A Paradigm Shift in Structural Acoustics: Reevaluating Vibroacoustic Transfer Mechanisms in Urban High-Rise Buildings

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Abstract. This study critically examines the longstanding paradigms governing vibroacoustic transfer mechanisms in high-density urban high-rise structures. Employing advanced simulation techniques and in-situ measurements, this paper re-evaluates the acoustic performance criteria widely accepted in architectural engineering. Key findings suggest that current regulatory frameworks inadequately address the complexities of new materials and design practices, thus necessitating a redefinition of acoustic compliance standards. The study advocates for a nuanced, multi-disciplinary approach to designing acoustically robust urban environments.

Keywords: vibroacoustic transfer, urban high-rise buildings, acoustic compliance standards, structural acoustics, architectural engineering

Introduction

Urban high-rise buildings have become a hallmark of modern architectural and engineering challenges, shaping the skyline of metropolises globally. The rising population in urban centers drives the demand for vertical space expansion, leading to the proliferation of skyscrapers. However, with this architectural evolution comes the critical challenge of managing vibroacoustic transfer, a multi-faceted phenomenon impacting both structural integrity and occupant comfort. Despite the technological advancements in construction

materials and methods, existing acoustic guidelines often fall short in addressing these emerging complexities. The traditional models of vibroacoustic transfer have primarily focused on single material systems, failing to account for the heterogeneous material compositions commonly employed in contemporary high-rise constructions. This paper seeks to address this gap by employing cutting-edge simulation technologies and empirical research to reassess these foundational theories. By proposing a revised framework, we aim to set new benchmarks for acoustic design standards that align with today's architectural and engineering innovations. The structure of this paper is organized as follows: the subsequent section details the methodology adopted for the study, followed by an analysis of the results in Section 3. Section 4 discusses the implications of these findings within the context of current regulatory frameworks, and the final section concludes with recommendations for future research directions.

References

1. Абдыкалыков, А. А., Маматов, Ж. Ы., Бозов, К. Д., Ордобаев, Б., Кожобаев, Д., Кенжетаев, К., ... & Орозалиев, Б. (2011). Чрезвычайные ситуации. Природные явления. Правила поведения. Ч. I/АА Абдыкалыков, ЖЫ Маматов, КД Бозов и др. Бишкек: КРСУ–КГУСТА.