A STUDY ON ACID AND ALKALINE ATTACK ON SCC

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Abstract: Self-Compacting Concrete is generally defined as the "Concrete, which does not need Compaction." It means SCC gets compacted without external efforts like vibration, tamping etc. The mixture therefore is required to have the ability of flowing, filling voids and being stable. The ingredients used for SCC are 53 grade Ordinary Portland cement, Fine aggregate, coarse aggregate, super plasticizer, class-F Flash from Thermal power plant, Viscosity modifying agent. Cement is replaced by fly ash at 20% by weight of cement. The basic properties of Cement, Flash, and Coarse aggregate, Fine aggregate are studied. The Mix design is carried out for M40 grade concrete by European method. The Workability tests such as Slump Flow, V-Funnel, L-box, U-box test are carried out for self-compacting concrete. Cubes and cylinders are casted and tested at 7, 14, 28 Days for self-compacting concrete and its results are compared with Conventional M40 grade concrete. In the present experimental investigation the main concentration is focused on Workability, Compressive and split tensile strength of Self compacting concrete. The future enhancement of work to evaluate the Acid attack and alkaline attack on Self Compacting concrete and comparative study with Conventional concrete.

Key words — Compressive Strength, Split Tensile Strength, Fly ash, workability Tests.

INTRODUCTION

Concrete is the most versatile construction material because it can be designed to withstand the harshest environments while taking on the most inspirational forms. Engineers are continually pushing the limits to improve its performance with the help of innovative chemical admixtures and supplementary cementitious materials. Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense, homogeneous and has the same engineering properties and durability as traditional vibrated concrete. Concrete that requires little vibration or compaction has been used in Europe since the early 1970s but self-compacting concrete was not developed until the late 1980's in Japan. In Europe it was probably first used in civil works for transportation networks in Sweden in the midl990's. The multi-national, industry lead project "SCC" 1997-2000 and since then SCC has found increasing use in all European countries.

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Self-compacting concrete offers a rapid rate of concrete placement, with faster construction times and ease of flow around congested reinforcement.

The fluidity and segregation resistance of SCC ensures a high level of homogeneity, minimal concrete voids and uniform concrete strength, providing the potential for a superior level of finish and durability to the structure. SCC is often produced with low water-cement ratio providing the potential for high early strength, earlier remolding and faster use of elements and structures.

The elimination of vibrating equipment improves the environment on and near construction and precast sites where concrete is being placed, reducing the exposure of workers to Noise and Vibration. The improved construction practice and performance, combined with the health and safety benefits, make SCC a very attractive solution for both precast concrete and civil engineering construction.

- To identify the three key properties of SCC i.e. filling ability, passing ability and segregation resistance
- To determine the workability of SCC using Slump Cone Test, U box Test, L Box Test, Fill box test and V Funnel Test.
- To study the Strength and behavior of using Fly ash to the SCC.
- The main objective of this project is study the chemical attack and acid attack of SCC.
- To improve filling capacity through highly congested reinforcement by using the Self-Compacting concrete.
- To reduce the construction time in the project.

MATERIALS AND METHODS

Cement

In the most general sense of the word, cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The volcanic ash and pulverized brick additives that were added to the burnt lime to obtain a hydraulic binder were later referred cement. Cement used in construction is characterized as hydraulic or non-hydraulic. Hydraulic cements (e.g., Portland) harden because of hydration, chemical reactions that occur independently of the mixture's water content; they can harden even underwater or when constantly exposed to wet weather.

The chemical reaction that results when the hydrous cement powder is mixed with water produces hydrates that are not water-soluble. Non-hydraulic cements (e.g.gypsumplaster) must be kept dry in order to retain their strength. The most important use of cement is the production of mortar and concrete, the bonding of natural or artificial aggregates to form a strong building material that is durable in the face of normal environmental effects. 53 grade Ordinary Portland Cement (OPC) is used for the study programme.

Table Properties of Cement

S.No	Name of the test	Value
1	Consistency	36 %
2	Initial Setting Time	32 minutes
3	Fineness modulus	1.75
4	Specific gravity	3.14

Fine Aggregate

For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent. River sand was used in preparing the concrete as it was locally available in sand quarry. The properties of this fine aggregate have been tested and given below:

Table Properties of Fine Aggregate

S.No	Name of the test	Value
1	Specific Gravity	2.60
2	Fineness modulus	2.85
3	Water absorption	2.5 %
4	Bulk Density	1487.6 kg/m^3

Coarse aggregate

As with fine aggregate, for increased workability and economy as reflected by the use of less cement, the coarse aggregate should have a rounded shape. Even though the definition seems to limit the size of coarse aggregate, other considerations must be accounted. In strength and durability, aggregate must be equal to or better than the hardened cement to withstand the designed loads and the effects of weathering. The properties of this coarse aggregate have been tested and given below:

Table Properties of Coarse Aggregate

S.No	Name of the test	Value
1	Specific Gravity	3.02
2	Fineness modulus	3.15
3	Water absorption	1.0 %
4.	Bulk density	1652.89 kg/m^3

Water

Water acts as lubricants for the fine and coarse aggregate and acts chemical with cement to form the binding paste for the aggregate. Water is used for curing the concrete after it has cast into the forms. Water used for both making and curing should be free from injurious amount of deleterious materials. Portable water is generally considered satisfactory for mixing and curing of concrete. If water contains any sugar or an excess of acid or salt, it should not be used. Portable tap water available in laboratory with pH value of 7.0 ± 1 and confirming to the requirement of IS: 456-2000 was used for mixing concrete and curing the specimens as well.

Fly ash

Fly ash consists of fine, powdery particles that are predominantly spherical in shape, either solid or hollow, and mostly glassy (amorphous) in nature. The carbonaceous material in fly ash is composed of angular particles. The particle size distribution of most bituminous coal fly ashes is generally similar to that of silt (less than a 0.075 mm or No. 200 sieve). Although sub bituminous coal fly ashes are also silt-sized, they are generally slightly coarser than bituminous coal fly ashes.

Fly ash is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants, and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) and calcium oxide (CaO), both being endemic ingredients in many coal-bearing rock strata.

Ash used as a cement replacement must meet strict construction standards, but no standard environmental regulations have been established in the United States. 75% of the ash must have a fineness of 45 µ or less, and have a carbon content, measured by the loss on ignition (LOI), of less than 4%. In the U.S., LOI needs to be under 6%.The particle size distribution of raw fly ash is very often fluctuating constantly, due to changing performance of the coal mills and the boiler performance. This makes it necessary that, if fly ash is used in an optimal way to replace cement in concrete production, it needs to be processed using beneficiation methods like mechanical air classification. But if fly ash is used also as a filler to replace sand in concrete production, beneficiated fly ash with higher LOI can be also used. Especially important is the ongoing quality verification.

Table Chemical properties of fly ash

S.No.	Properties	Value in %
1	Silica	59.62
2	Alumina	26.43
3	Iron oxide	6.61
4.	Calcium oxide	1.2
5.	Magnesium oxide	0.76
6.	Sculpture tri oxide	0.58
7.	Titanium oxide	1.56
8.	Loss of ignition	1.76

Table physical properties of fly ash

S.No.	Name of the test	Value
1	Fineness modulus	78.60
2	Specific Gravity	2.10

Super plasticizers

Super plasticizers, also known as high range water reducers, are chemicals used as admixtures where well-dispersed particle suspension are required. These polymers are used as dispersants to avoid particle aggregation, and to improve the flow characteristics (rheology) of suspensions such as in concrete applications. Their addition to concrete or mortar allows the reduction of the water to cement ratio, not affecting the workability of the mixture, and enables the production of self-consolidating concrete and high performance concrete. This effect drastically improves the performance of the hardening fresh paste. Indeed the strength of concrete increase whenever the amount of water used for the mix decreases. However, their working mechanisms lack of a full understanding, revealing in certain cases cement-super plasticizer incompatibilities.

Characteristics:

- Pronounced increase in the early strength development, resulting in very economic stripping times for precast and in situ concrete
- Extremely powerful water reduction, resulting in high density, high strength and reduced permeability for water etc.
- Excellent plasticizing effect, resulting in improved flow ability, placing and compacting behaviour.
- Reduced energy cost for steam cured precast elements.

Mixing procedure of Super plasticizer

Plasticizer must be properly and intimately mixed in concrete to bring about proper dispersion with cement particles. Therefore, hand mixing out of question. When you use concrete mixer, generally about 80% of the total water is added to the empty drum and then materials are loaded into the drum by hopper. When you use super plasticizer, it is better to add all the water to the drum keeping about one liter of water in spare. The exact quantity of super plasticizer is diluted with that one liter of water and thrown into drum in two or three installments over the well mixed concrete so that proper dispersion of plasticizer actually takes place in the drum. Having added the plasticizer the concrete must be mixed for about one more minute before discharging. The practice of adding super plasticizer along with the bulk mixing water is not giving good results. Experimental results showed that adding plasticizer after three minutes if mixing has yielded better results. Electrically operated small laboratory mixer is used for conducting laboratory trials. These laboratory mixers are inefficient and they do not mix the concrete ingredients thoroughly, leave partly efficient mixing of super plasticizers.

The results obtained from the trials, using laboratory mixer, is far from realistic. In such situations the following procedure gives better consistent results. Add all the calculated quantity of water into the drum. They add all the quantity of cement and sand. Mix these ingredients very well. When they are well mixed, add the calculated quantity of plasticizer and thoroughly mix them together. You will notice the full action of plasticizer in fluidifying the mix. Then you add the coarse aggregates and mix them for another one minute, the mixture is not efficient as in the case of laboratory mixer, the above procedure of mixing will give good results.

Viscosity Modifying Agent (VMA)

Viscosity modifying admixtures (VMAs) are water-soluble polymers that increase the viscosity of mixing water and enhance the ability of cement paste to retain its constituents in suspension. Cement paste serves as the basis for the workability properties of self-compacting concrete (SCC) and these properties could be assessed by self-consolidating cementitious materials (SCCM). SCCMs have to be sufficiently fluid to ensure the fluidity of the SCC itself and sufficiently viscous to support the coarse aggregates.

MIX PROPORTIONING

General

The desired properties of concrete can be obtained by using the ingredients in a certain proportion. Thus determining the relative amounts of materials is known as mix design. Thus it can be defined as the process of selecting suitable ingredients of concrete and determining their relative quantities for producing the concrete of desired properties strength, durability and consistency, etc., as economical as possible. The object of mix design is to decide the properties of material, which will produce concrete having the required properties. The mix proportions should be selected in such a way that the resulting concrete is desired workability while fresh and it could be placed and compacted easily for the indented purpose.

Mix design by European method

The mix design of M40 grade of concrete is done by using the European method by using the test results of the materials known.

Design stipulations:

Characteristic strength required: 40 M Pa.
Standard deviation: 5
Maximum size of aggregate: 12.5mm

Test data of materials:

Specific gravity of fine aggregate: 2.60
Specific gravity of coarse aggregate: 2.66
Bulk density of coarse aggregate: 1487.6kg/m^3.
Fineness modulus of fine aggregate : 2.85.

Design:

Target mean strength
Target mean strength = f_{eck} + 1.64S

Selection of WPR and water content

Water/Powder = 1
Water = volume of paste x water powder ratio
(Relative slump- Flow value)

= 300.57 x 1 / 1.9
= 158.2 lit
From relation of water/powder
Quantity of powder = 158.2 lit

Selection of cement & fly ash

Cement = 80%
Fly ash = 20%
Quantity of Cement = 0.8 x 158.2 x 3.14
= 397.40 kg
Quantity of Fly ash = 0.2 x 158.2 x 2.5
= 79.10 kg
Table 1 Mix Proportion of SCC

Water	Cement	FA	CA
158.2	397.40	955.16	830.06
0.35	1	2.13	1.85

EXPERIMENTAL INVESTIGATIONS

The ingredients of Self compacting concrete are Cement, Flash, Coarse aggregate, Fine aggregate, super plasticizer, viscosity modifying agent and water. Here the cement is replaced by class-F flash by 20% of its weight. The size of Coarse aggregate is 10mm to 12mm is used. The quantity of super plasticizer is 0.8 lit per 100kg of cement and the quantity of viscosity modifying agent is 0.4 lit per 100 kg of cement.

The ingredients are weighed and now ready for mixing. First dry mix is prepared then80% of total quantity of water is added. After two minutes mixing remaining 20% of water is added with a super plasticizer and viscosity modifying agent. Now we obtain self-compacting concrete

TESTS ON FRESH CONCRETE

- A Slump flow & T_{50} test
- V- funnel test & V-funnel at T_5 minute
- . L- box test
- U-box test

Slump flow test and T50cm test:

The slump flow test aims at investigating the filling ability of SCC it measures two parameters, flow spread and flow time T50 (optional). This is a simple, rapid test procedure, though two people are needed if the T_{50}time is to be measured. It can be used on site, though the size of the base plate is somewhat unwieldy and level ground is essential. It is the most commonly used test, and gives a good assessment of filling ability.

Slump flow test Apparatus

The apparatus is shown

- Mold in the shape of a 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 of 500 mm diameter.

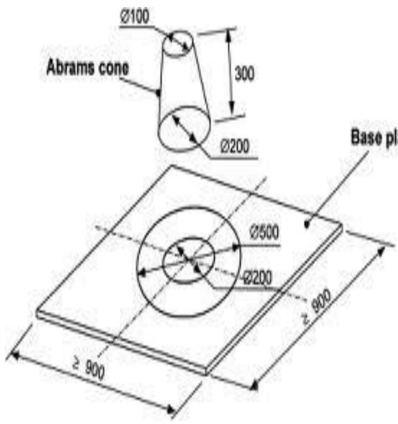

Fig Slump-flow test

- Trowel, Scoop, ruler, stop watch. About 6 liters of concrete is needed to perform the test, sampled normally moisten the base plate and inside of slump cone, Place base plate on level stable ground and the 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 500mm spread circle.

- (This is the T_{50} time).Measure the final diameter of the concrete in two perpendicular directions. Calculate the average of the two measured diameters. (This is the slump flow in mm).

Fig Slump flow test for SCC

V FUNNEL TEST AND V FUNNEL TEST AT T_5MINUTES:

- V-funnel, Bucket, Trowel, Scoop, Stop Watch
- About 12 liters of concrete is needed to perform the test, sampled normally.
- Set the V-funnel on firm ground. Moisten the inside surfaces of the funnel Keep the trap door open to allow any surplus water to drain. Close the trap door and place a bucket underneath.

Fill the apparatus completely with concrete without compacting or tamping, simply strike off the concrete. Level with the top with the trowel. Open within 10 sec after filling the trap door and allow the concrete to flow out under gravity. Start the stopwatch when the trap door is opened, and record the time for the discharge to complete (the flow time). This is taken to be when light is seen from above through the funnel. The whole test has to be performed within 5 minutes.

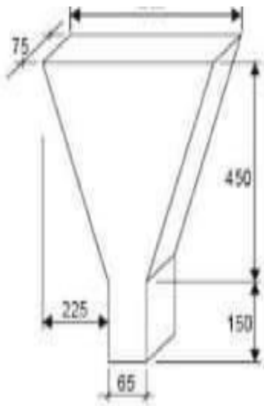

Fig V-funnel test

PROCEDURE FLOW TIME AT T_5 MINUTES:

- Do not clean or moisten the inside surfaces of the funnel again. Close the trap door and refill the V-funnel immediately after measuring the flow time. Place a bucket underneath. Fill the apparatus completely with concrete without compacting or tapping, simply strike off the concrete level with the top with the trowel.
- Open the trap door 5 minutes after the second fill of the funnel and allow the concrete to flow out under gravity. Simultaneously start the stopwatch when the trap door is opened, and record the time for the discharge to complete (the flow time at T_5 minutes). This is taken to be when light is seen from above through the funnel.

PROCEDURE OF THE L-BOX TEST

- L box, Trowel, Scoop, Stop watch
- About 14 liters of concrete is needed to perform the test, sampled normally. Set the apparatus level on firm ground, ensure that the sliding gate can open freely and then close it. Moisten the inside surfaces of the apparatus, remove any surplus water. Fill the vertical section of the apparatus with the concrete sample. Leave it to stand for 1 minute. Lift the sliding gate and allow the concrete to flow out into the horizontal section. Simultaneously, start the stopwatch and record the times taken for the concrete to reach the 200 and 400 mm marks. When the concrete stops flowing, the distances "H_1" and "H_2" are measured. Calculate H_2/H_1, the blocking ratio.

- The whole test has to be performed within 5 minutes. If the concrete flows as freely as water, at rest it will be horizontal, so $H_2/H_1 = 1$. Therefore the nearer this test value, the 'blocking ratio', is to unity, the better the flow of the concrete. The EU research team suggested a minimum acceptable value of 0.8. T_{20} and T_{40} times can give some indication of ease of flow, but no suitable values have been generally agreed. Obvious blocking of coarse aggregate behind the reinforcing bars can be detected visually.

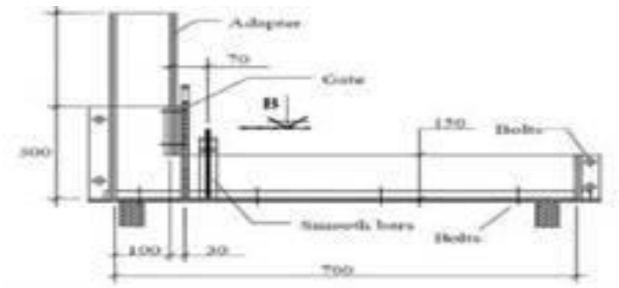

Fig 3 shows L-box test

PROCEDURE OF THE U-BOX TEST

- U - Box, as shown in Fig 4, made of steel, with a flat, horizontal top and placed on Vertical supports, and with a momentary releasable, watertight sliding gate. The apparatus consists of vessel that is divided by a middle wall into two compartments as shown by R1 and R2 in fig.
- An opening with a sliding gate is fitted between the two compartments. Reinforcement bars with normal diameter of 12mm are installed at the gate with centre to centre distance of 50mm. this creates a clear spacing of 35mm between the bars. The U - box is mounted vertically and the central door is closed. The fresh concrete is filled in the left compartment of U - box.

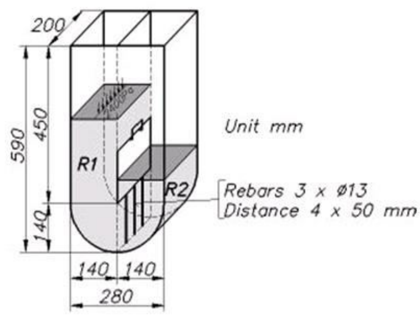

Fig U-box test

- The gate is opened. The concrete will now flow out from one compartment to another. The difference in height between the concrete surfaces on either compartment is measured. This difference in height indicates the self-leveling ability and passing ability of self-compacting concrete. If the concrete flows as freely as water, at rest it will be horizontal, so $H_1\text{-}H_2 = 0$. Therefore the nearer this test value, the 'filling height', is to zero, the better the flow and passing ability of the concrete.

Table 2 workability test results

S. No	Workability Test Methods	Minimum	Maximum	SCC
1	Slump flow (mm)	600	800	660
2	T_{50} cm Slump flow(sec)	2	5	2
3	V – funnel test (sec)	6	12	7
4	V – funnel test at T_5 min (sec)	0	+3	5
5	U – box test (sec)	0	30	40

TESTS ON HARDENED CONCRETE

COMPRESSION TEST

Specimen Details

The cube specimen is of the size 15 x 15 x 15 cm the largest nominal size of the aggregate does not exceed 20 mm. Compression test develops a rather more complex system of stresses. Due to compression load, the cube or cylinder undergoes lateral expansion owing to the Poisson's ratio effect. The steel plates do not undergo lateral expansion to the some extent that of concrete, with the result that steel restrains the expansion tendency of concrete in the lateral direction.

This induces a tangential force between the end surfaces of the concrete specimen and the adjacent steel plates of the testing machine. It has been found that the lateral strain in the steel plates is only 0.4 of the lateral strain in the concrete. Due to this the platen restrains the lateral expansion of the concrete in the parts of the specimen near to its end. The degree of restraint exercised depends on the friction actually developed. When the friction is eliminated by applying grease, graphite or paraffin wax to the bearing surfaces the specimen exhibits a larger expansion and eventually splits along its full length. The compression test specimens were tested on a compression testing machine of capacity 2000 KN. The specimen was placed on machine in such a way that its position is at right angles to its own position which it had at the time of casting. Load is applied gradually as the rate of 14 N/mm^2/min or 320 KN/min.

Table 3 compressive strength in 7, 14, 28 days

S.No	Type of Concrete	Compressive strength (N/mm^2)				
		Age of curing	Specimen 1	Specimen 2	Specimen 3	Average
1	Conventional concrete 1:1.79:2.77:0.4	7 days	22.87	26.45	24.22	24.51
		14 days	30.60	31.70	32.80	31.07
		28 days	40.46	43.55	41.23	41.75
2	Self-Compacting concrete 1:2.13:1.85:0.4	7 days	17.44	18.91	18.12	18.15
		14 days	26.49	24.56	26.50	25.85
		28 days	34.44	37.70	37.15	36.43

Fig compression test

SPLIT TENSILE TEST

Tensile strengths are based on the indirect splitting test on cylinders. This is also sometimes referred as, "Brazilian Test". This test was developed in Brazil in 1943. At about the same time this was also independently developed in Japan. The test is carried out by placing a cylindrical specimen horizontally between the loading specimen of a compression testing machine and the load is applied until failure of the cylinder, along the vertical diameter.

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 its low tensile and brittle in nature. However the determination of tensile strength of concrete is necessary to determine the load at which the concrete members crack. The cracking is a form a tensile failure. The main of this experimental test is to determine the maximum load carrying capacity of test specimens.

Cylinders of size 150 mm in diameter and 300 mm height were cast for split tensile test. Two numbers of specimens were tested 28days.
The splitting tests are well known as indirect tests used for determining the tensile strength of concrete. They are sometimes referred as split tensile strength of concrete.

Table 4 Split tensile strength in 7, 14, 28 days

S.No	Type of Concrete	Split tensile strength (N/mm^2)				
		Age of curing	Specimen 1	Specimen 2	Specimen 3	Average
1	Conventional concrete 1:1.79:2.77:0.4	7 days	2.59	3.15	2.65	2.80
		14 days	3.56	3.60	3.43	3.53
		28 days	4.20	4.47	4.32	4.33
2	Self-Compacting concrete 1:2.13:1.85:0.4	7 days	2.20	2.14	2.24	2.19
		14 days	2.79	2.96	3.80	3.18
		28 days	3.62	4.24	4.14	4.00

Fig split tensile strength on cylinder specimen

ACID RESISTANCE TEST

The acid attack generally occurs when Calcium Hydroxide present in the concrete gets exposed to the acidic substances in the surroundings. The acidic substances both mineral acidic substances (hydrochloric, nitric, phosphoric and sulphuric chemicals) and organic acidic substances (lactic, acetic, formic, tannic chemicals) are the most aggressive agents inducing the acid attack on the concrete. The acid attack on the concrete will not cause deterioration in the interior structure of the concrete without the cement paste on the outer portion being fully deteriorated. The acid attack on the concrete occurs at the value of pH below 6.5, a pH of less than 4.5 leading to severe acid attack. The rate of acid attack also depends on the ability of hydrogen ions to be diffused through the cement gel (C-S-H) after calcium hydroxide ($CA(OH)_2$) has been dissolved and leached out of the concrete.

The cubes of size 150mm x 150mm x 150mm will be caste and gets cured for 28 days. The initial weight of cubes after 28 days will be taken as (W_1).
After that the cubes are immersed in 3% by weight of water of diluted hydrochloric acid (Hcl) with pH value of 2 for a period of 90 days. The concentration of this solution should be maintained throughout this period.
After that the cubes are taken from acid water at every 15 days interval up to 90 days and the surfaces should be cleaned well and weight will recorded as (W_2). The compression strength of the cubes should be calculated after 90 days. The loss in compressive strength and the improvement of resistance of acid attack of the concrete cubes should be calculated. The above test also performed with sulfuric acid (H_2SO_4)

ALKALINE RESISTANCE TEST

It is an important test to determine the alkaline behavior of the concrete. The alkaline attack test was carried out on the cubes of size 150mm x 150mm x 150mm. The cubes will casted and gets cured for 28 days. After that the cubes are immersed in Five percent by weight of water of sodium hydroxide (NAOH) for a period of 90 days.
The concentration of this solution should be maintained throughout this period.

After that the cubes are taken from alkaline water at every 15 days interval up to 90 days and the surfaces should be cleaned well and weight will recorded as (W_2). The compression strength of the cubes should be calculated after 90 days. The loss in compressive strength and the improvement of resistance of alkaline attack of the concrete cubes should be calculated.

RESULT AND DISCUSSION

- The Fresh concrete properties of SCC are showing satisfactory results. Table 2 shows the workability test results of SCC

- The Fresh concrete properties of SCC are showing satisfactory results. Table 3, 4 shows the Split tensile strength, Compression test results of SCC

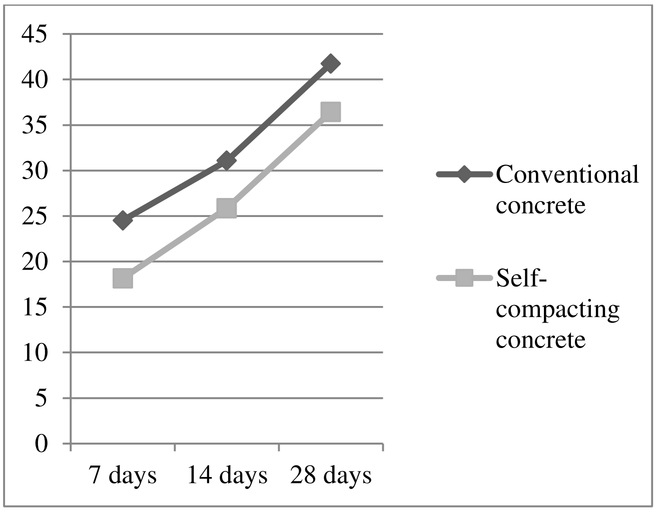

Fig compression test

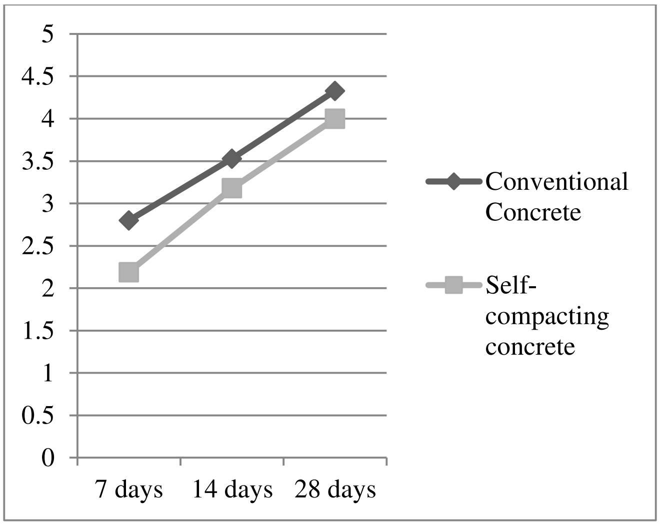

Fig split tensile strength

- From the test results cube compressive strength SCC is 10% lesser than conventional concrete

- And also the split tensile strength SCC is 10% lesser than conventional concrete

CONCLUSION

Based on the results presented, the following conclusions are arrived: The basic properties of materials were tested and results tabulated. The Self compacting concrete is achieved by Cement, Fly ash, Coarse aggregate, Fine aggregate, super plasticizer, viscosity modifying agent and water. The fresh concrete tests like L box, V funnel, U box and slump flow tests were conducted and results tabulated. Cubes and cylinders were casted and tested at 7 Days, 14 Days, 28 Days for Self Compacting Concrete and its results were compared with conventional M_{40} grade concrete.

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