

Summary

In Germany the safety of structures is guaranteed by the regulations in the Eurocode. The Eurocode consists of ten series of standards which include regulations for the structural design of structures and information on the application of individual materials and their respective design verifications. This research focuses on steel construction and in particular on bolted steel connections. The design of bolted connections is regulated by DIN EN 1993-1-8. In the context of current research results, a new design proposal for steel connections was published in the draft prEN 1993-1-8 in 2021.

The aim of this research is to verify the reliability and safety of the existing design concept for bolted steel connections from DIN EN 1993-1-8 and the draft prEN 1993-1-8 by means of statistical evaluation procedures. The two design concepts were compared with experimental results from the literature.

The method according to DIN EN 1990, Annex D was used as an evaluation method. The aim of this method is to determine a partial safety factor for the verification of results. The partial safety factor compares the theoretically calculated values with the experimentally determined values. This statistical analysis was carried out both for the design concept according to DIN EN 1993-1-8 and for the concept according to prEN 1993-1-8.

The main focus of the research is the verification of bearing resistance on steel plates. It is concluded that the currently valid standard DIN EN 1993-1-8 can be regarded as safe and reliable. However, the statistical evaluation showed that the actual bearing resistance is highly underestimated by the design concept.

The statistical evaluation of the draft prEN 1993-1-8 has shown that it can also be regarded as safe and reliable. Here, however, the resistances are not underestimated, which means that the design concept can be considered more reasonable.

An additional parameter study on a bolted steel connection has shown that, in addition to the plate thickness and tensile strength of the steel, the edge distance and the hole distance in the direction of the force mainly have an influence on the bearing resistance. However, it has been proven that the edge distance and the hole distance transverse to the force have no influence on the actual resistance and that DIN EN 1993-1-8 reduces the calculated bearing resistance by including these parameters.

In order to increase the bearing resistance of a bolted steel connection, apart from the general parameters such as the sheet thickness and the tensile strengths of bolted and steel materials, the edge and hole distance in the direction of force, should be increased, since these two characteristic values have a great impact on the bearing resistance.