Acoustic Engineering Report

Baldwin Road Development

Project No: 204773-A
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Fire Engineering | Acoustics | Access | Building Solutions | Façade Testing

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Project: Baldwin Road Development

Project No: 204773-A

Prepared For: Millar & Merrigan Pty Ltd

Prepared By: DDEG (Acoustics)
ABN: 13 610 344 986
Building 2, Ground Floor, 195 Wellington Road
Clayton, VIC 3168
03 8814 3250

Author: [redacted]
BE(Mech)(Hons), BCom
MAAS
[redacted]

Signature [redacted]

Reviewer: [redacted]
BE(Mech)(Hons)
MAAS, MIEAust
[redacted]

Signature [redacted]

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AER	0	21/12/2023	Not for endorsement	[redacted]	[redacted]
AER	1	14/03/2024	Original issue	[redacted]	[redacted]
AER	2	13/12/2024	Revised treatment options	[redacted]	[redacted]

Executive Summary

DDEG has been appointed by Millar & Merrigan Pty Ltd to provide acoustic engineering consulting services associated with the proposed residential subdivision at the corner of Baldwin Road and Traralgon-Maffra Road, Traralgon, VIC.

Advice in relation to the following acoustic engineering element has been requested, and is presented in this document:

Table 1 Acoustic Engineering Element and Reference Criteria

Acoustic Engineering Element	Reference Criteria
Potential noise impacts on proposed future dwellings due to noise from Traralgon-Maffra Road	▪ Environment Protection Act 2017 ▪ Environment Reference Standard for Ambient Sound ▪ AS/NZS 2107:2016 ▪ AS 3671:1989

Results of environmental noise logging (see Section 5) and subsequent traffic noise modelling (see Section 7) indicate that external noise levels within the majority of the proposed residential development area will exceed the ERS Objectives 10 years after the assumed development finalisation date of 2027. Two potential noise attenuation options are outlined in Section 8, and are summarised below:

- Option 1 involves construction of a 3 m high noise barrier / berm along the eastern boundary of the site (closest to Traralgon-Maffra Road), as shown in Figure 6.
- Option 2 involves construction of a 5 m high noise barrier / berm along the eastern boundary of the site (closest to Traralgon-Maffra Road) and a section of the northern boundary of the site, as shown in Figure 7.
- Residential buildings constructed within the lots highlighted in orange in Figure 6 for Option 1 and in Figure 7 for Option 2 should be constructed in general accordance with Construction Category 2 as prescribed in AS 3671:1989.
- Residential buildings constructed within all remaining lots (i.e. those not highlighted in Figure 6 for Option 1 or Figure 7 for Option 2) should be constructed in general accordance with Construction Category 1 as prescribed in AS 3671:1989.
- Recommended indicative construction details for Construction Category 2 are outlined in Section 8. If deviations from the indicative construction details are sought for any residential building where Construction Category 2 is recommended, specialist acoustic advice from a qualified acoustic consultant should be obtained during planning permit stage.

Contents

1 Introduction

1.1 Purpose

DDEG has been appointed by Millar & Merrigan Pty Ltd to provide acoustic engineering consulting services in relation to the proposed residential subdivision at the corner of Baldwin Road and Traralgon-Maffra Road, Traralgon, VIC.

The scope of this document comprises review of existing environmental noise levels at the site and provision of advice on noise attenuation measures to protect future occupants from external noise due to road traffic.

A glossary of the acoustic nomenclature used in this document is presented in Appendix A.

1.2 Reference Documentation

This document is based on information contained in the following documents and drawings:

Table 2 Reference Documentation

Document	Prepared by	Issue
Baldwin Road Development Plan; Ref No. 25950 DP1, Version No. 5	[redacted]	May 2024
Letter (Ref No. 2687785) To: [redacted] Subject: DRAFT BALDWIN ROAD DEVELOPMENT PLAN	[redacted] City Council	23/10/2024
Letter (Ref No. REQ005720) To: [redacted] Subject: RE: PROPOSAL: DRAFT BALDWIN ROAD DEVELOPMENT PLAN ADDRESS: BALDWIN ROAD, TRARALGON-MAFFRA ROAD, TRARALGON	[redacted] Environment Protection Authority Victoria	05/12/2024

1.3 Document Limitations

The following limitations are applicable with respect to the acoustic advice presented in this document:

- DDEG has prepared this document for the sole use of the relevant stakeholders and approval authorities and for the specific purpose expressly stated in the document. No other party should rely on this document without the prior written consent of DDEG. DDEG undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document.

- The information contained in this document provides advice in relation to acoustics and vibration only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics and vibration engineering including and not limited to structural integrity, fire rating, architectural buildability and fitness-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.
- Documents marked 'Not for Construction' or 'Draft' may be subject to change and are not released as final documents. DDEG accepts no liability pending release of the final version of the document.
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- The recommendations, data and methodology presented in this document are based on the listed reference documentation. The recommendations apply specifically to the project under consideration and must not be utilised for any other purpose. Any modifications or changes to the project from that described in the listed reference documentation may invalidate the advice provided in this document, necessitating a revision.
- Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

2 Project Characteristics

2.1 Site Location

The project site is located at the corner of Baldwin Road and Traralgon-Maffra Road, Traralgon, VIC, as shown in Figure 1.

Figure 1 Aerial Image of Site (Aerial Photo Source: Google Maps)

2.2 Proposed Project

The project comprises a proposed residential subdivision following the rezoning of existing rural land for the purpose of general residential development.

Figure 2 shows the proposed concept site layout.

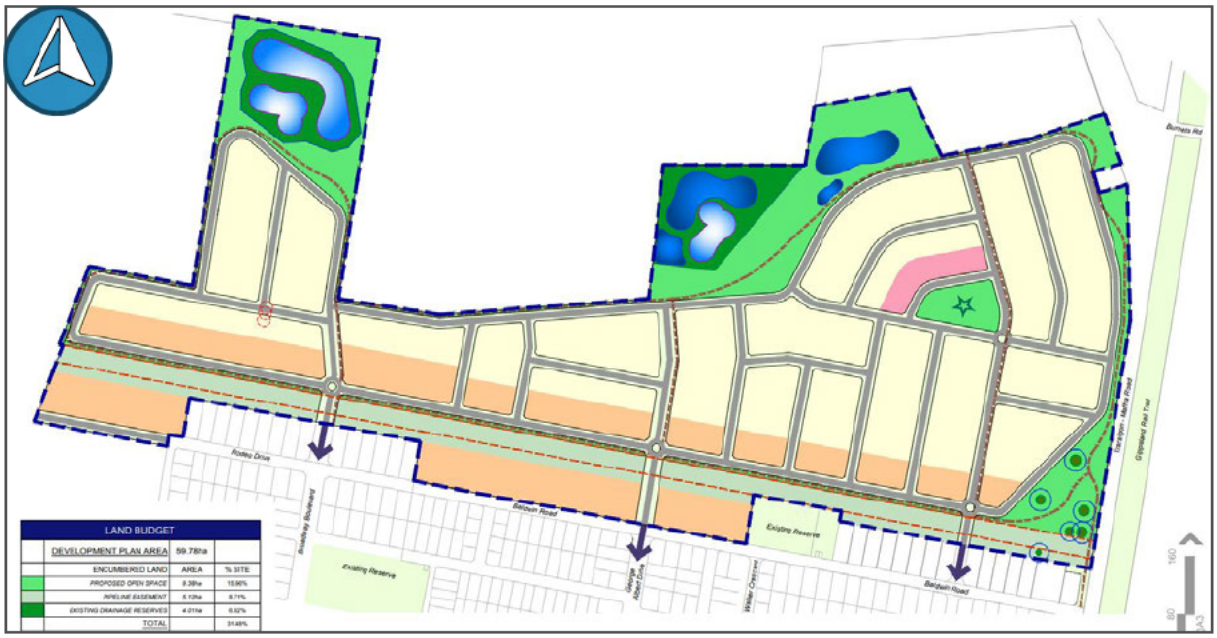


Figure 2 Proposed Concept Site Layout (Image Source: Millar & Merrigan)

3 Legislation and Guidelines

Table 3 presents a summary of the relevant legislation and guidelines applicable to the proposed project. The information contained in these documents forms the basis of the design criteria and advice presented in this document.

Table 3 Summary of Relevant Statutory Requirements and Guidelines

Document	Status	Relevance to this Project
Environment Protection Act 2017 (EP Act) (State of Victoria, 2021)	Legislation	Prescribes an overarching General Environmental Duty (GED) to minimise the risk of harm to human health or the environment due to noise, so far as reasonably practicable.
Environment Reference Standard (State of Victoria, 2021)	Legislation	Prescribes the indicators and objectives applicable to the ambient sound environment of proposed developments, depending on the land use category.
AS/NZS 2107:2016 Acoustics – Design Sound Levels and Reverberation Times for Building Interiors (Standards Australia, 2016)	Guideline	Provides guidance on internal noise levels and reverberation times for different types of spaces. The guidance provided is relevant to the development in respect of noise intrusion from external sources.
AS3671:1989 – Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction (Standards Australia, 1989)	Guideline	Provides guidance on determining the required traffic noise reduction from outside to inside a building exposed to traffic noise, and the types of construction required to achieve acceptable internal noise levels.

4 Development Plan Overlay Requirements

It is understood that a Development Plan Overlay prescribing requirements applicable to the development was issued following the successful rezoning of the land at the project site. Table 4 presents the relevant acoustic requirements:

Table 4 Relevant Acoustic Requirements

Item	Text from Development Plan Overlay
Sensitive Land Use	▪ Preparation of an assessment on the potential for noise and air pollution impacts from the Traralgon Maffra Road considering the Environment Reference Standards for Ambient Sound and Guidelines for Minimising Air Pollution in Victoria (EPA publication 1961). ▪ Any proposed mitigating measures that are required to be included as part of the noise and air pollution assessment.

It should be noted that assessment of air pollution is outside the scope of this document.

5 Existing Acoustic Conditions

5.1 Exterior Soundscape

During our site visits on 5 and 12 December 2023, the soundscape was dominated by road traffic noise from Traralgon-Maffra Road.

5.2 Road Noise Levels

Environmental noise logging was performed at the site to establish the road traffic noise. The measurements were performed along the eastern boundary of the site between 5 and 12 December 2023. Details of the measurement location and measurement methodology are presented in Appendix B. Table 5 presents a summary of the measured Sound Pressure Levels. Graphs showing the variation of the Sound Pressure Levels over the full measurement period are presented in Appendix C.

Table 5 Summary of Measured Environmental Noise Levels

Date	Measured Sound Pressure Level, dB(A)	
	Overall $L_{Aeq,16hr}$ (6 am to 10 pm)	Overall $L_{Aeq,8hr}$ (10 pm to 6 am)
Tuesday, 5 December 2023	76[1]	68
Wednesday, 6 December 2023	76	68
Thursday, 7 December 2023	76	68
Friday, 8 December 2023	76	67
Saturday, 9 December 2023	76	68
Sunday, 10 December 2023	75	68
Monday, 11 December 2023	77	68
Tuesday, 12 December 2023	77[2]	-
Adopted Design Sound Level	**77**	**68**

1 Partial measurement period: 3:30 pm to 10 pm only

2 Partial measurement period: 6 am to 12:30 pm only.

Attended noise measurements were performed along the eastern boundary of the site on 5 December 2023. The purpose of the attended measurements was to compare with the noise logging data and determine any differences in traffic noise levels along the eastern boundary of the project site with Traralgon-Maffra Road. Details of the measurement locations and measurement methodology are presented in Appendix B. Table 6 presents the measured road traffic noise levels.

Table 6 Measured Octave Band Sound Pressure Levels

Measurement Location	Overall, L_{Aeq} dB(A)
1B	74
2	64
3	70

6 Acoustic Criteria

6.1 Environment Reference Standard

The *Environment Reference Standard* (State of Victoria, 2021) prescribes the indicators and Ambient Sound Objectives (ERS Objectives) applicable to the ambient sound environment of proposed developments, depending on the land use category.

The project site has been rezoned as a General Residential Zone, which falls under Category III in accordance with Table 3.2 of the *Environment Reference Standard* (State of Victoria, 2021).

Table 7 presents the applicable external noise level design criteria in accordance with the ERS Objectives.

Table 7 Design External Noise Levels

Land Use Category	Applicable Times	Design External Noise Levels, dB(A)
Category III	6 am to 10 pm	$L_{Aeq,16hr} \leq 50$
	10 pm to 6 am	$L_{Aeq,8hr} \leq 40$

6.2 Australian Standard AS/NZS 2107:2016

Where the ERS Objectives cannot be met, consideration should be given to the recommended internal noise levels prescribed by *AS/NZS 2107:2016 Acoustics – Design Sound Levels and Reverberation Times for Building Interiors* (Standards Australia, 2016). To achieve acceptable overall internal noise levels within the development, it is considered that buildings should be designed to achieve the middle to lower end of the range recommended by AS/NZS 2107:2016 for overall internal noise levels during the daytime and night-time (i.e. $L_{Aeq,16hr}$ (6 am to 10 pm) and $L_{Aeq,8hr}$ (10 pm to 6 am) respectively).

Table 8 presents the adopted internal noise level design criteria based on the above approach:

Table 8 AS/NZS 2107:2016 Recommended Internal Noise Levels

Type of Occupancy / Activity	AS/NZS 2107:2016 Recommended Design Noise Level Range, L_{Aeq}, dB(A)	Adopted Project Design Criteria, dB(A)
		Day or Night Overall
Houses and apartments in inner city areas or entertainment districts or near major roads		
Living areas, work areas	35 to 45	$L_{Aeq,16hr} \leq 40$
Sleeping areas (night-time)*	35 to 40	$L_{Aeq,8hr} \leq 35$

* The noise criteria for sleeping areas have been taken to apply during the night-time (10 pm to 6 am) only. Higher noise levels in sleeping areas are considered to be acceptable during the daytime when occupants would generally not be sleeping, provided that the daytime noise levels in sleeping areas do not exceed the adopted criteria for living areas. The noise criteria for living areas has therefore also been adopted for sleeping areas during the daytime.

6.3 Australian Standard AS 3671:1989

Australian Standard *AS 3671:1989 – Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction* (Standards Australia, 1989) provides recommended building construction to reduce road traffic noise intrusion.

AS 3671:1989 provides recommendations based on the required Traffic Noise Reduction (TNR) which is the difference between the external noise level and AS/NZS 2107:2016 design internal noise level. Depending on the required TNR, the recommended building construction will be categorised into one of four categories ranging from standard construction to where specialist acoustic advice should be sought.

Table 9 presents details of the AS 3671:1989 required Construction Categories.

Table 9 AS 3671:1989 Required Construction Categories for Residential Buildings

External Traffic Noise Level		Traffic Noise Reduction, dB(A)	AS 3671:1989 Construction Category
$L_{Aeq,16hr}$ dB(A)	$L_{Aeq,8hr}$ dB(A)		
≤ 50	≤ 45	≤ 10	1
51 to 65	46 to 60	11 to 25	2
66 to 75	61 to 70	26 to 35	3
> 75	> 70	> 35	4

7 Road Traffic Noise Assessment

7.1 Noise Modelling

SoundPLAN environmental noise modelling software was used to calculate the existing and future traffic noise levels at the development.

Traffic noise has been modelled on Traralgon-Maffra Road only. No other roads have been included in the modelling.

Full details of noise modelling input parameters and data sources are presented in Appendix D.

7.2 Noise Model Calibration

For model calibration purposes, a version of the model representing the existing scenario (year 2023) was generated and used to calculate the road traffic noise levels at the noise logging position. The traffic noise levels calculated by the model were then compared with the measured road traffic noise levels, as shown in Table 10.

Table 10 Traffic Noise Model Calibration Results

Location	Sound Pressure Level Parameter	Measured Sound Pressure Level, dB(A)	Modelled Year 2023 Sound Pressure Level, dB(A) (Without Calibration Adjustment)	Difference, dB
1A	$L_{Aeq,16hr}$	77	69	-8
1A	$L_{Aeq,8hr}$	68	62	-6
1B	L_{Aeq}	74	69	-5
2	L_{Aeq}	64	62	-2
3	L_{Aeq}	70	64	-6

The results show that a deviation of up to -8 dB(A) was calculated between the measured and modelled noise levels. It is considered that the deviation between the measured and modelled noise levels are primarily due to the modelled levels having been based on VicRoads data taken in year 2020, when travel restrictions may have been in place due to COVID-19. The data obtained is the latest traffic volume data published by VicRoads.

The speed limit along Traralgon-Maffra Road is understood to be vary between 80 km/h and 100 km/h, as shown in Figure 3. The speed limit is 80 km/h at Location 2, and 100 km/h at all other locations.

Therefore, a +2 dB(A) calibration adjustment has been applied to the modelled traffic noise levels generated by sections of road which feature a speed limit of 80 km/h. A +8 dB(A) calibration adjustment has been applied to the modelled traffic noise levels generated by all other sections of road.

Figure 3 Posted Speed Limits Along Traralgon-Maffra Road (Aerial Photo Source: Google Maps)

7.3 Input Parameters

Traffic noise modelling will be conducted for the situation 10 years after the assumed development finalisation date of 2027.

Year 2037 traffic noise levels were calculated by adjusting the traffic volumes in the model to represent year 2037 traffic volumes.

The noise modelling has considered the acoustic screening effect from first two rows of proposed residential properties along the eastern boundary of the site (i.e. closest to Traralgon-Maffra Road). As building layouts have not been developed at the time of writing, modelling has been based on indicative building layouts and locations. Screening effects of buildings further back from Traralgon-Maffra Road have not been modelled. Therefore, the modelling may over-predict the noise levels at greater distances from Traralgon-Maffra Road.

7.4 Modelling Results

Figure 4 and Figure 5 presents noise contour maps showing the calculated $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ traffic noise contours in year 2037.

Figure 4 Calculated Year 2037 $L_{Aeq,16hr}$ Traffic Noise Contours

Figure 5 Calculated Year 2037 $L_{Aeq,8hr}$ Traffic Noise Contours

The noise modelling results indicate that external noise levels within the majority of the proposed residential development area will exceed the $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ ERS Objectives in the year 2037.

On the above basis, noise attenuation measures are recommended to reduce the impact of traffic noise on the residential development area.

8 Recommended Noise Attenuation Measures

Two potential noise attenuation options are outlined below:

Option 1:

- A 3 m high noise barrier / berm (may be either a barrier or a berm or a combination of the two to achieve the recommended 3 m total height) should be constructed along the eastern boundary of the site (closest to Traralgon-Maffra Road), as shown in Figure 6. This considers that the barrier / berm will not span within the pipeline easement area at the southern corner of the site.
- Residential buildings constructed within the lots highlighted in orange in Figure 6 should be constructed in general accordance with Construction Category 2 as prescribed in AS 3671:1989.
- Residential buildings constructed within all remaining lots (i.e. those not highlighted in Figure 6) should be constructed in general accordance with Construction Category 1 as prescribed in AS 3671:1989. Note that while the results of the noise modelling conducted in Section 7 indicate that some of these buildings will not meet the ERS Objectives, it is expected that the screening effects of buildings further back from Traralgon-Maffra Road (which have not been included in the modelling) will result in the external noise levels at these locations being broadly in accordance with the ERS Objectives.

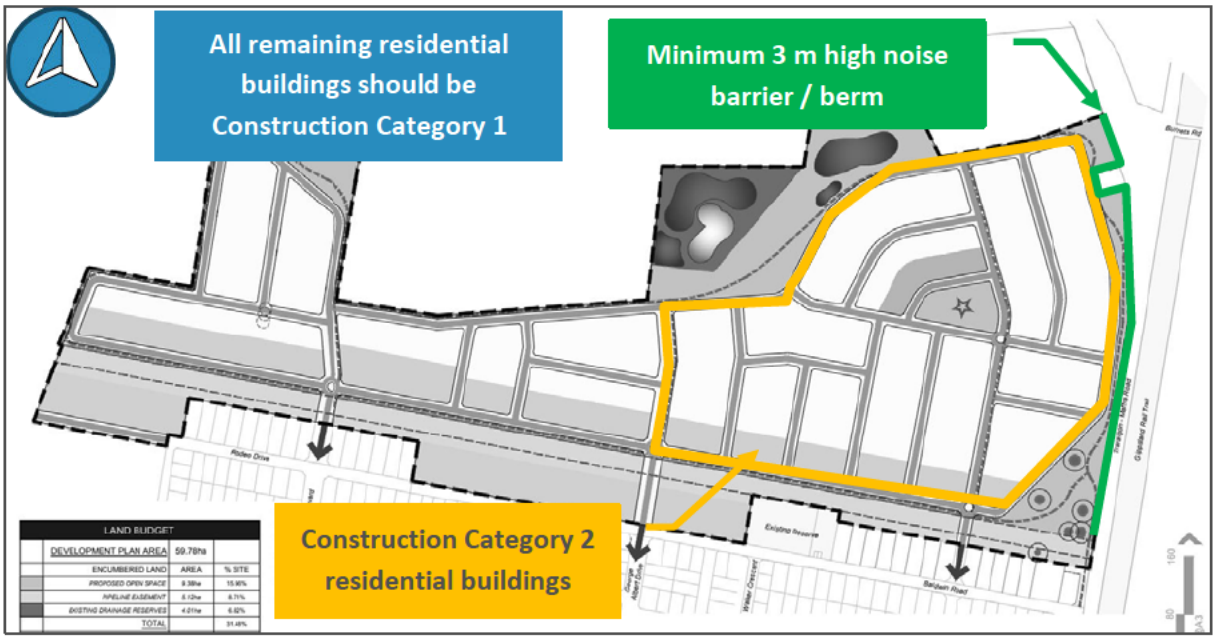


Figure 6 Recommended Noise Attenuation Measures – Option 1 (Image Source: Millar & Merrigan)

- Where Construction Category 2 is recommended, acceptable forms of construction will indicatively require:

- Masonry external facade construction with 90 mm thick, 20 kg/m^3, fibreglass or mineral wool insulation (equivalent to R2.5 wall batt) in stud wall cavity;
- Double glazed window units consisting of 6 mm glass + 12 mm air gap + 6.38 mm laminated glass; or alternative equivalent glazing system rated to $R_w \geq 34$ / $R_w + C_{tr} \geq 29$;
- Framing specified to match the required acoustic rating of the glazing;
- Glazing area comprising no more than 20% of the total floor area of the subject room;
- Roof / ceilings complete with minimum 210 mm thick, 11 kg/m^3 fibreglass, or mineral wool insulation (equivalent to R5.0 ceiling batt) cavity infill and minimum one layer of 13 mm fire-rated or acoustic plasterboard (min. mass 10.5 kg/m^2) ceiling lining fixed to underside of roof framing.
- Openable windows and exterior doors should be fitted with rubber-type acoustic seals;
- Fresh air intake or exhaust systems should be ducted, and consideration should be given to fitting acoustic attenuators or internal acoustic lining to the ductwork.

- If deviations from the indicative construction details outlined above are sought for any residential building where Construction Category 2 is recommended, specialist acoustic advice from a qualified acoustic consultant should be obtained during planning permit stage. The acoustic specialist should take into account the guidelines prescribed by AS/NZS 2107:2016 and AS 3671:1989. The sound insulation performance of each facade should account for the location of each room, their intended occupancy, and exposure to traffic noise.
- These requirements and this report shall be referenced on future subdivision permits.

Option 2:

- A 5 m high noise barrier / berm (may be either a barrier or a berm or a combination of the two to achieve the recommended 5 m total height) should be constructed along the eastern boundary of the site (closest to Traralgon-Maffra Road) and a section of the northern boundary of the site, as shown in Figure 7. This considers that the barrier / berm will not span within the pipeline easement area at the southern-corner of the site.
- Residential buildings constructed within the lots highlighted in orange in Figure 7 should be constructed in general accordance with Construction Category 2 as prescribed in AS 3671:1989.
- Residential buildings constructed within all remaining lots (i.e. those not highlighted in Figure 7) should be constructed in general accordance with Construction Category 1 as prescribed in AS 3671:1989. Note that while the results of the noise modelling indicate that some of these buildings will not meet the ERS Objectives, it is expected that the screening effects of buildings further back from Traralgon-Maffra Road (which have not been included in the modelling) will result in the external noise levels at these locations being broadly in accordance with the ERS Objectives.

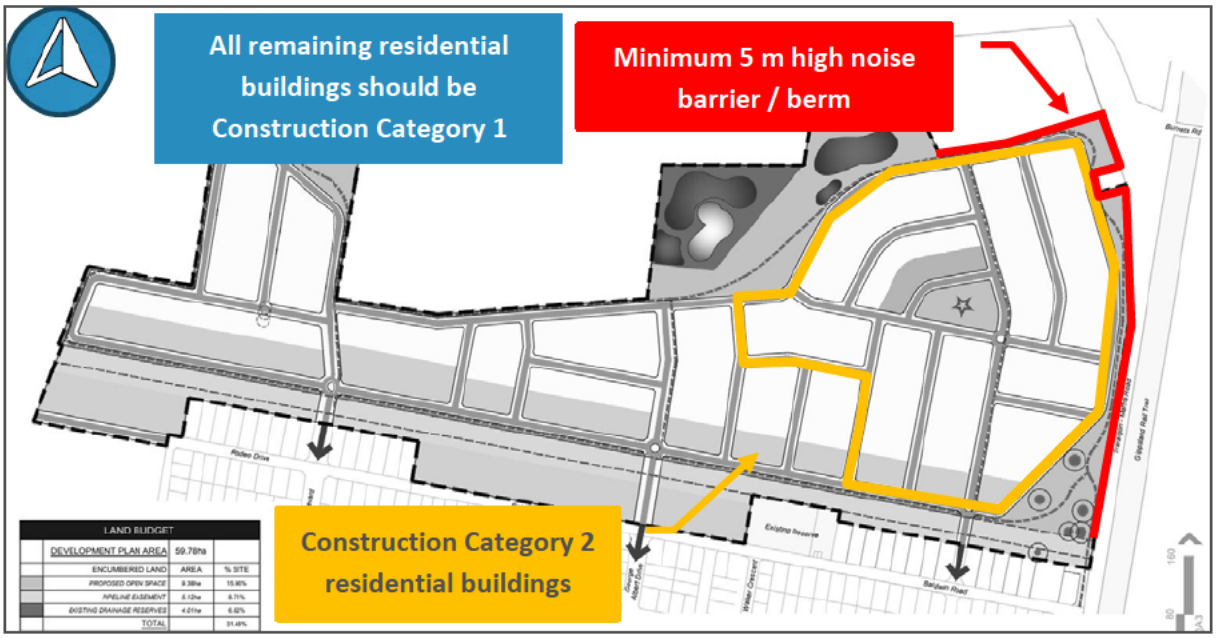


Figure 7 Recommended Noise Attenuation Measures – Option 2 (Image Source: Millar & Merrigan)

- Indicative construction details to achieve Construction Category 2 are outlined in Option 1. If deviations from the indicative construction details outlined in Option 1 are sought for any residential building where Construction Category 2 is recommended, specialist acoustic advice from a qualified acoustic consultant should be obtained during planning permit stage. The acoustic specialist should take into account the guidelines prescribed by AS/NZS 2107:2016 and AS 3671:1989. The sound insulation performance of each facade should account for the location of each room, their intended occupancy, and exposure to traffic noise.
- These requirements and this report shall be referenced on future subdivision permits.

9 Conclusion

This document has presented an acoustic assessment for the proposed residential subdivision at the corner of Baldwin Road and Traralgon-Maffra Road, Traralgon, VIC.

The assessment has been undertaken with regard to the acoustic criteria prescribed by the *Environment Reference Standard* (State of Victoria, 2021) and the recommendations prescribed by *AS/NZS 2107:2016 Acoustics – Design Sound Levels and Reverberation Times for Building Interiors* (Standards Australia, 2016) and *AS 3671:1989 – Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction* (Standards Australia, 1989).

Acoustic engineering advice for the proposed project has been presented in Sections 7 and 8.

Subject to implementation of the advice presented in this document and either of the noise attenuation options outlined in Section 8, it is considered that the proposed project will satisfy the applicable acoustic legislation and guidelines.

10 References

Abbott, P. G. (2002). *Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping.* TRL Limited.

ISO. (1996). ISO 9613-2:1996 Acoustics - Attenuation of Sound During Propogation Outdoors - Part 2: General Method of Calculation. International Standards Organisation.

Standards Australia. (1989). AS 3671:1989 Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction.

Standards Australia. (2016, October). AS/NZS 2107:2016 Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

State of Victoria. (2021, July 01). Environment Protection Act 2017.

State of Victoria. (2021, May 25). Environment Reference Standard.

UK DoT. (1988). Calculation of Road Traffic Noise (CoRTN). Department of Transport, Welsh Office.

Appendix A Glossary of Acoustic Terms

dB / dB(A)

Decibels or 'A'-weighted Decibels, the units of Sound Pressure Level. 'A'-weighting adjusts the levels of frequencies within the sound spectrum to better reflect the sensitivity of the human ear to different frequencies at Sound Pressure Levels typical of everyday sounds. [Unit: dB / dB(A)]

The following are examples of the decibel readings of every day sounds;

- 0 dB The faintest sound we can hear
- 30 dB A quiet library or in a quiet location in the country
- 45 dB Typical office space. Ambience in the city at night
- 60 dB The sound of a vacuum cleaner in a typical lounge room
- 70 dB The sound of a car passing on the street
- 80 dB Loud music played at home
- 90 dB The sound of a truck passing on the street
- 100 dB The sound of a rock band
- 120 dB Deafening

C_{tr}

A spectrum adaptation term, commonly used with R_w. C_{tr} adjusts the sound insulation ratings to better describe the performance of the particular construction under consideration when subject to low frequency noise, such as noise from heavy vehicle traffic or subwoofers. [Unit: dB]

Frequency

The rate of repetition of a wave i.e. the number of cycles per second [Unit: Hz]

$L_{A10,18hr}$

This is the arithmetic average of the 18 individual $L_{A10,1hr}$ values for the hours from 6 am to midnight in a single day. It is one of the standard traffic noise descriptors used in Australia. [Unit: dB / dB(A)]

$L_{Aeq,T}$

The Equivalent Continuous A-weighted Sound Pressure Level measured over the period T (also known as Time-Average Sound Pressure Level). The Equivalent Continuous A-weighted Sound Pressure Level is the constant value of A-weighted Sound Pressure Level for a given period that would be equivalent in sound energy to the time-varying A-Weighted Sound Pressure Level measured over the same period. In simple terms, this can be thought of as the average Sound Pressure Level. [Unit: dB / dB(A)]

R_w	Weighted Sound Reduction Index. A single number rating of the airborne sound insulation performance of a specific building element in the absence of flanking transmission. R_w is a laboratory test rating for a single building element (e.g. a door, a window or a wall) determined under ideal conditions with minimal flanking transmission, and is largely independent of partition size and room effects. R_w ratings cannot be accurately tested outside of a controlled laboratory environment. A higher R_w value indicates better airborne sound insulation. [Unit: dB]
Sound Pressure Level	A measure of the magnitude of a sound wave. Mathematically, it is twenty times the logarithm to the base ten of the ratio of the root mean square sound pressure at a point in a sound field, to the reference sound pressure; where sound pressure is defined as the alternating component of the pressure (Pa) at the point, and the reference sound pressure is $2x10^{-5}$ Pa. [Unit: dB]

Appendix B Noise Measurement Methodology

A.1 Measurement Location

Table A.1 presents details of the noise measurement locations. Figure A.1 to Figure A.3 present a map and photographs of the noise measurement locations.

Table A.1 Noise Measurement Location Details

Location Reference	Measurement Description	Microphone Height Above Ground Level
1A	Environmental noise logging	1.3 m
1B, 2, 3	Attended traffic noise measurement	1.5 m

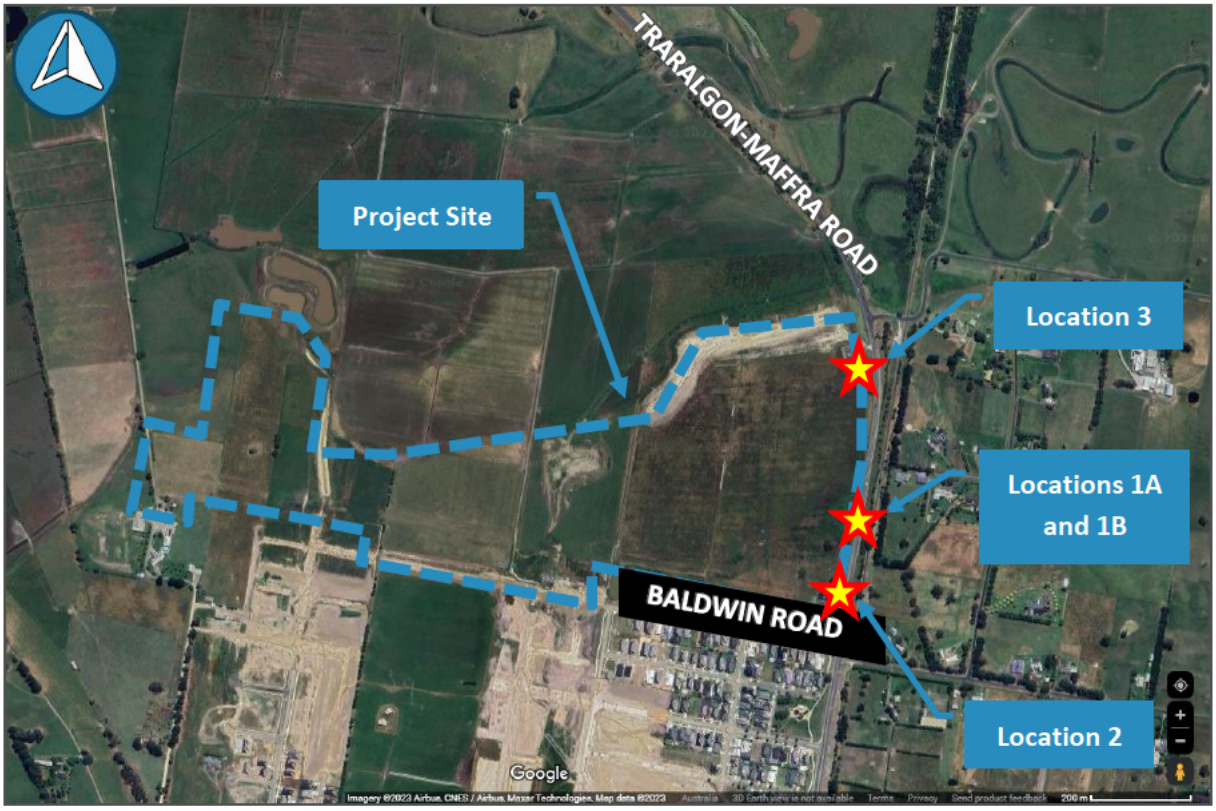


Figure A.1 Noise Measurement Locations (Aerial Photo Source: Google Maps)

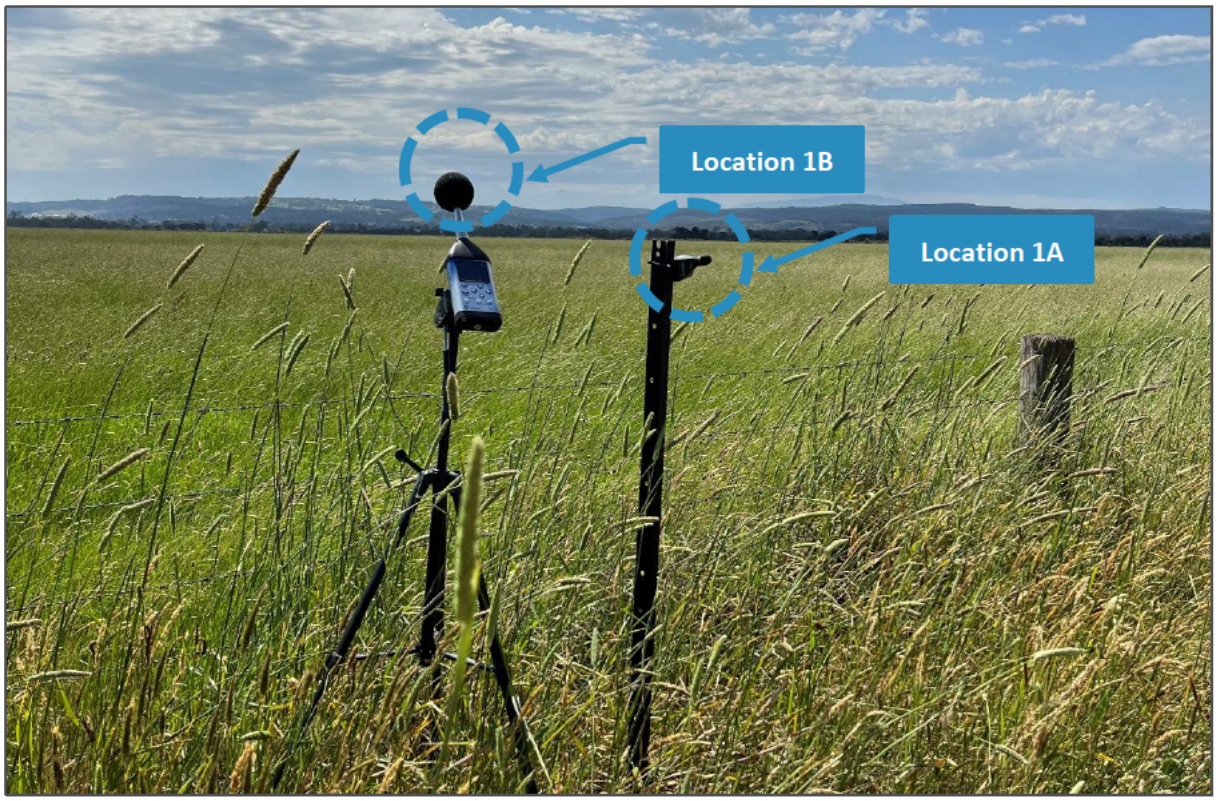


Figure A.2 Noise Measurement Locations 1A and 1B – Photo Facing North-West

Figure A.3 Noise Measurement Location 2 – Photo Facing South

Figure A.4 Noise Measurement Location 3 – Photo Facing North

A.2 Measurement Procedure

Noise measurements were performed at the site to establish the environmental noise levels. Table A.2 presents details of each measurement:

Table A.2 Details of Measurement Period

Location Ref.	Measurement Type		Start Time	Start Date	End Time	End Date
	Attended	Unattended				
1A	☐	☒	3:30 PM	Tuesday 5/12/2023	12:30 PM	Tuesday 12/12/2023
1B	☒	☐	3:38 PM	Tuesday 5/12/2023	3:48 PM	Tuesday 5/12/2023
2	☒	☐	3:05 PM	Tuesday 5/12/2023	3:20 PM	Tuesday 5/12/2023
3	☒	☐	3:55 PM	Tuesday 5/12/2023	4:05 PM	Tuesday 5/12/2023

The equipment was configured to provide the measurement results as a continuous series of 1 second A- and Z-weighted Sound Pressure Levels. Metrics used for the assessment were then post-processed from this data.

A foam windscreen was installed on each microphone to minimise the effect of wind-induced pressure fluctuations on the measurements.

A.3 Instrumentation

All acoustic instrumentation used for the measurements held a current certificate of calibration from a National Association of Testing Authorities (NATA) accredited laboratory or from the manufacturer at the time of the measurements.

A field check to confirm correct calibration of the instrumentation was performed at the beginning and end of the measurement period using a laboratory calibrated portable Sound Level Calibrator. At the time of each check the instrumentation was found to be reading correctly and the deviation between consecutive checks was found to be less than 1 dB.

Details of the acoustic instrumentation used for measurements are presented in Table A.3.

Table A.3 Acoustic Instrumentation Details

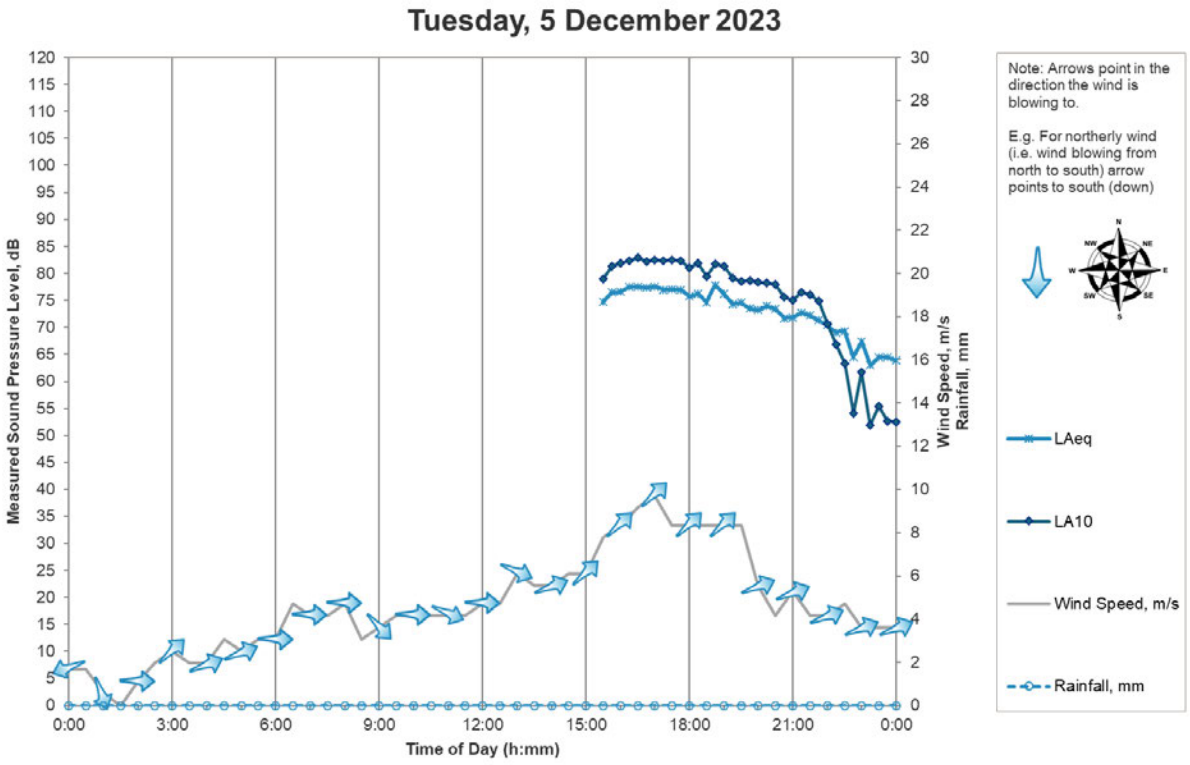
Location Reference	Instrument Description	Serial No.	Date of Last Laboratory Calibration*
1A	Convergence Instruments NSRT_mk2 Type 1 Sound Level Meter	CFh+pP0YcdWXKjNgSyLRHD	10/10/2018
1B, 2, 3	Svantek 977 Class 1 Sound Level Meter	45758	20/10/2023
-	Svantek SV33B Portable Sound Level Calibrator	112498	16/01/2023

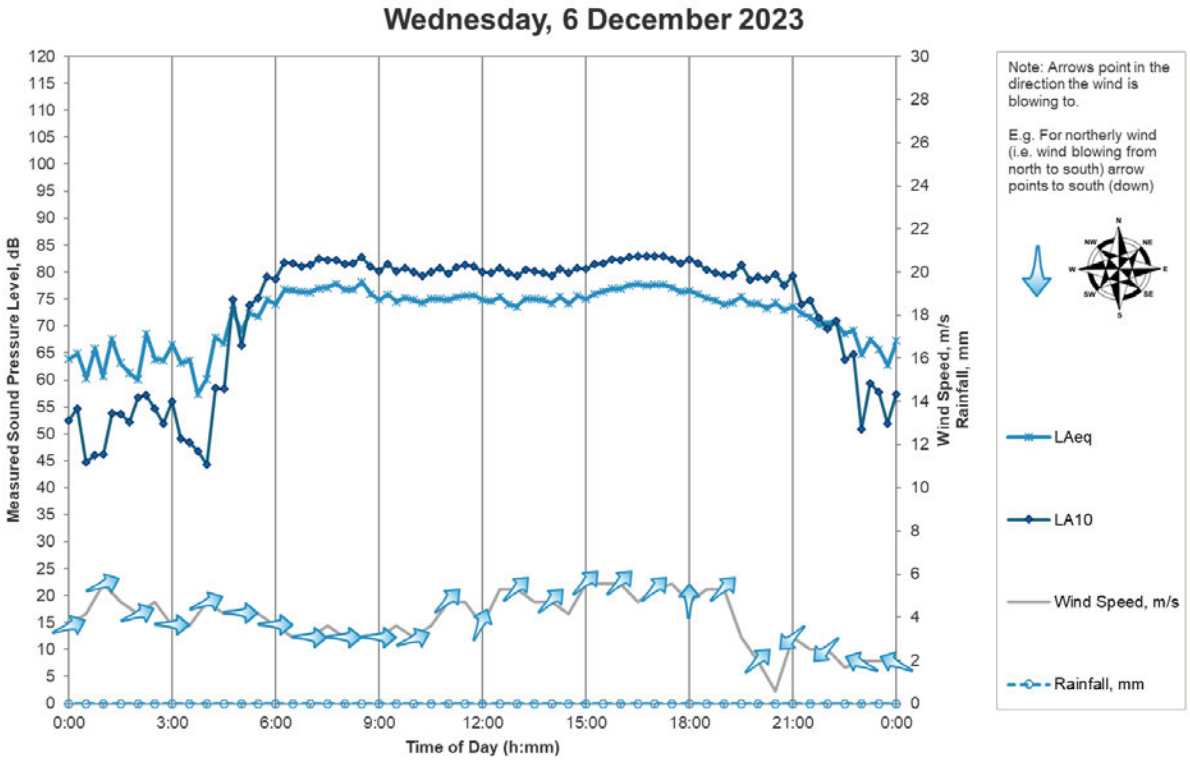
* In accordance with AS 1055.1-1997 and National Association of Testing Authorities Guidelines, Sound Level Calibrators require calibration annually.

A.4 Meteorological Data

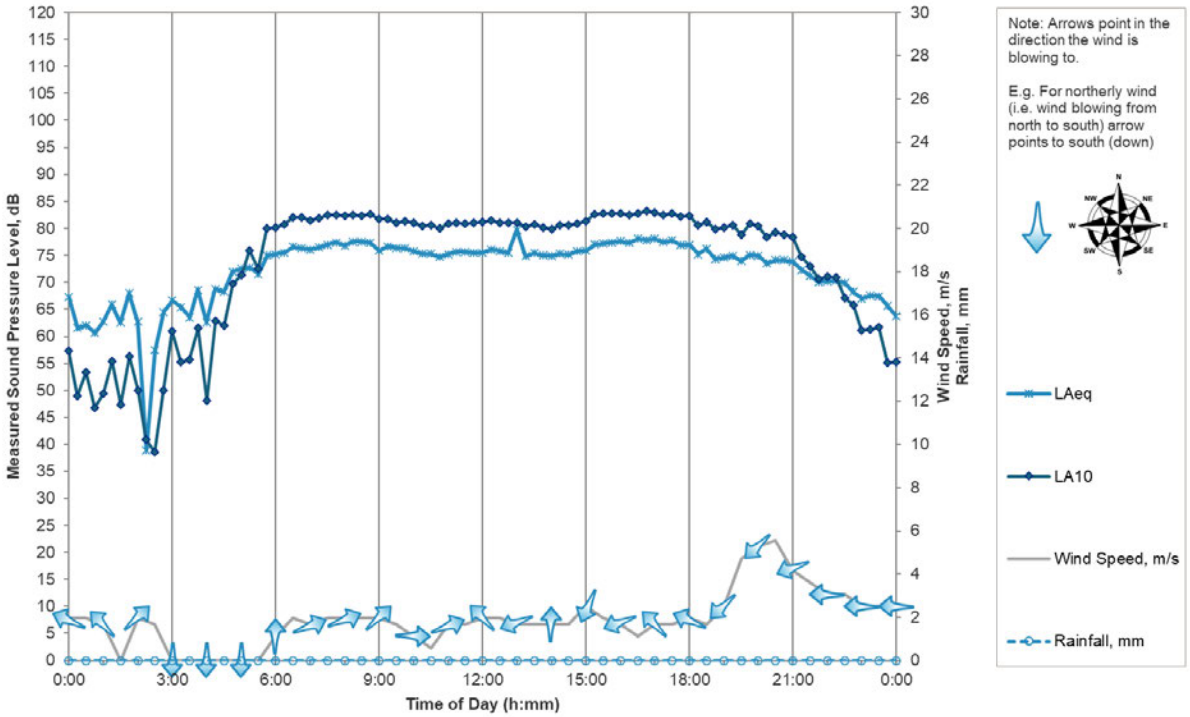
Weather observations during the monitoring period were taken from the Bureau of Meteorology Weather Station at Latrobe Valley, approximately 9 km away. Appendix C shows the meteorological observations plotted against the measured L_{Aeq} and L_{A10} Sound Pressure Levels for the duration of the measurement period.

Appendix C Graphed Noise Measurement Results

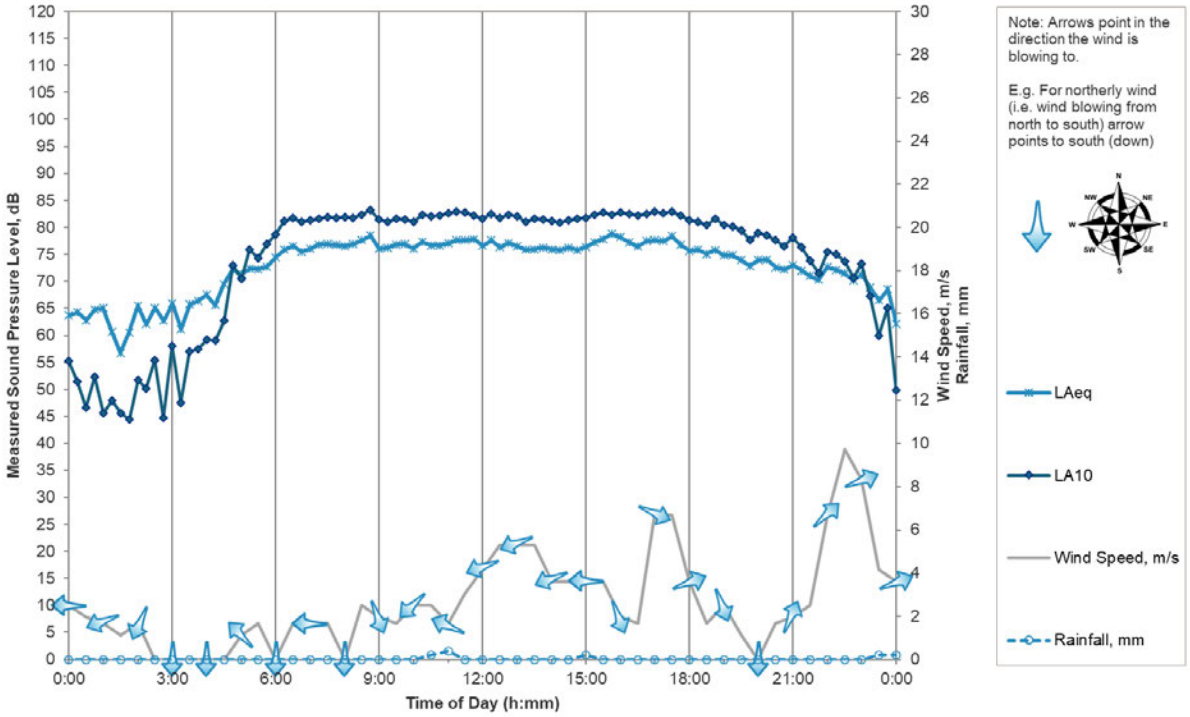




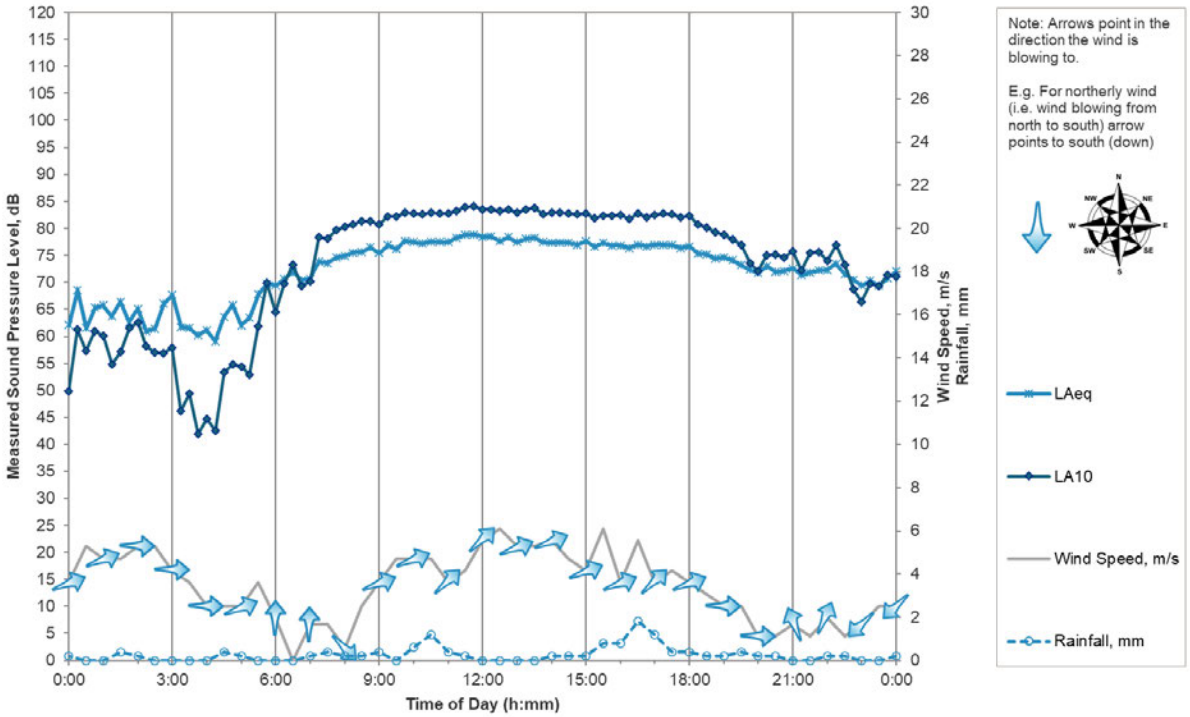
Thursday, 7 December 2023



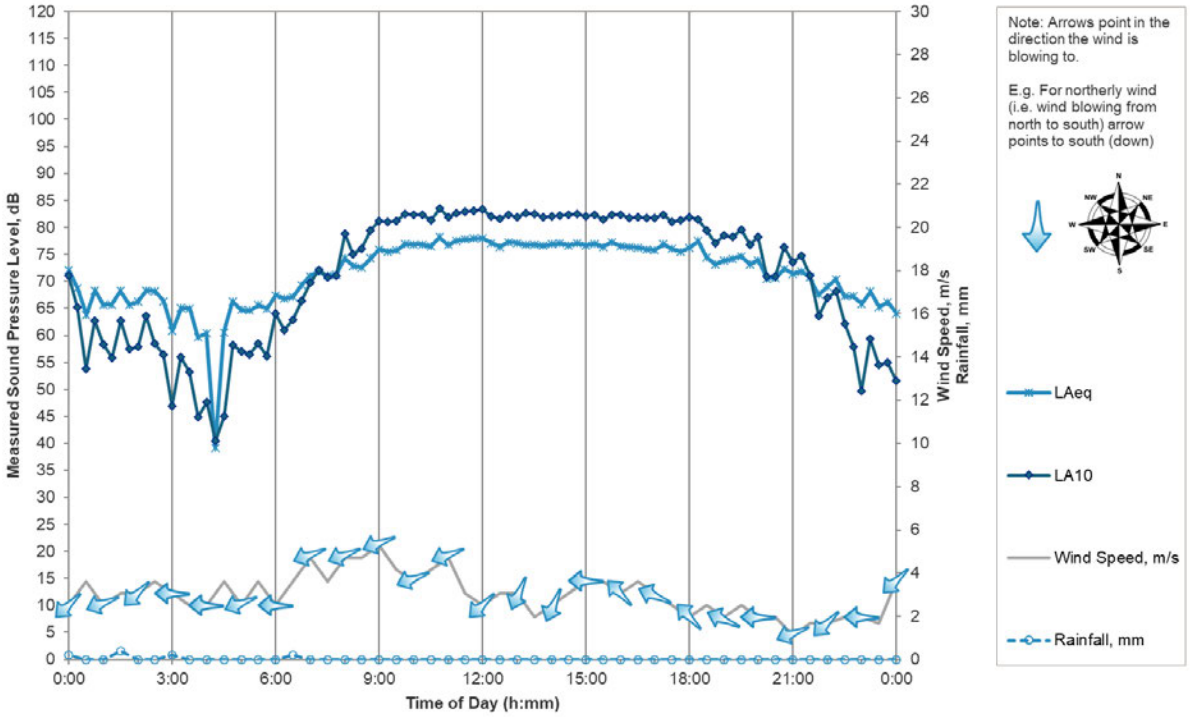
Friday, 8 December 2023



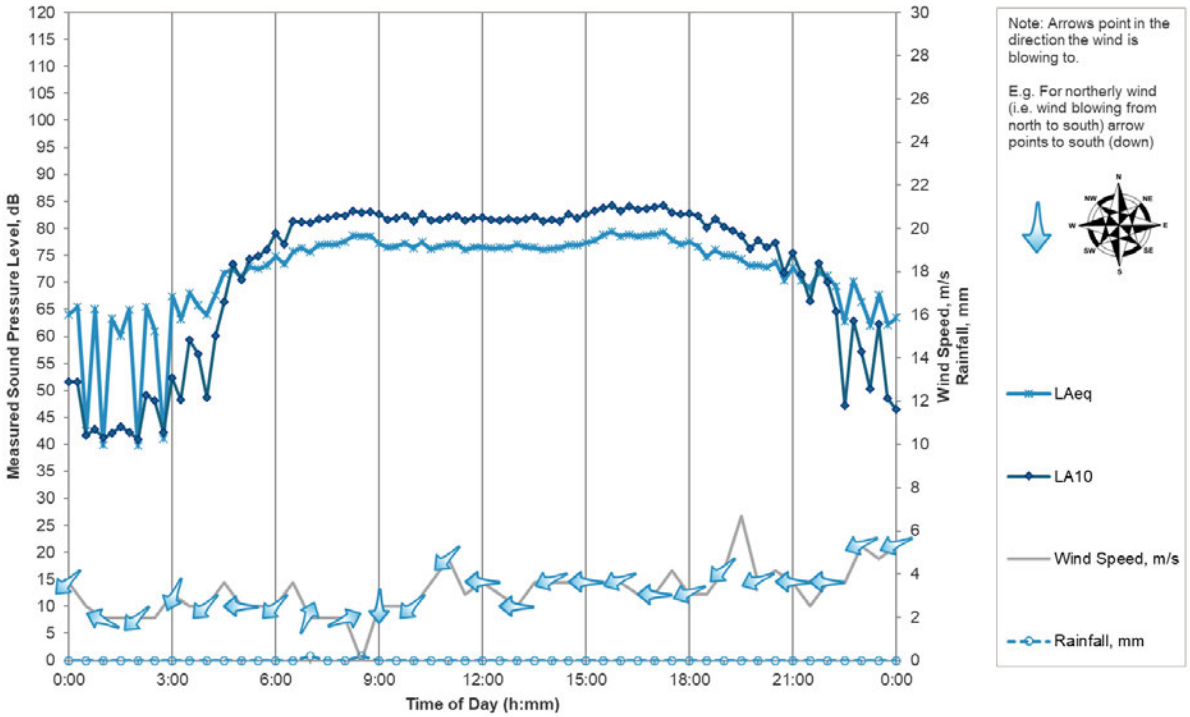
Saturday, 9 December 2023



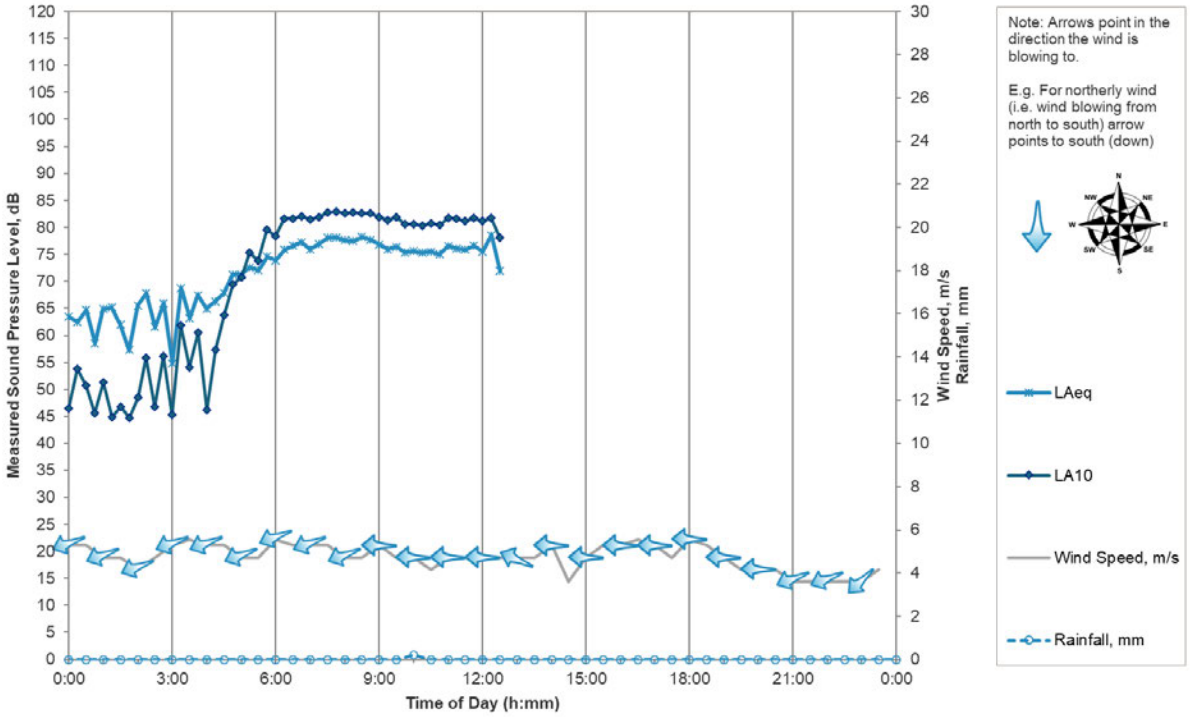
Sunday, 10 December 2023



Monday, 11 December 2023



Tuesday, 12 December 2023



Appendix D Modelling Parameters

A.5 General Parameters

Parameter	Description
Software	SoundPLAN Version 7.4
Calculation Method	ISO 9613-2:1996 (ISO, 1996) Road Noise: CoRTN (UK DoT, 1988)

A.6 Geometrical Parameters

Parameter	Description
Site Layout	▪ As per reference documentation.
Terrain	▪ Ground modelled according to elevation data from ELVIS (Elevation Information System).
Ground absorption	▪ Traralgon-Maffra Road has been modelled as hard ground using a ground factor of 0. ▪ All other areas have been modelled as a combination of hard and soft ground using a ground factor of 0.6.
Buildings	▪ Residential boundaries within the project have been modelled as per reference documentation. ▪ Buildings within the project site nearest to Traralgon-Maffra Road were modelled as 3.5 m high with a rectangular outline.
Receptors	▪ Noise levels calculated at proposed residential boundaries have been modelled 1.5 m above ground level.

A.7 Environmental Parameters

Parameter	Description
Air Absorption Calculation	ISO 9613-2:1996
Air Temperature	10 degrees Celsius
Air Pressure	1013.3 mbar
Humidity	70%
Propagation Conditions	▪ The propagation conditions used in the modelling are the standard ISO 9613-2 conditions. These represent downwind propagation with: o Wind direction ± 45 degrees of the direction connecting the centres of the dominant sound source and the specified receiver region, with the wind blowing from source to receiver; and o Wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above ground.

Parameter	Description
	▪ The modelled conditions would similarly represent average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights. ▪ Such conditions result in enhanced noise propagation and can be considered to represent a worst-case scenario for noise propagation.

A.8 Road Parameters

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Road Geometry</td><td>▪ Traralgon-Maffra Road modelled as two single-lane carriageways, with each lane modelled as 4 m wide.
▪ No other roads have been included in the model.</td></tr>
<tr><td>Traffic Volumes</td><td>▪ VicRoads Open Data provided the data used to model traffic volume along Traralgon-Maffra Road. Forecast year 2037 AADT was derived based on the current annual traffic growth rate. The AADTs used in the traffic noise modelling therefore as follows:
<table>
<tr><th>Traralgon -Maffra Road</th><th>2023 All Vehicles AADT</th><th>2023 %HV</th><th>Annual Growth Rate</th><th>2037 All Vehicles AADT</th><th>2037 %HV</th></tr>
<tr><td>Two-Way</td><td>5,100</td><td>7%</td><td>2.5%</td><td>7,200</td><td>7%</td></tr>
</table>
▪ The CoRTN modelling methodology uses 18-hour traffic volumes (6 am to midnight) rather than AADT volumes. To account for this difference the 18-hour road traffic volume used in the modelling was based on 96% of AADT volume.</td></tr>
<tr><td>Vehicle Speeds</td><td>Modelling of traffic flow based on a mean speed limit of:
▪ 80 km/h along the section of Traralgon-Maffra Road highlighted in orange in Figure 3.
▪ 100 km/h along all other sections of Traralgon-Maffra Road (i.e. to the east and the north of the project site, highlighted in purple in Figure 3).</td></tr>
<tr><td>Conversion from $L_{A10,18hr}$ to $L_{Aeq,16hr}$ (Day) and $L_{Aeq,8hr}$ (Night)</td><td>Conversion from $L_{A10,18hr}$ to the L_{Aeq} metrics used for the assessment performed in accordance with the equations recommended in Converting the UK Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping (Abbott, 2002).</td></tr>
</table>