ANALYSIS OF SLOPE STABILITY USING LIMIT EQUILIBRIUM

BY

ABDOULLAH NAMDAR

Abstract. In achievement of slope load sustainability using mixed soil technique, is considered acceptable the method for slope construction technology. This paper deals with evaluation of mixed soil technique for construction of stable slope and proves the soil capability by analysis of computerized modeling, the revealed result of investigation, the possibility of using nearest local material, reducing project cost, solving the construction geotechnical problem and accurate understanding of soil property when it is developed under different types of geometry.

Key words: modeling; mixed soil; liquefaction and soil foundation geometry.

1. Introduction

Several methods could be applied in increasing slope stability, in a scientific work computer modeling and analysis of slope stability is advanced and accurate technique in construction of safe slope is utilized.

It has been reported a real-coded genetic algorithm (GA), used to find out the factor of safety for the soil slopes using wedge method. The analysis is formulated as constrained optimization problem to solve the nonlinear equilibrium equation and finding out the factor of safety [1]. There is an investigation on the stability of slope. It is one of the most important problems in stability analysis of geomechanics. The limit equilibrium method was used and it is considered as 2-D plane strain problem with no variation in geometry, material and surcharge in direction parallel to the crest of the slope. The problem lies in finding out the critical failure surface and its corresponding factor of safety (FOS) [2], [3]. It is presented the three-wedge method for stability analysis of slopes, which is a force equilibrium method [4]. There is a scientific research on different moisture contents of rock and soil, it can...
influence the slope stability, especially for the weathered state and it is much sensitive to water. Based on water character experiment of completely weathered state, and according to the wedge theory under plane strain condition, analysis is proposed on not only the stress field of the excavation of high cut slope but also on the excavation disturbance effect under different moisture content according to Mole-Coulomb strength criterion and uniaxial tensile strength criterion after safety margin, which could provide theoretical support to the actual excavation works and effective reinforcements [5]. It has been studied influence of root trees on slope stability and different factors like slope geometry and gradient, geologic materials, stratigraphy, hydrology, and the local effects of shore processes have been analysed too [6].

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Characteristics of 31 mixed soils under loose optimum moisture content (OMC) condition in the laboratory have been determined and using computer modeling, characteristics of slopes have been evaluated.

2. Methodology and Experiments

The computerized mixed soil sample modeling is a novel method of solving geotechnical problems. It is quite clear that a mixed soil characteristic is totally different from individual soil.

Earth slopes are formed for railway formation, highway embankment, earth dam, canal banks and many earth structures. In slope construction from mixed soil for increasing slope stability, different types of soil with proper percentage is best option employed; in this regard 31 mixed soil types from red plastic soil and black, green, dark brown, yellow and light brown non plastic soils, sand, and two types of gravels (2 mm, 4.75 mm) developed, and also from previous investigation (Table 1) safe bearing capacity, angle of friction, unit weight and cohesive of mixed soils sample for computerize model have been used, the Geo-Slope software in identification of models behavior employed and the results of these modeling research work by interpretation of mixed soil types characteristics and slope computerized model evaluated.

3. Results and Discussion

Identification of laboratory developed mixed soil behavior in the construction activities is possible through the application of computerized modeling for safe, stable and reliable approaching any earth structure. Increasing dimension of slop has exhibited positive correlation with soil cohesion, pore water force, base shear force and base normal force (Figs. 1,…,7 and Tables 3,…,6).

Sand is very vulnerable against liquefaction but under loss condition if mixed with red plastic soil could results in reduction of liquefaction and pore water pressure. Mixture of gravel mitigated of pore water force as well as shear force. The result revealed when the level of soil cohesion force is half of cohesion strength, the maximum pore water pressure appeared, it could be empirical applicable at preanalysis of any slope construction. Due to complicate character of soil characteristics when it is under load and used for construction material, it is essential to evaluate the cohesion, pore water force, base shear force, base normal force and factor of safety of soil by computing modeling at any soil structure, these are deduced from different behavior of slopes model. Analysis of slope has close similarity with structure analysis, it is observed that all load sustainability, deformation, settlement, reliability and safety of soil structure not depend only on strength of material, but soil structure geometry also represents one of the important factors in the design and analysis of slope.
Table 2

**Experiments Results of Mixed Soil under Loose OMC Condition [7]**

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Fig 1. Shape of failure in the slope type 1.
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Fig. 3 – Cohesion force, [kN/m²], vs. model No.
### Table 5

**Analytical Results of Slopes Types 1 by Morgenstern–Price Method**

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![Fig. 4 – Pore water force, [kN/m²]], vs. model No.](image-url)
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Fig. 5 – Base shear force, [kN], vs. model No.
4. Conclusions

1. Simulation technique could be acceptable for slope construction.
2. Application of suitable material significantly reduces liquefaction.
3. Soil characteristics in slope construction depend on slope geometry.
4. The factor of safety decreases when dimension of slope diminishes.
5. Soil structure geometry plays one of the important roles in the design and analysis of slope.
6. Result of slope analysis could not be similar if a single parameter of soil or geometry changes.
Notations

Φ – friction angle, [°];
C – soil cohesion, [kN/m²];
OMC – optimum moisture content, [%];
SBC – safe bearing capacity, [kN/m²];
γ – unit weight, [kN/m³].

Received, February 12, 2010
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REFERENCES

6. * * * www.Greenbeltconsulting.com

ANALIZA STABILITĂŢII TALUZURILOR IN CONДIŢII DE ECHIPÍBRU LIMITĂ

(Rezumat)

În dezvoltarea durabilă prin construirea eficientă a terasamentelor, metoda de construire folosind amestecurile de pământ este considerată acceptabilă. Lucrarea de faţă studiază posibilitatea de sporire a stabilităţii pantelor utilizând amestecurile de pământuri. Aspectele teoretice sunt însoţite de simulări numerice ce evidenţiază faptul că procedeul poate fi aplicat cu succes folosind materiale locale sau care se află în imediata vecinătate a şantierului, reducând astfel costul total al investiției. Mai mult, metoda prezentată ajută la o mai bună înțelegere a comportamentului pământurilor atunci când este folosit în lucrări geotechnice cu geometrii și forme variate.