Evaluation of landslide possibility based on pore water pressure mechanism and mitigation

AbdoullahNamdar

Faculty of Civil Engineering & Earth Resources, Universiti Malaysia Pahang
anamdar@ump.edu.my

Abstract

In this investigation more than 200 papers have been evaluated for mitigation of natural hazard, it is important issue in human life. The landslide repeated periodically in the world due to several reasons. The site geological, geotechnical and geomorphological characteristics along with force nature and surcharge are playing important role in pore water pressure mechanism which is one of the main factors in landslide. This is a study for better understanding landslide phenomenon. Author made an attempt by using shaking table test result for explaining pore water pressure mechanism in saturated sandy subsoil affected by liquefaction. The embankment-subsoil model is helped to simulate pore water pressure in landslide. The investigation is analyzed pore water pressure in experimental, and provides appropriate guidance for landslide failure prediction. It is recommended for research priorities in next generation of research. These included i) Analysis of pore water pressure in generating landslide. ii) Identify liquefiable layer and zone, and liquefaction magnitude movement for realize landslide zone and slope stability assessment. iii) Mitigation technique for landslide to understand slope potential failure.

Recent problems and mitigation challenges

The latestdevelopmentreconnaissancediscovery has been made near preciseexplanations in landslide, although considerablyevolution is necessary forunderstandin summarizing requirement research work and feasiblescience. The triggering landslide and rockslide in subsoil is a big earthquakegeotechnical engineering problem.

The geology and geomorphologyknowledge are required for predicting geo-hazard mitigation. The geo-hazard mitigation has to be study in order to improve human settlement and provide safe urban design.

There is a research on landslide mitigation[1]. There are many factors like rain, earthquake, erosion, major uplift and hurricanes accelerate landslide and rockslide [2-6). The landslides bring huge economic costs in Japan, China, Nepal, Canada, United States, India and many other parts of the world annually [7]. The pore water pressure behavior is important factor in landslide.

The acceptable recommendations can be discuss for mitigate landslide hazard. Analysis ofnonlinear pore water pressurein triggering landslide helpsin mitigation through the laboratory modeling. The pore water pressure is able to generate stress and if it is more than strength of slope material resulted in subsoil and embankment failure.

The nonlinear pore water pressure collapsed partiallyof slope and ended to failure of whole body of earth structure. The underground water level is very important issue in producing pore water pressure and required to be more investigated.The soil degree of saturation, flow speed, permeability coefficient, internal stress in soil mass, friction angle of soil mass,soil cohesive, soil natural displacement, and soil natural deformation and soil suction will govern landslide and rockslide magnitude and susceptibility.

When the sandy saturated subsoil is subjected to the static and dynamic force, the pore water pressure in initial reachto high level and after some time due to reducing force magnitude and fabricating soil particle in appropriate place, the pore water pressure will be constant or decreased. The site geomorphologyis important in reducing pore water pressure and resulted in controlling landslide and improving subsoil resistance. The pore water pressure may not be linear in all part of subsoil. The pore water pressure characteristic governs landslide failure types. The dense zone in subsoil reduced pore water pressure and can mitigate liquefaction phenomenon.

The pore water pressure is produced byshaking table force is able to generate near accurate stress. The pore water pressure could be reduced if in the some part of subsoil built up barrier. The subsoil shear strength-stress-strainmodification is very important in stopping pore water pressure magnitude.One of the key issues for decision-making inlandslide mitigation is estimate the pore water pressure level to predict landslide time and,it can be realize based on site geological and geomorphological characteristics as well as surcharge on subsoil.

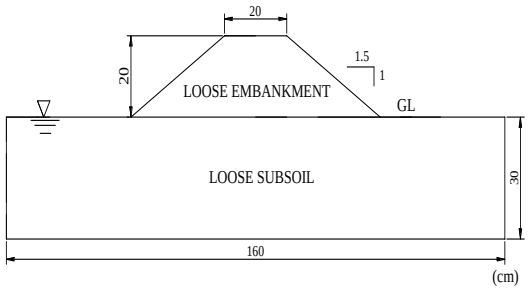

Fig. 1.The model of moist loose embankment and fully saturated subsoil [8].

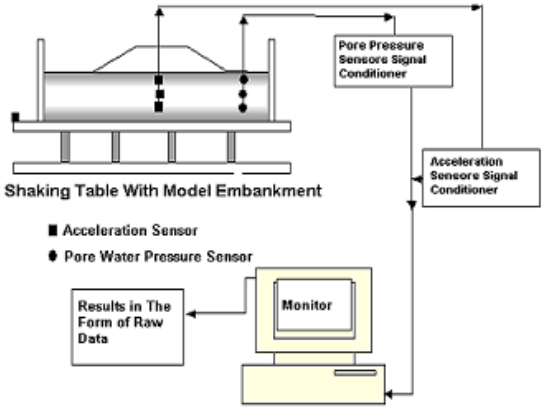

Fig. 2. Schematic diagram of shaking table and, embankmentmodel[9].

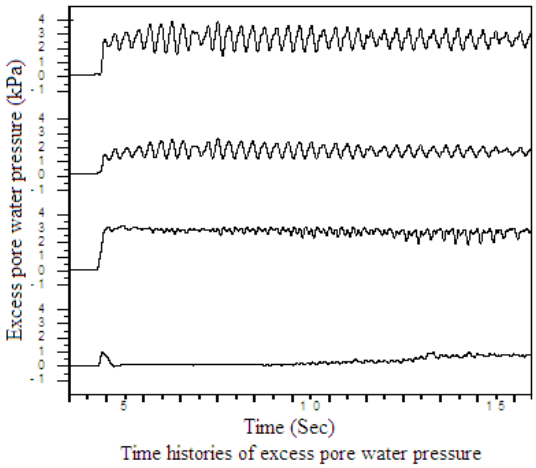

Fig. 2.Pore water pressure variations in the sandy subsoil[8].

The investigation on dynamic porewater pressure torealize landslide in saturated sandy subsoil requires accurate laboratory and field modeling. The Figure 1 has been indicated the subsoil-embankment model under laboratory condition without mitigation, the Figure 2 explained the subsoil-embankment model and procedure for studying pore water pressure, and subsequently the graph of pore water pressure is shown in Figure 3.

For identification liquefaction zone,slope stability, landslide susceptibility, and studying unacceptable settlement this modelis applicable as a low cost research work as well as an effective education tool.

Understanding the processes involved in the formation and failure of landslide dams is crucial for the purpose of hazard mitigation [10], and in this regard serious education and research work are required.

References

[1]Korup, O., Densmore, A.L., Schlunegger, F., 2010. The role of landslides in mountain range evolution. Geomorphology 120, 77-90.

[2]Dai, F.C., Xu, C., Yao, X., Xu, L., Tu, X.B., Gong, Q.M., 2011. Spatial distribution of landslides triggered by the 2008 Ms 8.0 Wenchuan earthquake, China. Journal of Asian Earth Sciences 40, 883-895.

[3] Bozzano, F., Lenti, L., Martino, S., Paciello, A., ScarasciaMugnozza, G., 2008. Self-excitation process due to local seismic amplification responsible for the reactivation of the Salcito landslide (Italy) on 31 October 2002.Journal of Geophysical Research 113, B10312.

[4] Ma, K.F., Lee, C.T., Tsai, Y.B., Shin, T.C., Mori, J., 1999. The Chi-Chi, Taiwan earthquake: large surface displacements on an inland thrust fault. EOS Trans Am Geophys Union 80, 605-11.

[5] Mulder, T., Alexander, J., 2001. The physical character of subaqueous sedimentary density flows and their deposits.Sedimentology 48(2), 269-99.

[6]Song, K.Y., Oh, H.J., Choi, J., Park, I., Lee, C., Lee, S., 2012. Prediction of landslides using ASTER imagery and data mining models Advances in Space Research 49, 978-993.

[7] Sidle, R.C., Ochiai, H., 2006. Landsli des Processes, Prediction, and Land Use: Water Resources Monograph, 18. American Geophysical Union, Washington D.C.

[8] Namdar, A., 2010. Modeling for seismic mitigation of embankment. Published by Lambert Academic Publishing. Germany.

[9] Namdar, A., and Gopalakrishna, G.S., 2008. Seismic Mitigation of Embankment by Using Dense Zone in Subsoil. Emirates Journal for Engineering Research 13 (3): 55-61.

[10]Korup, O., 2002. Recent research on landslide dams - a literature review with special attention to New Zealand. Progress in Physical Geography 26, 206-235.