

## **ii. Abstract**



Nowadays, the importance of earth retaining structures, basically in urban areas, has lead engineers to develop some calculation methods that try to simulate the real behaviour of soils. However, the amount of parameters that are involved in real soil problems makes difficult to predict how the earth retaining structure and the surrounding soil behave.

In the present Graduation Thesis, the two predominant numerical methods available to calculate retaining walls at serviceability state are presented: spring models based on Winkler's theory and models based on finite element methods. The computer codes used for that are probably the most widely extended around Spain: PLAXIS (based on finite element method) and RIDO and CYPE (based on Winkler's theory).

First, an introduction of both theories has been included in order to make easier the subsequent comprehension of the obtained results and the reason of their own peculiarities and differences between them. Such explanation includes the governing equations of the stress-strain problem and how they are used by each analysis method. When describing the Finite Element Method, the constitutive models theory is also presented. Secondly, all defining parameters of the models considered codes are described.

After that, an exhaustive comparison between both calculation procedures is presented and, in addition to that, a comparison with a real case has been included as well. It becomes from the fact that the author of this document has been working in the construction of an industrial building located on Hospitalet de Llobregat district (province of Barcelona) with two different underground levels. To retain the soil (sands basically) it was necessary to build an earth retaining structure and in this case, a diaphragm wall with one level of anchors was the choice. While constructing, displacements of the wall were monitored and subsequently registered - such registers were taken throughout different key moments during the construction.

Stresses located at fixity elements, bending moments and soil pressures applied on the retaining wall are taken as basic variables for the comparison between the two methods under study; besides, in the case the comparison is carried out making reference to the real case, the displacement is the only characteristic of the diaphragm wall that is going to be considered.

On top of that, and taking into account we are basically dealing with a problem governed by the plastic behaviour of the soil, internal friction angle of the sand is essentially the parameter which is going to determine the displacements of the diaphragm wall. Consequently and based on the results obtained at the construction site, backanalysis of such angle is going to be carried out as well as an estimation of the friction angle between the concrete of the retaining wall and the sand of the area. The methodology for that is, firstly, defining an objective function based on the real differences between measured and computed movements and, secondly, to carry out several manual iterations so as to obtain an isoline map and on the basis of such map, to observe the minimum of the objective function.

Finally, some conclusions are proposed (based on the results obtained trough the research) in order to, first, establish advantages and disadvantages of both calculation methods, and second, to define pros and cons regarding the use of the commercial codes considered in this work.

