130 Wellington St, Mosman Park

Acoustics Report

Development Application

Attention: Australian Development Capital Pty Ltd

Date: 1 April 2021

Prepared by: Jason Lim & Imran Khan

Ref: 301248261

Stantec Australia Pty Ltd
Ground Floor, 226 Adelaide Terrace, Perth WA 6000
Tel: +61 8 6222 7000 Web: www.stantec.com

P:\301248261\PROJECT DOCUMENTATION\ACOUSTICS\DESIGN\REPORTS\AC-DA-AUS-301248261_004.DOCX

Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
001	15/09/2020	Draft DA for Review	JLM	IK
002	6/10/2020	Draft DA for Review	JLM	IK
003	25/03/2021	Development Application Issue	JLM	IK
004	1/04/2021	Development Application Issue - Revised	JLM	IK

Contents

Executive Summary

Stantec has been appointed by Australian Development Capital Pty Ltd to undertake acoustic assessment for the proposed mixed-use development located at 130 Wellington St, Mosman Park WA.

As part of the development approval process for the mixed-use development, an acoustic assessment has been carried out in order to satisfy the requirements stated in the relevant policies and guidelines applicable to the project. This includes:

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Australian and New Zealand Standard AS/NZS 2107:2016 - Acoustics – Recommended design sound levels and reverberation times for building interiors (AS2107);
- National Construction Code 2019, Building Code of Australia (NCC 2019); and

The acoustic criteria derived from the aforementioned documentation forms the basis of acoustic design for the project and includes the following acoustic parameters;

- Airborne sound insulation and impact sound isolation between adjoining apartments;
- Internal noise levels resulting from noise intrusion from mechanical services and via the façade due to external sources;
- Noise emissions from the proposed development to the nearest noise sensitive receivers.

Traffic Noise Intrusion

A traffic noise assessment has been carried out based on on-site measurements conducted by Stantec. preliminary treatments have been recommended including external façade construction including wall, glazing and roof configuration in order to achieve the recommended AS2107 internal noise levels.

The external glazing configuration required for all noise sensitive locations has been shown below.

Façade Location	Glazing Configuration	Rw + Ctr	Spectrum Sound Transmission Loss (dB)						
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Bedroom façade facing Turnbull Way Level 1 and 2	6mm glass + 12mm air gap + 6.38mm glass	**32 (38; -5)**	22	24	24	35	43	44	49
All other bedrooms and living rooms	6mm glass + 12mm air gap + 6mm glass	**29 (36; -7)**	22	23	19	35	43	42	50

Bedrooms on level 1 and 2 facing Turnbull Way will require upgraded glazing due to the proximity to ground floor tenancies and transport corridors that are expected to utilized by service trucks.

Mechanical Services Noise Emission

Based on the latest architectural drawings, the development is expected to contain the following mechanical services:

- Refrigerant condensers serving ground floor tenancies
- Roof Condenser units serving Tower A, B and C

Preliminary condenser unit selection serving residential tenancies has been provided to Stantec and are compliant to the relevant EPNR criteria at the closest noise sensitive receivers.

At this stage no information has been provided regarding refrigerant condenser selection. Based on the advice of the mechanical engineer and Stantec's experience on projects of similar size and capacity, assumed sound levels have been used to determine anticipated treatments required for the refrigerant condenser units serving the ground floor retail tenancies.

Based on the noise emission assessment conducted, the following treatments will be required to be implemented:

- A maximum of Nine refrigerant condenser units may be implemented at the locations specified in this report
- A noise barrier extending 1m above the top height of the highest unit
- Limit the Sound Power Level of each unit to a maximum of 70 dB(A)

Once a complete schedule of mechanical equipment information has been provided a detailed noise assessment will be conducted to ascertain the specific acoustic treatments required to achieve compliance to EPNR criteria.

1. Introduction

1.1 Overview

Stantec has been appointed by Australian Development Capital Pty Ltd to undertake acoustic assessment for the proposed mixed-use development located at 130 Wellington St. The project will see the development of a multi-storey mixed-use development that consists of retail premises and apartments, located at the above address in Mosman Park, WA 6012.

This report presents the key acoustic considerations and criteria pertinent to the project. The criteria will form the basis of the acoustic design for the following areas;

- Traffic noise impact on the development; and
- Noise emission from the mechanical equipment servicing the building.

1.2 Project Layout

The project site is bound to the North by Wellington St and Samson St to the south. Additionally, Turnbull Way is adjacent to the proposed project site. The surrounding area is largely residentially zoned properties.

Figure 1 below shows the surrounding area of the project location.

Source: Nearmap

Figure 1: Site location and surrounding area

2. Acoustic Criteria

The acoustic criteria presented in this Development Application report are derived from the following documentation;

- Western Australian Environmental Protection (Noise) Regulation 1997 (EPNR);
- Australian and New Zealand Standard AS/NZS 2107:2016 - Acoustics – Recommended design sound levels and reverberation times for building interiors (AS2107);
- National Construction Code 2019 Volume 1, Building Code of Australia Class 2, 3 Buildings (NCC 2019);

2.1 Environmental Protection (Noise) Regulation 1997

Environmental noise impacts resulting from the noise emissions from the project are addressed through the Environmental Protection Act 1986, with the regulatory requirements detailed in the Environmental Protection (Noise) Regulations 1997 (EPNR).

The EPNR establishes the maximum permissible noise emission levels (assigned levels) to be received at all adjacent noise-sensitive premises during specific periods of the day as a result of the cumulative noise emissions from all sources proposed for the project site. Compliance to relevant noise limits outlined in the EPNR is compulsory.

The EPNR states noise emissions from any premises are considered not to *significantly contribute to* the noise at a receiver if the noise emissions are 5 dB or below the assigned levels.

In brief, the assigned levels are determined by considering of the amount of commercial and industrial zones, as well as main transport corridors and sporting venues surrounding the noise sensitive premises. The assigned levels apply at premises receiving the noise (noise sensitive receiver) and not to areas within the project site or lot. In addition, the Environmental Protection (Noise) Regulations 1997 identify the following in Schedule 3, clause 2A.

"If the land within either of the circles is categorised on the land use map as land in respect of which mixed uses are permitted, the use of that land that results in the highest influencing factor is to be used in the determination of the influencing factor."

The nearest noise sensitive receivers have been considered as the residential properties surrounding the area, with the closest measurable noise sensitive receivers being located at 19 Samson St, Mosman Park.

The current Local Planning Scheme 3 (LPS3) was accessed via the Town of Mosman Park online mapping system.

Traffic data for roads surrounding the nearest noise sensitive receiver were obtained from Main Roads Western Australia (MRWA) on the 2nd September 2020. The available traffic data has been presented in Table 1.

Table 1: Traffic count data (MRWA)

Transport Corridors	EPNR Classification [1)]	Average Daily Traffic Volumes					
		2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Wellington St (East of Stirling Hwy)	Secondary Road	-	-	-	7677	7718	-

1) As defined by the EPNR. Secondary roads have between 6000-15000 vehicles per day. Major roads have greater than 15000 vehicles per day.

2.1.1 Influencing Factor for 19 Samson St

The influencing factor for 19 Samson St results from identifying major roads, commercial and industrial areas for all nearest noise sensitive receivers is 0 dB, as summarised in Table 2.

Table 2: Influencing factor (IF) noise sensitive 19 Samson St

Noise Sensitive Premises	Commercial Zones	Industrial Zones	Transport Corridors	Influencing Factor
19 Samson St	8 % within a 100 m radius	0 % within a 450 m radius	No major traffic corridors within 450m radius	0 dB

Source: Town of Mosman Park online mapping system

Figure 2: Zoning map of areas surrounding 19 Samson St

2.1.2 Assigned Noise Levels for Nearest Sensitive Receiver

Table 3 summarizes the assigned levels at the nearest noise sensitive premises. It is required that all noise emissions from the development are below the assigned level for all defined periods of the day and at the lot boundary of the receiver or 15m from any associated building. It is noted that the EPNR assigned levels only apply at the premises receiving the noise only and not to noise within the site.

Table 3: Assigned levels for 19 Samson St

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: Highly sensitive area	0700 to 1900 hours Monday to Saturday	45	55	65
	0900 to 1900 hours Sunday & public holidays	40	50	65
	1900 to 2200 hours all days	40	50	55
	2200 hours on any day to 0700 hours Monday to Saturday, and 0900 hours Sunday & public holidays	35	45	55
Noise sensitive premises: any area other than highly sensitive areas	All Hours	60	75	80
Commercial premises	All Hours	60	75	80
Industrial and utility premises	All Hours	65	80	90

2.1.3 Noise Character Adjustments

Regulation 7 states that the noise character must be “free” of annoying characteristics, namely —

- Tonality, e.g. whining, droning;
- Modulation, e.g. like a siren; and
- Impulsiveness, e.g. banging, thumping.

Regulation 9 (1) establishes the methodology for determining noise characteristics. If these characteristics cannot be reasonably and practicably removed, a series of adjustments to the measured levels are required, indicated in Table 4.

Table 4: Noise character adjustment

Adjustment where noise emission is not music these adjustments are cumulative to a maximum of 15 dB			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

2.1.4 Noise Emissions mechanical services

Typically, projects of this type involve noise emissions from mechanical services such as air conditioning units and condensers and exhaust fans.

It is important that noise emissions from the site do not present any form of tonality, modulation or impulsiveness (as defined by the EPNR).

Given that data from mechanical plant manufacturers is generally limited to broadband data or in 1/1 octave band value, it is not possible to objectively determine tonality, as it is described in the EPNR. 1/3 octave band data is required yet is typically unavailable.

Therefore, a +5 dB correction shall be conservatively assigned when assessing noise emissions from mechanical equipment. In summary, Noise emissions from mechanical equipment shall comply with L_{A10} 35 dB at the nearest noise sensitive receiver (19 Samson St).

2.2 Internal Noise Levels

2.2.1 Australian Standard AS2107:2016

The internal noise level criteria detailed in this section are based on the recommendations provided in the Australian / New Zealand Standard AS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (AS 2107:2016).

AS2107 provides recommended internal noise levels (defined as the equivalent continuous A-weighted sound pressure level — $L_{Aeq,t}$) for optimising the acoustic amenity in occupied spaces. The level of noise in an enclosed space typically consists of noise from building services and/or noise intrusion due to external sources (e.g. traffic).

The relevant internal noise level criteria have been outlined in Table 5 below.

Table 5: Recommended internal noise levels from AS2107

Type of occupancy/activity	Recommended design sound level, Leq dB(A)
Residential Buildings – Houses and apartments in suburban areas or near minor roads –	
Sleeping areas (night-time)	30 – 35
Living areas	30 – 40
Common areas (foyer, lift lobby)	45 – 50
General Areas	
Enclosed Carpark	< 65
General Retail Tenancies	45 – 50
Specialty shops	40 – 45
Supermarket	50 – 55
Enclosed Carpark	< 65

The internal noise level criteria in AS2107 recommend continuous equivalent (L_{Aeq}) levels for background noise. This document is a common reference for establishing satisfactory goals for quasi-static mechanical and external traffic noise ingress.

AS2107 provides recommended reverberation times for optimising the acoustic amenity in occupied spaces. The relevant reverberation times have been outlined in Table 6.

Table 6: Recommended reverberation times from AS2107

Type of occupancy/activity	Recommended reverberation time (T), s
RESIDENTIAL BUILDINGS - Houses and apartments in inner city areas or entertainment districts or near major roads —	
Sleeping areas (night-time)	-

Type of occupancy/activity	Recommended reverberation time (T), s
Living areas	-
Work (study) areas	-
Apartment common areas (e.g. foyer, lift lobby)	See Note 1
General Areas	
Enclosed Carpark	–
General Retail Tenancies	See Note 1
Specialty shops	See Note 1
Supermarket	See Note 1

1) Reverberation time should be minimised as far as practicable for noise control.

2.3 Sound Transmissions and Insulation — National Construction Code 2019

The acoustic requirements for inter-tenancy walls, floors etc. in residential buildings are outlined in the National Construction Code 2019 Volume 1, Building Code of Australia Class 2, 3 and 9c Buildings (NCC 2019). The acoustic requirements outlined in NCC 2019 are summarised in Table 7.

Table 7: Sound insulation requirements in accordance with NCC 2019

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements
Walls	**Airborne Sound Insulation**		
	Between sole-occupancy units	Minimum $R_w + C_{tr}$ 50	Minimum $D_{nT,w} + C_{tr}$ 45
	Between a sole-occupancy unit and a plant room, lift shaft, stairway corridor, public corridor or the like	Minimum R_w 50	Minimum $D_{nT,w}$ 45
	Impact Sound Insulation		
	Between a laundry, kitchen, bathroom or sanitary compartment in a sole-occupancy unit, and a habitable room in an adjoining unit	Discontinuous construction [1)]	As deemed to satisfy
	Between a sole-occupancy unit and a plant room or lift shaft	Discontinuous construction [1)]	As deemed to satisfy
Floors	**Airborne Sound Insulation**		
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Minimum $R_w + C_{tr}$ 50	Minimum $D_{nT,w} + C_{tr}$ 45
	Impact Sound Insulation		
	Between sole-occupancy units and between sole occupancy unit and lift shaft, stairway or public corridor	Maximum $L_{n,w}$ 62	Maximum $L_{nT,w}$ 62
Services	**Airborne Sound Insulation**		

Construction	Condition	Deemed-to-Satisfy Requirements	Verification Requirements
	Between a habitable room (other than a kitchen) in a sole-occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole-occupancy unit)	Minimum $R_w + C_{tr}$ 40	N/A
	Between a kitchen or non-habitable room in a sole-occupancy unit and a duct, soil, waste or water supply pipe duct (if the duct or pipe is located in a wall or floor cavity and serves or passes through more than one sole-occupancy unit	Minimum $R_w + C_{tr}$ 25	N/A
	If a storm water pipe passes through a sole-occupancy unit (habitable room other than kitchen)	Minimum $R_w + C_{tr}$ 40	N/A
	If a storm water pipe passes through a sole-occupancy unit (kitchen or non-habitable room)	Minimum $R_w + C_{tr}$ 25	N/A

1) *For the purposes of this Part, "discontinuous construction" means a wall having a minimum 20 mm cavity between two separate leaves.*

3. Noise Survey

3.1 Overview

Typically, the two main sources of noise considered in noise intrusion assessments are transportation (i.e. road, rail or aircraft noise) and mechanical services noise from within the same or adjoining developments.

Attended measurements were conducted at the project site to ascertain the typical noise levels at the proposed development. This section provides discussion of the measurement methodology and summary of measured noise levels which were used to calibrate the noise model for the project.

3.2 Measurement Methodology

3.2.1 Equipment Details

Attended measurements have been conducted using instrumentation equivalent to an integrating sound level meter equipped with one octave and one-third octave band filters, and an omni-directional condenser microphone. All instrumentation meets Type 1 specifications as per ANSI S1.4 and ANSI S1.43.

All sound level meters were calibrated by an authorised NATA (National Association of Testing Authorities) laboratory less than 2 years ago and have successfully passed all AS 1259 and AS/NZS 4476 standards and specifications.

The time constant for the RMS detector were set to a slow response (1 sec) for all measurements on all sound level meters. The sound level meters were calibrated before and after each measurement session using a Type 1 acoustic calibrator. The calibrator was also calibrated less than 2 years ago and is in compliance with AS IEC 60942-2004.

A complete schedule of all equipment used during for acoustic measurements is provided in Table 8. A copy of calibration certificates for the relevant instrumentation may be provided upon request.

Table 8: Equipment and calibration details

Manufacturer / Model	Serial Number
Brüel & Kjær 2250 - Sound Analyser	3002096
Brüel & Kjær 4189 - Microphone	2888182
Brüel & Kjær ZC 0032 - Preamplifier	17886
Brüel & Kjær 4231 - Calibrator	3005155

3.3 Measurement Location

Short-term attended noise measurements were conducted to determine the general noise impacts from traffic utilising Wellington St, adjacent to the project development.

The location of the noise measurements is indicated in Figure 3.

Source: NearMap

Figure 3: Noise measurement location (attended)

3.4 Noise Measurement Summary

3.4.1 Attended Monitoring

A summary of the noise data for the attended noise measurements has been provided in Table 9.

Table 9: Attended noise measurement results

Ref	Location	Date and Time	$L_{eq, 5min}$ dB(A)	Spectrum Noise Levels (dB)							
				63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
A1	Turnbull Way (near loading area)	15/09/2020 11:35am	**58**	60	57	57	55	53	52	46	39
A2	Corner of Wellington St and Manning St	15/09/2020 11:43am	**63**	71	63	60	58	59	55	51	45
A3	Corner of Samson St and Manning St	15/09/2020 11:59am	**57**	61	56	52	52	55	49	42	35

Note that the following was observed while conducting the measurements on-site:

- A1: loading vehicles was parking and running approximately 15-20m away throughout the majority of the measurement period. General ambient noises from nature observed.
- A2/A3: major noise sources were cars passing by and entering the shopping area, pedestrians walking and talking nearby typical ambient nature noises (trees rustling, wind)

4. External Envelope

Noise intrusion calculations were undertaken based on the on-site measurements taken. Calculations follow the methodology described in British Standard BS EN 12354:2000 and by utilizing the worst case (i.e. highest predicted) noise levels at each façade to determine suitable glazing to achieve the required internal noise levels. Appropriate corrections were applied to the linear spectral noise levels to compensate for potential losses due to flanking paths and façade correction.

4.1.1 External Wall

The noise intrusion has been calculated for all façade elements, which is relative to their surface area.

Stantec recommends solid wall elements have a minimum performance of $R_w + C_{tr}$ 40 - 45. The proposed construction is typical in achieving the required performance:

- 110mm Concrete Panel; OR
- 150 or 162 AFS wall system

Alternative construction material may be used to achieve the required performance. This will, however, require review and approval of the Acoustic Engineer.

Where lightweight construction is proposed, this will result in reduced acoustic performance specifically in the lower frequencies. As a result, this may have some impact on the recommended glazing types. The following constructions are recommended if lightweight walls are to be used (Table 10), to ensure compliance with the recommended internal noise levels for residential units.

Table 10: Lightweight External Wall Configurations

Airborne Sound Insulation Performance (R_w)	Configuration
40 - 45	One row of 92mm studs at 600mm centres with – • Min. 100mm thick glasswool insulation (min. density 14kg/m^3) positioned between row of studs; • One-layer 9mm fibre cement sheet to outside face; and • One layers 13mm thick fire rated plasterboard fixed to the other side of the row of studs

4.1.2 Glazing

Glazing systems and entryway elements typically provide lower airborne sound insulation performance than external walls, forming weak acoustic links in the building envelope.

To satisfy internal noise level design targets, glazed elements located at the façades are determined based on the composite sound reduction index (i.e. the combined sound insulation performance of all façade elements relative to their surface area).

Glazing types for each noise sensitive space located at each façade of the proposed development have been comparatively assessed against the noise levels detailed in this report. The table below provides the glazing performance and proposed locations required to satisfy internal noise level design targets.

The performance ratings outlined in

Table 11 are required for compliance to internal noise level design targets and apply to the glazing system as a whole (i.e. frame, seals and window hardware), with a maximum allowable deviation of 2-3dB only.

Table 11: Glazing configuration

Façade Location	Glazing Configuration	Rw + Ctr	Spectrum Sound Transmission Loss (dB)						
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Bedroom façade facing Turnbull Way Level 1 and 2*	6mm glass + 12mm air gap + 6.38mm glass	**32 (38; -5)**	22	24	24	35	43	44	49
All other bedrooms and living rooms	6mm glass + 12mm air gap + 6mm glass	**29 (36; -7)**	22	23	19	35	43	42	50

Note: Glazing performance provided for glass only. Overall performance of the glazing system including the frames and seals shall not degrade by more than 3 dB as per the performance requirement stated.

*Due to the proximity to ground floor tenancies and transport corridors that are expected to utilized by service trucks, bedrooms on the stated floors will require upgraded glazing to achieve design internal noise levels.

4.2 Roof Construction

Roof construction should be adequately designed to control external noise intrusion from noise sources identified in this report to satisfactorily provide internal noise levels which are compliant with the criteria established in Section 2.2.1.

The following roof configuration is expected to achieve the above objectives:

One layer of Colorbond sheet metal or similar (0.42 mm); and

- 75 mm thick high-density Anticon insulation hard-fixed to the underside of roof and over steel purlins;
- Min. 50 mm thick glasswool insulation (min. 11kg/m^3) one layer of 13 mm standard plasterboard.

5. Noise Emission Assessment

Mechanical services will be expected to comply with the respective EPNR criteria at the nearest noise sensitive receivers for all periods of the day.

Based on the latest architectural drawings, the development is expected to contain the following mechanical services:

- Refrigerant condensers serving ground floor tenancies
- Roof Condenser units serving Tower A, B and C
- Fire Pump Room

Noise emissions from mechanical equipment shall comply with L_{A10} 35 dB at the nearest noise sensitive receivers surrounding the project site. These include the following developments:

- 39 Manning St
- 132 Manning St
- 50 Samson St
- 116 – 129 Wellington St
- 19 Samson St
- 23 Samson St

Noise modelling software (SoundPlan v8.2) was used to calculate the predicted noise levels generated at the closest receivers. Treatments have been recommended in the following sections where necessary to achieve compliance to EPNR.

5.1 Condenser units

5.1.1 Roof Plant

The architectural drawings indicate two roof plant locations which are expected to contain condensing units serving the residential and ground floor retail tenancies. The locations have been illustrated in Figure 4.

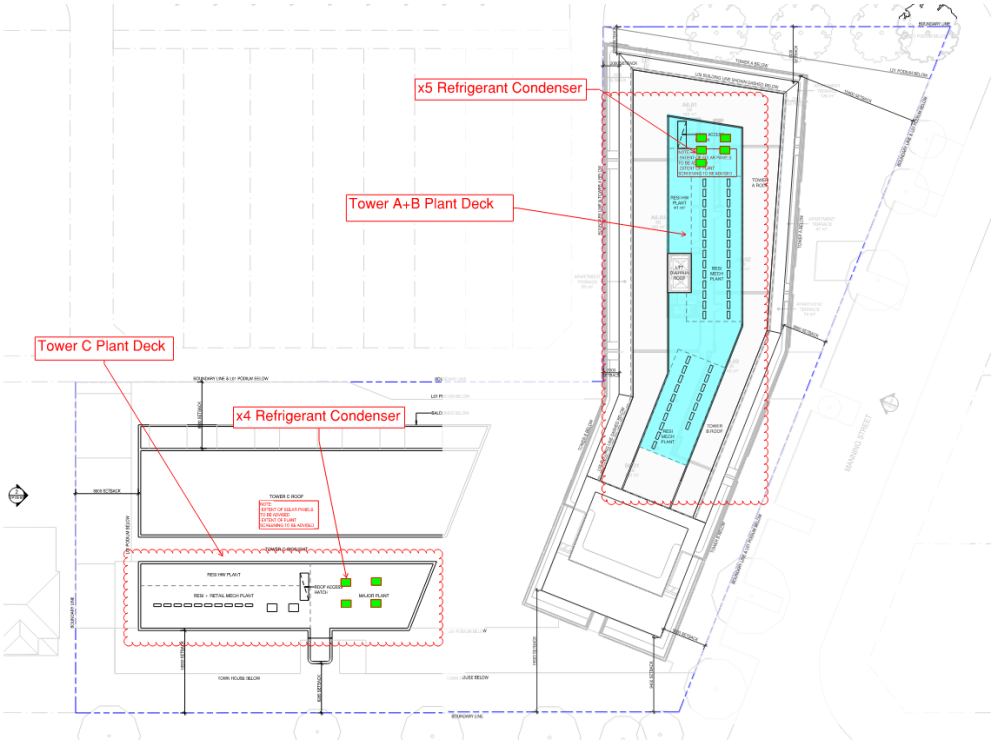

Figure 4: Roof plant layout

Note that Figure 4 has assumed the nine refrigerant condensers will be located within this plant area.

Level 1-5 Residential Tenancies

Preliminary condenser unit selection serving residential tenancies has been provided to Stantec and are compliant to the relevant EPNR criteria at the closest noise sensitive receivers.

The sound data for each unit has been provided by the mechanical engineer with unit schedule summarized in Appendix B. A +5 dB penalty is to be conservatively been applied to account for the likely presence of sound tonality.

Ground Floor Retail Tenancies

At this stage no information has been provided regarding refrigerant condenser selection. Based on the advice of the mechanical engineer and Stantec's experience on projects of similar size and capacity, the following assumed information has been used to determine anticipated treatments required for the refrigerant condenser units serving the ground floor retail tenancies.

These assumptions are as follows:

- A maximum of Nine refrigerant condenser units are expected
- These units may run during night-time periods (2200 – 0700)
- Each unit has a maximum sound power level of 84 dB(A)
- A +10 dB penalty is to be conservatively been applied to account for the likely presence of sound tonality and modulation.

The predicted noise levels at the closest receivers has been shown below in Table 12.

Table 12: Predicted Noise level of refrigerant condensers – Without Treatments

Scenario / Description	Highest Predicted Level, dB(A)	Receiver	Relevant EPNR Criteria [1]	Exceeds EPNR
Night (2200 – 0700) All Refrigerant condensers operating at respective full load	48	116 – 129 Wellington St (Residential)*	L_{A10} 35 dB	Yes
	44	132 Manning St		Yes
	48	50 Samson St		Yes
	44	39 Manning St		Yes
	42	19 Samson St		Yes
	42	23 Samson St		Yes

*the properties along 116 – 129 Wellington St are currently commercial developments. They have been assessed as noise sensitive developments in the event they are redeveloped into mixed-use or residential dwellings as allowed by the Town of Mosman Park.

Exceedance to the relevant EPNR criteria by 13-15 dB at the closest noise sensitive receivers is predicted.

Based on the noise emission assessment conducted, the following treatments will be required to be implemented:

- A noise barrier extending 1m above the top height of the highest unit (Figure 5)
- Limit the Sound Power Level of each refrigerant condenser unit to a maximum of 70 dB(A)

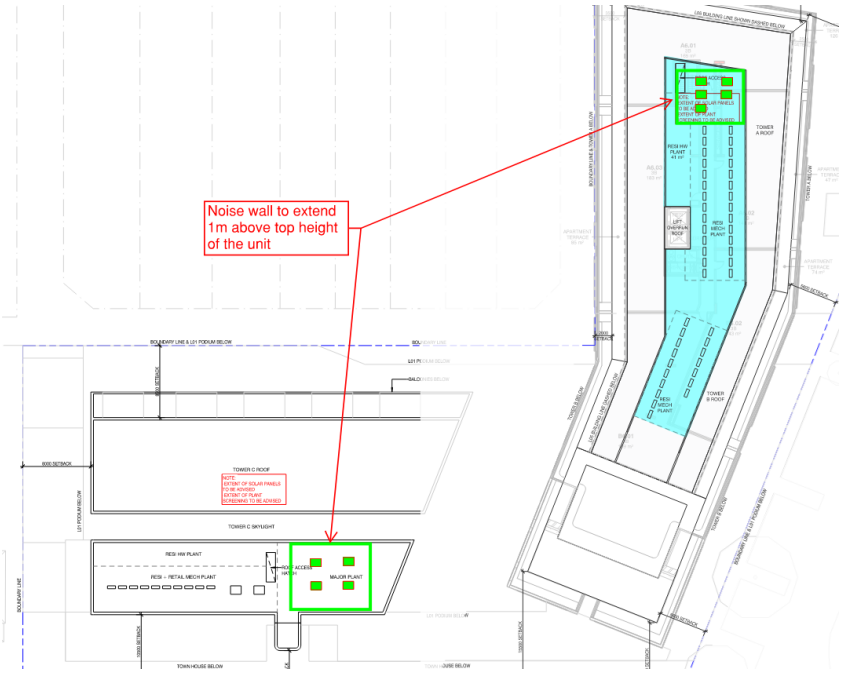

Figure 5: Noise barrier locations

Noise Wall

Noise walls to be effective are required to be without air gaps or features that would allow sound to be transmitted through the material with the wall to extend to the top height of the tallest unit. The wall should be positioned no more than 1m away from the units. Typical barrier shall be constructed using materials having a surface density of 15kg/m^2. Example materials include 12mm thick fibre cement sheet or Perspex.

Additionally, the internal side facing the units is to be lined with absorptive material in order to mitigate noise reflection generated from the enclosure and reduce noise build up.

Example product: 50mm Megasorber or similar and approved.

Table 13 summarises the predicted noise levels at closest noise sensitive receivers with the mentioned acoustic treatments.

Table 13: Predicted Noise level of refrigerant condensers – With Treatments

Scenario / Description	Highest Predicted Level, dB(A)	Receiver	Relevant EPNR Criteria [1]	Exceeds EPNR
Night (2200 – 0700) All Refrigerant condensers operating at respective full load	35	116 – 129 Wellington St (Residential)*	L_{A10} 35 dB	No
	33	132 Manning St		No
	35	50 Samson St		No
	33	39 Manning St		No
	30	19 Samson St		No
	32	23 Samson St		No

*the properties along 116 – 129 Wellington St are currently commercial developments. They have been assessed as noise sensitive developments in the event they are redeveloped into mixed-use or residential dwellings as allowed by the Town of Mosman Park.

5.1.2 Ground Floor Mezzanine units

The latest mechanical drawings indicate condensing units are expected on the ground floor inside the various retail tenancies. They have been assumed to be located at a similar location on the latest architectural layouts as per the information provided by the mechanical engineer. This has been shown below in Figure 6.

Figure 6: Ground Floor retail condenser units

Preliminary sound data has been provided by the mechanical engineer and is summarized in Appendix B. It is assumed that these units will only run during Day/Evening periods (0700 – 2200).

Existing Scenario

The highest predicted noise levels at both nearby commercial and noise sensitive developments has been summarized in Table 14 below.

Table 14: Predicted Noise level of ground floor condensers

Shortest distance to Receiver (m)	Highest Predicted Level, dB(A)	Receiver	Relevant EPNR Criteria [1]	Exceeds EPNR
~ 7	50	116 – 129 Wellington St (Commercial)	L_{A10} 60 dB	No
~21-25	40	Closest surround noise sensitive developments	L_{A10} 40 dB	No

Future Scenario

In the event that developments along 116 – 129 Wellington St are redevelopment into mixed-used or residential buildings, the nominated condensing units are expected to exceed EPNR criteria by 10 dB(A) at the closest noise sensitive receiver.

In this case, all condensing units facing Turnbull way will be required to implement acoustic louvres to attenuation the noise impact.

Example product: Fantech SLB1 or similar approved.

The units locations are shown in Figure 7.

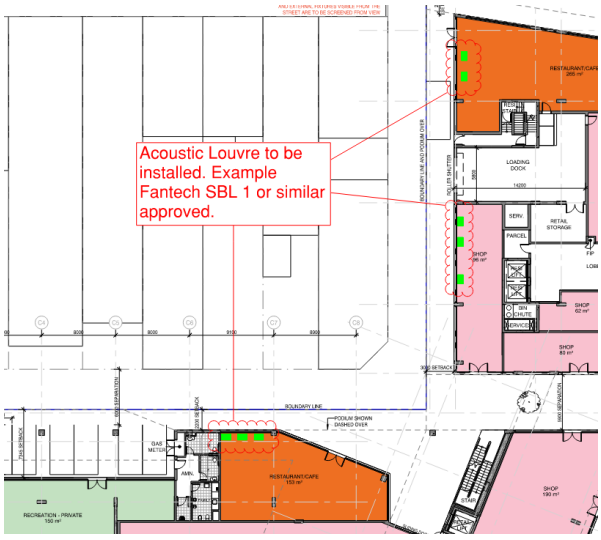

Figure 7: Acoustic louvre locations

Note that no internal elevations have been provided at the time of assessment. Treatments to be reviewed once these details become available and are provided to Stantec.

6. Loading Area Noise Impact

As discussed with the client, Turnbull Way is classified as a Gazetted road as per the Town of Mosman Park Local Planning Scheme 3 (LPS3). The location of the traffic corridor is shown in Section 1 Figure 1.

Therefore, a noise emission assessment from service vehicles operating through this road is not required for the proposed development.

As per the latest architectural layouts, it is expected that servicing and waster collection truck activities will be undertaken within the fully enclosed basement car park which will minimise noise emitted to neighbouring developments from these activities.

Stantec notes the importance of maintaining appropriate acoustic amenity within the area and reducing noise emissions from traffic corridors that are anticipated to be used for deliveries and servicing the project development.

6.1 Acoustic Treatment

Typically, cars driving on a road generate noise due the following reasons;

- Tyre noise
- Engine / exhaust noise

It is generally expected cars travelling at lower speeds along Turnbull Way would have mostly engine noise in comparison to road /tyre noise.

The following strategies have been recommended to reduce the impact of traffic noise to the surrounding residents:

- Using dense graded asphalt which is considered quieter road surface in comparison to open graded asphalt or chip seal surfaces.
- There are no speed bumps or drainage openings along the drive-way as it creates impulsive noises
- The screening with the existing fence will be enhanced by provision to acoustic materials that would reduce the noise through the color bond fence and also control the reflection of noise along the Turnbull way. Treatments would be applied to the East side of the fence along Turnbull Way (Figure 8)

Figure 8: Acoustic panel location

Example acoustic material types include the following:

- Perforated screen with absorptive backing
- Integrating the proposed architectural design with absorptive panels that are suitable for outdoor areas – Example Quiet stone Panels

7. Conclusion

A traffic noise assessment has been carried out based on on-site measurements conducted by Stantec. preliminary treatments have been recommended including external façade construction including wall, glazing and roof configuration in order to achieve the recommended AS2107 internal noise levels.

Preliminary condenser unit selection serving residential tenancies has been provided to Stantec and are compliant to the relevant EPNR criteria at the closest noise sensitive receivers.

At this stage no information has been provided regarding refrigerant condenser selection. Based on the advice of the mechanical engineer and Stantec's experience on projects of similar size and capacity, assumed sound levels have been used to determine anticipated treatments required for the refrigerant condenser units serving the ground floor retail tenancies.

Based on the noise emission assessment conducted, the following treatments will be required to be implemented:

- A maximum of Nine refrigerant condenser units may be implemented at the locations specified in this report
- A noise barrier extending 1m above the top height of the highest unit
- Limit the Sound Power Level of each unit to a maximum of 70 dB(A)

Once a complete schedule of mechanical equipment information has been provided a detailed noise assessment will be conducted to ascertain the specific acoustic treatments required to achieve compliance to EPNR criteria.

Appendix A Glossary of Acoustic Terms

NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
Ambient Noise:	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment Period:	The period in a day over which assessments are made.
Assessment Location	The position at which noise measurements are undertaken or estimated.
Background Noise:	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	Noise having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent Noise:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound Absorption:	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter:	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level:	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level:	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise:	Containing a prominent frequency and characterised by a definite pitch.

Appendix B Mechanical Equipment Schedule

Supplier	Model	Spectrum Sound Transmission Loss (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 KHz
Daikin	RXYMQ4AV4A	67	64	64	58	59	54	51	45
Daikin	Q14TY1	75	75	72	70	64	58	54	47
Daikin	RXYMQ6AV4A	74	61	61	63	63	56	53	42

Design with
community in mind

Ground Floor
226 Adelaide Terrace
Perth WA 6000
Tel +61 8 6222 7000

For more information please visit
www.stantec.com

Stantec