Stabilization of Pavement using Geogrid

Survey on Soil Reinforcement

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***Abstract*— Geogrid reinforcement is a method used in permanent paved roadways in two major application areas.They are: base reinforcement and subgrade stabilization. The strength and life of pavement is greatly affect the type of sub-grade, sub base and base course materials.But in India most of the flexible pavements are mainly constructed over weak andproblematic sub-grade. In base reinforcement, the geogrids are placed at the bottom of unbound layers of a flexible pavement system and improve the load-carrying capacity of the pavement under repeated traffic. In subgrade stabilization applications, the geogrid is used to build construction platform over weak subgrades to carry equipment and facilitate the construction of the pavement system without over deformations of the subgrade**.If **the California bearing ratio(CBR) of these sub-grade are very low, it leads to more thickness of pavement.**

Keywords*— *CBR, Geogrid

I. INTRODUCTION

Properties of subgrade are compressive and shear strength. Sub -grade soils vary considerably, the relationship of density ,texture ,moisture content of sub-grade is highly complex. are sub –base ,sub-grade, base course and hearing course effect of geo-grid on maximum dry density optimum moisture content and Californian Bearing Ratio of sub-grade soils.,

Also reinforced soils are often treated as composite materials in with reinforcement resisting tensile stress and interacting with soil through friction. There is lot of experience with geo-grid reinforcement of subgrade soils, many pavement failures still happen.Hence laboratory tests are required to study strength characteristics of both reinforced and unreinforced sub-grade soils.This project work describes the effects of reinforcing the sub-grade layer with a one layer of geo-grid at different positions and thereby determination of optimum position of reinforcement layer. The optimum position is determined based on CBR value. and unconfined compression tests were conducted to decide the optimum position of geo -grid. Soil reinforcement is a highly attractive alternative for pavement construction.

A.Scope And Objectives Of The Study

This paper investigates the effects of placing geogrids in thin layers of granular material within marine clay soil. Many researches were done to determine the effect of using geogrids in different types of soil. So we can concluded that use of this type of reinforcement will increasing the bearing capacity and reducing the settlement compared to the unreinforced soil. Hence, the ultimate bearing capacity of the reinforced soil would be increased but the initial settlement at small loads still will not be avoided. This is important in geo technique as the design of foundation systems are usually controlled by limiting the settlements,

The interaction between the geogrid and soil is very complex. Kerala is experiencing sudden failures in the behaviour of pavements, erosion structures, embankments, hydraulic structures etc. The failures are usually due to the heavy rains in the state and left as such the basic defects in the public works scenario is not usually discussed.

It is to be accepted that the State is experiencing torrential rains during the monsoons and the monsoons are spread for a major portion of the year. The design approach on the public utilities like pavements, coastal protections etc is to be in considering with this context and the required paradigm shift has to be applied. The behaviour of the natural soil is subject to serious behavior problems under various hydraulic situations. Adequate filter media separating the natural bed and the structure for preventing behaviour of the soil bed affecting the structure is to be used. The failure of conventional filters in use has been identified as the cause for the total failure in many soils and the modern materials like geo-grids has to be experimented and evaluated for Kerala conditions.

II. METHODOLOGY

Firstly different tests were done on marine clay. The different tests were vane shear test, unconfined compression test, permeability test, specific gravity test, standard proctor test. Intial properties of soils were determined from various tests. As a second phase again soil is tested. CBR is done on soil. Results are noted. Then the soil is reinforced with geogrid. Again CBR is done by placing geogrids on layers of soil. Graphs are plotted and CBR values are obtained.The strength of marine clay before and after placing geogrids were determined from the test.

III. GEOGRID PROPERTIES

A. Physical Properties

Many of the physical properties of geogrids including the type of structure, rib dimensions ,junction type, aperture size and thickness can be measured directly. Other

properties are mass per unit area which varies over a range from 200 to 1000g/m^2 and percent open are varies from 40-90%.

B. Density or specific gravity of a geogrid depends upon the polymer from which it is made. Homogenous geogrids are made from HDPE or PP.

C. Shear strength

One type of performance test that is used regularly on geogrids is an adapted from of a conventional geotechnical engineering direct shear test.The geogrid is fixed to a block and is forced to side over stationary soil in a shear box while being subject to normal test. This process is repeated sufficiently often to develop a set of shear strength v/s normal stress points

IV. TESTS DONE

A. Specific Gravity Test

The specific gravity of soil particle is the ratio of the weight in air of a given volume of dry soil particle to the weight in air of an equal volume of distilled water or it is the ratio of unit weight of solid soils to that of water. Specific gravity of soil is used in determining the void ratio, porosity, degree of saturation, etc.

B. Permeability Test

The property of soil which permits the flow of water through the pores of soil is known as permeability. According to Darcy's law the rate of flow of water (q) in the saturated soil mass under the hydraulic gradient i and through a cross sectional area A is given as q= kiA

The permeability is one of the most important engineering properties of soils. The quantity of seeping water through and beneath an earthen dam and banks of canal depend upon the permeability of soil used for construction of these structure.The permeability of soil is found to be 2.0296x10^{-6}

C. Vane Shear Test

Vane shear is a quick test, used in the laboratory or in the field, to determine the undrained shear strength of cohesive soil.The shear strength of soil is found to be 3.410kN/m^2

D. California Bearing Ratio

CBR tests was conducted on marine clay. The test was conducted both by unreinforced and reinforced with a single layer of geo-grid. The sample reinforced with geo-grid by placing in a single layer at different positions. That is 20%, 40%, 60% and 80% of the specimen height. It was cut in circular shape of diameter slightly less than that of the specimen to avoid separation in the specimen by the reinforcing layer. The dry weight required for filling the mould was calculated by finding maximum dry density (MDD) and corresponding optimum moisture content. This was achieved from standard proctor test. The load penetration curve was drawn for the soil samples with geo-grid and the CBR values were calculated from these graphs. In case of unreinforced soil the value of CBR is 2.9% and with geo-grid reinforcement the value of CBR is 9.4%. The highest increase in the CBR value was achieved when geo-grid was placed at 20% depth from the top of the specimen.

V. GEOGRIDS IN ROADWAYS AND PAVEMENTS

Geogrid provide significant improvement in pavement construction and performance. Figure 1 illustrates a number of potential geogrid applications in a layered pavement system to improve its performance. The reinforcement applications shown in Figure 1 can be provided by geogrids. These applications include subgrade stabilization, base reinforcement and asphalt reinforcement. Subgrade stabilization refers to situations where geogrid are placed on weak subgrade prior to the placement of an aggregate layer.

Fig.1 Aperture and ribs of geogrid

Fig. 2. Placing geogrids in pavements

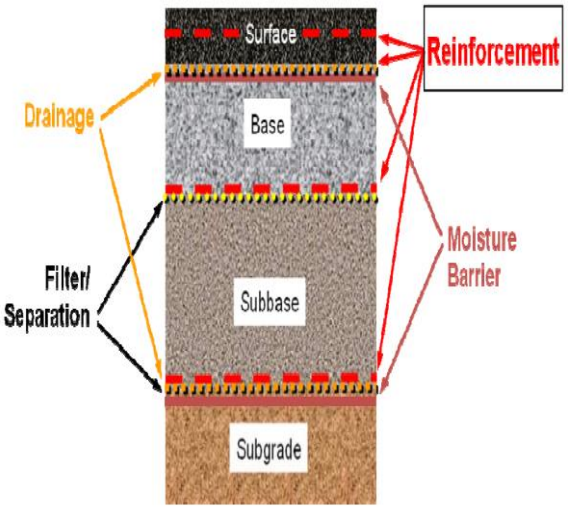

Fig.3 Potential applications of geogrids in a layered pavement system.

Fig.4. CBR Test Apparatus

VI. CONCLUSION

Geogrid reinforcement has increase significantly the bearing capacity of soils. However, allowable settlements, and not ultimate bearing capacity, generally dictate the design of spread foundations on cohesionless soils.

The CBR of marine clay increases by 50-100% when it is reinforced with a single layer of geo-grid. The amount of improvement of strength depends upon the type of soil and position of geo-grid.

VII. ACKNOWLEDGMENT

The kind co-operation and technical support provided by the Faculties of Civil Engineering at Christ Knowledge city is gratefully acknowledged.

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