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BEHAVIOR OF UNREINFORCED SOIL SLOPE UNDER STATIC LOADING

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ABSTRACT

Slope stability is considered as one of the most important sector which should be addressed properly in the area of Geo-technical engineering. This paper investigates and discusses the stability of unreinforced soil mass with different slope angles. It presents the results of 45° and 60° unreinforced soil slopes subjected to static loading. The equipment used for testing and procedures used for this investigation are outlined. The results show that the unreinforced soil slopes with 45° slope angle are more stable and carry more load as compared to unreinforced soil slope with slope angle 60°. In general, the results demonstrate that the unreinforced soil slopes with lower slope angle have more stability and load carrying capacity therefore for construction works on unreinforced soil masses; higher slope angles must be avoided.

Keywords*: stability; unreinforced soil; slope angle; loading.*

1. INTRODUCTION

The focus of this paper is on studying the impact of slope angle on the stability of unreinforced soil slope. Therefore no reinforcement materials were used in this study. Two soil slopes of 45o and 60o were constructed in metal box and various loads were applied on them. In the many conditions it has been seen that the increasing amount of load comes on to soil slope. In such situations Geo-technical engineers face some common problem like large settlement and slope instability. Therefore from this study the difference between the stability of 45o and 60o soil slope were recorded and the findings of this study will be useful for the future research by helping to determine the safe slope angle and safe slope height for any Embankment or construction where reinforcement cannot be used.

1.1 Aim

- To determine the stability of unreinforced soil slope under static loading.

1.2 Objective

The principal objectives of the project are:

- To Study the effect of Slope inclination on stability of soil.
- To study the effect of height of slope on soil stability

2. MODELLING AND TESTING

2.1 Universal Testing Machine :

Instrument Servo hydraulic Universal Testing Machine (UTM) with a load frame capacity of 2000 KN is used to apply an increasing surcharge load on the crest ofsoil slopes. The loads are applied at the rate of 10 N/s continuously as surcharge load.

2.2 Metal Box :

A box of dimension 50 cm x 22 cmx 35 cm is fabricated by using perspex sheets of 4mm. thickness as shown in Figure 1. The dimensions of metal box are determined by the maximum horizontal and vertical test space available in the UTM. Perspex sheets are transparent sheets used to observe the failure pattern ofthe slopes.

2.3 Backfill Material:

The backfill material used for the slopes is collected from Nagpur, Maharashtra. Preliminary tests for soil identification are carried out in the laboratory to determine its backfill properties. The properties of the backfill material used are given in the table 1.

Table 1: Properties of the material used.

Sr. No.	Property	Result	IS Code Reference
1	Material	Sand	-
2	Grain Size Distribution	Well graded soil	IS 13468:1985
3	Moisture Content	21%	IS 2720:1970
4	Specific Gravity	2.5	IS 2720:1970
5	Field Density	1410 Kg/m^3	IS 13468:1992
6	Angle of Friction	30^0	IS 2720 : 1970

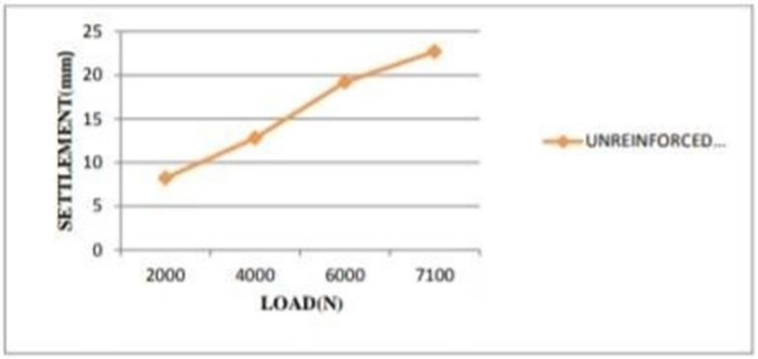
3. PREPARATION OF UNREINFORCED AND REINFORCED SOIL SLOPES

- Well graded soil is used to prepare predetermined slopes at slope angles of 45o and 60o respectively by adding 5% water to the soil.
- The slope is prepared in layers of thickness 50 mm each.
- A soil layer of 50 mm thickness is made as the base layer completely along the length of model.
- The layer is formed by placing given soil in a metal box and lightly compacting it after every 20 mm.
- For identification of failure pattern of the slopes a fine layer of Gulal (Red dye) is used in between the layers.
- The procedure is repeated till a complete height of 300 mm is achieved.
- For all the slope angles, a crest width of 150 mm and the base width of 500 mm is maintained.

FOR 60^0 UNREINFORCED SLOPE:

Table 6.5: Values of load and settlement for 60^0 unreinforced slope

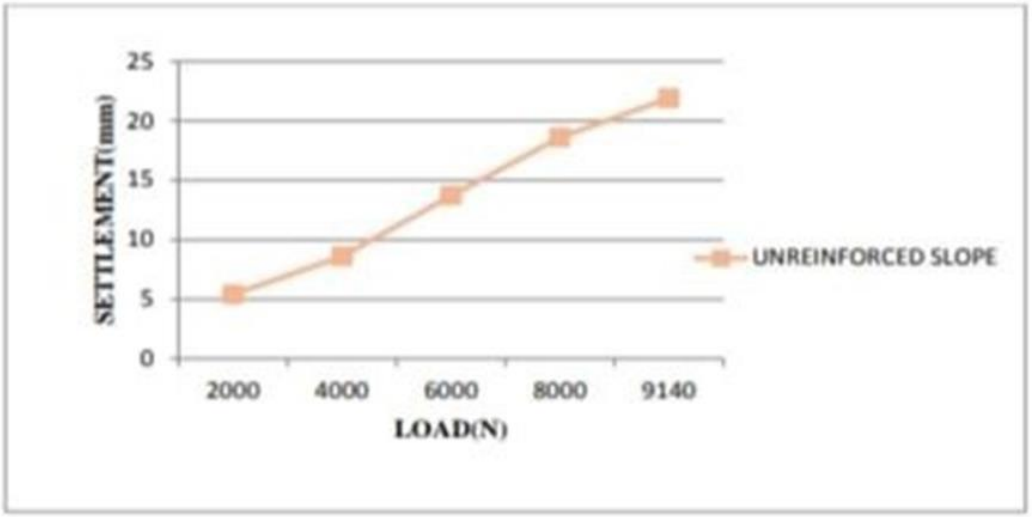
LOAD(N)	2000	4000	6000	7100
SETTLEMENT(mm)	8.2	12.8	19.2	22.7



FOR 45^0 UNREINFORCED SLOPE:

Table 6.1: Values of load and settlement for 45^0 unreinforced slope

LOAD(N)	2000	4000	6000	8000	9140
SETTLEMENT(MM)	5.4	8.6	13.7	18.6	21.9



4. CONCLUSION AND RESULT

- It is observed from the result's that the unreinforced soil slope at first have a settlement of the crest which then leads to the failure of the slope.
- It is observed that the maximum load is carried by 45° than 60° slope angle.
- It can be concluded that unreinforced soil slope with different slope angles leads to a certain increase or decrease in load carrying capacity and stability of soil slope.
- The preparation of soil reinforcement within the soil slope also affects the Overall stability of soil slope with the considerable decrease in the final Settlement of the crest.
- It can be summarized that 45° slope angle is best slope angle in this project as compared to 60°.
- Bearing capacity of the soil slope is found to be decreased with an increase in slope angle for both unreinforced soil slope.

5. FUTURE SCOPE

- Relatable work can be carried out with different densities of soil.
- Similar work can be carried out with different thickness of the Reinforcements used.
- The slope angles for variable reinforcements can be changed.
- Plastic pins can be used as reinforcements for stability of slope.
- Bamboo grids can be used as reinforcements for slope stability.
- Analytical studies such as moment reduction method, limit equilibrium method along with the experimental study can also be carried out.
- Software's such as Plaxis program etc. can also be used for accurate results In comparison with experimental and analytical studies.

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