

# EXPERIMENTAL INVESTIGATIONS ON SELF COMPACTING CONCRETE WITH PARTIAL REPLACEMENT OF FINE AGGREGATE USING CRUMB RUBBER

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**Abstract** - Parallel to the need for protecting the environment and to preserve natural aggregate by using alternative materials which are recycled or waste materials. hence study on experimental investigations on self compacting concrete with partial replacement of fine aggregate using crumb rubber becomes essential. his study Self Compacting Concrete mix design are prepared by using EFNARC(for M30 grade of concrete).Furthermore, this study examined the mechanical and durability properties of concrete by partially replacing the fine aggregate by varying weight percentages Crumb Rubber(CR) (0%, 5%, 10%, 15%&20%) respectively. Tests were done for fresh concrete (i.e. Slump test & U-box ) and for hard concrete (i.e. compressive strength, shear strength and Splitting Tensile strength test) for M30 Grade of concrete.

**Key Words:** Crumb rubber, Self-Compacting, Compressive Strength, Flexural strength and Split Tensile Strength Test.

## 1.INTRODUCTION

Self-Consolidating concrete (SCC), also referred to as self-compacting concrete with excellent deformability and segregation resistance, was first developed in Japan in 1986. The most popular mix design method used for the self-compacting concrete was introduced by professor Okamura. It is a special kind of concrete that can be used to fill the gaps of reinforcement and corners of moulds without any need of vibration and compaction during the casting process.

Self-Consolidating Concrete are made using an innovative world renowned technology widely used in the vast field of construction. The increasingly extensive developments in the construction industry throughout the world along with the need for the application of concretes with such qualities as of the SCC, has lead to many studies on such type Of concrete.

This kind of concrete like the common vibrated concrete (CVC) is comprised of cement, aggregate, water and also chemical and mineral admixtures. Chemical admixture are super plasticizer which usually affects the physical properties of concrete. Mineral admixture consist of pozzolanic powders, used as part of cement replacement. Fly ash (FA), Silica Fume (SF), Limestone powder (LP), Marble powder (MP) is such of these pozzolanic powders, used as part of cement replacement.

## 2. LITERATURE REVIEW

In this literature review the through study of research papers on partial replacement of fine aggregate with crumb rubber

**Dr. B. Krishna Rao**

In this investigation he did casting and testing of cubes, cylinders, and prisms for M20 grade of concrete and added 5% and 10% of crumb rubber fibre by volume of concrete. There the specimens are tested for compression, split tensile and flexural strength. The test results were done and noted that due to addition of rubber fiber, strength of concrete decreases, but as observing ductility is improving. Hence it is used for medium grade of concrete. The various rubberised concrete mixes were designed in accordance with standard mix design procedure for normal concrete with grade of M20. As expected the target strength were not achieved for the mixes incorporating rubber fibre.

## 3. MATERIALS

### 3.1 CRUMB RUBBER

It is the processing of the tire into fine granular or powdered particles using mechanical or cryogenic processes. The steel and fabric component of the tires are also removed during this process. Crumb rubber consists of particles ranging in size from 4.75 mm to less than 0.075 mm Crumb rubber used for the replacement of fine aggregate in concrete. Size of the Crumb rubber used is 24mesh.

### 3.2 COMPOSITION OF CRUMB RUBBER

**Table:1 Composition Of Crumb Rubber**

Composition	Percentage
Recoverable rubber	71%
Steel	14%
Fiber	3%
Extraneous material	12%

### 3.3 SUPER PLASTICIZER

The super plasticizer used in the work is CONPLASTSP 430 is a sulphonated naphthalene polymer, specific gravity 1.18.

### 4. EXPERIMENTAL INVESTIGATION

In the present investigation, studies were carried out on the fresh and hardened properties of SCC for all the mixes. Experimental work consist casting cubes of size 150mm×150mm×150mm will cast to determine compressive strength, cylinders of size 150mm dia×300mm height will cast to determine split tensile strength, beams of 1300mmlength ×150mm width ×200mm depth to determine flexural strength.

### 5. RESULTS AND DISCUSSIONS

#### 5.1 Mix design for SCC M30 grade concrete (as per ENARC)

Table No. 2: Mix Ratio For Various Percentage Of Replacement of FA

Trial mix	% Replacement CR	Cement kg/m <sup>3</sup>	CA kg/m <sup>3</sup>	FA kg/m <sup>3</sup>	CR kg/m <sup>3</sup>	Water kg/m <sup>3</sup>
CM	0%	502.4	798	892.44	-	162
M1	5%	502.4	798	847.81	44.62	162
M2	10%	502.4	798	803.19	89.24	162
M3	15%	502.4	798	758.57	133.86	162
M4	20%	502.4	798	713.95	178.48	162

#### 5.2 COMPRESSIVE STRENGTH

Compressive strength is compared with the results obtained from the conventional mix. It was observed that the increase in compressive strength gradually up to 5% replacement of fine aggregate by Crumb rubber and then decreased. The maximum compressive strength **38.6 N/mm<sup>2</sup>** are obtained is shown in the Fig 1.

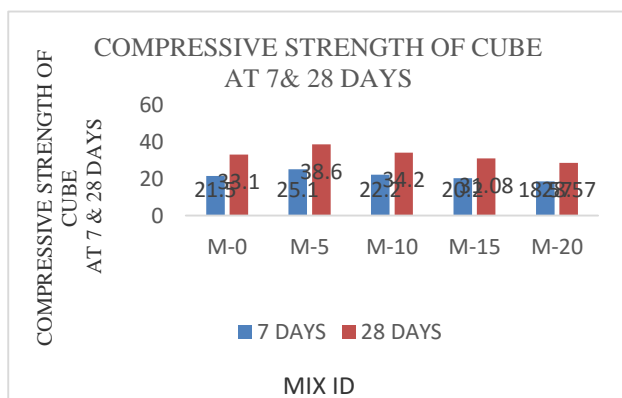


Fig 1 Compressive Strength Of Cube At 7 & 28 Days

#### 5.3 SPLIT TENSILE STRENGTH

Split tensile strength is compared with the results obtained from the conventional mix, It was observed that the increase in tensile strength gradually up to 5% replacement of fine aggregate by Crumb rubber and then decreased. The maximum split tensile strength **3.86 N/mm<sup>2</sup>** are obtained is shown in Fig 2.

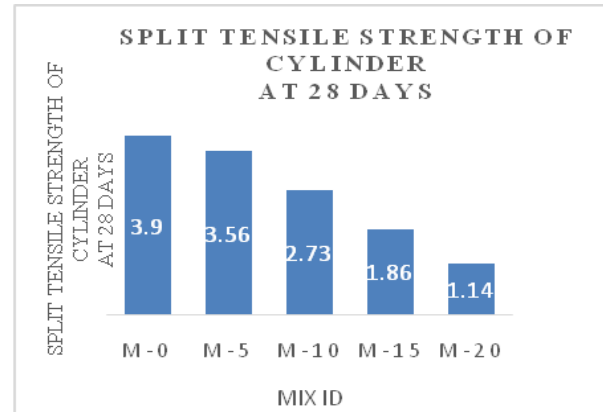


Fig 2 Split tensile strength of cylinder at 28 days

#### 5.4 FLEXURAL STRENGTH

The flexural strength of concrete with crumb rubber was tested according to IS:516-1959. The flexural strengths of control mix and optimum mix is shown in Table 3.

Table 3 Failure of Beam

Beam	Control specimen	Optimum mix(M1)
Load At Initial Crack (KN)	45.6	50.2
Ultimate load (KN)	65.3	82.2

#### Load Vs Deflection Curve

The beams were tested and the deflections were observed for the corresponding loads. The crack pattern was marked on the beams. The load and deflection values obtained are given in the Fig 3

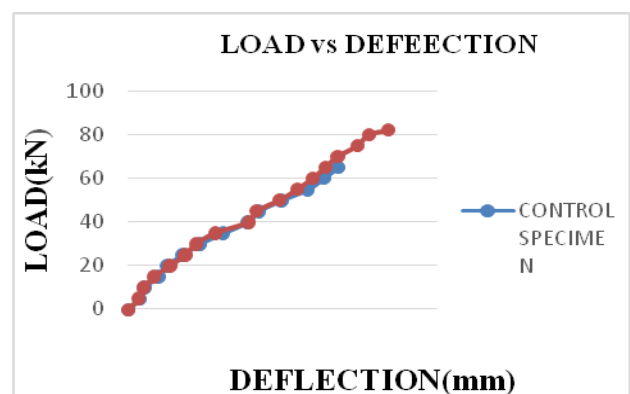


Fig 3 Load Vs Deflection

## 6. CONCLUSIONS

Based on the above studies, the following observations are made regarding to the strength properties of concrete on a partial replacement of fine aggregate by crumb rubber.

- 1.The maximum compressive strength was obtained as 38.6 N/mm<sup>2</sup> at 5% use of crumb rubber in the concrete, which was 16.6%(33.1N/mm<sup>2</sup>) less than the control mix.
2. The maximum split tensile strength was obtained as 3.86 N/mm<sup>2</sup> at 5% use of crumb rubber in the concrete, which was 1.02%(3.9N/mm<sup>2</sup>) more than the control mix.
- 3.The maximum ultimate load at optimum specimen is found to be 82.2kN at 5% use of crumb rubber is less than the control specimen m is 65.3kN.

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