Strength and deformation of stainless steel bolted joints with reference to Eurocode 3

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Abstract

While the use of stainless steel structural elements is not very common, the number of applications is steadily increasing because new potential uses continue to be identified. It is for this reason that a ECSC project, covering all major aspects of the design of stainless steel elements in buildings, was initiated in 1998. One of its principal objectives was to verify, and propose improvements to, the supplementary part of the Eurocode 3 concerned with stainless steel design (ENV 1993-1-4).

The ductile nature of stainless steel guarantee an excellent global joint behaviour, but its non linear behaviour and the relatively low value of the yield strength to ultimate strength ratio may require attention in design. The EC3-1.4 requirements for stainless steel joint design are essentially the same as those for carbon steel. Since these latter rules are in general based on the concept of strength only, some modifications were introduced in Part 1-4 to avoid excessive joint deformations at the serviceability limit state.

In this paper, the experimental results for the cover plate joints, conducted at LERMES-Clermont Ferrand, are compared to the predictions of EC3-1.4. While the tests show that the various ultimate state joint strengths are safely predicted, the net section and bearing resistances are underestimated. A presentation of the major differences between carbon and stainless steel is given. That concern the Ultimate and Serviceability Limit States criterion applied on bearing, net and gross sections.

The study is now being complimented by the use of finite element modelling in order to better understand joint behaviour. It should also help to extend the results of the study to the design of other geometrical configurations and other types of joints (beam-to-column joints for example).

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