

A comparison of the Casagrande and fall cone penetrometer methods for liquid limit determination in marls from Crete, Greece

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(Received November, 8, 1990; accepted after revision March 21, 1991)

ABSTRACT

Christaras, B., 1991. A comparison of the Casagrande and fall cone penetrometer methods for liquid limit determination in marls from Crete, Greece. *Eng. Geol.*, 31: 131–142.

Marls from three areas in Crete (Chersonissos, Agios Vlassis, Agia Varvara) were studied to determine their liquid limits by the Casagrande and fall cone penetrometer methods and the results were compared. The first method is the classic one, the second a later proposal for measurements in clays. In addition to these tests, various aspects of the materials were studied, such as: their qualitative and quantitative mineralogy, the specific gravity of their solid particles, their particle size grading, their Atterberg limits (liquid and plastic limits), their plasticity index and their activity. The results were interpreted using statistical methods in order to identify the mathematical expressions and diagrams which represent the interrelationships existing between the above properties. According to the present investigation, the two methods of liquid limit determination give similar results. This similarity was greater in finer soils, especially in pure clays; a more shallow fall cone depth could give better results in soils with lower clay concentrations, expressed by the equation $z = 6C^{0.14}$.

INTRODUCTION

Consistency limit tests are frequently used in geotechnical soil investigation. The Casagrande method is the classic method for liquid limit determination. This is described the ASTM D-4318 specification. According to Karlsson (1977), fall cone penetrometer method results, used originally for shear strength measurements (Hansbo, 1957), can be related to Casagrande's liquid limit for pure clays. In this method the water content in a soil, necessary for a 10 mm fall cone penetration corresponds to the liquid limit of the Casagrande method.

In this study marls, from the Chersonissos, Agios Vlassis and Agia Varvara areas of Crete, were classified according to their physical properties and engineering geological characteristics. The main purpose was to compare the results obtained by the fall cone penetrometer method with those of the commonly used Casagrande method, not only for pure clays, but also for relatively coarser fine soils. It was