COMPARISON OF HIGH STRENGTH CONCRETES

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ABSTRACT

Conventional concrete tends to present a problem with regard to adequate consolidation in thin sections or areas of congested reinforcement, which leads to a large volume of entrapped air voids and compromises the strength and durability of the concrete. Self-compacting concrete (SCC) can eliminate the problem, since it was designed to consolidate under its own mass. Normal concrete was designed by using IS method and self-compacting concrete was designed by a simple mix design proposed by Nan Su(2). SCC was developed in 1988’s by Prof. Hagime Okamura in Japan. SCC was one of the special concrete in across the world.

This paper deals with the comparison of two different types of high strength concretes they are high strength conventional concrete and high strength self-compacting concrete. An experimental and numerical study on mechanical properties, such as compressive strength, flexural strength and split tensile strength of self-compacting concrete (SCC) and the corresponding properties of conventional concrete (CC) were studied. The age at loading of the concretes for 7 and 28 days curing.

Keywords: SCC, Conventional Concrete, CS, Flexural Strength, Split Tensile Strength.

1.0 INTRODUCTION

There are many types of concrete available, created by varying the proportions of the main ingredients. By varying the proportions of materials, or by substitution for the cementitious and aggregate phases, the finished product can be tailored to its application with varying strength, density, or chemical and thermal resistance properties. The mix design depends on the type of structure being built, how the concrete will be mixed and delivered, and how it will be placed to form this structure.
Unlike the conventional concrete, self-compacting concrete doesn't require compacting using external force from mechanical equipment such as an immersion vibrator; instead SCC is designed in such a way that it gets compacted using its own weight and characteristics. The self-compacting of concrete is achieved without losing any kind of strength, stability, or change in properties.

1.1 How is SCC made?
Self-compacting concrete is a type of concrete, which is not a product of mixing substances having different properties but a combination of several mixes having the same flow characteristics. Manufacturing of a Self-Compacting Concrete requires three main aspects to be fulfilled. They are as follows:

- High amount of water reducing substance or super plasticizers is added for obtaining high flowing characteristics.
- A type of aggregate mixture is added to gain the desired compactness. Note that the aggregate content is of round shape and proportional in size in order to increase the locking tendency of the concrete.
- Alteration of fluid properties is done to ensure a cohesive mix which will keep the aggregate and paste together. These fluid properties can be achieved by adding a high quantity of fine content such as cement fly-ash or by adding viscosity modifying admixtures (VMA).

1.2 Two Main Methods of Making SCC

There are two known and main methods for making SCC. They are as follows

**Powder method**
In this method superplasticisers are mixed with cementitious materials such as fly ash, slag, etc. to form a paste. The paste increases the flow of the concrete and holds all the constituents together.

**Admixture method**
In this method instead of the conventional superplasticisers, new types of superplasticisers known as polycarboxylate superplasticisers are used. This not only increases the flow capability of the concrete but also improves the viscosity and the constituent's retention property.

1.3 Objectives of Self-Compacting Concrete
The SCC should meet the some functions at the plastic stage are different from those on a traditional vibrated fresh concrete. Filling of formwork with a liquid suspension requires workability performance which is recommended to be described as follows:

- **Filling Ability**
  SCC is filling of entire formwork and encapsulation of reinforcement and other inserts with maintaining homogeneity in both vertical & horizontal directions are essential.
• **Passing Ability**
  SCC is passing through congested area such as narrow sections of the formwork even closely spaced reinforcement etc without blocking caused by interlocking of aggregate particles.

• **Resistance to Segregation**
  SCC is maintaining of homogeneity throughout mixing and during transportation and casting. The dynamic stability refers to the resistance to segregation during placement. The static stability refers to resistance to bleeding, segregation and surface settlement after casting.

**2.0 MIX DESIGN: THIS MIX DESIGN WAS PROPOSED BY NAN-SU (2)**

To produce SCC, the major work involves designing an appropriate mix proportion and evaluating the properties of the concrete thus obtained. Initial trail mixes are obtained from Nan Su mix design procedure and mixes are modified according to get fresh, hardened properties and hardened properties. Among them the bold ones satisfy the specifications and economical mixes. From the obtained mixes a simplified mix design was developed for PPC and SCC on the lines of Non-su method using Portland pozzolana cement and micro silica. The procedure is described in the following steps.

**Step 1: Calculation of coarse aggregate and fine aggregate**

The packing factor (PE) of aggregate is defined as the ratio of mass aggregate of tightly packed state in SCC to that of loosely packed state. Clearly, PF affects the content of aggregates in SCC. A higher PF value would imply a greater amount of coarse aggregates used, thus, decreasing the content of binders in SCC consequently, its flowability, self-compacting ability and compressive strength will be reduced. On the other hand, a low PF value would mean increased dry shrinkage of concrete. As a result, more binders are required, thus, raising the cost of materials. In addition, excess binders used would also affect the workability and duration of SCC. Therefore, it is important to select the optimal PF value in the mix design method so as to meet the requirements for SCC properties, and at the same time taking economic feasibility into consideration. The content of fine and coarse aggregates can be calculated as follows:

\[
W_g = PF \times W_{gl} \times (1-(s/a))
\]

\[
W_s = PF \times W_{sl} \times (s/a)
\]

Where
- \(W_g\) = content of coarse aggregates in SCC (kg/m³);
- \(W_s\) = content of fine aggregates in SCC (kg/m³);
- \(W_{gl}\) = unit volume mass of loosely piled saturated surface-dry Coarse aggregate in air (kg/m³);
- \(W_{sl}\) = unit volume mass of loosely piled saturated surface-dry fine aggregates in air (kg/m³);
- \(PF\) = packing factor;
- \((s/a)\) = volume ratio of fine aggregates to total aggregates, which ranges from 50% to 57%.
Step 2: Calculation of PPC content

To secure good flowability and segregation resistance, the content of binders (power) should not be too low. However, too much cement used will increase and drying shrinkage of SCC. Generally, it was observed that SCC produce with PCC provides a compressive strength of 0.11 Mpa/kg cement. Therefore, the cement content to be used is:

\[ C = \frac{f_c}{0.110} \]

Where
- \[ C \] = Portland pozzolana cement (kg/m^3);
- \( f_c \) = designed compressive strength (Mpa).

Also while arriving at cement content one should remember that the total powder content to be maintained in SCC is 400-600 kg/m^3 as per EFFNARC specifications.

Step 3: Determining the Micro silica content

The ultra fine particles of micro silica fill the gaps between cement grains refining the voids in the fresh concrete. These particles act like ball bearing which give more mobility to the concrete and make it much more cohesive. Because the micro silica particles are ultra fine, with a specific surface area of around 20,000 m^2/kg and SiO2 content around 90%, the reactivity is very high. The crystalline structure formed by this reaction is very fine and fills the void spaces within the matrix. This densifies the whole concrete structure, resulting in increased strength and significant in permeability.

So, based on propose and economy micro silica can be used up to 10% of the cement used as addition. But in this work the dosage of micro silica is restricted to 2-4% only.

Step4: Determining the mixing water content

Although factors such as content of fine and coarse aggregates, material proportions, and curing age can affect the compressive strength of SCC, the ratio of water to binders by weight (W/B) is the most prominent determinant of compressive strength. The smaller PF value, the more the paste volume in SCC will be. As a result, the compressive strength becomes higher. W/B ratio is studied from the fig and required water content to be used is:

\[ WW = (W/B) \times (C + Wms) \]

Where
- \( C \) = Portland pozzolana cement content (kg/m^3);
- \( Wms \) = micro silica content (kg/m^3);
- \( WW \) = water content(kg/m^3);

Step5: Determining SP dosage

Adding an adequate dosage of SP can improve the flowability, self-compacting ability and segregation resistance of fresh SCC for meeting the design requirements.

Optimum dosage of GLENIUM B233 should be determined with trail mixes. As a guide, a dosage range of 500ml to 500ml per 100kg of cementitious material is normally recommended. In this work dosage of SP is taken as 1.3% of amount of binders. Dosage of SP in kg/m^3 is given by

\[ WSP = 0.013 \times (C + Wms) \]
Step 6: Adjustment of mixing water content needed in SCC

According to the moisture content of aggregates at the ready-mixed concrete plant or construction site, the actual amount of water used for mixing should be adjusted.

Step 7: trial mixes and tests on SCC properties

Trial mixes can be carried out using the contents of materials calculated as above. Then, quality control tests for SCC should be performed to ensure that the following requirements are met.

1. Results of slump flow, L-flow and V-Funnel tests should comply with the specifications of the European standards.
2. The segregation phenomenon of materials should be satisfactory.
3. Water–binders ratio should satisfy the requirements of durability and strength.
4. Air content should meet the requirement of the mix design.

Step 8: Adjustment of mix proportion

If results of the quality control tests mentioned above fail to meet the performance required of the fresh concrete, adjustments should be made until all properties of SCC satisfy the requirements specified in the design. For example, when the fresh SCC shows poor flow abilities, the PF value is reduced to increase the binder volume and to improve the workability.

2.1 Acceptance criteria for SCC (1)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Method</th>
<th>Unit</th>
<th>Typical Range of Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>Slump Flow Test</td>
<td>Mm</td>
<td>650</td>
</tr>
<tr>
<td>2</td>
<td>$T_{50}$ cm Slump Flow</td>
<td>Sec</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>V-Funnel Test</td>
<td>Sec</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>V-Funnel at $T_{5}$ minutes</td>
<td>Sec</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>L-Box Test</td>
<td>$h_2/h_1$</td>
<td>0.8</td>
</tr>
</tbody>
</table>

2.2 Mix Design of SCC for M 50

- Characteristic Strength = 50 Mpa
- Maximum size of aggregates = 20mm
- Specific gravity of coarse aggregates, $G_g$ = 2.74
- Specific gravity of fine aggregates, $G_s$ = 2.67
- Bulk density of loose coarse aggregates = 1385.50 kg/m$^3$
- Bulk density of loose fine aggregates = 1450.19 kg/m$^3$
- Specific gravity of cement, $G_c$ = 3.15
- Volume of fine/course aggregate ratio(s/a) = 0.55
Determination of Coarse aggregate
Assume P.F = 1.15
Amount of coarse aggregate \( W_g \) = \( 1.15 \times 1385.50 \times (1-0.55) \)
\( W_g = 717.177 \text{ kg/m}^3 \)

Determination Fine aggregate
Amount of fine aggregate, \( W_s \) = P.F x \( W_{sl} \) (s/a)
\( = 1.15 \times 1450.19 \times 0.55 \)
\( = 917.125 \text{ kg/m}^3 \)

Determination of cement
\( C = \frac{F_c}{0.110} \)
Given 0.11 Mpa = 20PSI
\( \therefore C = \frac{50}{0.110} \)
\( = 529.540 \text{ kg/m}^3 \)

Determination of micro silica content
Assume 2% of micro silica in cemen
\( W_{ms} = 0.02 \times 529.54 = 10.59 \text{ kg/m}^3 \)

Determination of water
For water to binder ratio for 58.25 Mpa is = 0.34
\( \therefore \frac{W}{B} = 0.34 \)
\( W = (W/B) \times (C+W_{ms}) \)
\( = 0.34 \times (529.54+10.59) \)
\( = 183.64 \text{ kg/m}^3 \)

Determination of SP dosage
SP dosage = 1.3 % of (529.54+10.59)
\( = 7.02 \text{ kg/m}^3 \)

Adjustments: After conducting no of trails we conclude that, the following SCC mix ratios are satisfying the required workability and flow ability conditions.

Water binder ratio = 0.340

2.3 CONVENTIONAL CONCRETE MIX DESIGN (6)

DESIGN PARAMETERS (FOR M50)

(a) Maximum size of aggregate : 20 mm
(b) Degree of workability : 0.90 Comp., factor
(c) Degree of quality control : Good
(d) Type of Exposure : Mild
(e) Compressive Strength of cement : 53 N/mm² at 28 days
(f) Selection of W/C ratio : 0.40 for M50
Concrete mix design for M50 grade of concrete was done according to IS: 10262 – 2009 and the final proportion achieved are given in table – 5.4.

A) Target strength for mix proportioning  
\[ f'ck = f'ck + ks \]

From Table 1 standard deviation, \( s = 5 \text{ N/mm}^2 \)

Therefore target strength = \( 50 + 1.65 \times 5 = 58.25 \text{ N/mm}^2 \)

B) Selection of w/ c ratio  

From Table 5 of IS 456:2000, maximum water cement ratio = 0.4 (Mild exposure)  

Based on experience adopt water cement ratio as 0.40 (0.4 < 0.55, hence ok)

C) Selection of water content  

From Table 2, maximum water content = 186 litres (for 25 mm –50 mm) slump range and for 20 mm aggregates.

D) Calculation of cement content  

Water cement ratio = 0.40  
Cement content = \( 186/0.4 \) = 465 kg/m³ >320 kg/m³ (given)  

From Table 5 of IS 456, minimum cement content for mild exposure condition = 300 kg/m³, Hence OK

E) Mix calculations  
The mix calculations per unit volume of concrete shall be as follows

a) Volume of concrete = 1 m³  
b) Volume of cement = \( \frac{mass \text{ of cement}}{\text{specific gravity of cement}} \times \frac{1}{1000} \)  
\[ = \left( \frac{465}{3.15} \right) \times \left( \frac{1}{1000} \right) = 0.147 \text{ m}^3 \]

c) Volume of water = \( \frac{186}{1} \times \frac{1}{1000} \) = 0.186 m³  
d) Volume of all in aggregates (e) = \( a - (b + c) \)  
\[ = 1 - (0.147 + 0.186) \]  
\[ = 0.666 \text{ m}^3 \]

e) Volume and weight of coarse aggregates  
Volume of coarse aggregate = 0.62 + 0.02 = 0.64 m³  
Weight = (Volume of all in aggregates x volume of coarse aggregate x specific gravity of CA x 1000)  
\[ = 0.666 \times 0.64 \times 2.74 \times 1000 = 1170 \text{ kg} \]

f) Volume and weight of fine aggregates  
Volume = 0.667 x 0.36 = 0.240 m³  
Weight = Volume of all in aggregates x Volume of FA x specific gravity of FA x 1000  
\[ = 0.240 \times 2.67 \times 1000 \]  
\[ = 641 \text{ kg} \]
### F) Mix proportions

<table>
<thead>
<tr>
<th>Material</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>465 kg/m³</td>
</tr>
<tr>
<td>Water</td>
<td>186 kg/m³</td>
</tr>
<tr>
<td>Fine aggregate</td>
<td>641 kg/m³</td>
</tr>
<tr>
<td>Coarse aggregates</td>
<td>1170 kg/m³</td>
</tr>
<tr>
<td>Water cement ratio</td>
<td>0.40</td>
</tr>
</tbody>
</table>

**MATERIALS**

**MIXING and Pouring**

**Slump flow test & T50**
Lbox test

Compressive strength test

Flexural strength test

Split tensile strength test
3.0 EXPERIMENTAL RESULTS

3.1 PHYSICAL PROPERTIES OF ORDINARY PORTLAND CEMENT 53 GRADE

<table>
<thead>
<tr>
<th>S. No</th>
<th>Property</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal consistency</td>
<td>30%</td>
</tr>
<tr>
<td>2</td>
<td>Specific gravity</td>
<td>3.15</td>
</tr>
<tr>
<td>3</td>
<td>Setting time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initial setting time</td>
<td>35 min</td>
</tr>
<tr>
<td></td>
<td>Final setting time</td>
<td>230 min</td>
</tr>
<tr>
<td>4</td>
<td>Fineness of cement (IS sieve no.9)</td>
<td>4.0%</td>
</tr>
<tr>
<td>5</td>
<td>Compressive strength 1:3 sand mortar cubes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>At 7 days</td>
<td>35 Mpa</td>
</tr>
<tr>
<td></td>
<td>At 28 days</td>
<td>53 Mpa</td>
</tr>
</tbody>
</table>

3.2 PROPERTIES OF FINE AGGREGATE & COARSE AGGREGATE (9)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Properties</th>
<th>Fine aggregates</th>
<th>Coarse aggregates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Specific gravity</td>
<td>2.670</td>
<td>2.74</td>
</tr>
<tr>
<td>2</td>
<td>Loose bulk density</td>
<td>1450 kg/m³</td>
<td>1365 kg/m³</td>
</tr>
<tr>
<td>3</td>
<td>Rodded bulk density</td>
<td>1713 kg/m³</td>
<td>1610 kg/m³</td>
</tr>
</tbody>
</table>

3.3 SIEVE ANALYSIS FOR FINE AGGREGATE

<table>
<thead>
<tr>
<th>S. No</th>
<th>I.S. sieve designation</th>
<th>Weight retained (grams)</th>
<th>Cumulative wt retained (grams)</th>
<th>Cumulative % of weight retained</th>
<th>Percentage passing By weight</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>Fine Aggregate conforming to Grading Zone II of IS: 383 – 1970</td>
</tr>
<tr>
<td>2</td>
<td>20 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.75 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2.36 mm</td>
<td>20</td>
<td>20</td>
<td>2</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.18 mm</td>
<td>80</td>
<td>100</td>
<td>10.0</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>600 microns</td>
<td>344</td>
<td>444</td>
<td>44.4</td>
<td>55.6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>300 microns</td>
<td>329</td>
<td>773</td>
<td>77.3</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>150 microns</td>
<td>199</td>
<td>972</td>
<td>97.2</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>&lt; 150 microns</td>
<td>28</td>
<td>1000</td>
<td>100</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Total = 1000 grams  330.90
3.4 SIEVE ANALYSIS FOR COARSE AGGREGATE

<table>
<thead>
<tr>
<th>S. No</th>
<th>I.S. sieve designation</th>
<th>Weight retained (grams)</th>
<th>Cumulative wt retained (grams)</th>
<th>Cumulative % of weight retained</th>
<th>Percentage passing By weight</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>Coarse Aggregate conforming to Grading Zone II of IS: 383 – 1970</td>
</tr>
<tr>
<td>2</td>
<td>20 mm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10 mm</td>
<td>9155</td>
<td>9155</td>
<td>91.55</td>
<td>8.45</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4.75 mm</td>
<td>750</td>
<td>9905</td>
<td>99.05</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2.36 mm</td>
<td>0</td>
<td>9975</td>
<td>99.05</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.18 mm</td>
<td>0</td>
<td>9905</td>
<td>99.05</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>600 microns</td>
<td>0</td>
<td>9905</td>
<td>99.05</td>
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<tr>
<td>8</td>
<td>300 microns</td>
<td>0</td>
<td>9905</td>
<td>99.05</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>150 microns</td>
<td>0</td>
<td>9905</td>
<td>99.05</td>
<td>0.95</td>
<td></td>
</tr>
</tbody>
</table>

Total = 9905 grams          685.85

3.5 MIX PROPORTIONS FOR M50 GRADES OF CONCRETE

(Quantities of Materials per 1 Cubic Meter of Concrete)

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Cement (kg)</th>
<th>Fine Aggregate (kg)</th>
<th>Coarse Aggregate (kg)</th>
<th>Water (litres)</th>
<th>W/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>M50</td>
<td>465</td>
<td>641</td>
<td>1170</td>
<td>186</td>
<td>0.4</td>
</tr>
</tbody>
</table>

3.6 WORKABILITY OF CONVENTIONAL CONCRETE

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Slump test (mm)</th>
<th>C.F</th>
</tr>
</thead>
<tbody>
<tr>
<td>M50</td>
<td>90</td>
<td>0.9</td>
</tr>
</tbody>
</table>

3.7 FOR CONVENTIONAL CONCRETE (10)

<table>
<thead>
<tr>
<th>Grade of concrete</th>
<th>w/c ratio</th>
<th>Compressive Strength (N/mm²)</th>
<th>Split Tensile Strength (N/mm²)</th>
<th>Flexural Strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7days</td>
<td>28days</td>
<td>7days</td>
<td>28days</td>
</tr>
<tr>
<td>M50</td>
<td>0.4</td>
<td>37.20</td>
<td>57.69</td>
<td>2.9</td>
</tr>
</tbody>
</table>
3.8 FOR SELF COMPACTING CONCRETE

<table>
<thead>
<tr>
<th>Grade of concrete</th>
<th>W/B ratio</th>
<th>Compressive Strength (N/mm²)</th>
<th>Split Tensile Strength (N/mm²)</th>
<th>Flexural Strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7days</td>
<td>28days</td>
<td>7days</td>
</tr>
<tr>
<td>M50</td>
<td>0.34</td>
<td>34.97</td>
<td>61.3</td>
<td>3.12</td>
</tr>
</tbody>
</table>

3.9 COMPARISON OF RESULTS

<table>
<thead>
<tr>
<th>Strengths(in days)</th>
<th>SCC (N/mm²)</th>
<th>Conventional Concrete(N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression Strength</td>
<td>7days 34.97</td>
<td>28days 59.5</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>7days 4.9</td>
<td>28days 7.5</td>
</tr>
<tr>
<td>Split Tensile Strength</td>
<td>7days 3.12</td>
<td>28days 4.05</td>
</tr>
</tbody>
</table>

4.0 GRAPHS

4.1 Comparison of Compression Strength & Flexural Strength

4.2 Comparison of Split Tensile Strength
5.0 CONCLUSION

1. After conducting various trial tests, M50 grade self-compacting concrete is finally obtained which satisfied all the SCC characteristics such as flowability, passing ability and segregation resistance given. As there are no Indian standards for Self compacting concrete(SCC) comparison could not be made.
2. From the observations it was found that nearly 2/3of the compressive strength is gained in 7 days curing which satisfies IS: 456-2000.
3. It was observed that the Split Tensile strength & Flexural Strength of SCC has attained the permissible values for 7 days and 28 days as per IS: 456-2000.
   Finally can conclude that the strength of Self-Compacting Concrete is higher than the Conventional Concrete.

6.0 REFERENCES

14. IS 383-1997 used for zonation of coarse and fine aggregate.