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Sydney International Convention, Exhibition and Entertainment Precinct (SICEEP)

The Haymarket SSDA5

Noise and Vibration Response to Submissions

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CONTENTS

List of Tables

1 INTRODUCTION

The purpose of this document is to provide a response to submissions received on the Noise and Vibration Assessment prepared for the Stage 2 Development Application (referred to as the SSDA5 Report). It specifically responds to the submission received from City of Sydney Council in regard to the Stage 2 DA for the SICEEP Haymarket Southwest Plot currently before the NSW Department of Planning and Infrastructure.

Recommendation 28 of the City of Sydney submission (Section 4.9) states:

> "*The Stage 2 DA should be accompanied by detailed acoustic modelling which discusses the probable design and management techniques which would be necessary for the interface between ground floor uses and residential uses above. Consider changing the lower level balconies to sunrooms which can provide some protection from ground plane activities, but allow the room to be opened up as a balcony. This will increase the gross floor area.*"

As outlined in the SSDA2 report, the amenity of residential premises is proposed to be addressed through a combination of physical design measures at the residential building as well as design and management measures for the retail type uses. Noise control measures at the residential building are expected in order to address general noise from use of the public realm and from areas of retail type uses such as outdoor dining, which cannot reasonably be controlled by other means. Control of mechanical services equipment and music noise is expected to be controlled at the source.

Whilst it is understood that The Haymarket Square may be used for special activities, details of such activities are not known at this stage however Lend Lease has advised that the activities could include:

- Passive recreation;
- Seasonal events such as markets, fairs and an open air cinema; and
- Community and civic events such as Chinese New Year Parades and Xmas carols.

The SSDA2 Report discusses not only a design and management response but also the criteria and assessment framework for the approach. It is noted that current noise policy does not specifically address the balance between commercial (retail) operations and residential acoustic amenity in mixed use areas.

This is discussed in further detail in the following sections.

2 RESPONSE TO CITY OF SYDNEY

2.1 Current Noise Policy Overview

2.1.1 Noise Criteria for Commercial Premises (Retail Type Premises)

Standard noise policy and criteria applicable to retail type development places the onus of noise control and management upon the operator (noise emitter). With respect to the Haymarket, it is expected that standard City of Sydney conditions of consent will be utilised to mitigate noise impacts. In addition, where premises are licensed, the Office of Liquor Gaming and Racing (OLGR) has standard noise criteria that is similar to planning conditions of consent relevant to noise mitigation.

The standard noise criteria vary at different times of the day, but are all relative to the existing background noise level at the sensitive receptor location. This is in contrast to road traffic and light rail noise intrusion, which is assessed against a fixed L_{Aeq} noise level criterion.

The typical criteria that apply are as follows:

- Between **7am – 12midnight**, at the boundary of the nearest affected residential boundaries/balconies, with an allowance of **background noise + 5dB**[1];
- Between **12midnight – 7am**, at the boundary of the nearest affected residential boundaries/balconies, with an allowance of **background noise + 0dB**[2];
- Between **12midnight – 7am**, noise is also required to be **inaudible** inside habitable rooms of the residential premises and applies with the windows of the residential premise open or closed.

The result of these standard criteria is that the imposition of noise control is placed firmly on the retail use.

Further to the above, the control of noise at the commercial premises does not address noise from the public realm. However the criteria do protect both the internal and external amenity of residential premises without the need for any specific acoustic treatment to the residential building.

On the basis of the current concept plan for retail and public realm, noise generating developments such as cafes, restaurants and bars are unlikely to comply with the standard noise conditions given the proximity of the residential apartments.

2.1.2 Noise Criteria for Residential Premises

As outlined above, the standard criteria for retail type noise emission, including patrons and music noise, is applied upon the noise emitter. However the alternative to applying controls at the source of noise is to apply the mitigation measures at the receptor location. In this case,

[1] Applies in octave band centre frequencies from 31.5Hz to 8kHz.
[2] Applies in octave band centre frequencies from 31.5Hz to 8kHz.

the typical design response would be to design the residential building envelope to control noise intrusion. Design responses could typically include:

- Windows and doors to residential apartments need to remain closed in order for the acceptable level of amenity to be achieved;
- Residents may need to be advised of noise – expectations managed, such as in lease notations;
- An acceptable internal noise level needs to be determined – the extent to which noise may still be audible is dependent upon what controls the background noise level inside the apartment (discussed further below);
- A design criterion for the façade system needs to be established.

2.1.2.1 Comparative to Background and Fixed Noise Level Criteria

An important aspect of this issue is the difference in noise criteria applicable to retail type operations, when compared with other sources such as road traffic, light rail and aircraft. As outlined above, the criteria for assessing noise from retail type development at residential receptors is compared against the prevailing background noise level. It is the emergence of noise above the background noise level that both determines how audible the noise may be.

By comparison, the noise criteria for road traffic, trains or aircraft are fixed noise levels relevant to the type of receptor location and are therefore independent of the prevailing background noise level inside the residential premises. These criteria do not necessarily address the audibility of noise, but rather set a fixed noise level at which the particular noise source is considered acceptable. In these cases the control of noise can be readily addressed by the building envelope, as the outside noise can be reduced down to the prescribed level.

However when the background noise level is relevant to the assessment, the blocking out of external noise by the building envelope can also reduce the internal background noise level within an apartment. As a result, the more the external noise is reduced, so too is the background noise level.

Given this complexity, the use of a criteria related to the background noise levels, particularly in octave bands is not readily adopted for developing sites such as the Haymarket.

2.1.2.2 City of Sydney DCP

Section 4.2.3.11 'Acoustic privacy' of the City of Sydney Development Control Plan 2012 sets out the following relevant guidelines, inclusive of fixed noise level criteria:

> *"(2) Where necessary, a residential development is to include acoustic measures to reduce the impact of noise from external sources.*
>
> *(3) Development is to incorporate measures that reduce the entry of noise from external sources into dwellings.*

(4) Where possible, the attenuation of noise at its source is preferred. Where this option is adopted, the applicant will need to demonstrate that the measures to be undertaken:

(a) have the consent of relevant parties associated with that noise source; and

(b) last for the life of the development proposal.

(7) The repeatable maximum $L_{Aeq\ (1\ hour)}$ for residential buildings and serviced apartments must not exceed the following levels:

(a) for closed windows and doors:

(i) 35dB for bedrooms (10pm-7am); and

(ii) 45dB for main living areas (24 hours).

(b) for open windows and doors:

(i) 45dB for bedrooms (10pm-7am); and

(ii) 55dB for main living areas (24 hours).

(8) Where natural ventilation of a room cannot be achieved, the repeatable maximum $L_{Aeq\ (1hour)}$ level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:

(a) 38dB for bedrooms (10pm-7am); and

(b) 48dB for main living areas (24 hours).

(9) These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally.

As the criteria does not stipulate the type of noise source that the criteria is applicable to, it is assumed to be applicable to all sources of noise typical of the city environment, which would include patron and pedestrian noise.

2.1.2.3 AS2107:2000

Australian Standard 2107:2000 sets recommended internal noise levels for steady/quasi-steady state sounds such as road traffic noise. Noise from patrons and the public is not necessarily steady/quasi-steady state and therefore have not been relied upon.

2.1.2.4 AAAC Star Ratings

The Association of Australian Acoustical Consultants (AAAC) also provides guidance on internal noise levels within residential premises[3]. The AAAC guideline and star rating system adopts an L_{Aeq} criteria for continuous noise sources, similar to the City of Sydney Policy, but also includes

[3] Association of Australian Acoustical Consultants (AAAC), Nov 2009, Acoustical Star Ratings For Apartments and Townhouses

an average L_{AMax} criteria for intermittent noises. Table 1 presents the external noise intrusion criteria from the rating system.

Table 1 – AAAC Star Ratings for Residential Internal Noise Levels

Descriptor	AAAC Star Rating and Internal Noise Level				
	2 Star	3 Star	4 Star	5 Star	6 Star
Bedrooms					
Continuous noises L_{Aeq} ≤	36dB(A)	35dB(A)	32dB(A)	30dB(A)	27dB(A)
Intermittent noises ave L_{Amax} ≤	50dB(A)	50dB(A)	45dB(A)	40dB(A)	35dB(A)
Other habitable rooms including open kitchens					
Continuous noises L_{Aeq} ≤	41dB(A)	40 dB(A)	37 dB(A)	35 dB(A)	32dB(A)
Intermittent noises ave L_{Amax} ≤	55dB(A)	55 dB(A)	50 dB(A)	45 dB(A)	40dB(A)

Notes: Measurements are made in bedrooms and any nominated habitable rooms. Bedrooms are measured over a period between 2200hrs and 0700hrs. Noise measurements in other habitable rooms are undertaken between 0600 to 2400hrs. In any event the measurement period must be representative of the noise being measured. Measurements must include LAeq and LAmax.

2.1.2.5 WHO Guidelines

The *Guidelines for Community Noise* developed by the World Health Organisation (WHO) seek to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments. The WHO guidelines suggest that to avoid sleep disturbance, indoor guideline values for bedrooms are L_{Aeq} 30 dB(A) for continuous noise and single noise events should not exceed more than L_{Amax} 45 dB(A) approximately ten times per night.

2.1.3 Noise Criteria Summary

Preliminary assessment has been based upon the current City of Sydney DCP. Further consideration may need to be given to the expected standard of residential occupancy and it would be beneficial to measure and reference other deemed satisfactory developments.

2.2 Noise Assessment

2.2.1 Overview

Whilst it is expected that this matter will require further detailed design and consideration, the following presents a conceptual design solution for The Haymarket, a master planned, mixed use precinct situated at Darling Harbour in the middle of the CBD:

- Residential premises exposed to high external noise levels as a result of retail type and public realm activities will need to close windows in order to meet acceptable acoustic amenity objectives within dwellings. Alternative solutions for ventilation will be provided where windows and doors are required to be closed;
- The building envelope (primarily glazing system and floor/ceiling of first floor apartments above retail) will be designed to mitigate the intrusion of noise from external sources;

- Retail type premises will be designed such that they minimise noise transfer via the floor/ceiling to first floor apartments where they are located below a residential apartment; and
- Retail operations, particular use of outdoor areas is likely to be restricted to between 7am and 12 midnight only.

2.2.2 Future External Noise Levels

The noise assessment for this concept proposal has focussed on the first floor residential premises which will be most exposed to noise from The Haymarket ground floor uses and activities. As the specific uses of retail type tenancies and use of the Haymarket Square are not defined, measurement results of areas considered to be similar to the future Haymarket site have been used for reference. We note that preliminary noise modelling of external areas associated with the retail type component also indicated noise levels in the order of L_{Aeq} 65-70dB(A) at the façade of first floor residential apartments. By reference to the L_{A1} noise levels, the maximum noise levels are generally within 10dB(A) of the L_{Aeq} and therefore satisfying the City of Sydney L_{Aeq} noise goals in bedrooms would also satisfy the WHO maximum noise level criteria of 45dB(A). It is recommended that further supporting measurements and/or modelling be carried out during the design development process.

Table 2 – Measured Noise Levels of Comparable Acoustic Environments

Location	$L_{Aeq\ Period}$			$L_{A1\ period}$		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
Darling Walk	65	65	64	71	71	69
Harbourside, Darling Harbour	66	71	64	72	76	71

Notes *Measurements carried out by Wilkinson Murray ref: Report No. 10232 NMP 120912 SF Version A*

2.3 In-Principle Design Recommendations

A preliminary assessment has been carried out for first floor residential apartments fronting the Boulevard in order to provide an indication of the potential acoustic mitigation measures and demonstrate that the noise objectives can be practically achieved. Acoustic treatment to apartments on higher floors and less exposed orientations would have reduced acoustic requirements.

Assuming external noise levels at the façade of first floor residential premises ('free field' level) to be between 65 and 70dB(A), the following in-principle building envelope treatments are likely to be required when considering the internal noise level criteria set out within the City of Sydney DCP 2012. The acoustic recommendations focus on the window/door glazing as it is typically the weakest element of the building envelope in regard to noise intrusion.

It is noted that design strategy for the following east facing balconies fronting Haymarket Square and the Boulevard are to be provided with glazed balcony screens above solid balustrades:

- lower 4 levels of SW2; and
- lower 2 levels of SW3 podium (east facing only)

In the case of living rooms, the secondary glazing will allow the secondary glazing to be of a lower acoustic performance, whilst for bedrooms, it will allow a single glazed secondary glazing where double glazing is otherwise nominated.

Table 3 – Indicative Acoustic Treatment Options, External Noise Level L_{eq} 65 to 70dB(A)

Room Type	Internal Criteria	Façade Element	Acoustic Rating (R_w)	Indicative Construction
Bedroom	L_{Aeq} 35	Glazing	35 – 42*	10.38mm laminated glazing with acoustic seals, up to Laminated double glazed, insulated glazing unit or Balcony operable glazing and secondary single glazing.
Living Rooms and other habitable Areas	L_{Aeq} 45	Glazing	28 - 33	6.38mm laminated glazing with acoustic seals, up to 10.38mm laminated glazing with acoustic seals or Balcony operable glazing and secondary single glazing.

Notes: *Bedroom - 12m² floor area, glazing area 5.5m²*
Living Room - 30m² floor area, glazing area 12m²
Wall construction is recommended to have an acoustic performance 10-15dB greater than the specified glazing.
** Higher Rw performance expected that is not directly relative to the dB difference in external noise level.*

It is noted that the floor/ceiling construction of first floor apartments is also expected to require acoustic treatment, however will be dependent upon the nature of the ground floor use. Given that the building construction will comprise a concrete slab separating the ground floor retail and first floor residential occupancies, acoustic upgrade is likely to be in the form of a supplementary acoustically sealed ceiling in the retail tenancy.

2.4 Consideration of Other Existing Licensed Operations

Consideration of existing operations, such as licensed premises (Pumphouse), needs to be given in terms of their potential to affect the acoustic amenity of the future residential development at The Haymarket. As noted above, the control of noise from such premises is best achieved at the source; however an existing premise is not readily controlled, either through negotiation with operators or legislation. The OLGR considers order of occupancy when assessing noise complaints and therefore it should not be expected that a premises will comply with the standard noise criteria when encroachment has occurred by a new residential receiver.

It is noted that measurement carried out in proximity to the Pumphouse revealed noise levels lower than 70dB(A) at the alignment of the future buildings within the Haymarket. Where necessary, affected residential premises should be designed in accordance with the principles outlined above.

3 CONCLUSION

As outlined, the noise amenity of residential premises in relation to noise from the retail type uses and public realm requires additional detailed design to enable active uses to operate as well as the provision of suitable residential acoustic amenity. However, further to the preliminary noise assessment, indicative building envelope construction requirements for the residential premises have been provided in accordance with the standard noise criteria set out within the City of Sydney DCP 2012. An external noise limit of 65 to 70dB(A) has been assumed for the cumulative impact of retail type premises and the public realm to worst impacted locations at lower floor levels and fronting the Haymarket Square and Boulevard.

In regard to mitigation measures, an amended design strategy for lower level east facing balconies has been adopted for which glazed balcony screens are proposed to the lower two levels of SW3 (east facing only) and the lower four levels of SW2. It is noted that acoustic treatment to apartments on higher floors and less exposed orientations would have reduced acoustic requirements.

Whilst noise from the public realm cannot be directly controlled, use of the area for special events should be managed accordingly. The external noise limits can also be used to derive appropriate limits for individual retail type premises. These criteria would be developed during the design development phase.

We trust that the information and assessment presented demonstrates that internal acoustic amenity within the residential premises of the Haymarket can be provided by suitable design for the building façade as well as management of the retail type uses.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

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 L_{90} 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 L_{90} 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.