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2 December 2024

Jake Burgess
Sydney Zoo
700 Great Western Highway
Bungarribee NSW 2767

Re: **Sydney Zoo - SSD 7228 - Condition C32C(b) - Noise Verification Report**

Introduction

RWDI has been commissioned by Sydney Zoo to prepare a Noise Verification Report to confirm that the operations of Sydney Zoo are compliant with the noise conditions of Approval (SSD 7728), specifically Conditions C32, C32A, C32B, C32C, and C32D as reproduced below:

Operational Noise Limits:

***C32**: The Applicant shall ensure that noise generated by the operation of the Development does not exceed the noise limits in Table 3*

Table 3: Project Specific Noise Limiter (dBA) table:

Receiver Location	Day $L_{Aeq,15min}$	Evening $L_{Aeq,15min}$	10pm to 12 midnight $L_{Aeq,15min}$	Night (after midnight) $L_{Aeq,15min}$
Bungarribee, Eastern Creek	51	50	47	40
Place of residence at R1 (Great Western Highway)	57	50	50	30
S1 (Eastern Creek Primary School)	45	N/A	N/A	N/A

***C32A:** The Applicant shall ensure that the $L_{A10\ (15\ Minutes)}$ noise generated from the use of the site as a function centre or by any temporary and community event held on site does not exceed the background noise level in any octave band centre frequency (31.5 Hz-8kHz inclusive) by more than 5dB between 7am and 12pm at the boundary of any affected residence.*

Noise Verification Report

C32B. *Within six months of the commencement of operation of the Development the Applicant must prepare a Noise Verification Report for the Development to the satisfaction of the Planning Secretary. The report must:*

a) *be prepared by a suitably qualified acoustic consultant, with qualifications and experience consistent with the technical eligibility criteria for membership to the Association of Australian Acoustical Consultants or the Australian Acoustical Society;*
b) *be prepared in consultation with Council;*
c) *include an analysis of compliance with the noise limits specified in Condition C32 for all activities specified in Condition B10;*
d) *include an outline of management actions to be taken to address any exceedances of the limits specified in Condition C32; and*
e) *describe contingency measures in the event management actions are not effective in reducing noise levels to an acceptable level.*

C32C*. A Noise Verification Report must be submitted to the satisfaction of the Planning Secretary at the following stages of the Development:*

a) *within three months of the conclusion of the Sydney Zoo Light Festival 2021 event held at the site in July and August 2021 or an equivalent temporary and community event agreed to by the Planning Secretary; and*
b) within three months of the conclusion of the first twilight concert event held at the site.

C32D*. The Noise Verification Report required by Condition C32C must:*

a) *be prepared by a suitably qualified acoustic consultant, with qualifications and experience consistent with the technical eligibility criteria for membership to the Association of Australian Acoustical Consultants or the Australian Acoustical Society;*
b) *be prepared in consultation with Council;*
c) *include an analysis of compliance with the noise limits specified in Condition C32 and Condition C32A for any event held on site;*
d) *include an outline of management actions to be taken to address any exceedances of the limits specified in Condition C32 and Condition C32A and a timetable for the implementation of any required actions; and*
e) *describe contingency measures in the event management actions are not effective in reducing noise levels to an acceptable level.*

Condition C32C(a) refers to a "Sydney Zoo Light Festival 2021" which was cancelled in 2021 due to COVID-19 restrictions. An equivalent event was agreed with the Department and was the Sydney Zoo Glow Festival 2022, which was the subject of a Noise Verification Report (6th July 2022), that was approved by the Department on 1st August 2022 as having satisfied Condition C32C(a) of the SSD7228 consent.

This Noise Verification Report responds to Condition C32C(b) which relates to a twilight concert event. Sydney Zoo held a Halloween themed activation, which included a twilight concert, was held between 31st October and 3rd November between the hours of 3pm and 7pm (3pm to 5pm on Sunday).

The site inspection identified that noise sources mainly consisted of patrons speaking. Only one installation included amplified music, though the music levels were not significant enough to be audible at nearby sensitive receivers. This installation was the Monster Mash Disco at the Lion Deck, which featured:

- Amplified music
- Children's games
- Spooky Halloween characters
- Spooky dress competition

Figure 1 presents an event map and the location of the installations.

Figure 1: Event Map

Noise Monitoring

In order to assist with determining noise compliance, unattended and attended noise monitoring was completed.

It should be noted that the residence at receiver location R1 (715 Great Western Highway, Eastern Creek) has been demolished. Review of Nearmap aerial imagery confirmed that this residence was demolished sometime after December 2020.

Therefore, noise monitoring was only conducted at the Bungarribee, Eastern Creek receiver location at 30 Velocity Parade, Bungarribee. **Figure 2** presents the location of noise monitoring relative to Sydney Zoo.

Figure 2: Noise Monitoring Location

Unattended noise monitoring was conducted between 31st October 2024 and 4th November 2024.

The noise monitoring equipment used for this measurement consisted of ARL environmental noise loggers set to A-weighted, fast response, continuously monitoring in 15-minute intervals. This equipment is capable of remotely monitoring and storing

noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines L_{Amax}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A10} and L_{A90} are the levels exceeded for 10% and 90% of the sample time. The L_{Amax} is indicative of maximum noise levels due to individual noise events. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period.

Table 1 presents the results of noise monitoring. As the event only occurs between 3.00pm and 7.00pm (up to 5pm on Sunday), only noise levels for the evening period have been considered. Values presented in **BOLD** have been rain affected. The full noise monitoring charts are presented in the **APPENDIX**.

Table 1: Unattended Noise Monitoring Results

Date	ABL	L_{eq}
31st October 2024	42	48
1st November 2024	45	53
2nd November 2024	**39**	49
3rd November 2024	42	50

Attended noise monitoring was also conducted on the first afternoon of opening. Attended measurements were conducted at the assessment location before the commencement of the event as well as during the event.

All attended measurements were conducted using an NTi Type XL2 sound level meter (SLM). This SLM is a type approved system offering Class 1 performance according to IEC 61672-1:2013 *Electroacoustics – Sound level meters – Part 1: Specifications* and has current with National Association of Testing Authorities**,** Australia requirements (NATA) calibrated and has current with National Association of Testing Authorities, Australia requirements (NATA) calibrated to IEC 61672-3:2013 *Electroacoustics – Sound level meters – Part 3: Periodic tests.* The A-weighting filter of the meter was selected, and the time weighting was set to "Fast". The field calibration of the meter was checked before and after the measurements with a Brüel & Kjær Type 4231 sound level calibrator (SLC) and no significant drift was noted. This SLC is a Class 1 calibrator according to AS IEC 60942-2004 *Electroacoustics – Sound calibrators* and has been calibrated to the same Standard.

The NTi Type XL2 and Brüel & Kjær Type 4231 hold current laboratory calibrations in accordance with NATA and our in-house Quality Assurance Procedures.

Table 2 presents the results of attended noise measurements.

Table 2: Attended Noise Monitoring Results – 31 October 2024

Time	L_{Amax}	L_{Aeq}	L_{A90}	L_{AEQ} Contribution	Comments
4.45pm – 5.00pm	67	44	39	<29	Background noise controlled by distant road traffic noise – assumed to be heavy vehicle movements on Great Western Highway Lmax 67 dBA from passing vehicle on Velocity Parade No noise from Sydney Zoo is audible/discernible.
6.20pm – 6.35pm	75	50	46	<36	No noise from Sydney Zoo is audible/discernible. Ambient noise dominated by insect noise. Background noise controlled by road traffic noise on Great Western Highway. L_{max} 75 dBA from resident's child

Noise Assessment

The attended noise monitoring identified no significant noise sources at Sydney Zoo and determined that noise from the twilight concert held at the Sydney Zoo was not audible at the assessment location at Bungaribee.

The ambient noise environment at the assessment location was dominated by nearby insect noise, and road traffic noise from the Great Western Highway. Thus, the measured L_{Aeq} noise levels at this location would not be appropriate to compare the noise impact from the operation of the event.

The ABLs at these locations may be more appropriate but will be still quite conservative. When reviewing the results from the unattended noise monitoring, the measured ABL levels were consistently below the L_{Aeq} criteria of 50 dBA. Furthermore, review of audio recordings confirmed that the noise form Sydney Zoo was not audible at any point.

As noise from Sydney Zoo is inaudible, it is expected that noise from the site when measured as an L_{A10} would not exceed the background noise level in any octave band by more than 5 dB.

On this basis, noise from the carrying out of a twilight event at Sydney Zoo during a temporary community event complies with the Project Specific Noise Limits stipulated in Condition C32C(b). Furthermore, noise levels comply with the noise limits specified in

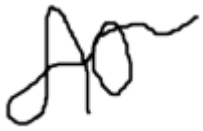
Condition C32 and Condition C32A for any event held on site. No further management or contingency measures is recommended or required.

As per Condition C32D(b), Sydney Zoo will be submitting this report to Blacktown City Council for review.

This report was compiled by Alex Jang, who is suitably qualified to issue this Noise Verification Report as a Project Engineer of RWDI with 3+ years' experience in the field of acoustics.

Further, this report underwent Quality Assurance processes, conducted by Remi Larmandieu. Remi Larmandieu is a Senior Engineer of RWDI with 10+ years' experience in the field of acoustics, as well as being a Charter Engineer (CPEng Mech) and a member of the Australian Acoustical Society (MAAS).

Yours faithfully

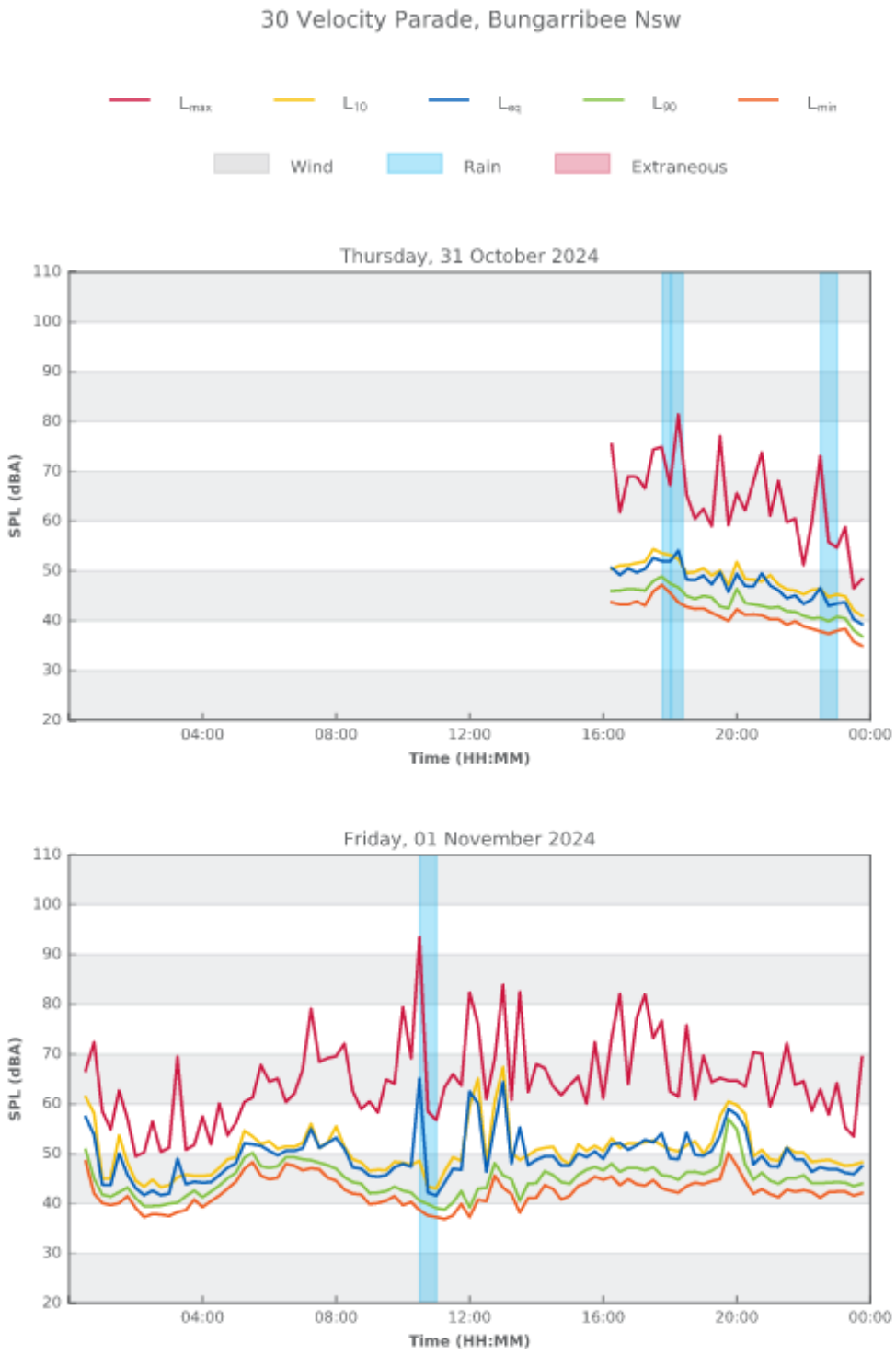


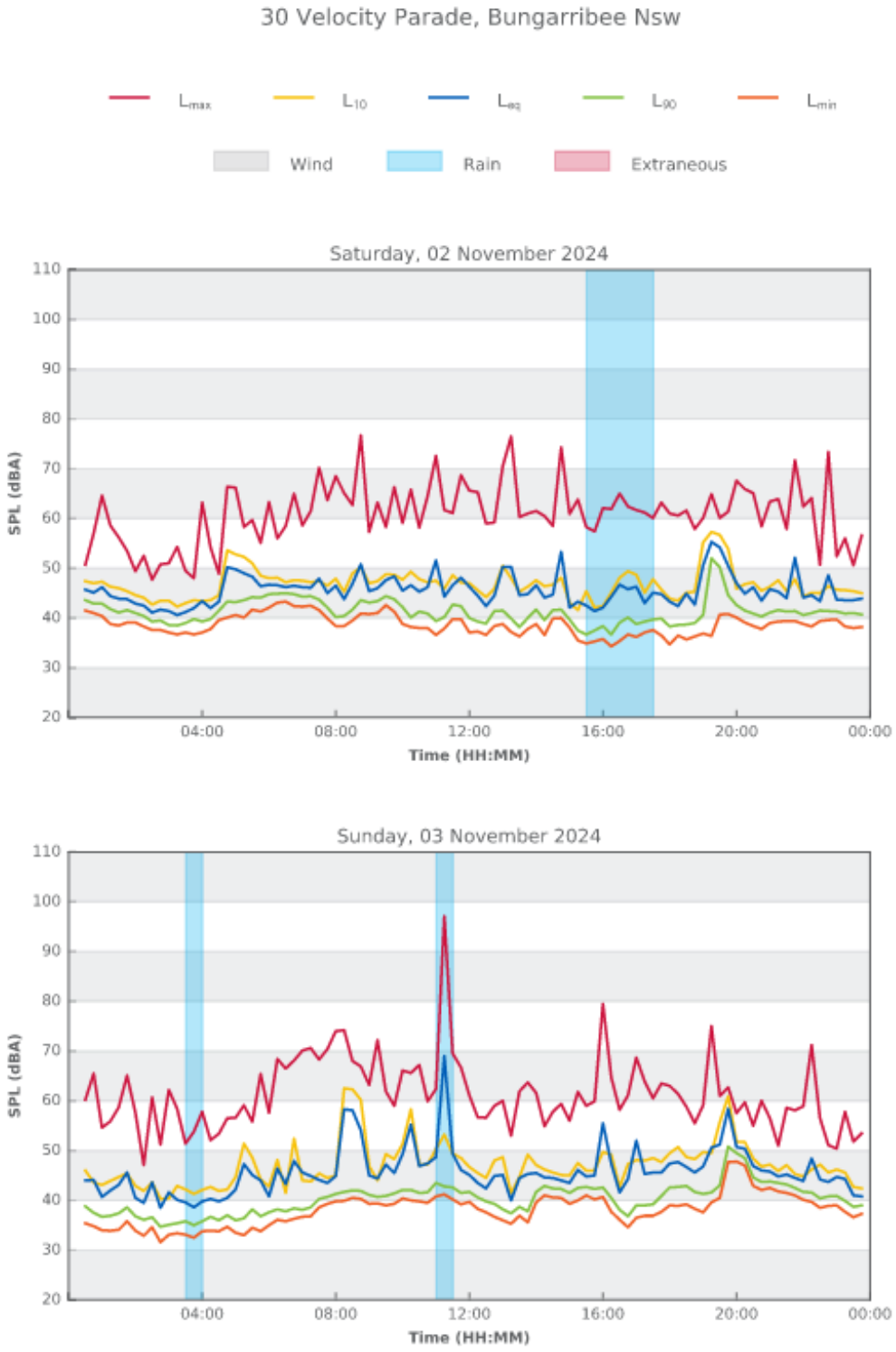
Alex Jang
Project Engineer
RWDI

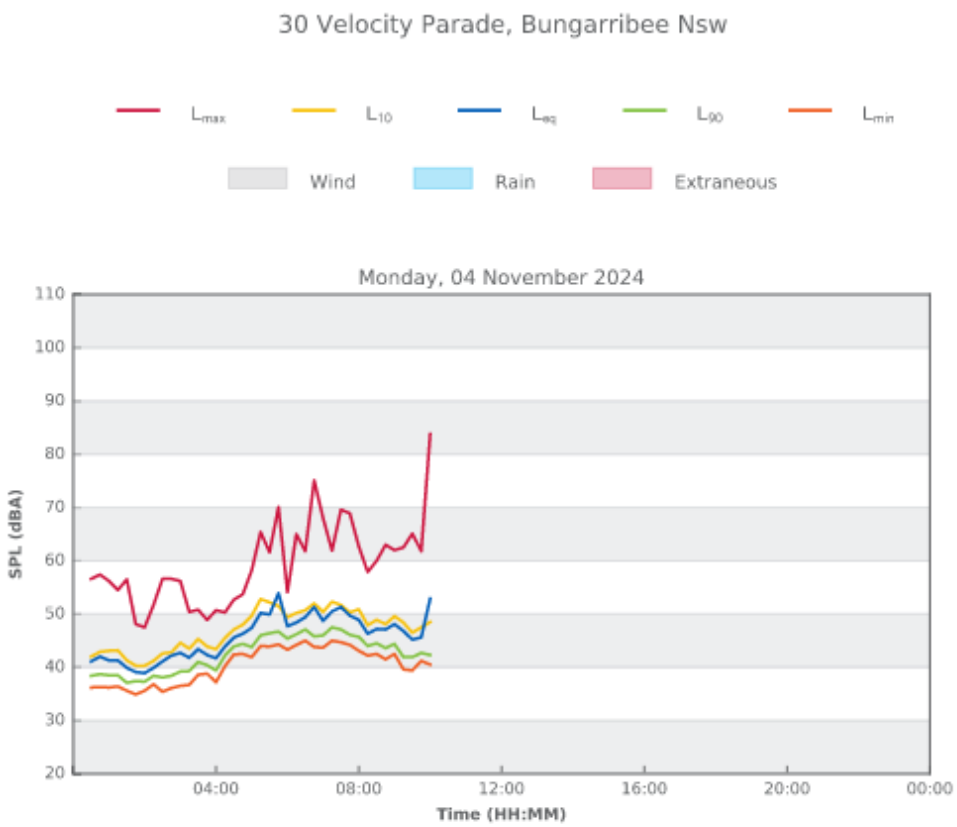
APPENDIX A

NOISE MEASUREMENT GRAPHS

APPENDIX


30 Velocity Parade, Bungarribee Nsw
L_{max}
L_{10}
L_{eq}
L_{90}
L_{min}
Wind
Rain
Extraneous
Thursday, 31 October 2024
SPL (dBA)
Time (HH:MM)
Friday, 01 November 2024
SPL (dBA)
Time (HH:MM)


30 Velocity Parade, Bungarribee Nsw
L_{max}
L_{10}
L_{eq}
L_{90}
L_{min}
Wind
Rain
Extraneous
Saturday, 02 November 2024
SPL (dBA)
110
100
90
80
70
60
50
40
30
20
04:00
08:00
12:00
16:00
20:00
00:00
Time (HH:MM)
Sunday, 03 November 2024
SPL (dBA)
110
100
90
80
70
60
50
40
30
20
04:00
08:00
12:00
16:00
20:00
00:00
Time (HH:MM)


30 Velocity Parade, Bungarribee Nsw
L_{max}
L_{10}
L_{eq}
L_{90}
L_{min}
Wind
Rain
Extraneous
Monday, 04 November 2024
110
100
90
80
70
60
50
40
30
20
SPL (dBA)
04:00
08:00
12:00
16:00
20:00
00:00
Time (HH:MM)

30 Velocity Parade, Bungarribee Nsw

INP Descriptors

Descriptor	Date	Day	Evening	Night	AM Shoulder*	PM Shoulder*
ABL	31-Oct-24	46.0	41.8	39.5		36.9
ABL	01-Nov-24	40.6	44.6	39.3	47.2	43.5
ABL	02-Nov-24	38.3	38.7	35.8	43.6	40.7
ABL	03-Nov-24	38.2	41.6	38.1	36.4	38.7
ABL	04-Nov-24	41.9			45.4	
RBL	**ALL**	**38.3**	**41.7**	**38.7**	**44.5**	**40.7**

Descriptor	Date	Day	Evening	Night	AM Shoulder*	PM Shoulder*
Leq	31-Oct-24	50.9	47.5	49.0		43.6
Leq	01-Nov-24	55.0	53.0	45.9	51.1	46.8
Leq	02-Nov-24	47.0	49.2	43.8	47.1	44.9
Leq	03-Nov-24	49.4	50.0	46.3	45.5	44.6
Leq	04-Nov-24	48.9			50.4	
Leq	**ALL**	**51.8**	**50.4**	**46.7**	**49.1**	**45.5**

**** AM Shoulder = 05:00 - 07:00, PM Shoulder = 22:00 - 00:00***

Transport Descriptors

Descriptor	Date	15hr	9hr
Leq	31-Oct-24	48.9	49.0
Leq	01-Nov-24	54.5	45.9
Leq	02-Nov-24	47.8	43.8
Leq	03-Nov-24	49.6	46.3
Leq	04-Nov-24	48.9	
Leq	**ALL**	**51.6**	**46.7**

Hourly Traffic Leq

Hour	1	2	3	4	5	6	7	8
Leq	49.3	44.0	41.7	43.4	45.9	49.6	48.6	49.8
Hour	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Leq	51.6	47.5	56.1	53.3	55.7	48.5	47.6	49.4
Hour	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**

Leq	50.2	50.2	48.7	53.8	48.6	47.1	46.0	44.0

APPENDIX B

STAFF RESUMES

ALEX JANG
PROJECT ENGINEER
T: 0434 111 829 | Alex.Jang @rwdi.com

A project engineer with professional experience in building and environmental acoustics, Alex has consulted with a plethora of industries throughout Australia and the UK. He has utilized his experience and knowledge to numerous projects, managing and conducting environmental noise impact assessments involving detailed and complex noise models. Alex specializes in building and environmental noise and vibration acoustics. His experience in building and environmental noise stems from extensive involvement in numerous projects such as Railway Noise Mapping of the Hong Kong East Rail & Tuen Ma Rail lines, 42 High Street, Birmingham, and Kellingley Colliery Coalfield, Knottingley.

Selected Project Experience

Transport

- TfNSW Noise Abatement Program – Traffic Noise Impact Assessment and Monitoring
- Hong Kong Tuen Ma & East Rail Lines – Railway Noise Modelling

Building

- MLA North Sydney – Internal Acoustic Testing and Acoustic Design
- White & Case Sydney – Internal Acoustic Testing
- Regent Street, Kogarah – Acoustic Compliance Testing
- Victoria North Metro Station, Sydney – Internal Testing
- Viadux, Phase 1, Manchester – UKAS Testing
- Monk Bridge Viaduct, Leeds – UKAS Testing
- Commerce House, Leeds – UKAS Testing
- AQA Manchester – BCO Testing

Environmental

- 146 Arthur Street, North Sydney – SSDA Noise Impact Assessment
- Bella Vista Farm Park – Event Noise Compliance Monitoring
- D'Albora Marinas The Spit – Compliance Monitoring
- Wade House & Merrion Centre – Noise Impact Assessment
- 42 High Street, Birmingham - Noise and Vibration Impact Assessment
- Back Turner Street, Manchester – Condition Discharge Assessment
- Camp Hill, Birmingham – Noise and Vibration Impact Assessment
- City South, Manchester – Noise Impact Assessment & Existing Internal Testing

Industry

- Calga Sand Quarry, Calga – Compliance Measurements
- Wilpinjong Coal Mine, Wilpinjong – Calibration Study
- Box Hill Recycled Water Plant, Box Hill – Compliance Monitoring
- PLDC, Castlereagh – Compliance Monitoring
- Valmont Coatings, Girraween – Compliance Monitoring
- Kellingley Colliery Coalfield, Knottingley – Noise Impact Assessment
- Upper Trinity Street Gas Governor, Birmingham – Noise Impact Assessment

Employment History

2023-Present
Scientist Engineer, RWDI

2022-2023
Assistant Consultant,
Hann Tucker Associates

Education

BEng(Hons) Audio and Acoustical Engineering

REMI LARMANDIEU, ME, MEM, CPEng, MAAS, NER, MIEAust, RPEQ, RPEV

NOISE & VIBRATION ENGINEER | ASSOCIATE PRINCIPAL

T: +61 406 827 782 | Remi.Larmandieu@rwdi.com

Remi has played an integral role in the delivery of a range of projects, including analyses of road, rail, aircraft and industrial noise intrusion, analysis and prediction of noise emissions from mechanical plant and equipment, analysis of building acoustics and building services noise control. He has also been heavily involved in detailed modelling of operational noise on roads and highways. Remi's areas of expertise include transportation noise & vibration assessment, environmental noise monitoring, industrial and environmental noise modelling and assessment, air quality impact assessment, construction noise, and building acoustics.

Selected Project Experience

Transportation Noise

- Tuggerah to Doyalson - M1 Pacific Motorway Upgrades
- Tenterfield Heavy Vehicle BypassReview of Environmental Factors (REF)
- Garfield Road West REF
- NorthConnex Post-Compliance Noise Assessment
- M5 Widening Post-Compliance Noise Assessment
- Nowra Bridge – Operational Noise Impact (tender)
- Warringah Freeway Upgrade – Operational Noise Mitigation Review
- Noise Abatement Program - TfNSW

Industrial Noise

- Patons Lane Resource Recovery Centre (RRC) – Noise Impact Assessments, Noise and Dust Monitoring
- Eastern Creek Recycling Ecology Park (& Landfill) – Noise Impact Assessments
- Bingo Recycling Centre - Mortdale - Noise Impact Assessments

Environmental / Infrastructure

- Central Precinct Renewal Project – Noise & Vibration Impact Study
- Project Emily, Port Kembla
- Victoria Cross Station | Sydney Metro – Construction Noise & Vibration Impact Statement (CNVIS), Noise and Vibration Monitoring
- Sydney Metro | Crows Nest, Victoria Cross, Barangaroo, Martin Place – Tunnel Station Excavation Noise & Vibration Monitoring
- Sydney Metro – Sydenham to Bankstown
- Central Precinct Renewal Project – Noise & Vibration Impact Study

Residential / Commercial/Mixed Use

- Misk City, Riyadh – Concept Design and Detailed Design
- One Sydney Harbour – Masterplan
- Green Square Mixed Use Development

Hospital and Aged Care

- North Shore Hospital Redevelopment
- Port Macquarie Base Hospital Redevelopment

Employment History

2020-Present
Senior Engineer, RWDI

2019-2020
Project Engineer, Wilkinson Murray

2014-2019
Project Engineer, Acoustic Logic Consultancy

2013
Acoustic Engineer, GHD Pty Ltd

2011-2013
Project Engineer, Acoustic Logic Consultancy

Education

Postgraduate Master of Engineering Management, University of Wollongong

Master of Mechanical Engineering, Institut Catholique des Arts et Métiers, Toulouse, France

Higher National Degree in Mechanical and Manufacturing Sciences

Affiliations

Member of the Australian Acoustical Society (MAAS)

Chartered Professional Engineer (Australia) - Mechanical

MIEAust, NER, APEC Engineer, IntPE(Aus)

Registered Professional Engineer (Queensland #33162, Victoria PE0015829)