Abstract

Spatio-temporal variation in rainfall leads to surplus amount of water in some parts of the country while deficient conditions in others. Considering the growing need for industrialisation and urbanisation, regular water supply becomes imperative. Therefore, hydraulic structures are required to store and regulate surplus water. Given the high hazard potential of dams and barrages, their safety is crucial to prevent the damage to lives and livelihoods of people. Barrages are hydraulic structures which are used to divert excess water to another region. They don't store and only regulate the water. Ayodhya barrage is proposed on Saryu (Ghaghara) river for religious, irrigation, drinking water and environmental purposes. A barrage is susceptible to failure due to piping in the foundation or damage due to uplift pressure. In this paper, a numerical analysis of Ayodhya barrage is conducted to determine the seepage and uplift pressure on the barrage under static and dynamic loading. Slope stability analysis is also done for the afflux bunds (dykes) under different filter and drain configurations. SEEP/W, SLOPE/W, SIGMA/W and QUAKE/W packages of GeoStudio software are used for finite element analysis of the under-sluice section and the bunds. Factor of safety is also calculated for the operating and high flood level conditions. The under-sluice section comes out to be safe against overturning and sliding under normal operating conditions and high flood level conditions. The afflux bunds turn out to be unstable with the present 2H:1V slope. However, with the use of upstream berm and chimney filter, both the upstream and downstream slope become stable under steady as well as drawdown conditions. Stability of the barrage was checked against earthquake forces. It was found that the top layer of soil is prone to liquefaction. The under-sluice portion of the barrage may be susceptible to overturning in case of Maximum Credible Earthquake (MCE) with factor of safety less than 1.5. Soil stabilization and design modification may help in achieving the stability.

Keywords: *Numerical Analysis, GeoStudio, Barrage, Dykes, Drainage, Overturning, Sliding, Slope Stability, Liquefaction.*