CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Melanie N. Wathugala

Project Number
J0625

Project Title
War Against Water: Using Electrical Analogy to Study the Resistance to Seepage under Dams with Different Seepage Curtain

Abstract

Objectives/Goals
The objective is to find out what location (front, middle, back) and length of seepage curtains cause the most resistance to seepage under dams. If dams with seepage curtains in three locations of two lengths (short and long) are compared for resistance to seepage, then the dam with the longest curtain in the middle of the dam will create the most resistance.

Methods/Materials
It was tested by using electrical analogy. Different amounts of voltage (that represent the difference in water level) were applied across the graphite paper (that represents soil) with the shape of the dam cut out. The voltage and current were taken from each dam tested for all five applied voltages (batteries). First, a dam with no curtain was measured. Then a short curtain was cut out in the front and measured. Then the longer part was cut out and measured. All of that on the same paper to eliminate most errors. The same was done for the middle location of seepage curtains and back on their own papers. The resistance was found using a graph of measured voltage and current. The resistance was normalized using the resistance of the control dams, and then compared.

Results
The middle curtains had the highest normalized resistance with 1.198 (short curtain) and 1.604 (long curtain). The normalized resistances for the front and back curtains were (a) 1.072 (short), 1.410 (long) and (b) 1.175 (short), 1.573 (long) respectively. Overall, longer curtains were more successful than the shorter curtains by around 40%.

Conclusions/Discussion
Overall, the seepage curtains increased the resistance. The increase of resistance from the second three centimeters on the curtains was higher than the increase of resistance due to the first three centimeters. Another trend was that the resistance was independent of the applied voltage. More voltage led to more current as higher water level upstream will lead to more seepage. For the curtain placement, the hypothesis was supported, as the middle curtain consistently showed higher resistance compared to the other locations. This is useful in building new dams so that they are more effective and if there is a crisis like Hurricane Katrina, then the dams will already be working well and the seepage will not be making it weaker.

Summary Statement
This project finds where a seepage curtain is most effective and which of short and long lengths are better by using a model with graphite paper and electricity to follow an electrical analogy.

Help Received
Dad helped get research materials and acted as an at-home advisor.