

The influence of gantry rails on twin-box bridge deck aerodynamics: Experimental investigation

Background

Aerodynamic performance is one of the major concerns in design and construction of long span bridges. As suspension and cable-stayed bridges continue to grow in length, the aerodynamic stability of the bridge girder becomes increasingly important.

The twin-box bridge deck, composed of two individual girders separated by a central air gap, have proven to have superior structural and aerodynamic performance as compared to a similar mono-box girder. During the wind tunnel tests carried out for the industrial PhD entitled “Stability optimisation of twin-box girders” (funded by COWIfonden), it has become evident that the gantry rails and their position has a profound but unexpected impact the aerodynamics of the twin-box girder. The wind tunnel tests performed to date indicate that the gantry rails have a larger effect on the moment coefficient, and consequently on the flutter stability, than the wind screens. This is quite an interesting and surprising finding that such a small detail in the girder design can have such a pronounced impact on the stability. This is the reason why further wind tunnel investigations are needed.

The objectives of the project

COWIfonden have granted financial support for the experimental investigation. Different deck configurations of a twin-box girder are to be examined through wind tunnel tests. These tests will involve measurement of the critical wind speed along with the static rotation under wind loading, flutter derivatives, and static force and moment coefficients.

The purpose of the project is to acquire in-depth investigation on how the gantry rails impact the aerodynamic stability on the twin-box girder. The main objective of this research project is to enhance our knowledge regarding the beneficial effect of the gantry rails. This knowledge will be useful for the development of deck sections for future long-span bridge projects.

The outcomes represent innovative findings in the field of bridge aerodynamics, which are of interest to the wider bridge engineering community and hold significant “news value” in applied engineering and physical science.

Project organisation

Maja Rønne will conduct the experimental investigation. The wind tunnel tests will be performed at Politecnico di Milano, Milan, with the use of the laboratory’s free-motion rig as well as forced-motion rig. The already existing 1:44 scaled section model of the 1915 Çanakkale bridge deck will be used. The tests will take place in beginning of September this year, 2024.