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Abstract

Geocell is a material which is made up of high density polyethylene and it is used for slope protection, railway embankment and as a base material in a flexible pavement construction.. Geocell is basically a 3D honeycomb structure which is divided into number of cells. Geocell holds the filling material in each and do not spread material through it. Geocell is interconnected synthetic material made up of polymer and which is used to improve the soil bearing capacity of the pavement and it is also use to decrease the permanent deformation of pavement. Geocell reinforcement is used were soil have low bearing capacity and material requirement for base is more. Geocell reinforcement gives better stability and increase the bearing capacity of the soil and to give better performance in less material .In this study, the test were conducted on the base coarse under gradual and impact loading to check that the iron slag is suitable for the geocell or not. The ultraviolet roofing sheet has the same property like high density polyethylene geocell which is use as geocell reinforcement in road as sub-base material with iron slag.

Keyword: Geocell, iron slag, UV roofing sheet, soft murrum *etc.*

1. INTRODUCTION

India is the second largest country in road network in the world having total length of around 4,32,00,000 kilometres. The road is classified according to the material used, traffic volume and function etc. The material use for road construction is muroom, kanker, WBM (water bound macadam), bitumen and concrete. Out of these 90% of road is bitumen, 8% road of concrete and 2% of other type. Other type of road contains some special type of road such as plastic road and road constructed by using geocell in India. According to nature or weather condition road are constructed and classified. Nature condition is different at a different in

direction like in North, South, East and West. So that considering the weather condition is the main point of construction of road.

According to the weather forecasting it is found that 80% more precipitation is occurred in the year of 2019 and due to these most soil is runoff by heavy rainfall so in such type of condition it is essential to provide the stability and to hold the soil from runoff, there are many material and type used for stabilizing the road. One of these, use of geocell is advanced technique of soil stabilization. Therefore geocell provide better stability at low cost.

Geocell is the material which is used to give and provide the stability to the soil. Geocell is not only for the road construction but also used for sloping portion of the ground to resist the soil from landslide, where was the chance of landslide geocell gives the better stability to the soil and reduce 80% cost of construction. Recently geocell used for road construction in Assam Tripura for providing stability to the soil. There are many of the filling material used for geocell like gravel, murrum or which is locally available

The term geo cell also have two parts first is geo which is means soil and second is cell which means cellular type of shape for infill material such as soil. 3 dimensional structure, thus preventing the lateral spreading of the material due to which much stiffer structure is form and distribute load to wider area. Geocell consists of series of single cell interconnected to each other; it is manufactured from different polymer material. Geocell are manufacture in different sizes. Size of geocell depends on the depth of cell and area of cell. Strength of geocell depends on the material which is filled into it. Iron slag is used as filling material in geocell. It is the by product coming from steel industry. Slag causes reduction in porosity of soil as well as permeability of soil thus causing water logging problem. Uttam galva is the steel manufacturing industry in wardha (442001) has name Lloyd steel. Iron slag is available from this steel industry that we are used in our project which is the waste product of steel

The main objective of our project is to construct the WBM road for the rural areas where traffic intensity is not as that much, to construct economical and durable road. For study the behaviour of road settlement the patch of road constructs and tested.

1.1 Application of Geocell

- i. The geocell reinforcement reduces the vertical stresses transfer to the sub grade by distributing the load over wider area in WBM road.
- ii. In railway, confinement of the ballast using geocell was quite effective in reducing vertical deformation especially when low quality material materials were used.
- iii. If the geocell is use to increase the strength of ballast which reduces the need for reinforcement use for substructure improvement.
- iv. In slope protection, geocell reinforcement is found to be advantageous in increasing the factor of safety and reduce the lateral deformation of the slope due to tensile strength and bending moment of geocell reinforcement.

2. MATERIAL STUDY

Geocell

The term geocell also have two parts first is “geo” which means soil or earth and second is “cell” which means cellular type of shape for infill material such as soil. Geocell products are three dimensional, expendable panels made from

high density polyethylene (HDPE), polyester and another polymer material.

Properties of Geo cell

- i. It withstands low and high temperature.
- ii. It is complex three dimensional honeycomb structures.
- iii. It is durable.
- iv. Geocell have a lower thermal expansion coefficient.
- v. It has higher tensile stiffness.

Iron slag

Iron and steel slag, also known as ferrous slag, is produced by adding limestone lime and silica sand to blast furnaces and steel furnaces to strip impurities from iron ore, scrap and other ferrous feed materials and to lower the heat requirements of the iron- and steelmaking processes

Properties of Iron slag

- i. It has high melting point.
- ii. Low surface tension.
- iii. It is hard.
- iv. It is tough and durable.
- v. Low water absorption.
- vi. It has rough surface.

Soft murrum

Murrum is a gravelly lateritic material. The reddish colour of these soils is imparted by the iron compounds. They are good material for building huts and paths, as they can be compacted easily to form hard surfaces. They are generally impervious. Murrum or Moorum is typically an Indian term.

UV (ultra violet) sheet

Polycarbonate is the synthetic resin which is made from the polymers which contain carbonate groups. Polycarbonate has excellent physical properties. It has excellent toughness, It has very good heat resistance, It is light weight and easy to handle.

2.1 Tests perform on materials

Sub Soil Test

- i. Specific Gravity of Soil by pycnometer.
- ii. Dry density of soil by core cutter method.
- iii. Optimum moisture content & Dry Density of Soil.
- iv. Atterberg limit
 - a. Liquid Limit
 - b. Plastic limit

Murrum Test

- i. Specific Gravity of Murrum by pycnometer

Slag Iron Test

- i. Sieve Analysis
- ii. Specific Gravity of Slag Iron
- iii. Bulk Density of Slag Iron
- iv. Crushing Test of Slag Iron
- v. Impact Test of Slag Iron
- vi. Abrasion Test of Slag Iron

Fig. Laying of iron slag

Step 4:-compact the iron slag.



Fig. Roller compaction

Step 5:-Laying of geocell



Fig. Spreading of geocell

Step 6:- Filled the geocell layer with iron slag



Fig. Filling by material

Step 7:- compaction of geocell with filling of iron slag .



Fig. Compaction of filler.

Step 8:- Cover surface with locally available material murrum.



Fig. Filling of murrum

3. METHODOLOGY

3.1 Design

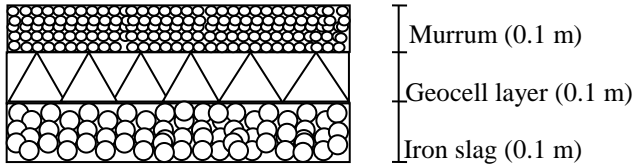


Fig. cross section of patch

First of all we marked the layout on the ground surface for dimension of (2.0mx2.5m).then excavate the patch at a depth of 0.3m.then divide that excavated portion in 3-layers one which is iron slag layer then the geocell layer with iron slag as a filler material in cells and covered with locally available material murrum. Each layer of the pavement is well compacted and well settled.

3.2 Procedure

Step1:- Finalized the site for construction of work and mark (2m × 2.5 m × 0.3m).



Fig. Layout

Step 2:- Excavate the marked surface.



Fig. Excavation

Step 3:- Laying of iron slag.



Step 9:- Compact murrum layer by roller and cure it by using water.



3.3 Settlement Test on Pavement

Impact loading test

- i. In this test the impact loading is applied over the centre of the pavement and 20 cm away from all direction from centre.
- ii. The impact loading is given by standard rammer of a size having bottom, Ø 140mm thickness of bottom 75mm, height of handle 900mm, Ø of handle 25mm and 12.07 kg in weight.
- iii. Firstly the rammer is falling from height of 30cm at centre and then fall from another marked point around centre the height of falling rammer is varied and at what distance the maximum settlement cause is then recorded.



Fig. Impact loading test

Observation table

Sr. No.	WBM Road With Geocell Reinforced		WBM Road Without Geocell Reinforced	
	Height of Filling (cm)	Settlement (mm)	Height of Filling (cm)	Settlement (mm)
1.	30	-	30	0.24
2.	60	0.24	60	0.5
3.	90	2	90	4
4.	120	4	120	6
5.	150	6	150	8

Table no. 1

Gradual loading test

- i. Gradually load applying over the road to check the settlement, this test is done with the help of vehicles.
- ii. Gradual load is applied by using vehicle over the surface of road.
- iii. Two wheeler and four wheeler vehicles with variation in load are used for the application of load. Following vehicles are to be tested over the road.
Avg. weight of moped = 104 kg.
Avg. weight of bike = 111 kg.
Weight of 4 wheeler = 650 to 1200 kg.



Observation table

Sr. No.	WBM Road With Geocell Reinforced		
	Type of vehicle	Weight of vehicle (kg)	Settlement (mm)
1.	Pleasure	104	-
2.	CD Deluxe	111	-
3.	Alto 800	750	-

Table no. 2

Sr. No.	WBM Road Without Geocell Reinforced		
	Type of vehicle	Weight of vehicle (kg)	Settlement (mm)
1.	Pleasure	104	1
2.	CD Deluxe	111	1.5
3.	Alto 800	750	4

Table no. 3

4. CONCLUSION

- i. From the above result we concluded that all the properties of iron slag gives the effectively results as compare to the natural aggregates.

- ii. Geocell made by UV sheet is also giving the efficient stability like a HDPE material.
- iii. Time required for the total construction can be greatly reduced with reduce in cost of construction.
- iv. Iron slag is the waste product of steel industry and it can be utilized in road construction with geocell as a filler material and as a base material in WBM road.
- v. Iron slag is used in geocell when the iron slag is properly grinded.

5. REFERENCES

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