Minimum Slope Required for Liquefaction Induced Lateral Ground Displacement to Occur in a Confined Soil Mass Subject to a Simulated Seismic Shock

Yahne, Rosemary (School: Northern Utah Academy for Math, Engineering and Science)

Earthquake generated lateral ground displacement is a very dangerous soil phenomenon that can cause extreme damage to buildings and infrastructure. Few research studies have investigated how different soil and slope characteristics impact the minimum slope at which lateral ground displacement occurs. One unverified assumption is that lateral ground displacement cannot occur in a confined sand mass. The hypothesis of this project was that lateral ground displacement can still occur in a confined sand mass, but the slope will be greater than with an unconfined sand mass, due to larger, counter-acting, passive soil pressures that must be overcome. A custom chamber simulated worst-case conditions in the tested sand. The chamber was filled with loose saturated sand and then subjected to a seismic shock simulated by 30 mallet blows against the back wall once per second. Ground displacement was measured by video and still cameras, side tracings were drawn to record the initial ground level while ten 3-axis accelerometers in the soil and on the walls measured energy propagation. Four grain sizes were tested at six slope angles, each repeated three times for a total of 72 datasets. The results showed that lateral ground displacement can occur in a confined sand, but the slope is 1.5 times greater than in unconfined sand masses. These results are important because they help engineers and scientists better understand where and when lateral ground displacement can occur. By better understanding this, mitigation can be implemented more effectively to help reduce damage caused by this phenomenon.

Awards Won:

U.S. Agency for International Development: Third Award Working in Crisis and Conflict