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A Review on Mechanical Properties of High Strength Self Compacting Concrete

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***Abstract*:** High strength self compacting concrete is a fluid mixture suitable for congested reinforcement. It should posses a good balance between the deformability and suitability. This is being used in increasing volume in recent years due to its mechanical properties durability properties than conventional concrete. In this review the High strength self compacting concrete with different minerals used and their performances were presented. By adding admixtures like silica fume, fly ash and quarry dust will decrease the flow ability, to improve this super plasticizers were added. The successful utilization of silica fume, fly ash and quarry dust could turn this waste material into valuable resources. This paper presents the results of an experimental work of high strength self compacting concrete with silica fume, fly ash and quarry dust and super plasticizer and their mechanical properties.

Keywords: Self compacting concrete, silica fume, fly ash, quarry dust, mechanical properties.

I. INTRODUCTION

The purpose of High strength self compacting concrete is one of the most important development in the building industry. The purpose of using this concrete is to decrease the human risk. The properties of high strength self compacting concrete differ from conventional concrete.

Venkat Rao (2013) observed that the growth of population, industrialization and increasing urbanization needed the demand for infrastructure. Concrete plays an important role in creating infrastructure very significant and fulfill the need of construction industry. The concrete have increased its utility at every stage of construction due to its flexibility, suitability and adoptability. In conventional concrete, through vibration workability may be achieved but it is not possible to get full compaction. Inadequate compaction forms the large number of voids. The voids in the concrete reduces the strength and durability of concrete. The contribution of self compacting concrete satisfies requirement. European federation (EFNARC) gave design specifications, guidelines to produce and use high quality self compacting concrete. Concrete in the fresh state decides the characteristics of self compacting concrete. The fresh concrete should posses the filling ability, passing ability and resistance against segregation. The fresh concrete is tested by slump flow Test, V-Funnel test, L-Box test. Higher water binder ratio leads to volume change, permeability and cracks. Therefore lower water binder ratio need to produce the dense, impermeable and durable concrete. Lower water binder ratio reduces the corrosion on steel reinforcement. The super plasticizers had made it easy to produce the concrete with lower water/binder ratios and it makes a high strength and high performance self compacting concrete . The concrete with low water/binder ratio reduces the intensity of damage by resisting the impact of magnesium sulphate.

Gaywala N R (2011) ascertained that, self compacting concrete with fly ash decreased Permeability and increased density by long term pozzolanic action. It is more resistant to sulphate attack and reduced shrinkage because fly ash ties with lime. The maximum compressive strength, tensile strength and flexural strength were obtained by 15% of fly ash replacement with cement.

Self-compressed concrete by Ahmed Fathi resist segregation and not flow through its own weight by the oscillation was proposed to be a concrete mixture having an ability. As well as the addition amount of the cement admixture of super plasticizer chemistry can be achieved by reducing the necessary mixing aggregate content increased. Increase in the content of the cement will increase the total cost. Itdayi cement replacement material can be used to prevent the problem. Fly ash, cement replacement content in a microwave oven burning rice husk ash and silica fume concrete and concrete-mixing can improve the compression characteristics of sexual self is a famous type of cement replacement materials. Allow the concrete mixtures showed a slump flow value to compress all the good deformability self militia 650-768mm. Compressing the concrete mix has a self-value in the range of 1.0 0.8 L- box test. In order to achieve the fresh properties, microwave chaff incineration will require more water than silica fume. The high compressive strength and a split tensile strength is achieved in 30% of silica fume and fly ash 5% of the concrete mix. All mix cement replacement materials where a high flexural strength, negligible results because of bleeding and high cohesion. Microwave performance of incineration of rice shell to replace the cement depends on the degree to affect the microstructure of the binder burn.

Muhammad Nouman Haral (2013) It is believed to be a natural pozzolan binder alternatives for the construction industry. Current environmental aspects have been a number

of major concern in the construction site. By minimizing the amount of CO2 introduced in the cement industry CO2.It environment, a significant amount was about the environment, it is essential to control the overall process of manufacturing cement contamination. The introduction of the supplementary cementitious materials may be achieved. Another added after the increase in demand and in the supplementary cement material chosen because from day one of the other applications. The concrete must have a small amount of higher quantity, higher aggregate content and aggregate content of the compressed self-binder. Therefore, it is essential to include a super plasticizer chemical admixtures such as to maintain a proper consideration of the processability aspects of viscosity itself compressed concrete. In order to achieve the properties of fresh concrete, it is added to the high quantity of fine particles. As a self-compressing concrete alternative binder mix can provide a mixed flow of the application up to 20% natural pozzolan. Determination of the optimal dosage of polycarboxylate ether for a variety of paste can be found in the modified Marsh cone test. Flow capacity and a polyether carboxylic increase with the increase of the dosage of the paste mix. Slump flow increases with the increase of the volume fraction of the high binder content of the paste. High volume water separation occurs and the risk of settlement of the aggregates. Value of T500 is decreased with the increase in the volume fraction of the paste, and non-water agents.

Mostafa Jalal (2015) explained that, high strength concrete is one of the classification of high performance concrete. The grade above M60, concretes refers to high strength concrete. High strength and durability properties achieved by reducing porosity, in homogeneity, micro cracks in concrete . The reduced sizes of structural member, increased building height in congested areas, early removal of form work, in prestressed concrete construction makes greater span-depth ratio, early transfer of prestress and application of service loads can be achieved by using high strength concrete. Reduction of corrosion of steel and attack of aggressive chemicals can be done by Low permeability characteristics of high strength concrete. This permits the use of high strength concrete in nuclear power plants, bridges, marine structures and places of extreme climatic conditions. High strength concrete reduces maintenance and repair cost. By combining the BIS method , ACI methods for concrete mix design and the available literatures simplified mix design procedures are formulated. Some times the mix proportion should be modified to meet the desired workability and strength criteria, by adjusting the % replacement of cement by SF, % dosage of super plasticizer solid content of binder, air content and unit weight by means of trial batches to optimize the mix proportion. Based on the above formulated mix design , mix proportions are arrived for M80 and M100 grades of concrete and by replacing 0, 2.5, 5, 7.5, 10, 12.5 and 15% of the mass of cement by silica fume. The increased percentage of silica fume content decreases the workability of concrete. The cement replacement by silica fume 10% is the optimum percentage for M80 and M100 grades of concrete. The maximum compressive, split tensile and flexural strength and elastic modulus are achieved by the optimum percentage of cement replacement by 10% silica fume.

D.W.S. Ho (2002) Reported segregation without magnetic compression known to achieve the appropriate compression by having the self-weight without the use of a long-range transducer that fresh concrete flow. It should have a plastic viscosity, yield stress with low access to a Newtonian fluid. The introduction of the surface active agent, such as a high powder content and super plasticizer causes the compression itself. The by-products of the rock crushing process in the production of concrete aggregate is known as granite fine powder. Granite quarry fines referred to as dust. Concrete mix is introduced in a quarry dust is limited due to its fine. Fresh concrete will increase the cement content according to job requirements and strength requirements given additional water demand and quarry dust. The use of compressed concrete quarry dust itself can be set euroyi waste valuable resources, and you can save money. It requires a high dose of super plasticizers for quarry dust yield stress and other rheological properties similar. High fineness of the fine granite may facilitate the durability problems such as alkali silica reaction.

Prajapati Krishnapal (2013) found that, the most revolutionary development in concrete industry is Self-Compacting Concrete. It has advantages like faster construction, reduction in size for concrete sections, better durability, suitable for congested reinforcement. Therefore this concrete becomes popular in the construction industry. The self compacting concrete is developed by using various percentages of fly ash (10%, 20% and 30%) by weight of cement as partial replacement of cement. The fresh properties of self-Compacting Concrete are been assessed by using the methods such as T500 time, V funnel and , L-box test as per EFNARC specification. The poly carboxylic ether is used as water reducing admixture. The cement is replaced by fly ash up to 30% (10%, 20% and 30%) by weight of cement and quantities of the fine aggregates and coarse aggregates are kept constant. The fine aggregate is kept approximately 37% by weight of concrete. The coarse aggregate is kept approximately 34% by weight of concrete. The water binder ratio is kept 0.40 and 0.45 by weight. The mixes thus prepared follow the EFNARC guidelines. The addition of Fly ash decreases the addition of super plasticizer content for same and better workability. The addition of Fly ash results is decrease in 7 days and 28 days of compressive strength. The 28 days compressive strength is decreased and the fly ash content is increased to 30%. However all the mixes have good 28 days compressive strength. Therefore, it is possible to produce a good performing self compacting concrete using locally available Fly ash.

Rahul Dubey (2012) developed that, the self compacting concrete has more powder content, less coarse aggregates,

high range water reducing super plasticizer and small dosage of viscosity modifying agent . Self-compacting concrete has to posses high flowing ability when it is being cast and high viscosity when it is at rest, in order to prevent bleeding and segregation. To achieve above properties super plasticizers were used. Trial mixes were prepared by varying the dosage of super plasticizers from 2% to 12% of cement material with an increment of 2% to achieve required strength. Self compacting characteristics in fresh state of mix proportion with varying dosages of super plasticizers slump flow test, V-funnel flow test and L-Box test were performed according to the procedure proposed by EFNARC. The filling ability of self compacting concrete can be determined by Slump Flow test. The filling ability and passing ability can be determined by L-box test. The addition of super plasticizer upto 4% gives good strength. Addition of super plasticizers up to 8% increases the compressive strength at all ages but the increase was marginal. The setting time was increased with increase in dosage of super plasticizers .On addition of super plasticizers more than 10% ,the mix was not set even after 11 days.

K.S. Johnsirani (2013) proposed that, a concrete which can be placed and compacted under its self weight without vibration effort and at the same time cohesive enough to be handled without segregation is considered as self-compacting concrete. It contains super plasticizer, high content of fines and viscosity modifying agent. The use of super plasticizer maintains the fluidity. The resistance against bleeding and segregation is attained by using high fine content and super plasticizer. The use of blast furnace slag fly ash and quarry dust in self compacting concrete reduces the super plasticizer dosage. Self compacting concrete may result in up to 40% faster construction than using normal concrete. The use of mineral admixtures improved the performance of self compacting concrete in fresh state and also reduces the use of viscosity modifying agents. Passing ability, filling ability and segregation resistance are well within the limits only when water/binder ratio is 0.4.The compressive strength and split tension strength had shown higher strength when replacement of admixture is 25% of finest materials. Beyond that limit the hardened properties of concrete decreases.

M.Iyappan (2014) ascertained that, self compacting Concrete is one of the category of high performance concrete characterized by ability to spread and self consolidate under its own weight without bleeding and segregation. Among the various manufactured nano materials such as nano silica, nano alumina, nano titania, nano zirconia, nano Fe2O3 etc, the addition of Nano Silica (NS) enhances the possibility for the reaction with Calcium Hydroxide (CH) to develop more strength. Self compacting concrete with partial replacement of cement by nano silica in three different percentage such as 2%,4%,6% and hardened properties were found. Mix design was designed by ACI Mix Design method. The water Cement Ratio is 0.32 and the mix ratio is 1:2.05:2.3.The nano silica has large surface area which improves the compressive, flexural and split tensile strength at early ages and reduced porosity and water absorption when compared with conventional concrete. The nano silica about 4% in self compacting concrete gives more acid resistance compared with conventional concrete due to reduced porosity.

H.A.F. (2012) High Concrete Reinforced Concrete Members congestion that can integrate itself without vibration, even if Dehwah is expected to flow freely without separation of the components to form geouieul, every recess, explaining that filling the space with empty space the level of molded concrete surface is magnetic. This is generally the ratio of the filler material to be used as high fine material, requires the incorporation of chemical admixtures, and high range water reducer. The filler comprises fly ash dust metallic powder, blast furnace slag, silica fume, and silica powder. Results in a reduction of the magnetic compression concrete working speed and cost of deployment the construction time, and thus productivity is enhanced to remove the integration. Magnetic compression concrete leads the potential to increase the time to place the noise reduction in casting, better working conditions, urban areas. Test mixture was prepared with different ratios of the filler, that is, quarry dust powder, silica fume + quarry dust powder and fly ash. Designing a mixture thereof by a reasonable mix design method and is carried out in proportion to the weight of the material. Subjected to slump flow test, V flow test, U and L boxes flow test box flow test to evaluate the flow properties of the test mixture. Maximum compression bending got a split tensile strength (8% quarry dust, powder, water / binder = 0.38) sample and mix design. Alone provides more strength than manufacturing alone or mixed with fly ash silica fume plus quarries quarry dust, dust powder, including powder. The ash or silica fume represents a quarry dust powder plus a further 8-10% own quarry dust with flour filler better than flying. The use of silica fume and fly ash quarry dust powdered the result of significant cost savings in areas that are not available locally.

Caijun Shi (2015) explained that , mix design is a critical step to obtain high quality self compacting concrete. A good self compacting concrete mixture design method should consider, widely applicable, strong robustness for variable raw materials, technical requirements, sustainability and cost.There are various methods available for mix design of self compacting concrete, such as EFNARC, design method , Compressive strength method , close aggregate packing method, mixture design method based on statistical factorial model , mixture design method based on rheology of paste model . Silica fume and quarry dust were observed to improve the mechanical properties of self compacting concrete because of the pozzolanic action of silica fume. It has been indicated that self compacting concrete having silica fume have higher compressive strength,split tensile strength and flexural strength. As the water cement ratio reduces and cement content increases, strength increases in self compacting concrete made with silica fume and self compacting concrete made with quarry dust.

P. Vinayagam (2012) explained that, High Strength Concrete refers to concretes of grade above M60. High strength and durability properties become reality for Conventional concrete by reducing porosity, in homogeneity and micro cracks in concrete. The use of high strength concrete reduces size of structural member, increased building height in congested areas and early removal of formwork.

II. CONCLUSION

In this review, self-study silica fume, fly ash and quarry dust and then compress the concrete using a cement replacement materials arrived at the same conclusion. Because of the extreme fineness of the material is very reactive pozzolan quarry dust flying acts as a high content of amorphous silicon dioxide, silica fume concrete is dense ash causes filler. Depending on the quarry dust shows good results in both tension and compression compresses the magnetic silica fume concrete. High-strength magnetic silica fume, a simple mix design procedures using the optimum ratio of cement replacement by fly ash, silica fume concrete is compressed up to high intensity magnetic compression splitting tensile bending strength.The 20% of silica fume to achieve compression using quarry dust concrete workability .The spare part also due to the magnetic require high dosages of super plasticizer concrete compression parameters .Hence high strength bulking reduces fluctuation of the particle size decreases workability. Over 4% of the mixing ratio of the dose of super plasticizer affects the strength. Silica fume promote durability problem than the amount used by the quarry dust causes an alkali silica reaction. The optimum ratio of silica fume dust quarries provide the best results, and also to reduce the cost, thereby reducing the environmental pollution. Finally, the use of industrial waste silica fume, fly ash and quarry dust valuable resources and can reduce the human risk

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