Strength Evaluation and Economic Analysis of Concrete Using Recron -3s Fiber

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Abstract: A concrete cement is mixture of coarse aggregate, fine sum, sand and water. Concrete is one of the most versatile materials. It can adapt to any kind of structure. Concrete is used for various construction purposes such as in buildings and their components, roads, water retaining structures, air fields, docks and harbours because of its exceptional qualities. It has numerous other advantages over other construction materials. The production of cement is an energy intensive process, resulting in emission of greenhouse gases which adversely impact on the environment. Concrete advantages are good compressor strength, good fire resistance and high water resistance. But concrete tensile strength week to overcome these difficulties, we use strong power to consolidate. And fiber is used to overcome these advantages. Fiber bending, resistance to tensile strength and impact resistance is good. This thesis explores the combination of fiber-3s in combination of glass fiber to strengthen the concrete and strengthen the concrete. The solution is available that the cost of combining glass fiber is effective, when the resistance of the glass takes time compared to 3S fiber. This paper explore to find the Strength Evaluation of Recron -3S Fibre USING M30 Concrete and to find the Strength of Glass Fibre Using M30 Concrete. Further the comparison of Strength and Cost Analysis and Economical between Recron-3S Fibre and Glass Fibre has been evaluated.

Keyword: A concrete cement, coarse aggregate, fine sum, sand and water, 3S fiber, glass fiber

1. Introduction

Concrete is the most widely used man-made construction materials in the world. Slightly more than a ton of concrete is produced each year for every human being on the planet fundamentally, concrete is economical, strong, and durable. Although concrete technology across the industry continues to rise to the demands of a changing market place. The construction industry recognizes that considerable improvements are essential in productivity, product performance, energy efficiency and environmental performance. The industry will need to face and overcome a number of institutional competitive and technical challenges. One of the major challenges with the environmental awareness and scarcity of space for land-filling is the wastes/byproducts utilization as an alternative to disposal. Throughout the industrial sector, including the concrete industry, the cost of environmental compliance is high. Use of industrial by-products such as foundry sand, fly ash, bottom ash and slag can result in significant improvements in overall industry energy efficiency and environmental performance.

1.1 Recron 3S fibre

Recron 3S fibre Recron 3S is a modified polyester fibre. It is generally used as secondary reinforcing material in concrete and soil to increase their performance. Recron 3S sample used in experiment was of 12mm length and manufactured by Reliance Industries Limited. Physical parameters of Recron 3S fibre as obtained from RIL Safety data sheet. Use of Recron-3S as a reinforcing material is to increase the strength in various applications like cement based precast products, filtration fabrics etc. It also provides resistance to impact, abrasion and greatly improves the quality of construction during foundation, retaining wall design etc [7]. Polypropylene fibre is the most widely used inclusion laboratory testing of soil reinforcement [8-9]. Currently Polypropylene fibre is used to enhance the soil strength properties, to reduce the shrinkage properties and to overcome chemical and biological degradation [10].

• Controls Cracking:
RECRON 3s prevents the shrinkage cracks developed during curing making the structure/plaster/component inherently stronger. Further when the loads imposed on concrete approach that for failure, cracks will propagate, sometimes rapidly. Addition of RECRON 3s in concrete and plaster prevents/arrests cracking caused by volume change (expansion & contraction).

• Reduces water permeability:
A cement structure free from such micro cracks prevents water or moisture from entering and migrating throughout the concrete. This in turn helps prevent the corrosion of steel used for primary reinforcement in the structure. This in turn improves longevity of the structure.

• Reduces Rebound In Concrete - Brings Direct Saving &Gain:
RECRON 3s fibers reduce rebound "splattering" of concrete and shotcrete. The raw material wastage reduces & results in direct saving in terms of raw material. More importantly it saves a great deal of labour employed for the job, which could be completed earlier.

• Increases Flexibility:
The modulus of elasticity of RECRON 3s is high with respect to the modulus of elasticity of the concrete or mortar binder. The RECRON 3s fibers help increase flexural strength.

• Safe and Easy To Use:
RECRON 3s fibers are environmental friendly and nonhazardous. They easily disperse and separate in the mix.

1.2 Waste Foundry Sand
Classifications of foundry sand mainly depend primarily upon the type of binder and binder system used in metal casting. There are two types of foundry sand; Green sand (clay bonded) and chemically bonded. Resin coated sand, cold box sand, hot box sand and Co2 sands are some common type of chemically bonded sand. (Mold and core test handbook, American foundry society).

Primary Applications of RECRON-3s:
• Plain concrete & Wall plastering
• Footings, foundations, walls and tanks
• Pipes, burial vaults, pre-stressed beams etc.
• For improving the properties of soil by increasing its strength.
• Roads & pavements
• Bridges and dams

2. Background
Krishna *et al.* (2017) High-performance concrete is defined as concrete that meets special combinations of performance and uniformity requirements that cannot always be achieved routinely using conventional constituents and normal mixing, placing, and curing practices. Ever since the term high-performance concrete was introduced into the industry, it had widely used in large-scale concrete construction that demands high strength, high flow ability, and high durability. Gehlot, T., & Sankhla, study of the fly ash bricks are comparatively lighter in weight and stronger than common clay bricks. Fly ash bricks are better alternative to conventional burnt clay bricks in structural, functional and economic aspects. This industry has the potential to consume at least 50% of the ash production in India. Kumar, S. R. C., Ratnam,(2017) study High-performance concrete is defined as concrete that meets special combinations of performance and uniformity requirements that cannot always be achieved routinely using conventional constituents and normal mixing, placing, and curing practices. Usman, N., & Masirin, M. I. M. (2019). Study of this chapter highlighted the advantages of recycled PET fiber in performance improvement of asphalt mixture. Based on experimental studies conducted, the following conclusions were drawn. Water absorption of PET was found to be 0.18%, which is very low. Gurubaran, P. S., & Andal, N. M. (2016).purposed to Engineered Cementitious Composites (ECC) is an ultra-ductile fibre reinforced cementitious material that embodies a micromechanics based design concept. The tensile ductility and self-controlled tight crack width characteristics are conducive to enhancing structural safety under severe loading, and durability under normal service loading. Ahmad, S., Elahi, A., Iqbal, H. W., & Mehmood, F. (2018). Study of the objective of this research work was to determine the effect of fiber cocktail on mechanical properties of concrete. Three types of fibers were used namely monofilament polypropylene fiber, steel fiber and glass fiber. Steel and glass fiber were incorporated in concrete at different dosages while the content of Polypropylene fiber was kept constant. Bhaskar, R., Nallanthel, M., & Teja, K. (2018). Purposed to Self-Compacting concrete (SCC) is a high – performance concrete that can flow under its own weight to completely fill the form work and self-consolidates without any mechanical vibration. In this project, the investigations were carried out on the M20 grade SCC, prepared using four different ratios (0.3, 0.6, 0.9 and 1.2%) of polypropylene fiber and a water cement ratio of 0.47.

3. Experimental Result & Analysis
Research findings have reported a behavioural relationship between the splitting tensile strength and compressive strength of concretes. This work studied both the experimental and analytical relationships that exist between splitting tensile strength and compressive strength.

The following three tests are to be done on M30 concrete using first as Recron 30 with it and than Glass fibre and than check the Compressive Strength, Split tensile strength and and Flexure Strength and than compare each as follows .

Table 1: Compressive Strength of M30 with using Recron Fibre

Fiber content (%)	7 days compressive strength (N/mm2)	28 days compressive strength (N/mm2)	60 days compressive strength (N/mm2)
0	29.86	32.23	34.121
0.1	23.22	26.19	27.853
0.2	25.12	30.11	34.231
0.3	18.05	28.12	27.121

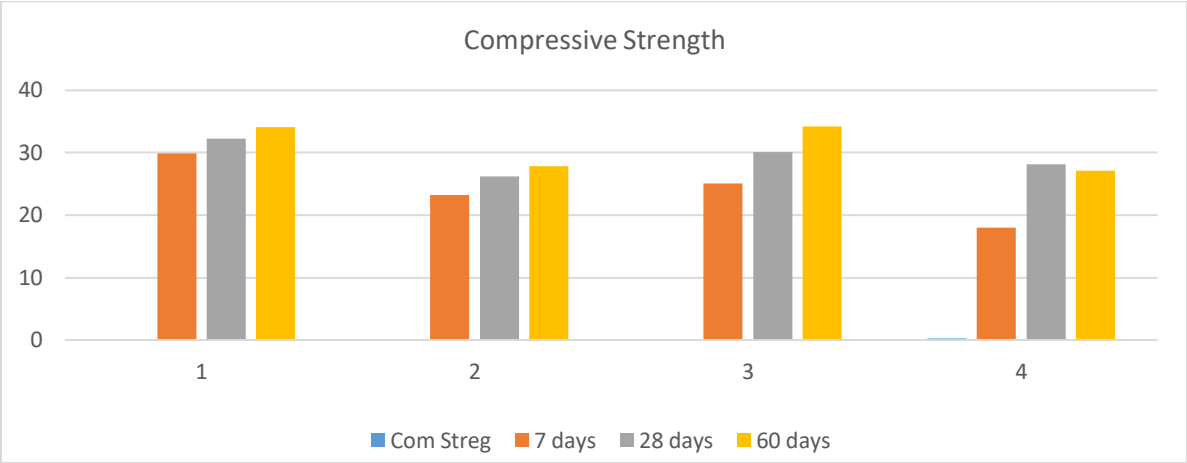

Fig 1

This graph and table shows the fiber content % 7 days compressive strength (N/mm2), 28 days compressive strength (N/mm2), 60 days compressive strength (N/mm2). In 0.and 0.1 compressive strength % decreases and in 0.2 strength is increase and again is decreases in fiber content percentage 0.3 %.

Table 2: Split Tensile Strength Test of M30 with using Recron Fibre

Fiber content (%)	7 days Split tensile strength (N/mm^2)	28 days Split tensile strength (N/mm^2)	60 days Split tensile strength (N/mm^2)
0	2.452	2.783	2.838
0.1	2.29	2.636	2.622
0.2	2.862	3.526	3.556
0.3	2.822	2.335	2.345

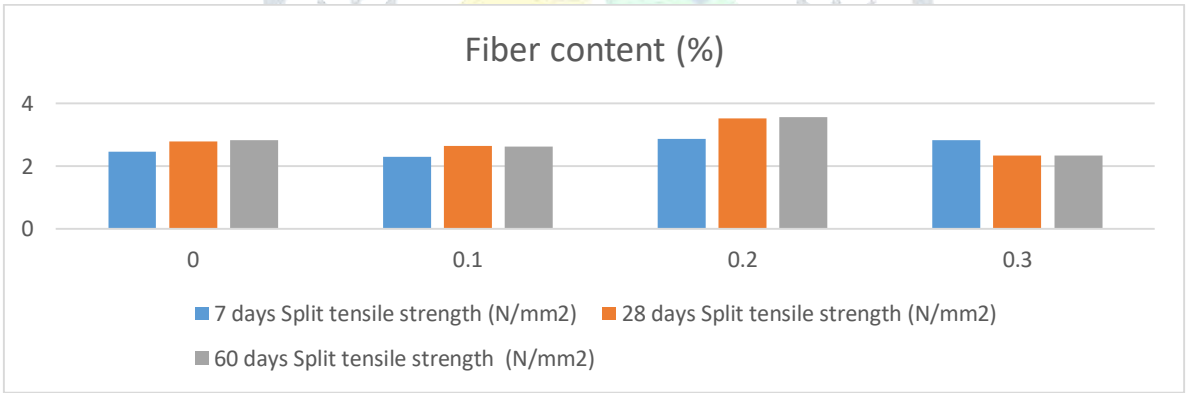

Fig 2

Percentage Tensile strength of fiber content is increases in the 0.2 % in 28 days Split tensile strength (N/mm2) and 60 days Split tensile strength (N/mm2). Decreases the strength in % in 0, 0.1, 0.2 and 0.3 of Recron 3s .

Table 3: Flexural Strength Test of M30 with using Recron Fibre

Fiber content (%)	7 days flexural strength (N/mm2)	28 days flexural strength (N/mm2)	60 days flexural strength (N/mm2)
0	5.981	6.445	8.934
0.1	5.923	6.536	6.021
0.2	5.453	7.678	9.986
0.3	5.324	5.981	8.087

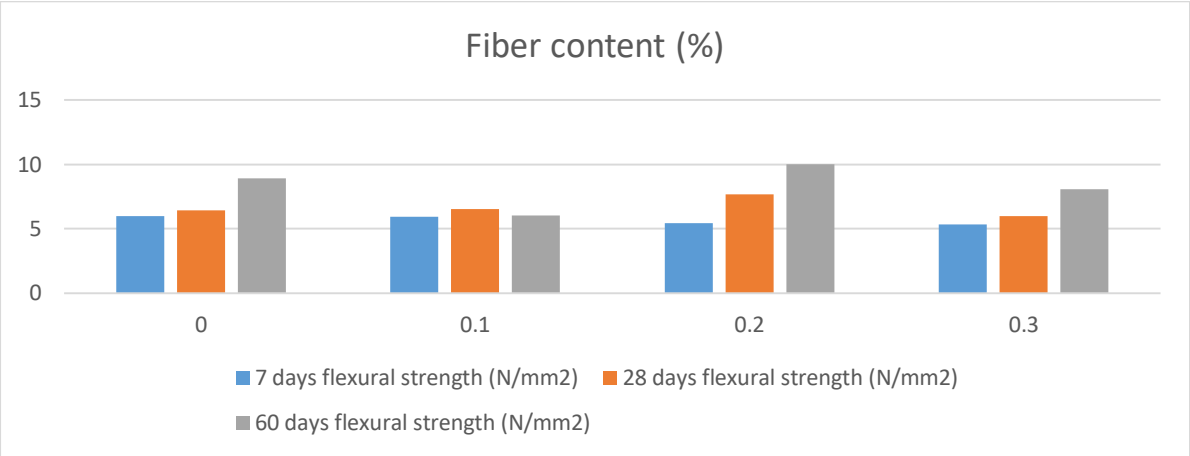

Fig 3

Flexural Strength goves increasing for 28 days and 60days for fiber content . So more days to b tested more strength to be gained.

Using Glass fibre & Checking the Results and than comparing with results of Recron 3s Fibre.

Table 4: Compressive Strength Test results using Glass Fibre with M30

Glass Fiber (%)	7 days compressive strength (N/mm2)	28 days compressive strength (N/mm2)	60 days compressive strength (N/mm2)
0	25.21	33.134	34.986
10	22.98	31.321	30.344
20	25.97	33.647	36.325
30	22.012	28.986	30.456

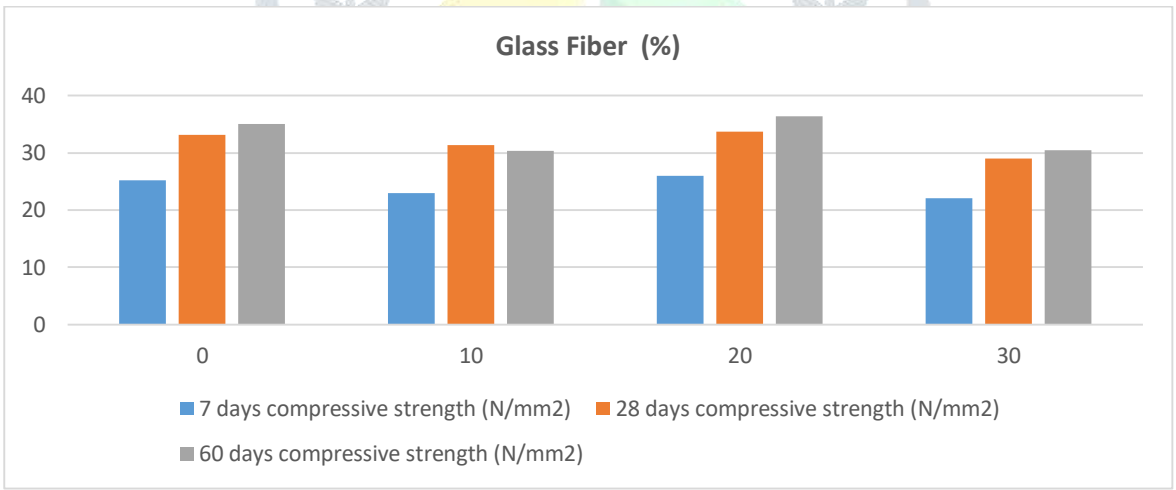

Fig 4

Glass fiber % increasing 28 days compressive strength (N/mm2), 60 days compressive strength (N/mm2 as compare to 7 days compressive strength (N/mm2). More percentage increases for more days .Means Compressive strength goes increases for more days and using Glass fibre content as above.

Table 5: Split Tensile strength of M30 with using Glass Fibre with M30

Glass Fiber (%)	7 days Split tensile strength (N/mm2)	28 days Split tensile strength (N/mm2)	60 days Split tensile strength (N/mm2)
0	2.234	3.356	3.678
10	2.986	2.346	3.677

20	2.345	3.345	3.345
30	2.975	2.977	3.577

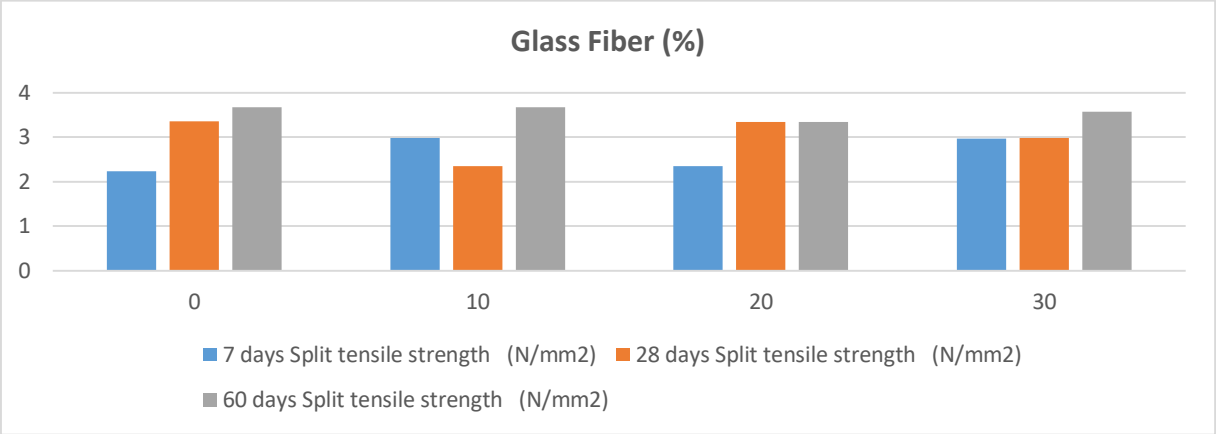

Fig 5

As seen above the table found that Glass Fiber (%) from 7 days compressive strength (N/mm2) from 60 days compressive strength (N/mm2) increase.

Table 6: Flexural Strength of M30 with using Glass Fibre with M30

Glass Fiber (%)	7 days flexural strength (N/mm2)	28 days flexural strength (N/mm2)	60 days flexural strength (N/mm2)
0	7.021	8.986	8.67
10	6.556	7.456	7.677
20	5.981	8.644	8.233
30	5.983	7.956	7.566

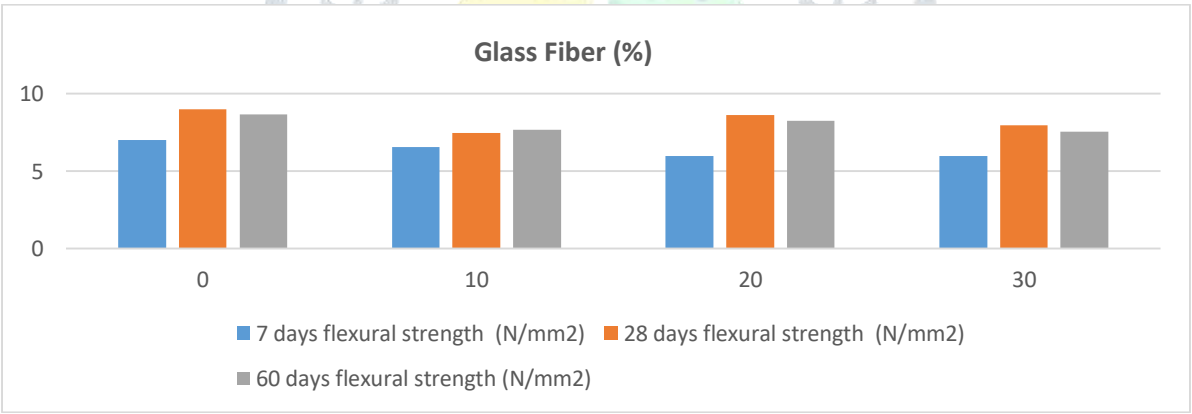

Fig 6

As seen above the table found that Glass Fiber (%) from 7 days compressive strength (N/mm2) to 60 days compressive strength (N/mm2) increase. As same at the percentage varies from 0 to 30 the same follows the increasing trends.

Table: 7 Comparing Glass Fibre with Recron 3S Fibre with Split Tensile Strength Results

	7 days Split tensile strength (N/mm2)	28 days Split tensile strength (N/mm2)	60 days Split tensile strength (N/mm2)
Fiber content (%)	2.822	2.335	2.345
Glass Fiber (%)	2.975	2.977	3.577

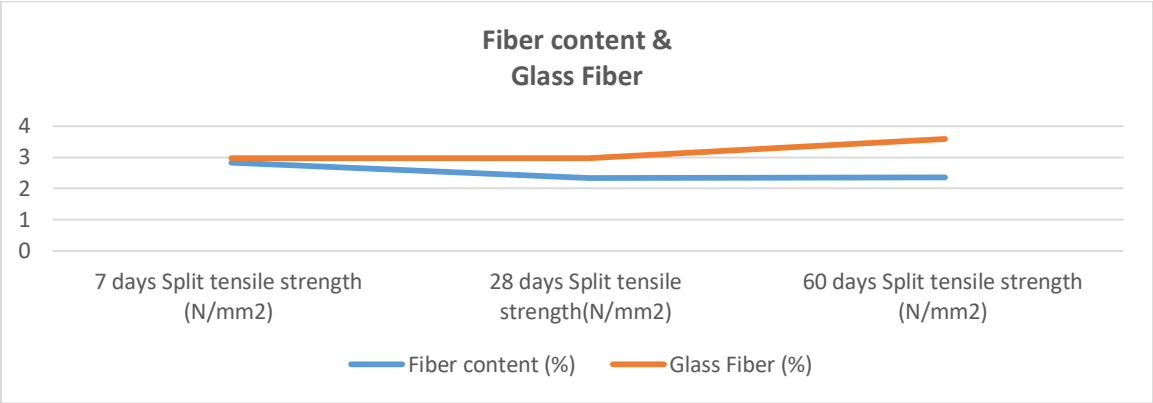

Fig 7 Split tensile strength of Fiber (3S)

As seen above the table found that in glass fiber the strength reach short time while the 3s fiber also get strength very quick. It find its maximum strength within the seven day further it loose and again stagnant.

Table 8: Cost Comparision of Glass Fibre with Recron 3S Fibre

	Grade 1 (lowest)	Grade 2	Grade 3	Grade 4(Highest)
Fiber content (%)	2	3	4	6
Glass Fiber (%)	0.7	0.9	1	1.2

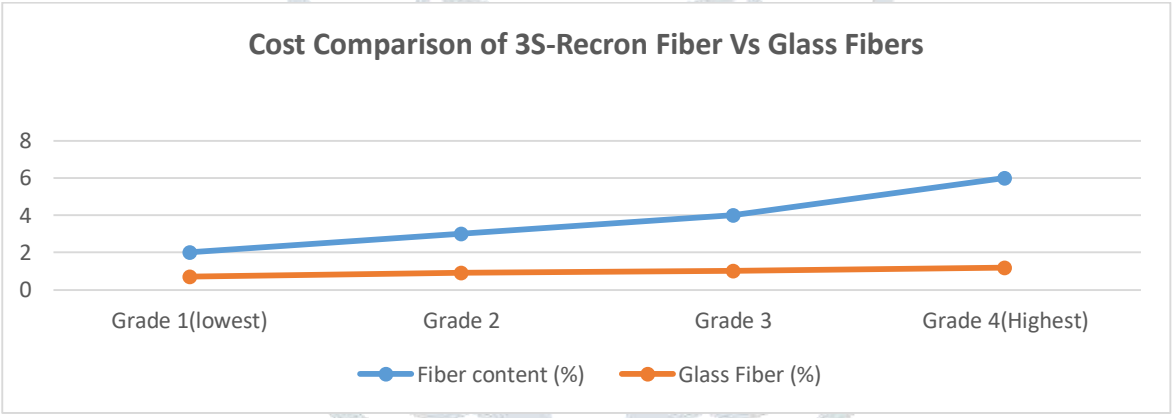

Fig 9: Cost Comparison of 3S-Recron Fiber vs. Glass Fibers

As seen above the table found that in glass fiber the cost increase lower rate as compared to Recron- 3s fibers. So as per the cost effect terminology it is found that the glass fiber missing is effective in cost.

4. Conclusion and future Scope

Concrete is a mix of cement, coarse aggregates, fine aggregates, sand and water. Concrete is one of the most versatile material. It can be caste to fit any type of structures. The advantages of concrete is good compressive strength, good fire resistance, and high water resistance. But the concrete is week in tensile strength. To overcome these disadvantages we use

the reinforcement which is good in tensile strength. And the fibers are used to overcome these advantages .Fiber is good in flexural strength, tensile strength toughness and impact resistance. This thesis explore the mixing of fiber-3S in concrete strengthen and mixing of glass fibers in concrete strengthen. The solution find the glass fiber mixing is cost effective while in strength glass takes time as compared to 3S-Fiber.

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