George A. Afriyie

Title: **Effects of explosions on embankment dams**

Abstract:

The efficient management and protection of critical infrastructure such as dams is relevant to safety of the population of every country. A breach of any dam could have serious ramifications on downstream communities including loss of electricity, flooding, injury and fatality. The associated economic losses can also be enormous depending on the size and emergency preparedness of the community. The level of damage caused by an explosive device on an embankment dam depends on the type and amount of explosive as well as the placement of the explosive relative to the dam cross-section.

This thesis is a numerical study into the effects of explosion on embankment dams using the high fidelity physics based finite element package, LS-DYNA. A numerical model was developed in LS-DYNA and validated using field testing. The numerical results indicated that the LS-DYNA model was able to predict the crater dimensions on the embankment dam when compared with the field testing. The investigation on the effects of charge mass showed that there was an increase in crater diameter and depth as the charge mass increased. The effect of reservoir water level on crater dimensions was also investigated; the crater dimensions predicted were highest when the reservoir level was maximum and lowest when the embankment was dry. The dry embankment showed an increment in crater depth whereas there was a significant decrease in crater depth for the embankment with the water reservoir. Effects of negative pore water pressure (suction) above the phreatic surface was also investigated and the crater dimensions predicted showed a decrease in crater dimensions when compared to when suction is not incorporated into the model.

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