Technical Note TN610

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Ventilation of cattle and sheep buildings

It is widely recognised that the provision of effective ventilation is crucial to the operation of any livestock building. In cattle and sheep buildings it is usual to rely on natural ventilation to create the required internal climatic conditions for housed livestock.

SUMMARY

The motive power to drive natural ventilation is provided from two distinct sources: thermal buoyancy and wind. Thermal buoyancy means the rising of warm air or the stack effect (Figure 1). If inlets and outlets are correctly sized and placed, natural ventilation will operate even on days when there is no wind. On still days thermal buoyancy will provide a minimum ventilation rate. The design of ventilation systems are therefore based on thermal buoyancy to cater for still, wind-free days often encountered in late autumn.

Ventilation openings are sized and located with reference to the number and live weight of animals and the shape and size of the building structure.

In practice the area of ventilation openings required for a building with a given stocking rate can best be calculated using a computer. Figure 2 gives a sample printout of the calculation of ventilation openings for a house for 240 in-lamb ewes (Figure 3).

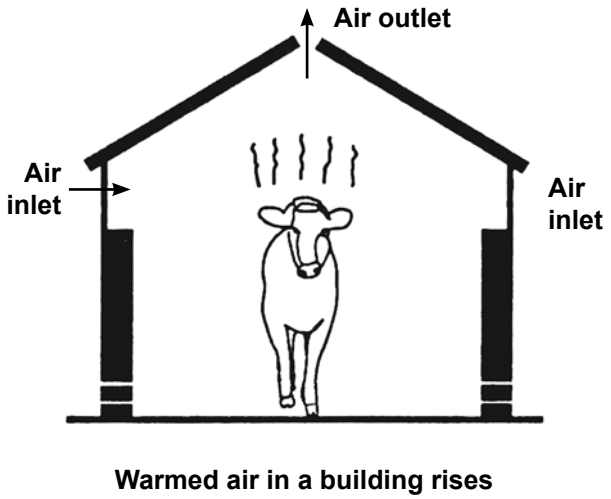

Figure 1: Ventilation by thermal buoyancy – warm air rising

Natural Ventilation Design Program for Beef and Sheep Buildings

Floor area of building (m²) 450	
Stocking density:240 animals at 80kg	
Open ridge, spaced boarding design	
Length of building (m)	27
Width of building (m)	16.5
Eaves height of building (m)	3.6
Roof pitch of building (degrees)	15
Width of spaced boarding (mm)	100
Width of gap in spaced boarding (mm)	20
Area of open ridge (m²)	6
Width of open ridge (mm)	210
Area of eaves openings (m²)	12
Void ratio in spaced boarding	0.167
Depth of spaced boarding on side Walls only (mm)	1250
Depth of spaced boarding on walls And gables (mm)	770

Figure 2: Printout of ventilation programs

The output from the computer shows that an open ridge of 6 m² and eaves openings of 12 m² will provide a satisfactory minimum ventilation rate for this particular building under still-air conditions. It is important to realise that the ventilation rate will increase under windy conditions.

In practice a 200 mm wide open ridge will be fitted to the building. Although openings 200 mm deep below eaves level up each side of the building would be acceptable, it is normal to provide some protection from draughts and rain by using some form of perforated opening. In this case spaced boarding

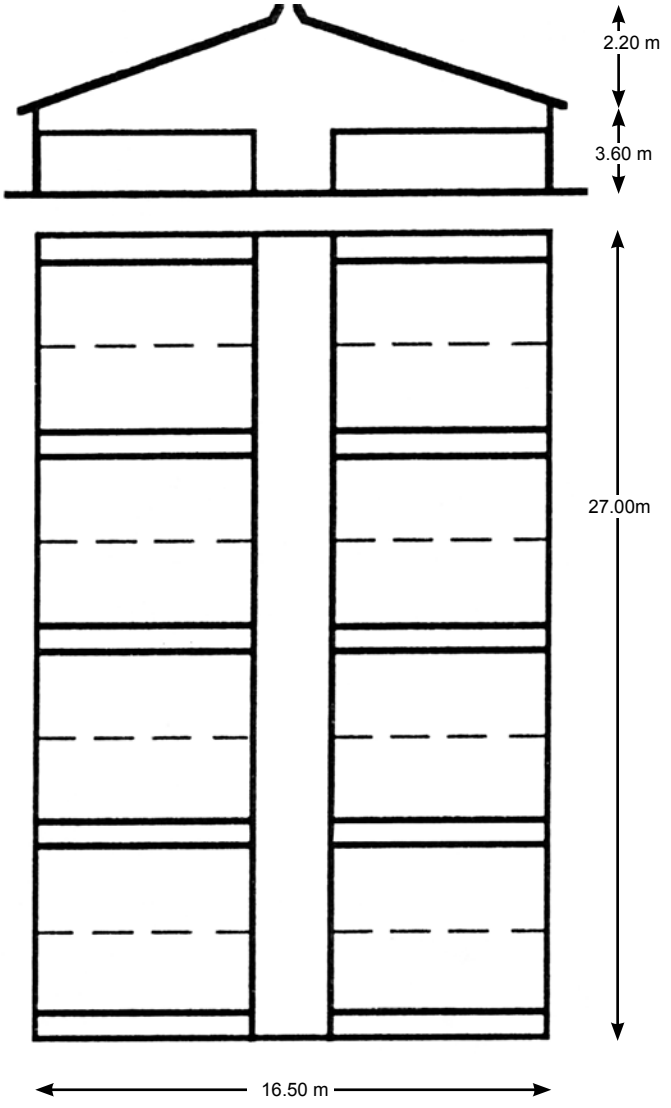

Figure 3: House for 240 in-lamb ewes used in example

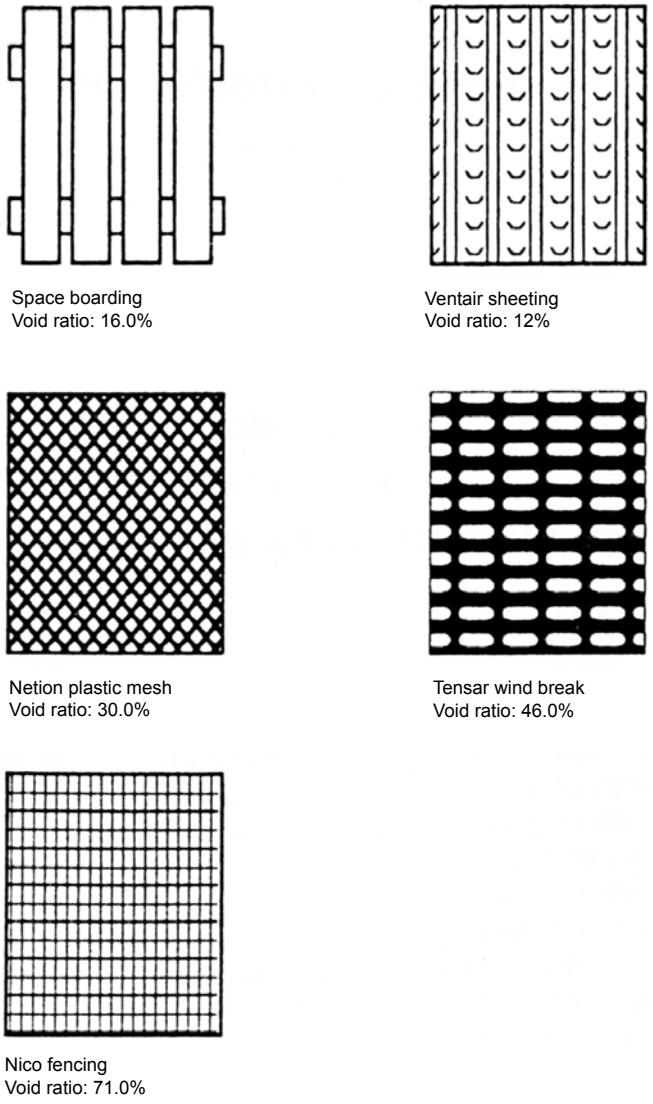

Figure 4: Perforated openings for side-wall air inlets

With 100mm board and 20 mm gaps will be used. In order to provide openings equivalent to 12 m² calculated the spaced boarding must be 1.25 m deep. There are several types of material suitable for making perforated openings; some of these are shown in Figure 4.

Although an open ridge with upstands to prevent driven rain entering the building is suitable for most buildings, full protection can be achieved by installing a protected open ridge (Figure 5), full details of which are available from the SAC Building Design Service.

The design of ventilation for sheep and cattle buildings is relatively straightforward in most buildings. However, difficulties can occur in buildings with restricted areas available for side-wall inlets, in very wide buildings and in buildings where a lean-to has been constructed after the erection of the original building. Figure 6 shows a typical arrangement where the area for side wall inlets is non-existent.

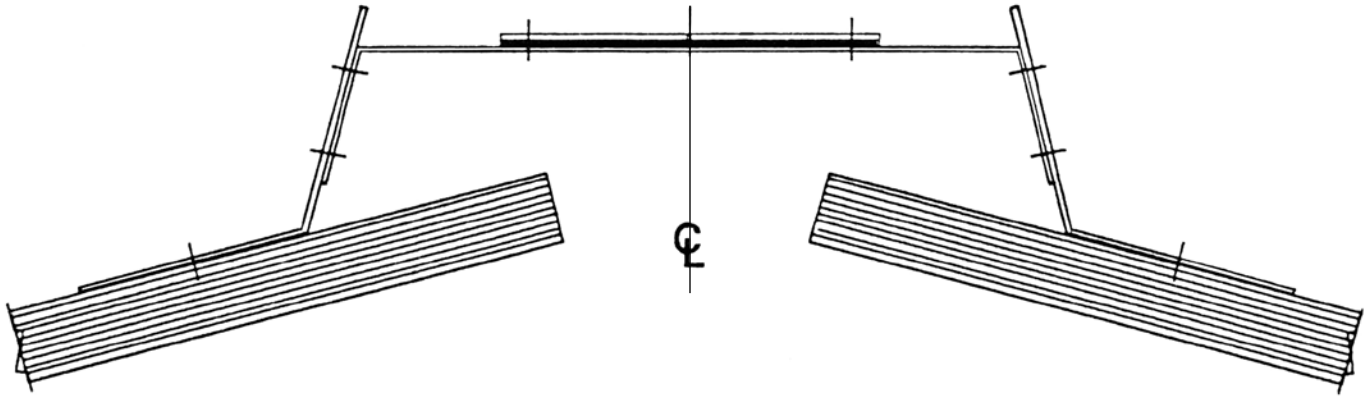

Figure 5: Protected open ridge

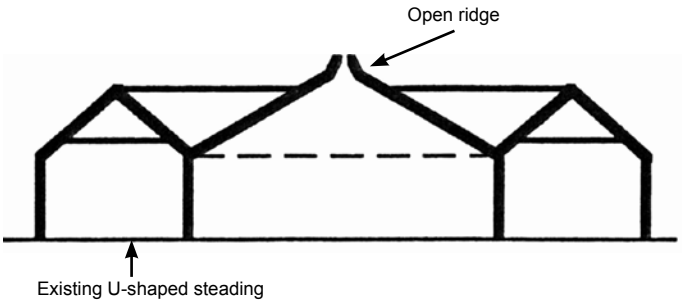

Figure 6: Problem building

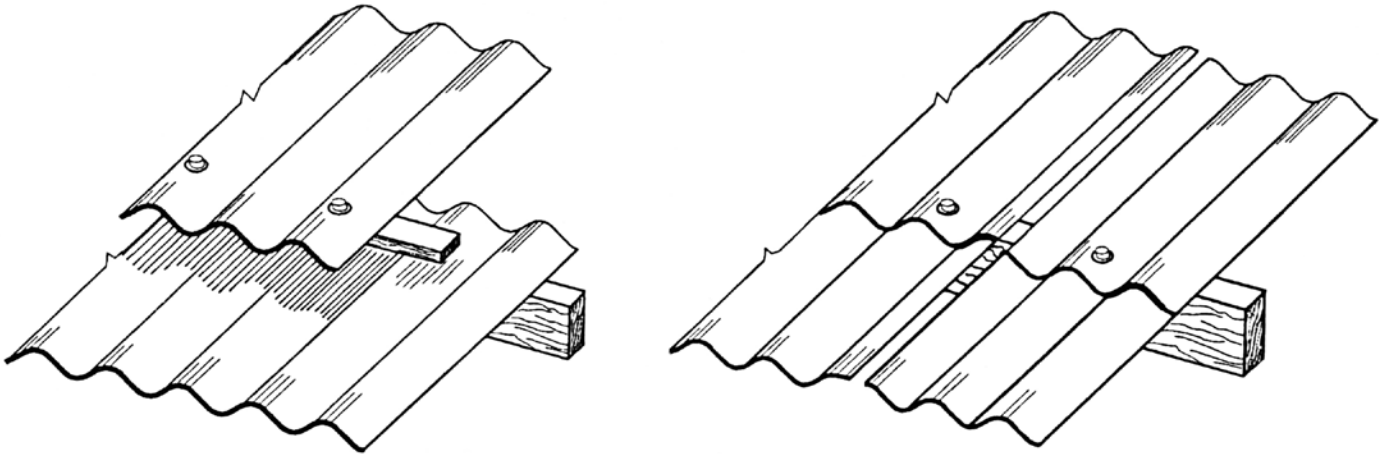

Figure 7: Two forms of spaced roof sheets

Whilst it would have been prudent to increase the eaves height of the new building to provide side-wall inlets, the arrangement shown above exists on many farms. Satisfactory ventilation can be achieved by providing spaced boarding in the gable and spaced sheeting in the roof. It is vital that the area of spaced boarding and spaced roof sheeting is calculated to meet the requirements of the housed stock. Figure 7 shows two forms of spaced roof sheeting.

There is no doubt that the health of housed animals depends on good ventilation. It is important to seek the advice of a specialist when designing new buildings or when the ventilation in an existing building or when the ventilation in an existing building is giving rise to problems such as respiratory disease in housed animals. There are many reasons for poor ventilation in livestock buildings. Building specialists in the Scottish Agricultural College can help solve your problems by identifying the solution most appropriate to your needs. They have computer programs to do the design calculations combined with the knowledge and experience to apply them to practical situations.

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