

Title: *Influence of temperature in the Liquid Limit for soils with different plasticity indexes*
Author: *Alberto José Puy Santín*
Tutor: *Josep Suriol Castellví*

ABSTRACT

This thesis describes an experimental research consisting of the study of the relationship between the temperature and the liquid limit of three soils usually tested in the Laboratory of the Geotechnical Engineering Department (DIT). In order to get results, different soils have been tested at temperatures ranging between 10 °C and 40 °C.

For the accomplishment of the study, a significant amount of experimental evidence by several authors on this subject has been previously studied. Among the consulted literature, the experiments carried out by Youssef et al. have provided significant understanding on this subject and they have been useful as a reference for the present thesis. In his study, the variation of the liquid limit is obtained according to the temperature for three high plastic clays, with liquid limits over 60%.

Other researches of interest for this thesis have been taken into account, especially all those in which the influence of specific factors has been compared with the results of the liquid limit of the soils. So, it has been necessary to adapt the corrective measures suggested by these authors to the methodology of the test procedures.

Among all the factors to take into account, some of them stand out such as the tempering, the drying in the heater, the type of grooving, and the way to add water. Regarding to the time of tempering, it has been proved that once 12 hours have passed of the kneading of the paste "soil-water", its reductive effect in the liquid limit ends. On the other hand, we conclude that drying the soil in the heater before its disgregation only has reductive effects in organic soils. Regarding the grooving tool used during the test, it must be taken into account that using the ASTM's grooving gives, systematically, lower liquid limits than by Casagrande. And, finally, it is established that the best way to obtain the liquid limit is kneading the soil, previously to the test, with the humidity corresponding to the liquid state, and reducing the humidity in order to obtain the different determinations with successive kneadings. All these conditions and the ones specified in the code UNE 103-103-94 have defined the methodology used during the test procedures.

The determination of the liquid limit was carried out on three different kinds of soils: soil from *Campus Nord*, soil from *Sant Sadurní d'Anoia* and clay from *Boom* (Belgium). The range of temperatures chosen for this research was 10-40°C, since these temperatures are easily found in the nature, without being extreme climatic situations. An oven or refrigerator were used on the samples of soils in order to get the desired sample temperature, and the liquid limit was obtained later. The soil's liquid limits were obtained at the temperatures of: 10, 20, 30 and 40 °C approximately, repeating the process until obtaining several determinations for each temperature and soil, always in the range between 15 and 35 knocks.

The results obtained have been interpreted and checked, and we have come to the conclusion that based on this experience, the influence of the temperature in the three different soils is negligible to practical effects since the variations obtained as consequence of the temperature are very small. However, it has been noticed that there's a trend to decrease the liquid limit when an increase of the temperature takes place, as well as the increase of the influence of the temperature once the plasticity of the soil increases.

At the end of the research, we have compared the results obtained in the laboratory of the DIT with the study done by Youssef et al. With this comparison, we have come to the conclusion that the behavior described in this research is similar to the one obtained in the laboratory. However, it's noticed that, for soils with similar liquid limits, the results of both researches are far away quantitatively from each other, without any possibility to understand the reason for this difference of results, because of not having enough information regarding the procedure of the test done in this research.