Public Abstract
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Graduation Term:SP 2017
Department:Civil Engineering
Degree:MS
Title:Estimating the Rock Mass Modulus of Missouri Shale Using Pressuremeter Tests

Rock mass modulus can be a useful property in the design of foundations. Rock mass modulus is defined as the stress strain response of a rock mass in-situ. The stress strain response of the rock mass can be estimated by directly measuring the stress strain relationship via in-situ field tests, such as the pressuremeter, or it can be estimated from the results of laboratory intact specimen tests. Intact laboratory test results are often reduced to account for imperfections or discontinuities and other properties of the rock mass that may be present in the entire system, but are not easily replicated in the lab. The rock mass modulus can be used to design piles, drilled shafts and shallow foundations that are typically employed on Missouri Department of Transportation projects. Most current methods of estimating this modulus requires coring and sampling the material, transporting samples back to a lab with appropriate equipment, extruding and preparing samples and finally performing triaxial tests and estimating the modulus from the resulting stress strain curves. Shale formations found in Missouri are typically sensitive to changes in moisture content and disturbance from sampling and sample preparation. Generally lab tests are only performed on samples that can withstand the disturbances associated with sampling and preparation. Therefore lab tests generally yield values of intact modulus and the in-situ rock mass modulus must be estimated or implied from these results. The pressuremeter test (PMT) offers a potentially better method to assess the in-situ rock mass modulus. The PMT allows testing of difficult to sample materials, e.g., shale, under in-situ stress and structure conditions resulting in a modulus more representative of the shale mass. Pressuremeter tests were performed at five sites in Missouri and the results were reduced to yield rock mass modulus. Intact samples of shale recovered from each site and returned to the laboratory for unconsolidated undrained and unconfined triaxial tests to yield intact modulus values. In general, the modulii from the intact specimens were equal to or less than the in-situ modulii measured using the pressuremeter. In these practical cases, the modulii from the intact specimens did not require any reduction to provide rock mass modulus. Rather, the modulii from the intact specimens could be used directly as the rock mass modulii. This result is surprising, but not unheard of.