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Study on Retrofitting of RC Beams using Self Curing Self Compacting Concrete

Abilash C S
Research Scholar, Department of Civil Engineering,
REVA University,
Bengaluru, Karnataka, India.

Dr. Sunil Kumar Tengali
Professor, Department of Civil Engineering,
REVA University
Bengaluru, Karnataka , India.

Abstract
The disposal of wastes from thermal, steel industries and from demolition of building is causing severe land pollution. About 5% of Global warming is caused due to production of cement and by using pozzalonic materials such as Fly Ash, GGBS, Silica fume, Metakaoilin and Alccofine, by using such kind of mineral admixtures. These materials posses the cementitious property when mixed with water. In congested reinforcement conditions it is difficult to compact the concrete with a vibrator, hence self compacting concrete is used . Concrete is the most used material after water, but water is the most important ingredient for the production of concrete, due to the scarcity of water self curing compound is used for the production of concrete by replacing M-sand in place of natural river sand conforming EFNARC Codal provisions
This study mainly focuses on the partial replacement of Cement by Fly ash and alccofine at varied prooportions by weight of Cementitious material for producing Self curing self Compacting Concrete. Mechanical properties at 3,7,28,56 and 90days will be done by casting. Validation of the test results will be obtained using Neural network and Mat labs To produce concrete with appreciative strength using different pozzalonic material and to Further experimental investigation is to study the deflection and crack behavior of RC Beam with Fly ash and Alccofine will be done by casting number of beams of size 2800*150*300. Two methods of retrofitting methods such as CFRP Jacketing and Concrete jacketing will be done for the cracked beam and the ultimate load carrying capacity of CFRP Jacketing and Concrete Jacketing will be observed. To study the different retrofitting methods and comparing the values of CFRP and Concrete Jacketing.

Keywords: Alccofine, Fly Ash, Jacketing, Retrofiiting ,Self Curing, Self Compacting.

Introduction
In recent days the problem in India is the disposal of waste lands directly cause seviour Environmental pollution, mainly from Thermal and Steel Industry. These waste products can be efficiently used to produce innovative substance which can be used as efficient filler material in concrete upto a greatter extent in place of cement . This substance may result in the cost saving by using Industrial wastes. In congested Reinforcement it is difficult to consolidate the concrete with a vibrating machine; improper consolidation may lead to deterioration of concrete due to unfilled voids and pores in concrete. In this study cement is used as primary cementitious material and Fly ash is used as secondary cementitious material and alccofine as filler material in concrete blast furnace slag as ternary cementitious material. The motivation for developing this concrete is reduction in number of skilled labour and to shorten the construction period. Here in this study the behaviour of Self Curing self compacting concrete beams was studied for both conventional concrete and replacement concrete for different types of retrofitting methods under different loading condi**tions**

Objectives of the study
1) The present objective is to produce concrete with appreciative strength and durability properties using admixtures in partial to cement.
2) Use of Fly ash and alccofine as a partial replacement to cement.
3) To find out the properties of concrete such as strength properties and durability properties etc and comparing it with the conventional concrete and concrete with different Fly ash percentage replacement and alccofine in it and also to find the carbon reduction.
4) Is to reduce land pollution by adopting different retrofitting methods such as concrete jacketing and CFRP wrapping and comparing the load carrying capacity of different retrofitted beams.

Methodology:
Binder selection:
Mostly used OPC (Ordinary Portland Cement) and then only few have used PPC (Portland pozzolana cement) for their research because of its durability, high strength (more than 80-85 % strength is achieved within 28 days as compare to that of PPC which only achieves 70-75 % maximum within 28 days)

Additive selection:
Mostly there are two types of additive, these are mineral admixture and chemical admixture and research has been

performed by different researcher over all additive for their properties of performance and influence when mix with Portland cement. As per demand of high strength, high performance, durability,workability and anti corrosive concrete. A mineral admixture which performs in superior manner than that of all other admixture found/use in India is Alccofine and GGBS and chemical admixture is Glenium B233 and water proofing compounds.

Aggregate selection:

Aggregates for concrete consist of gravel and sand which represents the grain skeleton for the concrete. All cavities which are within this skeleton need to be filled with binder paste as much as possible. Concrete aggregates occupy approximately 80% of total concrete weight and 70 – 75% of total concrete volume. Optimum use of the aggregates quality and size improves the concrete quality, mainly coarse aggregate maintain better improvement for performance.

Fine Agregate:

There are four grading zone for fine aggregate as per IS383:1970 and these are Grading Zones I, II, III & IV. These grading zone classified as per percentage passing material from various sieves and there are mainly four zones and they all have different passing percentage limit for different sieves but there is only one sieve(600 micron) which is almost common to all Zone specification .

Tests On Fresh Properties Of Concrete:

Slump Flow & T50 Test:

Slump flow is one of the most commonly used SCC tests at the current time. This test involves the use of slump cone used with conventional concretes as described in ASTM C 143(2002).The main difference between the slump flow test and ASTM C 143 is that the slump flow test measures the "spread" or "flow" of the concrete sample.

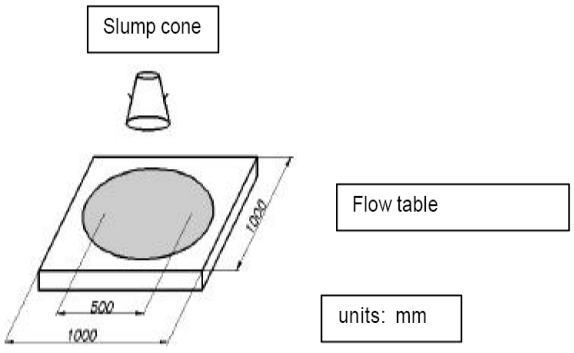

Figure:1- Slump test

L-Box Test:

The L-box value is the ratio of levels of concrete at each end of the box after the test is complete . The L-box consists of a "chimney "section and a "trough "section after the test is complete, the level of concrete in the chimney is recorded as H1,the level of concrete in the trough is recorded as H2.The L-box value(also referred to as the "L-box ratio", "blocking value", or "blocking ratio")is simply H2/H1.Typical acceptable values for the L-box value are in the range of 0.8 to 1.0.If the concrete was perfect.

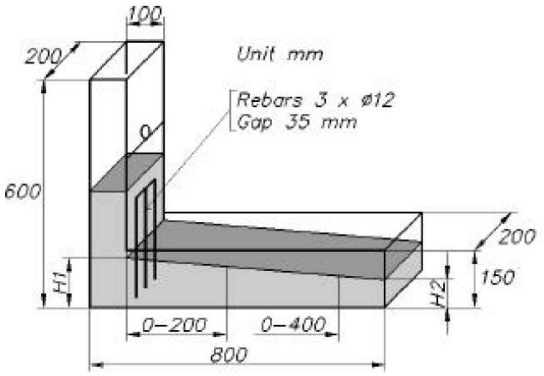

Figure 2- L-Box Test

V-Funnel Test:

V-funnel test is used to determine the filling ability (flow ability) of the concrete with a maximum aggregate size of 20 mm. The funnel is filled with about 12 liters of concrete and the time taken for it to flow through the apparatus is measured .After this the funnel can be refilled concrete and left for 5 minutes to settle .If the concrete shows segregation then the flow time will increase.

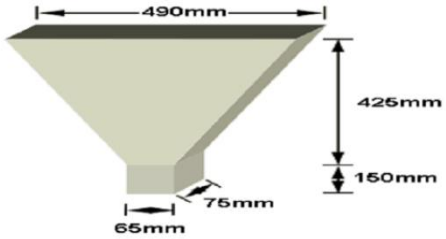

Figure 3 – V-Funnel apparatus

Table no1: Fresh properties of SCSCC

Sl.No.	Method	Unit	Result
1.	Stum flow by Abrams cone	Mm	690
2.	$T_{50\,cm}$ Stump flow	Sec	7
3.	V-funnel	Sec	11
4.	L-box	(h_2/h_1)	0.9

Tests Strength And Durability Properties Of Hardened Concrete

Compressive Strength:

The compressive strength of all mixes was measured with cube specimen of size 150mmx150mmx 150mm.The specimens were tested after curing for 7 days and 28 days

fully immersed in water tank as per IS 516:1959 for method of tests for strength of concrete. Compressive strength = P/A (Unit = N/mm2 or MPa) Where P = Load, A = Area of Specimen.

Flexural strength:
Flexural Strength The Flexural strength of all mixes was measured with beam specimen of size 700mmx 150mm x 150mm.The specimens were tested after curing for 28 days fully immersed in water tank as per IS 516:1959 for method of tests for strength of concrete. The central point loading method was used for this testing.

Split Tensile Strength:
The split tensile strength of all mixes was measured with cylinder specimen of size 300mm x 150mm.The specimens were tested after curing for 28 days fully immersed in water tank as per IS 5816:1999 for method of test splitting tensile strength of concrete.

Acid attack:
Acid attack involves conversion of calcium compound to calcium salts after attacking acid. The structure of the hardened concrete destroyed by acid attack, the rate of deterioration depends not only on the strength of the reactants but also upon the solubility of the resultant salts and their transport. The acids like sulfuric acid , hydrochloric acid , nitric acid etc…., destroy concrete by converting hardened concrete, and its pore system. Impermeability of concrete is of little consequence in this case. In this paper we used HCL for the curing of concrete for 7 and 28 days . It leads to loss in the mass of the concrete and strength of the concrete ,which leads to early deterioration of concrete structure.

Sulphate attack:
Sulphate attack is on only aluminate compounds, calcium and hydroxyl of hardened Portland cement forming ettringite and gypsum. In the presence of sufficient water, these reactions of delayed ettringite formation cause expansion of concrete leading to irregular cracking. The cracking of concrete provides further access to penetrating substances and to progressive deterioration. The effects of sulphate on concrete depend upon the severity of attack, accessibility (Permeability and Cracking), presence of water and susceptibility of cement-Concrete can be protected against sulphate attack by limiting the aluminates between 3 to 8%.

Chloride immersion test:
The specimens were removed from curing tank, blot off excess water. Specimen of size 50 × 100 mm was insert and clamped the two halves of the test cell together to seal with sealant around the boundaries of the specimen and cell. Record the current value at every 30 min up to 6 hrs. Each half of the test cell must remain filled with the appropriate solution for the entire period of the test. The procedure was adopted as per ASTM C1202.

Test on Beam Specimen:

RC beams of 150mm X 250mm X 2800 mm overall and 150mm X 219mm X 2600mm effective will be casted. with different reinforcing conditions. Linear variation deflection transmission(LVDT) were used to note down the deflections of the test beams at three positions. One below mid- span and other two below the loading points as shown in figure 4

Figure-4 : Experimental setup of beam.

Conclusions:

The rate of strength development in Partially replaced concrete will be very slow at 3rd days and 7th day due to pozzalonic behaviour. After conducting all the basic tests on fresh and hardened properties and mechanical properties of concrete such as acid attack, sulphate attack will be done and the grade of concrete with appropriate strength will be fixed and the casting of beams will be done. The beams will be tested for ultimate loading capacity and the values will be noted down , after the beams obtains its ultimate load carrying capacity the beam fails. The failure beam will be retrofitted foe two kinds of retrofitting methods such as Concrete jacketing and carbon wrapping method, the values of three loading methods will be noted down and the appropriate method for retrofitting will be concluded by test results.

References:

[1] Alvin Harison, Vikas Srivastava and Chandra Bhan Gupta, “Fly Ash as Supplementary Cementious Material in Portland Pozzolana Cement Concrete”International Journal of Engineering Trends and Technology (IJETT) – Volume 6 Number 3- Dec 2013

[2] Choi.Y.W.,Lee.H.K.,Chu.S.B., Cheong.P.K andJung.W.Y., “Shear Behavior and Performance of Deep Beams Made with Self-Compacting Concrete."

[3] Divya L, Mini Soman and SyamPrakash V “Flexural Behaviour of Fibre Reinforced Self Compacting Concrete”.

[4] Ganeshwaran.P. &Dr.Suji.D. “Behavioural Studies on Potential Aspects of Self Compacting Concrete with M- Sand and Fly Ash" International Journal of Emerging Technology and Advanced Engineering Volume 3, Issue 11, November 2014.

[5] Hossam El-Din M. Sallam, Tarek A. Ghareib& Mohamed M. Hussein, “Flexural and Shear behaviour of Hybrid Fibre reinforced self compacting” Journal of Advanced Concrete Technology, Vol. 5 No. 2,pp 259-273. (2007).

[6] Kiran Devi, Abhishek Gupta, VivekVerma, Bhupinder Singh - ""Experimental Study of Self Compacting Concrete made With GGBS and RHA under Axial Compression and Flexure". International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, Issue 3, December 2014, pp. 118-120

[7] M.S.Shetty, "Concrete technology-Theory and Practice", Multicolour Illustrative Edition, S.CHAND & company ltd.

[8] Neville,A.M, "Properties of concrete", FourthEdition, PEARSON publications

[9] Sonali K Gadpalliwar,Deotale.R.S and Abhijeet R. Narde "To Study the Partial Replacement of Cement by GGBS & RHA and Natural Sand by Quarry Sand In Concrete"-IOSR Journal of Mechanical and Civil Engineering (Volume 11, Issue 2 (Mar- Apr. 2014), PP 69-77.

[10] Sangeetha.S.P&Joanna.P.S"Flexural Behaviour of Reinforced Concrete Beams with Partial Replacement of GGBS". -American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN : 2320-0936 Volume-03, Issue-01

[11] Shah D.L. and Modhera.C.D., "Evaluation of Shear Strength OF Self Compacting Concrete deep Beam"

[12] Unni Krishna Pillai and DevadasMenon, Text book "Reinforced Concrete Design". 3rd Edition, Tata McGraw Hill Education Private Limited.

[13] Vijayananda.M.,Angeleseu.K.U.Muthu,C.G.,Put tappa&H.SudarshanRao,"Flexural Characteristics of Steel Fibre Reinforced Self Compacting Concrete Beams

[14] Divya L, Mini Soman and Syam Prakash V "Flexural Behaviour of Fibre Reinforced Self Compacting Concrete".

[15] Hossam El-Din M. Sallam, Tarek A. Ghareib & Mohamed M. Hussein, "Flexural and Shear behaviour of Hybrid Fibre reinforced self-compacting" Journal of Advanced Concrete Technology, Vol. 5 No. 2,pp 259-273. (2007).

[16] Youcef Fritih, Thierry Vidal, Anaclet Turatsinze , and Gérard Pons - "Flexural and Shear Behavior of Steel Fiber Reinforced SCC Beams"." KSCE Journal of Civil Engineering (2013)

[17] Y. W. Choi, H. K. Lee,, S. B. Chu, S. H. Cheong, and W. Y. Jung, "Shear Behavior and Performance of Deep Beams Made with Self-Compacting Concrete."

[18] A. Maria Rajesh, Dr.C. Selvamony, Dr.T.R. Srthuraman & M.Shaju Pragash - "Behaviour of low volume Fly Ash basedgeo polymer concrete structural elements with GGBS and Steel fibre", International Journal of Scientific Research Engineering & Technology (IJSRET)Volume 2 Issue 11 pp 782-789 February 2014

[19] Rameshkumar U More, D. B. Kulkarni - "Flexural behavioral study on RC Beam with externally Bonded Aramid fiber reinforced polymer"-International Journal of Research in Engineering and Technology.

[20] Kiran Devi, Abhishek Gupta, Vivek Verma, Bhupinder Singh - ""Experimental Study of Self Compacting Concrete made With GGBS and RHA under Axial Compression and Flexure". International Journal of Recent Research Aspects ISSN: 2349-7688, Vol. 1, Issue 3, December 2014, pp. 118-120