Geo Textile Material Used in Road Construction

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***Abstract*—In any civil engineering construction work, there are two basic criteria's which are to be followed, firstly the structure should be safe against any type of failure and second is that structure should be economical as far as possible. When the structure is constructed over loose or weak soil then it is very difficult to follow these basic criteria. Poor soil condition usually is the reason behind the lack of strength, and associated deformability. Unpaved road stabilization / reinforcement using 3d-cellular confinement systems stabilizes the material of road subgrade, acting like a semi-rigid slab, loads are distributed latterly reducing subgrade contact pressures and minimizing deformations and settlement. Soil stabilization with geocell in road, highway construction, improves load distribution characteristics on paved and unpaved surfaces. The experiment of use of geocell in road construction carried out at our government polytechnic Bramhapuri campus. The model has prepared for road pavement consrtuction using geocell on weak soil filled with concrete. The result compares with road pavement without geocell with reference to cost, material required etc. The result shows use of geocell in road pavement is very economical as compare to concrete road and WBM road.**

1. INTRODUCTION

The Cellular Confinement Systems are popularly "Geocells" are strong, lightweight, three-dimensional systems fabricated from ultrasonically welded High Density Polyethylene (HDPE) strips that are expandable on site a honeycomb like structure. Geocells are compact non cohesive soils which are confined within the cellular walls.

Fig.1 Geocell filled with concrete The composite forms a rigid to semi rigid structure. The depth of the geocells size cellular unit can vary as per design requirements. Typical Geocell Generally, the infill is sandy or gravelly material. The surface of the geocell is textured soil geocell

wall friction. The geocell wall is punctured in immediate dissipation of developed pore water pressures increased stresses within the infill of the individual cells.

Concrete road is durable and safe. They are apparently less wear and tear defects like rutting cracking stripping, less of texture and potholes occur with flexible pavement surface and also requires low maintenance but can't be constructed on soft clayey soil. The field model of size 4mX2.5m show the comparison between the road concreted with geocell and CC road. Experimental as well as comparative study was carried out on the embankment supported with geocell and without geocell. A 4m x 2.5m field model was prepared for study. In that 2.5mx2m area was prepared with plan cc embankment and another 2.5mx2m area with geocell embankment. Geocell was direct placed on the levelled ground surface as the soil was strong and on the other hand proper subase was prepared for CC road. The main aim and objectives of study is to determine the various property of embankment with geocell and cement

concrete road. Then to make comparative study of the road reinforced with geocell and CC road. To study the various characteristics, load carrying capacity of pavement with geocell and simple CC road. Cement concrete of grade M25 was used as an infill material in the geocell as well as for preparing pavement.

1.2 Aim & Goal of Geocell:

Cellular confinement systems (CCS)—also known as geocells—are widely used in construction for erosion control, soil stabilization on flat ground and steep slopes, channel protection, and structural reinforcement for load support and earth retention. Slope protection: In road construction, geocells can protect slopes and prevent slope collapse and landslides. Reinforcing slopes with geocells can ensure terrain stability along roads and reduce safety risks caused by soil erosion and slope collapse.

1.3 Scope of the Project

Infrastructure development includes the design and construction of structures while ensuring that they do not have a detrimental influence on natural resources. Soil stabilization and reinforcement are a major source of worry and a possible threat to the long-term stability of roads, bridges, and pathways.

Engineers profit from cellular confinement systems in a variety of ways, including lower cost, enhanced weight-bearing capacity, and improved stability.

2. LITRATURE REVIEW

Strata Geosystems (India)

Several days of torrential rain in March 2016 completely destroyed a stretch of National Highway 44 (NH-44) in India. The roadway is the main throughway for commercial traffic to the State of Tripura. The failed road zone was located on the Assam side of the Assam- Tripura-border.

Pokharel et al. (2009a)

Conducted an experimental study to evaluate the behaviour of geocell- reinforced bases under static and repeated loading. Two base course materials, Kansas River sand and quarry waste were used as the infill material. The test result showed that geocell confinement increased the bearing capacity and stiffness of the Kansas River sand by improvement factor of 1.75 and 1.5 respectively, under static loading However, geocell confinement had minor effect on the stiffness of the quarry waste under static loading due to the existence of apparent cohesion. The single geocell reduced the permanent deformation of the quarry waste base by a factor of approximately 1.5 compared to the unreinforced base. The Kansas River sand had a lowest percentage of elastic deformation as compared with the unreinforced and reinforced quarry waste

due to the poor gradation, sub- rounded particles, and no apparent cohesion of the sand. The reinforced quarry waste had a higher percentage of elastics deformation than the unreinforced quarry waste due to the contribution of the geocell. Pokharel et al. (2009b) conducted another similar experimental study to evaluate the influence factors for single geocell- reinforced sands. This study found that the geocell placed in a circular shape had a higher bearing capacity and stiffness of the reinforced base than that placed in an elliptical shape.

Bender and Barenberg

Bender and Barenberg showed that over ground of low bearing limit having a California Bearing Ratio (CBR) not exactly around 2, the utilization of geotextile could empower a 30% decrease in total aggregate depth. Another 2 to 3 inch (50 to 70mm) decrease in base thickness was likewise conceivable since total aggregate loss didn't happen during construction obviously, uniform bases on delicate subgrades. Later work by Barenberg and Lai and Robnett accentuated the significance of the firmness of the geotextile.

3. METHODOLOGY

Geocells provide the solid stiffness and creep resistance needed to reinforce soft soils. They prevent the shrinking and cracking of the clay, facilitate lateral dispersion and filtration of sandy soils, and strengthen the subsoil in all soft soils. Road maintenance with cellular restraint systems keeps them in the right conditions. Roads can have maintenance problems due to unsuitable underground conditions (due to inappropriate characteristics of subsoil), which can lead to damage, cracking, washing out, and settlement of unpaved surfaces. By using geocells permanent and temporary roads can be constructed, and their ground stability condition can be improved. Geocell improves the load-bearing

capacity of granular pavements and porous surfaces used in heavy machines, are and, at the same time, reduces costs.

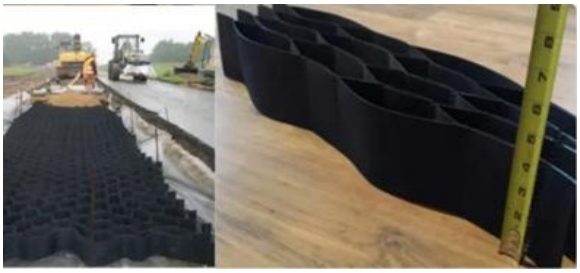

Fig. No. 2 Geocells.

Step followed during preparing model on comparisons between geocell road and cement concrete road.

STEP-1: Site clearance and layout marking for both geocell road and cement concrete road of (2.5Mx2M) each.

STEP-2: Placing bolder on cement concrete road and 40mm aggregate on geocell road.

STEP-3: Placing moorum on both the side of 200mm thick layer.

Fig. 3 Placing Moorum

STEP-4: Compacting and spreading water alternately on both the side of road.

STEP-5: Placing aggregate on cement concrete road and compacting it.

STEP-6: Applying formwork for cement concrete road.

STEP-7: Spreading and fixing the geocell confinement on the prepared sub-base course.

STEP-8: preparing concrete of grade M25 and filling geocell web evenly with it. Also pouring concrete in prepared formwork for cement concrete road.

STEP-9: Removing formwork after 24hr of cement concrete road.

STEP-10: Curing for 28 days two times a day.

2. Laboratory Test Compression Strength Test

It is mandatory to have at least 3 specimens for testing from different batches. The mean of compressive strength achieved by this specimen is used to determine actual strength of the batch.

Fig.5 Compressive strength tested cubes

Test Procedure: -

3.1. Place the prepared concrete mix in the steel cube mould for casting. Once it sets, after 24 hours remove the concrete cube from the mould. Keep the test Pros

- A few of the advantages of geocells are as follows. First, the manufactured quality control of geosynthetics in a controlled factory environment is an advantage over outdoor soil and rock construction. To ensure high quality geocells, factories that are ISO 9000 certified are ideal.
- Geosynthetic installation is much easier than installing thick soil layers like sands, gravels, or clays that require large earthmoving equipment.
- Another advantage is that published standards, such as test methods and specifications, are well advanced in standards-setting organizations such as ISO, ASTM, and GSI. Geocell design methods are currently

available from many publication sources, and universities even have courses in geosynthetics or have integrated geosynthetics in traditional geotechnical, geoenvironmental, and hydraulic engineering courses.

- Geosynthetic designs are usually less expensive than alternative natural soil designs are seen as more sustainable since they have a lower CO2 footprint.

3.2. Cons:

- Geocells do have some disadvantages. First, the

long-term performance of the particularly formulated resin used to make the geosynthetics must be assured by using proper additives, including antioxidants, ultraviolet screeners, and fillers.

- The clogging or bioclogging of geotextiles, geonets, geopipes, or geocomposites is a challenging design for certain soil types or unusual situations. These types include loess soils, fine cohesionless silts, highly turbid liquids, and farm runoff. They require specialized testing evaluations when installing geocells. Another disadvantage is that careful quality control and quality assurance must ensure handling, storage, carrying, and installation.

4. CONCLUSIONS

The main purpose of Geocell in Construction is mainly used to control and prevent soil erosion and stabilize the soil, structural reinforcement to sustain load support. Geocell is a proven way to create a strong, efficient, reliable, and cost-efficient way of construction. Geocell is generally widely used in many environmental projects.