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Experimental Study Of Mineral Admixture Of Self Compacting Concrete

T.Subramani[1], A.Anbuchezian[2]

[1]Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions University, Salem, India

[2] Professor & Head, Department of Civil Engineering, Annapoorana Engineering College, Salem, India.

ABSTRACT

In this study, the advantages of limestone powder (LP) and marble powder (MP) as fractional substitution of Portland cement are set up. Besides, LP and MP are utilized straightforwardly without endeavoring any extra preparing in the creation of self - compacting concrete (SCC). The water to fastener proportion is kept up at 0.4 for all mixtures. The examined properties include workability, compressive strength, flexural strength and static and dynamic elastic moduli. Workability of the fresh concrete is determined by using both the slump-flow test, T50 test and the L-box test. The outcomes demonstrate that it is conceivable to effectively use squander LP and MP as mineral admixtures in delivering SCC. Because of its watched mechanical preferences, the work of waste mineral admixtures enhanced the monetary possibility of SCC generation on a unit quality premise.

Keywords: Experimental Study, Mineral Admixture, Self Compacting Concrete, limestone powder, marble powder

1. INTRODUCTION

As of late, there has been a sensational increment in utilizing self-compacting concrete (SCC). Self-compacting concrete (SCC), requiring no consolidation work at site nor concrete ready-mix plants, was developed in Japan to improve the uniformity of concrete in 1988. A standout amongst the most vital contrasts amongst SCC and conventional concrete is the consolidation of a mineral admixture. Along these lines, many learns about the impacts of mineral admixtures on the properties of SCC have been finished. These reviews demonstrate the benefit of mineral admixture use in SCC, for example, enhanced workability with lessened concrete substance. Since cement is the most costly part of solid, lessening concrete substance is an efficient solute-particle Moreover, the mineral admixtures can enhance molecule pressing and lessening the porousness of concrete. In this way, the durability of concrete is likewise expanded. Mechanical repercussions or waste materials, for example, limestone powder, fly fiery debris and granulated impact heater slag are by and large utilized as mineral admixtures in SCC . In this way, the workability of SCC is enhanced and the utilized measure of by items or waste materials can be expanded. Other than the financial advantages, such employments of repercussions or waste materials in concrete decrease natural contamination In limestone and basalt quarries, critical measures of limestone (LP) and are delivered as by-results of stone crushers. Vast volumes of these powders are amassed and it is a major issue to propose usage of these results from the parts of transfer, ecological contamination and wellbeing dangers. Additionally, marble powder (MP) is a waste material with limestone birthplace and 7 million tons of MP are created every year and are stored as squanders in India. This implies MP is not reused and utilized as a part of any regions in India. Along these lines, it would be productive if MP could be utilized as a part of SCC as a mineral admixture and consequently demonstrate significant for the solid business.

2. OBJECTIVE

SCC might be utilized as a part of pre-cast applications or for concrete put nearby. It can be fabricated in a site clumping plant or in a ready mix concrete plant and conveyed to site by truck. It can then be put either by pumping or filling level o r vertical structures. In designing the mix, the size and the form of the structure, the dimension and density of reinforcement and cover should be taken in consideration. These viewpoints will all impact the particular prerequisites for the SCC. Because of the streaming attributes of SCC it might be hard to cast to a fall unless contained in a frame. SCC has made it conceivable to concrete structures of a quality that was impractical with the existing concrete technology.

3. EXPERIMENTAL WORK

3.1 Materials:
Ordinary Portland cement utilized as a part of this review was delivered by the Indian Standards 12269 and named as CEM I 42.5 R. The measure of coarse total was chosen as 20 mm&10mm so as to maintain a strategic distance from any blocking impact of SCC. Additionally, MP and LP were utilized as mineral admixtures in SCC. 28 days compressive quality of the cement as per Indian Standards 12269 is 53 MPA, separately. MP was given from a marble overseeing plant in Bilecik and straightforwardly utilized as a part of SCC with no further preparing. LP were by-results of quarry crushers and gathered from their filtration frameworks.

Aggregates:
A wide range of aggregates are appropriate. The normal maximum size is generally 10 -20 mm; however particle sizes 12 to20 mm have been used in SCC. Consistency of grading is of vital importance. As to qualities of various sorts of aggregate, squashed aggregate have a tendency to enhance the quality as a result of the interlocking of the precise particles, while adjusted totals enhance the stream in view of lower interior contact. Hole evaluated aggregate are every now and again superior to anything those constantly reviewed, which may encounter more prominent inside grating and give diminished stream.

Fine Aggregates:
All typical concreting sands are reasonable for SCC. Both smashed and adjusted sands can be utilized. Siliceous or calcareous sands can be utilized. The measure of fines under 0,125 mm is to be considered as powder and is imperative for the religious philosophy of the SCC. A base measure of fines (emerging from the folios and the sand) must be accomplished to maintain a strategic distance from isolation.

Cement:
A wide range of concretes complying with IS 12269 are reasonable. Choice of the kind of cement will rely on upon the general prerequisites for the concrete, for example, strength, durability, etc.C_3A content higher than 10% may bring about issues of poor workability maintenance. The common substance of cement is 350-450 Kg/m^3. More than 450 Kg/m^3 bond can be unsafe and increment the shrinkage. Under 350 Kg/m^3 may just be appropriate with the incorporation of other fine filler, for example, fly fiery debris, pozzolan, and so forth.

Lime Stone Powder:
Limestone is utilized as a part of more day by day items than one may might suspect. Limestone is a sedimentary shake, framed by inorganic stays, for example, shells or skeletons that have packed for quite a while. The primary component found in limestone is calcium carbonate yet it might contain magnesium, iron or manganese also, which influence the whiteness and hardness. Limestone is one of the real fixings utilized as a part of development materials additionally has numerous different uses in day by day life.

Steel:
Limestone is utilized as a part of making steel items. Limestone is added to blend with contaminations in the softened iron, delivering slag. The slag is isolated from the iron abandoning it clean of all pollutions and limestone, which is then made into steel

Plastic:
Limestone is utilized as a part of an extensive variety of plastic and elastomeric, or elastic, items. The consistent and controlled state of the limestone particles and size of these particles makes it an extraordinary filler material for the generation of plastic and elastic. Fillers are utilized to grow costly plastics or different materials to build the item measure without the cost. Since limestone is a non-responsive material, it is ideal for this application

Construction:
Limestone is utilized as a part of for all intents and purposes all development materials. Limestone is included with dirt and warmed to frame cement, which can be made into mortar by including sand and water. Mortar is utilized to set bricks and go about as a cement when it dries. Limestone is additionally utilized as a part of concrete and asphalt filler.

Neutralizer:

Limestone can be added to water to expel debasements and contaminations. Since limestone is principally made of calcium carbonate, a base substance, it can be utilized to kill sharpness in mechanical waste and keep running off. Limestone can likewise be utilized to decrease soil corrosiveness for agribusiness.

Superplastisizer (Fosroc Auramix 400):
Auramix 4OO is a one of a kind mix of the most recent era superplasiiciser, in light of a polycarboxylic ether polymer with long horizontal chains. This incredibly enhances cement scattering. Toward the begin of the blending procedure an electrostatic dispersion happens however the cement molecule's ability to isolated and scatter This system extensively lessens the water request in flowable cement Auramix 400 joins the properties of water decrease and workability maintenance lt permits the creation to superior cement as well as concrete with high workability Auramix 4OO is a solid super plasticizers permitting generation of predictable solid Properties around the required dose.

3.2 Test methods:
Many different test methods have been developed in attempts to characterize the properties of SCC. So far no single method or combination of methods has achieved universal approval and most of them have their adherents. Similarly no single method has been found which characterizes all the relevant workability aspects so each mix design should be tested by more than one test method for the different workability parameters. Alternative test methods for the different parameters are studied. In this study, fresh and hardened properties of SCC were investigated by using waste materials (LP, MP) at two replacement rates for cement. The ability of SCC for compacting under its own weight is generally the main subject of such studies according to appropriate criteria given by the EFNARC Committee. In the present study, such properties of SCC produced with LP and MP were investigated based on fresh concrete tests, specifically workability tests.

4. WORKABILITY
The slump-flow values for SCC with LP and MP promptly after the blending procedure are introduced. The customary slump test is not suitable to measure the workability of SCC. the slump flow test is an esteem framework for the capacity of concrete to disfigure under its own weight against the contact of the surface with no outside restriction show. All blends showed great workability with stream estimations of no less than 690 mm. Droop streams of 650 mm to 800 mm are ordinarily required for SCC, and every one of the blends under scrutiny fall into this classification. The water request and workability are controlled by molecule shape, molecule estimate appropriation, molecule pressing impacts and the smoothness of the surface. As appeared in the consequences of slump-flow tests propose that in the blends containing LP, there is a further increment in slump-flow values contrasted and the control and those containing other mineral admixtures. This may be clarified by the expanded surface territory of the MP particles expanding the water request . The water substance was kept steady for the majority of the blends in this review. Thus, LP needs less water and it has given more slump flow. By and large, the mixture which contain mineral admixtures have indicated preferred execution over the control mixture as to workability. The use of mineral admixtures in SCC aims to increase the particle distribution of the powder skeleton, and thus, reduce the inter particle friction. This can provide some free mixing water, otherwise entrapped water in the system. Related to the various parameters, such as the dosage, the reactivity of the LP and the w/p control the volume of the entrapped voids in the system, the total volume in the fresh system and the required volume of fine particles to fill voids. Thus, the packing density increases and the flow resistance decrease. The L-box ratio characterize the filling and passing ability of SCC. There is generally a blocking risk of the mixture when the L-box blocking ratio is below 0.8. The blocking ratios of SCCs produced with LP and MP are given in Fig. 7 and 8. The blocking ratio (h2/h1) should be between 0.8 and 1.00. All mixtures of SCC are within this target range. The blocking ratio (h2/h1) of the MP30 mixture was 1.00, although the yield stress of this mixture was high compared with other MP mixtures, because the MP30 mixture includes more mineral admixture than the other two MP mixture . When LP and MP content have increased, it has not negatively affected the blocking ratio because of the concurrent decrease in viscosity. However, it can be noted that each SCC investigated in the present study has adequate filling capability and passing ability. The workability tests results of SSC with LP and MP given in Table.1

Table.1: Workability tests results of SSC with LP and MP

Workability tests on ssc with LP and MP

MIX	SLUMP FLOW(mm)	T50 TEST (sec)	L-BOX TEST
CONTROL	690	4.25	0.8
LP10	712	4.12	0.85
LP20	722	3.75	0.9
LP30	720	3.95	0.89
LP40	719	3.65	0.87
LP50	718	3.42	0.88
MP10	713	2	0.9
MP20	715	3.12	0.92
MP30	713	2.5	0.96

5. CONCLUSIONS

As a result of this experimental study, the following conclusions can be drawn:

- All the mixtures had satisfactory self-compacting properties in the fresh state. The addition of LP and MP had positive effects on the workability. When the properties of fresh SCC such as slump-flow, T50 time, L-box ratio are considered as a criterion to determine the best mineral admixture among LP and MP, it can be said that MP is the most suitable for improving all of them.
- The results for hardened properties of the SCC mixtures containing different mineral admixtures were investigated; all the mineral admixtures have shown significant performance differences and the highest compressive strength has been obtained for the MP mixtures. There was a reasonable correlation between the compressive strength and flexural strength stress of the ten SCC mixtures.
- When the strength of SCC mixtures increased, static and dynamic elastic moduli also increased and the highest static elastic modulus and dynamic elastic modulus have been obtained for MP20 and MP10, respectively. Generally, the addition of mineral admixtures has decreased both the static and the dynamic elastic moduli of these SCC mixtures.

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AUTHOR

Prof. Dr.T.Subramani Working as a Professor and Dean of Civil Engineering in VMKV Engineering College, Vinayaka Missions University, Salem, TamilNadu, India. Having more than 27 years of Teaching experience in Various Engineering Colleges. He is a Chartered Civil Engineer and Approved Valuer for many banks. Chairman and Member in Board of Studies of Civil Engineering branch. Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies. Guided more than 400 students in UG projects and 250 students in PG projects. He is a reviewer for number of International Journals and published 164 International Journal Publications and presented more than 25 papers in International Conferences.

Dr.A.Anbuchezian completed his B.E. Degree in the branch of Civil Engineering in IRTT, Erode, Bharathiyar University and M.E-Structural Engineering, GCE, Periyar University. He also completed his **Ph.D. in** of Civil Engineering in Vinayaka Missions University. Having more than 20 years of Teaching experience in Various Engineering Colleges. Currently he is working as a Professor and Head of the Department of Civil Engineering in Annapoorana Engineering College, Salem, TamilNadu. He is also holding the additional responsibility of Dean – Academic (Non Circuit branches) in Annapoorana Engineering College, Salem, TamilNadu. He published 14 International Journal Publications and presented more than 5 papers in International Conferences