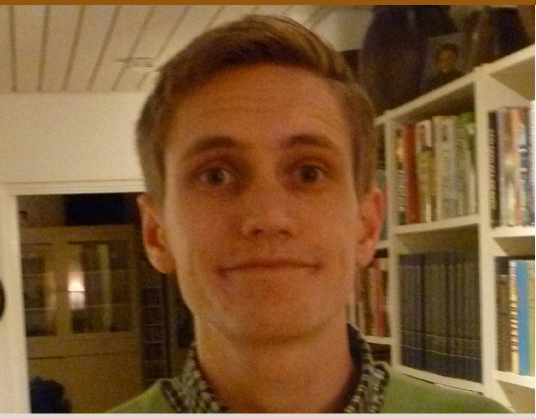
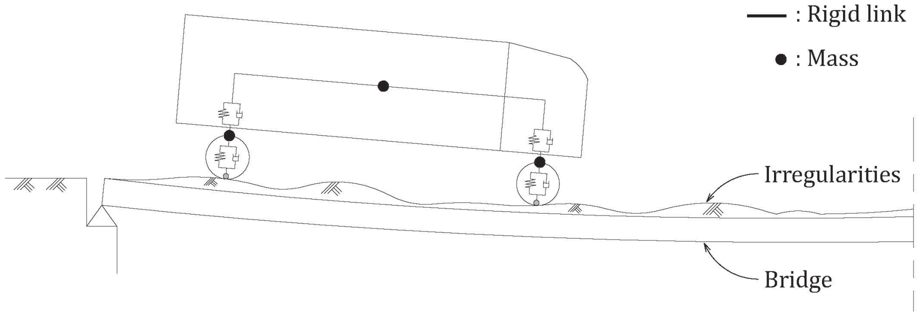
MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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



REFINED MODEL FOR CALCULATING THE DYNAMIC AMPLIFICATION FACTOR FOR ROAD BRIDGES



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BACKGROUND

Most of the bridges in Sweden are classified according to TDOK 2013:0267. In this standard, different types of vehicle scenarios with axle loads A and B are used and the maximum values of these are determined in order to classify the bridge. A vehicle moving on a bridge provides an additional dynamic load due to road surface irregularities and the dynamic response of the vehicle-bridge interaction. The bearing capacity calculations therefore includes a dynamic amplification factor (DAF), which currently depends on the speed of the vehicle and the determining length of the bridge.

In a proposal for a pilot study by Plos and Svedholm from Chalmers University of Technology it is considered possible to develop a refined model of DAF. The present formulation is assumed to be too conservative as there are many parameters that are not considered. The proposal mentions that the increased use of air suspension in vehicles introduced to the market provides a reduced DAF. This has been demonstrated in several studies where the use of air suspension provided a smaller DAF in comparison to the traditional leaf suspension.

A lower value on the DAF can subsequently provide existing bridges with a higher classification. This means that measurements, such as reinforcing or replacing the bridge, to allow for heavier vehicles might not be needed which provides economic and environmental benefits.

OBJECTIVE

The aim of the thesis is to simulate and evaluate vehicle-bridge interaction due to road surface irregularities and different vehicle models with varying parameters. Parametric studies will be carried out for different bridges. The results from these simulations will be compared with the current formula for the DAF according to Trafikverket.

METHODOLOGY

A toolbox in MATLAB that solves the vehicle-bridge interaction will be used and verified. The vehicles are modeled as mass-spring-damper systems moving across the bridge. The two subsystems, i.e. bridge and vehicle, are modeled with coupled equations using FEM and the time-varying dynamic response is solved with the Newmark-β integration scheme. Road surface irregularities are modeled using Power Spectral Density (PSD) functions with varying surface roughness.

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