Review Paper on Experimental Study of Ultra High Strength Concrete by Partial Replacement of Cement By Using Ultra Fine

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Abstract: This study investigate the effect ultrahigh strength concrete using ultrafine lot of alternative material is has been found in most recent years and subsequently the strength attain by those material is also slightly high. The experiment was conducted to assess the concrete strength, in which the cement material is partially replaced by the ultrafine. A little amount of basalt fiber is added with respect to the weight of the cement. Ground Granulated Blast-furnace Slag (GGBS) is used at the constant percentage of 40%. And the test were conducted for various percentage as 0%, 2.5%, 5%, 7.5% and 10% replacement of cement by using ultrafine. And different types of test were conducted for workability, compressive strength, split tensile strength, and flexural strength to determine the concrete strength.

Key words: Cement, Ultra fine, Basalt fiber, GGBS

1. Introduction

In current situation the world is moving to the use of high strength and ultrahigh strength. For getting high strength and ultrahigh strength there are many chemical are available by adding those material the achieved strength is attained. Generally concrete is weak in tension and strong in compression. The compressive strength is determined by the UTM machine which is made up of hydraulic jack. However these construction and engineering material should meet new and better demands. Once facing problems with productivity, economy, quality and atmosphere, they need to contend with different construction material like plastic, steel and wood. Ultra high strength concrete has high strength of above 100MPa. In this paper we are going to design M100 mix by the reference of journal paper, with use of fine aggregate, crushed angular coarse aggregate, cement with partial replacement of Ultrafine, Ground Granulated Blast- furnace slag, water, basalt fiber and super plasticizer. The OPC cement with fifty three grade (53) material is used in the research work. Now a day's high rise building are constructed using high strength concrete to attain its high strength. The ultrafine powder content is added in the different ratio as 0%, 2.5%, 7.5% and 10% and the Ground Granulated Blast-furnace Slag is added at constant percentage as 40%. If a correct viciousness of the self-consolidating concrete is obtained by the high amount of binder and super plasticizer, a number of segregation occurring throughout the pumping may be prevented with the graceful movement of recent concrete within the pumping pipe.

MATERIALS USED:

CEMENT:

Ordinary Portland Cement (OPC) of fifty three grades is employed in this investigation. OPC cement settle set at very cheapest time. This type of cement is generally employed in the high rise buildings.

Portland cement is that the foremost typical kind of cement normally use around the world as a basic ingredient of concrete, mortar, stucco, and non-specialty grout.

FINE AGGREGATE:

The most vital capability of the fine aggregate is to assist with making workability and consistency in mixture, and it assist with holding the coarse aggregate particles in suspension. This activity advances malleability within the mix and stops isolation of glue and coarse aggregate, and basically throughout transport from mixing plant to the purpose of position.

In this way the expense of development are constrained by the utilization of fabricated sand as an choice material. This M-sand is while not mud and therefore the sizes are often effectively controlled therefore it meets the mandatory reviewing for construction.

COARSE AGGREGATE:

It is the material which is used to give strength and elastic property of the concrete. It occupies the 60-80% of the volume of concrete. The crushed angular aggregate with the size of 12.5mm is used in the research. The use of aggregate can control the shrinkage level and crack forming.

GGBS:

Ground-granulated blast-furnace slag (GGBS or GGBFS) is obtained by ending liquid iron slag (a by-product of iron and steel-making) from a furnace in water or steam, to supply a glassy, granular product that's then dried and ground into a fine powder. Ground-granulated blast furnace slag is extremely a building material and high in CSH (calcium silicate hydrates) which will be a strength enhancing compound that improves the strength, durability and appearance of the concrete.

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WATER:

Water may be a important part of concrete because it effectively takes associate interest within the concoction response to border(C-S-H) gel. The higher water concrete proportion can diminish the water tightness, durability and strength and further it has completely different properties of cement, in addition of water it results in formation of voids. The PH value should lies between 6-8 and it must be free from acids and impurity. The standard specified IS code is used IS:456-2000.

ULTRAFINE:

It is a fine particle which plays a very important role in each hardened concrete and fresh concrete and is often added more as filler to offer concrete specific properties.

SUPER PLASTICIZER:

In this super plasticizer - CONPLAST-SP 430 within the variety of sulphonatednapthalene polymers complies with IS:9130-1999 is employed to enhance the workability.

LITERATURE REVIEW:

COMPRESSIVE STRENGTH:

Syed Alireza, Farshad Ameri, et al(2019).In this paper the compressive test has done on 7days, 28days & 91days cubic sample. Wollstonite is the material which is used in the work for the partial replacement of cement. When the wollastonite content increases compressive strength decreases.

B.Venkatesan, M. Venuga, et al(2020).In this research paper the cement is replaced by Alco fine and iron powder. 10% Alco fine and iron powder up to 20% is replaced. The peak compressive strength is achieved at 28days of curing as 43.52 N/mm^2 at M_4 mix.A rate increment of 29.69% has been accomplished from multi day to 28 days

ShehdehGhannam, HusamNajm, Rosa Vasconez(2016).In this research paper the granite powder and iron powder has been used with the partial replacement of sand .The load of 2000KN compressive strength testing machine is used for the testing.From the test 10% of granite powder is enough to attain the maximum increase in compressive strength.

SeyedAlizeraZareei, Farshad Ameri, et al(2020). In this research paper the author said that they have achieved positive result while using basic oxygen steel slag and nano-slica.This chemicals are used for the partial replacement of cement and sand. This increase the compressive strength. The size of the specimen for the testing is 150mm.

Abdul Ghani, Zeeshan Ali, et al(2019).In this research paper waste marble powder is used for the partial replacement of sand. The compressive strength is determined by the different mix .SR-0, SR-20, SR-40, SR-60, SR-80 are the different mix used for the testing in the age of 14days, 28days, & 70days.In this paper the W/C ratio is used constantly so it affects in reduction in workability.

K.E. Prakash, D.M. Sangeetha and ShakeelBagwan(2020).In this the author replaced the fine aggregate by using vermiculate and cement is replaced by Marble powder. The replacement is done by 5%, 10% and 15%. When the 10% of marble powder is replaced the maximum compressive strength is obtained, the is compressive strength increases, when the percentage of vermiculate increases.

HemrajRamadasKumarat(2020).In this research paper both compressive strength and modulus of elasticity is the main thing to find the bearing capacity and deformation. In this paper the sand is replaced by the clay brick waste.

Hyun-oh Shin, Doo-YeolYoo et al.(2020).In this paper they have done design to gain 180MPa strength. For this they had cured the specimen at room temperature. Compressive strength is measured in the 2500KN capacity. In this research they have achieved 180MPa strength as per they required. When the micro hardness and compressive strength decreases the porosity increases.

C. Manikandan, M. Vijayakumar, M. Chandru(2018).In this research paper the admixture were used. The size of the specimen were 150mm, after the casting of the mould it was cured up to 28days.The result of the compressive strength according to 7days, 14days and 28days are 45.7N/mm^2, 66.6N/mm^2 and 75.6N/mm^2.In this result the 28days cured specimen gives the high compressive strength.

S. Nagaraj, D. Jayakumar (2010). In this research paper they are using super plasticizer to increase the strength. There are totally 5 Batches had been done. For B-1: gives maximum compressive strength attained as 47.46MPa in 28 days. For B-2: they added 0.5%superplasticizer, strength increased upto 40.2% than the reference specimen (B-1). On the far side this percentage of super plasticizer the strength are going to be decline in its price. B-3 1% of super plasticizer is added and therefore the strength is increased up to 10%. B-4 1.5% of super plasticizer is added and the strength is increased up to 9%. Finally for B-5 5% of super plasticizer is accessorial and therefore the compressive strength are going be reduced to 6%. For decrease in strength is occurred due to the addition of a lot of super plasticizer.

Siva Kishore. R (2020). In this research they are mixing waste marble dust with the concrete. Fine aggregate is replaced with the marble dust. Te test result of 7days and 28days has an equal strength. The compressive strength at 0% replacement is 28.95N/mm^2, at 10% replacement 32.42N/mm^2, at 15% replacement 34.6n/mm^2, at 20% replacement 33.10N/mm^2 is achieved. In this 0%, 10%, 15% replacement strength will be increasing and 20% replacement strength will decrease.

Dr. Qassim Ali, Al. Quraishy. In this paper the result of mechanical properties compressive strength for normal high and ultra-high strength concrete their strength will be increasing be adding of 0%, 1%, 2% steel fiber. For ultra- high strength concrete when steel fiber increase from 0%,1% and 2% which increase in average compressive strength of about 0%, 18%, 42%.

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SPLIT TENSILE TEST:

AlaaM.Rashad (2013):In this split tensile test the strength is increased at 40% replacement but the strength is less when compared to compressive strength at 50% replacement and also the split tensile strength decreases.

HanmedSalahuddin, Liaqat Ali et al (2020).In this split tensile strength has been increased with the replacement up to 50%. In this two types of curing are used .In normal curing the percentage attained for split tensile strength is between 1.28% to 19.6% and for hot curing it is between 2.77% to 18.24%.

Chan-Hui Liu, Ji- Yang-Lui pi, et al(2017).In this the split tensile strength the strength decrease with the increase in the replacement and the modulus of elasticity will decrease with increase in the replacement ratio.

T.Sathish, B.PalanikumarS.Karthick(2019):In this the optimum split tensile test for M30 mix is 2.77N/mm^2 and were for control mix it is 2.42 N/mm$^{2.}$The split tensile strength is increases for 20% replacement of RCA and the carbon fibre with the addition of 0.8%.

Wang, Yuyin, et al. (2019):In this split tensile strength with 100% replacement of CRA the strength decreases form 12.6% to 2%

Premakuma W.P (2014):In the method steel fibers and partial replacement of sand by iron ore tailings. Max tensile strength of 2.64Mpa occurs for 35% of sand replacement by (IOT).Zero percentage of sand replacement by (IOT) being 2.10Mpa.Both % of steel fibers are varies max tensile strength for 25% of sand replacing by (IOT) and 1.2% of steel fibers. According % it is 25% to 35% strength range of tensile strength.

FLEXURAL STRENGTH:

HanmedSalahuddin, Liaqat Ali et al (2020):In this flexural strength the reactive powder concrete containing recycled fine aggregate as raised up to 50% and in the normal curing the increase is between 15.79% to 47.37% and for hot curing it is between 30.77% to 53.85%.

Chan-Hui Liu, Ji- Yang-Lui pi, et al(2017).The flexural strength increases with increase in replacement and also the modulus of elasticity increases with increase in replacement.

Daniel N.N,Taiwo E.E (2018): In the tensile strength there are specimens. Adding 0, 0.1, 0.2, 0.3, 0.4, 1, 1.5 and 2% of shredded polythene bag waste. Along the result 0.2% specimen only gives result of good. All specimens are 7,14 and 28 days curing.

Verian, Kho Pin, Warda Ashraf, and Yizheng Cao.(2018): In this flexural strength when replaced with RCA shows result which is lesser than natural aggregate and the RCA shows less flexural strength when the saturated RCA mixture was used in concret.

Jagadeesh S (2018):Along specimens are 7 and 28 days curing. They added replacement of natural aggregate with recycled aggregate along 0,25,50,75 and 100%.Without pozzolanic materials 25% replacement RCA gives 5.97Mpa during 28 days curing. Withpozzolanic(10% S.F and 20% F.A)materials 0% replacement RCA gives 6.28Mpa during 28 days curing.

Siva kishore R(2006):0% admixture added the tensile strength 2.4(N/mm^2).2% admixture added the tensile strength 2.7(N/mm^2).4% admixture added the tensile strength 3.4(N/mm^2).Among tensile strength specimens are 28 days curing specimens. While addition steel fibers admixture the tensile strength will be increased.

CONCLUSION:

The replacement of fine aggregate by demolished waste is more appropriate for both strength and workability. This reused aggregate in cement can be utilized to limit the destroyed waste in development. And it is used as a alternate for conventional concrete. The workability increases the percentage of demolished waste. And the optimum level of replacement is obtained from the test. By replacing this demolished waste we can reduce the environmental impacts and land falls

REFERENCE:

[1] S. Jagadeesh, Dr. K. VenkataRamesh,S. Ganesh and Er. DarapuSrikanthSatish Kumar, Study On Tensile Strength Properties of Recycled Aggregate Concrete with and Without Pozzolanic Materials, 2018:671–679.

[2] Ghorbani, Saeid, et al. "Effect of crushed concrete waste's maximum size as partial replacement of natural coarse aggregate on the mechanical and durability properties of concrete." Resources, Conservation and Recycling 149 (2019): 664-673.

[3] Sani, R.O, Daniel N. N, Taiwo E. E and Odetoyan, A.O, Evaluation of Split Tensile Strength of Shredded Polythene Bags in Concrete,2018:1041–1047.

[4] Kirthika, S. K., M. Surya, and S. K. Singh. "Effect of clay in alternative fine aggregates on performance of concrete." Construction and Building Materials 228 (2019): 116811.

[5] M. Jagadeesh and Dr. K. Chandrasekhar Reddy, Experimental study of high strength concrete.

[6] Rashad, Alaa M. "A preliminary study on the result of fine aggregate replacement with met kaolin on strength and abrasion resists.

[7] Vardhan, Kirti, RafatSiddique, and ShwetaGoyal. "Influence of marble waste as partial replacement of fine aggregates on strength and drying shrinkage of concrete." Construction and Building Materials 228 (2019): 116730.

[8] Zheng, Chaocan, et al. "Mechanical properties of recycled concrete with demolished waste concrete aggregate and clay brick aggregate." Results in Physics 9 (2018): 1317-1322.

[9] Salahuddin, Hammad, et al. "Effect of recycled fine aggregates on

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performance of Reactive Powder Concrete." Construction and Building Materials 243 (2020): 118223.

[10] Fan, Cheng-Chih, et al. "Properties of concrete incorporating fine recycled aggregates from crushed concrete wastes." Construction and Building Materials 112 (2016): 708-715.

[11] Liu, Chun-Hui, et al. "Influence of demolished concrete blocks on mechanical properties of recycled blend concrete." Construction and Building Materials 136 (2017): 329-347.

[12] Nepomuceno, Miguel CS, Rui AS Isidoro, and José PG Catarino. "Mechanical performance evaluation of concrete made with recycled ceramic coarse aggregates from industrial brick waste." Construction and Building Materials 165 (2018): 284-294.

[13] Rao, Akash, Kumar N. Jha, and SudhirMisra. "Use of aggregates from recycled construction and demolition waste in concrete." Resources, conservation and Recycling 50.1 (2007): 71-81.

[14] Sathish, T., B. Palanikumar, and S. Karthick. "Comparative study on addition of carbon fiber in concrete with partial replacement of demolished concrete waste in structural concrete." Materials Today: Proceedings (2020)

[15] Berredjem, Layachi, NourredineArabi, and Laurent Molez. "Mechanical and durability properties of concrete based on recycled coarse sand fine aggregates produced from demolished concrete." Construction and Building Materials 246 (2020): 118421.

[16] Wang, Yuyin, et al. "Prediction of the elastic modulus and the splitting tensile strength of concrete incorporating both fine and coarse recycled aggregate." Construction and Building Materials 215 (2019): 332-346.

[17] Verian, Kho Pin, Warda Ashraf, and Yizheng Cao. "Properties of recycled concrete aggregate and their influence in new concrete production." Resources, Conservation and Recycling 133 (2018): 30-49.

[18] c"Properties of porous concrete from waste crushed concrete (recycled aggregate)." Construction and building materials 47 (2013): 1243-1248.

[19] Seyed Alireza Zareei, Farshad Ameri, Parham shoaei, Nasrollah Bahrami. Recycled ceramic waste high strength concrete containing wollastonite particles and micro-silica: A comprehensive experimental study.

[20] B. Venkatesan, M. venuga, P.R Dhevasenna, V.Kannan. Experimental study on concrete using replacement of cement by Alccofine fine aggregate as iron powder.

[21] Seyed AlirezaZareei, Farshad Ameri, Nasrollah Bahrami, Parham Shoaei, Hamid Reza Mossaei, Niloofar Salemi. Performance of sustainable high strength concrete with basic oxygen steel-making (BOS) slag and nano-silica (2019)

[22] Hemraj Ramdas Kumavat. An experimental investigation of mechanical properties in clay brick masonry by partial replacement of fine aggregate with clay brick waste.(2016)

[23] Abdul Ghani, Zeeshan Ali, Fasih Ahmed Khan, Said Rehan Shah Sajjad Wali Khan Muhammad Rashid. Experimental study on the behavior of waste marble powder as partial replacement of sand in concrete.(2020)

[24] K.E.Prakash, D.M.Sangeetha and Shakkel Bagwan. An experimental study on partial replacement of fine aggregate by vermiculate and cement by marble powder.(2019)

[25] Shehdeh Ghannam, Husam Najm, Rosa Vasconez. Experimental study of concrete made with granite and iron powders as partial replacement of sand.(2016)

[26] Hyun-oh Shin, Doo-yeol yoo, Joo-Ha Lee, Seung-Hoon Lee, Young-Soo Yoon. Optimized mix design for 180Mpa ultra-high-strength concrete.(2019).

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