MARSHALL DAY Acoustics

THE NATIONAL FALE MALAE

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Rp 002 20220330 | 27 May 2025

MARSHALL DAY Acoustics

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Project: **THE NATIONAL FALE MALAE**

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SUMMARY

We have been requested by Urban Perspectives, on behalf of Fale Malae Trust, to prepare an assessment of construction noise and vibration effects for the proposed construction of a Fale on Wellington Waterfront.

Following submission of the Resource Consent Application, Wellington City Council (WCC) issued a Request for Further Information which included an assessment of noise and vibration effects from construction activities.

At this stage, a final construction methodology has yet to be determined. However, the structural engineer has confirmed the piling methodology. Where we have not been provided information, we have assumed the activities to be carried out based on our experience with similar projects.

We have assumed that construction works will consist of three main stages: site preparation, piling/foundations, and structure/façade. We have predicted that the guideline noise limits in NZS 6803:1999 would be exceeded during the project works at four of the receivers closest to the subject site, for at least one stage of works. This is predominantly due to piling activities.

During construction, the expected noise effect during piling operations would be up to '*annoyance for some occupants and personal conversations would require a slightly raised voice*' at one location (WCC Offices). This is based on predicted internal noise levels and no use of noise mitigation measures.

We predict vibration from construction activities would comply with the applicable vibration limits, and therefore, no risk of cosmetic building damage is expected.

We recommend implementing a construction noise and vibration management plan (CNVMP) during the project works. The CNVMP will ensure that construction noise and vibration emissions are no higher than necessary. It will be key to minimising any potential construction noise and vibration effects at the closest sensitive receivers.

The CNVMP should include mitigation and management measures, guidance for communication with nearby receivers, and details relating to any monitoring surveys that may be required.

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1.0 INTRODUCTION

The Fale Malae Trust is seeking Resource Consent to construct a Fale within Frank Kitts Park on Wellington Waterfront. The planner for the project is Urban Perspectives.

Following submission of the Resource Consent Application, Wellington City Council (WCC) issued a Request for an assessment of construction impacts which includes acoustic items (noise and vibration).

This report addresses noise and vibration from activities associated with the construction of the Fale only. We have been advised by Urban Perspectives that demolition of the existing car park on the site would be under a separate (WCC) consent application. Therefore, this report does not include an assessment of noise and vibration from demolition activities.

As the proposal is in the initial stages, we have made assumptions on construction methodologies for this type of development.

Appendix A provides a glossary of acoustic terminology used in this report.

2.0 SURROUNDING ENVIRONMENT AND RECEIVERS

The subject site is located within the southern portion of Frank Kitts Park. The Fale would be constructed in the area which is currently occupied by a car park. Following demolition of the car park, construction of the Fale would commence.

The proposed Fale is bounded by Jervois Quay (west), Whairepo Lagoon (south), and the remainder of Frank Kitts Parth (north and east).

Under the Wellington City 2024 District Plan (the 'District Plan'), the underlying zoning of the site is *Special Purpose Waterfront Zone* as are the immediate surrounds. Across Jervois Quay to the west are sites zoned *City Centre Zone*.

Sites potentially affected by noise and vibration from construction activities include the following:

- TSB Arena/Shed 6 to the north
- Wellington Rowing Club and the Wharewaka Function Centre to the south
- Commercial properties to the west

Appendix B shows

- An aerial view identifying the Fale location
- The closest noise and vibration sensitive locations considered in this assessment, and
- The proposed development and site layout

Other sites in the area may be affected by construction noise and vibration. However, the levels would be lower due to increased propagation distances and shielding from existing structure.

We note that some of the assessment locations are currently unoccupied and as such, the performance standards would not apply (Section 5.1). However, these may be occupied once construction commences. Therefore, we have considered them as potentially affected within our assessment.

3.0 ACTIVITY DESCRIPTION

As noted previously, this assessment applies to potential noise and vibration effects from construction only and excludes demolition works.

At this stage, we are not aware of a contractor being appointed and therefore, final construction methodologies are not available. Based on the type of proposal, the information received to date,

and our experience with similar projects, we expect the following main stages of construction works would be required. For each stage, we have identified the highest noise generating activities.

1. Site preparation: Expected to be minimal, but may be some excavation, loaders, roller and/or other compaction, and truck movements
2. Piling[1]/foundations: Large diameter bored piles (vibratory driven), sheet piling, concrete pours, and trucks movements
3. Structure/façade works: Cranes, hand tools, concrete pours, and trucks movements

Trucks are assumed to access the site using Jervois Quay.

We have carried out our assessment of construction noise and vibration emissions by:

- Adopting methodologies that have been used on similar projects
- Modelling worst-case construction noise levels at nearby receivers
- Prediction of vibration levels from high vibration generating activities

We have assumed that the site working hours would be from 7.30am to 6pm, Monday to Saturday (excluding public holidays). Intention to work outside of these hours may warrant a further assessment as more stringent noise limits would apply.

4.0 RESOURCE MANAGEMENT ACT

Regardless of compliance with any noise or vibration limits, the overarching requirement for the construction of the Fale is to satisfy Section 16 of the Resource Management Act (s16).

s16 states that an activity shall adopt the best practicable option (BPO) to ensure that the emission of noise does not exceed a reasonable level. Within the RMA the definition of noise includes vibration. s16 of the RMA also states that there is a duty to avoid, remedy, or mitigate any adverse effect on the environment

5.0 NOISE

5.1 Noise Performance Standards

Rule NOISE-R2 of the District Plan states for an activity to be Permitted, then compliance is required with NOISE-S2 (Construction Activities). In respect of noise, NOISE-S2.1 states:

> *"The noise from any construction, maintenance, earthworks and demolition activities must be measured, assessed, managed and controlled in accordance with the requirements of NZS6803:1999 Acoustics Construction Noise".*

Rule NOISE-R2 also states that construction activities must occur between 7.30am and 6.00pm Monday to Saturday (the 'site working hours').

External Noise Levels

We have used New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*" (NZS 6803:1999) in accordance with the District Plan to determine guideline noise limits that apply to the construction activities. We note that the wording of the District Plan does not require compliance with these noise limits, only that an assessment is required.

Construction work would likely be in excess of 20 weeks. Therefore, we have applied the long-term duration noise limits of NZS 6803:1999.

[1] Piling methodology confirmed by structural engineer

Full details of the guideline noise limits are included as Appendix C.

In summary, the relevant guideline noise limits for all nearby receivers are **70 dB L_{Aeq} and 85 dB L_{Aeq}** during site working hours.

The noise limits apply at 1 metre outside the façades of buildings, and only when they are occupied.

Internal Noise Levels

NOISE-R2 does not require an internal noise assessment. However, we have carried out a further assessment on occupants to estimate the potential indoor noise effects of construction noise where the external construction noise infringes the noise limits.

The noise level received inside a sensitive space (e.g. a office) will depend on the external noise level, the façade performance (particularly the glazing) and the acoustics of the room.

NZS 6803:1999 states that, where it is not possible to measure at 1 metre from the façade, an internal assessment can be done instead assuming a façade sound level difference of 20 decibels. For commercial buildings which have a sealed façade, the façade sound level difference from outside to inside would be closer to 30 decibels.

The responses of building occupants vary, but with effective prior engagement, can be summarised as follows:

- < 45 dB L_{Aeq} — Noticeable, but unlikely to interfere with daily activities
- 45 – 50 dB L_{Aeq} — Typically acceptable, but concentration and communication would begin to be affected
- 50 – 55 dB L_{Aeq} — Annoyance for some occupants and personal conversations would require a slightly raised voice
- 55 – 60 dB L_{Aeq} — Generally unacceptable and occupants would actively seek respite for any extended periods
- > 60 dB L_{Aeq} — Unacceptable if sustained for extended periods

5.2 Predicted Noise Levels

Table 1 shows the sound power levels of activities/equipment assumed to likely be required to construct the Fale, including setback distances at which the risk of infringing the guideline noise limits begin with no mitigation implemented.

The sound power levels are sourced from British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites, Part 1: Noise*, and from measurements of similar equipment, carried out by us.

Table 1: Indicative noise levels at 1m from a building facade[2] with no mitigation or screening from buildings

Equipment/Activity	Construction Stage	Sound Power Level (dB L_{WA})	Noise Level (dB L_{Aeq})			70 dB L_{Aeq} setback distance (m)
			10 m	20 m	50 m	
Excavators (20T)	Site prep.	103	78	72	63	25
Roller	Site prep.	103	78	72	63	25
Loader	Site prep.	103	78	72	63	25
Bored Piling (large rig)	Piling/Foundations	111	86	80	71	50

[2] In accordance with the requirements of NZS 6803:1999, inclusive of 3 decibels façade reflection

Equipment/Activity	Construction Stage	Sound Power Level (dB L_{WA})	Noise Level (dB L_{Aeq})			70 dB L_{Aeq} setback distance (m)
			10 m	20 m	50 m	
Sheet Piling	Piling/Foundations	116	91	85	76	85
Concrete Truck/Pump	Piling/Foundations, Structure/Façade	103	78	72	63	25
Mobile Crane	Structure/Façade	98	73	67	58	15
Angle Grinding	Structure/Façade	108	83	77	68	40
Hammering	Structure/Façade	107	82	76	67	35
Electric Sawing	Structure/Façade	105	80	74	65	30
Nail Gun	Structure/Façade	101	76	70	61	20
Truck movements	All stages	106	81	75	66	33

Appendix D provides our worst-case predicted construction noise levels at specific receivers within assessment sites. Our worst-case scenario assumes all activities within each stage operating simultaneously. For the majority of the project, the worst-case scenario would not occur and when it does, it would be for a limited time and only when all noisy plant is operating.

For the piling/foundations stage, we have considered the sheet piling and bored piling separately, as these are unlikely to occur concurrently.

We predict that without mitigation, construction noise levels would, at times, be higher than the noise limits of NZS 6803:1999 at four of the assessment locations. This is not unusual for construction works in a city environment.

5.3 Construction Noise Effects

Table 2 summarises our internal noise level predictions and effects assessment at receivers where we predict construction noise levels infringe the guideline construction noise limits for at least one stage (see Appendix D). These are the worst-case potential noise effects because they are based on our worst-case construction scenario.

We have predicted the internal noise levels by assuming an outside-to-inside façade reduction of 30 dB for all assessment locations, excluding the rowing club where we have applied 20 dB due to the age of the building and likely lower comparative sound insulation performance.

The cells in Table 2 have been highlighted with the colour corresponding to the potential internal noise effects as summarised in Section 5.2.

Table 2: Predicted internal noise levels

Building	Predicted noise levels (dB L_{Aeq})			
	Site Preparation	Piling/Foundations		Structure/Façade
		Sheet Piling	Bored Piling	
Pencarrow House	< 45	45 - 50	< 45	< 45
WCC Offices[1]	< 45	50 - 55	45 - 50	45 - 50
Wellington Rowing Club[2]	< 45	50 - 55	45 - 50	45 - 50
City Gallery[1]	< 45	< 45	< 45	< 45

[1] Building currently fully or partially unoccupied. However, may be occupied once works comments
[2] 20 dB outside to inside reduction applied. All others 30 dB

We note that the effects are representative of sustained noise, and only apply to individuals within a building i.e., if a building is unoccupied, there would be no noise effect.

Our assessment has shown that for sheet piling (if required), then annoyance for some occupants may occur at the WCC Offices and the Wellington Rowing Club. For all other stages, internal noise levels are expected to be typically acceptable.

The potential noise effects arising from the construction works can be best managed using adequate communication with noise sensitive receivers. Implementation of a CNVMP would allow for such communication and would enable the management of noise emissions to be reasonable and assist with meeting Section 16 (s16) of the Resource Management Act (RMA).

6.0 CONSTRUCTION VIBRATION

6.1 Vibration Performance Standards

Construction vibration must be measured and assessed in accordance with DIN 4150-3:2016 as per District Plan Standard NOISE-S2.1. The limits are for avoiding cosmetic building damage, such as cracking in paint or plasterwork. The Standard states:

> *"Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur."*

For the proposal, we've applied the long-term vibration limits (DIN 4150-3:2016 Table 4) as a conservative approach. For all buildings within assessment sites, the vibration limit is 10 mm/s PPV (commercial buildings).

Appendix E provides further information about DIN 4150-3.

6.2 Predicted Construction Vibration Levels

Table 3 shows the setback distances at which the risk of cosmetic building damage begins for the high vibration activities we have assumed to be required for the proposed works. Our predicted setback distances contain a 100% safety factor as a conservative approach to manage risk.

For completeness, within Table 3, we have also included setback distances to meet the limit of 5mm/s applicable to residential buildings.

Table 3: Predicted vibration setback distances from construction activities to building foundations

Equipment/Activity	Cosmetic building damage setback distance for PPV (m)	
	10 mm/s*	5 mm/s
Sheet Piling	4	11
Bored piling (vibratory driven)	6	3

* Applicable limit at surrounding buildings

As the nearest building (WCC Offices) is at least 30 metres from the site, compliance with the DIN 4150-3 limits is predicted.

7.0 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

The most effective way of managing noise and vibration from the site so that it is no louder than necessary would be to prepare and implement a CNVMP. The overarching intent of a CNVMP is to fulfil the requirements of s16 of the RMA.

While compliance with the guidelines limits is typically not possible to achieve with construction works in a city environment at all times, a CNVMP would provide project-specific mitigation, management, and contingency measures to enable the minimisation of any potential noise effects. It could also provide guidance on monitoring, complaints response, and staff training procedures.

We recommend a CNVMP is prepared by a suitably qualified person and submitted to Council for approval at least 10 working days before construction commences.

Appendix F shows high-level descriptions of items to be included in the CNVMP.

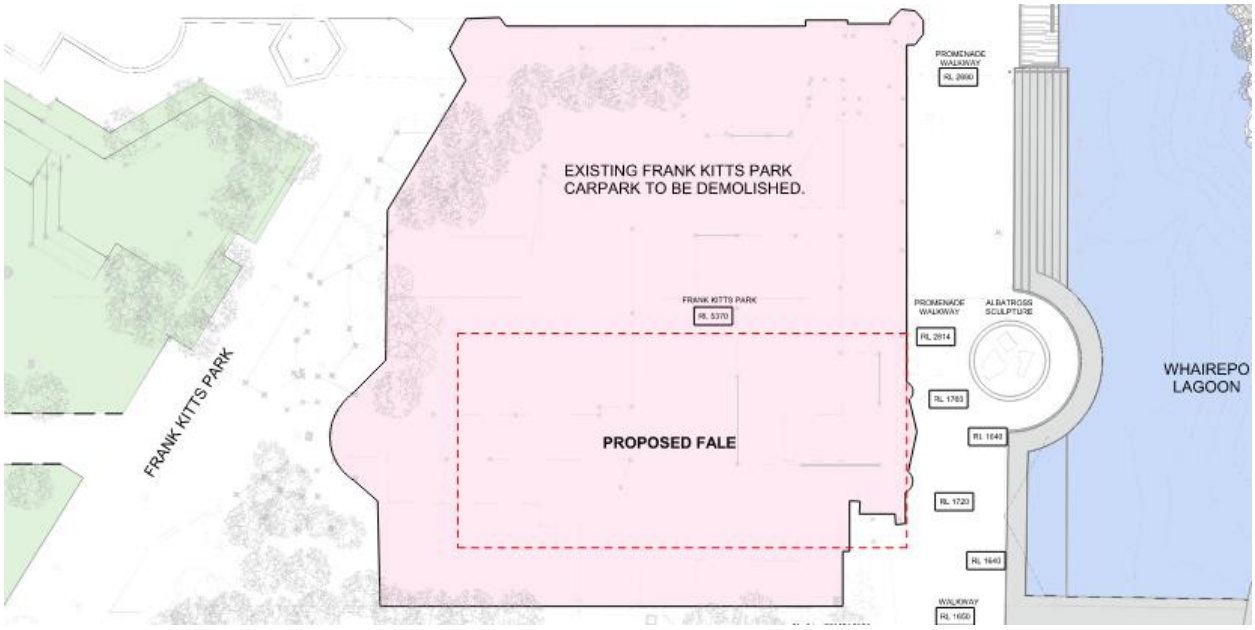
APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dB or dB(A).
dB	Decibel. The unit of sound level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in I.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time–weighting i.e. L_{Afmax}
L_w	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA}.
PPV	Peak Particle Velocity. The measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.
Vibration	When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity. Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).

APPENDIX B SITE AND SURROUNDING ENVIRONMENT

B1 Subject site and surrounds. Buildings in blue are considered as potentially affected receivers for this assessment *[base image: WCC District Plan]*

B2 Site Plan *[base image: Jasmax drawing RC-015]*



APPENDIX C CONSTRUCTION NOISE LIMITS

Standard NOISE-S2.1 in the Wellington City 2024 District Plan states the maximum permitted noise and vibration levels for construction activities and is reproduced below:

> "*The noise from any construction, maintenance, earthworks, and demolition activities must be measured, assessed, managed and controlled in accordance with the requirements of NZS6803:1999 Acoustics Construction Noise.*
>
> *Noise due to the following activities shall be exempted from compliance:*
>
> 1. *Urgent repair of utilities to maintain continuity of service, to protect life or limb or minimise or prevent loss of serious damage to property.*
> 2. *In the City Centre Zone, where the best practicable option to reduce noise to a reasonable level requires construction work to be undertaken outside normal working hours.*
>
> *The vibration from any construction, maintenance, earthworks and demolition activities must be measured, assessed, managed and controlled in accordance with the requirements of DIN 4150-3:2016 Structural Vibration – Part 3: Effects of Vibration on Structures.*"

The noise limits of NZS 6803:1999 depend on the duration of construction works. Construction projects which are of a shorter duration have a higher allowable noise limit than those of a longer duration. The long-term duration limits apply for this project.

The noise limits from NZS 6803:1999 for long-term duration construction projects are shown in Table C1 and Table C2, excluding Sunday and public holidays.

C1 Construction noise levels for activities sensitive to noise (e.g. occupied dwellings)

		Long-term duration[3]	
Time of week	**Time period**	**dB L_{Aeq}**	**dB L_{AFmax}**
Weekdays	0630 – 0730	55	75
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	45	75
Saturdays	0630 – 0730	45	75
	0730 – 1800	70	85
	1800 – 2000	45	75
	2000 – 0630	45	75

C2 Construction noise levels for noise affecting any other activity (e.g. occupied commercial building)

		Long-term duration
Time of week	**Time period**	**dB L_{Aeq}**
All days	0730 – 1800	70
	1800 – 0730	75

[3] Construction work at any one location with a duration exceeding 20 weeks

APPENDIX D PREDICTED RECEIVED CONSTRUCTION NOISE LEVELS WITHOUT MITIGATION

Table D1 summarises the predicted noise levels of construction activities received at nearby receivers without mitigation measures or site hoarding implemented. Expected infringements of the guideline noise limits are indicated by the red highlight.

The noise levels modelled are a worst case-scenario, i.e. when all activities within each stages are operating simultaneously. For the majority of the project, the worst-case scenario would not occur and when it does, it would be for a limited time and only when all noisy plant is operating.

D1 Predicted noise levels from construction without mitigation measures

Building	Predicted noise levels (dB L_{Aeq})			
	Site Preparation	Piling/Foundations		Structure/Façade
		Sheet Piling	Bored Piling	
Shed 6	55 - 60	65 - 70	60 - 65	55 - 60
TSB Arena	60 - 65	65 - 70	65 - 70	60 - 65
Westpac Building	60 - 65	65 - 70	60 - 65	60 - 65
Pencarrow House	65 - 70	75 - 80	70 - 75	70 - 75
WCC Offices	70 - 75	80 - 85	75 - 80	75 - 80
Michael Fowler Centre	55 - 60	60 - 65	60 - 65	55 - 60
Wharewaka	55 - 60	65 - 70	60 - 65	60 - 65
Wellington Rowing Club	60 - 65	70 - 75	65 - 70	65 - 70
City Gallery	60 - 65	70 - 75	65 - 70	65 - 70

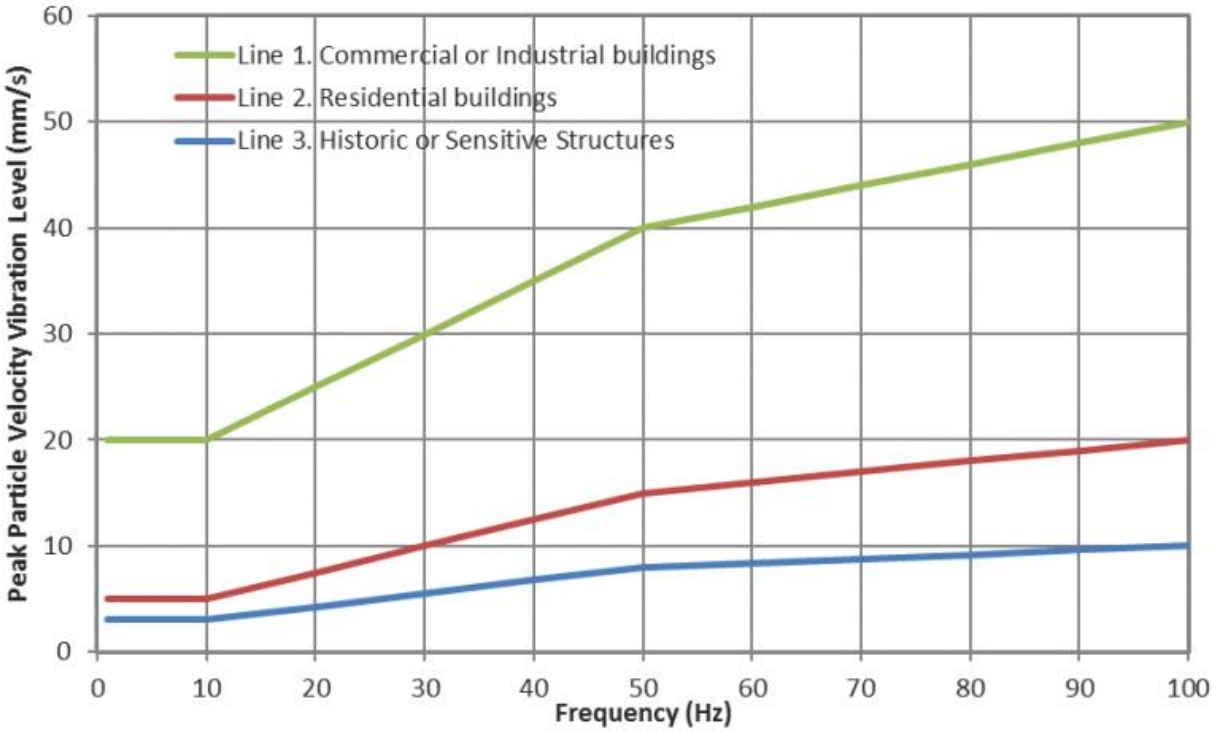
APPENDIX E CONSTRUCTION VIBRATION LIMITS

DIN 4150-3:2016 limits are for avoiding cosmetic building damages, such as cracking in paint or plasterwork. Cosmetic building damage effects are deemed 'minor damage' in the Standard and can generally be easily repaired. The Standard states: "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur.*" Much higher vibration levels (i.e. an order of magnitude higher) would be needed for potential structural damage.

The short-term (transient) vibration limits from DIN 4150-3:2016 are shown in Figure E1 and apply at building foundations in any axis.

The long-term (continuous) vibration limits from DIN 4150-3:2016 are shown in Table E2 Error! Reference source not found.and apply at all floor levels, but levels are normally highest in horizontal axes on the top floor.

E1 Short-term (transient) vibration at building foundations (source: DIN 4150-3:2016: Fig. 1)



E2 Vibration limits at horizontal plane of highest floor (DIN 4150-3:2016: Tables 1 and 4)

	Peak Particle Velocity Vibration Level (mm/s)	
Building Type	**Short-term (transient)[4]**	**Long-term (continuous)[5]**
Line 1. Commercial or industrial	40	10
Line 2. Residential	15	5
Line 3. Vibration sensitive	8	2.5

DIN 4150-3:2016 states that Line 3 should be used for buildings "*that, because of their particular sensitivity to vibration, cannot be classified under Lines 1 and 2 and are of great intrinsic value (e.g. listed building)*".

[4] Short-term (transient) vibration is "*vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated*"

[5] Long-term (continuous) vibration includes types not covered by the short-term vibration definition

APPENDIX F CNVMP CONTENTS

The CNVMP should include (but not be limited to) details regarding:

- Community liaison and engagement outcomes
  - Letter drops and/or newsletters containing information about upcoming works relevant to construction noise/vibration
  - Scheduling and timing agreements made with engaged receivers
  - Actions to take following the reception of any complaints
- Physical noise and vibration mitigation measures
- Construction noise and vibration monitoring
  - Monitoring would provide the contractor with information regarding construction methodologies; the identification of any processes that are unnecessarily noisy and/or high vibration; confidence to potentially affected receivers that their concerns are being addressed; and assessments of compliance with the relevant limits
  - Vibration monitoring may be necessary to ensure that the cosmetic building damage vibration limits are being complied with at all times
- Contingency measures including, but not limited to, scheduling of activities to mutually agreed times, the review of methodologies, mitigation measures, and management strategies to ensure they represent the BPO
- Staff training
- Building condition surveys for where there is risk of cosmetic building damage due to construction vibration