PORE PRESSURE IN CONRETE: THEORY AND TRIAXIAL TESTS

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Abstract

This dissertation describes theoretical and experimental work on the effect of pore pressure in wet hardened concrete. The theoretical part is concerned with the likely mechanical effect of the presence of water in the pores of concrete in structures such as may be found in offshore engineering. By considering the compressibility's of the three components which make up wet hardened concrete, consolidation equations defining the behaviour of the material under external stresses are written for a linear elastic matrix. The pore fluid is treated as homogenous and simple model is proposed to show how the compressibility of the pore fluid may change with external conditions for different degrees of saturation.

Analytical and numerical methods of solution of the consolidation equations are them proposed, the former method being restricted to simple problems. An existing finite element program dealing with consolidation in soil is modified according to the theory set out above and more complicated problems are solved, for example, the effect of rapidly lifting out of deep water a concrete previously under water for a long time.

On the experimental side, techniques for measuring pore pressure in wet hardened concrete cylindrical specimens in a conventional triaxial test are developed. A novel strain measuring device is commissioned and used in the compact and mobile triaxial apparatus which a testing program involving concrete specimens of three different degrees of initial saturation is performed. Results of the tests are presented in a number of graphical forms, and discussed in terms of effective stress and other concepts from soil mechanics.