Analysis of Geogrid Reinforced Road Embankment using PLAXIS 2D

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***Abstract*: Geogrids are increasingly used as reinforcement in road embankments in soft soils. The aim of this study is to determine the optimum strength of embankment with or without geogrid and the placement of multilayer geogrid for least deformation, taking into account the permissible displacement and load. It was carried out with the finite element method using PLAXIS 2D. In this study, three types of sequential modeling were carried out: first, the stability of the road embankment without reinforcement was analyzed; secondly, the stability of the model-reinforced embankment with different tensile strength of the geogrid and In last, we calculated the allowable load on embankment after placement of multilayer geogrid for least deformation in embankment was examined.**

***Keywords:* road embankment; PLAXIS 2D, geogrid; tensile strength, optimum spacing, multilayer.**

1. Introduction

In recent years, due to the increasing volume of road traffic in India, many road embankments are being built on soft ground. In this situation, geotechnical engineers face a common problem such as large deformation and instability. Geogrids are increasingly used as reinforcement in road embankments on soft soils. Use of geogrid as reinforcement in soft soils reduces the amount of deformation. It provides more strength and stability to the road embankment.

According to IRC 113: 2013, geogrid is a permeable geosynthetic material composed only of textiles. The design of embankment reinforced with geogrid must have sufficient safety and displacement margin. There are some studies on the use of geogrid reinforcement in soft soils. **Kasim et al.** ... Use different geogrid as soil reinforcement to determine the safe height of the embankment in soft soil. **Siavoshnia et al**. The influence of the number of geogrid layers, the stiffness of the geogrid and the effective length of the geogrid was checked. **Vashi et al.** studied the horizontal and vertical stress, horizontal and shear displacement on the embankment foundation reinforced with geogrid in the embankment.

The aim of this research is to determine the sufficient strength and load capacity of embankment with or without geogrid , while considering the allowable load and displacement factor. The stability of the embankment is calculated PLAXIS version 8.2 a finite element method.

2. Geometry Model

A 6 m high embankment with slopes as 2.5H: 1V as presented in Figure 1. Was with a UDL of 70KN/m examined. Multiple layer of bonded geogrid at interval of 2m is placed between the embankment. The tensile strength of geogrid reinforcement was varied from 20KN/m to 50KN/m and analysis of various construction phases is carried out.

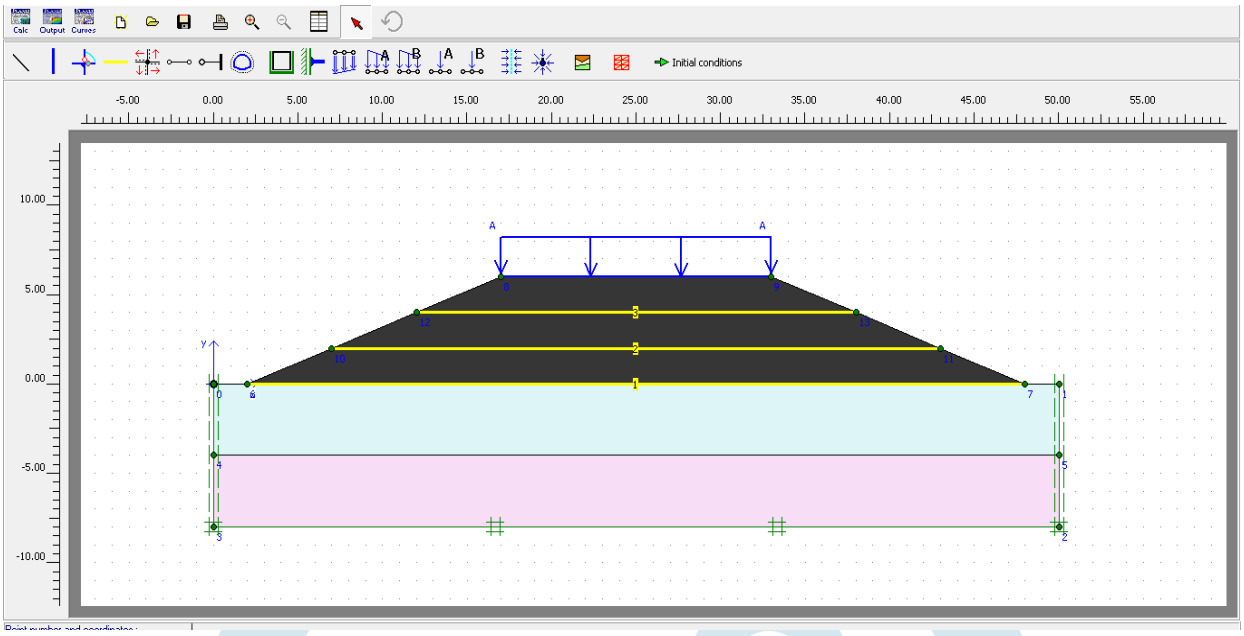


Figure 1 Geometry Model

3. Method of Analysis

In order to determine the optimum strength of the embankment, a UDL of 70 KN/m which is general load on embankment were applied and the tensile strength of the geogrid reinforcement is varied from 20KN/m to 50KN/m. The stability analysis of the road embankment was carried out using the finite element method with PLAXIS 2D. The Mohr Coulomb model was used as the first simple analysis of the problem under consideration. The analysis for the embankment and the sand blanket was modeled as a drained condition, while the clay soil was modeled as an undrained condition for the entire foundation. Two types of sequential modeling were performed in this study. The stability of the road embankment was examined with or without reinforcement. The second model should determine, the stability of the model-reinforced embankment with different set of tensile strength of geogrid were examined and in last the load carrying capacity were analysed at different cases.

4. Result and Discussion

The geogrid-reinforced embankment design is carried out by sequential determination of the modified reinforcement safety factor table shows the deformation pattern for embankments reinforced with or without geogrid. The result of the analysis of a geogrid-reinforced embankment with PLAXIS 2D taking into account the various phases construction which shows settlement along the embankment base is summarized in Table.1and the maximum load carrying capacity of embankment with or without geogrid reinforcement is shown in Table.2.

SETTLEMENT ANALYSIS (LOAD =70KN/M)

CASE	T.S.=20KN/M	T.S.=50KN/M
ALL LAYER + LOAD	99.8mm	80.26mm
BOTTOM 2 LAYER+LOAD	101.5mm	80.60mm
BASE LAYER+LOAD	104mm	82.60mm
NO LAYER + NO LOAD	30.75mm	30.75mm

. Table 1

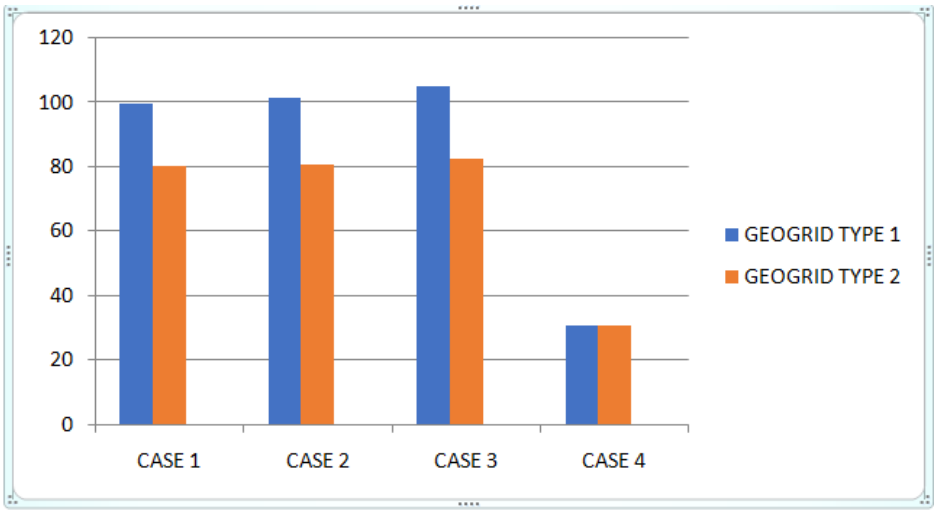
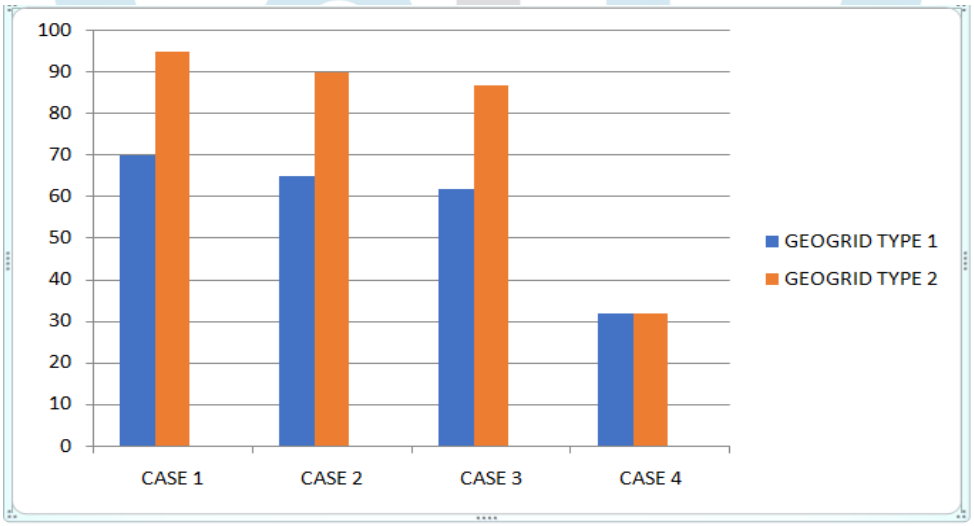


Fig. 1

LOAD ANALYSIS (MAX. ALLOWABLE SETTLEMENT=100MM)

CASE	T.S.=20KN/M	T.S.=50KN/M
ALL LAYER	70KN/M	95KN/M
BOTTOM 2 LAYER	65KN/M	90KN/M
BASE LAYER	62KN/M	87KN/M
NO LAYER	32KN/M	32KN/M

Table 2



Fig,2

Conclusion

In this study, On increasing Tensile strength and axial stiffness of the geogrid layer embankment displacement has decreased.On application of Geogrid Layer, Load carrying capacity of embankment increases significantly upto 95KN/m.Therefore it can be concluded that the geogrid reinforcement was strongly influenced the bearing capacity of Embankment.

The settlement was analyzed along the embankment base to obtain the maximum allowable strength of the geogrid reinforced embankment. Geogrid increased the load carrying capacity along the base of the embankment. The effect of using the geogrid could be helpful in areas where soil having low bearing capacity

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