

# Passenger Gangway Optimization

## Customer

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## Challenge

The adjustable passenger gangway is used to board passengers into ferries at Gothenburg harbor. This steel structure is subjected to wind, snow and live loads and was designed and modeled to meet specifications for stiffness, natural frequency and maximum deflection. However during the manual design process only a limited number of selections for beam cross-sections were considered. The need to reduce mass, and hence cost, was the basis to incorporate optimization methodology for selection and dimensioning of beam cross-sections.

## Solution

The gangway was modeled in three different configurations in STAAD-Pro engineering software. HEEDS MDO and its proprietary hybrid optimization algorithm SHERPA were used to select the best combination of beam-cross sections to meet the requirements. In total 25 beams were included as design parameters, to be dimensioned from a pool of 92 standardized cross-sections. All the beams were subjected to constraints on maximum stress. The structure was also subjected to maximum deflection and natural frequency constraints. In total 78 constraints were defined in HEEDS with a single objective: Minimize total mass.

In just 27 hours, 2600 design iterations were completed. In each iteration 3 different configurations were analyzed simultaneously. Only 9.7% of the designs were deemed feasible, a testament to the complexity of the optimization problem. The optimal design resulted in **reduction of 5500 Kg of steel** from the structure with baseline design weight of 83000 Kg.

