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Research Article

AN EXPERIMENTAL INVESTIGATION ON BEHAVIOUR OF RCC BEAM BY USING OF SISAL FIBER

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ABSTRACT

Conventional strong is solid in compression and weak in strain so as to overcome the fragility diverse sorts of simulated and characteristic strands are utilized to strengthen the pressure conduct of the concrete. Fibers are most generally discontinuous, randomly distributed throughout the concrete matrices. This paper manages the trial examination of presentation of sisal fiber in the ordinary strengthened solid bars to upgrade its torsional quality, researches attempted to inherit the tensile property by introducing Sisal fibers to incorporate tensile strength in conventional concrete and special concrete under M40 grade of concrete with different reinforcement detailing. In present work study of Torsional behavior of sisal fiber reinforced concrete beams has been carried out over the normal reinforced concrete beams. The torsional moment and angle of twist has been studied of sisal fiber reinforced concrete and normal reinforced concrete beams under pure torsion.

INTRODUCTION

Natural fiber has exceptional interest in the field of structural Building. The upsides of normal fiber materials are Quality, better strength, aggressive cost, natural Similarity and biodegradability (Leslie and Kuruvilla, 1999). The utilization of normal fiber in concrete is suggested since a few sorts of filaments are Accessible locally and are abundant of every common fiber, sisal is hard and intense fiber, polygonal to round in section has the vast mangle strength and retains this property even in wet condition (Athiappan and Vijaychandrakanth, 2014). Sisal fibers are bio degradable necessaryfiber material containing46% lignin, 54% cellulose. Because its high content oflignin, sisal is much more advantageous than other naturalfibers.fiber can be added to concrete based particles as primary or optional reinforcement (Saandeepani and Krishna, 2013; Jeyabharathy and Ravi, 2013). Fibers work as primary reinforcement in thin items in which conventional reinforcing bars can't be utilized. In these operations, the fibers act to raise both the quality and the durability of the composite. In parts, for example, chunks and pavements, fibers are added to oversee breaking initiated by mugginess or temperature varieties and in these applications, they work as optional reinforcement (Fig. 1) (Sanket and Sachinkandekar, 2015; Likhil, *et al*., 2014; Rasmussen and Baker, 1995).

Sisal fiber require just a low level of industrialization for their preparing and in correlation with a same weight of the most well-known engineered strengthening strands, the vitality required for their creation is little and consequently the cost of

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Fig. 1 Sisal fiber.

manufacturing these composites is likewise low. Sisal fiber concrete composites the test and the answer for consolidating individualistic building materials with familial Construction strategies. The utilization of sisal, a characteristic fiber with upgraded automatic execution, as support in a concrete in view of cause has appeared to be a promising likelihood (Girisha, *et al*., 1999). The vast majority of the reviews on sisal fiber concrete include the utilization of ordinary Portland cement. Be that as it may, high alumina concrete, bond with supplement, for example, fly ash, slag, silica slag have likewise been utilized to enhance the toughness of the composites. When green sisal leaves are pounded, the plants Fibers can easily be separated and used for weaving and sewing. The size of sisal fiber is 3 cm or 30 mm is used to mix with concrete for special concrete or for fiber concrete (Augustine and Stephen, 2003, Jagannatha and Tara, 2007).

The scope of this investigation is to find out the behavior of sisal fiber in concrete, find out the torsional behavior of beam in normal and special concrete. The main objective of this research is to study the Following properties are to study the torsional behavior of beam of M40 grade of concrete, To study the stress strain relation of the Beams and crack pattern.

Properties of fibre reinforced concrete and effect of fibre in concrete

Fiber mixed concrete will containment the cracking due to plastic shrinkage and to drying shrinkage. The Fiber concrete will reduce the permeability of concrete and also reduce bleeding of water. The fiber reinforced concrete has some important properties. such as Durability, Workability, Compressive behavior of FRC, Tensile behavior, Modulus of elasticity, Flexure, Toughness, Splitting tensile strength, Fatigue strength, Impact resistance (Jeevan and Shree, 2013). Benefits of fiber reinforced concrete are Develop mix cohesion, improve freeze-thaw resistance, improve resistance to unstable condition in case of fire, improve impact resistance– and abrasion–resistance, Increase resistance to synthetic shrinkage duringcuring, develop structural strength, Reduce steel reinforcement requirements. Reason of choosing M40 grade of concrete are High early strength is available, high modulus of elasticity is available, High durability, High abrasion resistance, Low permeability (Jeyabharathy and Ravi, 2013).

Mix proportion

Concrete mix configuration is a course by which the extents of the different raw materials of cement are resolved with an expect to accomplish a specific least quality and toughness, as monetarily as would be prudent. In view of the translated blend outline system, a concrete mix of extents with trademark aim mean compressive quality of 40 Mpa was composed with no mineral mixing. The cross section dimensions of the beam are taken as 200 × 275 mm and the concrete mix was designed as per IS 10262:2009 for M40 grade of concrete (IS 456:2000).

Torsion

The project deals with the behavior or torsion in the reinforced sisal fiber concrete beams subject to pure torsion. To find out the effect on torsional stiffness and ultimate torque carrying the capacity of the reinforced concrete beams with strength of concrete and amount of torsional reinforcement is the prime concern of the study. Twelve full sized beams are to be tested under pure torsion. The beams were divided under the different reinforcement detailing's under M40 grade of concrete. The below mentioned (Fig. 2) shows up the torsion beam detailing.

Set of 4 beams containing 2 conventional concrete beam of M40 grades of concrete and different reinforcement detailing's (10 mm and 8 mm dia) and 2 beams contain the special concrete of M40 grades with different reinforcement detailing's (10 mm and dia). length of beam is taken as 1575 mm for both conventional and sisal fiber concrete beams.

METHODOLOGY

Start of demonstrating sisal fiber in concrete was

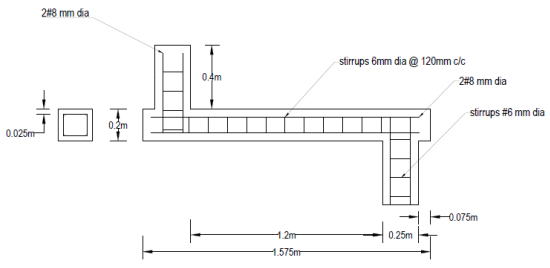

Fig. 2 Torsion beam design.

appreciate. In light of the possibility of extension of fiber into the concrete was gained by implying various journals and an idea seeing the ordinary fiber known as the sisal fiber being used as a piece of concrete was gotten. The apprehension on fiber reinforced cement was likewise acquired by alluding different journals. Writing survey in view of the idea was done and concluded. Different sorts of tests on bond, fine aggregate and coarse aggregate were performed and the outcomes were gotten.Keeping a mind the ultimate objective to do asset the benefits and faults characteristic of any special concrete, it must be compared with conventional concrete. In this way, an arrangement of conventional concrete example is required. In order to cast a set of conventional concrete, at the beginning mix design for M40 grade of concrete has to be done..

The same mix ratio of M40 grade of concrete was used to cast both conventional solidand special solid specimens. OPC grade 53 cement was used in casting. The coarse aggregate added to the mix was divided into two portions 60% of 20 mm aggregate and 40% of 12.5 mm aggregate was used..Torsion has become a predominant action in structures such as eccentrically loaded beams, curved girders, spandrel beams, etc...Torsion has so far has been given secondary consideration in design of structures. Two theories i.e. skew bending theory and space true analogy have helped in rendering a clear understanding of the problem. It is now known that longitudinal steel or transverse steel all put cannot increase the ultimate torque of beam significantly. In order to cast torsion beams, wooden moulds were prepared and reinforcements were placed. With optimum aspect ratio and percentage of fiber, torsion beams were cast. Strain Gauge of 10 mm was fixed at the main bars to measure the bending moments. These beams were cured daily by converting the beams with wet gunny bags and pouring water on the beams daily. The beams were tested for failure after 28 days.

RESULTS AND DISCUSSION

Torsion is generally associate with bending moment and shear forces, the collaboration or connection between these strengths is important. Along these lines conduct of solid part in torsion is principally directed by the tensile response of the material, especially its pliable breaking qualities.

Strain Gauge of 10 mm was fixed at the main bars to measure the bending moments. The inner surface of the mould was laminated with the thin film of oil to prevent the adherence of the concrete to the mould. All the ingredients of the mix were weighted; the fiber demonstration to increment both the quality and the strength of the composite and manual blend. The concrete was placed in the plywood moulds in three layers and internally compacted using needle vibrator. Care was taken to give uniform compaction in the specimen to avoid voids and honey combs. The reinforcement bars were cut to the required length plywood moulds for the beam as shown in the (Fig. 3) below.

Strain Gage of 10 mm was settled at the principle bars to gauge the bending moments. The inward surface of the mould was covered with the thin film of oil to keep the grip of the concrete to the mould. The concrete was set in the plywood mould in three layers and inside compacted utilizing needle vibrator. Care was taken to give uniform compaction in the example. The conventional concrete beams casting with different reinforcement are shown below (Fig. 4).

Torsion beam test for conventional concrete

Specimen name: A and A1

Grade of concrete: M40

Main bars (Fe415 HYSD): 10 mm and 8 mm

Stirrups (Fe415 HYSD): 8 mm at 120 mm c/c for 10 mm main bars and 6 mm at 100 mm c/c for 8 mm main bars. The testing was done in loading the frame of capacity 40 tons. Load was applied by means of hydraulic jack of capacity 25 tons. Strain gauge was

Fig. 3 Torsion beam.

Fig. 4 Conventional concrete beams.

used to measure the twist.The load was measured using a proving ring of 20 tons capacity. Twist of the beam was measured by using strain gauge which are fixed on the beam.The below mentioned (Fig. 5) show up the torsion test performed on the conventional beam.

Casting and testing of special concrete

Addition of fiber in the concrete greatly increases and improves the physical, chemical and mechanical properties of the concrete. Particularly, there is an increase in the tensile strength. The fiber absorbs moisture content, therefore a superplasticizer is used. Fiber can also be treated with various chemicals to reduce water absorption. Optimum location of stirrups in the torsion beam contributes to torsional strength when centric of two or three stirrups is near the center of the test span. Torsional ductility is maximum when the stirrups are placed at their optimum location.the below mentioned (Fig. 6) describes the special concrete beams casted for the torsion test.

Fig. 5 Torsion test on conventional beam.

Torsion test on special beam

Specimen name: B and B1

Grade of concrete: M40

Main bars (Fe415 HYSD): 10 mm and 8 mm

Stirrups (Fe415 HYSD): 8 mm at 120 mm c/c for 10 mm main bars and 6 mm at 100 mm c/c for 8 mm main bars.

Same as the testing procedure of conventional concrete beam was followed to the special concrete beam to differentiate the test result. The frame was loaded with the capacity 40 tons. Load was applied by means of hydraulic jack of capacity 25 tons. Strain gauge was used to measure the twist. The load was measured using a proving ring of 20 tons capacity. Twist of the beam was measured by using strain gauge which are fixed on the beam. The below mentioned (Fig. 7-9) show up the torsion test performed on the special beam.

The above-mentioned graph explains the comparison of conventional concrete beam with special concrete beam for 10 mm main bars were as the result the special concrete beams has high cracking torque,

Fig. 6 Special concrete beams.

Fig. 7 Torsion test on special concrete beams.

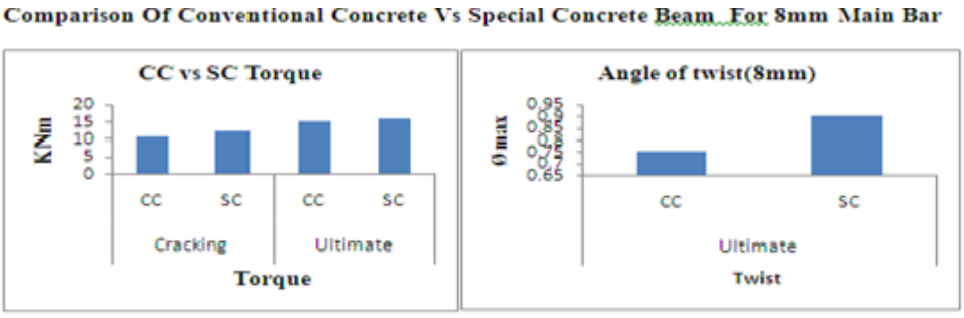

Fig. 8 Graphical comparison of CC vs. SC for 8 mm main bar.

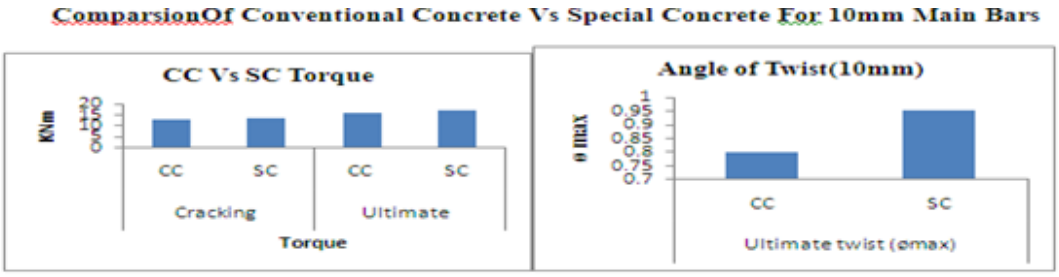

Fig. 9 Graphical comparison of CC vs. SC for 8 mm main bar.

ultimate torque and ultimate twist comparing to that of conventional beam.

CONCLUSION

- Special concrete showed improved physical properties in both fresh and hardened state.
- Compared to the conventional concrete, special concrete is found to have increased compressive, tensile and flexural strength.Reduction in water content was observed in concrete in its fresh state.

Optimum results were obtained in 300 aspect ratio and 1.5% dosage of fibers.Therefore, fiber reinforced concrete has improved torsion resistance over conventional concrete.

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