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Effect of Styrene-Butadiene-Rubber(SBR) Latex on Compressive Strength of High Performance Concrete.

Shabnam Mujawar[1], Vidya Patil[2]

[1]Student of AnnasahebDange College of Engineering and Technology Affiliated to Shivaji University Ashta
[2]Assistant Professor in AnnasahebDange College of Engineering and Technology
Affiliated to Shivaji University Ashta.

Abstract: The difference between ordinary concrete and HPC is basically the use of chemical and mineral admixtures. This research was carried out to establish the effect of polymer addition on compressive and flexural strength using concrete with mix design of constant water-cement ratio. The mixes are prepared with styrene-Butadiene Rubber and latex cement ratio of 0%, 3%, 5%. In addition of SBR latex in concrete results in enhancement of Compressive strength and Flexural Strength. The dosage of SBR latex needs to be adjusted to maintain required workability of concrete.

Index terms: Concrete, High performance concrete, Styrene Butadiene Rubber (SBR), Compressive Strength, and Flexural strength.

I. INTRODUCTION

Concrete is composed mixtures of certain amounts of cement, aggregate, water and admixtures. It is possible to obtain several types of concretes according to their usage. Compared with most materials, concrete is considered as a brittle material. The brittleness of concrete increases with strength, and for super high-strength concrete, failure can be sudden, explosive and disastrous. Therefore, it is necessary to carry out research on the brittleness of concrete in order to establish parameters for assessing the brittleness, find ways to improve the brittleness and to design and manufacture concrete materials with high strength and low brittleness. Strength, stiffness, toughness and fracture energy are all the fracture properties for such purpose. The purpose is to study the effects of SBR on the flexural modulus of high performance concrete (HPC) made with Artificial Sand and OPC. In addition, the optimum quantity of SBR that should be added to the HPC mix will also be determined.

II. LITRATURE REVIEW

Mohsen A. Issa et al. (2008). Studied focus on new factor which significantly affects the properties of latex modified cement paste, mortar or concrete. The designed LMC and MSC overlay normal weight mixtures have the desired workability, 28-day *fc* and *fr* greater than 41 and 4.5 MPa, respectively, drying shrinkage less than 600 at 90 days, low permeability, and adequate hardened air-void parameters. In comparison, the LMC showed lower shrinkage and permeability values than the MSC. The fibrous LMC and MSC mixtures experienced toughness indices *I*30 values in the range of 8.78–16.42 and had lower shrinkage values than identical mixtures without fibres.

Mohamed Yahya et al. (2013). Studied the design to investigate the effects of SBR latex on the fracture properties of high-performance concrete, including fracture energy and modulus of rapture. A series of high-performance concrete (HPC) mixes containing 1.5%, 3% and 5% SBR latex by weight of cement were prepared, cured and tested in this study. The main finding in this study was that the adding 1.5% SBR latex to the high-performance concrete enhanced the fracture energy, compressive strength, tensile strength, modulus of rupture and modulus of elasticity. However, adding 3% and 5% SBR latex decreased the fracture energy and other properties.

Kapil Soni (2014). Studied to improve the performance of concrete, polymers are mixed with concrete. It has been observed that polymer-modified concrete (PMC) is more durable than conventional concrete due to superior strength and high durability. In this research, effect of Styrene-Butadiene Rubber (SBR) latex on compressive strength and flexural strength of concrete has been studied and also the optimum polymer (SBR-Latex) content for concrete is calculated. This research was carried out to establish the effects of polymer addition on compressive and flexural strength using concrete with mix design of constant water-cement ratio at local ambient temperature. The mixes were prepared with Styrene-Butadiene Rubber (SBR) latex -cement ratio of 0 %, 5%, 10%, 15% and 20%. Slump test was conducted on fresh concrete while compressive strength and flexural strength were determined at different age. A locally available Perma-Latex is used as SBR Latex. It has been observed that SBR latex has negative effect at early age while at 28 days, the addition of SBR latex in concrete results in enhancement of compressive strength and Flexural Strength. Based on the results of this study, latex modified concrete made using Perma-Latex may be recommended to be used with various types of concrete structures.

III. OBJECTIVES OF THE STUDY

The main objective of the present work is to study the Effect of SBR latex on compressive strength of High-Performance Concrete made with Artificial Sand and OPC. In addition to this objective:

1. To Design a High-Performance Concrete by using SBR latex in Different proportions.

2. The main investigation is to find out percent of SBR at which percent of SBR latex used good enhanced the fracture energy, compressive strength.

3. To compare ordinary concrete and HPC using SBR latex.

4. To develop a design concrete mix of high-performance concrete and to study analytically and theoretically.

Table no.1 Properties of SBR

Type	SBR
Form	White Liquid
Density	1 KG/L

IV. METHODOLOGY

A proposed research work comprises a study of the styrene-butadiene-rubber (SBR) latex on compressive strength of high-performance concrete made with artificial sand, in order to evaluate the fracture energy at seven days, fourteen days and twenty-eight days by conducting three-point bending tests. A series of high-performance concrete (HPC) mixes containing by percent of styrene-butadiene-rubber (SBR) latex by weight of cement will be used. And the results will be compared and the proportion of styrene-butadiene-rubber (SBR) latex will be found for better results which can be used in future. This study aim is to investigate the effects of styrene-butadiene-rubber (SBR) latex on flexural modulus of high-performance concrete, including fracture energy. For achieving the objectives, the study will be conducted in following phases-

1. Collection of data and materials to be used in this project.

2. The grade of High-Performance Concrete will be used.

3. Percent of Material will be used as follow-

Artificial sand – 50%

Natural sand – 50%

O.P.C - 100%

4. The concrete cubes of high-performance concrete will be prepared applying 0%, 1%, 2%, 3%, 4% and 5% styrene-butadiene-rubber (SBR) latex by weight of cement.

5. This cube is cured for 3days, 7 days and 28days. And then it is tested by compressive and flexural.

6. Study the effect of styrene-butadiene-rubber (SBR) latex, by comparing various results which have founded.

V. MATERIAL TESTING:

Table no.2 Properties of Fine and Aggregate

Properties	Fine aggregate	Coarse aggregate
Specific gravity	**2.67**	**2.74**
Water absorption	1.20	0.50

Table no. 3 Physical and Chemical Properties of SBR

Viscosity	100-1000mpa
Water Solubility	Miscible In Water
Relative Density	0.9-1.1
pH	9-11
Odour	Aromatic
Colour	White
State	Liquid

Figure no.1 Casting of cube at Site

Figure no. 2 Testing of Cube at Site

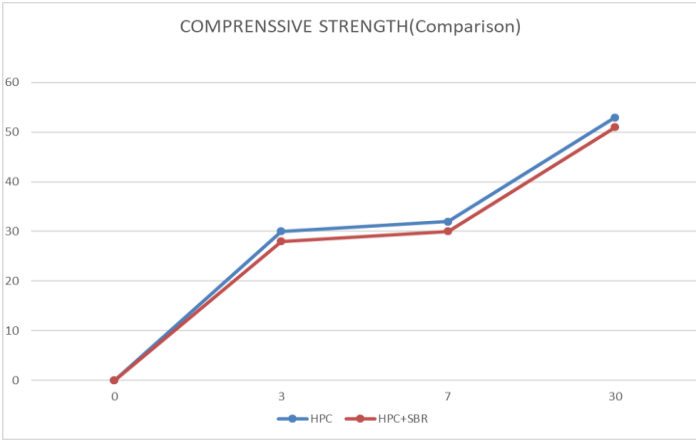

Figure no. 3 Compressive strength comparison

VI. EXPERIMENTAL RESULTS

Table no. 4 Test specimen result of HPC (compressive Strength)

Days	HPC strength in N/mm2			
	1	2	3	Average
7	14	15	13.5	14.16
14	29	27.5	24	26.83
28	54.3	51.4	56	53.9

Table no. 5 Test specimen result of HPC+SBR (Compressive Strength)

Days	HPC + SBR strength in N/mm2			
	1	2	3	Average
7	26	25	24	25
14	31	30	32	31
28	51	49	48	49.33

Flexural Strength: Flexural strength values obtained for HPC and HPC+SBR concrete test conducted to determine the ductility of the concrete. And the values are shown in table below.

Table no. 6 Test specimen result of HPC (Flexural strength)

Days	HPC strength in N/mm2			
	1	2	3	Average
7	1.89	2.38	2.15	2.14
14	2.45	2.57	2.52	2.51
28	3.51	3.59	3.46	3.52

Table No.7 Test specimen result of HPC+SBR (Flexural strength)

Days	HPC+SBR strength in N/mm2			
	1	2	3	Average
7	1.71	1.64	1.93	2.14
14	1.98	2.72	2.93	2.51
28	3.45	3.43	3.94	3.60

VII. CONCLUSIONS:

1. Compressive strength for 28 days of HPC and SBR latex are 42.33 MPa and 39.33 MPa.The compressive strength is lower in case of SBR Latex modified HPC because of low density of SBR.

2. Flexural strength for 28 days of HPC are 3.52nand 3.6 MPa Flexure strength is higher in case of SBR latex modified HPC due to compactness.

3. Both mixes HPC is highly brittle and SBR latex modified is found to be more ductile.

4. For all mixes, the test result at 28 days indicate that the addition of SBR could largely improve the compressive strength.

VIII. REFERENCE:

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