THE SHEARING RESISTANCE OF SAND AT VARYING MOISTURE CONTENTS

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I INTRODUCTION

The stability and safety of a structure depends upon the performance of each of the structural members. The structural members are generally considered to be only the steel, masonry and wood involved in the structure. These materials are found to have a high degree of uniformity, exactly known physical properties, and a high degree of resistance to loss of strength under varying moisture content or other external conditions. The underlying soil acts as the fundamental support for these members and is the weakest link of all of the members. The "weakness" lies in a lack of general knowledge of the true fundamental properties of strength, the great variations that exist within short distances, and changes in strength which may occur with time. Hence, the strength characteristics of soil are difficult to analyse and predictions of performance are often inaccurate.

Statement of the Problem

In all soil stability problems, such as the design of foundations, retaining walls, and embankments knowledge is required concerning the strength parameters of the soil. The determination of the proper strength parameter to use in the solution of a problem can be the most difficult question which arises in soil mechanics and foundation engineering. A soil can be classed as cohesive or cohesionless depending on the source of its strength. Cohesive soils are soils with a very

small grain size bound together by molecular attraction (Van Der Waal's forces) and are not considered in this report. Cohesionless soils are soils which have little cohesion or molecular attraction between individual particles. The resistance to shear of a cohesionless soil is derived from friction between grains and the interlocking of grains. The friction between grains results from rolling and sliding friction but normally no attempt is made to distinguish between them. The interlocking of the particles contributes a large portion of strength in dense sands and has a lesser effect in loose sands.

The shear strength of sand was first defined by Coulomb (1), whose classical equation ($\tau = \sigma \tan \phi$) has formed the basis for most of the work on this subject since it was originally proposed in 1773. The equation was based on some rather crude sliding friction tests of wood on wood. These tests showed that frictional resistance increased linearly with normal pressure and Coulomb assumed that the same law would be applicable for soils. This empirical equation has proved a valuable tool for many practical purposes. The strength of clean sand is conventionally determined by direct shear or triaxial compression tests performed on samples which have been formed in the laboratory to the desired conditions. Because of ease of forming and testing dry samples, as compared to moist or saturated samples, the laboratory tests are often performed on air dry soil.