ABSTRACT

Lately, new methods of design and control of the bituminous mixtures are being studied. There are two very important parameters which are being used to characterize the bituminous mixtures. They are the resilient modulus and the indirect tensile strength.

In a pavement there are two types of deformations. The resilient or elastic deformations, of instantaneous recover, and the plastic ones, which stay in the pavement after stopping the load. When we subdue a pavement to cyclic loads, after a certain number of cycles, the modulus reaches to be constant and the pavement's answer can be assumed as elastic. The modulus, which remains constant, is the resilient modulus.

The resilient modulus is a parameter that is often used to check the state of the pavement's cape. It give us an idea about the cape's quality and the durability, since it is obtained from applying cyclic loads, which starts a tensional state similar to the service one. It is an important parameter in the studies of permanent deformation and fatigue, and it gives us an idea about the useful life of the pavement.

The resilient modulus' values can be employed to evaluate the relative quality of the materials and to generate entrance data for the design, evaluation and analyses of the pavements. The laboratory methods for determinate the resilient modulus' values is based on the application in the indirect tensile essay with repeated load.

The indirect tensile strength is being used in Catalonia as a control of quality process of the bituminous mixtures in service, as it has been demonstrated in the last years from the ETSECCPB that it has a direct relation with the properties and characteristics of each type of mixtures. With the determination of the indirect tensile strength not only can be evaluated the materials' quality but also it is a tool for the design of the pavement.

This thesis analyses the equipment effect and measure process in the determination of the resilient modulus and the indirect tensile strength of the bituminous mixtures. For that, it has been elaborated specimens with three different types of mixtures (S-20, S-12 and G-20) and with two types of bitumen, one of them normal and the other modified with polymers.

Half of the specimens have been tested by resilient modulus in two different machines, the NU kit and the MTS press, to see if similar values were obtained. The results of the tests made show that the resilient modulus' values are equal in both machines when they are tested with the same load frequency.

Later, all the specimens were tested by indirect tensile strength and the results obtained were analyzed to determinate whether there were influences of the previous test of resilient modulus on the indirect tensile strength values obtained. The study allows concluding that there is no influence of the test for the determination of the resilient modulus in the indirect tensile strength values obtained.

It also has been analyzed the influence of the different kinds of mixtures and bitumen on the resilient modulus and the indirect tensile strength values obtained. The mixtures done with bitumen 60/70 give bigger values of resilient modulus and indirect tensile strength than those which are being done with modified bitumen. In respect of the type of mixture, the resilient modulus values are bigger for the mixture S-20, followed by the G-20 and the S-12. The indirect tensile strength values are bigger for the mixture S-20, followed by the S-12 and the G-20.

The present thesis brings some very useful information for future investigations related to the characterization of the bituminous mixtures and their influence in the parameters studied. Likewise, the values obtained in the tests done with both presses could be used to make future studies about the repeatibility and reproducibility of the tests if they are complemented with the necessary information.