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Reassessment and extension of the fatigue classification catalog according to Eurocode 3 for a sustainable design of highly stressed steel structures AiF No.: 19178N

Summary of the research project AiF No.: 19178N

In many areas of our infrastructure, such as bridge construction, crane and crane runway construction, and also in building construction or chimney and mast construction, steel structures are subject to cyclic stress, which requires verification against fatigue. The fatigue classification catalog in DIN EN 1993-1-9 [1], which regulates the fatigue strength of specific construction details, is of great importance in the design of such highly stressed structures in civil engineering. Standards are actually intended to provide reliable evidence, but should not be overly conservative in order to enable cost-efficient dimensioning in the interests of resource conservation. In fact, it can be shown that, in comparison to previous German standards or regulations in other areas, the fatigue classification catalog according to DIN EN 1993-1-9 [1] leads in many cases to more conservative, i.e. economically worse, results. The basis of the fatigue classification catalog dates back to 1989 and earlier, and more recent findings have not yet been included. At that time, test data were compiled and evaluated using methods that no longer correspond to the current state of the art or were provided with significant safety margins.

Furthermore, the processing of the project has shown that a relatively large number of important details are only poorly documented by experimental data, but were chosen based on engineering considerations, oriented towards other details or even numerical investigations. However, these cannot always be confirmed. For this reason, the research project presented here aimed at developing recommendations for the further development of the fatigue classification catalog in DIN EN 1993-1-9 [1] with regard to design details of steel and composite bridge construction, crane and crane runway construction as well as mast and chimney construction. The test basis of the existing fatigue classification catalog according to DIN EN 1993-1-9 [1, 4] was critically examined in areas relevant for practice, re-evaluated using modern statistical methods, and expanded to include current research results and tests. For this purpose, statistical analysis methods were evaluated and a modern database structure was developed. Furthermore, the fatigue classification catalog was supplemented with missing or insufficiently classified details: This concerns new details of the belt slat end and the end plate

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joint with preloaded screws. The most important result of the project was the proposal of improved notch tables for more economical, differentiated and safer fatigue design.

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