Project No: 212210R

# Rail Noise Assessment
# Proposed Residential Subdivision
# Kezia Road, Oakhampton, NSW

Prepared for:

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# INTRODUCTION

This report provides the results, findings and recommendations arising from an acoustical assessment of the potential for noise and vibration emanating from trains travelling on the North Coast Railway Line (NCRL) to impact on parts of an area proposed for residential purposes in Oakhampton, NSW as shown in **Figure 1**.


*Figure 1 - Site Plan*

The assessment was requested by Walker Corporation to accompany a D.A. to Maitland City Council (MCC).

# NOISE CRITERIA

For new residential developments near a railway line, or a major road, criteria for the assessment of potential noise impacts are adopted from the NSW Department of Planning publication *"Development near Rail Corridors and Busy Roads - Interim Guideline"* (Guideline).

The Guideline advises that land use developers must meet the internal noise goals in the Infrastructure SEPP (Department of Planning NSW, 2007).

The Infrastructure SEPP is aimed at facilitating the effective delivery of infrastructure across NSW. Key objectives of this planning policy were to:

- protect the safety and integrity of key transport infrastructure from adjacent development; and
- ensure that adjacent development achieves an appropriate acoustic amenity by meeting the internal noise criteria specified in the Infrastructure SEPP.

The Infrastructure SEPP states that if the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the relevant Leq levels are not exceeded.

The Guideline gives the following noise criteria in Section 3.5:

**TABLE 1**
**NOISE CRITERIA**

| Type of Occupancy | Time Period | Acceptable Noise Level |
|---|---|---|
| Sleeping areas (bedrooms) | Night (10pm to 7am) | 35 dB(A) Leq (9 hr) |
| Other habitable rooms (excluding garages, kitchens, bathrooms and hallways) | At any time | 40 dB(A) Leq (15 hr) |

These criteria originated from the Rail Infrastructure Corporation (RIC) publication "Consideration of Rail Noise and Vibration in the Planning Process" (2003) where it is explicit that the criteria apply with windows and doors closed.

The Guideline also states that "if internal noise levels with windows and doors open exceed the criteria by more than 10 dB(A), the design of ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia."

# EXISTING NOISE LEVELS

The south eastern parts of the proposed subdivision adjoin the NCRL and, therefore, may be impacted by noise from trains travelling on that rail line.

To quantify the existing acoustic environment of the area a series of attended and unattended noise measurements were made at various locations near the NCRL in June 2022.

Unattended noise logging was carried out, between 7th and 9th June, 2022, at the location shown on **Figure 2** using an ARL Ngara environmental noise logger. Attended noise logging was undertaken at the location indicated as A1 on Figure 2.

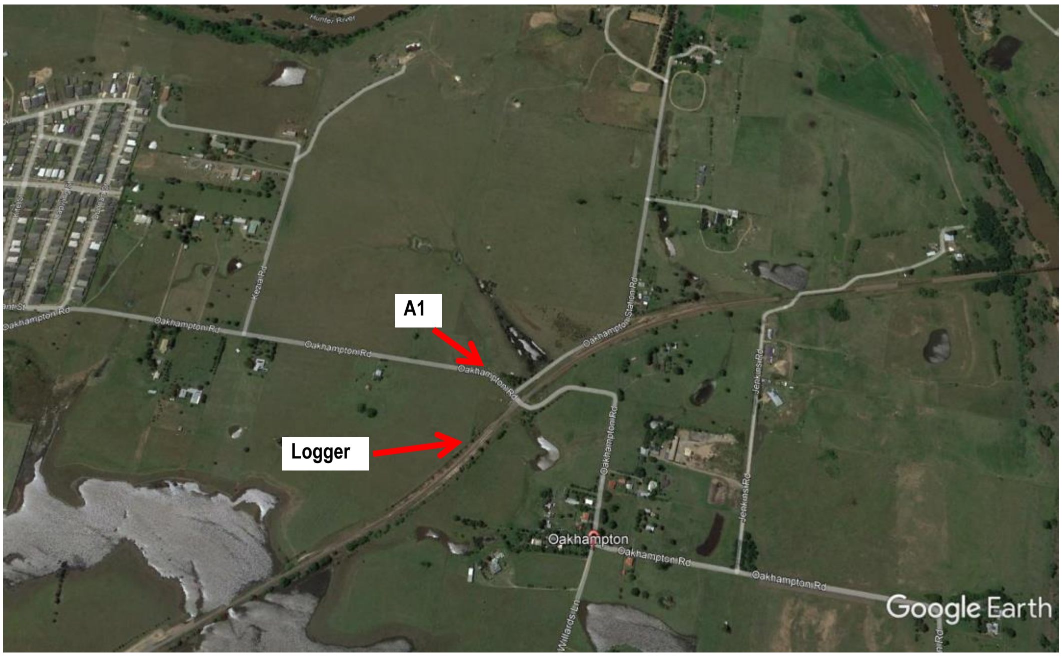



*Figure 2 – Noise Measurement Locations*

The logger was programmed to continuously register environmental noise levels over 15 minute intervals with internal software calculating and storing $L_n$ percentile noise levels for each sampling period. Calibration of the logger was performed as part of the instrument's initialisation procedures, with calibration results being within the allowable ± 0.5 dB(A) range.

The noise logger measurements were done in accordance with relevant OEH guidelines and AS 1055-2018 "Acoustics – Description and Measurement of Environmental Noise". The noise logger used complies with the requirements of AS 1259.2-2004 "Acoustics – Sound Level Meters", and has current NATA calibration certification.

The logger was located along the fence at the top of a cutting beside the railway line. The location was approximately 15m from the NCRL and had full line of sight to the rail line.

The relevant metrics taken from the logger measurements are shown in **Table 2** and graphically in **Appendix I**. The applicable noise criteria are based on 15 hour and 9 hour Leq noise levels. The worst case 1 hour Leq noise levels are also shown in Table 2.

**TABLE 2**
**MEASURED AMBIENT NOISE LEVELS**

| | Ambient Noise Levels dB(A) | | |
|---|---|---|---|
| Percentile | Day | Evening | Night |
| $L_{90}$ | 40 | 31 | 31 |
| $L_{eq}$ | 65 | 65 | 59 |
| Leq (1hr) | 70 | | 65 |

At the time of the noise logging the area was an open paddock. The logger was located along the fence line with some trees in the adjoining paddock. An analysis of the logger data shows regular elevated Leq and Lmax noise levels (see graph in Appendix I). These elevated levels may correspond to train passbys, or may also relate to the noise from birds, or other natural sources.

Attended noise measurements were also made at the location shown on Figure 2. Noise levels were measured with a Brüel & Kjær Type 2260 Precision Sound Analyser. This instrument has Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters". Calibration of the instrument was confirmed with a Brüel & Kjær Type 4231 Sound Level Calibrator Prior to and at the completion of measurements.

Noise levels were measured of one second intervals for later analysis. The attended measurements were made over a period of approximately three hours (8.00am to 11.00am) during the morning of 9$^{th}$ June, 2022, on a day where there were typical train movements on the NCRL

During this time there was one passenger train past the monitoring location. The train had an Leq noise level of 65 dB(A) for a duration of 22 seconds.

Published timetables for passenger train movements along the line at this point show that there are up to six passenger trains per day past the site. Freight train movements along the line are sporadic, and dependent upon many factors and schedules may vary for different days and times of year.

For the calculation of a conservative scenario all of the Leq noise, measured by the logger, was assumed to be due to trains.

The noise logger was located approximately 15m from the rail line. Figure 1 shows a concept layout plan for the site. This shows that the closest residential lots will be over 100m from the rail line.

Assuming standard ground conditions and no acoustic barriers this would equate to a noise level at the facade of the closest residences of **54 dB(A) Leq (1hr)** during the day and **49 dB(A) Leq (1hr)** at night. That is, based on the worst case Leq (1hr) noise level from the logger, and calculating the additional distance loss between the logging location and the proposed residences.

# RESULTS AND DISCUSSION

The proposal is for a residential subdivision on the site. At the time of undertaking the current assessment there are no defined dwelling designs. Individual dwelling designs will be lodged to council under the local government regulations in the future. A generic approach to possible noise control options is, therefore, taken here.

The concept layout plans show that there is to be a buffer zone between residences and the boundary with the NCRL such that the closest residences will be a minimum of approximately 100m from the rail line.

The Environmental Noise Management Manual (ENMM) details that the facade of a single glazed, light framed house, with the windows closed, will typically attenuate up to 20 dB(A) of traffic noise (note with the windows open it will attenuate up to 10 dB(A)). The acoustic weak point in a typical residence is through glazing (windows and/or glass doors) with line of sight to the noise source.

Road and rail traffic noise are generally broad spectrum sources and the discussion above is considered applicable to the noise from trains potentially impacting on the site.

This means that an external noise level of 54 dB(A) Leq (1hr) will result in internal noise levels of about 34 dB(A) Leq (1hr) in living areas (i.e., day time use). Similarly, an external noise level of 49 dB(A) Leq (1hr) will result in internal noise levels of about 29 dB(A) Leq (1hr) in bedrooms.

This indicates that standard building design will achieve compliance with the acceptable internal noise levels, without the requirement for specific noise control.

With windows open the noise would not exceed acceptable internal noise criteria (of internal criterion plus 10dB).

# NOISE CONTROL

The results of the noise measurements have shown that, even considering the worst case, there is no requirement for noise control at the most potentially affected residences.

The following generic discussion is included here for reference only and to encourage the application of best practice in relation to acoustics.

In general, when considering the development of land located near railway lines, potential noise impacts should be taken into account at the master planning/concept planning stage. At that stage there is more opportunity to address noise and vibration through setbacks, building orientation, layout, building height controls or noise barriers.

The other noise control option available to the current development is for design and construction modifications to proposed buildings.

**Figure 3** is a reproduction of Figure B2 from the Guideline showing a typical situation of a dwelling adjacent to a busy road. It is also applicable to noise from a railway line.

Acoustic consultants often use this Guideline (and Figure B2 specifically) in recommending possible modifications to achieve the recommended internal noise levels.

Figure 3 shows a traffic noise level of 68 dB(A) at windows W1 and W2 directly facing the road. Windows W3 and W4 are on facades perpendicular to the road or railway line, thereby being shielded from 50% of the traffic noise by the building structure, and noise levels are 2-3 dB below the traffic noise level at W1 and W2.

This indicates that designing a residence such that windows are on facades that do not have direct line of sight to the road or rail line can reduce noise levels by up to 3 dB(A). Windows in facades which face away from the road or rail line (i.e., shielded from the noise source by the structure of the building) would see reductions in noise of at least 10 dB(A).

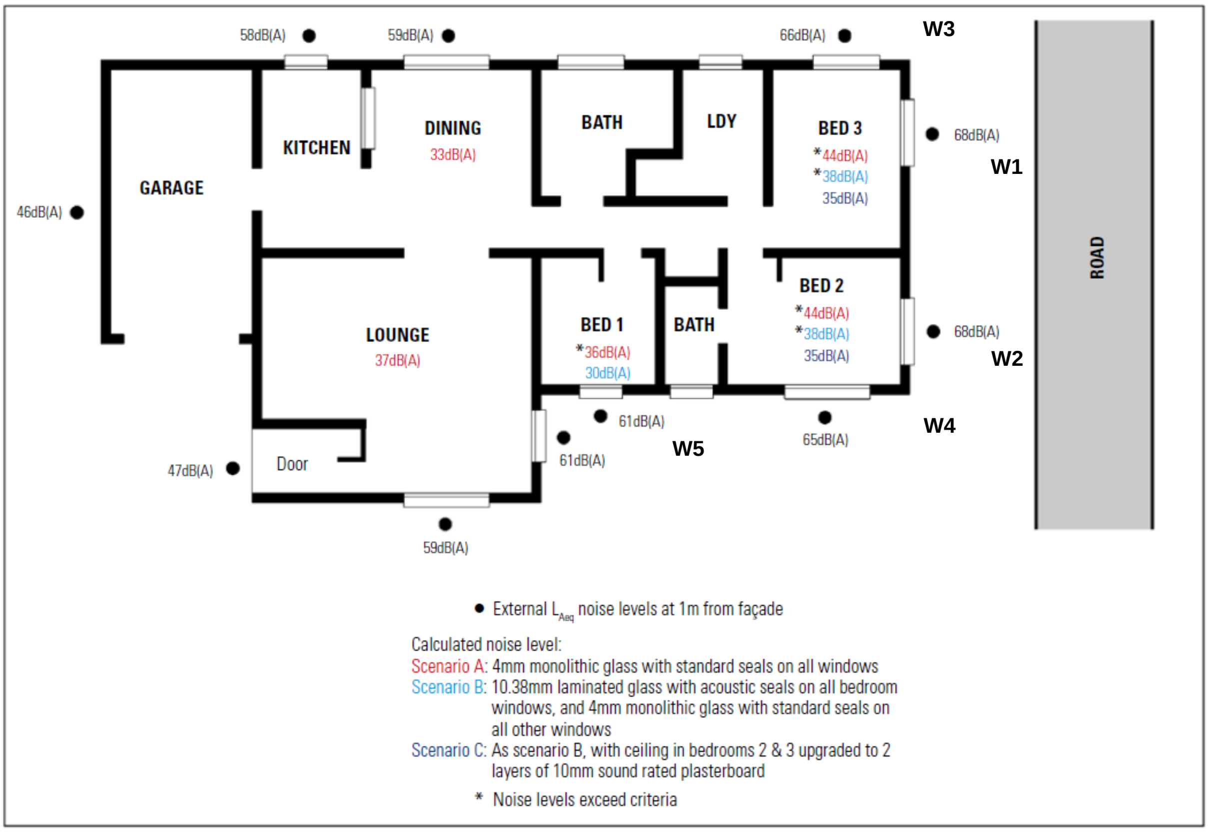



*Figure 3. Traffic noise reduction for various construction types*

## Building Treatments

The acoustic treatment for any residence requires specific analysis based on floor plans and the surface area of the various building elements which are potentially exposed to a noise source.

In general terms, however, the Guideline indicates that where a new residential development is planned to occur near a busy road appropriate building design, layout and construction techniques should be applied to minimise noise intrusion and provide suitable internal noise levels for sleeping and other uses.

The following sections provide some general information in relation to incorporating sound acoustic practises in house design.

## Walls

Typically walls are not a significant noise transmission path. Walls of lightweight construction (e.g. weatherboard, compressed fibrous cement sheeting, timber slats, timber sheeting etc.) provide less noise insulation than masonry walls to low frequency noise. At particularly noisy sites lightweight cladding should include adequate acoustic insulation in the wall cavity.

Whether the walls are masonry or of light-weight construction, the wall's insulation capacity will be weakened if it contains ventilators, doors or windows of a lesser insulation capacity. To improve insulation response, ventilators can be treated with sound-absorbing material or located on walls which are not directly exposed to the external noise.

### Windows

In acoustic terms windows are one of the weakest parts of a facade. An open or acoustically weak window will severely negate the effect of an acoustically strong facade. Whenever windows are incorporated in a building design their effect on acoustic performance of the building facade should be considered. Reducing the number and/or glazed area of windows and/or appropriately positioning them away from the road can be beneficial.

Proper sealing is crucial to the success of noise reduction of windows. To prevent sound leaks, windows should be caulked (with a flexible sealant such as mastic or silicone) thoroughly from the inside, and outside between the wall opening and the window frame. Usually the best option is use one of the many commercially available double glazed or laminated windows with acoustic seals.

Laminated glass is usually cheaper and easier to install than double glazing and is relatively effective in reducing moderate to high levels of traffic noise as indicated previously in this report. Double-glazing: is cost-effective when a very high level of noise attenuation is required. When using double-glazing, the wider the air space between the panes the higher the insulation.

Other factors influencing the acoustic performance of windows include:

- Window seals: ensure windows are fitted with high quality acoustic seals and close windows to reduce internal noises levels.

- Reduction in window size, recognising that reducing the proportion of window to wall size from 50% to 25% reduces noise by only 3 decibels.

- Increase the glass thickness: the thicker the glass the more noise resistance it provides. However, glass thickness is only practical up to a point before the costs exceed the acoustic benefits of increasing glass thickness.

- The presence of absorbent materials on the window reveals will improve noise insulation.

- Window frames and their installation in wall openings must be air tight and operable. Windows must incorporate acoustic seals for optimal noise insulation.

In summary, it is considered that, based on the measured and calculated noise adequate internal noise levels can be achieved within the proposed residences using standard building techniques.

# VIBRATION ASSESSMENT

Section 3.5.1 of the Guideline contains screening tests for the assessment of rail vibration as shown in **Figure 4**.

The closest of the proposed dwellings would be over 100m from the rail line.

Figure 4 shows that the zone requiring assessment of rail vibration impacts for single residences ends at 25m from the rail line, implying that there will be no rail vibration impacts at any residences.

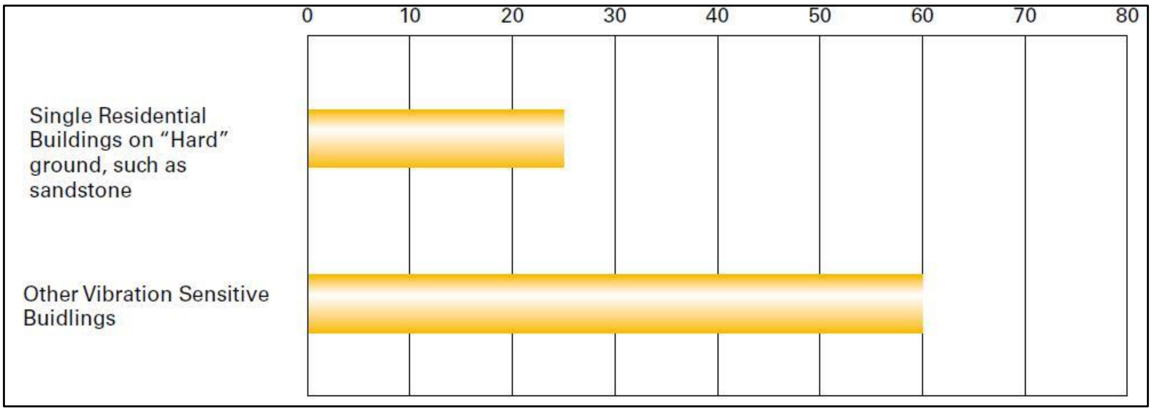



*Figure 4. Rail Vibration Screening Test*

By way of confirming this, reference is made to a series of measurements of vibration levels from train passbys made previously at a location near Diamond Circuit (which is adjacent to the NCRL about 1.8km south of the current site).

Vibration levels from 12 train passbys were measured at a distance of about 40m from the rail line. The results of the measurements showed that vibration levels were slightly above an adopted trigger level of 0.05 mm/s but significantly lower than the applicable criterion of 0.5 mm/s.

This indicates there is no potential for structural damage as a result of vibration from trains.

**Table 5** presents a summary of vibration levels and likely human perception of these.

**TABLE 5**
**HUMAN PERCEPTION OF VIBRATION**

| Vibration Levels, mm/s | Likely Perception |
|---|---|
| 0.15 | Perception threshold |
| 0.35 | Barely noticeable |
| 1.0 | Noticeable |
| 2.2 | Easily noticeable |
| 6.0 | Strongly noticeable |
| 14.0 | Very strongly noticeable |
| Ref: German Standard DIN 4150 (1986) | |

As most people do not readily notice vibration levels of less than 0.5 mm/s, future residents at the proposed dwellings are unlikely to notice vibration caused by train passbys.

# CONCLUSION

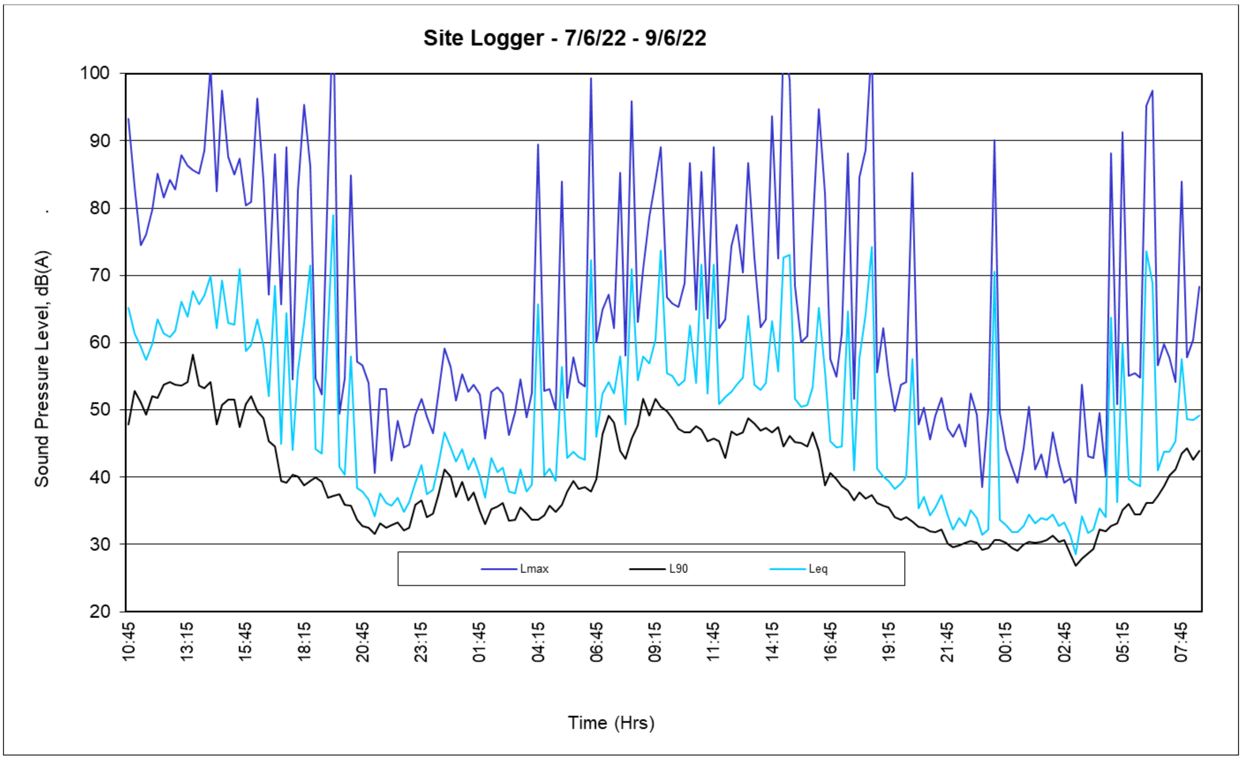
An assessment has been carried out into the potential for train noise and vibration to impact on a proposed residential estate in an area at Kezia Road, Oakhampton, NSW.

The results of site noise measurements and theoretical calculations have shown that the train noise will be at levels that should be readily attenuated by the structure of typical dwelling and that standard building techniques will suffice for the estate.

There are also no potential vibration impacts.

# APPENDIX I

## Noise Logger Chart


Site Logger - 7/6/22 - 9/6/22
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
Lmax
L90
Leq
10:45
13:15
15:45
18:15
20:45
23:15
01:45
04:15
06:45
09:15
11:45
14:15
16:45
19:15
21:45
00:15
02:45
05:15
07:45
Time (Hrs)