REVIEW PAPER ON SELF COMPACTION OF CONCRETE

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Abstract - The main objective of a civil engineer is to construct that type of structure which is able to resist against the forces for many years. As every structure has its own life span depending upon the material used and its design critics. Self compaction of concrete is also called as self consolidating concrete is a innovative technique in the field of civil engineering. This technique was introduced to overcome the issue of workmanship. As we know ordinary concrete is dense and require external vibratos and other techniques (for compacting the concrete) to remove air bubbles and honey comb, especially at the surfaces. For this purpose skilled labour was required and it was also a time consuming process. However, in order to overcome this issue of Self-consolidating of concrete was introduced in which no compaction is required and therefore reducing the labour and time. This review paper explains the history and the current scenario and the application of this method in various fields and its composition.

Index Terms– Self consolidating concrete (SCC), workmanship, vibrators, honey comb and air bubbles.

I. HISTORY

Self consolidating concrete was conceptualized in the year of 1986 by Prof. Okamura at Ouchi University, Japan. The main reason for introducing this technique was that the labour at that time was at limited in supply, which was causing difficulties in the concrete related industries. This product was based on technologies used in under water concrete placement. The application of these criteria in the Akashi- kaikyo bridge – Anchor blocks, 180,000 cubic yards of SCC. Moreover, test methods and procedures were well established. The first generation of SCC was used in North America and was characterized by the use of relatively high content of binder as well as high dosages of chemicals and admixtures and usually super plasticizer to enhance flow ability and stability. In Europe this method was first used in the field of transportation engineering works in Sweden in the mid 1990's.

II. INTRODUCTION

Self compaction of concrete (SCC) is a technique that does not require any external source of vibration, means no vibrator is required for placing and compaction. In these innovative technique concrete flows under its own weight completely filling the form work and achieving its full compaction. Self compaction of concrete has the following properties:- such as it produces low yield stress, high deformability, good segregation and moderate viscosity. This method can be used in relatively highly reinforced sections and in places where there is no requirement of vibrator for compaction and typical complex shapes and form works. Self compacting concrete offers rapidly a new ease of doing construction work in many sectors resulting in faster construction and ease of flow in the small congested areas of reinforcement. The properties such as fluidity and segregation of SCC results in high level homogeneity reduce concrete voids and uniform concrete strength. Hence providing the potential ability and durability of the structure. This idea of SCC has not only given the improvement of doing construction work faster but also environmentally this idea is very useful because the use of vibrators may produce noise resulting in noise pollution and effecting the environment. This improved construction practice not only thinks economically but environmentally also. Current Indian scenario in construction shows increased construction of large and complex structures, which often leads to difficult concreting conditions. Vibrating concrete in congested locations may cause some risk to labor in addition to noise stress. There are always doubts about the strength and durability placed in such locations. So it is worthwhile to eliminate vibration in practice, if possible. In countries like Japan, Sweden, Thailand, UK etc., the knowledge of SCC has moved from domain of research to application. But in India, this knowledge is to be widespread.

III. LITERATURE REVIEW

The literature review is categorized in four parts Admixtures, Development of SCC, Fiber reinforced SCC and Fiber Reinforced Concrete Wall Panels.

3.1. Admixtures

3.1.1 M Ouchi, Hajime Okamura (1997)-The writers have reported the effect of super fertilizers on the parameters of flow ability and viscosity of self compaction of concrete. As the results obtained after investigation seems that, they have proposed an index on the effect of super fertilizer and viscosity in order to obtain self compact ability.

3.1.2. Gao Peiwei., et al. (2000)-Concrete is generally made of three fundamental materials such as cement, aggregates and water. In the mix, the water cement ratio plays an important role. Now in this new era the High Performance Concrete has come into existence in the concrete construction industries. For having high performance concrete use of chemical admixtures, minerals, viscosity modifying agents are necessary apart from the fundamental materials. The main motive now a days is to reduce the content of cement in HPC. The following are the reasons:-

A) Preserve natural resources.
B) Reduction of cost and energy.
C) To get durability.

3.1.3. Neol P Mailvaganam (2001)-Mineral and chemical admixtures get reacted with the cement and undergoes in the process of hydration. The reaction of these admixtures with the concrete depends on the variety of admixture and dosage, its proportion, design mix, specifics surface area of the cement, humidity, temperature and conditions of curing. The study of compact ability of cement and mixture is necessary to know the use of this material.

3.1.4. Raghu Prasad P.S. et al. (2004)-According to these researchers, the setting time of cement is delayed both initial and final. The main reason for delay of setting time initially and finally is the use of admixtures and slow pozzolonic reaction caused by using some admixtures. They concluded that this type of delay sometimes is beneficial during concreting in hot weather.

3.2. Development of Self Compaction Concrete (SCC)

3.2.1. Kuroiwa [1993]- He introduced a new type of concrete using the fundamental materials as used in normal concrete such as cement, aggregates, water and admixtures. By the use of chemical admixtures the deformability and viscosity was improved. They newly introduced concrete was called as super workable concrete. This concrete fills heavily reinforced, complex formworks completely without using the external vibrators.The test done in the laboratory shows that the type of concrete shows superior fresh and hardened state properties with good durability.

3.2.2. Okamura et al. (1995)-Developed a new concrete in which that flows under its own weight and get compacted in small form works. Professor Kokubu of Kobe University, Japan was the one who suggests to do research to develop a new type of concrete that flows under its own weight and gets compacted without the use of vibrators. He was the main advisor of Okamura.There ideas results in developing new concrete called as anti wash out concrete, which was already in use. This new developed concrete was used in under water concreting structures with the use of large amount of viscosity modifying agents. The use of modifying agents helps the cement particles not to disperse in the water.

3.2.3. Khayat K. H (1999)-He studied the properties of viscosity enhancing admixtures used in chemical mixture of concrete.After studying the behavior he concluded that by properly adjusting the combination of viscosity enhancing admixture and high range water reducing agent , a fluid without washout resistant can be produced. However this will improve the properties of underground water and will increase the Ph value of surrounded water.

3.2.4. Nan Su, Kung-Chung Hsu and His-Wen Chai (2001)-He came out with the proposal of new mix design procedure for SCC and its aim was to fill voids present in the loosely filled aggregates with the use of binding agent. He proposed a factor called Packing Factor (PF) for aggregate. This is defines as the ratio of mass of aggregate in tightly packed state to the mass of

aggregate in the loose state. If we get higher value of PF that shows larger content of aggregate which requires less binding agent and will have less flow ability.

3.2.5. Ho.D et al. (2002)-He studied the usage of quarry dust in SCC applications.

3.2.6. Hajime Okamura and Masahiro Ouchi (2003)-The author computed that SCC was first developed in 1988 in Japan in order to achieve durable concrete structure. Since after that many researchers have been carried out and the idea of SCC was used practically in the structures was Japan, in order to shorten the construction period .The example are:-

A) Anchorages of Akashin-Kaikyo (Akashi Straits) Bridge opened in April, 1988.
B) Suspension bridge (Kashima 1999) which has longest span (1,991 meters) in the world is the remarkable example of this technique.
C) SCC was also used in the large LNG tank, which belong to the gas company called Osaka.

3.2.7. Cho-Lung Hwang And Chich-Ta-Tsai (2005)-He used three different types of aggregates which was having different paste content in the percentage of 1.2 , 1.4, 1.6, 1.8 and 2.0% of voids in aggregates. These were the major parameters to know the properties of SCC. When the results declared it shows that under sufficient paste content good work ability and good engineering properties were obtained with denser aggregate packing.

3.3. Fiber Reinforced Concrete

3.3.1. M. Veera Reddy and M.V. Seshagiri Rao (2007)-He presented a complete mathematical model for stress strain relationship for steel fiber reinforced high-strength concrete and observed that analytical model obtained was in close comparison with the experimental test data. Besides that he concluded that second degree polynomial form suggested by Saenz is of the better fit which is the same as reported by MLV Prasad, P. Rathish Kumar et al (2009) in the case of GFRSCC.

3.3.2. MLV Prasad, P. Rathish Kumar and Toshiyuki Oshima, 2009-He noticed that the presence of SCC in glass fibers improved the strain at peak stress and it shows that strain at peak stress varies linearly.

3.3.3. Pedro J.D. Mendes, Joaquim A.O. Barros, Jose M. Sena-Cruz and Mahsa Taheri (2011) -The author performed an experiment on 12 meter long bridge which consists of two I profiles. In this the combination of both fibers reinforced SCC and Steel Reinforced Polymer was shown. Due to this cracks, tensile strength and durability was improved.

3.3.4. Valeria Corinaldesi and Giacomo Moriconi (2011) -This paper deals with the investigation of properties of SCC using three different types of fibers that are Steel, Poly-Vinyl-Alcohol and Poly Propylene high tough fibers. In this practice they have added the lime powder and recycled concrete powder. The properties of fresh and hardened concrete such as work ability, strength and shrinkage were evolved and observed that SCC with the above fibers had good durability.

3.4. Fiber Reinforced Concrete Wall Panels

3.4.1. Joaquim Barros, Eduardo Pereira and Simao Santos (2007)-The author motive was to study the light weight precast panels used for building. His main motive was to get the SFRSCC post crack behaviour.These panels are studied to get the access of age on SFRSCC fracture behaviour.In order to get the punching resistance and flexural strength SFRSCC prototype panels were tested. At the end he concluded that negative bending moment was formed and punch crack were observed on the bending of steel plates.

3.4.2. N. Abdul Rahman, S.H. Hamzah and E.T Wong (2008)-This paper deals with the steel fiber reinforced panel under axial compression with the end conditions applied pinned fixed end, until its failure. After performing experiment results indicate that steel fiber wall panels sustained more than 30% carrying capacity compared to the axial design load.

3.4.3. R.L. Sreenivasa, Ph.D Thesis (2010)-The experiment was performed to know the axial compressive strength and stiffness of unfilled concrete M20and RC filled wall panels. After completion of experiment it was found that there was increase in axial compressive strength and stiffness due to filling of wall panels. There was increase found in eccentric loading for filled wall panels but not in unfilled wall panels.

IV. CONCLUSION

To scuttle up my points, as in India the use of SCC technique is not much as compared to other countries like Canada, America, Japan, Sweden, Thailand, U.K. etc. The reason of less wide spread of this Self compacting of concrete is lack of awareness. SCC is used in routine construction in many countries and is resulted to be beneficial. The advantages of this technique are as follows.

1. It reduces the time during the construction work.
2. It requires less workmanship.
3. In compacted areas and in congested form works this methodology is useful.
4. As in this technique no vibrators are requires so there is no noise pollution.
5. This technique is not only economical but environmentally also it's very useful.

V. REFRENCES

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