

Contact author: Simon Fryer simon.fryer@burohappold.com

LESSONS LEARNT FROM THE STRUCTURAL DESIGN AND CONSTRUCTION OF THE LILLE LANGEBRO, COPENHAGEN

Authors: Simon FRYER¹, Thomas ECKHART²

Affiliation: ¹ Technical Director, BuroHappold Ltd, UK

² Senior Engineer, BuroHappold Ltd, UK

Summary

The Lille Langebro is the latest movable bridge to be built across the harbour in Copenhagen. Its design was the subject of an international competition commissioned in 2014 by the client, Realdania, and won by a collaboration of BuroHappold, Wilkinson Eyre and Eadon Consulting. The bridge has an overall length of 160m and carries pedestrians and cyclists over a 7m wide deck. The superstructure is steel comprising main longitudinal members that are triangular in cross section along each edge and led to some novel details. The geometry is complex with plan curvature and an undulating profile, resulting in an interesting form with double curvature of the steel plates.

The bridge has two sections that swing to allow shipping through a 35m wide navigation channel. The mechanical parts are hidden within the concrete piers and steel superstructure. In order to maintain a slender profile in elevation, an innovative moment connection has been designed to connect the moving parts together at midspan. This connection clamps the sections together but is released to allow longitudinal movements arising from temperature. It also acts as a viscous damper to reduce vibrations and improve the user experience.



Fig. 1. The completed Lille Langebro open to users (left) and in operation (right). Source: Buro Happold

The team were very aware of problems that can arise with locking swing bridges due to thermal movement. Therefore, an extensive investigation was made of the bridge's behaviour involving a shading study and the application of pattern loading in order to predict the displacements that would occur at different times of the day and of the year. Tolerances in the connections and joints could then be accurately determined.

The bridge was entirely prefabricated and delivered to site by sea. Its design and construction have presented many challenges and this presentation will explain how these were successfully overcome and the lessons that can be learnt for use in future projects.

Keywords: Competitions, steel, moveable bridges, dynamics; structural concepts; lessons learnt, innovation, future experimentation.