

### AUDITORIA

#### *WHY DO WE NEED TO CONTROL NOISE IN AUDITORIA?*

Auditoria can be used for a variety of activities: theatre, concerts, opera, cinema, conference rooms, examinations, meetings, banquets, dances, etc.

When they are used for a theatre production, the actors on the stage must be able to be heard by the audience. However, during a dinner the groups of people seated round the room must be able to talk at the same time without having to shout and without disturbing neighbouring groups. Cinemas require reverberation times of less than 1 second whereas concert halls require between 1.5 and 2.5 seconds.

**Each activity has its own very specific and different acoustic requirements.**

The total flexibility of such premises is not generally compatible with providing good acoustics. The acoustic treatment of auditoria can be described as a compromise between the different requirements. In general the acoustics need to be designed to suit the most important acoustic function of the building.

Furthermore local planning requirements and other legislation often limit the amount of sound escaping from buildings in order to protect people living nearby. This means that if a noise-tolerant site is not available extensive noise precautions may be required, especially as many of the activities in auditoria are by their very nature noisy.

**Acoustic comfort must be taken into account at the design stage of a building.**

**INTERNAL CORRECTION**

This concerns the internal comfort of the auditorium. There are no regulations concerning this type of building and each activity will have a different optimum requirement. The Department for Education recommends a reverberation time at 500 Hz of between 0.8 and 1.7 seconds in halls used for music, drama, PE, AVA and assembly.

The optimum (not the maximum) reverberation time depends on the volume and on the use of the hall.

The French Department of Youth and Sport has published guidelines in relation to  $T_m$ , the mid-frequency reverberation time:

For low frequencies optimum reverberation time  $T_L = 1.2$  to  $1.3 \times T_m$

For high frequencies optimum reverberation time  $T_H = 0.9 \times T_m$

The table below shows  $T_m$  values (in seconds) in relation to auditoria volume:

Volume m <sup>3</sup>	500	1000	2000	4000	8000	10000
Empty auditoria	1.00	1.15	1.30	1.35	1.50	2.00
Occupied auditoria	0.85	0.95	1.05	1.10	1.20	1.30

**INSULATION WITH RESPECT TO THE EXTERNAL ENVIRONMENT**

This concerns the transmission of noise from the inside to the outside of the building and vice versa.

Current legislation ensures the protection of people living next to industrial and other noise producing establishments. The permitted noise levels from any building, particularly close to residential areas, are usually defined by the local planning authority.

Outdoor noise entering auditoria must be controlled especially on sites where intrusive noise from road, rail or underground traffic is likely. Recommended maximum peak levels of intrusive noise are:

- (a) concert halls, opera houses, large theatres and auditoria: 20 dB(A) to 30 dB(A)
- (b) small auditoria: 30 dB(A) to 35 dB(A).

The performance of the roof or wall is limited by certain weak points (doors, windows, ducts, chimneys, etc....) and therefore specifying even the highest quality cladding could prove to be a futile exercise. (A concrete wall one metre thick will be completely ineffective if the doors and windows are left open).

Such characteristics depend upon the type of materials used in the building's construction and the distance from its neighbours.

**Due to the different usage requirements of each building an acoustic analysis must be carried out for each separate situation to identify the optimum performance; it is impossible to make general observations as to the requirements in auditoria.**

**ESSENTIAL INFORMATION REQUIRED FOR AN ACOUSTIC ANALYSIS**

**Internal Correction**

- types of activities to take place in the auditoria
- plans and sections showing the internal layout of the premises
- type and composition of the internal surfaces - walls, floor and roof
- report on any existing acoustic control measures or previous acoustic studies
- type and location of treatment envisaged and any specific aesthetic requirements

**Insulation with respect to the exterior of the building**

- plans and sections showing the external layout and its environment
- type and composition of all external surfaces - doors, windows , walls, ventilation units...
- report on any measures already undertaken or previous acoustic studies
- any specific aesthetic requirements

**MATERIAL CHARACTERISTICS**

The materials to be used in the construction must:

- be absorbent
- be shock-resistant and durable
- be non-combustible
- be designed to eliminate the problems caused by condensation

Priority:

Because of its large surface area, in relation to the walls, treatment of the roof or ceiling is vital. However, if the auditorium is not designed for sporting activities, the surfaces must not be too absorbent. This is achieved by limiting the absorption to the higher part of the walls. The partition at the back of the stage should be reflective in order to increase the sound level reaching the audience.

**SOLUTIONS FROM AXTER**

**Internal correction**

The following roofing systems meet the conditions commonly required in auditoria:

Roof:	<b>ANTISON THERMOSON A SUPER ALPHA AQUALPHA</b>
Cladding:	<b>ANTISON</b>

For premises with high levels of humidity **AQUALPHA** should be used.

**Internal correction + insulation**

When protection of the neighbourhood and/or a reduction of external noise entering the building are necessary, **THERMOSON A** is used for the roof and **THERMOSON A or B** for the cladding.

## SALLE des FETES, GUER (56)

### Parties involved:

- Building Owner            Guer Town Council
- Architect                    M. BILLOT and M. LECONTE
- Control Body                APAVE

### Composition of internal surfaces:

- Floor:                        Parquet and plastic flooring (400m<sup>2</sup>)
- Walls:                        Glass, absorbent wall covering & masonry
- Roof (height 8m):        THERMOSON 52 A

### History:

The auditorium is used for balls, banquets, cinema and theatre production. In relation to these various activities, the architects defined the acoustic requirements of the hall. These requirements included maintaining the tranquillity of the neighbouring area (definition of R value of the internal partitions) and ensuring a high comfort level inside the hall (with a reverberation time conforming to recommendations).

**THERMOSON 52 A** roofing system fulfilled these requirements.

### Results:

Once the building was finished control tests were carried out with the following results in seconds:

Frequency (Hz)	125	500	4000
Required Tr	1.2 to 1.5	1.0 to 1.2	0.9 to 1.1
Measured Tr	1.1	1.1	1.1

These results fulfilled all the initial requirements for the comfort of all users.

### Bibliography

1. Noise at Work Regulations 1989
2. Templeton, D W and Saunders D - Acoustic Design - Architectural Press
3. Department for Education - Building Bulletin 51 (draft) - Acoustics in Education Buildings
4. 'Maitrise de l'Acoustique dans les équipements de sports' du Secrétariat d'Etat à l'Environnement et Secrétariat d'Etat à la Jeunesse et aux Sports
5. BS 8233:1987 British Standard Code of Practice for 'Sound insulation and noise reduction for buildings'

