

MANAGING NOISE FROM MOTOR SPORT

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1 ABSTRACT

How is motor sport noise assessed and managed in the UK and beyond? The balance between the enjoyment for participants and spectators against the annoyance to local communities of an inherently noisy sport will never be easy. Unlike other noisy activities such as pop concerts, air travel and industrial noise there is limited available specific technical guidance to assist circuit operators, decision makers and members of neighbouring communities. The management of environmental noise will always be specific to the individual race circuit, testing site or temporary venue. This paper presents an overview of some of the different noise assessment, management and mitigation measures currently in practice for a selection of different sites. This highlights the different approaches used and discusses their relative merits.

2 INTRODUCTION

Sound from motorsport and the impact on surrounding communities appears to be becoming more of a controversial issue. Complainants represent a threat to the successful enjoyment of the sport for participants, spectators and businesses, whilst operators represent a threat to the peaceful enjoyment of neighbouring residents. Recent legal action at venues such as that at Croft and Spa Francorchamps have made headlines recently and the future of Grand Prix at Monza was threatened by legal action from a residents group. Most other circuits have restrictions imposed to reduce noise impact for local residents.

There is little agreed published guidance available to assess noise impact from motor sport. This paper summarizes some of the general guidance on environmental noise that can, and has been, used for the assessment of noise impact. A brief review of individual sites is also presented to illustrate how noise impact is managed in practice and to highlight examples of good practice.

3 CURRENT UK GUIDANCE

3.1 PPG24

The UK Government's planning policy on noise is set out in PPG24¹. The aim of this guidance is to provide advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restriction on development or adding unduly to the costs and administrative burdens of business. Whilst accepting that development will generate noise, the essence is to ensure that it does not cause an unacceptable degree of disturbance.

With regard to noisy development PPG24 states *"Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone*

will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to include activities such as engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities."

With regard to noise from recreational and sporting activities the document 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 on the hours of use, and the control of noise emissions (including public address systems) during unsocial hours*".

But how will the relevant decision makers balance the enjoyment of the participants of the enjoyment of the participants against the nuisance to other people?

PPG24 also adds that "*The bodies and authorities responsible for offering advice or for implementing these controls will often have expertise or experience which planning authorities may find helpful in assessing proposals for development. For example, in the case of proposals for noisy indoor or outdoor sports developments, authorities should liaise with the regional office of the Sports Council and with the governing body for the sport, who may be able to advise on ways of minimising the disturbance*"

The following documents and guidance represents some of the available guidance to assist those assessing the noise impact starting with planning policy guidance on sport and guidance from the Sports Council.

3.2 PPG17 Planning for open space, sport and recreation²

In identifying where to locate new areas of open space, sports and recreational facilities, local authorities should assess many variables including the requirement to "*avoid any significant loss of amenity to residents, neighbouring uses or biodiversity;*"

With regards to noisy sports PPG17 advises that in National Parks or Areas of Outstanding Natural Beauty these should be restricted to locations where they will have minimal or no impact on residents or other recreational users.

3.3 Sport England – Land based motor sports

This document³ summarises current planning legislation and advises that most motor sports activities operate within the scope of the general permission granted by the Town and Country Planning (General Permitted Development) Order 1995 (GPDO). This permits use of any land, subject to a number of specified exclusions, for any purpose for not more than 28 days each calendar year, of which not more than 14 may be for 'motor car and motorcycle racing, including trials of speed, and practising for these activities'.

The document also states that "This allows the temporary use of open land for 14 days for motor sports racing or practice and 14 days for other motor sports activities such as training or other non competitive events. In fact most clubs appreciate that some sites cannot support 14–28 days of motor sport use a year and work to self-imposed limits much lower than would legally be allowed."

3.4 Sport England

Sport England have recently provided planning policy and implementation guidance⁴ to form a reference point for consideration of how sports and active recreation issues should be treated in the determination of planning applications.

"A number of sports, including shooting, motor sports, powered air sports, water skiing and the use of personal water craft can generate levels of noise which, in certain locations, may be intrusive and disturbing to people and wildlife. However, great strides have been taken to minimise noise through noise attenuation techniques. Like all sports which rely on access to extensive areas of land or water, these activities are under considerable pressure from other forms of development (encroaching or reusing the site) and from environmental interests (wanting the cessation of activities)."

"PLANNING POLICY OBJECTIVE 24: To support the provision of opportunities for motorised sports and gun sports (clay pigeon shooting and target sports) in appropriate locations and to seek to ensure that proper consideration is given to such development in land use development plans."

- *identify and allocate sites for noise generating sports in locations where their environmental impact can be minimised;*
- *use a sound assessment of the adequacy of existing sites and the demand for new and extended ones;*
- *include positively worded criteria for site selection rather than operate a general presumption against development;*
- *seek to ensure that proposals will minimise conflicts with other users and interests; and*
- *seek to utilise, wherever possible, existing degraded or brownfield sites where the environmental impact is minimised."*

This recent planning guidance report offers a more liberal view than PPG17, whilst seeking to maintain a balance.

3.5 Guidance notes on noise control at motor sport circuits

These guidance notes⁵ contains a wealth of useful, practical information on noise management best practice through static and trackside noise monitoring, noise control from PA systems, tyre squeal, noise management plans and community liaison.

There is limited objective guidance on the assessment of community noise levels. A suggestion of comparing the source motor sport noise against prevailing ambient and/or background noise is presented. The guidance notes advise that a decision needs to be made regarding acceptable noise levels and their frequency of occurrence. No objective assistance on how to make this decision is provided. This is understandable as there has been little research into the acceptability of noise from motor sport.

3.6 Code of practice on noise from organised off-road motor cycle sport

This code of practice⁶ was provided to establish guidelines to ensure that suitable and reasonable actions are taken to minimise the impact of neighbourhood noise from organised off-road motor cycling events.

With regards to the frequency of events the document suggests that “a judgement needs to be made on the suitability of a site taking into account the proposed frequency of its use. It is suggested that a site be used for not more than 10 days per year, with at least 4 weeks between events.”

3.7 Code of practice for the control of noise from oval motor racing circuits

A similar code of practice⁷ was prepared by the NSCA with an aim of establishing guidelines so that both local authority and organising bodies can show suitable and reasonable actions have been taken to minimise the noise impact of this type of motor sport. It is understood that application of this guidance is currently being reviewed by the ORCi (Oval Racing Council International) with a view to updating the document.

3.8 WHO Community Noise

The Guidelines for Community Noise⁸ included guideline noise values for the onset of health effects from noise exposure. The relevant values for residential areas are presented in Table 1.

Specific Environment	Critical Health Effects	Type	Internal Limit, dB(A)	External Limit, dB(A)
Dwellings, indoors	Speech intelligibility & moderate annoyance, daytime and evening	$L_{Aeq,16h}$	35	50
Outdoor living area	Serious annoyance, daytime and evening	$L_{Aeq, 16h}$		55

Table 1 - WHO guideline values for community noise in specific environments

These absolute noise levels are frequently considered as benchmarks or guideline values to assess the acceptability of noise. The WHO term “critical health effect” is considered potentially misleading especially considering that these guidelines refer to moderate annoyance. In addition to this it is the case that that many people in the UK are exposed to levels in excess of these guidelines.

3.9 BS 8233

This Standard⁹ gives recommendations for the control of noise in and around buildings, and suggests appropriate criteria and limits for different situations.

These criteria are primarily intended to guide the design of new or refurbished buildings undergoing a change of use exposed to anonymous transportation noise sources, rather than to assess the effect of changes in external noise level. The document states that “Occupants will usually tolerate higher levels of anonymous noise, such as that from road traffic, than noise from neighbours which may trigger complex emotional reactions that are disproportionate to the noise level. For simplicity, only anonymous noise is considered in Tables 5 and 6”

Criterion	Typical situations	Design range $L_{Aeq, T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living rooms	30	40

Table 2 - Indoor ambient noise levels in spaces when they are unoccupied

With regards to external noise the standard advises that for gardens and balconies etc. it is desirable that the steady noise level does not exceed 50 $L_{Aeq,T}$ dB and 55 $L_{Aeq,T}$ dB should be regarded as the upper limit.

3.10 BS 4142: 1997

A method for assessing the effect of industrial noise is given in BS 4142¹⁰. The noise level ($L_{Aeq,T}$) outside a residential building due to plant noise is calculated or measured. If the noise contains a distinguishable note or includes bangs/thumps/intermittent/impulsive characteristics an additional penalty is applied. This rating level is compared with the background noise level ($L_{A90,T}$) measured without the industrial noise source operating. The difference between the industrial noise level and the background noise level determines the likelihood of complaints, see Table 3 below.

BS4142 Plant noise rating level	BS 4142 Semantic
10 dB or more below background	BS4142 " <i>Positive indication that complaints are unlikely</i> "
10 dB below to 5 dB above background	No BS description but the more negative the difference the less the likelihood of complaints
5 dB above background	BS4142 " <i>Marginal significance</i> "
10 dB above background	BS 4142 " <i>Complaints are likely</i> "

Table 3- BS4142 industrial noise rating

It is not appropriate to assess motor sport noise using this standard, which was devised solely to rate noise from factories, industrial premises and other fixed plant (e.g. air conditioning condensers, chillers, etc.). However, the principles of rating the sound level by comparison with background noise levels and taking into account its characteristics provide a useful indicator of the audibility and intrusiveness of a noise. These principles are also used in the draft BS9142 and the Code of Practice for control of noise from concerts discussed below.

3.11 Draft BS9142: 2005 Assessment methods for environmental noise – Guide

The scope of this draft standard¹¹ is to give guidance on a generic approach which is effective and transparent to inform decision making in environmental noise, based on selecting the most appropriate method or methods of assessment depending on the type, quantity and quality of available input information and on the type of decision to be made. The generic guidance advises that consideration should be given to:

- the absolute noise level from the source
- the existing noise environment and
- the change in noise environment

No prescriptive objective guidance is provided.

3.12 Audibility

The audibility of a sound source will vary from person to person. As a general 'rule of thumb' noise from motor sport noise needs to be around 15 dB(A) less than the prevailing background noise to be inaudible. For a noise source which does not have the annoying tonal and temporal

characteristics of motor sport noise the noise needs to be around 10 dB(A) less than the prevailing background noise to be inaudible.

As soon as a noise source becomes audible it has the potential to cause annoyance and trigger complaints. The audible 'whine' from motor sport can cause annoyance when people are trying to enjoy the peace and quiet of their properties and this will be worse when people are outside in their gardens or in their houses with windows open. The impact on communities will not only depend on the audibility of the noise but also the frequency, i.e. number of days per year, of the noise impact and time of day. An activity which occurs almost every weekend and during most of the week will clearly cause more disturbance than more occasional events.

3.13 Code of practice on environmental noise control at concerts

These guidelines¹² were the result of work undertaken by a government appointed working party comprising specialists who are experienced in the particular problems that can arise with environmental noise control at concerts and similar musical events.

Using the code of practice to assess noise from motorsport is outside the scope of this document. It does however provide a useful benchmark for assessing a leisure/recreation activity by balancing the recommended community noise level against the frequency of events. The numerical guidance given in the document is as follows:

'The Music Noise Levels (MNL) when assessed at the prediction stage or measured during sound checks or concerts should not exceed the guideline values shown in Table 4 at 1 metre from the façade of any noise sensitive premises for events held between the hours of 0900h and 2300h.

Concert days per calendar year, per venue	Venue Category	Guideline
1 to 3	Urban Stadia or Arenas	The MNL should not exceed 75 dB(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

Table 4 - Code of practice music noise levels

The code of practice does not provide guideline values for more than 12 concert days per calendar year from outdoor concerts. A note to the Table suggests an MNL limit of 5 dB(A) above background for indoor venues used for up to about 30 events per calendar year.

3.14 Domestic and entertainment noise limits

Specific noise limits for amplified music are given in the Clean Neighbourhoods and Environment Act¹³. Directions under the Noise Act, which sets the 'permitted level' for noise heard in affected premises with the windows closed at 34dB(A) where the underlying level of noise does not exceed 24dB(A), and 10dB(A) over the underlying level where this exceeds 24dB(A). This was based on research into noise from amplified music.

Objective guidance on noise nuisance is available in Scotland¹⁴ and noise limits within a dwelling as measured inside with windows closed set at;

- Daytime 07.00 – 19.00 hours L_{Aeq} 41dB
- Evening 19.00 – 23.00 hours L_{Aeq} 37dB
- Night-time 23.00 – 07.00 hours L_{Aeq} 31dB

3.15 Germany – noise limits for sports noise

Unlike the UK, there is specific objective guidance within German Legislation¹⁵ to assess noise levels from sporting activities. However racing circuits require licensing according to the 4th ordinance of the Federal Immission Control Act and are not subject to the sporting noise limits set out below. The principles are of interest for application to motor sport.

A series of objective noise limits are set for various land use categories. These limits are reproduced in Table 5.

Land use	Commercial areas	Core areas/village areas/mixed areas	General residential/ Small housing estates	Purely residential	Hospitals / care homes
Day	65	60	55	50	45
Rest periods	60	55	50	45	45
Night	50	45	45	35	35

Table 5 - Noise immission limits for sporting noise, dB(A)

A 5dB relaxation is allowed for sports facilities which were granted planning permission prior to the above legislation coming into force.

For “infrequent events” a 10 dB relaxation is allowed and an absolute maximum of 70 dB(A) during the day, 64 dB(A) during rest periods, and 55dB(A) at night. Infrequent events occur no more than 18 calendar days a year.

In addition to a relaxation for infrequent events the legislation also allows for relaxation for significant individual events.

“In the case of national or international sporting events of paramount importance to public interest, the appropriate authority can permit exceptions to the regulations set out in section 5, subsection 5, inclusive of exceeding the number of infrequent events as set out in 1.5 of the annex.”

3.16 Australia

Specific local objective guidance is provided in Australia¹⁶ and this has been developed to balance the need to provide adequate protection to neighbouring residents from the noise with the rights of motor sports enthusiasts to participate in their sport in accordance with the objects of the Environment Protection Act 1997.

This balancing act is carried out using a penalty system based on a noise limit at the community, in this case 45 dB L_{Aeq} , using the following table. There are no restrictions on events which do not exceed the “zone noise standard” in this case 45 dB L_{Aeq} .

Maximum noise permitted above zone noise standard at the compliance location	Number of event credits required to stage the event
2.5 dB(A)	0.5
5 dB(A)	1
7.5 dB(A)	1.5
10 dB(A)	2
12.5 dB(A)	2.5
15 dB(A)	3
17.5 dB(A)	3.5
20 dB(A)	4*

Table 6 - Australian noise limits and event credits

The number of event credits allocated to each facility annually is calculated to enable existing levels of activity to continue. The annual number of event credits allocated to each facility for the relevant sites was 27 at Fairburn Park Cluster and 7 at Stromlo Forest.

There are further restrictions on the frequency of events

- events may not be held on any more than two weekends in any month;
- events may not be held on any more than two consecutive weekends; and
- events may not be held on any more than 2 consecutive days.

3.17 UK Guidance, published papers

In many papers⁷¹⁷ Watson has advocated the management of noise through a tiered structure. This uses various noise categories based on the highest average noise level (using the dB L_{Aeq} parameter) measured at a suitable trackside location. Similar to propagation tests carried out for outdoor concerts, a trackside noise limit needs to be agreed with the local authority which corresponds to a suitable noise limit at neighbouring communities.

Tier 1 - 'no limit' will usually relate to a very limited number of prestigious events (such as MotoGP/Formula 1/GT)

Tier 2 – A suggested guideline community noise limit of up to 50 dB L_{Aeq} and these events would be restricted to 50 days.

Tier 3 – A suggested guideline level of up to 40 dB L_{Aeq} is presented for events restricted to 100 days

Tier 4 – No limits are suggested for event days where community noise levels do not exceed 35 dB L_{Aeq}

This tiered structure shares some similarities to the German sporting limits, i.e. for sufficiently important sporting events there is no limit, for infrequent events there is a relaxed standard and for more frequent events there are more stringent standards.

4 NOISE MANAGEMENT AND MITIGATION MEASURES ADOPTED

4.1 Introduction

The following information has been obtained from information published on websites, planning inspectors' reports and published scientific papers. It is intended to give an overview of the various management and mitigation measures being used around the UK.

4.2 Sporting noise limits (static)

The various sporting authorities set various static noise limits. These noise limits are set at a reference distance close to the vehicle exhaust, generally about 0.5m. These limits are set for a with the throttle open at a specified rpm. These are robust and simple tests that can be checked easily by competitors and race officials. The equipment is relatively inexpensive and easy to use. While it has been agreed that these static noise tests are not representative of on-track noise levels these simple measures can be used to ensure excessively noisy vehicles are not permitted to race.

Most sites will specify their own static noise limits. In addition to this some sites even have an on-site facility offering exhaust modifications to reduce noise levels of individual vehicles. As an example, Merlin Motorsports are on-site at Castle Coombe and can usually supply additional silencing to reduce noise to required levels.

Road legal cars, when constructed, need to comply with the noise limits defined by the relevant EC directive.¹⁸

4.2.1 MSA/FIA Handbook

The UK governing body for motor sport, the MSA, sets out current static noise levels for a variety of different vehicle classes. These range from around 98-110 dB at 0.5m for many categories and rise to 118 dB (A) for the noisier British Formula 3, British GT and British Touring Car Championship classes.

Similar static noise limits for international competitions are set out within the FIA Yearbook.

4.2.2 Motorcycles – ACU/FIM Handbook

The current static noise limits are set out within the 2009 ACU Handbook¹⁹. The current FIM noise limits are set out in the 2009 FIM Technical Rules.

The noise limits are set next to individual bikes with the microphone placed at 0.5m from the exhaust pipe at an angle of 45° measured from the centre-line of the exhaust end and at the height of exhaust pipe, but at least 20 cm above the ground. The noise limits vary depending on bike class.

4.2.3 Oval racing – ORCi

Standard MSA or “blue book” noise limits do not apply to oval racing. A new static noise limit testing protocol and associated noise limits for racing carried out at Oval racing circuits managed by the Oval Racing Council International (ORCi) have recently been developed²⁰. This protocol aims to address many of the practical difficulties associated with checking Oval racing vehicles. As an example, exhaust positions and directions vary from vehicle to vehicle, if the exhaust position can be identified, a position 45 degrees and 0.5m from the exhaust may not be achievable.

4.3 Site specific noise management measures

4.4 Introduction

In addition to the above static tests required by sporting authorities most circuits will have additional noise management and mitigation measures in place. A brief overview of the additional measures in place at a selection of tracks follows.

4.5 Brands hatch

Brands Hatch has a noise action plan²¹ which has been agreed with the local authority. This sets out, formally, the noise management and mitigation measures adopted and includes:

- Static noise limits for track days and race meetings
- A classification procedure for race meetings based on static noise level
- Limits on the number of noisier race meetings
- Restrictions on excessive tyre squeal enforced by track officials
- Drive-by limits for track days based on previous data and assessed in consultation with the local authority
- Commitments to a number of quiet days (vehicles with static noise levels lower than 98 dB(A)) during weekends and following louder race meetings.
- Complaints management procedure
- Providing information to local residents (and the local authority) on the scheduling of noisier events
- An on-going review of the noise management plan

4.6 Goodwood

A critique of the Goodwood noise monitoring system has been presented by Watson²². The circuit is used for both historic racing along with test days/corporate days/driving school days. A noise management procedure was agreed with the local authority comprising:

- Noise monitoring terminals at three locations around the track to check for compliance with both average dB $L_{Aeq, 30min}$ and individual noise maxima dB $L_{AF,max}$ limits
- Noise limits were split into two categories. 90 days of activity were permitted with the higher limits and 90 days with the lower limits
- Access to data for both race officials and local authority

Whilst the average L_{Aeq} limit has rarely been exceeded, Local authority information suggests that the individual noise maxima have been consistently breached. The local authority investigated these breaches and found that they were almost always unpredictable and the circuit officials were taking effective action where breaches did occur. Despite vehicles passing previous drive-by tests, exceedances were found due to mechanical failures, driver errors and vehicles driving close

together. This demonstrates one of the shortcomings of using strict drive by noise maxima limits for noise management enforcement.

4.7 Bedford Autodrome

This track is frequently used for track-days and many of these cars are street legal and will not have to comply with any sporting limits such as those set out by the MSA/ACU/FIA/FIM. However, all vehicles are subject to static noise testing (101 dB). In addition to this the venue operates a strict drive-by limit as measured at 20m. Further noise management measures include²³:

- Any driver generating excessive, unnecessary or constant tyre squeal or deemed to be driving recklessly or in a manner considered to endanger themselves or other track users will be black flagged, removed from the track and given a warning that such driving is inappropriate
- More stringent static and drive- by limits on Easter Monday and a Bank Holiday Monday.

4.8 Bruntingthorpe

A very recent (December 2009) planning inquiry and subsequent inspector's report²⁴ summarises new noise management procedures set out in a noise management plan agreed with the local authority. These include:

- Recording and monitoring equipment for both drive-by limits and community noise limits
- Restrictions on days and times of use
- Complaints handling procedure
- A new noise bund for modest levels of sound reduction
- An ongoing review procedure of the noise management plan

A stringent 10 minute dB L_{Aeq} noise limit was agreed with noise monitoring made available to the Council on request.

4.9 Donnington Park

Donnington Park is subject to a number of measures to reduce noise impact including,

- Maximum 40 days (maximum three consecutive) for testing or racing
- Drive-by noise maxima limits for track days within two tiers, one higher noise limit and one quieter limit for road-legal days
- Guidance in advance to participants on how to comply with limits
- Availability of exhaust inserts or “dB killers” to reduce noise levels significantly (3-4dB)
- Liaison committee

DISCUSSION

As recommended by PPG24 noise impact from motor sport needs to be controlled to balance the enjoyment of the participants against nuisance to other people. Is this balance being achieved?

The participants of the various 'non-core' racing activities at Croft will take the view that this balance is not being achieved as the circuit is now limited, due to private nuisance action, to a restriction on its core 40 days of activity only. The motor sport fans who previously enjoyed the British GT/Formula Three weekend at Castle Coombe, banned since 2005, will not agree that this balance is being achieved for these prestigious events.

Conversely, some residents who live near various circuits and testing sites may feel that not enough is being done to manage community noise impact.

The decision makers need to balance these conflicting interests. This decision is normally based on conflicting evidence using a variety of assessment methods, many of which are discussed in this paper. In some instances even more diverse methods are being used, one circuit has even been evaluated using guidance for wind farms. It would appear that in some cases this reasonable balance is not being achieved. How can we improve this?

In the author's view, the following would help to improve the current situation;

- The adoption of best practice to help to minimize noise. This should include the adoption of a noise management plan (NMP) including, as a minimum. static noise testing, community liaison and an on-going review of the NMP.
- Robust research to investigate the impact of motor sport noise on communities. This could be in the form of either (A) research into complaints based on current venues similar to that research undertaken to establish the guideline values set out for the code of practice on noise at concerts¹¹ and/or (B) laboratory based research based on perceived annoyance against noise level using impartial test subjects comparable to that recently carried out to assess noise from licensed premises²⁵.
- A single, consolidated, code of practice presenting objective guidance covering all motor sport categories. This would include guidance on suitable noise management plans and reference to guideline noise levels based on robust research (not limits). This should also address the relaxation of noise levels for sporting events of importance to public interest, and protect existing venues which already operate satisfactory noise management plans from any further restrictions.

5 REFERENCES

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