TWO-DIMENSIONAL SLOPE STABILITY ANALYSIS WITH VARYING SLOPE ANGLE AND SLOPE HEIGHT BY PLAXIS-2D

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Abstract: ***Stability of Slope is one of the most important sector which should be addressed properly in the area of Geo-technical engineering. The main purpose of this study to determine the Factor of safety and the Displacement vertical as well as horizontal for the given angle of slope of the soil. The stability analysis of the slope has been done here by Finite Element Method using PLAXIS-2D. In this study different types of sequence modelling were conducted here. Every sequence of the model was to investigate for the stability analysis purpose with various slope angle with variable slope height were taken into account. The results of this study showed the different value of Factor of safety for different sequence and comparative study with the displacement. In this paper the value of cohesion and internal friction are taken constant and results compared here for soil with varying slope but for constant two dimensional model.***

Index Terms: Finite element method, Factor of safety, Drained condition, Displacements

I)INTRODUCTION:

The focus of this paper is on Numerical Modelling using measurement from a series of set up of systematically sequence set of soil slope and monitored for Finite Element programme by PLAXIS-2D version 8.2 was used here to predict the performance of the slope. Here in this study no inclusion of any kind of soil reinforcement considered. In the recent years it has been seen that as the increasing amount of load comes on to soil slope. In this situation Geo-technical engineers are faced some common problem like large settlement and slope instability. For the future research purpose the content of this paper will help to determine the safe slope angle and safe slope height for any Embankment or construction of any Reinforced earth wall. The purpose of this study is to determine the Factor of safety for allowable displacement by stability analysis which has been done by Finite Element method using PLAXIS -2D version 8.2.

II)GEOMETRY OF MODEL FOR HOMOGENEOUS SOIL:

Firstly, a homogeneous soil with 25m height, and width =50m and Slope Height=7m,12m,17m respectively as presented in the below figure, was investigated in this study. Here the water level was at same level or taken as constant for all variable soil slope. The fill and entire soil material were modeled as Mohr-coulomb.

GENERAL PARAMETERS	
Material set	Common for all variable sets
Material model	Mohr's-Coulomb model
Material type	Drained condition

The below table states the summarize soil properties used in this PLAXIS-2D modelling where the Cohesive strength(C), the angle of Internal friction (φ), the density, permeability co-efficient, Elastic modulus, Poisson's ratio which are stated as Stiffness Factors of soil property and along with the other parameters are kept constant for all variable data set respectively in all stages of these analysis.

SOIL PARAMETERS	
PARAMETER	**VALUE**
γ_{unsat}	**18KN/m^3**
γ_{sat}	**20KN/m^3**
K_y	**0.0001m/day**
K_x	**0.0001m/day**
E_{ref}	**50,000 KN/m^2**
C_{ref}	**10 KN/m^2**
φ	**35 degree**

III)METHOD OF ANALYSIS:

The Stability analysis of soil slope has been done by Finite Element method using PLAXIS-2D. The Mohr-Coulomb model was used as the analysis of the problem considered. Here different slope height and slope angle and the combination of both considered here where we got the Displacement and Factor of safety and the relation between these two important factors for all variable data set.

IV)VARIABLE INPUTS PROVIDED HERE:

GEOMETRIC DIMENSIONS: FOR SET-2: Top:25m, Right=50m, Slope Height=7m

DATA	SLOPE ANGLE	SLOPE HEIGHT
SET-1.1	25 degree	7 METRE
SET-1.2	30 degree	
SET-1.3	38 degree	
SET-1.4	42 degree	

GEOMETRIC DIMENSIONS: FOR SET-2: Top:25m, Right=50m, Slope Height=12m

DATA	SLOPE ANGLE	SLOPE HEIGHT
SET-2.1	25 degree	12 METRE
SET-2.2	30 degree	
SET-2.3	38 degree	
SET-2.4	42 degree	

GEOMETRIC DIMENSIONS: FOR SET-3: Top:25m, Right=50m, Slope Height=17m

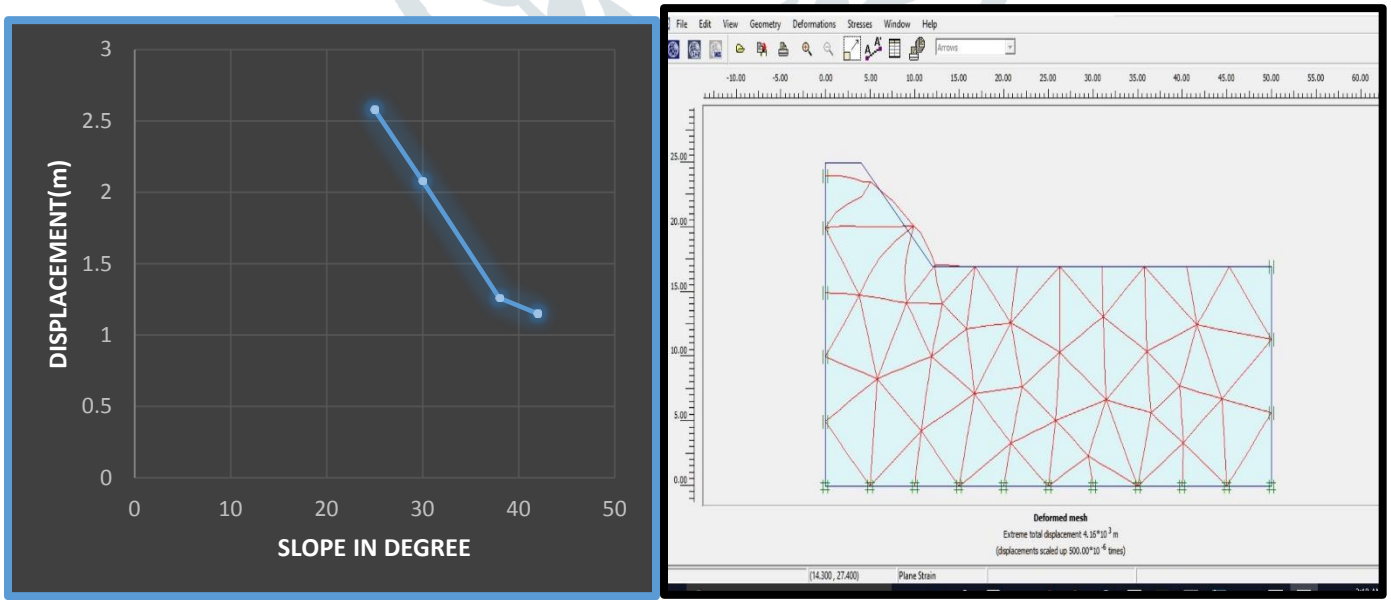
DATA	SLOPE ANGLE	SLOPE HEIGHT
SET-3.1	25 degree	17 METRE
SET-3.2	30 degree	
SET-3.3	38 degree	
SET-3.4	42 degree	

V) COMPARATIVE RESULTS OF OUTPUT FROM DIFFERENT DATA SET:

Here for set-1 this table shows the comparative output for slope height of 7m and for slope angle (25,30,38,42) degree respectively.

PARAMETERS	SET1.1	SET1.2	SET1.3	SET1.4
1.EXTREME TOTAL DISPLACEMENT	2.58m	2.08m	1.26m	1.15m
2.FACTOR OF SAFETY	1.91	1.684	1.512	1.317

[RESULTS PLOTS IN GRAPH SLOPE vs DISPLACEMENT] ***[FIGURE-1]***

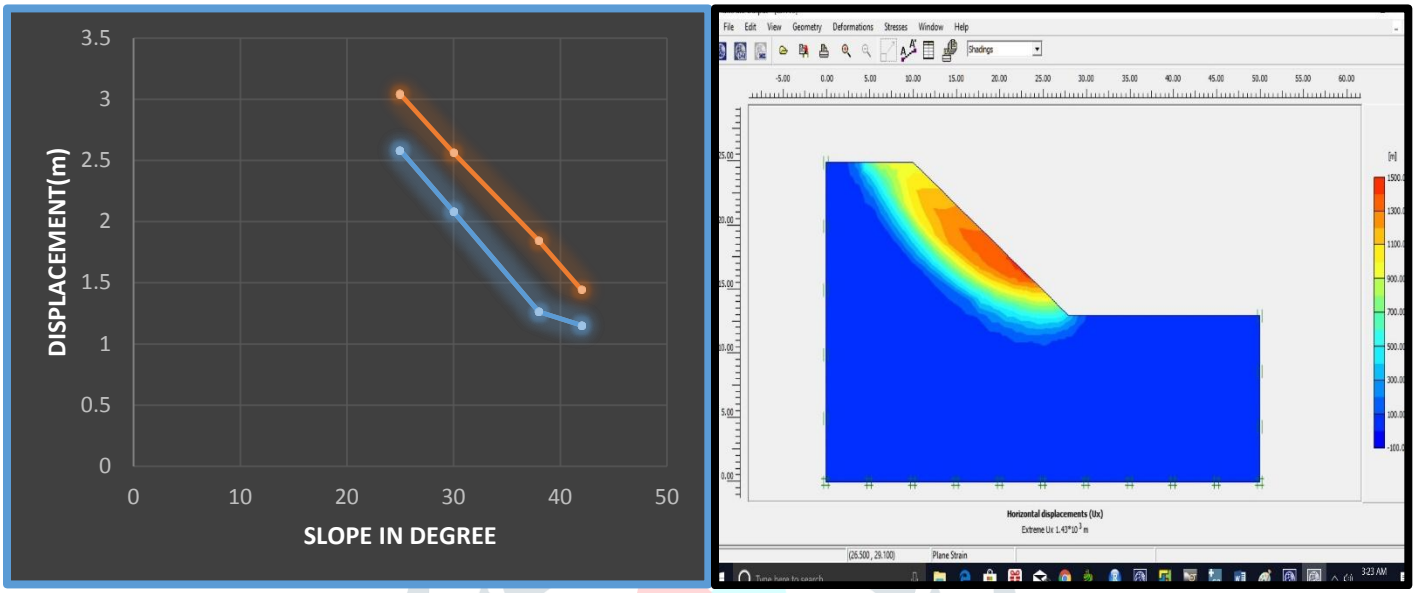


[The above (FIGURE-1) shown the amount of Displacement of soil slope of 30 degrees with slope height of 7m.]

Here for set-2 this table shows the comparative output for slope height of 12m and for slope angle (25,30,38,42) degree respectively.

PARAMETERS	SET2.1	SET2.2	SET2.3	SET2.4
1.EXTREME TOTAL DISPLACEMENT	3.04m	2.57m	1.84m	1.44m
2.FACTOR OF SAFETY	1.790	1.603	1.400	1.292

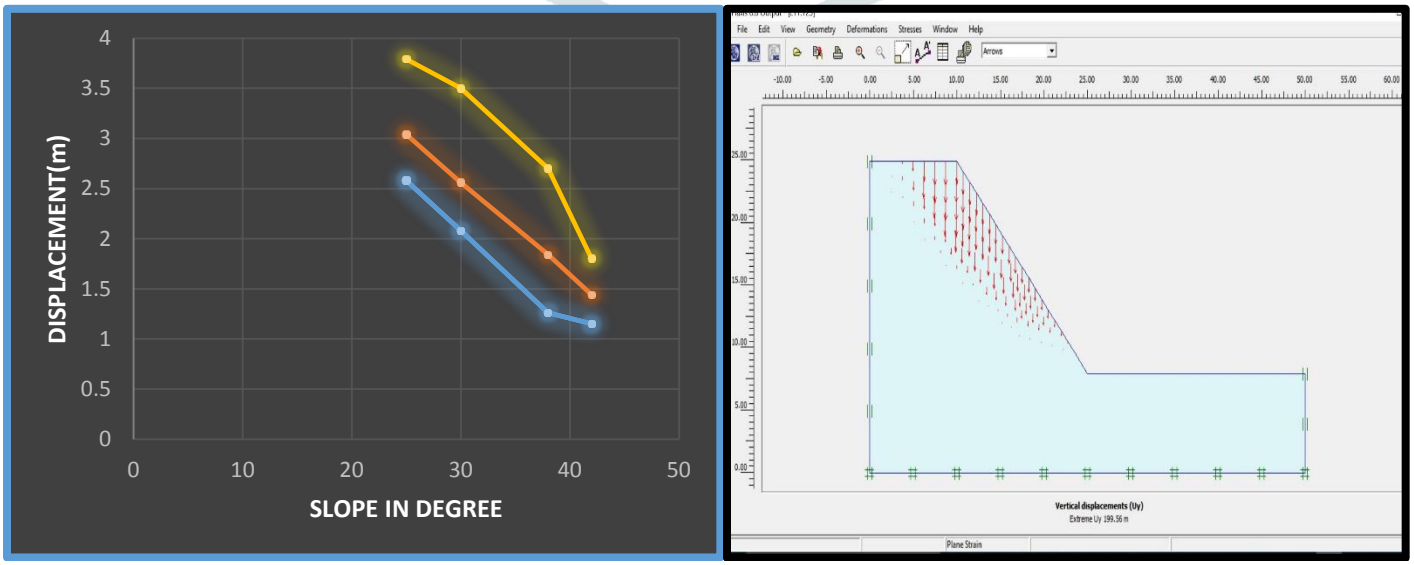
[RESULTS PLOTS IN GRAPH SLOPE vs DISPLACEMENT] *[FIGURE-2]*



[The above (FIGURE-2) shown the amount of Displacement of soil slope of 25 degrees with slope height of 12m.]
Here for set-3 this table shows the comparative output for slope height of 17m and for slope angle (25,30,38,42) degree respectively.

PARAMETERS	SET3.1	SET3.2	SET3.3	SET3.4
1.EXTREME TOTAL DISPLACEMENT	3.79m	3.50m	2.70m	1.80m
2.FACTOR OF SAFETY	1.661	1.514	1.386	1.229

[RESULTS PLOTS IN GRAPH SLOPE vs DISPLACEMENT] *[FIGURE-3]*



[The above (FIGURE-3) shown the amount of Displacement of soil slope of 38degrees with slope height of 17m.]

VI) DISCUSSION AND CONCLUSION:

The Numerical simulation techniques adopted in this paper which is captured the overall behavior of the stability of the soil slope. Later the same can be observed between the field observation and the simulated values. The important simulation consideration in the Finite Element Model analysis is the selection of appropriate parameters. The predicted results were shown to be generally or rather in good agreement with measured settlements, excess pore water pressure and lateral displacements.

The observed and predicted surface or mainly sloped surface settlements are plotted here together with the determined value of Factor of safety for different slope angles. As expected from the predictions from closely followed observed output data, the predicted surface settlements of soil slop from FEM analysis agreed well with the observed data. The computed slope surface the beginning is higher value of Factor of safety and it simultaneously decreased with increase of slope angle and slope height. and in other hand where the Displacement value is greater the value of height of embankment is also greater respectively in general, but in some cases for some particular soil slope these trends or relation between settlement and Factor of safety didn't followed. However, the computed soil slope settlements after 90 days agreed well with the drained behavior and with the actual permeability values as well.

VII) REFERENCES:

[1] Numerical simulations of Geo-grid reinforced light weight geo materials on soft ground area by T. Tanchaisawat, D.T. Bergodo, Y.P. Lai, S. Piyaboon and P. Anujorn.

[2] Analysis of Geo-textile reinforced road embankment using Plaxis-2D by Pravita Sri Wulandari, Daniel Tjandra.