



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Hope Xu	Project Number S0834
Project Title The Effect of Different Soil Textures upon the Permeation Rate of Water	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine how different soil textures affected the permeation rate of water.</p> <p>Methods/Materials A device was constructed that effectively measures water permeability of soils at selected soil texture points on the soil texture triangle according to a customized Mixture DOE design. This Mixture DOE was then applied to derive a regression response surface of permeability as a function of soil textures over the Soil Texture Triangle.</p> <p>Results An empirical 3D surface function of water permeability in relation to soil textures by percentage mixtures of sand, silt, and clay was derived. In addition, a 2D plot was developed allowed for permeability at any soil texture to be conveniently and graphically estimated by simply locating the corresponding points on the plot for the sand, clay, and silt mixture percentages. Pure sand was found to have the greatest permeability, while pure clay had near zero permeability. Sand and clay had the greatest impact on soil permeability in opposite directions. Silt had a similar impact as clay, but to a much lesser degree.</p> <p>Conclusions/Discussion This project found that the water permeability of soil follows an exponential relationship with soil textures. This relationship, as found in this project, further follows a parabolic function. The 2D plot derived from the parabolic function allows for permeability to be conveniently and graphically estimated for any soil textures without the immediate need for time and cost prohibitive testing. Rather than testing discreet points to find a soil sample's permeability, the response surface regression plot also allows for an empirical and continuous estimation of soil texture permeability. The ranges of permeability for a soil region that consists of texture variations can also easily be estimated.</p> <p>This project also found that any slight variation in especially high sand consistencies (the sand corner region of the Soil Texture Triangle) could mean significant differences in permeability. As a result, the "sand corner" should be considered a danger zone for any applications that depend on the permeability of soil. A larger safety margin or factor may be required in these cases.</p> <p>The permeability did not change significantly in areas away from the three corners of the Soil Texture Triangle.</p>	
Summary Statement This project is designed to understand the effect of soil texture upon the permeability of water, and its practical applications.	
Help Received Father helped construct setup, carry out experiment, clarify derivations and calculations, and organize data using Microsoft Excel and Minitab; Used professional references and applications from civil engineer, Zhou YouWei; Dr. Hunsicker provided due dates and guidelines.	