SUMMARY

A slatted concrete floor is commonly used as a draining floor in the aisles of cattle cubicle barns in Sweden as well as in the rest of Europe. A high-performing slatted concrete floor will usually be dryer, and thus less slippery, than a solid floor with the same surface structure. When using a slatted floor the width of the gap between slats, i.e., the slot, is always a compromise between the demand for good draining capacity, for manure and urine, and the requirement that the animals should not be harmed by treading through or getting jammed in the slots. The slats should also have a certain width to give sufficient support for the hoof, reducing the contact pressure. Narrower slats and a ratio of slots to slats will on the other hand, improve the drainage.

In Sweden, the allowed dimensions for slatted floors are stated in the Swedish animal protection regulation, in which the prescribed width of slats and maximal slots are stated. These prescribed dimensions are regarded not to be an optimal compromise. They are suspected to allow too wide slots, but require unnecessarily wide slats. The regulations are, therefore, currently (2002) under review in Sweden. Instead of prescribing slit width, an option would be to state the maximum percentage of the floor that may be constituted by slots. The highest permitted width of the slots would still be given. In this way, the manufacturers of these floorings would get more freedom in designing the floors.

The purpose of this project was to provide measurable facts to be used in the review of the recommendations and regulations concerning concrete slatted floors for cattle. In the project we have studied the effect of varying the dimensions of slats and slots on the contact pressure between hoof and slatted floor. The hypothesis was that the support for the hoof could be increased and maximum pressures at sensitive points under the hoof reduced at a given percentage of slot area in the floor, by reducing the width of both slats and slots.

The contact pressure between hoof and floor was registered using a thin (0.1 mm) sensor unit connected to an analyzing computer system. The sensor unit consisted of a matrix of individual pressure sensing locations also referred to as “sensels”. Each sensel acts as a variable electrical resistor in an electrical circuit. Two different measuring units were used, one with 3.2 sensels/cm² and the other with 15.4 sensels/cm². The result of a measurement could be displayed as a pressure distribution map on a monitor or printed.

After some initial field measurements on a dairy cow, a laboratory set up simulating a standing cow by use of a cadaver hoof was developed. With this equipment, pressure maps for eight different hoof positions on each of the following floor dimensions: 125/40, 125/30 (90/30) and 75/25 (slat width in mm / slot width in mm) were recorded and compared to solid floor.

For each position of the hoof a comparison was made between the different floor dimensions, using the parameters mean contact pressure and maximum local contact pressure. The contact area of the hoof was divided into four anatomically separate zones: the rear part of the sole, the abaxial wall bulb junction, the wall zone and the bulb. For each of
the zones, the maximum local contact pressure was determined. Due to the high vulnerability of the rear part of the sole and the abaxial wall bulb junction, the recorded pressures for these two zones were considered most important in the subsequent evaluation of the result.

The conclusion of this study was that when both slat and slot width was reduced from 125/40 to 90/30 the support for the hoof was improved (i.e. a lower mean contact pressure was recorded). The maximum local contact pressures on the rear part of the sole and the abaxial wall bulb junction were also lowered. When the width of slats and slots were further reduced, this tendency was not as clear. Here, an improved support and reduced maximum local contact pressure was only found in 50% of the measurements.