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cc SOH, TZG

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Subject Function Centre Operational Noise

1 Introduction

This note sets out the proposed strategy for limiting and assessing noise from events at the proposed Function Centre at Sydney Opera House (SOH).

As well as the Function Centre, this note reviews noise from the outdoor space adjoining the Function Centre, a space that would normally be separated off from the rest of the publicly accessible areas of the Northern Broadwalk. This is illustrated below (Figure 1 - see area demarcated in red).



Figure 1: Function Centre and Proposed External Breakout Area

The note has been prepared following discussions with Department of Planning and Environment meeting held 11 April 17. The discussion included attendees; Chris Barling (SOH), Dan Keary

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(Keylan Consulting), Andy Nixey (DPE), Geoff Parnell (DPE) and Ashley Cheong (DPE), Nick Boulter (Arup). The note sets out the strategy for the control of noise from external activities which was discussed at the meeting and agreed in concept. It was also agreed at the meeting that the main issue is noise from reinforced music or speech rather than noise from patrons. This note therefore concentrates on proposals for controlling music and speech noise.

The procedures and policies described below are necessary to protect the amenity of the nearby residential noise receivers. External events on the Northern Broadwalk are the primary concern but for completeness, the assessment has also looked at events within the Function Centre itself.

Separate internal policies (not described here) will be implemented to control noise from the Function Centre affecting the internal areas of the SOH.

This note is intended to be read with the Noise Impact Assessment¹ which details the basis of the calculations and overall noise control strategy.

Function Centre events with loud music located outside on the Broadwalk are unlikely to be acceptable as regular operations. Any one-off events, such as New Year's Eve, would be managed under the Northern Broadwalk DA and are therefore not part of this application.

2 Events *Inside* the Function Centre

The calculations described in the Noise Impact Assessment show that, when the doors are closed, acceptable external noise levels can be achieved with the types of events proposed for the Function Centre at the proposed operating hours.

The key recommendations are set out below. These will allow the Function Centre to operate internal events without restrictions:

- SOH to manage audio at events in the Function Centre. This is recommended primarily to control noise to sensitive spaces *within* SOH but would also help ensure that doors are not left open, etc. when high noise levels are being generated.
- If there are loud events within the Function Centre after 10 pm, it is recommended that only one door be allowed to be opened at a time to allow access to the outdoor area.
- If there are loud events within the Function Centre after Midnight, it is recommended that all doors on the northern façade shall be closed and entry/exit shall only be allowed through the entry foyer doors on the western side of the Function Centre (with those doors remaining closed when not in use).

With these controls in place, there is no requirement to limit the number of events held internally.

¹ Noise Impact Assessment - Function Centre. Arup Report 245827 Rev E. 30 January 2017

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3 Events *Outside* the Function Centre

3.1 Description

Events on the Northern Broadwalk may take place in conjunction with events within the Function Centre (e.g. as a break out area) which will result in people standing outdoors in a designated section of the Northern Broadwalk. Such external events may include amplified speeches or low level background music, in keeping with the internal function centre (i.e. functions would run concurrently).

As noted above, the issue of noise from reinforced music or speech is the primary driver for the assessment as noise from patrons only is very unlikely to generate complaints.

3.2 Screening of Event Types

3.2.1 Deemed to Satisfy

The Noise Impact Assessment (see Table 8 thereof) showed that noise from many types of external event would not be expected to exceed the target noise criteria. It is therefore proposed that the following types of event be “*deemed to satisfy*” the noise criteria.

- Any outdoor event with no sound reinforcement up until midnight
- Any event with only light foreground music or background music or amplified speech with less than 200 people (eg cocktail party, product launch etc), up until midnight

Table 1: External Event Types deemed to meet noise criteria

3.3 Events with Sound Reinforcement

3.3.1 Event Infrastructure

The design of the Function Centre includes technical infrastructure to be used with external loudspeaker systems. This avoids the need to run power / signal cables through doorways etc. Figure 2 below shows the location of the external facility panels which include data and loudspeaker connections on the sunshade outside the northern façade at deck level.

These would be the default location for external event sound systems.

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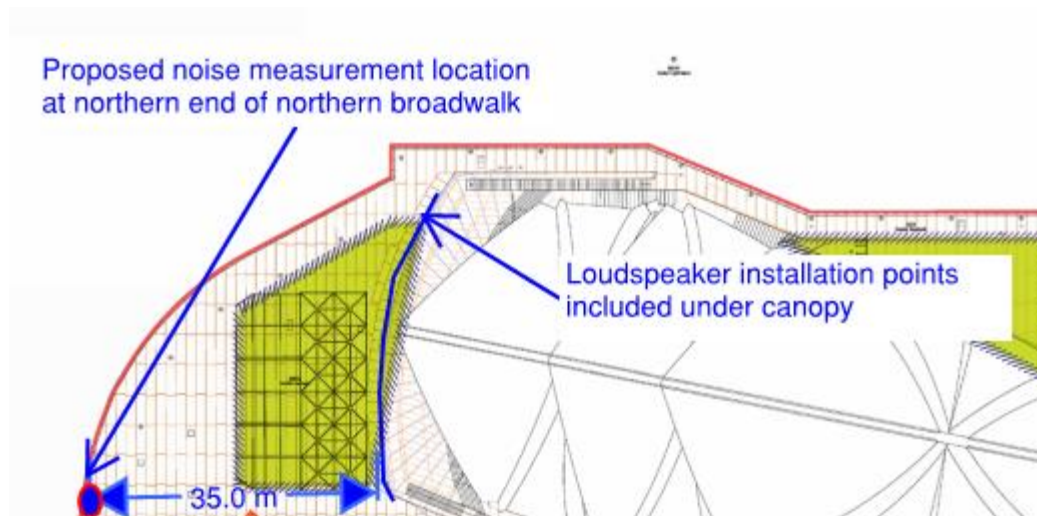


Figure 2: Plan showing location of loudspeakers on external roof/façade and noise measurement location

3.3.2 Event Noise Limits

From the calculations described in the Noise Impact Assessment, calculations have been undertaken to derive the expected noise level from different types of event. Table 8 of the NIA summarises the results of these calculations.

With a knowledge of the ‘default’ noise source location, it is possible to extrapolate from the expected noise level at the ultimate residential receiver to a location on the edge of the Northern Broadwalk. Allowing for worst case wind conditions, a proxy noise limit has been calculated at the edge of the Northern Broadwalk. The intention is for noise levels at this location to be the enforced limit, rather than limits in Kirribilli.

To simplify the measurement at this location, corrections have also been made to derive an appropriate limit in dBL_{Aeq} which can be used in place of the L_{10} noise limit proposed at the residential receivers in Kirribilli. The L_{eq} metric is featured on most commercially available sound level meters and, if measured over a reasonable time period, is less prone to interference by short term events such as passing ferries, helicopters etc which have made criteria defined in L_{10} and L_{max} units difficult to monitor effectively. A measuring period of 15 minutes is considered appropriate given that the area is affected by slow moving intermittent noise sources such as ferries which take a significant time to pass.

Low frequency music noise would be controlled by including a dB(C) limit in addition to the dB(A) limit. This is an approach commonly used in NSW for music noise control and avoids the need for specialist noise monitoring equipment.

The option of using a lower powered sound system with distributed loudspeakers around the external event has been assessed. Calculations show that this would result in less noise spillage for the same coverage. However, because the loudspeakers would be closer to the measurement microphone (assumed to be on the northern edge of the Northern Broadwalk), the actual levels at the measurement location would be higher than would be the case for the loudspeakers located at the building façade, despite the noise levels being *lower* in Kirribilli.

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Given that an assessor may find it difficult to determine what type of loudspeaker system is being used, it is proposed that the worst case be assumed (ie with loudspeakers fixed at the façade) for assessment purposes.

Based on these calculations, the following noise limits are proposed for events that have a risk of exceeding the target noise criteria. These are based on minimising the risk of the L_{A10} event noise at the Kirribilli receivers exceeding the existing late night background noise and the L_{C10} noise level exceeding the existing background noise by more than 15 dB. Full details are given in the Noise Impact Assessment.

Table 2: Noise Limits to be met at the northern edge of the Northern Broadwalk, opposite the Function Centre

Period	Noise Limit at measurement location (see Figure 2) along northern edge of the Northern Broadwalk
Daytime and Evening (1000h to 2200h)	65 dBL _{Aeq, 15 min} and 80 dBL _{Ceq, 15 min}
Night (2200h to 2400h)	62 dBL _{Aeq, 15 min} and 77 dBL _{Ceq, 15 min}
2400h to 1000h	No external events (Function Centre events to continue until 0130 internally)

4 Summary

The table below summarises the proposed approach to controlling noise. For completeness, the table includes events that are *not* intended to take (highlighted in pink). The table shows which types of events would require monitoring (which would take place at the measurement location shown on Figure 2).

Table 3: Summary of Noise Control Proposals

Time of Day	Function Type	Proposed Monitoring
Daytime & Evening (1000- 2200h)	Indoor Event full capacity (<u>No use</u> of Northern Broadwalk) Up to 500 people All doors closed; and Amplified speeches; and/ or Loud amplified music (assumed to be up to 85 dBL _{Aeq} and 92 dBL _{Ceq} within the Function Centre)	Deemed to satisfy- no monitoring
	Indoor & Outdoor Event full capacity (<u>Use</u> of Nth Broadwalk) Up to 500 people All doors open; or Amplified speeches; and/ or Light amplified music. (70 dBL _{Aeq} and 74 dBL _{Ceq} within outdoor audience area)	Deemed to satisfy- no monitoring
	Indoor & Outdoor Event full capacity (Use of Nth Broadwalk) Up to 500 people All doors open; or Amplified speeches; and/ or Loud amplified music (assumed to be up to 85 dBL _{Aeq} and 92 dBL _{Ceq} within the Function Centre)	Monitoring Required. Proposed noise limit levels; 65 dBL _{Aeq, 15 min} and 80 dBL _{Ceq, 15 min} at measurement location

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Time of Day	Function Type	Proposed Monitoring
Night (2200-2400h)	Indoor Event full capacity (No use of Nth Broadwalk) Up to 500 people All doors closed; and Amplified speeches; and/ or Loud amplified music. (assumed to be up to 85 dBL _{A10} and 92 dBL _{C10} within the Function Centre)	Deemed to satisfy- no monitoring
	Indoor & Outdoor Event full capacity. (Use of Nth Broadwalk) Up to 200 people; One double doors open; and Amplified speeches; and/or Light amplified music. (assumed to be up to 70 dBL _{Aeq} and 74 dBL _{Ceq} within outdoor audience area)	Deemed to satisfy- no monitoring
	Indoor & Outdoor Event full capacity. (Use of Nth Broadwalk) Up to 500 people; All doors open; and Amplified speeches; and/or Light amplified music. (assumed to be up to 70 dBL _{Aeq} and 74 dBL _{Ceq} within audience area)	Monitoring Required. Proposed noise limit levels; 62 dBL _{Aeq} , 15 min and 77 dBL _{Ceq} , 15 min at measurement location
	Indoor & Outdoor Event full capacity (Use of Nth Broadwalk) Up to 500 people All doors open; and Amplified speeches; and/or Loud amplified music.	Not proposed- SOH to manage through closing all doors, except one set after 10pm.
Past Midnight (2400- 0130h)	Indoor Event full capacity (No use of Nth Broadwalk) Up to 500 people All doors closed; and Amplified speeches; and/ or Loud amplified music. (assumed to be up to 85 dBL _{Aeq} and 92 dBL _{Ceq} within the Function Centre)	Deemed to satisfy- no monitoring
	Indoor & Outdoor Event full capacity (200ppl)- (Use of Nth Broadwalk) One double doors open; and Amplified speeches; and/or Light amplified music.	Not proposed- SOH to manage through all doors closed after midnight
	Indoor & Outdoor Event full capacity (500ppl)- (Use of Nth Broadwalk) All doors open; and Amplified speeches; and/or Light amplified music.	

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DOCUMENT CHECKING

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