MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING LTH | LUND UNIVERSITY

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PRESENTATION
JUNE 2021

REPORT
Will be published as
Report TVSM-5253

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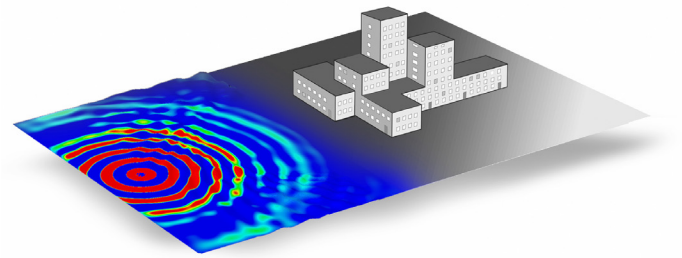
DIVISION OF STRUCTURAL MECHANICS, LTH

IN COOPERATION WITH
DIVISION OF CONSTRUCTION MANAGEMENT, LTH

BALANCING OF VIBROACOUSTIC PERFORMANCE AND EMBODIED ENERGY IN LIGHTWEIGHT BUILDINGS



BACKGROUND

Multi-family houses are in a larger extent being built using lightweight material such as timber. The benefits of lightweight constructions often lie in lower costs and lower environmental impact. A large part of the total energy consumption of a building is the embodied energy found in the material itself. This energy consumption is found in the production and construction stages of a building where materials such as concrete and steel are considered to have a high embodied energy.

Studies have shown that residents in buildings using lightweight floors experience annoyances due to impact sound in a greater extent than residents in heavyweight buildings. Low frequency vibration can also be significant in timber constructions. These vibrations are problematic as they can be a source of annoyance among residents. In buildings with sensitive equipment the vibrations are also considered an issue.

By constructing buildings using lightweight materials a low embodied energy can be achieved while giving rise to potential issues with low frequency vibrations and sound. The choice of material must therefore be carefully considered in order to achieve a good balance between the embodied energy of a structure and the user's requirements.

AIM

The aim of this master's thesis is to improve the knowledge regarding the balance between embodied energy and vibrational performance of a structure. The objective is to establish a methodology in which the embodied energy and vibroacoustic performance can directly be compared for a chosen material. The master's thesis is expected to show how different alternatives can be compared and evaluated with regards to the choice of material in an early stage.

METHOD

Through finite element analyses a model of a structure and the ground will be created for calculations of the vibrational response due to different types of harmonic loading. The vibrational responses will be analysed for different building materials and and variations of parameters such as the thickness of a floor. A literature study will be performed regarding the embodied energy of different materials with the purpose of establishing a basis on the calculations of embodied energy. Different methods of summarising the vibrational response of a building will be evaluated in order to calculate a scalar value which reflects the vibrational performance of a structure and can directly be compared with its embodied energy.

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xpTVSM-5253 (2021-01)