

# ASSESSMENT OF NOISE FROM NEW STADIA

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## 1 INTRODUCTION

Many sports stadia are being refurbished, replaced or completely new stadia are being built. However, in order to ensure the financial viability of the stadium under consideration, it is often used for events other than just the original sporting function, and other development is now often undertaken in tandem with it.

At the planning application stage, either just a noise assessment or a full environmental statement (ES) is likely to be required, depending on the size of the development and the proximity to noise sensitive receptors. The noise assessment or the noise chapter of the ES will both be required to address the key acoustic issues. Due to the nature of such development, the design is likely to be finalised after planning permission is granted and thus a number of assumptions will need to be made.

In this paper, the criteria and assessment methodology that have been used in addressing various aspects of noise from stadia and associated development at the environmental assessment stage are reported.

## 2 ISSUES

Clearly, noise from the stadium when there is a full crowd attending a match is a key element. However, as noted earlier, stadia are often now designed and used for other things besides the sport that was the original driving force for the stadium - concerts and big screen events, for example. The noise from the crowd arriving and leaving (on foot, by vehicle) needs to be considered, as do any associated commercial uses, such as retail, food outlets and fitness units, etc. The impact of existing sources on any new housing associated with the project also needs to be assessed, as does the impact of the use of the new development on the new housing. The impact of demolition/construction is likely to also require consideration.

## 3 NOISE AND PLANNING

### 3.1 Planning Policy Guidance (PPG24)

Although the English, Welsh and Scottish planning policy guidance is broadly similar, there are minor differences. These differences are beyond the scope of this paper, and reference is only made to the guidance in PPG24.

PPG24 outlines the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities which will generate noise. Annex 3 of PPG24 gives "detailed" guidance on the assessment of noise from different sources.

Section 11 of PPG 24 advises:

"The impact of noise from sport, recreation and entertainment will depend, to a large extent, on frequency of use and the design of facilities. More detailed advice on factors to consider in relation to the major noise sources, including roads, railways, airports, industrial and recreational noise and measurement, are given in Annex 3."

In relation to noise from recreational and sporting activities, Annex 3, paragraph 22 states:

"For these activities (which include open air pop concerts), the local planning authority will have to take account of how frequently the noise will be generated and how disturbing it will be and balance the enjoyment of the participants against nuisance to other people. Partially open buildings, such as stadia, may not be in frequent use. Depending on local circumstances and public opinion, local planning authorities may consider it reasonable to permit higher noise emission levels than they would from industrial development, subject to a limit of the hours of use and the control of noise emissions (including public address systems) during unsocial hours. A number of sports activities are the subject of Codes of Practice and further details of these can be found in Annex 7. Some noisy activities enjoy permitted development rights, granted by Part 4 of Schedule 2 to the Town and Country Planning General Development Order 1988 and so may not require specific planning permission, provided that they only occur on a temporary basis. However, this permission may be withdrawn by making a direction under Article 4 of the Order. Further details are contained in Annex 7. Additional advice on sport and noise can be found in PPG 17 "Sport and Recreation." [6].

Paragraphs 45-50 of PPG 17, Sport and Recreation specifically considers football stadia, in particular requirements post the Taylor report. Paragraph 49 makes clear that "possible conflicts with neighbouring uses" is a relevant issue. The section of the note dealing with Sports and Noise (paragraphs 51 to 54) deals only with the sports that generate high noise levels themselves, such as motor sports, shooting, war games and model aircraft.

## **4 ASSESSMENT CRITERIA**

Assessment criteria for the various aspects that are often associated with stadium proposals have been developed, taking into account existing standards and guidelines, current best practice and the techniques used in environmental assessment for other, similar, projects, including other football stadia.

### **4.1 Construction Noise**

There are no set standards for the definition of the significance of construction noise effects. The assessment of whether changes in noise levels due to construction constitute significant effects, will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration and time of occurrence.

Having examined the assessment criteria used for the assessment of a number of other projects, it is considered that a significant effect would occur at a receptor in an urban area when the construction noise level  $L_{AeqT}$  is predicted to be greater than the noise thresholds given in Table 4.1 and the total ambient is at least 3 dB greater than the future baseline.

TABLE 4.1: CONSTRUCTION NOISE EVALUATIVE CRITERIA

ASSESSMENT PERIOD		CONSTRUCTION NOISE THRESHOLD
DAY OF WEEK	TIME OF DAY	SPL, dB $L_{Aeq,T}$
Monday - Friday	08:00 - 18:00	75 dB $L_{Aeq,10hour}$
Saturday	08:00 - 13:00	75 dB $L_{Aeq,5hour}$
Monday - Friday	18:00 - 23:00	65 dB $L_{Aeq,5hour}$
Saturday	13:00 - 23:00	65 dB $L_{Aeq,10hour}$
Sunday	08:00 - 23:00	65 dB $L_{Aeq,15hour}$
Each day	23:00 - 08:00	55 dB $L_{Aeq,9hour}$

## 4.2 Noise From Crowd Within Stadium

An approach has been used in the UK over a number of years for assessing noise, based on the premise that subjective response to noise from a new source is proportional to the change in overall noise level.

As a 3 dB change in noise level is just noticeable, it is generally accepted that, in environmental assessment terms, this can be assumed as the threshold at which a noise impact becomes significant. However, this has normally been applied to projects where the noise occurs every day over the whole day, such as roads, railways and commercial developments, such as shopping centres. It is considered to be unduly onerous for a development that is only likely to be used for only part of the day for 30 - 40 days per year. Following the principles in the Code of Practice on Environmental Noise Control at Concerts, which has a varying level, depending on the number of events per year, and recognising the guidance in PPG24, noted earlier, it is therefore considered that a 6 dB change is the onset of significance for noise from the crowd inside the stadium.

In addition, it is often considered useful to categorise the degree of impact according to the extent of the predicted noise change. This is frequently implemented by the use of semantic descriptors associated with noise change bands. The scale adopted for use in this assessment is shown in Table 4.2 below.

TABLE 4.2: SEMANTIC SCALE FOR RATING OF NOISE IMPACT

PREDICTED CHANGE IN $L_{Aeq,T}$	SEMANTIC SCALE RATING	SIGNIFICANT?
Decrease of 6 dB or more	Significant Decrease	Yes
Decrease of less than 6 dB	No significant change	No
Increase of less than 6 dB	No significant change	No
Increase of 6 - 10 dB	Slight Increase	Yes
Increase of 10 - 15 dB	Moderate Increase	Yes
Increase of 15 - 20 dB	Substantial Increase	Yes
Increase of more than 20 dB	Severe Increase	Yes

### 4.3 Crowd Noise Outside the Stadium

As with noise from the crowd inside the stadium, it is considered that a 6 dB change is the onset of significance for crowd noise outside the stadium, and the categorisation of the degree of impact has been taken to be the same as that shown in Table 4.2, discussed earlier.

### 4.4 Road/Rail Traffic Noise

As a 3 dB change in noise level is just noticeable, it is generally accepted that, in environmental assessment terms, this can be assumed as the threshold at which a noise impact becomes significant for traffic noise.

A scale to categorise the degree of impact according to the extent of the predicted noise change is shown below.

TABLE 4.3: SEMANTIC SCALE FOR RATING OF NOISE IMPACT

PREDICTED CHANGE IN $L_{A10,18hr}$	SEMANTIC SCALE RATING	SIGNIFICANT?
Decrease of 3 dB or more	Significant Decrease	Yes
Decrease of less than 3 dB	No significant change	No
Increase of less than 3 dB	No significant change	No
Increase of 3 - 5 dB	Slight Increase	Yes
Increase of 6 - 10 dB	Moderate Increase	Yes
Increase of 11 - 15 dB	Substantial Increase	Yes
Increase of more than 15 dB	Severe Increase	Yes

### 4.5 Concert/Other Event Noise

For existing noise sensitive properties, it is considered that if the noise levels from any concerts do not exceed those set out in the Code of Practice on Environmental Noise Control at Concerts, shown in Table 4.4 below, there would not be a significant effect.

TABLE 4.4: GUIDELINES FOR NOISE FROM CONCERTS

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 65 dB(A) over a 15 minute period
4 to 12	All Venues	The MNL should not exceed the background noise level by more than 15 dB(A) over a 15 minute period

### 4.6 Plant Noise

The criteria for the assessment of fixed plant noise has been based upon the principles of BS 4142, with Rating Levels greater than the background  $L_{A90}$  level minus 5 dB being considered a significant impact. However, at the assessment stage, it is not often possible to provide detailed specification

of the plant or enclosures, etc that will be used. It is therefore likely that a planning condition to this effect would be attached to any planning permission associated with the development.

#### **4.7 PA Noise**

The PA system will be required to meet relevant safety standards. However, in order to minimise disturbance at noise sensitive properties it should be designed and operated to meet Local Planning Authority requirements, and would be the subject of a planning condition to this effect, which would be attached to any planning permission associated with the development.

#### **4.8 Noise Affecting New Residential Developments**

It is considered that, provided the internal levels achieved in new properties when their windows are closed meet the "good" criteria in BS 8233 during the day to day running of the development, there would be no significant impact to residents.

However, whilst 'good' internal noise levels can be achieved within the proposed residential accommodation, it is considered that it would be unduly onerous to protect purchasers of residential property from noise due to concerts or similar events in the stadium that only occur on a limited number of days per year, especially as purchasers would be aware before they purchase that events are likely to occur.

A design criterion for internal living spaces can be derived from the guidelines set out in the Code of Practice on Environmental Noise Control at Concerts. Based on the attenuation afforded by a closed, single glazed window of 27 dB(A) (PPG24 worst case), the criterion for noise in internal living areas can be set at 27 dB(A) below the relevant guideline given in the Code. Thus for a situation where the MNL should not exceed 75 dB(A), the internal noise criterion would be 48 dB(A), where the MNL should not exceed 65 dB(A), the internal noise criterion would be 38 dB(A), and so on. This is subject to a lower limit of 57 dB(A) for the MNL (i.e. an internal criterion of 30 dB(A)), as at this level and below, the internal noise level will meet the "good" standard in BS 8233.

By choosing the specification of the building envelope carefully, the developer can then build close to the stadium and achieve the internal noise criterion, even though external noise levels are those recommended in the Code. It may, however, be necessary to provide some form of assisted ventilation to such residential properties in order that there is no need for occupiers to open windows.

#### **4.9 Vibration During Construction**

Piling and the use of other plant and machinery can generate groundborne vibration at properties close to construction sites. The primary cause of community concern generally relates to building damage, although concerns are often expressed at levels of vibration significantly lower than that likely to cause damage. The human body is an excellent detector of vibration, which can become perceptible at levels which are substantially lower than those required to cause building damage. The human body is most sensitive to vibration in the vertical direction (foot to head). The effect of vibration on humans is guided by British Standard 6472:1992 (Ref 11.12).

Where vibration is intermittent or occurs as a series of events, the use of Vibration Dose Values (VDVs) is recommended in BS 6472 for the assessment of subjective response to vibration. However, however, experience of construction activities on a number of projects has shown that residents reaction to vibration from this type of source is generally easily related to the peak particle velocity (PPV), and this is reflected in the advice given in BS 5228 Part 4. Criteria based on the PPV have therefore derived, and are shown in Table 4.5, below.

**TABLE 4.5 - THRESHOLD VALUES FOR THE ASSESSMENT OF CONSTRUCTION VIBRATION**

<b>DAYTIME PPV (<math>\text{mms}^{-1}</math>)</b>	<b>SEMANTIC SCALE RATING</b>	<b>SIGNIFICANT?</b>
<0.28	No Significant Impact	No
0.28 - 0.56	Slight	Yes
0.56 - 1.12	Moderate	Yes
>1.12	Substantial	Yes

Table 4.6 presents the thresholds for the evaluation of the onset of risk of minor or cosmetic damage to buildings (i.e. levels below which minor or cosmetic damage is unlikely). These levels are described in term of peak particle velocity (ppv) for both intermittent and continuous vibration and are drawn from the guidance given in British Standard BS 5228 Part 4. Exceedence of these criteria is considered significant.

**TABLE 4.6 - THRESHOLD VALUES FOR THE EVALUATION OF BUILDING DAMAGE DUE TO VIBRATION**

<b>BUILDING CLASSIFICATION</b>	<b>PPV IN mm/s</b>	
	<b>INTERMITTENT</b>	<b>CONTINUOUS</b>
Residential in generally good repair	10	5
Residential where preliminary survey reveals significant defects	5	2.5
Industrial/commercial - light and flexible structure	20	10
Industrial/commercial - heavy and stiff structure	30	15