

## **APPENDIX 9B: CONSTRUCTION NOISE & VIBRATION MITIGATION MEASURES**

## A9.1 Construction Noise & Vibration Mitigation

### A9.1.1 Liaison with the Neighbours

The Contractor should be proactive in engaging with the occupants of neighbouring properties and should notify them of any works forecast to generate appreciable levels of noise, explaining the nature and duration of the works.

A designated noise liaison should be appointed by the contractor for the duration of the construction works. This person should log any issues and follow up in a prompt fashion.

### A9.1.2 Noise & Vibration Monitoring

The following ongoing noise monitoring programme is recommended for the site in relation to demolition and construction activities.

Noise Monitoring Terminals, number and locations to be agreed, to be installed with the following specifications (or similar approved):

- Logging of two concurrent periods, e.g. 15-minute & hourly;
- Daily CIC automated calibrations;
- E-mail alert on threshold exceedance;
- E-mail alert on low battery and low memory;
- Remote access to measured data, and;
- Live display of noise levels.

Vibration monitoring stations should continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with *BS ISO 4866: 2010: Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures*.

The mounting of the transducer to the vibrating structure will need to comply with *BS ISO 5348: 1998: Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply:

- The transducer and its mountings should be as rigid as possible;
- The mounting surfaces should be as clean and flat as possible;
- Simple symmetric mountings are best, and;
- The mass of the mounting should be small in comparison to that of the structure under test.

The monitoring equipment should be set to monitor vibration in 5 minute periods. Noise and vibration data should be downloaded and reviewed on a fortnightly basis.

In addition, it is recommended that spot check noise & vibration measurements are conducted on a monthly basis. These spot checks can be organized to coincide with works that have potential to generate high levels of noise or vibration on site in order to confirm the potential extent of impact.

A monthly Noise & Vibration Monitoring Report should be prepared by the contractor. Reports should identify any exceedances above nominal limit values and attempts to clarify the causes etc. Where remedial measures are required and identifiable these should also be clearly stated.

### **A9.1.3 Noise Control Audits**

It is recommended that noise control audits be conducted at regular intervals throughout the demolition/construction programme. In the first instance, it is recommended that such audits take place on a monthly basis. This is subject to review, however, and the frequency of audits may be increased if deemed necessary.

The purpose of the audits will be to ensure that all appropriate steps are being taken to control construction noise emissions. To this end, consideration should be given to issues such as the following (note that this list is not intended to be exhaustive):

- Hours of operation being correctly observed;
- Opportunities for noise control “at source”;
- Optimum siting of plant items;
- Plant items being left to run unnecessarily;
- Correct use of proprietary noise control measures;
- Materials handling;
- Poor maintenance, and;
- Correct use of screening provided and opportunities for provision of additional screening.

#### **A9.1.4 Hours of Work**

Construction activity will mostly take place during daytime hours Monday to Friday and a half day on Saturdays. In the event of it being deemed necessary to undertake works outside these, it will be necessary to obtain prior written approval from Dublin City Council. Such approval would typically only be granted on submission of details of the activity accompanied by an assessment of potential noise impact.

Consideration should be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity should be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control.

Depending on the noise emission levels experienced and associated noise impact, the contractor should be flexible and able to conduct certain works at hours which reflect periods when the neighbouring properties have lower sensitivities to noise.

#### **A9.1.5 Selection of Quiet Plant**

Careful consideration must be given to the noise emission levels of plant items when they are being considered for use on the site. This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

#### **A9.1.6 Control of Noise Sources**

If the use of low noise plant or replacing a noisy item of plant are not viable or practicable options, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods, often in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS 5228-1:2009+A1:2014 states that “as far as reasonably practicable sources of significant noise should be enclosed”. In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures that could be moved around site as necessary may also be used to screen operatives using hand tools such as angle grinders.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. It is therefore proposed to adopt the concept of “Best Available Techniques”. Best Available Techniques is defined as follows in EC Directive 96/61:

*“...the most effective and advanced stage in the development of an activity and its methods of operation which indicate the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent or eliminate or, where that is not practicable, generally to reduce an emission and its impact on the environment as a whole.”*

In this context “best” means “the most effective in achieving a high general level of protection of the environment as a whole”.

The expression “available techniques” means “those techniques developed on a scale which allows implementation....., under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the operator carrying on the activity”.

The term “techniques” includes “both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned”.

In specifying or otherwise determining Best Available Techniques, consideration should be given to a specified list of considerations and also to “the likely costs and advantages of measures” as well as “the principles of precaution and prevention”.

Thus, the concept of Best Available Techniques requires a degree of balance between the attainment of environmental benefits and the likely cost implications. In the identification of Best Available Techniques, regard should be had to a wide range of factors, however, emphasis should be given to “practical suitability” and the need “to reduce an emission and its impact on the environment as a whole”.

Proposed techniques should also be evaluated in light of their potential effect on occupational health and safety.

BS 5228-1:2009+A1:2014 makes a number of recommendations in relation to “use and siting of equipment”. These are relevant and hence are reproduced below. These recommendations should be implemented on the site.

*“Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas.*

*Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*

*Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*

*Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.*

*Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.*

*Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material.”*

We would also offer the following outline guidance in relation to specific considerations.

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling.

- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover.
- For percussive tools such as pneumatic concrete breakers, rock drills and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.
- For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials.
- For compressors, generators and pumps, these can be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary.
- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

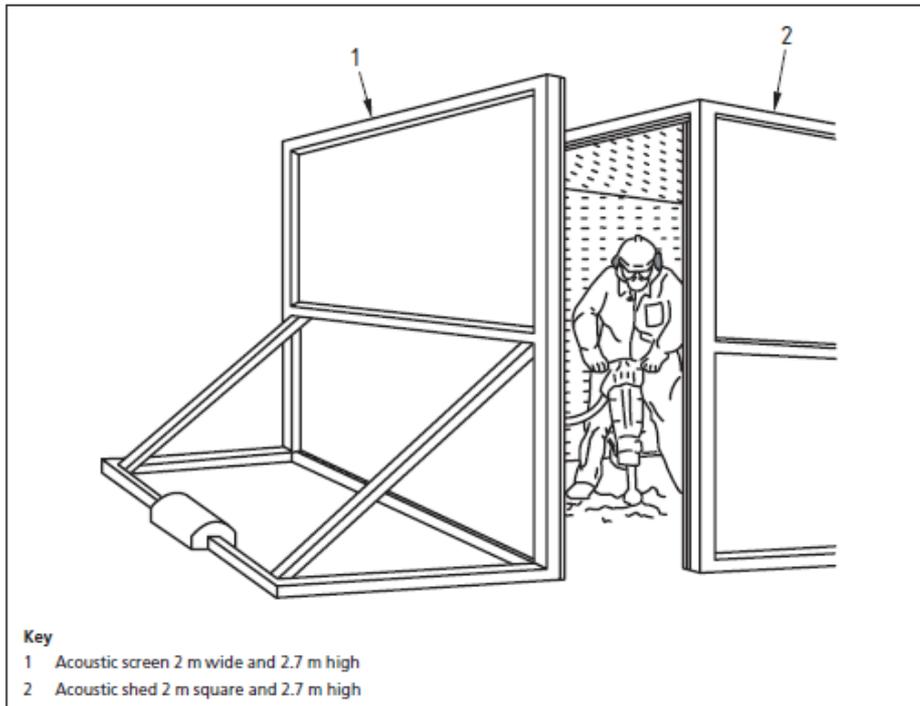
#### **A9.1.7 Screening**

The use of screens can be effective in reducing the noise level at a receiver location and should be employed as a complementary measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver. The height and length of any screen should, where practicable, be such that there is no direct line of sight between the source and the receiver.

*BS 5228-1:2009+A1:2014* states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the screen should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the barrier rather than the transmission through the barrier itself. Screens constructed of materials with a surface mass greater than 10kg/m<sup>2</sup> typically offer adequate sound insulation performance.

Annex B of BS 5228-1:2009+A1:2014 (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials. BS 5228-1:2009+A1:2014 Figure B2 is included here for information purposes.

**Figure A9.1: Typical acoustic screen/shed detail**



**Table B.4 Measured sound reduction given by types of partial enclosure**

Type of enclosure (see Figure B.3)	Reduction dB(A)		
	Facing the opening(s)	Sideways	Facing rear of shed
Open-sided shed lined with absorbent material; no screen	1	9	14
Open-sided shed lined with absorbent material; with reflecting screen in front	10	6	8
Open-sided shed lined with absorbent material; with absorbent screen in front	10	10	10

### A9.1.8 Vibration

The vibration from construction activities will be limited to the values set out within Section 9 of the EIAR, Volume 4. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Limit values have been provided for the following building types:

- Soundly constructed residential and commercial properties;

- Protected structures and sensitive buildings such as those with no or minimal foundations, and;
- Clinical buildings.
- It is understood that bored piling is to be used in this instance which is a piling method which generates relatively low levels of vibration. Notwithstanding this considerations should be given to the following methods to further mitigate the vibration levels,
- Minimise obstructions between the vibration source and the sensitive receiver, e.g. old basement floors, old foundations etc., which exacerbate the transmission of vibration;
- Reduce the resistance to bored piles by "mudding in". This technique involves lubricating the borehole with a small amount of bentonite slurry.

#### **A9.1.9 Piling**

Piling is the construction activity which is most likely to cause disturbance. General guidance in relation to piling is outlined in the following paragraphs.

Piling programmes should be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling works are in progress on a site at the same time as other works of construction or demolition that themselves may generate significant noise and vibration, the working programme should be phased so as to prevent unacceptable disturbance at any time.

During consultation the planner, developer, architect and engineer, as well as the local authority, should be made aware of the proposed method of working of the piling contractor. The piling contractor should in turn have evaluated any practicable and more acceptable alternatives that would economically achieve, in the given ground conditions, equivalent structural results.

It should be remembered that a decision regarding the type of pile to be used on a site will normally be governed by such criteria as loads to be carried, strata to be penetrated and the economics of the system, for example the time it will take to complete the installation and other associated operations such as soil removal. It may not be possible for technical reasons to replace a noisy process by one of the 'quieter piling' alternatives. Even if it is possible, the adoption of a quieter method may prolong the piling operation; the net result being that the overall disturbance to the community will not necessarily be reduced.

On typical piling sites the major sources of noise are essentially mobile and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to noise sensitive areas can represent only a part of the piling period.

Noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover.

Screening by barriers and hoardings is less effective than total enclosure but can be a useful adjunct to other noise control measures. For maximum benefit, screens should be close either to the source of noise (as with stationary plant) or to the listener. Removal of a direct line of sight between source and listener can be advantageous both physically and psychologically. In certain types of piling works there will be ancillary mechanical plant and equipment that may be stationary, in which case, care should be taken in location, having due regard also for access routes. When appropriate, screens or enclosures should be provided for such equipment.

Contributions to the total site noise can also be anticipated from mobile ancillary equipment, such as handling cranes, dumpers, front end loaders etc. These machines may only have to work intermittently, and when safety permits, their engines should be switched off (or during short breaks from duty reduced to idling speed) when not in use.

All mechanical plant should be well maintained throughout the duration of the piling works. When a site is in a residential environment, lorries should not arrive at or depart from the site at times incontinent to residents.