

Numerical analysis of vibrations due to impact pile driving

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Vibrations deriving from constructional work can affect the nearby soil and structures. Depending of the properties of the vibrations, these can result in settlements in the soil and damages to existing structures. Along with blasting, impact pile driving is one of the greatest source of vibration on a construction site.

In the dissertation, *Numerical analysis of vibrations due to impact pile driving*, the vibrations of a single hammer blow at different pile depths are studied and compared with a field test. The object is to investigate the possibility to make a satisfactory finite element simulation of the vibrations due to pile driving. Two soil plasticity models are used along with a linear elastic model. The plastic models are the Mohr-Coulomb yield criterion and the Drucker-Prager yield criterion.

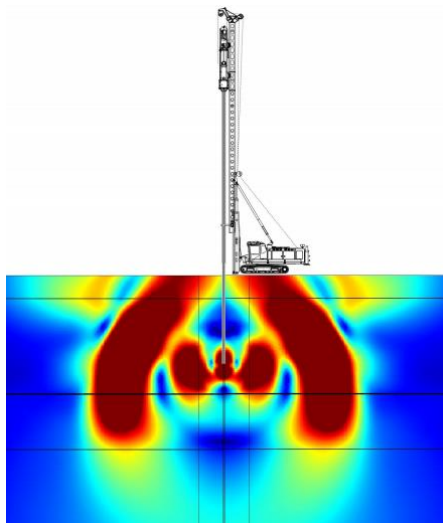


Figure 1 Illustration of wave propagation in a Drucker-Prager model

No significant discrepancies were found in the vibration velocities in the different material models. Although, small differences in vibrations occur with the plastic Drucker-Prager model in comparison with the elastic model. Results show that the Young's module for a soil is decisive for the behaviour and magnitude of the vibrations. The settlement is hard to predict for a single impact since it is cumbersome to extract whether the computed settlement originates from actual impact, or from boundary issues in the model.

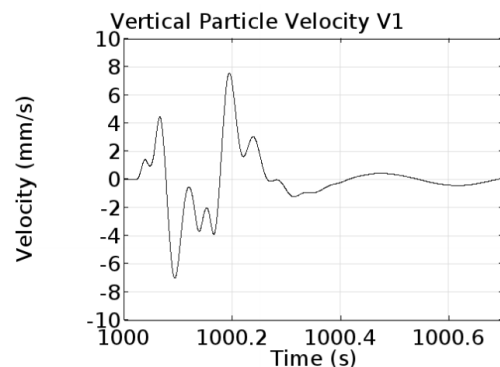


Figure 2 Illustration of a particle velocity extracted from the simulations

The conclusion is that the finite element method can be successfully used to predict wave propagation and vibrations due to impact pile driving, regardless of which of the three material models that are used in the computation.