EFFECTIVE STRESS METHODS APPLIED TO OFFSHORE PILES

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INTRODUCTION

General

The modern use of piles to support offshore structures is more than thirty years old, beginning in the late 1940's development of petroleum in the Gulf of Mexico. During this period, the methods used for design and analysis have evolved in response to more severe challenges and with a better understanding of the relationship between prediction and actual performance. Effective stress principles have been incorporated into some of these methods. The arguments for including effective stress principles are that the fundamental response of soils is dependent upon effective stresses and not total stresses. Therefore, it is reasonable to anticipate that better, more accurate, predictions of performance can be made using effective stress methods.

The capacity of a pile can be addressed in several major problem groups: the axial capacity in tension or compression, the lateral capacity and behavior of groups. Both static and dynamic behavior are important problems. Static axial capacity is the most important design problem and has been studied much more extensively than all others. For this reason, and because most fundamental principles of pile behavior apply to all the major problem groups, static axial capacity can be used to describe the application of effective stress methods to offshore piles.

All existing rational methods for predicting the axial capacity, Q_c (compression) or Q_t (tension), are based on establishing a relationship between the applied load and resistance along the shaft and at the tip. Thus, in compression,

$$Q_c = Q_{pc} + \int_{surface} \tau(z)dz - W \qquad ...(1)$$