IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 25-26

Improving Strength Properties of Concrete using Fibres: A review

Shweta S. Bhoyar[1], Akanksha P. Tawade[2], Sapana A. Thengare[3], Shradha S. Shahare[4], Lomesh P. Chandewar[5].

[1,2,3,4]*Under Graduate Students: Department of Civil Engineering*
[5]*Assistant Professor: Department of Civil Engineering Tulsiramji Gaikwad-Patil College of Engineering and Technology, Mohgoan, Nagpur, Maharashtra (India)*

Abstract: *The present review paper focuses on the addition of fibres in fresh concrete increases the durability, workability, flexural strength & compressive strength properties of concrete, the properties of concrete such as splitting tensile test and compressive strength can increase by the addition of fibres such as steel, nylon polythene, glass fibre etc. The gradients of fibre reinforced concrete are cement, aggregate and fillers with the addition of suitable percentages of fibres which ultimately increase the concrete toughness. Irregular fibres are added to fill the cracks of composite members. The present paper review the literature related to the addition of fibre and their increase in the strength properties of concrete. As concrete is weak in tensile strength and strong in compression strength, so to overcome this defect partial addition of fibres is practiced. Fibre reinforced concrete material is cost effective materials for increasing the strength of concrete structure.*

Keywords: *Fibre, Compressive Strength, Flexural Strength, Fibre Reinforced, Steel Fibre, Split Tensile Strength, Workability, Toughness.*

I. Introduction

Fibres are used as resistance of cracking and strengthening of concrete, there are various fibres which function to provide strength and durability to concrete. According to the American Concrete Institute (ACI) committee Fibre Reinforced Concrete categorised into four parts (1) S.F.R.C. (Steel), (2) G.F.R.C. (Glass), (3) N.F.R.C. (Natural), S.N.F.R.C. (Synthetic). A steel fibre gives the maximum strength in comparison to glass and poly propylene fibres. Steel fibre used to reduced maintenance and to enhance the strength of concrete. Fibre Reinforced Concrete successfully used in slabs, architectural panels, precast products, also in seismic region for thin and thick repairs, hydraulic structures, footing and many other applications, this concept of use of fibres was first recorded with the ancient Egyptians who used the hair of animals and straw as reinforcement for mud bricks and walls in housings. The cement based material are world transforming man made construction material which consist of binding sand and aggregate mix with water. Concrete is good in compression while very poor in tension.

Due to lack of tensile strength reinforcement bar and mesh are used in construction for crack control remoulds and due to reason the use of steel fibre as reinforcement material in concrete. They are usually produced from glass, steel and other organic polymer as the material of fibre changes the character of fibre reinforced concrete change. A fibre reinforced concrete is a composite material consisting of cement based matrix with an ordered or random distribution of fibre which can be steel nylon, poly ethylene etc. use of metals as container has become popular and safe now especially to carry liquid. Hence

The plain cement concrete used in construction site is dangerous because in this concrete the tensile strength of concrete is very low but is compressive strength is good then it hazardous of building and other construction work. The aim of this study to increase the tensile strength as compare to compressive strength using fibre and to reduce the percentage of cracking due to plastic shrinkage. The concrete is permeable material then the chances of void or honeycombing is increasing then the using of the fibre material to reduce voids and increase the quality of material and it also reduce bleeding of concrete and defect of building. The main purpose of fibre reinforced concrete (FRC) is to reduce the maintenance cost of the structures.

II. Literature Review

Ram Meghe et. al. (2015):- The experimental study of steel fibre reinforcement concluded that steel fibre are used to increase the strength of concrete as compare to other fibre such as glass fibre. It is observed that for decreasing the % of steel fibres the compressive strength and the flexural strength of concrete decreases and by addition of different contain of steel fibre shows the split tensile strength which shows the addition of steel fibre is increase with and optimum fibre content found to be 1.75%.

Nitin Kumar et. al. (2015):- The experimental result & study on the use of fibres as reinforcement material with concrete for improving the durability and strength of parent substance various material such a chemicals and natural material are mixed. The result shows that steel fibre reinforced increase the strength, ductility, toughness and flexural strength of concrete. In which M40 grade of concrete used having mix proportion 1:4:3. It reduce the structural weight and give the strength property to structure.

Ahsana Fathima et. al. (2014):-Studied on the three type of fibres used of length 30mm, crimped steel fibre of length 25mm and endure 600 polyproylene of the length 50mm with aspect ratio 50. in which study on the effect of steel fibres and polypropylene. Bond strength in concrete can be increased by the addition of concrete, the stresses due to static and dynamic loading on structure can reduce by adding fibres on concrete.

A.M.Shinde et. al. (2):-Introduced steel fibres of 50,60 and 67 aspect ratio. It is observed that compressive strength increased from if to 24% with addition of steel fibre. All the strength properties are observed to those for aspect ratio 60 and 67. Using poly propylene fibre it improve impact resistant and it increases the durability of concrete. Fibre improve structural strength to reduce heavy steel reinforcement requirement.

D. Kandasamy and Murugesan (4):-Studied that influence of addition of polyethelene fibre for which M20 mix and test have been carried as per relevant codes. It was been observed that use of fibre reinforced concrete increase the compressive strength of concrete. In 7 days to an extent of 0.68% in 28days to an extent of 5.12% and increase the various mechanical properties of concrete mixes.

Milind V Mehod:-In this experimental investigation for M30 grade of concrete to study the compressive strength and tensile strength of steel fibre reinforced concrete containing fibres varied by 0.25%, 0.50%, 0.75% by the volume of cement cubes of sizes 150 x 100 x 100 mm to check the compressive strength and seam of size 500 x 100 x 100 mm for checking flexural strength were casted. All the specimen were cured for the period of 3,7 and 28 days before crushing the result of fibres reinforced concrete 3 days, 7 days and 28 days curing with various % of fibre were studied. The optimum fibre content while studying the compressive strength of cube s found to be 10% and 0.75% for flexural strength of beam.

Romildo D. Toledo Filhoetal (2005):-Made experiment on free restrained and drying shrinkage of cement mortar composite reinforced with vegetable fibres. this experiment is perform by subjecting the specimen to wind speed of 0.4-0.5m/s at 40 degree Celsius for 280 min for finding the free and restrained shrinkage and the drying shrinkage tests were carried out at room temp. with 41% relation humidity for 320 days from which it was result that the presence of sisal and coconut fibre promote an effective self healthy of plastic cracking after 40 days.

III. Conclusion on literature review

- Addition of fibres in fresh concrete reduces the crack generation on structure.
- With increase in fraction of fibres compressive strength & splitting tensile strength of concrete is increased.
- In addition of fibres in concrete improve ductility & toughness, also post cracking load carrying capacity.
- Compressive strength of the concrete after 28 days of curing increases up to 5.12% ads compare to normal concrete.
- Addition of fibres on concrete percentages of shock & shrinkage of structure can be reduced to great extent.

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