is substantially reduced. It is very important in acoustic detailing to ensure that all gaps are well sealed.

Flanking Transmission

The sound transmission between two rooms is determined not simply by the insulation of the intervening partition. Flanking paths must also be considered. These can be structure borne paths such as along flanking walls or by sound going out of a window and back in another in the adjacent room. The formed is best analysed by statistical energy theory. A useful introduction is provided by Craik (ref 13). The practical insulation of a heavy partition wall will be considerably reduced by lightweight flanking walls. Discontinuities in the flanking walls (e.g. windows) near the junction with the partition help reduce the flanking transmission. The mode of fixing of the partition (or party wall) into the flanking walls is also of importance.

Sound Insulation Requirements

Sound Insulation requirements are divided into airborne and impact. The former measures the sound level difference between the sound level in room and that in an adjacent room. The impact sound level measures the sound level in a room when the floor above is directly excited by a standard tapping machine, measuring the insulation against noise created by such sources as footsteps.

Airborne Sound Insulation

In a laboratory a transmission suite of two adjacent parallel rooms described in BS 2750 or ISO 140 is used to measure airborne sound insulation and by correction for the absorption area in the receiving room and the partition area the sound reduction index can be calculated. For building acoustics measurements are made in the 16 l/3rd octave bands between 100Hz and 3150 Hz.

The sound reduction index (SRI), also known in the USA as the transmission loss, is then given by:

$$SRI = L_1 - L_2 + 10 \log S/A \text{ dB}$$

where L_1 = average sound pressure in the source room
L_2 = average sound pressure in the receiving room
S = area of the dividing partition
A = absorption area of the receiving room

For field measurements the standardised sound level difference is given by

$D_{nt} = L_1 - L_2 + 10\log(t/0.5)$ where t is the reverberation time of the receiving room. 0.5s is assumed to be the reverberation time of a typical sitting room.

In the U.K. BS5821 describes a method for achieving a single rating, either the weighted sound reduction index (R_w) (laboratory) or the weighted standardised sound level difference (D_{ntw}) (field). This compares the measured values with standard curves the rating specified by the curve @500 Hz. To satisfy the rating the partition should not have a total aggregated deviation of more than 32dB and in no single 1/3rd fail by more than 8dB.

Impact insulation

Impact insulation is measured as the actual sound level experienced in a receiving room below a source room where the floor is excited by a standard tapping machine

In the laboratory the the normalised impact sound pressure level is calculated from:

$L_m = L_i - 10 \log (A_0/A)$
where L_i = measured impact sound level
A_0 is the reference absorption area
A is the absorption area of the receiving room

For field measurements the standardised impact sound pressure is calculated from:

Lnt = Li + 10 log (0.5/t)
where t is the reverberation time of the receiving room.
The weighted standardised impact sound pressure level is calculated according to a similar procedure to that of the airborne sound insulation.

Noise Control

In problems associated with noise it is always best to try and control the noise at source. This may be possible with machines but cannot be fully successful with sources such as traffic or aircraft, despite increasing attempts to make these quieter. In building design space planning can help avoid expensive solutions at a later date. Noise sensitive spaces should be placed away from noise sources. Airborne and structure borne noise need to be considered. Machines will usually transmit most of their low frequency sound energy directly into the floor so that good insulation over the whole frequency range cannot be achieved by a simple enclosure but the machine needs to be isolated from the floor. This is done using vibration isolators which are found in the form of a resilient pad (e.g. rubber) or as steel springs. The theory of vibration isolation is discussed in appendix 2.
Mechanical service noise can be a problem in buildings. This can arise from the boilers, compressors for cooling units, pumps and fans. Apart from normal airborne and structure borne transmission Noise can be transmitted through pipes but from the fans the noise will be duct borne. The main sources of fan noise are caused by boundary layer separation sa air flows over the blades and the vortices created at the tips of the blades. Centrifugal, axial and propeller fans have different noise spectrums but all fans tend to be tonal related to the fan running speed and the number of blades on the fan. Out of balance fans can be particularly noisy and the noise from failed bearings often give warning of early failure.
Duct borne noise can be controlled by silencers. These can be reactive or absorptive. The attenuation achieved by a duct is normally described in terms of the Insertion Loss. This is the difference in decibels between the sound pressure levels, assuming the area of duct remains the same before and after insertion, or otherwise the sound