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Emerging Trends in Ground Improvement Technique towards Sustainable Infra-Structure

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Abstract—*Infrastructure is the key to provide a healthy, happy and economic life to the communities around the world. It is amongst one of the basic components to be provided. With increasing population pressure on this planet sustaining life for many more years will be dependent on how we design our systems today. Our success can only be ascertained in future, if today we are able to employ and adopt sustainable means in building infrastructure. Stability and economy for any construction is a major concern to ensure sustainable development of infrastructure. Seeing the present scenario of increased population pressure in developing countries, both in rural and urban areas thus it is imperative to address this concept of sustainable development at this conjecture. To address sustainability in infrastructure, foundations forming the sub-structure of constructions can be analyzed in the domain of achieving sustainability. Thus, to highlight traditional foundations alone are not sufficient to take the heavy load in the form of self-weight, wind load and seismic load. In the early times before the advancement in the field of geotechnical engineering, the only chance for the foundation engineers to design the foundation was based on matching to the sub soil conditions at the site provided. But now a day due to the improvements in geotechnical techniques and with the help of latest technology it is possible for us to modify the weak foundation soil to the strength and compressibility characteristics to suit the foundation of our choice. These geotechnical processes of improving the quality of the foundation soil to the desired quality are called as ground improving techniques.The main objective of these processes is to increase the density and shear strength parameters and to decrease the compressibility, permeability and the settlement, which makes the soil more water resistant, durable and stable.To mitigate natural geological hazards, different advanced techniques of ground improvement have been mainly studied, such as: Geosynthetics, Reinforcement techniques, Ground treatment (Admixture mixing technique). To improve the soil behavior, Geosynthetics, a modern construction material is used frequently nowadays to develop specific function in construction. On the other hand reinforcement techniques which addresses soil improvement are Stone columns, Micro piles and Fibers. Fly ash, lime, cement, surkhi are used as an admixture. Through these techniques an engineer can improve the mechanical and engineering properties of the soil as per the project requirement. This study will help in exploring the concept of imparting sustainability coupled with the usage of ground improvement techniques.*

Keywords*: Sustainable Infra-structure, Ground improvement, Geosynthetics*

1. INTRODUCTION

Behaviour of soil is the most important parameter which we have to consider before the construction of any type of civil engineering structure. Construction of civil engineering structures over weak soil can be a problem for any designer, and also the backfilling and excavation is not always economical. So it is important for a civil engineer who designs, build to get well the land properties by some expert ways of art and soon. The reinforcement of soil is one of the ground improvement techniques.Geotextiles are the largest and most different group of geosynthetic materials and cover all fabrics produced from polymer fibers. There are five main functions of geosynthetic materials: to separate dissimilar geomaterials; to reinforce soil masses; to act as a filter in controlling the transport of solid particles within the soil; to provide drainage pathways within the soil mass; or to impede fluid flow by acting as a containment/flow barrier. Geosynthetic functions of separation, filtration, and reinforcement involve interactions with the surrounding soil.

2. TYPES OF GEO-SYNTHETICS

Geotextiles

Geo-textiles are in fact textiles in an old and wise sense, but form of produced by uniting threads rather than natural ones like cotton, wool and silk Geo-textile polymer is made from polyester or polypropylene. Polypropylene is a material lighter than water (it has a special weight of 0.9). It is taken into account to be strong and very durable. Polyesters used are of greater weight than water and it gives very good, of highest quality power and go with body near earth properties. There are 2 types of geotextiles .They are woven and non-woven geotextiles.

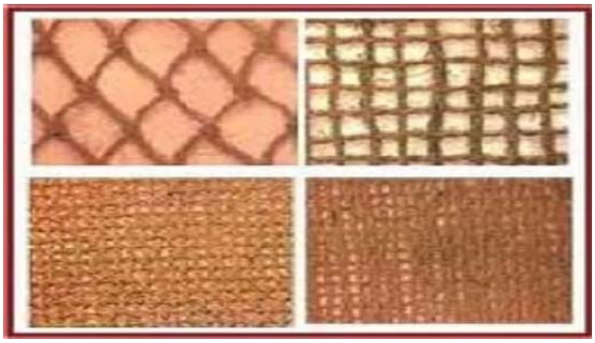

Fig. 1: Geotextiles

Geogrids

Geo-grids are plastics formed into a very open netlike form. One only or multi-layer materials are usually made from pushing out and stretching high measure of space between parts polyethylene or by make by putting things together or knitting the polypropylene. The coming out net-work structure is owner of greatly sized openings called openings. These openings give greater value to the effect on one another with the land and mass. It is a good land and mass support needing payment to its good stretching power and stiffness.

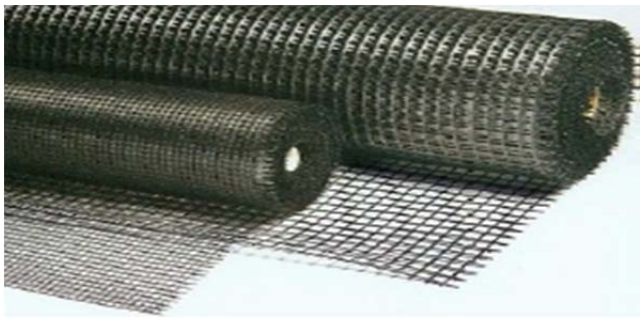

Fig. 2: Geogrids

Geonets

Geo-nets are well made criss-crossing polymer gets stuck that make ready inplane draining. The geo-nets are all made of polyethylene. The molted polymer is pushed out through slits in opposite rotating-dies which forms a matrix or a net of closely spaced well madegets stuck. When the levels of get stuck are two then it is called as ‘biplanar’ and three levels of get stuck are called ‘triplanar’.

Fig. 3: Geonets

Geocomposites

Geocomposites are geotextile apparatus for making liquid clean all round, nearby a geonet .Some of the group events of the geocomposites are as bed cover drains, panel drains, edge drains and waxed thread drains. bed cover drains are generally used as leachate pumping in drop by drop collection, taking away levels within land used to put waste in. flat square bit drains are placed nearest to the structure to get changed to other form the hydrostatic force. Edge drains are used nearest to sidewalk structures which helps keep (self, thoughts) in order, under control and take away side seepage from the road base.

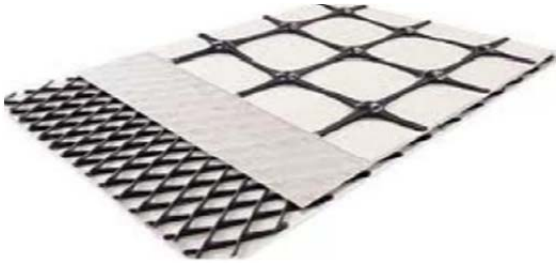

Fig. 4: Geocomposites

Geocell

3-D honey comb like structures made full with land, great stone and building material made of small stones, sand, and cement. They are made of long (thin) bits of polymer bits of paper/ geotextiles connected at staggered points in order to form a greatly sized dear one comb floor covering when its long (thin) bits are pulled without. Geo-cells were made from a fiction story polymeric alloy called Neoloy. The Geocell with a higher elastic modulus has stiffness of the made stronger base and a higher directing amount of room. Geocells made from NPA are discovered to be importantly better in stiffness, last directing amount of room and support in comparison with to geocells made from HDPE.

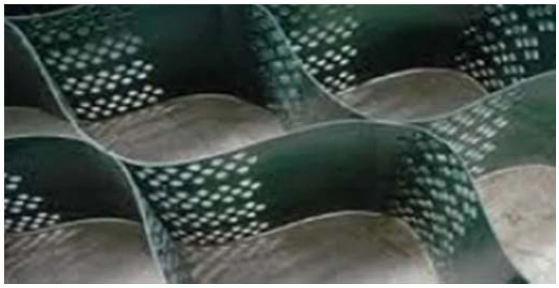

Fig. 5: Geocell

3. IMPROVEMENT OF SOIL DUE TO GEOSYNTHETICS

Ling& Liu (2001) showed that geosynthetic support increased the stiffness and bearing capacity of the asphalt concrete sidewalk. Under forcefull adding weight, amount, the living of

the asphalt concrete level was going on for a long time in the existence of geosynthetic support.

Sireesh (Article in press) showed that geocell bed-cushions can importantly increase the bearing capacity and get changed to other form Settlement of the Clay sub-grade with void. The geocell bed-cushions must put out on top beyond the nothing at least a distance equal to the distance across circle of the nothing. With increase in the high level of the geocell level, its short time of inertia and for this reason making bent and get cut stiffness of the geocell bed-cushions increases that it effectively bridges the nothing and gives on the safe position force to the nearest soil mass. The overall bearing capacity of the base bed increases with increase in measure of space between parts of the put in earth. It is therefore profitable to have a thick put in the geocells.

Ghazavi&Lavasan (2008) did a parametric work-place that let be seen the part of the distance between giving support levels and safe positions and the distance from side to side and distance down of giving support levels on the bearing capacity. The results showed that the directing amount of room of coming between, against safe position increases with the use of geogrid levels, depending on the distance between 2 safe positions. Support caused the bearing capacity of coming between, against safe positions to increase by about 1.5 and 2 for one and 2 support levels.

4. APPLICATION OF GEOSYNTHETICS

Geotextiles and geogrids are widely used to reinforce soil masses in the design of retaining walls and slopes. In these Mechanically Stabilized Earth (MSE) applications, horizontal layers of the geosynthetics are sandwiched between compacted layers of fill during construction. Lateral spreading of the soil mass is resisted by shearing along the soil–geosynthetic interface and the development of tensile stresses within the reinforcing layers. Internal stability also requires that the geosynthetic layers provide tensile anchorage against potential slope failures by extending into the stable soil mass. The principal parameters in design are the tensile strength and stiffness of the geosynthetic, and the soil–geosynthetic interface shear and bond resistance. Horizontal layers of geosynthetics are also used as basal reinforcements for embankments constructed over soft foundation soils.The use of geotextiles to separate the soil sub grade from the overlying aggregate (unpaved) road base on tensile stiffness and strength properties of the geosynthetics.

The geotextile allows drainage but prevents intrusion of aggregate into a softer underlying material while preventing the pumping of fine particles from the sub grade into the ballast. Geotextiles are frequently used as filter fabrics in subsurface drainage and erosion control applications. Geosynthetic materials are routinely used for subsurface drainage; these include edge/fin drains behind earth retaining walls and prefabricated vertical drains used to accelerate the consolidation of low permeability clays.

5. ADVANTAGE OF GEO-SYNTHETICS

- Cheaper in product cost, transport and installation.
- Can be designed (predictability)
- Can be installed quickly with flexibility to construct during short period.
- Consist over a wide range of soil
- Space saving
- Material quality control – more homogeneous than soil and aggregate
- Better construction quality control at site
- Easy material deployment

6. DISADVANTAGE OF GEO-SYNTHETICS

- Long-term performance of a particular formulated resin being used to make the geo-synthetic must be assured by using right substances mixed including antioxidant, ultraviolet screeners and fillers.
- Clogging of geotextiles, geo-nets, geo-pipes and geo-composites is hard design for certain soil types or uncommon places and position. For example, loess soil, fine cohesion less silts, high turbid liquids and microorganism weighted down with liquid(farm run-off) are needing much care and generally have needof expert with special knowledge testing values.
- Handling, storage, and installation must be assured by taking care of quality control and quality certainty.

7. CONCLUSION

- It is looked on as to come that the use of geosynethetics will become increasingly regularly order, and that geosynethetics will be the quality example material of good quality for several application.
- Use of geosynethetics in pavement structure (to act the function of separating, filtration draining and support) should increase importance in the new millennium as the benefits of these material are measured.
- In additional, the versatility and usage of geo-synthetics will be enhanced with the development and adoption of in situ and rapid soil testing procedures
- Geo-synthetics are magic material to yield excellent result.

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