Effect of Matrix Material on the Engineering Properties (Stiffness and Unconfined Compressive Strength) of a Rock-Like Material

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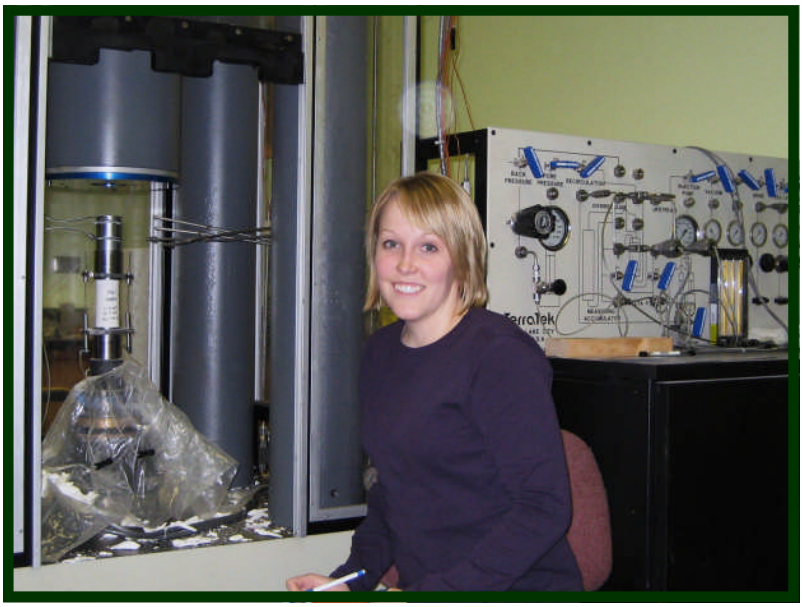

ABSTRACT

The engineering properties of rock are strongly influenced by the amount of void space found within the rock material and the matrix material. Prof. Nick Hudyma at the University of North Florida has had success conducting research on materials with large voids, using samples made using plaster of Paris with Styrofoam inclusions to represent rock with large voids. He recently collaborated with Prof. Mary MacLaughlin and Graduate Student, Bethany Erfourth, of Montana Tech, to study variation in compressive strength with porosity of these plaster-Styrofoam samples. With these tests, they demonstrated that the strength of the plaster-Styrofoam samples were representative of real rock, using previous test results for tuff (a macroporous volcanic rock) from the Yucca Mountain Nuclear Waste Repository Site.

In 2005-2006, I participated in an undergraduate research project studying the effect of pore size on the unconfined compressive strength of a rock-like material with large voids. Specimens made using Plaster of Paris as the rock matrix and Styrofoam balls as the void space were tested. In my research, two different brands of Plaster of Paris were used. The testing of these specimens revealed inconsistent data, especially for the strength of the specimens. It is suspected that the data inconsistencies may be related to inherent variability in the plaster matrix material. The goal of my research is to determine a matrix material that reveals consistent data.

Specimens were made similar to those tested in 2005-2006, but with Polylite (a transparent plastic material) and Hydrocal (a high quality plaster) as the matrix material. The specimens are 2" diameter by 4" tall cylinders, solid matrix only (no voids). Approximately 30 specimens are currently being tested from each matrix material under uniaxial compression to measure the unconfined compressive strength (UCS) and elastic modulus (E).

The scientific hypothesis is that these new matrix materials will display less variability than the regular plaster. This will be demonstrated by a lower coefficient of variation (found using the statistical analysis tools in *Excel*) as compared to pre-existing data for solid specimens with original plaster matrix.

BIOGRAPHY

I am a graduating senior studying Geological Engineering with an option in Geotechnical Engineering. Born in Billings, Montana, I am the oldest of three children and am an avid outdoors fan. During my college experience, I have completed two very interesting undergraduate research projects; this is my third! Next fall, I will be attending Graduate School at The University of California Berkeley, continuing my education in Geotechnical Engineering.