

## Wind actions on simple girder bridges under construction

G. Martínez-López\*, R. Karoumi<sup>a</sup>, M. Ülker-Kaustell<sup>b</sup>, S. Sadrizadeh<sup>a</sup>

\* Universitat Politècnica de València  
Camino de Vera s/n, 46022 Valencia, Spain  
mtnzguillermo@gmail.com

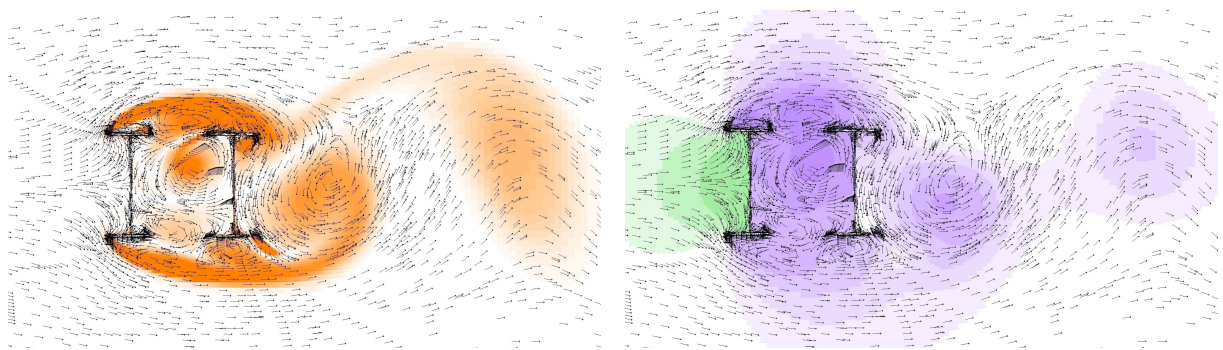
<sup>a</sup> Royal Institute of Technology, Stockholm, Sweden

<sup>b</sup> Tyréns AB, Stockholm, Sweden

### Abstract

Due to advancements in the field of civil engineering, structures are becoming lighter and slenderer every year, which makes them also more vulnerable to dynamic wind loads. Some structures, like cable-supported bridges and simple girder bridges, are specially vulnerable during construction stages, when the structure has not its final stiffness yet. In the case of small projects, like some simple girder bridges, there is usually no budget to carry out wind tunnel tests, and the aerodynamic analysis needs to rely in the analytical methods proposed in the codes. However, the codes only provide aerodynamic coefficients for simple shapes.

This study intends to assess wind loading on a particular bridge cross-section, formed by two steel *I* beams supporting a concrete slab. The analysis was made when only the steel parts are in their final locations, before the concrete slab construction. Several CFD simulations were done to test different geometrical parameters. Three construction stages were considered: when only one beam is placed, when both beams are placed but are not connected yet and when both beams are placed and connected. Additionally, an extra situation where the space between beams is isolated by steel or wooden plates was considered. In total, 456 simulations were done.



**Figure 1:** Vorticity field (left) and pressure field (right) for a simulation with two beams. Orange colours represent the vorticity, purple represents low pressure zones and green high pressure zones.

It was observed that the effects of vortex shedding are more dangerous in the along-wind direction, due to the low horizontal frequencies and the large area perpendicular to the flow. The most sensitive case is when only one beam is exposed to the wind. About the geometrical parameters, increasing beams' distance showed to be a good solution to reduce wind effects. By last, it was noted that closing the section with light plates leads to a considerable reduction in section's vulnerability.