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STRUCTURAL BEHAVIOUR OF CONCRETE BEAM USING NON BIODEGRADABLE MATERIALS

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Abstract - *The Material which does not decompose into the soil and causes the soil to pollute is called as NBD materials which are abbreviated as Non Bio Degradable materials. These will prevent the supply of oxygen, nitrogen etc., to the micro-organisms presents in the soil and make it a barren land. In order to prevent such mechanism these materials should be used in a proper way there by making it eco-friendly. Here in this project plastic fibre obtained from cement bags are chipped based on the aspect ratio based added in concrete by using such fibre in the construction helps in clean construction site. In this project Cylinders, Prisms, and Cubes of standard dimensions have been made to introduce NBD Fibers with various mix ratio as 1%, 2%, 3%, 4%. Various tests are conducted to find the property of the NBD Concrete materials. The Main tests such as Compressive Strength for Concrete and Flexural Strength of Concrete have been conducted. On comparing the results of NBD Fiber Concrete with that of Conventional Concrete, 3% additionally Adding of NBD fibers showed Maximum Compressive strength of concrete value at 28 days is 25% increase compared with in Conventional Concrete and Maximum Flexural Strength of Concrete value at 28 days is 55% increase compared with in Conventional Concrete. During Phase II, Mechanical Properties like Split tensile Strength and Durability properties of NBD Fibers will be discussed.*

***Key Words*: NBD Concrete, NBD Fiber, Compressive Strength, Flexural Strength.**

1. INTRODUCTION

Concrete is a versatile material for civil engineering building construction. It has ability to get cast in any different type of form and shape. All basic ingredients of concrete are natural origin. But the properties of concrete can be changed by adding some special natural or artificial ingredients.

The Concrete has many advantageous properties such as good compressive strength, durability, impermeability and fire resistance. However the concrete has some better properties like as weak in tension, brittleness, less resistance to cracking, lower impact strength, heavy weight, etc. Some remedial measures can be taken to minimize these more better properties of concrete. The some of the better properties of concrete are due to micro cracks at mortar aggregate interface. The addition of fibers in concrete would act as crack inhibitors and substantially improve the tensile strength, cracking resistance, impact strength, wear and tear, fatigue resistance and ductility of concrete.

1.1 NON BIODEGRADABLE MATERIALS (NBD):

The definition of non-biodegradable is the direct opposite of the word biodegradable. When something is biodegradable that means that its components are able to be broken down with the influence of microorganisms after it is discarded into the environment. Non-biodegradable is defined as that the components of the item will not break down over time. An example of a non-biodegradable item would be a tire, Polythene sheets/covers, disposable plastic glasses, syringes, cement bags etc. The nature of decomposition of various materials is given in the following table.

Table -1: Decomposition of Various Waste Materials

Type of Small waste	Approximate time taken to degenerate	Nature of material
Peels of vegetable and leaves	1 to 2 weeks.	Biodegradable
Paper	10–30 days	Biodegradable
Cotton cloth	2 to 5 months	Biodegradable
Plastic bags	Several years	Non-biodegradable

1.2 CLASSIFICATION OF FIBRES:

A fibre may be defined as a flexible, macroscopically homogenous body having a high ratio of length to width and a small cross-section. On the basis of their origin, fibres are classified as follows

Natural fibres are those derived naturally from the animal, vegetable and mineral kingdoms. These include cotton, linen, hemp, jute and ramie all obtained from vegetable cellulose; wool, mohair, vicuna from animal; and asbestos from minerals.

Synthetic fibres are manufactured from natural organic fibres, synthetic organic polymers and inorganic

substances. Included in this category are: rayon, acetate, azlon based on natural organic polymers; acrylic, aramid, nylon, olefin, polyester, vinyon based on synthetic polymers, and glass, metallic fibres, ceramics based on inorganic substances.

2. PROPERTIES OF CONCRETE MATERIALS

2.1 CEMENT

The Cement used for this study is Portland Pozzolona Cement as per IS Requirements. The requirements of the properties of all these cements are given the following Indian Standards. IS: 12269 - 1987 (53 Grade), IS: 8112- 989 (43 Grade), IS 269 - 1989 (33Grade). In this Project Work the Ultra Tech Cement PPC is selected.

Table-2: Properties of Cement

Physical Property	Value
Consistency	**29%**
Initial Setting Time	**34 Minutes**
Final Setting Time	**340 Minutes**
Specific Gravity	**3.04**

2.2 FINE AGGREGATES

Fine Aggregates are material passing through an IS sieve that is less than 4.75 mm gauge beyond which they are known as a coarse aggregate. Coarse aggregate form the main matrix of the Concrete, whereas fine Aggregates form the filler matrix between the coarse aggregate. The most important function of the fine Aggregates is to provide workability and uniformity in the mixture. In this project work, Grade I Fine Aggregates of particle size less than 2 mm and greater than 1 mm are chosen.

Table -3: Properties of Fine Aggregates

Physical Property	Value
Specific Gravity	2.35
Fineness Modules	2.733

2.3 COARSE AGGREGATES

Coarse Aggregates are material passing through an IS sieve that is greater than 4.75 mm gauge beyond which they are known as a coarse aggregate. The most important function of the coarse aggregates is to provide workability and uniformity in the mixture. According to IS 383: 1970 the coarse aggregates is being classified based on the shape. The shapes are Rounded, Irregular, Angular, and Flaky. The Aggregates are available is different size are 40 mm, 20 mm, 10 mm, and 4.75 mm respectively.

In this project work, Coarse Aggregates Shape and Size is Crushed Angular Aggregates in 20 mm size are chosen.

Table -4: Properties of Fine Aggregates

Physical Property	Value
Specific Gravity	2.80
Fineness Modules	6.13

2.4 NBD FIBERS

A fibre may be defined as a flexible, macroscopically homogenous body having a high ratio of length to width and a small cross-section. On the basis of their origin. Fibers are classified as reinforced plastics falls into two classes:

Short Fibers are also called as discontinuous fibers, with a general aspect ratio (defined as the ratio of fibers length to diameter) between20 to 60.

Long Fibers, is means of continuous fibers, the general aspect ratio is between 200 to 500.

Polypropylene

Polypropylene is a 100% Synthetic Fiber which is transformer from 85% propylene. The monomer of polypropylene is propylene.

- Polypropylene is a by-product of petroleum
- It is available 3 different sizes i.e. 6mm, 12mm, 24mm
- In the present investigation 12mm is used.

Fig .1: NBD Fibers from Cement Bags

Fig .2: Polypropylene Fibers

3. RESULTS AND DISCUSSIONS

3.1 COMPRESSIVE STRENGTH OF CONCRETE CUBE

Compressive strength is the capacity of the material to withstand axially directed pushing forces. It provides data of forces versus deformation for the conditions of the test method. When the limit of Compressive strength of concrete is reached, brittle materials are crushed. It is calculated using following formula

Compressive Strength

Compressive Strength of Concrete Cube = Load / Area
Unit of Compressive Strength is N/mm²

Table -5: Compressive Strength of Concrete

% OF ADDITION OF FIBER	7th DAY Compressive Strength N/mm²	14th DAY Compressive Strength N/mm²	28th DAY Compressive Strength N/mm²
0%	**35.18**	**37.49**	**37.75**
1%	**40.59**	**41.35**	**41.49**
2%	**40.89**	**42.96**	**43.41**
3%	**41.48**	**45.92**	**47.35**
4%	**39.65**	**40.10**	**45.39**

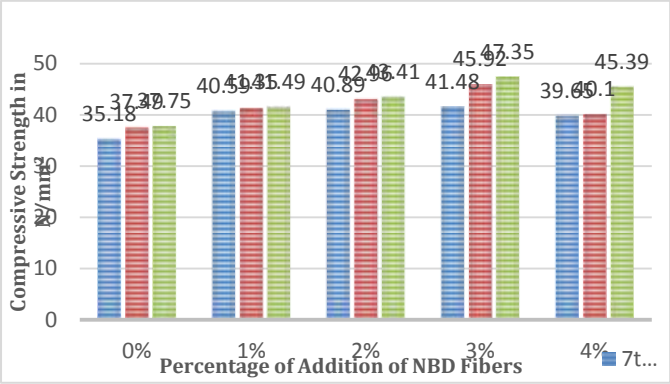

Chart-1 Compressive Strength of NBD Concrete

3.2 DISCUSSIONS FOR COMPRESSIVE STRENGTH

- In 7th day curing Compressive Strength value for the control mix was 40.59 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 40.89 N/mm², the Strength was gradually increased and reduced to 39.65 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreases.**
- Similarly In 14th day curing Compressive Strength value for the control mix was 41.35 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 42.96 N/mm², the Strength was gradually increased and reduced to 40.10 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreases.**
- Similarly In 28th day curing Compressive Strength value for the control mix was 37.75 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 43.41 N/mm², the Strength was gradually increased and reduced to 45.39 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreased.**
- Hence the Optimum Amount of NBD Fibers is 3%. **The Compression Strength value for NBD Concrete is 19.69% is greater than the Conventional Concrete.**

3.3 FLEXTURAL STRENGTH OF BEAMS

Flexural strength is the properties of the hardened concrete which gives details about the capacity of concrete in bending when a load acted at the midpoint of the beam. It is calculated by using the following formula, Flexural Strength = Pa/bd² (when a > 13.3 cm for 10 specimen)

Where,

P= Applied Load in KN to the specimen.
b = Width of specimen in mm
d = Depth in mm of the specimen at the point of failure.
a = Distance of the crack from the near to the support in mm

Table -5: Flexural Strength of Concrete

% OF ADDITION OF FIBER	7th DAY Flexural Strength N/mm²	14th DAY Flexural Strength N/mm²	28th DAY Flexural Strength N/mm²
0%	**1.60**	**1.79**	**2.42**
1%	**1.62**	**2.26**	**2.72**
2%	**1.75**	**2.59**	**2.87**
3%	**2.25**	**2.73**	**3.76**
4%	**1.84**	**2.43**	**2.62**

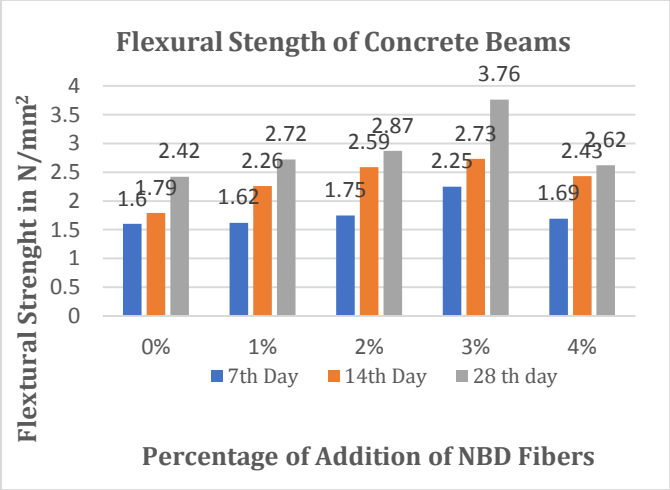

Chart-2: Flexural Strength of NBD Concrete

3.5 DISCUSSIONS FOR FLEXURAL STRENGTH

- In 7th day curing Compressive Strength value for the control mix was 1.62 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 1.75 N/mm², the Strength was gradually increased and reduced to 1.69 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreases.**
- Similarly In 14th day curing Compressive Strength value for the control mix was 2.26 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 2.59 N/mm², the Strength was gradually increased and reduced to 2.43 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreases.**
- Similarly In 28th day curing Compressive Strength value for the control mix was 2.72 N/mm² for adding 1% of NBD Fiber the Compressive Strength value is 3.76 N/mm², the Strength was gradually increased and reduced to 2.62 N/mm² for 4 % of addition of NBD Fiber. **Strength increment is 1% more than the nominal mix when adding the NBD Fiber upto 4% and this percentage is strength is decreased.**
- Hence the Optimum Amount of NBD Fibers is 3%. **The Flexural Strength value for NBD Concrete is 55.37% is greater than the Conventional Concrete.**

4. CONCULSIONS

On performing test Structural Behaviour of Non-Biodegradable Materials are learned and the following conclusions are arrived.

- About 18% increase in Compressive Strength is attained when Concrete is addition with 3 % of NBD Fibers on 7-Days
- About 23% increase in Compressive Strength is attained when Concrete is addition with 3 % of NBD Fibers on 14-Days
- About 25 % increase in Compressive Strength is attained when Concrete is addition with 3 % of NBD Fibers on 28-Days
- About 41% increase in Flexural Strength is attained when Concrete is addition with 3 % of NBD Fibers on 7-Days
- About 53% increase in Flexural Strength is attained when Concrete is addition with 3 % of NBD Fibers on 14-Days
- About 55% increase in Flexural Strength is attained when Concrete is addition with 3 % of NBD Fibers on 28-Days

The Strength Characteristics of Concrete with various percentages of adding NBD Fiber in Concrete have been studied.

The Compressive and Flexural Strength of Concrete was improved by 25 % and 55% with three percentage addition of NBD Fibers and beyond this percentage of addition of fibers in concrete, strength of concrete is gradually reduced.

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