BB93: PAST, PRESENT AND FUTURE

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1. INTRODUCTION

Over the last 10 years or so, schools have been a major source of work for UK Acousticians. The government's commitment to renewing and refurbishing, and later to remodeling, of schools has provided a constant workstream.

The forms of procurement for schools has ranged from individual build or refurbishment projects by Local Authorities, through the Private Finance Initiative (PFI), Public Private Partnerships (PPP) and Building Schools for the Future (BSF). The latter of these, BSF, is the largest school construction project ever. Over the lifetime of the scheme, around 3500 secondary (11-19 years) schools will be rebuilt or remodelled. The total estimated cost over the period of the scheme (2005 to 2025) is £45bn (50bn Euros).

In the UK there are a suite of Building Bulletins that have been published by the Department for Children, Schools and Families (DCSF). The primary Building Bulletin for Acoustic design is BB93[2], which came into force in 2003. Whilst Building Bulletins are not statutory instruments, they are commonly cited in building contracts and therefore have to be complied with. Also, a number of BBs are classed as means of compliance with Building Regulations; in the UK, Building Regulations are mandatory compliance documents for construction programmes. BB93 is a means of compliance with Part E of Building Regulations: in the absence of any other means of compliance, it is used almost exclusively as the standard that all schools are designed to.

Further and Higher Education institutions, whilst not bound by Part E of Building Regulations, often use BB93 as a good practice guide.

As can be seen, BB93 is a vitally important document. It is by this measure that thousands of schools, colleges and universities are designed and constructed to. It is therefore imperative that BB93 accurately reflects the correct acoustical values and provides all the tools necessary for Acousticians to design great buildings.

2. THE REASON FOR BB93

Immediately preceding BB93, the guide for designing acoustic aspects of schools was BB87. Acoustics played only a small part of this document and there was no mandatory requirement to use its advice. It was often considered during construction projects, but then either only complied with in part, or discounted altogether, as it was convenient and less costly than complying fully.

In 2003 there was a major change. The section on Acoustics was taken out of BB87 and BB93 was born. BB93 is referenced in Part E4 of Building Regulations, as being a means of compliance with these Regulations, as follows:

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"Each room or other space in a school building shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use"

The purpose of this shift was to ensure that acoustics were properly addressed in school design. By including schools within Building Regulations, this also invoked the scrutiny of a Building Control officer for each project. The same pattern was later followed when the Indoor Air Quality section of BB87 was removed and became BB101, a means of compliance with Part F of Building Regulations.

Section 8 of Approved Document E (2003) states:

"In the Secretary of State's view the normal way of satisfying Requirement E4 will be to meet the values for sound insulation, reverberation time and internal ambient noise which are given in Section 1 of Building Bulletin 93 'The Acoustic Design of Schools', produced by DfES...".

So, the sound insulation, reverberation time and internal noise levels are all covered by Building Regulations. However, the main omission is Speech Transmission Index (STI). Criteria are given for this measure in open plan teaching areas - however, this is excluded from being mentioned in Part E; this omission has been used as a means of avoiding compliance with this element of the Regulations, resulting in poor quality open plan teaching spaces.

Also in BB93 is Section 1.2.1, which reads as follows:

"In some circumstances alternative performance standards may be appropriate for specific areas within individual schools for particular educational, environmental or health and safety reasons. In these cases, the following information should be provided to the Building Control Body:
• a written report by a specialist acoustic consultant, clearly identifying (a) all areas of non-compliance with BB93 performance standards (b) the proposed alternative performance standards and (c) the technical basis upon which these alternative performance standards have been chosen
• written confirmation from the educational provider (eg school or Local Education Authority) of areas of noncompliance, together with the justification for the need and suitability of the alternative performance standards in each space."

This section, although well-meaning and intended to provide for innovation, has been often abused and misused. In theory it is possible to write a much less stringent set of performance criteria which a school is to comply with and, unless Building Control are particularly well informed or skilled in acoustics, can seem to be well meaning and valid; when put into practice, however, the resulting acoustic conditions can be far inferior to those set our elsewhere in BB93.

3. THE SPIRIT OF BB93

It is important to understand the thinking and process behind BB93 in order to understand how best to apply it and to appreciate why most elements can not readily be discounted or circumvented by means of an Alternative Performance Standard (APS).

As mentioned earlier, the predecessor to BB93 was largely ignored and opted away from. This resulted in many schools that were simply not fit for purpose as teaching and learning environments. If teachers have to put unnecessary strain on their voices then the environment is having an actively negative effect as a work place. If children can not learn because background noise levels are too high, spaces are too reverberant or they are unduly disturbed by other school activities, then it is simply not suitable as a learning tool.

Certain stakeholders are more vulnerable to poor acoustic environments than others. Children with Special Educational Needs (SEN) or hearing impairments are particularly disadvantaged when the acoustic conditions are not suitable, less able to compensate for the shortfalls of the environment than other, more able children.

BB93 was written at the time when there was a distinct move away from segregating SEN or the hearing impaired children out of mainstream schools. An important factor in the criteria put forward and the way the document was put together was to allow for Inclusion (i.e. schools being used by all user groups, including SEN and hearing impaired); for this reason, performance criteria are more stringent than in the previous BB87.

It is also important to note that BB93 was written around the teaching practices and styles current at the time. Open plan teaching was fashionable in the 1960s and 1970s but was not largely adopted in 2003; design provision for open plan teaching was therefore nominal as it was seen as an acoustically inferior solution. BB93 requires open plan teaching areas to be computer modelled (by ray tracing) in order to demonstrate that reverberation time ($\leq$ 0.8s in mid frequencies) and STI criteria ($\geq$ 0.6) can be achieved. However, it was expected that these values would not be able to be achieved in practice for most of the time and that it would therefore discourage people from opting for open plan.

Educational Advisors and other decision makers were not put off by the failure of spaces to meet these criteria. Indeed, the major push under the BSF programme is for Flexible Learning; this agenda requires teaching and learning spaces to offer maximum flexibility for current and future provisions, invariably involving minimal partitions to divide adjacent spaces and encouraging individual learning by project working. There are therefore many schools and Academies that are similar to large, open plan offices, even open to multi-story atria. It is no surprise that there are well documented cases of schools that are so acoustically challenging that

activity noise levels approach Noise at Work limits where teachers should really be wearing hearing protection!

4. THE IMPACT OF BB93

Not surprisingly, the shift from the largely-unused BB87 to a mandatory requirement for acoustic design under Building Regulations caused a stir. There were obvious cost implications on school projects that were not immediately catered for in the amount of funding provided for each school. Where would the additional money come from to pay for BB93 compliance? Estimates when BB93 were first published were that a school designed under this document would have a 1.7% increase in nett building cost over an equivalent designed under BB87.

When BB101 was published, some 2 years after BB93, further criticism was made to the effect that the documents were mutually exclusive and could not be effectively used together. It is the opinion of the author that these claims are unfounded and it is more the case that school designs needed to adapt to the new regulations rather than stay as they always had been and not comply. Many manufacturers of glazing and ventilation systems have risen to the challenge and created systems that can meet the internal ambient noise levels internally, even with high external noise levels, whilst providing air flow rates set out in BB101.

A cost estimate of the increased cost of compliance with BB101 over the previous BB87 was an extra £20 per m^2. Again, the lag in funding to cater for this increase made compliance difficult to justify and achieve. However, when the correct balance has been struck and compliance with BB93 and BB101 have been achieved, the results have been very successful.

At the time of writing, a set of case studies is being completed. The studies have involved carrying out objective measures of ambient noise levels, reverberation times, sound insulation and speech intelligibility within completed and operational schools, together with subjective questionnaires for teachers and pupils. The results of these studies are to be published by Partnership for Schools (PfS) later on in 2010 and will demonstrate the extent of correlation between good acoustic performance and subjective response from the end users. Post Occupancy Evaluation such as this is invaluable in the ongoing review process of BB93 and will help inform any future changes.

5. THE CURRENT NEED

As mentioned above, BB93 was written to cater for the design trends current in 2002/2003. Most teaching and learning areas were cellular, of around 56 m^2. In 2010 the prevailing style of teaching and learning environment focuses around open plan in order to facilitate flexible learning.

In the period since 2003, there have been a number of developments that are not covered fully by BB93, including rain noise, ventilation (co-ordination with BB101) and a clearly defined provision for children with SEN and hearing impairment (apart from the inherent Inclusion).

A lot can happen in both education and acoustics in 7 years. It is becoming increasingly difficult to adequately design modern school buildings using BB93, without having to resort to APS. Open plan spaces, especially, are increasingly complex and more guidance is required. There has been a lot of research carried out in recent years that can be very useful[3], but is not all in strict accordance with BB93. Also, a number of successful open plan spaces have been designed in the intervening period, from which lessons can be learnt.

There are very strong links between the acoustics of open plan teaching and learning spaces and open plan offices[4]. There is a whole host of research on this topic that can be used to inform modern school designs.

There is therefore a pressing need to either supplement existing BB93 guidance or revise the document to be more applicable to the needs of designers and end users in the current climate.

6. 2009 DRAFT REVISION

In the Autumn of 2008 the BB93 Review Panel was reconvened after 5 years. The reason was to pull together a minor revision to BB93 in order to address some of the concerns above.

By March 2009, after an industry call for feedback on BB93 and a joint Institute of Acoustics (IOA)/Association of Noise Consultants (ANC) forum day, a draft revision document was presented to the Department for Communities and Local Government (DCLG) and the DCSF. The intention was for this minor revision to be published in mid-2009, to act as a supplement to the existing BB93 document.

However, the planned revision never took place. The reason for this appeared to be twofold: firstly, some had concerns that the revisions, however minor, would cause contractual problems with existing school projects, and that a full 3-month industry consultation should take place; secondly, there was concern by some groups representing SEN and hearing impaired children that the amendments were not far-reaching enough. Consequently, the document is still in its original, 2003 format.

In October 2009, a Ministerial announcement was made[5], signalling that the issue had not been forgotten. This announcement stated the following:

- Building Contractors must commit to carrying out acoustic testing of all schools under the BSF process
- Continued funding under a BSF contract will be conditional upon schools meeting BB93 (including agreed APS) design targets
- DCSF would publish a design practice note on acoustics, strongly recommending testing is carried out pre completion

[3] "Acoustics of Open Plan Classrooms in Primary Schools", PhD Thesis, London South Bank University, E Greenland, 2009
[4] "Lessons to be learnt from open plan offices and classrooms", Proceedings of Euronoise 2009, A Parkin, 2009
[5] http://www.publications.parliament.uk/pa/cm200809/cmhansrd/cm091016/wmstext/91016m0001.htm

- DCSF would write to all Building Control bodies[6], reminding them of the importance of acoustics in schools
- DCSF would ask Building Control bodies to only accept APS when a 'full and proper case' has been made
- DCSF would appoint a series of case studies that would help inform how BB93 has been used in practice
- DCSF would give increased attention to the acoustic performance of 'innovative learning spaces'
- DCSF will go out to public consultation in 2010 on an updated version of BB93
- DCSF and DCLG will investigate whether mandatory pre-completion testing (under Building Regulations) is practicable and, if so, to look at tying this in with the scheduled revision of Document E in 2013

7. THE POSSIBLE FUTURE OF BB93

DCSF have committed to putting a revision to BB93 out in 2010. It remains to be seen how little or much of the 2009 minor revision is included. What does appear to be the case is that the revision will be more exhaustive than was originally intended. The benefit of this is that more of the issues will be ironed out, but the downside is that it will take longer for the revised document to make it into circulation. By the time any revised document is published (potentially mid-2011), several hundred schools will have been designed to the 2003 version of BB93 that could otherwise have benefitted from the minor revision had it been published in mid-2009.

From working on the draft 2009 revision, subsequent discussions with PfS/DCSF and a wealth of experience working with BB93 on a day-to-day basis, the author considers that the following will be included in the revised document, BB93 (2011? edition):

- Clarification as to what performance targets are to be used for SEN areas
- Specific performance targets for SEN areas (possibly existing 'hearing impaired' criteria)
- Expanded Tables 1.1, 1.4 and 1.5 of room types to include omissions such as ICT teaching and recent additions
- Addition to Table 1.1 of ambient noise levels under natural ventilation (i.e. including +5 dB allowance stated in BB101)
- Updated Table 1.3 to give optional composite R_w targets for walls dividing rooms and corridors
- Clarification of whether stair cores require acoustic absorption when they do not lead directly on to teaching areas
- Expanded Table 1.5 to include increased frequency range for reverberation time to cater specifically for the hearing impaired
- Expanded Table 1.6 to include maximum STI values between adjacent teaching clusters (≤ 0.2)
- Expanded guidance in Section 1.1.7 to give physical guidance on how to comply with STI targets in Table 1.6, e.g. internal finishes, use of FF&E etc.
- Replacement of $D_{nT(Tmf,max),w}$ with D_w
- Replacement of $L'_{nT(Tmf,max),w}$ with L'_w
- Expanded guidance under Section 1.2.1 for Alternative Performance Standards

[6] DCSF published a letter to all Building Control bodies on 7th April 2010

- Strong recommendation for pre-completion testing of internal noise levels, reverberation time and sound insulation. However, it is likely that testing of STI will not be included, but will be 'deemed to satisfy' based on computer modeling at design stage
- Cross-referencing with BREEAM (Building Research Establishment Environmental Assessment Method) to ensure greater cohesion between the documents
- Strong recommendation to employ the services of an Acoustician from the earliest stages of a project
- Expansion and clarification of rain noise criteria, to tie in with BS EN ISO 140-18, with automatic approval for 'heavy' roofing systems such as sedum or concrete
- Increased guidance on the limitations of using operable/moveable partitions
- Expanded notes on ventilation, with cross references to BB101 and encouragement to utilize 'natural' ventilation wherever possible
- Enhanced worked examples showing how BB93 can successfully be used in the design of a school
- Case studies of schools where BB93 has successfully been applied
- Cross referencing with updated DCSF guidance on music teaching areas

The exact content and extent of any revision is not known at the time of writing. However, DCSF have committed to a revision to BB93 and must now see this through. Whatever happens, a revised document needs to be able to fully equip Acousticians to effectively design schools to meet the ever-changing trends in educational design. Such a document is sorely needed.