



Effects Of Glass Fibre On Concrete

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Abstract: This study was undertaken to understand the effects of glass fibre on concrete. Glass fibres are available readily in market at cheaper cost. Glass fibre was used as an admixture to test its effects on concrete. Glass fibre reinforced concrete can be used to increase the strength of concrete thereby improving the life of structure. In this study various percentage of glass fibres were added in concrete and the results were compared with Plain Cement Concrete to understand the Effects of glass fibre on concrete. Concrete beams were casted and allowed to cure for 28 days. The result showed that addition of 1% of glass fibre increased the flexural strength of concrete, there were minimal or no changes noted in workability of concrete. On further addition of 2% of glass fibre, although the strength of concrete increased significantly but the workability of concrete decreased. It became very difficult to handle the concrete and carry out tamping process.

1. INTRODUCTION

GFRC stands for Glass Fiber reinforced Concrete. It is a composite constructed from Portland cement, exceptional combination, water, acrylic co-polymer, alkali resistant glass fiber reinforcement and components. In many worldwide markets, it's miles known as GRC – Glass fibre strengthened Concrete. The glass fibers make stronger the concrete, a whole lot as metal reinforcing does in conventional concrete. The glass fiber reinforcement consequences in a product with a good deal better flexural and tensile strengths than everyday concrete, permitting its use in skinny-wall casting programs. GFRC is a lightweight, durable material that may be forged into almost unlimited shapes, colorations and textures. There are primary techniques used to manufacture GFRC – The Spray-Up process and Premix technique.

2. LITERATURE REVIEW

- Durga Chaitanya Kumar Jaagarapu concluded that workability of concrete increases at 1% and mentioned that the compressive strength, flexural strength and Split tensile stress increases at 1% and glass fibre- a waste product can be used in concrete. The compressive strength is very high at 1% o 7 days and 28 days testing. He also mentioned that on further addition of glass fibre, the workability of concrete decreases.
- B Vandevyvere, studied the mechanical behaviour of glass fibre bolstered concrete with coarse recycled concrete Aggregates were studied. The mechanical properties which might be taken into account are the compressive strength, the split tensile energy and the modulus of elasticity. Three-point bending assessments on the beam specimens were performed in line with the EN 14651 to determine the flexural performance of beams.
- V. R. Sivakumar and O. R. Kavitha studied that including more extent of glass fibre in concrete reduces the workability of SCC. The outcomes show that fiber addition of glass fibre had no full-size effect at the compressive strength, however split tensile and flexural strength of GFSCC changed into elevated when dosage of glass fibers became accelerated this may be due to the bridging impact of concrete.
- JAMBOO KUMAR JAIN on this experimental application, the effect of brief discrete glass fibers on the compressive, split tensile strength and flexural strength of concrete turned into studied. The impact of glass fibres on cement and concrete tiles that are produced through vibration technique are also studied. The homes studied are compressive strength, wet transverse strength and Water absorption. The concrete mix gets harsher and much less achievable with growth of fiber Content material therefore use of admixture emerge as necessary. But even after giving dosage of Admixture as excessive as 1.5% proper workability couldn't be acquired and some segregation were Discovered. Consequently it became no longer viable to head beyond 0.7% fiber content material.
- Engineer. Pshtiwan N. Shakor and Prof. S. S. Pimplikar, did trial checks for concrete with glass fibre and without glass fibre to indicate the variations in compressive strength and flexural strength by means of the usage of cubes of varying sizes. The experimental test consequences, techno-economic contrast with different kinds, in addition to the monetary calculations supplied, indicate the exquisite ability of GFRC as an alternative construction material.

3. EXPERIMENTAL ANALYSIS

3.1 FACTORS AFFECTING THE CHOICE OF MIX PROPORTION

The various factors affecting the mix design are:

1. **Compressive strength** : It's miles one of the most vital properties of concrete that affects many other describable properties of the hardened concrete. The mean compressive strength required at specific age, usually 28 days, determines the nominal water cement ratio of the combination .The opposite issue affecting the energy of concrete at a given age and cured at prescribed temperature is the degree of compaction. In keeping with Abrahams laws the power of completely compacted concrete is universally proportional to the water cement ratio.
2. **Workability** : Degree of workability required depends on three elements. These are the dimensions of the phase to be finished, the quantity of reinforcement and the technique of compaction to be use. For the slim and complicated segment with numerous corners or inaccessible component, the concrete need to have high workability in order that complete compaction can be performed with affordable amount of efforts. This additionally applied to embedded metal section. The desired workability depends upon the compacting system to be had on the website online.
3. **Durability** : The sturdiness of concrete is its resistance to the abrasive environmental situations. High energy concrete is usually extra durable than low electricity concrete. Inside the situations at the same time as the excessive strength isn't vital however the conditions of exposure are such that high durability is vital, the durability requirement will determine the w/c ratio for use.
4. **Maximum nominal size of aggregate** : In trendy, larger the size of combination, smaller is the cement requirement for a specific w/c ratio, due to the fact the workability of concrete will increase with increase in maximum size of combination. However the compressive energy has a tendency to growth with the decreasing length of mixture. IS 456-2000 and IS 1343-1980 endorsed that the nominal length of the combination have to be as huge as possible
5. **Grading and type of aggregate** : The grading of mixture impacts the mixture percentage for a precise workability and w/c ratio. Coarser the grading leaner can be mix which may be used .Very lean blend is not perfect because it does no longer incorporate enough finer cloth to make the concrete cohesive. The form of aggregate impacts strongly the combination cement ratio for the favoured workability and stipulated water cement ratio. A crucial functions of a first-rate combination is the uniformity of the grading which can be carried out through blending extraordinary size fractions.
6. **Quality Control** : The degree of control can be estimated statistically through the difference in check consequences. The difference in strength results from the versions in properties of the mixture component and absence of accuracy in batching, mixing, curing , placing and testing, The thing controlling this distinction is called as Quality control.

3.2 APPARATUS NEEDED FOR PROJECT

1. Trolley type weighing balance is used to measure the materials as per required quantity.
2. **Vibrating machine** : Vibrating machine is mainly used for compaction of moulds filled with concrete mix. The primary aim of this to remove the air bubbles. It sets the concrete and helps to achieve maximum strength.
3. **Universal Testing Machine** : A standard testing machine (UTM) is used to test the mechanical properties of a given check specimen through exerting tensile, compressive or transverse stresses. The system has been named so because of the extensive range of tests it may carry out over special kind of materials.
4. **Moulds** : The mould was of cast iron used in lab for casting the beams. The beam mould was of size 500mm x 100mm x 100mm. The base plate is also provided at bottom of the moulds. The total assembly of moulds was done by using nuts and bolt. The moulds were properly oiled before casting.

3.3 CASTING PROCEDURE

All the cylinders and beam were casted taking proper measures which are described below,

1. All materials such as sand, cement and coarse aggregates were prepared.
2. Proportioning of material consisting of water as according to amount derived.
3. Weighing, all the materials as per quantity required.
4. **Mixing of concrete** – All the prepared materials were put in the concrete mixer and mixed well as per the proportions derived.
5. **Filling** – The concrete was filled in beams in three different layers and after each layer the concrete was tamped with a tamping rod. Due to tamping all the air gaps are removed and it makes mix dense.

6. Compaction – It is done by tamping and by vibrating on vibrating machine to achieve stable concrete with no air voids.
7. Casting – Concrete was kept in beam mould for setting for 24 hours and after 24 hours, we de-moulded the beam mould and put it for curing for 28 days.
8. Curing - After curing, flexural strength on beam is carried out on universal testing machine.
9. Results - The results were noted down, necessary calculations are done and then results are displayed.

4. RESULTS AND DISCUSSION

It is very important to understand the load carrying capacity of structural members. Failure of one members can cause the failure of entire structure. Thereby the amount invested in construction and design of particular structure will be wasted.

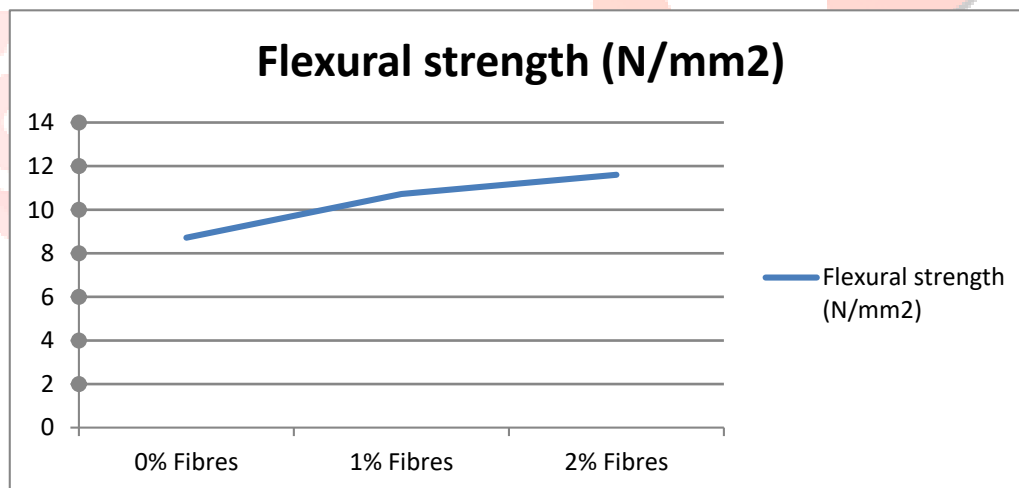
To increase the load carrying capacity of the members, we carried our test by adding various percentage of glass fibres in proportion.

It was found that addition of 1% of glass fibres can increase the flexural strength of beam as compared to plain cement concrete. We further added 2% glass fibres and to our surprise the flexural strength increased insignificantly however the workability of concrete was so affected that even addition of glass admixture did not help us in workability.

Thus, Fibres can increase the Flexural strength of concrete in a passive way eg : confining effect upto a certain range of fibre content.

Sr No	Member	PCC (stress in N/mm^2)	1% Fibres (stress in N/mm^2)	2% Fibres (stress in N/mm^2)
1	Beam	8.72	10.72	11.60

Table No : 1 : Results of comparison between PCC and GFRC



Graph showing average flexural strength of concrete at different percentage of glass fibers.

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