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LIVE MUSIC SOUND MANAGEMENT – FROM THE WOMB TO THE TOMB

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1. INTRODUCTION

We suspect that the title of this paper has caused some raised eyebrows and some curios thoughts – *many along the lines of what on earth are they on about.* Well, we thought it aptly – if tongue in cheek – described the range of services we, as acoustic consultants, provide in the overall process of staging live music events, namely concerts.

Initially we act as (one of many) midwives in the birth of an idea by a promoter/band/artiste/venue operator to stage a concert – they conceive the idea and we nurse them through the labour pains of the licensing regime. The event itself might be considered a fun filled family holiday, or perhaps a mid-life crisis would occasionally be more apt. After the concert, we sometimes feel like a coroner, dissecting the whys and wherefores and finally the undertaker laying the outcome to rest, having learnt from the experience.

Of course all of this sounds a bit pompous and is meant to be light-hearted but underlying the frivolous analogies lay our role in assisting the *conceivers* of these concerts from proving the feasibility or otherwise of their proposals through to possibly having to mount a defence in court, should claims of nuisance or a breach of licence condition arise. It should also be noted here that consultants such as ourselves also represent local authorities in their deliberations concerning the acceptability of proposed concerts and that therefore we have to always take a balanced and fair view of the proposals no matter the nature of our client.

In essence this paper sets out to describe the role of the acoustic consultant, in more down to earth terms that referred to above, in the live music industry. We also seek to illustrate the responsibility of other key players who, like us, have a role in making a concert a success with respect to obtaining a fine balance between ensuring sufficient *sound* to provide a satisfactory form of entertainment for the audience whilst minimising the *noise* intrusion for nearby residents.

Symonds has monitored and controlled over 400 music events since 1988. The range of events and venues has been vast from the traditional 'pop concerts' held in Stadia or purpose built indoor venues, to festivals held in green field sites, to all night music events 'raves' held in cow sheds, to canto pop music held in the Hong Kong Stadium to classical concerts held at notable venues such as Kenwood House and Leeds Castle. The sound management for these events has been developed from a common control procedure, however, the precise process has to be tailored for each specific event.

To date, the control procedures have been successful in that no action has been taken through the courts with respect to noise for any of the UK music events where we have implemented a sound management procedure.

2. GUIDELINES

The first environmental noise guidelines for music events were published by the GLC Code of Practice [1] in 1976. These were based on a comparison of the music L_{A50} with the background noise L_{A50}. For outdoor events, an increase of up to 10dB(A) was allowed up to 2000 hours reducing to 6dB(A) until to 2300 hours. This guideline was applicable for up to three events per year. For more frequent events and for all indoor concerts, a 1dB(A) increase of the L_{A50} was allowed.

At night, from 2300 hours to 0700 hours, the Code stated that the sound from the music should not be audible within any premises.

Throughout the 1970's, the use of the L_{Aeq} index to describe disturbance, following dose response studies, was becoming the norm, and with the many improved sound level meters being able to measure L_{Aeq}, the GLC reviewed their work [2] and replaced L_{A50} with L_{Aeq}. The Code was revised in 1978 to reflect this change with a further minor revision in 1985 [3].

Since this time further research [4][5] resulted in the publication of the latest guidance adopting absolute values for up to 3 events per year and a comparison of Music Noise Level (MNL) with the background L_{A90}. This was published in a Code of Practice by the Noise Council in 1995 [6]. The familiar guideline table is reproduced in table 1.

The Music Noise Levels (MNL) when assessed at the prediction stage or measured during sound checks or concerts should not exceed the guidelines shown in Table 1 at 1 metre from the façade of any noise sensitive premises for events held between the hours of 0900 and 2300.

TABLE 1

Concert days per calendar year, per venue	Venue Category	Guideline
1 to 3	Urban Stadia or Arenas	The MNL should not exceed 75dB(A) over a 15 minute period
1 to 3	Other Urban and Rural Venues	The MNL should not exceed 65dB(A) over a 15 minute period
4 to 12	All Venues	The MNL should not exceed the background noise level[1] by more than 15dB(A) over a 15 minute period

The Code also addresses the issue of low frequency noise, and from research at that time [7], a noise level of 80dB in the 63Hz or 125 Hz was shown to cause complaints of low frequency noise, whereas a level of 70dB in these octave bands was satisfactory. With limited research available this guidance was issued as a note for information.

The guidelines in table 1 are for daytime events. For events held at night, after 2300 hours, the Code specifies an inaudibility criterion, assessed inside a premises with the windows open for ventilation. There was much debate by the Noise Council committee on this issue and with the limited research in this area at that time, this was felt to be the safe option.

Since the publication of this Code, other work [8] has indicated that the inaudibility criterion may be an unnecessarily stringent guideline to apply to one off all night events. An absolute guideline has been successfully adopted [9] restricting one-off all night events to an external L_{Aeq} of 45dB(A).

3. FEASIBILITY STUDIES

In the early days, sound management was mainly related to the control of noise during the event. However, over the past decade, concert promoters have been educated on the importance of noise related to the viability of an event. Not dissimilar to the account that has to be taken for noise for Development Planning, noise feasibility studies are now undertaken in many cases to establish the following:-

1. Whether the music event is viable on noise grounds,
2. The likely predicted noise levels inside and outside the venue
3. The need for noise control measures
4. The detail and options for effective noise control
5. To provide details on all noise issues required by the Licensing Authority.

A critical step at the feasibility stage, is to be able to accurately predict the likely noise levels in the community. Clearly, incorrect advice at this stage can have serious consequences on noise at a later date.

Historically, our predictions have been primarily based on empirical data, but more recently, research has been carried out to more accurately assess long range sound propagation from concert sound systems.

Recognising the fact that, unlike most environmental noise sources such as roads, railways and industry, there is, at present, no standard method for predicting and assessing music noise impact from outdoor concerts, Symonds recently embarked on the development and validation of a practicable model to predict sound propagation from large outdoor music festivals.

The model was constructed by considering individually, the input of Source, Propagation and Receptor information. In conceptualising the development of the model, it was apparent that there is a wealth of research on outdoor sound propagation theory, but that information relating to the definition of an arrayed sound system as a noise source was limited.

Technical data offered by sound system manufacturers is generally specific to performance qualities of system components, as opposed to established radiation characteristics that would normally be associated with a typical noise source. It was considered that the most important aspects in defining the whole of a concert sound system as a noise source were music noise levels and directivity, (which from a concert promoter's point of view would relate to adequate sound level and audience coverage). We know that modern popular music audiences usually require at least 95 dB(A) with a tendency for high levels of bass. Hence, the main stumbling block in describing a large arrayed sound system was to define system directivity.

A literature search highlighted that although it may be possible to accurately predict directivity of arrays, the methods require a high degree of data acquisition and processing. It was considered that such accurate definition may in any case, be unnecessary, where in reality the significance may be blurred by multiple reflections, atmospheric scattering, and multiple sources facing in different directions. Furthermore, it was recognised that in terms of sound propagation beyond audience areas, we are most concerned with low frequency music noise, and that sound systems characteristically tend towards omni-directionality at the bottom end of the spectrum. The most appropriate approach in providing practicable source input data, therefore, was to measure the directional characteristics of a large arrayed sound system typically used at outdoor festivals. The outcome of a measurement exercise was a series of frequency polar response plots, which could be used to define a typical concert system as a noise source.

In terms of outdoor sound propagation theory, much of the published research on specific elements such as ground or meteorological effects was considered academic and in many cases has not been widely adopted. On this basis it was decided most appropriate to implement selective prediction techniques offered within ISO 9613 [10] and CONCAWE [11]. Taking care to avoid conflict between methods, it has been possible to provide detailed consideration of environmental conditions during propagation.

Having developed a practicable model, a validation exercise was conducted. This entailed a strictly controlled experimental music noise measurement survey during a large outdoor concert, where all environmental conditions were recorded. The results of the validation indicated that an accuracy of 2 dB(A) could be achieved. Statistical confidence limits compared closely with CONCAWE [11] confidence deviation and trend.

It is considered that the development and validation of a practicable model for predicting sound propagation from large outdoor music festivals should benefit all party's involved in such events, by providing an accurate and confident feasibility evaluation. Further work is ongoing on defining various source characteristics for different types of concert sound system.

4. EXPERT WITNESS

An important role of the consultant is that of acting as an expert witness at any legal hearings that may be involved with the event. Although there are various avenues that the legal process can take, depending on the nature of the proposed concert(s), generally for a one –off or short series of concerts the initial stage is a formal proposal document (by the promoter or venue owner) being considered by local authority officers. The officers make their recommendations, which are then, together with the proposal document, put before a licensing committee made up of elected local authority councillors.

Consultants frequently represent the promoter/venue owner at the license hearing to explain the assessment and conclusions first hand to the committee and any objectors there might be and to face any cross examination by these parties. In controversial/sensitive cases the promoter/venue owner is often assisted by solicitors and/or barristers to enable the case to be put formally to the committee.

The committee may decide not to grant a licence to the promoter/venue owner who is then at liberty, if they consider they have a valid case, to appeal the decision at a Magistrates Court. The particular aspects that the application was refused on are then debated, with the consultant again providing testimony both written and verbally. Obviously the greater the experience of the consultant and fairness in which they have conducted any assessment the better the likelihood is for a positive results for the promoter/venue owner.

The consultant will always need to be vigilant and reasonable otherwise anything they have to say in future cases will be viewed more sceptically. Further instances of the consultant acting as expert witness are discussed later in Section 7.

5. ASSISTING PA COMPANIES

More and more of the PA companies involved with concerts are becoming (some for a long time previously) aware of the importance, where necessary, to provide a sound system that not only delivers the appropriate quality and level of sound to the audience but also contains the sound within the venue as much as possible. The PA companies are experts in their field of providing a

sound system that delivers the appropriate quality and level of sound to the audience but there is often a role for the consultant to assist with measures and concepts to contain the sound.

There is inevitably an element of compromise here, but providing sufficient thought is given to the issue well in advance of the concert(s) the simple control of turning down the volume is minimised and some PA companies do actually go to considerable lengths to contain the sound.

The consultant can assist in various ways from actually advising promoters/venue owners, especially in one–off festival situations (as opposed to long tours) on the actual system that would be most appropriate and the PA companies with the greatest experience in containing sound. An example of this is a venue, not on these shores, where we know for a fact (through our work there) that a certain type of, long established, PA system (well known!) will nearly always produce around 10dB(A) more at residential properties for the same given level at the mixer than many other systems.

The consultant through their experience of witnessing numerous different systems (virtually all the widely used systems) at common venues can advise on a wide range of practical measures to contain sound or minimise disturbance and work with the engineers from the PA companies to arrive at the most feasible solution for a particular situation.

6. NOISE CONTROL DURING CONCERTS

Experience has shown that events where there has been thorough consultation with all parties involved in an event, including, at an early stage, the local authority, (prior to the event) run the most smoothly during the event. A meeting prior to the event, preferably on site with layout drawings and details of the sound systems to be used, is a useful forum in which to raise concerns anybody may have. For example, local authorities may have useful local knowledge regarding the area which can assist is establishing an off-site measurement strategy beforehand. Circumstances during the event may require this to be amended as the concert progresses. It may also give an opportunity to make changes to the site layout that can increase the propagation distances or change the orientation between sources and nearby sensitive receptors.

For events which run through the night, and license conditions change at 23.00 hours to reduce off-site noise levels, we have spoken to the promoter and artist's representatives to change the running orders in arenas thereby maximising on-site noise levels for headline acts. Feedback from these sources has been generally positive when such changes have been suggested,

It is also useful to carry out an initial propagation test on the evening before the event, but generally before 22.00 so as not to create more off-site noise at unsocial hours than is necessary, preferably in the presence of the EHO. Meteorological conditions may change between such tests and the event, but conducting the test pre-event allows for some adjustments to be made if necessary that may reduce off site noise levels. Any sound system testing should be restricted to 10.00 hours - 20.00 hours wherever possible. As the sound systems do not often arrive on site until the day before an event, this can be very tight, but no testing should occur after 22.00 hours.

On the day of the event, logging sound meters should be set up at the mixing positions in each arena. Where there are no 'live' acts on a stage, the mixing position may be either to the side of, or behind the stage, and the sound level shown on the meter will not necessarily represent the sound level in the area itself. For example the mix position may be located directly behind speaker stacks or unduly influenced by the monitor speakers serving the D.J. podium. There is generally a lighting tower set up in the front of house position at an event. This position, or some other clearly identifiable and easily accessible point should be used to set the level for the arena. The level shown on the meter at the mixing position should then be noted, and this level used as the

reference level for the engineers' benefit. As the audience fills up the arena, the propagation between these two points is likely to change. Propagation tests should be carried out in these arenas during the event and any changes relayed to engineer. Symonds are currently investigating the logistics of installing remote microphones at audience related positions connected to rear of stage mix position sound meters. This would obviate the need for such arrangements within arenas. It can help to have a sign at the mix position indicating the level maximum level to which the sound is to be controlled.

Clear communication between members of the sound control team and the local authority is crucial to a smooth control operation. Dedicated radios have been found to be the best method for achieving this on site. Mobile phones are a useful backup, but high level of on site use of phones can often cause a delay in response. They are however useful when communicating between on and off-site locations, as the distances that can be involved are beyond the range of may radio systems.

We have found that using $L_{Aeq,1\ minute}$ periods at the mix positions provides the most satisfactory measure by which to control sound levels on site. All sound level measurements taken both on and off site should be taken in such a manner that may assist future license applications. All sound measurements should be taken with Type 1 sound meters. Details of off site meteorological conditions should be noted, and the outcome of any adjustments to sound levels be recorded for future reference.

Frequent off site checks need to be made, and during an event it often becomes apparent that propagation is of more concern at particular locations. The balance of off-site monitoring should be adjusted to reflect these changes. If an area is prone to temperature inversions, and this information is often available from the local authority, particular attention must be taken at these times.

The control strategies adopted have proved successful to date, aided no doubt by our long history with such events. Independent sound control acts as a useful interface between the local authority and the event production including the sound system company. Our experience over the wide range of environmental noise issues and the employment backgrounds of our consultants has helped foster an atmosphere of trust and understanding between the persons involved in events. Over the years, we have found that promoters and sound system companies are much more aware of the importance of independent noise control to the continuation of these events in noise sensitive locations. They offer useful advice and are co-operative when control measures which may result in reduced arena sound levels have to be implemented.

7. POST EVENT

Hopefully, through all the careful preparation beforehand and control during, the concert(s) run smoothly and without causing undue disturbance to the venues neighbours but of course there are times when you can't please everyone.

For instance, the local authority or neighbours may claim certain license conditions were not met or the expected disturbance was greater than envisaged. The promoter/venue owners may find themselves faced with possibility of landing in court with a prosecution under the terms of the Environmental Protection Act. The consultant would then be expected to liasie with the parties involved to prevent a court appearance or mount a defence, assuming that it is justifiable, and again act as expert witness.

In any case, the lessons that can be learnt, be they positive or negative, should be recorded and used for future reference either at further events, at the same venue, or for feeding back into guidelines for concerts in general.

8. CONCLUSIONS

This paper has considered the life circle of live music sound management, discussing the laws which must be met, the reasons and measures of assessing feasibility of concerts, the attitudes of the industry towards problems of music noise, and our independent approach in providing advice, be it in court gaining permission, or in a field ensuring control with all other parties.

Some parts of the discussion may strike fear into anyone proposing a concert at a venue where noise is a particular issue but it should be emphasised that through the diligent application of their role, the consultant can greatly reduce the likelihood of major problems arising.

To put this into perspective we have been carrying out the acoustics consultants' role for over twenty years now and no action has progressed through the courts post any concert.

9. REFERENCES

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