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Shear Strength Behavior of M-30, M-35 and M-40 Grade Concrete using Steel and Polyethylene Fiber for Concrete Structure

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Abstract- *The effect of all types of fibers has been studied by many researchers. They have studied the physical properties along with mechanical properties of concrete. But there hasn't been done much research on polyethylene fiber reinforced concrete and waste tire fiber concrete. The knowledge regarding these fibers as reinforcement in concrete is limited. Waste substances in the shape of polyethylene and tires purpose environmental pollution which leads to numerous fitness issues. Polyethylene and waste tires can be recycled and used efficiently in the concrete as reinforcement in the fiber form. Polyethylene is a synthetic hydrocarbon polymer that may improve the ductility, power, shrinkage traits and so on. This paper offers with the effects of addition of polyethylene fiber on the houses of concrete. Polyethylene and tire fibers have been cut into the dimensions of 30mm x 6mm and that they were used 1.5% every by using quantity. Grade of concrete used were M30, M35 and M40. IRC 44:2008 changed into observed for the layout of concrete blend. In this observe, the consequences of the Strength residences of Polyethylene fiber bolstered concrete had been supplied. Double shear test were accomplished in the laboratory for shear electricity determinations. There changed into visible a boom of and 32% in shear power. Check and 36% decrease in double shear test in deflection turned into found out from the experiments. Theoretical evaluation of deflection changed into performed by way of the assist of electricity strategies. Practical values were confirmed with the theoretical values inside the permissible limits.*

Keywords:- Shear test Slump value, polyethylene fiber, Steel Fiber, Deflection.

I. Introduction

For a developing country like India, Road infrastructure development assumes a vital part in giving a sturdy and agreeable surface for vehicles. Roads are generally made utilizing bitumen. Notwithstanding, in specific circumstances, solid asphalts are additionally liked. Numerous added substances have been investigated for gainful utilization of concrete as a clearing material. New exploration has shown that fiber-reinforced concrete can be utilized for the development of Infrastructure as it is discovered to be excellent in strength and it additionally displays other attractive properties.

Plastics are extremely solid and non-biodegradable in nature. The compound bonds in plastics make it incredibly durable and impenetrable to normal regular procedures of debasement. The day by day utilization of plastics has expanded quickly and it has become a typical propensity for individuals to simply toss out the plastic and causing ecological contamination. More than 1 billion tons of plastic have been delivered since 1950s, and the equivalent is probably going to stay as such for a long time. These squanders get blended in with

MSW or they are basically tossed making disturbance the general public. There is a major need of reusing of the plastics also squander tires since we don't have some other choice of arranging them without getting climate from contamination. For instance, there are two cycles for the removal of squanders: land filling and cremation. In the event that the squanders are basically unloaded, they cause soil and water contamination and on the off chance that they are burned, they cause air contamination. Henceforth, there is a need to reuse the losses into something valuable which won't hamper the climate and the cycle where it is utilized.

2. Objectives

The objectives of the research are outlined below:

- To achieve the desire strength in high performance concrete.
- To find out the dosage of the Waste polyethylene and tirefibersat which the concrete gain the higher strength.
- Determination of the shear strengthofconventionalconcrete beams**,** Deflection of the concrete Beam.
- Waste polyethyleneandtire-steelfibersis also industrial waste by the use of it we can reduced the environmental degradation.

3. Literature Review

Works on waste materials are discussed in the subsequent headings comprehensively.
Chips away at squander materials are talked about in the ensuing headings extensively.
Hasan, M.J., Afroz, M., and Mahmud, H.M.I. (2018) "An Experimental Investigation on Mechanical Behavior of Macro Synthetic Fiber Reinforced Concrete," International Journal of Civil and Environmental Engineering, Vol. 11, Concrete is an unquestionable material for the development of different sorts of designs in the cutting edge progression of common frameworks. Concrete is solid in pressure however feeble in strain and shear. To wipe out those issues, the presentation of fiber was acquired as an option in contrast to creating concrete considering upgrading its malleable and shears strength just as improving its pliable property. Consequently, the motivation behind this examination was to explore the mechanical conduct of cement built up with full scale (primary) engineered filaments. To decide these properties test work was completed. Four bunches of cement were projected: one without any strands and the leftover three with three diverse volume parts filaments of 0.33, 0.42 and 0.51%, separately. Substantial examples (blocks, crystals and pillars) were cast to decide the mechanical conduct, for example, compressive, pliable, shear strength and stress-strain connections. Test outcomes showed that large scale engineered fiber improved the compressive strength irrelevantly. Nonetheless, large scale engineered filaments at 0.33, 0.42 and 0.51% volume divisions improved the rigidity by at any rate 10, 15 and 14%, separately, contrasted with the control example. Essentially a definitive shear strength was expanded fundamentally by at any rate 15, 45 and 65% for full scale manufactured strands of 0.33, 0.42 and 0.51% volume portions, separately, contrasted with the control radiates. The disappointment of plain substantial examples was unexpected (fragile) for both the malleable and shear strength tests. Nonetheless, the substantial built up with full scale manufactured filaments showed more bendable conduct contrasted with the plain concrete. Full scale manufactured strands improved a definitive strain esteem by in any event 50, 60 and 60% for large scale filaments of 0.33, 0.42 and 0.51% volume divisions, individually.

Omanakuttan Athira, An Experimental investigation on Strength Behavior of Steel Fiber, Glass Fiber with Fly Ash and Rice Husk Ash (IJARIIT-2017) ISSN: 2454-132, Hybrid Fiber-supported cement is a composite material comprising of combinations of concrete, fine total, coarse total, steel fiber and glass fiber. The half breed fiber supported substantial displays better exhaustion strength and expanded static and dynamic rigidity. In this task, the strength of fiber supported cement was explored with halfway supplanting of concrete with rice husk debris and fly debris. Steel fiber and glass fiber was included the request for 0.25%, 0.5% and 0.75% by volume of concrete and 0.25%, 0.5% and 0.75% by weight of concrete. Rice Husk Ash was utilized to

supplant conventional Portland concrete by 20% and fly debris 20% by weight of concrete extent, AswaniSabu, Thomas Paul, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Volume 4 Issue IX, September 2016, Fibers are by and large utilized as a typical designing material for break opposition and fortifying of cement. Their properties and attributes extraordinarily impact the properties of substantial which has been demonstrated effectively in numerous past explores. In like manner it has been discovered that steel strands invigorate the most extreme in contrast with glass and polypropylene filaments. In this exploratory examination, two sorts of steel strands in particular snared end and pleated filaments are utilized. The volume parts taken are 0.75%, 1.0% and 1.25% and M30 grade concrete is received. Concrete has been supplanted with 25% of Class F flyash. The essential center is to analyze the mechanical properties of substantial utilizing the two filaments.

Aswani Sabu, Thomas Paul, International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 4 Issue IX, September 2016, Fibers are all things considered used as a commonplace orchestrating material for break check and supporting of concrete. Their properties and traits without a doubt impact the properties of strong which has been shown enough in various past investigates. Moreover it has been found that steel fibers support the best on the other hand with glass and polypropylene strands. In this test study, two kinds of steel strands explicitly got end and wrinkled fibers are used. The volume parts taken are 0.75%, 1.0% and 1.25% and M30 grade concrete is embraced. Concrete has been ousted with 25% of Class F fly ash. The principal local area is to consider the mechanical properties of solid utilizing the two strands.

4. Materials

- **Basic materials**

The basic materials which compose concrete are:

1. Water
2. Cement
3. Fine aggregate
4. Coarse aggregate
5. Admixture (Plasticizer)

Incase ofpolymerfiberreinforcedconcretefibersareadded.Forthisexperiment2typesoffiberare chosen. The fibers to be used in the concrete mixare: Polyethylene fiber and Tire(Steel) fiber

A. Water

Water is the most important material in concrete. It performs the following roles in concrete matrix:

a. It gives cement the adhering property. The quality, quantity, stability and rate of formation of the adhesive material that binds the aggregates depend on the quality and quantity of water added.

b. It also controls the workability of concrete. The more the water content (up to certain limit) the more is the workability.

c. The mechanical properties of hardened concrete as compressive, flexural strength and toughness also depend on hydration products of cement and there by depend on water content.

d. The plasticity of concrete depends on the water content.

e. Water is also needed for curing of hardened concrete to help concrete acquire its required strength.

B. Ordinary Portland cement (OPC)

It is a normal cement made by burning calcareous (Calcium carbonate) and argillaceous (Clay) together at a very high temperature and then grinding the resulting calcined product known as clinker with a minute amount of gypsum (for quicker hardening) into fine powder.

B. Fine Aggregate

Regular sand is generally used as the fine aggregate. In some cases quarry dust or dust from stone crushers are also used as fine aggregate. It contributes to a major portion of concrete matrix. Both natural and artificial sand can be used as fine aggregate.

C. Coarse Aggregate

It is generally comprises of crushed stones like granite. Sometimes gravel or broken bricks are also used as coarse aggregates. Coarse aggregate occupy the most part of the concrete matrix and contribute toward weight and strength of the hardened concrete.

D. Fibers

These are short discrete materials, may be metallic or polymeric, used as composing reinforcement for concrete structures. These are mixed with other components of concrete to form the matrix and add certain properties to it.

E. Preparation of fibers

The polythene used in milk packets is used as raw material for preparation of the fiber. These polythene packets are collected; they are washed and cleaned by putting them in hot water for 3- 4 hours. They are then dried.

Similarly waste tires are collected. The steel wires inside them are striped out of the tires. They are washed in hot water and then dried.

5. Methodology

To study the various parameters of polymeric fiber reinforce concrete that affect the service life of a pavement with minimal maintenance, the following experiments are needed to be carried out:

• Test of aggregates
- Abrasion resistance of aggregates
- Impact resistance of aggregates
- Crushing resistance of aggregates

• Test of concrete
- Physical inspection of concrete
- Shear strength test

The flexural strength test to be conducted is 2-point load test (4-point bend test) and the shear strength test to be conducted is double shear test.

a. Casting and curing

Standard sized cubes (150mm x 150mm x 150mm) are casted for compression test of concrete. The beams casted are however different than standard size. The beams are casted with dimension 500mm x 100mm x 75mm.

Total 18 numbers of beams are casted. They are allowed to stay in the mould for 24 hours. Then they are immersed in water for curing. After 28 days they are taken out from water, dried and then tested.

6. EXPERIMENTAL WORK

Double shear test

The shear strength is one of the most important characteristic of concrete. The shear strength of concrete represents the resistance offered by concrete towards shear force applied to it. The casted beams are tested for shear strength in compression test machine with certain arrangements.

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Table 1: Shear strength gain and deflection reduction in fiber introduced concrete beams

Grade of concrete	Mean shear strength(N/mm^2)	Gain in shear strength (%)	Mean deflection(mm)	Reduction in deflection (%)
M30	11.26	31.33	0.44	38.69
M35	11.42	32.56	0.44	36.23
M40	11.52	32.72	0.43	33.75

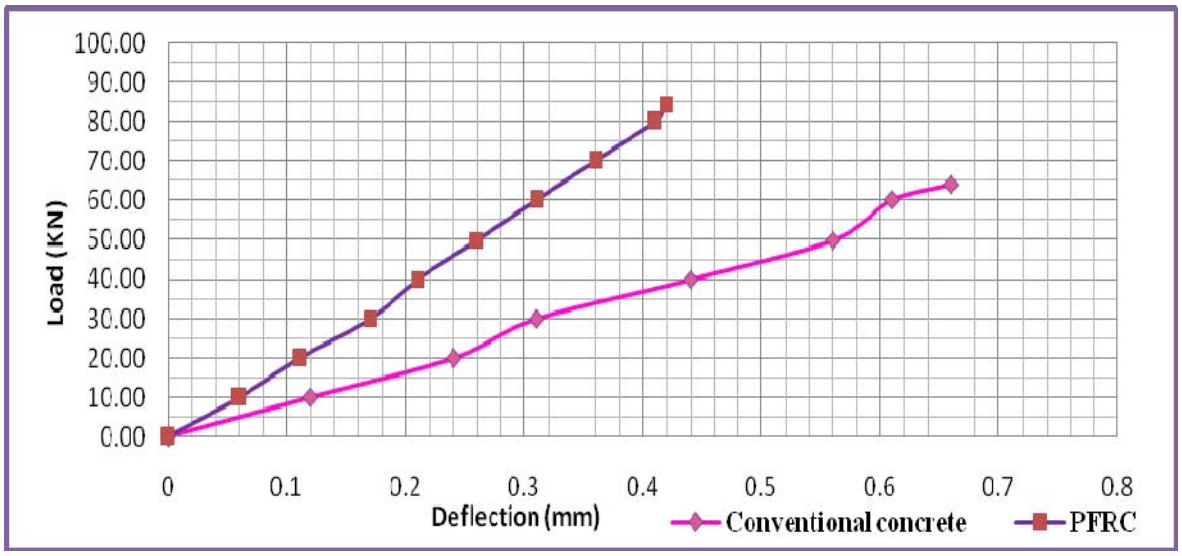


Fig-1: Double shear test Load vs Deflection for M30 concrete

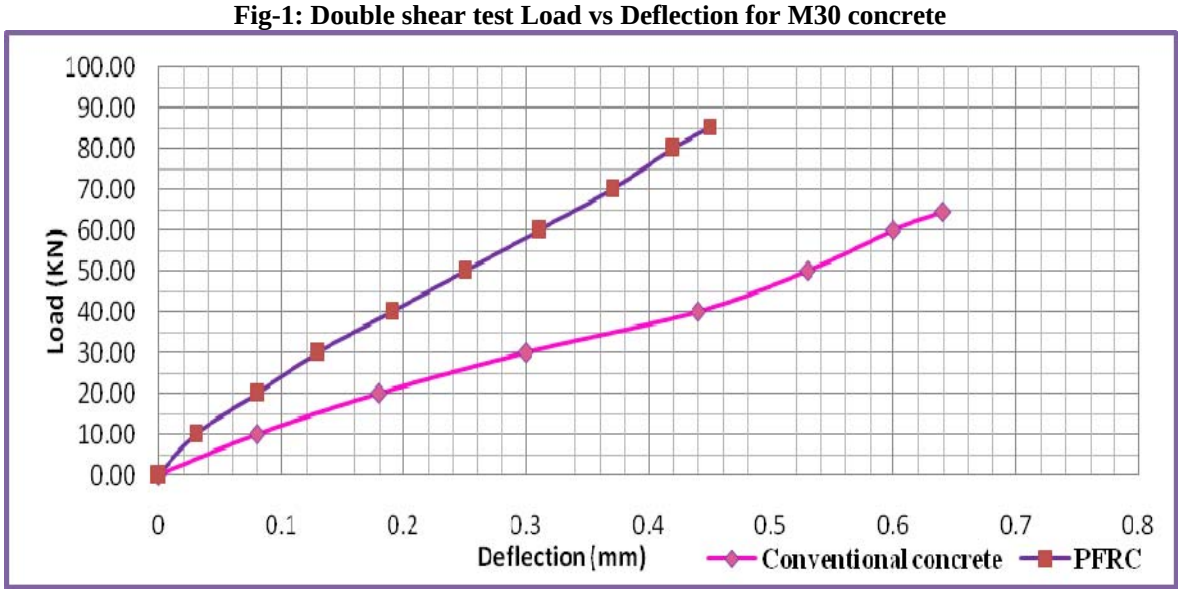


Fig-2:Double shear test Load vs Deflection for M35 concrete

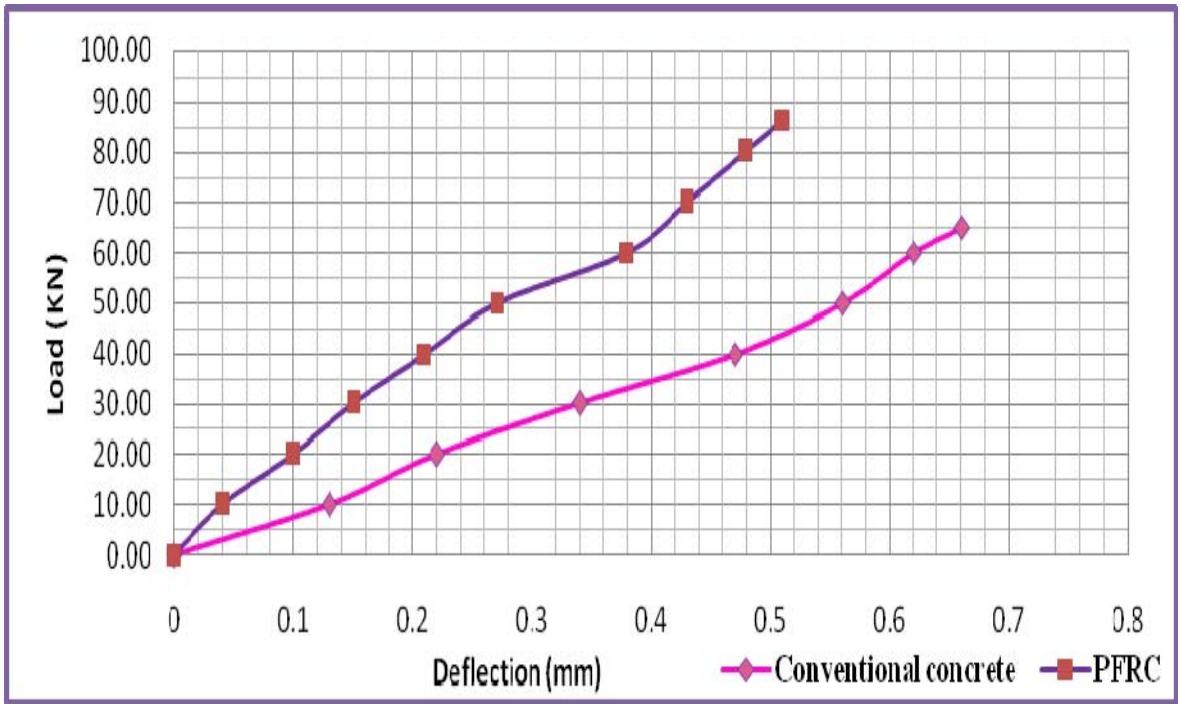


Fig-3: Double shear test Load vs Deflection for M40 concrete

Table 2:Comparison of theoretical and experimental deflection

Type of Concrete	Grade of Concrete	Mean Theoretical Deflection (mm)	Mean Experimental Deflection (mm)	Percentage of Variation
Conventional concrete	M30	0.0945	0.09	4.76
	M35	0.091	0.085	6.59
	M40	0.088	0.077	12.5
Fiber Introduced concrete	M30	0.0796	0.07	13.7
	M35	0.0786	0.065	17.3
	M40	0.0756	0.061	19.31

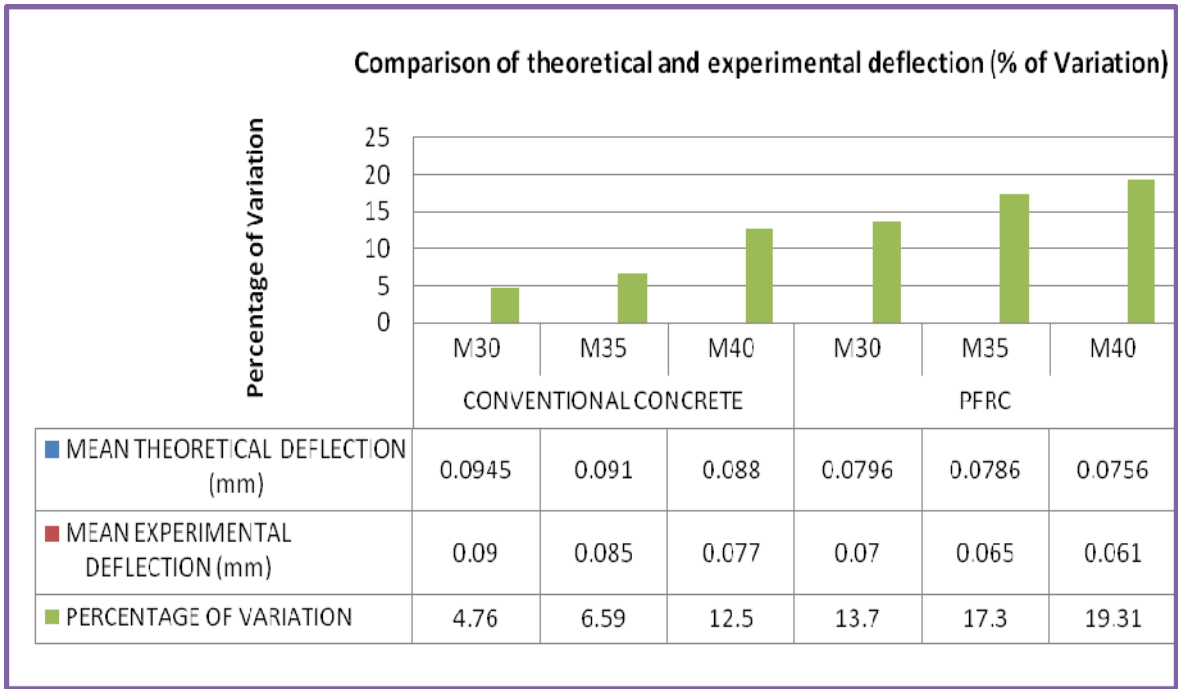
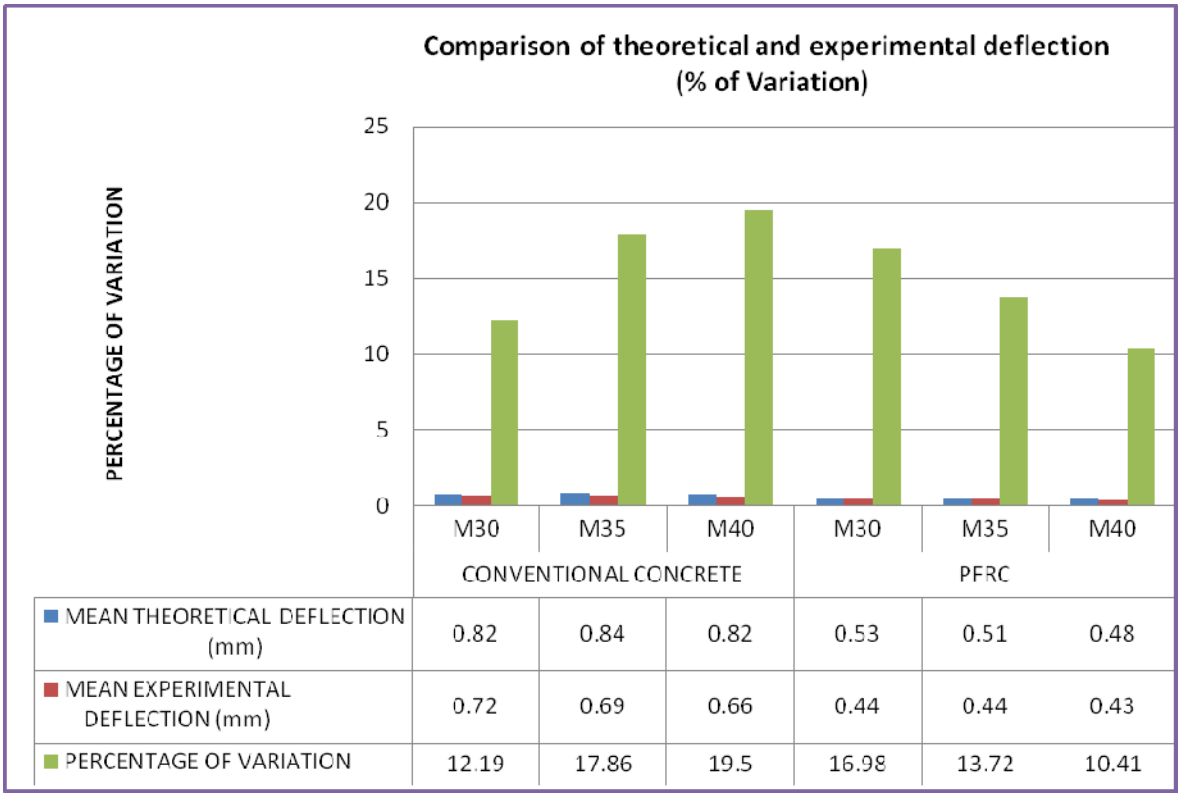


Fig-4 Comparison of theoretical and experimental deflection for 4-point bend test

Table 3:Comparison of theoretical and experimental deflection

Type of Concrete	Grade of Concrete	Mean Theoretical Deflection (mm)	Mean Experimental Deflection (mm)	Percentage of Variation
Conventional Concrete	M30	0.82	0.72	12.19
	M35	0.84	0.69	17.86
	M40	0.82	0.66	19.5
FiberIntroducedConcrete	M30	0.53	0.44	16.98
	M35	0.51	0.44	13.72
	M40	0.48	0.43	10.41



	M30	M35	M40	M30	M35	M40
MEAN THEORETICAL DEFLECTION (mm)	0.82	0.84	0.82	0.53	0.51	0.48
MEAN EXPERIMENTAL DEFLECTION (mm)	0.72	0.69	0.66	0.44	0.44	0.43
PERCENTAGE OF VARIATION	12.19	17.86	19.5	16.98	13.72	10.41

Fig-5 Comparison of theoretical and experimental deflection for double shear test

8. Conclusions

The following inferences have been drawn from the experiments done on concrete with polyethylene and tire fibers:

- There is a significant amount of gain found in shear strength.
- Gain in shear strength were found to be 31.33%, 32.56% and 32.72% for M30, M35, and M40 respectively.
- Respective reduction in deflection were 38.69%, 36.23% and 33.75%.
- The percentage of variation of deflection in conventional concrete is found to be 12.19%, 17.86% and 19.5% for M30, M35 and M40 respectively and for fiber introduced concrete it is found to be 16.98%, 13.72% and 10.41%.

From the above mentioned findings it can be concluded that the wasted polyethylene and tire fibers can be used effectively to positively influence the mechanical properties of the fiber reinforced concrete.

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