

London Diocesan Advisory Committee



THE ACOUSTICS OF YOUR CHURCH

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1. WHY DO THEY MATTER?

(a) Sound affects worship in many ways yet, because acoustics are unseen, many people regard the subject as rather mysterious and uncertain. Too often, decisions made on visual grounds have

unanticipated acoustic consequences that vitally affect the way in which a congregation experiences worship

2. OBJECTIVES

- (a) In an ideal building:
 - (i) Speech from the front of the church should be as clear as possible and of adequate loudness in all parts of the building.
 - (ii) The singing of both congregation and choir (if there is one) should be encouraged by the acoustic environment.
 - (iii) In an age when congregations will be familiar with recordings of music performed to the highest standards, it should be possible to perform choral and instrumental music in the context of worship without distorting the intentions of the composer.
 - (iv) External sounds such as traffic noise should not disturb quiet contemplation and prayer.

3. BASIC PRINCIPLES

(a) A sound made in the open air will appear to diminish rapidly with the distance of the listener and to stop as soon as the source of sound ceases. In an enclosed space, however, the sound will be reflected many times between the walls, ceiling and floor of the space, giving it increased carrying power. The reflected sound will however arrive later than the direct sound. The effect of sound dying away gradually is known as 'reverberation' and is measured by the time in seconds for a loud impact to die away to virtual inaudibility.

(b) Speech becomes less intelligible if, in a very large church, the number of reflections is too great and the reverberation time too long. Sometimes reflections from distant surfaces cause distinct echoes which have an adverse effect on clarity. However, too little reinforcement from reflections is a more common problem and will lead to a reduction in the volume of sound heard by the congregation and a perceived 'dryness' of sound which is discouraging for singing.

4. ABSORBENTS

(a) Every surface absorbs sound. Some surfaces absorb very little. For example, a polished tile floor reflects 99% of the sound striking it, being more an efficient reflector of sound than a mirror is of light. Porous materials absorb sound; curtains absorb up to 50% of the higher-pitched sounds striking them and carpet absorbs up to 75%. Because people

themselves absorb sound, acoustic conditions in the building will vary with the numbers present. Scientific bodies have published tables of absorbencies for many different materials.

5. REFLECTIVE SURFACES

(a) Reflective surfaces close to the source of sound help to boost the power of that sound; absorbent surfaces at the rear of a church help to avoid confusing echoes. The converse arrangement, with absorbent surfaces close to the source of sound and reflective surfaces further away, leads to an under-powered and confused-sounding result. Although these principles have long been known - they lie behind the provision of testers over pulpits - there are many churches whose acoustics are spoiled by poor positioning of reflectors and absorbents.

6. UNWANTED SOUND

(a) The transmission of unwanted sound occurs both through air passages and through thin panels. Sound will both go round an ill-fitting door and also through it if lightly constructed. Sound-absorbent materials in lobbies can help. Unwanted sound will always look for the weakest link; there is no point in expensive precautions elsewhere if doors fit badly or windows are left open. It is more difficult to stop low-pitched sound than high-pitched sound. This is a particular problem with the low rumble of buses and heavy lorries.

7. TYPICAL ISSUES:

7.1. Speech from the front of the church is too soft at the back of the building.

(a) It is assumed that the speaker is speaking clearly and not just mumbling. Are there curtains behind the speaker, or carpet in front? Both will absorb sound. Raised pulpits and testers were designed to help project the spoken word. Removal of absorbents and addition of speech reinforcement systems will both help to overcome this problem. However, beware of excessive reliance on speech reinforcement. Because the placement of loudspeakers is always a compromise between cost, appearance and acoustic effect, speech coming only from loudspeakers often sounds unnatural.

7.2. Speech heard at the back of the church is confused by excessive 'echo' or reverberation.

(a) The first rule is not to speak too fast! Clarity can be enhanced by providing some acoustic absorption on the back wall of the church - banners perhaps. However, do not introduce absorbent surfaces at the *front* of the church; this will only make matters worse. The intelligent use of speech reinforcement will also help. Tall 'line source' loudspeakers are better in such circumstances than short fat ones.

7.3. The choir seem dispirited and cannot be heard at the back of the church.

(a) Amateur singers are easily discouraged by difficult acoustics. Are the choir members placed so that they can hear each other? Are they singing in reverberant surroundings? A chancel-based choir surrounded by carpet will find the conditions discouraging. We all like singing in bathroom acoustics. The remedy is to remove the carpet near the choir. A carpeted podium between choir and congregation will also reduce the volume of sound heard by the congregation.

7.4. The congregation doesn't sing like they do on 'Songs of Praise'.

(a) The same considerations apply as for choirs. People don't like singing if they cannot hear themselves. This problem often arises where pews have been replaced by chairs and the nave floor covered in carpet. Even an aisle carpet can be bad. A cork floor can be a compromise that does not emphasise children's footfalls. If we ignore this issue, mission will be impacted because congregational participation will be reduced.

7.5. The sound of the organ or piano is very soft and dull.

(a) This commonly happens if alterations have reduced the reverberation in the building. There are long-established guidelines for the 'reverberation time' depending on the size of the church. Too little reverberation not only reduces the volume of instruments but also makes the music sound very different to the composer's intentions. This particularly applies to choral music. The remedy is to remove carpets or soft materials, particularly where placed close to instruments.

7.6. We mainly use amplified percussion-based music rather than traditional instruments. What difference does this make?

(a) Rock-style music was originally written for open-air 'gigs', without reverberation. Amplification makes up for the lack of sound reinforcement by reflections, although relatively large and unsightly loudspeakers are required. The problem with reducing the reverberation of the church to match music of this type is that it then becomes unsuitable for all other types of music. All speech will need amplification. Individual singers can be assisted by artificial reverberation and 'foldback' loudspeakers but congregational singing cannot be helped in this way. Hard choices have to be made - there is no easy way out.

7.7. One member of the congregation thinks that in our church a colourful carpet will make no practical difference to the acoustics.

(a) Every church is different but no-one can opt out of the physical rules of God's universe. The principles of architectural acoustics were discovered in the USA about a century ago, although only applied consistently in more recent times. They are now well proven in the design of opera houses and concert halls.

8. FURTHER READING

Council for the Care of Churches, 1993, *Churchscape*, CCC

N.B. The article *No Carpet Baggers Please* gives the methodology for calculating the effect of additional absorption on church acoustics..

Taylor, C, *Sounds of Music*, BBC Publications.

N.B. Chapter five gives an excellent introduction to architectural acoustics

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