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Study of self-compacting concrete

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ABSTRACT

SCC (Self-Compacting Concrete) was developed to enhance the resilience of concrete constructions. Since its inception, numerous studies have been conducted, and SCC has been successfully applied to real structures in Japan, particularly by prominent construction firms. Research has focused on establishing a rational mix-design technique and self-compactability testing methodologies to standardize SCC as regular concrete.

SCC is cast in a manner that eliminates the need for additional inner or exterior vibration during the compaction process. As a result, it exhibits a smooth surface and flows in a manner similar to honey. In comparison to traditional vibrated concrete, SCC requires a significant amount of powder content (either through fine aggregate or fillers) to achieve a homogeneous and cohesive mixture (Topcu&Uygunoglu, 2010).

According to Okamura & Ozawa (1995), self-compactability in SCC can be achieved through various methods, including increasing the fine aggregate content, reducing the maximum aggregate size, increasing the powder content, using viscosity-modifying admixtures (VMA), and decreasing the water-to-binder ratio by employing superplasticizer (SP). These strategies help optimize the self-compacting properties of the concrete mixture.

Key Words: Opening Area, Core Type Shear Wall, Shear Wall, Highest Importance Factor

INTRODUCTION

In accordance with Indian Standard, IS 456:2000, the constituent materials for SCC are the same as those used in conventional vibrated concrete. However, extra caution is required in both the initial selection and ongoing monitoring for uniformity of fresh concrete in order to ensure uniform and consistent performance for SCC. To meet these standards, it is necessary to tighten the control over the constituent materials and limit the permissible deviations, ensuring that the production of SCC meets the conformity criteria without the need for testing and batch adjustments.

The mix ratios for SCC are distinct from those for conventional concrete. The SCC has a greater powder content while having a lower powder content and more coarse aggregate. Additionally, SCC usually uses tiny dosages of a VMA together with greater quantities of HRWR or SP.

Below is a discussion of the SCC materials and their requirements according to IS code rules and EFNARC (2005) guidelines:

OBJECTIVE OF THEWORK

The following are the main goals of the investigation: 1. To compare and evaluate the compressive strength of beams by testing general M20 and a percentage-replaced PEG 400 based on concrete.

2. To test general M20 and PEG 400 based on concrete in order to identify and compare the split tensile strength of concrete cylinders.

3. To compare and determine the flexural strength of beams using tests on general M20 and PEG 400 that has been partially replaced based on concrete.

4. A comparison of general concrete's behavior with and without PEG-400.
5. Using design software, conduct an extensive parametric analysis on PEG-400 members.
6. To determine the smallest PEG-400 % necessary to determine the highest concrete strength.
7. To investigate how durability testing on cubes can increase strength and to describe the durability characteristics of both M20 and M25 grade concrete with and without concrete replacement.

Result:-Compressive Strength Test: Each batch mix is cast with a minimum of three cubes to determine compressive strength. The specimens are tested when they are 28 days old.According to IS: 516-1959 clause no. 5.5.1 page no. 11, specimens are loaded and placed in the test machine in

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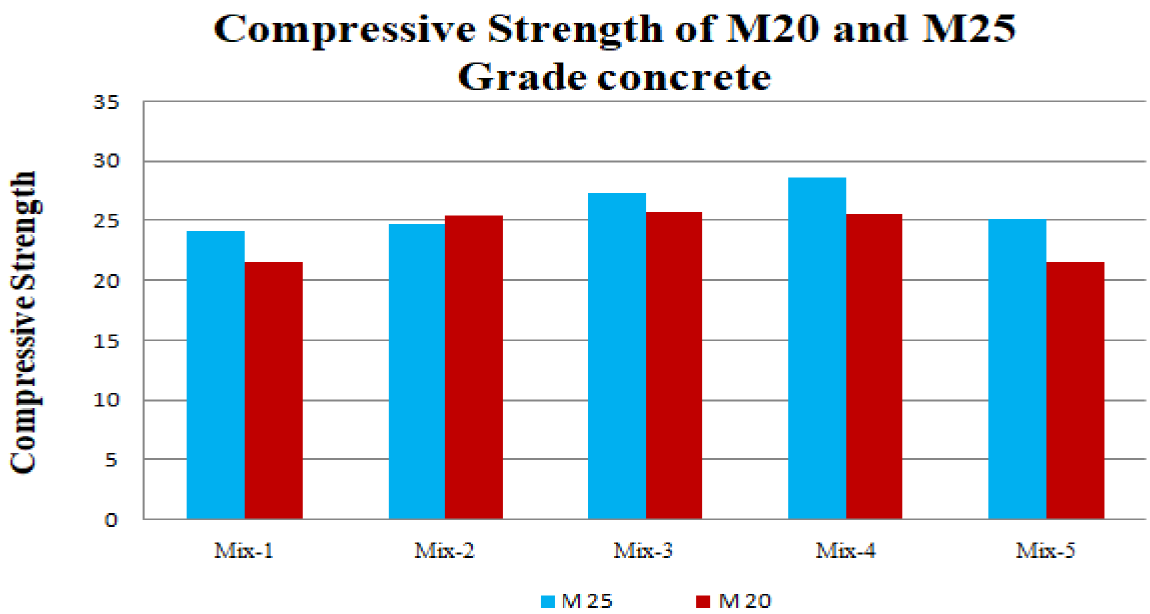
accordance with the same IS code.

Table -1: Result of Compressive Strength on Cubes

Mix	% Replacement	Compressive Strength (N/mm^2) for M-25 Grade	Compressive Strength (N/mm^2) for M-20 Grade
		28 Days	28 days
Mix-1	0	24.13	21.62
Mix-2	1	24.75	25.41
Mix-3	1.5	27.36	25.8
Mix-4	2	28.67	25.6
Mix-5	2.5	25.16	21.6



Graph -1: Graphical Representation of Compressive

Flexural strength: For the purpose of calculating flexural strength, 10cm*10cm*50cm beams are cast. At the specimen's age of 28 days, tests on beams are conducted. It is done in accordance with IS: 516-1959 in clauseno8.3.1pageno17 while placing the specimen in the machine.108 KN/min of increasing load is applied per minute. Applying load till the specimen fails and recording the load at which it fails. Flexural strength is determined and tabulated below according to the IS code.

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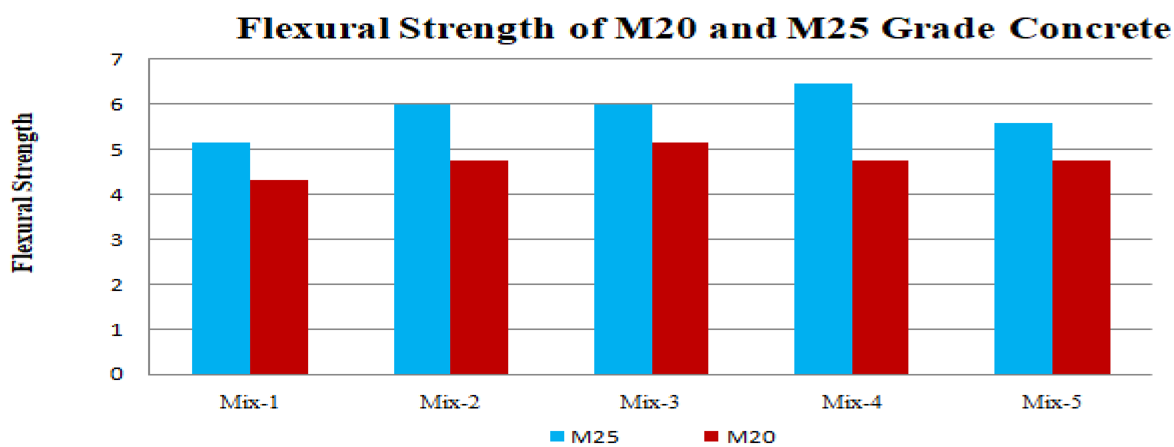
Table -2: Result of Flexural Strength on Beams

Mix	% Replacement	Flexural Strength (N/mm2)for M-25 Grade	Flexural Strength (N/mm2)for M-20 Grade
		28 Days	28 Days
Mix-1	0	5.14	4.30
Mix-2	1	5.96	4.75
Mix-3	1.5	5.98	5.13
Mix-4	2	6.43	4.74
Mix-5	2.5	5.57	4.73

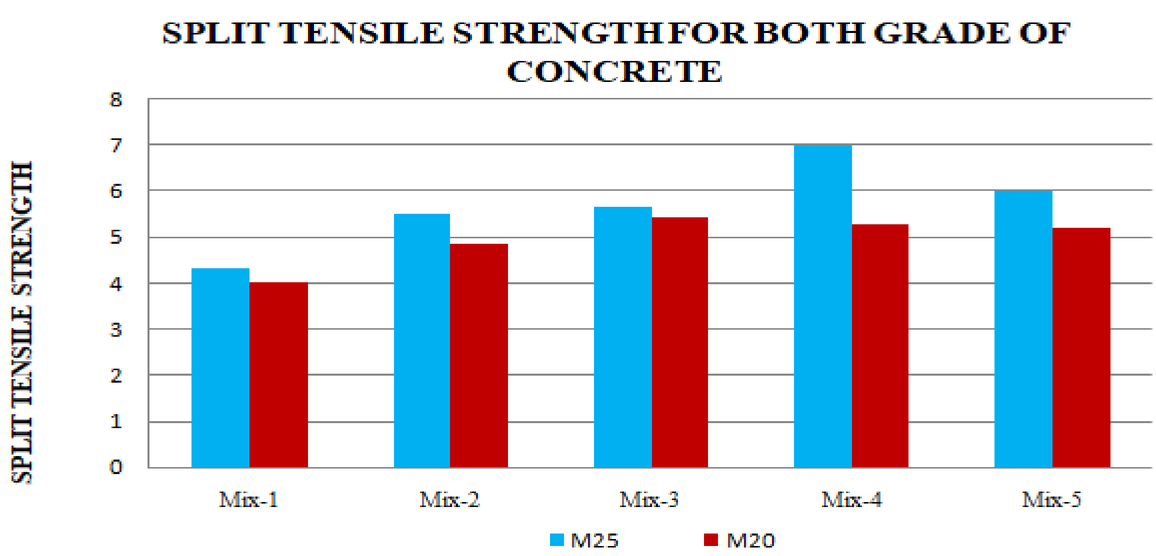


Graph -2: Graphical Representation of Flexural strength

Split Tensile Strength Test:

Table 3: Result of Tensile Test

Batch Mixes	Batch Mix-A	Batch Mix-B	Batch Mix-C	Batch Mix-D	Batch Mix-E
PEG 400 % Replacement in cement	0 %	1 %	1.5 %	2%	2.5 %
Tensile Strength observed (N/mm^2) for 28 days in M 25 grade concrete	4.31	5.51	5.65	7.00	6.01
Tensile Strength observed (N/mm^2) for 28 days in M 20 grade concrete	4.01	4.87	5.45	5.3	5.2

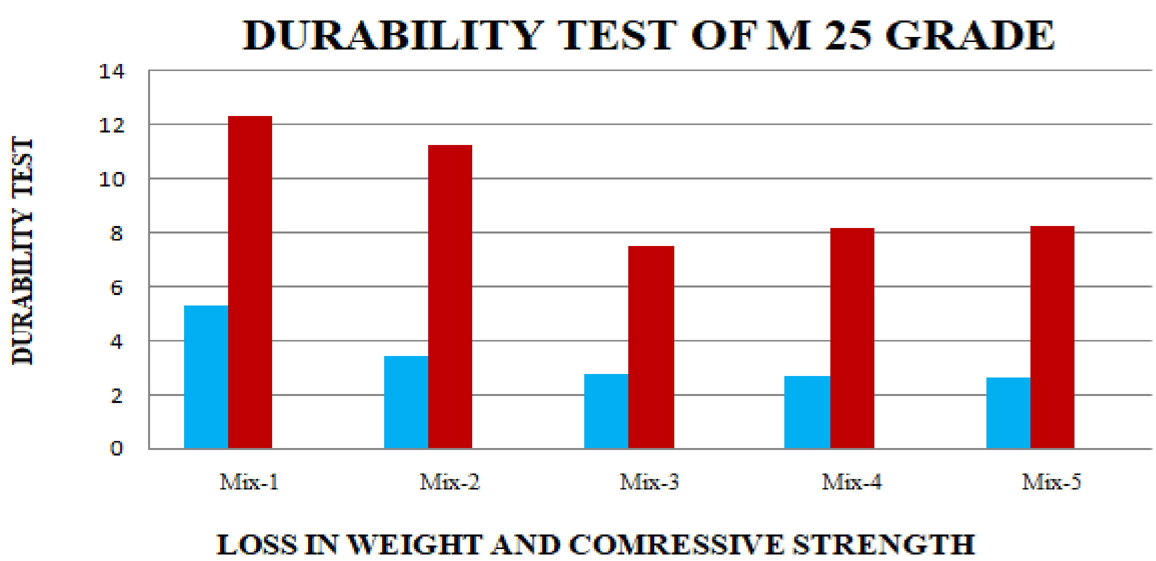


Graph 3: Split Tensile Strength in N/mm^2 at various percentages

Durability Test:

Table 4: Results of Durability Test for Mix-25

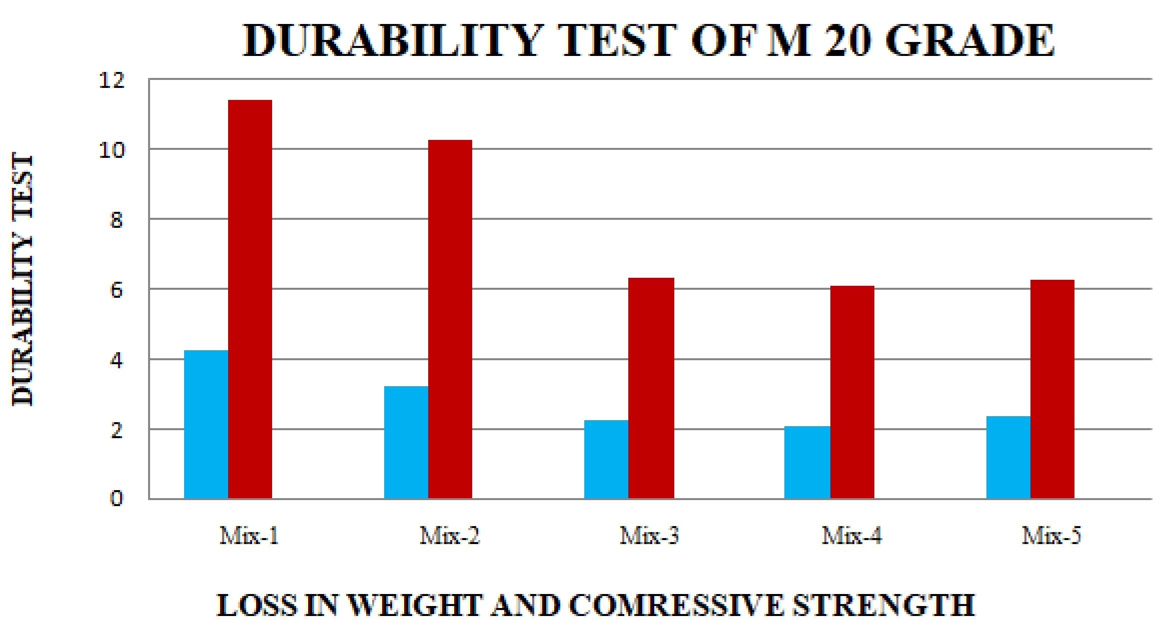
Batch Mixes	Batch Mix-A	Batch Mix-B	Batch Mix-C	Batch Mix-D	Batch Mix-E
PEG 400 % Replacement in cement	0 %	1 %	1.5 %	2%	2.5 %
Tensile Strength observed (N/mm^2) for 28 days in M 25 grade concrete	4.31	5.51	5.65	7.00	6.01
Tensile Strength observed (N/mm^2) for 28 days in M 20 grade concrete	4.01	4.87	5.45	5.3	5.2



Graph 4: Graphical representation of durability test for Mix-25

Table 5: Results of Durability Test for Mix-20

Batch Mixes	Batch Mix-A	Batch Mix-B	Batch Mix-C	Batch Mix-D	Batch Mix-E
PEG 400 % Replacement in cement	0 %	1 %	1.5 %	2%	2.5 %
% Loss in weight (at 28 Days)	4.2 %	3.2 %	2.24 %	2.06 %	2.32 %
% Loss in Compressive strength (at 28 days)	11.35 %	10.20 %	6.26 %	6.08 %	6.22 %



Graph 5: Graphical representation of durability test for Mix-20

Conclusion-

To determine flexural strength, 10cm*10cm*50cm beams are cast. When the specimen is 28 days old, tests on beams are conducted. In accordance with IS: 516-1959, clause 8.3.1, page 17, the specimen is placed in the machine.The applied load is increased at a rate of 108 KN/min. Up until the specimen fails, load is applied, and the load at which the specimen fails is noted.

Flexural strength is computed and summarized in the following table in accordance with the IS code.

5.1 Conclusion of the work

It can be inferred from the findings that are discussed in the preceding chapter that PEG 400 is a better alternative to cement.

1. According to the findings of the current study, polyethylene glycol has a significant deal of promise for use in concrete as a cement substitute, even if it just replaces it by 1.6%.

2. As the quantity of PEG 400 chemical grows, concrete's workability increases.

3. The maximum compressive strength rose when PEG 400 was substituted for concrete of the M 20 grade at a rate of roughly 1.6%. Additionally, it has been determined that the maximum compressive strength rose when PEG 400 was substituted for concrete of the M25 grade at a rate of roughly 2.4%.

4. When PEG 400 was substituted for concrete of the M 20 grade at a rate of roughly 1.6%, the maximum flexural strength rose. Additionally, it has been shown that the maximum flexural strength rose when PEG 400 was substituted for concrete of the M 25 grade at a rate of roughly 2.4%.

5. When PEG 400 was substituted for concrete of the M 20 grade at a rate of roughly 1.6%, the maximum split tensile strength increased. Additionally, it has been shown that the maximum split tensile strength improved when PEG 400 was substituted for concrete of the M 25 grade by roughly 2.4%.

6. Through the durability test, it was discovered that cement replaced both M 20 and M 25's weight loss with a minimum loss in compressive strength of 2.4%.

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