

Determination of Stability of Layered Homogenous Finite Slopes

Pruthviraj Nayak¹, Rajashekhar Malagihal²

¹M.Tech. Student, Department of Civil Engineering Jain College of Engineering, Belagavi, India

²Professor, Department of Civil Engineering Jain College of Engineering, Belagavi, India

Abstract: The slope stability is a very important problem in geotechnical engineering. Slope stability analysis using computers is an easy task for engineers when the slope configuration and the soil parameters are known. However, the selection of the slope stability analysis method is not an easy task and effort should be made to collect the field conditions and the failure observations in order to understand the failure mechanism, which determines the slope stability method that should be used in the analysis. The project "Slope Stability Analysis" Provides analysis soil slopes using Geo Studio 2007 Slope/w software. SLOPE/W has been designed and developed to be a general software tool for the stability analysis of earth structures. In order to undergo the mountainous region project, the most important thing that must be taking care of is the slope stability.

Keywords: Finite element method, Factor of safety, Slope stability, Geo slopes.

1. Introduction

Study of the slope stability is essential to protect the slope against failure and to decrease the likelihood of failure of the slope. This study's determination was to discover the stability of the software Geo Studio 2007 Slope / w. The design and development of SLOPE / W is a general-purpose software tool for the analysis of the stability of the Earth's structure. SLOPE / W can be used to explore a importance retaining wall's stability or to development active ground forces on a wall. The stability of prestressed anchors, soil nails, geotextiles or other materials can be assessed using SLOPE / W. The software will evaluate the data for stability by make known to the data into the software.

In many engineering activities, the stability of the slope must be computed, for example:

- The plan of dams and embankments on earth.
- Study of stability in natural slopes.
- Investigation of the excavation slope's stability.
- Investigation of profound harm to foundations and retention of walls.

A. Types of slopes

1. Natural Slopes
2. Engineered Slopes

B. Types of failures

1. Face failure
2. Toe failure
3. Base failure

C. Types of LEM methods

1. Swedish slip circle method
2. Log-Spiral procedure
3. Ordinary method of slices
4. Bishop method
5. The friction circle procedure
6. Janbu's simplified method

D. Types of FEM methods

- SLOPE/W
- GALENA
- GEO5
- PLAXIS

E. Objectives

1. Using Geo Studio 2007 Slope/w software to study slope stability.
2. To conclude the critical slip surface and factor of safety in two dimensional using geo slopes for many slopes in view of such as coarse grain soil (ϕ soil), fine grain soil (c soil), C- ϕ soil.
3. To discuss the results of above started slopes and practical implementation of the same.

2. About geo slopes

SLOPE / W has appeared on the market in other forms. for any specified situation, slip plane. Thereafter, many hills landslides were evaluated. Recently, slope stability radar technology has been introduced to collect real time confirmation and help define the probability of slope failure, especially in the mining sector. the code was totally reworked as a PC setting when a private computer was available. Processing time can now be developed at a reasonably small fixed computer price and the computer for this hardware setting has been reconfigured. The item was renamed by PC slope and published in 1983, the graphics became evident in the early 1980s. interactions were better than the future, and created a

CAD-like user line, to represent Microsoft windows environment, software is re named slope / w and has a graphical user interface. The first geotechnical item is SLOPE / W stability that can be used to survey slopes.

SLOPE / W is a software product that utilizes the concept of limit equilibrium to calculate the Earth's and rock slopes, safety factor. SLOPE / W's extensive preparation makes studying easy the use of these two variables and various methods. SLOPE / W is suitable for geotechnical, civil engineering and excavating projects assessment and plan.

3. Methodology

The stability of layered homogeneous slope of varying cohesive strength and frictional angle is determined by the geo slope software. In which the Geo slope involves four sub stages they are geo slope input, geo slope calculation, geo slope output, geo slope curve, the generally setting for the starting of program is defined in the previous chapter. Firstly a layered homogeneous soil slope with slope height 20m, top 15m, right 50m (common for all data set). The constant ratios of density, modulus of elasticity, poisson ratio and variable are the same.

The slope with variation of C and Phi values are tabulated in the below tables, the first table show the combination of C and Phi value for slope of inclination 1:2 and similarly the second table shows the combination of C and Phi values for slope of inclination 1:1.5.

4. Steps to be followed

1. Adding the side function for the slopes in order to define the required parameters.

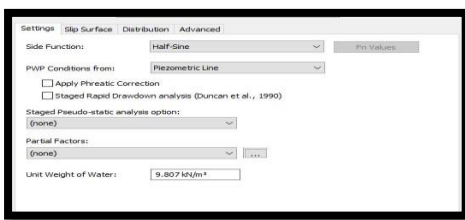


Fig. 1. Adding the side function for the slope in order to define the required parameter

2. Assigning Required Dimensional parameters in x direction as well as also in Y direction.

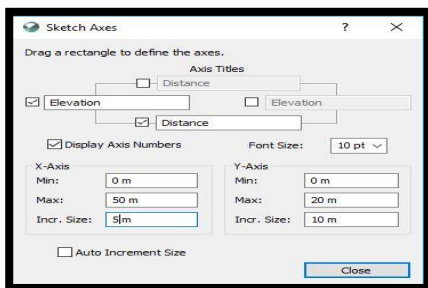


Fig. 2. Assigning required dimensional parameters in x direction as well as also in y direction

3. Creating a slope in ratio of 1:2 considering the preliminary requirements.

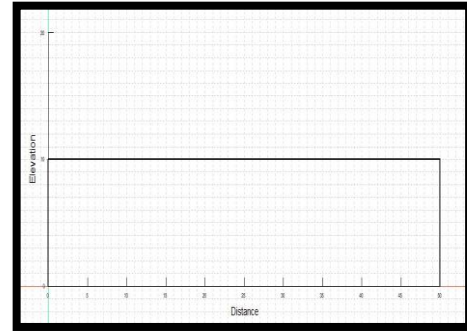


Fig. 3. Creating a slope in ratio of 1:2 considering the preliminary requirements

4. Creating a slope at the continuation to the top row.

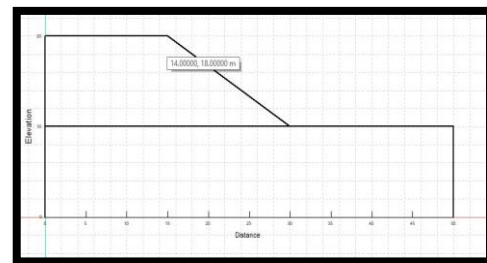


Fig. 4. Creating a slope at the continuation to the top row

5. Creating region for the demanding slopes after assigning the ratio.

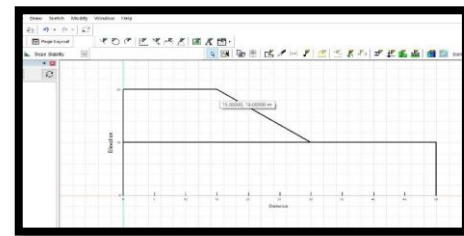


Fig. 5. Creating region for the demanding slopes after assigning the ratio

6. Complete creation of the region for lower and top sections

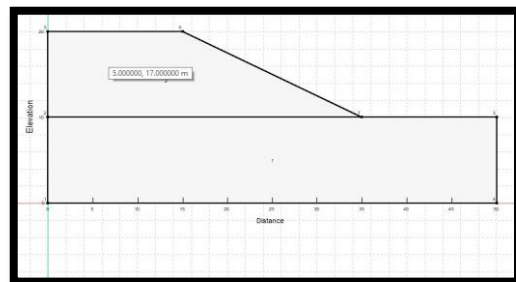


Fig. 6. Complete creation of the region for lower and top sections

7. Defining the materials for the lower slope and upper slope as per material is Mohr coulomb and unit weight 20kn/m2 and cohesion of 10 kpa and phi 10°.

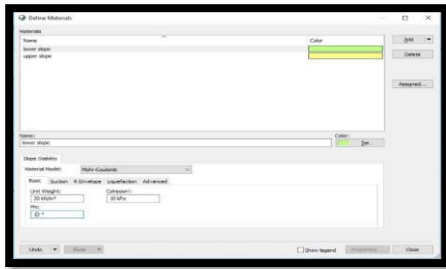


Fig. 7. Defining the materials for the lower slope and upper slope

8. After creating the materials in previous steps, the materials are assigned to top and lower slopes.

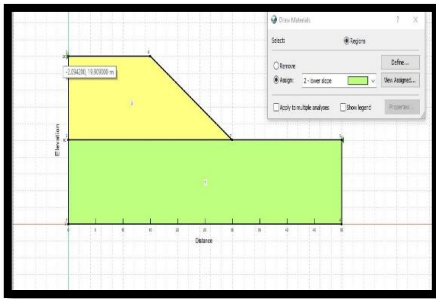


Fig. 8. After creating the materials in previous steps, the materials are assigned to top and lower slopes

9. Defining the required pore water pressure after the assignment of the materials in previous steps.

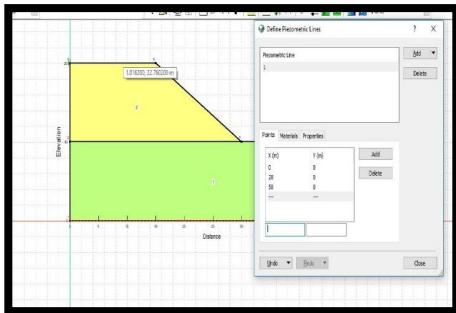


Fig. 9. Defining the required pore water pressure after the assignment of the materials in previous steps

10. Drawing the slip surface from exit to entry at upper slope edge.

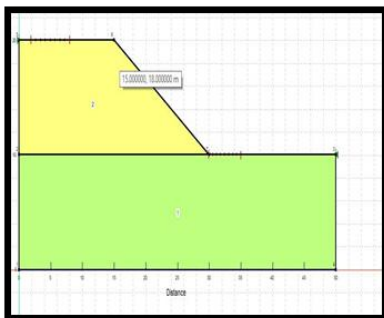


Fig. 10. Drawing the slip surface from exit to entry at upper slope edge

11. Adding the phi parameter is being considered in this step.

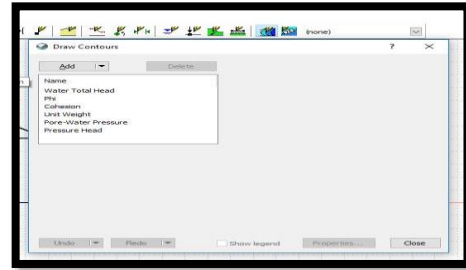


Fig. 11. Adding the phi parameter is being considered in this step

12. Creating and adding the pore water pressure as shown in fig.

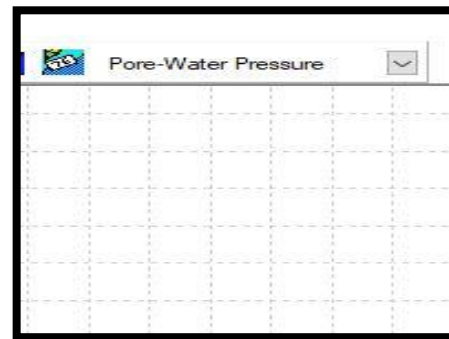


Fig. 12. Creating and adding the pore water pressure

13. Consider and assigning the required Pressure and kind of the slice as per water pressure v/s slice graph.

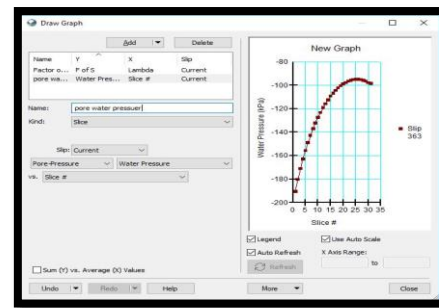


Fig. 13. Consider and assigning the required Pressure and kind of the slice as per water pressure v/s slice graph

14. Viewing the Object Information once done of the preliminary steps.

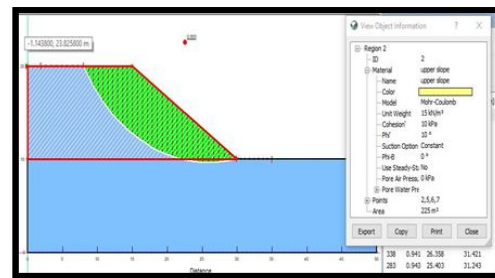


Fig. 14. Viewing the Object Information once done of the preliminary steps

15. Viewing the slice values information

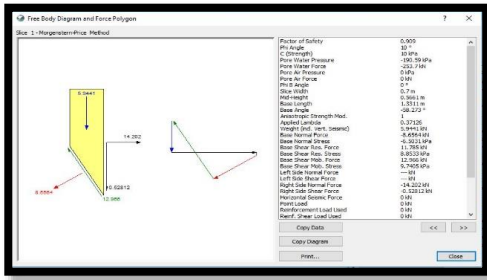


Fig. 15. Viewing the slice values information

16. Finally, to drawing the slice information before getting in to the final results.

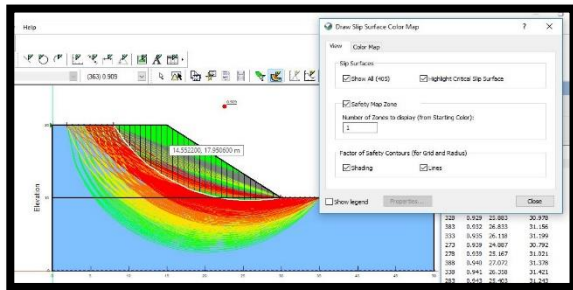


Fig. 16. The slice information before getting in to the final results

17. Checking for the Print and page layout for the Final Results Evaluations.

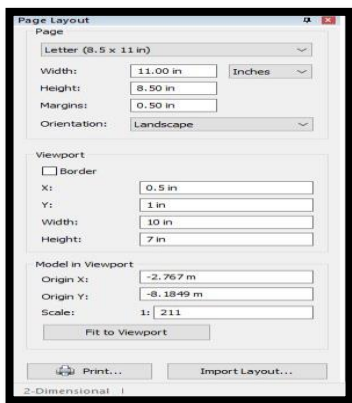


Fig. 17. Checking for the Print and page layout for the Final results Evaluations

5. Results and Discussions

The following table and graph shows the resulting of the combination of varying Phi and C value this results to check the factor of safety by concluding in geo slope software Phi and C value are adding to plotted the critical slip surface in the model. the curves to be plotted that the parameter on X and Y axis in the model, output is given Calculating the safety factor using the Phi and C value in the given results.

Table 1
Results for the slopes 1:1.5.

Phi \ C	10	20	30	40
0	0.403	0.803	1.204	1.618
10	0.927	1.363	1.820	2.244
20	1.387	1.821	2.299	2.757
30	1.869	2.389	2.845	3.319
40	2.454	3.029	3.514	3.973

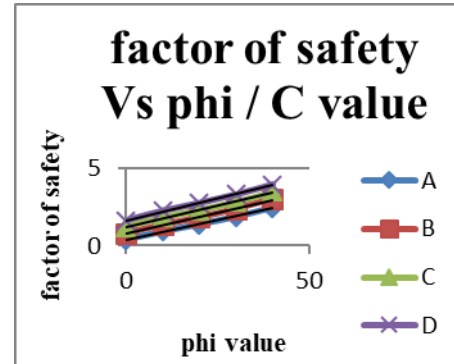


Fig. 18. Factor of safety vs. phi / C value

By seeing the above graph X and Y axis in the graph, Y axis in the factor of safety and X axis in the Phi and C value. In this figure all curves are the parallel to each other we can say that curve A and curve B are not stable at Phi=0 and curves C and D are the stable at greater than 0, Phi and C values in this graph

Table 2
Results for the slopes 1:2

Phi \ C	10	20	30	40
0	0.411	0.838	1.232	1.642
10	1.02	1.536	2.018	2.469
20	1.624	2.133	2.621	3.102
30	2.253	2.817	3.304	3.784
40	2.994	3.606	4.144	4.622

to calculate factor of safety in the curves are stable or not stable to check the factor of safety.

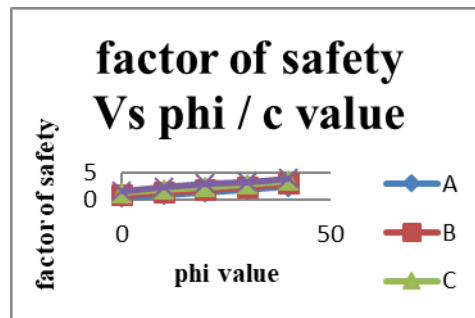


Fig. 19. Factor of safety vs. phi / C value

By seeing the above graph X and Y axis in the graph, Y axis in the factor of safety and X axis in the Phi and C value. In this figure all curves are the parallel to each other we can say that curve A and curve B are not stable at Phi=0 and curves C and

D are the stable at greater than 0, Phi and C values in this graph to calculate factor of safety in the curves are stable or not stable to check the factor of safety.

6. Conclusion

The scope of this study has been compared to geological slopes. The following findings are summarized as follows:

1. The factor of safety value computed using the geo slope software by each method for analysis is found varying for the different value of the slope parameters such Cohesion, internal. Friction angle inclination of the slope and height of the slope as the unit weight of the soil. Slopes were evaluated by performing experiments on slope models in the geo slope program.
2. As the height of the slope decrease the factor of safety value for the slope also increases.
3. The calculation results of the model is the same as that of theoretical results.
4. It is recommended to use the resulting pore pressure conditions when analyzing wet slopes.
5. By using the software geo slopes in that varying the value of inclination.
6. Factor of safety has been determined using geo slope software.
7. In this project the factor of safety for the slopes for different inclination is calculated.

8. All curves are parallel to each other by seeing graph. Curves A and B are not stable (when $\Phi = 0$) and curves C and D are stable (when Φ value greater than 0).

References

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