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# Advances in Multilayer Concrete Slab Technology: Structural Performance, Vibration Mitigation, and Acoustic Insulation

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## Abstract

This state-of-the-art review provides a critical overview of advances in multilayer concrete slab technology by systematically exploring three interconnected performance pillars: structural integrity, vibration serviceability, and acoustic insulation. The development of these composite systems is inherently complex due to the conflicting performance requirements and hence inevitable trade-offs; most notably, the role of stiff shear connectors as acoustic and vibration bridges. The basis for the analysis is a systematic survey of the literature for studies published between 2014 and 2025. Experimental evidence shows that composite action, and in particular connector behavior, significantly enhances bending stiffness and load-carrying capacity against monolithic construction; substantial gaps remain regarding stress redistribution, combined states of stress, and impact-related behavior. Vibration serviceability, which controls occupant comfort, is governed by natural frequency but also acceleration response, damping, mode shapes, and boundary conditions; simplified frequency limits such as those in Eurocode 5 shall hence be interpreted with regard to human perceptual response. Acoustic performance, in particular impact sound insulation, is often neglected within structurally oriented studies, despite bare slabs frequently failing to meet regulatory limits; hence, separation strategies, such as floating floors, are required, although these may conflict with rigid structural connections. The review points out a need for system-level multidisciplinary research, innovative connector solutions, validated multiphysics models, and holistic design frameworks in order to achieve an optimum balance between strength, comfort, and sustainability in high-performance building systems.

## Keywords

Sandwich Panels, Composite Systems, Vibration Serviceability, Acoustic



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