ABSTRACT

During the seventies the fibre reinforced concrete (FRC) was introduced, since that moment it has been developed, adding new materials to improve the concrete properties. There are a lot of applications of FRC, in pavings, concrete bases, concrete slabs or precast members, the aim is the partially or total replace of reinforcing steel. This material has a range of applications depending on the type of fibre, which are classified by the material that are made, the making process or the shape and the length of the fibre. Therefore, if we want to spread the use of FRC, a better process of characterization and control of quality is required.

In this line, the Construction Engineering Department in the Civil Engineering School (ETSECCPB) in UPC has adapted the double punching test, which was proposed by Chen in 1970, for the FRC quality checking. Nowadays, it has been re-named as Barcelona test (BCN test), and is the alternative to the traditional tests as the beam bending tests (the belgium, NBN B 15-238, or the european, EN 14651:2005). These tests have problems because the results dispersion and the specimens are heavy weight (more than 30 kg). On the other side, the BCN test, use small cylindrical specimens (Ø150x150 mm), has less dispersion and avoid the problem of preferent orientation of fibres.

These tests measure the strength and the toughness after the concrete cracking. The toughness is a very important property, it is the measurement of the required energy to crack the concrete, and it is calculated as the area under the load curve obtained in the test. This parameter is very interesting. Because it gives information about the energy absorption and the residual strength added by the fibres.

This work is focus on the Barcelona test applied to the high workability FRC. The main aim is to find the mechanical properties of the material, and check the BCN test outcome with the bending test EN 14651. To reach this objective, a wide experimental campaign was designed with two different concretes, one of them of high strength, and with four different fibre contents. Each material we had been tested in fresh and hardened state.

Tests in fresh state are used to evaluate the influence of the fibres in the workability. After that, we cast specimens for the Barcelona test and the beam bending test. In the later analysis, we have compared the both test results, and were found connections with the toughness and the residual strength. In the other side, there are models which explain the BCN test behavior, and how obtain the residual strength. The expressions used to get the tensile concrete strength from the double punching test are checked and compared. In this analysis are compiled information about the specimen breaking, in order to reach a better understanding of the BCN test mechanical cracking.