# Experiments and Analysis of Water-filled Tubes Used as Temporary Flood Barriers

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(ABSTRACT)

Geosynthetic tubes filled with water are considered. The tubes can be used in applications to resist rising floodwaters. They can also be used to form breakwaters and protect shores from erosion. This thesis considers single and stacked tubes resting on a rigid and deformable foundation resisting rising hydrostatic headwater.

Experiments were carried out to determine the behavior of a three-tube stacked configuration resting on a sand foundation. This study was a continuation of previous work on unstacked tubes. Many tests were performed to determine the deformation and stability of the system. A geosynthetic drain was placed beneath the tubes to prevent piping. The objective was to cause failure of the system in a sliding manner and formulate a hypothesis according to the placement of the drain beneath the tubes. In order to cause a sliding failure, a strapping system was developed to try and prevent the tubes from rolling.

A single tube at rest, filled with water but with no external hydrostatic pressure, was considered for analysis first. The tube rested on a rigid foundation and was assumed to be infinitely long. The friction between the tube and the foundation was neglected, and the bending stiffness of the tube was assumed to be negligible. The tube material was assumed to be inextensible. Mathematica was used to solve the system of equations and compute the unknowns. Excel was used to plot the data and observe the behavior of the tubes.

An analysis was also performed on a single tube with an apron attached, resting on a rigid foundation. The apron was attached on the rising headwater side to increase stability. The assumptions for the tube at rest were also applied in this analysis. Two cases were derived and analyzed: a case where the internal hydrostatic pressure remains constant, and a case where the cross-sectional area remains constant. For the second case, the internal pressure changes as the floodwater level rises.

The results from this study demonstrated that water-filled tubes, stacked or with an apron attached, can be an effective alternative method to sandbags in resisting floodwaters.