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MODELLING OF THE STORAGE RACK JOINTS

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1. INTRODUCTION

Steel storage pallet racks are three-dimensional framed structures, similar to multi-storey building structures. For practical reasons pallet racks are not braced in down-aisle direction, so the main source of the stiffness required for down-aisle stability is the stiffness of the connections between columns and beams. Most of the recent design codes and papers, e.g. [1], recommend experimental tests of beam-to-column connections to obtain semi-rigid joint characteristics that can be applied in the global analysis. The aim of the paper is to present the application of the component method to assess main properties of the joint which is shown in Fig. 1.

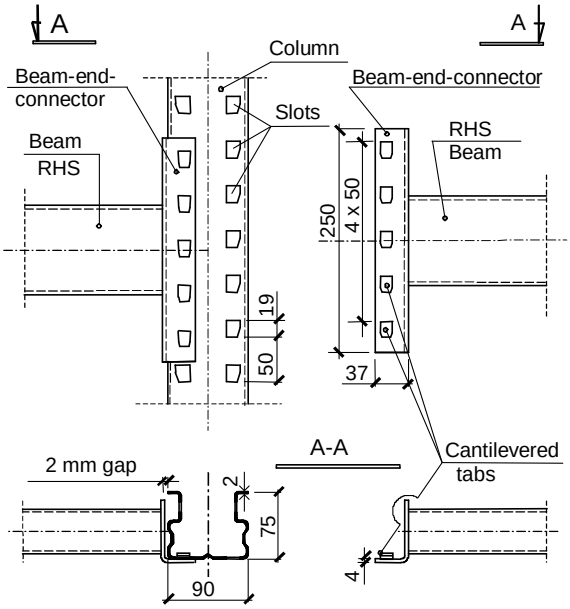

Fig. 1. Dimensions of analysed joint.

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2. ANALYSIS

Application of the component methods was performed in three stages. The first stage was the identification of components in the analysed joint, where the complex connection was subdivided into parts. In the case of analysed storage rack joint, the following components were identified: column web in tearing, column web in bearing, column web in tension (compression), tabs in shear, connector in bending and shear, connector web in tension (compression) and beam flange in tension (compression).

In the second stage initial stiffness and strength were predicted for each component. The behaviour of each component was described by a bilinear relationship between displacement and force. The third stage was the evaluation of flexural strength and rotational stiffness of the whole joint. In this stage the lever arms were also predicted for every group of components. The mechanical model adopted to predict the initial rotational stiffness is shown in Fig. 2.

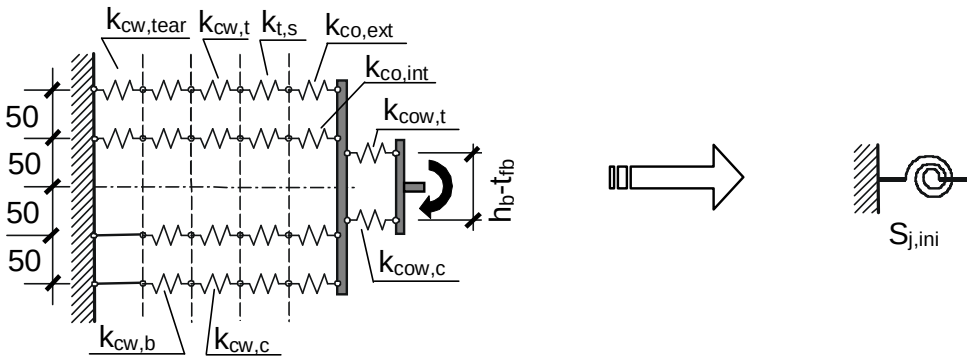

Fig. 2. Mechanical model for evaluation the rotational stiffness.

3. RESULTS AND CONCLUSIONS

Results obtained using the proposed model are compared with test results [2], both in predicting the initial stiffness and flexural resistance.

Modelling the behaviour of such joints using the component method shows high level of accuracy and gives the possibility to predict mechanical characteristic of joints without expensive experimental work. Also the influence of each component on the global resistance and stiffness is easy to observe. The weakest component can be identified and improved. It makes easier to conduct the optimisation of joints, especially for the systems, which are produced in long series, as steel storage pallet racks.

REFERENCES

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