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Study of Strength Properties of Waste Plastic Fiber Reinforced Concrete

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Abstract— The field of concrete technology is vast expanding ultimately with new inventions .Among these inventions the fiber reinforced concrete (F.R.C) is gaining more popularity since it has several applications. The FRC can be employed in many structural elements of building as well as other infrastructure project. Several industrial wastes can be made use in the concrete. Among them waste plastic fibers can be used as fibers for productions of fiber reinforced concrete. Different percentages of fibers in concrete affect various strength aspects such as compressive strength, tensile strength, flexural strength.
Keywords— Concrete, Waste plastic, Aspect ratio, FRC

I. INTRODUCTION

The idea of combinations of two materials to obtain composite in not new to civil engineer. Fibers have been used to reinforce brittle materials since ancient times. The use of straw to strengthen bricks and stabilise their dimensional instability has been practiced for centuries. Fiber reinforced concrete (F.R.C) is relatively new construction material developed through extensive research and development work during last three decades. Is has found a wide range of practical applications and has proved as reliable construction material having superior performance as compared to conventional concrete. Incorporations of various fibers in concrete has been found to improve several of its properties like tensile strength, cracking résistance, impacts wears resistance, ductility and fatigue resistance, due to which FRC is now being used in structures such as airport pavement, bridges decks, machine foundations, blast resistance structure, sea-protective structures etc.

II. FIBER REINFORCED CONCRETE

Fiber reinforced concrete is a composite material of cement, aggregates, water and fibers. As the ingredients are responsible for producing good as well as bad concrete, their contributions should be clearly understood.

A. Components of FRC

Cement- it is main component of concrete which has good adhesive and cohesive properties so as to render it to form good bond with other martials.
Aggregate- aggregates are inert martial which gives body to concrete. Sand crushed rock and gravels are some examples.
Water- it is an essential part as it takes part in chemical reaction with cement and also forms a workable mix.
Fibers- these are strong thread like filament which when used in the concrete act as crack arrestors. The main aim of introducing the fibers is to arrest cracks developed due to loading. The fiber is often described by convenient numerical parameters call as "Aspect Ratio". It is ratio of the length to the least lateral dimension of same.

B. Types of Fibers

Fibers are to classified under various under various heads. Great variety of fiber material in various sizes and shapes has been developed for use of use in FRC. Fibers are classified as

1) *Naturals fiber*- coconut fiber, sisal fiber, bamboo fiber, jute fiber
2) *Artificial fiber*- plastic fiber, asbestos fiber, glass fiber, in organic metallic fiber.
3) *Organic fiber*- agaves fiber, akwara fiber, bagasse fiber, cotton fiber,.
4) *Inorganic fiber*- asbestos fiber, carbon fiber, synthetic fiber, polypropylene fiber.
5) *Metallic fiber*- caron fiber, steel fiber, aluminium fibers.

C. Applications of FRC

The application of FRC will depend on the ingenuity of designer and builder in taking advaages of the static and dynamic tensile strength energy absorbing characteristics and fatigue strength.

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1) *Hydraulic Structures*- the principle reason for using FRC in hydraulic projects is its resistance to cavitations or erosion damage by high velocity water flow.
2) *Highways and Airfield Pavements*- high flexural strength result in reduction of thickness of pavements. FRC use increased resistance to impact and repetitive loading.
3) *Structural Applications*- used in various structural members of buildings.
4) *Blast Resistant Structures*-the design of blast resistant structures made from FRC which provide necessary strength to resist the blast induced pressure waves.
5) *Break Water Armour Units*- FRC can used as an ideal material for break water armour units as is posseses good physical properties such as density, strength toughness, resistance to impact.

III. EXPERIMENTATION

An attempt is made to study the strength properties of concrete when waste plastic fibers are added in different percentage. The strength properties of concrete like compressive strength , tensile strength and flexural strength have been found when the waste plastic fibers is added in different percentage like 0%, 1%, 2%, 3% of cement .in the test locally available fine aggregates and coarse aggregates were used. The waste fibers cut into strips having with 3 mm and having thickness generally 5mm. An aspect ratio of 35 was adopted. Concrete of mix proportion 1:1.5:3 was used. The compressive strength specimens were dimensions 150mm X 150mm X 150 mm. The tensile strength specimen of dimension 150mm dia and 300mm in length was used, and direct tension (split tensile test) is carried out. The flexural strength specimen was size 100mm X 100mm X 500 mm. Two points loading were used over span of 400 mm while testing. The concrete ingredients namely cement, sand, coarse aggregates were taken in proportion 1:1.5:3 and they were mixed in dry form. The required amount of water was added to mix and mix was homogeneously mixed. The concrete mix was placed in mould layer by layer and sufficient compaction was given by hand and by table vibrator also. After 24 hrs the moulds were demoulded and specimens were transferred to curing tank where in they were allowed to cure for 28 days. After 28 days of curing these specimens were tested for their strength. The following results were obtained.

Fig 1- Mixing of ingredients

A. Compression Test Results

% of Waste Fibers Added	Comp Strength (Mpa)
0	22.21
1	23.11
2	24
3	25.03

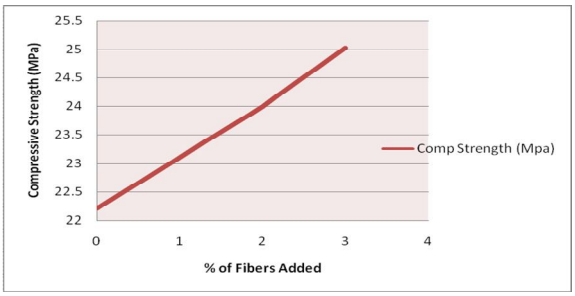

Fig 2 – Compression Strength Test

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B. Tensile Strength Test Results

Fig 3 Tensile strength Test

Fig 4 Tensile strength Test

% of Waste Fibers Added	Tensile Strength (Mpa)
0	4.24
1	4.95
2	5.37
3	5.8

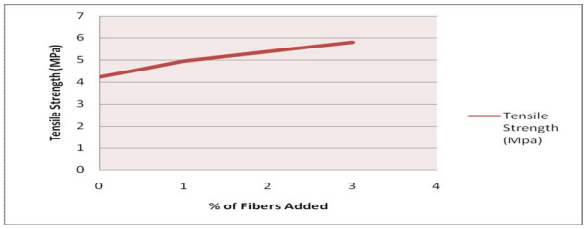

Fig 5 – Tensile Strength Test

C. Flexural Strength Test Results

Fig 6 Flexural Strength Test

% of Waste Fibers Added	Flexural Strength (Mpa)
0	5
1	5.8
2	7
3	8.24

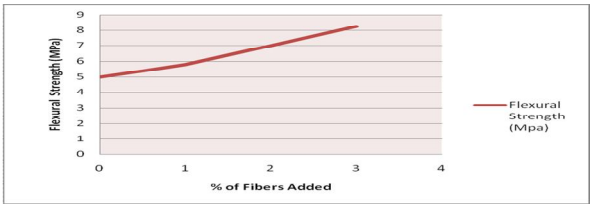

Fig 7 Flexural Strength Test

IV. CONCLUSION

Based on experiments it is concluded that the compressive strength increase about 13 % than conventional concrete. Tensile and

flexural strength increases about 38 % and 65% respectively as we increase percentage of waste plastic fibers in conventional concrete. We can use waste plastic in FRC to control pollution of environment.

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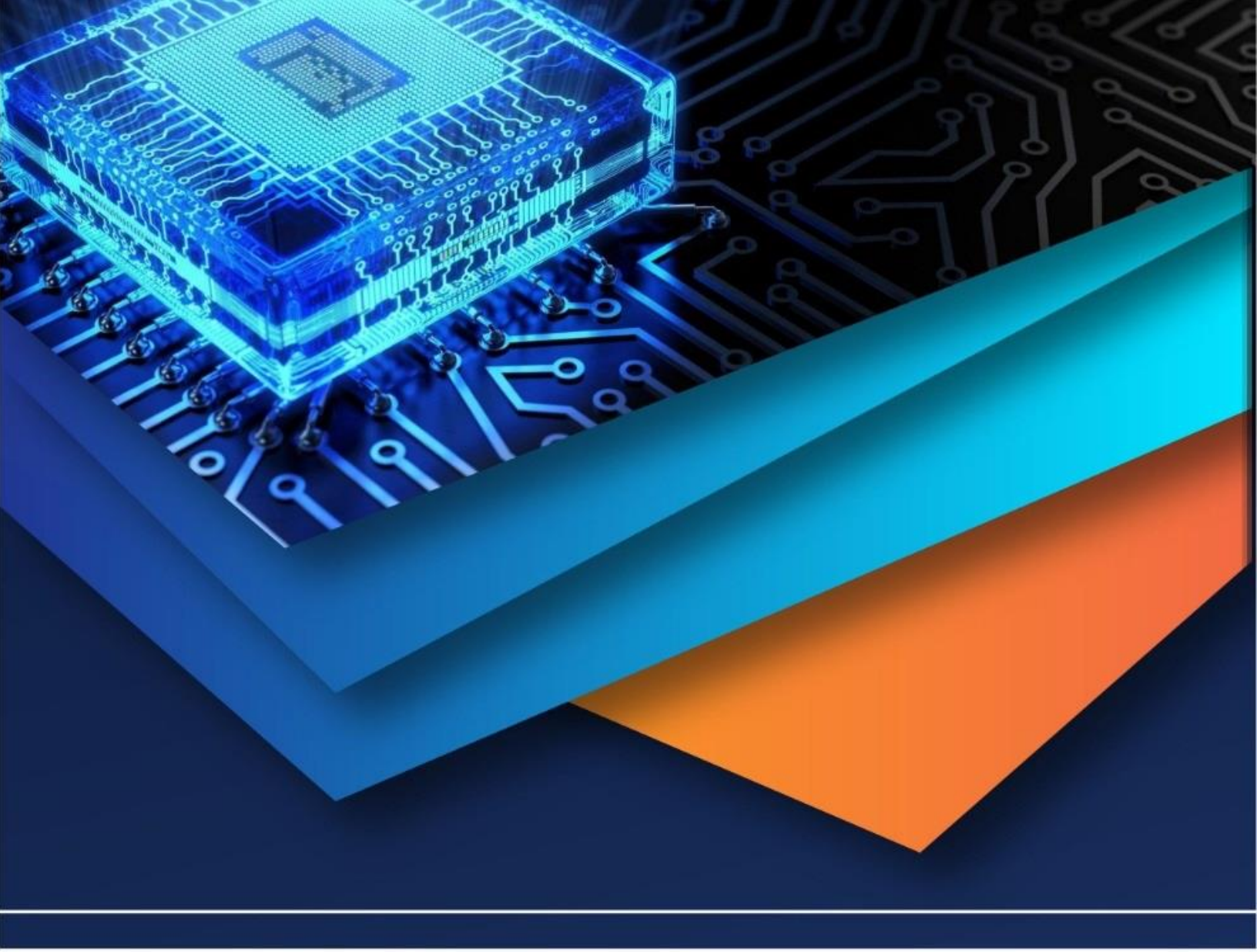

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