Pedestrian-induced lateral vibrations of footbridges: A literature review

The earliest scientific descriptions of excessive pedestrian-induced lateral vibrations are dated back to the 1970s, but it was not until the beginning of the new millennium that bridge engineers fully comprehended the potential negative effect of pedestrian crowds on long-span footbridges. Following the unexpected serviceability failures of Paris’ Solférino and London’s Millennium footbridges in 1999 and 2000, a new tract of research was initiated, focused on understanding the phenomenon which has become known as Synchronous Lateral Excitation (SLE). In this paper, a comprehensive review of studies related to pedestrian-induced lateral vibrations of footbridges is provided, primarily focusing on studies published within the last decade. Research in this field can generally be split into three categories; (i) fullscale testing of existing bridges subject to crowd loading, (ii) laboratory studies on human-structure interaction between single pedestrians and laterally moving platforms and (iii) mathematical modelling of the pedestrian-induced load. It is shown herein, that a significant amount of research has been carried out within each of the three categories, but there is only limited interconnection, particularly between the mathematical models on one side and the empirical observations on the other. The main purpose of this review is to provide this link, through a detailed and critical review of publications within each of the three categories.

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