Compare the Fresh and Hardened State Properties of Self Compacting Concrete Produce by Using Fresh and Recycled Aggregate

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CHAPTER-1

INTRODUCTION

1.1 General

Self-compacting concrete (SCC) is a smooth concrete mixture that be bright to combine below its personal load. The extremely liquid life of SCC makes it proper for placing in hard situation and in sections with heaving reinforcement. Use of SCC can also help reduce inquiry-connected damage on the worksite that is inducing by shaking of concrete. Any more benefit of SCC is that the moment in time necessary to position outsized sections is greatly cheap.

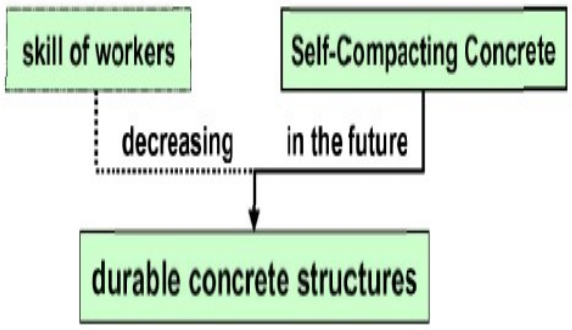


Fig.-1.1 Necessity for self-compacting concrete

After the assembly production in Japan experience a reject in the accessibility of capable labour in the 1980, a require was feel for a material that can beat the attempt of damaged workmanship. This guide just before the movement of self-compacting concrete, generally at some stage in the work by Okamura. An agency was produced to learn the properties of self-compacting concrete, include a basic study on workability of concrete, which was approved out by Ozawa et al. on the academe of Tokyo. The initial working version of self-compacting concrete was finished in 1988 and was name "High Performance Concrete", and presently planned as "Self Compacting High Performance Concrete". Self-compacting concrete offer an express price of concrete appointment, through earlier production period and no difficulty of stream approximately packed reinforcement. The flexibility and separation resistance of SCC ensure a far above the ground intensity of homogeneity, nominal material void and regular material strong point, given that the latent for a higher intensity of come to an end and toughness to the composition. SCC is repeatedly created among low downstream cement percentage given that the possible for far above the ground before time power, before remolding and closer make use of fundamentals and structure.

The removal of vibrate apparatus improve the surroundings going on and by construction and precast site somewhere concrete is individual to be found, dipping the experience of workforce to sound and shaking. The better constructions perform and performance, combine with the strength and protection settlement, build SCC a extremely attractive solution for both precast concrete and civil engineering construction.

In 2002 EFNARC available their "capacity & plan for Self-Compacting concrete" which, on with the purpose of end, present position of the ability in arrange on behalf of manufacturer and user. because at that moment, greatly extra technological information on SCC one-time available but European drawing, creation and assembly ideals do not until now specially pass on to SCC and for place application this has incomplete its wider acceptance, more than always by specify and purchaser.

In 1994 European organisations BIBM, CEMBUREAU, ERMCO, EFCA and EFNARC, everyone these organizations dedicated to the use of proceed material and systems designed for the make available and use of concrete, made a "European Project Group" to study and give their views for early best practice and to make a new report (code book) which cover every part of facet of SCC. This codebook **"The European Guidelines for Self Compacting Concrete"** serves to mainly those problems-(issue) connected to the absence of European qualifications, standards and decided test method.

Mixture size for SCC change from individuals of regular concrete, in that the previous has additional powder content and less coarse aggregate. Likewise, SCC in-corporate wide range water reducers (HRWR, super plasticisers) in higher

amounts and generally a viscosity modifier in small quantities. Major challenge is that to select the materials for SCC are: (a.) restrictions on the amount of marginally not suitable aggregates, i.e. , those not matching from ideal shapes and sizes, (b.) choice of super plasticiser, (c.) choice of viscosity modifier, and (d.) interaction and compatibility between cement, super plasticiser, and viscosity modifier. As vibrator is not required for compaction, with this environment improves near where concrete is being placed, by doing so workers are not exposed to noise and they work pleasant.

After structure made of concrete are demolish or renovate, concrete recycling is an gradually more general process of utilize the wreckage. Concrete be formerly more often than not trucked to landfills for dumping, previous than recycling has a amount of turnover that include through it a additional striking preference in this age of better ecological knowledge, additional ecological laws, and the need to maintain construction costs downwards.

Crushing at the concrete structure place by transportable crushers reduces structure expenses and the pollution generate after compared with transport material to and from a quarry. Great path-transportable plant life can compress concrete and blacktop rubble at up to 600 tons per hour or more.

1.2 Advantage

1. SCC is able to be found at a faster rate by means of no automatic shaking and a reduced amount of distribution, follow-on in investments in assignment overheads.
2. Better and further homogeneous architectural plane come to an end with small to no corrective plane work.
3. No difficulty of filling controlled sections and solid-to-arrive at area. Opportunity to produce structural and architectural shape and plane finish not possible with conservative concrete.
4. Better consolidation approximately reinforcement and relation with reinforcement.
5. Improved force capacity.

1.3 Disadvantage

1. Use of admixtures & super plasticizers influence the cost considerably.
2. Besides its numerous attributes it becomes uneconomical at small.
3. Adequate knowledge & experience is must to obtain self-compacting concrete.

1.4 What is Need to Use the Recycled Aggregates?

One of the most important challenges of our current culture is the safeguard of environment. Some of the important elements in this respect are the reduction of the consumption of energy and natural raw materials and consumption of waste materials. These topics are getting considerable attention under sustainable development now days. The make use of recycled aggregates since construction and destruction wastes is performance future purpose in construction as another to primary (normal) aggregates. It conserves normal resources and reduces the necessary for the landfill removal.

This project presents the new outcome of recycled common aggregate concrete and results are compared with the normal compressed aggregate concrete. The fine aggregate used in the concrete, recycled and predictable is 100% normal. The used collections are composed since four source every one demolish structure. For both types of concrete and w/c ratio, super plasticizer dosage, maximum size of aggregate and mix proportion are kept constant.

at all construction action requires several equipment such as concrete, steel, brick, stone, glass, clay, sludge, wood, and so on. Though, the cement concrete remainder the main construction material used in construction industries. Used for its suitability and flexibility with deference to the shifting surroundings, the concrete must be such that it can protect property, protect the environment, waste less and lead to suitable operation of energy. In the direction of absolute this, main meaning have to be laid on the use of wastes and by-product in cement and concrete used for new constructions. The utilization of used aggregate is mainly very capable as 75 percent of concrete is complete of aggregates. During that container, the aggregates measured are present slag, control place waste, recycled concrete, removal and quarrying wastes, waste glass, and incinerator remainder, red sludge, well done clay, sawdust, combustor dust and foundry smooth. The giant quantity of demolish concrete is available at different construction sites, which are at the moment pretense a serious problem of dumping in town areas. The major reasons for enlarge of quantity of destruction concrete / sandstone waste are as follow

1. various older buildings, concrete pavements, bridges and additional structures include defeat their become old and limit of use suitable to structural decline further than maintenance and have to be there demolish.
2. The structure, smooth enough to make use of is below destruction since they are not allocation the requirements in current situation.
3. Innovative construction for improved economic development.
4. Structures are turned interested in remains resultant starting normal disaster similar to earthquake, storm and floods etc.

At home various closely settled countries of Europe, anywhere dumping of waste problem is attractive more and more complicated, the recycling of destruction waste has before now be started. by the part of the equal time as per the inspection conducted in European Demolition Association (EDA) in 1992, the above a few recycling plant life were prepared in European countries such as 60 in Belgium, 50 in France, 70 in the Netherlands, 120 in United Kingdom, 220 in Germany, 20 in Denmark and 43 in Italy. The recycling of

construction & demolition waste becomes easy & economical, wherever combined project involving demolition and new construction are taken up simultaneously.

1.5 Indian Status

Present is harsh deficiency of infrastructural services similar to houses, hospitals, roads etc. in India and great quantity of construction materials for creating these facilities are needed. The development expenses to be paid just about 50% of investment spend for infrastructure progress in following 10th & 11th five year policy. Express infrastructural progress such highway, airports etc. and on the increase require for housing have led to shortage & get higher in cost of construction materials. Mainly of dissipate materials created by demolish structures inclined of by removal them as landfill. Removal of waste on ground is cause deficiency of removal position in town areas. For that reason, it is compulsory to create recycle and use again of destruction concrete waste to put away environment, price and power.

Essential toxic waste organize Board has projected in progress quantum of concrete waste creation in India to the adjust of 48 million tons per annum absent of which, waste beginning construction industry just accounts for more than 25%. Management of such elevated quantum of waste put gargantuan difficulty on solid waste organization arrangement.

In view of important responsibility of recycled construction material and technology in the progress of town infrastructure, TIFAC have conducted a techno-advertise survey on consumption of Waste since Construction Industry' targeting accommodation /structure and road subdivision. The overall quantum of throw away from assembly industry is expected to be 12 to 14.7 million tons annually not in of which 7-8 million tons are material and brick waste. According to conclusion of investigation, 70% of the respondent include certain the cause for not adopting recycling of waste from Construction Industry is "Not aware of the recycling technique" at the same time as residual 30% have indicate that they are not constant conscious of recycling potential. Additional, the consumer agencies/ industries critical out that at the moment, the BIS and additional codal requirements do not make available the condition for make use of recycled product in the construction actions.

In view of above, there is urgent must to take subsequent procedures:-

- Sensitization/ broadcasting/ capability building towards operation of creation & destruction waste.
- Grounding and performance of techno-legal management together with legislations, regulation, penalty etc. for dumping of building & construction waste.
- Definition of removal areas for pre-mixture, healing, transport of RCA.
- National level maintain on research studies on RCA.
- Research of techno-monetary management, financial maintains for introducing RCA in construction together with support in transportation, establish recycling plant etc.
- Preparation of information found on use of RCA.
- Formulation of guiding principle, terms and addition requirements.
- Preparation of record of expert presented in this field who can make available knowledge and technology on whole foundation.
- Incentives on by means of used aggregate concrete-funding or tax exemptions.

CHAPTER-2

LITERATURE REVIEW

2.1 Introduction

- "Hajime Okamura and Masahiro Ouchi. Self-Compacting Concrete .Journal of difficult concrete technology Vol.1.no.1, 5-15April 2003.
  This study provides a rational design method and suitable approval testing method for self-compacting concrete".
  Predictable difficult method for self-compact capability requires example and this be able to particularly difficult if the self-compact capability getting test is to be passed out for the complete amount of concrete. A proper approval test method for self-compact ability has been developed by Ouchi et al (1999).
  The testing method urbanized by Ouchi et al (1999) consists of installing the apparatus involving the protester means of transportation and the drain at the job site. The complete quantity of concrete is poured into the tools. If the concrete flow during the equipment. The concrete is measured as self-compactable for the structure. If the concrete is closed by the equipment the concrete is well thought-out as having not enough self-compact capability and the mix proportion have to be used to.
- "Zoran Gridic, Iva Despotovic, Gordana Toplicic Curcic. property Of Self Compacting Concrete by diverse Types Of Additives; Facta Universitatis sequence Architecture and Civil Engineering .Vol 6, november 2008
  This study reveal that addition of fly ash to the mixture containing hydraulic lime is rather advantageous, bringing a considerable development in the act of SCCFAHL concrete. The silica fume, a additional exclusive stabilizer imparts a comparable performance in SCC that induced by vibration in average predictable concrete
  Passing ability was determined using L box test. Passing ability is calculated using the equation: PA=H2/H1 should not be less than 0.8.

- Dhiyaneshwaran, Ramanathan, Baskar and Venkatasubrmnia. Study going on stability individuality of self-compacting concrete by means of fly ash. Jordan academic journal of Civil Engineering,Vol.7, 2013
  As per this study with the enhance in super plasticizer prescribed amount the workability is increased. For 30%fly ash replacement the fresh properties observed were good as compared to 10%, 20%, 40%and 50% fly ash alternate. It was also found that dosage of viscosity modifying agents must be suitably designed otherwise the slump may decrease beneath 500mm.It was also found that acid resistance of SCC with fly ash was higher as compared to SCC not including fly ash. Compressive strength decrease with the enlarge in fly ash substance.
- Pratibha Aggarwal, Rafat Siddique, Yogesh Aggarwal, Surinder M Gupta. Self-Compacting Concrete –procedure for mix design
  This study reveals that when the contents of cement, fly ash, coarse aggregates and fine aggregates were varied to 520kg/m^3,146kg/m^3,684kg/m^3,and 775kg/m^3 respectively all properties of SCC were obtained. In adding to this super plasticizer contented was reserved at 1.14%.
  Mixes TR1 to TR9 be measured as testing mixes, because these mixes do not fulfill every one the requirements of the SCC mix. SCC1 to SCC5 are the SCC mixes that please all the properties of SCC mixes and purpose of optimal water-powder ratio be carried out for these mixes.
- Effect of Super plasticizer (Polycarboxylic) on Fresh and Hardened Properties of Self-Compacting Concrete Containing Fly Ash (BY-S. M. Dumne)
  The observations show that compressive strength of Self-Compacting Concrete contains fly ash and super plasticizer is increases comparatively earlier up to 7 days thereafter its rate becomes slower for equal water cement ratio. Overall, on can conclude that super plasticizer dose increases the compressive strength of concrete mix at both 7th and 28th days of curing.
- Comparison Of Self Compacting Concrete Using Recycled Aggregates & Normal Aggregates. (BY-Rafiya Majeed Khan, Farah Amin)
  The compressive strength of every one mix increased with the decrease in water powder percentage. This validates Abram's law.
  Additional the compressive strength of SCCRA resultant to compressive strength of SCCNA was creating lower by 15-20%. This is preferably because of higher crushing value of recycled aggregates.
  Experimentally it was create that crushing Value of recycled aggregates used for the project was 27.87% in contrast to the crushing value of normal aggregates, which was found out to be 22.8%.For 30% replacement of fly ash with 15% silica fume, and by reducing the water content from 0.5 to 0.42, there was sharp increase during the compressive strength.

CHAPTER-3

METHODOLOGY ADOPTED

3.1 Introduction

The method for achieving self-compact capability involves not only elevated deformability of insert or mortar, but also not only elevated deformability of insert or mortar, but also resistance to isolation involving coarse aggregate and mortar after the concrete flows throughout the limited zone of reinforcing bars. Following methods to achieve self-compact capability.

1) Partial aggregate content
2) Low water-powder ratio
3) Use of super plasticizer

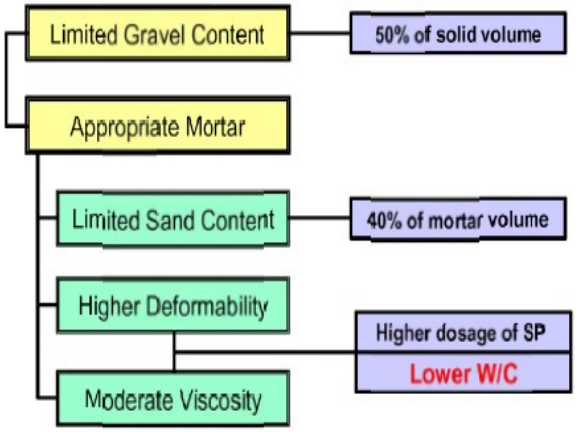


Fig-3.1 Method for Achieving Self-Compacting Concrete

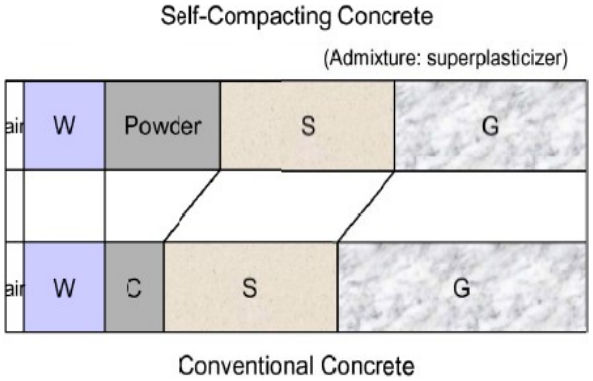


Fig-3.2 Comparison of Mix Proportion between Self-Compacting Concrete and Conventional Concrete

The frequency of impact and make contact with involving aggregate particles can increase as the relation distance between the particles decreases and then internal stress be able to increase after concrete is collapsed, mainly near obstacles. Research has established that the energy requisite for flowing is extreme by the increased internal stress, resulting in obstruction of aggregate particles. Limiting the coarse aggregate substance, whose energy utilization is particularly deep, to intensity lower than typical is efficient in avoiding this kind of obstruction extremely viscous paste is also necessary to stay away from the obstruction of coarse aggregate as concrete flows through obstacles. When concrete is distorted, paste with a high viscosity also prevents restricted increases in internal stress caused by the advance of coarse aggregate particles. High deformability can be achieved immediately by the check of a super plasticizer, protection the water-powder ratio to a very low impact. The mix proportioning of self-compacting concrete is revealed and compared with persons of typical concrete and RCD (Roller Compacted concrete for Dams) concrete. The aggregate content is minor than expected concrete to require vibrate compaction. Ratio of the coarse aggregate quantity toward its durable volume (G/Glim) of each one type of concrete. The measure of stuffing of coarse aggregate in SCC is just about 50% to decrease the interface involving coarse aggregate particle after the concrete deform. In accumulation, the ratios of fine aggregate volume to solid volume (S/Slim) in the mortar are shown in the same figure. The measure of filler of fine aggregate in SCC mortar is just about 60% so that shave deformability as the concrete deforms possibly partial. On the new hand, the viscosity of the insert in SCC is the premier between the mixtures of types of concrete caused by its lowest water-powder ratio. This typical is valuable in inhibit segregation.

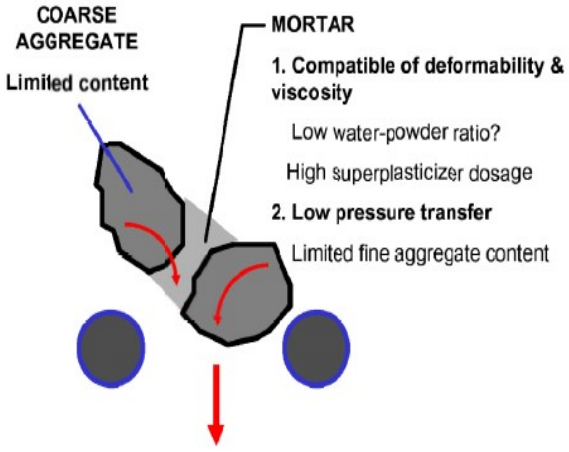


Fig-3.3 Mechanism of Achieving Self-Compacting Concrete

*EFNARC guidelines for achieving self-compacting concrete-(*European Federation of Specialist Construction Chemicals and Concrete Systems)

1) The coarse aggregate substance in concrete is rigid at 50% of the solid volume.
2) The end aggregate content is fixed at 40% of the volume mortar.
3) The water-powder ratio in volume is assumed as 0.9 to 1.0, depending on the properties of the powder.
4) The super plasticizer measure and the final water powder ratio are firm so as to make sure self-compact facility.

3.2 Engineering Properties of S.C.C

In the design of concrete structures, engineers can refer to a numeral of concrete properties, which are not always part of the concrete specification. The mainly significant are:

- Compressive strength
- Tensile strength
- Modulus of elasticity
- Creep
- Shrinkage
- Coefficient of thermal expansion
- Bond to reinforcement
- Fire resistance

3.3 Compressive Strength

The Self-compacting concrete through a related water cement or reinforce binder ratio determination generally contain a to some extent upper strength compared with predictable vibrated concrete, caused by the required of vibration giving an enhanced boundary involving the aggregate and hardened paste. The strength progress will be related so development testing will be a valuable way to control the strength development whether accelerated heating is used or not. A quantity of concrete properties possibly connected to the concrete compressive strength, the just concrete engineering property that is usually specified and tested.

3.4 Tensile Strength

Self-compacting concrete possibly supplied by some particular compressive strength class. Designed for a given concrete strength class and development, the tensile strength possibly safely assumed to be similar as the one used for a normal concrete because the capacity of paste (cement + fines + water) has no considerable produce on tensile strength.

In the design of reinforced concrete sections, the bending tensile strength of the concrete is used for the evaluation of the cracking moment in prestressed elements, for the design of reinforcement to organize break width and spacing resultant as of reserved early-age thermal reduction, used for illustration instant curvature diagrams, for the design of unreinforced concrete pavements and for fiber reinforced concrete.

3.5 Static Modulus of Elasticity

The modulus of elasticity (E-value, the relation between stress and strain), is used in the elastic estimate of deflection,

regularly the calculating factor in slab design, and of pre or post tensioned fundamentals.

As the bulk of the volume of concrete is aggregate, the type and amount of aggregate as fine its E-value have the most influence. Selecting an aggregate through a high E-value will enhance the modulus of elasticity of concrete. However, increase the insert volume can decrease the E-value. Because SCC frequently has higher paste content than usual vibrated concrete, a few differences are able to be predictable and the E-value may be to some extent minor but this must be effectively covered by the safe assumption on which the formula provide in EN1992-1-1 are based.

If SCC does include a somewhat lower E modulus than conventional vibrate concrete, this will change the correlation between the compressive strength and the curvature due to prestressing or post-tensioning. For this reason, suspicious manage should be exercised above the strength at the time while the prestressing and post-tensioning strands or wires are free.

3.6 Creep

It is defined as the measured increase in deformation (strain) through time for a constant functional stress, also taking into description other time dependent deformations not related with the useful stress, i.e. shrinkage, swelling and thermal deformation.

Creep in density reduce the prestressing forces in prestressed concrete element and causes a slow transfer of load from the concrete on the reinforcement. Creep in tension is able to be valuable in that it in part relieve the stresses induced by further restrained activities, e.g. drying shrinkage and thermal effects.

Creep take place in the cement paste and it is inclined by its porosity which is straight connected to its water/cement ratio. During hydration, the porosity of the cement paste reduces and so for a given concrete, creep reduces as the strength increases. The type of cement is important if the age of loading is fixed. Cements that hydrate further quickly resolves have top strength at the age of loading, a lower stress/strength ratio and a lower creep. Because the aggregates contain the creep of the cement paste, the high the volume of the aggregate and the superior the E-value of the aggregate, the minor the creep will be. Suitable to the advanced volume of cement paste, the creep coefficient for SCC could be expected to be there higher than for ordinary concrete of equal strength, but such difference are little and covered by the secure assumptions in the tables and the formulae provided in the Euro code.

3.7 Shrinkage

Shrinkage is the addition of the autogenously and the drying shrinkage. Autogenously shrinkage occurs during situation and is caused by the inside utilization of water for the duration of hydration. Exclusive volume of anhydrate cement and water and this reduction in volume causes tensile stresses and results in autogenously

It is caused by the loss of water from the concrete to the environment. Commonly this failure of water is starting the cement paste, other than by a few types of aggregate the major loss of water is from the aggregate. Aeration shrinkage is rather slow and the stresses it induces are in some measure objective by tension creep relief.

3.8 Coefficient of Thermal Expansion

Concrete is the strain formed in concrete after a division change in high temperature where the concrete is not controlled each within (by reinforcing bars) or externally. The coefficient of thermal expansion of concrete varies by its composition, age and humidity content. As the bulk of concrete comprises aggregate, by an aggregate with a minor coefficient of thermal expansion determination decrease the coefficient of thermal expansion of the resultant concrete. Dropping the coefficient of thermal expansion leads to a comparative decrease in the break manage reinforcement.

Whilst the choice of the coefficient of thermal expansion is as of 8 to13 micro strains/K, EN 1992-1-1 states that if not more correct information is available, it may be taken as 10 to 13 micro strains/K. The same may be assumed in the case of SCC.

3.9 Bond to Reinforcement, Prestressing and Wires

Reinforced concrete is based on an effective bond between concrete and the reinforcing bars. The concrete bond strength should be sufficient to prevent bond failure. The effectiveness of bond is affected by the situation of the embedded bars and the feature of concrete as cast. An adequate concrete cover is necessary in order to properly transfer bond stresses between steel and concrete. Reduced bond regularly results from a collapse of the concrete to totally encapsulate the bar through insertion or bleed and isolation of the concrete facing hardening which reduces the feature of contact on the substructure surface. SCC flexibility and structure decrease these downbeat effects, particularly for top bars in deep Sections.

3.10 Fire Resistance

Concrete is non-explosive and does not maintain the spread of flames. It produces no smoke, toxic gases or emissions when exposed to fire and does not supply to the fire load. Concrete have a measured relocate useful below typical fire circumstances, concrete retains mainly of its strength. has given concrete the maximum achievable fire description. is related to ordinary concrete In common additional level to leading the aggregate type, concrete quality and humidity contented. SCC can easily complete the supplies for high strength, low permeability concrete and determination present in a related way to some general high strength concrete under fire conditions. The to be effective in improving its resistance to spalling. The mechanism is assumed to be due to the fibers

melting and being captivated in the cement matrix. The fiber voids followed by present.

Increase chambers for steam, thus reducing the possibility of spalling. Polypropylene fibers have been productively used by SCC.

3.11 Durability

The durability of a concrete structure is directly connected to the permeability of the outside level, the individual that must limit the access of substances that can start or circulate probable deleterious measures (CO_2, chloride, sulphate, water, oxygen, alkalis, acids, etc.). In observe, durability depends on the material selection, concrete composition, as well as on the degree of supervision all through insertion, compaction, concluding and remedial. Require of compaction of the surface layer, payable to vibration difficulty in contracted spaces involving the formwork and the re-bars or other inserts (e.g. post-tensioning ducts) has been known as a key factor of reduced durability performance of reinforced concrete structures exposed to destructive environments.

Overcoming this was one of the major reasons for the original development of SCC in Japan.

Established vibrated concrete is subjected to compaction using vibration (tamping), which is an irregular process. During the case of inside vibration, even when properly executed, the quantities of concrete in the area of pressure of the vibrator do not collect the similar compaction energy. Also, during the case of outside vibration, the resultant compaction is basically various, depending scheduled the expanse to the vibration sources.

CHAPTER-4

LABORATORY TESTING

4.1 Introduction

Table-4.1 Acceptance Criteria for Self-Compacting Concrete

S. No.	METHOD	PROPERTY SHOWS	UNIT	RANGE	
				MIN.	MAX.
1	Slump flow by Abrams cone	Filling ability	Mm	650	800
2	T_{50cm} flow	Filling ability	Sec	2	5
3	J-ring	Passing ability	Mm	0	10
4	V-funnel	Filling ability	Sec	6	12
5	V-funnel at $T_{5minutes}$	Segregation resistance	Sec	0	3
6	L-box	Passing ability	H2/h1	0.8	1
7	U-box	Passing ability	(h2-h1)mm	0	30
8	Fill box	Passing ability	%	90	100
9	GTM screen stability test	Segregation resistance	%	0	15
10	Orimet	Filling Ability	Sec	0	5

4.2 Tests We Performed On Fresh Concrete

Table-4.2 Test results

S. No.	METHOD	PROPERTY	UNIT	RANGE (MIN)	RANGE (MAX)
1	Slump flow by Abrams cone	Filling ability	Mm	650	800
2	T_{50cm} flow	Filling ability	Sec	2	5
3	V-funnel	Filling ability	Sec	6	12
4	L-box	Passing ability	h2/h1	0.8	1

4.3 Slump Flow Test

The essential gear utilized is the same by deference to the customary Droop test. The test method varies from the traditional one by the way that the solid specimen put into the mold is not rodded and when the droop cone is evacuated the example collapses. The measurement of the increase of the example is measured, i.e. a level separation is deceased set moderately than the vertical separation in the traditional Droop test. The Droop Stream test can give Evidence as to the consistency, filling capacity and workability of SCC. The SCC is expected of have a decent filling capacity and stability if the width of the extend achieves value between 650 mm to 800 mm

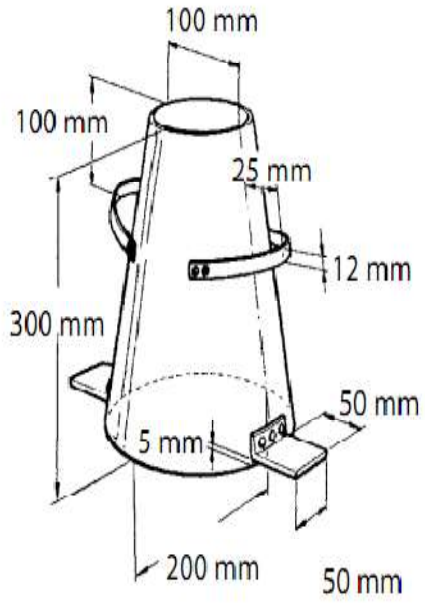


Fig.-4.1 Slump Flow Apparatus and Its Dimensions

4.4 T 50cm FLOW TEST

In this test the concrete have to flow 50cm or 500mm after slump flow test. This test shows the filling capability of the self-compacting concrete and the acceptance criteria is to flow about 650-800mm in 2-5 sec

Fig.-4.2 T50cmFlow Test

4.5 V-FUNNEL TEST

Fresh the funnel and base gate, the reduce all the within surface include the gate. Shut the gate and empty the sample of concrete into the funnel, exclusive of any disturbance or Roding, next strike off the top with the instantly edge so that the concrete is blush with the top of the funnel. Positions the container below the funnel in arrange to retain the concrete to be approved. behind a holdup of (10 ± 2)s since satisfying the conduit, release the door and evaluate the instance *T*V, to 0,1 s, starting cavity the entry to after it is probable to observe upright through the funnel into the container below for the first time. *T*V is the V-funnel stream moment.

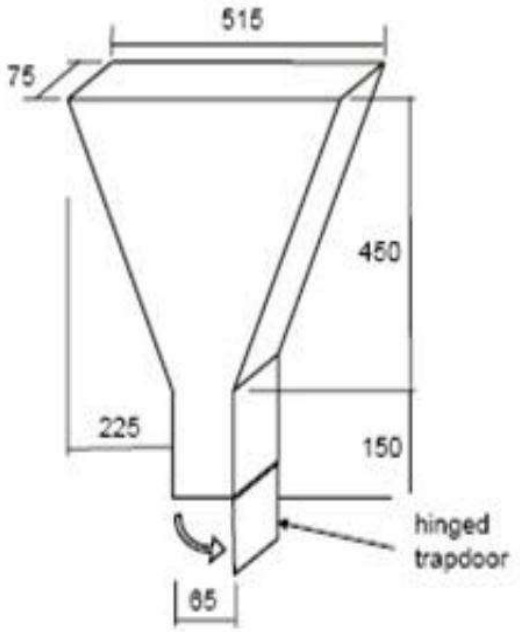


Fig.-4.3 V-Funnel Apparatus and Its Dimensions

4.6 L-BOX TEST

Maintain the L-box on a plane level bottom and close the door involving the perpendicular and parallel section. Transfer the material from the pot into the satisfying hopper of the L-box and permit status for (60 ± 10) s. confirmation any isolation and then raise the gate so that the concrete flows into the level segment of the box.

After progress has ceased, calculate the perpendicular space, at the ending of the parallel division of the L-box, involving the peak of the material and the peak of the level sector of the container at three positions similarly spaced transversely the measurement of the package. With variation through the elevation of the level division of the container, these three dimensions are use to estimate the represent intensity of solid as H2 mm. The equivalent method is old to estimate the intensity of actual instantly after the door as H1 mm.

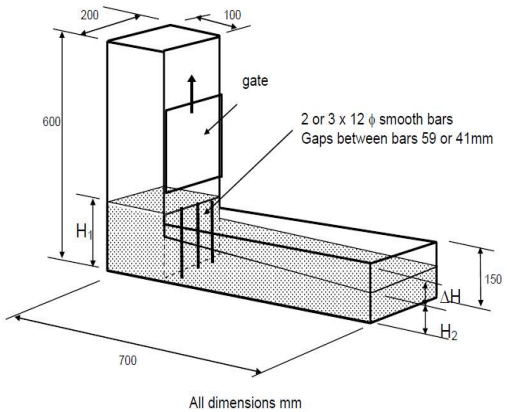


Fig.-4.4 L-box apparatus and its dimensions

4.7 Compressive Strength Test

Compressive strength is the capability of a fabric or formation to bear up loads treatment to decrease size, as different to tensile strength, which withstand loads tending to elongate. Various yielding metals such as mild steel include extremely great compressive strength but the concrete ideals are complex to evaluate. When a load is applied to a ductile metal it deforms elastically up to a certain point and then plastic deformation occurs

Compressive strength can be calculated by intrigues applied force beside deformation in a testing machine, such as a compression testing machine.

After an objective produced of an only material, like a timber beam or a steel rod, is curved, it experiences a collection of stresses across its deepness. On the border of the article on the within of the curve (hollow face) the strain determination be at its most compressive stress value. At the outer surface of the corner (rounded face) the stress resolve be on its most tensile value. These internal and external edges of the beam or rod are known as the intense fibers'. Mainly materials fail below tensile stress by they not succeed under compressive stress, so the maximum tensile stress value to be capable of be constant before the beam or rod fail is its flexural strength.

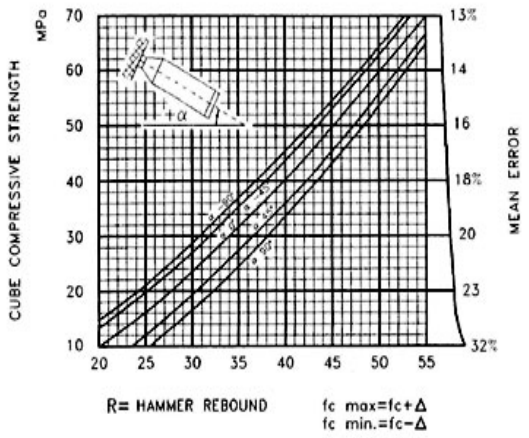
4.8 Flexure Strength Test

Flexural strength, as well identified as modulus of rupture, curve power, or burst strength, is a fabric property defines as the stress in objects just before it yields in a flexure test. The sloping twisting test is mainly normally employed, in which an example was having also a circular or rectangular cross-section is twisted pending crack or elastic by a three top flexural test procedure. The flexural strength represents the maximum stress practiced in the objects at its instant of crack.

4.9 Rebound Hammer Test

Rebound hammer test (Schmidt strike) is worn to supply a expedient and fast signal of the compressive strength of concrete. It consists of a spiral prohibited collection that slide on a nozzle inside a tubular board.

After the nozzle of rebound hammer is pushed beside the exterior of concrete, a bounce forbidden mass by a stable authority is finished to beat concrete surface to rebound back. The level of rebound, which is determine of exterior rigidity, is careful on a graduated balance. This deliberate value is selected as Rebound Number (rebound index). A concrete with small strength and low stiffness determination take in more energy to capitulate in a minor rebound value.



Graph-4.1: Rebound no. v/s compressive strength

Principle of the Rebound Hammer:

Rebound hammer test process is base on the opinion that the rebound of an flexible mass depends on the rigidity of the material surface beside which the mass strike. The procedure of the rebound hammer is shown in figure above. After the nozzle of rebound hammer is pushed next to the concrete exterior, the spiral forbidden mass in the hammer rebounds. The sum of rebound of the collection depends on the stiffness of actual plane. Therefore, the stability of concrete and rebound hammer analysis is able to be connected with compressive strength of concrete. The comeback value is study off along a graduated level and is designated as the recover number or rebound guide. The compressive strength is able to be study straight since the chart provided on the remains of the tack hammer.

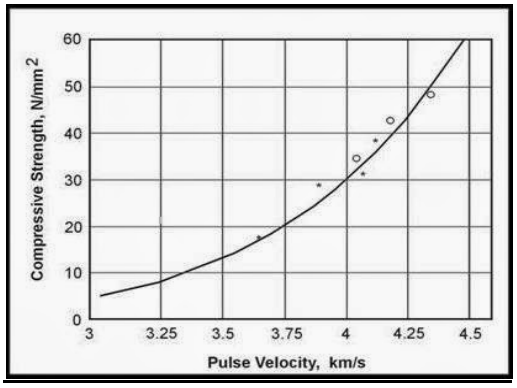
4.10 Ultrasonic Pulse Velocity Test

The ultrasonic pulse velocity test is an in-situ, nondestructive test to ensure the value of concrete and ordinary rocks. inside this test, the strength and value of concrete or rock is assess by measure the rate of an ultrasonic pulse transient through a concrete organization or ordinary rock formation. This test is conducted by transient a pulse of ultrasonic signal during concrete to be present hardened and measuring the instance in use by pulse to obtain during the structure. Advanced velocities show good value and stability of the material, as slower velocities can signify concrete with various cracks or voids.

Table-4.4 Velocity Criteria for Concrete Quality Grading

S. NO.	PULSE VELOCITY BY CROSS PROBING(KM/SEC)	CONCRETE QUALITY GRADING
1	Above 4.5	Excellent
2	3.5-4.5	Good
3	3.0 – 3.5	Medium
4	Below 3.0	Doubtful

Note: In case of “Doubtful” quality it may be necessary to carry out further test.



Graph-4.2 Pulse Velocity V/S Compressive Strength

CHAPTER-5

TEST RESULTS

5.1 Fresh State Properties of SCC

Table-5.1 Result of SCC Using Fresh Aggregates

S. No.	MIX	SLUMP (MM)	T50CM (SEC.)	H2/H1	V-FUNNEL (SEC.)
1	SCC1FA	720	3.3	0.92	7.3
2	SCC2FA	685	4.2	0.88	9.2
3	SCC3FA	695	4.0	0.90	9.7
4	SCC4FA	670	4.2	0.82	11

Table-5.2 Result of SCC Using Recycled Aggregates

S. No.	MIX	SLUMP (MM)	T50CM (SEC.)	H2/H1	V-FUNNEL (SEC.)
1	SCC1RA	705	3.6	0.89	7.9
2	SCC2RA	680	4.3	0.86	9.4
3	SCC3RA	660	4.6	0.82	11
4	SCC4RA	665	4.4	0.83	11.2

COMPARISON OF RESULTS

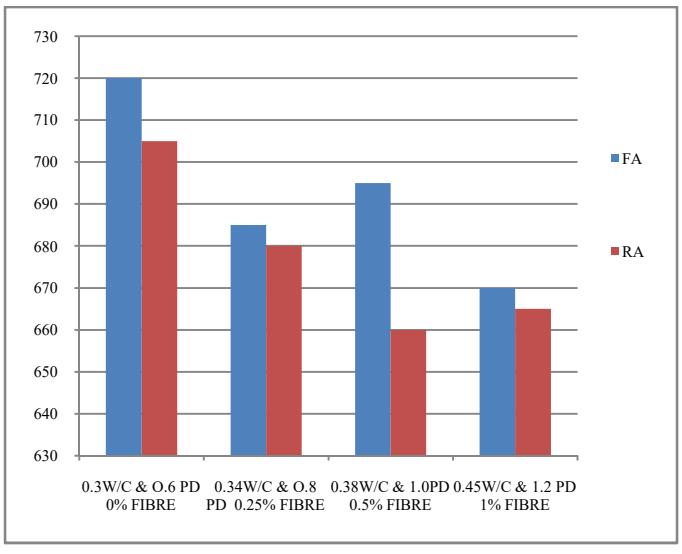
5.2 Slump Comparison

W/C= WATER CEMENT RATIO

PD= SUPERPLASTICIZER DOSADE

Y-axis = SLUMP VALUE IN MM

X-AXIS = W/C & PD DOSE & FIBRE PERCENT



Graph-5.1 Slump Comparison

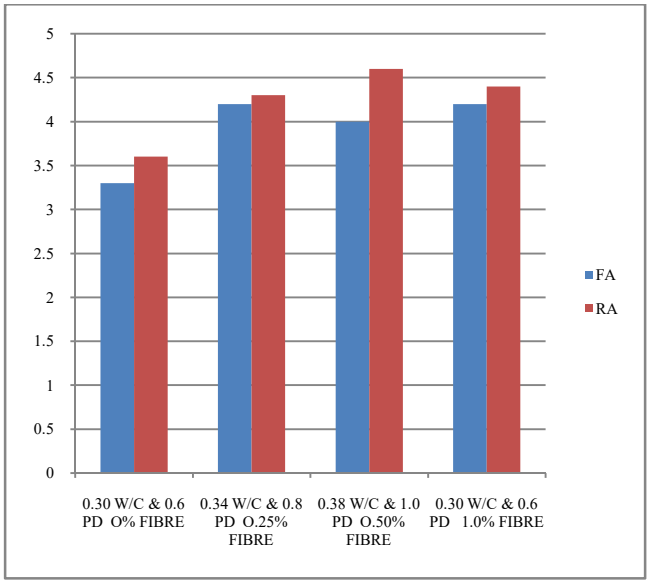
6.3 T_{50cm} Comparison

W/C= WATER CEMENT RATIO

PD= SUPERPLASTICIZER DOSADE

Y-axis = TIME TO FLOW 50 CM IN SEC

X-AXIS = W/C & PD DOSE & FIBRE PERCENT



Graph-6.2 T50cm Comparison

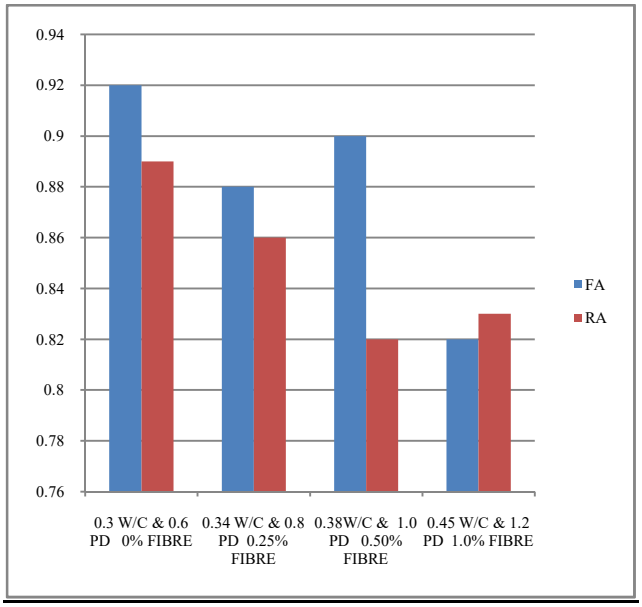
6.4 L-BOX Comparison

W/C= WATER CEMENT RATIO

PD= SUPERPLASTICIZER DOSADE

Y-axis = HEIGHT RATIO

X-AXIS = W/C & PD DOSE & FIBRE PERCENT



Graph-6.3 L-Box Comparison

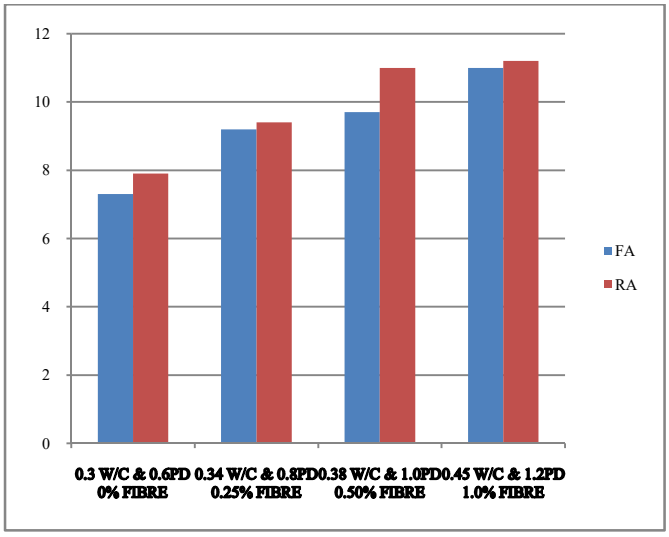
6.5 V-FUNNEL

W/C= WATER CEMENT RATIO

PD= SUPERPLASTICIZER DOSADE

Y-AXIS = TIME IN SECOND

X-AXIS = W/C & PD DOSE & FIBRE PERCENT



Graph-6.4 V-Funnel Comparison

CHAPTER-7

CONCLUSION AND RECOMMENDATION FOR FUTURE WORK

7.1 Conclusion

Based on the analysis conducted for the study of activities of self-compacting concrete the

Following conclusions are arrived.

1. As no particular mix design measures for SSC are obtainable mix design can be done with convention BIS method and suitable adjustments can be done as per the procedure provided by special agencies.
2. Trail mixes include being ready for maintaining course ability, self-compatibility and barrier consent.
3. Increasing the percentage of fiber in mix proportion increases the water demand.
4. There is a reduction in the strength on increasing the super plasticizer content.
5. Reduction in strength also observed from non-destructive testing result.
6. There is average 10-20% reduction in the strength by recycled aggregates.

7.2 Future Scope

Already a normal mix design and a proper taking testing method at work site include be conventional for self-compacting concrete, thus the major obstruction for its wide have been solved. The next charge is to encourage quick

distribution of the techniques for the construction of self-compacting concrete. Self-compacting concrete must be treated as standard concrete not special concrete. Balanced guidance and qualification systems for engineers should be established, for the construction of self-compacting concrete. Awareness should me made among engineers and general public to recycle the C & D waste. Recycling of Construction and destruction waste has to be made mandatory and recycling plants should be recognized in every part of the country. There should be ISO certification for every recycling plant.

Recycling and reprocess of structure wastes have been create to be a proper resolution to the troubles of removal hundreds of thousands tons of rubbish accompany with shortage of normal aggregates. Recycled aggregate have moderately minor bulk density, crushing and impact values and superior water inclusion as compared to natural aggregate. The compressive power of recycled aggregate concrete is moderately lower up to 15% than ordinary aggregate concrete. There are several consistent applications for in recycled coarse aggregate in construction. Though, more study and beginning of direct plan for request of RCA is desirable for modifying our plan codes, condition and process for use of recycled aggregate concrete. The matter of use of RCA in structure works in India should be given thrust, as of big infrastructural projects are creature specially made counting Common Wealth Games in 2010.

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