# Fatigue behaviour of tubular bracings in steel and composite bridges

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## Abstract

In steel and composite bridges, a practice-oriented and fatigue-suitable design is crucial for sustainable and economical infrastructures. The welded joints of slitted tubular elements, especially of circular hollow sections with gusset plates for cross girder bracings or box girder diaphragms, are critically assessed in view of their fatigue behaviour. The gusset plate welding at the end of the slit is the critical fatigue spot. For the currently various design variants used in bridge construction with basically different notches, there is no clear rule given regarding the detail category by the standards EN 1993-2 or EN 1993-1-9. This paper summarises the experimental und numerical results of a research project on three different fatigue design solutions for tubular bracings in steel and composite bridges. An overview of the practice-oriented design, the benefits for the execution and manufacturing as well as the proposals for prEN 1993-1-9 and design recommendations are given.

**Keywords:** fatigue design, tubular bracings, steel and composite bridges.

## 1 Introduction

For medium spans in steel and composite bridge construction, the superstructure is often designed as a box girder section due to the high torsional stiffness. In order to retain the shape constancy of the cross-section inside the box girder, a truss-framed solution is regularly realised.

For wider bridge cross-sections, the cantilevered slabs are typically supported by diagonal bracings outside of the box girder. For these two functions acc. to Figure 1, tubular cross-sections are mostly used since circular hollow sections are preferred for trussed beams due to the reduced risk of buckling in combination with isotropic stiffness.

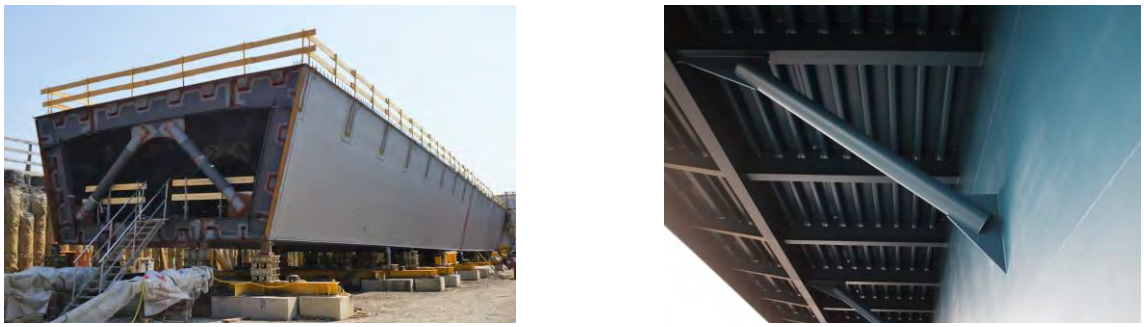

*Figure 1. Design variants of tubular bracings inside and outside of box girders of the German bridges Heidingsfeld (left) and Hochmosel (right)*