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Economic design of fillet welds for seal-welded hollow box sections in bridge construction
ICR No.: 01IF22244N

Summary of the research project ICR No.: 01IF22244N

Non-accessible, seal-welded hollow box sections are frequently used in bridge construction for short to medium spans due to their economic efficiency and structural advantages. A characteristic feature of this construction method is that the dimensions of the hollow boxes generally do not permit access to the interior. As a result, the longitudinal welds at the flange-to-web connection, by design, can only be welded from the outside and are therefore single-sided welds. Since an inspection of the inside of the hollow box is not possible or only possible to a very limited extent during operation, these constructions are hermetically sealed by welding. Measurements on existing structures have shown that temperature variations due to climatic conditions in airtight sealed hollow boxes lead to pressure changes in the enclosed air volume. The resulting fluctuations in internal pressure cause additional bending stresses on the fillet welds welded on one side. For this load case, there was previously neither reliable information on the magnitude of the action effects nor reliable experimental data on the load-bearing capacity of fillet welds welded on one side. The design is currently carried out in

accordance with the German RE-ING guidelines, which are based on simplified and intentionally conservative engineering assumptions. The aim of the research project “Economic design of fillet welds for seal-welded hollow box sections in bridge construction” was therefore to scientifically investigate the governing actions and the structural behavior of single-sided fillet welds and to establish a verified and reliable basis for their design. For this purpose, thermal simulations were carried out to determine the relevant internal pressure loading of seal-welded hollow boxes. In addition, experimental investigations were carried out on the structural behavior and fatigue performance of single-sided fillet welds, as well as supplementary numerical simulations. The results show that design values for the internal pressure loading of seal-welded hollow boxes could be derived based on the investigations carried out. Experimental investigations into the static load-bearing capacity of one-sided-welded fillet welds show that design taking this stress into account is possible in accordance with EN 1993-1-8. Additional investigations into fatigue behavior indicate that no adverse effects are expected

as a result of internal pressure loading, even under cyclic stress. Based on this, a design recommendation was developed that enables a systematic and at the same time more efficient design of one-sided welded fillet welds.



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