KNOWLEDGE AND IGNORANCE: 10 THINGS YOU OUGHT TO KNOW ABOUT MOTOR SPORTS NOISE.

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1 INTRODUCTION

Motor sports events are noisy. For their supporters the noise may be an essential part of the experience adding a frisson of elemental thunder to the whole drama. To many near neighbours the noise is a cause of disturbance and annoyance. These differing reactions often lead to conflict and acrimonious disputes between the noise complainants and the motor sport event organisers. The thorny question faced by noise professionals when asked to assist is 'how can one fairly and accurately assess the degree of noise intrusion?' Motor sport noise has many significant differences from other noise sources; differences that will make it easier to pick out motor sports noise from an ambient noise climate and differences that may render the normal noise assessment methods inadequate. In this paper I have set out some of the truths that I have experienced in over 18 years of dealing with the community impact of motorsports noise but I also too aware of the numerous gaps in our knowledge of this topic so the paper concludes with some suggestions of where and what we should seek by way of answers.

2 Knowledge

2.1 There is no correlation between static testing and on-track noise emissions.

Motor sports regulators usually rely on static testing of individual vehicles as their means of noise control. Static tests can be carried out with a simple SLM, require no special test facilities, are relatively quick and do rule out those with defective silencers but the static test does not adequately measure the potential for noise emissions when the vehicle is moving. Many have tried to correlate the static test with the noise emission from a moving vehicle without success[1, 2].

2.2 Static tests are often abused.

Another problem with static testing is that it difficult to police properly and is open to cheating by competitors. The training and equipment of noise testers has been improved over the recent years but they are only human. There are several ways to defeat the testing procedure. For example, the test can be invalidated by modern engine management systems that allow the static vehicles to be run at the required rpm but at a much reduced power output resulting in much lower noise emissions

2.3 Race officers and noise testers are human.

Consistent testing of vehicle requires regular training and proper equipping of noise officers. The motorsport organisations approach to this issue has vastly improved over recent years. Nevertheless no matter how correct or how fair the testing, there can be considerable pressure upon race officers to turn a blind eye if a significant number of competitors fail their noise test.

2.4 Noise Protesters are human too.

Once an individual is driven to protest about a noise, it is natural for them to state their case in the most positive terms. Self-justification in the enemy of truth. Noise consultants are bound by their professional ethics to tell the truth but a private individual may over-exaggerate in a bid to establish the validity of their claim. This can lead to wild claims that do not stand up to realistic scrutiny. For example the often repeated claim 'The track is so loud that I can't hear the TV even with the windows closed'. A simplistic but conservative analysis will reveal the improbability of this claim. If the TV is at a normal level of around 65 dB then the intrusive track noise would need to be at least 20 dB above this, around 85dB. With the windows closed the transmission loss from outside to inside would be of the order of 40 dB. This gives an external facade noise level of 125 dB. If we take the track-to-facade transmission attenuation as only 15 dB, assuming that the dwelling is reasonably close to the track, then the track-side noise level would need to be in excess of 140dB. This level might occur for an F1 race but is rarely, if ever, seen at UK tracks.

I know of two different race circuits where complainants were issued with noise monitors of the type commonly used for noise nuisance recording. With this type of monitor the complainant is asked to switch on the device whenever the noise nuisance starts. The monitor then records the incident noise and the time of the recording. In each of the two cases, despite the claims of excessive noise, there were no valid instances of noise nuisance recorded. At one community the local authority installed the monitor on thirty occasions in one year without obtaining a single instance of excess noise levels from the adjacent race circuit.

2.5 L_{AeqT} is not a reliable indicator of noise intrusion.

The use of $L_{aeq,T}$ is firmly established as a useful measure of environmental noise impact and as such it is very tempting to use $L_{Aeq,T}$ when assessing the effect of motor sport noise, especially as the national and international guidance on noise impact is expressed in terms of $L_{Aeq,T}$ values. Nevertheless it must be remembered that those guidance levels are set relative to general 'community noise' which would be noise of a non-specific character composed of a range of human noisy activities without any particular source being dominant. This is very different from the noise from motorsports which will have a very definite character. This makes the use of general guidance levels expressed in $L_{Aeq,T}$ in the context of motorsport noise unreliable[3].

In rural locations with few other noise sources motorsports activities may cause a measurable rise in the $L_{Aeq,T}$ which in turn could be related to the degree of local noise intrusion. However in my experience either the local noise climate is such that any track activity does not cause a meaningful change in the $L_{Aeq,T}$, or despite the noise from track activities being apparent at a distant location there is no change in the prevailing $L_{Aeq,T}$

2.6 Motorsports noise can easily be heard below ambient noise levels.

Motorsports noise has a very distinctive character. There are many branches of motorsport and many different types of engines used in the different vehicles. For the informed ear it is possible to tell from the noise the type of sport, the type of vehicle, the type of engine, the speed and how in-tune the engine is at any one time. For the non-enthusiast they may all sound similar and for the complainant they all are the same... too noisy.

Since the noise from motorsports is so distinctive and the human ear is capable of selectively responding to unusual sounds then the sounds of motorsport can easily be picked out even when the relative level of the motorsport noise is below the ambient noise level as measured by an obedient but dumb sound level meter. Even when the ambient noises effective mask the motorsport noise for most of the time, a listener sensitised to motorsport noise will be disturbed by motorsport noise when the ambient noise levels falls even if only for a brief period. Whether such brief periods of exposure to noise from a specific source are a valid cause for complaint is a topic worthy of much debate but not for this paper. Audibility is not a reasonable ground for claiming a disturbance.

2.7 We don't know what a reliable motorsports noise indicator is but L_{AMax} works well.

For a number of years now the L_{AMax} has been the criterion used to control noise levels on Quiet Use days at Donington Park. The L_{AMax} limit for sensitive locations was set as at 5dB above the ambient $L_{Aeq,T}$. To this basic community limit the transmission loss to trackside was added to give a trackside drive-by L_{Amax} for any individual vehicle. Continuous monitoring ensures that any transgressors can be immediately removed from the track thus establishing a direct link between the environmental impact and the individual vehicle. This provides both circuit operator and the community with an instant response to overly loud vehicles, unlike the delayed response resulting from a daily $L_{Aeq,T}$ limit. The L_{Amax} may not be the 'best' criterion for motorsport noise but it does offer a practical and pragmatic measure that closely accords with community nuisance and is also in line with the criterion already used by the MSAUK static noise tests for individual vehicles[4].

2.8 Cars don't get noisier as they get faster.

For his M Sc project one of my students, Robin Lyons, investigated the variation in the noise levels of cars as they travelled along the straight at different race circuits. His findings showed that the noise output from different cars varied considerably but in generally once maximum power was achieved in top gear the noise output reached a maximum even though the car may continue to gain speed. This agrees with the intuitive reasoning that the noise of high powered cars is dominated by engine noise and hence power output, rather than rolling noise which may be the major noise source for road vehicles[5].

2.9 The faster cars are not the noisiest.

In 1996 I carried out a survey for the Association of Motor Racing Circuit Owner, AMRCO on the practice of noise control on their circuits throughout England. During that survey I was able to take many noise readings at the various events I attended. One interesting finding was that for most events not involving major sponsorship, that means most club and amateur events, the noise level from cars increased with the finishing position. That is the faster a competitor was then the quieter was his car. This can be explained by the observation that the faster cars would be the better prepared with higher budgets and so their exhaust systems would be newer and in good order. Whereas the tail-end Charlies struggling to compete with limited resources would have to make do

and mend with knock-on effects to the silencing of their cars. Another possibility is that some competitors will deliberately reduce the silencing in the mistaken idea that more noise equates to more power on the road.

2.10 Low noise tarmac surfaces do reduce noise emissions.

Back in the last century, I was involved with the setting up of a new driving venue for a major circuit operator. As the track surface had to be converted from old rough concrete or new connecting sections it was decided to use a low noise tarmac surface throughout. In practice this surface showed a reduction of 3dB in the L_{AMAx} recorded in the drive-by levels when compared with an equivalent monitoring position at a sister track that had an ordinary tarmac coating. It is thought that the reduction is a combination of a reduction in tyre noise from the surface and absorption of the engine noise reflections but this conjecture has not been tested.

3 Things we don't know but ought to investigate

3.1 What is a reliable and reasonable criterion for assessing motor sports noise? This might be sought using the research method used in the Defra project investigating the best noise indice for music at outside events. This study compared the values given by different noise indices with the response of a range of listener's to different levels of music recorded at outside events.

3.2 What really bugs noise complainants? Is it the level or the frequencies of the noise? Is it the character of the noise? The number of noise events per hour, per day, per week? Is it the duration of noise emission? Or is that the noise itself is secondary and the noise just serves as an indicator that a motor sport event is in progress?

3.3 How loud does the noise need to be for spectators? Would a lowering of the received noise levels affect the enjoyment of an event? Are their H&S aspects to this? Should the IOA make representations to the international motor sports authorities?

3.4 How can we set up effective means of dialog between noise complainants and motorsports? How do we strike a balance? What is the role of Local Authorities?

3.5 Does a BPM defence work for a motor sport event? What level of noise management represents BPM?

These are a few of the many questions that need answering if the assessment of the noise impact of motorsport noise can be placed on a secure footing. At the moment there are few answers based on robust science. In a 2006 Defra study of the impact of leisure noise, Environmental Health Officers rated motor sport noise as the most frequent source of noise complaint from sports and leisure activities[6]. It is regrettable that since that time little effort has been made to further the study of this significant source of noise complaints. This seems to coincide with a general reluctance of government agencies to give anything by way of positive guidance on noise issues. There has been a concentration of developing strategic targets for the distant future at the expense of establishing practical guidelines and tools for those tasked with dealing with noise in the real world of today.

4 References

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