REVERB ACOUSTICS

Noise and Vibration Consultants

# Rail Traffic Noise & Vibration Impact Assessment Residential Development 40-46 Eighteenth Street Sawtell NSW

## July 2023

**Prepared for Brewster Murray Pty Ltd**
**Report No. 23-2884-R1**

**Building Acoustics-Council/EPA Submissions-Modelling-Compliance-Certification**

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# 1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a rail traffic noise and vibration impact assessment for a proposed residential development at 40-46 Eighteenth Street, Sawtell. The purpose of the assessment is to theoretically determine the noise and vibration impact within habitable spaces from passing rail traffic on the North Coast Rail Line and to recommend acoustic modifications that must be incorporated into the design. This noise and vibration impact assessment has been conducted with reference to NSW Department of Planning and Environment's (DPE's) Guideline, *Development near Rail Corridors and Busy Roads – Interim Guidelines.*

The Assessment was requested by Brewster Murray Pty Ltd to form part of and to support an Application to NSW Planning & Environment Land & Housing Corporation (LAHC), and to ensure that noise levels comply with the requirements of the NSW Environment Protection Authority (EPA), LAHC and Coffs Harbour City Council (CHCC).

# 2 TECHNICAL REFERENCE / DOCUMENTS

AS/NZS 2107-2016 *"Acoustics-Recommended Design Sound Levels and Reverberation Times for Building Interiors"*.

Department of Planning (2008). *"Development near Rail Corridors and Busy Roads - Interim Guidelines".*

State Rail Authority of NSW (1995) *"Rail related noise and vibration issues to consider in local environmental planning – development applications and building applications".*

Rail Infrastructure Corporation. (2003). *Interim Guidelines for Councils – Consideration of rail noise and vibration in the planning process.*

Rail Infrastructure Corporation. (2003). *Interim Guidelines for Applicants – Consideration of rail noise and vibration in the planning process.*

A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

# 3 CRITERIA

## 3.1 Rail Traffic Noise (Internal Noise Levels)

### 3.1.1 Internal Noise Levels

State Environmental Planning Policy (Transport and Infrastructure) 2021 states the following:

**Subdivision 2 Development in or adjacent to rail corridors and interim rail corridors – notification and other requirements**

**2.100 Impact of rail noise or vibration on non-rail development**
(1) This section applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration—

(a) residential accommodation,
(b) a place of public worship,
(c) a hospital,
(d) an educational establishment or centre-based child care facility.

(2) Before determining a development application for development to which this section applies, the consent authority must take into consideration any guidelines that are issued by the Planning Secretary for the purposes of this section and published in the Gazette.

(3) If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded—

(a) in any bedroom in the residential accommodation—35 dB(A) at any time between 10.00 pm and 7.00 am,
(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

Cognate performance requirements for residential developments can be sourced from DPE's *"Development near Rail Corridors and Busy Roads - Interim Guidelines*" (released in December 2008). Limits specified within the Policy, which are identical to SEPP (Infrastructure) 2007, will be used for the purpose of this assessment, are shown below:

| *Type of Occupancy* | *Noise Level in dB(A)* | *Applicable Time Period* |
|---|---|---|
| Sleeping areas (bedroom) | 35 | Night 10pm to 7am |
| Other habitable rooms (excluding garages, kitchens bathrooms & hallways) | 40 | At any time |

If criteria are exceeded by more than 10dB(A) with windows open, mechanical ventilation should be incorporated into the design of affected rooms.

### 3.1.2 External Noise Levels

DPE's. *"Development near Rail Corridors and Busy Roads - Interim Guidelines"*, does not specify limits for outdoor recreational areas associated with a dwelling. However, their Guideline, *"Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects"* suggests a limit of **60dB(A),Leq**. We have therefore adopted this limit for assessment purposes.

## 3.2 Rail Traffic Vibration

### 3.2.1 Personal comfort

Various authorities have set maximum limits on allowable ground and building vibration in different circumstances and situations, all directed at personal comfort rather than building damage. This usually leads in virtually every situation to people who interpret the effects of a vibration to ultimately determine its acceptability. The most recent criteria for assessment of rail traffic vibration impacts upon occupants of a building are those contained in DPE's *"Development near Rail Corridors and Busy Roads - Interim Guidelines*". The Guideline recommends that the EPA's *Assessing Vibration: A Technical Guideline (2006)* should be used for the assessment of vibration. Limits set out in the Guideline are for vibration in buildings, and are directed at personal comfort for continuous, impulsive and intermittent vibrations. Table 1 shows the Vibration Dose Values for intermittent vibration activities such as train passbys, pile driving and use of vibrating rollers, taken from Table 2.4 of the Guideline, above which various degrees of adverse comment may be expected.

**Table 1: Acceptable Vibration Dose Values (m/s$^{1.75}$)**
**Above which Degrees of Adverse Comment are Possible**

| Location | Day (7am-10pm) | | Night (10pm-7am) | |
|---|---|---|---|---|
| | Preferred | Maximum | Preferred | Maximum |
| Critical areas # | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences | 0.20 | 0.40 | 0.13 | 0.26 |
| Offices | 0.40 | 0.80 | 0.40 | 0.80 |
| Workshops | 0.80 | 1.60 | 0.80 | 1.60 |

# Hospital operating theatres, precision laboratories, etc.

### 3.2.2 Building Safety Criteria

Australian Standard AS2187.2-1993, dealing specifically with blasting vibration, specifies a maximum peak particle velocity of 10mm/sec for houses and a preferred limit of 5mm/sec where site specific studies have not been undertaken. German Standard DIN 4150 - 1986, Part 3 Page 2, specifies a maximum vibration velocity of 5 to 15 mm/sec in the foundations for dwellings and 3 to 8 mm/sec for historical and sensitive buildings, for the range 10 to 50Hz. British Standard BS 7385 Part 2, specifies a maximum vibration velocity of 15mm/sec at 4Hz increasing to 20mm/sec at 15Hz increasing to 50mm/sec at 40Hz and above, measured at the base of the building.

The above listed criteria vary from 3mm/sec up to 15mm/sec, therefore, the more conservative limit of **5mm/sec** will be adopted for the purposes of this assessment. It should be acknowledged, however, that intermittent ground vibration velocities at 5mm/sec are generally considered the threshold at which architectural (cosmetic) damage to normal dwellings may occur and velocities at 10mm/sec should not cause any significant structural damage, with the exception of the most fragile and brittle of buildings.

# 4 METHODOLOGY & ANALYSIS

*Figure 1: Location Plan*


A rail traffic noise level survey was conducted at a nearby site in Sawtell in August 2022. The survey was carried out using a Class 1, Svan 977 environmental noise logging monitor, installed approximately 80 metres from the North Coast Rail Line over an extended time period. The instrument was calibrated with a Brüel and Kjaer 4230 sound level calibrator producing 94dB at 1kHz before and after the monitoring period, as part of the instrument's programming and downloading procedure, and showed an error less than 0.5dB. A summary of measured noise levels is shown in Table 2. Noise level data are not shown, but available upon request.

**Table 2: Summary Rail Traffic Noise Levels – 80m from Rail Line**

| Descriptor | Noise Level dB(A) | Time Interval |
|---|---|---|
| Leq,1hr (day) | 55.8 | 07:00 to 22:00 |
| Leq,1hr (night) | 51.6 | 22:00 to 07:00 |
| Leq,9hr | 49.6 | 22:00 to 07:00 |
| Leq,15hr | 53.8 | 07:00 to 22:00 |
| Leq,24hr | 54.0 | 06:00 to 06:00 |

Site, weather and measuring conditions were all satisfactory during the noise survey. We therefore see no serious reason to modify the results because of influencing factors related to the site, weather or our measuring techniques.

Applicable noise level metrics, namely, Leq (day) and Leq (night) are those calculated from our measurements at the site.

A +2.5dB(A) facade adjustment must be applied to results as measurements were conducted in free-field conditions.

*Measured noise level + facade correction - distance correction = received noise*

Applying the above formula gives:

| | | |
|---|---|---|
| Day | 53.8dB(A) + 2.5dB(A) - 2.7 = **53.6dB(A) Leq, 15hr** | 7am – 10pm |
| Night | 49.6dB(A) + 2.5dB(A) - 2.7 = **49.4dB(A) Leq, 9hr** | 10pm – 7am |

Theoretical results in the above table indicate that rail traffic noise impacting on the proposed residence are compliant with DPE's limits. To put results into context, an L(A)eq,1hr impact of 14 implies that the facade of a residence must be capable of attenuating 14dB (i.e. 49dB(A),Leq(9hr) – 35 = 14). RMS publication, *"Development Near Rail Corridors and Busy Roads-Interim Guideline"* Specifies different Categories of treatment based on the required Rw rating of each building component. The lowest Category 1 requires treatment for windows that have an Rw24 rating. Given that the Living Room and Bedroom windows only require a rating of <Rw15, standard glazing will suffice, confirming standard construction is adequate.

External noise levels at exposed facades will be in the order of 54dB(A) in fully exposed locations, and substantially less in partially shielded locations used as recreational areas. Levels are below the adopted criterion of 60dB(A),Leq and considered acceptable.

Typical vibration levels for train passbys were measured at a nearby site, at varying distances from the rail line and also sourced from our library of technical data for comparison purposes. Vibration levels of trains were measured with a Vibroch V801 Seismograph coupled to a triaxial geophone installed on hard packed earth. A sandbag was placed over the geophone during each measurement to ensure elevated readings were not recorded due to bouncing and movement, which may occur at higher vibration amplitudes. The unit is capable of measuring and storing peak Z-axis vibration velocities, as well as vibration in three directions simultaneously and gives peak velocity and acceleration on the x, y and z axes.

Attended vibration monitoring revealed that no perceptible vibration was recorded from train passbys at a distance greater than 60 metres from the rail line. Under certain circumstances, say if a large vibrating track maintenance machine was to pass the site and the resonant frequency of the ground happened to be an exact multiple of the driving frequency of the source, then higher vibration levels could be expected. However, it is doubtful that levels would reach a magnitude capable of causing any adverse comment or structural damage.

Vibration can be felt at levels well below those considered to cause structural damage. Complaints from occupiers are usually due to the belief that if vibration can be felt then it is likely to cause damage. Slamming of doors or footfall within a building can produce vibration levels above those produced by passing rail traffic. Passing trains will only produce loads, and therefore vibration, when their mass is accelerated, for example when hitting joins or deformities in rails. This emphasises the importance of properly maintained rail lines.

Vibration levels caused by trains passing the site are unlikely to cause direct failure, and it is considered the main action is triggering cracks in materials already subjected to stress or natural forces, however, as previously mentioned, this may also arise from internal forces such as slamming of doors. In our experience, vibration will only begin to trigger "natural cracking" at levels above 1mm/sec.

# 5 CONCLUSION

A rail traffic noise and vibration impact assessment for a proposed residential development at 40-46 Eighteenth Street, Sawtell, has been completed. The report has shown that the site is suitable for the intended purpose.

An assessment of external noise impacting upon the development has confirmed that no special acoustic features need to be incorporated into the design to comply with the requirements of the RMS, EPA, AS/NZS2107-2000 and DPE. We therefore see no acoustic reason why the proposal should be denied.

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*Principal Consultant*

# APPENDIX A
## Definition of Acoustic Terms

# Definition of Acoustic Terms

| Term | Definition |
|---|---|
| dB(A) | A unit of measurement in decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear. |
| Rw | Weighted Sound Reduction Index. The ability of a partition to attenuate sound, in dB. Given as a single number representation. |
| Leq | Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event. |
| L90 | The noise level which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA). |
| Lmax | The maximum level for the measurement period (usually in dBA) |