MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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

ALFRED JOHANSSON

PRESENTATION
FEBRUARY 2018

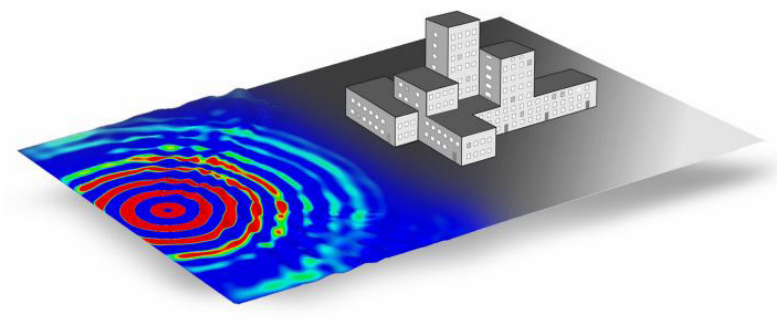
REPORT
Will be published as
Report TVSM-5230

SUPERVISOR
PETER PERSSON *PhD*
Div. of Structural Mechanics, LTH

EXAMINER
Professor KENT PERSSON
Div. of Structural Mechanics, LTH

THE WORK IS PERFORMED AT
THE DIV. OF STRUCTURAL MECHANICS, LTH

TOWARDS SITE-CITY EFFECTS ON TRAFFIC-INDUCED BUILDING VIBRATIONS



BACKGROUND

The demands on buildings regarding vibrations are becoming higher than ever before. Disturbing vibrations in buildings can be traffic-induced and caused by placing new buildings closer to existing roads than before or by building new transportation systems near existing building structures. The vibrations can be disturbing for both humans and sensitive equipment in for example hospitals and laboratories. The degree to which the vibrations affect both humans and equipment depends on the amplitude and frequency as well as the sensitivity of said subject.

To investigate these vibrations and their effects, studies can be conducted using large three dimensional numerical models, often using finite elements. A problem with this is that these simulations require a lot of computational time.

In a master's dissertation at the Division of Structural Mechanics from 2017 [1], a methodology was developed for analyzing traffic-induced building vibrations. A large 3D finite element model can, using this methodology, be reduced by using dynamic condensation. Reassembling the reduced model, the computational time needed can be reduced by 99.7 % compared to the initial non-reduced model. There is still a big need in the building industry for more knowledge and better tools for predicting vibrations, for use in many stages and phases of building projects.

OBJECTIVE AND METHOD

The study intends to investigate which factors that are important to consider when analyzing traffic-induced vibrations in the built environment. Specifically, with respect to involvement of surrounding buildings in numerical models and so-called site-city effects, i.e. how neighboring houses affect each other's vibrational response. A literature study will be conducted to establish a knowledge base about the subject and approach the state-of-the-art. Numerical analysis will be performed using finite element models in the commercial software Abaqus. Different ways to model the building structures will be investigated, for example: full 3D finite element models; applying component mode synthesis; simple structure with equivalent mass, stiffness and/or damping; or simple one degree-of-freedom system.

[1] T. Svensson, R. Torndahl. "Methodology for analysis of traffic-induced building vibrations", Master's Dissertation, Report TVSM-5224, Division of Structural Mechanics, Lund University, 2017.

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-5230 (2017-10)