ACOUSTICS AND AIR

EDMONDSON PARK FRASERS TOWN CENTRE BULK EARTHWORKS AND SERVICES REMOVAL

CONSTRUCTION NOISE & VIBRATION REVIEW

REPORT NO. 16178
VERSION A

MAY 2016

PREPARED FOR

FRASERS PROPERTY AUSTRALIA
GROUND FLOOR, 1C HOMEBUSH BAY DRIVE
RHODES, NSW, 2138

WILKINSON MURRAY

DOCUMENT CONTROL

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

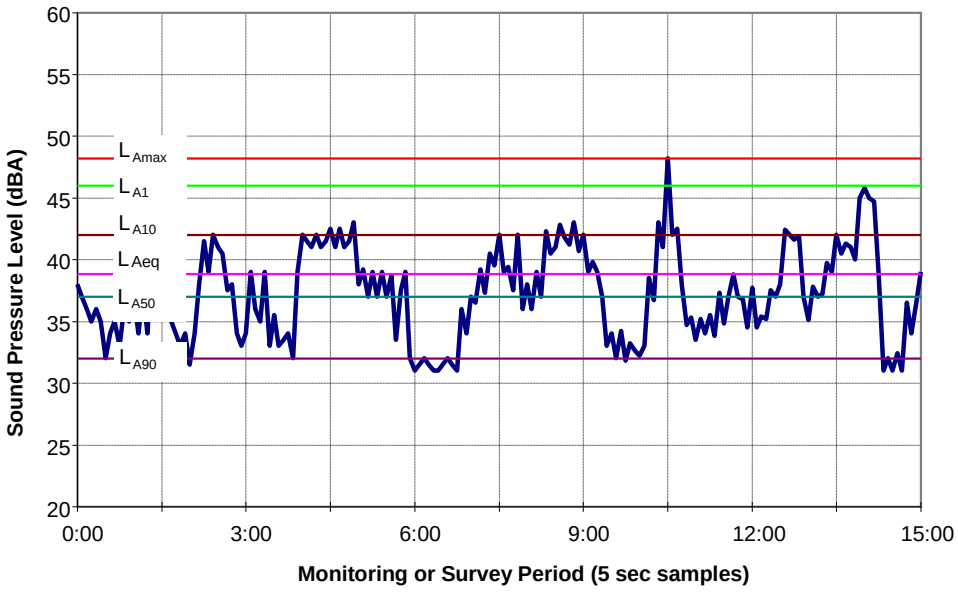
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

This construction noise and vibration review has been prepared by Wilkinson Murray Pty Ltd (WMPL) in relation to the Edmondson Park Frasers Town Centre Bulk Earthworks and Services Removal.

Frasers is proposing to deliver a mixed use development at the Edmondson Park consisting of a mixed used area adjacent to the rail line and a residential area to the south of this area.

A review of potential noise and vibration impacts has been conducted consistent with previous reports conditioned in the project approval namely:

> The detailed design of future development will address the recommendations contained within the Noise and Vibration Impact Assessment, prepared by Wilkinson Murray included at Appendix U of the Concept Plan Environmental Assessment Report prepared by JBA Urban Planning Consultants Pty Ltd dated September 2010 and Supplementary Noise and Vibration Impact Assessment, prepared by Wilkinson Murray included at Appendix I of the Concept Plan Preferred Project Report prepared by JBA Urban Planning Consultants Pty Ltd dated November 2010

The referenced reports contain an initial assessment of construction noise and vibration for the entire Edmondson Park Site. This review relates to the Frasers component of the site.

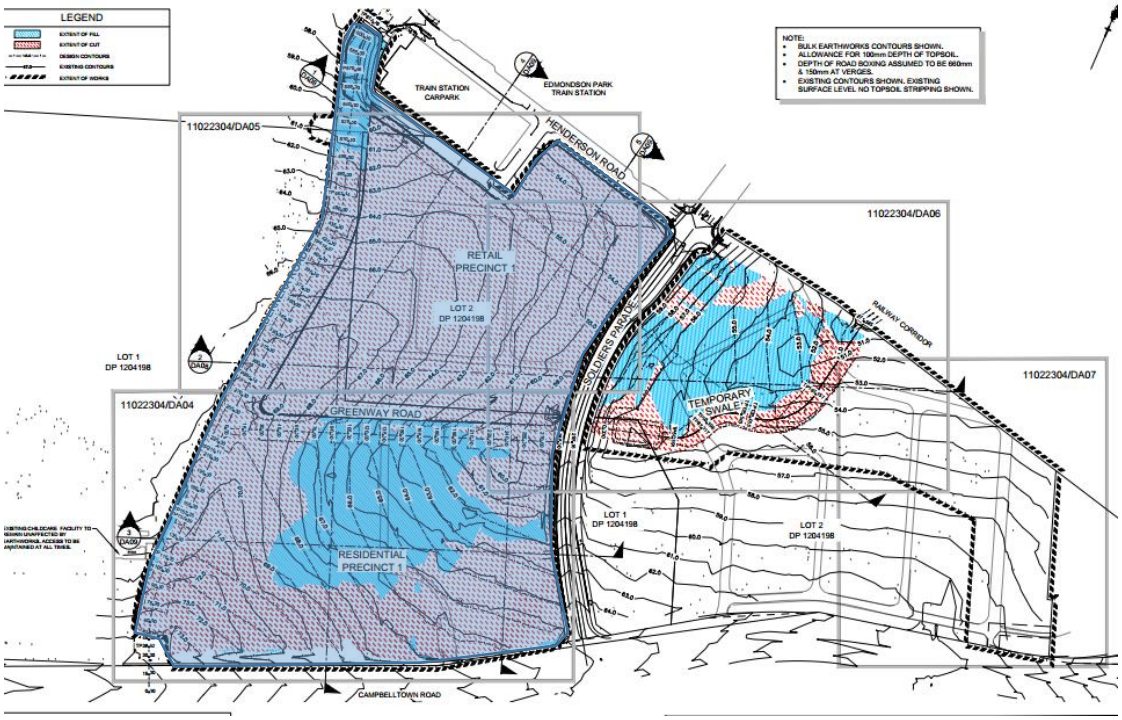
2 SITE & WORKS DESCRIPTION

The entire site to be developed by Frasers is shown in Figure 2-1.

Figure 2-1 Site Locality Plan

The component of this site is the subject of this review is the area on the western side of Soldiers Parade, as shown in Figure 2-2.

Figure 2-2 Area of Subject Bulk Excavation



The proposed bulk earthworks are to consist of the following works

Deep excavation

- 7 trucks per hour
- Stage 1 - 8 months, Stage 2 - 4 months and Stage 3 - 3 months.
- 3 month gap between stages

General Cut and Fill

- 10 trucks per day
- 4 months work

Hours of work

- 7.00am to 5.00pm Monday to Friday
- 7.00am to 1.00pm Saturday
- No work Sunday and Public Holidays

Sound Power Levels (SWLs) associated with typical construction plant are identified in Table 2- 1. These SWLs have recently been measured at other similar construction sites. The table gives both Sound Power Level and Sound Pressure Levels (SPL) at 7m for the equipment. Sound Power Level is independent of measurement position.

Table 2-1 Typical Construction Plant Sound Levels – dBA

Plant	Sound Power Level	Sound Pressure Level at 7m
Bulldozer	119	94
Excavator	108	82
Mobile Crane	104	79
Concrete Truck	109	84
Concrete Crushing & Screening Plant	116	91
Dump Truck & Dog	108	83
Front End Loader	112	87
Excavator	107	82
Hammer Hydraulic	122	97
Compressor	100	75
Bobcat	103	78
Backhoe	95	70
Scraper	119	94
Grader	109	84
Skid Steer Loader	112	87
Off Road Loaders	114	89
Compactor	110	85
Roller	104	79

2.1 Surrounding Residential Receivers

The nearest residential receivers to the site are:

- Residences to the NW on Zouch Road at a distance of 500 m from the site boundary.
- Residences to the NE at a distance of 400 m from the site boundary
- Residences to the South on Arthur Allen Drive at a distance of 330 m from the site boundary.
- Residences to the East on Lowe Avenue at a distance of 850 m from the site boundary.
- Bardia Public School to the South at a distance of 100 m from the site boundary.
- Edmondson Park Railway station and carpark immediately to the North of the Site.

3 CONSTRUCTION NOISE & VIBRATION OBJECTIVES

Noise and Vibration objectives have been established based on EPA guidelines. The following sections detail these issues.

3.1 Construction Noise Management Levels

DECCW released the "*Interim Construction Noise Guideline*" *(CNG)* in July 2009. The guideline provides noise goals that assist in assessing the impact of construction noise.

For residences, the basic daytime construction noise goal is that the noise should not exceed the RBL background noise by more than 10dBA. This is for construction during standard hours: Monday to Friday 7.00am to 6.00pm, and Saturday 8.00am to 1.00pm. Outside the standard hours, the criterion would be background + 5dBA. A more complete description of the guidelines is in Table 3-1.

Table 3-1 Construction Noise Goals at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,(15min)}$ *	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dBA	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{ea,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. • If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq,(15min)}$ *	How to Apply
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

In addition, the following construction noise management levels $L_{Aeq,15\ min}$ are recommended for other receivers and areas as follows.

- Active recreation areas (such as parks): external $L_{Aeq,15\ min}$ 65dBA;
- Industrial premises: external $L_{Aeq,15\ min}$ 75dBA; and
- Offices, retail outlets external $L_{Aeq,15\ min}$ 70dBA.
- Classrooms internal $L_{Aeq,15\ min}$ 45 dBA

Based on the above, Table 3-2 presents the applicable noise management levels for construction activities. These are based on the noise logger at location B which was on Bardia Avenue of the previous Wilkinson Murray noise assessment, which is the location most representative of noise levels at existing surrounding residences to the South of the site.

Table 3-2 Site Specific Construction Noise Management Levels

Location	Construction Noise Management Level, L_{Aeq} (dBA)				Maximum Construction Noise Level, L_{Aeq} (dBA)
	Day	Evening	Night	Saturday	
All Residences	58	54	49	56	75
Active recreation areas (such as parks)	65 dBA				
Schools*	55 dBA (during school hours)				

* *Based on an open window reducing noise levels by 10 dBA*

3.2 Predicted Construction Noise Levels

Noise levels at receiver locations will vary considerably depending on the location and nature of

work being undertaken.

Table 3-3 shows predicted noise levels from each stage of construction.

Table 3-3 Predicted Bulk Earthworks Noise Levels - L_{Aeq}

Receiver	NML	Estimated Noise Level
Bardia School	58-56	50 - 56
Zouch Road Residence	58-56	30 - 34
NE Residences	58-56	35 - 39
Arthur Allen Drive	58-56	42 - 47
East Lowe Drive	58-56	30-35
Rail Station	70	50-56

It is noted that compliance with noise management levels is likely to occur at all surrounding receivers.

4 CONSTRUCTION VIBRATION OBJECTIVES

Vibration criteria for assessment of the effects of vibration on human comfort are set out in British Standard 6472-1992. Methods and criteria in that Standard are used to set "preferred" and "maximum" vibration levels in the document "*Assessing Vibration: A Technical Guideline*" (2006) produced by the NSW DECCW.

Acceptable values of human exposure to continuous vibration are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous vibration is set out in Table 4-1.

Table 4-1 Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Critical working areas (e.g. hospital operating theatres precision laboratories)	Day or night time	0.14	0.28
Residences	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2

4.1 Building Damage

In terms of the most recent relevant vibration damage objectives, Australian Standard AS 2187:Part 2-2006 *"Explosives - Storage and Use - Part 2: Use of Explosives"* recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 *"Evaluation and measurement for vibration in buildings Part 2"* as they "are applicable to Australian Conditions" BS 7385.

The British Standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 4-2.

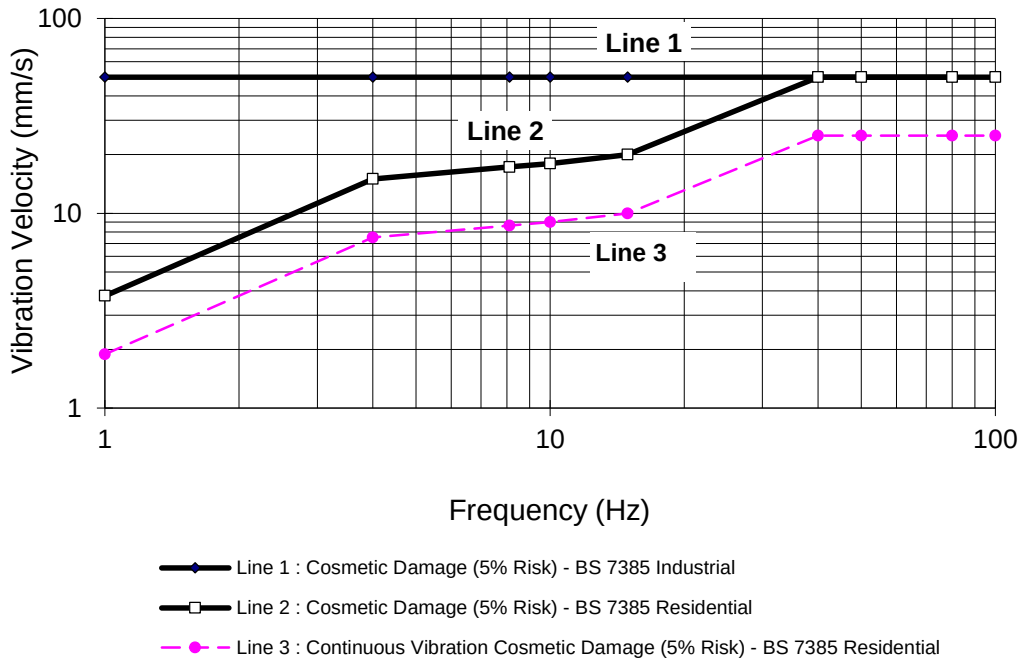
Table 4-2 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4 Hz and above	N/A
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20mm/s at 15 Hz increasing to 50mm/s at 40 Hz and above

The Standard states that the guide values in Table 4-2 relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

The British Standard goes on to state that "*Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity*". In addition, a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.

Figure 4-1 Graph of Transient Vibration Guide Values for Cosmetic Damage



Operation of vibratory rollers and the like generate ground vibration that has the potential to transmit to nearby southern buildings.

Table 4-3 sets out the typical ground vibration levels at various distances for safe working distances (Extracted from the TfNSW Construction Noise Strategy).

Table 4-3 Recommended safe working distances for vibration intensive plant

Item	Description	Safe working Distance	
		Cosmetic Damage	Human Response
Vibratory Rollers	<50 kN (Typically 1-2 tonnes)	5 m	15-20 m
	<100 kN (Typically 2-4 tonnes)	6 m	20 m
	<200 kN (Typically 4-6 tonnes)	12 m	40 m
	<300 kN (Typically 7-13 tonnes)	15 m	100 m
	300 kN (Typically 13-18 tonnes)	20 m	100 m
	300 kN (>-18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Bored Piling	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

It is noted that these nearest receivers to the site are at the rail station and carpark. Based on the location of this receiver and proposed construction equipment the use of vibratory rollers should be managed in line with the relative distances presented in Table 4-3.

The use of smaller vibratory rollers or drum rollers should be used at distances closer than 25 metres from station structures.

It is noted that all residences are too far from the site to be affected by construction vibration.

6 NOISE AND VIBRATION MANGEMENT

In general, the likelihood of adverse impact from bulk earthworks noise and vibration is considered low. However it would be prudent to incorporate standard noise and vibration management measures in the site Environmental Management Plan as detailed below.

6.1 Recommended Mitigation Measures

The following noise mitigation measures are considered best practice and are recommended to be adopted on site.

- Inform affected residents/owners of the works program and contact details for the site representative.
- Diesel powered machines such as trucks, bobcats and excavators should be switched off if not required for more than a few minutes, rather than left idling unnecessarily.
- Machines used on site should be maintained in good condition, particularly considering the exhaust system on diesel powered machines, to minimise noise emissions. Excessively loud machines should be repaired, modified or removed from the site. Sound pressure level measurements should be conducted on all plant prior to works beginning on-site.
- A representative from the construction contractor should be available to respond to questions and complaints from the community in a professional, considerate and timely manner.
- Reversing alarms should be controlled to the minimum sound level consistent with safety by replacing, shielding or relocating the alarm unit on noisy machines.
- A representative should be nominated by the contractor to monitor, manage and respond to complaints.

The above recommendations, and any other feasible measures should be included in a site Environmental Management Plan (EMP).

6.2 Community Liaison & General Approaches to Mitigation

An effective community relations programme should be put in place to keep the community that has been identified as being potentially affected appraised of progress of the works, and to forewarn potentially affected groups (eg. by letterbox drop, meetings with surrounding tenants, etc) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms..

Close liaison should be maintained between the communities overlooking work sites and the parties associated with the construction works to provide effective feedback in regard to perceived emissions. In this manner, equipment selections and work activities can be coordinated where necessary to minimise disturbance to neighbouring communities, and to ensure prompt response to complaints, should they occur.

6.3 Noise & Vibration Management Plan

The contractor should prepare a construction Noise and Vibration Management Sub-Plan for the site in its entirety. Areas to be addressed in the plan include:

- noise and vibration monitoring;
- response to complaints**;**
- responsibilities;
- monitoring of noise emissions from plant items;
- reporting and record keeping;
- non-compliance and corrective action; and
- Community consultation and complaint handling.

7 CONCLUSION

A review of potential noise and vibration impacts associated with the bulk earthworks at Frasers Edmondson Park Site has been conducted consistent with the concept plan assessment. The following findings have been made in relation to the proposed works.

Construction Noise

Noise from construction activities is likely to meet established noise management levels at all residential receivers and at Bardia Public School.

Vibration

The use of vibratory rollers on the northern boundary of the site should be limited when closer than 25 metres from any rail structures.

Environmental Management Plant

As a matter of good practice it is recommended that noise and vibration management be included in the site Environmental Management Plan.