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Stability Analysis of Slopes

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ABSTRACT
Stability analysis of slopes is a very important component of various infrastructure projects throughout the life cycle of the project. A failure of slope in the area being worked can lead to some severe social, economic as well as a great safety catastrophe. The basic failure conditions are diverse and complicated. These failure mechanisms are mainly dependent on local geology, which are unique to a specific location of the rock mass. In the recent years, the methods of designing slopes are completely based on the field knowledge. A better approach can be made through safe designing of slopes.
The aim of the project is to carry out modeling for slopes having various dimensions and different soil properties. The numerical modeling is carried out for finding out the factor of safety. The parameters are changed for each slope. These values are correlated with bench parameters to find out how factor of safety changes with changing parameters.
Keywords: *Slope stability, angle of internal friction, cohesion, Factor of safety.*

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I. INTRODUCTION

Analysis of slope stability is an essential part of any civil operation during the full life of the project. In Indian scenario, slope design rules are not yet framed for different types of infra practices, and there is an increasing need to develop strategies to maintain safety while increasing production. Still now many designing methods are mostly based on field knowledge and rules of thumb followed by critical engineering judgment. In last few decades, the concepts of slope stability analysis have developed under the field of engineering mainly to address the difficulties in designing and stability of excavated slopes. As a result, analysis of stability of working slopes is becoming a major concern. Slope failure causes a loss in life, production, increased stripping cost for recovery and handling of resulting failed material. In the view of the above, there is a strong need for proper practices in slope design and management so that the suitable corrective actions can be taken to minimize any type of slope failure beforehand.

II. METHODOLOGY

The main problem of determining the system of the various forces of interaction between soil and the sections, which is unsuitable with respect to stability of slopes, is solved by the working diagram of the “method of sections” and stability is evaluated.

- Setting up objective
- Review of literature
- Study of slope and its parameters
- Study of manual
- Modeling of slope using model and comparing change in fos with change in parameters
- Scope for future work

III. MODELING AND ANALYSIS

1) Plane Surface of Failure

2) Friction-Circle Method

3) Taylor's Stability Number

4) Stability Analysis by Method of Slices for Steady Seepage

5) Fellenius Method

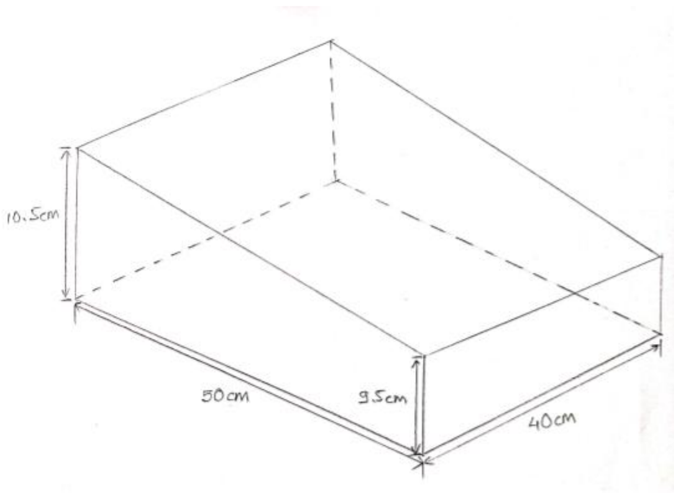

Figure 1: Model Design

Volume = area of trapezoid * thickness
= (1/2(9.5+10.5)*50)*40
= 20,000 cm3

IV. RESULTS AND DISCUSSION

As the cohesion increases, the binding property increases which makes the slope stable. High water content weakens cohesion because abundant water lubricates and also adds weight to the mass. Alternating expansion due to wetting and contraction due to drying of water reduces strength of cohesion. The stability of a slope is controlled by the ratio between the available shear strength and the acting shear stress, which can be expressed in terms of a factor of safety. A slope can be stable if the factor of safety, computed along any potential sliding surface running from the top to its toe of the slope, is always larger than 1.

Table 1. W/C and Angle Observation

Angle of Failure	% of water content
45 degree toe failure	3%
45 degree toe failure	5%
40 degree toe failure	8%
35 degree slope failure	10%
35 degree slope failure	12%
30 degree slope failure	15%

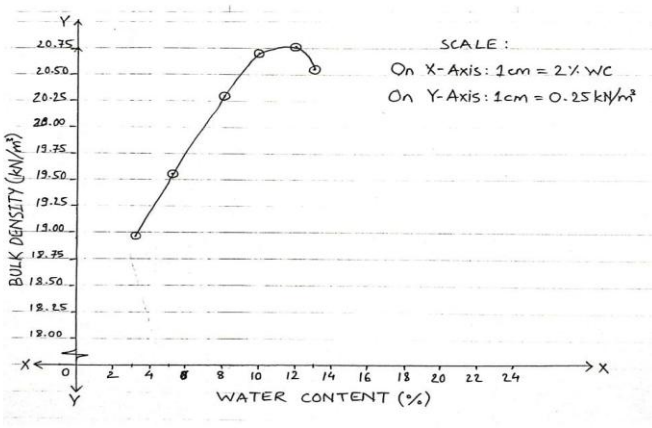

Figure 2: W/C vs bulk density graph

V. CONCLUSION

Cohesion and angle of internal friction are very important factors affecting slope stability. With increase in these parameters the stability increases. Water content is dependent on soil properties such as grain size, which can impact many factors such as infiltration rate, runoff, and water retention. Generally, fine grained soils rich in clay and silt retain much more water than coarser sandy soils. This effect is due to capillary action, where the adhesive forces between the fluid, particle and the cohesive forces of the fluid counteract gravitational pull. Therefore, smaller grain size results in a less surface area on which gravitational forces can act. Smaller surface area also leads to extra capillary action, more water retention, much more infiltration, and less runoff. A previously stable slope can be affected by a number of predisposing factors or processes that make the safety factor decrease either by increasing the shear stress or by decreasing the shear strength and can ultimately result in slope failure.

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