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EXPERIMENTAL INVESTIGATION ON CHARACTERISTICS OF BENDABLE CONCRETE

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Abstract: - An Engineered cementitious composites (ECC) or Bendable concrete is an easily moulded mortar based composite which is reinforced with specially selected short random fibres. Traditional concrete suffers catastrophic failure when strained in an earthquake or by routine overuse. The word ECC is engineered, means to addition to reinforcing the concrete with micro scale fiber that acts as ligaments to bond concrete more tightly. As this is the special type of concrete there are no defined codes for it and also it is rarely developed in india hence no Indian codes can be found related to this, thus for this reason the parameters needed are to be obtained using trial and error method. This project includes different sets of test such compaction test slump cone test, compressive strength test, flexural test, sieve analysis etc. In this paper, to overcome the demand for concrete in future and to develop the fibre materials, the Poly Vinyl Alcohol Fibre is used so as to reduce the cement content and to enhance flexibility. It has high aspect ratio, high ultimate tensile strength, relatively high modulus of elasticity, good chemical compatibility with Portland cement, good affinity with water and no health risks.

Key word ; ECC, Poly Vinyl Alcohol

I. INTRODUCTION

Conventional concrete is almost unbendable. This lack of bendability is a major cause of failure under strain. It has been a pushing factor in the development of an elegant material namely, bendable concrete also known as Engineered Cementitious Composites (ECC) which is Capable of exhibiting considerably enhanced flexibility. ECC is reinforced with micromechanically designed PVA fibres..ECC is made from the same basic ingredients as conventional concrete but with the addition of High-Range Water Reducing (HRWR) agent. When ordinary concrete is subjected to tensile load it tends to crack. For this reason, researcher have long been interested in making the concrete more flexible and (ECC) has proved to be 50 time more flexible and 40 times lighter than conventional concrete. Additionally, the excellent energy absorbing properties of ECC makes it especially suitable for critical elements in seismic zones.

II. LITERATURE REVIEW

1. Victor C. Li (2007), "Engineered Cementitious Composites Material, Structural and Durability Performance". It says that the specimen undergoes failure the fracture plane is formed and to overcome this the formation of multiple micro cracking is necessary to achieve high composite tensile ductility. Between first cracking strength (about 0.01%) and 1% strength, the micro crack opening increase from zero to about 60micron in short in simple words we can say that where steel reinforcement is used to control width in concrete, such steel reinforcement can be completely eliminated ECC. . Compressive strength of ECC ranges from 30mpa to 90mpa. With an elastic modulus (around 20-25gpa) which is typically lower than concrete due to the absence of coarse aggregate. The compressive strain capacity of ECC slightly higher, around 0.45% to 0.65%. Normal concrete is brittle in nature while ECC is ductile in nature, due to this property; it has wide applications & wide future scope in various fields

2. Victor C. Li [2009] "Damage Tolerant ECC for Integrity of structures Under Extreme Loads", ASCE, According to this reaserch ECC can give all the advantages of concrete or more than that of normal concrete . Experimental studies concluded that ECC is highly damage tolerant under very high loading, including reverse cyclic loading , earth quake loads and low velocity impact. Between first cracking strain (about 0.01%) and 1% strain, the micro crack opening increases from zero to about 60 µm. Further loading beyond 1% causes more multiple cracks to form, but with no additional crack opening beyond the steady state value of 60 µm.

3. Jun Zhang et al (2013)

Published a potential applications of the fibre reinforced engineered cementitious composite with characteristic of low drying shrinkage (LSECC) in concrete pavements for the purpose of eliminating joints that are normally used to accommodate temperature and shrinkage deformation. It was found that a composite slab containing both plain concrete and LSECC, with steel bar at the LSECC concrete interface, and designed construction procedures, it is possible to localize the tensile cracks into the LSECC strip instead of cracking in adjacent concrete slab. Due to the strain-hardening and high strain capacity of the LSECC, the overall strain capacity and the integrity of the composite slab can be significantly improved. The temperature and shrinkage deformations can be accommodated by adequate selection on the length ratio of LSECC strip and concrete slab

4. Kallepalli Bindu Madhavi, Mandala Venugopal ,V Rajesh , KunchepuSuresh (2016)

Carried out the experiment and found that this material is capable of exhibiting considerably enhanced flexibility. In this paper literature survey of fresh and mechanical properties of different ECC mixtures are evaluated by incorporating supplementary materials such as fly ash, and different tests are done eg flexure, deflection, compressive strength. Bendable concrete is ductile in nature: The tensile strain capacity of ECC can reach 3-5%, whereas for normal concrete 0.01%. The compressive strength of ECC is similar to that of normal to high strength concrete. It is found that Normal concrete is brittle in nature while ECC is ductile in nature, due to this property it has wide applications & wide future scope in various fields

5. Zhang Z. et al (2019)

It says that the impact of directly adding vegetative Bacillus aldurans and its mutant cells into ECC material affect ECC. The mechanical performance of ECC together with compressive strength and tensile properties were extremely influenced once the incorporation of microorganism. At the macroscale level, the compressive strength and strength of bacteria-ECC magnified as compared with Control-ECC thanks to microorganism ECC. metabolism on the opposite hand, the tensile strain capability shows a reverse trend in bacteria-ECCs, however, continues to be maintained at a high level. At the microscale level, kind of like the strength improvement, the matrix fracture toughness was additionally magnified in bacteria-ECCs. For the matrix/fiber interface properties related to fiber bridging performance, lower chemical bond and slip-hardening constant were determined bacteria-ECCs, nonetheless the magnified resistance bond strength prevailed over the shranked chemical bond that successively results in the reduction of complementary energy. It's noted that a form of biofilm and microorganism aggregation was connected to the fiber surface, thereby ever-changing the interface properties

6. Agarwal et al 2020

In this study the strength parameters of the concrete specimens made by inducing bacteria along with a suitable cement replacing substance. Therefore, the use of sustainable strategies like inducing bacterial culture into the concrete mix can act as active support for both natural as well as the economy of construction industries. Many substitutes are used for replacing cement. In this paper, control concrete, concrete made by replacing cement with 8% of Micronized Biomass Silica (MBS), and bacteria-induced concrete are compared. The bacteria used is Bacillus Sphaericus and is mixed in the concrete specimens at different levels of 10ml, 20ml, 30ml. M60 grade high strength concrete is cast in the form of cubes and cylinders and their compressive strength and split tensile strength at the age of 7 and 28 days are compared with that of conventional concrete. From the test results, it was concluded that specimens with 20ml bacteria and 8% MBS showed optimum results. Hence, this combination of bacteria and MBS would not only increase strength but also help the concrete against moisture and other harmful

III. CONCLUSION

It is concluded from the literature survey that some researchers have focused on mechanical properties of ECC and some on microorganisms mix ECC. therefore it is proposed to study the different percentage of fiber for which it gives best results of all mechanical properties of concrete like compression, flexural, tensile strength

IV. REFERENCES

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