ABSTRACT

Examples of stainless steel construction have mainly been adopted for architectural applications thanks to its corrosion resistance, easy maintenance and its pleasing appearances. However, its use as a structural material has been limited due to its mechanical characteristics and its non-linear stress/strain behaviour, making it difficult to apply classical procedures for material and structural analysis. Recently its utilisation has been growing due to its advantageous properties and a greater understanding of its behaviour as a structural material. In Spain during the last few years, we can find some examples of stainless steel used as a structural material, a few cases being, Estación Amezola de Bilbao, Cúpula del Teatro-Museo Dalí Figueres, Piscina Municipal de Pinto and Museo Reina Sofía Madrid.

The various codes of practice that exist for the design of structural elements using stainless steel tend to be excessively conservative due to a lack experimental data, therefore making the need to develop a methodology for calculation and design in this area. At the current moment the understanding lacks an experimental basis and applicable methodology, especially when considering thin plates and sections. Specifically, in the design of stainless steel beams with slender webs under shear actions, the existing codes are based on adaptations of the simplified methods obtained for carbon steel, such that this does not reflect the real behaviour of this type of section.

For these very reasons the objective of this work is to contribute to the study of the behaviour at ultimate limit state of built-up girder beams using stainless steel plates. In order to do this, an evaluation of the influence of longitudinal stiffeners in the stainless steel beams have against the shear actions and the resulting buckling produced, in both the pre-critical phase (the influence over the value of the critical shear stress) and the post-critical phase (formation of diagonal tension field action). This work has been experimentally carried out by testing 5 stainless steel plate girder beams with longitudinal stiffeners. The geometry of the beams is identical except for the longitudinal stiffeners, which have various inertias. The beams have beam subjected to what is basically a pure shear load until frame failure mechanism has occurred.

Once completed, the results from the experimental study have been analysed and compared with the results obtained using analytical methods presented in existing codes of practice and with the results for a beam with the same geometric characteristics, but without longitudinal stiffening.

Finally, the conclusions are presented on one side related to the experimental work and on the other the background study for this work.