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"Soil Stabilization by Using Geocell"

Prof. Birajdar S. J.[1], Iraganti J. G.[2], Mungapatil P. A.[3]Jamadar S.V.[4], Gajul P.U.[5], Kshirsagar R. S.[6]

[1]*Professor, Civil Engineering Department, N. B. Navale Sinhgad College of Engineering, Solapur, India.*
[2,3,4,5,6]*Student, Civil Engineering Department, N. B. Navale Sinhgad College of Engineering, Solapur, India.*

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ABSTRACT: In any civil engineering there are mainly two basic criteria first the structure should be Safe from failures second it should be economical. Geocell materials is three-diamensional expandable panels made from high density polyethlene (HDPE). Geocell material acts as important roll in Combination of reduction of thickness in loyers and improvement of life of pavement in terms of million standard axle (MSA) and bearing capacity of soil. Poor soil condition, is usually reason behind the lack of strength so, to overcome this problem using of geocell is one of the suitable method in construction of road pavement. In this study laboratory and field test where conducted to observe the porformance of geocell. Soil stabilization of geocell improves load distrution in reinforced pavement and unreinforced pavement. In Laboratory test, test on soil were conducted to know properties of soil and in field test, on geocells test on geocell by using infill material (soil). were taken. The test carried out are CBR and plate Load test under gradually loading. The test results show that the geocell reinforcement increases the Settlement bearing capacity and occurs settlement.

KEYWORDS: Soil,Geo-cell, unreinforced pavement, Reinforced pavement, HDPE Material, CBR Test and Plate load test, Bearing Capacity, settlement.

I.INTRODUCTION:

Basically pavements are classified as rigid and flexible pavement. Mostly geocell is used in flexible pavement because they fail due to two reasons fatigue cracking and rutt formation so, to overcome this problem geocell is used .Geosynthetics are available in a wide range of materials Such as Geocell, Geomesh and Geogrid. There are many applications were geocell can be used i.e. in constructions, Slope protections, structures to overcome failures or settlement. The Geocells are three dimensional honey comb geosynthetic product that provide all round confinement to the Soil. The main objective of geocell reinforcement is to improve stability, increase in bearing capacity and reduce thickness layers. Soil is strong in Compression but weak in tension and Vice-versa. Geosynthetics are week in compression but strong in tension. In unreinforced pavement due to presence of aggregate abrasion or movement takes place so this causes loss in strength and increases maintenance. In reinforced pavement geocell is introduced by infill material as soil this builds strength and reduces maintenance Cost. Flexible Pavement is composed of several layers of materials each layer receives some amount of load and distribute to the another layer. The main four layers of flexible pavement are Surface Course, Base Course, Sub-base course and Subgrade. The use of geocell in flexible pavement helps to maintain a good level Surface and evenly distribute the vertical loads of heavy moving vehicles. Lateral Confinement of infill materials prevents movement and Shearing under loading. The main Aim and Objective of the Study is to determine the increase in Safe bearing capacity and decreases settlement. In this paper We have shownthe comparative study of reinforced and unreinforced pavement . A number of researchers have Investigated the fundamental Properties of Soil Rajagopal et al 2005, Bhagaban Acharya et al 2007 , Lathaet al 2006 ,Pokharel et al 2009.

II.OBJECTIVES

- To Plan the layout and thickness of flexible pavement and analyse, design the geocell reinforcement flexible pavement to improve its performance.
- To check the behavior of geocell flexible pavement in contrast to conventional pavements.
- The focus of this study is to increase the bearing capacity of soil.

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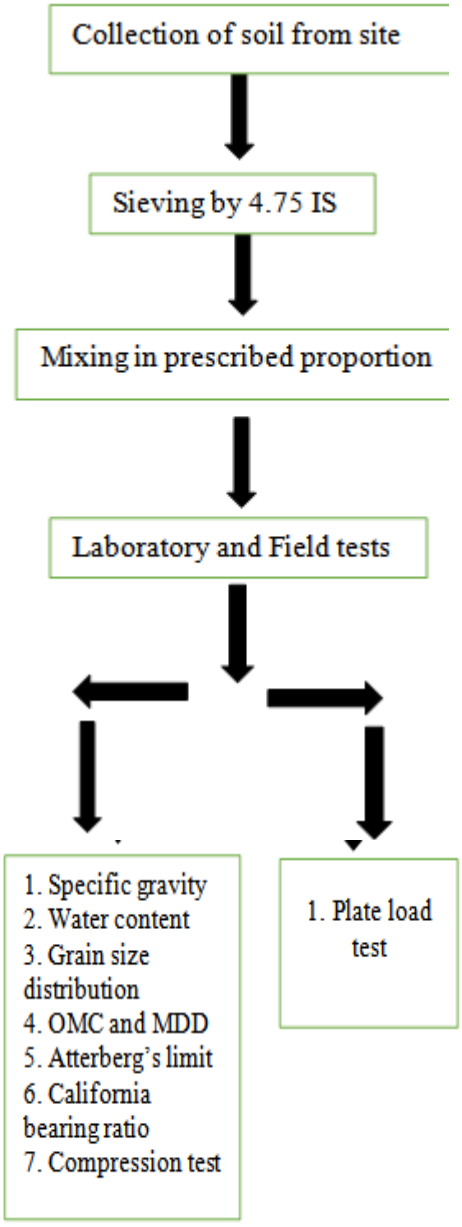
• To determine the life of reinforced pavement compare to the unreinforced pavement and o study about the settlement of pavement and rutt formation in pavement

III. METHODOLOGY



Collection of soil from site: Our site location is at kegoan to Mangalveda Highway. From this site we collected ample amount of soil required to conduct all the test which are mentioned above i.e. Laboratory and field test.

Sieving by is 4.75mm: After collection of soil from site it is dispatched in laboratory. Then the soil is taken in prescribed proportion as required for carried out the tests and sieving is done accordingly by mechanical method.

Mixing in prescribed proportion: After sieving the soil, the soil passes from 4.75mm sieve is taken and mixing is done in required amount of water content.

Laboratory tests

Specific gravity:Specific gravity (G) is determined by pycnometer method. In this test our aim is to find out the value of 'G'. Specific gravity is calculated from following formula

Gs'= (W2-W1)/(W2-W1)-(W3-W4)

Where,

W1= Mass of pycnometer

W2= Mass of pycnometer + Dry soil

W3= Mass of pycnometer + Dry soil + water

W4= Mass of pycnometer + water

Water content: Water content is determined by oven- drying method. In water content the main aim is to find out the moisture content present in the soil. In our project the objective of water content is used to determine the bearing capacity and settlement. Water content is calculated from following formula

W= W2-W3/W3-W1 x100

Where,

W= water content percent,

W2=mass of container with lid with wet soil in g,

W3=mass of container with lid with dry soil in g, and

W1=mass of container with lid in g.

Grain size distribution: The main aim of grain size is to determine the percentage of various size particles present in a soil sample. In our project the main objective is to determine or classify the category of soil i.e. coefficient of curvature (cc) and coefficient of uniformity (cu). So as to know that the soil is poorly graded, well graded or gap graded.

The formula to calculate Cu and Cc is,

Cu= D60/D10

Cc= $D30^2$/D60xD10

Optimum moisture content and maximum dry density:OMC and MMD helps to determine the optimum water content that is required for to know the maximum compaction. In our project this OMC and MDD is used in plate load test to obtain water content and compaction required

Plastic limit: In this test we observe the stage of soil at which its start to crumble or becomes semi-solid. It is used to find out the plasticity at which we get to know the strength and stiffness of soil.

Liquid limit: In liquid limit the soil loses its plasticity. The main aim of liquid limit in our

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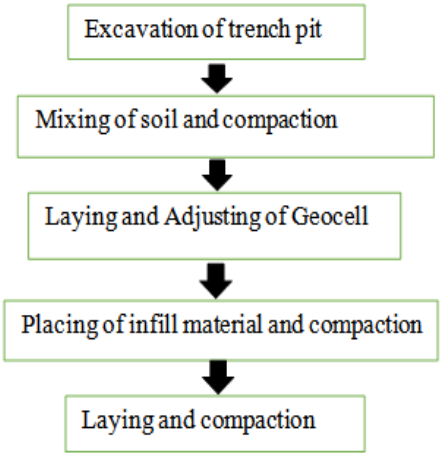
project is to calculate allowable bearing capacity and settlementLiquid limit is conducted by casagrande's Apparatus

California bearing ratio: The main aim of this test is to determine the CBR of geocell which is used in a sub-grade of flexible pavement. This ratio is measured using a standardized penetration test.

Plate load test: It is a field test which is used to determine the ultimate bearing capacity of the soil and the probable settlement under a given load. Ultimate bearing capacity is calculated by,Safe bearing capacity= ultimate bearing capacity/ cross-section area x factor of safety.

IV.PLANNING AND INSTALLATION OFGEO-CELL



Excavation of trench pit Excavation of 1mx1mx0.25m is done on particular site.

FIG. 1 EXCAVATION OF TRENCH PIT

Mixing of soil and compaction: In mixing, the soil of about 450kg and water of about 40 liters is taken for over all mixing. After that the first layer is laid in the entire pit and compaction is carried out by hammer with 56 blows.

FIG. 2 COMPACTION

Laying and adjusting of geocell: In laying the geocell material is first cut into 1mx 1m and its spread on the first layer and expanded it tightly.

FIG. 3 LAYING OF GEOCELL

Placing of infill material and compaction: After laying and expanding geocell the infill material i.e. soil is filled into the geocell properly and the surface is levelled and then compaction is carried out

FIG. 4 PLACING OF INFILL MATERIAL

Laying and compaction: After compaction of geocell layer the surface has been leveled with another layer of soil and compaction is done.

FIG. 5 LAYING AND COMPACTION

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V.LABORATORY INVESTIGATION

TABLE NO 1: RESULTS OF SOIL

Property	Result
Gravel	0.35mm
Sand	1.25mm
Fines	4.3mm
Silt	14%
Specific Gravity	2.475
Liquid limit	48%
Plastic limit	40.175%
OMC	16%
MDD	1.63gm/cc

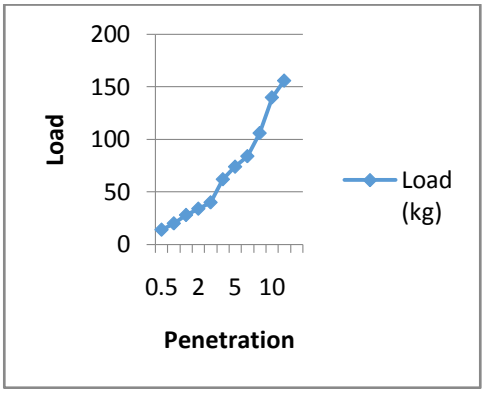
VI. OBSERVATION AND RESULTS

1. CBR TEST

A.Observation table of unreinforced pavement:

TABLE NO 2

Penetration (mm)	Loads (KG)
0.5	14
1	20
1.5	28
2	34
2.5	40
4	62
5	74
5.5	84
7.5	106
10	140
12	156

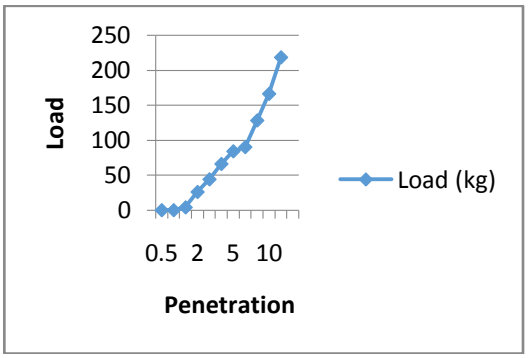


Graph of Unreinforced pavement

B.Observation table of reinforced pavement

TABLE NO 3

Penetration (mm)	Loads (KG)
0.5	0
1	0
1.5	4
2	26
2.5	44
4	66
5	84
5.5	90
7.5	128
10	166
12	218



Graph of reinforced pavement

Results:

Final CBR Value:-

TABLE NO 4

Type of soil	CBR and MSA	Total thickness (mm)
Unreinforced	CBR 4.08 % & MSA 21	730
Reinforced	CBR 5.54 % & MSA 21	675

FIG.6 CBR TEST WITHOUT GEOCELL

FIG.7 CBR TEST WITH GEOCELL

2.PLATE LOAD TEST

A.Observation table of unreinforced pavement:

TABLE NO 5

Load (KN)	Settlement of unreinforced (mm)
0	0
20	4.5

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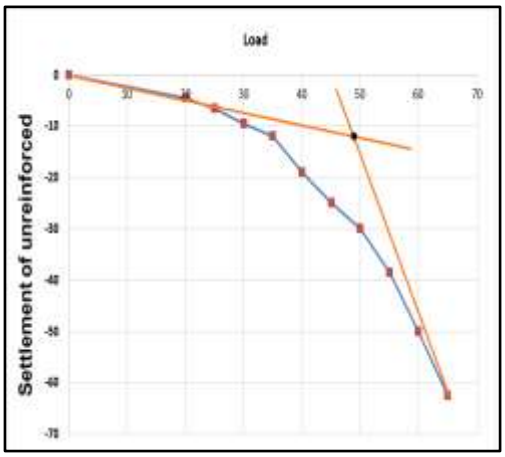
25	6.5
30	9.5
35	12
40	19
45	25
50	30
55	38.5
60	50
65	62.5

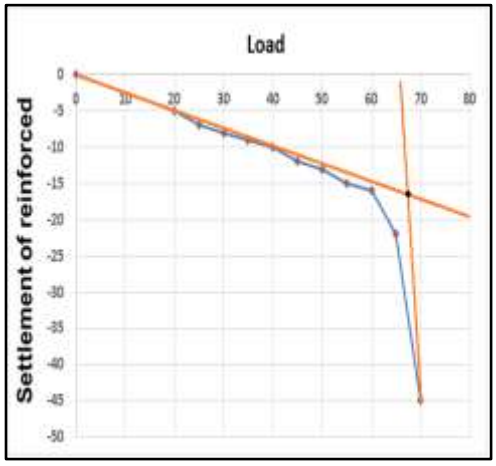


Graph of Unreinforced pavement

B.Observation table of reinforced pavement:

TABLE NO 6

Load in (KN)	Settlement of reinforced (mm)
0	0
20	5
25	7
30	8
35	9
40	10
45	12
50	13
55	15
60	16
65	22
70	45



Graph of reinforced pavement

Results of plate load test:

TABLE NO 7

Ultimate bearing capacity	Readings
Unreinforced section	49.5
Reinforced section	69.3

Safe bearing capacity	KN/M^2
Unreinforced section	22 KN/M^2
Reinforced section	30.8 KN/M^2

Images of plate load test

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FIG.8 SET-UP OF PLATE LOAD

FIG.9 HYDRAULIC JACK

FIG. 10 SETTLEMENT WITHOUT GEOCELL

FIG.11 SETTLEMENT WITH GEOCELL

VII.CONCLUSION:

At the end of this project we can conclude that by using geocell in subgrade of flexible pavement we observed that the increase in safe bearing capacity and decrease in rate of settlement.

Curve of settlement changes as use of geocell with soil. We can use geocell where bearing capacity of soil is very less. So we can increase the service life of pavement.

With the help of geocell safe bearing capacity increases up to 1.4 times for C=0 soil

The cost and duration of the construction depends upon the availability of materials at the site.

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