DURABILITY STUDY ON SELF COMPACTING CONCRETE BY USING STEEL FIBERS AND M SAND

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ABSTRACT- *Self-compacting concrete is the very flowable, non-isolating solid that can spread into spot, fill formwork, and exemplify even the most blocked fortification by methods for its very own weight, with next to zero vibration. It conveys these appealing advantages while keeping up or improving all of standard mechanical and strength qualities of cement. Changes in accordance with customary blend plans and the utilization of superplasticizers make this solid that can meet stream execution prerequisites. Oneself compacting cement is perfect to be utilized for throwing intensely strengthened segments or be set where there can be no entrance to vibrators for compaction and in complex states of formwork which may some way or another be difficult to cast, giving a far better surface than customary cement. Self-compacting concrete, likewise alluded to as self-solidifying concrete, can stream and unite under its very own weight and is deaerated totally while streaming in the formwork. It is durable enough to fill the spaces of practically any size and shape without isolation or dying. This makes SCC especially valuable any place putting is troublesome, for example, in vigorously strengthened solid individuals or in convoluted work structures.*

This study aims to focus on the possibility of using Self-compacting concrete in self compacting concrete (SCC) for M30 Grade using additives of super plasticizer and viscosity modifying agent. The fresh and hardened properties and durability of SCC (M30) are studied in laboratory experiments. The possibility of potential use of M Sand being one of the major agro-wastes in South India, as partial replacement of fine aggregate in making a special concrete such as SCC in structural component is verified and discussed.

Key words: *Self-compacting concrete, superplasticizers, steel fibers, M sand, compressive strength, split tensile strength, flexural strength, durability.*

1. INTRODUCTION

Durability is one of the most significant parts of cement because of its crucial frequency in the functionality life of structures. The structures must probably oppose the mechanical activities, the physical and synthetic hostilities they are submitted during their normal administration life. In this regard, breaking assumes a key job in the strength of solid structures. Because of this reality it is important to build up measures so as to keep up the splits under utmost that infer a non huge hazard for the sturdiness of auxiliary components. In this unique circumstance, steel filaments are displayed as an answer for this issue, since because of fiber support systems the solid pliability and post-splitting obstruction can be altogether improved. In spite of the fact that much research has been performed to recognize, explore, and comprehend the mechanical attributes of steel fiber strengthened cement (SFRC), little research has focused on the vehicle properties of this material. Material vehicle properties, particularly penetrability, may influence the solidness and uprightness of a structure. The expansion in solid porousness, because of the inception and proliferation of splits, gives entrance of water, chlorides and other destructive specialists, encouraging crumbling.

Research on the strength of SFRSCC is as yet inadequate, especially consumption obstruction, which is treated in an early structure, giving uncertainty, for instance, regardless of whether the erosion of the filaments could conceivably prompt breaking and consequent spalling of the encompassing cement. In this way, the sturdiness of SFRC is as yet a subject with absence of learning, and subsequently the need to acquire strength markers is of vital significance for a huge approval of this composite material.

Fiber reinforced self compacting concrete

Fiber reinforced concrete turns into a choice at whatever point sturdiness (restricted break widths) or wellbeing contemplations are structure criteria. They improve the exhibition (quality and durability) of weak bond based materials by spanning splits, transmitting worry over a break and neutralizing the split development. The steel fiber is the most widely recognized fiber type in the structure business; plastic, glass and carbon strands add to a littler part to the market. There are different sorts of steel filaments, for example, wave cut, end enormous steel fiber, twisted sheet and furthermore snared end steel fiber. When all is said in done, snared end steel filaments are broadly utilized in the fiber fortified cement since it has higher fortifying impact on the bond framework as contrasted and different kinds of steel strands.

Consolidating steel filaments with SCC to deliver steel fiber fortified self-compacting concrete (SFSCC) is, in this way, exceptionally alluring and conveys a ton of potential for the solid business. SFSCC is a creative kind of solid, which joins the favorable circumstances and broadens the conceivable outcomes of both SCC and steel fiber strengthened solid, subject to the sort and the substance of the strands, the usefulness of SCC can be fundamentally influenced. In customary solid, Steel strands have been connected to supplant bar support, to diminish the width of breaks, to increment elastic and flexural quality, and to improve the post-splitting conduct. Steel fiber fortification impacts the manner in which breaks create in cement and may give improved split development obstruction, expanded surface harshness of individual splits, and a more prominent probability for split stretching and different break advancement. Because of this, steel fiber fortification might be utilized to essentially decrease the penetrability of solid, hence improve the solidness.

OBJECTIVES OF THIESES

The following are the main objectives for the self compacting concrete

1. To study the strength like compressive, split, flexural and durability properties of M sand as fine aggregates
2. To study the workability of self compacting concrete.
3. To compare the fresh and hardened properties of self compacting concrete made with different proportion of M Sand as fine aggregates.

2. LITERATURE REVIEW

Ferraris et al., (1999) The droop test is generally used to assess the usefulness of cement, however on account of self-compacting solid, it has genuine downsides. Other stream qualities, for example, consistency or filling limit are expected to characterize the stream in self-compacting cements. The examination targets of Ferraris (1999) et al. were to test stream attributes of SCC utilizing two solid rheometers and the generally perceived V-stream and U-stream tests, and to decide the connection between's the two rheometers and the tests.

Russell et al., (1997) In his exploration, Russell (1997) discovered that the utilization of slag bond brings down solid penetrability, in this way decreasing the pace of chloride particle dispersion. Legitimate proportioning of slag bond can take out the need to utilize low soluble base or sulfate-safe Portland concretes. Russell's outcomes demonstrated that BFS can be utilized to improve the quality increase at later ages than 28 days, it replaces 20 to 30 percent by mass of the Portland concrete.

Sobolev et al., (1999) Studied the impact of signifying half by mass granulated impact heater slag in the cementitious material that brought about the expanding of substance and warm obstruction. The exceptionally low penetrability of the solid acquired, gave high protection from synthetic assault and to solidifying and defrosting cycles. There was no noticeable devastation of impact heater slag solid examples after 140 cycles of solidifying and defrosting at - 50ºC, and they likewise showed high protection from raised temperatures.

3. MATERIALS USED AND MIX DESIGN

Materials used

Cement

Ordinary Portland cement of 53 grade from the nearby market was utilized and tried for physical and compound properties according to May be: 4031 – 1988and observed to acclimate different determinations according to May be: 12269-1987.

OPC 53 Grade cement

Fine aggregates

In the present examination fine aggregates is normal sand from nearby market is utilized. The physical properties of fine aggregate like explicit gravity, mass thickness, degree and fineness modulus are tried as per IS:2386.

Fine aggregates

Coarse aggregates

The crushed coarse aggregate of 12.5 mm greatest size adjusted acquired from the neighborhood pulverizing plant, Robo silicon, keesera gutta; Hyderabad is utilized in the present investigation. The physical properties of coarse total like explicit gravity, mass thickness, degree and fineness modulus are tried as per IS ; 2386.

Coarse aggregates

Manufactured sand:

Manufactured sand (M-Sand) is a substitute of stream sand for solid development. Fabricated sand is delivered from hard rock stone by pounding.

The squashed sand is of cubical shape with grounded edges, washed and evaluated to as a development material. The size of fabricated sand (M-Sand) is under 4.75mm.

Steel fibers

Tempered steel wire of 0.5 mm separation crosswise over has been used as a piece of the game plan of SFRC. The steel fiber of length 40 mm and of point of view extent 80 has been used as a piece of this exploratory work. All the steel fibers are secured, trapped, deteriorated perfectly healthy.

Steel fibers

Superplasticizer

The super plasticizer utilized in solid blend makes it exceedingly useful for additional time with a lot lesser water amount. It is perceptive that with the utilization of enormous amounts of better material (fine total + bond + fly fiery debris) the solid is much firm and requires more water for required functionality subsequently, in the present examination SP430 is utilized as water decreasing admixture.

Mix design of ssc

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining with the object of producing concrete of certain minimum strength and durability as economically as possible.

Final Mix of M30 grade concrete = 1:1.07:1.38 at w/c of 0.42

4. EXPERIMENTAL INVESTIGATION

Mixing of concrete

Measured quantities of coarse aggregate, fine aggregate and cement were spread out over an impenetrable solid floor. Steel strands are included arbitrarily while blending the solid. The blend again and again until consistency of shading was accomplished the season of blending will be 10 15 minutes.

Concrete mixing

Casting and curing of test specimens

The specimens of standard cubes (150mm x 150mmx 150mm), Standard prisms (100mm x 100mm x500mm) and standard cylinders (150mm diameter x300mm height) were casted.

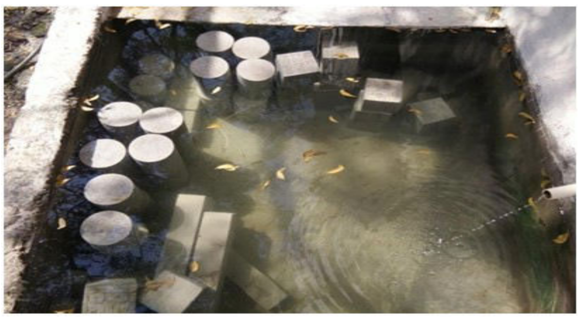
Placing and compacting

The segments of shape were covered with form oil and a comparable covering of form oil was connected between the contact surfaces of the base of the molds and the base plate so as to guarantee that no water evades during the filling. At that point the solid is filled in the molds layer insightful by appropriate compaction. Lastly the molds are leveled once they completely filled. Utilization of slurry on the last solid surface makes solid surface plain by filling the voids.

One thing must be noticed that compaction of cement ought to be done before the start of solid beginning settling time.

Curing

The test example 3D shapes, crystals and chambers were put away in a spot, free from vibration, in most air at 90% relative mugginess and at a temperature of 27 ± 2c for 24 hours ± ½ hour from the season of expansion of water to the dry fixings. At that point the solid 3D shapes, crystals and chambers are expelled from molds and put for restoring for 3 days, 7 days, and 28 days.



Test specimens kept for curing

Tests to be conducted on concrete

Workability

Slump flow test

The concrete slump test is utilized for the estimation of a property of crisp cement. The test is an exact test that estimates the functionality of crisp cement. All the more explicitly, it gauges consistency between bunches.

Slump flow test

Compaction factor test

Compaction factor test is the functionality test for cement directed in research facility. The compaction factor is the proportion of loads of mostly compacted to completely compacted cement. It was created by Road Research Laboratory in United Kingdom and is utilized to decide the usefulness of cement.

Compressive strength of concrete

This test was directed according to ([9] IS516-1959). The 3D shapes of standard size 150x150x150mm were utilized to locate the compressive quality of cement. Examples were set on the bearing surface of CTM, of limit 200T without whimsy and a uniform pace of stacking connected till the disap pointment of the 3D shape. The most extreme burden was noted and the compressive quality ([21] AS Alnuaimi,) was determined.

Compressive strength test machine

Tensile strength of concrete

This test was led according to IS516-1959. The chambers of standard size 150mmx300mm were utilized discover the quality of cement. Examples are set on the bearing surface of CTM, of limit 200T without flightiness and a uniform pace of stacking is connected till the disappointment of chamber. The most extreme burden was noted and the quality was determined. Split rigidity testing Procedure from IS5816-1999

Flexural strength of concrete

This test was led according to IS516-1959. The chambers of standard size 150mmx300mm were utilized discover the quality of cement. Examples are set on the bearing surface of CTM, of limit 200T without flightiness and a uniform pace of stacking is connected till the disappointment of chamber. The most extreme burden was noted and the quality was determined. Split rigidity testing Procedure from IS5816-1999

Durability of concrete

Durability of concrete might be characterized as the capacity of cement to oppose enduring activity, compound assault, and scraped area while keeping up its ideal building properties.

Sturdiness is characterized as the ability of cement to oppose enduring activity, synthetic assault and scraped spot while keeping up its ideal building properties. It typically alludes to the term or life expectancy of inconvenience free execution. Various cements require various degrees of strength relying upon the presentation condition and properties wanted. For instance, concrete presented to tidal seawater will have unexpected prerequisites in comparison to indoor cement.

In the present investigation solidness of SCC was led because of impact of corrosive and sulfates

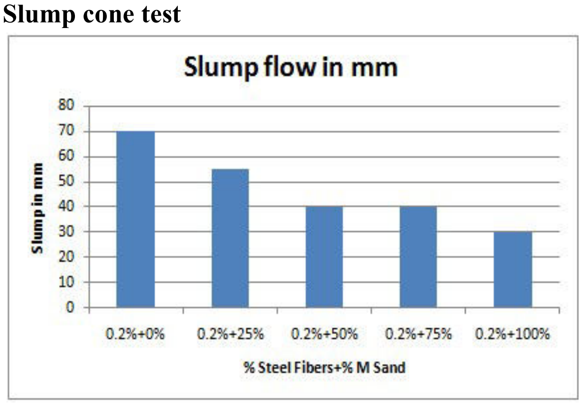
Mixing acid

Specimen tested after acid attack

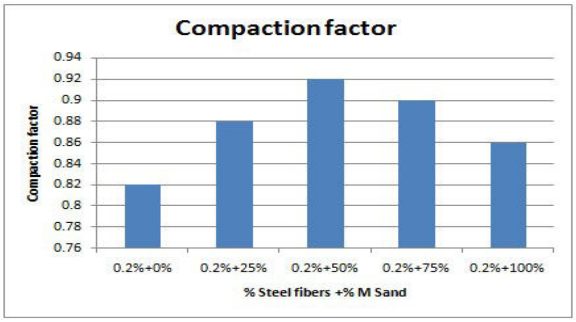
Test specimen after sulphate attack

5. RESULTS AND ANALYSIS

Workability of concrete
Slump cone test



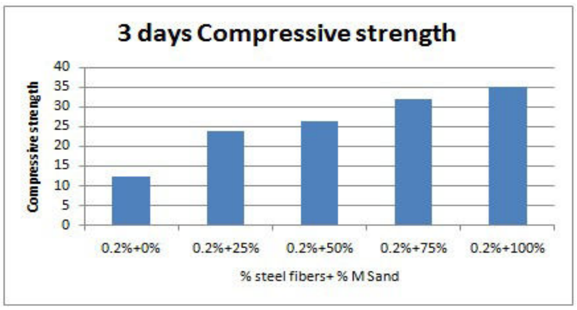
Compaction factor test



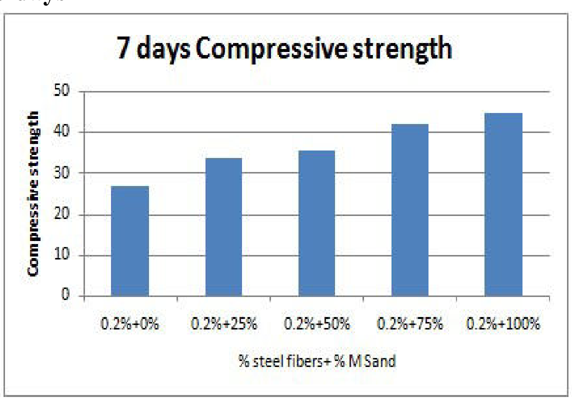
Strength of concrete

Compressive strength

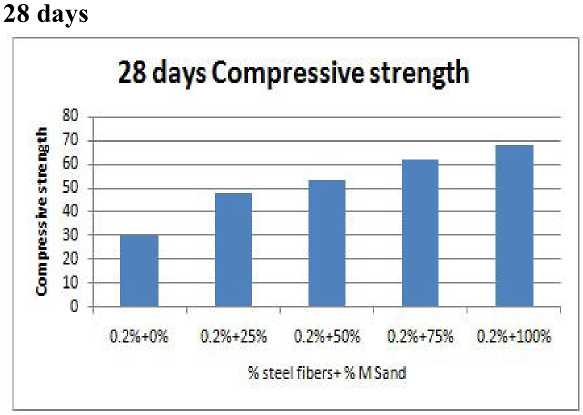
3days



7 days

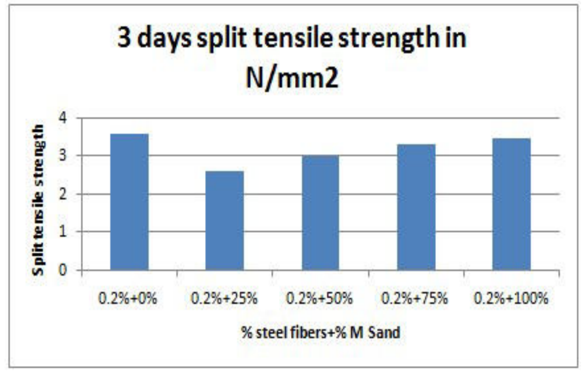


28 days



Split tensile strength

3days



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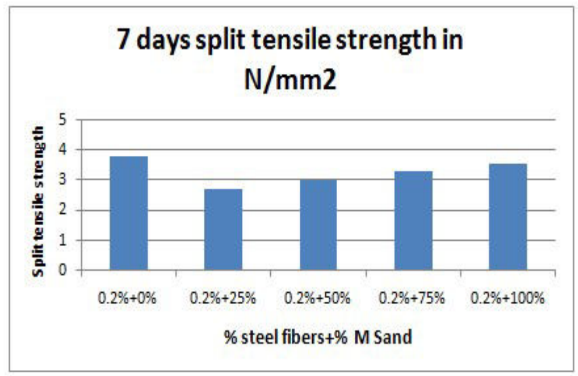

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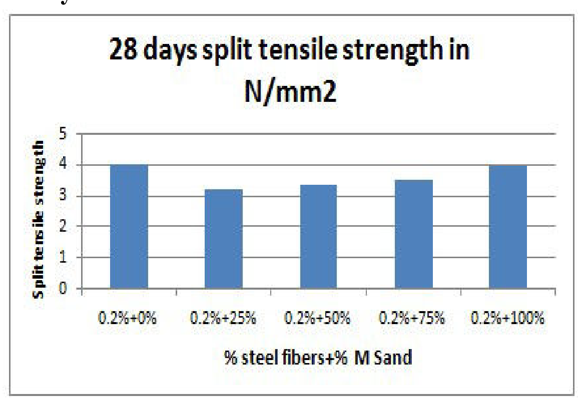
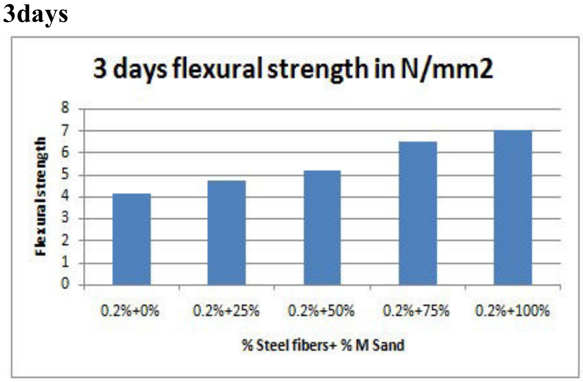


Flexural strength

3days



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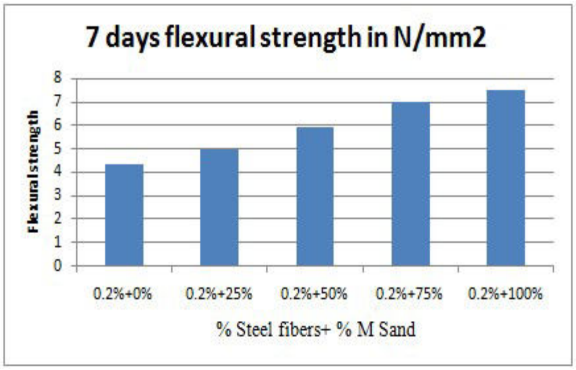

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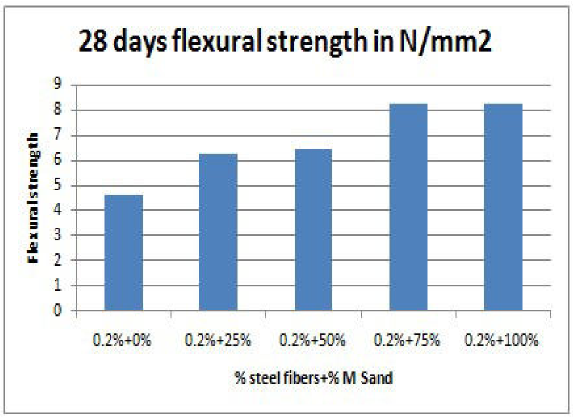
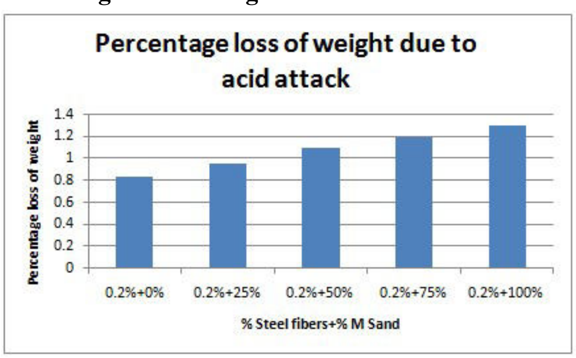


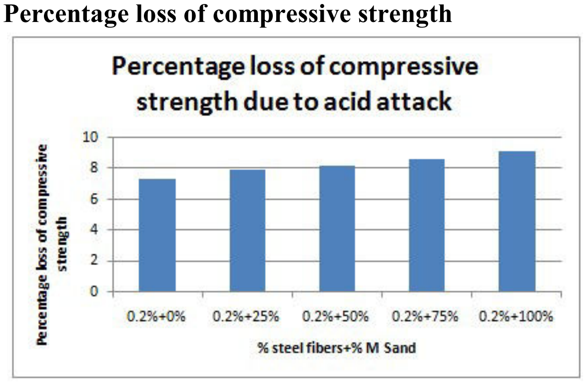
Durability of concrete

Acid attack

Percentage loss of weight



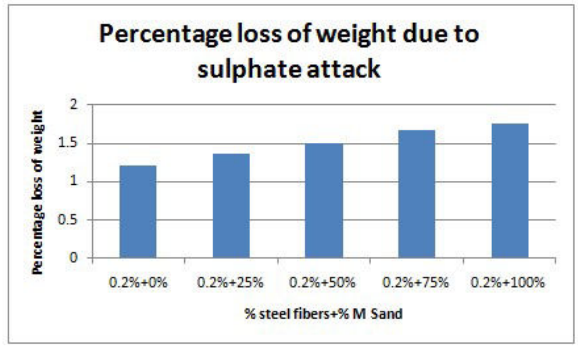
Percentage loss of compressive strength



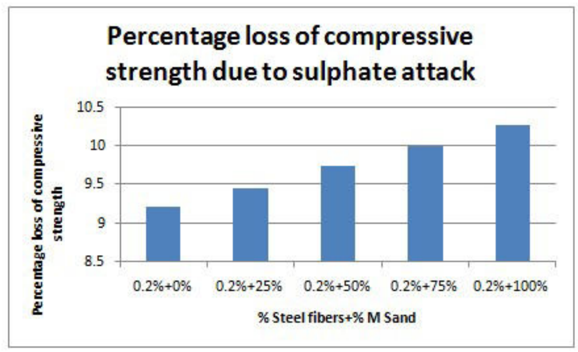
Sulphate attack

Acid attack

Percentage loss of weight



Percentage loss of compressive strength



6. CONCLUSIONS

From the above experimental study the following conclusions were made

1. Self-compacting concrete can be obtained in such a way, by adding chemical and mineral admixtures, so that its splitting tensile and compressive strengths are higher than those of normal vibrated concrete.
2. The slump flow value for the SCC by using steel fibers and M sand decreases with increasing the percentage.
3. The optimum value of SCC was observed at 20% steel fibers and 50% M sand after that compaction factor value will be decreases.
4. The optimal value of compressive strength of SCC was observed at 2% steel fibers and 100% M sand case. The value of split tensile strengths increases with increase in the percentage of M sand in SCC up to 100%.

5. The optimal value of split tensile strength of SCC was observed at 2% steel fibers and 100% M sand case. The value of split tensile strength increases with increase in the percentage of M sand in SCC up to 100%.
6. The optimal value of flexural strength of SCC was observed at 2% steel fibers and 100% M sand case. The value of flexural strength increases with increase in the percentage of M sand in SCC up to 100%.
7. The percentage of weight loss and strength loss increases with increasing the percentage of M sand in SCC for both acid attack and alkaline attack case.
8. In addition, self-compacting concrete has two big advantages. One relates to the construction time, which in most of the cases is shorter than the time when normal concrete is used, due to the fact that no time is wasted with the compaction through vibration.
9. The second advantage is related to the placing. As long as SCC does not require compaction, it can be considered environmentally friendly, because if no vibration is applied no noise is made.

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