

NOISE CONTROL ON BUILDING SITES

Sources of noise

On a building site the worst noise comes from contractors' plant and mostly from machines used for demolition, piling and excavation. Noise from concrete mixing is often troublesome. Hammering, riveting and cartridge fixing are also noisy, not only in new building but also when extending occupied buildings, as the noise can be transmitted through the structure to rooms remote from the noise source.

The nuisance caused by noise depends on the sort of noise as well as its loudness. Intermittent noise is usually more disturbing than continuous noise, and a high-frequency noise is more worrying than a low-frequency one. The high-pitched noise of sawing, for instance, is more troubling than equally loud noise from an excavator. Typical noise levels of contractors' plant are shown in Table 1.

Maximum tolerable noise levels on building sites

Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. The noise can be measured with a simple sound level meter, as we hear it, in A-weighted decibels (dB(A))—see note below. Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the closest room closest to the site boundary should not exceed:

70 decibels (dB(A)) in rural, suburban and urban areas away from main road traffic and industrial noise.

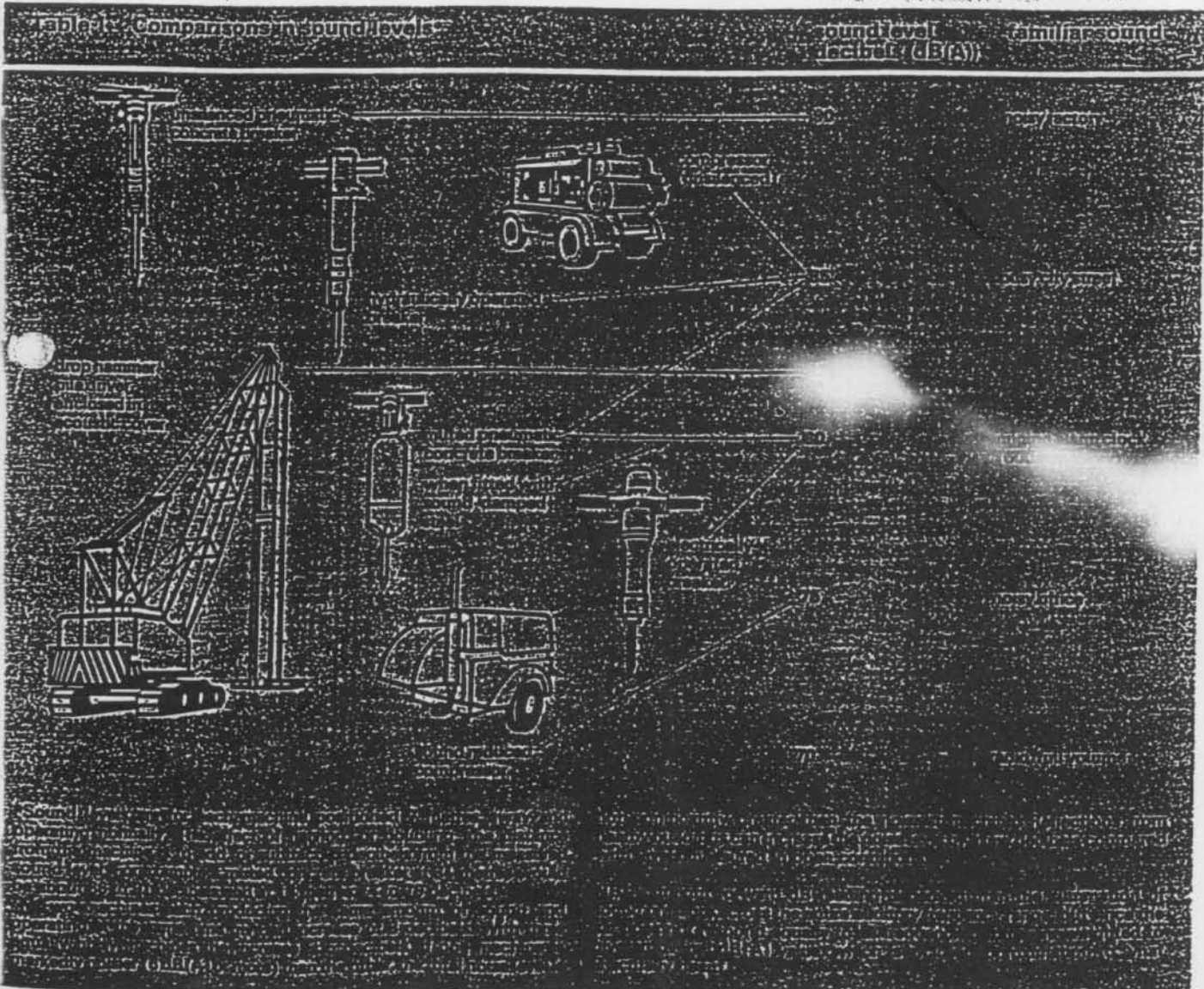
75 decibels (dB(A)) in urban areas near main roads or heavy industrial areas.

These limits are for daytime working outside living rooms and

offices. In noise sensitive situations, for example, near hospitals and educational establishments—and when working outside the normal daytime hours say between 19.00 and 22.00 hours—the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10 dB(A) may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours.

The recommended noise levels should be observed on all jobs except on emergency work necessary for safety or public health.

Methods of reducing the noise nuisance from normal building operations are shown overleaf.



The characteristics of the site and construction will restrict what can be done but it is clearly desirable to locate noisy static plant as far as practicable from people living and working nearby. The noisiest side of plant should also be orientated away from noise sensitive areas. It is frequently possible to take advantage of the screening effect of buildings under construction. Noisy compressors, generators and pumps can be put in a basement, the shell of which has been completed. When using such internal combustion engine plant in enclosed areas, see that the

exhaust gases are discharged directly to the outside air—or that there is good cross ventilation to prevent the build-up of poisonous carbon monoxide fumes. Access to the site can often be arranged at points where the noise of vehicles will cause least disturbance.

In demolition work, form a break in solid connections (eg concrete paving) between the working area and adjoining buildings to reduce the transmission of vibration and structure-borne noise.

If noisy processes must be used the contractor should explain to nearby people, perhaps by letter, the problems to be overcome and what he has done to avoid disturbing the public more than is necessary.

Such an effort can be amply rewarded in goodwill. Contractors should seek advice from the Environmental Health Officer in situations likely to cause a noise nuisance.

Protecting men's hearing

Most men realise that violent noise, say from unsilenced concrete breakers, pile drivers or from cartridge fixing, can injure their hearing. This sort of noise can rupture the ear drum.

Deafness can also be caused by continual exposure to noise which might well be regarded as acceptable in ordinary industrial life. This sort of damage is often slow to develop and it may take ten years of exposure to noise for eight hours a day, five days a week, before the effects become serious. Although deafness often develops with age, it is much worse in people who work in noisy conditions. Hearing protectors should be worn by people exposed for 8 hours to a noise level exceeding 90 dB(A).

Ear plugs, if properly fitted, can do a great deal of good. They are certainly better than using cotton wool and similar materials, which are not very effective in reducing the amount of noise reaching the ear. It is, however, difficult under site conditions to get ear plugs to fit each individual properly. Ear muffs, on the other hand are usually of one size, give greater protection because of their size and can be seen to be worn. Models are available to wear with a safety helmet (Fig 4) or as an attachment to a helmet.



Fig 4

Table 2 Some noise sources and possible remedies

Machine	Source of noise	Possible remedies (discuss with manufacturer)	Possible alternatives
Piling equipment	Pneumatic/diesel hammer or steam winch vibrator driver	Enclose hammer head and top of pile in acoustic screen; 'dampen' sheet steel piles to reduce vibration and resonance.	<ol style="list-style-type: none"> 1 Use different method of piling 2 Alternative methods of soil retention and ground improvement eg diaphragm walls, ground anchors, shafts formed of precast concrete segments sunk into ground under kentledge, use of pre-treatment prior to excavation such as dewatering, freezing soil injection etc.
	Impact on pile	Use resilient pad (dolly) between pile and hammer head, eg 2 layers of asbestos cloth stuffed with glass fibre or mineral wool and protected by plywood.	
	Crane cables, pile guides and attachments	Careful alignment of the pile and rig.	
	Power units or base machine	Fit more efficient silencer or exhaust. 'Dampen' panels and covers. When intended by manufacturer keep engine panels closed. Use acoustic screens where possible.	
Excavator, scraper, shovel, loader, dumptruck, lumper, crane, grader, compactor and bulldozer	Engine and ancillary components	Fit more efficient silencer or exhaust.	Enclose engine compartment but allow for engine cooling. Dampen metal panels. Before modifying machine get advice from manufacturer.
Generator or compressor	Engine	Fit more efficient exhaust silencer.	Use electric motor in preference to diesel or petrol engine. If there is no mains supply a sound-reduced generator or compressor can be used to supply several pieces of plant. Hydraulic and electric tools are also available. A thermic lance can be used to burn holes in concrete and to cut through large sections of concrete: any reinforcement helps the burning process. Where possible use BRE 'Nibbler' instead of concrete breaker.
	Generator or compressor	'Dampen' metal casing. Enclosure panels should be kept closed.	
Concrete breakers	Power unit	Fit more efficient silencer on engine exhaust. Dampen metal casing and line with sound absorbent material. Before modifying machine obtain advice from manufacturer.	
	Tool	Fit a muffler or silencer on pneumatic tools—this will reduce the noise without impairing efficiency.	
	Bit	Little noise once surface is broken—use sound damped or muffled steels.	
Riveter	Impact on rivet	Enclose working area in acoustic screen.	Design for high tensile steel bolts instead of rivets.
Cartridge gun	Explosion of cartridge	Use a sound reduced gun.	Drilled fixings.
Stamp	Engine pulsing	Enclose in acoustic screen (allow for engine cooling and exhaust).	
Concrete mixer, charging plant	Engine	Fit more efficient silencer on diesel or petrol engine.	Locate static mixing plant as far as possible from those likely to be inconvenienced by the noise. Use electric motor in preference to diesel or petrol engine. Use ready mixed concrete.
	Filling	Don't let aggregates fall from an excessive height.	
	Cleaning	Don't hammer the drum—see leaflet 26, <i>Making concrete on site</i> .	

See a reference of sound-reduced equipment. Wherever possible choose from sound-reduced units when replacing plant.

noise from building operations can be controlled

by reducing the actual cause of the noise at source
by screening the noise
by locating noisy plant as far as practicable from those who might be disturbed.

The cost of controlling noise can be offset by savings in lost working time caused by the inability to converse (particularly over the telephone) and inefficiency through annoyance.

reducing noise at source

Noisy processes can often be avoided if alternative quieter constructional methods are considered at design stage. Where piling is required, careful attention should be given to the selection of the most suitable system of piling, keeping in mind the prevailing sub-soil conditions, design loads, programme and the noise levels produced. High tensile bolts should be used to assemble steel frames instead of riveting. Noisy processes cannot be avoided the best way to reduce noise is to use 'sound reduced' plant, together with acoustic screens, in some cases.

Noise from engines and machinery can be reduced by the efficient silencing of exhaust systems and by better-fitting moving parts, such as gears. Anti-vibration mountings at the supports and covers lined with sound absorbent material form an acoustic shield also help. It may be possible to overcome engine noise by using electric motors instead of the more common diesel or petrol engines. Removable parts, especially thin metal plates, should be 'damped' to stop them vibrating and ringing. These measures really add up to better design of contractors' equipment and most manufacturers now recognise that quietness in operation is an important factor when comparing different machines. Some equipment can be made quieter by fitting a muffler.

Pneumatic concrete breakers, for instance, are available in different types of silencing devices. Mufflers, acoustic silencers or exhaust silencers can be incorporated in the design of the breaker. The muffler or silencer need not be heavy or bulky, and should not interfere with the operator's view of the work. Tests by the Building Research Establishment show that noise from pneumatic concrete breakers can be effectively reduced without any loss of performance.

Proper silencing will not make the job take longer but the silencer should be carefully matched with the breaker and be specially



Fig 1. Heavy duty concrete breaker fitted with a light exhaust muffler which effectively reduces the operating noise without loss of performance.



Fig 2. Sound reduced air compressor. The air cooling system is designed to enable the compressor to operate with the canopy fully closed on all sides. The canopy and the chassis are lined with sound absorbent material.

designed for it (Fig 1). Manufacturers will recommend the type of muffler or silencer most suited to their tools. Commercially available damped steels also contribute to a reduction in overall breaker noise.

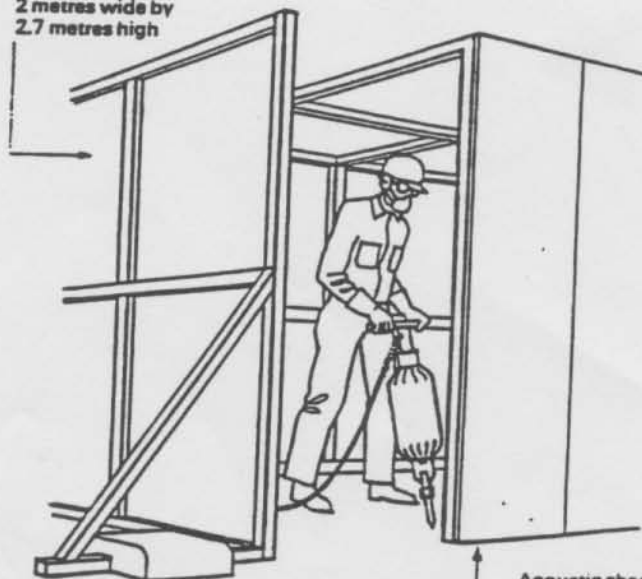
Compressors feeding air to concrete breakers must also be 'sound-reduced'. There are several types on the market (Fig 2). Acoustic linings are applied to the canopy, chassis and undersides of the compressor, including all covers and grilles. The cooling system is specially designed to permit the compressor to operate with the covers closed. Don't leave compressors (and other plant) running unnecessarily.

Acoustic screens and sheds

Effective screening depends on the extent to which the noise can be enclosed without hampering the operation of the machine. In the BRE tests timber-framed screens and sheds lined with plywood and faced with a sound absorbent material (Fig 3). Using a breaker fitted with a suitable muffler or silencer inside an open shed with a screen in front of the open end, the noise was reduced by 20 decibels. This represents a 50 per cent reduction in loudness as judged by the ear, compared with the unsilenced unscreened breaker.

The use of a silencer on the tool inside the enclosure not only reduces the emitted noise level, but also helps to make life tolerable for the operator. Even so, the operator should wear earmuffs or earplugs. Eye protection should also be worn. Artificial lighting in the enclosure may be necessary. Acoustic screening can also be used on generators, pumps, diesel and petrol engines. Reciprocating hammers used for pile driving can be partially screened.

Acoustic screen
2 metres wide by
2.7 metres high



Acoustic shed
2 metres square
by 2.7 metres high

Acoustic Screens and Sheds. The enclosure can be of 6 mm or other solid material weighing about 5 kg/m² on simple timber framing. There must be no gaps at joints or corners. There is no worthwhile saving in using a heavier construction for portable enclosures. The interior should be lined with sound absorbent material for example, 50 mm polyurethane. If glass fibre or mineral wool blankets are used they need protecting by a wire mesh or a perforated sheet. Sheet should have at least 10 per cent of the surface perforated and the spacing between perforations should not exceed 13 mm. The lining build-up of noise inside the enclosure and improves conditions for the operator, it does not appreciably reduce the noise transmitted through the screen or shed. Gaps between the sides and the ground must be sealed with a flap of special tough grade of black polythene sheeting or similar flexible material. Pre-fabricated acoustic screens and sheds are made commercially. They are ready assembled or in kit form in sections which can be dismantled.

		after treatment dB(A)
Diesel concrete mixer	Acoustic silencer. Enclosure of engine	5
Tracked loading shovel	Enclosure of the engine	7
	Better silencer	10
Pneumatic concrete breaker	Muffler and screen	20
	Hydraulic system	25
Pneumatic breaker	Fabric muffler or rubber silencer	6
Diesel compressor	Silencer and enclosure	20
Crawler moulder rock drill	Silencer and enclosure	20
Small pneumatic hand grinder	Exhaust silencer	13
½ tonne pneumatic hoist	Diffuser	27
	Screen drop hammer driver	37
Piling (sheet steel)	Vibrating driver	18
	Jacking piling system	57

Further information

DOE Advisory leaflet:

80 Health risks in construction

Building Research Digests:

95 Choosing a type of pile

128, 129 Insulation against external noise

140 Double-glazing and double windows

143 Sound insulation: basic principles

Health and Safety at Work etc Act 1974

Control of Pollution Act 1974—
Sections 60 & 61

Land Compensation Act 1973

All above obtainable from HMSO and
other booksellers

'Bothered by Noise? How the Law can
Help You' published by the
Noise Advisory Council obtainable from the
DOE Library Store, 414 Government Buildings,
Bromyard Avenue, Acton, London W3 7AY.

BS Code of Practice:

5228—Noise control on construction
and demolition sites

Obtainable from

British Standards Institution

101-113 Pentonville Road, London N1 9ND
(01-837 8801)

Building Research Establishment film:

'Keeping out the noise' (30 min colour)

Obtainable from the

Film Library

Department of the Environment

Thames House South, Millbank,

London SW1P 4QH

(01-211 3119)

Information about ear defenders, safety
helmets, and other protective equipment for
workers can be obtained from
Industrial Safety (Protective Equipment)
Manufacturers Association,
69-75 Cannon Street, London EC4N 5AB
(01-248 4444)

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ON BUILDING SITES

Noise from building operations can cause disturbance, danger and damage. It frequently disturbs people nearby and may even prevent them doing their normal work efficiently. Danger of accidents is more likely if men working on the site cannot hear instructions clearly and noise, say from an unmuffled concrete breaker or pile driver, can permanently damage man's hearing. This leaflet explains how to reduce noise on building sites by silencing hoisy tools and plant, by screening and by properly planning the building development in accordance with British Standard Code of Practice 5228.



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