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Theoretical Behaviourof Soil Stability Using Geo Grids.

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ABSTRACT
The subgrade of any pavement plays an important role in load bearing and support of traffic in the form of foundation. The present scenario describes that use of geogrid is used to stabilize a soft soil of highway subgrade so that a firm working platform could be provided for pavement construction.It is found that geo-grids placed at 3/5 the distance from the base shows higher CBR value than when placed at 2/5 and 4/5 distances from the base.The first objective of the study is to be the evaluation of the soil properties like particle size, liquid limit, plastic limit, plasticity index to identify as a soft soil. Second objective of the study is to, improve the bearing capacity of soft soil by using flyash, lime, lime/flyash as a admixture and geogrids as a reinforcement. California Baring Ratio (CBR) and Unconfined Compression (UCC) tests were conducted in the laboratory on the soil.

Keywords: *Geogrid, CBR, geogrid, subgrade,UCC, SoilStability, Bearing Capacity.*

I. INTRODUCTION

Geogrids are the most popular type of geosynthetics used in the road construction industry for mechanical stabilisation and reinforcement purposes. Geogrids are commonly used over weak subgrade soils to provide a working platform for construction equipment. Laterite, soil layer that is rich in iron oxide and derived from a wide variety of rocks weathering under strongly oxidizing and leaching conditions. It forms in tropical and subtropical regions where the climate is humid. Lateritic soils may contain clay minerals; but they tend to be silica-poor, for silica is leached out by waters passing through the soil Ismeik, 1997). Geogrids can perform as tensile reinforcement for aggregate base courses inflexible or asphalt pavements. Adding a geogrid layer can mechanically stabilize aggregate particles and develop along alternate, higher shear strength surfaces. Through the interlock between the geogridsand aggregate, geogrids are assumed to have higher friction and confining stresses than the smoother surfaced geotextiles.The quality of the sub-grade soil used in pavement applications is classified into five types (soft, medium, stiff, very stiff and hard sub-grade) depending on unconfined compressive strength values. The sub-grades having CBR values of (0-3%) are very poor and poor to fair (3-7%). Sub-grades having Unconfined Compressive Strength (UCS) values (25 – 100 KN/m2) are soft and medium. These types are considered as unstable sub-grades and need to be stabilised especially in terms of pavement applications. The load coming on the road crust istransferred to the underlying soil. If the soil supporting theroad crust is weaker, the crust thickness of road increases,which leads to the more cost of construction and most likelyroad pavement failures in the nearest future, but with theapplication of geogrids, it helpsto reduce cost of transportingearth materials from a borrow pit, rather the initial earthmaterials available on the construction site is used for the roadpavement.

II. BEHAVIOUR OF STUDY MATERIAL

Geogrid
Functions:
Primary -Reinforcement
Secondary -Separation
Properties:
Survivability , Aperture opening size .
Soil

Lateritic soils usually have relatively high to very high cohesion and internal friction angle Decreasing moisture content usually causes an increase both in cohesion and internal friction angle .This behavior is attributed to the variation in soil structure with varying moisture content, such that, as the soil dries out part of the hydrated colloidal iron and aluminum oxides dehydrates . and forms strong bonds among certain soil grains which, in turn, causes an increase in strength.

Type Of Test Shear Test For Soil : **Direct Sher Test**

The direct shear test is conducted in conformance with ASTM D3080 to measure the friction angle and adhesion at the interface between the subgrade and the aggregate base layer, with and without a geogrid in place. The soil, aggregate and geogrid products of the test specimens are the same as those used in the APT. The geogrids are placed between the upper aggregate box and the lower soil box. The dimensions of both the boxes are 5.1 cm £ 30.5
cm £ 10.2 cm. The base aggregate is remoulded and
compacted to 100% of maximum dry density at optimum moisture content. The subgrade soil for these tests is compacted to 92.5% of maximum dry density at optimum moisture content (10%). Direct shear tests are performed under three different normal pressures: 12, 27 and 36 kN/m2. The selected pressure of 27 kN/m2 is an estimate of the pressure imparted on the pavement subgrade during
the APT based on the applied traffic loading. Shear forces are applied at a constant displacement rate of 0.1 cm/min, slow enough to dissipate soil pore pressure.

Common Test :

Grain Size Analysis :

Grain size analysis or gradation test is a procedure used in the experiment to assess the particle size distribution of preliminary sample .

Atterberg Limit Test:

According to whitlow (1995), liquid limit less 35% indicates low plasticity, between 35% and 50% indicates intermediate plasticity, between 50% and 70% high plasticity and between 70% and 90% very high plasticity and greater than 90% extremely high plasticity.

California Bearing Ratio:

California Bearing Ratio (CBR) test is developed by the California Division of Highway as a method of classifying and evaluating soil-sub grade and base course materials for flexible pavements. CBR test, an empirical test, has been used to determine the material properties for pavement design. Empirical tests measure the strength of the material and are not a true representation of the resilient modulus. It is a penetration test wherein a standard piston, having an area of 3 in^2 (or 50 mm diameter), is used to penetrate the soil at a standard rate of 1.25 mm/minute. The pressure up to a penetration of 12.5 mm and it's ratio to the bearing value of a standard crushed rock is termed as the CBR. In most cases, CBR decreases as the penetration increases.

Plate Bearing Test:

Plate bearing test is used to evaluate the support capability of sub-grades, bases and in some cases, complete pavement. Data from the tests are applicable for the design of both flexible and rigid pavements. In plate bearing test, a compressive stress is applied to the soil or pavement layer through rigid plates relatively large size and the deflections are measured for various stress values. The deflection level is generally limited to a low value, in the order of 1.25 to 5 mm and so the deformation caused may be partly elastic and partly plastic due to compaction of the stressed mass with negligible plastic deformation. The plate-bearing test has been devised to evaluate the supporting power of sub grades or any other pavement layer by using plates of larger diameter. The plate-bearing test was originally meant to find the modulus of sub grade reaction in the Westergaard's analysis for wheel load stresses in cement concrete pavements.The modulus of subgrade reaction is calculated from the relation.

$$K = \frac{P}{0.125} kg/cm^2/cm.$$

Pull Off Test:

The pull-off is a near-to-surface method in which a circular steel disc is glued to the surface of the concrete with an epoxy or polyester resin. The force required to pull this disc out from the surface, together with an attached layer of concrete, is measured. Simple mechanical hand-operated loading equipment has been developed for this purpose. Partial coring may be used, if necessary, to eliminate surface skin effects.

III. DISCUSSION

The objective of this study addresses the evaluation of geogrids for weak subgrade stabilization. Interfacing soil with a geogrid material increases the penetration resistance and hence the CBR strength. Therefore the performance of a subgrade material in a
pavement system is better with the inclusion of a geogrid. Base course thickness reduction as a result of geogrid reinforcement for a subgrade soil tends to
decrease with increasing traffic volume.Geogrids have a good potential to reduce the cost of pavement layers if weak subgrades are encountered on the alignment. On low volume paved roads, designers should consider the installation of geogrids to improve the California Bearing Ratio, reduce layer thicknesses and increase structural number of
pavements. It is seen that both the strength and stiffness of the pavement system can be improved by the use of geogrids

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