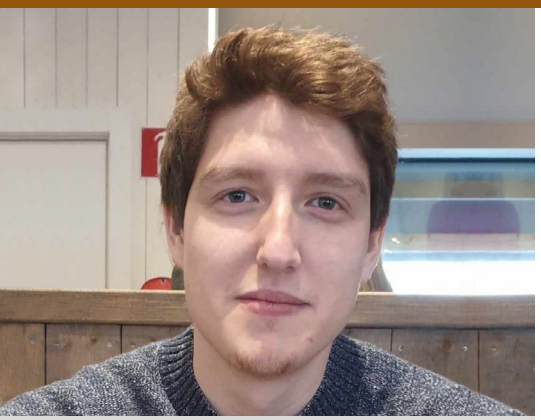
MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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



FILIP RASMUSSEN
fi4543ra-s@student.lu.se

PRESENTATION

DECEMBER 2023

REPORT

Will be published as
Report TVSM-5268

SUPERVISOR

PETER PERSSON *Associate Professor*
Div. of Structural Mechanics, LTH

ASSISTANT SUPERVISOR

Professor
LARS VABBERSGAARD ANDERSEN
Aarhus University

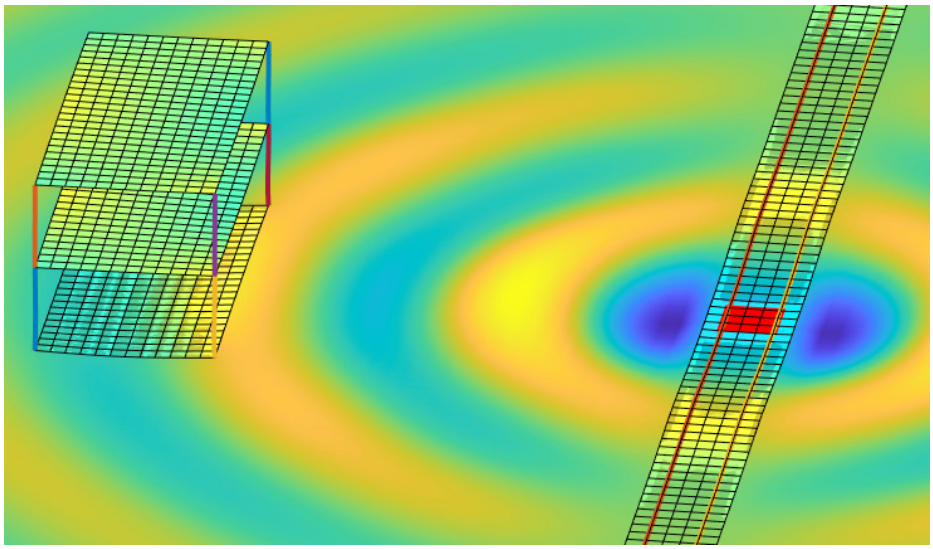
EXAMINER

Professor KENT PERSSON
Div. of Structural Mechanics, LTH

THE WORK IS PERFORMED AT

DIVISION OF STRUCTURAL MECHANICS, LTH

RAILWAY-INDUCED VIBRATIONS IN WOODEN BUILDINGS



BACKGROUND

Vibrations in buildings have become a more important factor to consider when constructing buildings with new techniques, less material and in a denser urban environment. But wooden buildings are met with resistance in the industry as there are still knowledge gaps about their functions, such as in regards to railway-induced vibrations. In order to investigate the effects of vibrations on buildings there is a need for detailed computer models. These models are often very demanding in terms of time and computational requirements, which leads to them often not being used in early stages of a building project. Then, when the choice between wooden buildings and concrete buildings is made it can become easy to choose the material with the largest knowledge base, especially for buildings in vibration exposed situations. With more comprehensive knowledge of how wooden buildings and concrete buildings behave dynamically in relation to each other, the materials can compete on equal terms.

AIM

The aim with this master's dissertation is to improve the knowledge about the dynamic behavior of wooden buildings exposed to railway-induced vibrations. This will be accomplished by answering the following questions:

- Which frequencies result in the largest vibration response in lightweight wooden buildings and in concrete buildings?
- Where in a simplified example building is the vibrational response the largest, and does this vary with different frequencies?
- How do wooden buildings perform compared to equivalent concrete buildings when exposed to railway-induced vibrations, according to commonly used evaluation methods?
- What variables in a simplified example building can be varied in order to reduce the vibration response when exposed to railway-induced vibrations?
- Are wooden buildings and concrete buildings sensitive to different train speeds?

The work is limited to examining comfort vibrations in buildings and train speeds below the critical speed of wave propagation in soil.

METHOD

A newly developed semi-analytical soil simulation model will be used to simulate railway vibrations and their transmission through soil and into buildings. A wooden building and a concrete building will be compared when exposed to a stationary periodic load and a realistic moving train load. For each load case a parameter study will be conducted by varying dimensions, building placement and train speed.

DIVISION OF STRUCTURAL MECHANICS
Faculty of Engineering LTH, Lund University, Box 118, SE-221 00 Lund, Sweden
• Tel: + 46 (0)46-222 73 70 • Fax: + 46 (0)46-222 44 20 • www.byggmek.lth.se

xpTVSM-5268 (2023-09)