

PARRAMATTA LIGHT RAIL

PLR-SOM Noise and Vibration Monitoring Report

January 2023

PLR1SOM-GLR-ALL-NV-RPT-000001 Rev A Version 01

Version History Control Box

Date	Version Number	TeamBinder Revision	Author	Comments
6 February 2023	1	A	Raju Divakarla	For issue

Approval Box

Action	Responsible Person
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Table 1 – Abbreviations and Definitions

Abbreviations	Definition
AADT	Annual average daily traffic
AARNet	Australia's Academic and Research Network
AC	Alternating current
ACCB	Alternating current circuit breaker
ACM	Asbestos containing material
AEO	Authorized engineering organization
AEP	Annual exceedance probability
AFC	Approved for construction
AFG	Aboriginal focus group
AFIL	Audio frequency induction loop
AGS	Association of Geotechnical & Geo-environmental Specialists
AIS	Asset information system
AMP	Asset management plan
APAS	Australian paint approval scheme specifications
AQF	Australian qualifications framework
ARI	Average recurrence interval
AS	Australian Standards
ASA	TfNSW Asset Standards Authority
ASCI	American Standard Code for Information Interchange
ASTM	American Society for Testing and Materials
ATL	Active transport link
AVLS	Automatic vehicle location system
BCA	Building code of Australia
BIM	Building information modelling
BOCC	Back-up operational control center
BTS	Base transceiver station
CCAA	Cement, concrete & aggregates Australia
CAD	Computer aided design
CALD	Culturally and linguistically diverse
CBD	Central business district
CCB	Configuration control board
CCR	Configuration change request
CCS	Central control system
CCTV	Closed circuit television
CDE	Common data environment
CEMP	Construction environmental management plan
CEP	Communication and engagement plan
CERT	Carbon estimate and reporting tool
CFCs	Chlorofluorocarbons
CLM Act	NSW Contaminated Land Management Act 1997
CM	Connection monitoring
CNC	Computer numerical control
CoA	Conditions of approval
COBie	Construction operations building information exchange
COF	Coefficient of friction
CoP	City of Parramatta
CoPC	City of Parramatta Council
CPTED	Crime prevention through environmental design
Cr(VI)	Hexavalent chromium
CRM	Customer relationship management
CSELR	CBD and South East Light Rail
CSO	Customer service officer
CSR	Combined services route
CSS	Customer satisfaction survey
CT	Connection timetable
DBH	Diameter at breast height
DBYD	Dial before you dig
DC	Direct current
DCCB	Direct current circuit breaker

Abbreviations	Definition
DDA	Disability Discrimination Act
DDR	Detailed design review
DECC	Department of Environment and Climate Change
DEM	Digital engineering manual
DKE	Developed kinetic envelope
DP	Deposited plan
DP&E	Department of Planning and Environment
DSAPT	Disability Standards for Accessible Public Transport
ECM	Environmental control measures
EFT	Electronic funds transfer
EFTPOS	Electronic funds transfer at point of sale
EHP	Emergency help point
EIS	Environmental impact statement.
EMC	Electro-magnetic compatibility
EMI	Electromagnetic interference
EMS	Environmental management system
EN	European standards
EPA	NSW Environmental Protection Agency
EPDM	Ethylene propylene diene monomer
ESA	Environmental site assessment
ESDAT	Environmental data management software
ET	Estimated timetable
ETS	Electronic ticketing system
EWT	Excess waiting time
FAIT	First article inspection test
FAT	Factory acceptance test
FLR	Fixed location reader
FM	Facilities Monitoring
FMECA	Failure mode, effects, and criticality analysis
FRACAS	Failure review and corrective action system
FSC	Forest Stewardship Council
GIS	Geographical information system
GM	General message
GPOs	General purpose outlets
GPS	Global positioning system
GTP	Groundwater treatment plant
HMI	Human machine interface
HV	High voltage
HVAC	Heating, ventilation and air-conditioning
IACA	Institute of Australian Consulting Arboriculturists
IC	Independent Certifier
ICNG	Interim construction noise guideline
ICT	Information and communications technology
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
IFC	Industry foundation classes
IK	Impact protection rating
IP	Ingress protection rating
IS	Infrastructure sustainability
ISAA	Interim site audit advice
ISCA	Infrastructure Sustainability Council of Australia
ITP	Inspection and test plan
ITT	Invitation to tender document
IWLR	Inner West Light Rail
LAN	Local area network
LDNSP	Local distribution network service provider
LED	Light emitting diode
LOTO	Lockout-tagout
LRU	Line replaceable unit
LRV	Light rail vehicle

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Abbreviations	Definition
LTEMP	Long term environmental management plan
LV	Low voltage
MCF	Master control File
MCG	Mobile communication gateway
MPM	Major preventative maintenance
MPMC	Major preventative maintenance capital
MRs	Management requirements
MS	Microsoft
MTP	Mechanized track patrol
NBN	National Broadband Network
NCC	National construction code
NLR	Newcastle Light Rail
NMV	Mean comfort index
NSW	New South Wales
NSW Fire	Fire and Rescue NSW
NTP	Network time protocol
NZS	New Zealand standards
O&M	Operations & maintenance
OCC	Operations control center
ODRE	Operational data real-time exchange
OEMP	Operations environment management plan
OESS	On-board energy storage system
OHW	Overhead wiring
OLE	Overhead line electrification
ONRSR	Office of the National Rail Safety Regulator
ONVR	Operational noise and vibration review
PA	Public address
PABX	Private automatic branch exchange
PCM	Public communication material
PDF	Portable document format
PDR	Preliminary design review
PID	Passenger information display
PIM	Project information model
PLR	Parramatta Light Rail
PLRC	Permanent Light Rail corridor
PMF	Probable maximum flood
POS	Point of supply
PT	Production Timetable
PV	Photovoltaic
PVC	Polyvinyl chloride
RAMS	Reliability, availability, maintainability and safety
RAP	Remediation action plan
RAV	Restricted access vehicle
RCA	Root cause analysis
REF	Review of environmental factors
RFID	Radio-frequency identification
RGB	Red, green, blue
RICS	Royal Institute of Chartered Surveyors
RM	Recurrent maintenance
ROL	Road occupancy license
RSNL	Rail Safety National Law
RTU	Remote terminal unit
RVTM	Requirements verification and traceability matrix
SAR	Site audit report
SAS	Site audit statement
SAT	Site acceptance tests
SC	Station computer
SCADA	Supervisory control and data acquisition
SCATS	Sydney Coordinated Adaptive Traffic System
SCO	Sydney coordination office
SDR	System definition review
SEADMP	Systems engineering, assurance and design management plan
SIL	Safety integrity level

Abbreviations	Definition
SIRI	Service interface for real-time information
SIT	System integration tests
SLS	Serviceability limit state
SM	Stop monitoring
SME	Small to medium enterprise
SMP	Sustainability management plan
SOM	Supply, operate and maintain
SPR	Scope and performance requirement
SRV	Slip resistance value
ST	Stop timetable
STARS	Significance of a tree assessment rating system
STIPA	Speech transmission index for public address
SWMS	Safe work method statement
SX	Situation exchange
T2W	Track to wayside
TCP	Traffic control plan
TCS	Traffic control signal
TETRA	Terrestrial trunked radio
TNAC	Transport Network Assurance Committee
TfNSW	Transport for New South Wales
TGSI	Tactile ground surface indicator
TMC	TfNSW Transport Management Centre
TMP	Technical maintenance plan
TOTM	Top-up ticket machine
TPG	TPG Telecom
TPS	Traction power substation
TPZ	Tree protection zone
TSP	Traffic Staging Plan
TSR	TfNSW Standard requirements
TTLG	Traffic and transport liaison group
TVOC	Total volatile organic compounds
TWA	Trade wastewater agreement
TXC	TransXChange
UHF	Ultra-high frequency
ULS	Ultimate limit state
UPS	Uninterruptable power supply
UV	Ultra-violet
VC	Vibration criterion
VCHs	Volatile chlorinated hydrocarbons
VDC	Volts direct current
VM	Vehicle monitoring
VMP	Voluntary management proposal
WBS	Work breakdown structure
WHS	Work, health and safety
WRI	Wheel / rail interface

1 Introduction

1.1 Project Background

A key element of the future transport network announced by the NSW Government is the development of the Parramatta Light Rail network. This would deliver a new light rail system for Western Sydney, between Westmead and Carlingford via the Parramatta CBD and Camellia.

By providing connections to precincts and with transport hubs along the corridor, Parramatta Light Rail will improve accessibility within the greater Parramatta precinct growth area as a key component of an integrated transport network supporting growth.

By 2026 approximately 28,000 people will use Parramatta Light Rail every day and an estimated 130,000 people will be living within walking distance of light rail stops.

1.2 Parramatta Light Rail

The Parramatta Light Rail (PLR) comprises approximately 12km alignment from Westmead to Carlingford via Camellia and consists of a mix of both on-street and dedicated corridor.

PLR1 is being delivered under five contracts:

- Early Works – Remediation
- Enabling Works
- Infrastructure Works (INFRA)
- Supply, Operations and Maintenance (SOM)
- ETS Works.



Figure 1 – PLR route

The key features of PLR include the following:

- A total of 16 stops in a combination of side and island platforms along the route
- Light Rail Vehicle driver amenities at light rail termini at Westmead & Carlingford and at the stabling and maintenance facility at Camellia
- An integrated stabling and maintenance facility located at Camellia
- Ancillary infrastructure including seven (7) traction power substations and overhead wiring and poles to allow for LRV operations
- Six new bridge structures along the alignment and modifications to existing bridges.

1.3 Scope of SOM Works

As System Integrator for PLR Stage 1, the SOM Contractor's Activities include:

- Delivery Activities
- LRV Procurement
- Operation and Maintenance (O&M)

The delivery activities include all investigation, selection, specification, design, approvals, construction, manufacture, installation, testing & commissioning, operational readiness and activities to transition from the Delivery Phase to the Operations Phase. In summary works include:

- All works above and additional to the platform concrete foundation slab at all Stops
- Stabling & Maintenance Facility (SaMF)
- Central Control System
- Light Rail signaling system
- Elements of the road intersection signaling system
- Communications and passenger information systems
- Power Supply system
- Procurement of Light Rail Vehicles (LRV)
- Maintenance plant and machinery for the LRVs
- Earthing & bonding, electrolysis and electromagnetic compatibility
- Electronic Ticketing system (ETS) for top up or Ticket Machine and Fixed Location Reader.

1.4 Scope of this report

This report has been prepared to provide noise and vibration monitoring information each month to the Acoustic Advisor when such monitoring was undertaken as per section 6.1 of the Appendix F Construction Noise and Vibration Monitoring Program. The information, in turn, can be used as required by the AA can provide the information as per Planning Approval condition A29 to the Secretary.

1.5 Noise and Vibration Monitoring

1.5.1 Acoustic Advisor (AA) Monitoring

During the period of July 2022 to January 2023, AA has undertaken Noise and Vibration monitoring as shown in Table 1.

Table 1. AA SOM Noise and Vibration Monitoring

Date	Location	Activity Covered	Findings
13 July, 2022	Dundas Station	Minor Excavation & Spoil Removal	Mitigation controls were deemed sufficient for this site.
5 August, 2022	-	No SOM Activity	Nil
23 August, 2022	Dundas Station	Crane for Canopy fitting	No additional mitigation controls are required
5 September, 2022	-	No SOM Activity	Nil
13 September, 2022	TPS 6-Telopea	Bored Piling – Auger Shaking was the principal noise	Auger shaking produced 80dB(A) max at 30m. Opportunity for improvement – Acoustic Blankets could be implemented to screen nearest residential areas, however not critical for daytime works.
27 September, 2022	-	No SOM Activity	Nil

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PLR1SOM-GLR-ALL-NV-RPT-000001 [A.01] Noise and Vibration Monitoring Report - January 2023

Date	Location	Activity Covered	Findings
10 October, 2022	Children's Hospital, Westmead	Canopy Installation close to residences	Action – Non tonal (broadband) reversing alarms to be utilized for any OOHW activities. This action was closed out on 11/10/22 and this action was closed on 17/1/22
14 October, 2022	Stop-Teloepa	Canopy Installation-OOHW	No actions. Average sound levels, LA _{eq} (1Min) not significantly impacted by the activities however the LA _{max} level exhibited some short-term spikes.
12 November, 2022	Stop-Teloepa	Canopy Installation (OOHW)	No actions. Rattle guns were not used to reduce noise.
11 December, 2022	Teloepa TPS 6	Delivery of TPS Unit (OOHW)	Three opportunities for improvement were raised relating to Plant manoeuvring, Minimising use of air brakes and generator use. These were responded to.
24 January, 2023	Site wide	Minimal Activity	No Actions (Verbally notified)

Inspections carried out by the Acoustic Advisor (AA) have been valuable in identifying the key issues and opportunities for improvement that were diligently implemented by GRCLR in addition to other measures that ensured that no construction noise complaints were received by the SOM project.

1.5.2 GRCLR Noise and Vibration Monitoring

In the period of 13 July 2022 to 13th November, no monitoring was undertaken by GRCLR as TfNSW have offered the assistance from AA team to GRCLR. GRCLR informed the AA of key activities that have a potential for the generation of noise and worked collaboratively to improve the noise management.

GRCLR have carried noise monitoring between 14 November 2022 and 31 January 2022 as detailed in Table 2 below:

Table 2. GRCLR SOM Noise and Vibration Monitoring

Date	Location	Activity Covered	Date Report Submitted
14 November 2022	Ngara Stop	Canopy Lift	15 November 2022
10/11 December 2022	TPS 6	TPS Unit Delivery and Installation	12 December, 2022
31 January 2023	Parramatta Square	Rail Milling and Signalling works (OOHW) Noise and Vibration Monitoring by Renzo Tonin	3 February, 2023

While the noise monitoring information was not provided as part of a specific Noise and Vibration Report, the information from the monitoring was communicated to the AA, ER and TfNSW Environmental Team as soon as such information was available. For completeness, these reports are also included as Appendix A.

1.6 Community Satisfaction

There were no community complaints related to construction noise in this period despite working in very close proximity to residences in high density setting and carrying out "Out of Hours Works".

1.6.1 Feedback from Acoustic Advisers and TfNSW Support

Both Roger Treagus and Beau Weyers provided robust practical feedback from their inspections and attended noise monitoring. This has helped the SOM project to implement measures that have contributed to reduced noise impact. Their valuable inputs have also raised an awareness within the construction team who in turn have responded quickly. Some opportunities for noise reduction were identified through ER inspections as well. TfNSW support to make the AA resource available since September is appreciated.

1.6.2 Reducing the number of OOHW days

- The planned scope was to undertake 8 OOHW days per area to cover Canopy lift, TPS Unit Delivery and Utility works. This has been decreased substantially by carrying out such works instead during standard work hours.
- There was a net reduction in OOHW works from planned OOHW days by 76%.
- In addition, works were meticulously planned to complete in shorter time periods sometimes by combining canopy lift and utility works at the same time.
- The work method was changed, and the pre-work planning was streamlined for the Canopy lifts so that such works can be completed during standard working hours without the need for OOHW works. Except for the first three canopy lifts, all the others were completed during standard work hours and in one shift.

1.6.3 Cycling the High Noise Intensity works

The OOHW's and high noise intensity works were cycled throughout the construction area so that no one area had continuous exposure to high noise works for more than 2 days/nights in this quarter.

1.6.4 Noise Reduction Measures Implemented

Following noise reduction measures have been taken to improve community amenity during the OOHW works:

- Attended noise monitoring by the AA and our team during all the OOHW's has assisted immensely to identify best practices such as
 - elimination of tonal beepers
 - avoidance of rattle guns
 - reducing speed when driving light vehicles
 - Cutting pavers away from sensitive receivers
 - Limiting use of compressor and compound air conditioner
 - Scheduling paving works for outside peak trading times
 - on-the-job training and toolboxes to reduce the banging sounds while establishing traffic controls and use of rigging gear.

have contributed to improved community amenity demonstrated by nil construction noise complaints from the community during OOHW periods. This is consistent with the expectation of the condition E48 and E49 of the Planning Approval. It is to be noted that the measured sound levels from attended noise monitoring were significantly lower than the model predicted sound levels.

- Reducing the use of the number and high noise generation equipment together with carrying out high noise generating activities during standard work hours.
- Use of sound barriers to reduce noise at source.
- Use of battery-operated lights.
- Installing additional noise blankets and shade cloth
- Provision of respite periods more frequently than required.

This report should be read in consideration of the above noise risk mitigation measures as the effectiveness of the consultation has increased due to the stringent implementation of the above detailed measures by our

construction teams.

1.6.5 Program Changes

Where reasonable and feasible, Great River City Light Rail altered the works schedule or methodology in response to stakeholder preferences. This included:

- Managing pedestrian diversions to maintain preferred business access arrangements.
- Delaying business driveway closures until after trading finished
- Scheduling service outages at convenient times for stakeholders
- Scheduling road closures and works for weekends.
- Restricting parking and access by project heavy vehicles.

Great River City Light Rail site teams are often contacted directly by members of the public, business operators and residents and the works methodology or timing is altered on the spot to suit the circumstances. This has included rescheduling works near Marie Stopes health facility and the use of lower impact work methods near Westmead research centres following direct feedback during the reporting period.

Utilising the knowledge gained of sensitive receivers and community preferences since construction started in 2020, works have been proactively planned to avoid impacts and minimise disruption to the community. This included:

- Scheduling residential driveway closures to start after 9am and finish before 4pm
- Scheduling high impact works outside peak trading hours.
- Scheduling noisy works during the day or early in the night shift.
- Planning road closures for weekends to minimise business impacts.
- Individually tailored compensatory measures were put in place.

2 Conclusions

Construction output has increased substantially, and a large volume of work was completed both at SaMF as well as the mainline including delivery and assembly of LRV, lifting of canopies, and installation of TPS Units. Utility works and Rail Milling works have also commenced.

Attended noise monitoring carried out by GLCLR have been included in this report for completeness although these have been previously issued to AA, ER and TfNSW as soon as such information was available. AA have also carried out attended noise monitoring.

No construction relation noise complaints were received due to a collaborative noise reduction focussed efforts by all contractual stakeholders, construction planning, and implementation of control measures by the construction team. This meets the intent of the Planning Approval conditions E48 and E49.

From this point forward, a Noise and Vibration Report will be issued monthly where such monitoring has been carried out by GRCLR.

APPENDIX A

Noise Monitoring – Impact on Grey Headed Flying Fox

Ngara Stop

14 November 2022

FLYING FOX MONITORING

In accordance with the Grey Headed Flying-Fox Impact Assessment undertaken on 14 November 2022, works carried out at the Ngara stop were considered of a low-medium risk of impacting upon the GHFF Camp at Parramatta Park, due to the low levels of noise expected to be generated by the works, and the distance to the Camp (approx. 260 m +), however conducted during a high-risk period due to breeding. This Assessment was provided to TfNSW on the same day (Teambinder ref: PLR-PLR1SOM-GLR-TFNSW-CORR-002968), and feedback was received from the PLR Flying-Fox Expert via TfNSW on 15 November 2022 (Teambinder ref: PLR-PLR1SOM-TFNSW-GLR-CORR-002872).

Works were proposed to be carried out by implementing the “medium risk” control measures identified in the GHFF Mitigation Application Procedure (the Procedure). All controls/actions proposed in the Assessment were implemented during the works on 16 November 2022, along with the advice provided by the PLR Flying-Fox Expert.

Although the camp extent shown in the Procedure extended to the eastern bank of Parramatta River (closer to the Ngara stop), on 16 November 2022 no flying-foxes were observed in this location. The nearest flying-foxes to the works were observed at the northern end of the camp extent on the western bank of the river, to the edge of the Wistaria Gardens. This location is approximately 350 m from the Ngara stop. Flying-fox activity was observed at this location between 08:40 and 11:24 on 16 November 2022, during four 30-minute sessions coupled with 15-minute sessions of noise monitoring. The first two sessions were considered representative of background observations/noise, as no works at the Ngara stop were occurring during these times.

Works undertaken at the Ngara stop included the arrival of trucks delivering the stop canopies, the attaching of these canopies to the crane, the lift of the canopies into position, and their installation. These works were inaudible at the monitoring location, and the noise levels recorded were consistent across all sessions. Flying-fox activity throughout both the background sessions and sessions during which works were occurring was considered normal, with the majority of animals sleeping/roosting, and only minor movement/squabbling observed. A small number of individuals were observed to fly and return to roost, however they did not seem distressed or impacted by general background noise or intermittent periods of increased noise including passing vehicles and overhead aeroplanes. General background noise included birds, insects, water passing over the weir in Parramatta River, wind passing through trees, and background traffic. Some distant construction noise was also intermittently faintly audible.

As no impacts were identified, works were continued until complete, and no alternatives were required to be implemented.

The completed observation sheets and accompanying photographs, as well as the noise monitoring forms are provided within this report.



FLYING FOX MONITORING



Monitoring/observation location (marked as "0"), showing the distance to the Ngara stop works. The trees directly north of the monitoring location were considered the nearest flying-foxes to the works.



FLYING-FOX MONITORING SHEET

Project Activity:	None – background measurements	Date:	16/11/2022
Work site (+ distance):	Ngara stop (350 m)	Start Time:	08:40
Monitoring location:	Wistaria Gardens, close to Parramatta River	Finish Time:	09:15 (35 minutes)
Weather:	Sunny, warm	Noise level:	L _{Aeq} (15 mins): 57.8 dBA
Flying-Fox presence (+ species):	Yes, Grey-Headed Flying-Foxes	Breeding status:	
Activity of Flying-Foxes:	Flying-foxes were very calm, generally asleep. There was occasional movement from a small number, including scratching, stretching etc. Some intermittent squabbling occurred. No flights observed.		
Impact of Project Activities?	N/A – no activities were carried out at the Ngara stop during the session.		

General observations / comments:

Flying-foxes seemed very unperturbed by the noise present. No reactions during periods of elevated noise e.g. overhead planes.

Observations made by:

Name: Rhys Thompson (CAF Environment Manager)

Signature: 



FLYING-FOX MONITORING SHEET

Images:



Figure 1: Flying-foxes roosting during session. Photo taken at 08:57.

FLYING-FOX MONITORING SHEET

Project Activity:	None – background measurements	Date:	16/11/2022
Work site (+ distance):	Ngara stop (350 m)	Start Time:	09:25
Monitoring location:	Wistaria Gardens, close to Parramatta River	Finish Time:	09:55 (30 minutes)
Weather:	Sunny, warm	Noise level:	LAeq (15 mins): 55.2 dBA
Flying-Fox presence (+ species):	Yes, Grey-Headed Flying-Foxes	Breeding status:	
Activity of Flying-Foxes:	Virtually no activity except for sleeping. Very minor movements throughout groups observed.		
Impact of Project Activities?	N/A – no activities were carried out at the Ngara stop during the session..		

General observations / comments:

Observations made by:

Name: Rhys Thompson (CAF Environment Manager)

Signature: 



FLYING-FOX MONITORING SHEET

Images:



Figure 2: Flying-foxes roosting during session. Photo taken at 09:32.

FLYING-FOX MONITORING SHEET

Project Activity:	Ngara stop ISC/canopy lift	Date:	16/11/2022
Work site (+ distance):	Ngara stop (350 m)	Start Time:	10:20
Monitoring location:	Wistaria Gardens, close to Parramatta River	Finish Time:	10:50 (30 minutes)
Weather:	Sunny, warm	Noise level:	L _{Aeq} (15 mins): 53.3 dBA
Flying-Fox presence (+ species):	Yes, Grey-Headed Flying-Foxes	Breeding status:	
Activity of Flying-Foxes:	Sleeping, stretching. Two flying-foxes were observed returning to the trees early in the session, and then at 10:40 approx. 20 returned as a group. These animals quickly found roosts.		
Impact of Project Activities?	The hooking up of the canopies to the crane commenced at the beginning of the session. The canopy lift commenced at 10:28. These works were inaudible at the monitoring location and no significant change in activity of the flying-foxes was observed.		

General observations / comments:

No flying-foxes were identified in trees on the opposite bank of the river (closer to and within 300 m of the Ngara stop). As such, the monitoring location was selected as the nearest groups to the works (350 m distance).

A loud train passed at one stage during the session, no impact on the flying-foxes was observed.

Noise levels were comparable to the background readings obtained in the earlier sessions.

Observations made by:

Name: Rhys Thompson (CAF Environment Manager)

Signature: 



FLYING-FOX MONITORING SHEET

Images:



Figure 3: Flying-foxes roosting during session. Approx. 20 flying-foxes returned to roost during the session. Photo taken at 10:40.

FLYING-FOX MONITORING SHEET

Project Activity:	Ngara stop ISC/canopy lift	Date:	16/11/2022
Work site (+ distance):	Ngara stop (350 m)	Start Time:	10:54
Monitoring location:	Wistaria Gardens, close to Parramatta River	Finish Time:	11:24 (30 minutes)
Weather:	Sunny/cloudy, warm	Noise level:	LAeq (15 mins): 55.4 dBA
Flying-Fox presence (+ species):	Yes, Grey-Headed Flying-Foxes	Breeding status:	Pregnant. Young observed.
Activity of Flying-Foxes:	Mostly sleeping. Some minor squabbling. Approx. 10 flying-foxes returned to roost during the session.		
Impact of Project Activities?	Works were inaudible at the monitoring location and no significant change in activity of the flying-foxes was observed.		

General observations / comments:

Canopy lift was underway during the session (10:54-11:02).

Observations made by:

Name: Rhys Thompson (CAF Environment Manager)

Signature: 



FLYING-FOX MONITORING SHEET

Images:



Figure 4: Flying-foxes roosting during session. Very little activity during session, approx. 10 flying-foxes returned. Photo taken at 10:57.

NOISE MONITORING DATA SHEET

Activity:	None – background measurements	Date:	16/11/2022
Work site:	Ngara stop (350 m)	Start Time:	08:52
Monitoring location:	Wistaria Gardens, Parramatta Park	Finish Time:	09:07
Weather:	Sunny, warm	Meter Ref #:	NL-42: 00510388

Observations / Comments:

Bells chimed at the Cumberland Hospital at 09:00. Frequent bird chirps, occasional planes. Water rushing over weir was constant. Some traffic through park.

Results: (15 mins)

L_{Aeq}	57.8	L_A(MAX)	77.2
Meter record:	#0006	L_A(MIN)	50.6

Measurements taken by:

Name:	Rhys Thompson (CAF Environment Manager)	Signature:	
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NOISE MONITORING DATA SHEET

Activity:	None – background measurements	Date:	16/11/2022
Work site:	Ngara stop (350 m)	Start Time:	09:25
Monitoring location:	Wistaria Gardens, Parramatta Park	Finish Time:	09:40
Weather:	Sunny, warm	Meter Ref #:	NL-42: 00510388

Observations / Comments:

Construction noise audible (generally faint) to the north-west: excavators, sawing. Medium-high wind gusts during session. Weir water noise constant. Traffic to west consistently audible (generally faint with some loud vehicles). Planes regular. Bird noise constant.

Results: (15 mins)

L_{Aeq}	55.2	L_{A(MAX)}	77.8
Meter record:	#0007	L_{A(MIN)}	49.9

Measurements taken by:

Name:	Rhys Thompson (CAF Environment Manager)	Signature:	
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NOISE MONITORING DATA SHEET

Activity:	Ngara stop ISC/canopy lift	Date:	16/11/2022
Work site:	Ngara stop (350 m)	Start Time:	10:21
Monitoring location:	Wistaria Gardens, Parramatta Park	Finish Time:	10:36
Weather:	Sunny, warm	Meter Ref #:	NL-42: 00510388

Observations / Comments:

Crane hook-up and prep underway. Lift commenced at 10:28. Not audible.

Weir water, birds, planes, traffic, wind gusts.

Results: (15 mins)

L_{Aeq}	55.3	L_{A(MAX)}	69.9
Meter record:	#0008	L_{A(MIN)}	51.6

Measurements taken by:

Name:	Rhys Thompson (CAF Environment Manager)	Signature:	
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NOISE MONITORING DATA SHEET

Activity:	Ngara stop ISC/canopy lift	Date:	16/11/2022
Work site:	Ngara stop (350 m)	Start Time:	08:52
Monitoring location:	Wistaria Gardens, Parramatta Park	Finish Time:	09:07
Weather:	Sunny, warm	Meter Ref #:	NL-42: 00510388

Observations / Comments:

Bells chimed at the Cumberland Hospital at 11:00. Birds, insects, weir water, planes, traffic.

Results: (15 mins)

L_{Aeq}	55.4	L_{A(MAX)}	72.9
Meter record:	#0009	L_{A(MIN)}	51.9

Measurements taken by:

Name:	Rhys Thompson (CAF Environment Manager)	Signature:	
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APPENDIX B

Noise Monitoring

TPS Unit Delivery and Installation – Telopea

10th/11th December 2022

Dec 12, 2022 at 12:16 PM

Beau,

Thanks Beau. We used some of the battery-operated lights yesterday. I will look into eliminating this particular generator that was causing the noise yesterday and also not to use generator operated light makers where we can get away.

Appreciated your help in making Roger available.
Many Thanks and Much Appreciated.

Kind regards
Raju

On 12 Dec 2022, at 11:28 am, Beau Weyers <Beau.Weyers@trinityconsultants.com> wrote:

Hi Raju,

There are battery powered light generators you could look into.
Great news otherwise.

Regards,
Beau Weyers
Senior Acoustic Consultant
Manager – Event Noise Management

D: +61 7 3188 1427 | P +61 7 3255 3355 | M +61 413 530 524
Email: beau.weyers@trinityconsultants.com



Connect with us: www.trinityconsultantsaustralia.com.au | [LinkedIn](#)

From: Raju Divakarla <raju.divakarla@icloud.com>
Sent: Monday, 12 December 2022 10:19 AM
To: rtreagus@optusnet.com.au
Cc: Rhys Thompson <Rhys@4pillars.com.au>; Beau Weyers <Beau.Weyers@trinityconsultants.com>
Subject: Re: PLR-SOM: AA Audit Inspection - Telopia lift

Roger,

Thanks for being there. Much Appreciated.

It all went well. The actual lift was very quiet, quieter than Canopy Lift by about 10dB. It actually took place at 2:53 AM.

The biggest noise source was from air brakes while reversing for which I picked up 75.6 dB. The average for pre-lift activities was 61.3 and for the actual lift was 51.6 dB with a peak of 67.2dB. I was between 12-15m from the crane.

The most annoying noise for me was the generator driving the lights and I will get the boys to put this generator in an acoustic enclosure for the next time. I do not know what we can do with the air brakes.

The other 5 TPS unit lifts will be easier as we have better access and therefore less braking.

No complaints were recorded as of now. I have footage of the lift that I will share via Teambinder. Thanks again for all your assistance.

Kind regards
Raju Divakarla
0439 903 906

On 12 Dec 2022, at 10:56 am, rtreagus@optusnet.com.au wrote:

Hi Raju, I hope it went well after I left last night. Are you able to send me the video of the actual list. Just 20 seconds or so of the lift would be ok for me.

Thanks for your assistance last night.

Regards Roger

APPENDIX C

Noise and Vibration Monitoring

Parramatta Square Rail Milling Operation

31st January and 1st February 2023.

3 February 2023

TK868-21D02 OOH signalling installation SWL and Vibration Report (r1).docx

CAF Australia

Parramatta Light Rail - Stage 1 – Signalling installation SWL and Vibration Report

1 Introduction

Renzo Tonin & Associates was engaged by CAF Australia to conduct noise monitoring to determine the sound power level (SWL) and the risk of vibration impact from the plant and equipment used for the signalling installation works on the vibration sensitive equipment at Westmead Hospital, for the Parramatta Light Rail Stage 1 – Westmead to Carlingford project. This report provides a summary of the monitoring results.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 Details of monitoring

Noise and vibration measurements were undertaken during the signalling installation works on 31st January 2023 and 1st January 2023 at the Westmead Terminus on Hawkesbury Road. The measured works included rail cutting, rail grinding and rail milling. No other significant works were occurring during the time of this activity.

2.1 Monitoring location

The monitoring details of the measurements are listed in Table 2-1. Photos depicting the monitoring location are also included in APPENDIX A.

Table 2-1: Measurement details

Location ID	Assessment Point	Date	Time	Activity	Measurement type	Measured distance
M1	Westmead Terminus	31.01.2023	10:51am – 11:06am	N/A	Noise baseline	N/A
M2	Westmead Terminus	31.01.2023	10:02am – 10:03am	40KVA generator	Noise	2m
M3	Westmead Terminus	31.01.2023	10:16am – 10:17am	40KVA generator	Noise	3m
M4	Westmead Terminus	31.01.2023	10:18am – 10:19am	40KVA generator	Noise	4m
M5	Westmead Terminus	31.01.2023	10:08am – 10:09am	Rail miller and 40KVA generator	Noise	4m
M6	Westmead Terminus	31.01.2023	10:07am – 10:08am	Rail miller and 40KVA generator	Noise	5m
M7	Westmead Terminus	31.01.2023	10:10am – 10:11am	Rail miller and 40KVA generator	Noise	6m
M8	Westmead Terminus	31.01.2023	10:12am – 10:13am	Rail miller and 40KVA generator	Noise	7m
M9	Westmead Terminus	31.01.2023	11:30am – 11:32am	N/A	Vibration baseline	N/A
M10	Westmead Terminus	31.01.2023	11:27am – 11:30am	Rail miller and 40KVA generator	Vibration	2.5m from miller 2.5m from generator
M11	Westmead Terminus	31.01.2023	11:33am – 11:48am	Rail miller and 40KVA generator	Vibration	5.5m from miller 2m from generator
M12	Westmead Terminus	31.01.2023	11:49am – 11:58am	Rail miller and 40KVA generator	Vibration	7.5m from miller 1.5m from generator
M13	Westmead Terminus	01.02.2023	09:41am – 10:05am	N/A	Noise baseline	N/A
M14	Westmead Terminus	01.02.2023	10:12am – 10:14am	Rail saw	Noise	4m
M15	Westmead Terminus	01.02.2023	10:15am – 10:17am	Rail saw	Noise	5m
M16	Westmead Terminus	01.02.2023	10:18am – 10:22am	Rail saw	Noise	8m
M17	Westmead Terminus	01.02.2023	10:13am – 10:15am	Rail saw	Vibration	2m
M18	Westmead Terminus	01.02.2023	10:16am – 10:19am	Rail saw	Vibration	4m
M19	Westmead Terminus	01.02.2023	10:32am – 10:33am	Rail grinder	Noise	4m
M20	Westmead Terminus	01.02.2023	10:24am – 10:25am	Rail grinder	Noise	5m

Location ID	Assessment Point	Date	Time	Activity	Measurement type	Measured distance
M21	Westmead Terminus	01.02.2023	10:26am – 10:32am	Rail grinder	Noise	7m
M22	Westmead Terminus	01.02.2023	10:24am – 10:25am	Rail grinder	Vibration	2m
M23	Westmead Terminus	01.02.2023	10:32am – 10:36am	Rail grinder	Vibration	6m

2.2 Monitoring methodology

The SWL monitoring was conducted at a varied distances relative to each plant during the signalling installation works.

Noise measurement equipment consisted of one NTi Audio XL2 Type 1 sound level meter and microphone calibrator. The microphone was checked prior and after measurements using a Bruel & Kjaer Type 1 model 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with AS IEC 61672.1 2004 'Electroacoustics – Sound Level Meters' and carries current NATA certification (or if less than 2 years old, manufacturers certification). Photos depicting equipment setup are included in Appendix A.2.

Table 2-2 provides a summary of the noise measurement equipment.

Table 2-2: Summary of noise measurement equipment

Instrument	Make	Model	Serial Number	Last Calibrated
Type 1 Sound Level Meter	NTi	XL2	#A2A-16217-E0	13 August 2021
Type 1 Sound Level Meter Calibrator	B&K	4231	# 3009707	17 January 2023

The accelerometer was mounted at varied distances relative to each plant during the signalling installation works.

The instrumentation used for the vibration measurement are summarised in Table 2-3. The transducers used in the measurements have current calibration certificates. For monitoring on hard surfaces (e.g. asphalt), in accordance with AS 2775-2004¹, the surface was brushed to displace any dirt and the transducers were attached to the surface using double sided adhesive tape.

Table 2-3: Summary of vibration instrumentation

Type	Make / Model
Type 1 Signal Analyser	Soundbook-2
Accelerometer	Endevco 61C3

¹ Australia Standard 2775-2004 Mechanical vibration and shock – Mechanical mounting of accelerometers

3 Calculated sound power level

Based on the conducted noise measurements, the calculated sound power level spectrum of the plants used in the signalling installation works are shown in Table 3-1.

Table 3-1: Calculated sound power level spectrum

Plant	Calculated sound power level spectrum – Hz (dB(Z))									Calculated Overall Sound Power Level, dB(A) $L_{Aeq,15min}$	Calculated I_{Amax} Sound Power Level
	31.5	63	125	250	500	1000	2000	4000	8000		
40KVA generator	118	108	104	108	106	102	96	91	85	93	94
Rail miller and 40KVA generator	129	117	115	119	120	118	118	113	106	104 (+5) ¹	106
Rail saw	86	113	128	126	126	125	129	126	118	113 (+5) ¹	116
Rail grinder	120	115	115	107	108	115	119	118	109	104 (+5) ¹	109

Notes: 1) 5dBA penalty due to annoying characteristics

4 Vibration monitoring results

The results of the vibration monitoring for the signalling installation works at Westmead Terminus are presented in Table 4-1.

Table 4-1: Measured vibration level summary

Measurement ID	Plant	Distance from source	95 th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M9	Baseline measurement	N/A	0.05	0.07	
M10	Rail miller and 40KVA generator	2.5m from miller 2.5m from generator	0.16	0.23	The rail miller and generator produced low vibration levels measured distance, therefore risk of construction vibration impacts is low.
M11	Rail miller and 40KVA generator	5.5m from miller 2m from generator	0.11	0.13	The rail miller and generator produced low vibration levels measured distance, therefore risk of construction vibration impacts is low.
M12	Rail miller and 40KVA generator	7.5m from miller 1.5m from generator	0.14	0.20	The rail miller and generator produced low vibration levels measured distance, therefore risk of construction vibration impacts is low.
M17	Rail saw	2m	0.09	0.21	Rail saw produced low vibration levels at 2m away, therefore risk of construction vibration impacts is low.

Measurement ID	Plant	Distance from source	95 th percentile PPV (mm/s)	Maximum PPV (mm/s)	Comments
M18	Rail saw	4m	0.07	0.10	Rail saw produced low vibration levels at 4m away, therefore risk of construction vibration impacts is low.
M22	Rail grinder	2m	0.06	0.08	Rail grinder produced low vibration levels at 2m away, therefore risk of construction vibration impacts is low.
M23	Rail grinder	6m	0.05	0.12	Rail grinder produced low vibration levels at 6m away, therefore risk of construction vibration impacts is low.

The work which produced the greatest vibration levels was the rail milling which included the rail miller and generator operating concurrently. This work produced vibration levels <0.25mm/s at 2.5 metres away. Given that the closest Westmead hospital building to the works is located approximately 100 metres from the work areas, the risk of vibration impact on the vibration sensitive equipment at Westmead Hospital is negligible.

5 Conclusion

Renzo Tonin & Associates was engaged by CAF Australia to conduct noise monitoring to determine the sound power level and the risk of vibration impact for the plant and equipment used in the signalling installation works.

Monitoring results show that sound power levels of the proposed plant and equipment are lower than the levels assumed in the OOH Signalling Installation Works addendum².

Vibration measurements confirm that the risk of vibration impacts on vibration sensitive equipment at the Westmead Hospital is negligible.

² TK868-21F01 OOH signalling installation (r1), 10 February 2022

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
03.02.2023	First Issue	0	1	D. Auld	M. Tabacchi	M. Tabacchi

File Path: R:\AssocSydProjects\TK851-TK900\TK868 cw Parramatta Light Rail Stage1 - SOM\1 Docs\14 - OOH\TK868-21D02 OOH signalling installation SWL and Vibration Report (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

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We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

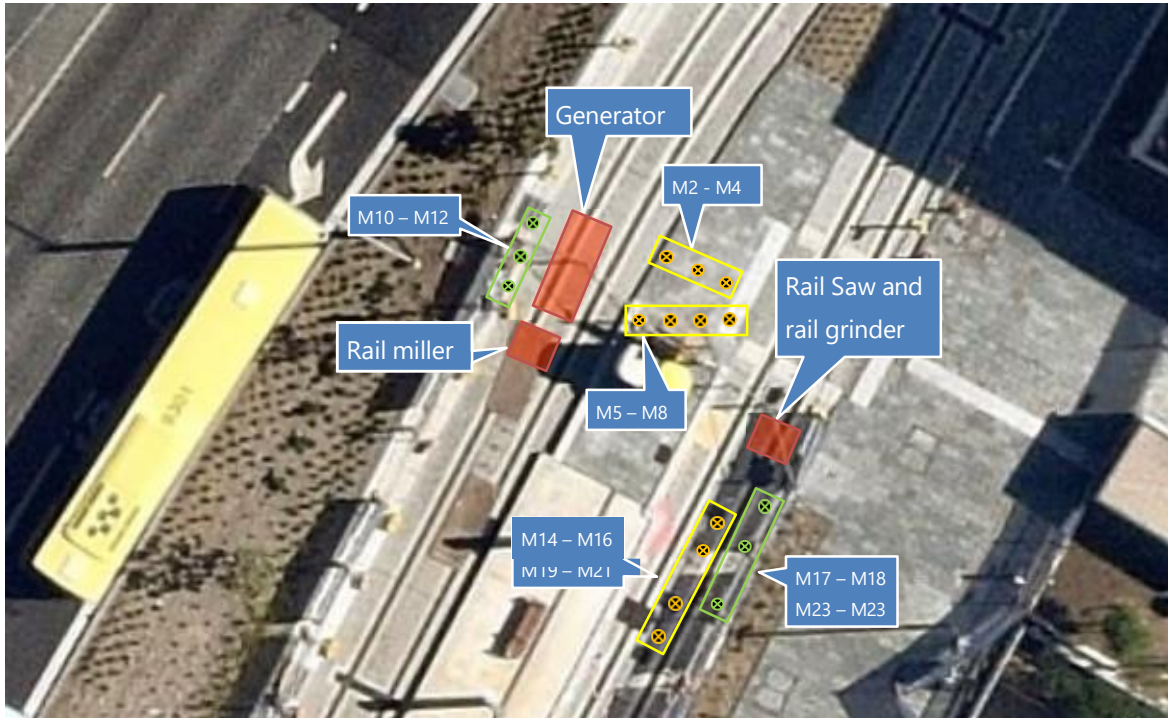
We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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APPENDIX A Measurement locations

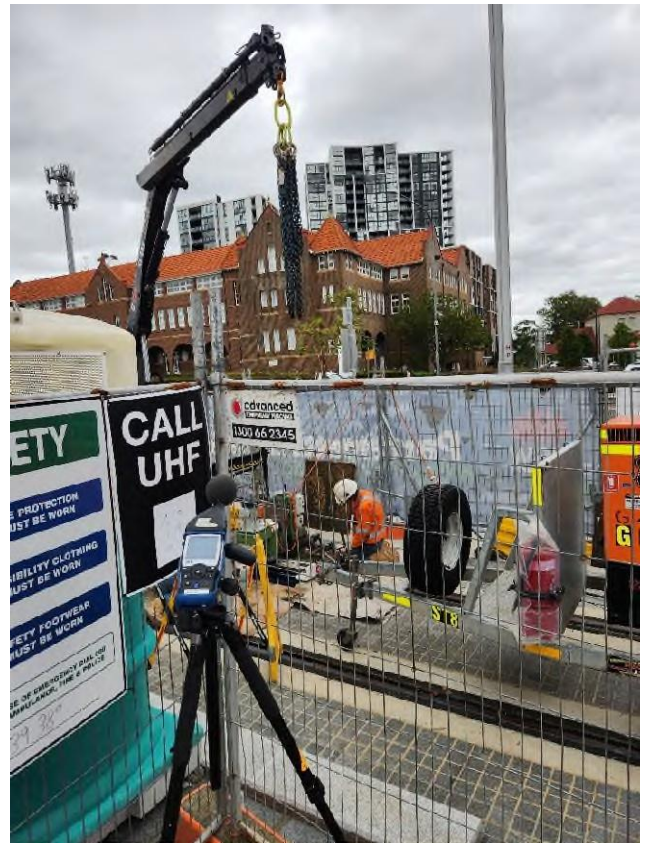
A.1 Monitoring Location: Westmead Terminus along Hawkesbury Road



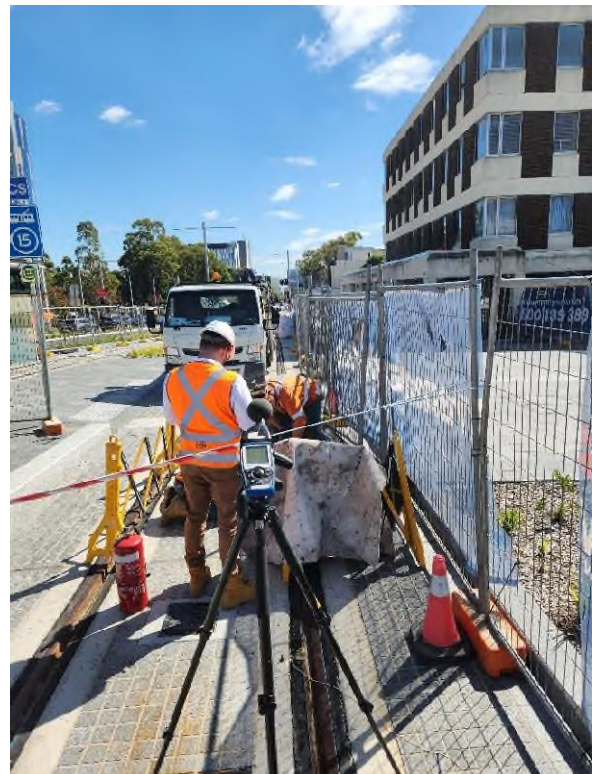
A.2 40KVA generator



A.3 Rail miller



A.4 Rail saw



A.5 Rail grinder

