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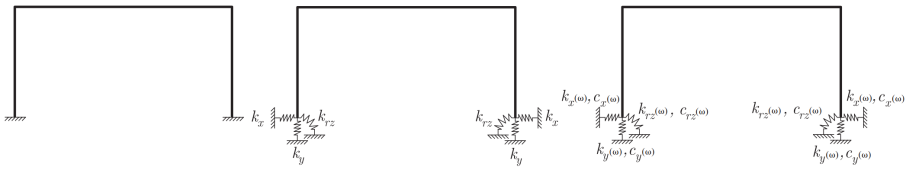
SOIL-STRUCTURE INTERACTION OF PORTAL FRAME BRIDGES FOR HIGH-SPEED RAILWAYS



BACKGROUND

In Sweden, high-speed railways is a subject for public debate. The first stage of the high-speed train network, Ostlänken between Stockholm and Linköping, is under investigation, and is planned to be trafficked in 2028. The high-speed railway is intended to hold traffic with speeds up to 320 km/h. At such speeds, the design requirements of the accelerations of the bridge superstructure become more stringent. Previous studies show that the interaction between the bridge and the backfill soil can reduce these accelerations.

Dynamic analyses of portal frame bridges are at the consultant offices performed with finite element software using shell and beam theory. A way to model the effects of the surrounding soil is to apply static springs and dashpots to the foundation. Apart from being a complex matter to determine the correct parameters of these springs and dashpots, they do not take into account the moving masses of the backfill. A way of taking the dynamic nature of the soil into account is to calculate impedance functions, and then apply them to the bridge model as boundary conditions through so-called connector elements.

OBJECTIVE AND METHOD

Impedance functions will be studied. Impedance is a complex valued measure of how much a structure resist motion when subjected to a harmonic force. The resistance of motion of a soil-structure interface can be represented by impedance functions consisting of dynamic springs (real part) and dashpot coefficients (imaginary part). The impedances are in this thesis calculated in the frequency domain through steady state analyses on 3D solid bridge-embankment models. Unity loads and moments are applied to a reference node for a certain frequency range. In the same point, the displacements (receptance) are measured and then inverted, giving the impedance. A parameter study will be performed, determining what parameters influence the response of the soil-structure model the most.

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