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FOOTFALL INDUCED FORCES ON STAIRS

Liga Gaile*, AP, M.Sc. Eng.

Ivars Radins, prof. Dr. sc. ing

Riga Technical University, Department of Structural Analysis

Address: Āzenes Str. 16, LV 1048, Riga, Latvia

Phone: 371+27555757r, Fax: 371+67089195

e-mail*: Liga.Gaile_1@rtu.lv

To get a reliable dynamic performance of the modern flexible light-weight structures such as pedestrian bridges, flexible stairs, long span floors and even tall public observation towers it is important to check the structure's vibrations induced by human movement dynamic loads.

The paper gives some background information about recent advances determining the human induced dynamic forces and presents a convenient method in order to obtain the equivalent continuous walking force histories and therefore essential parameters (dynamic load factors and corresponding phase shifts) that can be used in the structural design. The imperfectness of individual footfall forcing functions and differences between continuous walking force histories among individuals is taken into account. There are analyzed the experimental data obtained by using inverse dynamic method (accelerometer technology) for walking load amplitude dependence on various pacing frequencies during the stair ascending or descending action.

The data in Fig. 1 and Fig. 2 that are obtained from the mean walking force history reveals differences between the stair ascending and descending process.

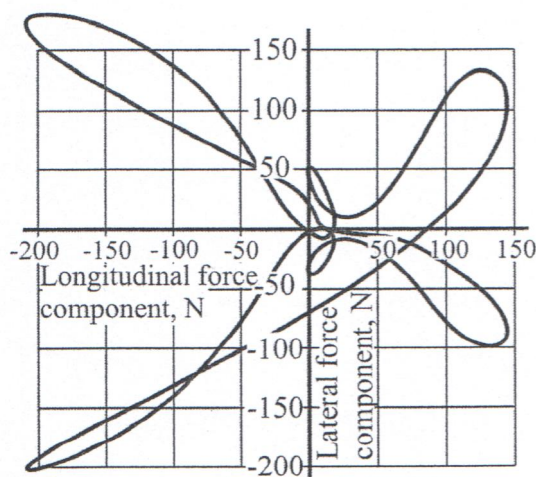


Figure 1. Path of the mean pedestrian force vector end point (ascending case at rate 2Hz)

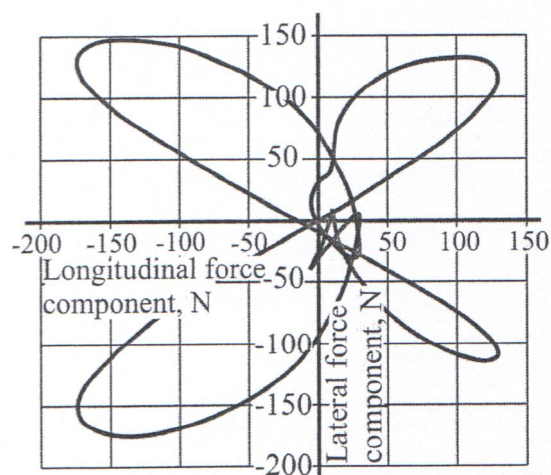


Figure 2. Path of the mean pedestrian force vector end point (descending case at rate 2,15Hz)

To test the method there were obtained equivalent DLFs and their dependence on walking pace for all three force directions (the stair ascending and descending case): vertical, longitudinal and lateral. Results were compared with other researchers' findings that utilized the direct measurement technologies.