MIX DESIGN PROCEDURE FOR SELF COMPACTING CONCRETE

S. Venkateswarlu[1], N. Vikram[2]

[1]Student, Civil Department, Gandhiji Institute of Science and technology, Andhra Pradesh, India
[2] Assistant Professor, Civil Department, Gandhiji Institute of Science and technology, Andhra Pradesh, India

ABSTRACT

Self-compacting concrete (SCC) has upgraded qualities and enhances profitability and working conditions because of end of compaction. SCC is appropriate for setting in structures with congested support without vibration and it helps in accomplishing higher nature of surface completions. However usage of high receptive Metakaolin and Flyash as an admixtures as a viable pozzolan which causes awesome change in the pore structure, additionally similarity is influenced by the attributes of materials and the blend extents, it winds up plainly important to advance a methodology for blend outline of SCC .In this paper exhibits an exploratory technique for the plan of selfcompacting concrete blends. The relative extents of key parts are considered by volume instead of by mass. A straightforward apparatus has been intended for self compacting concrete (SCC) blend outline with 29% of coarse total, supplanting of bond with Metakaolin and class F flyash, Mixes of both and controlled SCC blend with 0.36 water/cementitious ratio(by weight) and 388 liter/m3 of bond glue volume. Smashed rock stones of size 16mm and 12.5mm are utilized with a mixing 60:40 by rate weight of aggregate coarse total. Definite strides are talked about in this review for the SCC and its mortar.

Keyword *Self compacting concrete, Metakaolin, Flyash, mix design, simple tool*

1. Introduction

In Japan, in early eighties, premature deterioration of concrete structures were detected almost everywhere in the country. The main cause of the deterioration was recognized as inadequate compaction. In addition, the gradual reduction in the number of skilled workers in Japan's construction industry led to a reduction in the quality of construction work. As a solution for these social and technical requirements, the concept of SCC was proposed by Prof Okamura1 at Tokyo University in 1988. He gave the first prototype of SCC using materials already in the market. Later studies to develop SCC, including a fundamental study on the workability of concrete, were carried out by Ozawa and Maekawa2 . SCC has now been taken up with enthusiasm across Europe and other parts of the world, in both site and precast concrete work. Practical application has been backed up by research on its physical and mechanical characteristics of SCC.Early SCC relied on very high contents of cementitious paste, the mixes required specialized and well-controlled placing methods to avoid segregation, but the high contents of cement paste made them prone to shrinkage and high heat generation. The overall costs were very high and applications therefore remained very limited. After series of advancements it is no longer a material consisting of cement, aggregates, water and admixtures. As already mentioned it is now an engineered material with several constituents.

A. Basic Principle

The SCC is that which gets compacted due to its selfweight and is deaerated (no entrapped air) almost completely while flowing in the form work. In densely reinforced structural members, it fills completely all the voids and gaps and maintains nearly horizontal concrete level after it is placed. With regard to its composition, SCC consists of the same components as conventionally vibrated normal concrete, ie, cement, aggregates, water, additives or admixtures. However, the high dosage of super-plasticizer used for reduction of the liquid limit and for better workability, the high powder content as 'lubricant' for the coarse aggregates, as well as the use of viscosity-agents to increase the viscosity of the concrete have to be taken into account. Superplasticizer enhances deformability and with the reduction of water/powder segregation resistance is increased. High deformability and high segregation resistance is obtained by limiting the amount of coarse aggregate. These two properties of mortar and concrete in

turn lead to selfcompactability limitation of coarse aggregate content. Figure 1 shows the basic principles for the production of SCC.

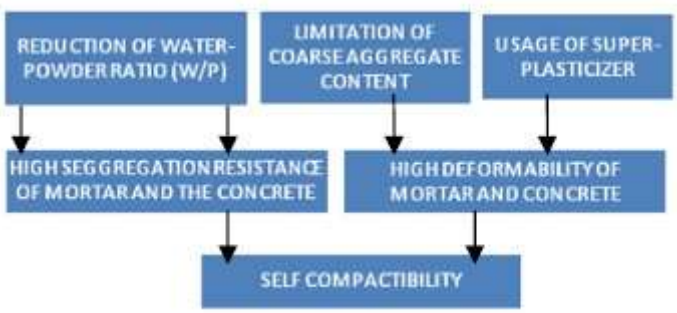


Fig. 1.Basic principles for production of self-compacting concrete

At the stage before solidification, self-compacting concrete is required to have three qualities: high-flowability, resistance against segregation and passibility, ie, ability that is necessary to pass the space between reinforcing bars. Other additional properties, such as, washout resistance and finishability, may be significant and specified for individual projects/applications. Therefore, it is important to test whether the concrete is selfcompactable or not and also to evaluate deformability or viscosity for estimating proper mix proportioning if the concrete does not have sufficient selfcompactability. The existing procedures for self-compacting characteristics are those, which measure height differences at different points under free flow and also resistance against blocking. The common tests currently used, although not standardized for assessment of fresh SCC, are described here. 1. Slump Flow Test for Measuring Flowability: The basic equipment used is the same as for the conventional Slump test4 (Figure 2). The test method differs from the conventional one in the way that the concrete sample placed into the mould has no reinforcement rod and when the slump cone is removed the sample collapses. The diameter of the spread of the sample is measured, ie, a horizontal distance is measured as against the vertical slump measured in the conventional test. While measuring the diameter of the spread, the time that the sample takes to reach a diameter of 500 mm (T50) is also sometimes measured. The Slump Flow test can give an indication about the filling ability of SCC and an experienced operator can also detect an extreme susceptibility of the mix to segregation. However, this information cannot be obtained from numerical results alone, a substantial previous experience in using the test and carrying out construction in SCC is essential.

2.Material Properties

This section will present the chemical and physical properties of the ingredients. Bureau of Indian Standards (IS) and American Society for Testing and Materials (ASTM) procedures were followed for determining the properties of the ingredients in this investigation.

Parameters for mix design M40:
Grade Designation = M40
Type of cement = O.P.C43grade
Admixture = Metakaolin
Fine Aggregate = ZoneII
Sp. Gravity Cement = 3.15
Fine Aggregate = 2.61
Coarse Aggregate (20mm) = 2.65
Coarse Aggregate (10mm) = 2.66
Minimum Cement (As per contract) = 400 kg / m3
Maximum water cement ratio (As per contract) = 0.45

Fig.2 Shows the Equipments used for the Experiment

- Mould the shape of truncated cone with the internal dimensions 200 mm
- diameter at the base 100 mm diameter at the top and a height of 300 mm.
- base plate of a stiff non absorbing material, at least 700 mm square, marked
- with a circle marking the central location for the slump cone, and a further
- concentric circle if 500 mm diameter.
- Trowel
- Scoop
- Ruler
- Stopwatch

3. Procedure

- About 6 liters of concrete is need to perform the test, sampled normally
- Moist the base plate and inside slump cone
- Place base plate on level stable ground and slump cone centrally on the base
- plate and hold down firmly.
- Fill the cone with the scoop. Do not tamp, simply strike off the concrete level
- with the top of the cone with the trowel.
- Remove any surplus concrete from around the base of the cone.
- Raise the cone vertically and allow the concrete to flow out freely
- Simultaneously start the stopwatch and record the time taken for the concrete
- to reach the 500 mm spread and record the time taken for the concrete to reach
- the 500 mm spread circle.
- Measure the final diameter of the concrete in two perpendicular directions.
- Calculate the average of the two measured diameters (in mm).
- 10.Note any border of mortar or cement paste without coarse aggregate at the
- edge of the pool of concrete.

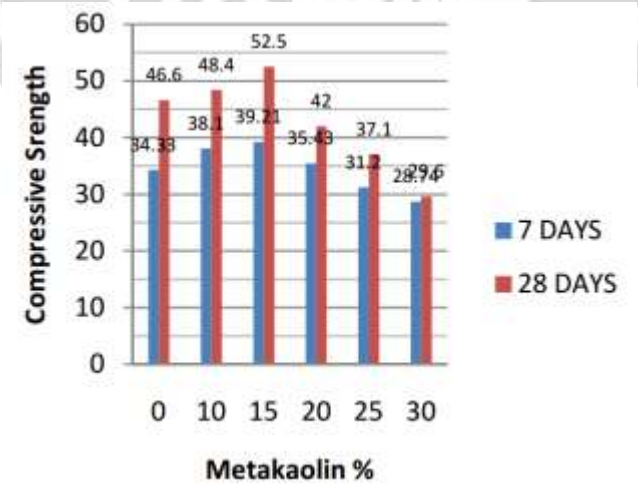
Fig-3. Showing the apparatus & Slump flow is measuring with Tape.

Fig:4 showing the Equipments used for V-funnel Experiment.

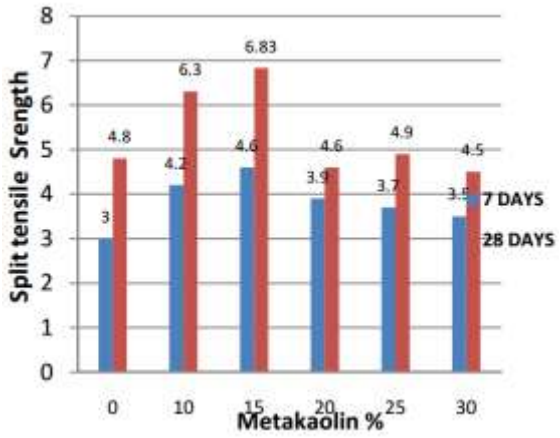
Fig:5. L-Box Apparatus

4. Test and Result

Compressive strength is one of the most important and useful property of concrete. Compressive strength of concrete is considered as a qualitative measure for other properties of hardened concrete. In the present study, the compressive strength test has been conducted on cube specimen of 15cm side. The compression strength test is undertaken as per the provisions mentioned in IS: 516–1959. For given water cement ratio, the compressive strength for SCC mix will be higher as compared to normally vibrated concrete. This is on account of improved interface between aggregate and hardened paste.. The compressive strength of the hardened SCC mix was measured at 7 days, 28 days .



Graph:1. Graph Showing Compression Strength at Various Proportions of Metakaolin



Graph:2. Graph Showing Split Tensile Strength at Various Proportions of Metakaolin

The tensile strength is one of the basic and important properties of the concrete. The concrete is not usually expected to resist the direct tension because of materials and the long time ecological effect of such techniques have been considered. Utilized the impacts of Red mud on the unconfined compressive quality Red mud as a concrete stabilizer, swelling rate of compacted earth liners as water powered obstruction and study pressure driven conductivity. The test outcomes demonstrate that compacted mud tests containing cement-Red mud and Red mud added substances have diminished water driven conductivity and high compressive quality and swelling rate when contrasted with normal earth tests. Thusly, it is presumed that cement-Red mud and Red mud materials can be effectively utilized for the adjustment of dirt liners in geotechnical applications. The 28-day 2 compressive quality of the bond quality can achieve 63MPa and has concentrated the planning of conventional Portland concrete from Red mud, free stone and lime.

5. CONCLUSIONS

The accompanying conclusions can be drawn on the premise of SCC blend configuration apparatus Self-Compacting Concrete is thought to be the most encouraging building material for the normal progressive changes at work site and also on the work area of architects and structural specialists. Self compacting solid blend configuration device is produced in view of the key extents of the constituents. This instrument is extremely straightforward and easy to understand for the self compacting solid blend outline. It can be utilized for the SCC blend with or without mixed bond and coarse total with or without coarse total mixing. This instrument can likewise be upgraded for multi mixed concretes with more added substances and furthermore helpful for Self compacting mortar plan. It shows every single fundamental data for SCC blend plan and furthermore shows constituent materials for SCC or SCM for the required volume.

6. REFERENCES

[1] IS recommended method from IS: 10262-2009.
[2] IS recommended method from IS: 456-2000.
[3] Marcio R. Morelli, Joao A. Labrincha and Daniel VerasRibeiro, published in 2010, Materials research, “Potential .use of natural red mud as pozzolana for Portland cement”, Vol. 14, PP. 60-66.
[4] S.K. Gowtham, M.P.Suresh Kumar, published in 2015 ‘Potential utilization of industrial waste red mud in concrete’.
[5] Shinde T. B, Kamble D. B and Sawant B, published in 2016, Int jour of Innovative Research in Science and Engineering, Utilization of industrial waste (red mud) in concrete construction, Vol2 (3), pp 112-121
[6] Rajput S, Akhtar S and Kushwaha M published in 2013, Int. Journal of Engineering, Research and Applications (IJERA) Development of the Self Compacting Concrete By Industrial Waste (Red Mud), Vol. 3 (4), pp 539-542.