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2 FIGTREE DRIVE, SYDNEY OLYMPIC PARK

S4.55 Assessment of Building 3 Communal Area

19 December 2018

Mirvac

TH297-07-01F02 Acoustic Assessment of Building 3 communal area (r0)

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1 Introduction

Renzo Tonin & Associates was engaged to review the acoustics aspects relating to the construction and operation of a communal area proposed for Building 3 of the development at 2 Figtree Drive, Sydney Olympic Park along with the inclusion of a Leasing office in Building 5.

This report is intended to be submitted as part of the S4.55 application. The purpose of this assessment is to outline the acoustic parameters, design aspects and criteria relevant to the development in regard to operational noise impact onto noise sensitive uses, as well as noise impact upon the proposed residential component of the development.

As an overview, the following objectives for the development have been identified:

- To provide acceptable acoustic amenity for the residential apartments, considering both internal and external (on balconies) areas
- To not unduly restrict the operations of the communal area, either through onerous operating hours or capacity restrictions, etc.

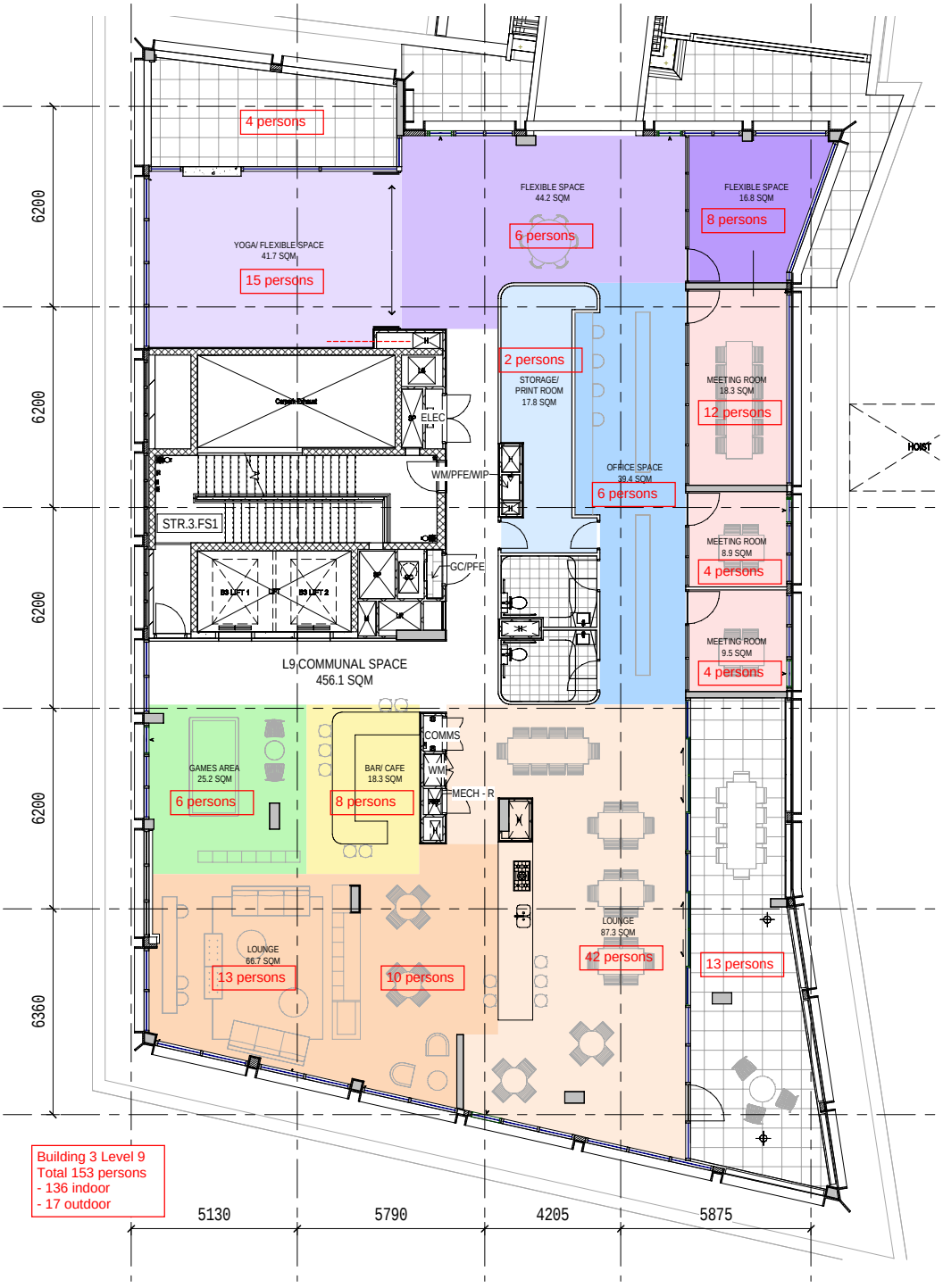
The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. APPENDIX A contains a glossary of acoustic terms used in this report.

2 Description of site and proposal

The following section presents a description of the subject site and the proposed development.

2.1 Proposed Building 3, Level 9 Communal Area

A communal area is proposed for Level 9 of Building 3 within the development at 2 Figtree Drive Sydney Olympic Park.



The following areas are proposed:

- 3 flexible spaces (yoga and the like)
- An office space and three meeting rooms
- Two large lounge areas
- A bar/ café
- Games area
- An outdoor terrace

It is proposed that the space has the potential to operate 24 hours a day using a booking system with managers/security on-site at all times (those managers/security may not be located within the Community Centre, but within the building overall).

The communal area is to have a maximum capacity of 153 over all spaces identified above however, it is unlikely that all spaces will be fully occupied at any one time.

Whist a bar/ café has been included in the design submission, the space is not a licensed premise and a liquor license will not be applied for. Therefore, an assessment in accordance with the NSW Office of Liquor and Gaming is not required.

2.2 Building 5 Leasing Office

A leasing office is proposed for Ground Floor of Building 5. It is expected to operate 9am-5pm Monday to Saturday.

The leasing office is not expected to be noise producing and will not required additional acoustic treatment. All separating partitions are to comply with the minimum requirements of the Building Code of Australia Part F5. Further assessment is not required.

2.3 Acoustic aspects

Based on the proposed design, the following aspects are deemed to require acoustic assessment:

- Patrons within designated internal spaces, in particular the flexible spaces, the office/ meeting areas and the lounge/ bar/ café/ gaming area.
- Patrons within the designated external areas including the two proposed outdoor terrace areas.

2.4 Acoustic assessment methodology

In order to assess the potential noise impacts from subject proposal, the following methodology was used:

- Identify nearest most potentially affected receiver locations to the subject site
- Determine noise targets at the nearest most potentially affected receiver locations
- Using predictive noise modelling, determine the extent of noise impact from the proposal at the nearest most potentially affected receivers
- Identify if noise emission from the area under investigation may exceed the relevant criteria, and
- Where noise emission from the area under investigation may exceed the relevant criteria, provide recommendations to reduce noise impacts from the site.

2.5 Existing ambient noise levels

Existing ambient noise levels have previously been established at the Development Application phase of the project through long-term monitoring.

These results were published in the acoustic report for DA prepared by Renzo Tonin & Associates [Ref: TH297-01F02 Acoustic Assessment for DA (r0), dated 23/07/2015] and are presented below:

Table 1: Measured Ambient Nosie Levels

Location	Period	Measured Ambient Noise Level
		LA90
2 Figtree Drive, Sydney Olympic Park	Day 7am – 6pm	56
	Evening 6pm – 10pm	54
	Night 10pm – 7am	50

3 Operational noise criteria

The following section presents a discussion regarding operational noise criteria.

3.1 Policies and guidelines

3.1.1 General operational criteria

In the absence of specific noise criteria stipulated by the consent authority, reference is made to the NSW *Noise Guide for Local Government* ('NGLG'). According to the NGLG, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level ('RBL') plus 5dB(A)

The allowable $L_{Aeq\ 15minute}$ noise emission from a site is therefore dependant on the background noise level in an area without the subject development in operation. The background noise levels at times during which the development is to operate therefore need to be quantified.

Table 2: External noise criteria from use of communal area

Assessment Location	Determined criteria		
	Day time	Evening	Night
Apartment facade	61 dB(A)	59 dB(A)	40 dB(A)*
Notes: Day, Evening and Night assessment periods are defined as follows. 1. Day is defined as 7am to 6pm 2. Evening is defined as 6pm - 10pm 3. Night is defined as 10pm to 7am Night time criteria has been established as inaudible internally which equates to Background - 10dB at the facade			

3.1.2 Internal Noise Goals

Internal noise levels as a result of the use of the space are dependent on whether noise levels are assessed with windows opened or closed. For apartments directly below the proposed communal space, noise may enter the apartment via the facade or through the building elements (slab and ceiling).

For the assessment of apartments surrounding the communal area the following acoustic criteria is proposed via the facade and via the building elements.

When windows are opened, the background noise level within the apartment is dependent on the background noise level outside. A loss of 10dB can be assumed through an opened window, therefore the internal background noise level is assumed to be:

Internal Background Noise Level (LA90) = External Background Noise Level (LA90) – 10dB

Therefore the internal criteria would be assessed as External Background Noise Level (LA90) – 10dB + 5dB.

Given that the communal area has the potential to be used 24 hours a day it is recommended that noise associated with the use of the communal spaces not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00am.

For the assessment of inaudibility, Renzo Tonin & Associates adopts a design criterion of 10dB below the background noise level in each octave band for intermittent noise sources such as patrons and music. For steady state sources such as mechanical plant, a design criterion of 5dB below the background level in each octave band is adopted.

When windows are closed, the internal background noise level is dependent on internal noise sources such as air conditioning, appliances, apartment orientation to noise sources and the like.

In order to determine suitable internal noise criteria is sought from Australian/New Zealand Standard AS/NZS 2107:2016 "Acoustics - Recommended design sound levels and reverberation times for building interiors", which recommends design criteria for conditions affecting the acoustic environment within building interiors to ensure a healthy, comfortable and productive environment for the occupants and the users.

The lower level range of the design sound level range should be used to establish internal background noise levels with windows closed.

The following table presents the recommended internal noise criteria for noise associated with the use of the Communal Area.

Table 3: Proposed internal noise criteria from use of communal area

Assessment Location	Condition	Proposed criteria		
		Day time	Evening	Night
Apartment Internally (habitable spaces)	Windows opened	51 dB(A)	49 dB(A)	30 dB(A)
	Windows closed	35 dB(A)	35 dB(A)	Inaudible (<25dB(A))

3.1.3 Offensive Noise

The use of the Communal space should not give rise to offensive noise. The *NSW Protection of the Environment Operations Act 1997* ('POEO Act') defines offensive noise as:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

Section 2.1.4 of the NGLG presents a checklist for council officers to guide them into making a judgement about whether a particular noise is offensive. It states:

… In other cases it will be necessary to consider a range of factors to determine whether the noise is offensive, including the following:

- *the loudness of the noise, especially compared with other noise in the area*
- *the character of the noise*
- *the time and duration of the noise*
- *whether the noise is typical for the area*
- *how often the noise occurs*
- *the number of people affected by the noise.*

4 Operational noise assessment

The following section provides an indicative assessment of expectant noise levels resulting from the operation of the communal areas and communal outdoor areas on Level 9 of the development. It should be noted that the current study takes into consideration noise generated by patrons only and not other noise generated by the operation of the F&B tenancies such as waste management, deliveries, mechanical services and refrigeration system plant and equipment, etc.

4.1 Noise sources

4.1.1 Level 9 Communal Area

The individual areas within the Level 9 communal area have been identified in Section 2.1. The acoustic assessment has been based on a worst-case scenario where all the areas are operating concurrently at capacity. A day time and night time assessment has been undertaken. Table 4 presents the source noise levels adopted for the assessment which have been determined from measurements previously conducted by Renzo Tonin & Associates.

Table 4: Source noise levels - L_1, L_{10}, L_{eq}

Noise source	Overall dB(A)	Octave band centre frequency – Hz (dBZ) (for highest level)								
		31.5	63	125	250	500	1k	2k	4k	8k
Loud voice, male (Lw per person, L1)1	88	-	-	69	78	85	84	79	73	64
External restaurant seating (LW per person, L10)1	71	-	-	-	62	66	66	64	59	50
Casual voice, male (LW per person, Leq)1	66	-	-	57	58	60	59	55	51	46

Note: 1. In the cases where patron grouping is expected to be small (ie. two or four patrons per group), only half of the group is expected to talk at any one time.

4.1.2 Mechanical plant and equipment

Mechanical plant associated with the communal areas located on the roof has been assessed as part of the detailed design for the base building and recommendations made in the site-specific Acoustic Specification. Any additional plant and equipment located externally is to be assessed prior to installation.

4.2 Assessment locations

The nearest locations most potentially affected by the noise sources outlined in Table 4 have been identified in Table 5 below. The nearest most affected locations are directly below the proposed communal area. Assessments have also been undertaken to apartments on Level 10 of Building 2 and Building 5 opposite the communal area.

Table 5: Assessment locations

ID	Location	Description
A1	Building 3, Level 8	Balcony, external assessment
A2	Building 3, Level 8	Internal assessments windows opened and closed
A3	Building 5 Level 10	Bedroom window, level 2 residence located directly above café seating area.
A4	Building 2, Level 10	Bedroom window, level 2 residence located directly above café seating area.

Figure 2 - Site Layout

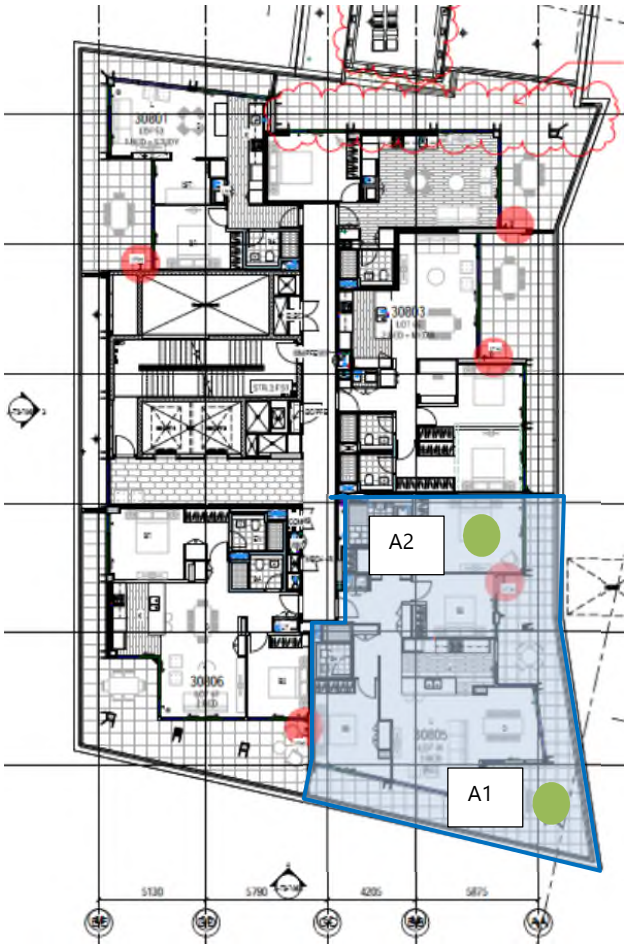


Figure 3 - Building 3, Level 8 Assessment location

Figure 4 - Building 5, Level 10 Assessment location

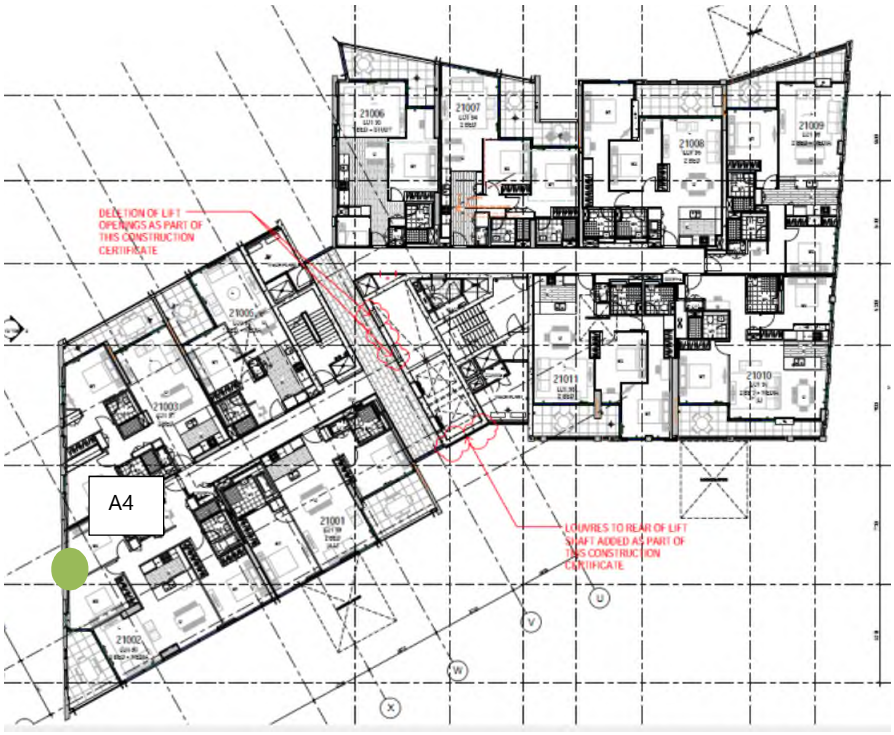


Figure 5 - Building 2, Level 10 Assessment location

4.3 Noise predictions and discussion

Noise modelling has been undertaken to determine the external noise levels received at the assessment locations presented in Table 5 above.

4.3.1 Flexible Spaces (facing Building 5)

The calculated noise levels have assumed that all flexible spaces are operating concurrently to capacity with people actively talking in each space (one person talking and one person listening). It has been assumed that windows to the flexible spaces are closed and air conditioned for the purpose of assessment.

Table 6: Cumulative predicted noise level assessment, L_{A1}

Receiver ID	Time	Predicted noise level, L_{A1} 15 min	Noise goal, L_{A1} 15 min
A3	Day time (7am - 6pm)	30	61
	Evening (6pm - 10pm)	30	59
	Night (10pm - 7am)	30	40

Notes: 1. Noise goals and noise levels presented are external noise levels.

4.3.2 Lounge/ Bar/ Café/ Gaming Area (excluding terrace)

The calculated noise levels have assumed that the large lounge/ café/ bar/ gaming area is operating to capacity with people actively talking in each space (one person talking and one person listening). It has been assumed that windows are closed and air conditioned for the purpose of assessment.

Table 7: Cumulative predicted noise level assessment, L_{Aeq}

Receiver ID	Time	Predicted noise level, $L_{Aeq,1hour}$	Noise goal, $L_{Aeq,1hour}$
A1	Day time (7am - 6pm)	38	61 (external)
	Evening (6pm - 10pm)	38	59 (external)
	Night (10pm - 7am)	38	40 (external)
A2 (windows closed)	Day time (7am - 6pm)	31	35 (internal)
	Evening (6pm - 10pm)	31	35 (internal)
	Night (10pm - 7am)	31	25 (internal)
A4	Day time (7am - 6pm)	21	61 (external)
	Evening (6pm - 10pm)	21	59 (external)
	Night (10pm - 7am)	21	40 (external)

Internal noise levels cannot be achieved during the night time period, regardless as to whether windows to the lounge/ café/ bar/ gaming area are opened or closed.

4.3.3 Lounge/ Bar/ Café/ Gaming Area terrace doors opened (including terrace)

The calculated noise levels have assumed that the large lounge/ café/ bar/ gaming area is operating to capacity with people actively talking in each space (one person talking and one person listening). It has been assumed that windows are opened and the terrace is being utilised for the purpose of assessment.

Table 8: Cumulative predicted noise level assessment, LAeq

Receiver ID	Time	Predicted noise level, LAeq,1hour	Noise goal, LAeq,1hour
A1	Day time (7am - 6pm)	51	61 (external)
	Evening (6pm - 10pm)	51	59 (external)
	Night (10pm - 7am)	51	40 (external)
A2 (windows opened)	Day time (7am - 6pm)	41	51 (internal)
	Evening (6pm - 10pm)	41	49 (internal)
	Night (10pm - 7am)	41	30 (internal)
A4	Day time (7am - 6pm)	46	61 (external)
	Evening (6pm - 10pm)	46	59 (external)
	Night (10pm - 7am)	46	40 (external)

Internal noise levels cannot be achieved during the night time period, regardless as to whether windows to the lounge/ café/ bar/ gaming area are opened or closed.

4.4 Recommendations

The following recommendations are made to comply with the nominated acoustic criteria:

- The Communal area is not capable of complying with the established night time noise criteria and should therefore be restricted to the hours of operation 7am - 10pm daily.
- Communal areas are to be promoted as passive areas and high noise activities such as late-night parties are to be discouraged.
- Windows of the flexible spaces and meetings rooms are to be closed when in use.
- All windows within the flexible spaces and meeting rooms are to be a minimum Rw 32.
- All windows within the lounge/ bar/ gaming area are to be a minimum Rw 35.
- A speaker system to provide background noise will be provided by the developer. The noise level from this system is to be limited to 65dB(A). Amplified music (provided by patrons) is not to be used within the common area spaces (personal devices at a volume suitable for personal use (<65 dB(A) are acceptable). No music is allowed on outdoor terrace areas.
- The assessment has been based on carpeted floors throughout the Level 9 communal area. Structure-borne noise as a result of footfall noise on hard floor surfaces has not been assessed. Additional treatment to flooring and ceiling in apartments below may be required in the event hard floor surfaces are used. This is to be assessed in the design development of the spaces.
- Additional absorptive materials may be required in order to achieve the acoustic criteria nominated. This will be dependent on the selected floor and wall finishes for the development.

In consideration of noise impacts to nearby apartments, a management plan is to be implemented and the following preliminary management controls are recommended, and these shall be reviewed by the executive committee on a regular basis, based on feedback from the adjacent residents and the strata body:

- All residents of the building and adjacent buildings on site are to be provided with contact details for management/security, so that they may report unruly behaviour should it occur.
- At all times, the patron behaviour shall be managed by the event hosts. In the event of unruly behaviour, the on-site managers/security may cancel the booking (and future bookings) without prior warning and clear the area.
- Signs shall be installed at the Community Centre exit reminding patrons to be mindful of the adjacent residents, particularly when departing via the lift.

5 Conclusion

Renzo Tonin & Associates has completed an acoustic review and assessment of the proposed Communal Area to be located on Level 9 of Building 3 of the development at 2 Figtree Drive, Sydney Olympic Park. The purpose of the assessment was to outline the parameters, design aspects and relevant acoustic criteria in relation to operational noise emission from the communal area on the the residential component of the development.

We have considered the following acoustic aspects of the development:

- Operational noise emission from the internal and external areas of the communal area

The assessment made the following findings:

- Operational noise from the site can be managed through physical noise controls and may be supplemented by management measures. In-principle controls have been outlined; however detailed acoustic assessment should be undertaken once the finishes have been finalised.
- Internal noise criteria can be easily achieved based on the specified facade design with windows and doors closed during the day time and evening time periods.
- Typically the night time noise criteria cannot be achieved. Therefore it is recommended that the use of the communal area be restricted during the night time period
- The acoustic amenity of residential premises can be provided through a combination of noise control and management of the communal area during the day time and evening periods .

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
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 Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken 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 (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive 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	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L_{90}	The 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).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) 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	A fluctuation of air pressure which is propagated as a wave through air.
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.