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An experimental study on high performance fibre reinforced concrete

Vikalp Singh Thakur
vikalpsingh1008@gmail.com
Kalinga University, Raipur, Chhattisgarh

Swati Agrawal
agrawalswati1111@gmail.com
Kalinga University, Raipur, Chhattisgarh

ABSTRACT

Concrete is the most extensively used construction material in the world. The main ingredient of conventional concrete is Portland cement. However, the conventional concrete is of low compressive strength, split tensile strength, flexural strength. In current research is going to carry out the test on latex modified steel fiber reinforced concrete. According to various research papers, it has been found that steel fiber gives maximum strength as compare to other fiber. Hence, steel fiber (straight) of two different percentage that is 0.5% and 1% with incorporation of Styrene Butadiene Rubber (SBR) latex polymer in concrete modified with a percentage 10% of M25 grade, two different mix proportion is cast. The comparison between conventional concrete and HPFRC were found out by different test above. The various parameter s like load carrying capacity, ductility character, and stress-strain variation has to be analyzed.

Keywords— *HPFRC, FRC, Tensile stress, Compressive stress, Fibre orientation*

1. INTRODUCTION

Concrete is a composite material containing hydraulic cement, water, coarse aggregate and fine aggregate. The resulting material is a stone like structure which is formed by the chemical reaction of the cement and water. This stone like material is a brittle material which is strong in compression but very weak in tension. This weakness in the concrete makes it to crack under small loads, at the tensile end. These cracks gradually propagate to the compression end of the member and finally, the member breaks. The formation of cracks in the concrete may also occurs due to the drying shrinkage. These cracks are basically micro cracks. These cracks increase in size and magnitude as the time elapses and the finally makes the concrete to fail.

The formation of cracks is the main reason for the failure of the concrete. To increase the tensile strength of concrete and bonding properties of the ingredients, many attempts have been made. One of the successful and most commonly used methods is providing steel reinforcement with polymer latex modification. Steel bars, however, reinforce concrete against local tension only. Cracks in reinforced concrete members extend freely until encountering are bar. Thus need for multidirectional and closely spaced steel reinforcement arises. That cannot be practically possible. Fiber reinforcement gives the solution for this problem. The ductility of the concrete is increase due to polymer and steel fiber.

1.1 Fibre-reinforced concrete

The fibre-reinforced concrete originates from the 19th century; the first patent is American in 1874. Modern research on fibre-reinforced concrete began in The United States in the mid-1950s. In the years 70 of the twentieth century, the commercial use of this material began to increase, especially in Europe, Japan and USA.[11] The common areas of application today are paving, industrial floors, prefabricated elements and various types of repairs, renovations.

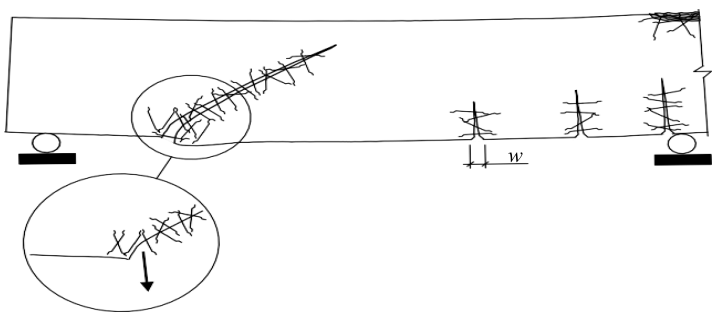

Fig. 1: Bridging effect on fibre reinforced concrete

Generally, concrete containing a hydraulic cement, water, fine and coarse aggregate and dis-crete discontinuous fibres is called Fibre-Reinforced Concrete (FRC). It is possible to use fibres of various shapes and sizes made of steel, synthetic materials, glass and natural materials. However, for most structural and non-structural purposes, steel fibres (figure 1[12]) are the most used of all fibrous materials, while synthetic fibres (example, polypropylene and nylon) are mainly used to control plastic micro-cracks in slabs.

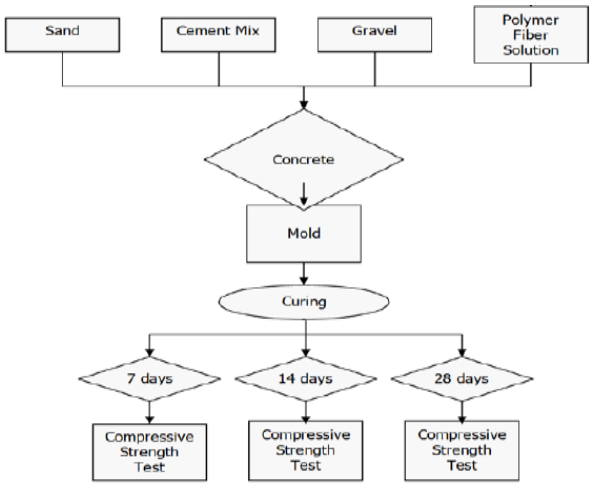

Fig. 2: Conceptual Framework

2. CONCLUSION

In this thesis, the technique of reinforcement with HPFRC of structural elements was analyzed, entering into the details of the characteristics of the material, matrix, fibres and the fibre-matrix interface.

In addition, the mechanical properties of the reinforcing composite, its compression and tensile behavior with experimental characterization tests have been presented. Direct tensile tests, indirect test of Brazilian splitting, bending on 3 and 4 points, Wedge splitting test and Double Edge Wedge splitting test have been described. A series of direct tensile tests on dog-bone like specimens and numerous 3 point bending tests on notched specimens were carried out in the laboratory of material testing's at the University of Bergamo.

Behavior at high temperatures was illustrated and a research in literature was done about the characterization of the adherence or bonding between the HPFRC strengthening material and the traditional plain concrete by tests on jacketed specimens and specific tests for the adherence. Simplified models were examined; the rigid-plastic one and the line are elastic model.

Afterwards, in the chapter 4 Applications, the application aspects of the technique were discussed. Various studies and researches were shown which demonstrated the validity of the strengthening solution. The operational aspects for the making of the strengthening in HPFRC, from the design and preparation of the support to the casting of the jacket, were all studied extensively.

Next, specific details of the strengthening of slabs, beams, columns, beam-column nodes and masonry were analysed.For each of the structural elements were indicated the methods of design, execution and control of the strengthening with high-performance fibre-reinforced concrete jacket. In the end it was studied also the intervention of strengthening with HPFRC of elements damaged by the fire.

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