ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

EFFECT OF INFLUENCE OF PLASTIC FIBERS IN THE MECHANICAL PROPERTIES OF CEMENT CONCRETE

P. Manthru Naik*, E.V.Chandra Sekhar
* P.G Student Department of Civil Engineering, Krishna Chaitanya institute of Technology & Sciences, Markapur, A.P, India
Assistant Professor Department of Civil Engineering Krishna Chaitanya institute of Technology & Sciences, Markapur, A.P, India

DOI: 10.5281/zenodo.800634

ABSTRACT

For the comfortable living of people shelters like buildings and for convenient and luxurious living Infrastructures are use full, which are constructed by using concrete. We know that concrete consumption plays second role after water. So concrete plays a predominant role in the construction field. Even though concrete is a good construction material we can see some problems with concrete like availability of ingredients, low ductility, less tensile strength compared to its compressive strength and so. Entire the world many researches are carried by researchers to eliminate the drawbacks of it. To convert the concrete to more advantageous providing fiber reinforcement is one of the techniques. In this we are dealing with usage of plastic fibers in concrete. Plastic disposal is one of the major problems, using this waste plastic we can decrease the bothering of the plastic disposal.

The following points are observed in this project:

- We are adding the plastic fibers 0%, 0.25%, 0.50%, 0.75%, and 1.00% by the volume of concrete
- There is increase in the compressive strength of 28.06% by increasing the percentage of plastic fibers.
- Tensile strength increases in the range of 40.82%.
- It is observed that there is a decrease in workability by increasing plastic fibers.

KEYWORDS: Zemax , Kaplerians telescope, lens.

INTRODUCTION

General:

Concrete is most widely used construction material in the world due to its ability to get cast in any form and shape. It also replaces old construction materials such as brick and stone masonry. The strength and durability of concrete can be changed by making appropriate changes in its ingredients like repetitious material, aggregate and water and by adding some special ingredients. Hence concrete is very well suitable for a wide range of applications. However concrete has some deficiencies as listed below:

- Low tensile strength
- Low post cracking capacity
- Brittleness and low ductility
- Limited fatigue life
- Incapable of accommodating large deformations
- Low impact strength

The presence of micro cracks in the mortar-aggregate interface is responsible for the inherent weakness of plain concrete. The weakness can be removed by inclusion of fibers in the mixture. Different types of fibers, such as those used in traditional composite materials can be introduced into the concrete mixture to increase its toughness, or ability to resist crack growth. The fibers help to transfer loads at the internal micro cracks. Such a concrete is called fiber-reinforced concrete (FRC).

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

PLASTIC FIBERS:

We are using plastic fibers to study the behavior of fresh and hardened concrete. Fibers, which are mixed with concrete, are obtained from plastic industries. At industries these are prepared by collecting waste plastic like carry bags, covers, etc…and melting this waste material, cleaning the melted plastic paste and then by using these raw plastic threads are prepared. These plastic threads are cut into required length based on the selected aspect ratio. Now days many researcher are carrying on plastic fibers in concrete. Using of plastic fibers in concrete is advantageous due to the following reasons

- Ductility property
- Resistance to conductivity of electricity
- Crack arresting property
- Availability
- Flexibility
- Not affected by corrosion

Fig: 1 Plastic fiber

EFFECT OF PLASTIC FIBERS IN CONCRETE:

Fiber reinforced concrete is composite material comprised of Portland cement, aggregate and fibers .Normal UN reinforced concrete is brittle with low tensile strength and strain capacity. The function of the irregular fibers distributed randomly is to fill the cracks in the composite.Fibers are generally utilized in concrete to manage the plastic shrink cracking and drying shrinks cracking. They also lessen the permeability of concrete and therefore reduced the flow of water. Some types of fibers create greater impact, abrasion and shatter resistance in the concrete usually fibers don't rise the flexural concrete strength .The quality of fibers required for a concrete mix is normally determined as a percentage of the total volume of the composite materials .The fibers are bonded to the material, and allow the fiber reinforced concrete to with stand considerable stress during the post cracking stage. The actual effect of the fibers is to increase concrete toughness.

USE OF PLASTIC IN A CONCRETE TO IMPROVE ITSPROPERTIES

Raghatate Atul M.Address for Correspondence A.S. Polytechnic, Pipri Dist: Wardha, Maharashtra- 442001, India Plastic bags which are commonly used for packing, carrying vegetables, meat etc creates a serious environmental problem.. Plastic bag last in environment up to 1000 years because of plastic bag last so long the number of plastic bag accumulated increases each year. Disposal of large quantity of plastic bag may cause pollution of land, water bodies and air. The proposed concrete which is made up by adding plastic in concrete may help to reuse the plastic bag as one of the constituent's material of concrete, to improve the certain properties of concrete. The properties of concrete containing varying percentages of plastic were tested for compressive strength and Split tensile strength and shows that an appreciable improvement in tensile strength of concrete can be achieved by introducing cut pieces of plastic bags.

TESTS ON CEMENT

Cement used: 53 grade Cement

Table1: Test results of Cement

S.No.	Tests on cement	Result
1	Consistency	30%
2	Fineness	4%
3	Initial setting time	55 min
4	Final setting time	7hrs
5	Specific gravity	3.17

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

TESTS ON FINE AGGREGATES

Table2: Test results of Sand

S.No.	Tests conducted	Test Results
1	Sieve analysis of sand	Zone-II
2	Moisture content	2%
3	Bulkage of sand	8.33
4	Specific gravity	2.69

Table 3: Sieve Analysis for FA

S.No.	IS sieve	Wt. retained in gms	Cumulative wt. retained	Cumulative % wt. retained	Cumulative % passing
1	4.75mm	9	9	0.9	99.1
2	2.36mm	9	18	1.8	98.2
3	1.18mm	92	110	1.10	89
4	600	371	481	48.1	51.9
5	300	379	860	86	14
6	150	126	986	98.6	1.4
7	Residue	13	999	99.9	0.1

Fineness modulus = 4.726

Bulk age of sand is found to be 8.33%.
Slit content of sand is found to be 2.726%.

TESTS ON PLASTIC FIBERS

This test is carried by sticking these plastic threads to a hook and the bottom is 5ttached with some tray arrangement to carry load. Carry bags may be used and these are gradually filled up by sand up to its failure. The failure load divided by area gives the tensile strength of fibers.
Average diameter of plastic fibers = 0.25_{mm}

Table 4: Test results of PLASTIC FIBERS

S.No.	Tests conducted	Test result
1	Specific gravity	0.87
2	Tensile strength	13.58kg/mm^2

Aspect ratio: we are using plastic fibers with an aspect ratio of around 100 which has a length in the range of 20mm to 30mm. These are mixed in concrete in percentages comparing to the volume of concrete.

TEST RESULTS OF COARSE AGGREGATE:

Table 5: Test results of Coarse aggregate

S.No.	Tests conducted	Test results
1	Specific gravity of 20mm coarse aggregate	2.98
2	Water absorption	0.5%

MIX DESIGN

STIPULATIONS FOR PROPORTIONING:

- Grade designation : M20
- Type of cement : OPC 53 Grade
- Maximum nominal size of aggregate : 20mm
- Minimum cement content : 240 kg
- Maximum water cement ratio : 0.60
- Workability : 50mm (slump)
- Exposure condition : Moderate
- Degree of supervision : Good

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

- Type of aggregate : Crushed angular
- Maximum cement content : 350 kg
- Chemical admixture type : Super plasticizer(not used)

TEST DATA FOR MATERIALS:

- Cement used : OPC 53 Grade confining to IS 8112
- Specific gravity of cement : 3.16
- Chemical admixture : Not used
- Specific gravity of:
- Coarse aggregate : 2.98
- Fine aggregate : 2.69
- Sieve Analysis:
- Fine aggregate : Zone II confining to IS 383
- Pond ash : Zone IV confining to IS 383

MIX PROPORTIONS:

Cement = 339.28 kg
Coarse aggregate = 1272.998 kg
Fine aggregate = 740.877 kg
Water = 190 lit

EXPERIMENTAL PROGRAM:

The project mainly deals with influence of adding PLASTIC FIBERS on nominal mix proportion of M20 grade of concrete (1:1.5:3:0.5). Adding different percentages of PLASTIC FIBERS in concrete such as 0%, 0.25%, 0.5%, 0.75%, 1.0%, by volume. The present study is intended to study the adding of PLASTIC FIBERS in conventional concrete and to assess the rate of compression strength and flexural strength development.

Volumes of materials and specimen:

Vol. of cubes =0.15×0.15×0.15×6 = 0.02m^3
Vol. of beams = 0.7x0.15x0.15x6 = 0.95m^3
QUANTITY OF MATERIALS [OVERALL PROJECT]:

Table 6: Quantity of materials required.

S.No.	Ingredients	Quantity
1	Cement	232.43 kg
2	Fine aggregate	507.54 kg
3	Coarse aggregate	872.08 kg
4	Water	130.16 lit
5	Plastic fibers	3567.02 gms

TESTS ON FRESH CONCRETE

Workability of concrete: Workability is defined as the **"**property of concrete which determines the amount of useful internal work necessary to produce full compaction**"**. Another definition which envelopes a wider meaning is that, it is defined as the **"**ease with which concrete can be compacted 100% having regard to mode of compaction and place of deposition**"** widely in India.

Table 7: Slump Values

S.No.	W/C ratio	Adding % of plastic fibers	Slump in mm
1	0.56	0	100
2	0.56	0.25	90
3	0.56	0.5	70
4	0.56	0.75	30
5	0.56	1	0

TESTS ON HARDENED CONCRETE: Size of cube = 0.15m x 0.15m x 0.15m

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Table 8: Compressive Strength of 0% PLASTIC FIBERS adding in concrete (w/c=0.56)

S.No.	Compressive strength in N/mm2	
	7 days	28 days
1	28.44	46.67
2	20.44	34.07
3	20.44	34.07
Average	23.106	38.27

Table 9: Compressive Strength of 0.25% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Compressive strength in N/mm2	
	7 days	28 days
1	28.89	46.60
2	22.22	35.84
3	31.11	50.18
Average	27.40	44.21

Table 10: Compressive Strength of 0.50% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Compressive strength in N/mm2	
	7 days	28 days
1	32.00	52.79
2	31.11	49.38
3	26.22	41.61
Average	29.78	47.26

Table 11: Compressive Strength of 0.75% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Compressive strength in N/mm2	
	7 days	28 days
1	36.44	53.58
2	33.33	49.01
3	30.22	44.44
Average	33.32	49.01

Table 12: Compressive Strength of 1.00% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Compressive strength in N/mm2	
	7 days	28 days
1	33.78	46.92
2	33.33	46.29
3	34.22	47.53
Average	33.77	46.91

RESULT:

The compression strength result of fiber reinforced concrete obtained at the age of 28 days.

- For 0% fibers of concrete = 38.27 N/mm^2
- For 0.25% fibers of concrete = 44.21 N/mm^2
- For 0.50% fibers of concrete = 47.26 N/mm^2
- For 0.75% fibers of concrete = 49.01 N/mm^2
- For 1.00% fibers of concrete = 46.91 N/mm^2

FLEXURAL STRENGTH TEST

Flexural strength, also known as modulus of rupture, bend strength, or fracture strength, a mechanical parameter for brittle material is defined as a material' stability to resist deformation under load. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross- section is be until fracture or yielding using attest technique. The flexural strength represents the highest stress experienced within the material at its moment of rupture. It is measured in terms of stress, here given the symbol.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

*Fig 2: **Beam under two point loading***

Beam dimensions: 0.70m x 0.15m x 0.15m

Table 13: Flexural Strength of 0% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Flexural strength in N/mm2	
	7 days	28 days
1	3.79	5.21
2	3.72	5.20
3	3.72	4.95
Average	3.74	5.12

Table 14: Flexural Strength of 0.25% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Flexural strength in N/mm2	
	7 days	28 days
1	3.98	5.50
2	3.82	5.50
3	3.75	5.45
Average	3.85	5.50

Table 15: Flexural Strength of 0.50% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Flexural strength in N/mm2	
	7 days	28 days
1	3.77	6.32
2	4.00	6.34
3	4.30	6.60
Average	4.02	6.62

Table 16: Flexural Strength of 0.75% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Flexural strength in N/mm2	
	7 days	28 days
1	4.57	7.25
2	4.77	7.22
3	4.05	7.15
Average	4.46	7.21

Table 17: Flexural Strength of 1.00% PLASTIC FIBERS adding in concrete (w/c=0.56).

S.No.	Flexural strength in N/mm2	
	7 days	28 days
1	4.62	7.30
2	4.75	7.28
3	4.20	7.00
Average	4.52	7.19

RESULT

The Flexural strength result of fiber reinforced concrete beam obtained at the age of 28 days.

- For 0% fibers of concrete = 5.12 N/mm^2
- For 0.25% fibers of concrete = 5.50 N/mm^2
- For 0.50% fibers of concrete = 6.42 N/mm^2

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

- For 0.75% fibers of concrete = 7.21 N/mm^2
- For 1.00% fibers of concrete = 7.19 N/mm^2

CONCLUSIONS

The concept of adding PLASTIC FIBERS in M20 grade of concrete increases the compressive strength and flexural strength. From adding this PLASTIC FIBERS pieces the compressive strength and flexural strength will increase in high manner. Thus reduces the burden of the strength of concrete in construction management.

From the study of the literature review it is noticed that the PLASTIC FIBERS has significant effect on the strength and durability of concrete. This may produces the high strength motors and concrete at lower cost. As the percentage of PLASTIC FIBERS increases, the compressive strength increases also flexural strength is increases and the concrete is going to be more ductile on adding PLASTIC FIBER Spices. The following conclusions could be given from the present investigation.

- It is observed that compressive strength, flexural strength are on higher side for 0.75% PLASTIC FIBERS as compared to that produced from 0%, 0.25%, 0.50%, 0.75% & 1.0% PLASTIC FIBERS.
- There is 28.06% increase in compressive strength at 0.75% addition as compared with normal plane concrete (without fibers).
- There is 40.82% increase in flexural strength at 0.75% addition as compared with normal plane concrete (without fibers).
- As the percentage of PLASTIC FIBERS increases it is observed that the workability of concrete goes on decreasing.
- In the account of workability we should prefer low percentage of plastic fibers otherwise we may use some additional chemical admixtures.

REFERENCES

[1] Colin D. Johnston, **"**Fiber reinforced cements and concretes**"** Advances in concrete technology volume 3 - Gordon and Breach Science publishes - 2001.
[2] Perumalsamy N. Balaguru, Sarendra P. Shah, Fiber reinforced cement **composites"", Mc Grew Hill International Editions 1992.**
[3] **ArnonBentur& Sidney Mindess, Fiber reinforced cementations composites"** Elsevier applied science London and New York 1990.
[4] ASTM C1018 - 89, Standard Test Method for Flexural Toughness and First Crack Strength of Fiber Reinforced Concrete (Using Beam with Third - Point Loading), 1991 Book of ASTM Standards, Part 04.02, American Society for Testing and Materials, Philadelphia, pp.507 - 513.
[5] JCI Standards for Test Methods of Fiber Reinforced Concrete, Method of Test for Flexural Strength and Flexural Toughness of Fiber Reinforced Concrete (Standard SF4), Japan Concrete Institute, 1983, pp. 45 - 51
[6] ACI committee, **"**State - of - the art **report in fiber reinforced concrete"" ACI 554** IR - 82 Detroit Mechigan 1982.
[7] C.H. Henager, **"**Steel fibrous shot Crete**"**. A summary of the State - of - the art concrete Int.: Design and construction 1981.
[8] J.Erdington, D.J. Hannant& R.I.T. Williams, **"**Steel fiber reinforced concrete**"** Current paper CP 69/74 Building research establishment Garston Watford 1974.
[9] C.D. Johnston, **"**Steel fibre reinforced mortar and concrete**"**, A review of mechanical properties. In fibre reinforced concrete ACI - SP 44 - Detroit 1974.
[10] C.D. Johnston, **"**Definition and measurement of flexural toughness parameters for fiber reinforced concrete**"** Cem. Concr.Agg.1982.

CITE AN ARTICLE

Naik, P. M., & Sekhar, E. C. (2017). EFFECT OF INFLUENCE OF PLASTIC FIBERS IN THE MECHANICAL PROPERTIES OF CEMENT CONCRETE. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 6*(5), 641-647. doi:10.5281/zenodo.800634