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VIBRATIONS OF A LOW-FREQUENCY FLOOR UNDER VARIOUS PEDESTRIAN LOADING SCENARIOS

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Abstract
Contemporary floor vibration guidelines limit the discussion of walking-induced vibrations to single-pedestrian loading scenario. Nevertheless, the inclusion of more than one pedestrian in the vibration evaluation would result in a more realistic range of floor responses. In this paper, an attempt was made to experimentally and numerically investigate the combined effect of two persons walking simultaneously on an actual building floor. The floor fundamental frequency and damping ratio were obtained from physical heel drop tests and the footfall response was measured in a series of walking tests. A finite element model was created for prediction of floor responses under different walking scenarios. A probabilistic prediction was also performed where random variations in pacing rates, body weights and arrival times of the pedestrians were considered in a large number of Monte Carlo simulations. It was showed that the response due to a single person with resonant step frequency can be greater than that due to two persons walking at off-resonant pacing rates. However, the resonant response induced by two pedestrians can be 1.29–1.38 times greater than that caused by a pedestrian.

Keywords: **Coordination; Floor vibrations; Probability; Resonance; Walking excitation.**