

Lighter and longer-lasting steel bridges with Mechanical Post Weld treatment

A research project on applying high frequency mechanical impact treatment for steel bridges

Bridges are a critical part of transport infrastructure, connecting communities and supporting economic activities. Transport authorities manage large numbers of existing bridges, while new bridges continue to be planned. For steel bridges, one of the key challenges affecting the structural integrity is progressive damage in welded connections caused by cyclic traffic loading (i.e. fatigue of welds). This type of damage can reduce service life and limit the weight of traffic on bridges.

This project focuses on improving the sustainability of steel bridges by High-Frequency Mechanical Impact (HFMI) treatment. HFMI is a post-weld treatment method that has proven effective in enhancing fatigue performance. However, there are still gaps in knowledge, particularly regarding its application to bridge-specific welded details and under loading conditions that realistically represent traffic effects. The outcomes of the project are expected to pave the way for lighter and more durable steel bridges.

The project is organised into the following five work packages:

- 1 **literature review** - review and evaluate existing research, and available experimental data related to HFMI treatment on welded details relevant to steel bridge industry
- 2 **analytical studies** - develop numerical models to support the design of the experimental program in the subsequent steps
- 3 **experimental investigations** - conduct laboratory fatigue tests to assess the effectiveness of HFMI treatment on welded connections relevant to steel bridges under realistic loading conditions
- 4 **application to bridge design** - perform case studies on road and railway bridges to quantify the potential benefits and limitations of HFMI treatment in terms of material saving and cost cutting
- 5 **dissemination of results** - share results internally within COWI through technical presentations, and externally through conferences and peer-reviewed journal publications. In addition, available technical report on HFMI treatment will be complemented by the produced results on new types of weldments

The project will be carried out from March 2026 to March 2028 in collaboration between COWI and Chalmers University. Chalmers will lead the academic aspects of the project and conduct the experimental work using its laboratory facilities. Steel engineers and experts from COWI offices in Denmark, Sweden, and the UK will contribute practical industry experience to ensure the relevance of the research. Additionally, supervised thesis work will be integrated into the project to strengthen outcomes within the available timeframe.