–356.

[9] N.VenkataRamanaa, G Reddy babu, U.Raghu Babu 2018, Bearing Strength of Steel Fiber Reinforced, Black Marble Stone Waste Aggregate Concrete, Construction and Building Materials, 91, 69–75.