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OPTIMIZATION OF FIBER REINFORCED CONCRETE IN DRAINAGE COVER APPLICATIONS

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***ABSTRACT*: Many a times the drainage covers that cover potholes for sewage and other underground civil access points are made from cast concrete. These structures lack durability owing to non-flexibilty and do not sustain under cyclic load as in the vehicles on road moving over this drainage cover point . Considering that there are two load cycles per vehicle passing the durability study needs to be done for the structure. More over innovation needs to be done in this regards as to changes in material used for these drainage covers, FRC being a good option . This project will study the application of FRC technology to the drainage cover manufacturing , more over effect of specific gravity of mixture before it is cast (in form of slump test) on the structural durability and integrity of the product. The FRC will be developed, cast and tested in form of slabs that will be tested on the set up developed. Curing time will be same for all specimens as to 28 days. The durability of the specimens will be determined as to number of cycles the specimen with stands before failure, process variabiles being the specific gravity of mixture to be cast (tested by slump test) and percentage of fiber additive.**

Keywords : FRC, slump test, durability

I. INTRODUCTION

Compared to other building materials such as metals and polymers, concrete is significantly bleeding, plastic settlement, thermal and shrinkage strains and stress concentrations imposed by external restraints. To produced macro-cracks due to an applied load, distributed micro-cracks propagate coalesce. When loads are increased the conditions of growth of critical crack rises.

The micro and macro-fracturing processes can improve by using randomly distributed fiber materials. The formation of cracks smother by fiber. The resulting material with a random distribution of short, discontinuous fibers is termed fiber reinforced concrete (FRC) and is becoming a well-accepted mainstream construction material. Important progress has been made in the last thirty years towards perception of the short and long-term performances of fiber reinforced cementatious materials. Our ability to create safe reinforced concrete (R/C) structures has continued to grow with experience. The problem of infrastructure deterioration is not limited to the US alone. In countries like Japan and Korea, the annual outlay for infrastructure maintenance will soon surpass that of new construction. In Europe, it has been estimated that more than 50% of the European infrastructure needs improvements.

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1.1 OBJECTIVES

The goal of this research are as follow:

- To identify causes of delay in construction project with help of literature review.
- Design and development of FRC slab specimens with varying Fiber content (% by volume).
- Determination of slump value and categorization of specimen before casting.
- Testing of cast specimen on test-rig development to find the durability of the specimen of varied composition, with number of cycles withstand before failure.

II. LITERATURE SURVEY

[1] T.A.Soylev,T.Ozturan(2014) deals with the physical properties and durability of fiber reinforced concrete. The effect fiber reinforcement evaluated for short and long term benefits. A variety of test methods and properties are reported. The various properties listed based on specification of concrete materials using fiber become a feasible option. To provide the document on the basis of current knowledge of FRC materials for sustainable and durable concrete mixtures. This document is divided into three sections. The first section discuss the physical properties of FRC in terms of electrical, magnetic, and thermal. Rheological properties, which affect fiber dispersion and distribution. The creep, shrinkage and role of various fiber types will affect the plastic shrinkage cracking and restrained shrinkage. The durability of alkali-resistant glass and cellulose fibers are studied by an evaluation of long-term accelerated aging results. To discussed degradation and embrittlement due to alkali attack. Literature on the use of FRC materials under aggressive environments and extreme temperatures is presented. The final section the of FRC has resulted in beneficial durability considerations.

.**[2]** A.L. Ardeshana, Dr. Atul K Desai (2012) deals with mechanical properties and durability of fiber reinforced concrete. Civil infrastructure all over the world the problem is at the apparent lack of durability in our construction materials, inability on part of the owners to provide timely maintenance absence of advanced condition assessment tools and lack of long-lasting, cost effective repair materials and technologies. This paper will present data to support the logic that fiber reinforced concrete (FRC) is an ideal material for achieving these goals.

[3] E. Vasanelli , F. Micelli , M.A. Aiello , G. Plizzari and M. Molfetta (2014) deals with Fibers embedded into concrete matrix generally reduce crack widths of ordinary reinforced concrete structural elements and, hence, may improve durability of reinforced concrete structures, especially of those exposed to aggressive environments. The present research aims at studying the influence of fibers on durability of RC beams exposed in a coastal area under sustained load. In this test to assess the influence of the presence of fibers on carbonation depth and chloride content.

[4] A.B. Mahadik1 and M.H. Jaiswal2 (2014) deals with to create awareness amongst the civil engineers, residents and owners of building towards the health examination of existing concrete buildings called as Structural Audit. The need of structural audit is for maintenance and repairs of existing structures whose life has exceeded the age of 30 years to avoid any mishaps and save valuable human life. The concrete is widely used as construction materials being inexpensive. More than ever, the construction industry is concerned with improving the social, economic and environmental parameters of sustainability. There are many buildings during this period to reduced strength because of structural deficiency, materials deterioration and physical damage. There is demand of appropriate actions and measures for all such building structures to improve its performance which may leads to increase its functional life.

[5] Victor C. Li1 and Henrik Stang2 (2004) deals with The lack of durability of concrete infrastructure has been a recognized concern. Research in fiber reinforced concrete (FRC) often addresses the issue of material brittleness. However, To improved ductility of FRC into infrastructure durability. This paper explores the concept of elevating the ductility of high performance fiber reinforced concretes (HPFRCC) material to the improved durability of reinforced (HPFRCC) structural elements. The first level involves the control of entrance of aggressive agents through the HPFRCC cover thereby reducing the rate of corrosion of the rebar. The second level involves the resistance to spalling associated with expansion of corroding action of steel reinforcing bars. Experimental results supporting both levels of protection are presented

III. RESEARCH METHODOLOGY

3.1.Material selection for reinforcement in FRC
3.2 Slump test for various grades of FRC prepared

3.3 System design of testing mechanism as for the component selection, geometry and profile selection, charge system selection , mounting & orientation.

3.4 Mechanical design of components under given system of forces to determine functional dimensions of the components to be used using various formulae and empirical relations

3.5 Manufacturing , assembly of the device and test-rig for experimental analysis and validation.

3.6 Testing and trial to derive performance characteristic of equipment under various load conditions.

3.7 Statistical analysis &/or Mathematical modeling for validation.
3.8 CAE of critical component and Result discussion and thesis preparation.

IV. SYSTEM DEVELOPMENT:

a) System Design :
(Here we define the principle of working , functional Components , discuss their shapes and geometry though graphical / pictorial representation and define the list of components (Bill of materials) --- categorizing the Standard parts and bought out parts)--accordingly we decide as to which parts are to be designed / drawn / manufactured.

b) Mechanical Design :
This section is where we carry out theoretical design and analysis of the critical components we fear will fail under the given system of forces . The design work is carried out in two stages as elaborated sample below :

Part -1 : Mathematical Design of the part using standard text book formulae
Title : Design and Analysis of slabs with different Pour value of concrete , and fiber content layout for minimum weight and minimum cost configurations Materials Template : What we need that we save the data below as standard template and recall it for each new design of different concrete mixes of different pour value

Part -2 The experimental results will be determined using Universal testing machine and the maximum stress produced (σ Mpa) and maximum deformations (δ mm) will be determined and thus all three results of (Theoretical / Analytical / Experimental) will be compared.

Part-3 Statistical tools and Software used : Minitab

I) Types of Analysis: Design of Experiment using Taguchi Analysis between three subject factors

a) Pour Value of concrete

b) fiber content

c) Additive addition

For Concrete mix designs M20 ....

Result parameters under study will be Strength, Weight and Cost

II) One way anova to study the effect of different subject factors on output parameters a& thereby determining the optimum parameters for

a) Maximum Strength.

b) Minimum Weight.

c)Minimum Cost.

V.WORK IN PROGRESS

I) M20 Grade of concrete
II) Four Factor with proportion

i)Quantity of fiber(%)-20,25,30,35

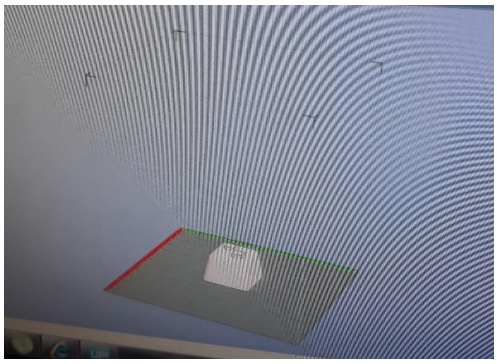
ii)Steel(%)-5,8,11,14

iii)pour (water%)-1,1.5,2,2.5

iv)Additive(ml)-2.,30,40,50

Additive-Epoxy Resine

IV) Design of fiber-



a)Draw structure in minitab software

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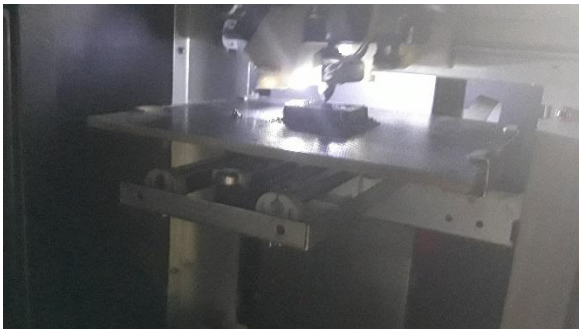

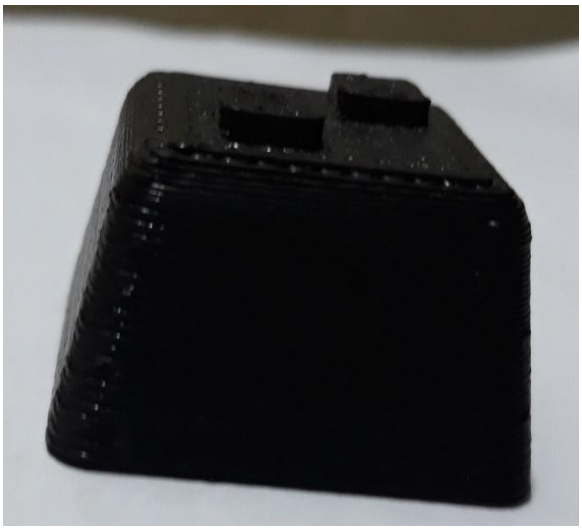

VI.EXPECTED RESULT

1.Careful review of literature conducted that no specific research in the area of drainage cover was done so the project work false in the exact research gap
2.Reduction in weight of structure by application of FR

3.Optimal Strength Value of Structures By combination of Re-bar Structures and FRC

4.Experimental Strength Value of Structures By combination of Re-bar Structures and FRC using UTM testing

5.Reduction in cost by application

6.Optimal Process parameters as to number of fiber content , Rebar structure for minimal weight but maximum strength .

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