International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL INVESTIGATION ON ENGINEERED CEMENTIOUS COMPOSITE

PROF. CHETAN MACHHI[1], N.PARTH[2], P.AKSHAY[3], N.HARDIK[4]

[1]ASSISTANT PROFFERSOR, CIVIL, SARDAR PATEL COLLEGE OF ENGINEERING, ANAND, GUJARAT, INDIA
[2,3,4]STUDENT, CIVIL, SARDAR PATEL COLLEGE OF ENGINEERING, ANAND, GUJARAT, INDIA

Abstract :- New trend in fiber reinforced concrete which has an improved strain hardening capacity is called engineered cementious composite (ECC).Research determined that Polyvinyl Alcohol ECC with low volume fraction of fiber has tensile strain capability of concerning 3-5% in direct tension, 300 times more durability than normal deformability than the normal concrete which makes concrete bendable. A flexible concrete is strengthened with micromechanically designed chemical compound fibers. The results of Flexural strength of assorted ECC combine with completely different proportion of fibers area unit compare with standard Concrete style in step with Indian customary. The Poly Vinyl Alcohol Fiber is employed therefore on scale back the cement content and to reinforce flexibility. It has high ratio, high ultimate tensile strength, relatively high modulus of elasticity, good chemical compatibility with Portland cement, good affinity with water and no health risks. To increase the workability of concrete super plasticizer is used. The compressive strength and flexural strength of cubes and slabs (two totally different thicknesses) is decided and conjointly the flexibleness characteristics of the concrete square measure checked throughout flexural strength check**.**

KEYWORD: Bendable Concrete, ECC-Engineered Cementations Composites, Deflection, Compressive Strength, Flexural Strength.

1. INTRODUCTION

Conventional concretes are almost un-bendable and have a strain capacity of only 0.1 percent making them highly brittle and rigid. This lack of flexibility could be a major explanation for failure beneath strain and has been a pushing think about the event of a chic material particularly, Bendable Concrete also known as Engineered Cementitious Composites abbreviated as ECC. This material is capable to exhibit significantly increased flexibility. A bendable concrete is reinforced with micromechanically designed polymer fibers.

1.1 POLYVINYL ALCOHOL FIBER (PVA)

While choosing fibers for ECC, it absolutely was found that polyvinyl alcohol (PVA) fiber was of low price and high performance. The hydrophilic nature of PVA fiber obligatory nice challenge within the composite style, because the fibers area unit vulnerable to rupture rather than being force out as a result of the tendency for the fiber to bond powerfully to building material matrix. The objective of this paper is to produce a performance outline of associate degree exemplary PVA-ECC. PVA fibers have some structural strength and might even be used for shrinkage management. While they can't replace reinforcing steel, they improve the mechanical properties of cured concrete, boosting its strength. Polyvinyl alcohol fiber (PVA) is a perfect environment-friendly cement bolstered material, which possesses alkali and weather resistance due to its unique molecular structure, taking on good affinity to cement, effectively stop and suppress the crack formation and development, improve bending strength, impact strength and crack strength, improve permeability, impact and seismic resistance of concrete. This product can be widely used in civil and industrial buildings, walls, roofing, flooring and roads, bridges, tunnels, reinforcement for embankment slopes.

1.2 BENDABLE CONRETE

Bendable concrete additionally referred to as designed building material Composites abbreviated as ECC is category of ultra-ductile fiber bolstered building material composites, characterized by high plasticity and tight crack dimension management.

Conventional concretes area unit nearly steady and have a strain capability of solely 0.1% creating them extremely brittle and rigid. This lack of flexibility may be a major reason behind failure beneath strain and has been a pushing think about the event of a chic material particularly, flexible concrete. This material is capable to exhibit considerably enhanced flexibility. A bendable concrete is reinforced with micromechanically designed polymer fibers. ECC is formed from identical basic ingredients as standard concrete however with the

addition of High-Range Water Reducing (HRWR) agent is needed to impart sensible workability.

However, coarse aggregates aren't employed in ECCs, the powder content of ECC is comparatively high. Cementitious materials, such as fly ash, silica fume, etc., may be used in addition to cement to increase the paste content. Additionally, ECC uses low amounts, typically 2% by volume, of short, discontinuous fibers. ECC incorporates super fine silicon dioxide sand and little Polyvinyl Alcohol-fibers coated with a really skinny (manometer thick), silk coating. This surface coating allows the fiber to begin slipping when they are over loaded so they are not fracturing. It prevents the fiber from rupturing which would lead to large cracking. Thus associate degree ECC deforms way more than a standard concrete however while not fracturing. The behavior of ECC under flexural loading and it can be seen that the beam can deform sufficiently without direct failure. ECC has proved to be 50 yet one more versatile than ancient concrete, and 40% lighter, which could even influence design choices in skyscrapers. Additionally, the excellent energy absorbing properties of ECC make it especially suitable for critical elements in seismic, crushed stone, river sand and water. Zones. The challenge in creating a light-weight concrete is decreasing the density whereas maintaining strength and while not adversely touching value. Introducing new aggregates into the combination style may be a common elements that area unit typically replaced with light-weight aggregates. Thanks to lower density of concrete. Normal concrete contains four elements, cement

2. INGREDIENTS OF ECC CONCRETE

Engineered cementitious composite is composed of

- Cement (53 grade of OPC)
- Sand
- Water
- Super plasticizer
- PVA fiber (length is 12mm and diameter is 40μm).

In the mix, coarse aggregates area unit deliberately not used as a result of property of ECC Concrete is formation of small cracks with massive deflection. Coarse aggregates will increase crack dimension that contradicts the property of ECC Concrete.

FIG: 1.MIXING OF ECC CONCRETE

FIG: 1.1 MIXING OF PVA FIBER IN CONCRETE

FIG: 1.2 MIXING OF ECC CONCRETE

3. PROCEDURE FOR MAKING ECC CONCRETE MIX RATIO:

The initial mix proportion was PVA fiber at 2% and super plasticizer dose was 30ml per slab mould (700x150x60 mm),(700x150x30 mm) and 10ml per cube mould(70.6x70.6x70.6 mm), then water to cement ratio of 0.5. By using this proportion workability was achieved. The ratio of concrete mix is 1:2 (cement: sand) and w/c=0.5. Figure 1, 1.1, 1.2 shows the mixing of ECC concrete.

3.1 CASTING PROCEDURE OF ECC CONCRETE:

The performance of the ECC Concrete was influenced by the blending. This means that a correct apply of blending will result in higher performance & quality of the computer code Concrete. The quality of the

concrete is additionally influenced by the homogeneity of the combination material. Flexural Test was carried out on the slab during the mixing & after the placement of fresh concrete. A proper compounding of concrete is inspired to get the strength of concrete bonding of cement with the PVA fibers. Once the concrete combine style was finalized, the mixing was carried out. The compounding of ECC Concrete was allotted by exploitation hand mixing. The procedure of hand compounding was as follows: - Add sand, cement, add the PVA fibers slowly then add 50% of water & super plasticizer. Add slowly remaining quantity of water & super plasticizer and mix till the homogenous mixture is formed. Figure 2 represents the casting of slabs.

FIG: 2 CASTING OF ECC CONCRETE IN SLAB

3.2 PLACING, COMPACTING & CASTING OF CONCRETE SPECIMEN.

Before inserting of concrete, the concrete mould must be oiled for the ease of concrete specimens stripping. Once the workability test of ECC concrete was done, the fresh concrete must be placed into the concrete moulds for hardened property tests. During the inserting of recent concrete into the moulds, tamping was done using Tamping rod in order to reduce the honeycombing. It allows full compaction of the fresh concrete to release any entrained air voids contained in the concrete. If the concrete wasn't compacted during a correct manner, the maximum strength of the concrete cannot be achieved. After this operation, the levelling of concrete was done on the surface of the concrete. Levelling is that the initial operation administered when the concrete has been placed & compacted. After the levelling of the fresh concrete was done, the concrete in the mould was left over night to allow the fresh concrete to set. Figure 3 shows the demoulding of slabs with different thickness.

FIG: 3 ECC CONCRETE IN SLAB WITH 60mm THICKNESS AFTER DEMOULDING

3.3 CURING OF CONCRETE SPECIMEN:

. After twenty four hours, the concrete specimens are demoulded from the moulds. All the concrete specimens were placed into the solidification tank with a controlled temperature of 25°C for an amount of 28 days to achieve the hardening property of concrete shown in figure 4 Curing is an important process to prevent the concrete specimens from losing of moisture while it is gaining its required strength. Lack of hardening can cause improper gain within the strength. After 7, 14 and 28 days of solidification, the concrete specimens were removed from the curing tank to conduct hardened properties test of ECC Concrete.

FIG : 4 CURING OF SLAB

4.TESTING ON CONCRETE

After hardening natural action activity process, the specimen has to be tested. Investigations area unit administrated by testing cubes, slabs for 7, 14, 28 days. Cubes were tested on Compression testing instrumentation and blocks of (two totally different thickness) were tested on flexural testing machine and through this flexural testing the flexible characteristics of slab also been determined. The results are given below:

Table.1 Mechanical Properties of bendable concrete and conventional slabs.

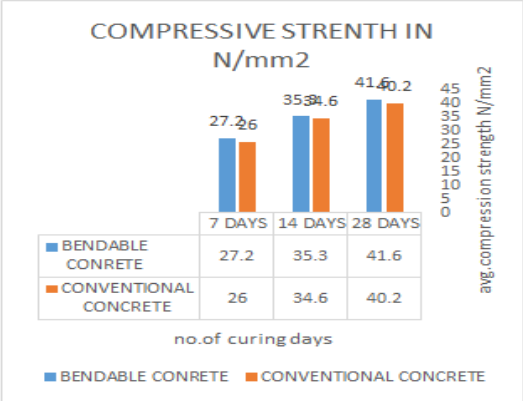
Mechanical	Bendable concrete	Conventional concrete
Compressive strength in N/mm^2 at		
7 days	27.2	26
14 days	35.3	34.6
28 day	41.6	40.2
Flexural strength in N/mm^2 at		
7 days	3.76	3.03
14 days	4.83	3.89
28 days	5.56	4.24

Discussion

The strength of the bendable concrete is comparatively higher than the conventional cubes and slabs. This higher strength shows that the presence of PVA fiber in bendable concrete has increased its efficiency.

5. COMPARISION

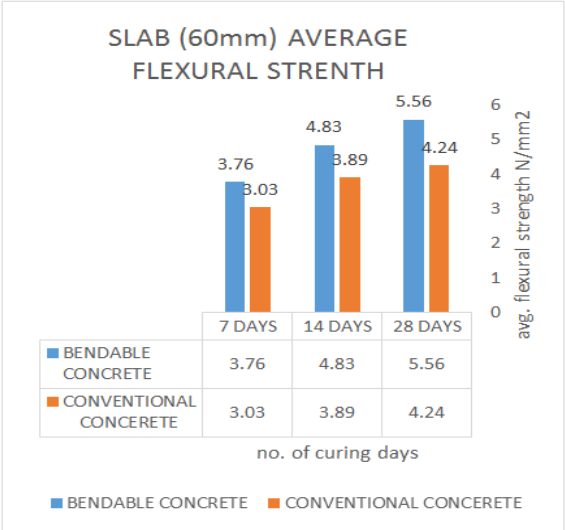
The comparison of results of mechanical property test between the bendable concrete and conventional concrete.



GRAPH 2: COMPARISON OF BENDABLE AND CONVENTIONAL SLAB (60mm).

Discussion

In the on top of comparisons the compression strength and flexural strength of the pliable concrete is relatively beyond the standard cubes and slabs. The reason behind the upper strengths of pliable concrete is thanks to the presence of fiber as reinforcement. The strength of standard cubes and slabs is relatively low since it's not bolstered.



GRAPH 3: COMPARISON OF BENDABLE AND CONVENTIONAL SLAB (60mm).

6. CONCLUSION

In this paper the compression and flexural strength of pliable concrete is completed the values area unit compared with standard cubes and slabs. Therefore it's established that the pliable concrete is a lot of strength than the standard concrete and it's a lot of versatile so it resists cracks and acts as a lot of efficiency in seismic regions.

7. REFERENCES

1) Sagar Gadhiya, Patel T N and Dinesh Shah (2015) "Parametric study on flexural strength on ECC 2015 ijscer vol: 4 no: 5

2) S.Z. Qian, J. Zhou, E. Schlangen"Influence of curing condition and pre cracking time on the self-healing behavior of Engineered Cementitious Composites" Journal of Cement & Concrete Composites 32 (2010) pp. 686–693.

3) Jain Zhou, Shunzhi Qian, Guang Ye, Oguzhan Copuroglu, Klaas van Breugel , Victor C. Li," Improved fiber distribution and mechanical properties of engineered cementitious composites by adjusting the mixing sequence, "journal of Cement & Concrete Composites" 34(2012)pp.342–348

.4) Seminar report on "Bendable concrete "presented by Chitari Nagesh Babasahebi m.tech. In structural engineering Basaveshwar Engineering College Bagalkot

5) Li VC, Kanda T. "Engineered cementitious composites for structural applications". ASCE J Mater Civil Eng. 1998.

6) Bensaid Boulekbache, Mostefa Hamrat, Mohamed Chemrouk, Sofiane Amziane, "Influence of yield stress and compressive strength on direct shear behaviour of steel fiber- reinforced concrete", Journal of Construction and Building Materials 27 (2012) pp. 6– 14.