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Introduction

Due to economic development within the European community the amount of transported load by road will grow substantially within the next 15 years. This increase is in conflict with the growing environmental awareness. Therefore, in order to decrease the emission of CO_2 and NO_x, there is a need to increase the maximum pay-load, by reducing the net tare weight or by increasing the inner volume, and, at the same time, increase the utilisation of a tractor-semitrailer combination with a multi-functional design.

Design

In the proposed design all objectives are reached with a self supporting box structure, built up from foam-cored sandwich panels. Initially, the design of the sandwich panels is governed by both the required stiffness, (core) insulating properties and ruled dimensions of the semitrailer (Fig. 1). With the sandwich built up the panel stiffness increases with a reduction in weight. By minimising heat-bridges, the thickness of the panels is minimised, and consequently the inner volume is maximised.

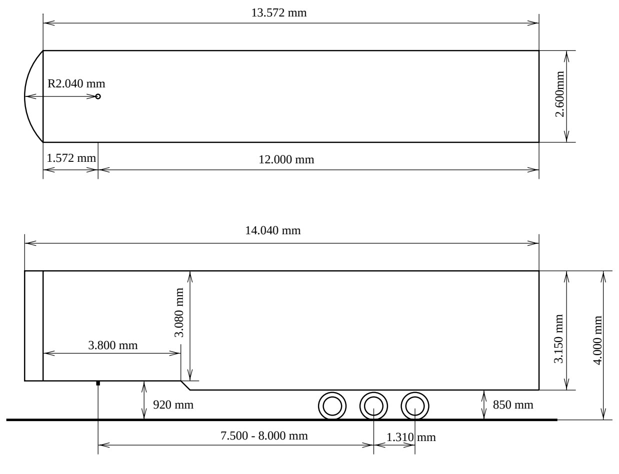

Fig. 1 *Strictly ruled dimensions of semitrailer.*

Besides the insulating properties of the closed box structure (for conditioned transport), the design is suitable to transport airfreight, hanging garment and double (or triple) stocked goods.

The floor panel requires integrated reinforcements at kingpin and axles. These reinforcements divide the local high forces evenly over the panel. On the one hand this increases the complexity of the floor panel and, consequently the production process. On the other hand, an even distribution of loads, makes local reinforcements in the wall redundant.

Fig. 2 shows the deformed semitrailer loaded with 35 tonnes and with a wind load on the side wall. For clarity half of the model is presented and the front wall is not shown. It clearly shows the even distribution of stresses over the sandwich facings, apart from the kingpin and axle frame.

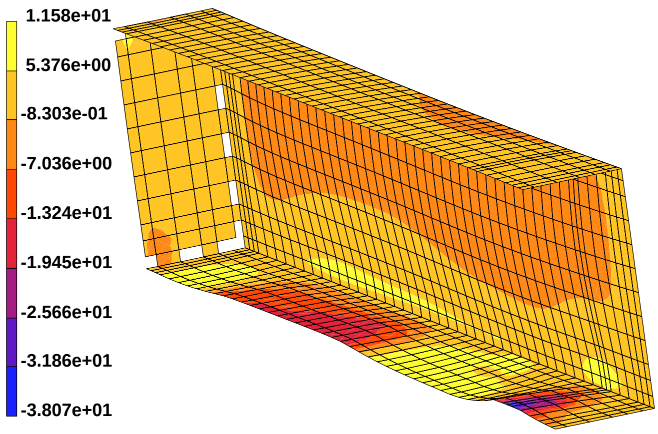

Fig. 2 *Maximum stresses in the sandwich structure.*

Results

- Net tare weight of 7100 kg, i.e. weight reduction of nearly 30 %.
- Inner volume of 95 m^3, i.e. increase of 11 %.
- Utilisation of 65 %, i.e. increase of 8 %.
- Return of investment time of less than two years.
- Annual fuel savings of 6500 litre, i.e. reduction of fuel consumption with 14 %.

References:

[1] Howard G. Allen: *Analysis and Design of Structural Sandwich Panels* (Pergamon Press Ltd., 1969.)

[2] Hammami, A. et al.: *Vacuum Infusion Moulding Process* (ECCM-8, Naples, June 1998).