

Improving speech clarity in classrooms

Why is speech clarity so important?
 Being able to hear clearly what is said is essential if pupils are to achieve their learning potential. Sounds obvious doesn't it? The fact is, however, that most school classrooms have not been designed with **speech clarity** in mind. In a typical classroom, with the teacher at one end, sound reaches the pupils both directly from the teacher and via sound **reflection**. The reflected sound masks the direct sound, in this instance the teacher's voice, making it difficult for pupils at the back and sides of the classroom to hear what is said.

A two-year survey of over 2,000 children aged 7–10 years in London schools looked at the effect of different types of noise on the results obtained in Standard Assessment Tests (SATs). The **survey** found that excessive noise levels were associated with lower SATs results. Language-based tasks were particularly affected by background 'babble'. Children with special educational needs suffered the most. The research team stressed that appropriate acoustic design reduces noise levels in schools, and should be given a high priority when schools are being built or refurbished. A further piece of **research** in the United States found that good acoustic design in schools can give significant cost savings. Whilst there is an initial on-cost in making the necessary acoustic provision, this cost is significantly outweighed by the pay-back in terms of improved learning and reduced teacher 'lost time' due to stress and vocal fatigue.

The research

Failure to control the level of reflected sound in a school classroom will result in pupils being exposed to excessive sound levels. Because they are not able to understand distinctly what the teacher is saying they will tend to 'switch off' – in effect short changing their educational opportunities and creating stress for teaching staff.

SURVEY:
SOUTH BANK UNIVERSITY/
LONDON UNIVERSITY
INSTITUTE OF EDUCATION

RESEARCH:
GOOD CLASSROOM ACOUSTICS IS A GOOD INVESTMENT—
DAVID LUBMAN AND LOUIS C SUTHERLAND

SOMETIMES REFERRED TO AS SPEECH INTELLIGIBILITY

HARD CEILING, WALL AND FLOOR SURFACES WILL REFLECT SOUND

AN INSTALLATION OF GYPTONE QUATTRO 20 AT PIPER'S VALE COMMUNITY PRIMARY SCHOOL, IPSWICH



Project File

Casoprano tiles

St. Joseph's School, Pontefract
 Bebington School, Liverpool
 Wirral Grammar School, Wirral
 John Smeaton High School, Leeds
 Bentham Park High, Leeds
 Burton Green Primary School, York
 Whitcliffe School, Cleckheaton
 Weston County School, Crewe
 Parkwood School, Sheffield
 Sandhill School, Sunderland

Gyptone boards/tiles

Piper's Vale School, Ipswich
 Thorne Green Top, Doncaster
 Edlington Hill Top, Doncaster

Leiston School, Leiston
 Windhill Primary School, Rotherham
 York University
 Lincoln University

Rigitone boards

Girls High School, Leeds
 Kirkstead Junior School, Pinxton
 Mary Swannick Community School, Chesterfield
 Girls High School, Nottingham

AN INSTALLATION OF GYPTONE PLANK, QUATTRO 55 AND BASE 33 AT PIPER'S VALE COMMUNITY PRIMARY SCHOOL, IPSWICH



ARTECO

CEILING PRODUCTS

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For a comprehensive and up-to-date library of information visit the British Gypsum website at: www.british-gypsum.com

Technical enquiries

British Gypsum Limited
 Drywall Academy Technical Advice Centre
 East Leake
 Loughborough
 Leicestershire
 LE12 6JT

Telephone: 08705 456123

Fax: 08705 456356

E-mail: bgtechnical.enquiries@bpb.com

Training enquiries: 08702 406040



REVERBERATION IS MEASURED IN SECONDS AND INDICATES HOW ACOUSTICALLY 'DEAD' OR 'LIVE' A SPACE IS. A SCHOOL OFFICE WITH CARPETS AND SOFT FURNISHING WILL BE 'DEAD', I.E. NOT REVERBERANT, WHEREAS A SPORTS HALL WITH HARD SURFACES WILL BE 'LIVE', I.E. REVERBERANT

Why is it so important to control reflected sound?

Failure to control reflected sound will result in too much reverberation. The following waveforms of typical speech show the progressive reduction in clarity due to reverberation. The blocks of blue indicate distinct syllables and the sharp spikes are the consonants where the speech information is contained. Diagram A shows the phrase "Building solutions for active spaces" being spoken in a room with negligible reverberation; diagrams B to D show a stepwise increase in reverberation time from 0.8 to 2 seconds. The reverberant 'noise' in grey is masking the consonants making speech interpretation progressively more difficult.

What is the ideal reverberation time?

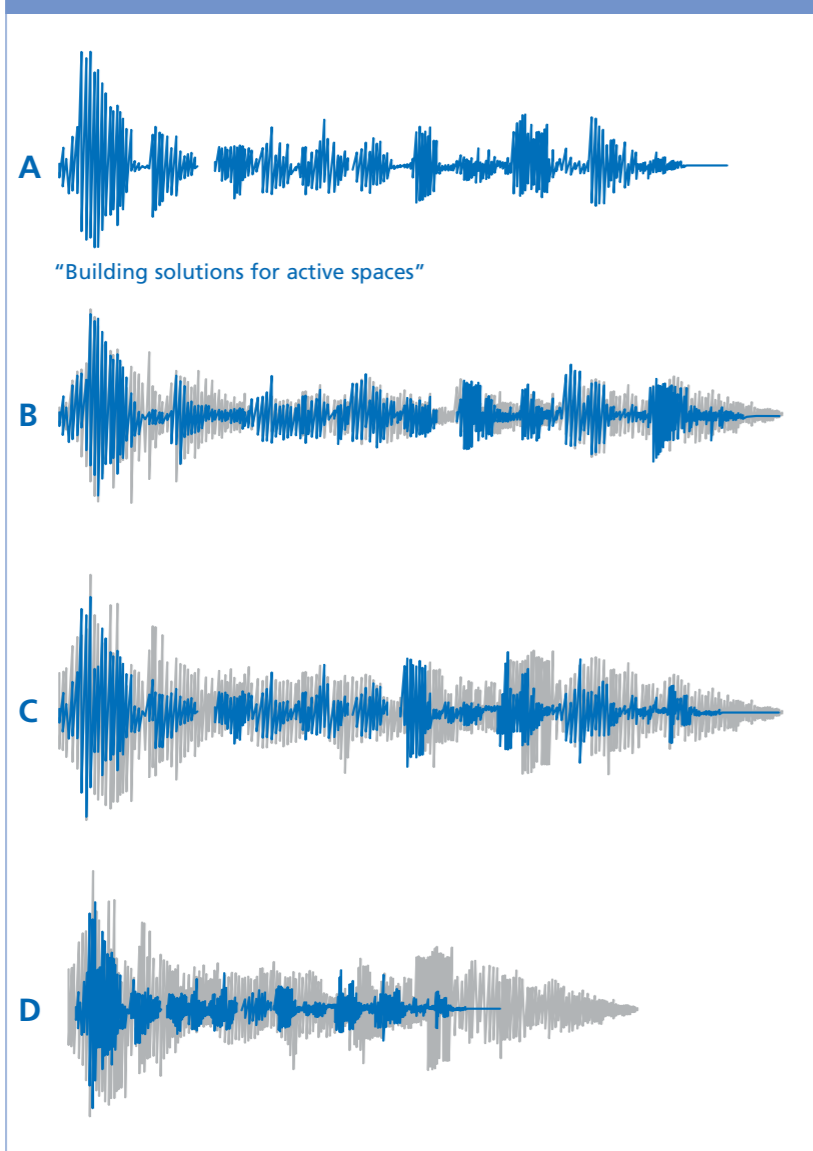
The level of reverberation that is desirable will vary depending on the room size and

range of activities carried out. In classrooms for example, a low level of reverberation is desirable whereas in corridors and general circulation spaces a higher level can be tolerated. Generally, recommended reverberation times range from 0.4 – 2 seconds.

How can speech clarity be achieved in practice?

After extensive objective speech clarity testing, a patented computer program has been developed to aid the specifier in the selection of ceiling tiles and wall linings required to provide the right acoustic environment. The program requires the following details to be entered; size and shape of the room, what materials are being used for the floor and walls, the size and shape of the windows and doors, together with the location of the teacher and pupils.

Fig. 1 Reduction in speech clarity due to reverberation



The program works out the type and location of ceiling and wall materials required to meet the recommended reverberation times, and to provide the best speech clarity.

Sound absorbing British Gypsum Artec Casoprano VOICE or NOVA ceiling tiles are combined with sound reflecting Casoprano FORTE or ALTO tiles to provide a ceiling layout that achieves optimum speech clarity. Casoprano FORTE or ALTO assist with projecting the teacher's voice, whilst Casoprano VOICE or NOVA control the overall reverberation time within the room. Artec Gyptone boards are included as a partial wall lining to further enhance the acoustic environment by reducing noise reflections off the back wall.

A further benefit of Casoprano VOICE or NOVA ceiling tiles is their ability to control low frequency reverberation. Bass sounds mask high pitched sounds. Strong bass sound reverberation, therefore, not only affects the clarity of the bass sounds, but also the clarity of the high pitched sounds.

The sound spectrum for speech is within the frequency range 250Hz – 4,000Hz. Low frequency (250Hz – 500Hz) must not exceed the reverberation time obtained at higher frequency ranges. Lining materials should therefore be selected which have good absorption levels at these low frequencies. Casoprano sound absorbing VOICE or NOVA ceiling tiles have a flat absorption curve.

-The superior sound absorbing performance of VOICE or NOVA tiles at low frequency, especially when compared with mineral fibre tiles, results in improved speech clarity.

Our pioneering approach

There are two elements to the British Gypsum solution – purpose-designed acoustic ceiling tiles and lining boards, which allow the acoustics of a room to be controlled, and a unique computer program that predicts the type and location of tiles and boards for optimum speech clarity in a room.

Our approach has two big benefits. Firstly, for upgrading a tiled suspended ceiling (an everyday construction in educational buildings), tiles can be readily substituted without changes to detailing or installation techniques, making the solution highly affordable in the context of ever tighter budgets.

Secondly, Artec Casoprano ceiling tiles have been developed to provide either sound absorption or sound reflection, but they are identical in appearance. It is therefore possible to retain a uniform ceiling appearance whilst at the same time achieving good speech clarity.

To find out more

Comprehensive information on specifying acoustic solutions in schools and other educational buildings is given in the British Gypsum **SchoolSpec** publication. Alternatively, contact the British Gypsum Drywall Academy Advice Centre.

Fig. 2 Sound absorption performance of Casoprano tiles and mineral fibre tiles

