

Issue 2022/1

Practical design of diagonal tube connections in steel and composite bridge construction | AiF No.: 20452N

Summary of the research project AiF No.: 20452N

The focus of the project was the development of practical and fatigue-resistant design variants of diagonal tube connections using inserted gusset plates, as they are commonly used for external and internal diagonals of bridge transverse systems. In German bridge construction, different design variants are used which have fundamentally different notches and are not regulated by the standards DIN EN 1993-2 or DIN EN 1993-1-9. The relevance and necessity for the investigations were demonstrated by bridge structures that were recently completed or are still in the planning stage, such as the Schierstein Rhine Bridge, the Hochmosel Bridge and the Rinsdorf Valley Bridge, where the construction detail was applied in different designs. Project-specific investigations are expensive and cannot be easily transferred to other bridge projects; there was also a need for optimization in manufacturing. Based on the experimental investigations, three different design variants could be classified into fatigue classification categories, making the fatigue verification using the nominal stress concept according to DIN EN 1993-1-9 possible. A corresponding proposal was prepared for the new generation of the Eurocode

prEN 1993-1-9, see Figure 1, and has already been implemented in the Final Document. This proposal was also incorporated in parallel into BEM-ING Part 1-3 EC 3 „Steel Bridges“, which will be published before the future Eurocode standards. Based on the numerical investigations of the research project, further geometric parameters were identified, from which notch factors were derived in order to optimize the geometry for execution and design recommendations such as the planning aids for steel and composite bridges, which are part of the RE-ING. From these investigations, a proposal was made to revise the currently valid planning aids for diagonal pipe connections.

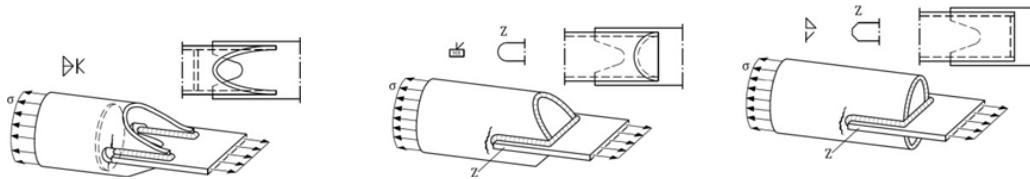


Image 1: Proposal for fatigue classification details for prEN 1993-1-9

By incorporating the results into the future Eurocode and the German BEM-ING as well as into the planning aids of RE-ING, an economical, secure approach for the design and construction of steel and composite bridges developed into a generally valid rule.

This creates clear design rules for the designing engineering offices as well as for the steel and composite bridge manufacturers, which lead to improved designs with regard to fatigue safety and thus to durable bridge structures.

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