APPLICABILITY OF THE NUMERICAL METHODS AND FIELD MONITORING DATA TO EVALUATE THE STABILITY OF AN EMBANKMENT SLOPE

Nawarathna, T.H.K.[1*] and De Silva, L.I.N.[2]

[1] Graduate school of Engineering, Hokkaido University, Japan
[2] University of Moratuwa, Sri Lanka
* Corresponding Author: th.nawarathna@gmail.com

Evaluation of the stability of an embankment slope during and after the construction is essential to ensure a safe and economical embankment. Stability of an embankment can be evaluated by using Numerical methods (Finite Element Method / FEM and Limit Equilibrium method / LEM) and using field monitoring data. In FEM, stability of the embankment slopes can be evaluated by using phi – c reduction method. In LEM numbers of appropriate failure surfaces are assumed and their Factor of Safety (FoS) values are determined. Use of field monitoring data to evaluate the embankment stability is more practicable and Matsuo and Kawamura (1977) proposed a prediction method of failure of soft ground by observing the settlement at the center of the embankment and lateral displacement at the toe of the embankment as shown in Figure 1[1]. Present study aimed at check the applicability of the FEM, LEM and the Field data to evaluate the stability of an embankment slope.

Actual failed embankment slope which is belong to the Colombo Katunayaka Exprssway in Sri Lanka was evaluated by using FEM (Plaxis 8.2) LEM (Geo Slope 2004) and the Matsuo chart. In FEM modelling 2D plain strain model and 15 nodes elements were used to define the problem and standard fixity option was used to define the boundary conditions. In LEM Morgentsern and Price method was used to analyze the embankment. According to the results obtained Matsuo chart (based on the field data) shows an instability condition. Since factor of safety value obtained from the Matsuo chart is equal to 1, it reaches to the failure criterion line. FoS value obtained from the FEM is equal to the 1.04 and the value from the LEM is equal to 1. Predicted failure surfaces from FEM and the LEM shown in Fig 2. So finally we can conclude that available numerical method and the field monitoring data can be successful used to evaluate the stability of embankment slopes.

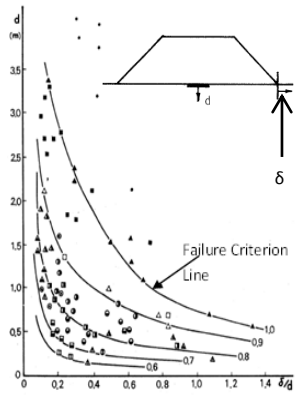

Fig. 1. (δ /d – d) diagram for prediction of failure.

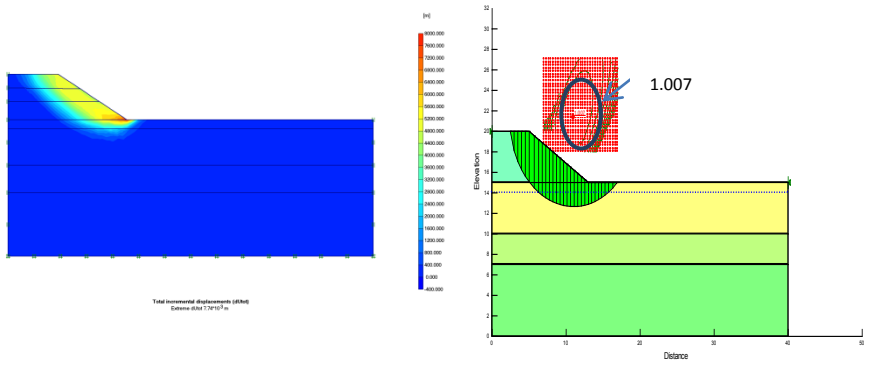

Fig. 2. Predicted failure surfaces using FEM and LEM.

References

[1] Matsuo, M., and Kawamura, K., (1977), Diagram for construction control of embankment on soft ground, Journal of soils and foundations, 17:37-52.