CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31601

Project Title
Soil Mechanics Engineering: The Effects of Moisture Content on Soil Strength

Abstract

Objectives/Goals
The objective of this experiment is to determine the optimum moisture content at which a soil becomes most stable and be used for structural foundations.

Methods/Materials
In order to create different soil mixes with different moisture contents, I combined 500 mL of soil with different amounts of water. The moisture contents ranged from 5% to 50%. Then, I used a cylindrical mold made of PVC pipe to make the soil specimens. To keep the soil particles together, I compacted the soil in the mold with a wooden dowel. After that, I put a 4 7/8 in by 4 7/8 in base on top of the soil cylinder and gradually added coins until the soil failed. I recorded the maximum pressure and repeated this for each mix. I used coins because the weights of coins are known. Finally, I used the soil with the optimum moisture content for my model house experiment. I placed 16 cylinders with 15% moisture content under a wooden model house and recorded how much pressure it could hold.

Results
The minimum percentage of water by volume that the soil specimen could hold without collapsing under its own weight was 5%. This specimen held 113.125 grams. The maximum percentage of water by volume that the soil could hold without collapsing was 40%. This specimen held 1271.25 grams. Initially, increasing the moisture content increased the strength of the specimen. However, this was only true up to 15% moisture content. After 15% moisture content, the soil strength decreased. The graph of strength vs. moisture content shows that then is an increase up to the optimum moisture content, where it reaches the maximum, then falls following a parabolic shape. Finally, I found that the model house held up to 19.79 lbs/ft^2. The failure angle of the house was 32 degrees.

Conclusions/Discussion
Since the optimum moisture content of this soil was 15%, my hypothesis was incorrect. I thought that a soil with a moisture content between 20 # 30% would be the strongest and hold the most pressure. I believe that any amount of water above the optimum moisture content makes the soils particles slide and prevents compaction. At this point, the water acts like a lubricant instead of like a glue. Therefore, 15% moisture content should be for building and structural foundations in order to make them more stiff and stable.

Summary Statement
My project analyzes how moisture content affects the strengths of soils used in structural foundations.

Help Received
No help.

Preliminary