Improvement of the mechanical model for mode 1 T-stub plastic strength

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In structural robustness studies, column loss events are considered. Such situations require the structure to be calculated in its deformed configuration. Joints response therefore plays a crucial role in such an analysis. However, nowadays , the component method for characterising joints has been developed essentially for the elastic domain. Researches are currently being carried out on components to extend this method up to joint failure. The component studied in this thesis is the T-stub.

First, the state-of-the-art is reviewed. A detailed presentation of this component is given. The same applies to various characterisation models. These range from the current standards, which is conservative and easy to apply, to the most recent and complex research models.

Next, a multitude of test campaigns were searched in the literature. From these, the most relevant specimens were selected for the study of **short unstiffened back-to-back T-stubs with one bolt row and made from mild steel welded plates**. The previously presented characterisation models are applied to these tests. As a result, an inadequate assessment of plastic strength is observed. This observation will be investigated in the remainder of this thesis.

Numerical modelling of the Timisoara test campaign was carried out. This enabled the modeling procedure to be validated.

In addition, a parametric study was carried out on three dimensionless parameters. These investigated the ratios of plates thickness to plates length, plates thickness to bolts diameter and the position of prying forces. From this study, it was observed that membrane effects are, indeed, negligible at yielding. Nevertheless, it was shown that the position of the plastic hinges is poorly evaluated. The same applies to the stress distribution under the bolt head. It has also been shown that the position of prying forces is safely overestimated. Finally, it has been observed that the range of application of the short T-stub theory is reduced in comparison with what the theory predicts. Indeed, non-rectilinear failure mechanisms were obtained.

Finally, analytical developments and formulations are proposed. Empirical formulae are proposed for the position of the hinges. Then, the work of the bolt head is re-evaluated by integrating the actual position of the hinges and a more realistic triangular stress distribution. For the non-rectilinear mechanism, an effective length is proposed. MV interaction is also introduced in the model to prove its influence. Last but not least, the EuroCode T-stubs classification criterion is invalidated and another one based on stiffness is proposed.

In conclusion, number of perspectives are suggested for further researches and improvements of the model proposed here. These include the establishment of a more accurate formula for the position of the hinges, and a more rigorous evaluation of the hybrid mechanism and the prying forces position. Once this has been done, a variation in the length of the T-stub can be considered.