# Road transportation of pigs in three tiers

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**Abstract**

The subject of this study was the vehicle microclimate and animal behaviour during transport. Pigs were transported in a road train in actual conditions. 803 pigs were transported during three trips. The reference vehicle, a double-decker front car loaded about 83 pigs and the three-tier test rear trailer loaded about 185 pigs, which had the live weight of 110 kg. Transport times varied from 7.7 hours to 8.7 hours. Loading density was 0.43 $m^2$ per pig. Temperature loggers were installed at the level of the pigs' heads in the vehicle. The standing, sitting and lying frequencies of pigs were monitored and recorded with mini cameras. The inside temperature of the vehicle varied from 7.5 to 26.5 °C from loading to stopped fully loaded vehicle respectively. The corresponding external temperature varied from 7.5 to 25.5 °C. The "hottest" pen was the front pen on the 1st deck of the front car, while, the "coolest" pen was on the 3rd tier of the rear trailer. All pigs generally remained standing in the initial phase of loading. When the pens were fully loaded, part of the pigs were sitting on the floor, and quite soon began to lie down. In a moving vehicle, the frequency of lying pigs was higher in the three-tier trailer (42.7 %) than the front car (36.9 %).

## Introduction

The new EU legislation coming into force from 5 January 2007 decreased significantly the loading density of pigs in vehicles in Finland. Therefore a new transport vehicle of three tiers was constructed for long trips. It had to be effective and practical in use while also ensuring animal welfare. It also had to meet the requirements of sustainable development since the effects of today's decisions and investments will still be felt 10 - 15 years from now. The subject of this study was the vehicle microclimate and animal behaviour during transport.

## Material and methods

Pigs were transported in a road train in actual conditions for the purposes of this study. The reference vehicle was a currently used double decker, which had the new three-tier test vechicle as a rear trailer. The deck height of the three-tier vehicle was from 100 to 105 cm, the same as the height of the 2nd deck of the reference double decker. The first deck of the latter was 140 cm high. The front car had three levels/pens measuring 5.63 $m^2$ which were lifted up with 13 pigs on them, after which the 1st deck was loaded with pigs (3 x 13). Finally, 13 pigs were loaded in the loading lift in the rear (Figure 1). The rear trailer had six levels/pens measuring 9.68 $m^2$ which were lifted up with 21 pigs on them to the 2nd and 3rd tiers. Then, the 1st deck was loaded with pigs (3 x 21) (Figure 1).

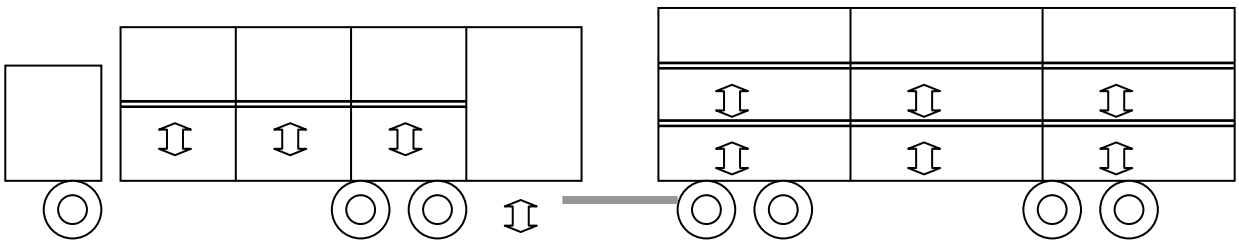

**Figure 1.** The studied road train with a double decker front car and a three-tier rear trailer. The up-and-down lifts are indicated by the arrows.

The front car and rear trailer were equipped with devices for air quality measurements and with monitoring cameras by the body constructor for the study. During the project, data were collected on animal transport from loading to unloading. The objective was to study e.g. the temperature inside the vehicle and animal behaviour during loading, driving, stops and unloading. Temperature was measured in both the front car and the rear trailer. Thermochron loggers were installed at the level of the pigs' heads in the front, middle and rear pens of the front car, and in the 1st, 2nd and 3rd tiers of the rear trailer.

Pigs were monitored with eight mini cameras (Velleman), four in the front car and four in the rear trailer. Behavioural events were recorded with four channel digital video recorders (AVTech). The standing, sitting and lying frequencies of pigs were calculated on the basis of observations made during trips.

**Results and discussion**

The live weight of transported pigs varied from 100 to 123 kg. Loading density varied from 0.40 to 0.48 $m^2$ per pig, heavier pigs had more floor space than lighter ones. Transport times were 8 hours 40 minutes, 7 hours 5 minutes and 7 hours 40 minutes for the 1st, 2nd and 3rd trip, respectively. The maximum height of live slaughter pigs, with a live weight from 100 to 123 kg, varied from 75 to 80 cm measured at the middle of the bowed back. Thus, there is 20 – 30 cm clearance above the animals where air is circulated by fans.

The results showed that temperature inside the vehicle increased during loading and reached the maximum value when a fully loaded vehicle stopped. When the vehicle was moving, the inside temperature decreased almost to the level of the external temperature. The inside temperature of the vehicle varied from 7.5 to 26.5 °C (from loading to stopped fully loaded vehicle). The corresponding external temperature varied from 7.5 to 25.5 °C.

The ”hottest” pen was the front pen on the 1st deck of the front car. While, the ”coolest” pen was on the 3rd tier of the rear trailer (Table 1). That indicates that the air quality of the vehicle was good.

**Table 1.** Average temperatures of pens of the fully loaded moving road train.

| Location of pens in the road train | Temperature, °C | | |
|---|---|---|---|
| | 1st trip | 2nd trip | 3rd trip |
| Front car, 1st tier, front pen | 22.2 ± 1.6 | 22.4 ± 0.8 | 21.9 ± 0.7 |
| Front car, 1st tier, middle pen | 21.9 ± 1.1 | 21.8 ± 0.8 | 21.4 ± 1.0 |
| Front car, 1st tier, rear pen | 20.1 ± 0.8 | 20.5 ± 1.0 | 19.9 ± 1.2 |
| Rear trailer, 1st tier | 21.3 ± 1.5 | 21.3 ± 0.8 | 21.6 ± 0.9 |
| Rear trailer, 2nd tier | 20.2 ± 1.4 | 19.9 ± 0.7 | 20.2 ± 0.9 |
| Rear trailer, 3rd tier | 18.4 ± 1.2 | 18.3 ± 0.7 | 17.7 ± 1.2 |
| External temperature, °C | 18.6 ± 4.3 | 21.0 ± 3.3 | 21.3 ± 1.5 |
| min - max, °C | 12.0 – 24.5 | 10.5 – 25.5 | 7.5 – 25.0 |
| Number of pigs in the front car | 87 | 74 | 88 |
| Number of pigs in the rear trailer | 185 | 183 | 186 |

All pigs generally remained standing in the initial phase of loading. When the pens were fully loaded, part of the pigs were sitting on the floor, and quite soon began to lie down. When a fully loaded vehicle moved, most of the pigs were lying. Pigs that were standing or sitting would generally lay down during a stop; during a longer stop from 10 to 25 minutes almost all pigs in the monitored pens were lying. As a rule, lying pigs gathered into groups where they could lie on top of each other in two or three layers.

The pigs were typically in very close contact with each other during transport. That made it easier for them to maintain their balance in a moving vehicle. In fact, they preferred to lean on each other whether standing, sitting or lying. As a result, there was always plenty of empty space between the ”pig clusters” and the clusters and the side walls of a pen. This behaviour indicated that pigs are very social herd animals that like to be in close contact with each other. Sometimes two pigs were observed to fight each other in a pen. Usually, fights started during loading and continued for the entire trip. As a result, all pigs were standing nervously in the pen and none could lie during transport.

In a moving vehicle, the frequency of standing pigs was highest in the 2nd tier of the rear trailer and lowest in the front pen of the 1st deck of the front car. The occurrence of sitting animals was highest in the rear pen of the 2nd deck of the front car and lowest in the 1st and 3rd tiers of the rear trailer. In general, the frequency of lying pigs was higher in the rear trailer than the front car. Pigs were lying especially in the 1st and the 3rd tiers of the rear trailer and in the front pen of the 1st deck of the front car (Table 2).

**Table 2.** Frequency of positions of pigs in a moving fully loaded road train.

| Location of pens in the road train | Frequency of positions, % | | | Number of pigs | Number of observations |
|---|---|---|---|---|---|
| | Standing | Sitting | Lying | | |
| Front car, 1st tier, front pen | 30.3 | 22.0 | 47.7 | 13 | 1156 |
| Front car, 2nd tier, front pen | 44.1 | 21.7 | 34.2 | 13 | 997 |
| Front car, 1st tier, rear pen | 48.2 | 17.9 | 33.9 | 13 | 1244 |
| Front car, 2nd tier, rear pen | 44.5 | 23.6 | 31.9 | 13 | 999 |
| Rear trailer, 1st tier | 39.8 | 9.9 | 50.3 | 21 | 1116 |
| Rear trailer, 2nd tier | 52.6 | 15.9 | 31.5 | 21 | 1128 |
| Rear trailer, 3rd tier | 43.9 | 9.9 | 46.2 | 21 | 1461 |
| Frequency of positions, % | 43.4 | 16.8 | 39.8 | | |
| Number of observations | 3512 | 1364 | 3225 | | 8101 |

## Conclusions

The results show that the studied three-tier vehicle met the loading and air quality requirements from the animal welfare point of view. In the three-tier vehicle, pigs exhibited their natural herd behaviour by leaning on each other during standing, sitting and lying. Thus it was concluded that the new three-tier vehicle is suitable for Finnish conditions. The results of the study support the construction of new two- or three-tier vehicles for pig transportation in the future.

## Acknowledgements

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## Reference

Council Regulation (EC) No. 1/2005 on the protection of animals during transport will enter into force in January 2007.