Prepared for
Major Projects Canberra
ABN: 66 676 633 401

AECOM

# Noise and Vibration Impact Assessment

28-Sep-2021
Raising London Circuit
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# Noise and Vibration Impact Assessment

Client: Major Projects Canberra

ABN: 66 676 633 401

Prepared by

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# Table of Contents

# Executive Summary

Major Projects Canberra (MPC) proposes to raise London Circuit between Edinburgh Avenue and Constitution Avenue to provide a new at-grade, signalised intersection with Commonwealth Avenue (the Project). London Circuit currently passes under Commonwealth Avenue in a grade separated interchange with ramp connections between Commonwealth Avenue, London Circuit and Parkes Way.

Subject to securing and complying with the conditions of environmental and planning approvals, construction of the Project would commence around April 2022 and would take approximately two years to complete.

Key construction activities that would be carried out for the Project include site establishment and preparatory works, closure and raising of London Circuit, and construction of retaining walls, demolition and infilling of the Commonwealth Avenue bridges over London Circuit, construction of permanent roadworks, and construction of ancillary infrastructure, including traffic signals and streetlighting, and finishing works.

Construction works would be generally undertaken between 7am – 6pm for weekdays and 7am – 1pm Saturdays. Any works outside of these hours would be the subject of a specific application to the Territory, detailing the need for such works and any additional or work specific noise mitigation measures.

A qualitative construction noise assessment identified that highly intrusive noise impacts (>30 decibels (dB) above background levels) are likely during standard work hours, associated with high noise generating equipment, typically required during excavation, surface preparation, piling, earthworks, backfilling, profiling, levelling and grading. Other activities, associated with structural work and finishing works, may be moderately intrusive (>20-30 dB above background levels). These impacts may be extensive for the nearest sensitive receivers to the noise generating activity. Construction impacts would be managed through a Noise and Vibration Management Plan.

The operational road traffic noise assessment criteria used in the assessment is from the Roads ACT Noise Management Guideline (NMG) (2018). Future road traffic noise levels have been modelled for the ‘no build’ (without the Project) and ‘build’ scenarios for the year of opening (2026) and design year (2036). Road traffic noise levels are predicted to exceed the NMG criteria at a total of two co-located noise sensitive receivers, however these do not reflect an actual increase in road traffic noise levels due to the Project. The exceedance of noise criterion at these receivers is predominantly caused by existing road traffic on Parkes Way. As a result, no operational road traffic noise mitigation is proposed.

# 1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned to undertake a noise and vibration impact assessment for the proposed works associated with the raising of London Circuit (the Project).

Raising London Circuit to be at-grade with Commonwealth Avenue would align the road network with strategic transport and land use planning for the City, improve urban amenity and support the revitalisation of the City precinct.

This technical report provides a noise and vibration impact assessment of the Project and has been prepared to support the Environmental Assessment (EA). The construction and operational phases of the report have been assessed using the applicable noise and vibration guidelines.

# 2.0 Project description

Raising London Circuit (the Project) would involve raising London Circuit between Edinburgh Avenue and Constitution Avenue on a gradual filled embankment to meet the current height of Commonwealth Avenue, and provision of a new signalised intersection between London Circuit and Commonwealth Avenue.

The completed Project, including its main features and elements, is shown in Figure 2-1. Key elements of the Project are summarised in Table 2-1. Further details of the Project are provided in Chapter 3.0 of the Environmental Assessment.

**Table 2-1 Key elements of the Project**

| Key element | Description |
|---|---|
| **Main embankment** | A main embankment with associated retaining walls and batters between Edinburgh Avenue in the west and Constitution Avenue in the east, rising in the centre to around the current height of Commonwealth Avenue. The main embankment would have a slope of up to 3.5 per cent, tapering off to around 2.0 per cent towards the new London Circuit-Commonwealth Avenue intersection |
| **London Circuit West** | A modified and reconstructed London Circuit West between Edinburgh Avenue and Commonwealth Avenue:<br>• London Circuit West would be generally one travel lane in each direction, widening to two lanes between the potential future intersection with the proposed West Road and the new Commonwealth Avenue intersection. |
| **London Circuit East** | A modified and reconstructed London Circuit East between Commonwealth Avenue and Constitution Avenue:<br>• London Circuit East would be two travel lanes in each direction |
| **New and modified intersections** | New and modified intersections would be delivered at Edinburgh Avenue (modified) and Commonwealth Avenue (new), as well as making provision for a future potential intersection to tie into the potential future West Road (which would run south from London Circuit West to the future New Acton Waterfront Precinct, but which does not form part of this project).<br>***Modified London Circuit-Edinburgh Avenue intersection***<br>The modified London Circuit-Edinburgh Avenue intersection would include some civil works and tie-in works with London Circuit to the west of the intersection. No changes to Edinburgh Avenue outside the intersection are proposed.<br>The intersection would retain three travel lanes in each direction on the approach to Edinburgh Avenue, and one travel lane in each direction on London Circuit south of the intersection.<br>***New London Circuit-Commonwealth Avenue intersection***<br>The new London Circuit-Commonwealth Avenue intersection would be signalised and would include tie-in works on Commonwealth Avenue to the north and south of the intersection. The intersection would be designed to integrate into the local landscape and to minimise intrusion into the significant vista along the Commonwealth Avenue corridor between City Hill and Capital Hill.<br>On Commonwealth Avenue, the southern approach would provide one left turn lane, two through lanes and a right turn lane into London Circuit East. On London Circuit there would be two travel lanes in each direction on both the eastern and western approaches. This intersection configuration would be integrated through tie-in works to the existing configuration of Commonwealth Avenue north and south of this intersection. |

| Key element | Description |
|---|---|
| | The new intersection would allow full vehicle movements in all directions between London Circuit and Commonwealth Avenue, except for:<br>• No right turn from London Circuit westbound into Commonwealth Avenue northbound<br>• No right turn from Commonwealth Avenue southbound into London Circuit westbound.<br>• No right turn from London Circuit eastbound into Commonwealth Avenue southbound |
| **Modification and removal of existing cloverleaf ramps** | Modification and removal of existing cloverleaf ramp connections between Commonwealth Avenue, London Circuit and Parkes Way:<br>• The cloverleaf ramp connections to the north west and to the south west of the existing London Circuit-Commonwealth Avenue interchange would be removed, with affected land stabilised and rehabilitated.<br>• The cloverleaf ramp connection to the south east of the existing London-Circuit-Commonwealth Avenue interchange would be modified. This would remove the connection from London Circuit (westbound) on to Commonwealth Avenue (southbound), but would retain the connection between Parkes Way (eastbound) and Commonwealth Avenue (southbound). |
| **Bicycle infrastructure** | Provision of bicycle facilities:<br>• Dedicated, separated off-road bicycle paths would be provided on the verge on both sides of London Circuit West and London Circuit East, which would operate as one-way pairs in each direction.<br>• Dedicated, separated off-road bicycle paths bicycle paths would be provided along both sides of the tie-in works on Commonwealth Avenue to the north and to the south of the new London Circuit-Commonwealth Avenue intersection. |
| **Pedestrian infrastructure** | Provision of pedestrian facilities:<br>• Dedicated, separated pedestrian paths would be provided on both sides of London Circuit West and London Circuit East, and along both sides of the tie-in works on Commonwealth Avenue around the new London Circuit-Commonwealth Avenue intersection. |
| **Ancillary infrastructure** | Ancillary infrastructure and works, including utility connections, lighting, street furniture, landscaping and drainage are included in the project. |

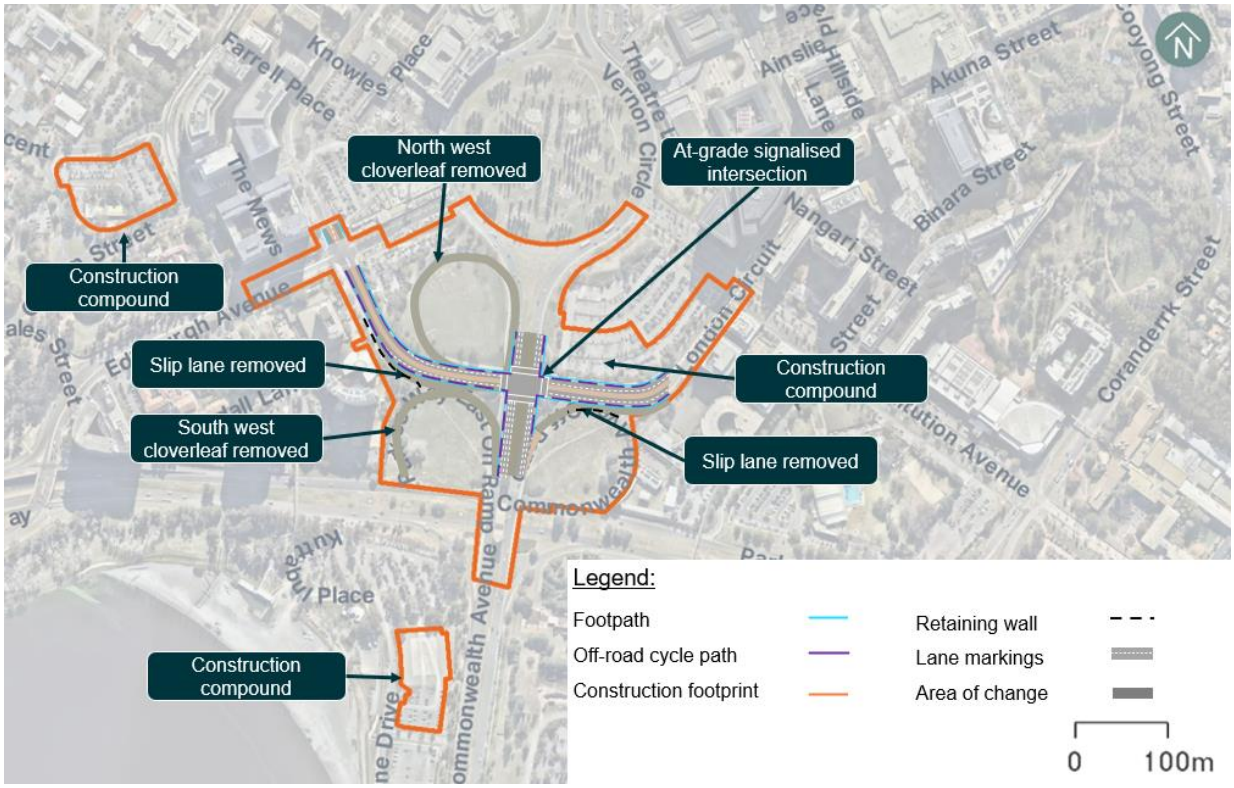


**Figure 2-1 The Project and its main features and elements**

Subject to securing and complying with the conditions of environmental and planning approvals, construction of the Project would commence around Q2 2022 and would take approximately two years to complete. The construction footprint for the Project, and the areas affected by separate early works are show in Figure 2-2.

Construction of the Project would be preceded by a series of early works required to allow construction works to commence around Q2 2022. These early works are subject to separate assessment and approvals, and would include:

- Relocation of utilities currently located within the Project construction footprint
- Translocation of Golden Sun Moth (*Synemon plana*) larvae from areas affected by utility relocations
- Traffic management works at the London Circuit-Edinburgh Avenue intersection to allow closure of London Circuit during construction of the Project
- Traffic management works at the Commonwealth Avenue-Vernon Circle intersection, including signalisation, and at the London Circuit-Constitution Avenue intersection to allow closure of London Circuit and traffic management along Commonwealth Avenue during construction of the Project.

Further details of early works are provided in Chapter 4.0 of the Environmental Assessment.

Key construction activities for the Project are summarised in Table 2-2. Further details of the construction of the Project are provided in Chapter 4.0 of the Environmental Assessment.

**Table 2-2 Key construction activities**

| Key construction activity | Description |
|---|---|
| **Site establishment and preparation** | Site establishment and preparatory works would involve:<br>• Mobilisation and establishment of construction compound sites. Construction compounds approved for use as part of the utility relocation early works would continue to be used for construction of the Project (refer to Figure 2-2)<br>• Translocation of Golden Sun Moth (*Synemon plana*) larvae from within the Project construction footprint<br>• Implementation of temporary surface water and drainage management infrastructure, including temporary grass swales, along areas of London Circuit which would be filled and raised with bulk earthworks<br>• Decommissioning and removal of utilities from within the Project construction footprint. Some decommissioning and removal works may also be carried out as part of construction works along London Circuit and around the new London Circuit-Commonwealth Avenue intersection<br>• Implementation of traffic management measures, including reliance on early works carried out at the London Circuit-Edinburgh Avenue, Commonwealth Avenue-Vernon Circle and London Circuit-Constitution Avenue intersections, and closure of London Circuit to traffic between Edinburgh Avenue and Constitution Avenue. |
| **Closure and raising of London Circuit** | Closure and raising of London Circuit would involve:<br>• Removal of existing street furniture, road pavement and vegetation along London Circuit and within the Project construction footprint<br>• Removal of existing street furniture and road pavement along the north west and south west cloverleaf ramp connections between Commonwealth Avenue, London Circuit and Parkes Way, and stabilisation and rehabilitation of land in those areas<br>• Removal of existing street furniture and road pavement for the connection between London Circuit East and the south east clover leaf ramp connection between London Circuit and Commonwealth Avenue. Only the connection with London Circuit would be affected, with the remainder of the ramp connection retained with potential minor modification to accommodate the embankment batter for London Circuit East. Land affected by removal of the London Circuit connection would be stabilised and rehabilitated<br>• Construction of retaining walls and batters, and staged filling of the London Circuit road corridor between Edinburgh Avenue and Constitution Avenue. The infilling along London Circuit would continue concurrently and in coordination with demolition and infilling beneath the Commonwealth Avenue northbound and southbound bridges (refer below) |
| **Demolition and infilling of Commonwealth Avenue bridges** | Demolition and infilling of the Commonwealth Avenue bridges would be carried out in stages to allow continued passage of traffic during the works. Indicative staging would be as follows:<br>• A temporary sidetrack would be constructed to the east of the existing Commonwealth Avenue southbound bridge and associated temporary pavement of the existing Commonwealth Avenue median to allow traffic diversion around the Commonwealth Avenue bridges during demolition works. The sidetrack would provide two traffic lanes as shown in Figure 2-3 |

| Key construction activity | Description |
|---|---|
| | • Implementation of traffic management measures, including reliance on early works carried out at the Commonwealth Avenue-Vernon Circle intersection, to divert traffic on Commonwealth Avenue so that:<br>- Southbound traffic travels via the temporary sidetrack<br>- Northbound traffic crosses onto the existing southbound carriageway<br>- The Commonwealth Avenue northbound bridge is free of traffic<br>• Demolition of the Commonwealth Avenue northbound bridge<br>• Infilling and stabilisation of the area beneath the demolished Commonwealth Avenue northbound bridge as part of the staged program to infill along London Circuit<br>• Construction of the western part of the new London Circuit-Commonwealth Avenue intersection, including a new northbound carriageway<br>• Implementation of traffic management measures following completion of the demolition and infilling of the Commonwealth Avenue northbound bridge so that:<br>- Southbound traffic continues to travel via the temporary sidetrack<br>- Northbound traffic travels via the new northbound traffic lanes and western part of the London Circuit-Commonwealth Avenue intersection<br>- The Commonwealth Avenue southbound bridge is free of traffic<br>• Demolition of the Commonwealth Avenue southbound bridge<br>• Infilling and stabilisation of the area beneath the demolished Commonwealth Avenue southbound bridge as part of the staged program to infill along London Circuit<br>• Construction of the eastern part of the new London Circuit-Commonwealth Avenue intersection, including a new southbound carriageway<br>• Implementation of traffic management measures to return southbound traffic on Commonwealth Avenue to the new southbound traffic lanes and eastern part of the London Circuit-Commonwealth Avenue intersection<br>• Demolition of the temporary sidetrack and infilling the area beneath it as part of the staged program to infill along London Circuit. |
| **Permanent road works** | Permanent road pavement, median works and kerb and guttering would be constructed in coordination with the completion of infilling London Circuit to provide the permanent reconstructed London Circuit. Road works would include intersection works at Edinburgh Avenue and Commonwealth Avenue, and tie-in works at Constitution Avenue and around the modified and new intersections with Edinburgh and Commonwealth Avenues. |
| **Ancillary infrastructure and finishing works** | Ancillary infrastructure and finishing works would be completed prior to commissioning and opening London Circuit to traffic, including:<br>• Construction of active transport infrastructure, permanent drainage and utilities works<br>• Installation of lighting and street furniture, and road line marking<br>• Landscaping<br>• Demobilisation, and stabilisation and rehabilitation of disturbed areas, including construction compound sites. |


**Figure 2-2 The Project construction footprint**


**Figure 2-3 Temporary Commonwealth Avenue sidetrack configuration**

# 3.0 Legislation and strategic context

## 3.1 Relevant guidelines and policies

The following acts and regulations are relevant for this assessment:

- ACT Government *Environment Protection Act* 1997 (EP Act)
- ACT Government *Environment Protection Regulation* 2005 (EPR or the Regulation)

The following guidelines and/or standards have been used for the noise and vibration assessment:

- General:
  - *Noise Measurement Manual* (ACT EPA 2009)
  - *Environment Protection (Noise) Environment Protection Policy* 2012 (ACT EPA 2012).
  - *Infrastructure Sustainability (IS) Rating Scheme* (ISCA) (Infrastructure Sustainability Council, 2018)
- Construction noise:
  - *Interim Construction Noise Guideline* (Department of Environment and Climate Change (DECC, 2009)
  - *Environment Protection Regulation* (ACT Government, 2005)
- Construction vibration:
  - *Assessing Vibration: a technical guideline* (NSW Department of Environment and Conservation (DEC) 2006a)
  - DIN 4150:Part 3-1999 Structural vibration – Effects of vibration on structures (*Deutsches Institut für Normung* 1999)
  - Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385:Part 2-1993) (BS 7385).
- Operational noise – Road traffic noise
  - *Roads ACT Noise Management Guideline* (Transport Canberra and City Services, 2018)
- Sleep disturbance during construction:
  - NSW *Road Noise Policy* (RNP) (DECCW 2011)
  - *Noise Policy for Industry* (NPfI) (NSW Environment Protection Authority (NSW EPA) 2017).

The above policies and guidelines are detailed further in the following Sections, including how they have been employed for the purposes of this assessment.

The Infrastructure Sustainability (IS) Rating Scheme (ISCA, 2018) was developed and is administered by Infrastructure Sustainability Council (ISC) (formerly referred to as Infrastructure Sustainability Council of Australia (ISCA)). The IS Rating Scheme encompasses the IS Rating Tool, a comprehensive evaluation of sustainability performance designed to help infrastructure meet its full sustainability potential across all project stages. The IS rating scheme offers credits for construction and operational noise and vibration. As summarised in Appendix A, this report responds to the Env-2 and Env-3 noise and vibration credit criteria and additional guidance.

# 4.0 Methodology

## 4.1 General assessment methodology

This section details the general methodology for this noise and vibration impact assessment. Specific methodologies pertaining to construction noise and operational noise are detailed in Sections 7.1 and 8.1 respectively.

1. Identify sensitive receivers near the Project that are likely to be impacted by construction and operational noise and vibration
2. Conduct noise monitoring and attended noise measurements to determine relevant noise criteria, where applicable
3. Assess noise and vibration impacts to nearby sensitive receivers using relevant guidelines and policies, and compare against relevant criteria

Provide indicative noise management measures, mitigation options or treatments where applicable.

## 4.2 Risk assessment approach

An environmental risk assessment is required to determine potential impacts from the construction and operation of the Project. A risk assessment for potential noise and vibration impacts associated with the Project was carried out to:

- Facilitate a consistent approach to risk assessment across the various specialist studies for the environmental assessment.
- Identify key project risks to inform the detailed investigations where required
- Ensure the level of investigation is proportionate to the relative environmental risk
- Assess the effectiveness of proposed mitigation measures and whether additional measures may be required.

Risks can be defined as a combination of:

- The magnitude of potential consequences of an event
- The likelihood of the event occurring

The risk assessment process developed for the project involved the assignment of consequence and likelihood ratings which were combined to give an overall risk level for each identified risk. The environmental risk assessment for the project is described below and summarised in Figure 4-1. Key steps include:

- Description of impacting process
- Description of environmental values affected
- Description of likelihood of impacting process occurring (assume no mitigation or controls applied) (Table 4-1)
- Description of consequence of impact on environmental value (assume no mitigation or controls applied) (Table 4-2)
- Calculate risk level (Table 4-3)
- Identify mitigation and management measures:
  - Apply industry standard management measures to relevant impacts (e.g. dust suppression) to impacts of all risk levels
  - Where risk level is medium or above, identify additional controls to reduce impacts
- Determine residual risk:
  - Likelihood and consequence of impact on environmental values with industry standard and additional controls applied

**Figure 4-1 Risk assessment approach**

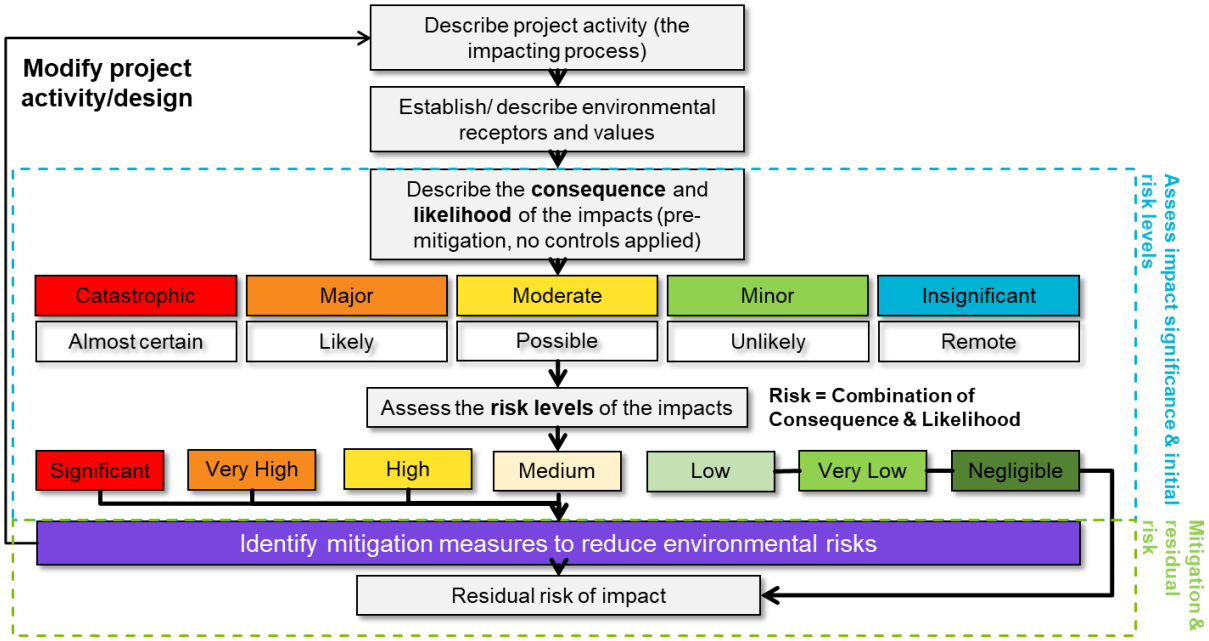


**Table 4-1 Quantitative likelihood descriptors**

| Likelihood | Description |
|---|---|
| **Remote** | Extremely rare/unprecedented |
| **Unlikely** | Not expected to occur in most circumstances |
| **Possible** | Could occur |
| **Likely** | Probably would occur |
| **Almost Certain** | Expected to occur |

**Table 4-2 Consequence descriptors**

| Consequence | Environment | Economic | Social |
|---|---|---|---|
| **Insignificant** | No environmental damage. | Minimal losses | No noticeable change experienced by people in the locality |
| **Minor** | Minor instances of environmental damage that could be reversed. I.e. negative impact on a specific species. | Several thousand dollars lost revenue or remediation costs | Mild deterioration, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable |
| **Moderate** | Isolated but significant instances of environmental damage that might be reversed with intense efforts. | Half million dollars lost revenue or remediation costs | Noticeable deterioration to something that people value highly, either lasting for an extensive time, or affecting a group of people |
| **Major** | Severe loss of environmental amenities and a danger of continuing | One million dollars lost revenue or remediation costs | Substantial deterioration to something that people value highly, either lasting for an indefinite |

| Consequence | Environment | Economic | Social |
|---|---|---|---|
| | | | time, or affecting many people in a widespread area |
| **Catastrophic** | Major widespread loss of environmental amenity and progressive irrecoverable environmental damage. | Several million dollars in lost revenue or remediation costs | Substantial change experienced in community wellbeing, livelihood, amenity, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20% of a community |

**Table 4-3 Risk matrix**

| Likelihood | Consequence | | | | |
|---|---|---|---|---|---|
| | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost Certain | **Medium** | **High** | **Very High** | **Significant** | **Significant** |
| Likely | **Low** | **Medium** | **High** | **Very High** | **Significant** |
| Possible | **Very Low** | **Low** | **Medium** | **High** | **Very High** |
| Unlikely | **Negligible** | **Very Low** | **Low** | **Medium** | **High** |
| Rare | **Negligible** | **Negligible** | **Very Low** | **Low** | **Medium** |

# 5.0 Existing noise environment

The noise environment is typically urban in nature, with existing road traffic and urban 'hum' dominant throughout the Project area.

## 5.1 Noise sensitive receivers

Land use in the area immediately surrounding the construction footprint is characterised by a CBD setting, transitioning to residential dwellings further to the north. Noise sensitive receivers within the study area were identified using aerial photography. The uses of all buildings within the study area were determined through a ground-truthing site survey exercise. This, in conjunction with cadastral information, was used to determine the classification of residential, commercial, recreational and other uses within the Project noise assessment study area.

## 5.2 Heritage items

There are a number of heritage listed places located in the vicinity of the Project (Table 5-1). These heritage items are assessed in the Heritage Impact Assessment (HIA) prepared by GML Heritage Pty Ltd in July 2021.

**Table 5-1 Listed historic heritage places**

| Place name | Register (Status) |
|---|---|
| Canberra the Planned National Capital | Nominated: National Heritage List (Nominated) |
| Parliament House Vista | Commonwealth Heritage List (Listed / 105466) |
| National Land Roads | Nominated: Commonwealth Heritage List (Nominated / 106324) |
| City Hill | ACT Heritage Register (Registered / 20002) |

## 5.3 Noise monitoring

### 5.3.1 Instrumentation

Details of the sound level meters (noise loggers) used for unattended long-term noise monitoring are presented in Table 5-2. The noise monitoring locations are shown in Figure 5-1 below. These noise monitoring locations were selected in consultation with MPC and relevant stakeholders in order to determine the nature of the local noise environment throughout the study area.

**Table 5-2 Noise logging locations, measurement periods and instrumentation**

| ID | Address | Logger type / Serial number | Measurement period | Days of data retrieved |
|---|---|---|---|---|
| NL1 | Archbishops House, Parkes | Rion NL-52<br>S/N: 00175537 | 26/07/2021 – 09/08/2021 | 14 |
| NL2 | 1 London Circuit, Canberra | Rion NL-52<br>S/N: 00164393 | 26/07/2021 – 09/08/2021 | 14 |
| NL3 | Police Station and RBA, Canberra | Rion NL-52<br>S/N: 00164394 | 26/07/2021 – 09/08/2021 | 14 |
| NL4 | 255 London Circuit, Canberra | Rion NL-52<br>S/N: 00164394 | 10/08/2021 – 24/08/2021 | 14 |
| NL5 | ANU School of Art, 61 Marcus Clarke Street, Canberra | Rion NL-52<br>S/N: 00164396 | 5/08/2021 – 19/08/2021 | 14 |

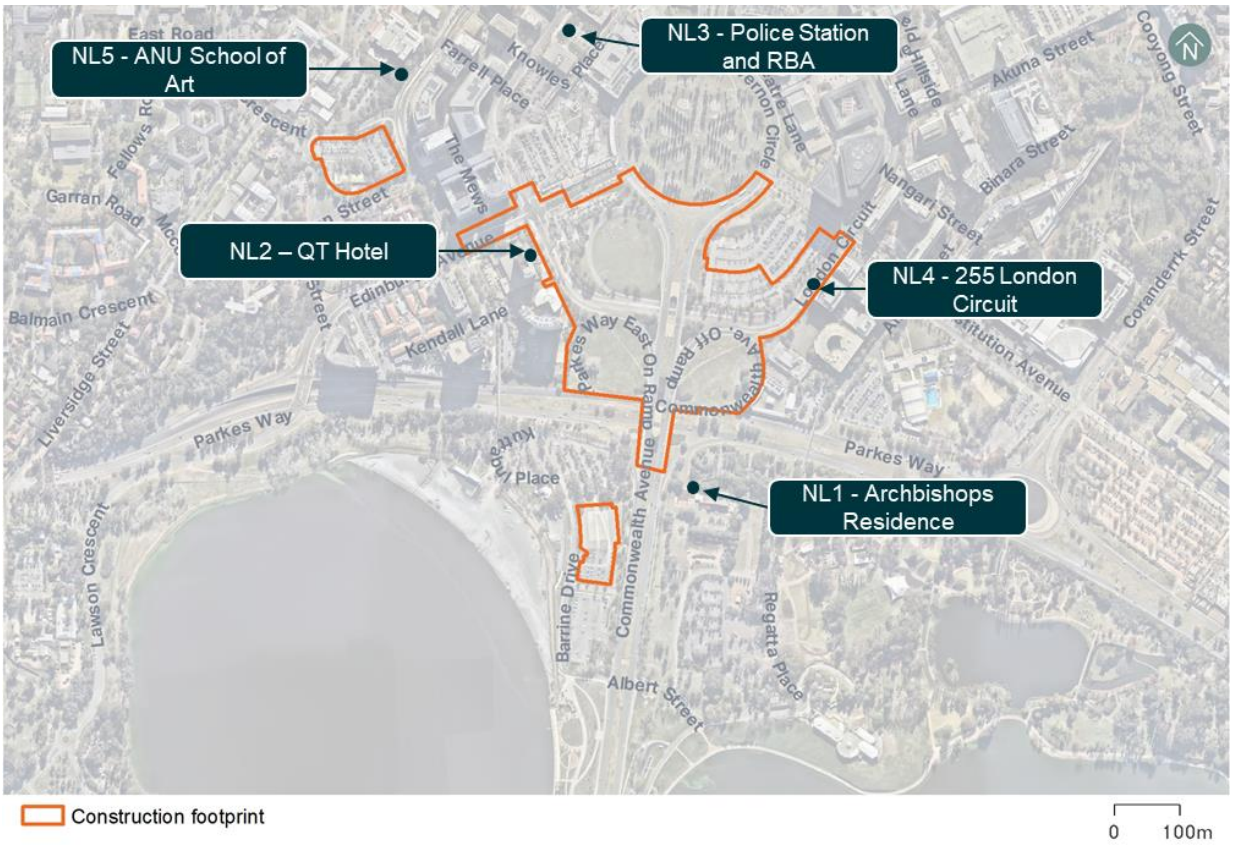


**Figure 5-1 Noise logger locations**

All acoustic instrumentation used in for the assessment comply with the requirements of *Australian Standard (AS) IEC 61672.1-2004 Electroacoustics – Sound level meters*, Specifications and were calibrated before and after monitoring sessions with a drift in calibration not exceeding plus or minus (±) 0.5 decibel (dB).

All instruments used were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

### 5.3.2 Unattended background noise monitoring

Ambient noise monitoring was undertaken at the five locations as listed in Table 5-2 between 26 July and 24 August 2021. The locations for the unattended noise loggers were determined through examination of aerial photography and site inspections. Final locations were selected in consultation with MPC and relevant stakeholders in order to determine the local noise environment throughout the study area.

A noise logger measures the noise level over a 15-minute sample period and then determines $L_{A1}$, $L_{A10}$, $L_{A90}$, $L_{Amax}$ and $L_{Aeq}$ levels of the noise environment. The $L_{A1}$, $L_{A10}$ and $L_{A90}$ levels are the levels exceeded for 1 %, 10 % and 90 % of the sample period respectively. The $L_{Amax}$ level is the maximum noise level due to individual noise events. The $L_{A90}$ level is taken as the background noise level. The $L_{Aeq}$ level is the energy averaged noise level over the 15-minute period.

Weather data recorded during the noise monitoring survey periods were obtained from the Bureau of Meteorology weather station, located at Canberra Airport (ID: 070351). Periods which were affected by noise from extraneous wind and rain were omitted from the results, as indicated in Appendix B.

The noise logging locations are shown in Figure 2. Photos of the noise loggers and the noise logging results are provided in Appendix B, and are summarised in Table 5-3 below.

**Table 5-3 Unattended background noise monitoring results**

| ID | Rating Background Level ($L_{A90}$), dB(A) | | | Ambient noise level ($L_{Aeq}$), dB(A) | | |
|---|---|---|---|---|---|---|
| | Day | Evening | Night | Day | Evening | Night |
| NL1 | 57 | 54 | 39 | 63 | 61 | 56 |
| NL2 | 53 | 50 | 45 | 61 | 58 | 54 |
| NL3 | 52 | 49 | 44 | 57 | 55 | 54 |
| NL4 | 43 | 40 | 34 | 58 | 55 | 53 |
| NL5 | 48 | 48 | 43 | 57 | 54 | 50 |

*Notes:*

*dB(A) represents A-weighted decibels, the relative frequency response used in sound measuring instruments.*

1. *In accordance with the NPfI, time of day is defined as follows:*
   *Day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays.*
   *Evening – the period from 6 pm to 10 pm.*
   *Night – the remaining periods.*

# 6.0 Assessment criteria

## 6.1 Construction noise and vibration criteria

### 6.1.1 Construction noise

Section 29 of the ACT Environment Protection Regulation (2005) states that:

> *"Under section 25 (1), noise is not taken to cause environmental harm in an affected place if it is noise mentioned in schedule 2, table 2.3, column 2 and the conditions (if any) mentioned in* column 3 for the noise are met."

Clause 16 of Table 2.3 of the Regulation then places no conditions on the "Noise emitted in the course of constructing or maintaining a major road…". This is the clause under which major road construction does not require noise assessment in the ACT.

Section 9.11 of the Environment Protection (Noise) Environment Protection Policy 2012 provides the following reasoning for the exemption of roadworks:

> *"9.11 Roadworks*
>
> *The construction and maintenance of roads is central to the economic and social well-being of the community. The Regulation restricts the times at which roadworks can take place to limit noise nuisance while not unduly affecting traffic.*
>
> *No time restrictions are placed on the construction and maintenance of major roads to enable work to take place during periods of low traffic flows."*

Accordingly, construction noise generated by the Project has not been assessed against specific numerical noise limits. Notwithstanding, as part of the Project's contract documents, the construction contractor is required to prepare and demonstrate compliance with a best-practice Construction Noise and Vibration Management Plan (CNVMP), subject to statutory authorities' approvals.

A qualitative assessment of the noise impacts along the alignment, based on the likely worst case at the nearest residential receivers to each of the proposed works has been undertaken and is presented in Section 7.0. The qualitative representation of the results of the assessment is provided to facilitate understanding of the level of impact for different activities. The qualitative descriptions are related to the likely noise levels as follows:

- Clearly audible: average noise levels >10-20 dB above the background
- Moderately intrusive: average noise levels >20-30 dB above the background
- Highly intrusive: average noise levels > 30 dB above background.

### 6.1.2 Construction vibration

The relevant standards/guidelines for the assessment of construction vibration are summarised in Table 6-1.

**Table 6-1 Standards/guidelines used for assessing construction vibration**

| Item | Standard/guideline |
|---|---|
| Structural damage | Heritage structures – German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)<br><br>Non-heritage structures – Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385:Part 2-1993) (BS 7385) |
| Human comfort (tactile vibration) | Assessing Vibration: A Technical Guideline (AVATG) [1] |
| Human comfort (ground-borne noise) | Interim Construction Noise Guideline (ICNG) |

*Notes:*

*1 This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. Although a new version of BS 6472 has been published, the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.*

Vibration and its associated effects are usually classified as follows:

- Continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities for example, a vibratory roller
- Impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with a duration of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- Intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

#### 6.1.2.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration. DIN 4150 and BS 7385-2 provide recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 6-2 and Table 6-3. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. Structural damage criteria for heritage items have been taken from DIN 4150, whilst criteria for commercial/residential items have been taken from BS 7385.

**Table 6-2 DIN 4150: Structural damage safe limits for building vibration**

| Group | Type of structure | Vibration velocity in mm/s | | | |
|---|---|---|---|---|---|
| | | At foundation at a frequency of: | | | Vibration at the horizontal plane of the highest floor |
| | | Less than 10 Hz | 10 Hz to 50 Hz | 50 Hz to 100 Hz | All frequencies |
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| 2 | Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 15 to 20 | 15 |
| 3 | Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g. Reserve Bank of Australia Building) | 3 | 3 to 8 | 8 to 10 | 8 |

*Notes:*
*mm/s represents millimetres per second*
*Hz represents hertz*

**Table 6-3 BS 7385-2: Transient vibration guide values for cosmetic damage**

| Group | Type of building | Peak component particle velocity in frequency range of predominant pulse | |
|---|---|---|---|
| | | 4 Hz to 15 Hz | 15 Hz and above |
| 1 | Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50 mm/s at 4 Hz and above | |
| 2 | Unreinforced or light framed structures<br>Residential or light commercial type buildings | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |

### 6.1.3 Human comfort

Humans are sensitive to vibration such that they can detect vibration levels well below those required to cause any risk of damage to a building or its contents. Criteria to avoid annoyance are therefore more stringent than those to prevent structural damage.

#### 6.1.3.1 Intermittent vibration

The assessment of intermittent vibration outlined in AVATG is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 6-4. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

**Table 6-4 Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$)**

| Location | Day time | | Night-time | |
|---|---|---|---|---|
| | Preferred | Max | Preferred | Max |
| Critical areas[1] | 0.10 | 0.20 | 0.10 | 0.20 |
| Residences[2] | 0.20 | 0.40 | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | 0.40 | 0.80 | 0.40 | 0.80 |
| Workshops | 0.80 | 1.60 | 0.80 | 1.60 |

*Notes:*
*m/s represents metres per second.*
*1 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria.*
*2 Criteria for residences are lower than schools as people expect to be able to relax/sleep in their homes without annoyance and are generally more concerned about structural damage than would be the case within schools and offices.*

#### 6.1.3.2 Continuous and impulsive vibration

Acceptable levels of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space. AVATG provides the preferred values for continuous and impulsive vibration. These are presented in Table 6-5.

There is low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values in Table 6-5. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short duration. Vibration levels above those indicated in Table 6-5 may be dealt with through negotiation with the regulator of the affected community. The following axes are defined in relation to the human body:

- x – back to chest
- y – right side to left side
- z – foot to head.

**Table 6-5 Peak particle velocity for continuous and impulsive vibration (mm/s) z-axis**

| Location | Assessment period | Preferred | Maximum |
|---|---|---|---|
| **Continuous vibration** | | | |
| Critical areas[1] | When in use | 0.14 | 0.28 |
| Residences[2] | Day<br>Night | 0.28<br>0.20 | 0.56<br>0.40 |
| Offices, schools, educational institutions and places of worship | When in use | 0.56 | 1.10 |
| Workshops | When in use | 1.10 | 2.20 |
| **Impulsive vibration** | | | |
| Critical areas[1] | When in use | 0.14 | 0.28 |
| Residences[2] | Day<br>Night | 8.60<br>2.80 | 17.0<br>5.60 |
| Offices, schools, educational institutions and places of worship | When in use | 18.0 | 36.0 |
| Workshops | When in use | 18.0 | 36.0 |

*Notes:*
1 *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria.*
2 *Criteria for residences are lower than schools as people expect to be able to relax/sleep in their homes without annoyance and are generally more concerned about structural damage than would be the case within schools and offices.*

## 6.2 Operational noise criteria – Road traffic noise

### 6.2.1 Roads ACT Noise Management Guideline

The operational road traffic noise assessment criteria used in this assessment is from the Roads ACT Noise Management Guideline (2018) (NMG). The criteria apply at 1 m from the building façade, approximately 1.2-1.5 m above ground level.

Road traffic noise criteria applicable to upgrading roads in existing areas is provided in Table 6-6 below.

**Table 6-6 Traffic noise levels resulting from upgraded road in existing areas of noise sensitive land use (ground level)**

| Existing traffic noise level at adjacent buildings, $L_{Aeq,15hr}$ | Traffic noise level at adjacent buildings after road works completed |
|---|---|
| > 60 dB(A) | Equal to existing level (not greater than 65 dB(A)) |
| 55 – 60 dB(A) | 60 dB(A) |
| < 55 dB(A) | Not more than 5 dB(A) above existing level |

The NMG also identified noise sensitive receivers that should be included in an assessment of road traffic impacts, these are defined in Table 6-7 below. The table also outlines how these have been addressed in this assessment.

**Table 6-7 Noise sensitive receivers**

| Building use | Corresponding receiver type in assessment |
|---|---|
| Apartment<br>Attached house<br>Boarding house<br>Caravan park/camping ground<br>Detached house<br>Guest house<br>Retirement complex<br>Special care establishment<br>Special care hostel | Residential |
| Childcare centre | Child Care |
| Community activity centre (except community halls) | Passive Recreation and Community Theatre |
| Educational establishment | Education |
| Health facility/hospital | None |
| Special dwelling | Place of Worship |

# 7.0 Construction noise and vibration assessment

## 7.1 Noise assessment methodology

Noise levels due to construction activities have been assessed qualitatively, taking into consideration the following factors:

- Construction equipment
- Background noise environment
- Location of works in relation to sensitive receivers
- Duration of activities

General mitigation measures for construction noise have been provided in Section 9.0.

## 7.2 Construction scenarios and equipment

Construction equipment and associated sound power levels typically used for these construction scenarios are identified in Table 7-1 below. The listed sound power levels are typical values taken from data provided in:

- *Construction Noise and Vibration Guideline* (NSW Roads and Maritime, 2016)
- Australian Standard AS2436-2010*, Guide to noise control on construction, demolition and maintenance sites*
- British Standard BS5228: Part 1 2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise.*

It has been assumed that all equipment is modern and in good working order. Noise measurements undertaken by AECOM and data provided in BS5228 indicate that $L_{A1}$ sound power levels are typically up to 8 dB(A) above $L_{Aeq}$ sound power levels for construction works.

**Table 7-1Sound power levels of typical construction plant**

| Phase | Works | Equipment | SWL, dB(A) |
|---|---|---|---|
| 1 | 1. Early works | Trucks | 98 |
| | | 20t Mobile crane | 104 |
| | | Scissor lift | 100 |
| | | Semi trucks | 108 |
| | | Hiab truck | 98 |
| | | Backhoe | 102 |
| | | Trencher | 99 |
| | | Hand tools | 94 |
| | | **Total** | **111** |

| Phase | Works | Equipment | SWL, dB(A) |
|---|---|---|---|
| 2, 3 & 4 | 2. Demolition | Excavator | 105 |
| | | Hydraulic breaker | 112 |
| | | Concrete saw | 110 |
| | | Water pump | 96 |
| | | Jackhammer | 108 |
| | | Hand tools | 94 |
| | | Chainsaw | 110 |
| | | Mulcher/chipper | 120 |
| | | Hydro demolition equipment | 112 |
| | | Vacuum truck | 110 |
| | | Demolition saw | 110 |
| | | 50-100t Crane | 99 |
| | | Oxy-cutter | 93 |
| | | Tipper | 98 |
| | | Semi trucks | 108 |
| | | **Total** | **123** |
| | 3. Bulk Earthworks | Bulldozer | 109 |
| | | Excavator | 105 |
| | | Tipper | 98 |
| | | Compactor | 106 |
| | | Vacuum truck | 110 |
| | | Truck and dog | 98 |
| | | Backhoe | 102 |
| | | Rock breaker & screening plant | 117 |
| | | Scrapers | 108 |
| | | Concrete vibrator | 97 |
| | | Jackhammer | 108 |
| | | Compressor | 109 |
| | | Grader | 109 |
| | | Trucks | 98 |
| | | Padfoot roller | 109 |
| | | Smooth drum roller | 105 |
| | | Water cart | 100 |
| | | **Total** | **121** |
| | 4. Drainage | Trucks | 98 |
| | | Excavator | 105 |
| | | Vacuum truck | 110 |

| Phase | Works | Equipment | SWL, dB(A) |
|---|---|---|---|
| | | Tipper | 98 |
| | | Wacker plate compactor | 106 |
| | | Wacker packers | 106 |
| | | Bulldozer | 109 |
| | | Piling rig | 116 |
| | | Concrete truck | 106 |
| | | Concrete pump | 106 |
| | | Compactor | 106 |
| | | **Total** | **119** |
| | 5. Structural work: Wall construction | Trucks | 98 |
| | | Excavator | 105 |
| | | Backhoe | 102 |
| | | Piling rig | 116 |
| | | Concrete truck | 106 |
| | | Concrete pump | 106 |
| | | Circular saw | 113 |
| | | Demolition saw | 110 |
| | | Grinder | 109 |
| | | Brick saw | 113 |
| | | Hand tools | 94 |
| | | **Total** | **120** |
| | 6. Pavement | Tipper | 98 |
| | | Excavator | 105 |
| | | Rigid truck | 98 |
| | | Grader | 109 |
| | | Water cart | 100 |
| | | Rubber tyre roller | 107 |
| | | Padfoot roller | 109 |
| | | Smooth drum roller | 105 |
| | | Spreader truck | 103 |
| | | Franna crane | 93 |
| | | Concrete truck | 106 |
| | | Concrete vibrator | 97 |
| | | Wacker Packers | 106 |
| | | Loader | 103 |
| | | Sealing truck | 98 |
| | | Asphalt Paver | 106 |

| Phase | Works | Equipment | SWL, dB(A) |
|---|---|---|---|
| | | Profiler | 108 |
| | | Bobcat | 104 |
| | | Asphalt truck | 98 |
| | | **Total** | **118** |
| 5 | 7. Finishing works | Line marking truck | 103 |
| | | Asphalt truck | 98 |
| | | Crane | 98 |
| | | Slipforming machine | 109 |
| | | Hand tools | 94 |
| | | Brick saw | 113 |
| | | Demolition saw | 110 |
| | | Excavator | 105 |
| | | Generator | 101 |
| | | Light vehicles | 90 |
| | | Dump trucks | 105 |
| | | Road sweeper | 101 |
| | | **Total** | **117** |

## 7.3 Construction hours

Works would be generally undertaken between 7am – 6pm for weekdays and 7am – 1pm Saturdays (normal working hours). From time to time works would need to be undertaken outside of these hours. Any such works outside of these hours would be the subject of a specific application to the Territory, detailing the need for such works and any additional or work specific noise mitigation measures. Activity specific communications and engagement activities would be undertaken in advance of the commencement of such works outside of normal work hours. A copy of the out-of-hours work plan is provided in Appendix E.

## 7.4 Construction noise assessment

It is important to note that the construction scenarios above consider sound power levels based on a worst-case 15-minute period and would likely not represent the ongoing day-to-day noise impact at sensitive receivers for an extended period of time.

Particularly noisy activities, such as concrete sawing, would not occur for the entire construction period. For linear works (works that move along the alignment, rather than works located at an ancillary facility), noise exposure at each receiver would reduce due to increases in distance loss as the works progress along the alignment.

**Table 7-2** below describes the anticipated impacts of each proposed activity, and considerations for noise impacts both during standard construction hours and outside standard hours.

As described in Section 6.1.1, qualitative descriptions are related to the likely noise levels as follows:

- Clearly audible: average noise levels >10-20 dB above the background
- Moderately intrusive: average noise levels >20-30 dB above the background
- Highly intrusive: average noise levels > 30 dB above background.

**Table 7-2 Qualitative construction noise assessment and activity specific considerations**

| Works | Qualitative assessment of noise impacts | Acoustic considerations | |
|---|---|---|---|
| | | Standard construction hours | Outside standard construction hours |
| 3. Bulk earthworks<br>4. Drainage<br>6. Pavement | Considered **highly intrusive** to nearest noise sensitive receivers when using high noise generating equipment, likely required during excavation, surface preparation, piling, earthworks, backfilling, compacting, profiling, levelling and grading.<br>Potentially long durations of **highly intrusive** noise, including night works. | Extended **highly intrusive** noise impacts are likely, however can be managed.<br>Consultation with nearby stakeholders to be considered before conducting activities requiring high noise to minimise impacts where possible.<br>Respite periods should be considered for noisy works taking place near non-residential noise sensitive receivers, including educational facilities and places of worship.<br>Use bored piling instead of impact piling where possible. | Likely required for busy road intersections and would include the use of high noise generating equipment.<br>• Community consultation<br>• Minimise the number of consecutive nights work impacting the same receivers.<br>• Respite periods for prolonged activities<br>• Types of equipment used |
| 1. Utilities<br>2. Demolition<br>5. Structural work: wall construction<br>7. Finishing works | **Highly intrusive** noise levels are associated with the use of concrete saws and jackhammers and<br>Remaining works are moderately intrusive. | Shorter duration **highly intrusive** noise impacts are likely, however can be managed.<br>Consultation with nearby stakeholders to be considered before conducting activities requiring high noise to minimise impacts where possible. | Likely required for busy road intersections and would include the use of high noise generating equipment.<br>• Community consultation<br>• Minimise the number of consecutive nights work impacting the same receivers.<br>• Respite periods for prolonged activities<br>• Types of equipment used |

## 7.5 Construction traffic assessment

Construction vehicle access to/from the Project would be largely facilitated by the existing arterial road network including:

- To/from the north - Vernon Circle and Northbourne Avenue
- To/from east –Constitution Avenue or Edinburgh Avenue to access Parkes Way
- To/from south – Vernon Circle and Commonwealth Avenue
- To/from west - Edinburgh Avenue to access Parkes Way

- To/from north and west – London Circuit and Marcus Clarke Street.

Assuming the heavy vehicle movements would be largely evenly distributed amongst the key haulage routes (excluding Northbourne Avenue), the RLC construction works could result in an additional 15-20 two-way trucks movements per day along Edinburgh Avenue, Constitution Avenue and Commonwealth Avenue. Therefore, the works are expected to generate up to six two-way truck movements per hour on each of these corridors, during construction hours. These roads are already highly trafficked and so would have a minimal impact on existing traffic volumes, and therefore construction traffic noise. It is proposed that these vehicle movements would normally occur only during normal working hours.

## 7.6 Construction vibration assessment

In order to comply with the cosmetic/structural damage and human discomfort criteria presented in Section 6.1.2, vibration intensive works should not be undertaken within the minimum working distances presented in Table 7-3.

**Table 7-3 Recommended minimum working distances for vibration intensive plant**

| Plant item | Rating/Description | Minimum working distance | | |
|---|---|---|---|---|
| | | Cosmetic damage (BS 7385) Light-framed structures | Cosmetic damage (DIN 4150) Heritage and other sensitive structures | Human response (EPA's Vibration guideline) |
| Vibratory Roller | < 50 kN (Typically 1-2 t) | 5 m | 14 m | 15 m to 20 m |
| | < 100 kN (Typically 2-4 t) | 6 m | 16 m | 20 m |
| | < 200 kN (Typically 4-6 t) | 12 m | 33 | 40 m |
| | < 300 kN (Typically 7-13 t) | 15 m | 41 | 100 m |
| | > 300 kN (Typically 13-18 t) | 20 m | 54 m | 100 m |
| | > 300 kN (> 18 t) | 25 m | 68 m | 100 m |
| Small Hydraulic Hammer | (300 kg - 5 to 12 t excavator) | 2 m | 5 m | 7 m |
| Medium Hydraulic Hammer | (900 kg – 12 to 18 t excavator) | 7 m | 19 m | 23 m |
| Large Hydraulic Hammer | (1600 kg – 18 to 34 t excavator) | 22 m | 60 m | 73 m |
| Vibratory Pile Driver | Sheet piles | 20 m | 50 m | 100 m |
| Pile Boring | ≤ 800 mm | 2 m (nominal) | 4 m | 4 m |
| Jackhammer | Hand held | 1 m (nominal) | 2 m | 2 m |

*Note:*

*More stringent conditions may apply to heritage or other sensitive structures. Any heritage property would need to be considered on a case by case basis and assessed in accordance with DIN4150:3 Structural vibration - Effects of vibration on structures.*

Where vibration intensive works are required within the minimum working distances above, alternative equipment would be identified and vibration monitoring would be implemented in accordance with the mitigation measures outlined in Section 9.1.

# 8.0 Operational noise assessment – Road traffic noise

The assessment of road traffic noise has been completed in accordance with Roads ACT Noise Management Guideline (2018) (NMG). To assess the potential impact of the Project on noise sensitive receivers, future road traffic noise levels have been modelled for the 'no build' (without the Project) and 'build' scenarios for the year of opening (2026) and design year (2036). This is discussed further in Section 8.2 and results are presented in Section 8.3.

## 8.1 Noise modelling methodology

Road traffic noise levels were calculated using SoundPLAN v8.0 software, which implements the Calculation of Road Traffic Noise (CoRTN) algorithm. The UK Department of Transport devised the CoRTN algorithm and with suitable corrections, this method has been shown to give accurate predictions of road traffic noise under Australian conditions.

The modelling parameters which are included in the model are detailed below in Table 8-1.

**Table 8-1 Modelling noise parameters**

| Parameter | Comment |
|---|---|
| Traffic volumes and mix | The number of vehicles using the road and the percentage of heavy vehicles. A higher percentage of heavy vehicles would increase the road traffic noise levels. The mix of heavy vehicles i.e. double or triple axles would also affect the road traffic noise levels.<br>Predicted traffic volumes for the year of opening (2026) and for the design year (2036) for the 'no build' and 'build' scenarios were sourced from traffic modelling (refer to the Traffic and Transport Impact Assessment prepared by AECOM). |
| Traffic speeds | An increase in speed generally causes an increase in road traffic noise. Traffic speeds have been based on current posted road speeds for all modelled scenarios |
| Roadway gradient | Road traffic noise levels vary dependent on the gradient of the roadway compared with a flat roadway. CoRTN calculates this variation, however it does not take into account noise from heavy vehicle engine braking. According to literature, similar A-weighted noise levels would be generated when heavy vehicles, with appropriately fitted OEM mufflers, use engine brakes as when under full throttle conditions. However, engine braking noise emitted from heavy vehicles without appropriate mufflers would be significantly higher than A-weighted levels emitted under full throttle conditions.<br>Given that all heavy vehicles should be fitted with OEM mufflers (Transport estimate 95% of trucks are) the noise levels predicted by CoRTN are considered to adequately represent typical road traffic noise levels. |
| Road surface | Road surface characteristics would determine the level of road/tyre interfacial noise created.<br>Dense graded asphalt (DGA) surfaces were modelled for all road surfaces. A correction (0 dB(A) for DGA) was applied to the road traffic noise model to account for the existing road surfaces |
| Ground absorption | Road traffic noise levels reduce with increasing distance from the noise source along the ground. A ground absorption factor of 0.6 was applied. |
| Terrain | Natural topographical features such as hills and valleys can shield sensitive receivers from road traffic noise. These effects are taken account of in the model which incorporates one metre terrain contours. |
| Buildings | The height of receiver buildings in the operational study area affects the road traffic noise exposure. It can also affect the amount of acoustic shielding provided to other nearby buildings. The height of all buildings within the |

| Parameter | Comment |
|---|---|
| | operational study area was determined through a ground-truthing exercise and the heights were then included in the road traffic noise model. |
| Noise barriers | No existing noise barriers were identified for this Project. |
| Facade | A correction of 2.5 dB(A) was added to all road traffic noise levels to take account of façade reflection effects.<br>Noise levels have been calculated and assessed at each façade of each sensitive receiver location. Only the noise level at the most affected façade for each receiver is presented in this report. |
| Road network | All existing major roads were included in the noise model. Noise levels at the noise logger locations used for the model validation were predominantly controlled by the traffic on London Circuit, Commonwealth Avenue and Parkes Way. This was verified during site activities. |
| Standard corrections | CoRTN provides $L_{A10}$ road traffic noise levels. The industry standard correction of -3 dB(A) was applied to convert the $L_{A10}$ levels to $L_{Aeq}$ road traffic noise levels to allow assessment of the results against the *Road Noise Policy* and *Noise Criteria Guideline* criteria.<br>The Australian Road Research Board Australian conditions correction (Saunders et al, 1983) of -1.7 dB(A) was applied. |

## 8.2 Modelled scenarios

To determine the noise impacts for sensitive receivers located close to the development two scenarios have been modelled. These are:

- Year 2026 'No build' scenario
- Year 2036 'Build' scenario

## 8.3 Predicted operational road traffic noise impacts

Noise levels have been predicted for each scenario across the extent of the proposal. Road traffic noise levels are predicted to exceed the $L_{Aeq(15hr)}$ noise criteria at a total of two noise sensitive receivers:

- Exceedance of noise criterion at these receivers is predominantly caused by existing road traffic on Parkes Way
- Road traffic noise levels are not anticipated to increase due to the proposal at these receivers.

As a result, no further consideration of operational road traffic noise mitigation is required. A summary of the aforementioned exceedances is provided in Table 8-2 below. All assessed receiver locations and their predicted road traffic noise levels are presented in Appendix C and Appendix D respectively.

**Table 8-2 Road traffic noise assessment**

| ID | Address | Road traffic noise level, $L_{Aeq,15hr}$, dB(A) | | | | Notes |
|---|---|---|---|---|---|---|
| | | Criterion | Predicted noise level, 2026 'No Build' | Predicted noise level, 2036 'Build' | Change | |
| 12 | 19 Marcus Clarke Street, Acton | 65 | 69 | 69 | 0.0 | No noise increase due to proposal |
| 14 | 19 Marcus Clarke Street, Acton | 65 | 68 | 67 | -0.1 | No noise increase due to proposal |

# 9.0 Mitigation measures

## 9.1 Construction noise and vibration

The qualitative construction noise and vibration assessment presented in Section 7.0 noted the likelihood of 'highly intrusive' noise impacts. As a result of this, noise and vibration safeguards have been identified in Table 9-1 below.

**Table 9-1 Noise and vibration safeguards**

| Impact | Environmental safeguards | Timing |
|---|---|---|
| Construction noise and vibration | A Construction Noise and Vibration Management Plan would be prepared as part of the Construction Environmental Management Plan. The CNVMP would identify:<br>• all potential significant noise and vibration generating activities associated with the activity<br>• noise and vibration sensitive receivers<br>• measures to be implemented during construction to minimise noise and vibration impacts.<br>• feasible and reasonable mitigation measures to be implemented, taking into account the RMS Construction Noise and Vibration Guideline process and principles<br>• a monitoring program to assess performance against relevant noise and vibration criteria<br>• arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures. | Pre-construction and construction |
| Construction noise and vibration | The CNVMP will also contain a comprehensive night works approval procedure, including:<br>• maintain a rolling schedule of upcoming night work periods<br>• inclusion of scheduled respite for the community for extended periods of night work<br>• methods for assessment and review of impacts<br>• methods for expanded community engagement, notification and agreements<br>• records of community engagement, and proposed mitigation measures. | Pre-construction and construction |
| Construction noise and vibration | All sensitive receivers likely to be affected would be notified at least five working days prior to commencement of any works associated with the scenario that may have an adverse noise or vibration impact. The notification would include details of:<br>• the construction activities likely to have noise or vibration impact<br>• construction period and construction hours<br>• any proposed mitigation measures for noise and vibration<br>• contact information for the project, including out of hours contact<br>• complaint and incident reporting and how to obtain further information. | Construction |

| Impact | Environmental safeguards | Timing |
|---|---|---|
| Construction noise and vibration | All employees, contractors and subcontractors are to receive awareness training in control of noise and vibration as part of their regular site induction and updated prior to any significant period of nightwork.<br>The induction must at least include:<br>• all relevant Project specific and standard noise and vibration mitigation measures<br>• relevant licence and approval conditions<br>• permissible hours of work<br>• any limitations on high noise generating activities<br>• location of nearest sensitive receivers<br>• construction employee parking areas<br>• designated loading/unloading areas and procedures<br>• site opening/closing times (including deliveries)<br>• environmental incident procedures. | Construction |
| Construction noise and vibration | Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Works generating high noise and/or vibration levels should be scheduled during less sensitive time periods.<br>Where it is unavoidable to conduct works in standard hours for safety of workers and the public, for the safe and efficient operation of the road network or to maintain critical access to local services, then an assessment and approval process will be undertaken as per the CNVMP. | Construction |
| Construction noise | Where high noise generating activities (75 dB(A) $L_{Aeq}$ at receiver) are required out of hours the following would be implemented:<br>The equipment would be used prior to 10pm where feasible and reasonable<br>Where the above cannot be achieved, the equipment can be used where feasible and reasonable controls are implemented. | Construction |
| Construction noise | The following would be implemented for deliveries to and from the Project:<br>• where possible, loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers, or;<br>• loading/unloading areas are to be shielded or screened if close to sensitive receivers where possible<br>• delivery vehicles are to be fitted with straps rather than chains for unloading, wherever possible<br>• delivery and handling methodology included in the CNVMP addressing mitigations to noise impacts.<br>When establishing work areas, site compounds and laydowns consideration would be given to arranging the site to limit the need for reversing associated with regular/repeatable movements, where safe and space permits. | Construction |
| Construction noise | Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. | Construction |

| Impact | Environmental safeguards | Timing |
|---|---|---|
| Construction noise and vibration | Consideration would be given to the layout of the ancillary facilities in order to maximise distance and shielding to nearby receivers (e.g. positioning of site sheds, earth bunds and localised hoarding with noise absorption to maximise shielding to residential receivers). Longer term screening and shielding of the boundaries of the site and will also be included in the CEMP, following a quantitative assessment of the risk of noise impact in pre-construction and proximity to sensitive receivers. | Pre-construction and construction |
| Construction vibration | Vibration intensive equipment size would be selected to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment would be considered where feasible and reasonable. | Construction |
| Construction vibration | Where the use of vibration intensive equipment within the relevant minimum working distances cannot be avoided, a detailed inspection would be carried out and a written and photographic report prepared to document the condition of buildings and structures within the minimum working distances.<br>This would be conducted during the development of the CEMP and reviewed prior to the commencement of vibration intensive work. A copy of the report will be provided to the relevant landowner or land manager. | Pre-construction |
| Construction vibration | Vibration generating activities will be managed to minimise the potential for impacts on structures and sensitive receiver(s), including maximising minimum safe working distances where practicable, or use of alternate methods to minimise vibration where minimum safe working distances cannot be achieved.<br>Where alternatives cannot be implemented, vibration monitoring is to be undertaken and receivers notified at least five days in advance of works. | Construction |

# 10.0 Conclusion

Major Projects Canberra (MPC) proposes to upgrade existing road infrastructure which would result in the raising of London Circuit to be at-grade with the existing Commonwealth Avenue.

## 10.1 Construction impacts

A qualitative assessment of construction noise impacts due to the Proposal has been undertaken.

Some activities are required to be conducted during the night-time period, the most noise and vibration sensitive period for residential receivers.

Due to the proximity of works to the receivers, and the noisy nature of the works, noise impacts at the worst affected receivers are predicted to be 'highly intrusive' at times, that is average noise levels 30 dB above background levels. Although the worst noise impacts would not continue over the entire duration of the main works since activities would move along the alignment as construction progresses, several weeks or months of 'highly intrusive' noise levels may be experienced by residences during the night-time period.

Noise mitigation measures, both activity specific and general, have been provided, with a focus on scheduling noisiest works outside of the night-time period, noise reduction measures, community consultation, and good work practices on site.

Vibration impacts should be managed by adhering to minimum working distances to buildings, and mitigation measures have been provided should works be required within these distances.

Based on the assessments detailed above, construction noise emissions are expected to generate significant disturbance to the community, primarily during the night-time periods during the noisiest construction activities. These activities are temporary in nature, however they would require implementation of mitigation and management measures typical of major infrastructure projects.

## 10.2 Operational impacts

An operational road traffic noise assessment has been conducted in accordance with the *Roads ACT Noise Management Guideline*.

Noise levels have been predicted at sensitive receiver locations throughout the proposal area during the daytime for the 'Year of Opening' 2026, and the 'Design Year' 2036.

Exceedances of the applicable noise criteria have been identified for two receivers, both located at 19 Marcus Clarke Street, Canberra. However, it should be noted that predicted noise levels at these receivers are due to road traffic noise from Parkes Way, and not roads in the proposal area. In addition, road traffic noise levels are not predicted to increase as a result of the proposal. Therefore, no further consideration of noise mitigation is required.

# Appendix A

## IS noise and vibration credits

# Appendix A IS noise and vibration credits

The Infrastructure Sustainability Council (ISC) Infrastructure Sustainability (IS) rating scheme is Australia's only comprehensive rating scheme for evaluating sustainability for infrastructure. The Project is seeking to achieve 'Leading' Design and As-Built IS ratings. As part of this process, alignment with the Env-1 (noise) and Env-3 (vibration) credits are required. This report seeks to align with the IS criteria and additional guidance where relevant to the scope of the assessment.

**Table G-1** outlines specific requirements as part of Env-2 to demonstrate achievement of the required target levels and where these are addressed in this report.

**Table G-1: ISC Env-2 requirements**

| ISCA requirement | Section addressed |
|---|---|
| DL1.1 Baseline studies of the existing noise environment have been carried out for the project. | Refer to Section 5.0 |
| DL1.2 Modelling and/or predictions for noise have been developed for construction and operation phases of the project. | Refer to Section 7.0 |
| DL1.3 Noise goals are identified for the project. | Refer to Section 6.0 |
| DL1.4 Measures to mitigate noise during construction and operation have been identified and implemented to meet the goals developed in DL1.3. | Refer to Section 9.0 |
| DL1.5 Monitoring requirements of noise impacts are included in relevant management plans (i.e. during high-impact activities) | Refer to Section 9.0 |
| Baseline studies must be undertaken by a suitably qualified professional to identifying the pre-exiting noise environment prior to any potential project impacts (for example, prior to demolition works or breaking ground in construction). | Refer to Section 5.0 |
| These studies must consider representative sampling and links to activities in the area likely to affect the baseline. | Refer to Section 5.0 |
| the baseline assessment must identify the relevant environmental parameters and the minimum time and location monitoring requirements to suitably demonstrate change in environmental impacts throughout the duration of the construction and operational phases. | Refer to Section 5.0 |
| The following must be included in the assessment:<br>• Peak and average measurements of monitoring parameters,<br>• Seasonal and/or time of day variations (whichever is most appropriate for accurate baselines to be established),<br>• Specific local variations, representative sampling and links to activities likely to affect the baseline (such as nearby construction works or rail transport services), and<br>• The measurement criteria/indicators/factors | Refer to Section 5.0 |

| ISCA requirement | Section addressed |
|---|---|
| used in the assessments and associated justification of how these link to goals and targets. | |
| A baseline for background noise levels must be determined using the assessment methodology for the type of works and operation for the asset development. | Refer to Section 5.0 |
| The measurements must be taken in locations that can be/are likely to be accessible throughout the construction and operational phases of the asset development. | Refer to Section 5.0 |
| The baseline assessment must consider existing long-term noise impacts that may be affecting human health and detail the noise source, time measured and associated peak and average noise levels. | Refer to Section 5.0 |
| Baseline studies must consider the location of sensitive receivers. | Refer to Section 5.0 |
| Noise predictions must be established for the construction and operation phases of the project, and consider a comparison against the baseline data as established in DL1.1. | Refer to Section 7.0 |
| Predictions must be developed by a suitably qualified professional and incorporate all equipment proposed to be used through the construction and operation of the project that could result in noise impacts. | Refer to Section 7.0 |
| Predictions must factor in sensitive receivers and the increased impact that noise may have on them. Impacts can vary greatly depending on the distance to each sensitive receiver, as well as any intervening topography or buildings. | Refer to Section 7.0 |
| Predictions must be incorporated and influence noise goals established in DL1.3. | Refer to Section 7.0 |
| If noise goals have been established and verified as part of a Planning rating, then those goals must be incorporated into the project's management plan or similar. | Refer to Section 7.0 and Section 9.0 |
| Noise goals must be established for the project considering the baseline data (DL1.1) and predictions (DL1.2). The goals must be SMART (specific, measurable, achievable, relevant and time-bound) and must align with a no net impact outcome. | Refer to Section 6.0 |
| The evidence for this criterion must include:<br>• Any assumptions made, with relevant calculations,<br>• The methodology used to develop the goals,<br>• Background information demonstrating how the goals align with the intended outcome/s, and<br>• How the baseline assessment has been incorporated. | Refer to Section 6.0 |

| ISCA requirement | Section addressed |
|---|---|
| Baseline studies and noise predictions must be used to inform the management process and measures. | Refer to Section 9.0 |
| Measures to meet the goals identified in DL1.3 must be identified for construction and operation and must be included in the project's Environmental Management, Construction and Operational Environmental Management Plans, specific Noise Management Plans or similar. | Refer to Section 9.0 |
| The measures implemented/adopted to meet the goals identified in DL1.2 must be detailed for construction and operation. | Refer to Section 9.0 |
| Where works are deemed unavoidable or essential, suitable control measures must be used to ensure that the impact is minimised as much as is feasible and reasonable. | Refer to Section 9.0 |
| DL2.1 Modelling and/or predictions demonstrate no recurring or major exceedances of the noise goals set in DL1.3. | Refer to Section 8.0 |
| Modelling and/or predictions must demonstrate no recurring or major exceedances of the noise goals set in DL1.3. | Refer to Section 8.0 |
| Where exceedances are predicted, these must be clearly identified with the appropriate control measures to limit the scale of the impact. | Refer to Section 9.0 |
| In addition, a report developed by a suitable qualified professional must be provided, providing justification and interpretation of the results with any recommended controls. | This report |
| DL3.1 Modelling demonstrates no exceedances of the noise goals. | Refer to Section 8.0 |
| Modelling and/or predictions must demonstrate no exceedances of the noise goals set in DL1.3. | Refer to Section 8.0 |

**Table G-2** outlines specific requirements as part of Env-3 to demonstrate achievement of the required target levels and where these are addressed in this report.

**Table G-2: ISC Env-3 requirements**

| ISCA requirement | Section addressed |
|---|---|
| DL1.2 Modelling and/or predictions for vibration have been developed for construction and operation phases of the project. | Refer to Section 7.6 |
| DL1.3 Vibration goals are identified for the project. | Refer to Section 6.1.2 |
| DL1.4 Measures to mitigate vibration during construction and operation have been identified and implemented to meet the goals developed in DL1.3. | Refer to Section 9.0 |
| DL1.5 Monitoring requirements of vibration impacts are included in relevant management plans (i.e. during high-impact activities) | Refer to Section 9.0 |

| ISCA requirement | Section addressed |
|---|---|
| Vibration predictions must be established for the construction and operation phases of the project, considering the baseline data established in DL1.1. | Refer to Section 7.6 |
| Predictions must be developed by a suitably qualified professional and incorporate all equipment proposed to be used through the construction and operation of the project that could result in vibratory impacts. | Refer to Section 7.6 |
| Predictions must factor in sensitive receivers and the increased impact that vibration may have on them. Sensitive receivers to be accounted for in predictions should include: | Refer to Section 7.6 |
| Predictions must be incorporated and influence vibration goals established in DL1.3. | Refer to Section 7.6 |
| Vibration goals must be established for the project considering the baseline data and predictions. | Refer to Section 6.1.2 |
| The goals must be SMART (specific, measurable, achievable, relevant and time-bound) and must align with a no net impact outcome. | Refer to Section 6.1.2 |
| The evidence for this criterion must include:<br>• Any assumptions made, with relevant calculations,<br>• The methodology used to develop the goals,<br>• Background information demonstrating how the goals align with the intended outcome/s, and<br>• How the baseline assessment has been incorporated. | Refer to Section 6.1.2 |
| The measures implemented/adopted to meet the goals identified in DL1.3 must be detailed for construction and operation. | Refer to Section 9.0 |
| The measures identified for construction and operational phases must be implemented. During the design phase, this means measures implemented into the design to mitigate impacts in operation and for construction, controls required to mitigate impacts in the construction phase. | Refer to Section 9.0 |
| DL2.1 Modelling demonstrates no exceedances of vibration goals for structural damage to buildings and structures. | Refer to Section 7.6 and Section 9.0 |
| Modelling must demonstrate there are no exceedances of vibration goals for structural damage to buildings and structures. | Refer to Section 7.6 and Section 9.0 |
| Where exceedances are predicted, these must be identified with the appropriate control measures to limit the scale of the impact. | Refer to Section 9.0 |
| Modelling must demonstrate there are no exceedances of vibration goals for human comfort criteria. | Refer to Section 7.6 and Section 9.0 |

| ISCA requirement | Section addressed |
|---|---|
| Where exceedances are predicted, these must be identified with the appropriate control measures to limit the scale of the impact. | Refer to Section 9.0 |

# Appendix B

## Noise logger reports

# Appendix C

## Road traffic noise - Assessed receivers

# Appendix D

## Road traffic noise levels

# Appendix E

## Out-of-hours work plan