



QUIET PLEASE!

Have you ever been in a room full of people all talking at once and found that the sound level builds up and up until you have to shout to be heard? I noticed this at a Christmas gathering where most people naturally assumed that this was only the effect of too much wine. But could the effect be made worse by the design of the room? Looking around I could see that all the walls and ceiling were very reflective. If the surfaces were designed to absorb the sound rather than reflecting it straight back then it would be deadened and maybe the crowd wouldn't go into that vicious circle of raising voices more and more to be heard.

The acoustics of Christmas parties is not particularly important but imagine having to teach 30 less than cooperative youngsters if the sound levels start to rise. Poor acoustic design of schools can seriously affect the learning experience, not to mention the teacher's throat and stress levels. It has been shown that a little more care at the design stage can greatly improve the atmosphere in the classroom, even improving standards of behaviour. That is why the design of schools to Building Bulletin 93 (BB93) has been made mandatory under the Building Regulations. The amount of absorption in a classroom must now be designed to reduce the build-up of reverberant noise.

Reverberant noise is not the only thing covered in BB93. There is also the issue of the next room having a loud lesson when your class is doing quiet study. It can be very frustrating if a class ends up listening to next door instead of concentrating on its own work. Therefore each wall and floor must be designed to give a specified level of sound insulation. That may seem simple – just specify the standard for all walls and floors to achieve. However, the standard depends on the type of rooms and so a single criterion becomes a matrix of figures. If there is a high noise generating room (woodwork and metal work – or rather CDT Resistant materials) next to a quieter room (a study room) then the required sound insulation will be high, although if the same types of rooms are adjacent then the requirements will be less stringent. This is a valuable system as it results in thought being given to the adjacencies at the start of the design process.

There are specific sound insulation performance requirements for doorsets, glazing and ventilators between circulation spaces and classrooms to prevent the noise from pupils in

the corridors disturbing teaching. It should be noted, however, that requirements for ancillary spaces (offices, toilets, etc.) are advisory and not mandatory under the Building Regulations.

Where classrooms are on more than one floor there are standards for impact sound insulation of the floors. This is to control the sound of footfall so that it doesn't sound as if a herd of elephants is running around in the room above. Impact sound insulation should be designed into the floor rather than just provided by a soft covering except for some types of concrete floor where the soft covering is integral.

It is not only the noise from adjacent spaces that can be disturbing. Noise from outside can make it difficult to teach, especially if the school is near a busy road or railway or under a flight path. It is now mandatory for a noise survey to be carried out and the building envelope (glazing, ventilation, etc.) designed to accommodate for external noise levels. Again the target internal noise level depends on the type of room and if there is mechanical ventilation this must be designed to meet noise criteria. Even rain must be considered as a heavy downpour on, say, a profiled metal sheeting roof can be loud enough to disrupt teaching if the roof and ceiling are not correctly designed.

The level of complexity increases dramatically if open plan areas are proposed. Speech intelligibility must then be calculated using computer modelling, although even with specialist software it is difficult to produce a design which meets the criteria. As a result, BB93 effectively steers design away from open plan, but even simply introducing an interconnecting door between two classrooms can create difficulties as the required sound insulation can make the door too heavy to be safely opened by children. If this cannot be solved, the two rooms will be regarded as an open plan area, creating a frustrating Catch 22 for the designer. In such a case the school must decide to either omit the door altogether or make a case to the Building Control Body for an exemption based on educational need.

Acoustic design of music facilities in schools is often given insufficient thought. It is not unusual to find relatively new buildings where walls between rooms have not been adequately sealed to the soffit above the ceiling, or there is exposed steelwork readily transmitting sound from one room to another. Music teachers often become used to working with a Beethoven violin concerto mixed with a Mozart horn concerto from next door but of course this is not satisfactory for a modern teaching environment. Under BB93 these areas must be designed to a very high standard. For instance if two ensemble rooms are next to each other the source room noise level would be classified as 'very high' and the receiver room noise tolerance level would be classified as 'very low'. This gives the maximum criterion for the airborne sound insulation between the spaces. Achieving

the required standard requires careful design not only of the wall but also of the junctions and flanking elements.

In larger recital rooms and assembly halls, acoustic quality should be considered. Small changes to the geometry and the addition of acoustically absorbent treatments to some surfaces can substantially improve speech intelligibility and the clarity of music. A head teacher once took me into a room with exactly the wrong geometry which resulted in a very strange acoustic effect, making it virtually unusable. Acoustic quality is not as obvious a consideration as other matters and can often be forgotten until it is too late. As these rooms play such an important part in school life I cannot stress highly enough the importance of ensuring speech can easily be heard and school concerts are a pleasant experience. Late reflections from untreated surfaces can make speech jumbled and difficult to understand and fast music difficult to listen to. The acoustic requirements for speech and music are different and in large assembly rooms, where both are important, some compromise cannot be avoided. Features can be included to vary the room's acoustics with change of use but they are not often correctly used in a school environment. Therefore it is better to design to criteria part way between those normally recommended for speech and music. Following some simple rules in designing the room can help a lot, such as giving a slight angle to the walls to reduce flutter echoes and standing waves. It is certainly advisable to use computer modelling software in the design process to optimise the acoustic quality at the outset.

Classrooms for hearing-impaired students have special requirements such as lower background noise levels and reverberation., although it is worth noting that most hearing impaired children are taught in mainstream schools and the policy is now in favour of inclusion rather than separation. In addition, many children suffer temporary hearing impairment due to illness and children whose first language is not English will have intelligibility problems compounded if the acoustics are poor. Therefore, it is all the more important to ensure that all classrooms are designed to the correct standard rather than just certain special facilities. For classes which include hearing-impaired children specialist design may be required for radio aids or soundfield systems.

Compliance with BB93 must be demonstrated to the Building Control Body by submission of relevant design details and testing on completion is not mandatory but strongly recommended. With acoustics, the devil is in the detail and lots of workmanship issues which may seem insignificant on site can have a profound effect. Therefore inclusion of a testing requirement in the contract is the only way to ensure that the good intentions at the design stage are carried through to the final construction.

BB93 is only mandatory for schools, not nurseries or further education colleges or universities. However, I recommend sticking as closely as possible to its guidance when

designing any educational establishment. Some colleges which teach music and performing arts obviously need to pay particular attention to acoustic quality and sound transmission issues and recording studios installed in educational establishments require specialist design. It is now common for colleges and universities building new auditoria to commission acoustic modelling to optimise parameters such as speech intelligibility and music clarity.

The learning experience can be greatly enhanced by the right approach to the design of educational establishments. Although legislation is playing a big part, it is imperative that acoustics is integrated into the design process from the outset and that initial good intentions are not watered down by subsequent 'value engineering' exercises. A bit of extra thought will pay big benefits as good acoustic design in our schools will have a significantly positive impact on the quality of education received by our children and future generations.