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SOUND INSULATION BETWEEN DWELLINGS

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Introduction

A BRE random survey of sound insulation performance between dwellings constructed since 1970 is nearing completion. Interim results covering the performance of party walls(1) were presented at the 1976 Spring Conference. Reports have been published on the overall performances of walls and floors(2) and on the performances of individual wall and floor types(3-6) and others will follow.

The present paper briefly outlines current UK sound insulation control procedures; it updates the information provided at the 1976 Spring Conference; it compares the current UK experience of sound insulation control with that in other countries and discusses possibilities for better control of sound insulation performance.

Regulations

Regulations to control sound insulation between dwellings were introduced in 1963 for Scotland and in 1966 for England and Wales. Current Regulations date from 1971, Scotland(7) and 1972, England and Wales(8).

Briefly the requirement for England and Wales is that the sound insulation between dwellings shall be adequate. The requirement is deemed to be satisfied if:

(a) the proposed construction is one of those included in the deemed-to-satisfy list or

(b) the measured performance, averaged over not less than 4 examples meets the performance standard.

The performance standards are specified at 1/3rd octave intervals over the range 100-3150 Hz. The measured airborne insulation values averaged over 4 or more examples or the averaged received impact sound pressure levels are compared, at each 1/3rd octave, with the relevant specified values. Adverse deviations, where the measured performance is worse than the specified value, are added, 1/3rd octave by 1/3rd octave, to give the Aggregate Adverse Deviation (AAD). Provided the AAD is no more than 23 dB the test results are considered satisfactory and may be used as evidence for granting approval for the construction of new dwellings of the same design and also of designs which are similar to those tested and which are unlikely to be less resistant to the transmission of sound than those providing the satisfactory test evidence.

Current standards were based mainly on the results of social surveys carried out between 1948 and 1957(9,10). The constructions included in the deemed-to-satisfy list were judged, on the basis of measurements made in the 1950s and early 1960s, as likely to return performances approximating to the present performance standards.

At these levels of insulation the social surveys had indicated that the occupants of dwellings would be less concerned about noise from their neighbours via party walls and floors than about other features of their homes. At insulation levels some 5 dB (average 100-3150 Hz) less, the occupants of dwellings would regard neighbours noise as the worst thing about their homes.

Current UK standards are very similar to those adopted or recommended in other European countries; if anything the UK requirements are slightly lower. Responsibility for enforcement in the UK rests with local Building Control Officers.

BRE survey results

The random survey of sound insulation between post 1970 dwellings shows that 55% of the 1300 party walls measured and 63% of the 500 party floors measured fail to meet the performance standard. Furthermore 11% of party walls and 33% of party floors have very poor performance - failing the now obsolescent Grade II (11), at which level people regarded neighbours noise as being the worst feature of their homes.

The mean AAD for all party walls was 35 dB and we calculate that 5% of recent walls had AADs greater than 83 dB. Similarly the mean AAD for floors was 44 dB with 5% having AADs greater than 98 dB. (The performance requirement is no more than 23 dB.)

Although direct comparisons between performances being achieved in the 1950s(12) and those encountered in the recent survey are difficult to draw, there is firm evidence of a general decrease in performance over the past 20 years or so. For example, solid whole brick walls measured by BRE during the period 1948-56 had a mean AAD of 14 dB whereas those in the recent survey had a mean AAD of 21 dB. And variability in performance between nominally identical or similar examples within a given type is a feature of recent constructions, standard deviations in AAD of 15-20 dB being typical from apparently properly built examples.

Contributory factors

A number of factors are identified as contributing to the findings of the recent BRE survey. These include the latitude given by the Regulations, the way in which they are implemented, trends in the industry, design faults and errors in construction.

Approval via a satisfactory performance test does not rule out the possibility of tests performed on just 4 good examples of a particular design being used as the basis for wide ranging approval of that design. For example, a construction with a genuine mean AAD of 43 dB, with a standard deviation of 20 dB, will have 16% of examples with AADs of 23 dB or less and 3% with AADs exceeding 80 dB. If the 4 examples for test were taken from the 16% meeting the performance standard, then very many more dwellings of this design could be approved even though 84% of examples of this design would fail the performance standard.

Further, judging whether a proposed design, similar to that which has given satisfactory test evidence, is unlikely to transmit more sound than the tested design is extremely difficult, even for an expert.

Several trends in the industry have tended to reduce performance. These include the decrease in open fires and hence in massive chimney breasts which used to

occupy as much as one third of the party wall area; the tendency to lay bricks frog down - increasing the possibility of air voids in supposedly solid walls; the substitution of dry linings for plaster finishes and the effects of continuing pressures to minimise building costs.
About one third of the number of party walls having very poor performance were associated with thermally insulating lightweight plastics ceilings to bedrooms. The loss of sound insulation from these very light ceilings, compared with that provided by conventional plasterboard ceilings, allowed significant transmission between dwellings via the loft space and the poorly sealed extensions of the party wall in the loft. This was a design fault. The majority of examples of very poor performance though, arose from faults in construction which ranged from the use of materials different from those specified in the design, to what would seem to be the obvious fault of mounting electrical sockets back to back on the party wall. Almost invariably it would have cost no more to avoid the design and construction faults which led to the high incidence of poor performance. The fact that materials and labour were expended to produce inferior performance points to waste since proper design and construction would have cost no more and would have resulted in better performance, although not always up to the performance standard.

Possibilities for better control

It is suggested that effective sound insulation control should give the occupants of new dwellings a high and a justified expectation of freedom from annoyance due to neighbours noise. In current Regulations attention is concentrated on the control of mean performance. But, even excluding the effects of construction faults, there remains the variability in performance encountered from very similar examples of a given construction and this suggests that control should take variability into account and concentrate on minimum standards to be achieved by a very high proportion of examples, if not all.
The level of the minimum standard would be selected with reference to people's needs, the performance of the better practicable constructions and, unavoidably, costs. But no matter what level is selected for the minimum standard and no matter how it is specified the findings of the BRE performance survey suggest that more effective enforcement procedures will be necessary.
Experience in other European countries of sound insulation performance compared with recommended insulation values or performance requirements of regulations indicates that without strict enforcement failure rates of around 50% are typical. In places where enforcement is taken seriously, for example in Stockholm, in parts of Germany and notably in France failure rates are much lower.
In France serious efforts to enforce minimum sound insulation requirements have been made over the last 5-6 years following a period of comparatively less rigorous enforcement. During the last 5-6 years the failure rate in France has fallen from the typical 50% or so to 14% and is still falling. Moreover detected failures are corrected to meet the minimum standard.
BRE has been considering possible means for effective control of minimum standards. These include:

(a) the standard quality control approach by which predictions of performance are made from limited data and revised continually as additional relevant performance data become available, as a basis for further approvals, and to build up a list of deemed-to-satisfy constructions. Even listed constructions would be subject to random performance monitoring to detect any trends towards reduced performance from recent examples.

(b) Random performance testing with the requirement that constructions detected as failing the minimum requirement be brought up to the minimum standard.

(c) Intensive, perhaps 100%, testing of all new dwellings using a simplified test procedure, indicated failures to be tested/by the standard method and remedial action being required, where necessary, to reach the minimum standard.

It seems clear that more effective control would require more resources, particularly those devoted to field measurement but already resources are being devoted to sound insulation control, albeit with a success rate of less than 50%, and these could partially offset the resources required for much more effective control. Any proposals for an increase in resources is bound to be resisted in the present economic climate and the need for better sound insulation control must be considered against other demands on limited resources. But at least there would seem to be a good case for considering the needs for sound insulation especially since we can expect a dwelling now being built to be occupied for the next 100 years.

References

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