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Category: **Rail**   Country: **Portugal**

Research Area 1: **Smart Solutions & Society**   Idea Number: **65**

Vulnerability Assessment of Existing Bridges to Scour, Based on an Indirect Monitoring Approach and Machine Learning Tools

Foundation scour is the principal reason why bridges collapse. Assessing vulnerability to scour is a challenging and complex task. This project proposes a method to detect scours based on the dynamic parameters of the train. To observe the impact of scour effects signals of multiple train passages across a bridge will be collected before and after strengthening of the bridge foundations. The numerical study will be followed by physical measurements on a train passing over the Eden Viaduct (Carlisle, UK). The train measurements will be provided from the ongoing project In2Track3 framework of a European Union funded project. Firstly, indirect monitoring results from the instrumented in-service train carriage will be collected, calibrated and processed. This will provide the 'apparent profile', the profile experienced by the wheels of the train, which is made up of true profile plus bridge/track deflection elements. Secondly, a 2-stage numerical approach will be followed. Finally, introducing the measured signals and the calculated influence ordinates to machine learning algorithms might help create a link between the scour effect and the bridge response. An optimization algorithm will be used to find the bridge foundation stiffness which minimizes the sum of squared differences between the calculated (by forward problem-numerical model) apparent profile, and the corresponding measured values of apparent profile (measured displacements).
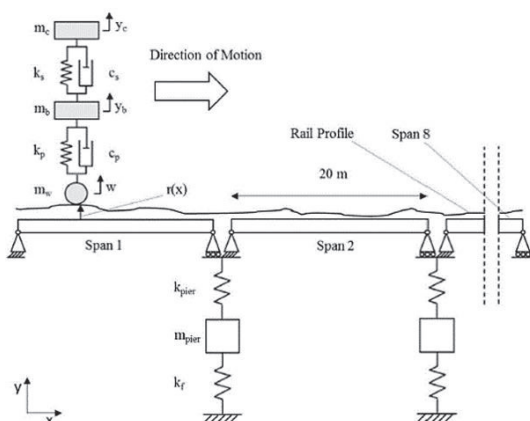

Figure 1. VBI Model [2].