# Appendix A.17.2

Construction Noise & Vibration Mitigation

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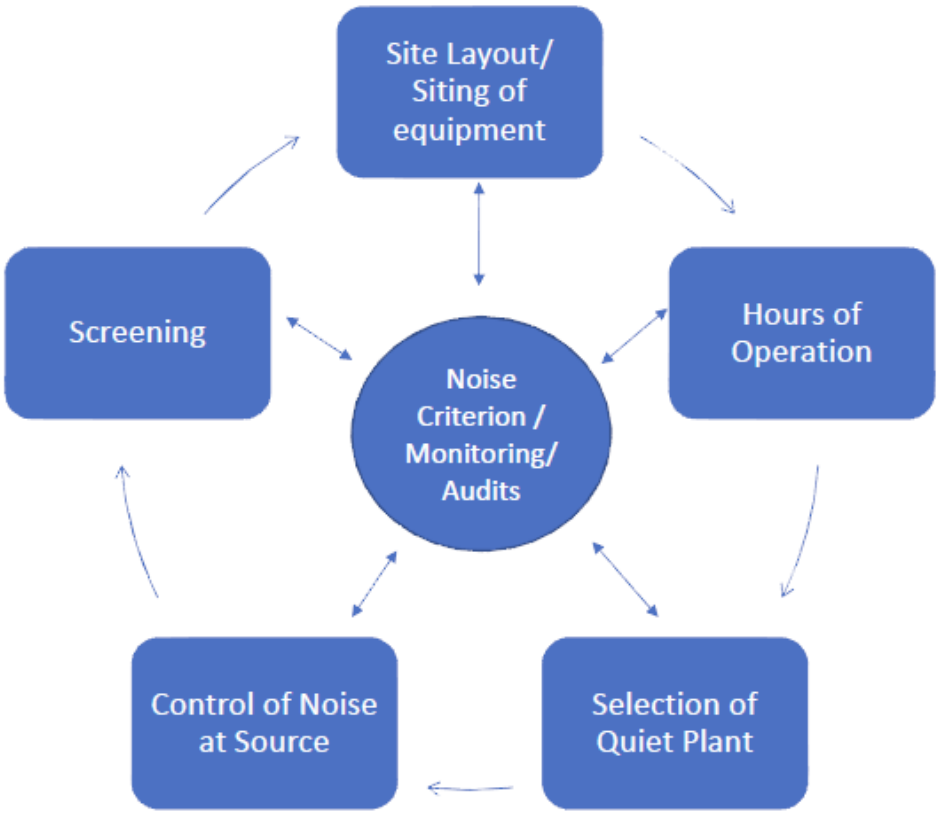
# Construction Noise & Vibration Mitigation

The principal of construction noise and vibration control relates to ensuring suitable noise limits are not exceeded through applying the most suitable form of noise and vibration control measures specific to each activity and its receiving environment. The general hierarchy relates to the following approach

- Control of noise at source
- Control of noise along the propagation path
- Control of noise at receiver

As activities on any one construction site will vary as the project progresses, particularly for linear type projects such a road construction, the specific noise and vibration control measures are continually reviewed to ensure construction noise limits are not exceeded. **Figure A17.2.1** illustrates the approach for construction noise and vibration on a working site.

**Figure A17.2.1: Construction Noise Control Process**




Commentary relating to the main items of this process are discussed in the following sections.

## A17.2.1 Noise & Vibration Monitoring

The following ongoing noise monitoring programme is recommended for the site in relation to 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. hourly & per period
- Daily CIC automated calibrations
- Alert notification system (email/text/alarm etc.) on threshold exceedance
- Remote access to measured data

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 is as rigid as possible
- The mounting surfaces is as clean and flat as possible
- Simple symmetric mountings are best
- The mass of the mounting is small in comparison to that of the structure under test

The monitoring equipment should be set to monitor vibration in 5 minute periods. Similar specification relating to the noise monitoring equipment apply to vibration monitoring equipment including alert notification systems and remote access to data.

In addition, it is recommended that spot check noise & vibration measurements are conducted by the contractor at additional sensitive properties for short term checks. 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 will identify any exceedances above nominal limit values and attempts to clarify the causes etc. Where remedial measures are required and identifiable these will also be clearly stated. This will feed into the live Construction Environmental Management Plan (CEMP).

## A17.2.2 Liaison with the Neighbours

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

A designated noise liaison officer will be appointed by the contractor for the duration of the construction works. This person will be in charge of logging noise queries and following up in a prompt fashion.

## A17.2.3 Noise Control Audits

It is recommended that noise control audits be conducted at regular intervals throughout the 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 or reduced 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 will 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
- Equipment maintenance
- Correct use of screening provided and opportunities for provision of additional screening

## A17.2.4 Hours of Work

Construction activity will mostly take place during daytime hours Monday to Friday and Saturdays. Depending on the noise emission levels experienced and associated noise impact, the contractor will be flexible and able to conduct certain works at hours which reflect periods when the neighbouring properties have lower sensitivities to noise.

It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the project. Over the expected 36-month construction phase there will be up to 10 weeks of night time working along different sections of the proposed road development primarily to facilitate bridge works over existing roads.

Consideration will 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 will be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control. In situations where a particularly noisy activity is scheduled e.g. activities identified in Chapter 17 of the EIAR (rock breaking/crushing/impact piling etc.) or other activities of similar noise level, the use of other on-site activities will be scheduled to ensure control cumulative noise levels.

## A17.2.5 Selection of Quiet Plant

Careful consideration will 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 e.g. within site compounds. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. 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 will be selected as far as practicable. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

## A17.2.6 Control of Noise Sources

If the use of low noise plant or replacing a noisy item of plant are not viable or practicable options, noise control "at source" options will be used. 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 will 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 will be had to a wide range of factors, however, emphasis will be given to *"practical suitability"* and the need *"to reduce an emission and its impact on the environment as a whole"*.

Proposed techniques will 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 will 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."*

The following outline guidance is will also be used 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 will 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 is 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. Erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction.
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials. This is an important consideration for site compounds where materials are loaded and unloaded. Site compounds in close proximity to noise sensitive areas (refer to **Table 17.10** of **EIAR**) will incorporate a strict noise control policy relating to materials handling.
- Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/areas and have potential to exceed noise criterion, these will 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 will 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.

## A17.2.7 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. **Section 17.5.3.1** of the **EIAR** has identified key site activities where exceedance of the construction noise criteria is possible in the absence of mitigation, depending on the source activity and distance from the source. In addition to the at source noise control measures detailed above, the use of screening will be used at site compounds, areas of major

excavation, structures etc. where potential of exceedance of the construction noise criteria has been identified.

*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 will 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$^2$ 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 A17.2.2: Typical acoustic screen/shed detail**

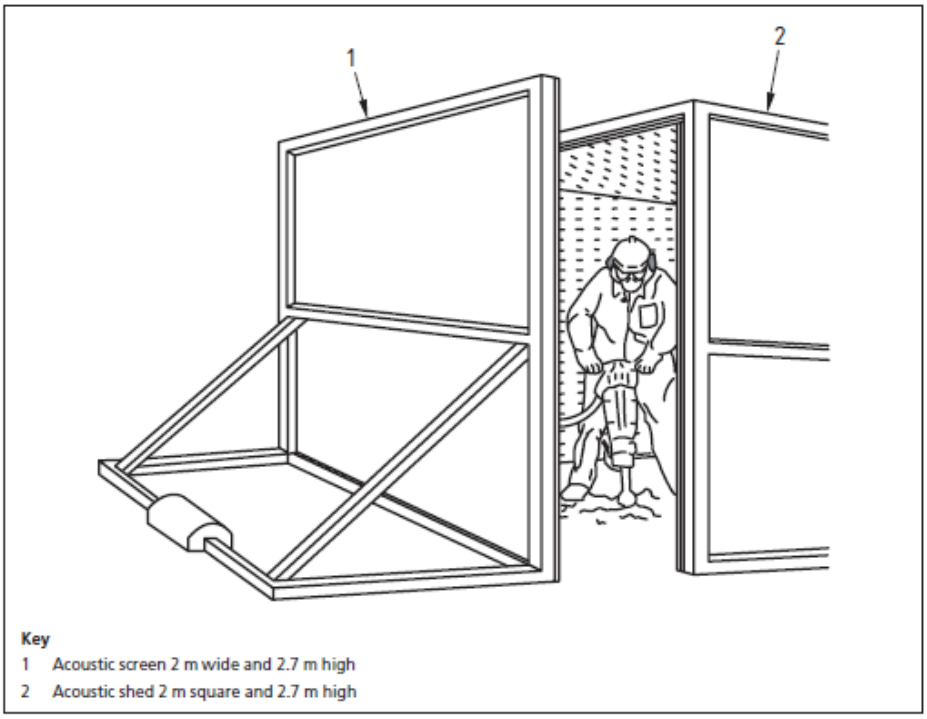



Table B.4 **Measured sound reduction given by types of partial enclosure**

| 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 |

## A17.2.8 Best Practice Control for High Noise Construction Activities

Piling, breaking, demolition, excavation programmes will 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 specific high noise/vibration 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 will be phased so as to prevent unacceptable disturbance at any time.

The contractor will evaluate the choice of piling, excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative low noise and vibration generating equipment that would economically achieve, in the given ground conditions, equivalent structural/excavation/breaking results, these will be selected to minimise potential disturbance,

The decision regarding the type of pile, excavation technique, rock breaking, crushing etc. to be used on a site will normally be governed by other engineering, environmental and economic constraints such criteria. In these instances, it may not be possible for technical reasons to replace a noisy process by a quieter alternative (e.g. rotary bored piling over driven piles). Even if it is possible, the adoption of a quieter method may prolong the overall process (e.g. manual rock breaking versus blasting); the net result being that the overall disturbance to the community will not necessarily be reduced.

On typical road construction 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, excavation, breaking and other high noise or vibration activities works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period. It is important, therefore, that clear forms of communication are established between the contractor and noise sensitive areas in proximity so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration.

For all the above construction activities, the various noise reduction options available will be determined depending on the activity involved. For example, noise reduction during piling 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.

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 will be switched off (or during short breaks from duty reduced to idling speed) when not in use.