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A Review on Utilization of Marble Waste Powder as a Partial Replacement of Cement in Glasscrete Concrete

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Abstract— *The utilization at solid waste in cement manufacturing company will help in conservation of natural resources. The use of waste marble powder as a partial replacement of cement can be reduce the cost of cement and may be control the emission of harmful gases into environment and proved eco-friendly to environment. Such that, Waste glass is also a major component of solid waste stream in many countries. It is found in many forms, container glass, flat glass as window, bulb glass. At present, a small proportion of post-consumer glass has been recycled with high performances and unique aesthetic properties which make it suitable for wide spread uses. The study is aimed at utilizing waste marble powder construction industry itself as cement and waste glass pieces as coarse aggregates in concrete. The various literature related to have been studied.*

Keywords-*Marble Powder, Glasscrete, Compressive Strength, Tensile strength, Flexural Strength*

I. INTRODUCTION

Concrete is very strong and versatile moldable construction material. It consists of cement, sand and aggregate (e.g., gravel or crushed rock) mixed with water. The cement and water form a paste or gel which coats the sand and aggregate. When the cement has chemically reacted with the water (hydrated), it hardens and binds the whole mix together. The initial hardening reaction usually occurs within a few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years. When aggregate is mixed together with dry Portland cement and water, the mixture forms a fluid slurry that is easily poured and molded into shape. The cement reacts chemically with the water and other ingredients to form a hard matrix that binds the materials together into a durable stone-like material that has many uses. Many types of concrete are available, distinguished by the proportions of the main ingredients below. In this way or by substitution for the cementitious and aggregate phases, the finished product can be tailored to its application. Strength, density, as well chemical and thermal resistance are variables. Aggregate consists of large chunks of material in a concrete mix, generally a coarse gravel or crushed rocks such as limestone, or granite, along with finer materials such as sand.Cement, most commonly Portland cement, is associated with the general term "concrete." A range of other materials can be used as the cement in concrete too. The concrete solidifies and hardens through a chemical process called hydration. The water reacts with the cement, which bonds the other components together, creating a robust stone-like material. Chemical admixtures are added to achieve varied properties. These ingredients may accelerate or slow down the rate at which the concrete hardens, and impart many other useful properties including increased tensile strength, entrainment of air and water resistance. Reinforcement is often included in concrete. Concrete can be formulated with high compressive strength, but always has lower tensile strength. For this reason it is usually reinforced with materials that are strong in tension, typically steel rebar.

II. MARBLE POWDER

Marble is obtained from the transformation of pure limestone. The purity of marble depends upon the colour of the marble. Since the ancient times, marble is widely used in monuments and historical buildings for decorative purpose. In India, tons of marble waste has been produced from the marble industries.But this impurities cannot be easily disposed off..Such type of impurities mixed with soils and water. When they mixes with the soil, it reduce the porosity and permeability of soil and also reduce the fertility of soil. Also, if it mixes with water it pollute the water and make water unfit for use. So, it is necessary to use the marble waste in functional manner.

Figure: 2.1 Waste Marble Powder

Advantages of Marble Powder

1. Marble powder can be used as filler in concrete and paving materials and helps to reduce total void conduct in concrete.
2. Marble powder can be used as an admixture in concrete, so that strength of concrete can be increased.
3. We can reduce the environmental pollution by utilizing this marble powder for producing the other products.
4. Marble dust is mixed with concrete, cement or synthetic resins to make counters, building stones and many other objects.
5. Marble dust is also used to make paint primer for canvas paintings and as paint filler.
6. Used as a component for manufacture of white cement.

III. GLASSCRETE

Glasscrete is an appropriate mixture of cement, sand, water and scrap glasses (as fine aggregates and coarse aggregates) with some admixtures. Concrete with glass aggregate is a material mixture that has a lot of potential but also a lot keeping it from reaching this potential. Any type of glass when broken down to about #8 to #4 sieve. With compression strengths comparable to that of normal weight concrete and when glass powder has the same glueing effect as cement. Glasscrete is the best aggregate alternative of concrete. Under ideal conditions this may be the case but there are reasons this material has not seen wide adoption. Glass is well known for having issues with ASR (alkali-silica reaction). When this silica chemically reacts with naturally occurring hydroxyl ions in the cement, silica gel is formed and causes cracks in the cement at it absorbs water.

Figure: 3.1 Glasscrete as Decorative Purpose

Figure: 3.2 Waste Glass Pieces

IV. LITERATURE REVIEW

The Various literature are studied and then we summarized below literature:

Aalok D. Sakalkale, G. D. Dhawale (2014)[1]gave replacement of fine aggregate (Natural sand).The use of sand in Construction activities result in increase in scour depth and sometime flood possibility. Disposal of the marble powder material from the marble industry is one of the environmental problems worldwide today. The aim of this study is utilizing Waste marble powder construction industry itself as fine aggregate in Concrete, replacing natural sand. The replacement is done partially and fully in the proportion 0%, 25%, 50% and 100% and its effect on properties of concrete were investigated. They studied the effect of use of waste marble dust on the mechanical properties of concrete, compared the compressive, flexural and tensile strength using WMD with the given design mix and established alternative for sand with partial use of WMD in concrete.

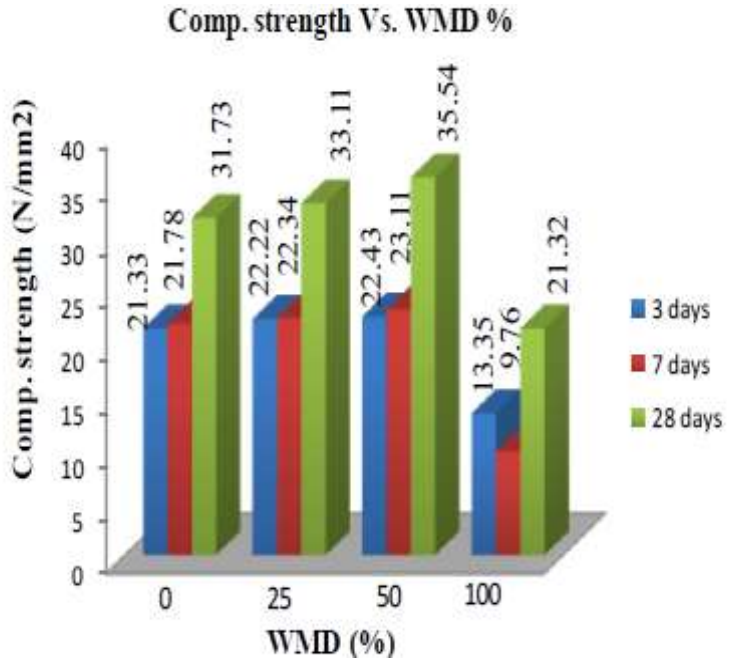

Fig.:4.1 *it is observed that 50 % WMD mix is the maximum optimum % of WMD and again further increasing the WMD% the compressive strength is gradually decreases.*[1]

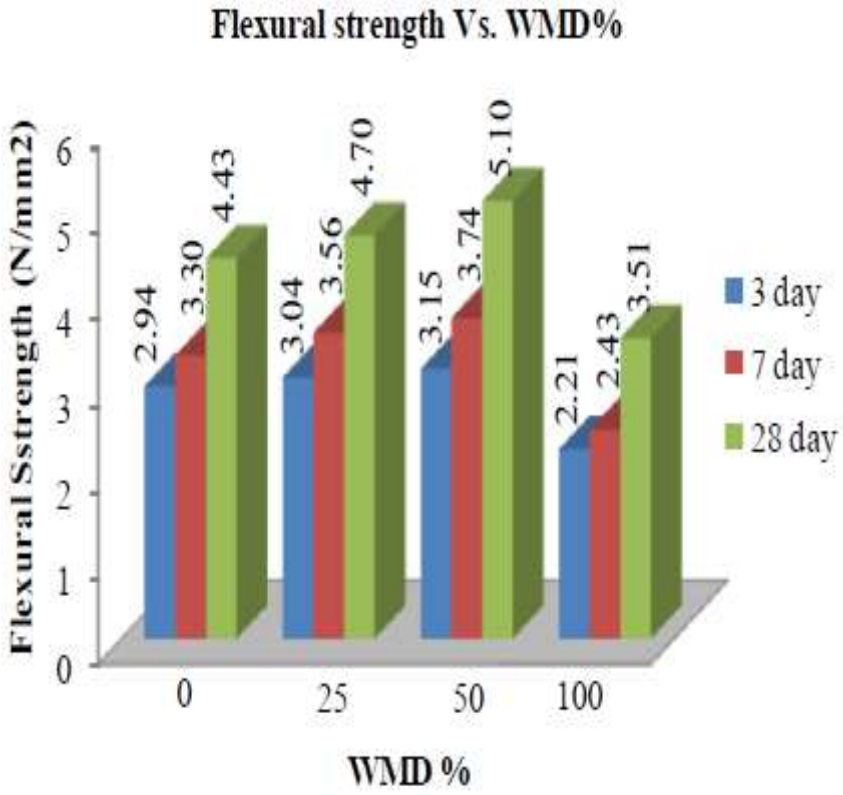

Fig.:4.2 *The maximum tensile strength is obtained at 0% WMD mix. However, the tensile strength at 25% WMD mix is coming nearly equal to the tensile strength at 0% WMD. Thus, 25% WMD mix can also give better tensile strength.*[1]

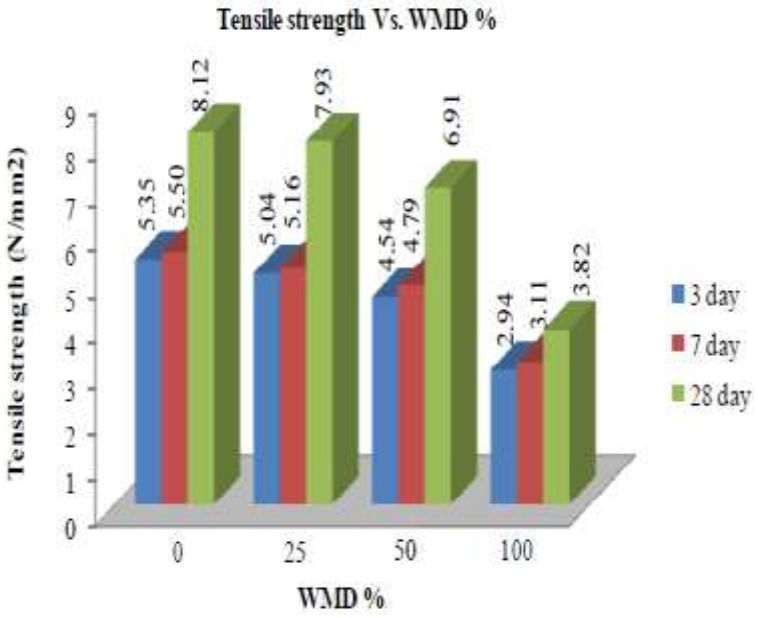

Fig.:4.3 *the maximum flexural strength is achieved at 50% WMD mix, at all the curing ages. Thus, 50% WMD mix gives the optimum percentage of WMD.*[1]

Raminder Singh, Manish Bhutani (2015)[8]gave the feasibility of the substitution of waste marble powder for cement and waste tile aggregates for coarse aggregates to achieve economy and environment saving.There is an increase in the Compressive strength of the concrete produced from waste marble powder as partial replacement of cement up to 10% and crushed tile aggregate as partial replacement of natural coarse aggregate up to 30%.The presentation on workability of concrete in this paper. They conducted ten mixes with different combinations of waste marble powder and waste tiles aggregates prepared. Study on partial replacement level of waste marble powder with cement in concrete. They conducted compressive strength for different proportional mixes of concrete 7 days and 28 days. Also check the workability of concrete with using of marble dust and tiles aggregate.

Muhammad Junaid Munir, Syed Minhaj Saleem Kazmi, Yu-Fei Wu (2017) [7] gave the efficiency of waste marble powder (WMP) in controlling alkali silica reactivity of concrete. To initiate the ASR phenomena, reactive aggregate was used in the study. Mortar bar specimens prepared with WMP as cement replacement material at 10%, 20%, 30% and 40% replacement levels (by cement weight) were evaluated. Mechanical properties as well as durability properties are greatly affected as a result of ASR in concrete. Chemical properties of raw materials (cement and WMP) were analysed through X-ray fluorescence (XRF) and X-ray diffraction (XRD)

Gerry Lee, Chi Sun Poon, Yuk Lung Wong (2013) [5]**,** gave the mixtures were proportioned with a fixed total aggregate/cement ratio of 4% and 50% of the total aggregate was fine aggregate. A total of 17 concrete block mixes, including a control (0% of glass) mix, were produced using four different particle sizes of FG (un-sieved, <2.36 mm, <1.18 mm and <600 lm) as replacements of sand. The replacement ratios were 25%, 50%, 75% and 100%. Properties such as packing density, hardened density and water absorption, as well as the effects of air and water curing upon 7 and 28-day compressive strength were studied. In each of the series, four concrete blocks were prepared by replacing sand with glass at the levels of 25%, 50%, 75% and 100%

Ali A. Aliabdo, Abd Elmoaty M. Abd Elmoaty (2014) [3]**,** gave the possibility of utilizing waste marble dust (MD) in cement and concrete production. The research work was divided into two sections. The first section deals with the properties of cement modified with marble dust (marble dust blended cement), whereas the second section discusses the properties of concrete contained marble dust as a cement replacement and as a sand replacement (cement addition). The replacement ratios which have been studied were 0%, 5.0%, 7.5%, 10.0% and 15% by weight. Water to powder ratio (w/p) or water to cement ratio (w/c) were 0.50 and 0.40 in case of cement replacement and in case of sand replacement respectively. Physical, mechanical and chemical properties of cement and concrete modified with marble dust were investigated. Many researchers recently were interested in studying the possibility of re-use of such wastes in useful industries especially with regard to the building and construction materials such as cement, concrete and brick blocks

Sara de Castro, Jorge de Brito (2013) [10], gave the mechanical properties of concrete made with glass, this one focuses on their durability performance. Mixes containing 0%, 5%, 10% and 20% of glass aggregates (GA) as replacement of natural aggregates (NA) were prepared. Also analysed is the influence of the size of the replaced aggregates (fine and coarse, separately or simultaneously), in a total of 10 concrete mixes. They was found that the particle size strongly affects the workability of concrete. Due to the lower density of the glass aggregates, the mixes made with glass had a lighter fresh density than the reference concrete. They also studied on the fresh properties such as workability and density of concrete and the hardened properties such as compressivestrength, water absorption by capillarity, water absorption by immersion, carbonation resistance, chloride penetration resistance and shrinkage

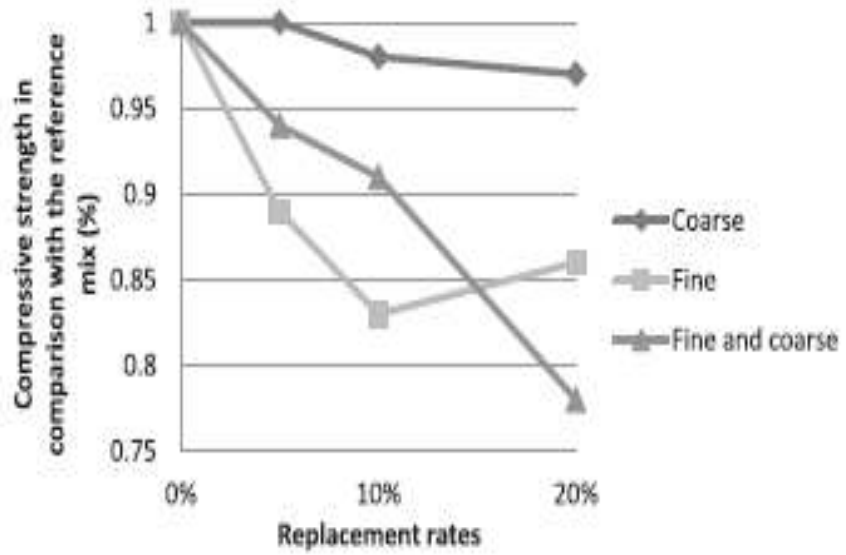

Fig.:4.4 *Compressive strength results compared with that of the reference mix* [10].

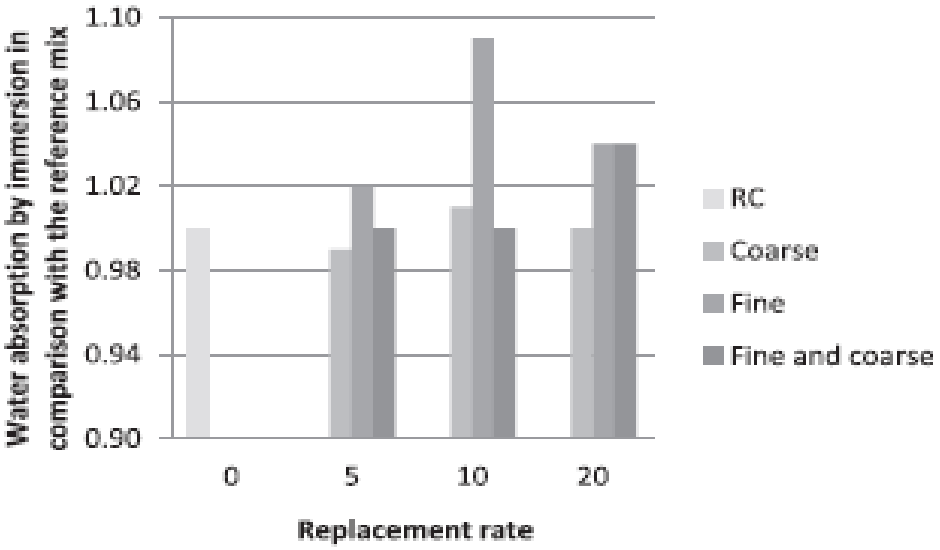

Fig.:4.5 *Water absorption compared with the reference mix* [10].

V. CONCLUSION

By reviewing above papers we can concluded as below:

- Compressive Strength of concrete is increased with addition of waste marble powder up to 50% by weight in place of sand and further addition compressive strength decrease.

- As the partial replacement level of waste marble powder with cement in concrete increases, workability decreases.
- WMP can be effectively used to control ASR expansion and to overcome related environmental issues leading to sustainable and economical construction.
- Workability of concrete with glass is strongly affected by the particle size, leading to an increase in w/c ration from 0.55 to 0.58 for mix with the 20% incorporation of fine aggregate.
- The use of marble dust powder as sand replacement has more significant effect on the mechanical properties of concrete compared with using it as cement replacement.

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