



## The Dynamic Behaviour of the “Erlebnisbrücke” on the BUGA in Ronneburg

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### Summary

The German Federal Garden Exhibition BUGA will be held in 2007 in the Thuringian towns Gera and Ronneburg. The most outstanding structure on the exhibition area is a 225 m long footbridge, the “Erlebnisbrücke”. This structure is a three span stress ribbon bridge with a timber superstructure. Several resonances in the range of typical step frequencies of pedestrians became obvious already during the design stage. Therefore the dynamic behaviour of the bridge and its response to dynamic loading generated by pedestrians were extensively investigated both experimentally and numerically. The predicted response amplitudes exceeded the values recommended in the codes. However, experience with large numbers of people on the bridge showed a good performance of the bridge under dense pedestrian loading. Nevertheless, the dynamic behaviour of the bridge will be observed carefully under service conditions. The installation of tuned mass dampers is considered as an option for the case of an unsatisfactory dynamic behaviour of the bridge.

**Keywords:** Footbridge, stress ribbon bridge, structural dynamics, timber bridge, BUGA Ronneburg.

### 1. Introduction

Human induced vibrations, especially of footbridges, are a problem which has been known for a long time. The most obvious phenomenon which might cause problems is a resonance between the step frequency and a natural frequency of a vertical bending mode of the bridge. Guidelines for the consideration of loads applied to a bridge by passing pedestrians are given e.g. in [1], [2], [3] and [4]. More recent research results in this field are reported e.g. in [5], [6] and [7]. The most spectacular example where horizontal forces generated by walking people caused lateral bridge vibrations at considerable amplitudes was the London Millennium Bridge [8], [9].

During the planning phase of the German Federal Garden Exhibition (BUGA) 2007 in Gera and Ronneburg it was decided to construct a very slender footbridge crossing a more than 200 m wide and 25 m deep valley in the exhibition area. Already at early stages of the planning it was suggested to design this bridge as a multi-span stress ribbon bridge. Within the decision process at the early planning stage a footbridge in Rostock built with stress ribbons of steel and concrete ballast spanning over three spans of 28 m, 38 m and 28 m was investigated to collect information on the dynamic behaviour of a similar structure as the one to be erected [10]. Since the investigated bridge showed considerable vibrations due to passing pedestrians and very low damping, as typical for steel structures, it was decided to design the bridge at the BUGA 2007 in Ronneburg as a timber structure.