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Dynamic analysis of a steel temporary grandstand subjected to human-induced excitations due to jumping

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Abstract: Steel grandstands are structures that are frequently used during sport games and many other non-sporting events such as festivals, music concerts, or even politicians rallies, where large number of attendees is also observed. Unfortunately, the presence of unexpected excessive dynamic loads due to unpredictable spectators behaviour (e.g. synchronized harmonic jumping or swaying), may lead to a structural damage or even total collapse of a structure, which was already observed in the past. Given that, steel grandstands should be designed so as to withstand the unexpected dynamic loads and, therefore, ensure maximum safety of all participants. Building codes, however, present different approaches. According to the Polish Standard an additional horizontal load equal to 6% of the total vertical load acting on a grandstand has to be consider at the design level. The British Standard, on the other hand, specifies a slightly higher value of horizontal load (i.e. 10% of the total vertical load) that should be taken into account. Therefore, the overall aim of the present paper is to conduct a dynamic numerical investigation focused on the response of a steel temporary grandstand subjected to human-induced vibrations due to jumping with two different values of horizontal load (6% and 10% of the total vertical load). The results will be discussed.

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