

Australian Standard[®]

**Guide to noise and vibration control on
construction, demolition and
maintenance sites**



This Australian Standard® was prepared by Committee EV-010, Acoustic Community Noise. It was approved on behalf of the Council of Standards Australia on 22 April 2010. This Standard was published on 18 May 2010.

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- AirServices Australia
 - Association of Consulting Engineers
 - Australian Acoustical Society
 - Austroads
 - Bureau of Steel Manufacturers of Australia
 - CSIRO Manufacturing & Infrastructure Technology
 - Department of Defence (Australia)
 - Institute of Marine Engineers Australia/New Zealand Division
 - Ministry of Health (New Zealand)
 - National Acoustic Laboratories
 - National Environment Protection Council
 - New Zealand Acoustical Society
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-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 2436—2010

Guide to noise and vibration control on construction, demolition and maintenance sites

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Technical Committee EV-010 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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Bureau of Steel Manufacturers of Australia
Department of Defence (Australian Government)
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Ministry of Health (NZ)
National Acoustic Laboratories
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NOTES

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee EV-010, Acoustic Community Noise to supersede AS 2436—1981, *Guide to noise control on construction, maintenance and demolition sites*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

This Standard is concerned with noise and vibration from construction, demolition and maintenance sites as it affects persons working on these sites and also those living and working in the neighbourhood. This Standard provides guidance in noise and vibration control on such sites and includes guidance in investigation and identification of sources, measurements of sound and vibration, and guidance in assessment with a view to planning measures for noise control and monitoring of their effectiveness. This Standard is applicable to a wide range of different activities associated with construction, demolition and maintenance works. It is intended to assist local and/or regulatory authorities, developers, builders, architects, engineers, planners, designers and contractors in planning and/or assessing measures for control of noise and vibration on and from construction, demolition and maintenance sites.

Construction, demolition and maintenance works pose different problems of noise and vibration control when compared with most other types of industrial activity, since—

- (a) they are mainly carried on in the open;
- (b) they are often temporary in nature although they may cause considerable disturbance whilst they last;
- (c) the noise and vibration arise from many different activities and kinds of plant, and their intensity and character may vary greatly during different phases of the work; and
- (d) the sites cannot be separated by planning control, from areas that are sensitive to noise and vibration.

Much of the noise and vibration from construction, demolition and maintenance work is caused by plant and equipment. In some cases the noise or vibration generated may be unacceptable and reduction is necessary for the benefit of people both on and off the site.

Noise from construction, demolition and maintenance work may cause impairment of hearing to persons working on site. Exposure of workers to excessive vibration may cause circulatory problems in the hands, damage to tendons and increase the risk of lower back pain. Noise and vibration may also be a cause of annoyance to people living and working in nearby premises, and to people outdoors in the vicinity.

In this Standard, measures are listed that can be adopted by those concerned in the planning and implementation of construction, demolition and maintenance works to ensure good practice is employed. Any such measures should always have due regard to safety. Many responsible sections of industry already make use of the measures included in this Standard for noise and vibration control on construction, demolition and maintenance sites.

Guidance on the estimation of noise from sites, typical noise levels from plant, noise sources and remedial actions, and screens and enclosures is given in appendices.

In the preparation of this Standard the following documents were consulted:

US Department of Transportation, *FHWA Highway Construction Noise Handbook*, Federal Highway Administration Final Report, August 2006, document number: FHWA-HEP-06-015, DOT-VNTSC-FHWA-06-02, NTIS No. PB2006-109102

NSW DECC Interim Construction Noise Guideline, July 2009

NSW DEC Assessing Vibration: A Technical Guideline February 2006

NSW RTA Environmental Noise Management Manual, December 2001

Department for Environment Food and Rural Affairs (United Kingdom). *Update of noise database for prediction of noise on construction and open sites, Phase 3: Noise measurement data for construction plant used on quarries*. July 2006.

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STANDARDS AUSTRALIA

Australian Standard

Guide to noise and vibration control on construction, demolition and maintenance sites

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard provides guidance on noise and vibration control in respect to construction, demolition and maintenance sites. This Standard also provides guidance for the preparation of noise and vibration management plans, work method statements and environmental impact studies.

1.2 OBJECTIVE

The purpose of this Standard is to assist local and/or regulatory authorities, developers, builders, architects, engineers, planners, designers and contractors in planning and/or assessing noise and vibration control measures on and from construction, demolition and maintenance sites.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1055 Acoustics—Description and measurement of environmental noise (series)
- 2187 Explosives—Storage and use
- 2187.2 Part 2: Use of explosives
- 2670 Evaluation of human exposure to whole-body vibration (series)
- 2763 Vibration and shock—Hand-transmitted vibration—Guidelines for measurement and assessment of human exposure
- 2775 Mechanical vibration and shock—Mechanical mounting of accelerometers

AS/NZS

- 1269 Occupational noise management
- 1269.0 Part 0: Overview and general requirements
- 1269.1 Part 1: Measurement and assessment of noise immission and exposure
- 1269.2 Part 2: Noise control management
- 1269.3 Part 3: Hearing protector program
- 1269.4 Part 4: Auditory assessment

AS/IEC

- 60942 Electroacoustics—Sound calibrators
- 61672 Electroacoustics—Sound level meters
- 61672.1 Part 1: Specifications

- ISO
- 1996 Acoustics—Description, measurement and assessment of environment noise
 - 1996-2 Part 2: Determination of environmental noise levels
 - 2631 Mechanical vibration and shock—Evaluation of human exposure to whole-body vibration
 - 2631-1 Part 1: General requirements
 - 2631-5 Part 5: Method for evaluation of vibration containing multiple shocks
 - 5349 Mechanical vibration—Measurement and evaluation of human exposure to hand-transmitted vibration
 - 5349-1 Part 1: General requirements
 - 5349-2 Part 2: Practical guidance for measurement at the workplace
 - 7731 Ergonomics—Danger signals for public and work areas—Auditory danger signals
 - 9533 Earth-moving machinery—Machine-mounted forward and reverse audible warning alarm—Sound test method
 - 9613 Acoustics—Attenuation of sound during propagation outdoors
 - 9613-1 Part 1: Calculation of the absorption of sound by the atmosphere
 - 9613-2 Part 2: General method of calculation
- BS
- 5228 Code of practice for noise and vibration control on construction and open sites
 - 5228-2 Part 2: Vibration
 - 7385 Evaluation and measurement for vibration in buildings
 - 7385-2 Part 2: Guide to damage levels from groundborne vibration
- NSW DEC Assessing Vibration: A Technical Guideline February 2006
- NSW RTA – Environmental noise management manual 2001
- On the minimum health and safety requirements regarding the exposure of workers to the risk arising from physical agents (vibration). Official Journal of the European Communities OJ L177, 6.2.2002, 13-19
- Commonwealth Government Occupational Health and Safety Code of Practice 2008
- Workplace Health and Safety Queensland. Queensland Tunnelling Code of Practice 2007

1.4 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

1.4.1 Site

The area under the control of a person, company or organization where various activities that have the potential to generate significant noise and/or vibration levels occur.

1.4.2 Neighbourhood

The area surrounding or affected by activities under investigation at the site.

1.4.3 Construction

Includes any excavation, demolition, construction, maintenance, alteration or related activity.

1.4.4 Plant

Includes any machinery, equipment, appliance, implement or tool and any component or fitting thereof or accessory thereto.

1.5 REGULATORY REQUIREMENTS

Legislation associated with the control of noise and vibration on and from construction, demolition and maintenance sites in Australia is generally the responsibility of the relevant State or Territory government, local council or a designated statutory authority. In order to ensure the relevant regulatory requirements may be addressed, it is essential for interested parties to obtain pertinent and/or current information in relation to the applicable or special requirements from the relevant authority.

Failure to comply with the relevant regulatory requirements may result in costly delays and alterations and subsequent penalties, as well as generating the potential for adverse public response.

SECTION 2 NOISE AND VIBRATION CONTROL FOR PERSONS ON SITE

2.1 GENERAL

The construction industry has the second highest incidence of compensation claims by workers for noise-induced hearing loss after the mining industry, according to a 2006 report from the Australian Safety and Compensation Council*. Therefore, it is important for the industry to adopt noise management strategies to prevent or minimize worker exposure to noise. The best way to achieve this is by including noise and vibration management strategies in the client specification, tender proposal, site-planning and construction/demolition phases of a project. Strategies may include the use of—

- (a) low-noise and low-vibration work practices;
- (b) low-noise and/or low-vibration plant and equipment;
- (c) time restrictions on processes involving exposure to potentially hazardous noise or vibration;
- (d) portable barriers and improved site layout to separate noisy work processes from potentially exposed workers;
- (e) provision of personal hearing protectors;
- (f) training; and
- (g) signposting of noise and vibration hazardous areas.

Occupational health and safety legislation mandates that companies, principal contractors, their subcontractors, and workers manage risks from noise and vibration from construction, maintenance and demolition work. This must be done by eliminating hazardous noise and vibration or, where that is not practicable, by minimizing the risks from noise and vibration to the health and safety of persons on or near the site.

2.2 EFFECTS OF HAZARDOUS NOISE AND VIBRATION

2.2.1 Noise

The main adverse effects of hazardous noise are permanent noise-induced hearing loss, tinnitus (ringing in the ears) and interference with clearly hearing instructions or audible warning signals. There is growing research evidence that long term exposure to noise may contribute to stress and cardiovascular diseases and that combined exposures to noise and ototoxins (e.g. solvents, heavy metals and carbon monoxide) or vibration lead to increased hearing loss.

* Australian Safety and Compensation Council, *Work-Related Noise Induced Hearing Loss in Australia*. Canberra, Commonwealth of Australia, 2006.

<http://www.safeworkaustralia.gov.au/NR/rdonlyres/3B4D5188-313F-416A-81A4-E7AEF2494AF9/0/NoiseReportwebversion.pdf>

2.2.2 Vibration

Vibration can adversely affect people through the hand-arm system, e.g. from hand-held power tools or steering wheels, as well as from the whole body being vibrated, e.g. riding in mobile plant or heavy transport vehicles. Excessive hand-arm vibration can lead to disruption of circulation in the hands (white-finger disease) and damage to tendons and nerves. Excessive whole-body vibration increases the risk of lower back pain, degeneration of the lumbar vertebrae and disc herniation. Certain whole-body vibration can cause motion sickness.

NOTE: The tolerance to whole-body vibration may be reduced for women and their foetuses during pregnancy.

2.2.3 Low frequency high intensity noise and vibration

There are potential physiological risks involved for people exposed to low frequency high intensity noise and vibration, from sources including large compressors, large ventilation fans, vibrating screens and pumps.

2.3 MANAGEMENT OF OCCUPATIONAL NOISE AND VIBRATION FROM PLANT AND EQUIPMENT

2.3.1 Noise

The series of Standards, AS/NZS 1269 Parts 0 to 4, sets out procedures to assess, control, manage and review noise hazards. These should be followed on construction, demolition and maintenance sites, noting in particular the emphasis on introducing controls further up the hierarchy such as—

- (a) eliminating a noise hazard by use of alternative work methods;
- (b) selecting the quietest plant and equipment for the job; and
- (c) proactively maintaining plant and equipment to minimize noise level increases.

Some of the work practices and controls described in Section 4 and Appendix C may provide both reductions in noise levels in the workplace as well as noise impacts on the community. These practices should be given high priority when planning a project.

When hazardous noise still exists on a site, its extent should be clearly identified and workers trained to either avoid these areas or, if necessary, enter them only if wearing suitable hearing protectors.

High level noise may not only cause hearing impairment but may also mask the audibility of warning signals and alarms. Guidance on assessing the audibility and the design of auditory danger signals can be found in ISO 7731. Also, ISO 9533 outlines the procedures and sets the criteria necessary to evaluate the audible performance of alarms mounted on earth-moving machines.

2.3.2 Vibration

The National Code of Practice for Prevention of Musculoskeletal Disorders from Performing Manual Tasks at Work (2007)* contains guidance on assessing and controlling vibration risks. If detailed measurement and evaluation of vibration are needed, refer to the following standards:

- (a) AS 2763.
- (b) ISO 5349 Parts 1 and 2.

* Australian Safety and Compensation Council, *National Code of Practice for Prevention of Musculoskeletal Disorders from Performing Manual Tasks at Work*. Canberra, Commonwealth of Australia, 2007 (<http://www.safeworkaustralia.gov.au/HealthSafety/HazardsSafetyIssues/ManualTasks/ManualTasks.htm>)

- (c) AS 2670.
- (d) ISO 2631 Parts 1 and 5.
- (e) Guidance on management and limiting exposure of both hand–arm and whole body vibration may be obtained from: EU Directive 2002/44/EC.
- (f) Queensland Tunnelling Code of Practice 2007.

The Commonwealth Occupational Health and Safety Code of Practice 2008 provides practical guidance on safe work practices and risk management in relation to specific hazards and hazardous activities, including noise and vibration, manual handling and many other workplace hazards. It provides guidance to duty-holders on standards of health and safety that must be achieved in the workplace in relation to those matters, hazards or hazardous activities.

2.4 MANAGEMENT OF VIBRATION AND AIRBLAST OVERPRESSURE FROM USE OF EXPLOSIVES

For guidance on the management of ground vibrations and airblast overpressure due to blasting with explosives during construction or demolition work for personnel on site, refer to AS 2187.2.

SECTION 3 NOISE AND VIBRATION IMPACTS EXTERNAL TO THE SITE

3.1 DISTURBING EFFECTS OF NOISE AND VIBRATION

Noise and vibration can cause a variety of problems in the neighbourhood, such as interference with speech communication, disturbance of work or leisure, disturbance of sleep, annoyance and effects on mental and physical health. A complicating factor is that some people may be more sensitive to noise and vibration than others.

Special audible characteristics likely to increase annoyance, including tonality, modulation or impulsiveness, may be generated at construction sites and need to be taken into account during planning, prediction, assessment, measurement and compliance phases. The assessment of noise from such sites should determine (e.g. from plant manufacturers' data) whether the noise from construction activities is likely to contain such noise characteristics. Manufacturers of plant and equipment may also provide a guarantee there will be no characteristics such as tones in the noise emissions from the plant.

Tonality and tonal audibility can be described or objectively determined by the methodology contained in AS 1055 or other methods such as ISO 1996-2 or those developed and accepted by the relevant regulatory authority.

Following the statutory consultation and approval process, it is essential to advise those likely to be affected of the activities about to occur.

Low-frequency noise and vibration generated at sites can cause significant disturbance over a range of distances. The likely impact of low-frequency noise and vibration needs to be considered and dealt with.

In the event that such characteristics are present, the relevant regulatory authority may require an adjustment to the assessed level to take into account the adverse subjective response or annoyance the noise or vibration is likely to cause. For noise, this adjustment is often the addition of a predetermined number of decibels to the measured noise or applied on a sliding scale that is related to the intrusiveness of the characteristic.

Careful consideration should be given to the use, placement and duration of operation of site plant and equipment that could contain such characteristics (see Section 4 for further guidance).

3.2 NOISE AND VIBRATION IMPACTS ON THE COMMUNITY

Whether or not noise or vibration from a construction, maintenance or demolition site is likely to constitute a problem depends upon a number of considerations, such as—

- (a) existing background noise level;
- (b) distance between the site and the area likely to be affected by the construction noise or vibration;
- (c) nature of neighbouring buildings and the activity therein, where the noise is likely to be heard, or vibration perceived;
- (d) the likely duration of construction, maintenance and demolition operations and the hours during which the above operations will be carried out (whether during the day, night or weekends);
- (e) the nature of the noise or vibration, e.g. audible pure tone components, low-frequency noise or vibration and impulsive character; and

- (f) the number of items of major plant and equipment being utilized simultaneously on the site and their cumulative impact.

Some construction and demolition activities are by their very nature noisy. The authorities responsible for setting noise level criteria for essential works will take note of the constraints imposed by such activities, especially when they are of short duration.

It is essential that prior consultation be arranged with the responsible authorities in relation to factors such as permissible noise level and permitted hours of operation, so that approvals (if necessary) can be gained prior to commencing any such activities.

Most statutory authorities will have either codes of practice, guidelines or formal policies for managing or regulating noise and vibration from work sites.

3.3 QUALITATIVE ASSESSMENT OF NOISE AND VIBRATION IMPACT

Planning for small-scale building projects, such as low-rise residential construction and renovations can be assessed using a qualitative method. A qualitative approach can avoid the need to perform complex predictions by following a series of questions such as:

- (a) Is the noise from the source likely to be loud either in an absolute sense or relative to other noise sources in the area?
- (b) Is the noise likely to include any audible pure tone components or impulsive characteristics?
- (c) Will noise or vibration occur at times when sleep or environmental amenity are likely to be adversely affected, for example, during the night-time?
- (d) Is there a likelihood that plant to be used on site will generate significant vibration?

If the answer to any of the above questions is yes, then a more detailed and quantitative approach should be adopted—see Section 4.

3.4 COMMUNITY RELATIONS

An effective community relations program is essential to keep the stakeholders informed throughout the project development process, to obtain valuable data related to the project, and to become aware of any project-related impacts in a timely manner. Additionally the community is likely to be more understanding and accepting of the noise and vibration where the information provided is frank, does not attempt to understate the likely noise and vibration impacts and if commitments made are firmly adhered to.

It is important for all personnel on construction, demolition, and maintenance sites to be considerate of people who live or work nearby so they are not subjected to unnecessary or excessive noise or vibration. Site induction training should address the need to take all necessary steps to minimize such adverse impacts.

Noise and vibration management plans should describe the approaches that will be applied in consulting with, and notifying, the community. Noise and vibration management plans should also show a commitment to work practices, such as scheduling of activities and selection of equipment and procedures that will be implemented to minimize impacts and manage complaints.

A range of media should be used to notify the community before and during construction, including use of community meetings, individual contact and letterbox drops. Contact details for complaints and further information, including emergency phone numbers, should be readily available to the community.

In large projects, a community relations plan should be developed and implemented. Complaints should be recorded and managed in conformity with the plan to ensure prompt and fair response.