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Soil reinforcement of soil:- Ground Improvement technique

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ABSTRACT:- Construction of building and other civil engineering on week or soft soil is highly risky, because such soil is susceptible to differential settlement ,poor shear strength and high compressibility. Various soil improvement technique is used to improve the engineering properties of soil. In this paper we are dealing with how to improve the soil properties using soil reinforcement technique . Reinforcement technique is a technique where tensile element are placed in the soil to improve stability ,bearing capacity and control deflections.

Key word:- Soil Reinforcement ,Material , Application , Geocell, geotextile .

Introduction:-Development of infrastructure is the most important aspect in the present world. To fullfill the infrastructural need of population, small multi-story building ,express highway, high speed rail track,new bridge ,airport etc. are required to contract . Ultimately all the above structure load comes into ground. So if the soil is poor then ground improvement is most important aspect to building construction. The reinforcement can be provided permanently or temporarily to increase strength of adjacent structure .basic principle of soil reinforcement already existing in nature and demonstrated by animals ,plants and birds. The modern form of soil reinforcement was first adopted by Vidal (1969). Based on the vidal's concept the interaction between soil and the reinforcing horizontal member is solely by friction generated by gravity. Applying the concept retaining wall were built in france in 1986. Nowadays this technique is widely used in Europe and U.S.A. This technique is yet to become popular in India , and the constraining factor being

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identified a the non-availability of fiber and cost of reinforcing material.

MECHANISM:-To understand the mechanism by which reinforcement improve the performance of soil, let us took at two laboratory scale experiments. In the first case , a tank ABCD as shown in figure-1 is filled with dry soil .When we remove side AB of the container ,the vertical face of the sand does not remain stable and soil mass rearrange itself as a sloping surface. We now repeat the same experiment by using geotextile material as reinforcement in soil mass. The geotextile is the flexible material that resembles a strong or thick sheet of cloth .the material is placed in horizontal layer when the sand is filled in the tank and it is folded at the end asshown in figure.After removing the side AB ,the vertical side does not collapse. This is so because ,when the soil particles in the failure zone begins to collapse, the geotextile ,reinforcement prevent their movement

1.during the shearing stage ,prior to failure ,the reinforced soil sample shows lower radial and axial strain under the same deviator stress as compared to unreinforced sample.

2.at failure stage the deviator stress of the reinforced sample is significantly larger than that of sample without reinforcement indicating higher shear strength of the former.

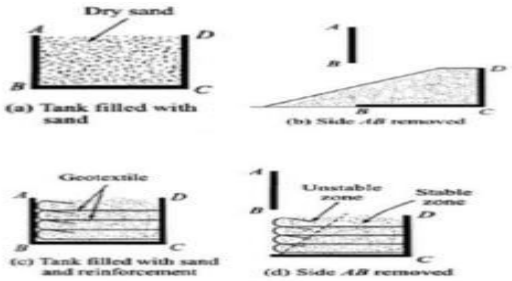

Fig-1:-Mechanism of Soil reinforcement

2.if we take two sample of medium-dense sand ,one reinforced and other not reinforced and test them into in the triaxial apparatus under unconsolidated drained conditions. The reinforced is introduced in one of the soil sample in the form of four discs of the thin aluminium foil placed horizontally in the sam

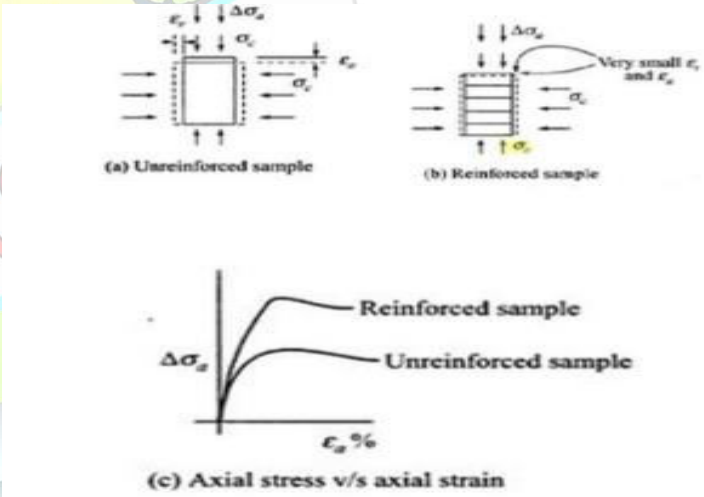

Fig -2

MATERIALS:-There are three basic material or material composites required in the construction of any reinforced soil structure :-

1.Soil or fill matrix

2.reinforcement or anchor system

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3.a facing if necessary

Although other material which are required ,in addition to the above ,to cover associated elements such as foundations, drainage connecting elements and capping units and act as barriers and fencing. Based on design considerations and availability ,the material are selected .

Soil /fill :- The shear properties of the soil can be improved as theoretically any soil could be used to form earth reinforced structure. In long term conventional structure the soil used is usually well graded cohesionless fill .

Advantage :-The major advantage of cohesionless fill stable, free drainage and relatively non-corrosive to reinforcing material .in case of cohesive soil the main advantage is availability but there may be long term durability problem together with distortion of the structure .as a convenient between both the above soil cohesive -frictional may be preferred . Sometime the use of waste material as fill for reinforced soil structure is attractive from an environmental as well as economical point view.

Disadvantage :-the only disadvantage is its cost.

Reinforcement: A variety of material including steel ,concrete ,glass ,fibre ,wood ,rubber ,aluminium and thermoplastic can be used as reinforcing material. reinforcement may take the form of strips ,grids ,anchors and sheet material , chain, rope and combinations of these or other material forms.

1.Strips are flexible linear material having breadth greater than thickness .strips are formed from aluminium ,copper ,polymer and glass fibre reinforced plastic and bamboss. It may be either plain or with projections such as ribs to increase the frictions between the reinforcement.

2.Grid of geogrids are also used as reinforcement. Grid are formed from steel in the form of plain or galvanised weldmesh or form expanded metal. Grid from using polymers are refereed to as geogrids and normally in the form of an expanded property plastic product.

3.Sheet reinforcement may be formed from metal such as galvanised steel sheet ,fabric or expendable metal.

4.Flexible linear element having one or more pronounced distortions which acts as abutments or anchors in the fill or soil.they may be made from steel ,rope plastic etc..

5.Composite reinforcement cab be formed by combining different material and material from such as sheet and strips , grids and strips depending upon the field conditions.

Other method of improving the soil reinforcement:-

Geosynthetics:- Geosynthetics are artificial fabrics used in conjunctions with

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soil or rock as an integral part of man made project. The two major groups in geosynthetics are geotextiles and geomembranes . While geotextile is a permeable fabric ,geomembrene is an impermeable one. One example of geosynthetics is Geocell. Now geocell is widely poplar and used .

Geocell:- It is a 3D structure of cellular confinement system than any other planer geosynthetics reinforcement. Hence geocell can provide better lateral confinement to in fill soils. The reinforced composite formed by geocell and the infill soil has a higher stiffness and shear strength than the unreinforced soil. The term geocell have two part first is “geo” means soil or earth where as “cell” which means cellular types of shape foe infill material such as soil. These cells completely encases weak material such as soil, stones etc and provide all round confinement due to its three dimensional structure thus preventing the lateral spreading of the material due to which a much stiffer mat like structure formed and distributed the overcoming load to a much wider area.

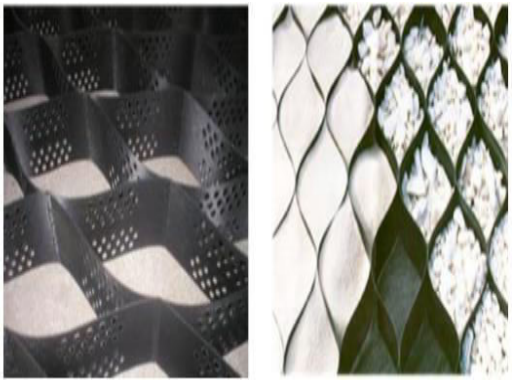

Fig-3 . Geocell closely spaced

Applications of soil reinforcement:-

1.Slope failure repairs:- Soil reinforcement is used in repairs of large and small landslides and failure of natural slopes. Geogrid or geocell allows using the same soil of the landslide to reinstate the slope thus achieving fundamental saving over the solutions of importing a soil with better mechanical characteristics.

2. Slope cutting repairs:-The installations of pipelines and other underground structure often requires cutting a slope in protected or valuable area where the authority imposes to repair the cutting to the original situations.

3.Steep slope embankments and bunds:- There are many situations where the shortage of space or fill material calls for the constructions of embankments and bunds with very steep slopes, greatly in excess of the naturally stable angle. Geogrid reinforced soil structure provided a safe ,sound and economical solutions.

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4.Bridge abutments and wing walls:- Bridge abutments and wing wall are often earth retaining structure that support the highest loads. Besides the high vertical and horizontal loads from heavy traffic and sometimes seismic loads, challenge the design.

5. Major Building constrictions:- If the soil present in constriction site is too much week. Then constriction of major building on that site to be risky .For that consideration ground improvement is must needed .So Soil reinforced can do in foundations and increase the bearing capacity of the soil.

Test result:- for testing the soil we used proposed **National institute oftechnology ,Andhra Pradesh campus**. The available red cotton soil has following properties:-

1.% of retained 75 micron- 99.345%

2.Liquid limit of soil- nil

3.Plastic limit of soil-26.305%

4.Specific gravity-2.18

5.Maximum dry density of soil-1.738 g/cc

From the above properties of soil, the soil is classified according to Indian standard of soil classification system (ISSCS) is poorly graded sand(SP).And from the Unconfined compressive test and shear box test of the soil we got very less shear strength parameter of that soil. So bearing capacity of this soil is less.

Comments: - Since bearing capacity of the available reddish brown soil is very week ,so we need to improve the ground properties of the soil for purposed building construction.For that consideration we suggest Geocell soil reinforcement. Because when compare Geocell reinforced base with unreinforced base then it is experimentally proved that geocell reinforced provided more lateral and vertical confinement. The confinement effect of geocell improves the shear strength of the granular soil. And it is also influenced by many other factors like shape(circular, rectangular and hexagonal cross sections), size and number of cells. The effect of the variables on the compression strength of the sample as well as the strain stress behaviour. It has been found that apparent cohesion of reinforced sample vary with size ,shape and number of cell. And also the number of cell is most significant factor. Among the cells of all shapes the circular cell induces the highest apparent cohesion. So using circular shape as well as less size ratio of geocell is better option improving the load bearing capacity of the above soil .

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