

Acoustic conditions within schools have been recognised as an important factor influencing the ability to learn. The acoustics of schools is now subject to regulatory enforcement through Part E of The Building Regulations. The Regulations refer to Building Bulletin 93 as the appropriate guidance to follow for the provision of a good acoustic environment within a school and thereby demonstrate regulatory compliance.

BB93 – Acoustics in schools

Sound Insulation between spaces

Section 8 of 2003 ADE states:

"8.1 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 and published by the Stationery Office (ISBN: 0 11 271105 7)."

H+H Celcon's aircrete products can be used throughout the construction of a school. The range of products can be used to construct external walls and internal walls enabling the requirements of BB93 to be met as part of a carefully designed overall solution.

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Acknowledgement

Acknowledgement is given to the contribution of Acoustical Investigation & Research Organisation Ltd (AIRO) in the preparation of this guide.

TABLE 1.1 Type of room	Room classification for the purpose of airborne sound insulation in Table 1.2	
	Activity Noise (source room)	Noise Tolerance (receiving room)
Nursery school playrooms	High	Low
Nursery school quiet rooms	Low	High
Primary school: classrooms, class bases, general teaching areas, small group rooms	Average	Low
Secondary school: classrooms, general teaching areas, seminar rooms, tutorial rooms, language laboratories	Average	Low
Open plan teaching areas	Average	Medium
Resource areas	Average	Medium
Music		
Music classroom	Very high	Low
Small practice/group room	Very high	Low
Ensemble room	Very high	Very low
Performance/recital room	Very high	Very low
Recording studio	Very High	Very low
Control room for recording	High	Low
Lecture rooms		
Small (fewer than 50 people)	Average	Low
Large (more than 50 people)	Average	Very low
Classrooms designed specifically for use by hearing impaired students (including speech therapy rooms)	Average	Very low
Study room (individual study, withdrawal, remedial work, teacher preparation)	Low	Low
Libraries		
Quiet study areas	Low	Low
Resource areas	Average	Medium
Science laboratories	Average	Medium
Drama studios	High	Very low
Design and Technology		
• Resistant materials, CAD/CAM areas	High	High
• Electronics/control, textiles, food, graphics, design/resource areas	Average	Medium
Art rooms	Average	Medium
Assembly halls, multi-purpose halls (drama, PE, audio/visual presentations, assembly, occasional music)	High	Low
Audio-visual, video conference rooms	Average	Low
Atria, circulation spaces used by students	Average	Medium
Indoor sports hall	High	Medium
Dance studio	High	Medium
Gymnasium	High	Medium
Swimming pool	High	High
Interviewing/counselling rooms, medical rooms	Low	Low
Ancillary spaces		
Kitchens	High	High
Offices, staff rooms	Average	Medium
Corridors, stairwells	Average-high	High
Coats and changing areas	High	High
Toilets	Average	High

BB93 Performance Standards

BB93 sets out standards for the airborne sound insulation between spaces according to how the spaces are used. The highest standards of sound insulation are necessary where a room with a low noise tolerance (for example, a classroom) is situated next to a noisy space. The overall objective is to ensure that clear communication is possible by reducing noise ingress to an insignificant level. Table 1.1 in BB93 classifies rooms for the purpose of determining the airborne sound insulation requirements and the relevant parts of the table are reproduced on this page.

Table 1.2 in BB93 sets out the minimum airborne sound insulation between spaces according to the nature of usage in the adjoining rooms. Using the room classifications listed, the appropriate airborne sound insulation standard for the wall or floor is established by reference to Table 1.2 in BB93 reproduced on this page.

As well as room to room airborne sound insulation, a minimum performance standard for walls which separate circulation spaces and other spaces (for example, corridor walls) is given. The minimum performance standard in BB93 for these walls is a Weighted Sound Reduction Index, R_w , of 40 dB.

TABLE 1.2 Minimum $D_{nT}(T_{mf}, \max)_w$ (dB)					
Noise tolerance in receiving room (see Table 1.1)		Low	Average	High	Very High
	High	30	35	45	55
	Medium	35	40	50	55
	Low	40	45	55	55
	Very Low	45	50	55	60

Table 1.1

Table 1.2: Performance standards for airborne sound insulation between spaces – minimum weighted BB93 standardised level difference, $D_{nT}(T_{mf}, \max)_w$

Complying with BB93 with H+H Celcon Products

H+H Celcon's aircrete products have excellent sound insulation qualities, allowing a range of construction solutions to be provided across the performance requirements between spaces set out in BB93.

Solutions are given in the following sections ranging from constructions that provide adequate sound insulation between general areas to higher performance solutions required for specialist locations.

To achieve the same level of clear communication between teacher and students, higher sound insulation is required for spaces with longer reverberation times compared with spaces with shorter reverberation times.

In all cases the range of mid-frequency reverberation time performance standards in BB93 has been taken into account in the solutions presented.

The solutions presume that flanking transmission via other paths will be adequately controlled. An external wall with an inner leaf of 100 mm H+H Celcon aircrete blockwork with a plaster or plasterboard on dabs finish should provide adequate control of noise transmission along this flanking path in relation to the separating wall solutions presented.

All of the solutions presented achieve the minimum requirement of a Weighted Sound Reduction Index of 40 dB for corridor walls or similar walls separating circulation spaces from other spaces.

Substantiation

Empirical conversions have been made where necessary of sound insulation data in units of either Weighted Sound Reduction Index or Weighted Standardised Level Difference for comparison against BB93 requirements. The approximations that have been used are:

$$D_{nT}(T_{mf,max}),w = D_{nT,w} - 6 \text{ dB}$$

$$D_{nT}(T_{mf,max}),w = R_w - 9 \text{ dB}$$

In practice the sound insulation achieved will depend on the area of the separating element, the ratio of the element area with the room volume and the actual reverberation time. The solutions identified should be suitable for the vast majority of situations but in extreme cases, for example, a very large separating wall area for a relatively small room volume, further advice may be necessary.



Celcon Solution	Technical Report
A-1	AIRO L/1763/A
A-2	AIRO L/1763/A
B-1	AIRO L/1807/A
B-2	AIRO L/1807/A
C-1	AIRO L/1807/A
D-1	Agreement Certificate No 01/3186
D-2	Agreement Certificate No 01/3186
D-3	Agreement Certificate No 01/3186
E-1	Robust Details

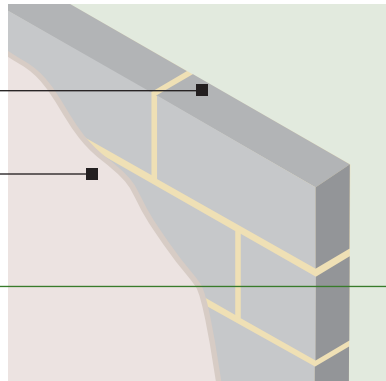
Quick Reference Solutions to BB93

$D_nT(T_{mf,max})_w$ of 30 dB

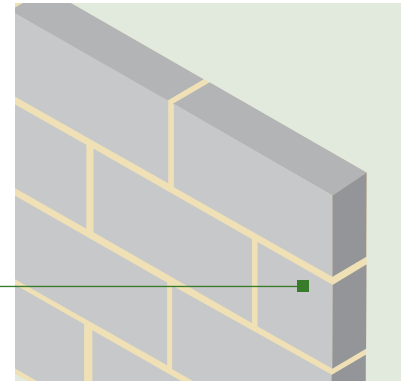
100mm H+H Celcon Standard blockwork with thin layer or conventional mortar

13mm plaster finish (both sides)

100mm H+H Celcon Hi-Strength blockwork with thin layer or conventional mortar, unfinished (both sides)



Wall Solution A-1



Wall Solution A-2

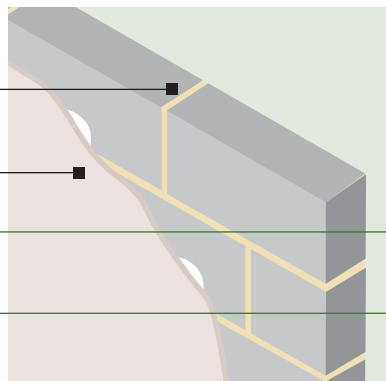
$D_nT(T_{mf,max})_w$ of 35 dB

115mm H+H Celcon Standard blockwork with thin layer or conventional mortar

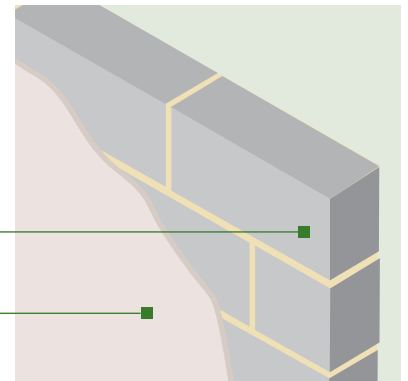
12.5mm plasterboard on dabs (both sides)

150mm H+H Celcon Standard blockwork with thin layer or conventional mortar

13mm plaster finish (both sides)



Wall Solution B-1

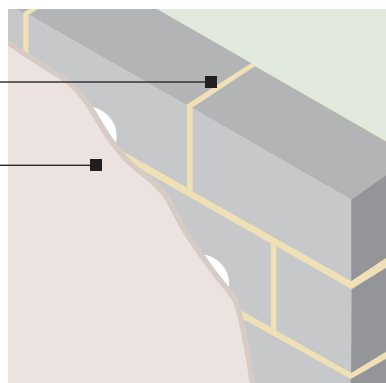


Wall Solution B-2

$D_nT(T_{mf,max})_w$ of 40 dB

215mm H+H Celcon Standard blockwork with thin layer or conventional mortar

12.5mm plasterboard on dabs (both sides)



Wall Solution C-1

$D_nT(T_{mf,max})_w$ of 45 dB

100mm H+H Celcon Standard blockwork with thin layer or conventional mortar

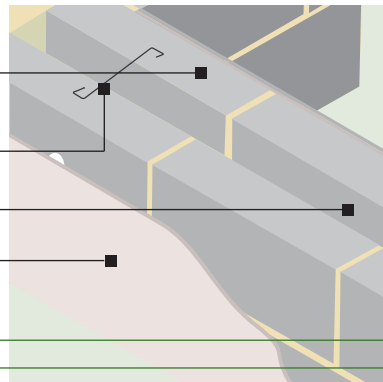
Type A wall ties

75mm clear cavity

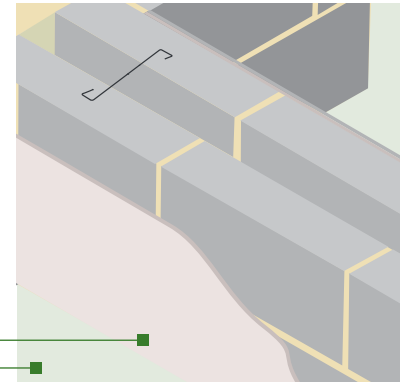
12.5mm plasterboard on dabs (each room face)

13mm plaster finish (each room face)

Blockwork, cavity and wall ties as D-1



Wall Solution D-1

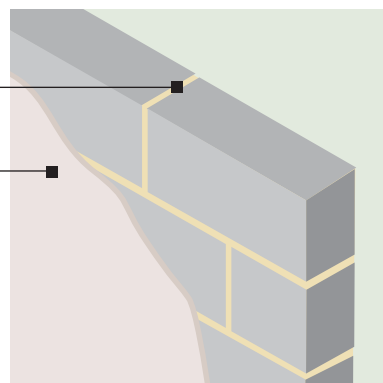


Wall Solution D-2

$D_nT(T_{mf,max})_w$ of 45 dB

215mm H+H Celcon Hi-Strength blockwork with thin layer or conventional mortar

13mm plaster finish (both sides)



Wall Solution D-3

$D_nT(T_{mf,max})_w$ of 50 dB

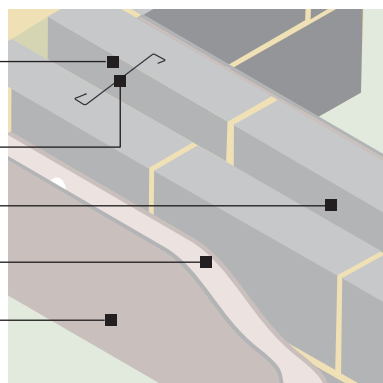
100mm H+H Celcon Standard blockwork with thin layer or conventional mortar

Type A wall ties

75mm clear cavity

8mm Sand/cement render (each room face)

12.5mm plasterboard on dabs (each room face)



Wall Solution E-1