Self Compacting Concrete

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Abstract- *Self Compacting Concrete (SCC) has many benefits in terms of production and placement compared to traditional concrete namely, elimination of external or internal vibration for compaction, better flowability, workability and pumpability, as well as increased bonding with congested reinforcement. The placement of SCC is faster and requires less labour. The appearance (surface finish), mechanical performance and durability of SCC can be considerably better than traditional concrete. Self compacting concrete is less tolerant to abrupt changes in aggregate moisture content, chemical admixtures and water content.*

I. SCOPE AND OBJECTIVE

- To design a suitable SCC mix utilizing local aggregates and locally available materials.
- To assess the strength development and durability of SCC exposed to thermal and moisture variations.
- To analysis the cost of the SCC.

II. MECHANISM FOR THE TECHNOLOGY

The self-compatibility of fresh concrete depends mainly on its ability to flow through obstacles (Fig.1). The method for achieving self-compactability involves not only high deformability of paste or mortar, but also resistance to segregation between coarse aggregate and mortar when the concrete flows through the confined zone of reinforcing bars

- Limited aggregate content;
- Low water-powder ratio;
- Use of superplasticizer.

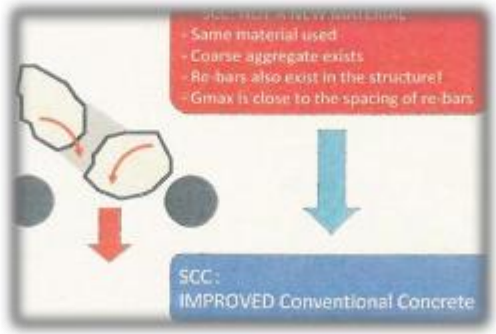

Fig1.a. Flowablity through Obstacle

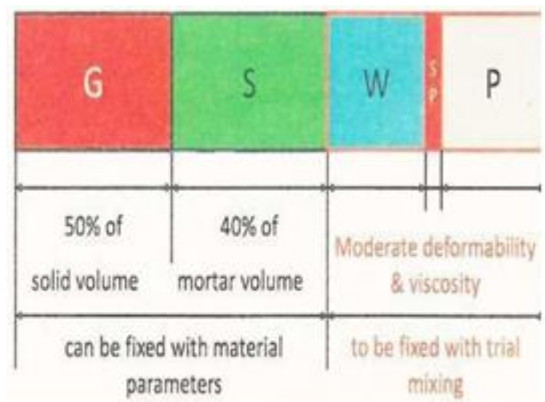

Fig 1.b: Rational mix-design

Characterizing high- performance concrete method for self-compacting

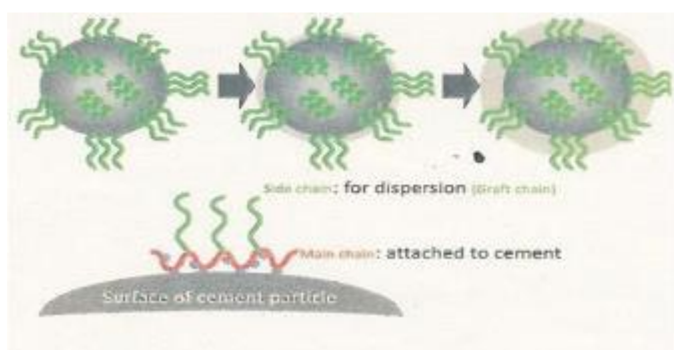

Fig 1.3 Poly-Carboxylate Type Of Superplasticizer Suitable For Self-Compacting High-Performance Concrete

CHARACTERISTICS OF SELF -COMPACTING CONCRETE

Properties Of Self -Compacting Concrete

Self-compacting concrete has excellent self-compactability and can be filled in all comers of forms without vibratory compaction, which is essential for conventional concrete. In addition, it has the following characteristics:

1. Self-compacting concrete contains a lower coarse aggregate content and higher dosage of air-entraining and high-range water-reducing admixture or super plasticizer than conventional concrete.
2. Self-compacting concrete causes smaller amount of bleeding water and laitance than Conventional concrete.

III. MEHODOLOGY

Methodology deals with the procedure of entire project in step by step process. From this we can study & understand the project easily.

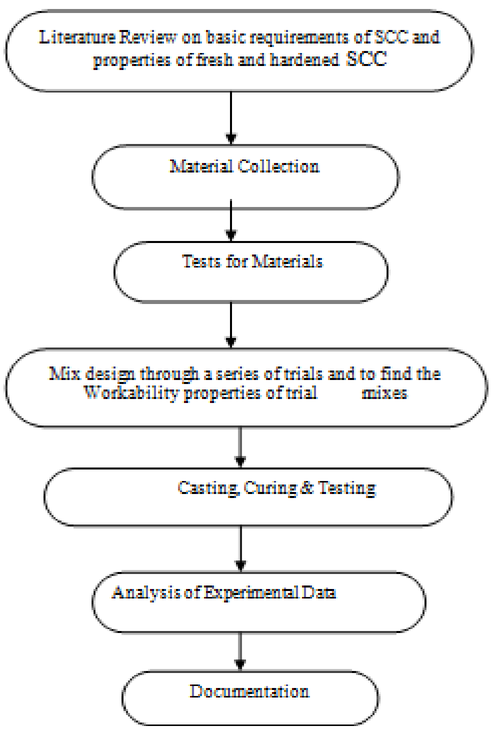

Fig2. Methodology for SC

General engineering properties

Self-compacting concrete and traditional vibrated concrete of similar compressive strength have comparable properties and if there are differences, these are usually covered by the safe assumptions on which the design codes are based

- Compressive strength
- Tensile strength
- Modulus of elasticity
- Creep
- Shrinkage
- Coefficient of thermal expansion
- Bond to reinforcement
- Shear force capacity in cold joints
- Fire resistance

IV. MATERIALS OF SCC

The constituent materials used for the production of SCC are the same as those for conventionally vibrated normal concrete except that SCC contains lesser aggregate and greater powder (cement and filler particles smaller than 0.125 mm). Fly ash, glass filler, limestone powder, silica fume, etc are used as the filler materials. To improve the self-compatibility, without segregation, a superplasticizer along with a stabilizer is added.

POWDER (Mixture of Portland Cement And Micro Filler)

The term 'powder' used in SCC refers to a blended mix of cement and filler particles smaller than 0.125 mm. The filler increases the paste volume required to achieve the desirable workability of SCC.

CEMENT

In our project, we are using OPC-53 grade cement which is confining to IS 12269-2013. The specific gravity of cement is 3.15. Cement used for SCC should not contain C3A content higher than 10% to avoid the problems of poor workability retention (EFNARC, 2002). Selection of the type of cement depends on the overall requirements for concrete, such as strength and durability.

Fig 3: Ordinary Portland cement

FLY ASH

Fly ash is also known as flue-ash, it is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. In an industrial context, fly ash usually refers to ash produced during combustion of coal. In India, fly ash was used for the first time in construction of Rihand Irrigation Project, Uttar Pradesh in 1962, replacing cement up to about 15%.

Fig 4. Class F Fly ash

AGGREGATES

Coarse Aggregate

Coarse aggregates are the portion of the aggregates used in concrete that are larger than 4.75 mm in size. Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. Earlier, aggregates were considered as chemically inert materials but now it has been recognised that some of the aggregates are chemically active and that certain aggregates exhibit chemical bond at the interface of aggregate and cement paste.

Fig 5: Coarse Aggregate

Fine aggregate

Fine aggregate is the portion of the aggregate that is less than the size of 4.75 mm in size. Fine aggregates are one of the important constituents of concrete. They help to fill the voids in coarse aggregate. They are three types of sand namely natural sand, manufactured sand and crushed sand.

ADMIXTURES

Superplasticizer:

Superplasticizers also known as **high range water reducers**, are chemical admixtures used where well-dispersed particle suspension is required. These polymers are used as dispersants to avoid particle segregation (gravel, coarse and fine sands), and to improve the flow characteristics (rheology) of suspensions such as in concrete applications.

Aura mix 400

Aura mix 400 is a unique combination of the latest generation superplasticizers, based on a polycarboxylic ether polymer with long lateral chains. This greatly improves cement dispersion.

Fig 6: Superplasticizer- Auramix 400

Viscosity modifying agent

The key function of a VMA is to modify the rheological properties of the cement paste. The rheology of fresh concrete can be mainly described by its yield point and plastic viscosity

Fig 7: Viscosity modifying agent

MIX DESIGN

There is no standard method for SCC mix design and many academic institutions, admixture, ready-mixed, precast and contracting companies have developed their own mix proportioning methods.

Test For Fresh Concrete

1. Slump flow test(As per EN12350-8:2010)
2. L-Box test(As per EN12350-9:2010)
3. V-funnel test(As per EN12350-10:2010)

V. CONCLUSION

As no specific mix design procedures for SCC are available, the mix design can be done with the conventional absolute volume method, and suitable adjustments can be done as per the guidelines provided by different agencies, especially by EFNARC 2005.

An analytical model is developed, using the multiple regression based on the analysis of the test results, to predict the targeted compressive strength of the SCC, after 28 days of curing by satisfying the workability characteristics.

A mix design method, based on the multiple regression analysis, is proposed as a modification of the existing method, by incorporating a high volume of fly ash with different strength grades of the SCC.

REFERENCES

[1] H. Okamura, “Self Compacting High Performance Concrete – Ferguson Lecture for 1996,” Concrete International, Vol. 19, No. 7, 1997, pp.

[2] K. Ozawa, K. Maekawa, and H. Okamura, “Development of the High Performance Concrete,” Proceedings of JSI, Vol. 11, No. 1, 1989, pp.

[3] H. Okamura and M. Ouchi, “Applications of Self-Compacting Concrete in Japan,” Proceedings of the 3rd International RILEM Symposium on Self-Compacting Concrete, O. Wallevik and I. Nilsson, Ed., RILEM Publications, 2003, pp.

[4] Testing SCC: Measurement of properties of fresh SCC, Contract GRD2-2000-30024, 2000.

[5] EFNARC, “Specifications and Guidelines for Self-Compacting Concrete”,

[6] EFNARC, UK (www.efnarc.org), may 2005, pp. 1-32

[7] N. Mishima, Y. Tanigawa, H. Mori, Y. Kurokawa, K. Terada, and T. Hattori, “Study on Influence of Aggregate Particle on Rheological Property of Fresh Concrete,” Journal of the Society of Materials Science, Japan, Vol. 48, No. 8, 1999, pp.

[8] Y. Kurokawa, Y. Tanigawa, H. Mori, and K. Nishinosono, “Analytical Study on Effect of Volume Fraction of Coarse Aggregate on Bingham’s Constants of Fresh Concrete,” Transactions of the Japan Concrete Institute, Vol. 18, 1996, pp.

[9] S. Grunewald and J. C. Walraven, “Parameter-Study on the Influence of Steel Fibres and Coarse Aggregate Content on the Fresh Properties of Self-Compacting Concrete,” Cement and Concrete Research, Vol. 31, No. 12, 2001, pp.

[10] L. J. O’Flannery and M. M. O’Mahony, “Precise Shape Grading of Coarse Aggregate,” Magazine of Concrete Research, Vol. 51, No. 5, 1999, pp.