Required Damping for Bridge Stay Cables

Introduction

Stay-cabled bridges are the bridges with tall towers and diagonal supporting cables, connecting the bridge deck to the tower. This type of bridge is cost competitive for main spans of over 200m and can be as long as 1,000m.

The slim profile of the cable makes it for a vibration susceptible structure. Therefore, many studies on the cause of the vibrations and how to mitigate them have been carried out. The mitigation is usually in the form of an external damping system (like dampers in a suspension of a car) or a special plastic pipe placed around the cables, the pipe has a raised helical strip that slightly change the shape of the cable, so the wind forces are reduced.

Aim

This project aims to quantify how much vibration reduction is required for the stay cables, to optimize the current design of cable-stayed bridges aiming for a reduction in the environmental impact, as described below.

Impact

The mitigation given by each of the several new types of surface modification pipes can be used to identify the requirement of the complementary external dampers. This could lead to a more optimized design where smaller or no dampers are needed, if the surface modification pipes are proven to be sufficient for the specific case. This reduction can lead to less weight in the bridge deck and so a less robust structure is needed with less material and smaller carbon footprint.

Not only the weight saving is important, but also the space that these external dampers can take in the bridge deck. This means there could be a simpler construction phase and that a bridge deck can be narrower due to the smaller dampers, which again can improve the carbon footprint of the construction. Another impact of the optimized design is that less maintenance might be needed during the operation of the bridge, which improves environmental impact, economical and operational performance.

Organization

The project is an Industrial PhD, which lasts for 3 years with a partnership with Aarhus University. The Industrial PhD is expected to start in September 2023.

The group is made of the PhD candidate Vitor Diniz Pinto, the company supervisor Don Bergman, the academic supervisor Prof. Christos Georgakis, and the company co-supervisor Allan Larsen. The project is anchored at the department Bridges International, within Business Line International in Lyngby office.