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Acoustics and Sustainability:

How should acoustics adapt to meet future demands?

Sound versus Noise in the Community

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ABSTRACT

Acoustic criteria work on the premise that there are acceptable levels of sound in particular areas and industries. These limits are enshrined in our regulatory codes providing the basis for monitoring and assessing acceptable sound generated by industry, transport, commercial development and entertainment events for example. Such limits are typically annoyance based criteria, derived from community expectations determined through social research and surveys. As our cities increase in density noise is increasingly becoming one of the key factors in how people measure quality of life. Determining acceptable noise limits is changing as the focus of noise intensifies. Increasingly how we manage noise is expected to consider the balance between regulatory limits and the views and experience of people in localities surrounding sites where industry or events generate high levels of sound. While this is not entirely new it does require that we collect and consider additional data from affected communities as well as sound levels generated. Using project case studies this paper explores how our approach to Noise Management Planning is changing to enable us to consider the social context of noise management planning as part of the technical assessment. Identifying the increasing requirement that noise management strategies meet public demand for greater input, transparency in monitoring and recording and in some cases review of regulation. The case studies presented demonstrate the effectiveness of various forms of noise management techniques based on measured noise levels, assessment against goals and importantly the community's response.

INTRODUCTION

This topic is the root of environmental noise impact assessment and discussions around it can be infinite. This paper explores a recent case study to highlight the dilemma for noise management planning of a 'one-size-fits-all' attempt to satisfy a community, in the context of a changing urban environment.

ACCEPTABLE NOISE LEVELS

Determining acceptable noise levels

There often exists a wide chasm between the community's expectation and the need of the operator of the subject noise source.

We have traditionally used a number of strategies to manage this chasm including annoyance based as well as place specific criteria such as industry limits and standards. One reason for adopting annoyance based criteria is that annoyance is linked to adverse health effects, a view consistent with that of the World Health Organisation (WHO). This can be in the form of interference with people's daily activities at school, work or home and leisure time.

However, determining suitable noise criteria for various noise categories varies from place to place (even within the same

country). These range from descriptive qualitative guidelines to specific quantitative targets. It is often found where quantitative noise level based criteria exist, these vary for the different categories of noise sources. For example, it is common in some countries to find noise limits for transport related sources that are much higher than that for industry. This is one way the local environment body attempts to delineate expected community tolerances for different categories of noise.

One reasoning behind this example is that the majority of the community would either drive or at some stage use such transport services, whilst the majority of us will not own an industrial site. This implies that if we are causing the noise we are more accepting or have greater tolerance of it.

Changes in our urban environments has seen changes in the discrete mix of activities with commercial and light industry being mixed with medium and high density development as well as changes in how we use open and recreational spaces such as parks and sports stadiums. In many cases our guidelines and standards have yet to catch up with these changes.

Noise Criteria

There are numerous different types of noise criteria around the world, which we will not get into here. Except to say that

these are typically quantitative (setting guideline noise level values) or non-quantitative (providing good practice management techniques such as time restrictions on noise producing activities) or a combination of both. In terms of quantitative criteria, these are usually fixed threshold values or derived on the basis of existing ambient conditions at receiver locations, typically determined through measurements to establish baseline values.

The case study in this paper looks at criteria specific to a particular site. Performance is measured by these criteria as well as the community's response.

CASE STUDY – COMMUNITY AND MAJOR OUTDOOR EVENTS

Introduction

This project required development and implementation of Noise Management Plans (NMP), inclusive of monitoring, for venues used for sporting and major outdoor concerts and music festivals. Separate plans were developed for venues in line with their major use and existing agreements. Figure 1 shows the site and specific activity venues. It should be noted that Figure 1 only identifies the central, southern and north western grounds (blue outline) of the broader parklands as these were the areas used for music events covered by this study.

As can be seen, the venues are within close proximity to one another and are surrounded by residences, some of which are impacted by several venues. This site is within the Central Business District (CBD) of a major capital city, populated by medium and high density residential land uses. Both the stadiums and the parklands are run by not-for-profit government formed trusts, for the interest of the public.



Figure 1: Site and Surrounding Community – Parkland and stadium event areas are in Blue and Red Outline respectively.

The NMP study included two major components:

1. Acoustic investigation and monitoring which involved
 - Site investigations and review of venue, stage layout & positioning of sound equipment;
 - Noise assessment of previous major events;
 - Noise modelling using three-dimensional terrain to predict levels for prevailing weather conditions;
 - Review of existing ambient & background noise levels;
 - Review & analysis of compliance data;
2. Social Research component which involved

- Consultation with impacted stakeholders;
- Survey of residents living in proximity to the site;
- Communication program;
- Focus group research with residents

In addition to the NMP, we undertook compliance noise monitoring during three major concerts or music festival events in the parklands. Two of these events involved multiple stages spread across the park, and hence required real-time monitoring at each stage front-of-house to delineate between these.

Acoustic Investigation and monitoring

Results - Sports Stadiums

Apart from major sporting events, the stadiums can accommodate up to 50,000 spectators for concerts having large scale music amplification. For the northern most of the two stadium venues in Figure 1, the closest residences are virtually across the road from that stadium.

The operations of the facility were governed by an environment protection licence issued by the local Environment Protection Authority (EPA). This was replaced by the NMP we prepared, which incorporated many aspects of the previous licence. This included quantitative limits and time restrictions for sound test(s), rehearsal(s) and concert(s). These are summarized as described below.

The LAmax and the LCmax measured at the most affected residences does not exceed:

- For activities conducted at the southern stadium: 70 dB(A) and 90 dB(C); and
- For activities conducted at the northern stadium: 80 dB(A) and 100dB(C).

The following also apply:

Concerts: A concert will not commence prior to 1000 hours or finish after 2230 hours on any day. The total length of a concert will not be greater than three (3) hours. Notwithstanding the above, events may continue until 2300 hours if an occurrence beyond the control of the manager delays the event.

Rehearsals: Rehearsals will not commence prior to 1000 hours or finish after 1900 hours. The total duration of rehearsals will be kept to an absolute minimum.

Sound Tests: Sound test(s) will not commence prior to 1000 hours or finish after 1900 hours. The total duration of sound tests will be kept to an absolute minimum.

It is important to reflect on these limits and understand that these relate to principally the same type of noise source, yet are 10dB higher for one stadium. This is more intriguing when it is evident that some residences are exposed to noise from both stadiums. Although there is little likelihood that concerts will occur at both stadiums concurrently, as both are operated by the one organization. These limits are understood to have been derived historically through striking a balance between practicably achievable levels (from a concert operator and patron perspective) and local community response. In this case the stadium (northern) that is in closer proximity to residences has been given the 10dB higher noise limit.

Noise Monitoring Results

The results of typical noise monitoring undertaken during one concert event are shown in Figure 2 by way of example. This

is typical of what was found for various (four) concert events at this venue held over a three year period (post 2000). The data presented is all that was attributed to music from the venue. Where breaches above the limit were identified a warning and instructions to reduce levels was issued to stage operators (as indicated in the chart).

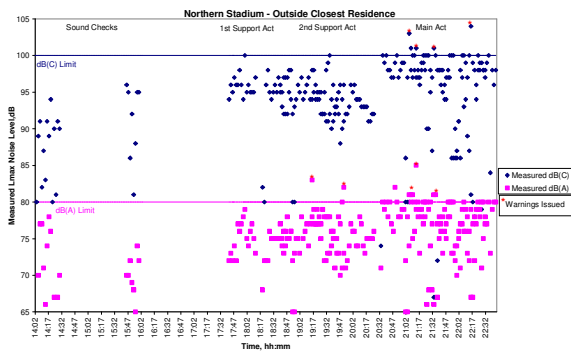


Figure 2: Example Noise Monitoring Data.

Results - Parklands

As in the case of the above stadiums, the site have an operating licence which stipulates prescriptive noise limits as described below. The NMP for this facility is currently being approved by the local EPA as the instrument that will supersede the licence.

Number of Events

Events may be held within the site on a maximum total of eight (8) events in any calendar year. As of 2008, current major music festivals entail three one day events having multi-stage configurations. A series of events may be held over a maximum period of four (4) consecutive days.

This condition does not apply to events of national significance organised by the Australian or State Government. The decision as to whether an event is of national significance lies with these governments.

Hours – Rehearsals & Sound Tests

The total combined duration of event rehearsals and sound tests that are audible beyond the Parklands must be kept to an absolute minimum, and must not exceed five (5) hours for each event. Rehearsals must not commence before 1000 hours or finish after 2200 hours. Sound test(s) associated with an event must take place on one day only and be conducted between 1000 hours and 2000 hours. This time is to be used to obtain a relationship between noise at the venue (eg mixing desk) and at residential locations.

As far as is practicable, sound tests and rehearsals should finish before 2000 hours if held on a day preceding a working day.

Main Event

A main event must not commence prior to 1000 hours or finish after 2230 hours on any day. If the completion of an event is delayed by an occurrence which is beyond the control of the park management, then the event may continue until 2300 hours.

Noise Limits

During the test(s), rehearsal(s) and main event(s), the A-weighted maximum sound pressure level (L_{Amax}) must not exceed 65 dB(A).

During the test(s), rehearsal(s) and main event(s), the C-weighted maximum sound pressure level (L_{Cmax}) must not exceed 85 dB(C).

Exemption for Exceedances at the Start of a New Performance

An exceedance of the noise level limit by a maximum of 5 dB(A) and/or 5 dB(C) during a single five (5) minute period during the first fifteen (15) minutes of the performance of each new separate band or act will not be taken to be a breach. The exceedances permitted by this condition must be kept to an absolute minimum.

Noise Monitoring Results

As for the stadiums, Figure 3 provides an example data set of noise monitoring which was undertaken for one major music festival having four main music stages. On this chart, both site (music) related and non-site related noise levels are shown. This places in context the measured music noise with general noise as observed at residences (typically road traffic). Where music related noise levels approached or exceeded noise limits, instructions were given to stage operators to reduce levels. The dB(C) scale is shown as it better correlates with live music. The data shows that music was at or below levels of ambient noise sources, however as will be explained later, it remained a major cause of complaints. One reason for this was that music was audible throughout much of the day as indicated by the ‘red’ data points.

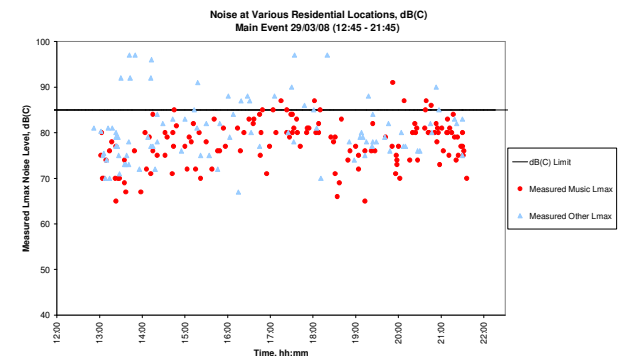


Figure 3: Example Noise Monitoring Data.

Noise complaints

Number and types of noise complaint

Our study looked at the period from 2002 through to 2005. During this period three (3) concerts took place at the southern stadium and three concerts (3) took place at northern stadium. These six (6) concerts included sixteen (16) performances (some concerts had several performances).

A total of forty-six (46) complaints were recorded by the venue management. Of these 46 complaints, 61% (28) related to a concert taking place at the southern stadium and 39% (18) were related to a concert taking place at the northern stadium.

An analysis of complaints received in relation to concerts that took place from 2002-2005 is shown in Table 1. The event held in February 2005 produced the lowest noise levels of all

events and consequently had the least complaints, when averaged over the six(6) days it was held. Further, the complaints for this event were partly attributed to fireworks released as part of the event.

Table 1: Complaints Recorded, 2002-2005

Concert Date	Location	Number of Complaints
29/11/02	Northern Stadium	3
22/03/03	Southern Stadium	16
13-14/12/03	Northern Stadium	7
29/01/05	Southern Stadium	2
2, 3, 4, 5, 7, 8/02/05	Northern Stadium	8
14/12/05	Southern Stadium	10
	Total	46

The types and frequency of queries or complaints recorded are summarized in Table 2. As shown, the majority of concerns (31) recorded in the complaint register were related to noise.

Table 2: Nature and Frequency of Complaints Recorded by venue management, 2002-2005

Nature of complaint	Number of times raised
General Noise Impact	31
Property Vibration	1
Fireworks	6
Received no prior notification that concert was taking place	3
Parking complaint	1
Nature of complaint not noted	4
Total	46

Locations of Complaints

Of the forty-six (46) complaints received, thirty five (35) complainant’s addresses were recorded. Twenty four (24) of these complainant’s were resident within the existing notification boundary – the majority of complainants reside east and south east (within the boundary) of the stadiums. Residents located to the north east of the northern stadium produced the largest number of complaints (5) within the notification boundary. Residents to the north and east of the stadiums generated four (4) complaints each. The remaining 11 (30%) of complainants did not reside within the existing notification boundary, living in the westerly or north westerly direction from the stadiums.

The existing notification boundary and location of complaints is shown in Figure 4.

As noted earlier, in response to review and consultation findings the notification boundary has been expanded to include additional areas.

Recommendations & Conclusion – Stadiums

Early Warning Noise Monitoring – Concerts

A common form of noise mitigation during previous concerts has been the issuing of warnings to the venue management and Front of House (FOH) or sound operators at concerts. This has been done when measured noise levels at residences is at or above limits. On many occasions this has been demonstrated to be effective in controlling subsequent noise levels. It is therefore proposed to improve such warnings from being re-active post breaches of limits to pro-active warnings prior to breaches. This means that warnings will be triggered when measured venue noise levels are not more than 3dB of

limits. This will result in better noise management, reduce the potential for breaches and result in lower noise levels at residences. The 3dB has been chosen on the basis of being slightly above the threshold of human perceptibility and also equates to half of the sound energy.

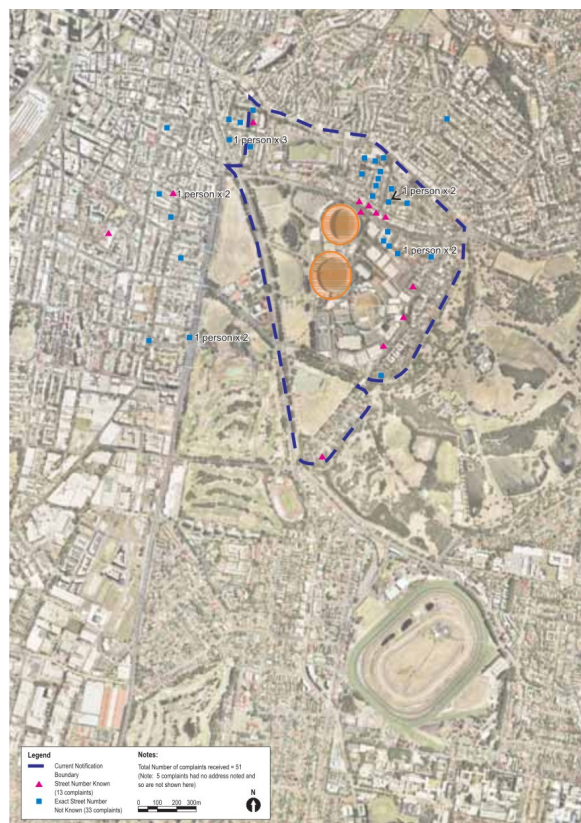


Figure 4: Current Notification Boundary and Location of Complaints.

Sound Amplification Equipment

Any sound amplification equipment used at any time on stadium lands will be installed in such a way as to minimise the noise impact on residential premises or sensitive receivers.

The sound amplification equipment will be maintained and operated in a proper and efficient condition so as to minimise the noise impact on residential premises or sensitive receivers.

Mandatory Pre Concert Sound Checks

Where rehearsals and sound checks are proposed as part of the concert event (typically during the daytime prior the concert) these will be used to inform the concert operators at what internal volume settings residential criteria are met. That is, residential noise monitoring during the day will be used to quantify the internal volume settings so that all parties, acoustic engineers outside and audio engineers inside, are equipped with data prior to the main concert at night. Where such rehearsals and sound checks are not proposed, a mandatory minimum 1-hour sound check will be imposed to test the system (during daytime hours prior to a concert). Typical data that will be reported includes L_{Amax}, L_{Cmax} noise levels at residences, L_{Amax} noise levels at the mixing desk (via attended or unattended monitoring), weather conditions (e.g. wind speed and direction) and other standard details.

Times Of Clean Ups

In the case of events extending into the evening, wherever practicable, street clean-ups will occur during daylight hours on the day following the concert or sporting event, rather than late night/early morning.

Police Presence Before And After Events

The venue management will engage the Police both before and after events for crowd control and minimisation of anti-social behaviour.

Coordination With Neighbouring Venues

The stadium management is a member of a local precinct group, which includes precinct partners, police, transport and other government agencies. The group aims to ensure a coordinated approach to the management of events held at this and various neighbouring venues. The stadium management is also a member of the local events Taskforce established in early 2005. The Taskforce comprises senior staff from relevant venues and government agencies. The Taskforce is responsible for developing short, intermediate and long-term strategies to address the traffic and parking issues facing the precinct and surrounding areas.

Structural Modifications

Given the small number of concerts held per year, the cost of major structural modifications to the stadiums to reduce noise such as enclosing of the roof is not considered financially viable in the medium to longer term for either venue. Consideration is however, currently being given to redevelopment of selected stands at the southern stadium which will result in off-site noise benefits by eliminating or reducing gaps between existing stands. Any future similar works will include consideration of noise control in design.

Ongoing Community Consultation

Ongoing community consultation will be conducted via newsletters. Annually the newsletter will be distributed to residents and other sensitive receivers in the proposed notification area and made available on the venue website. The newsletter will provide contact points for comment by community members.

The newsletter will report on:

Noise monitoring results for concerts, sporting events and other outdoor events with sound amplification held during the preceding 12 months; and

Activities undertaken or proposed to address noise impacts raised by the community during the preceding 12 months through the complaints phone line, email address or other avenues.

Open Day For Local Community

From time to time, the venue management will host an Open Day for residents in the notification area and representatives of sensitive receivers identified in the NMP.

Open Days will work to strengthen the relationship between the venue management and local residents and other sensitive receivers while showcasing to the community the heritage and social significance of the venues and lands.

Monitoring And Reporting Of Sporting Events

At least four times every calendar year, for at least one event at each stadium, noise levels will be continuously monitored by an accredited person throughout the entire sporting event.

The sporting events measured will be representative of the various sporting events held.

A report will be prepared by the consultant detailing the sound pressure levels, exceedances, exceedance management, complaints and other relevant information.

A copy of any report will be kept for at least two (2) years.

Monitoring And Reporting Of Concerts And Other Outdoor Events

For each concert or other outdoor event, rehearsal or sound test, noise levels will be continuously monitored by an accredited person throughout the entire concert, rehearsal or sound test as LMax and LCmax;

During the entire concert, other outdoor event, rehearsal or sound test, a venue management employee or agent is present at the sound-mixing desk for the event and is able to exercise ultimate control of the noise levels from the sound amplification equipment during the event;

The venue management will also ensure that, during the entire concert, other outdoor event, the employee or agent can contact and communicate with all of the persons conducting the monitoring of the noise levels from the concert;

A report will be prepared with full details;

A copy of any report will be kept for at least two (2) years; and

The venue management will report the outcomes of noise monitoring of concerts in the manner described earlier.

Community Issues – Parklands

Analysis Of Complaints Data

Complaints data was reviewed for the major events spanning 2005 to 2007. During the complaints assessment period, nine (9) major events took place, five (5) of which had available complaints data. The events in this period included six multi-stage music festivals (one in 2005, two in 2006 and three in 2007). These typically span 10 hours on one day, with a rehearsal period the previous day. Other major events included three single-stage concerts in 2005.

A total of two hundred and sixty one (261) complaints were recorded during the assessment period. Of these 261 complaints, 57% (148) were generated in relation to events within the central area of the park, 36% (94) were generated in relation to events within the north western area and 7% (19) were generated in relation to events within the southern area (refer to Figure 1).

A break down of complaints received in relation to events that took place from 2005-2007 is shown in Table 3.

Table 3: Complaints Recorded per event (all Multi-Stage), 2005-2007

<i>Event Date</i>	<i>Location</i>	<i>Number of Complaints</i>
29 - 30/09/06	Northwest	36
30/09/07 - 1/10/07	Northwest	58

Event Date	Location	Number of Complaints
16 - 17/02/07	Central	41
18 - 19/02/05	Southern	19
30 - 31/03/07	Central	107
	Total	261

The types and frequency of queries or complaints recorded on the hotline were as summarised in Table 4.

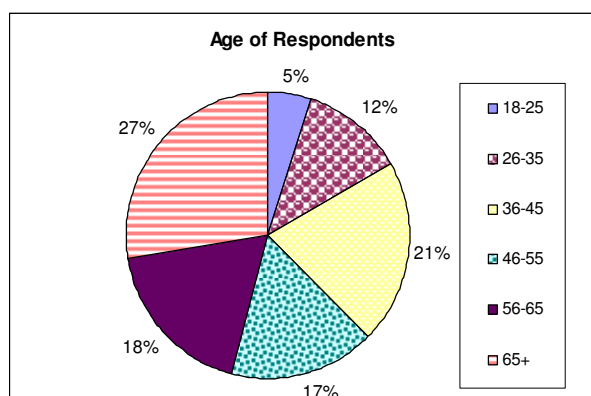
Table 4: Nature and Frequency of Complaints Recorded, 2005-2007

Nature of complaint	Frequency
General Noise Impact	187
Received no prior notification that event was taking place	16
Patron Behaviour (i.e. drunk, urinating in public)	15
Wildlife/Environmental Damage	9
Access to park or homes being restricted	7
Rubbish/Litter	6
Increase in Local Traffic	6
Intrusive Light	1
Nature of complaint not noted	14
Total	261

As shown in Table 4 above, 71% (187) of the complaints were noise related. The largest number of complaints (107) was recorded for one specific festival. One reason for this was the adverse wind conditions noted at the time. On commencement of the social research component of the study, this was derived from analysis of the complaints data available from the park management, feedback from the EPA and our understanding of noise impacts in similar sites. This area was used as the basis for conduct of the study telephone survey, recruitment of focus group participants, stakeholder interviews and distribution of the project information. The study area had a total population of approximately 26,000 people (Bureau of Statistics 2006). This area captured all of the residences from which complaints were received with the exception of one complaint which was well outside the area defined by all other complaints.

A telephone survey was conducted to capture the views of residents in the study area regarding noise generated by the venue. What we found was a relatively stable population with 70% having been resident in the area for 5 years or more. They were also a relatively older group as shown by Figure 5 with more than one quarter (28%) being aged 65+.

Figure 5: Age of Respondents.



Several issues emerged as a result of detailed analysis of the results of the phone survey, and other research activities, in terms of noise generated from the site. The overall results

provided a broad picture of the issues affecting the immediate and surrounding neighbourhood, as well as providing a more detailed understanding of resident perspectives in terms of noise. There were extreme responses to noise within the resident community and polarised views on how the venue should improve its approach to noise management. Most importantly the level of annoyance identified was not consistent with the level of noise which monitoring results showed individual areas experienced. That is those residents who experienced the highest recorded impacts were not necessarily those who reported the highest level of noise annoyance. Having said that the majority of people who heard noise lived within close proximity to the areas where events were held which correlated with historic complaint data. Of those respondents who did hear noise, the majority (91%) associated the noise with music from events (such as the multi-stage music festivals), and 24% identified crowd noise during events. A further 14% associated the noise with specific sounds, for example, “doof doof” sounds or bass noise, and 14% associated noise with people leaving and arriving at events. The majority reported that they heard noise between 4pm – 11pm (98%), followed by noise between 12 noon to 4pm (29%). This smaller proportion linked to the rehearsal and sound testing times for the three larger events held in the park.

Overall, the survey results show that noise generated from events held at the park primarily affected those people who live in its immediate proximity and that these people were prepared to accept the current level of noise as a consequence of living where they do. As part of this trade off however this group felt that there was an obligation on behalf of the venue to manage the other associated issues such as crowd behaviour, event start and finish times as well as maintaining good communication with its immediate neighbours i.e. them for events to continue.

It was quite clear that if the venue was not able to do this in the longer term then the current level of community tolerance would wain.

Focus Groups & Stakeholder Interviews

The focus group and stakeholder interviews which targeted particular groups and members of the community engaged more than 50 people which may seem a small number until compared with previous studies undertaken with a neighbouring venue which managed to engage less than ten people. This work allowed the study team to explore in more detail the underlying issues of concern which the survey research had identified.

While management of the noise generated by the events being held was clearly a key issue of similar importance were issues such as overcrowding of events, damage to open spaces, limiting access to public spaces, littering and antisocial behaviour following large events. How these issues were managed clearly had an impact on peoples opinions on the “acceptability” of the noise and disturbance particular events generated.

Unsurprisingly a key direct noise impact reported was the low frequency or bass noise generated from major events (i.e. all day multi-stage music festivals) and there were a small proportion of people who reported experiencing extreme disruption in their homes as a result of noise generated by the major events held. These people reported being unable to sleep, disruption to sleeping children and not only hearing but also being able to feel the bass generated during performances. Not all of the people who reported these levels of disruption were resident in those areas which noise monitoring

indicated as experiencing unacceptable levels of noise against current standards. For these people however all noise generated by events was considered to be too high and intrusive.

More generally the noise associated with these three events was the focus for people who felt that noise generated by these events was excessive. This included noise levels during testing as well as the event itself. The repetition of testing noise (called a 'sweep' by operators and is used to normalise the sound system) which occurred in the preceding period was highlighted as an irritant particularly because it was repetitive, loud and seemed to be conducted over an extended period. That noise did not stop at the specified time advertised in information fliers was also a key issue.

Reliable starting and finishing times for noise generated from events was also a very important issue for people. A guarantee that the music would stop at the advertised time not 15 or 20 minutes later as was a strong component in determining its acceptability for people. Importantly here the level of annoyance was not only about the noise generated but meeting the expectation that it would finish at a certain time. Similarly, of almost equal importance was the disruption to the surrounding community associated with people leaving major events. This included poor crowd behaviour, rubbish associated with events, traffic and parking difficulties for residents.

The inability to have any control over the noise was also a source of annoyance whether because individuals were not consulted about activities or whether they had been informed about an upcoming event. The lack of prior information, and therefore ability for residents to avoid an event by going away for the weekend was an important factor in people assessment of whether an event was tolerable or not. Good communication by the venue about an event was seen as an indicator of the level of respect and consideration the venue had for its neighbours. Poor communication was interpreted as a lack of consideration, similarly poor responses to complaints intensified the level of annoyance some individuals felt.

The clear lesson here is that management of noise generated by events is an important issue but that overall management of an event and of the relationship a venue has with its surrounds will determine the level of annoyance.

This will have impacts both positive and negative for venues in their choice of approach.

Monitoring Community Satisfaction And Understanding

The results from our research with the immediate and broader community assisted in development of a management approach to noise and event management in this case. They also reinforced the need for a range of measures which the venue was considering adopting in future.

The research was useful in identification of issues associated with noise but also generally issues regarding the impact of the venue on its surrounding community. Continued monitoring of the level of satisfaction and understanding of residents within this community will enable management to evaluate the effectiveness of the strategies which are adopted to manage noise. One recommendation is that management develop a formal system to monitor resident views and identify impact. This could include:

Conduct of a survey of residents in the study area identified in the report.

Conduct of more regular surveys would provide objective data on current views and issues and over time measure the effectiveness of mitigation strategies adopted.

Focus group research say bi annually. Again, focus group research would provide a longitudinal view of community views on noise impacts allowing the park management to gauge the impact of measures taken to manage noise. Most importantly however this style of research allows park management to engage with a cross section of the general community as opposed to a particular interest group ensuring that they have a representative view of the priorities and issues of concern to their neighbours.

Conclusion - Parklands

The study identified clearly that residents in the immediate vicinity of the park were those most affected by events. As such they constitute an easily defined stakeholder group that merits special attention. It was suggested a communication strategy which targets this group be established including activities such as:

An Immediate Resident email register; this would provide information to immediate residents about events.

Production of a Quarterly newsletter or flier which provides information about management activities, information lines, noise monitoring results and complaints management systems.

Bi annual invitation to neighbours "gathering". In the main people reported that public meeting or forums did not provide an opportunity for them to discuss issues of concern. A less formal opportunity was suggested such as a social gathering where management of the venue and its neighbours could meet and discuss issues, exchange information and make suggestions.

CONCLUSION

The above case study considered large scale live music events in an area surrounded by residential land uses. It included development of Noise Management Plans, noise monitoring, including analysis of data collected over several years, noise modeling and social research for a broad area of the surrounding community.

By raising noise issues with venue operators, music promoters, the community and government stakeholders, dialogue was established between all parties either directly or via our involvement. The information gathered suggested that only a relatively small number of residents were highly annoyed by music noise, irrespective of whether set noise limits were satisfied. However, by better informing the community and arming them with information such as the existence of noise limits and reasonable noise management practices, tendered to alleviate a lot of the angst. On the other hand, the music promoters were getting increasingly frustrated with venue managers having less and less flexibility in the way they operated their sound systems by the increasing noise management controls. Such controls included real time internal and external noise monitoring by attended means and having direct communications protocols during major events facilitating proactive control on music noise received at residences.

The key to the ongoing success and coexistence of such large scale music venues within residential areas is to ensure you have a good understanding of the obvious generators of annoyance but also the underlying issues which contribute to

the judgement communities make about acceptability of noise in the places they live. As our urban environments change how acceptability is determined will increasingly be an area for debate and therefore a challenge for noise management planning practitioners.

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