

# **Control estructural de fonamentacions profundes mitjançant assaigs d'integritat i de càrrega**

Autor: Jofre Rios i Osia

Tutor: Sebastian Olivella Pastelle

## **Abstract**

In this document you can find a description of the two most commonly used methods to study the integrity of the piles. The Mechanic Impedance method, also known as Sonic Method or PIT (Pile Integrity Test), and the Sonic Transparency Method, also known as Cross-Hole.

The Sonic Method is based on the answer given by one pile once a compression wave propagates inside it. The test starts with a knock on the pile surface, using a small hammer. This knock generates a wave which propagates in its insides. The possible changes that might take place within the pile: section changes, impedance changes, holes, cracks, etc...affect the propagation of the wave, producing modifications like reflections and refractions. These modifications are detected with an accelerometer, located on the pile surface. They are registered and subsequently analyzed. Factors such as the preparation of the pile surface, the choice of the exact location where to produce the knock or the right placement of the accelerometer can interfere with the correct performance of the test. You can also find a list of the basic items which form a complete Pile analysis system: small hammer, accelerometer and a computer used to register the data. Finally, there is a guideline based on: reflectograms examples having piles anomalies, from the analysis of the characteristics method or from the way some current software work. This guideline is mainly used to help the tester interpreting the obtained results.

On the other hand, there is the Sonic Transparency Method, which is based on the time that it takes for an ultrasonic constant wave to move from one point to another (both points known by the tester). Waves are generated by a transmitter and received by a receptor. Both items are introduced into metallic tubes, previously tied to the framework of the pile before being concreted, then they are brought up simultaneously to the surface of the pile. The possibility of delays in the propagation period of the waves from one point to the other depending on the depth, may indicate the presence of anomalies. Together with the time measurement, the one regarding the energy is also used. Factors such as dispersion or absorption may influence the loose of energy, in this case it can also indicate that there is some kind of anomaly. As with the Sonic Method, the specific requirements have also been described: typology of the tubes, useful criteria which help decide how many tubes to use and the right location of the tubes in each pile.

Apart from the Integrity tests, there is another huge group of tests to which the piles can be subjected: the Load Tests. In the text, you can find a short introduction to the Static Load Tests. Within the different types of Load Tests, there are two rapid ones: the Dynamic test and the Statnamic.

In the Dynamic test, one big mass is thrown onto the pile surface, once instrumented, the computer works in order to give you an answer. For these process a few mathematic models which emulate the pile behavior and its interaction with the ground using the wave equation are used. One of the most interesting results that you can obtain is an estimation of the bearing capacity. Even though this method can be used for all kinds of piles, it is mostly used for driven piles, the driven hammer is used.

The Statnamic test, first appeared as a way of gathering all the static and dynamic tests together. This test can be done on any pile with a minimum preparation. In this type of test a combustion system is used, it is located on the pile surface. The combustible causes the elevation of counterweights and due to their reaction an axial load is obtained. The equipment allows you to measure the applied load and the resultant displacement