bre

technical file

NOISE INGRESS THROUGH VENTS

Passive and trickle ventilators can have an adverse effect on the sound insulation of buildings. *S Jorro* outlines the BRE's work in assessing the extent of the problem.

Background ventilation in new dwellings is provided by purpose designed ventilation openings. The *Approved Document*[1] supporting the *Building Regulations* recommends the minimum size of such openings. It stresses also the need for such openings to be controllable, secure and located so as to avoid undue draughts.

One common solution is to use a 'trickle' ventilator mounted in a window frame. A trickle ventilator is basically a series of holes or a long slot cut in the window frame with a cowl on the outside and a closeable cover on the inside.

Another method being investigated at BRE is the 'passive stack' ventilator, a vertical pipe which will vent a room from the ceiling to the roof-top by the stack effect (see figure 1).

However, any such openings in the external envelope are likely to have an adverse effect on the sound level in dwellings exposed to high levels of noise from road traffic, aircraft, and other sources of external noise.

To gain an insight on the size of this adverse effect, acoustic measurements have been made on a variety of passive ventilators[2] in an experimental facility at BRE.

STACK TYPE

Experiments showed that more sound attenuation was provided by a flexible, spiral-wound, plastic tube which went up to the ridge of the roof of a two-storey test house by bending across the attic space, than by a smooth, rigid, plastic tube which went straight up to the roof slope with no bends.

There was little or no difference between the measured air flow rates of the two types of pipe when straight[3], but stacks with a bend to enable them to vent to the ridge provided up to 50% less ventilation than those that passed straight up to the roof slope. There is therefore a conflict between acoustic and ventilation requirements.

Surprisingly, for a given material and configuration, the 100 mm diameter stack invariably lets more sound into the vented room than the 155 mm diameter equivalent. This was particularly pronounced for frequencies above 630 Hz.

For pairs of otherwise similar pipes, one might expect the larger diameter pipe to transmit more sound energy. However, the acoustic behaviour of the pipes depends in a complex way on their physical arrangement and the frequency of the sound[2].

The air flow rates in the larger diameter straight pipes were about twice as high as in the smaller pipe, though only about 50% higher when there were bends. The larger size of pipe offers benefits in terms of acoustic and ventilation performance which makes it the better choice for passive stack ventilation.

TRICKLE TYPE

The performance of this type of ventilator was found to be consistent with its physical dimensions, ie large ventilators let in more sound than small ones. For a given ventilator size, those with holes through the window frame attenuate sound more than those with a slot. This is because the slot has a greater open area, and it is the total open area that determines the attenuation. When closed the attenuation of the ventilators increases by at least 5 dB compared with the value when open.

For a ventilator in the open position, some acoustic impedance to noise is evident in the frequency range up to a resonance dip caused by standing waves within the openings. Above this frequency, the sound passes unimpeded through the ventilators.

Consequently, in noisy areas, use of trickle ventilators could result in an increase in indoor noise level from above 630 Hz when used with single pane windows, and from above 315 Hz when used with more effective secondary pane double windows. This is shown in figure 2. The effect is no worse than if the window was opened in order to meet the ventilation requirement.

Laboratory tests showed no significant difference in the air flow rates through openings of given area made up by holes or a slot; the flow depends on the pressure difference across the opening, and this is determined by location, internal/external temperature difference and weather conditions.

CONCLUSION

Although both types of ventilator could admit noise at higher frequencies due to the decrease in acoustic impedance of openings with increasing frequency, they provide a quieter indoor environment and a generally more satisfactory means of controlling background ventilation than opening windows, unless they have a night latch setting.

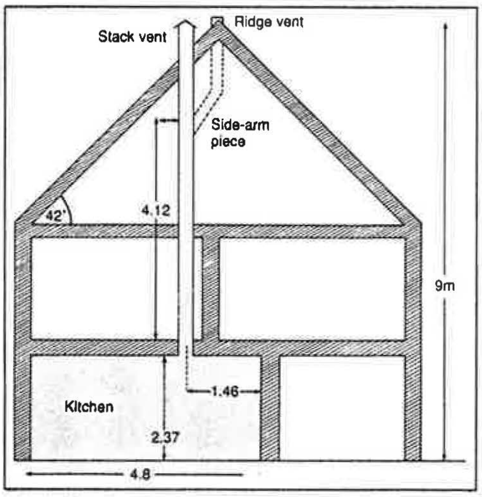

Figure 1: Location of stack pipes in test house (all dimensions in metres).

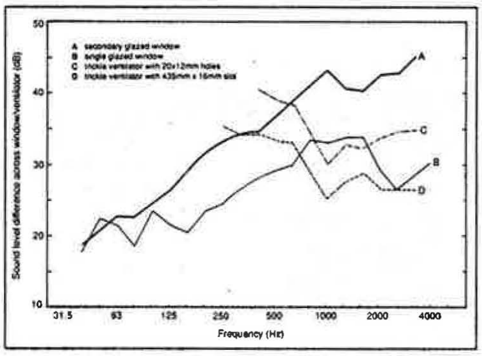

Figure 2: Comparison of sound insulation provided by different systems.

Where noise levels outside warrant additional sound insulation, for example by using thermal double glazing or secondary double windows, sound attenuating ventilators should be used instead. Such special ventilators are specified in Schedule 1 of *The Noise Insulation Regulations*[4].

Reference

[1] Department of the Environment and the Welsh Office, *The Building Regulations 1985, Approved Document F: Ventilation*, (1990 edition). HMSO.

[2] Jorro, S, "The sound attenuation of passive ventilators", *Proc Inst Acoustics 1990 12(5)* p41-47.

[3] Parkins, Lynn M, "Experimental passive stack systems for controlled natural ventilation", *Proc CIBSE National Conference 1991*, University of Kent, Canterbury, 7-9 April 1991.

[4] "The Noise Insulation Regulations 1975", *Statutory Instrument No 1763*.

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