# Experimental Studies on Response of Geogrid In Concrete Structure

**Ajit . K. Kakade[1], Prof. K. S. Patil[2]**
[1]Dept of Civil Engineering
[2]Assistant Professor, Dept of Civil Engineering
[1, 2] JSPM'S ICOERPune - 412207, India

***Abstract-*** *These days, the structures are having very less life span than they are designed for. That might have many reasons such as environmental conditions, material quality, improper execution, etc. Due to this beam and slabs of the structures are having reduction in their flexural and shear strength which is prone to failure before the span they designed for. In this paper an additional material for steel reinforcement of the beam is suggested. These paper assess the experimental studies of concrete beam and slab with geogrid reinforcement. The beams and slabs were tested for 7 days and 28 days of curing period. Beams and slabs are tested without geogrid and with convential reinforcement in the interval of 7 days and 28 days respectively. Rest of the beams and slabs are tested with single layer geogrid and double layer geogrid. And these results are compared with each other based on their achived strength.*

***Keywords***- Geogrid, Reinforcement, reinforced concrete beam.

## I. INTRODUCTION

Geosynthetic material named geogrid is being used for reinforcement of soils and similar materials. Geogrid is commonly used for subsoils under roads as well as reinforced retaining walls. It is very strong to withstand in tension as compared to soil. Due to this fact its allows to transfer the forces to a larger area of soil than would otherwise be the case. Geogrids may be heat-welded from strips of materials, produced by punching a regular pattern of holes in sheets of materials or woven or knitted from yarns, then stretched into grid. These geogrids can also be used as stabilization and reinforcement element in various civil and infrastructural projects, using geogrid as inter layers to mitigate reflective cracking in asphalt overlays of jointed plain concrete pavement has become widely used, particularly as it relates to geotechnical engineering. Some researchers have been performed on their use as reinforcement in thin PCC members and overlays. In the concrete sections with the geogrid instead of conventional reinforcement steel fibers can be used for shear reinforcement. Discontinuous, randomly oriented fibers used for shear reinforcement have long been recognized to provide post cracking tensile resistance to concrete. These act as effective shear reinforcement and increases shear-friction strength of concrete due to their dispersed position. Moreover, Fibers also prevent the crack propagation.

## II. LITERATUREREVIEW

P.Maheswar Reddy, J.Ravi Kumar(April.2018).This paper related to the experimental investigation on concrete beams reinforced with geogrid in uniaxial and biaxial directions. The use of geogrid in concrete sets a new dimension for employing geo-synthetics in structural engineering. Geogrids are being used in given that stabilization, confinement, and reinforcement of asphalt concrete layers, further to decrease reflective cracking in pavement applications.

S. Ramakrishnan(2018)In this paper illustrates the behaviour of reinforced concrete (RC) beam with biaxial geogrid as an extra reinforcement. The intention of examining the behaviour of geogrids in structural members gives chance to observe benefit and possibility of using geogrid in thin concrete layer. In this investigation consists of 1 control beams (CB) and 5 geogrid reinforced concrete beams (GB) with changeable geogrid layer from 1 to 5. These beams were subjected to slowly increased two-point load until failure occurred. The first crack load, ultimate load carrying capacity and behaviour was observed till fall down occurred.

Martin Ziegler(2017)Application of geogrid reinforced constructions: history, latest and future developments In this paper author represented the case study on to know the functioning of geogrid-reinforced constructions. It is useful to have a look on the principal behaviour of soil under various stress conditions.The objective of this paper is to study the principal behaviour of soil under various stress conditions. To get an insight in the "secret" of geogrid reinforced constructions he first considered the large triaxial test. This is 110 cm high and 50 cm in diameter, and the tests were conducted unreinforced, and reinforced with up to 5 layers of geogrids.

Sivakamasundari, Daniel, and Kumar(2017)have performed an experimental study to investigate the flexural behavior of biaxial geo-grid with and without steel fibers to know the possibility of biaxial geo-grid and steel fiber as a substitute for shear reinforcement. The experimental test shows that the significant improvement in the flexural strength, stiffness degradation, energy dissipation capacity, displacement ductility, and the ultimate load with its corresponding deflection. The present research work had focused on Geo-grid proportioned concrete elements basic tests and they are compared with regular controlled specimens.

X.Tang, G.R.Chehab & S. Kim (2016) Laboratory study of geogrid reinforcement in Portland cement concrete. The objective of this study is to find out the actions of geogrid reinforcement in Portland cement concrete (PCC) beams. The results from this study will pave the way for further investigation of using the geogrid as reinforcement in thin concrete overlays. Two geogrid products, for which the index material properties were obtained, are used for this study. The experiment comprises of four-point bending tests carried out on PCC beams without reinforcement, with 1 layer of geogrid-reinforcement, and with 2layers.

Saranyadevi M(2016)A total 18 beams, with (150mm ×100mm) rectangular cross section and of span 1200 mm were casted and tested. From totally 18 beams nine were used for 7 Days curing and remaining nine was used for 28 Days curing. In first set of 6 R.C.C. Under reinforced beams were strengthened with Geogrid in 1 layer from tensionface which is parallel to beam axis subjected to static loading tested until failure. In 2 set of R.C.C. Under reinforced beams were externally wrapped with Geotextile fabric. The remaining 6 beams were used as a control specimen. A Finite Element (FEM) model has been developed using ANSYS 14.5 to analysis beams. The finite element program ANSYS has been used to study the Strengthened behavior of a beam. The concrete was modeled using solid 65 elements.

F. El. Meski, G.R.Chehab(2014)Flexural Behavior of Concrete Beams Reinforced with Different Types of Geogrids. This paper shows the behavior of geogrid– reinforced concrete membersThe purpose of geogrids in concrete constitutes a new dimension for using geosynthetics in infrastructure. In pavement applications, geogrids have been used to give confinement, stabilization, and reinforcement of unbound and asphalt concrete layers, as well as inter layers to reduce reflective cracking. The crucial objective of studying the behavior of geogrids in concrete members is to assess the feasibility and benefit of using geogrids in thin concrete overlays. The experimental plan consisted of testing 21 simply supported plain and geogrid–reinforced beam specimens under 4 point bending. The test parameters included 3 types of geogrids with different aperture shapes, physical and mechanical properties, and material composition.Additionally, 2 Portland cement concrete mixtures were used: low and high strength. Results from testing prove there in forcing benefit.

***A.*** ***Aim:*** The aim is to investigate the feasibility and efficiency of the geogrid reinforcement over the conventional reinforcement.

***B.*** ***Objectives:*** The objectives of this work is as follows:

1. To study the structural behavior of concrete beamsreinforced with various types of geogrid reinforcement.
2. To study the structural behavior of Concrete slabs with two way span reinforced with geogrid reinforcement.
3. The structural response of each will be compared to that of a reinforced concrete specimen to quantify the benefit gained from such reinforcement.

## III. MATERIALS

***Cement:***Cementis the important required material for the construction of concrete. Cement is a well-known construction material and has engaged a very important place in construction work.There is a trade of cement obtained in marketplace and every kind is used below satisfied illness due to its singular properties such as color and arrangement of cement. Although cement creates about 10% of the volume of the various concrete mixes, it is the active portion of the required medium and the best systematically managed element of concrete. In this investigation Portland cement of 53 grades was used. The specific gravity of cement is 3.14

***Coarse Aggregate:*** The coarse aggregate is strongest and porous component of concrete. Presence of CA reduces the drying shrinkage and different dimensional adjustments happening on account of movement of moisture. The coarse aggregate used passes in 19 mm and retained in 11.9 mm sieve. It is nicely graded (must of different particle size and maximum dry packing density and minimal voids) and cubical in form. Specific gravity of coarse aggregate is 2.70

***Fine Aggregate:*** The A fine aggregate received from the river is used for experimental motive. The less quantity of clay and silt. The lease from silt, clay, salt and natural material and it became clean and dry. Its size retained in 1.19-micron sieve.

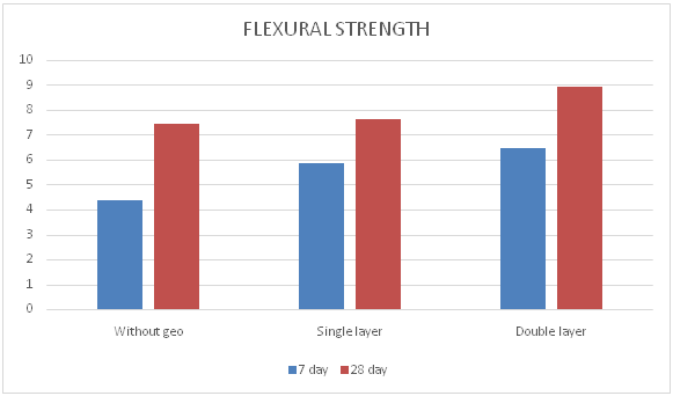
***Geo-grid:***Geogrids are geosynthetic formed with open apertures and grid-like configurations of orthogonal or non-orthogonal ribs. Keener (1998) defines a geogrid as a "geosynthetic material consisting of connected parallel sets of tensile ribs with apertures of sufficient size to allow for strike-

through of surrounding soil, stone, or other geotechnical material." Extruding and drawing sheets of Polyethylene (PE) or Polypropylene (PP) plastic in 1 or 2 directions or weaving and knitting Polyester (PET) ribs are methods used to generate geogrids

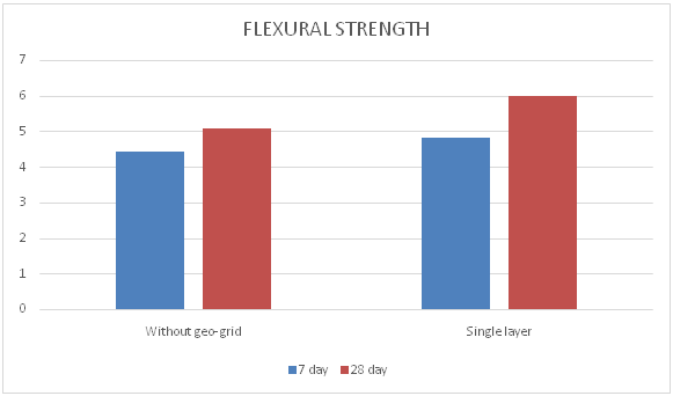
Fig 1 Geogrid

## IV. EXPERIMENTAL RESULTS ANDDISCUSSION

***Testing of concrete:*** Flexural strength test**.**




Graph 1 Flexural Strength Test For Beam




Graph 2 Flexural Strength Test For Slab

## V. CONCLUSION

1. The conventional beam with geogrid is more suitable in the concrete structure in terms of Flexural strength. As there is about 18.33% of increase in Flexural Strength.
2. As layer of geogrid increased towards the CG of beam the bending strength of beam increases.
3. Slab with geogrid reinforcement Compared to conventional reinforcement will help to increase load carrying capacity.
4. Geo-grid reinforcement compare to conventional reinforcement can help to increase Flexural strength as per above result.

## REFERENCE

[1] P.Maheswar Reddy, J.Ravi KumarStudy of Geo-Grid Confined Reinforced Concrete Beams*",*(April.2018). "*Effectiveness of geo-synthetics in stabilizing soft subgrades."* Final Rep. No. 0092-45-15, Dept. of Civil and Environmental Engineering, Univ. of Wisconsin-Madison, Madison WI,2005

[2] S. Ramakrishnan et al*, "*Strength and Behaviour of Geogrid Reinforced Concrete Beams*",* (June2018)**.,** **"***Effects of geo-synthetic reinforcement on the propagation of reflection cracking in asphalt overlays*", International journal of Civil Engineering, 2009, 7(2),131–140

[3] Martin Ziegler (April 2017),"*Geogrid reinforced base course for flexible pavements for light aircraft: Test section construction, behaviour under traffic, laboratory tests, and design criteria, Technical Report*", GL-93-6, U.S. Army Corps of Engineers, Waterways Experiment Station, andVicksburg.MS

[4] Sivakamasundari, Daniel, and Kumar (2017). "*Experimental study on triangular aperture geogrid reinforced bases over weak subgrade under cyclic loading*." M.S. thesis, Dept. of Civil and Environmental Engineering, Univ. of Kansas, Lawrence, KS.

[5] X. Tang, G.R. Chehab & S. Kim, (June. 2016), "*Laboratory study of geogrid reinforcement in Portland cement concrete.*" 6th RILEM Conf. on Cracking in Pavements, Pavement Cracking Mechanisms, Modeling, Detection, Testing, and Case Histories, RILEM, Taylor and Francis Group, London,769–778.

[6] Saranyadevi M (Dec. 2016)." *Laboratory evaluation of geogrids for flexible pavement reinforcement.*" 1st Pan American Geosynthetics Conf. and Exhibition, Geo Americas 2008 Conf. Proc., Industrial Fabrics Association International, Roseville,MN.

[7] F. El. Meski, G.R.Chehab**.** Mugeshkanna, *"Strength and Behaviour of Geogrid Reinforced Concrete Beams"* International Journal of Civil Engineering and Technology,Volume 9, Issue6.