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# Comparison of Polymer Fibre Reinforced Concrete with Conventional Concrete

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## ABSTRACT

*Road transportation is a lifeline of India and its development is a very important concern. In India, bituminous pavements are mostly used. Bituminous pavements are also called flexible pavement and it is made by petroleum crude. Petroleum crude are polluting to the Nature so we need to substitute to it and cement concrete is a better substitute. Cement concrete pavement has several advantages like, smooth riding, high compressive strength, etc. But some disadvantages are also like, low tensile strength, low durability, etc. To overcome these problems, we have Polymer fibre reinforced concrete pavement as a solution. It has higher tensile strength & longer life. It is also providing better pave road and it is proper binding with the concrete ingredients. In this experiment we are analyse to get optimum strength of polymer fibre reinforced concrete by adding different percentage of the Recron-3s Fibre and Nylon Fibre by volume of concrete and comparison between conventional concrete and Fibre concrete.*

***KEYWORDS: Compressive Strength, Nylon Fibre, Recron-3s Fibre, Tensile Strength.***

## 1 INTRODUCTION

India is a developing country and in developing country road transportation is a most important network and most of the population of India is depend on it. It provide comfortable durable surface to the vehicles and because of that it reduces stresses on underlying soil. Generally bitumen is used in road construction & because of bitumen burnt pollution occurs and bituminous pavements are not long durable but Cement Concrete pavement is better durable and reduce pollution so it is a better substitute of bituminous pavement. Because of some problems, we have an upgrade on cement concrete and it is called Polymer Fibre Reinforced Concrete Pavement. Cement concrete pavement have high compressive strength but it has low tensile strength. To overcome this problem, we used PFRC pavement. It fulfils two most demanded requirements of pavement, economy & reduced pollution. It also some other advantages like, longer life, low maintenance cost, fuel efficiency, good riding quality, increase load capacity & impermeability. In construction concrete is most widely used. Concrete is a mixture of cement, sand, aggregate and water. Concrete is not satisfied to control the post cracking process. To solve this problem, we increase flexural strength providing by reinforcing by fibre. There are different types of fibre used like steel fibre, glass fibre, synthetic fibre, polypropylene fibre, Natural fibre, etc. In this experiment we used polypropylene fibre and nylon fibre to find strength of concrete fibre after fibre is used in concrete. In this experiment we added various percentages of polypropylene fibre and nylon fibre in concrete by volume of concrete to know the optimum compressive strength. The strength is calculated at 0%, 1.4%, 1.8%, 2% of polypropylene (Recron-3s) and nylon (synthetic) fibre by volume of concrete.

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## 2 LITERATURE REVIEW

**S.Panda, N.H.S.Ray (2014)** established an experiment on design procedure and operations of polymer fibre reinforced concrete pavements. They explained a brief comparison of PFRC pavement with conventional concrete pavement. Polymeric fibres are gaining popularity because of its properties like zero risk of corrosion and cost effectiveness. They analysed of various forms of recycled fibres like plastic wastes, disposed tyres, carpet wastes and wastes from textile industry can also use as a fibre reinforcement. Concrete pavements may be weak in tension and against impact loads, but PPFRC is a suitable material which may be used for cement concrete pavement and it consist the extra strength in flexural fatigue and impact etc. There are two components of PFRC pavement; one is the concrete mix and other is polymer fibres. The polymer fibres increases the compressive strength 12 to16% and also the flexural strength 7 to 14% over the normal concrete.

**Amit Rai, Dr. Y.P.Joshi (2014)** conducted the experimental studies and application of fibres reinforced concrete. They study different types of fibres and their application. The improvement in concrete properties by polypropylene fibres, they analysed that compressive strength which is increased about 16%. The flexural strength of polypropylene fibres is improved about 30%. They study the different types of fibres and the concrete properties. Fibre addition improves ductility of concrete Slump test were examined to find out the workability and consistency of fresh concrete. The efficiency of all fibre reinforcement is dependent upon achievement of a uniform distribution of the fibres in the concrete, their interaction with the cement matrix, and the ability of the concrete to be successfully cast or sprayed.

**N Pannirselvam, V.Nagaradjane, K.Chandramouli (2009)** conducted the experimental strength behaviour of fibre reinforced polymer strengthened beam. They found that strengthening of structures using fibre reinforced polymer. The objective of their work is to determine the strength of structural behaviour of reinforced concrete beams. They observed that in the beam the deflection ductility values for beams showed increases over the corresponding the reference beams

**Kolli, Ramujee (2013)** conducted the experimental studies on the strength properties of polypropylene fibre reinforced concrete. A combination of high strength, stiffness and thermal resistance polypropylene fibres are preferred for the fibre reinforced concrete. In this study, the results of the Strength properties of Polypropylene fibre reinforced concrete have been studied. The compressive strength, splitting tensile strength of concrete samples made with different fibres amounts of percentage varies from 0%, 0.5%, 1%, 1.5% and 2.0% were studied. The samples with added Polypropylene fibres of 1.5 % showed better results in comparison with the other fibre percentage.

## 3 EXPERIMENTAL DETAILS

Material and Mix Design:

- Cement- We used Ordinary Portland Cement Ambuja 33 grade cement in the experiment. It is easily available.
- Sand- We used normal river sand which is easily available in Kota city. It is passed through by 75µ sieve.
- Aggregate - We used normal aggregate which is easily available in Kota city. It is passed through by 30mm sieve.
- Water - In concrete mixing we used fresh water. The pH of water is found 7.5 in pH meter. It should not be less than 6.
- Polypropylene Fibre - We used Polypropylene fibre, having 6mm long and 0.045mm diameter. It is manufactured by Reliance Company. It is also called Recron-3s fibre.
- Mixed Design - The concrete grade is M20 and its proportion is shown in below table 1. The raw material are mixed by hands and compacted by vibrator for casting cubes. The mix proportion are calculated as per IS code. Fibres are added 0%, 1.4%, 1.8% and 2% by volume of concrete.

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**Table 1:** Mix Design Proportions.

| Ingredient | Quantity (Kg/M$^3$) |
|---|---|
| Cement | 444.4 |
| Sand | 642 |
| Aggregate | 1234.5 |
| Water | 222.2 |

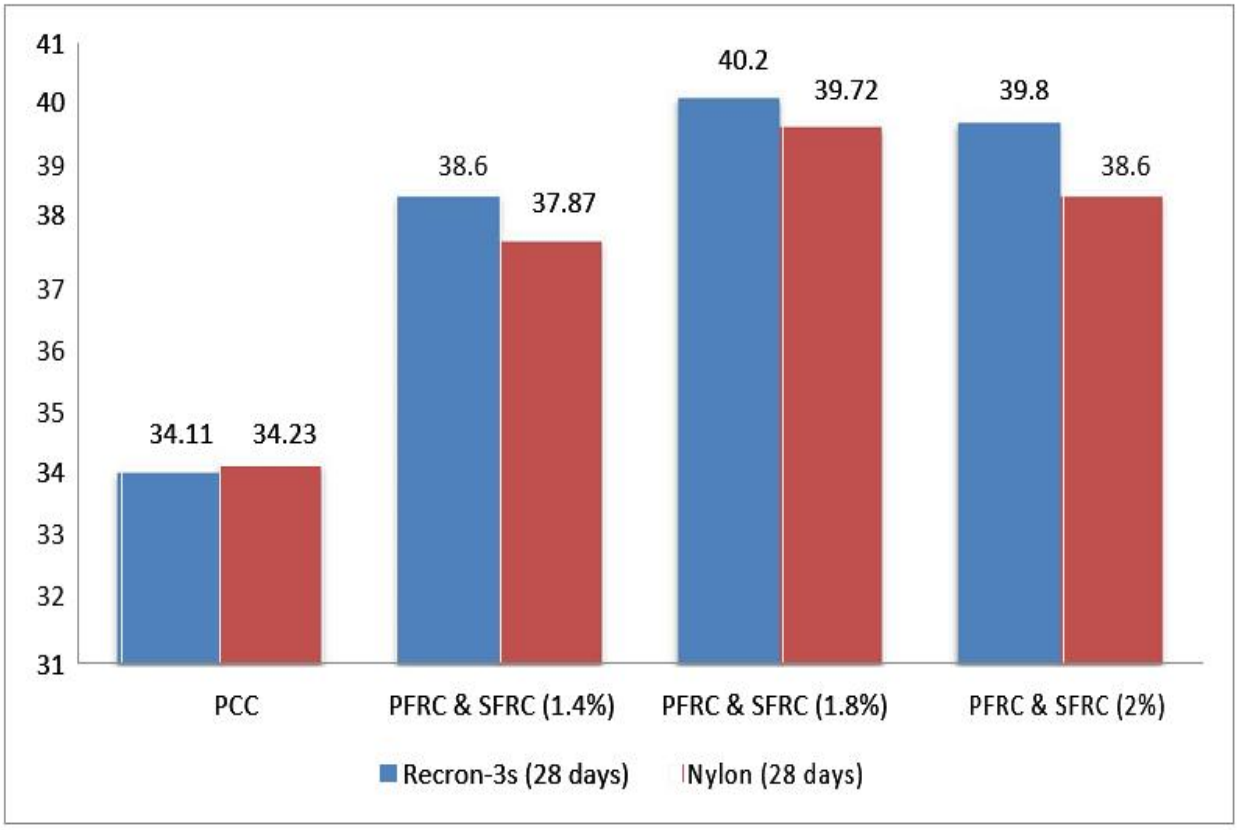
## 4 RESULT AND DISCUSSION

4.1 Compressive Strength Test

In compressive strength test, 3 cubes of each percentage of recron-3s fibre and Nylon fibre by volume of concrete are casted in size of cube which is 150Xmm150mmX150mm. Cubes are tested 28 days of casted each percentage of both fibres by volume of concrete.

4.2 Test Result

Compressive strength test results are calculated after 28 days. The following graph shows the variation of compressive strength at different percentages of fibres by volume of concrete at different age of days.



## 5 CONCLUSION

As we discussed in paper two forms of fibres are used. Casted samples are tested for compressive strength with various percentages of fibres. From the test and results, we found the subsequent conclusions are:

Compressive Strength improvement ranges from 4.15% to 13.2% compared of fibre will increase from 0.1% to 0.2% for PFRC & SFRC compared to the conventional concrete at 28 days. 0.2% is observed as the optimum value.

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