ACOUSTICS 2017 PERTH
SOUND, SCIENCE AND SOCIETY

Setting noise objectives for outdoor events at the Sydney Opera House

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ABSTRACT

Unwanted music from outdoor events is considered a form of noise pollution which presents a unique set of challenges for regulators when compared to other environmental noise sources. Unlike noise generated by sources such as transport or industry where lower levels are always desirable, there is a minimum level of music below which patron experience will be unacceptable. The challenge for regulators therefore lies in balancing the need for entertainment against the impacts of outdoor music on the surrounding population. Regulators and venue operators of outdoor music events in urban environments are also often required to comply with receiver based noise limits in noise catchments complicated by high levels of extraneous noise from ferries, trains, traffic, pedestrians, restaurants and the like. With this in mind, this paper describes the approach undertaken to review and contemporise the noise criteria for outdoor events held on the steps and forecourt of the Sydney Opera House by adopting Front of House (i.e. at the source) limits rather than receiver based noise objectives.

1 INTRODUCTION

An '*Outdoor Music Event*' is a term which can cover a wide range and combination of musical performances, however these events can generally be categorised as either:

- Urban Events – these tend to be single stage concerts held in stadia, parks or urban settings with city backdrops. Background noise levels will usually be high, and the nearest residents are generally in close proximity. Examples of these include the Sydney Cricket Ground, the Domain in Sydney, and Riverstage in Brisbane which hold events until around 11 pm.
- Rural Events - these tend to be festivals that run over several days and may run until midnight or later. These events will usually have multiple stages, with a main stage for the headline acts, and smaller stages and bars that cater for lesser known artists or music genres. Background noise levels will generally be low, and the surrounding area sparsely populated. Glastonbury in the UK is the most well-known of these types of festivals, with Blues Fest and Splendour in the Grass examples of similar type festivals held in NSW.

In setting noise limits for outdoor music events, regulators must achieve an appropriate balance between the level of music required to provide satisfactory patron experience and protecting the amenity of surrounding residents. In doing this, it must be understood there is a minimum music level below which patron experience will be substandard. This matter is not typically considered in setting of noise objectives for other development types, but is critical to the success of outdoor music events. The following *'rules of thumb'* for music levels have been derived from the measurement of music from outdoor events:

- A L_{eq} level of 100 dB(A) represents a strong sound which is typical of rock concerts, but not as loud as that experienced in a night club or at a heavy metal concert.
- A L_{eq} level of 95 dB(A) represents a reasonably strong, full sound that is typical of Indie/alternative rock concerts. This level is likely to elicit a few complaints from the patrons, from being either too loud or too soft.
- A L_{eq} level of less than 95 dB(A) is not considered to be sufficiently loud for most music genres, and is likely to elicit complaints from the event organisers and disgruntled patrons for being too low.

2 ASSESSMENT OF MUSIC EVENT IMPACTS

2.1 Assessment Metrics

Generally, noise is measured using the A-weighting curve. This curve is designed to approximate the response of the human ear and results in a single representative number for a noise exposure, rather than a level at multiple frequencies across the acoustic spectrum. In some cases where there are significant levels of low frequency noise, the C-weighting curve may be used to more appropriately assess music with a higher proportion of lower frequency bass.

In addition to the use of a frequency weighting, there is a range of metrics that can be used to assess noise. These can include the L_{max}, L_{10} and the L_{eq}. The L_{10} and particularly the L_{max} are prone to the influence of nearby extraneous noise and consequently the L_{eq} has gained favour as a more reliable assessment measure.

2.2 Duration of Measurement

Typically, environmental noise measurements are made over a period of 15 minutes or longer. For a music concert, this would typically represent 3 or more songs along with crowd applause. In order to allow a quick response (if required), it is preferable to have a shorter measurement period which also facilitates more locations or sampling to be undertaken. 5 or 10 minute periods are generally adequate for music assessment.

2.3 Low Frequency Content of Music

Not all music results in the same level of community complaints. Low frequency music with high levels of bass or dB(C) more commonly results in an adverse community reaction than does music with more mid frequencies including vocals and treble. The reason for this is twofold. Firstly, low frequency music is not attenuated as well by structures (barriers, windows, building walls) or air absorption when compared to high frequency music. Secondly, the resultant low frequency music heard indoors or at distance typically comprises distorted audio consisting only of the residual drum and bass guitar which is unpleasant to the ear and more intrusive.

There are several ways of identifying the low frequency content of music. Traditionally the use of the C–weighting scale has been used to provide a measure in dB(C). The C–weighting has a much flatter curve than the A–weighting scale and emphasises the low frequency content but can be influenced by acoustic energy in bands that are not audible or useful for the control of annoying characteristics.

From experience, when measured at large distances in dB(lin), most music is dominated by the 31.5, 63 and 125 Hz octave bands, particularly the 63 Hz octave. Whilst it is possible to mix music to avoid excessive levels in the 63 Hz band whilst maintaining excessive levels in the 31.5 and 125 Hz octaves, in practice this will not happen as the music would be significantly distorted and the spill from adjacent bands will still be evident in the 63 Hz band. Measurement of the 63 Hz band has an advantage over the 31.5 Hz octave in that it is generally the dominant frequency for most music genres including rock. For the same reasons, it is also preferred to the 125 Hz octave and has the added advantage that it is not as susceptible to contamination by extraneous noise as is the 125 Hz band, particularly road traffic noise. The use of the 63 Hz octave as a measure of excessive low frequency noise is supported by guidance provided by Brisbane City Council (BCC), Adelaide City Council and the UK Code of Practice (Noise Council, 1995). Whilst the use of 63 Hz has distinct advantages when measuring at distant receivers, these advantages are largely neutralised when the measurements are made in close proximity to the source, where dB(C) provides a satisfactory measure and is more widely used.

2.4 Relationship of dB(A) to lower frequencies

A summary of historical Sydney Opera House (SOH) noise monitoring data indicated the differential between the $L_{Ceq(5\ minute)}$ and $L_{Aeq(5\ minute)}$ was from minus 7 dB for rock music to minus 4 dB for classical music (Auditoria, 2016). The authors had previously used a differential figure of 10 dB for outdoor events which is consistent with that used by BCC. Given the current level of understanding of music noise impacts, the authors were reluctant to completely abandon the use of an A weighted noise descriptor and therefore, as a conservative approach, recommended the dB(A) be retained as an objective indicator to complement the dB(C) criteria. Additionally, it was recommended to set the $L_{Aeq(5\ minute)}$ level at $L_{Ceq(5\ minute)}$ minus 10 dB as standard across all genres.

2.5 Assessment Location

Most environmental noise guidelines set levels which are to be met at the nearest residence. This is a logical location as it is where the greatest impact will typically occur and if required, allows for mitigation measures to be developed that will reduce the receiver impacts. Such performance based criteria allow music event operators to determine how to best manage event impacts. However, in some cases, noise may be difficult to measure at the nearest receiver due to extraneous background noise contamination or issues gaining site access, and so alternate assessment practices may be required.

In a rural setting with low background noise levels, music may be audible over significant distances and consequently, potentially impacted receivers may be several km from the venue. Rural receivers are usually spread out and sparsely populated. In these circumstances, meteorology can play an important role in the propagation of music with positive or negative influences of 5 to 10 dB being common. In such cases, receiver based assessment is generally the most appropriate way to quantify impact.

In urban areas, potentially impacted receivers will be limited to those in the immediate vicinity of the music event. However, these receivers are much more densely populated and subject to higher background noise levels. In such circumstances, source based noise limits would have the advantage of providing a continual and auditable log of compliance, allow for much quicker response to any excursions beyond noise objectives, reduce the compliance burden, largely eliminate the influence of any extraneous noise and provide the event organiser with a greater ability to plan the event.

2.6 Front of House Levels

Music is, generally controlled by the sound engineer at the mixing desk which will be located in a position where a subjective assessment of the speaker performance and audience experience can be made. This position is known as Front of House (FoH) and is representative of the optimum listening location. It does not however represent the front row, nor the position where the most patrons would sit or stand to listen to the music. The majority of patrons will be generally located behind the FoH position.

Because the FoH is located in front of the stage, the sound heard can be considered '*source levels*', with noise levels reducing further away from the stage. For large events, delay speakers will often be deployed throughout the audience further from the stage to ensure that music levels do not drop too low. FoH levels of around 100 dB(A) and 110 dB(C) tend to represent levels that are acceptable to many patrons at a rock concert that has dominant bass levels.

3 NOISE MANAGEMENT AT OUTDOOR MUSIC EVENTS

3.1 Options to Manage Festival Noise

Once all reasonable and feasible noise mitigation measures have been implemented (noise barriers, noise limiters, speaker positions, speaker type etc), there are three key ways in which the resultant / residual festival noise can be realistically managed, including:

- Control of Music Level – this is an obvious measure, but unlike the control of noise from an industrial premise where lower is always better, in the case of a music festival there is a minimum level below which the patron experience will be compromised.
- Event Duration – restricting the noise dose is a management tool that can be used to manage impacts. For example, a 1 day music event is unlikely to result in as many complaints as a 3 day event. Likewise, a 4 hour event at a certain level may be tolerated whilst a 12 hour event at the same level is likely to result in an adverse community reaction.
- Finish Time – similar to control of duration, where louder music levels may be tolerated if the event finishes before most people would want to sleep.

In practice, regulators will consider combinations of all three of these management practices in developing noise conditions.

3.2 History of Festival Noise Management

Much of the initial management and regulation of outdoor music event impact comes from work undertaken in the UK, beginning in 1976 when the *Noise Council Code of Practice* was introduced which placed noise limits on outdoor music events in the L_{50} metric. Primarily music festivals at Knebworth were used as the test cases (Griffiths, 2004, 2010). Following improvements in sound level meters which allowed for integration, the L_{eq} noise descriptor began to gain favour as a more indicative tool for assessing annoyance. The Code of Practice evolved until the current version was released in 1995 (Noise Council, 1995).

The regulation of outdoor music events in Australia has occurred on an ad-hoc basis. As local councils are usually the appropriate regulatory authority, they generally develop site specific criteria based on what they believe is reasonable and acceptable to their local community. This is not to say these criteria have not been appropriate, just they have not generally been developed regarding any established policy document.

3.3 Current Guidance on Levels for Outdoor Music Events in Australia

There is only limited guidance on the levels that are appropriate for outdoor music events in Australia. In some jurisdictions, there are non-mandatory guidelines set at a State level, however in most instances the regulation of music is deferred to the local authorities to take account of site and locality specific issues.

3.3.1 Noise Objectives in NSW

Guidance provided by the *Noise Guide for Local Government* (EPA, 2010) is the most directly applicable. It does not however provide regulatory limits, but rather advice for local environmental authorities when considering approvals for outdoor concerts, festivals and cinematic or theatrical events using sound amplification equip-

ment. This document provides reference to the Royal Botanic Gardens, the Domain, Centennial Park, Moore Park, Parramatta Stadium, Sydney Cricket Ground, Sydney Football Stadium, Sydney Olympic Park, the Opera House and Darling Harbour. Criteria for these venues were developed separately and appear to have taken into account site specific factors, as well as the ability of the event to provide a reasonable patron experience. A summary of noise objectives for large music festivals and concerts at the major venues in Sydney is given in Table 1.

Table 1. Major NSW Event Locations

Location and Guiding Policy	Noise Objectives at Receivers (unless otherwise stated)
Centennial Park and Moore Park (Prevention Notice No.1)	8 events pa. of up to 4 days between 10 am and 10:30 pm L_{max} must not exceed 65 dB(A) / 85 dB(C)
Sydney Cricket Ground and Sydney Football Stadium (Prevention Notice No.2) 4 concerts pa. Up to 3 hrs between 10 am and 10:30 pm	For the SCG / SFS L_{max} must not exceed 70 dB(A) / 80 dB(A). L_{max} must not exceed 90 dB(C) / 100 dB(C)
Sydney Olympic Park (Sydney Olympic Park Authority Act 2001)	L_{10} 85 dB(A)

3.3.2 Noise Objectives in Other States

A summary of noise objectives for other States is given in Table 2 and as can be seen, a mix of noise indices such as L_{eq}, L_{10} and L_{max} have all been referenced. However, in general, these levels approximate to Leq 55 – 70 dB(A), or an L_{max} of around 65 – 80 dB(A). In some cases, effort has been made to limit the low frequency content of music by suggesting limits on dB(C) and octave bands.

Table 2. Australian Major Event Policies

State	Guiding Policy	Event Times	Noise Objectives at Receivers (unless otherwise stated)
Queensland	Environmental Protection Act	7 am – 10 pm 10 pm – Midnight	70 dB(A) 50 dB(A) or background + 10 dB
Brisbane	BCC Local Law Policy (Entertainment Venues and Events)	On a case-by-case basis	L_{eq} 55 dB(A) / L_{10} 70 dB(A). FoH: 95 dB(A) to max of 100 dB(A) and 105 dB(A) @ 63 Hz.
Victoria	State Environment Protection Policy (Control of Music Noise from Public Premises) No. N-2	Til 11 pm 10 pm if > 5 hrs Other hours	65 dB(A) Council criteria applies
Western Australia	Environmental Protection (Noise) Regulations. (Not applicable to approved non-conforming events)	7 am – 7 pm 7 pm – 7 am	65 dB(A) 60 dB(A)
South Australia	Adelaide City Council. Event Noise Mitigation SoP.	7 am – 11 pm	60 dB(A) / 75 dB(A) L_{max} 70 dB(lin) in 31.5 / 63 / 125 Hz FoH 110 dB(C) (recommended)

From experience, it has been found that for a rock concert the difference between the L_{Aeq} and L_{Amax} levels is often between 8 and 15 dB, whilst the difference between the L_{Ceq} and L_{Cmax} levels is often between 6 and 10 dB. It should be noted that these noise objectives generally apply to events scheduled to finish between 10:30 pm and 11:00 pm. There is very little guidance on the acceptability of music after midnight from open air events.

3.3.3 Urban noise objectives the UK and Ireland

Noise objectives at some major stadia and event locations in urban areas of the UK and Ireland are presented in Table 3. As can be seen, these are mostly an Leq of 75 dB(A) at the receiver without any control on the low frequency component of music spectrum.

Table 3. Noise Objectives at UK and Ireland Stadia and Event Locations

Venue	Internal Criteria L_{eq}	External Criteria L_{eq}	Low Frequency Limit
Lancashire County Cricket Club	None	80 dB(A)	No
Heaton Park, Manchester	None	80 dB(A)	No
Hyde Park, London	None	75 dB(A)	No
Victoria Park	None	75 dB(A)	No
RDS Showground, Dublin	None	75 dB(A)	No
Twickenham Stadium	None	75 dB(A)	No
Hampden Park, Glasgow	None	75 dB(A)	No
Ricoh Stadium, Coventry	101 dB(A)	75 dB(A)	No
Don Valley, Sheffield	None	75 dB(A)	No
Portman Road, Ipswich	None	75 dB(A)	No
Madejski Stadium, Reading	None	75 dB(A)	No
St Marys, Southampton	None	75 dB(A)	No
Rosebowl, Southampton	None	75 dB(A)	No
Stadium of Light, Sunderland	None	75 dB(A)	No

4 USE OF FOH LEVELS TO MANAGE NOISE IMPACTS AT RIVERSTAGE IN BRISBANE

The authors were aware that BCC had undertaken a significant amount of work in deriving appropriate acoustic measures for its urban events (Henry, F. Pers. Comm., 14/3/2016). In particular, the use of FoH levels have been used successfully since 2003 at Riverstage, an outdoor music venue in Brisbane which has many similar attributes to the Sydney Opera House forecourt area.

Riverstage is located in the heart of Brisbane bounded by the City Botanic Gardens and the Brisbane River. Multiple unit and high rise residential buildings are also located in the vicinity of the Riverstage, both in the Brisbane Central Business District and across the river at Kangaroo Point. There are approximately 24 large music events per year with a typical finish time of 10 pm. Similar to the SOH site, the venue benefits from a large separation distance, provided by the Botanical Gardens and the Brisbane River. The most significantly affected residential receptors are located over 400 m away to the east of the river in Kangaroo Point. This separation distance allows the concerts to achieve levels below 70 dB(A) at the nearest sensitive receptors by setting concert levels of 100 dB(A) and 110 dB(C) to be achieved at the FoH (assumed to be 30 metres from the stage).

Whilst technically, FoH measurements may not include the contribution from a distributed speaker system (particularly delayed speakers behind the FoH position), these speakers are designed to compensate for the hemispherical spreading of the music, not to increase overall levels. Their contribution can be generally ignored. The levels adopted at Riverstage have been reported to strike a good balance between patron experience and protecting residents from unreasonable impact in the Brisbane context (Marchuk and Henry, 2016).

5 SYDNEY OPERA HOUSE

The Sydney Opera House (SOH) is a World Heritage building and an iconic Sydney landmark which has a long history of operating outdoor events that cater to public and private patrons. In October 2016, the NSW Department of Planning and Environment (DPE) approved a modification to an existing planning approval held by the Sydney Opera House Trust to hold outdoor events on the Southern Forecourt, Monumental Steps and Western Boardwalk. As part of this modification, it was deemed appropriate to contemporise the existing receiver based noise objectives which had proved difficult to measure and assess compliance with. The remainder of this paper summarises the research, science and logic that underpinned the acoustic assessment process.

5.1 Site Location

The SOH site is located within a vibrant urban environment characterised by high levels of activity throughout the day and decreasing noise levels in the evening and night. Commercial receivers dominate the surrounding area with residential receivers, including Bennelong apartments 150 metres to the south, and Kirribilli residential area 700 metres across the Harbour to the north. Figure 1 shows the location of the Sydney Opera House and surrounds along with the approximate locations of the proposed SOH outdoor events and activities in the forecourt. A secondary outdoor event location, not associated with SOH activities, is Mrs Macquarie's Chair in the Domain.

Source (Google Images, 2017)
Figure 1. Aerial of Sydney Opera House and Surrounds

5.2 Existing Acoustic Catchment

Circular Quay is a lively, busy area governed by pedestrian noise, outdoor restaurant activities, and local buskers. The SOH itself is a destination and attracts large numbers of visitors even when there are no performances or activities. Traffic noise along Macquarie Street leading to the Opera House car park is largely screened by multiple-storey buildings along Circular Quay East. Constant traffic noise is audible from the Sydney Harbour Bridge, Cahill Expressway and Eastern Distributor. Intermittent rail noise is audible from the Sydney Harbour Bridge and from the Circular Quay viaduct with trains operating between 5 am and 12:30 am.

Ferry noise from the harbour is distinctly audible throughout the day, operating from 5 am to 1 am. Aircraft noise from relatively low flying helicopters is quite frequent, while commercial seaplanes and passenger jets are heard from a distance. There are no significant industrial noise sources in the near vicinity, beyond mechanical plant and equipment from commercial and residential buildings. Table 4 summarises noise data collected around the Opera House.

Table 4. Ambient levels in the vicinity of the Bennelong Apartments

Period	Noise Level dB(A)		Noise Level dB(C)	
	L_{90}	L_{eq}	L_{90}	L_{eq}
7 am – 6 pm	60	69	64	71
6 pm – 10 pm	61	68	64	72
10 pm – 11:30 pm	58	65	61	69

Note. Data from Auditoria Pty Ltd. 2015/2016.

5.3 Opera House Experience with Noise Criteria

The SOH's existing noise criteria were receiver based objectives as follows:

- Sunday to Thursday until 11 pm: L_{max} of 65 dB(A) / 85 dB(C) at Bennelong Apartments, or 60 dB(A) / 80 dB(C) at any other residential receiver.
- Friday to Saturday until 11 pm: L_{max} of 70 dB(A) / 90 dB(C) at Bennelong Apartments, or 65 dB(A) / 85 dB(C) at any other residential receiver.

These controls had not been successful in the past due to background noise contamination and a C – A differential of 20 dB which promotes a bass-heavy sound. Such a differential is unrepresentative of the various genres of music performed at SOH and is more associated with dance music. This encouraged sound engineers to

use excessive low frequency noise/bass (as represented by the dB(C) criteria) to compensate for overly stringent limits on high frequency noise/treble (as represented by the dB(A) criteria). This results in a perverse outcome as it is the lower frequencies which are most intrusive in residential buildings. Moreover, as can be seen with reference to Table 4, these A–weighted objectives were generally below the existing ambient levels in the noise catchment. Consequently, and in recognition of BCC's success at Riverstage, it was concluded that for outdoor events held in the forecourt of the SOH, it would be preferable to set FoH noise limits instead of receiver based limits.

The key benefits of setting new FoH noise limits were identified as:

- better signal-to-noise ratio which allows for a more accurate method for assigning noise to the event by reducing extraneous noise contamination;
- provides regulatory certainty as FoH levels can be used to calculate noise levels at the nearest residents, therefore compliance with the FoH limits would ensure receiver levels are also acceptable;
- allows for continuous real-time monitoring of FoH noise levels by a sound engineer;
- reflects a balanced acoustic spectrum reducing reliance on bass-heavy sound which is known to be the main cause of community complaints;
- allows for proactive management of potential exceedances and quicker corrective action response to noise complaints; and
- provides an auditable log of noise data post-event, thereby reducing compliance burden.

6 PRACTICAL APPLICATION OF ALTERNATE NOISE OBJECTIVES TO THE SOH

6.1 Varying FoH positions

There are 3 stage configurations that are normally considered for events held in the Forecourt and on the Monumental Steps of the SOH. For each configuration, the FoH location will be at a slightly different setback from the stage. Consequently, the equivalent FoH levels need to be adjusted from the standardised 40 metre position using Equation 1. The SOH 40 m FoH location equates to a level 2.5 dB lower than at the 30 metre FoH position adopted for Riverstage.

$$\text{Adjusted FoH Level } L_{Xm} = L_{40m} - 20\log(r_1/40) \quad (1)$$

where L_{Xm} = criteria modified for FoH setback distance X metres
L_{40m} = criteria at a standard FoH 40 metre setback
r_i = new FoH setback distance

6.2 Special event provision

In setting appropriate FoH levels, the evidence indicated that whilst the levels in Table 5 would provide a satisfactory patron experience for the majority of performances, these were conservative and it was recognised that there may be some rock/dance type music performances that acoustically would be sub-optimal at these levels. To accommodate such performances, the three management options discussed in Section 3 were revisited. Equation 2 was used to investigate the time weighted average impact of a 5 dB increase in noise criteria.

$$t_i = \frac{t}{10^{\left(\frac{L_i - L}{10}\right)}} \quad (2)$$

where t = approved event duration — in this case 13h
t_i = modified event duration
L = sound level criteria at FoH — in this case 92 dB(C)
Li = desired sound level at FoH — " 97 dB(C)

It was calculated that in order to maintain an equivalent noise dose it would require the event to be reduced from the 13 hours available between 10 am – 11 pm, to a modified duration t_i of around 4 hours.

Consequently, and consistent with the concept of using both duration and finish time as noise management measures, noise criteria 5 dB higher for events held on the Southern Forecourt and the Monumental Steps was recommended, subject to a 10 pm finishing time and a restricted total duration of not more than 4 hours on any given day (Table 6). This option would give the SOH flexibility to adapt event noise objectives to different music genres for these events and increase noise slightly on occasion where patron experience is predicted to be un-

acceptably low. By restricting event duration to 4 hours it was concluded that a 5 dB increase would not compromise the amenity of adjoining residents. The rationale is that there is no increase in noise dose, and slightly louder music is more likely to be acceptable when it is for a shorter duration and will finish earlier at 10 pm rather than 11 pm.

Table 5. FoH Noise Criteria for Events held between 10 am and 11 pm

Stage Configuration	$L_{eq(5\ minute)}$ dB(A)	$L_{eq(5\ minute)}$ dB(C)
Typical Forecourt Event	92	102
Australia Day	88	98
The Opera on the stairs	80	90
Western Broadwalk A – North End	90	100
Western Broadwalk B – South End	85	95

Table 6. FoH Noise Criteria for Events of no more than 4 hours held between 10 am – 10 pm

Stage Configuration	$L_{eq(5\ minute)}$ dB(A)	$L_{eq(5\ minute)}$ dB(C)
Typical Forecourt Event	97	107
Australia Day	93	103
The Opera on the stairs	85	95

7 CONCLUSION

As part of contemporising the noise objectives for SOH a comprehensive review of the music management practices used in NSW, Australia and internationally was undertaken. This review identified the setting of FoH noise objectives as being the most appropriate measurement and control mechanism for outdoor music events held on a single stage in an urban setting such as the SOH. The process also allowed the development of FoH noise limits which provide an appropriate balance between achieving an acceptable level of patron experience and protecting the amenity of adjoining residents. The FoH noise limits allow for the improved monitoring and management of noise for future events with key benefits, including they can be confidently attributed to an event (i.e. no issues with background noise contamination), allow for continuous compliance measurement and the ability to respond to any exceedances within a much quicker timeframe. A flexible approach to music limits, accompanied by corresponding changes to the duration and finishing times of performances, was also adopted to giving the SOH the ability to better plan for a broader scope of events whilst ensuring that impacts to surrounding noise sensitive receivers are satisfactorily managed.

The contemporary conditions provide a dB(A) / dB(C) differential which is more representative of the range of musical genres performed at the SOH, reflective of a more balanced acoustic spectrum and result in reduced reliance on bass frequencies to meet overall noise level objectives. Since November 2016 there have been 3 major outdoor events at SOH including three Crowded House performances, a Ben Harper performance and Australia Day celebrations. These events did not result in any noise complaints and the noise objectives resulted in positive feedback from the artists and music industry.

ACKNOWLEDGEMENTS

The authors are appreciative of the support of the NSW Department of Planning and Environment to disseminate aspects of the science and logic behind the approval process, however any opinions expressed are those of the authors and do not necessarily reflect those of the NSW State Government.

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