Review on Self compacting Concrete using GBFS

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Abstract:-Self-compacting concrete (SCC) is a propelled solid that spreads into the shape without the requirement for mechanical vibration for setting and compaction. It can stream under its own weight, totally filling formwork and accomplishing full compaction, even within the sight of congested fortification.

In this paper literatures of various researches were studied. Those paper give more information about the self compacting concrete and comparison of natural and manufacture Fine Aggregate cement concrete and mortar. Granulated Blast Furnace Slag as a fine aggregate substitute in self compacting concrete.

Keywords: Self-compacting concrete, GBFS

1.0 INTRODUCTION

Aggregate affect both rheological and mechanical properties of mortars and concrete. Their specific gravity, particle size distribution, shape and surface texture notably the properties of mortars and concrete in the fresh state. Then again, the mineralogical structure, toughness, elastic modulus and degree of alteration of aggregates are for the most part found to influence the properties of mortars and concrete in the hardened state.

In India, natural river sand (fine aggregate) is generally utilized as a part of mortars and concrete. Be that as it may, developing natural limitations to the misuse of sand from riverbeds have brought about a search for elective sand, especially close to the larger metropolitan regions. This has acquired extreme strains on the accessibility of sand forcing the construction industry to search for an elective construction material. Along these lines manufactured fine aggregate show up as an alluring contrasting option to characteristic fine aggregate for cement mortars and concrete. Manufactured sand is entirely different from regular natural river sand. The surface qualities are extraordinary. The vast majority of the manufactured sand is irregular and more porous. grading vary over wide range bringing about interior porosity and decrease in workability of mortar or concrete. Various investigations have managed the impact of both grading and particle shape of the fine aggregate in mortars and concrete. For good quality manufactured sand at a given water/cement ratio, it has been found that concrete made with manufactured sand achieved compressive strength equal To or higher than concrete made with characteristic sand diminishing the void substance of the aggregate in this manner greasing up the aggregate framework without expanding the water requirement of the mixture To understand the variations in mixing water requirements, many earlier researchers have investigated the effect of particle shape of aggregates on water demand in concrete. They have discovered that the shape of the fine aggregate has a more noteworthy effect on water request than the shape of the coarse aggregate. Promote inside the allowed standard confines the particle size distribution of the fine aggregate was found to have a more noteworthy impact in the properties of concrete than that of the coarse aggregate. Therefore the decision of the suitable type of fine aggregate for a given application is of essential significance to the extent properties of mortars and concrete are concerned. Various types of slag came from copper and steel industries which are utilized as a part of mortar and concrete. The utilization of granulated blast furnace slag (GBFS) as a aggregate in mortar and concrete gives ecological and also financial advantages. Many steel industries in India are supplying GBFS as an alternative to sand. Likewise there are numerous other elective materials for aggregate got from construction and demolition wastes recycle aggregates and quarry wastes. These aggregate are effectively used in concrete production which can likewise save natural materials and to diminish the cost of waste treatment before disposal

Self-compacting concrete (SCC) has been described as "The most revolutionary development in concrete construction for several decades". Initially created to counterbalance a developing lack of skilled labour.

It is initially created in japan SCC innovation was made conceivable by the significantly prior improvement of superplasticisers for concrete. SCC has now been taken up with excitement crosswise over world for both site and precast concrete work. Useful application has been joined by much research into the physical and mechanical characteristics of SCC and the extensive variety of knowledge created has been shifted and joined in this rule record

Granulated blast-furnace slag (GBFS) is obtained by quenching molten iron slag (a by-product of iron and steel-making) from a blast furnace in water or steam, to produce a glassy the chemical composition of a slag varies considerably depending on the composition of the raw materials in the iron production process. Silicate and aluminate impurities from the ore and coke are combined in the blast furnace with a flux which lowers the viscosity of the slag. In the case of pig iron production the flux consists mostly of a mixture of limestone and forsterite or in some cases dolomite. In the blast furnace the slag floats on top of the iron and is decanted for separation. Slow cooling of slag melts results in an unreactive crystalline material consisting of an assemblage of Ca-Al-Mg silicates. To obtain a good slag reactivity or hydraulicity, the slag melt needs to be rapidly cooled or quenched below 800 °C in order to prevent the crystallization of melilite. To cool and fragment the slag a granulation process can be applied in which molten slag is subjected to jet streams of water or air under pressure. Alternatively, in the pelletization process the liquid slag is partially cooled with water and subsequently projected into the air by a rotating drum.

2.0 LITERATURE REVIEW

M C Nataraja, P G Dileep Kumar, A S Manu and M C Sanjay Studied on a use of Granulated blast furnace slag as Fine aggregate in cement mortar. This study focuses on investigates the possibility of utilizing Granulated Blast Furnace Slag (GBFS) as a sand substitute in cement mortar, in order to reduce environmental problems related to aggregate mining and waste disposal. In their experiment, cement mortar mix is1:3 and GBFS at 0, 25, 50, 75 and 100% replacement to natural sand for constant w/c ratio of 0.5 is considered. They extended

their work to 100% replacements of natural sand with GBFS for w/c ratios of 0.4 and 0.6. The author tests the flow characteristics of the various mixes and their compressive strengths.

From their experimental study it is observed that GBFS could be utilizing somewhat as elective construction material for natural sand in mortar applications. Decrease in workability expressed as flow can be counterbalance by including suitable amount of super plasticizer.

The author of this paper is also observed that the flow of mortar decreases as the percentage of GBFS increases. The decrease in flow for 25% is marginal and for higher percentages the flow decreases substantially. Using suitable dosage of chemical, the flow can be maintained.

Krishna Murthy.N, Narasimha Rao A.V, Ramana Reddy I .Vand, Vijaya sekhar Reddy.M studied a Mix Design Procedure for Self Compacting Concrete. Self-compacting concrete (SCC) has upgraded characteristics and enhances productivity and working conditions due to elimination of compaction. SCC is appropriate for placing in structures with congested reinforcement without vibration and it helps in accomplishing higher quality of surface finishes. However use of high responsive Metakaolin and Flyash as an admixtures as a viable pozzolan which causes incredible change in the pore structure, additionally compactibility is influenced by the qualities of materials and the mix proportions, it ends up important to advance a methodology for mix design outline of SCC .In this paper presents an experimental procedure for the design of self-compacting concrete mixes. The relative proportions of key components are considered by volume rather than by mass. A simple tool has been designed for self-compacting concrete (SCC) mix design with 29% of coarse aggregate, replacement of cement with Metakaolin and class F flyash, combinations of both and controlled SCC mix with 0.36 water/cementitious ratio(by weight) and 388 litre/m3 of cement paste volume. Crushed granite stones of size 16mm and 12.5mm are used with a blending 60:40 by percentage weight of total coarse aggregate. The author describe detailed steps are discussed in this study for the SCC and its mortar. The author found on the basis of SCC mix design tool Self-Compacting Concrete is considered to be the most promising building material for the expected revolutionary changes on the job site as well as on the desk of designers and civil engineers.

V. Subathra devi, B. K. Gnanavel studied on properties of concrete manufactured using steel slag. This paper aims to study experimentally, the effect of partial replacement of coarse and fine aggregates by steel slag (SS), on the various strength and durability properties of concrete, by using the mix design of M20 grade. The author found that the optimum percentage of replacement for fine aggregate is 40% and for coarse aggregate is 30%, beyond which the compressive strength decreases on further replacement. Workability of concrete decreases as the percentage of replacement increases. Fine aggregate replacement shows better workability compared to coarse aggregate replacement. Compressive strength, tensile strength, flexural strength and durability tests such as acid resistance, using HCL, H_2SO_4, and rapid chloride penetration, are experimentally investigated. The results indicate that for conventional concrete, the partial replacement of fine and coarse aggregates by steel slag improves the compressive, tensile and flexural strength. The mass loss in cubes after immersion in acids is found to be very low. Deflection in the RCC beams gradually increases, as the load on the beam increases, for both the replacements. The degree of chloride ion penetrability is assessed based on the limits, given in ASTM c 1202. The viability of usage of SS in concrete is found.

J. Guru Jawahar, C. Sashidhar, I.V. Ramana Reddy and J. Annie Peter studied on A Simple Tool for Self Compacting Concrete Mix Design. SCC can be made from any of the constituents that are generally used for structural concrete. In the mix design of SCC, the relative proportions of key components are generally considered by volume rather than by mass. On the basis of these proportions, a simple tool has been designed for self compacting concrete (SCC) mix design. In this paper, this tool has been evaluated with a SCC mix having 28% of coarse aggregate content, 35% replacement of cement with class F fly ash, 0.36 water/cementitious ratio (by weight) and 388 litre/m3 of paste volume. Crushed granite stones of size 20mm and 10mm are used with a blending 60:40 by percentage weight of total coarse aggregate. Detailed steps used in this tool are discussed in this study. This tool can also be used for self compacting mortar (SCM) design. It is practically seen that this simple tool is very much useful for the mix design of SCC with or without blended cement and with or without coarse aggregate blending. This tool is also useful for Self compacting mortar design. It displays all necessary data for SCC mix design and also displays constituent materials for SCC or SCM for the required volume.

Gaurav Singh, Souvik Das, Abdulaziz Abdullahi Ahmed, Showmen Saha, Somnath Karmakar studied on Granulated Blast Furnace Slag as Fine Aggregates in Concrete for Sustainable Infrastructure. Growing environmental restrictions to the exploitation of sand from river beds leads to search for alternatives particularly near the larger metropolitan areas. This has brought in severe strains on the availability of sand forcing the construction industry to look for alternative construction materials without compromising the strength criteria of concrete. Granulated blast furnace slags are one of the promising sustainable solutions as they are obtained as solid wastes generated by industry. Hence it reduces the solid waste disposal problem and other environmental issues. Present experimental work explores the possibility of using GBFS as replacement of natural sand in concrete. In this study an attempt is done to understand the variation in compressive strength of concrete with GBFS content. Along with that cost analysis is also done to suggest the most optimized percentage of GBFS to be used in various conditions. The most optimum percentage of GBFS to be used in normal conditions considering both strength and economy factor is from 40% to 50% and for marine conditions it's from 50% to 60%. The long term strength development of BFS concrete is almost double of normal concrete in both normal and marine conditions.

Nagesh M K, Dr Y M Manjunath studied on Behaviour of Self Compacting Concrete by Replacing Sand with GBFS at Sustained Elevated Temperature. This study aims at investigating the possibility of replacing Granulated Blast Furnace Slag as a sand substitute in self-compacting concrete. In this investigation, natural sand is replaced by GBFS in various percentages (25%, 50%, 75% and 100%), with a constant water/cement ratio of 0.48. Mechanical properties such as compressive and split tensile strength were found by testing cubes and cylinders of 150x150mm and 150x300mm. The specimens were also tested at sustained elevated temperature (100ºc, 200ºc, 300º) for the duration of 2hrs.The author found that Workability of concrete mix decreases above 50% replacements and almost lost its basic property of flow ability at 100% replacement. Maximum increase of compressive strength was attained at 50% replacement of sand at room temperature. After 2hr duration at 100ºc compressive strength decreases as the percentage replacement increases.

S. Shrihari, Seshagiri Rao M.V studied on Properties of self compacting concrete with metakaolin replacing sand with GBFS. it is studied that the effect of MetaKaolin on the properties of GBFS self compacting concrete, the studies include the effect of GBFS and MetaKaolin on the fresh and hardened mechanical properties of SCC made with GBFS and MetaKaolin. The observation made that river sand can be replaced up to 60% with constant W/C ratio 0.38% the only problem with GBFS, it takes long time to gain strength. If we add the admixtures METAKAOLIN by 10%, then quick setting & early strength is possible. The GBFS is free from Co2, Alkalis and silt, Co2.The fresh properties & compressive strength of SCC increases with the increase in the percentage of GBFS. But limited to 60% replacement provided by adding 10% MetaKaolin. It is found that 70% replacement not reached satisfactory results. It is economical when

compared with natural sand and also reliable alternative material in terms of workability, strength and durability. The fresh properties and compressive strength of self compacting concrete is improved as percentage of GBFS increases with constant MetaKaolin (%). The study has revealed that using MetaKaolin in the replacement f river sand with GBFS gives better flow properties and compressive strength in comparison to only GBFS.

M R Suresh, Rajath U Pole studied on Development of Self Compacting Concrete by Replacing Foundry Sand and Granular Blast Furnace Slag for Sand. this investigation, natural sand was replaced by GBFS and foundry sand in various percentages), with a constant water/cement ratio. Tests such as sieve analysis, specific gravity, fineness modulus, and water absorption were done for fine aggregate and GBFS sample. Different mix proportions for different percentage replacement of fine aggregate was obtained for M40 grade concrete as per IS 10262:2009. The compressive strength test, split tensile strength test, flexural strength test, were done for cube, cylinder and slab specimens of control mix and GBFS mix. It was found the strength of concrete was improved due to the addition of GBFS as fine aggregate. Different mix proportions for different percentage replacement of fine aggregate was obtained for M40 grade concrete as per IS 10262:2009. The compressive strength test, split tensile strength test, flexural strength test, were done for cube, cylinder and prism specimens of control mix and GBFS mix. It was found the strength of concrete was improved due to the addition of GBFS as fine aggregate. By experimental investigations it is indicated that the strength parameters such as compressive strength, split tensile strength and flexure strength is similar when compared to the normal SCC.

3. CONCLUSION

The above research paper gives following conclusions-

- Comparison of natural and manufactured Fine aggregate in cement mortars and cement concrete.
- Properties of concrete mix decreases above 50% replacement of GBFS with natural sand.
- It is possible to get workability closer to reference mix by adding 0.5% to 1% of superplasticizer.

4. REFERENCES

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