

INDUSTRIAL BUILDINGS

WHY DO WE NEED TO CONTROL NOISE IN INDUSTRY?

Workers regularly subjected to high levels of noise run the risk of becoming deaf. Other effects of noise on the body are often ignored: accelerated heart rate, increase in blood pressure, irritability, aggression, sleeping problems.

The consequences for an employer are:

- increased levels of absenteeism
- low morale
- lower output
- greater risk of accidents

The level of daily exposure to noise is the average level of noise received by the worker during a working day and is expressed as $L_{EP,d}$. The Noise at Work Regulations 1989 require action to be taken where the noise is above any of the following three action levels:

First Action Level - a daily personal exposure ($L_{EP,d}$) of 85 dB(A)

Second Action Level - a daily personal exposure ($L_{EP,d}$) of 90 dB(A)

Peak Action Level - a peak sound pressure of 200 pascals (140 dB re $20\mu\text{Pa}$)

How can noise level be easily evaluated in a work place?

- If you can talk normally, sound level is usually less than 70 dB(A)
- If you have to talk loudly to a person nearby in order to be heard, then sound level is about 80 dB(A).
- If you have to shout to be understood, sound level is about 90 dB(A).

HSE Noise Guide No 1 states that as a rough guide an assessment will be needed if people have to shout or have difficulty being heard clearly by someone about 2 metres away, or if they find it difficult to talk to each other.

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 if the noise is impulsive or is of a strong tonal character.

An acoustic control system incorporated into the building envelope at the design stage will ensure protection of the workforce at very little extra cost compared to the cost of deafness caused at work. At the same time, productivity and working conditions will be improved.

INTERNAL CORRECTION

In the UK unless suitable ear protection is provided, no employee should work in situations where the equivalent continuous noise level $L_{Aeq,8h}$ greater than 90 dB over the working day. BS 8233:1987 and DoE 'Code of Practice for reducing the exposure of employed persons to noise' give advice on noise reduction methods. This advice includes the provision of acoustically absorbent materials applied to the wall or ceiling surfaces or hung freely in the space (functional absorbers). In this way the reverberant sound level within the enclosure will be reduced, thereby often improving the noise climate for people not affected by the direct sound from a noisy machine or activity.

The effectiveness of acoustic control is measured in DL (the reduction in level achieved by doubling the distance from the sound source) and can only be established by an acoustic study; it is not possible to make general observations- each building is different.

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 establishments. The permitted noise levels from any building, particularly close to residential areas, are usually defined by the local planning authority. This may require that no detectable increase in background level takes place at the premises boundary, i.e. the plant is at least 10 dB below background level $L_{A90,T}$ or they may allow a small increase in background level, generally no more than 1dB.

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.

An acoustic analysis will identify the optimum achievable performance and the most suitable materials to be specified.

ESSENTIAL INFORMATION REQUIRED FOR AN ACOUSTIC ANALYSIS

Internal correction

- plans and sections showing the internal layout of the premises
- type and composition of the internal surfaces - walls, floor and *roof*
- description of internal equipment - type, position, density...
- report on any existing acoustic control measures or previous acoustic studies
- constraints imposed by the function of the premises - humidity, hygiene, mobile plant...
- type and location of treatment envisaged and any specific aesthetic requirements

Insulation with respect to the exterior of the building

As Internal correction but in addition:

- plans and sections showing the external layout and its environment
- type and composition of all external surfaces - doors, windows , walls, ventilation...
- description of noise sources - nature (type of machines), position, noise levels...

MATERIAL CHARACTERISTICS

The materials to be used in the construction must:

- be as absorbent as possible
- avoid condensation problems
- be adapted to surroundings (dust, discharges, oil, etc)
- be shock resistant
- be effective at the frequency levels in the building.

Priority:

Roof construction of industrial buildings deserves special consideration because, as a rule, roofs are much larger in area than walls. If there are opening windows or ventilators as with north-lights or monitors it may be possible to orientate the building so that the less solid parts are screened from surrounding vulnerable buildings by the more solid. In some cases roofs can be screened by higher parapets than normal.

SOLUTIONS FROM AXTER

Internal correction

The following roofing systems meet the conditions commonly required in industrial buildings:

High absorbent roofing:	SUPER ALPHA AQUALPHA
Perforated cladding:	TYMPAN ANTISON

For premises with high levels of humidity, such as laundries, paper mills, cotton mills, etc, AQUALPHA and TYMPAN roofs are recommended.

Internal correction + insulation

If protection of the surrounding neighbourhood is essential, **THERMOSON A** should be installed as both roofing and cladding.

EXAMPLE

CITROEN RENNES

Parties involved:

- Building Owner CITROEN CARS
- Acoustic Consultants ACOUSTIQUE ET CONSEIL

Dimensions:

Rectangular building 80m x 64m x 9m (height)

Composition of internal surfaces:

- Floor: Concrete
- Walls: Metal cladding + glazing + masonry
- Roofing: SUPER ALPHA T13

History:

CITROEN had plans to build a new plastics factory.

Based on advice from CRAM at Rennes, CITROEN decided to integrate the problem of acoustics and subsequent acoustic treatment at the design stage of the building. The objective was to conform to current legislation and to ensure that the sound level reduction by doubling of distance (DL) was more than 4 dB(A).

Based on experience it is possible to simulate, using computer models, the noise reduction achieved by various absorbent materials. This method is effective in new buildings and where correction is required for existing premises.

Consultants ACOUSTIQUE et CONSEIL were appointed to carry out the calculations regarding sound level reduction with doubling of distance. From this analysis they were able to recommend the most suitable materials which conformed to the design brief.

AXTER's **SUPER ALPHA T13** was the chosen roofing system.

Results:

Once the building was finished control tests were carried out by CRAM of Brittany.

Required DL = 4 dB(A)
Achieved DL = 4.5 dB(A)

Conclusion:

Because of the acoustic treatment of the roof the building occupants were thus suitably protected in accordance with legislation.

Bibliography

1. Noise at Work Regulations 1989
2. Templeton, D W and Saunders D - Acoustic Design - Architectural Press
3. BS 8233 :1987 - British Standard Code of Practice for Sound insulation and noise reduction for buildings
4. DoE Code of Practice for reducing the exposure of employed persons to noise - HMSO



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