

PHYSICAL AND PSYCHOLOGICAL FACTORS INFLUENCING THE ACCEPTANCE OF VIBRATIONS ON LIGHTWEIGHT FOOTBRIDGES

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Summary

Especially lightweight and long-span footbridges are prone to vibrations and oscillations induced by users or environmental factors. While the interaction between construction, structure, stability and resulting vibrations have been investigated thoroughly in the past, research assessing user experience remains sparse.

In this paper, we discuss which factors may influence user's acceptance of footbridges. We propose a taxonomy consisting of properties of the bridge construction, the environmental situation and human factors. Bridge construction factors relevant for user's experience include e.g., vibrations and the ratio between width and height of the structure, surface (e.g., open-mesh providing a direct view down) and guardrails, while environmental factors include e.g., the specific location of the bridge (e.g., traffic situation, noise) or usability during extreme weather conditions.

As we discuss these factors not from a technical, constructional side, but enlighten their impact on user's experience, we put the most emphasis on human factors. These include physical factors (e.g., motor abilities, balance, illnesses, age) and psychological factors. Psychological factors like emotional states (i.e., varying psychological status like e.g., fear of heights, stress), cognitive factors (e.g., knowledge, reasoning and cognitive control of emotions) and personality traits (i.e., quite constant characteristics of the user's personality) are discussed with their potential to influence user's acceptance of footbridges.

For example, a very high, vibrating bridge (property of the bridge) may induce fear (psychological status) in users who are generally more anxious (personality state), but depending on the individual ability of the user to control the emotion cognitively (e.g., by understanding the physics of the bridge), (s)he may accept the bridge. For another example, depending on the height of the bridge and the individual perceived feeling of (un)safety (e.g., varied by the factors of bridge height, bridge width and guardrails), some pedestrians may refuse to use the respective bridge after evaluating alternative routes.

In our paper, we present the possible interplay of those bridge factors, environmental factors and human factors. We discuss possible solutions. We aim that our taxonomy helps to improve footbridge design with respect to user's experience and acceptance.

Keywords: Acrophobia; Architecture; Urban environments; Environmental psychology; Bridge vibrations; Psychological factors; User experience; Serviceability; Pedestrian mobility; Cognition

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