ABSTRACT

The use of concrete filled tubular columns has increased in the last years due to, on one hand, their good structural performance, taking advantage of the combined effect of concrete and steel working together and, on the other hand, their good behaviour in the fire situation, showing a high fire resistance without the need of external protection.

An extensive review of the state of the art has revealed that while the fire performance of these steel hollow sections filled with concrete has been deeply investigated in recent decades, the number of experimental investigations specifically designed to evaluate the fire resistance of slender circular steel hollow section columns filled with high-strength concrete and subjected to eccentric loads is scarce.

This research work discusses an experimental campaign consisting of 40 fire resistance tests conducted on slender circular steel hollow section columns filled with normal and high-strength concrete, subjected to concentric and eccentric loads, in order to analyse the effects of these variables.

Thus, the test parameters of this experimental program are the nominal compressive strength of concrete (30 and 90 MPa), the infilling type (plain concrete, reinforced concrete and steel fiber reinforced concrete), the axial load level (20 and 40%) and the load eccentricity (0, 20 and 50 mm). All of the tested columns have a total length of 3180 mm and an outer diameter of 159 mm, the steel tube wall thickness being 6 mm. Regarding the boundary conditions, each column is fixed at its bottom end and pinned at its top end, having all of the columns analysed a relative slenderness at room temperature higher than 0,5.

Finally, the results of the experimental tests are compared with the provisions of different simple calculation models provided by the existing international standards so as to validate the accuracy of these methods. This study evidences that Eurocode 4 provides unsafe predictions for slender circular CFT columns subjected to concentric axial load and, in turn, results excessively conservative when the load is eccentric.