GREAT RIVER CITY LIGHT RAIL
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PARRAMATTA LIGHT RAIL

PLR-SOM Noise and Vibration Monitoring Report

February 2023

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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	Authorised engineering organisation
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
ASCII	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 centre
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

Abbreviations	Definition
DBYD	Dial before you dig
DC	Direct current
DCCB	Direct current circuit breaker
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

Abbreviations	Definition
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
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	Mechanised 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 centre
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 licence
RSNL	Rail Safety National Law
RTU	Remote terminal unit
RVTM	Requirements verification and traceability matrix
SAR	Site audit report
SAS	Site audit statement

Abbreviations	Definition
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
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.

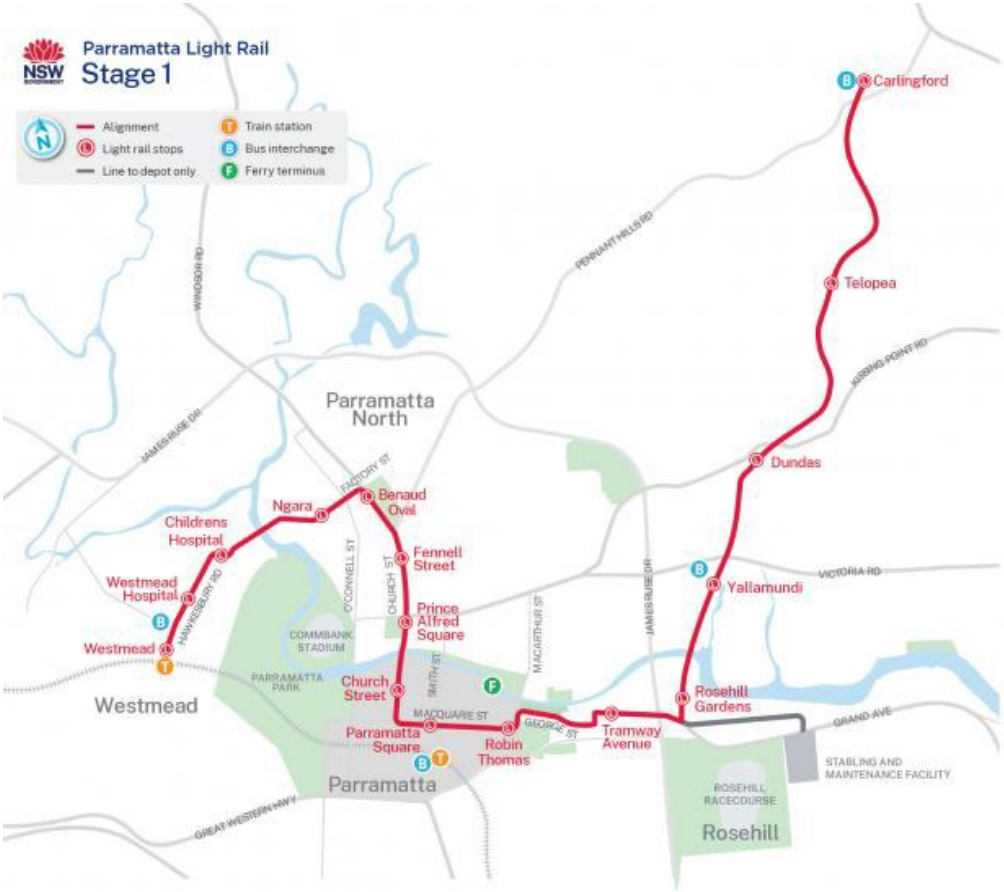

Figure 1 – PLR route

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 signalling system
- Elements of the road intersection signalling 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 including for providing 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 February 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

17 February, 2023	Parramatta Square	Rail Milling Works	0.5m Noise Curtains in place. Proposed an "Opportunity for Improvement" to consider use of full height noise enclosure for milling and saw cutting in highly sensitive areas"

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 month of February, noise monitoring was undertaken at Parramatta Square and the Hawkesbury Road while noise milling activities were being carried out. 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 31st January 2022 and 28th February 2022 as detailed in Table 2 below:

Table 2. GRCLR SOM Noise and Vibration Monitoring

Date	Location	Activity Covered	Date Report Submitted
31 January -1st February 2023	Parramatta Square	Rail Milling and Signaling works (OOHW) Noise and Vibration Monitoring by Renzo Tonin	3 February 2023. This report was included with the previous Noise and Vibration Monitoring Report
13 February, 2023	Westmead-Hawkesbury Road	Rail Milling and Signaling works	14 February 2023. This report is included as Appendix A.

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, Acoustic Advisors to the SOM/PLR Stage 1 Works, 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 month and also throughout the project duration thus far.

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
    - use of full noise curtains
    - 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 centers following direct feedback during the reporting period.

Utilizing 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 carrying out “out of hours works” in delivery of Rail Milling and Wheel Monitoring works near to residences, lifting of canopies, and installation of TPS Units. Utility works also continued.

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 focused 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.

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Appendix A - Rail Milling and Wheel Monitoring Works

APPENDIX A

Noise Monitoring – Rail Milling & Wheel Monitoring Works

12-13th February 2022

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The information here contained has been prepared by Great River City Light Rail and is of a general and indicative nature only. The information is current at the time of writing, and is subject to change without notice. The information is not intended to be relied upon unless expressly stated by an authorised person of GRCLR, nor is it to be a substitute for information or documentation submitted as part of a formal process. GRCLR accepts no responsibility, and shall have no liability for, any loss or damage which may arise from, or be related to, using or relying on this information or documentation.