

Motor Racing Noise—The Issues We Face

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Motorsport is a term used to cover a wide variety of sporting disciplines involving two-, three-, or four-wheel vehicles. This paper addresses one of these disciplines—motor racing, which involves vehicles with four wheels racing on the six permanent tracks (circuits) in New Zealand. These events are run according to the rules and regulations of the recognised governing body for motor racing in New Zealand, MotorSport New Zealand Inc. Motorsport noise emission is a delicate balance between retaining our viewing public and reasonable noise compliance. Since there are no laws governing the amount of sound a person can receive by choice, motorsport throughout the late '70s and early '80s conducted a range of tests to attempt to strike a balance between the need for workable noise emission regulations and public entertainment. As a result of this earlier planning, regulations were introduced in 1987 in a format that remains largely unchanged to day. The key issues addressed by the regulations were: (1) method of measurement on site; (2) method of check measurement off site; (3) establishing a sustainable maximum level of emission; (4) spectator retention; and (5) costs controls.

Method of Measurement on Site

The automobile engine is a complex product that must produce immense horsepower in a cost-effective, reliable manner at the smallest possible weight and size mass. In achieving these design goals, engineers must address the by-products of horsepower, particularly noise and gas emission. In reducing noise, you also create heat which must be dissipated to maintain reasonable levels of efficiency and reliability.

Against this background, a method had to be devised that ensured that the results shown on the track-side sound level meters were accurate.

Two completely differing approaches—static and competition—to measuring were developed by motorsport authorities. Briefly, these comprise the following.

Static Measurements

Measurements will be taken at

0.5m from the end of the exhaust pipe with the microphone at exhaust outlet level at an angle of 45° from the exhaust exit. Where more than one exhaust outlet is present, the test will be repeated for each exhaust and the highest reading will be used. In circumstances where the exhaust outlet is not immediately accessible, the test may be conducted at 2.0m from the centre-line of the vehicle with the microphone 1.2m above the ground.

Measurements should be made outdoors with no large reflecting objects like walls, etc., within 3.0m (in the case of the 0.5m test) or 10.0m (in the case of the 2.0m test) of the test site. A-weighted background sound levels should be at least 10 dB below the measured level.

Throughout the test, the engine will be running at 75% maximum rpm and the noise measured A-weighted sound level at 0.5m shall not exceed 110 dB.

This test will be repeated with the microphone at the 45° angle to 2.0m (98 dB), 8.0m (86 dB), and 16.0m (80 dB), to create a complete noise footprint for each competing vehicle.

Measurements During Competition.

The microphone shall be positioned in an open space 30m away from and at 90° to the racetrack at a point on the track where the competing vehicle is at its maximum (rpm) power. The test site shall have at least a further 60m of clear space extending through the measuring point out the opposite side of the track.

The microphone should be tripod mounted 1.5m above the track height with the microphone angled upwards 15°.

The operator must not stand directly behind the microphone.

Background noise shall be at least 10 dB below noise produced by the competing vehicle being tested.

No vehicle shall exceed an A-weighted sound level of 95 dB at all times irrespective of climatic conditions.

With both of these methods, the measuring instrument should be of a type that meets at least EC651 for type 2 meters. The meter shall be set for "A" weighting and fast response plus the microphone shall be fitted with a wind sock.

Both test methods have their drawbacks.

The static method requires a large flat common surface area of at least 20m squared.

It relies very much on the integrity of the competition vehicle engine builder to supply an accurate chart depicting horsepower and rpm to enable the 75% maximum to be established. Remember, this is a very competitive sport and engine power is a vital component. During competition, one does not want to

publicly declare for all to see the innermost secrets of the competition vehicle.

The major problem with this method is it is difficult to find an offending (noise excess) vehicle when the L_{10}/L_{max} records show an indiscretion.

The competition method require a very sharp-witted operator who requires minimal training to isolate any offending vehicle before the L_{10} figures recorded off site are exceeded. The method has its drawbacks—since the equipment and operator are only 30m from the track, they have to be protected from any possible accident risk. All safety barriers in the test site area must be of sufficient height and mass to achieve their prime safety function yet small enough in reflecting values not to influence the noise measurements.

To guard against competitors 'backing off' the throttle when

passing the test site to artificially control noise, more than one site is usually established around the track.

After reviewing both methods, MotorSport New Zealand decided upon the competition method because the results would be easier to monitor on race days. Additionally the competition method would dovetail more easily with each individual racetrack's noise management plan prepared in conjunction with their local government agency, all of which require L_{10}/L_{max} measurements off site.

Method of Measurement Off Site

As part of each circuit's noise management plan, a map of the circuit and its local surrounding district was drawn with overlaid radiating noise contour lines that

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enable off-site auditing of noise emission during a race. These maps considered local topography and highlighted any point of delicacy, ie., areas where noise must be eliminated, controlled, or deflected. Obviously, these audit points assist the local noise abatement officers in their dealings with complaints.

By carefully planning these sites, we have also achieved an audit system that immediately cross checks offences with the competition recording system, requiring the offending vehicle to be removed from the event until the problem is fixed.

Establishing a Sustainable Maximum Level of Emission

This is the most complex and crux issue which certainly has and continues to test us.

Consider these aspects.

In motorsport, we operate a wide mix of competition vehicles, some are like traditional, road-going cars, but others can be very sophisticated, single-seat, open-wheel race cars. With single seaters, there is simply very little room for an engineer to design and mount an exhaust silencer of sufficient size to achieve the limits imposed. In fact, in formula one racing, the size required to restrict the noise, dissipate the heat generated, and be able to be mounted safely on a vehicle that is constantly going from 0 to plus and minus up to 5g is virtually impossible.

As a consequence, the 16 grand prix events worldwide for formula on single seaters limit the track testing time over a four-day period

to 4 1/2 hours total time and the authorities running these events gain a dispensation to run unlimited noise levels for this time period.

The Competing Vehicle

All of our NZ classes must respect the 95 dB maximum rule at all times during competition and practice.

With assistance from the worldwide vehicle industry, mufflers have been established that delicately balance the noise emission with sufficient heat extraction and minimum weight. This has been easier to achieve on

whom find them oppressive as maintenance costs rise. On-going maintenance of exhaust is costly, especially on the single-seater cars where size and weight are serious problems, so mufflers are usually packed with fibreglass wool to help reduce noise. The effect of heat on the fibreglass is such that these packings have to be regularly replaced.

The Circuit

It is here that the cost of compliance have had a devastating effect.

If we look to a New Zealand average for our six permanent

racing venues, it is apparent that compliance to date with such issues as preparation of a noise plan and modifications to circuit to control noise release from the venue have cost an average of \$75,000 per circuit.



“...With single seaters, there is simply very little room for an engineer to design and mount an exhaust silencer of sufficient size to achieve the limits imposed...”

a saloon car, but harder on a single seater, as previously described.

We have, however, reached the edge of the delicate balance envelope. Given the performance outputs of our competition engines, any further reduction in maximum noise limits would severely impact on the engine's ability to gain sufficient heat dissipation and consequently destroy the engine reliability factors to a level making them totally uneconomic.

Current noise emission levels are not without their critics, many of

Not a lot of money in the scheme of things you might think. However, if you bear in mind all our circuits are non-profit organisations

established primarily to address the sporting needs of members, the costs take on more effect and meaning. Too often we are incorrectly labelled as a large commercial organisation profiteering from our race meetings. We wish!

The facts are, the sports six circuits employ a total of twelve paid employees, eight of whom are groundsman/caretakers. The National Body MotorSport New Zealand Inc. employs five staff. Against this we have a volunteer base assisting our circuits race events of between 2000 and 3000

people.

Over the years, we have learned a few skills in keeping noise within our boundaries, like careful placement of safety backs, i.e., tyre walls backed by solid earth compacted to a height of between 1 and 3m. With these, the first objective is to protect spectators and competitors but we can now use these to absorb and break up noise emissions.

Experts tell us that boundary trees achieve little in the way of noise absorption. On paper, we agree that this may be the case, but our actual checking show that trees can be reasonably effective. We have also experimented with boundary fence hoardings, and find that by angling these back slightly (up to 10°) we can also achieve good results.

Unfortunately, the area we struggle most with is the constant need to monitor resource management act consent notices and subsequently mount objections when the lifestyle blocks, housing developments, changes to district schemes, etc., etc., start to encroach on our circuits. Whatever happened to existing user rights and legislation at reasonable cost? It is our opinion that we as a nation have lost the plot in this regard.

We do not object to the need for those laws and a process for updating and amending them, but surely it should be in the “KISS” system (keep it simple stupid) and also must be at all times with costs within reasonable bounds.

Spectator Retention

We started off by saying “the amount of sound a person may receive by choice.” In our leisure activities, we like our noise (stereos, stage shows, rugby matches, etc.—all are noisy environments).

Motorsport is made up of a lot of distinct disciplines, this address covers only one: racing on the tracks. There are others outside of our (MotorSport NZ Inc.) control that still have unlimited noise, such as drag racing, where a car runs usually a quarter mile as quickly as possible.

These events attract crowds. Survey them, ask them to name the major reasons they attend—nine out of ten will answer to feel and hear the noise!

We have suffered since the introduction of maximum noise levels. Our spectators left us in sufficient numbers to severely test the continued economic viability of our circuits. As the rest of leisure activities quiet down we are slowly regaining some but nowhere near what we need. The downstream effect of this is fewer spectators and less sponsor appeal, so we now have less sponsor income to promote events.

To survive, we have had to become very efficient, question all costs, repack ourselves, and try to create new promotions to attract the paying public we need. Our competitors no longer receive any prize money or travel assistance to attend the events. They now fund these either themselves or by raising small packages for sponsor benefits.

Cost Controls

As mentioned earlier, we are undertaking more activities to ensure our survival. Monitoring resource consents and preparing submissions takes time and money that we do not really have. All surplus (which is not great in anyone's terms) is utilised to continue the development of our facilities and promote our activities aimed at getting our spectators back. Our competitors cannot absorb anymore nor can our circuit

-owning clubs. We do believe it's time for all to seriously rethink the costs of compliance as they relate to all government and local body regulations.

To conclude, let's look at a few facts. MotorSport New Zealand Inc. is made up of 107 clubs, totalling 12,162 individual members. Inside this governing body are our six permanent race tracks, owned or operated by one of our member clubs. The membership of these clubs averages 296 each. The tracks themselves stand out well in the world of motorsport with five of the six having international licenses issued by the world governing body. To put this in perspective, Australia has 300 clubs as members of CAMS (governing body), 300,000 individual members and 13 tracks. From this you will observe that with our small population base we achieve a lot through our passion and downright dedication to our chosen sport of motor racing. We have demonstrated our willingness to bring our sport into a level of voluntary compliance of noise emission. It has come at a huge cost. We trust that we have illustrated the difficulties we would have in any further lowering of the limits and the effects these would have on us. There is a need at all times to keep issues in perspective and ensure that all legislation and regulations are well researched, well balanced, and provide for achievable cost containment.

It is time for our government agencies to review this legislation as we contend that it does not meet all of these simple yet effective criteria. The resource management act has certainly demonstrated a high cost to all parties that have been directly affected by it. We are not against the principles of the legislation, merely the cost of compliance. A more simplistic compliance process is needed. ■