



Airport wide Construction Noise Management Plan

Prepared for

Wellington International Airport Limited

Prepared by

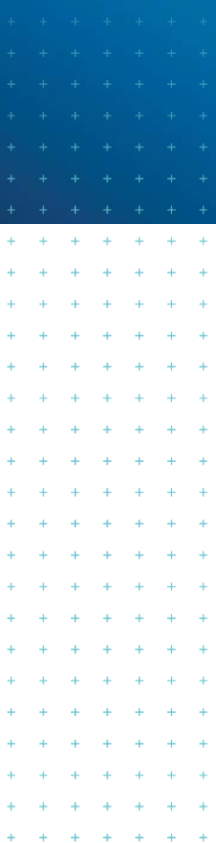
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1 Introduction

Wellington International Airport Ltd (WIAL) is committed to managing noise caused by airport related construction and maintenance works¹ such that it remains reasonable at neighbouring noise sensitive properties. This updated² Construction Noise Management Plan (CNMP) formalises this commitment and provides the necessary guidance and methods to manage noise from airport-wide construction works. This airport-wide CNMP is a requirement of the Main Site Area Designation³ (see Section 4).

The objectives of this CNMP are:

- Establish an airport-wide approach to construction noise management
- Identify appropriate noise limits and performance standards which balance residential noise amenity and the need to undertake works efficiently
- Develop and implement procedures and strategies to reduce noise impacts on the local community
- Develop an engagement procedure that will be undertaken with affected communities
- Provide a framework for project-specific noise management plans for ‘significant’⁴ construction works/projects
- Monitor and report on the effectiveness of the mitigation measures implemented in the CNMP

Although this CNMP focuses on noise management, vibration from construction activities also needs to be appropriately managed to minimise disturbance to buildings and their occupiers. The spatial separation between on-airport work sites and off-site vibration sensitive sites, will often negate the need to assess vibration.

Management of noise other than construction works is documented in the Airport Noise Management Plan (ANMP) **dated XXX 2022**. This CNMP is appended to the ANMP.

This CNMP has been reviewed by Wellington Airport’s Air Noise Management Committee (ANMC).

A glossary of terms is included in Appendix A.

¹ Maintenance includes any construction works occur on existing airport infrastructure such as buildings, pavement surfaces, seawall defences, etc.

² Initial CNMP – AECOM 11 August 2017

³ Environment Court, Decision No. [2022] NZEnvC 106, Airport Purposes Designation – Main Site Area (MSA) – Consent Order, 21 June 2022

⁴ For example, works close to residential neighbours (<50 m).

2 Airport-wide construction activities

WIAL regularly undertakes construction works within the airport precinct⁵ shown in Figure 2.1, including:

- Pavement construction and resurfacing
- General maintenance works to the runway/taxiway infrastructure, which includes vertical structures and ground level (and below) works
- Capital work projects such as new/replacement buildings
- Airfield Ground Lighting (AGL) installation and maintenance
- Work on marine defence systems including seawalls and structures

WIAL has extensive experience of undertaking these construction works and is mindful of the close proximity of its neighbours (residents and other noise sensitive properties) to the airport boundary. Figure 2.1 shows the residential areas near the airport - Miramar to the north east, Strathmore Park to the South East, and Rongotai to the west.

Construction works can include scheduled and unscheduled works. Where practicable, noisy works are to be undertaken during standard daytime hours of 7:30 am to 6 pm. However, maintenance of aircraft operating areas including runways, taxiways and aprons may often necessitate certain activities taking place at night during the curfew period (1 am to 6 am).

The requirements of this CNMP do not restrict the delivery of emergency construction works at Wellington Airport. The delivery of emergency works must consider methods to manage noise effects. Any emergency works carried out that involve noisy works shall be notified to the Airport Planning Manager⁶ within 24 hours.

This CNMP has been produced in accordance with best practice as detailed in New Zealand Standard NZS 6803:1999 'Acoustics – Construction Noise' (see Section 5).

⁵ Development of the East Side Area is excluded from this Main Site Area (MSA) CNMP – see ESA designation conditions.

⁶ planning@wellingtonairport.co.nz



Figure 2.1: Airport layout (source WIAL)

3 Approach to construction noise management

The effects of construction noise can be mitigated using both management and engineering controls. Mitigation measures should be planned and implemented for all projects in a structured hierarchy depending on the extent of the likely noise effects.

Each project, whether carried out under this CNMP or a project specific CNMP, should address the following questions (hierarchy of controls):

- 1 Is there anything preventing the works being done during normal work hours (7.30 am to 6 pm Monday – Saturday)?
- 2 Is it imperative that night-time works are undertaken, or can works be rescheduled to daytime?
- 3 Can the works be sequenced to avoid sensitive times for neighbouring residents/businesses?
- 4 Scheduling the noisiest work at the beginning of the shift. For example, performing concrete cutting during the day and then breaking and resurfacing at night, where practicable.
- 5 Minimising the number of consecutive nights that noisy works are to take place and not working Friday or Saturday nights, where practicable. The general shift pattern is Sunday-Thursday nights.
- 6 Use of broad band reversing alarms rather than tonal alarms for all moving plant within the construction site.
- 7 Use of quietest equipment and methodology available to minimise noise. This may include a balance between the overall noise level and the duration of noise. In some situations it may be preferable to undertake short term noisy works rather than having lower noise levels which may occur for a significant period of time.
- 8 Use of temporary construction noise barriers or screens to provide effective acoustic shielding of the equipment/activity. Use of screens may be limited depending upon wind conditions and stability of these structures. Use of screens will not be practicable when conducting milling or paving over large areas.
- 9 Use of multiple items of plant to shorten the construction period, e.g. two items of plant may halve the duration of the activity but at most only lead to a 3 dB increase in noise level.
- 10 Use of equipment and construction techniques in accordance with manufacturer's instructions / site protocols (method statements).

WIAL and its contractors will also consider these controls when planning and undertaking maintenance of the airport's pavement infrastructure. As these maintenance works can include scheduled and unscheduled activities, this CNMP addresses these works as a separate section to this management plan to reflect their routine/repetitive nature.

A key requirement of this CNMP is to provide information to the local community to raise awareness of planned construction works at Wellington Airport, either via WIAL's website⁷ or via letterdrops for significant projects (as required by their own individual CNMPs). Further information is provided in Section 7.

There is a duty on all persons carrying out construction activities to adopt the Best Practicable Option (BPO) to ensure noise does not exceed a reasonable level. This underpins WIAL's approach to all construction projects. Accordingly, all projects which fall within the framework of this CNMP should record in the project's construction methodology how the BPO has been adopted (with reference to the 10 questions listed above and the communication strategy).

⁷ <https://www.wellingtonairport.co.nz/noise/construction-noise/>

4 Standards

4.1 Noise

Designation condition 32 requires WIAL to prepare an ANMP and condition 33 requires that the ANMP includes an airport wide CNMP.

Designation condition 35 requires that:

'35. Construction noise from all construction work within the designation shall be managed so that it complies where practicable with the requirements of New Zealand Standard 6803:1999 Acoustics Construction Noise. In managing construction noise, the Requiring Authority shall prepare and implement a Construction Noise Management Plan (CNMP) based on the Airport Wide Construction Noise Management Plan. The CNMP shall be prepared in accordance with the guidance provided by the ANMP. Any construction activity or work that cannot comply with the recommended limits of New Zealand Standard 6803:1999 Acoustics Construction Noise shall be identified and the duration for each activity shall be specified. The best practicable option for reducing noise to a reasonable level shall be adopted for these construction activities.'

and condition 36:

36. The CNMP shall include the process for identifying the specific management and mitigation required for any night-time construction activity, including measures for consultation with the potentially affected community, procedures for notification prior to night works, maximum duration and frequency of night works, and processes for minimising the need for night-time construction works.

The Foreword of NZS 6803:1999 notes that:

'the generally acceptable level of intrusive noise in the community is assessed under the provisions of NZS 6802:1999 [current version 2008]. However, construction noise is outside the scope of NZS 6802:1999 because it usually cannot be kept within the specified limits. Although this may mean that the noise is undesirable, it is not necessarily unreasonable when all the relevant factors are taken into consideration. Construction noise is an inherent part of the progress of society.' table and requirements

NZS 6803:1999 includes guidance on recommended noise limits, which depend on the time of day and the duration of construction noise. Table 4.1 and Table 4.2 provide the relevant NZS 6803 noise limits depending upon the duration of noise:

- 'Short-term' means construction work at any one location for up to 14 calendar days
- 'Typical duration' means construction work at any one location for more than 14 calendar days but less than 20 weeks; and
- 'Long-term mean's construction work at any one location with a duration exceeding 20 weeks.

In most cases, construction noise limits are less restrictive than operational noise limits, on the basis that the effects of construction activities are of limited duration.

The Standard's noise limits apply at 1 m from external façades of occupied buildings. Noise is typically assessed over a representative 15-minute period of construction activity. A representative period of activity considers the number of construction plant present, how long they operate for and how the noise varies over the 15-minute period; i.e., whether constant or fluctuating.

NZS 6803 recognises that there may be situations when the recommended noise limits may be exceeded. In these situations, NZS 6803 states that BPO for noise avoidance or mitigation must be

implemented. NZS 6803 includes a detailed section on managing construction noise including the preparation of CNMPs. Section 8 of the Standard sets out a range of noise management measures:

- Noise management planning – via good project management to minimise noise problems arising;
- Noise reduction at source – including choice of machinery, noise enclosures and screens;
- Community relations – consultation and co-operation between the contractor and neighbours; and
- Site factors – such as the existing noise environment, distance between the activity and neighbours, sensitivity of the neighbours (residential / commercial), and duration and hours of working, etc.

If the relevant noise limits of NZS 6803 are met then construction noise can be considered reasonable. In situations when the limits are exceeded and BPO has been adopted and community engagement has taken place to raise awareness, then the resulting noise effects can also be considered reasonable.

Table 4.1: Construction noise limits for residential dwellings - NZS 6803 Table 2

Time of week	Time period	Duration of work					
		Typical duration dB		Short-term duration dB		Long-term duration dB	
		L _{Aeq}	L _{Amax}	L _{Aeq}	L _{Amax}	L _{Aeq}	L _{Amax}
Weekdays	6:30 am – 7:30 am	60	75	65	75	55	75
	7:30 am – 6:00 pm	75	90	80	95	70	85
	6:00 pm – 8:00 pm	70	85	75	90	65	80
	8:00 pm – 6:30 am	45	75	45	75	45	75
Saturdays	6:30 am – 7:30 am	45	75	45	75	45	75
	7:30 am – 6:00 pm	75	90	80	95	70	85
	6:00 pm – 8:00 pm	45	75	45	75	45	75
	8:00 pm – 6:30 am	45	75	45	75	45	75
Sundays and public holidays	6:30 am – 7:30 am	45	75	45	75	45	75
	7:30 am – 6:00 pm	55	85	55	85	55	85
	6:00 pm – 8:00 pm	45	75	45	75	45	75
	8:00 pm – 6:30 am	45	75	45	75	45	75

Table 4.2: Construction noise limits for commercial and industrial buildings - NZS 6803 Table 3

Time period	Typical duration dB	Short-term duration dB	Long-term duration dB
	L _{Aeq}	L _{Aeq}	L _{Aeq}
7:30 am – 6:00 pm	75	80	70
6:00 pm – 7:30 am	80	85	75

4.2 Vibration

There is no New Zealand standard for vibration, however the German Industrial Standard is typically referenced for vibration limits to avoid cosmetic damage to buildings and the British Standard for human perception of vibration within buildings:

- DIN 4150-3:2016 *Effects of vibration on structures* (DIN 4150-3) and
- BS 5228-2:2009 *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (BS 5228-2).

As stated in the Introduction, vibration from construction works is unlikely to be significant when experienced at sensitive sites outside the airport boundary and therefore there is no further consideration of vibration within this CNMP.

5 Noise management

5.1 Project risk rating

All construction activities at Wellington Airport have the potential to generate noise and potentially result in a disturbance to residents and other noise sensitive occupied properties. A noise risk assessment is required to ensure there is a comprehensive assessment of potential adverse effects. Each project will need to be ranked according to the noise risk as follows:

- **Low** – predicted noise levels are not considered to be significant and are below the relevant performance noise standard(s) of NZS 6803
- **High** – predicted noise levels without mitigation are likely to meet or exceed the performance noise standard(s) of NZS 6803.

To make this assessment, each project will need to be screened against the performance standards using a simple setback distance approach (see below and Appendix B).

Two tables are provided at Appendix B. The first table provides unmitigated sound levels at 10 m from typical construction plant that may operate at Wellington Airport. Calculated setback distances in metres are provided for each item of plant to achieve the different NZS 6803 performance standards (day of week and time of day). The second table provides similar information but includes an 8 dB reduction⁸ for screening either from a proprietary noise barrier/screen or from line of sight; typically from buildings, e.g. carpark or terminal buildings.

The overall noise risk for a project should be determined based on the highest risk type of construction activity. If applicable, the cumulative effects of multiple projects / work sites should also be considered.

The risk rating should also consider the duration of the works, a single night will be less disturbing than works which span consecutive nights, and the character of the noise, i.e. whether it is likely to attract attention due to the presence of tonality or impulsivity.

If a project is deemed high risk and involves multiple activities taking place for more than 14 calendar days⁹, then a project specific CNMP should be produced.

Screening assessment	Risk rating
Activities are outside the minimum setback distances and noise is below the relevant performance standard	LOW
Activities are within the minimum setback distances and noise is above the relevant performance standard	HIGH
Night works which span consecutive nights (at least 3) and are required within 100 m of residential (or other sensitive land use) neighbours of the Airport.	HIGH
Night works which may have noticeable audible characteristics but may marginally fall outside the minimum setback distance – examples including pavement grooving or use of impact tools	HIGH
Works involving impact piling, percussive concrete breaking or vibratory compaction within 20 m of a residential/commercial or industrial building.	HIGH

⁸ 8 dB is a typical level of reduction if there is no line of sight between the noise source and the receiving location. If there is partial line of sight then a lower level of reduction such as 3-5 dB is likely.

⁹ To be consistent with the typical and long-term project durations of NS 6803.

5.2 Project-specific CNMPs

The appointed contractor shall prepare and implement a project specific CNMP throughout the entire construction period of the project. The CNMP must describe the measures adopted to seek to meet the NZS 6803 noise limits, where practicable. Where it is not practicable to achieve those performance standards, alternative strategies should be described to address the effects of noise.

The CNMP shall be provided to WIAL for approval prior to commencement of the construction project. The CNMP shall, as a minimum, address the following:

- Description of the works, anticipated equipment/processes and their scheduled durations.
- Hours of operation, including times and days when construction activities causing noise will occur.
- The applicable construction noise performance standards for the project.
- Identification of affected dwellings and other sensitive locations where noise limits apply.
- Mitigation options, including alternative strategies where full compliance with the relevant noise limits cannot be achieved.
- Construction equipment operator training procedures and expected construction site behaviours.
- Methods and frequency for monitoring and reporting on construction noise.
- Procedures for maintaining contact with stakeholders, notifying of proposed construction activities and handling noise complaints.

Where vibration risk is identified, the project CNMP shall also include the following:

- The construction vibration limits for the project.
- Identification of affected dwellings and other sensitive locations where vibration limits apply.
- Methods required to mitigate adverse construction vibration.

5.3 General noise management – airport-wide works

To ensure noise levels are as low as reasonably practicable, all site staff will be made aware of and follow where applicable the following good practice:

- 1 Trucks should enter site without engine brakes and leave site with smooth acceleration and low engine revs.
- 2 When arriving at work, drive slowly on site and keep engine revs to a minimum. Keep stereos off and do not slam vehicle doors.
- 3 Equipment and vehicles should not be left running when not in use.
- 4 Limit vehicle horns to emergency purposes only.
- 5 Where possible, avoid reversing beepers on trucks, opting for flashing lights, broadband alarms or rear sensors where practicable. This is particularly important for any night works to minimise tonal noise.
- 6 All equipment is to be well maintained - simple maintenance can reduce noise levels by as much as 50 %. For example, preventing tracked vehicles from 'squealing' will help to minimise disturbance.
- 7 No shouting on site. Either walk over and talk to somebody or use a radio/phone.
- 8 Be careful with tools and equipment. Place them down and do not drop them.
- 9 Do not slam tailgates of vehicles.

- 10 Do not drag materials on the ground. Place them down when you arrive at the work area.
- 11 When loading and unloading trucks try not to drop material from a height. Load softer material at the bottom.
- 12 If you see anything/anyone making unnecessary noise, then stop it/them. If the source cannot be stopped then report it to the site manager.
- 13 It is essential that good relationships are maintained with local residents. Any queries from members of the public shall be responded to politely and referred to Wellington Airport's point of contact. Staff shall assist the public to contact this person. Staff shall not enter into a debate or argue with members of the public.
- 14 No potentially noisy work will be conducted until all staff involved in the task understands the required noise controls for that task.

5.3.1 Staff training

All site personnel will be made aware of the need to control noise from site activities and any specific noise or vibration mitigation relating to site activities. This can be included in the site induction or toolbox talks. In particular, attention shall be given to the following matters:

- Activities with the potential to generate high levels of noise and/or vibration
- Noise and vibration mitigation and management procedures
- The sensitivity of local properties and any operational requirements and constraints identified through communication and consultation.

5.4 Complaints

Any complaints received shall be recorded by WIAL in the airport's noise complaints register, detailing the complainant, time and date of complaint, and the site activity that the complaint relates to. The action taken will be noted, along with any follow-up actions.

5.5 Noise and vibration monitoring

5.5.1 Noise monitoring

Noise monitoring may be undertaken at locations representative of the nearest noise sensitive properties as follows:

- In response to a reasonable noise complaint
- At the start of any night works to demonstrate BPO is being implemented
- As required by the contractor's site manager / WIAL Airport Planning Manager

Noise monitoring will be in accordance with the requirements of NZS 6803, measured at 1 m from the façade of the most affected building or representative proxy location. The LAeq and LMax levels will be recorded over a representative period as a minimum.

5.5.2 Vibration monitoring

Vibration monitoring is not considered necessary due to the separation distances between vibratory works and sensitive properties. If reasonable complaints are received, then monitoring can be undertaken as part of the response if deemed appropriate.

6 Routine airport maintenance works

6.1 Work types

Regular maintenance works include pavement construction and resurfacing and maintenance of runway and taxiway infrastructure. Depending upon their location, i.e. within active operating areas of the airport, works may need to be undertaken at night during the flight curfew.

Works can include localised repair of surfaces, which can typically be undertaken in one shift, to replacement of larger areas of pavement, which may last a number of days or weeks depending upon the scale of the works and the ability to schedule works around aircraft operations.

To facilitate these routine works, a similar risk based approach as per Section 5.1 of this CNMP has been adopted. This approach is derived from activity noise levels rather than from individual items of plant.

6.2 Risk management

As this work is routine and repetitive in nature, rather than preparing specific CNMPs for each work package, maintenance works are managed as part of this airport-wide CNMP. For works which involve extensive work across large areas of the airport, e.g. runway / taxiway rehabilitation works, then a project specific CNMP will be prepared.

For the purposes of this airport-wide CNMP, pavement maintenance works will typically include:

- Breakout of existing surface
- Excavation and preparation of the subbase
- Milling of the existing surface for larger areas
- Paving of the new surface
- Line markings if needed and final cleaning.

For each activity, different plant will be used. For some works, such as saw cutting and use of breakers, localised noise screens can be used or there may be screening from building structures. For larger items of plant or for mobile activities, such as milling and paving, barriers will not be practicable. Appendix C provides a breakdown of the noise levels for the activities outlined above for unscreened and screened scenarios. This data is summarised in Table 6.1 and Table 6.2 for unscreened and screened noise sources respectively.

The distances quoted are based on indicative plant that would operate either at the same time, e.g. paving and rolling plant, or noise dominant plant which would operate in isolation, e.g. saw cutting. The set back distances can be used to determine whether notification is needed to potentially affected properties¹⁰. For the majority of works, notification is likely for works taking place on:

- Weekdays from 8:00 pm to 6:30 am
- Saturdays from 6:00 pm to 6:30 am
- all day Sundays and public holidays

WIAL's construction working week currently runs from Sunday night (Monday morning) to Thursday night (Friday morning). Night time working on Friday and Saturday night may occur in response to unscheduled works that require urgent remediation.

¹⁰ Notification will normally be undertaken for those occupied properties that are within the set back distances. The Airport Planning Manager may extend the area of notification to include additional properties that adjoin these buffer areas, for example to include a row of buildings on the same street.

The lower daytime and evening noise thresholds of NZS 6803 on Saturdays and Sundays ignore that aircraft operations will likely mask daytime maintenance works. If properties are within the 'after 8pm' set back distances (as highlighted in the tables) then engagement with affected property occupiers should be undertaken.

Table 6.1: Maintenance activity sound levels and set back distances – not screened

Activity	Lp @ 10m dB	Set back distance to NZS 6803 threshold (LAeq) / m						
		80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
Sawcut/Breakout Removal	87	20	25	40	65	100	160	400
Excavation & Prep	76	5	10	20	25	35	60	145
Milling	83	15	25	25	40	65	105	265
Paving	81	10	20	20	35	55	85	220
Line marking	77	5	15	25	25	40	65	160

Table 6.2: Maintenance activity sound levels and set back distances – screened (where practicable)

Activity	Lp @ 10m dB	Set back distance to NZS 6803 threshold (LAeq) / m						
		80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
Sawcut/Breakout Removal	79	10	15	20	30	50	75	190
Excavation & Prep	74	5	10	15	20	30	50	120
Milling	83	15	25	25	40	65	105	265
Paving	81	10	20	20	35	55	85	220
Line marking	77	5	15	25	25	40	65	160

As mentioned previously, maintenance may involve unscheduled works which, due to operational needs, may have to be undertaken at short notice. In these situations WIAL will endeavour to contact homeowners prior to works. The most practicable method in these situations is to provide timely notification via electronic means either by email or via WIAL's website.

The next section outlines WIAL's approach to engagement / notification. Community engagement should be a priority for all works which fall within the scope of this CNMP; providing advanced notice of works and the adoption of BPO will likely result in minimal disturbance effects.

7 Community engagement

7.1 Engagement

Effective stakeholder engagement is a critical part of managing construction noise. Stakeholder engagement can have a greater bearing on acceptance of the works and complaints than the actual noise levels. Neighbours who understand what, when and why the works are happening are often able to adjust their activities accordingly and are generally more tolerant of construction noise.

Stakeholder engagement for construction noise should be integrated with the wider project requirements. Engagement measures include:

- Updating the WIAL website¹¹ with a list of works both current and planned.
- Prior notification of the high risk works via directed email/letterbox drops or supplemented by other means (news article, website etc) to affected neighbours. The email/letterbox drop will provide contact details and will detail the overall nature and expected duration of the works.

In general, neighbours should be informed at least one week before construction work starts and any local issues/requirements should be identified. For larger projects, stakeholder engagement should commence during the planning and mobilisation phases.

Information provided should include the:

- Reason for the works
- Reason for the construction methodology proposed
- Overall timeframe and timing of specific noisy or vibration producing activities
- Reason for any night or weekend works
- Expected noise and/or vibration effects
- Point of contact including name and the air noise phone number - 0508 AIRNOISE (0508 247 664)

Occasionally unscheduled works may need to be undertaken for emergency repairs/maintenance. In these situations WIAL will use best endeavours to provide advanced warning if works are to occur at night. In this situation electronic means of notification are appropriate.

7.2 Responsibilities

WIAL, in conjunction with its contractors, will be responsible for ensuring that the relevant management plan(s) are correctly implemented. They will review all documentation relating to construction noise and vibration before it is issued.

If required, specific training will be provided for site personnel.

The contractor for each project shall carry out a screening exercise using this CNMP to determine if the works are considered high risk. If required the contractor will then:

- Prepare and implement a project specific CNMP
- Engage an acoustic specialist if complex noise calculations are required
- Monitor at the beginning of the project and when methodology or plant changes.

¹¹ <https://www.wellingtonairport.co.nz/noise/construction-noise/>

- Liaison with the WIAL project manager on any complaints received and undertake investigation and reporting on complaints as required by the WIAL Project Manager/ Airport Planner.
- Ensure all staff including subcontractors participate in an induction training session on the CNMP, including:
 - team roles and responsibilities for management of noise matters
 - noise mitigation and management procedures
 - sensitivity of neighbouring properties to noise and any operational requirements or constraints identified through communication and consultation
 - complaints management procedure

Awareness of current noise matters on, or near active worksites, will be addressed during site meetings and/or toolbox training sessions

7.3 WIAL Project Manager / Airport Planning Manager

- Identify and communicate across project teams actual/potential concurrent projects
- Undertake consultation with the community, particularly potentially affected residents and businesses prior to works being undertaken.
- Direct the contractor to undertake investigations, monitoring and methodology changes if required in light of monitoring results of complaints.

8 Applicability

This report has been prepared for the exclusive use of our client Wellington International Airport Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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Appendix A Glossary

Term	Definition
dB	A unit of measurement on a logarithmic scale which describes the magnitude of sound pressure with respect to a reference value (20 μ Pa)
$L_{Aeq(t)}$	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB)
L_{Amax}	The maximum A-weighted sound pressure, measured in units of decibels (dB)
PPV	Peak particle velocity. This is the instantaneous maximum velocity reached by the vibrating surface as it oscillates about its normal position
Noise	Unwanted sound

Every 10 dB increase in sound level doubles the perceived noise level. A sound of 70 dB is twice as loud as a sound level of 60 dB and a sound level of 80 dB is four times louder than a sound level of 60 dB. An increase or decrease in sound level of 3 dB or more is perceptible. A change in sound level of less than 3 dB is not usually discernible.

As sound level is measured on a logarithmic scale, the following table provides examples of typical sources of noise.

Decibel (dB)	Example
0	Hearing threshold
20	Still night-time
30	Library
40	Typical office room with no talking
50	Heat pump running in living room
60	Conversational speech
70	10 m from edge of busy urban road
80	10 m from large diesel truck
90	Lawn mower - petrol
100	Riding a motorcycle at 80 kph
110	Rock band at a concert
120	Emergency vehicle siren
140	Threshold of permanent hearing damage

Appendix B Construction activities

These tables provide an inventory of activities/plant, sound power and sound pressure level and the distance at which the NZS 6803 noise thresholds are met.

Appendix B Table 1: Equipment sound levels and set back distances – not screened

Plant	Lw	Lp @ 10m	Set back distance to NZS 6803 threshold (LAeq) / m						
			80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
2.5m Rotomill	111	83	15	15	30	45	70	110	275
Bobcat	104	76	5	10	20	25	35	60	145
Compressor	101	73	5	10	15	15	30	45	110
Concrete pump	103	75	5	10	20	20	35	50	130
Crane 25T	99	71	5	5	10	20	25	35	90
Dozer D61 18t	118	90	20	35	50	85	130	210	525
Drill Rig	111	83	15	15	30	45	70	110	275
Drop hammer 16T	124	96	35	60	90	145	230	365	910
Dumper 30T	108	80	10	20	20	35	50	85	210
Emulsion sprayer	97	69	5	5	10	15	20	30	75
Excavator 10T	94	66	0	5	5	10	20	25	60
Excavator 12T	94	66	0	5	5	10	20	25	60
Excavator 13T	94	66	0	5	5	10	20	25	60
Excavator 15t	96	68	5	5	10	15	15	30	70
Excavator 23t	102	74	5	10	15	20	30	50	120
Excavator 40T	115	87	20	25	40	65	100	160	400
Excavator 6t	92	64	0	5	5	10	15	20	50
Excavator Long Reach	115	87	20	25	40	65	100	160	400
Grader 110kW	110	82	15	20	25	40	65	100	250
Grader 13T	110	82	15	20	25	40	65	100	250
Impact wrench	104	76	5	10	20	25	35	60	145
Jackhammer	108	80	10	20	20	35	50	85	210
Line marking plant	104	76	5	10	20	25	35	60	145
Loader 10T	104	76	5	10	20	25	35	60	145
Loader 25T	112	84	15	20	30	50	75	120	300
Loader 5T	96	68	5	5	10	15	15	30	70
Paver	104	76	5	10	20	25	35	60	145
Road sweeper	98	70	5	5	10	20	20	35	85
Roller 12T Smooth	110	82	15	20	25	40	65	100	250
Saw cutter	121	93	30	45	70	110	175	275	690
Suction sweeper	105	77	5	15	20	25	40	65	160
Trench rammer	106	78	10	15	15	30	45	70	175

Truck 6-Wheeler	106	78	10	15	15	30	45	70	175
Trucks	99	71	5	5	10	20	25	35	90
Ute	98	70	5	5	10	20	20	35	85
Vac Truck	100	72	5	5	15	20	25	40	100
Vibratory plate	108	80	10	20	20	35	50	85	210
Vibro 5T	115	87	20	25	40	65	100	160	400
Water Cart	94	66	0	5	5	10	20	25	60
Water Pump	92	64	0	5	5	10	15	20	50
Water tanker	98	70	5	5	10	20	20	35	85
Welder	90	62	0	0	5	5	15	20	40

Appendix B Table 2: Equipment sound levels and set back distances – screened

Plant	Lw	Lp @ 10m	Set back distance to NZS 6803 threshold (LAeq) / m						
			80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
2.5m Rotomill	111	83	5	10	20	20	35	50	130
Bobcat	104	76	5	5	10	15	15	30	70
Compressor	101	73	0	5	5	10	20	20	50
Concrete pump	103	75	0	5	5	15	20	25	65
Crane 25T	99	71	0	5	5	10	15	15	45
Dozer D61 18t	118	90	15	20	25	40	65	100	250
Drill Rig	111	83	5	10	20	20	35	50	130
Drop hammer 16T	124	96	15	30	45	70	110	175	435
Dumper 30T	108	80	5	5	15	20	25	40	100
Emulsion sprayer	97	69	0	0	5	5	10	20	35
Excavator 10T	94	66	0	0	5	5	10	15	30
Excavator 12T	94	66	0	0	5	5	10	15	30
Excavator 13T	94	66	0	0	5	5	10	15	30
Excavator 15t	96	68	0	0	5	5	10	20	35
Excavator 23t	102	74	0	5	5	10	20	25	60
Excavator 40T	115	87	10	15	20	30	50	75	190
Excavator 6t	92	64	0	0	0	5	5	10	25
Excavator Long Reach	115	87	10	15	20	30	50	75	190
Grader 110kW	110	82	5	10	15	20	30	50	120
Grader 13T	110	82	5	10	15	20	30	50	120
Impact wrench	104	76	5	5	10	15	15	30	70
Jackhammer	108	80	5	5	15	20	25	40	100
Line marking plant	104	76	5	5	10	15	15	30	70
Loader 10T	104	76	5	5	10	15	15	30	70
Loader 25T	112	84	5	10	20	25	35	60	145

Loader 5T	96	68	0	0	5	5	10	20	35
Paver	104	76	5	5	10	15	15	30	70
Road sweeper	98	70	0	0	5	5	15	20	40
Roller 12T Smooth	110	82	5	10	15	20	30	50	120
Saw cutter	121	93	20	20	35	50	85	130	330
Suction sweeper	105	77	5	5	10	15	20	30	75
Trench rammer	106	78	5	5	10	20	20	35	85
Truck 6-Wheeler	106	78	5	5	10	20	20	35	85
Trucks	99	71	0	5	5	10	15	15	45
Ute	98	70	0	0	5	5	15	20	40
Vac Truck	100	72	0	5	5	10	15	20	50
Vibratory plate	108	80	5	5	15	20	25	40	100
Vibro 5T	115	87	10	15	20	30	50	75	190
Water Cart	94	66	0	0	5	5	10	15	30
Water Pump	92	64	0	0	0	5	5	10	25
Water tanker	98	70	0	0	5	5	15	20	40
Welder	90	62	0	0	0	5	5	10	20

Appendix C Maintenance works

Appendix C Table 1: Maintenance activity sound levels and set back distances – not screened

Activity	Lp @ 10m	Set back distance to NZS 6803 threshold (LAeq) / m						
		80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
Sawcut/Breakout removal	87	20	35	55	85	130	210	525
• Roadsaw for AC cutting	87	20	25	40	65	100	160	400
• Handsaw for concrete cutting	85	20	20	35	50	85	130	330
• Slurry vacuum	78	10	15	15	30	45	70	175
• 5T excavator rubber tracked	72	5	5	15	20	25	40	100
• Handheld breaker	80	10	20	20	35	50	85	210
• 4.5m ³ Tip Truck	70	5	5	10	20	20	35	85
Excavation & prep	76	10	15	20	30	50	80	200
• 5T Excavator rubber tracked	72	5	5	15	20	25	40	100
• 4.5m ³ Tip Truck	68	5	5	10	15	15	30	70
• 450kg Reversible Plate	76	5	10	20	25	35	60	145
• 88kg Trench Rammer	74	5	10	15	20	30	50	120
Milling	83	20	25	40	65	100	160	400
• Rotomill - 1.3m 19 ton	82	15	20	25	40	65	100	250
• Bobcat with broom attachment	74	5	10	15	20	30	50	120
• Tipper trucks 7m ³	68	5	5	10	15	15	30	70
• Concrete saw	85	20	20	35	50	85	130	330
Paving	81	10	20	20	35	55	90	225
• Paver 1.7m - 3.4m 14 ton	77	5	15	20	25	40	65	160
• Roller twin steel 10 ton	72	5	5	15	20	25	40	100
• Roller 5 ton	72	5	5	15	20	25	40	100
• PTR 12 ton	74	5	10	15	20	30	50	120
• Tipper trucks 7m ³	68	5	5	10	15	15	30	70
• Spray truck 10 ton load	64	0	5	5	10	15	20	50
• Water cart 10 ton	64	0	5	5	10	15	20	50
Line marking	77	10	15	20	30	50	80	200
• Ute	70	5	5	10	20	20	35	85
• Flatbed truck	72	5	5	15	20	25	40	100
• truck (mobile)	71	5	5	10	20	25	35	90
• Line marking plant	76	5	10	20	25	35	60	145
• Road sweeper	70	5	5	10	20	20	35	85

Note – equipment may differ depending on project details and contractor

Appendix C Table 2: Maintenance activity sound levels and set back distances – – screened (where practicable)

Activity	Lp @ 10m	Set back distance to NZS 6803 threshold (LAeq) / m						
		80 dB	75 dB	70 dB	65 dB	60 dB	55 dB	45 dB
Sawcut/Breakout removal	79	10	15	20	30	50	75	190
• Roadsaw for AC cutting	79	10	15	20	30	50	75	190
• Handsaw for concrete cutting	77	5	15	20	25	40	65	160
• Slurry vacuum	78	10	15	15	30	45	70	175
• 5T excavator rubber tracked	72	5	5	15	20	25	40	100
• Handheld breaker	75	5	10	20	20	35	50	130
• 4.5m ³ Tip Truck	70	5	5	10	20	20	35	85
Excavation & prep	74	5	10	15	20	30	50	120
• 5T Excavator rubber tracked	72	5	5	15	20	25	40	100
• 4.5m ³ Tip Truck	68	5	5	10	15	15	30	70
• 450kg Reversible Plate	71	5	5	10	20	25	35	90
• 88kg Trench Rammer	74	5	10	15	20	30	50	120
Milling	83	15	25	25	40	65	105	265
• Rotomill - 1.3m 19 ton	82	15	20	25	40	65	100	250
• Bobcat with broom attachment	74	5	10	15	20	30	50	120
• Tipper trucks 7m ³	68	5	5	10	15	15	30	70
• Concrete saw	77	5	15	20	25	40	65	160
Paving	81	10	20	20	35	55	85	220
• Paver 1.7m - 3.4m 14 ton	77	5	15	20	25	40	65	160
• Roller twin steel 10 ton	72	5	5	15	20	25	40	100
• Roller 5 ton	72	5	5	15	20	25	40	100
• PTR 12 ton	74	5	10	15	20	30	50	120
• Tipper trucks 7m ³	68	5	5	10	15	15	30	70
• Spray truck 10 ton load	64	0	5	5	10	15	20	50
• Water cart 10 ton	64	0	5	5	10	15	20	50
Line marking	77	5	15	25	25	40	65	160
• Ute	70	5	5	10	20	20	35	85
• Flatbed truck	72	5	5	15	20	25	40	100
• truck (mobile)	71	5	5	10	20	25	35	90
• Line marking plant	76	5	10	20	25	35	60	145
• Road sweeper	70	5	5	10	20	20	35	85

Note – equipment may differ depending on project details and contractor

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