Lehrstuhl und Prüfamt für Verkehrswegebau
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Comparing and Predicting the Design of Bridge Bearers Tested in the Laboratory by using Finite Element Analysis

Background

In the present times, with the banning of creosote treated wooden bridge bearers, there has been a growing necessity to explore the characteristics, behavior and workability of composite sleepers, for them to be more widely, confidently and extensively used. Therefore, ideas to carry out more and more tests on different types of bridge bearers have become of utmost importance. This could be made more optimal if iterative tests could be avoided or minimized.

This thesis is focused on creating FE models for railway composite sleepers to be installed on open steel bridges. This would be done by making models of already tested bridge bearers in the lab and calibrating them to check the accuracy of the models and then give out predictions for design (such as cross-section, eccentricity etc.) of future bridge bearers. This could save a lot of time and effort by omitting the necessity of several iterative testing. This would be done with the help of Ansys Workbench 2019 R3.

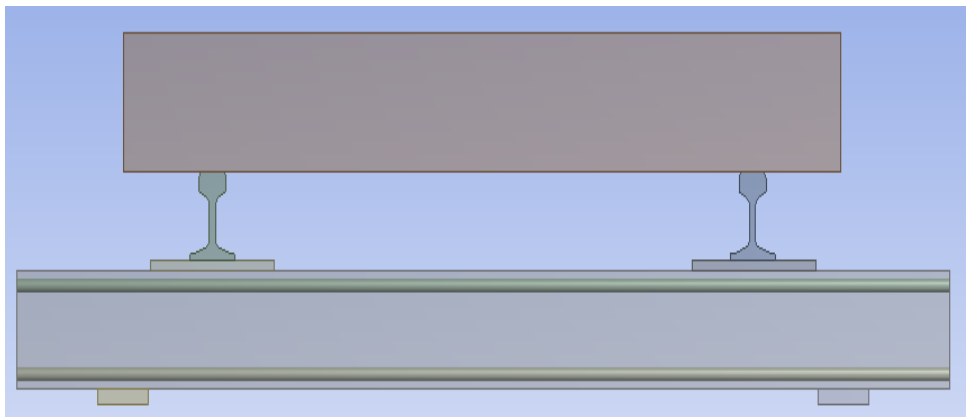

Figure 1: Geometry of the 4-point model of Lankhorst on Ansys Workbench

Workflow

- Create 3-point models of the pre-tested bridge bearers of Strail, Lankhorst and Sicut with Ansys Workbench.
- Create 4-point model of the pre-tested bridge bearers of Strail and Lankhorst with Ansys Workbench.
- Check for the accuracy of the models created and modify accordingly but with respect to all the information available.
- Give out predictions (cross-section and eccentricity) for the bridge bearers of Sicut and use the model for usage for the future bridge bearers.

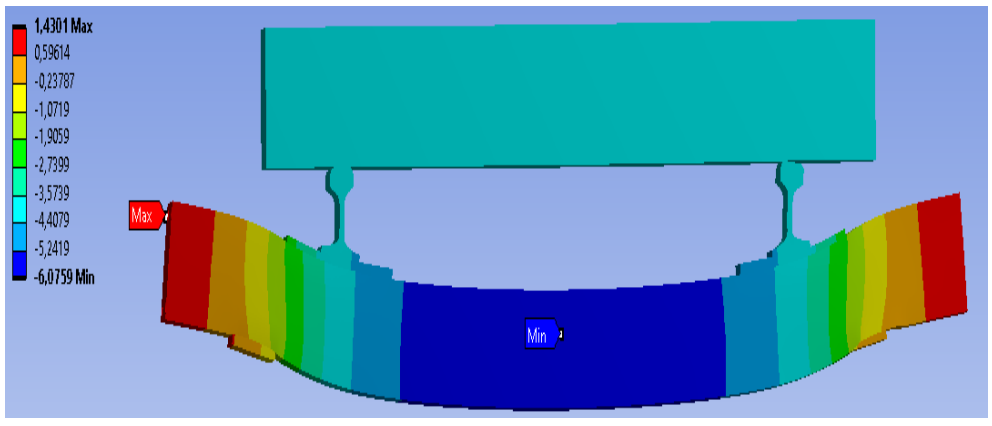

Figure 2: A 4-point FE model Deformation result on Ansys Workbench

Summary

The main aim of this master thesis was to compare the results obtained during the tests (3-point and 4-point) performed on the composite bridge bearers in the laboratory with the results achieved by creating FE Model simulations of the same bridge bearers. This was done to check the accuracy of the models created in order to give out recommendations on the design (cross-section and eccentricity) of the future bridge bearers. This could save a lot of time in the future in the testing of bridge bearers and eventually could increase the usage of composite bridge bearers more effectively, freely and abundantly. As it can be seen that Ansys could, to a great extent produce near to exact results as lab tests when simulated correctly. In most of the cases, the deflection in the center, under the rails and the gauge have been measured with very less error percentage. Therefore, apart from giving out predictions for Sicut, these models could also be used in the future to give out predictions for other bridge bearers. This could prove to be very beneficial in the testing of composite bridge bearers for them to be used more extensively.

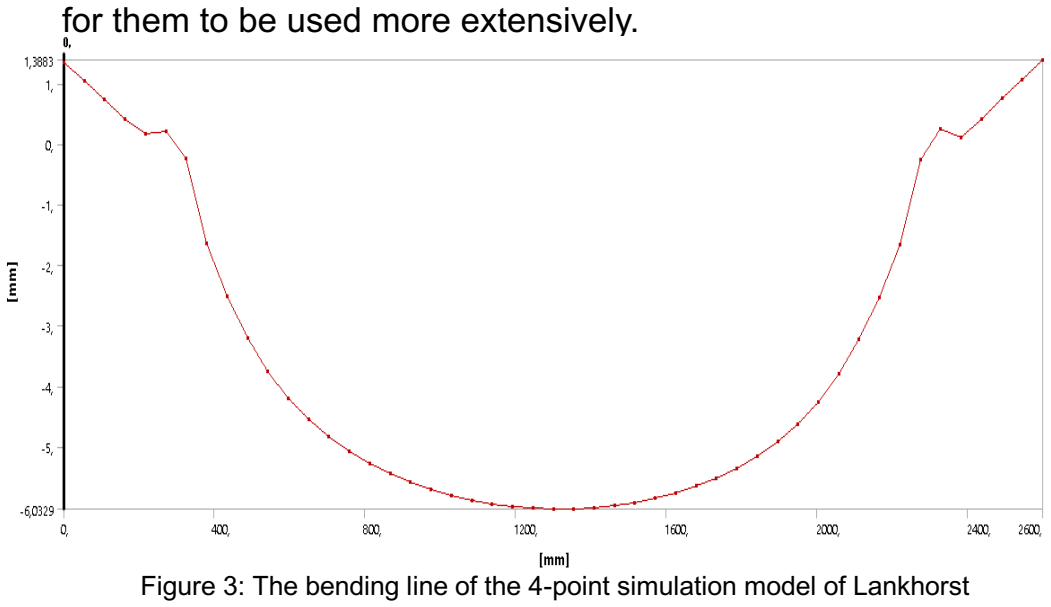

Figure 3: The bending line of the 4-point simulation model of Lankhorst

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