Welded Connections in innovative High Strength Steel Constructions

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Abstract

In addition to the common mild steels, nowadays high performance steels with good weldability and high ductility are available for the construction industry. By using steels with higher resistance/weight material ratio savings can be obtained especially in the case of heavy constructions such as bridges, wide spanning roofs and high-rised buildings. However, for the particular situation of joining high strength steel by welds, e.g. in many cases in design codes such as EN 1993-1-8 [1] the rules are inadequate because recent rules and safety margins are developed traditionally for standard steels and then transferred to high strength steels.

Keywords: High Strength Steels; welded dual-steel connections; mixed connections; fillet welds; butt welds; load carrying capacity; filler metal.

1 Motivation

1.1 General

In the last years high strength steels with good welding characteristics and a high ductility in addition to the higher strength have been developed by the steel industry. With increasing steel strength also the loadings are growing which have to be transferred by the welded connections. The use of high strength steels can bring significant savings in terms of material consumption, weight, transportation and fabrication costs. When using high strength steels it is very important to ensure strength as well as sufficient ductility and toughness of the welded connections in order to allow for the necessary redistribution of internal forces. However, especially for high strength steel grades S460 (f_y = 460N/mm^2) and S690 (f_y = 690N/mm^2) the benefit of savings cannot be fully used due to the present restrictive design rules e.g. in EN 1993-1-8 [1] and EN 1993-1-12 [2].

1.2 According to EN 1993-1-8

1.2.1 Load carrying capacity of fillet welds

According to EN 1993-1-8 [1], there are two methods to calculate the strength of fillet welded connections: the directional method and the mean stress method. For the more refined directional method forces transmitted by a weld are resolved into the stress components normal stress $\sigma_\perp$ and shear stress $\tau_\perp$ vertical and shear stress τ_{II} parallel to the weld axis, see Figure 1.

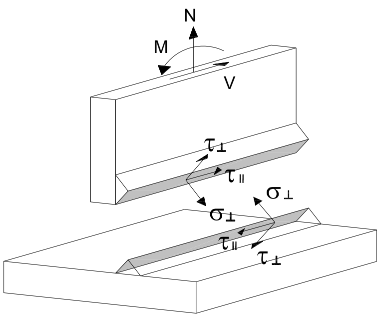

Figure 1. Stress components

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