

## Numerical Prediction and Environmental Impact Assessment of Ground Vibrations induced by Railway Vehicles

The topic of train-induced ground vibrations has received a lot of attention because of the severe effect of wheel-rail interaction force on railway facilities and surrounding buildings. As a result, this thesis presents a two-dimensional finite-infinite (2D FE-IE) ground numerical model. The goal of the study is to develop a numerical model based on assumptions for ground-borne vibrations in Abaqus to evaluate the effects on human and building damage in the surrounding residential area. The combined outputs from the transfer functions acquired from the three models 1) Vehicle-Track Dynamic model 2) 2D FE-IE ground model 3) Building model are obtained at the conclusion in terms of the velocity within the building to suit the study's aim. The outputs were assessed using standards and criteria from the Federal Transit Administration (FTA) and the Environmental Impact Assessment (EIA). Furthermore, the impact of various soil conditions on wave propagation and reflective behavior is investigated. At the end the calculations and model was verified and validated.



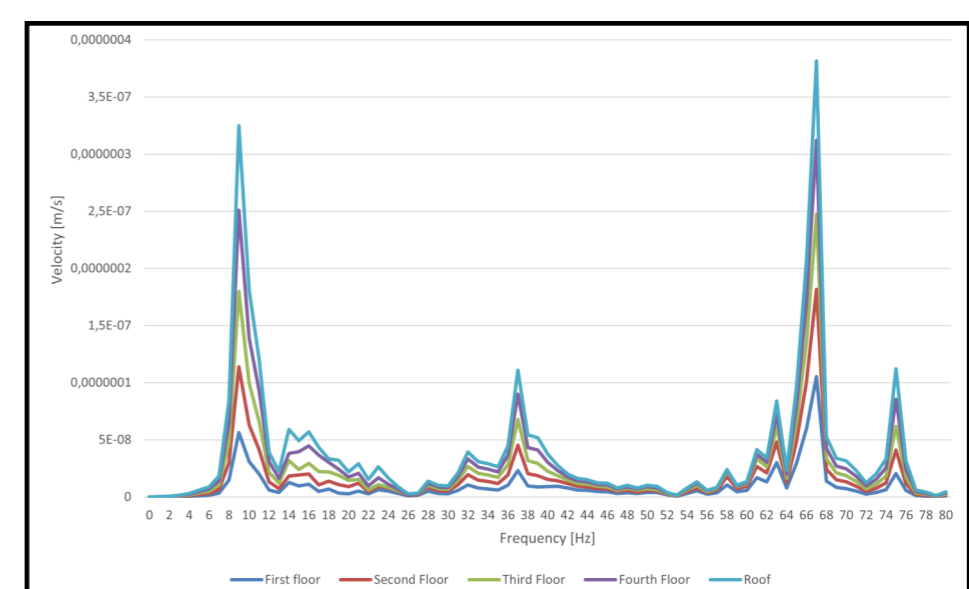
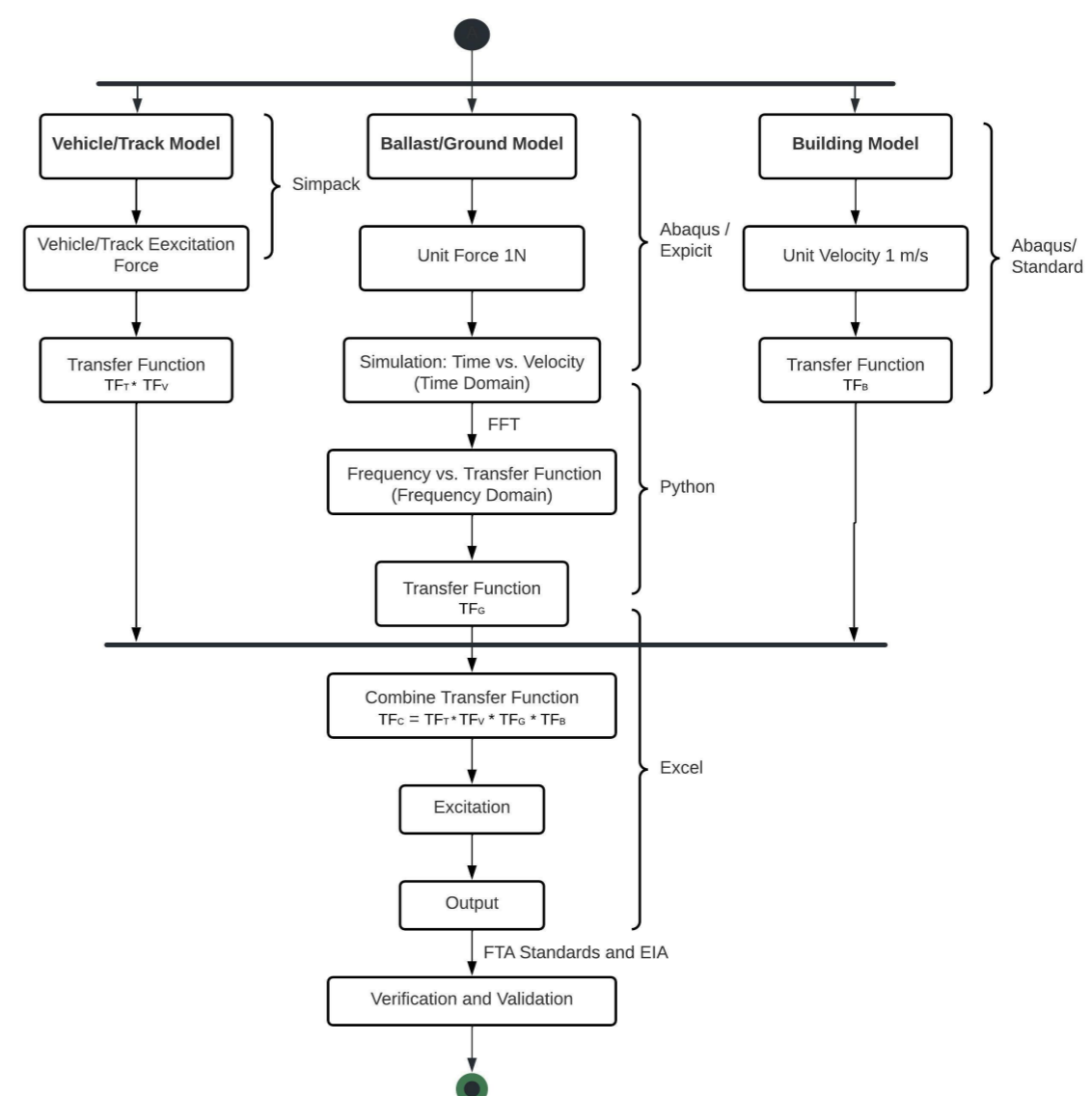
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**Figure 1** illustrates the thesis' overall concept for achieving the goal. Where, the entire work is divided into three basic processes called preprocessing, simulation and postprocessing which can be describe as follow:

- The 2D FE-IE ground model was preprocessed and simulated in time domain using Abaqus/explicit software.
- The simulation results were converted from time domain to frequency domain in the form of a transfer function for the ground model using Python postprocessing.
- My supervisor, Euiyoul Kim, provided transfer functions for the other two models, which were then integrated in Excel.
- Using Excel, a combined transfer function was obtained in the form of vibration velocity levels inside the building. This process is shown as excitation in Figure .
- The output obtained from excitation evaluated based on FTA and EIA guidelines and criteria.

The outputs were concluded for:

- The relationship between wave propagation and model properties in Abaqus.
- The effect of the various soil properties on the wave propagation and reflection.
- The reaction of humans and building damage.



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