Strengthening of structural elements using Geo Grid

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***Abstract*--**The aim of the present study is to find the effect of using geo-grids on various places in reinforced concrete beams. The use of geogrid in concrete setup a new dimension for employing a geo synthetics in structural engineering. The purpose of examining the behaviour of geo-grids in structural members gives opportunity to observe benefit and feasibility of using geogrid in various points of RCC beams. These materials have characteristics such as increased ductility and low weight to reduce inertial forces as well as reduce cost. Different studies have been performed to obtain new solutions for the construction industry, which has shown increasing interest in geo-grids. Recently the Flexural behaviour of different types of Geo-grids with Concrete structural members were studied and reported that all types of Geo-grids reinforcements provide a ductile post cracking behaviour, high fracture energy and flexural strength. Hence the geo grid are examined in recent research studies. By that way geo-grid are to be test by placing at various positions a different spacing in RCC beam and it is compared with the conventional concrete beams. In this study one control beam and three biaxial geogrid beams are tested to check whether geogrid can be used in addition or alternate to steel in structural member. Geo grids are placed in addition to stirrups and the results are formulated.

Keywords: Reinforced concrete beams, biaxial geogrid, flexural strength.

I.INTRODUCTION

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IV LITERATYRE REVIEWS

Ahmed Shaban Abdel-Hay Gabr [2019]Presented the study on strengthening of reinforced concrete slabs using different types of geo-grids. They used geo grid as strengthening material to one way slab and concluded that geo-grids are effective alternate material for strengthening of reinforced concrete slabs but the crack pattern observed in strengthen and unstrengthen slab are same. And also it is noticed that there is no bond failure between geo grid and slab. Geo-grid with high tensile strength had higher energy dissipation of slab and effective for resisting flexure tension. And from this study it is concluded that geo grids are good strengthening material when compared to conventional methods.

Aluri Anil Kumar Y. Anand Babu [2015] : Studied on Behaviour of Concrete Columns by Using Biaxial Geogrid Encasement. Here three type of model were casted and studied, one a conventional column, a column with geogrid (longitudinal bars) and pure geogrid reinforced columns, the geo grid reinforced columns fails when compared with conventional as the compressive strength of geogrid is low. The ultimate load carrying capacity of geogrid reinforced with longitudinal ties is 5% less when compared with conventional.

D. Chand Beebi , V.K. VisweswaraRao [2017]Investigated the flexural behaviour in geo grid reinforced concrete beams. In plain cement concrete beams the uniaxial and bi axial geo grids are arranged in form of different layers from one to three layers. As the result of the flexural tests it is observed that the geo grids can take the tensile force when these are kept in plain cement concrete beams, and also it is to be noted that flexural strength is more when three layers of uniaxial Geogrids are used when compared to bi-axial geo

grid reinforced concrete beams. It is to be conclude from this study the post cracking and ductile behaviour of the geogrid reinforced beam is

II. SOIL CEMENT

Since the soil is abundant in nature and also freely available near the construction site soil cement is cost effective. The cement content used to stabilize and bind the soil. The proper combination of these factors optimizes strength.The influence of other factors such as the limits of consistency, particle size distribution, and types of clay minerals should also be considered. Good homogenization of the mixture is critical. Mortar selection depends upon thedesired wall strength and bond between the mortar and bricks. The constructive process of the soil-cement mixture is very simple and can be conducted by unskilled labour. Soil cement is frequently used for slope protection, road construction and building materials provides good compressive and shear strength, but it is brittle and has low tensile strength, so it is prone to forming cracks. To minimize theseeffects, geogrids are used.

III .GEOGRID& REINFORCED BRICK

The Geogrids are geo synthetic material, geo-grids, are polymeric products which are formed by means of intersecting grids. The function of geogrids is

The geo-grids serve the function of holding or capturing the aggregates together.

This method of interlocking the aggregates would help in an earthwork that is stabilized mechanically.

The apertures in geo-grids help in interlocking the aggregates or the soil that are placed over them.

The geo-grids as mentioned above helps in redistribution of load over a wider area

IV.COLLECTION OF SAMPLES

Soil: Sathyamangalam (college campus), top soil has been removed and soil at 0.5 to 1 feet depth is used.

Cement: OPC 43 Grade cement (chettinad cement).

Fig.1. Geo-Grid

Mould : Wooden Moulds were prepared for the standard dimension of 15cm*15cm*60cm.

Fig .2. wooden mould

Material properties

A.SOIL

Sieve analysis and Atterberg limits were performed for the collected soil . Typically, the good soil consists of 15 percent gravel, 50 percent sand and 35 percent silt and clay together.

TABLE I.COMPARISON OF TEST RESULTS WITH STANDARD SOIL CEMENT BRICK

Features Requirement (%)	**Standard**	**Obtained**
% soil passing in 4.8 mm sieve	100	100
% soil passing in 0.075 mm sieve	10–50	49.2
Liquid limit	<45	41.3
Plasticity limit	<18	17.2

B.CEMENT

As per IS 4031-part 5 (1998)the Initial and final tests were performed for the cement and the results are tabulated.

TABLE II PROPERTIES OF CEMENT

Test	**Permissible Value as per 1S: 8221, 1989**	**Obtained**
Initial Setting time	30 mins(max)	22 mins
Final Setting time	600 mins (max)	498 mins

V .MIX PREPARATION

A. Mix proportion

The following mix proportions were arrived and it is tabulated

TABLE III MIX PROPORTION

Soil		**Cement10%**	**Geogrids**	
%	*kg*	*Kg*	*%*	*kg*
90	2.631	0.292	-	-
88	2.573	0.292	2	0.058
86	2.514	0.292	4	0.116
84	2.456	0.292	6	0.175

Fig.3. Dry mix of soil ,cement and coarse aggregate

B. *Experimental procedure*

The soil was first air dried by spreading them in an open space and the lumps were removed from it. The required quantities of coarse aggregates and cement were added to the dry soil and mixed uniformly. Only after homogenization, water is added in adequate amounts. After the preparation of mix in adequate consistency, the mould is placed on sand sprinkled flat surface and inner edge of mould is free from sticking. The mix is poured into the mould by means of three layers with proper compaction and the top surface is levelled. Finally the specimens are allowed to cure for 7 days in non-shady environment thoroughly sprinkled three times a day with the fine water.

Fig.4.Reinforced

A. Compression Test

The compressive test of each brick is tested using compressive testing machine and the average compressive strength were tabulated

TABLE IV Result of compression test

Proportion (Lathe-wastereplacement)	**Trial 1 (kgf/cm^2)**	**Trail 2 (kgf/cm^2)**	**Trail3 (kgf/cm^2)**	**Average compressive strength(kgf/cm^2)**
0%	17.83	18.14	18.34	18.10
2%	26.50	26.50	26.70	26.56
4%	38.73	39.95	39.75	39.47

Fig.5.Casting of Beam

B.Water absorption Test

Immerse completely dried specimen in clean cold water for 24 hours and then remove the specimen and wipe out any traces of water with damp cloth and weigh the specimen.

TABLE V

RESULT OF WATER ABSORPTION

Sample	Initial weight kg	Final weight kg	Water absorption in %
1	3.094	3.294	6.49
2	3.145	3.333	5.88
3	3.287	3.446	4.83

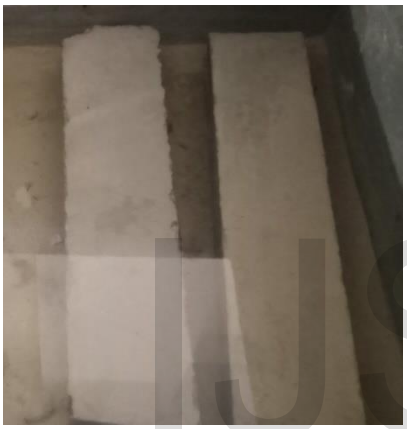

Fig.5. Water Absorption Test on beams

V. RESULT ANALYSIS

As per IS: 3495 (Part II)-19767, average water absorption shall not be more than 15 percent by weight. And shall have a minimum average compressive strength of not less than 20 kgf/cm^2 for Class **20**and 30 kgf/cm^2 for Class 30.All the results satisfied the codal provisions. The maximum compressive strength is obtained at 4%.

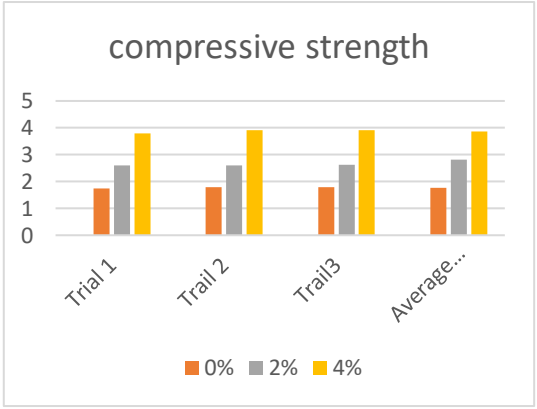

Fig.6. Variation of compressive strength

VI.ADVANTAGES

The reinforced Geogrid beam provides positive impact to environment as it is

- A product providing quality construction
- Light weight
- Excellent flexural strength
- Ease of handling
- High strength
- Easy installation

VII. CONCLUSION

The experimental study concluded the addition of geogrid increases the compressive strength and durability with reduction of permeability. This method reduces the negative impact to the environment. Reinforced geogrid beam requires no fuel consumption which is economical.

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