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Comparative Study of Ordinary Concrete with Reinforced Concrete Using Steel Fibre and Polypropylene Fibre

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ABSTRACT:The concept of using fibres to reinforce material is more than many years old. Since Portland cement concrete started to be used widely as a construction material. Where made to use fibre for arresting cracks and enhancing the strength of concrete. The development of fibre reinforcement for concrete was very slow before 1960. Fibres are generally used as the resistance to cracking and strengthening of concrete. Fibre Reinforced Concrete (FRC) is used large scale for structural purposes. The principal motive behind incorporating fibre into a cement matrix is to increase the toughness and tensile strength and improve the cracking deformation characteristics of the resultant composite to be valuable Construction material. Steel fibre gives more compressive strength and cracks resistance to Concrete as compared to polypropylene fibre.

KEYWORDS:Fibre Reinforced concrete, compressive strength, steel fibre, Polypropylene fiber

I. INTRODUCTION

Concrete is substantially more brittle and has lower tensile strength than other building materials like metals and polymers. Steel is at least 100 times more resistant to crack formation than concrete based on fracture toughness measurements. As a result, concrete in use is prone to cracking, which gives harmful agents easy access and causes early saturation, freeze-thaw damage, scaling, discoloration, and steel corrosion.

Concrete is one of the mostly use building materials. It can be cast to meet any structural shape, from a cylindrical water tank to a rectangular beam or column in a tall building. Concrete has many advantages, including great compressive strength, improved fire resistance, strong water resistance, low maintenance costs, and a lengthy service life. Compared to other building materials like metals and polymers, concrete is significantly more brittle and has lower tensile strength. According to measures of fracture toughness, steel is at least 100 times more resistant to the development of cracks than concrete. Since harmful agents can easily access cracked concrete in use, it is more likely to experience early saturation, freeze-thaw damage, scaling, discoloration, and steel corrosion. Its ability to absorb energy and apparent ductility an attempt has been made in this Project to provide the and benefits of using fibre reinforced concrete for a applications. The use of fibres help in modifying properties of ordinary concrete both in plastic and hardened stage and thus results into a more durable concrete.

Fibre reinforced concrete (FRC) is ordinary Portland cement concrete reinforced with more or less randomly distributed fibres concrete is a basic engineering material which is widely used in the world , It is commonly known that fibre can be utilized to reinforced concrete to reinforced concrete FRC must be able to function economically with the current reinforcing system in order to be a valuable construction material . it is obtained by mixing cement , sand , aggregate water sometimes required proportion of steel fibre , polypropylene mix with ordinary concrete .used grade M20 ratio (1:1.5:3). Percentage of fibre mix with concrete 1.5%various properties concrete or Weller reinforced concrete due to the additional of steel and polypropylene fibre.

The attributes of the materials, the amount of mix the method of compaction and most important the method of curing all effects and strength, durability and other features of concrete. beginning in the early 1960s, fibre reinforced concrete , underwent modern development concrete becomes homogeneous and isotropic when fibres are added to it endeavoured to explain the advantages and of using fibre reinforced concrete for various applications , using fibre modifies the properties of concrete making it more durable synthetic fibres prevent heat and shrinkage cracks concrete with fibre reinforcement typically consider of Portland cement and role of fibre is not planned in the process of making concrete , the fibre are added.

II. OBJECTIVE

The objective is to study the mechanical and durability properties of ordinary and FRC concrete reinforced with steel fibre and polypropylene fibre that include compressive strength, split tensile strength and flexural strength. For percentage of fibre for 1.5% with grade of M20.

The objectives aim at:

- To determine mechanical properties of FRC and ordinary concrete.
- To find optimum percentage of steel fibre and polypropylene fibre.
- To determine strength of steel fibre and polypropylene fibre.
- To determine concrete matrix has to stop crack expansion and split

III. MATERIAL

1. Cement :

The cement used in the mixtures was Ordinary Portland cement (OPC) of 53 grades manufactured by Ultratech Cement Ltd., which conforms to the Indian Standard (IS) 269. The specific gravity of this cement was measured to be 3.15.

2. Fine aggregate:

The sand has passed through a 4.75mm IS sieve, indicating that the maximum particle size is 4.75mm. The specific gravity of the sand is 2.8. Specific gravity is the ratio of the density of a substance to the density of a reference substance (usually water). In this case, the sand is 2.8 times denser than water.

3. coarse aggregate:

Locally available coarse aggregate has been used the maximum size of coarse aggregate is 20MM Aggregate are the important constituents in a concrete they give body to the concrete reduce shrinkage and effect economy. Almost all natural aggregate materials originate from bed rocks there are three kinds of rock namely igneous sedimentary and metamorphic this this classifications are based on the mode of formation of rock it may be recalled that igneous rock are formed by cooling of molten magma or lava at me the surface of the crest metamorphic rocks are originally either igneous or sedimentary rocks which RE Subsequently metamorphosed due to extreme Heat and pressure

4. STEEL FIBER:

Steel fibre of diameter 1mm fiber had a tensile strength and length 800 to 900 MPA (N/mm²) and 50mm respectively the value of aspect ratio is 50 steel fiber reinforce concrete commonly used in tunnel construction as if provide additional flexural strength reduce shrinkage cracking and reduces permeability Steel fiber of diameter 0.92mm, fiber had a tensile strength and a specific gravity of 331Mpa and 7.850, respectively. Three different values of percentage of volume fraction of steel fibers (0.5%, 1.0% and 1.5%) and the corresponding weights are 39.25, 78.50, and 117.75 kg/m³ respectively.

5. POLYPROPYLENE FIBER:

Fiber reinforced concrete is a composite material comprised of Portland cement, aggregate and fibers. Normal unreinforced concrete is brittle with a low tensile strength and strain capacity. The proportion of irregular fibers distributed is mixed to fill the cracks in the composite. Some type of fibers creates greater impact, abrasion and shatter resistance in the concrete. Usually fibers do not rise the flexural strength of concrete.



IV. SCHEDULE OF CASTING

COMPRESSIVE STRENGTH			
Type of concrete	Ordinary M ₂₀	Steel Fibre	Polypropylene Fibre
7DAYS	3	3	3
14DAYS	3	3	3
28DAYS	3	3	3

Table No 1. Schedule of Casting for Compressive Strength

SPILT TESNSILESTRENGTH			
Type of concrete	Ordinary M ₂₀	Steel Fibre	Polypropylene Fibre
28DAYS	3	3	3

Table No 2. Schedule of Casting for Spilt Tensile Strength

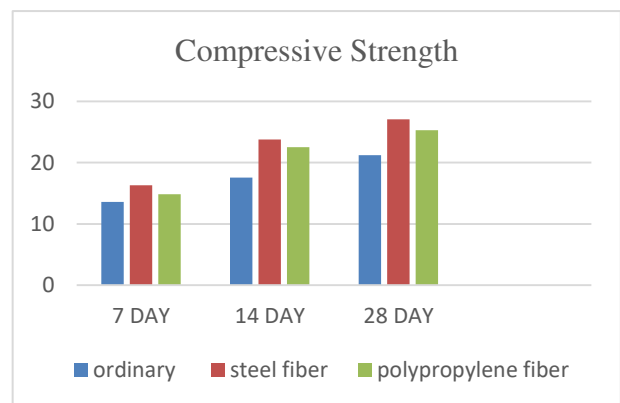
Flexural strength			
Type of concrete	Ordinary M ₂₀	Steel Fibre	Polypropylene Fibre
28DAYS	3	3	3

Table No 3. Schedule of Casting for Flexural Strength

V. RESULT AND ANYLEISIS

TYPE OF TYPE OF CONCRETE	COMPRESSIVE STRENGTH (N/MM ²)		
	7 DAY	14 DAY	28 DAY
ORDINARY CONCRETE	13.57	17.55	21.20
STEEL FIBRE	16.30	23.76	27.08
POLYPROP YLENE FIBRE	14.86	22.49	25.26

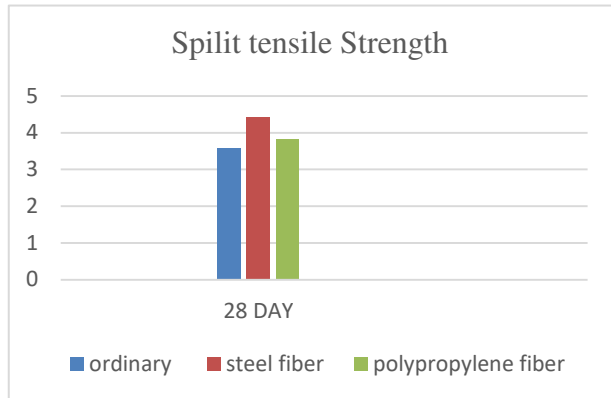
Table No 4 Average Compressive Strength



Graph No 1 Average Compressive Strength

TYPE OF TYPE OF CONCRETE	SPLIT TENSILE STRENGTH (N/MM ²)
	28 DAY
ORDINARY CONCRETE	3.57
STEEL FIBRE	4.41
POLYPROPY LENE FIBRE	3.83

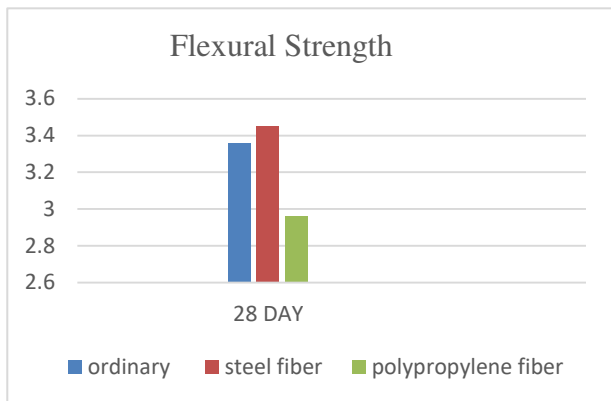
Table No 5 Average split tensile Strength



Graph No 2 Average split tensile Strength

TYPE OF TYPE OF CONCRETE	FLEXURAL STRENGTH (N/MM ²)
	28 DAY
ORDINARY CONCRETE	3.36
STEEL FIBRE	3.45
POLYPROPY LENE FIBRE	2.96

Table No 6 Average Flexural Strength



Graph No 3 Average Flexural Strength

VI. CONCLUSION

- 1]. the addition of steel fibres to concrete can indeed increase its compressive strength 1.27% compared to ordinary concrete
- 2.] The addition of Polypropylene fibres to concrete can indeed increase its compressive strength by 1.19% compared to ordinary concrete
- 3] The comparison between steel fibre-reinforced concrete (SFRC) and polypropylene fibre-reinforced concrete (PFRC) regarding their strength enhancement can vary depending on several factors, including the type and dosage of fibres used, the concrete mix design, and testing conditions. In addition 1.5% steel and polypropylene fibre in M20 mix of both fiber a 0.93% higher strength improvement with steel fibres over polypropylene fibres
- 4] The addition of steel fibers to concrete can indeed provide better flexural strength compared to polypropylene fibres. Steel fibers have higher tensile strength and stiffness, allowing them to effectively distribute stress and resist crack propagation in the concrete matrix. This reinforcement leads to improved flexural strength and overall structural performance. While the exact percentage increase in flexural strength may vary depending on factors such as fibre type, dosage, and concrete mix design, in case of 1.5% steel fibre and polypropylene fibre in M20 mix gives 1.02% higher strength improvement with steel fibres over polypropylene fibres
- 5] The addition of steel fiber in case of split tensile strength the steel fiber reinforced concrete give 1.07% more strength compare to polypropylene fiber

6] Compare to the steel fiber and polypropylene fiber the polypropylene fiber gives 0.93% less in compressive strength, 1.07% less in split tensile strength and 0.85% less than the steel fiber reinforced concrete

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