INVESTIGATION ON EFFICACY OF ADMIXTURES IN REPAIRING AND IMPROVING THE CHARACTERISTICS OF CONCRETE CYLINDERS

Abstract

Every building should be constructed with strong structural principles and attractive design for occupants. Disasters, poor construction practices, and poor design can all contribute to a building's failure. The use of suitable materials and repair methods can prevent structural failure. The use of preventative measures and early defect discovery are essential. Active cracks require further care since they propagate.As a consequence, it is necessary to determine the kind of crack, the pattern of cracks, the reason why the cracks are occurring, as well as the defensive actions that should be taken to deal with the cracks. This study makes use of fly ash, a result of thermal power plants, ground granulated blast furnace slag (GGBS), a byproduct of the steel industry, and Crack X plast, a chemical admixture with non-shrinking qualities. Investigations have been done into the effectiveness of the aforementioned chemical and mineral admixtures.

Keywords: Cracks, Chemical admixture, repair, mineral admixture.

Authors

Gandhimathi R.S
Associate Professor/Civil
Annapoorana Engineering College
Salem, Tamilnadu, India.
civilrsgmathi@gmail.com

Divya.T
Assistant Professor/Civil
Annapoorana Engineering College
Salem, Tamilnadu, India.
divyathiru25@gmail.com

Silpa N
Assistant Professor/Civil
Annapoorana Engineering College
Salem, Tamilnadu, India.
silumiet@gmail.com

I. INTRODUCTION

Concrete is the most durable and long-lasting material when properly prepared. It's difficult to create concrete of high quality. The reasons why concrete cracks are as follows. Although concrete doesn't need a lot of water to become strong, building sites utilize more water to make the material more workable. The strength of the concrete is more significantly impacted by this extra water. Shrinkage is another factor that causes cracks. Following hardening, concrete shrinks. Concrete's excessive water evaporation is to blame for this. Concrete cracks because it dries up too rapidly. Building foundations during the winter months might make cracking even worse. This blatantly implies that cracks may appear at any time, making their repair necessary.

II. MATERIALS

The table below contains a list of the items and its properties used in the study.

Table 1: Material Properties

Material	Classification
Cement	OPC 43 grade
Fine Aggregate	Manufacturing Sand (M-Sand)
Coarse Aggregate	12.5 mm angular aggregate
Water	Potable drinking water
Fly ash (FA)	Class F
Ground Granulated Blast Furnace Slag (GGBS)	Portland
Roff Shotcrete Acrylic Polymer	Acrylic polymer
Crack X Paste	Polymer modified type

Concrete cylinder was made using ordinary Portland cement, m sand, 12.5 mm angular aggregate, and potable water. Four materials were chosen and used in the repair process. Fly ash, GGBS, Crack X paste, and Roff shotcrete acrylic polymer are all used in the construction. For restoring concrete cylinders, two mineral admixtures and two chemical admixtures were chosen.

III. METHODOLOGY

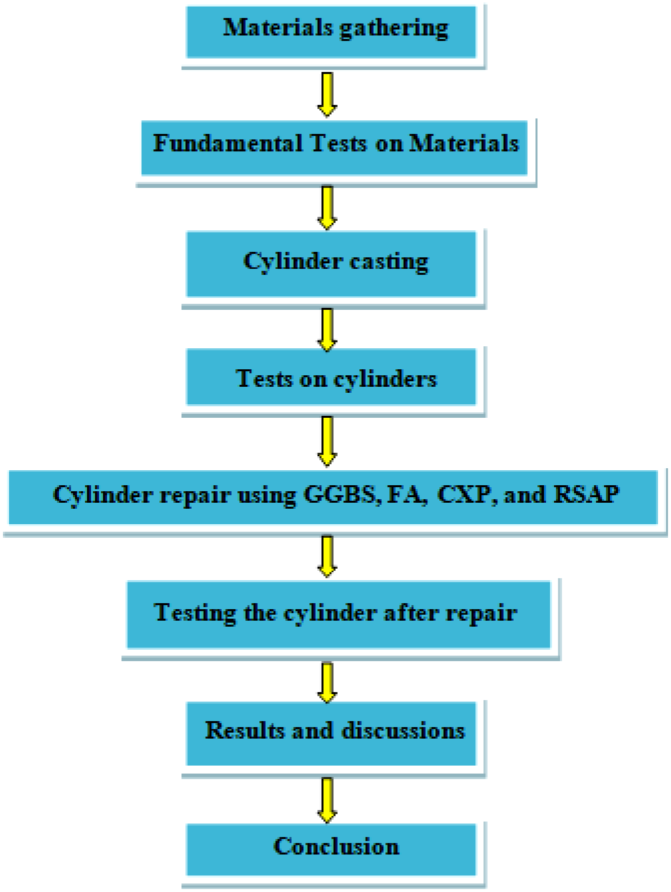

Figure 1

IV. EXPERIMENTAL STUDY

After the gathering of the materials, a preliminary cement, sand, and gravel test was carried out. For cement, tests on consistency, setting time, and specific gravity were performed. Both aggregates underwent a sieve analysis test, and the fineness modulus was determined. Bulk modulus testing were conducted in addition to measurements like specific gravity. IS 10262-2009 was used for mix proportioning. Use is made of M 25 grade concrete in a mix ratio of 1:1.62:2.57:0.4. 6 150 mm-sized cubes and 12 150 mm-diameter cylinders were cast together and let to cure. At 7, 14, and 28 days after curing, cylinders and cubes are tested for compressive strength and split tensile strength. The cracked cylinders that were put through testing are fixed. Initially, a crack measuring equipment was used to gauge the crack's depth. Later, the first crack propagation for the first day was observed and its length of propagation for the seventh day was compared. Following this, three cylinders' cracks were sealed using Fly ash mixed with water after GGBS powder was formed into a paste by adding water and then injected into the cracks. The last three cylinders were repaired using Crack X paste, three cylinders, and Roff Shotcrete Acrylic Polymer. Later, using a compression testing machine, the split tensile test was performed after being let to dry for 24 hours.

Figure 2: Cylinder Repairing Process

V. RESULTS AND DISCUSSIONS

1. The compressive strength test results for the concrete cube demonstrate that the mix proportioning was done properly. The target strength as it has been obtained is shown in Figure 3.

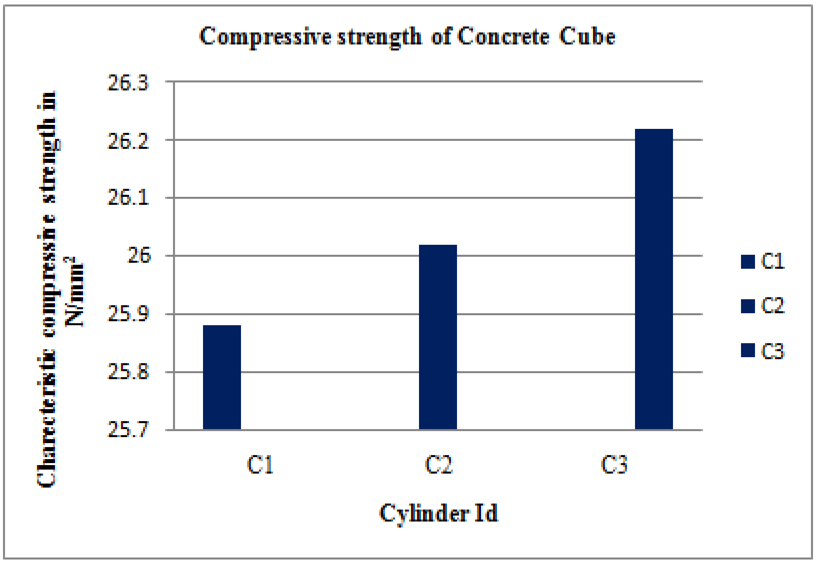

Figure 3: Compressive strength of concrete cubes

2. Figure 4 displays the Split Tensile Strength of Concrete Cylinders before and after Repairing Using GGBS.

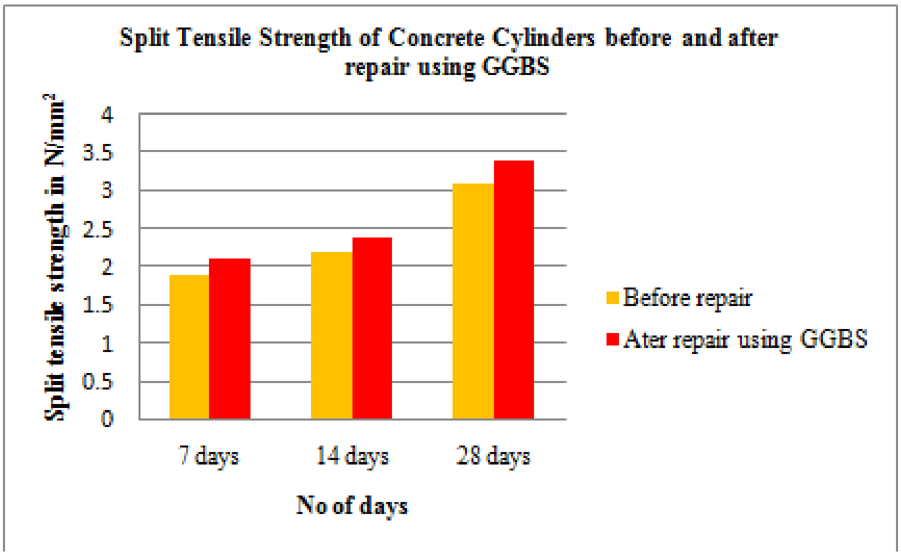

Figure 4: Concrete cylinders' split tensile strength before and after GGBS repair

3. Figure 5 depicts the Split Tensile Strength of concrete cylinders both before and after FA repairs.

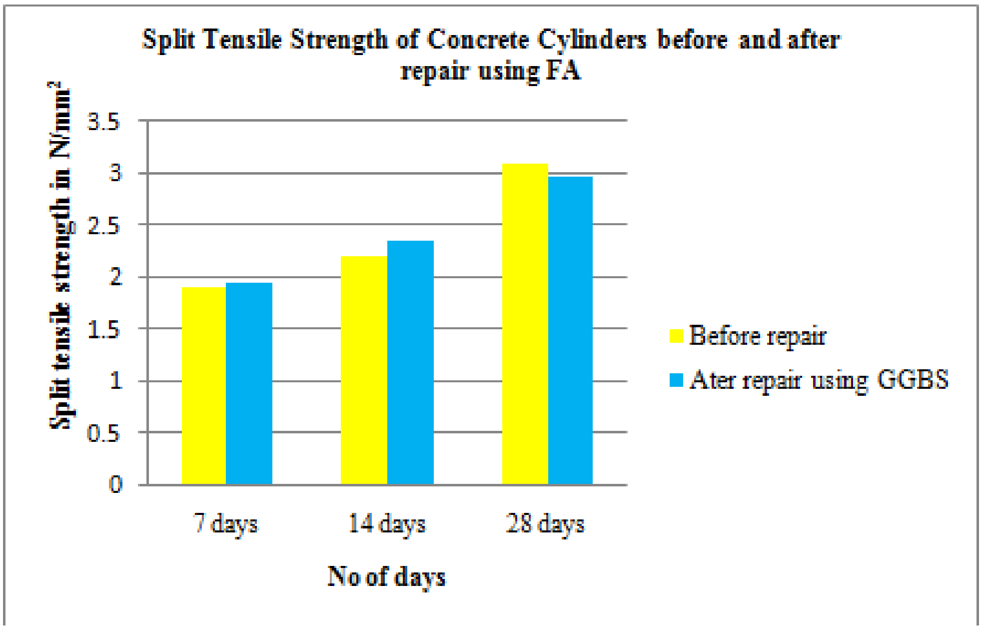

Figure 5: Concrete cylinders' split tensile strength before and after FA repair

4. Figure 6 displays the Split Tensile Strength of concrete cylinders before and after repair with CXP.

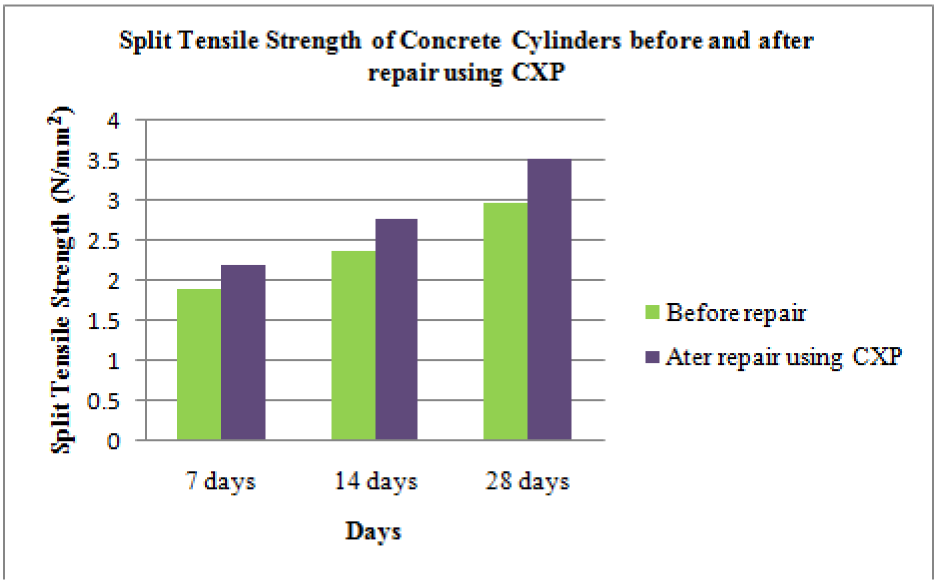

Figure 6: Concrete cylinders' split tensile strength before and after CXP repair

5. Figure 7 depicts the Split Tensile Strength of Concrete Cylinders before and after Repairing Using RSAP.

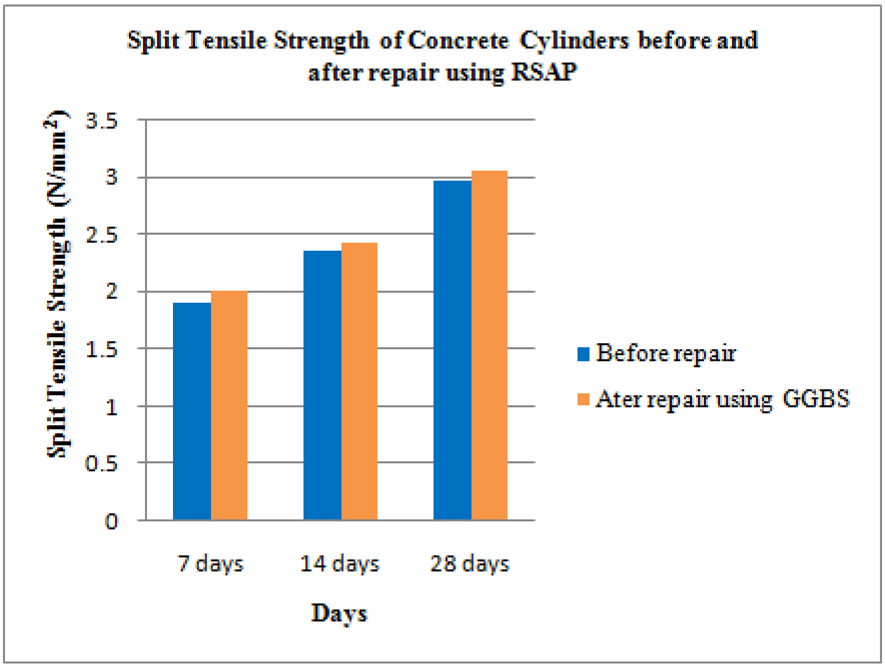

Figure 7: Concrete cylinders' split tensile strength before and after RSAP repair

6. **Comparative Analysis:** Comparative research on the effectiveness of chemical and mineral admixtures is presented. Figure 8 compares and graphically displays the split tensile strength of concrete cylinders repaired with GGBS, FA, CXP, and RSAP.

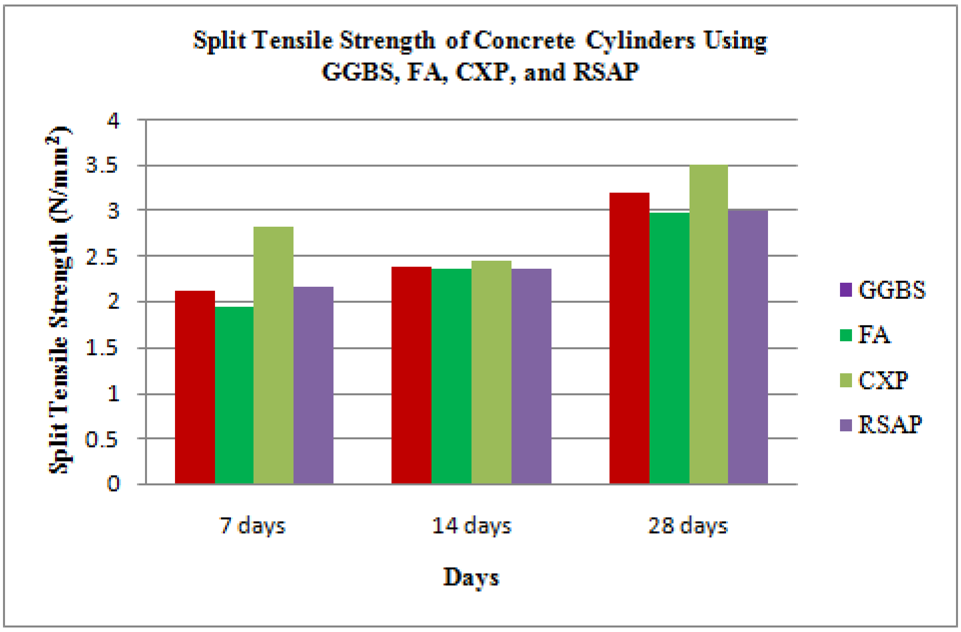

Figure 8: Split Tensile Strength of Concrete Cylinders using GGBS, FA, CXP & RSAP

VI. CONCLUSIONS

1 To fix cracks in concrete cylinders, two chemical admixtures, Crack X Paste (CXP) and Roff Shotcrete Acrylic Polymer (RSAP), and two mineral admixtures, Granulated Blast Furnace Slag (GGBS), Fly ash of F Class (FA), are employed. In this inquiry, M 25 grade concrete is used in the design. The desired strength has been attained.

2 The big straight-line cracks that had been repaired did not reopen, and the repaired cylinders failed as a result of the emergence of fresh significant straight-line cracks. When repair efforts include retrofitting, new cracks can be prevented.

3 When GGBS is used as an additive, the split tensile strength of concrete cylinders has improved, but when FA is used, there is only a little or marginal increase. GGBS functions effectively when used with the two mineral admixtures that were chosen. When CXP is used, the split tensile strength of concrete cylinders has risen, but when RSAP is used, it does not perform as well as CXP. The efficiency of Crack X Paste is superior than that of the other two chemical admixtures. These cheap, efficient admixtures may be used to restore concrete structures at any state of degradation.

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