



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: V Month of publication: May 2019

DOI: <https://doi.org/10.22214/ijraset.2019.5192>

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Evaluation of Mechanical Properties of Self Compacting Concrete by Partially Replacing Cement with Waste Marble Powder

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Abstract: *Marble markets are expanding dramatically as marble is made use of in the area of building and construction in monoliths as well as sculptures as ornamental as well as building and construction operate at a bigger range. As the markets are expanding, generation of waste marble is additionally raising and also triggering significant ecological effects. Opposite self-compacting concrete (SCC) is an advanced item which is not a lot prominent in the area of building and construction as a result of its greater manufacturing expense as it needs greater concrete web content. This research therefore intends to use the waste marble powder in SCC as partial substitute of concrete to reduce down the concrete material. Usually the issues taking place in traditional concrete in hard phase can be solved in Self Compacting Concrete. Self Compacting Concrete is a concrete which obtains compressed under its self-weight. Self Compacting Concrete is specified as a very flow able, non-segregating concrete mix that can be changed also it is most stuffed support through its very own weight with little or no resonances. The binding product utilized in Self Compacting Concrete is waste marble powder created in marble market. It can be gotten throughout quarrying of the overall manufacturing. In this research we are misting likely to locate the Workability, Compressive Strength & Split Tensile Strength of Self Compacting Concrete. By making use of the waste marble powder the mechanical homes can be enhanced and also is likewise made use of as a filler product.*

Keywords: *Self compacting concrete, marble power, tensile strength, self weight, waste marble power.*

I. INTRODUCTION

Concrete is the very best building product with high compressive stamina and also lengthy life. On our planet, the natural deposits are eaten each day as a result of the building relevant need of humans. In thermal nuclear power plant, coal has actually extensively made use of as resources for creating vapor. After using this basic material, the deposit left referred to as fly ash. We can likewise claim that fly ash is a by item of thermal nuclear power plant. If this by item straight via on the ground after that it can damage the groundwater homes along with it can additionally impact the human health and wellness. Marble is most generally utilized globally for decorative jobs. In marble reducing markets a significant amount of marble chips or little items of marbles is left each day. These marble chips are likewise referred to as by item or deposit of marble markets. If this by item straight drops on to the ground that it covers a lot of location as well as likewise influences the dirt fertility. The reuse of both type of by item is the very best means to conserve the ecological contamination, dirt contamination, and also water contamination along with to manage the hazardous results of these by items on human health and wellness. From the previous investigates, it has actually been discovered that we can utilize these by items as concrete active ingredients to boost the homes of regular concrete. So, the production of concrete by the assistance these by items is the most effective method to make use of these by items as a building and construction product. Waste marble powder (WMP) creating from marble markets is accountable for lots of ecological and also wellness relevant problems. Among the significant handicaps encountered in enhanced concrete building techniques is compaction and also positioning of the fresh concrete via restricted areas such as locations of overloaded support [3] several scientists checked out and also designed the methods to deal with over stated concerns. Self-compacting concrete (SCC) is an innovative development that can stream and also work out right into the greatly enhanced, slim as well as deep areas by its very own weight to entirely fill up the formwork with no interior or outside power. SCC is not a lot prominent in the building market as a result of its greater manufacturing price. SCC has greater powder material which boosts the concrete need therefore, often tends to greater expense of manufacturing [4] A file having spec as well as standard has actually been created by EFNARC (European Federation of Producers and also Contractors of Specialist Products for Structures) [5] which intends to give a structure for the layout as well as use top notch SCC in Europe based upon the research study searching's for incorporated with area experience. Hence, SCC can be cast without honeycombing where it is challenging to mechanically small fresh concrete, such as undersea concreting, cast in-situ heaps, as well as columns or wall surfaces with stuffed support. Furthermore, it can be pumped to fantastic elevations in skyscrapers without partition.

II. RELATED STUDY

Making use of loading products as well as mineral admixtures as changing ingredients in SCC has an excellent propensity to meet the assumptions in offering better sustainability in the building sector. The problems relating to the expense, reusing the hazardous wastes and also mechanical efficiency of concrete will certainly for that reason place a stress on the usage of such products. The existing research study focuses on highlighting the fresh as well as solidified attributes of SCC created with binary as well as ternary systems of Portland concrete, WMP as well as SF. For this objective, 2 collection of concrete combinations were made relative to the with as well as without SF, whereas WMP has actually partly changed the complete binder at the degrees of 10%, 15%, 20%, 25% and also 30%, by weight. Fresh residential or commercial properties of SCC were evaluated for circulation and also passing capacity, whereas, compressive toughness was gauged for decision of the mechanical residential or commercial properties.

Darzi Musaib, Bhumre Shivkumar (2016) supplies a testimonial paper on "reliable partial substitute of concrete and also sand with fly-ash as well as marble powder to make eco-friendly concrete". In the speculative examination, concrete was changed with fly ash in portions of 5, 10 as well as 15 % and also sand with marble powder in percents of 20, 40 as well as 60 %. The goal of the research was to evaluate compressive and also split tensile toughness of concrete as well as locate the maximum portion of substitute to obtain the optimal stamina as well as contrast it with the toughness of normal M20 concrete. After researching of testimonial documents it was anticipated that maximum percentage of substitute of concrete with fly ash will certainly be 10 %, which of sand with marble powder will certainly be in between 40 to 50 %.

III. METHODOLOGY

To examine the result of WMP substitute with concrete at various percent degree with as well as without SF overall twelve blends having 6 binary as well as 5 ternary blends of SCC mixes in addition to a control combination were created as well as cast at a water to binder proportion (w/b) of 0.36. The control SCC mix was made with only OPC as the binder whereas the staying combinations included binary (OPC + WMP, OPC + SF) and also ternary (OPC + WMP + SF) assimilates which the supplemental products were changed by equivalent quantity of concrete by weight. A consistent substitute degree of 5% by overall weight of binder material was thought about for SF, whereas the numerous substitute degrees (10%, 15% 20%, 25% and also 30%) were used for WMP.

A. Materials

- 1) *Cement*: Cement used in the investigation was 53 Grade Ordinary Portland cement confirming to IS 12269. The cement was obtained from a single consignment and of the same grade and same source. Latter procuring the cement was stored properly. The specific gravity, standard consistency, initial setting time, and final setting time are respectively 3.11, 33%, 35min, and 215min.
- 2) *Marble Powder*: Cement is replaced with Marble Powder which is obtained by Crushing and Grinding of the marble Chips or marble Stone. It can also be obtained from marble slurry. The purity of marble depends upon its colour and appearance.



Fig.3.1. Marble power.

- 1) *Fine Aggregate*: The Fine accumulation complying with Zone-2 according to IS 383 was made use of. The great accumulation made use of was acquired from a close-by river resource. The mass thickness, certain gravity, as well as excellence modulus of the sand utilized were 1.41 g/cc, 2.68, and also 2.90. The sand gotten was sieved based on IS screens (i.e. 2.36, 1.18, 0.6, 0.3, and also 0.15 mm). Sand maintained on each screen was completed various bags as well as piled independently for usage.

An admixture is a product aside from water, accumulations as well as concrete as well as is contributed to the set right away prior to or throughout its blending. Admixtures are utilized to enhance or offer unique buildings to concrete. Making use of admixture need to provide an enhancement not financially possible by readjusting the percentages of concrete and also accumulations and also ought to not negatively impact any type of homes of the concrete.

The admixture are composed primarily of those which increase and also those which slow down hydration or setup of the concrete, carefully split products which boosts workability, water proofers, pigments, moistening, distributing as well as air-entraining representatives and also pozzolonas. Admixtures varying from enhancements of chemicals to lose products have actually been utilized to boost specific homes of concrete. The admixture is typically included a reasonably minute amount. The level of control has to be greater to make certain that over does are not likely to take place. Excess amount of admixture might be damaging to the buildings of concrete. It might be stated below that concrete of bad amount will certainly not be transformed to the top quality concrete by including admixture.



Fig.3.2. Super Plasticizer

IV. EXPERIMENTAL ANALYSIS:

Compressive stamina’s of SCC combinations at 7 as well as 28 days are displayed in number 4 and also number 5 specifically. Thinking about the binary mixes, it was observed that there was an unexpected fall in compressive toughness at 10% substitute of WMP, nonetheless, it boosted on more substitute of WMP approximately 20%. After 20% substitute, the decrease in compressive toughness was located. Furthermore, the compressive stamina of all binary SCC blends was much less than control mix other than S5M0 mix at 7 days as well as S0M20 and also S5M0 at 28 days. The reduction in compressive stamina was because of the decrease in binder material as WMP is an inert and also non-pozzolanic product. Substitute of concrete with SF led to the greater compressive stamina at 7 and also 28 days.

Specimen identification	No. of days (curing)	Failure load (KN)	Compressive strength $f=P/A$	Average Comp., strength (MPa)
1.	7 days	510	22.6	23.05
		530	23.5	
2.	14 days	550	24.4	25.05
		580	25.7	
3.	28 days	590	26.2	26.85
		620	27.5	

Fig.4.1. Compressive strength of CC with 0% Marble Powder.

As marble powder plays the role of filler only instead of binder hence resulted poor compressive strength compared to control mix. Initially at 10% marble replacement, concrete mixture showed very less compressive strength (i.e. 13 and 10% less than control mix at 7 and 28 days respectively).

Specimen identification	No. of days (curing)	Failure load (KN)	Compressive strength $f=P/A$	Average Comp., strength (MPa)
1.	7 days	725	32.2	27.4
		510	22.6	
2.	14 days	690	30.6	33.85
		835	37.1	
3.	28 days	510	22.66	22.615
		508	22.57	

Fig.4.2. Compressive strength of CC with 10% Marble Powder.

Adding of Admixes with 25% Marble Powder and with combination of admixtures.

Specimen Identification	No. of days (curing)	Failure load (KN)	Compressive strength $f=P/A$	Average Comp., strength (MPa)
1.	3 days	210	9.3	9.55
		220	9.77	
2.	14 days	200	8.8	8.7
		195	8.6	
3.	28 days	150	6.6	20.06
		180	8	

Fig.4.3. Compressive strength of SCC with 25% Marble Powder and with combination of admixtures (SP).

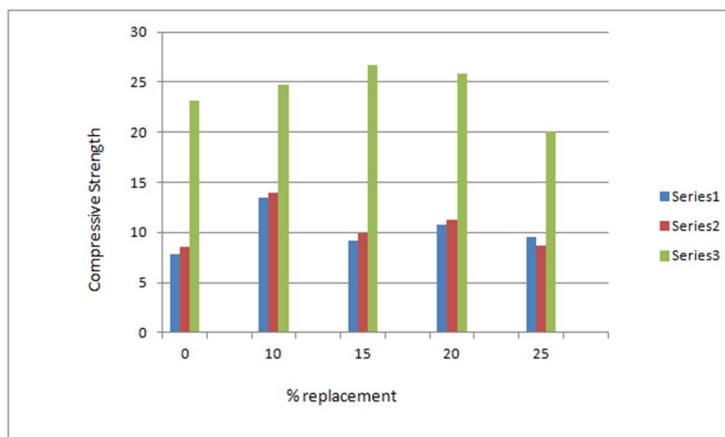


Fig.4.4. Graphical representation of Compressive Strength of Self Compacting Concrete for 3, 14 and 28 days

V. CONCLUSION

Because Of Waste Marble Powder, it verified to be really efficient in guaranteeing great cohesiveness of Mortar as well as Concrete. As much as 15% substitute of concrete with waste marble there is a rise in all mechanical homes. The substitute of 15% of concrete with waste marble powder acquires optimum compressive and also tensile stamina. The optimal portion for substitute of marble powder with concrete and also it is practically 15% concrete for both dices and also cyndrical tubes. To lessen the expenses for building with the use of marble powder which is openly or inexpensively readily available; a lot more significantly. To the world of conserving the ecological contamination by concrete manufacturing; being our major goal as Civil Engineers. As a result of this using results such as marble powder and also fly ash at the location of concrete in needed percentage appears to be an excellent option. By the previous investigates, it has actually located that a called for amount of fly ash as well as marble powder can boost the homes of concrete.

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