International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 2009-2013 www.ijaem.net ISSN: 2395-5252

A Review on Self-Compacting Concrete

Rashmi M P, Sandesh R Pawar, Darshan H H, Maniranganath H G, Satheesh Kumar C

Assistant Professor Department of Civil Engineering PES College of Engineering Mandya-571401, Karnataka India
UG Student Department of Civil Engineering PES College of Engineering Mandya-571401, Karnataka India
UG Student Department of Civil Engineering PES College of Engineering Mandya-571401, Karnataka India
UG Student Department of Civil Engineering PES College of Engineering Mandya-571401, Karnataka India
UG Student Department of Civil Engineering PES College of Engineering Mandya-571401, Karnataka India

Submitted: 01-07-2021 Revised: 13-07-2021 Accepted: 16-07-2021

ABSTRACT—Self compacting concrete was developed by Okamura in the 1980's. With changing technology and modernization, it is possible to produce high strength Self compacting concrete with replacements for cement. Significant research with regard to identification of mix proportion and properties for different application has been carried out around the world. The paper mainly focuses on the replacement of the main components of the concrete with mineral admixtures and to critically review the fresh and hardened properties of self-compacting concrete.

Keywords—Self-Compacting;Concrete;Hardened and Fresh Properties.

I. INTRODUCTION

To envision a world without concrete is inconceivable. Concrete is a spirit of foundations. Concrete is important to pick up strength in structures. Customary concrete, which is the combination of concrete, fine aggregate, coarse aggregate and water. Compaction is an important aspect of concrete and its strength. Compaction is the process which expels entrapped air from freshly placed concrete and packs the aggregate particles together so as to increase the density of concrete. It increases significantly the ultimate strength of concrete and enhances the bond with reinforcement. Self-compacting concrete (SCC) is an inventive concrete that doesn't requires vibration for placing and compaction. It can flow under its own weight, totally filling formwork and accomplishing full compaction, even within the sight of blocked reinforcement. The solidified concrete is thick, homogeneous and has similar mechanical properties and solidness as conventional vibrated concrete. Popularity of utilizing self-compacting concrete (SCC) in concrete development is expanded in numerous nations, since SCC is viably applied for improving toughness of structures while lessening the need of talented specialists at the building site. The objective of this paper is to review the study of self-compacting concrete containing innovative materials and to compile them in such a way that it would be helpful for selecting of best material.

II. REVIEW OF LITERATURE

Vashisht Patil 1, Prof. M. C. Paliwal: (2020)

- Concrete is one of the significant materials of the construction industry. These days because of expansion in a population, the demand of infrastructure is expanding day by day. This prompts the increment in production of cement. In the present scenario the overall cement production is about 4.1 billion metric tons worldwide. This huge amount of production prompts utilization of natural resources and it is very unsafe for environment. Enormous amount of waste by-products is delivered from the manufacturing enterprises, for example, mineral slag, fly ash, silica fumes, rice husk ash and so on. the rice husk ash is an agricultural byproduct which is obtained from the rice mills, the husk which is obtained from mill is of no use i.e it is not even be used for animals to eat. Hence it is used as a fuel in various big industries the burning temperature is very high hence, they are obtained from that. the RHA is very lightweight. The research work here deals with the partial replacement of cement with RHA in concrete at various percentage such as 0%,5%,10%,15%,20% and25% by mass of cement. Various experimental investigations are carried out to find out the compressive strength, split tensile strength and of concrete samples cured for period of 7 and 28 days. the results obtained from the experiments with satisfactory replacement of cement

with rice husk ash are presented in this research paper. [08]

Dipendra Dahal: (2020)- Concrete is basic construction material in the modern construction industry and occupies major cost components. The prime concern is the quality of varying specification in Normal to Special Concrete to meet the design expectation in real Practices. Application of Self-Consolidating Concrete (SCC) in the construction industry provides a potential solution to the limitations facing the use of traditional concrete in densely reinforced structural members. In response to the continual evolution towards an environmentally aware society, there is increasing demand for the application of sustainable building materials and minimizing of waste to landfill. Therefore, it has been identified that the practical application of Rice Husk Ash (RHA) as a Supplementary Cementitious Material (SCM) is capable of reducing both the quantity of Portland cement used in the construction industry, and also the quantity of rice husk contributing as waste to landfill. The aim of this research is to determine the optimum proportion of Rice Husk Ash (RHA) that can be incorporated as a supplementary cementitious material for partial replacement of Portland cement in a self-consolidating concrete. SCC was designed for the use of locally available aggregates and conducted through various trails as per SCC principles whereas RHA was extracted by uncontrolled burning of rice husk. This study was conducted through testing of the Compressive strength of six test samples that differ in amounts of RHA ranging from 0% to 30% of total replacement of cement for which Mix design for M20 concrete was calculated using IS mix design method. Outcomes suggest that RHA burnt under the proposed experimental conditions has the potential to be applied as a pozzolanic material which was proved by late gain of compressive strength in significant number shown at 45 days compressive strength. [04]

S. Gunasekar and M. Helen Santhi: (2019)- This paper presents the experimental investigation on concrete which attempts to utilize the industrial wastes to the possible extent and internal curing compound to promote self-compacting self-curing light weight concrete. Cinder, Ground Granulated Blast Furnace Slag (GGBFS), Super plasticizers and Polyethylene Glycol (PEG-400) are used in the concrete mix and the tests are conducted to confirm its suitability as self-compacting self-curing concrete. The test results of air cured concrete are well comparable with that of water cured conventional concrete. Cinder, an industrial waste product is used as a light weight aggregate by partial and full replacement for coarse aggregate to satisfy the property for structural concrete and optimum use of water in the construction contribute to the sustainable development. The compressive strength of the cinder concrete specimens satisfies the structural concrete requirement, so can be recommended for structural purposes.[14]

Abdallah Adnan Abdallah Al-Oran: (2018)- We know Self-compacting concrete to be a better version of the normal concrete, but it has a draw back. Achieving Self-compaction is not economical, the amount of Portland cement used is greater when compared to the conventional one. Here an attempt is made to use fly ash, wood ash and a combination of both in variety of quantity as replacement for cement. It was seen that the amount of viscosity reducing agent required decreased drastically and also the durability and mechanical properties of the concrete increased with decrease in water content. The results showed SCC with 10% replaced fly ash and wood ash better machinal properties with 1.5% of superplasticizer (Glenium b233). Guidelines given by EFNARC were followed during the mix proportion. [01]

S. Saranya: (2017)- Self-Compacting Concrete (SCC) is a flowing concrete mixture that has the capacity to consolidate under its own weight. The current trend all over the world is to utilize the treated and untreated industrial by-products, domestic waste etc. as a raw material in concrete, which gives an eco-friendly edge to the concrete preparation process. This practice not only helps in reuse of the waste material but also creates a cleaner and greener environment. This study aims to focus on the possibility of using industrial by-products like Ground Granulated Blast Furnace Slag (GGBS) and Fly Ash (FA) in preparation of SCC. This project presents the results of an experimental study aimed at producing SCC mixes of M30 grade by adopting different mix proportions, incorporating two mineral admixtures Fly Ash, Ground Granulated Blast Furnace Slag (GGBS), as supplementary cementing materials and comparison of their performances. The hardened properties were seen to be maximum for M40 mix at minimum replacement of admixtures. But in case of fresh properties mix with higher replacement showed better results.[2017]

J.Vengadesh Marshall Raman1 , V.Murali Krishnan: (2017)- The concept of partial replacement of cement which is capable for sustainable development is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. A presently large

amount of ground granulated blast furnace slag is a by-product of manufacturing of pig iron with an important impact on environment and humans. This research work describes the feasibility of using the GGBS in self compacting concrete production as partial replacement of cement. GGBS can be used as filler and helps to reduce the total voids content in self compacting concrete. Constant level of Fly ash is also used in all set of mix proportion to increase the powder content for achieve the Workability. The cement has been replaced by GGBS accordingly in the range of 0%, 25%, 30%, 35%, and 40% by weight of cement for M-30mix. After iterative trial mixes the water/cement ratio (w/c) was selected as 0.40. Self-compacting Concrete mixtures produced, tested and compared in terms of compressive, split tensile strength and flexural strength with the conventional concrete for 7,14,28 days. It is found that, 25% of GGBS can be replaced and strength obtained is comparable to the conventional concrete.[07]

Roopa and I. Soumya: (2016)- Concrete technology has made significant advances in recent years which results in economic improvement of the strength of concrete. This economic development depends upon the intelligent use of the locally available materials. Important constituent of self-compacting concrete (SCC) is natural sand and filler material which is expensive and scarce. The cheapest substitute for natural sand is quarry dust and for filler material is fly ash. In this work, the fresh and compressive strength properties of self-compacting concrete when the sand is partially replaced with stone dust , when the filler materials is increased by adding fly ash in % of the total powder content and when both substituent's are implemented simultaneously . Optimization of stone dust and fly ash is also obtained. The results indicated that the incorporation of quarry dust into the self-compacting Concrete mix as partial replacement material to natural sand resulted in higher compressive strength and optimization of sand replacement is 40%. Optimization of addition of fly ash in total powder content is 30%.[10]

Gajendra Koli, V. D. Gundakalle: (2016)- Self - compacting concrete (SCC), flows into place and around obstructions under its own weight, is extensively applied in many construction projects. In recent years, manufactured sand produced by crushing of rock is being identified as a suitable alternative source for river sand in concrete. Mineral admixtures usually added to concrete in large amount to enhance workability of fresh state and durability of concrete in hardened state. This paper covers the effect of replacing river sand by manufactured sand on SCC produced by using ground granulated blast furnace slag (GGBS) as a filler material. Nan Sumethod is being used for mix design; optimum mix proportion finalised with 10 percent GGBS as replacement for cement at water-powder ratio of 0.34 for M50 grade concrete. The study has shown that SCC with 10 percent GGBS and 30% replacement of river sand by manufactured sand indicate fresh SCC within EFNARC guidelines and enhanced strength properties.[11]

M.Adams Joe, A.Maria Rajesh: (2015)- Conventional concrete is the most widely used construction material throughout the world because of its versality, mouldability, durability, and resistance to fire and energy efficiency. However, its major disadvantages like poor tensile strength, limited ductility and little resistance to cracking resists its use as a structural material. To overcome this, mineral admixtures are added as replacement for cement. They increase the workability, decrease thermal cracking, increase sulfide resistance and enables reduction in cement content. In this paper Ground granular blast furnace slag (GGBS) is used as the mineral admixture which is replaced with cement. A maximum of 50% of GGBS as replacement can be used without disturbing the self-compaction of the concrete [13]

Sumrerng Rukzon and Prinya Chindaprasir: (2014)

- This paper presents the use of blend of Portland cement with rice husk ash in producing self-compacting concrete (SCC). CT was partially replaced with ground rice husk-bark ash (GRHBA) at the dosage levels of 0%–40% by weight of binder. Compressive strength, porosity, chloride penetration, and corrosion of SCC were determined. Test results reveal that the resistance to chloride penetration of concrete improves substantially with partial replacement of CT with a blend of GRHBA and the improvement increases with an increase in the replacement level. The corrosion resistances of SCC were better than the CT concrete. In addition, test results indicated that the reduction in porosity was associated with the increase in compressive strength. The porosity is a significant factor as it affects directly the durability of the SCC. This work is suggested that the GHRBA is effective for producing SCC with 30% of GHRBA replacement level.[15]

Shahana Sheril P.T(2013)- An attempt has been made in this paper to draw a line between M20 and M30 grade Self-compacting concrete and glass fibers reinforced Self-compacting concrete with fly ash as cement replacement (up to 25%). The glass fibers were added at 0.05%, 0.1%, 0.15% and 0.2%. the

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 2009-2013 www.ijaem.net ISSN: 2395-5252

mechanical properties were compared and results were obtained. For both M20 and M30 grades of concrete it was seen that SCC with glass fibers showed better mechanical properties.[12]

P. Dinakar, Kali Prasanna Sethy, Umesh C. Sahoo: (2012)

- Ground granulated blast furnace slag (GGBS), due to its pozzolanic nature, could be a great asset for the modern construction needs, because slag concretes can be of high performance, if appropriately designed. The use of GGBS as a cementitious material as well as fine filler is being increasingly advocated for the production of High-Performance Concrete (HPC), Roller Compacted Concrete (RCC) and self compacting concrete (SCC), The present paper is an effort towards presenting a new mix design methodology for the design of self-compacting GGBS concretes based on the efficiency concept. The methodology has already been successfully verified through a proper experimental investigation and the self-compacting slag concretes were evaluated for their self-compact ability and strength characteristics. The results indicate that the proposed method can be capable of producing high quality SCC.[02]

Mr. Giri Prasad Goud: (2011)- Self-compacting concrete is a type of concrete that can flow through dense and intense reinforcement purely because of its own weight. In this paper we aim to intoduce GGBS as a cement replacement and tothen understand the fresh and hardened properties of Self-compating concrete. The GGBS was varried from 0% to 30% by cement weight and experimenets were carried on. It was observed that as the GGBS proportion is increasing, initially there is a decrease in strength for 3 days, simultaneously there is increase in strength for 7,14,28 days for all the proportions except for the 30% proportion as there in a decrease in the strength for this proportion. The best results were obtained for 25% of replacement of cement by GGBS. It showed greater hardened properties and also better flow characteristics.[06]

Shankar H. Sanni1, R. B. Khadiranaikar: (2010)- Self-compacting concrete is a highly workably concrete which can flow through dense reinforcement and pass through every nook and corner. For Self-compacting concrete to achieve this it should be highly flowable and at the same time the water content should be less. This paper attempts to understand the compressive strength and flow characteristics of Self-compacting concrete. SCC with fly ash as replacement was produced with various amount of fly ash and the best amount of replacement which gives best compressive strength and fresh properties was observed. After conducting L-box, U-box, V-funnel and J ring test it was seen that SCC with 30% replacement of fly ash showed better flow characteristics and compressive strength [09]

Md. Safiuddin: (2010)- This paper presents the flowing ability of the mortars formulated from various self-compacting concretes (SCCs) incorporating rice husk ash (RHA). The mortars were produced with different RHA contents and water–binder (W/B) ratios, as used in their parent SCCs. The flowing ability of the mortars was determined with respect to the flow spread at various dosages of a polycarboxylate based high-range water reducer (HRWR). The effects of RHA, W/B ratio, and HRWR on the flowing ability of mortars were observed. The mortar flowing ability decreased with the higher RHA content and W/B ratio, but increased with the greater HRWR dosage. However, the excessive HRWR dosages were not conducive to the mortar flowing ability due to the segregation problem in the form of bleeding. The overall mortar flowing ability results were useful to examine the suitability of RHA, and to fix the HRWR dosages for different SCCs.[05]

III. CONCLUSION

- The addition of mineral adimixture proves to enhance the Fresh and Hardened properties of SCC
- The Fresh and Hardened properties of SCC with GGBS as mineral admixture increased gradually. The optimum results were obtained at 25% GGBS replacement in SCC.
- The Fresh properties of SCC with RHA as mineral admixture increased gradually but the hardened properties was seen to be decreasing with every percent of RHA replaced. It can be concluded that RH as a replacement for cement is difficult.
- The Fresh and Hardened properties of SCC with Fly ash increased exoinentially. The optimumresults were reached at 30% of fly ash as replacement for cement in SCC.
- GGBS and Fly ash are good replacement for cement and they also decrease the over all investment on project.

REFERENCES

[1] "Fresh and hardened properties of self-compacting concrete using metakaolin and

GGBS as cement replacement" Abdallah Adnan Abdallah Al-Oran. ISSN: 1964-8189 (Print) 2116-7214

[2] "Design of self-compacting concrete with ground granulated blast furnace slag" P. Dinakar chool of Infrastructure, Indian Institute of Technology, Bhubaneswar 751 013, India

[3] "Experimental Study on Self Compacting Concrete (SCC) Using Fly Ash and GGBS" S. SARANYA International Journal of Scientific & Engineering Research Volume 8, Issue 6, June-2017 ISSN 2229-5518

[4] Dipendra Dahala, Ramesh Banstolab, Nirmal Baralc and Keshav Basnet, "Evaluation of Rice Husk Ash as a Partial Replacement of Cement in Self-Compacting Concrete Using Mix Design". International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 http://www.ijert.org Vol. 9 Issue 07, July-2020

[5] Flowing ability of the mortars formulated from self-compacting concretes incorporating rice husk ash Md. Safiuddin, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada N2L 3G1.

[6] "Investigation On Strength Criteria Criteria And Cost Analysis Of Self-Compacting Cocncrete Using GGBS" Mr. Giri Prasad Goud, Volume: 04, Issue: 10, Oct 2009

[7] Partial Replacement of Cement with GGBS in Self Compacting Concrete for Sustainable Construction J.Vengadesh Marshall Raman1 , V.Murali Krishnan, SSRG International Journal of Civil Engineering (SSRG – IJCE) – Volume 4 Issue 3 – March 2017

[8] Partial Replacement of Cement with Rice Husk Ash in Cement Concrete Vashisht Patil 1, Prof. M. C. Paliwal, International Journal of Engineering Research & Technology (IJERT) Vol. 9 Issue 12, December-2020

[9] Performance of Self Compacting Concrete Incorporating Fly Ash Shankar H. Sanni1, R. B. Khadiranaikar, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE).

[10] "Preliminary investigation on Self-compacting concrete using stone dust and fly ash as partial replacement of fine aggregates" Roopa P, I Soumya; IJSR

[11] "Property of Self-compacting concrete using GGBS and M-Sand" Gajendra koli, V. D. Gundakalle. IJRSI

[12] "Self-Compacting Concrete Using Fly Ash and Glass Fibre" Shahana Sheril P.T. International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 9, September – 2013

[13] "Study on the Effect of GGBS & M Sand in Self Compacting Concrete" M.Adams Joe , A.Maria Rajesh The International Journal Of Engineering And Science (IJES) Volume 4 Issue 8 Pages PP -12-18 2015

[14] Self-compacting self-curing low density concrete using cinder aggregate and peg s. Gunasekar and m. Helen santhi international journal of civil engineering and technology (ijciet) volume 10, issue 01, january 2019

[15] Use of Rice Husk-Bark Ash in Producing Self-Compacting Concrete Sumrerng Rukzon1 and Prinya Chindaprasirt Hindawi Publishing Corporation Advances in Civil Engineering Volume 2014, Article ID 429727

[16] EFNARC Specification and Guidelines for Self-Compacting Concrete – February 2002.

[17] IS: 10262 -2009,"Recommended guidelines for concrete mix design", Indian stand bureau, New Delhi, India.

[18] I.S: 456 – 2000, Indian standard Specification for plain and reinforced concrete – code of practice. (Fourth revision), B.I.S, New Delhi.

[19] IS: 383-2016 specification for fine and coarse aggregate from natural sources for concrete.

[20] IS: 4031-1998 for physical tests on cement from natural sources for concrete, New Delhi

[21] Concrete Technology: Theory and Practice; Book by M.S. Shetty.

[22] "Specifications and guidelines for self-compacting concrete." published by EFNARC in February 2005