# AN EVALUATION OF UK AND INTERNATIONAL GUIDANCE FOR THE CONTROL OF NOISE AT OUTDOOR EVENTS

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## 1 INTRODUCTION

The most current guidance document used in the UK for the control of music noise at events is the *'Noise Council, code of practice on environmental noise control at concerts, 1995'* (referred to going forward as the 'Pop Code'). The published levels from the Noise Council are presented in Table 1 below.

*Table 1 - Summary of the suggested limits presented in the Pop Code*

| | No. of events per year | Music Noise Level |
|---|---|---|
| **Stadia** | 1-3 | 75 dB(A) |
| **Urban and Rural sites** | 1-3 | 65 dB(A) |
| **All Venues** | 4-12 | + 15 dB(A) above background |

Research undertaken in 2006 (Griffiths & Staunton, 2006) suggested that the guidance would benefit from further refinements to the noise levels, the number of concerts and the categories used. However, this research was never progressed further and at the time of writing this current article in September 2020, the Pop Code remains the most up-to-date guidance on the control of music noise at events. While the Pop Code is currently the main guidance document in the UK, it is not uncommon for individual events to deviate from that guidance.

## 2.0 UK RESEARCH

### 2.1 Current UK Practice

By taking a sample of 71 event venues across various cities within the UK, an overview of the range of limits and conditions applied can be produced. These 71 event venues are a culmination of all of the venues in which Vanguardia Ltd worked during 2019.

The assessed events can be divided into two distinct categories: 'stadia' or 'urban and rural sites', as is suggested in the Pop Code. Once divided into the two venue categories, each of the events can be further broken down into:

- The measurement period used for assessment
- The offsite limit at the closest noise sensitive receiver

- The onsite limit at a front-of-house location

Tables 2 to 4 summarise each of the evaluation points detailed above.

*Table 2 - Summary of measurement periods for each venue type*

| | Period in Minutes | Urban and Rural sites | Stadia | Overall |
|---|---|---|---|---|
| **Measurement period** | **5** | 3 | - | 3 |
| | **10** | - | 1 | 1 |
| | **15** | 52 | 18 | 70 |

Although the sample comprises a total of 71 event venues, Table 2 presents 74 measurement periods. This is because three of the venues in the sample use separate measurement periods for onsite and offsite measurements. A total of seventy venues use the suggested 15-minute measurement period laid out in the Pop Code. Meanwhile, one venue uses a measurement period of 10 minutes and three venues use a measurement period of 5 minutes. Two of the three event venues that use 5 minutes as a measurement period are parks located in central London.

*Table 3 - Summary of offsite limits used for each venue type*

| | Limit dB(A) | Urban and Rural sites | Stadia | Overall |
|---|---|---|---|---|
| **Offsite limit** | **No Limit** | 1 | - | 1 |
| | **$L_{90}$ + 10** | 1 | - | 1 |
| | **$L_{90}$ + 15** | 3 | 1 | 4 |
| | **45** | 1 | - | 1 |
| | **50** | 1 | - | 1 |
| | **55** | 1 | - | 1 |
| | **60** | 1 | - | 1 |
| | **64** | - | 1 | 1 |
| | **65** | 12 | - | 12 |
| | **68** | 2 | - | 2 |
| | **70** | 8 | 1 | 9 |
| | **71** | 2 | - | 2 |
| | **73** | 2 | - | 2 |
| | **75** | 23 | 15 | 38 |
| | **79** | 1 | - | 1 |
| | **80** | 2 | - | 2 |
| | **84** | 1 | - | 1 |

Over the 71 event sites there are 80 different offsite limits in total. This is the result of some venues using a combination of limits depending on the distance between the venue and the receiver location. Table 3 shows that of the 71 event sites, a total of 54 venues use one of the guidance values suggested by the Pop Code (38 using 75 dB(A), 12 using 65 dB(A) and 4 using the $L_{90}$ level + 15 dB(A)). However, when comparing the limit used by the venue against the venue type, the results suggest that only 25 of these use the suggested guidance in the Pop Code appropriate to their venue type. Furthermore, a total of 27 urban and rural venues use 75 dB(A) or higher as an offsite limit. This suggests that a large number of venues are basing their limits on what is now becoming best practice, rather than using the suggested Pop Code limits.

Of the 71 venues, 17 venues use only levels that do not correspond with the Pop Code (are neither 75 dB(A), 65 dB(A) or L90 + 15 dB), with chosen offsite limits ranging from 45dB(A) up to 84dB(A), with one venue using no offsite limit of any kind. It should be noted that some venues use a combination of limits, with some corresponding to the Pop Code and some being based on best practice.

*Table 4 - Summary of onsite limits used for each venue type*

| | **dB(A)** | **Urban and Rural sites** | **Stadia** | **Overall** |
|---|---|---|---|---|
| **Onsite limit** | **98** | 2 | - | 2 |
| | **101** | - | 1 | 1 |
| | **103** | - | 1 | 1 |

There were four events in total which had onsite limits ranging from 98 dB(A) to 103 dB(A). Three of these were also paired up with an offsite limit of either 65 dB(A) or 75 dB(A), dependent on their venue type, while one venue chose to control noise using an onsite level of 98 dB(A) and no offsite level. Other venues did have onsite target levels, but these were designed more as suggested levels as opposed to set limits.

What can clearly be seen from Tables 2 to 4 is that across the different events and venues there is a large amount of flexibility in the limits, brought about through the use of best practice and deviation from the Pop Code suggested limits.

## 2.2 UK Population Density

In order to define suitable limits for different venues, it is worth looking at current relationships between the limits being used successfully by events and other available data that could have influenced the setting of those limits. A potential contributing factor to the level of the limits used is the population density of the surrounding area. The higher the population density, the more people there are around the event site, and in turn the higher the background noise level (Stewart et al, 1999) which may influence the limits being applied.

Figure 1 plots the upper dB(A) limits used at UK event sites against the population density of the local area. The population density figures correspond to the local borough or district in which each event site is situated.

The correlation becomes apparent in Figure 1 with the application of a linear trend line.

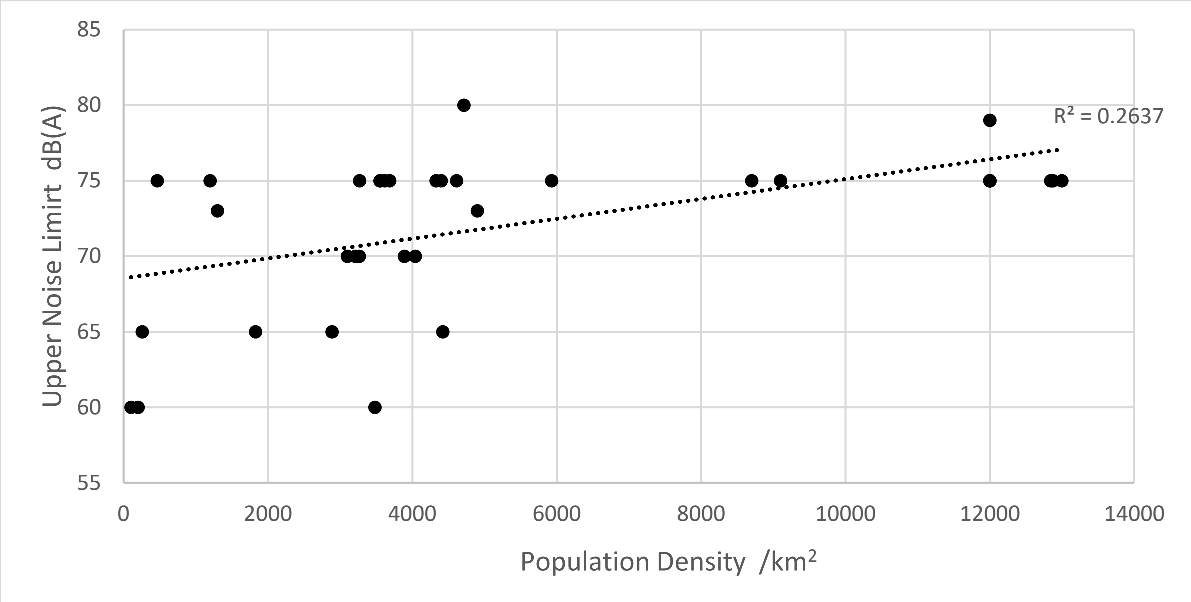


*Figure 1 - Upper dB(A) limit used in practice against population density of local area (UK)*

In social and behavioural science, an *R*-squared value is a calculated number between 0 and 1 that indicates the potential correlation between two variables. An *R*-squared value of 0.26 or higher indicates a large correlation between the dependent and independent variables (Cohen 1988). As the *R*-squared value in Figure 1 is 0.2637, this suggests that there is a large correlation between the limits used in practice in the UK and the local population density. Therefore, there is great potential for population density to be used as a guidance measure when deciding upon licence limits for new events or new event sites where councils or governing bodies are unsure of what a suitable limit would be. This is particularly relevant given the demonstrated tendency for individual events to deviate from the guidance currently laid out in the Pop Code.

## 2.3 UK LOW FREQUENCY

Until this point there has been limited guidance on low frequency noise, except for '*A study of low frequency sound from pop concerts''* (Griffiths, Staunton & Kamath, 1993) which, while not legislation, did address the issues of low frequency noise that concerts can have. The article indicates that at frequency bands of 63Hz and 125Hz, with a level of 80 dB(A) there would be a high probability of receiving complaints relating to low frequency at a distance of 2 km. The article goes on to suggest that, at a distance of 2 km, a level of 70dB(A) in the 63Hz and 125Hz octave bands is satisfactory. While this does address the issue of low frequency noise, it only accounts for music noise levels at a distance of 2 km and does not suggest limits or target levels for noise sensitive premises within this radius. Tables 5 to 7 give a break-down of the low frequency limits that were used at the 71 sample event venues during 2019, together with an analysis of which category of venue used the limits.

*Table 5 - Summary of 2 km offsite low frequency limits for each venue type*

| | dB(Z) | Urban and Rural sites | Stadia | Overall |
|---|---|---|---|---|
| **63 and 125Hz limit** | **75** | 3 | - | 3 |
| | **80** | 1 | - | 1 |
| | **85** | 1 | - | 1 |

*Table 6 - Summary of 'closest noise sensitive receiver' low frequency limits for each venue type*

| | dB(Z) | Urban and Rural sites | Stadia | Overall |
|---|---|---|---|---|
| **63 and 125 Hz limit** | **65** | 1 | - | 1 |
| | **80** | 1 | - | 1 |
| | **85** | 1 | - | 1 |

*Table 7 - Summary of 'closest noise sensitive receiver' C-weighted limits for each venue type*

| | dB(C) | Urban and Rural sites | Stadia | Overall |
|---|---|---|---|---|
| **C Weighted limit** | **90** | 2 | - | 2 |

From the above tables, it can be seen that there are only ten events that had low frequency limits, comprising only 14% of all the venues. Five events had low frequency limits in the 63 Hz and 125 Hz octave bands at a distance of 2 km. Three events had low frequency limits in the 63 Hz and 125 Hz octave bands at the closest noise sensitive receiver, while two events had a C-weighted limit at the closest noise sensitive receiver.

This means that out of a total of 71 sampled events only 10 events chose to use low frequency limits, and these varied widely in their level and application. It should be noted that all of the event venues that applied low frequency limits fall into the Pop Code category of urban and rural sites.

While low frequency limits are not currently a dominant feature of venue limits, there is the potential for them to become so. An evaluation of measured octave band frequency data from the sample events has been used to determine the average octave band spectrum and $L_{Ceq}$ at the front-of-house position for a selection of different genres. The genres of music have been categorised according to how they were labelled in the promotion of the event.

In Table 8 the results have been normalised to produce an A-weighted front-of-house level of 98 dB(A), which is the primary target front-of-house level used at events.

*Table 8 - average octave band levels and LCeq of different music genres*

| | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | $L_{Aeq}$ | $L_{Ceq}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pop** | 108 | 98 | 95 | 95 | 94 | 90 | 84 | 81 | **98** | **110** |
| **Alt & Rock** | 109 | 100 | 97 | 97 | 92 | 88 | 84 | 78 | **98** | **110** |
| **Urban** | 113 | 98 | 96 | 94 | 94 | 90 | 86 | 84 | **98** | **114** |
| **Dance** | 116 | 101 | 96 | 94 | 93 | 89 | 85 | 83 | **98** | **116** |

From Table 8 it is clear that there is a large difference in the C-weighted level between the genres when they are directly compared; this is predominantly due to the amount of low frequency being produced, which can be seen from the levels in the 63 Hz band.

With pop music having an average $L_{Ceq}$ of 110 dB and a level of 108 dB at 63 Hz, and dance music having both a C-weighted and 63 Hz octave band level of 116 dB, the disparity between the different genres is clear.

This comparison is a perfect representation of how the amount of low frequency energy has been increasing in some of the emerging genres of event music; for example, urban music such as grime or R&B and different sub-genres of dance, none of which were particularly prominent in the UK when the guidance for events was written in the 1990s. It is worth noting that Michael Jackson, the so-called 'king of pop', was the bestselling artist in 1995 when the Pop Code was written, whereas in 2018 and 2019 it was Drake, known for his R&B and Hip Hop, both of which fall into the urban genre category.

# 3.0 NATIONAL AND INTERNATIONAL

## 3.1 International and National Limits

In addition to the UK event limits evaluated above, events limits used in practice in international cities together with the limits laid out in national guidance from various countries have also been analysed in order to provide a comparison with common practice in the United Kingdom. To investigate the limits used in practice in international cities, data is collated from a sample of fifteen cities and regions from nine different countries: Canada, the United States of America, and seven European countries. Meanwhile, the evaluation of national guidance limits laid out by different countries has been assessed for fifteen countries from across the globe. This selection of countries and cities is extracted from the 2020 AES Technical Document for understanding and managing sound exposure and noise pollution at outdoor events (Hill et al, 2020)

A breakdown of (i) the dB(A) limits used in practice in international cities and (ii) the limits put forward as national guidance is presented below in Figure 2*Figure 2 -* .

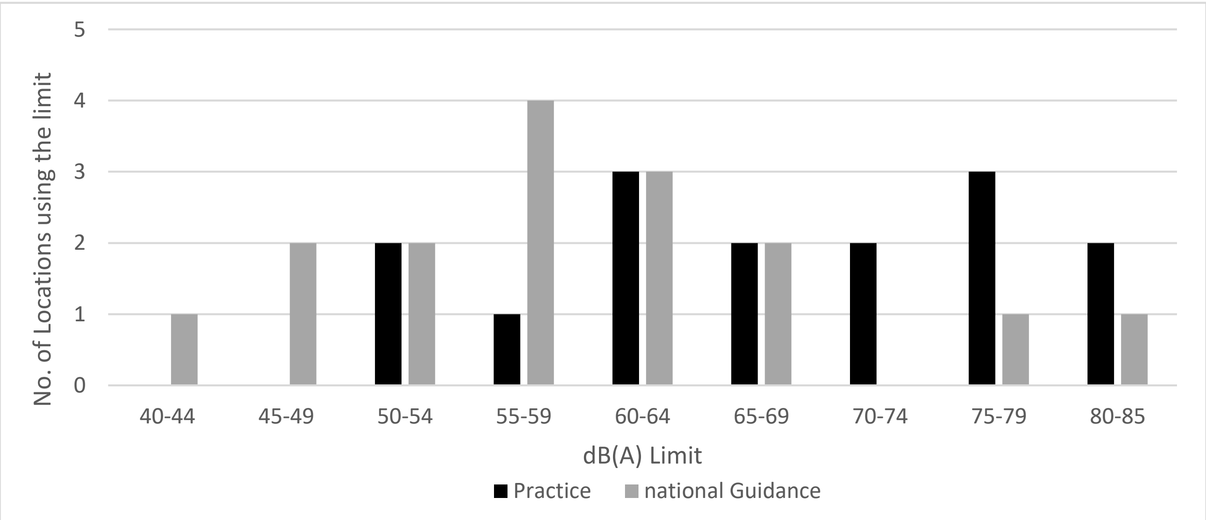


*Figure 2 - Upper dB(A) limits used in practice in international cities and laid out in the national guidance of different countries*

It is clear from Figure 2 that the most common limits used in practice in international cities fall in the 60 - 64 dB(A) and 75 - 79dB(A) categories. This is not too dissimilar from the outcome of the UK evaluation, where the most commonly used limits were 65 dB(A) and 75 dB(A). It can also be seen that the most frequently occurring national guidance limits are in the ranges of 55 - 59 dB(A) and 60 - 64 dB(A).

From Figure 2 it can be seen that the practical limits implemented in international cities are generally higher than the national guidelines for the countries considered. Examination of the national guideline data reveals that only thirteen percent of the countries that were considered have guidance limits of 75 dB(A) of higher, whereas thirty-three percent of those event venues in international cities that were considered implemented limits of 75 dB(A) or more.

## 3.2 International Cities Population Density

Following the same approach as for the UK limits, the upper dB(A) limits used in practice in international cities are plotted against local population density in Figure 3 3. However, unlike with the UK data, here each population density value is for the entire city rather than the exact local borough or district in which the event venue is situated.

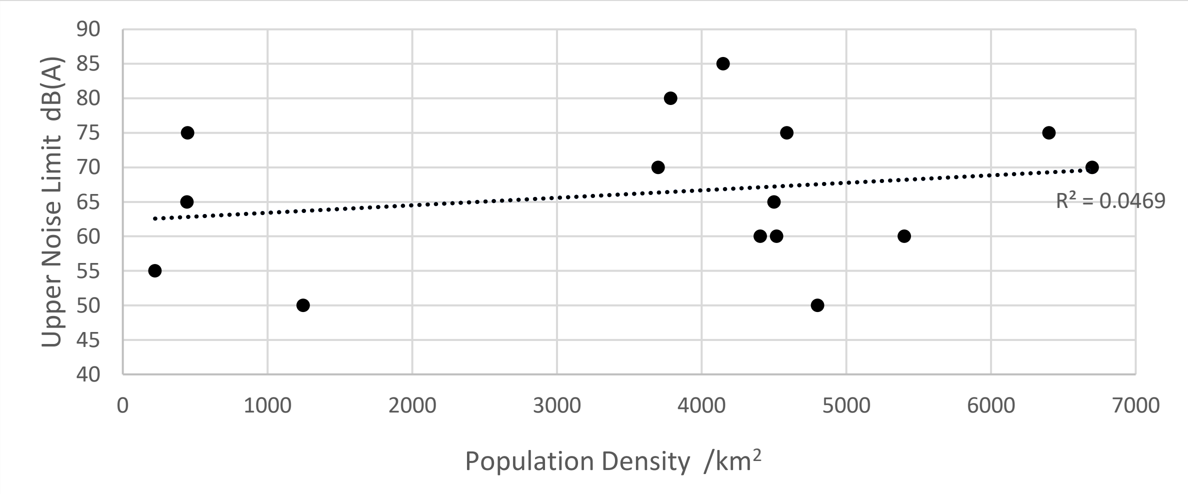


*Figure 3 - Population density of local area against upper dB(A) limit (international cities)*

Looking at Figure 3 there appears to be a positive trend between the population density and the limits used in practice. However, in social or behavioural science an *R*-squared value of between 0.02 and 0.13 suggests a small correlation between the dependent and independent variables (Cohen, 1988), and therefore with an *R*-squared value of 0.0469, any correlation between the population density and the limits used in practice is clearly small. This lack of a clear correlation may be due to limited data.

The difference in the strength of the correlation between population density and the limits used in practice in cities in other countries and the strength of the correlation between population density and the limits used in practice in the UK is quite possibly a result of the land area included in the population density figures. For the UK assessment, it was possible to secure data for the population density of the exact borough or district in which each site is situated, whereas for the international assessment, at the current time it has only been possible to gather population density data for the entire city in which each site is located (which may not always be representative of the population density local to the event venue).

# CONCLUSION

The above points, relating to both the limits used in practice in the UK and in international cities, and the increase in low frequency content, outline some of the reasons why current national guidance throughout the world is not being followed and instead the approach of following best practice has arisen. In the UK, the *'Noise Council, code of practice on environmental noise control at concerts, 1995'* guidance is being used less within the industry and the above evaluation of event data explains why an updated version of the guidance is required. It is proposed, based on the preliminary research included in this paper, that the population density of the immediate area around the site might be a useful parameter in developing the new guidance, in order to help councils and venues determine a suitable limit for events, particularly for new sites.

# REFERENCES

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