SMART DYNAMIC CONCRETE (SDC)

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ABSTRACT

Self-Consolidating Concrete (SCC) has tremendous benefits increasing productivity and overall efficiency and was poised to be very successful since its evolution in Japan (‘80s). However, the cost per cubic metre of SCC became a deterrent in the matured markets of Australia, Japan; or, the emerging markets of China, India and ASEAN countries, Hence SCC could never dominate traditional vibratable or pumpable concrete.

In today’s context, almost 65% of the traditional vibratable concrete classes are between 20-32 MPa. By default, classical SCC requires high fines content and any SCC specified by the consultant and subsequently produced by the concrete producer is an “overdesign”.

Today, low fines self-consolidating concrete, i.e. <340 – 380 kg / m^3 of cementitious content has become a reality for the lower grades of concrete. Low fines yet self-consolidating concrete. Low fines yet self-consolidating concrete uses a new state of the art synthetic viscosity modifying agent (VMA) incorporated in special Polycarboxylate ether (PCE) based hyperplasticizer. This low fines, self-consolidating, sustainable solution will help boost productivity and efficiency to help engineers, owners, and concrete producers, realize their respective dreams. Low fines SCC (referred to as smart Dynamic Concrete) realizes a host of benefits – economic (reduction of fines), enduring (durable), ecological (low fines) and ergonomic (almost negligible vibration)..

SDC: *Smart Dynamic Concrete*

1. Introduction of SDC

SDC is a special concrete which is highly flowable, non-segregating and by its own weight spread into place and completely fill the formwork even in the presence of dense reinforcement. SDC offers several economical and technical benefits. The concept of Self Compacting Concrete (SCC) was first developed in Japan in the 1980’s. Its use in the precast concrete is quite prevalent in several European countries and the USA. In the ready-mixed concrete industry however, the use of SCC is limited and restricted to specialized projects and applications despite all the benefits it offers. One of the main reasons why SCC is not commonly employed in the ready mixed industry is the higher cost associated with such mixes.

1.1 Advantages of SDC

SDC requires minimal to no vibration due to its self-compacting properties, thereby resulting in lower energy and manpower utilization. Demoulding can done in ust 16 hours and faster rotation of the formwork or in other words, shorter cycle times resulted in overall cost savings and more importantly, earlier completion times. Excellent surface finish with no honeycombing and voids is can be achieved with SDC, Hence, the repair costs of concrete members cast with SDC can be maintained at a low level. Similarly, the need for plastering of exposed faces as is common practice in most parts of the country prior to painting can be eliminated. SDC reduces the carbon footprint of concrete and the construction processes because of the lower cementitious content, less energy, lower in-place costs, better finishability and enhanced durability.

SDC is an attractive proposition for designers, contractors and owners because it is economically viable without compromising aspects such as the durability of structures.

1.2 VMF and Superplasticisers

Most VMA's are based on high molecular weight polymers with a high affinity to water. The strength of the three dimensional structure affects the extent to which the yield point is increased. **RHEOBUILD 619 RM As VMF and GLENIUM SKY 8233 As Super Plasticizer.**

2. MIX RATIO

Mixing of concrete may be done by hand and machine. Mixing should be done thoroughly so as to have a uniform distribution of ingredients which can be judged by uniform colour and consistency of concrete.On a clean, hard and water tight platform cement and sand are mixed. Dry using shovels untill the mixture shows the uniform colour. Then, aggregates are added thoroughly mixed using shovel untill the ingredients are uniformly mixed.

Mix Base	Water (l)	Cement (Kg)	Fine Aggregated (kg)	Coarse Aggregate (kg)	VMF kg	Super plasticizers kg
Weight	197	358	681	1112	3.58	1.79
Ratio	w/c= 0.55	Ratio = 1 : 1.9 : 3.1				

Table -1 Mix Ratio

2.1 Testing of RCC beam

Placing the R.C. beam on the simply supports, so that the projection beyond the supports are symmetrical. Fix the LVDT and deflectometer to the center of the beam.

Place the load cell on the top. Do the initial correction so that the dial in the deflect meter read zero, now the load is applied gradually and respective deflection are measured from deflectometer.

Data is also collected from the computer to regular interval. Three samples of each testing of concrete were tested to detrmine the 28 days compressive strength, flexural strength, split tensible strength and Test on RCC beam with Two Point Load application.

Fig-1 Casting of RCC beam

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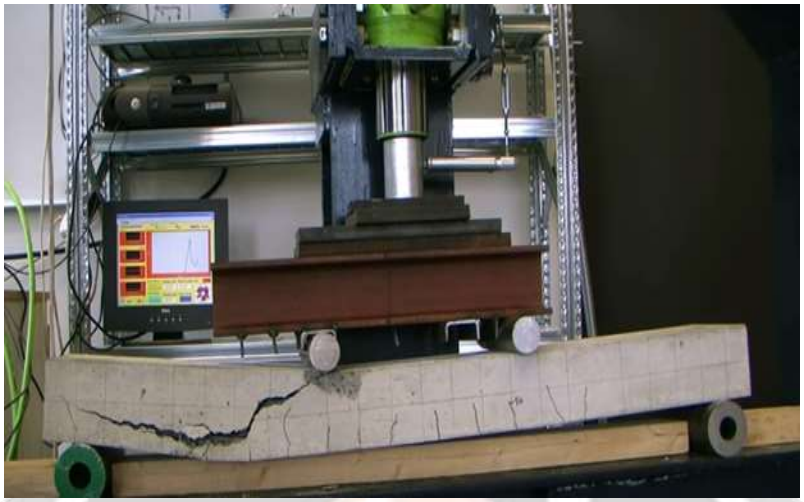
The load frame testing machine with 50 tonnes capacity was used for testing the specimens.For reinforced concrete beam size of the beam is 1000mm x 100mm x 150mm.



2.2 Ductile Flexural Failure

The steel force remains constant at Asfy with further loading, a slight additional load causes large elongation of the steel across the flexural cracks, resulting in wide cracking and a large increase in the strain at the extreme compression fiber of the concrete. This occurred due to yielding of the internal tensile steel reinforcement followed by concrete crushing at mid span section for control beams. Sagging flexural failure of control beam occurred as a result of the yielding of the tensile steel reinforcement at the beam mid span.

Load (KN)	Deflection(mm)
3	1.4
6	4.2
9	6.6
12	8.4
14.27	14.2

Table -1 Load-Deflection.

3.0 FLEXURAL STRENGTH

Tests are carried out on 1000 x 150 x 100 beams conforming to IS 516: 1959 to obtain the fleural strength at the age of 28 days in the flexural tests a standard plain concrete beam of rectangular cross section is simply supported and subjected to central point loading until failure.

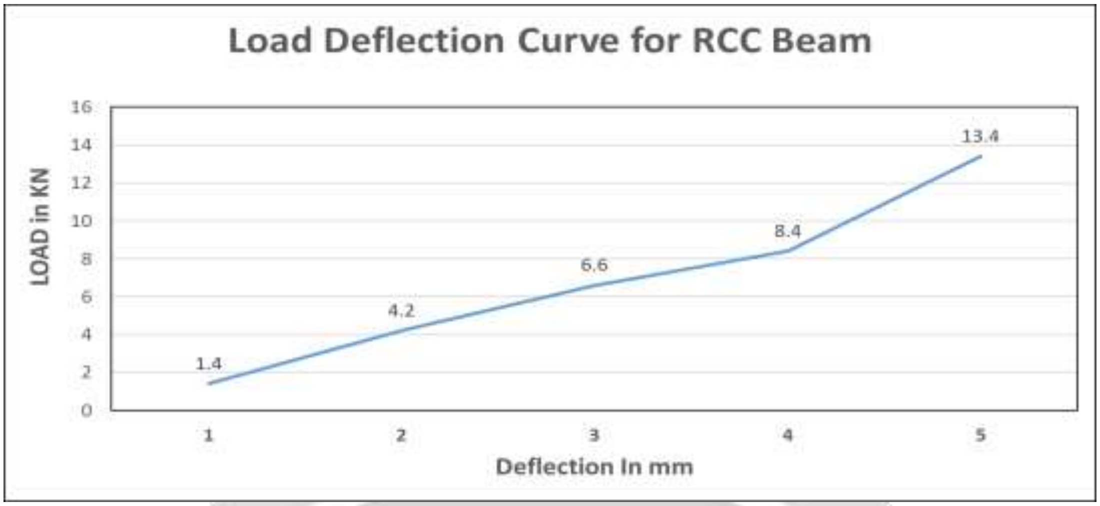


Chart -1 Load Deflection Curve

4. CONCLUSIONS

The use of SDC can be extended to "everyday" concrete in the ready-mixed and precast concrete industries. . SDC is an attractive proposition for designers, contractors and owners because it is economically viable without compromising aspects such as the durability of structures. SDC can be used as a substitute to normal conventional concrete because of its zero repair works in post concrete (honey combs causes 15% extra cost for repair/grouting. . As SDC is homogeneous high viscous mix, it can be poured from the max. 4mt height without any segregation. Flow of SDC is from 550-650mm. 50% of labour charges can be avoided while placing concrete (as it is self-flowing and self-compacting concrete, it does not require much man power while placing).

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