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RESEARCH INTO THE CONTROL OF MOTOR SPORT NOISE.

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1. INTRODUCTION.

In a paper presented to the Euro Noise conference in 1992, I referred to a research programme funded by the RACMSA (RAC Motor Sport Association) and the AMRCO (Association of Motor Racing Circuit Owners) The object of this programme was to investigate the effects of motor sport noise and establish better methods of controlling noise from fixed venues. The investigation began in 1994 and should be completed during this year.

This paper examines the research to date and highlights the work being done to improve the existing controls on reducing the impact of community noise from all motor sport activities.

2. BACKGROUND.

Noise in Motor sport has been controlled by the RACMSA since 1979 and the annual Regulations governing the sport include noise test methods and maximum permitted levels for the various types of motor sport throughout the UK. The test method is based on a static test carried out with the vehicle running at selected r.p.m. levels which usually equate to 3/4 Maximum engine speed. The regulations allow for testing at different distances from the vehicle.

Experience has shown that testing at 0.5m and 45degrees from the exhaust pipe is the most practical method and this is now widely used throughout the sport. Maximum levels have been reduced over the years and the car race level has dropped from 120dB(A) at 0.5m. to the 1994 level of 110dB(A). The static test has been the most practical method of carrying out a repeatable, fair test on large numbers of vehicles and it has succeeded in reducing overall noise levels. As the levels reduced, there was some speculation as to the effectiveness of static testing and to it's ability to relate to environmental noise levels. There is no doubt that an individual vehicle static test level does not always relate to the trackside noise produced when that individual vehicle is under load and being driven on the circuit.

It was agreed between the RACMSA and AMRCO (The Association of Motor Racing Circuit Owners) that they should fund a joint study into the environmental effects of Motor Sport noise including investigating current test methods and controls.

This study began in 1993 and should be completed later this year. The main phases of the study are:

1. SOURCE CONTROL.

2. VENUE CONTRIBUTION TO NOISE PROPAGATION.

3. VENUE AND EVENT MANAGEMENT TO MINIMISE INTRUSION.

4. PRODUCTION OF GUIDELINES OR CODE OF PRACTICE.

This paper will examine the progress of these phases and other RACMSA organisational changes to improve noise control.

3. TECHNICAL WORKING GROUP

As the objective was to produce new guidelines, or a Code of Practice, it was necessary to include a wide range of views and opinions in the course of the study. For this reason, it was decided to form a Technical Working Group to control the methodology of the investigations and to decide on the content of the final guidelines. This Group comprises representatives from the following organisations:

AMRCO /RACMSA
Institute of Sound & Vibration Research. Southampton.
Institute of Environmental Health Officers. (England & Wales)
Royal Environmental Health Institute of Scotland.
Local Authority Motor Sport Consortium.
National Assoc. for Clean Air & Environmental Protection.
The Noise Council.
The Institute of Acoustics.
Motor Industry Research Association.

4. PHASE 1 SOURCE CONTROL.

It is accepted that static noise testing may not be an accurate representation of the noise produced by a vehicle on the track and may not, therefore, correlate directly with the noise experienced in the community. This has led to different test methods being introduced by some venues to try to comply with Local Authority restrictions on environmental noise levels. Various forms of trackside testing are used at some venues and each venue operator has the right to impose stricter noise criteria than those contained in the MSA regulations. If the competitor is to be penalised, the MSA regulations are considered to be definitive unless an event has included stricter noise criteria and defined alternative test methods in the event regulations.

This phase of the project is designed to investigate the effectiveness of the existing MSA test method in controlling environmental noise and explore the possibility of improved test methods.

The key tasks in this Phase were:

1. Examine the correlation between existing static testing and actual track noise.

2. Examine the relationship between track noise and community noise.

3. From the above establish the relationship between the existing static test and community noise levels.

4. Research methods of improving noise control testing.

As there are a great many varieties of vehicles competing on motor racing circuits, it would have been impossible to try to carry out comparative tests on a wide range of vehicles under controlled scientific conditions. The best compromise was to measure the trackside noise during events and compare this with the static test levels measured by MSA noise officials at the same event. The method used was to measure 1 sec. maximum levels at trackside during practice and racing and note the order that the vehicles passed the measurement location. By using dataloggers with a computer output it was possible to expand the data and establish the maximum by-pass level of individual vehicles.

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The following table shows a summary of the results of tests on 258 vehicles over 9 different classes. i.e. an average of 20-25 vehicles in each class.

Table 1.
INDIVIDUAL VEHICLES STATIC v TRACKSIDE.dB(A).

CLASS	0.5m Range	10m Range	Diff Range	10mEvent Leq
BTCC	96-111	92-105	<0-14	93-94
CLIOUK	87-95	86-91	0-6	77-78
FFIESTA	92-109	87-102	<0-10	88-89
FVAUX2000	99-103	95-98	3-7	85-86
FVAUXJ1600	101-109	95-101	0-11	89-90
HISTSALOON	98-109	93-104	<0-17	89
NATFF1800	101-106	95-100	4-10	84-87
PRODCARS	91-110	82-110	<0-16	91
SPORTSGT	88-111	98-112	<0-7	97

Class = Class of vehicle tested.
0.5m range = Range of static test levels at 0.5m.
10m. range. = Range of trackside levels at 10m. from track.
Diff Range. = Range of reduction in level of individual vehicles.
10m.Leq. = Leq. of event at 10m. from trackside.

The results show that there is no direct relationship between static and trackside levels for individual vehicles, but that there can be a general relationship between the range of static levels and the overall Leq. levels of each event. Each class exhibits different characteristics. This confirms the view that control of static levels has an overall effect in reducing event noise but may not represent the track noise of individual vehicles.

Other source variables affect the environmental impact, especially the location of the vehicles on the track and the track configuration. Higher trackside noise levels are produced when vehicles are accelerating out of a bend along a straight. The more continuous noise from a straight increases the Leq. levels at a distance from the track.

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Table 2 shows samples of the variation in Leq. levels measured at three different trackside locations during one event. The study collected similar data from 9 different events and included 41 different classes of vehicle.

Table 2.
dB(A)Leq LEVELS AT DIFFERENT TRACKSIDE LOCATIONS.

CLASS	NUM	UR R	RC15	C5	S10
VECTA	30	28	81	87	81
PSPORT3000	12	35	83	85	86
SRSALOONAB	21	27	76	82	78
RSALOONAC	28	28	78	83	78
FXR2	28	21	77	84	79
MSALOON	20	24	81	87	82
FF1600PR9O	28	22	83	86	82
SRSALOONCD	31		79	86	79

Class = Class of vehicle.
Num = Number of vehicles on the track.
Dur = Duration of race and of Leq.measurement.
RC15 = 15m. from trackside at a fast curve.
RC5 = 5m. from trackside at a fast curve.
RS10 = 10m. from trackside beside a straight.

The data indicates that different classes of vehicle behave differently under varied track conditions.

The final information gathered in this Phase related to the overall event source noise expressed in environmental terms. Trackside levels measured over 9 different events showed the dB(A)Leq levels of various periods throughout the event days.

Table 3.
TRACKSIDE dB(A)Leq. LEVELS OF 9 EVENTS.

TYPE	DATEP	DATER	PL	RL	EL	HHOUR	HLEQ	FMAX
INT AB RACE	25/06/94	26/06/94	87	86		89	94	106
NAT B RACE	10/09/94	10/09/94	87	86	86	89	95	116
NAT B RACE	22/05/94	22/05/94	84	85	84	87	93	111
INT AB RACE	30/07/94	31/07/94		85		88	93	107
INT B RACE	29/05/94	30/05/94	87	86		91	97	113
INT AB RACE	26/03/94	27/03/94		83	82	90	95	105
INT AB RACE	02/04/94	04/04/94		88	87	93	98	110
INTHISTRACE	24/07/94	24/07/94	102	99	101	104	111	128
INT AB RACE	11/09/94	11/09/94		94	94	98	102	113

Type = Type of event.
DateP/R = Date of Practice/Race.
P/RL = Practice/Race overall Leq. level.
EL = Daily event Leq. level where Practice and Race was the same day.
HHOUR = Highest hourly Leq. level throughout the day.
HLEQ = Highest 1Min. Leq. level throughout the day.
FMAX = Highest Fast Max. level throughout the day.

This data shows the differences due to type of event and highlights the similarity between practice and event days.

5. PHASE 2 NOISE PROPAGATION.

This is a very complex subject and can not be covered in depth by this project. The many variables associated with noise propagation are well documented and some of these criteria can be applied when assessing the spread of noise from a circuit. One of the biggest problems is the degree of variation at distance caused by wind and weather effects. This one factor tends to cause the most problems as the public perceive the variations in noise as an indication that the source is not being properly controlled.

The source information from Phase 1 has been compared to measurements at various distances from venues. This Phase is not complete and detailed data is not yet available. The Technical Working Group decided that local conditions cause too many variables to try to collate meaningful data on general propagation and have suggested further research at this time might delay the project.

Future investigations will try to establish the beneficial effects of track design and trackside bunding and try to establish if specific source frequencies from motor sport contribute more to public reaction.

6. PHASE 3 VENUE AND EVENT MANAGEMENT.

This Phase concentrated initially on collecting data from all 14 permanent circuits in the UK regarding the nature of any noise problems. This information added to the findings from the other Phases will be used to produce the guidelines for assessing and controlling the noise impact of venues.

In summary, the findings indicate that the number of noise complaints from venues is much lower than expected. Many people are affected by motor sport noise and complaints tend to increase due to a fear of escalation in the levels or periods of occurrence of the noise. There is a high tolerance of noise from normal race days, but a much lower tolerance of unusual or unannounced events. A large proportion of complaints refer to noise from tyre squeal and public address systems rather than vehicle noise.

Where there is a good liaison between the venue and residents there is a greater flow of information and fewer complaints. Local authorities tend to be put under pressure by small groups who may not represent the feelings of the majority of the local community.

7. CONCLUSIONS AND FUTURE PLANS.

As the study is incomplete there are no firm conclusions at this stage. The initial investigations indicate that general control by static noise testing could continue as an overall measure to limit noise, but that other forms of monitoring may be required. This is venue dependant and the methods may be subject to agreement with the Local Authority. Local co-operation is very important and Motor Sport must continue to ensure that noise controls are enforced and understood by the public.

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The RACMSA and AMRCO are very conscious of this need for continued control and the RACMSA have developed a strategy for improving noise testing. In 1994, a new category of Environmental Scrutineer was created with initial responsibilities for noise testing but with a view to controlling other environmental issues in the future. Over 150 officials were trained in noise testing during 1994 and this will continue in 1995. By the start of the 1996 season, sufficient officials should be available to ensure that all testing is carried out by trained personnel under the control of an Environmental Inspector or Chief Scrutineer.

The RACMSA has also created a new Environmental Advisory group which will advise the governing body, sporting committees, venue operators and motor clubs on noise issues and other environmental matters.

These initiatives are very important. There is little point in producing new guidelines if there is no means of ensuring that they can be implemented and controlled. The new trained Environmental Scrutineers will ensure a higher standard of noise testing and the Advisory Group will provide a forum for the discussion and development of future initiatives concerning the control of noise and other environmental issues.