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VEHICLE NOISE LEGISLATION - AN OVERVIEW

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1. INTRODUCTION

Ever since its introduction in the late 19th century the use of the motor vehicle has been on an ever upward spiral. As traffic density increases and road congestion worsens so environmental concerns, such as noise and emissions, take on a higher profile.

Of course, these environmental concerns are nothing new. As far back as 1929 the noise nuisance from vehicles was recognised and the Motor Cars (Excessive Noise) regulations[1] were enacted. Soon after this, in 1931, the first Construction & Use regulations introduced specific requirements for silencers.

This trend towards controlling vehicle noise has continued and five years before joining the European Community in 1973 the United Kingdom introduced noise limits for different classes of new vehicle. Since joining the Community, the UK has been at the forefront in introducing regulatory measures specifically aimed at reducing the noise pollution from road vehicles. The vast improvements in drive-by noise achieved by the vehicle manufacturers can be clearly demonstrated when considered in the light of the present standards embodied in EC directive 84/424/EEC[2]. The noise reductions achieved by this directive, coupled to other previous changes, have allowed the UK to reduce drive-by noise levels of new motor vehicles by up to 10dB(A) in as many years. Considerable strides have been made, particularly with the heaviest trucks, where the perceived noise has been effectively halved over the last decade.

The Department of Transport recognises that the control of noise from motor vehicles is a multi-facetted problem. Taking the Utopian view then clearly the new vehicle standard should be enforced throughout the vehicle's life rather than just at type-approval. It has been argued that this could be easily achieved by introducing a metered noise check into the MOT test, supplemented by roadside enforcement checks. Unfortunately, experience suggests that it's not that simple!

By introducing a metered noise test into the annual test then the "polluter" would be paying through an increased test fee. The difficulty is, so would every other motorist - most of whom

maintain their vehicle and cause no significant noise pollution. This argument would not be lost on new car buyers who would also argue that the new vehicle purchaser is already saddled with the research and development costs of tighter new vehicle standards. By introducing a metered noise test into the MOT test, they would be doubly penalised by paying an increased test fee so that those minority of motorists who fail to maintain their vehicles, could be caught.

The legislator is, therefore, often caught between equally convincing arguments on all sides. This invariably means that we have to adopt a compromise between achievable and cost effective standards for new vehicles on the one hand and environmentally acceptable provisions on the other, whilst not forgetting, of course, that the costs will have to be borne by someone - usually the motorist!

2. LIMIT VALUES AND REGULATIONS.

The Wilson Committee Report on Noise[3] in 1963 was one of the first reviews of environmental noise pollution with specific mention of road vehicles. Wilson's report concluded that for a vehicle's noise emission to be judged on the threshold between acceptable and noisy, then the low speed full acceleration limit would need to be reduced to about 80 dB(A).

Following this report, in 1968, amending Construction and Use Regulations were introduced which for the first time provided maximum sound levels for all classes of road vehicle. The Regulations not only introduced requirements for new motor vehicles, but also provided test procedures and limit values for vehicles whilst in-service. Noise levels were measured using the acceleration test procedure of British Standard BS 3425:1966[4].

In 1973, having joined the European Community, the UK adopted the standards of the existing Council directive 70/157/EEC[5], which were less severe than proposed changes to our domestic regulations. The directive used procedures similar to those of the British Standard, as used in our earlier 1968 regulations. Since the introduction of this directive, several amendments have been agreed which have introduced special provisions for the testing of exhaust systems, tightened limit values (twice) and introduced a major revision of the test procedure.

Very recently, another amendment to directive 70/157/EEC has been agreed to take effect in the mid 1990s. This directive, 92/97/EEC[6], introduces new limit values and several new items not before seen in any noise directive or regulation. Some of the more substantive changes will be dealt with in more detail later in the paper.

3. QUIET HEAVY VEHICLE PROJECT.

In 1979, the then Minister of Transport, The Rt Hon.(now Sir) Norman Fowler MP commissioned a wide ranging study into *Lorries, People and the Environment*[7] under the chairmanship of Sir Arthur Armitage. This Armitage Inquiry, as it came to be generally known, included recommendations that lorries be manufactured to a maximum noise level of 80dB(A) by the year 1990. In response, the Government announced in its White Paper a collaborative research programme between Government and industry called the QHV-90 project (Quiet Heavy Vehicle for the nineties). This project followed on from an earlier feasibility study[8] carried out by The Transport Research Laboratory (TRL) in 1978.

The £7 Million QHV-90 project was equally funded by industry and Government, with the Departments of Trade & Industry and Transport sharing the Government's £3.5M contribution. The project made significant headway in helping vehicle and component manufacturers find engineering solutions aimed at reducing the noise at source, rather than applying remedial cures.

The DoT was particularly pleased with the outcome of the research as the project demonstrated that vehicles could meet lower limits without the need for extensive acoustic shielding or enclosures. These achievements supported the DoT's negotiating position in the European Commission's working group ERGA Noise (European Regulations Global Approach), during 1989/90, whose report culminated in directive 92/97/EEC.

4. THE LATEST AMENDMENT TO DIRECTIVE 70/157/EEC.

The most recent motor vehicle noise directive was agreed by the European Council of Ministers on 10 November 1992 and has since appeared in the Official journal as directive 92/97/EEC. This new directive consolidates the previous amendments to directive 70/157/EEC and introduces new standards to take effect in the mid 1990's on a mandatory basis throughout the European Community.

The application dates are:-

* from 1.10.95 the introduction of all new model types will have to be approved in compliance with the new directive,

* from 1.10.96 all new vehicles sold in the Community will have to comply with the new directive.

Its main effects will be to introduce new limits for all classes of vehicle, to lay down a uniform standard for the test track surface by drawing upon the specification of an ISO standard, to introduce a manufacturing (conformity of production [CoP]) tolerance of 1 dB(A), to introduce a limit value and test procedure for the noise from air brake systems and, last but not least, to require Member States to make type-approval data widely available before 1 October 1994.

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From the UK's point of view this directive represents a significant additional step in furthering the control of vehicle noise pollution. Notwithstanding the major advances of the new directive, there is an additional commitment in the directive which could have even greater ramifications on vehicle noise control, ie. tyre noise.

5. TYRE NOISE.

The type-approval test has always sought to limit the noise produced in a typical urban situation. This has inevitably focused attention on "mechanical" noise rather than tyre noise through the use of the low speed full acceleration type test. As limit values have fallen so the contribution of tyre noise has become more significant during the type-approval test. The point may soon be reached where tyre noise could restrict any further lowering of limits in the future.

The new directive places a commitment upon the European Commission to present, by 31 March 1994, a proposal to The Council of Ministers to deal with the noise generated by the interaction of the tyre and road surface. During negotiations on the draft directive the UK insisted that safety must not be compromised in any directive aimed at reducing noise. Despite an uphill battle, we were successful in securing a revision to the articles to reflect due consideration of the safety aspects.

The contribution of tyre noise from vehicles travelling at constant high speed is well known, especially to those people living in close proximity to busy motorways. For this reason, the concept of regulating tyre noise seems a positive move. Our principal concern is to ensure that any move to limit the tyre noise does not have *any* ramifications on the primary safety aspect of tyres, ie. that of being able to stop a vehicle quickly and safely. It is conceivable that the "plating" of tyres with a noise limit could have two unfortunate knock-on effects. Firstly, the tyre manufacturers may be encouraged to compromise on safety features such as traction and wet grip in order to achieve a very low "plated" noise number, and thus improve the marketability of their product. Secondly, the vehicle manufacturers may be tempted to fit such tyres in order to reduce the vehicle development costs needed to comply with the "drive-by" noise standards. It is these aspects which will be taxing the minds of government officials and industry experts in the very near future.

6. EUROPEAN PARLIAMENT.

Under the EC co-operation procedure, The Council of Ministers are required to consider all Commission proposals in the light of the opinion delivered by the European Parliament. Parliament, having considered the new noise directive, suggested several amendments, the most notable being considerable reductions in the drive-by limit values (see Table 1).

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It is generally accepted that the lower limit values proposed by the European Parliament may be ultimately achievable, but the UK considered the Parliament's limit values to be impractical for two reasons; firstly, there is no certainty that the limits are achievable for production vehicles in the timescale laid down and, secondly, the limits would undoubtedly have lead to an increase in the use of acoustic shields - something the QHV90 project had sought to keep to a minimum - with the attendant in-service problems associated with such installations and, probably, at the expense of more permanent and longer lasting solutions.

However it has to be recognised, given natural technological development, that the Parliament's proposed limit of 71dB(A) for cars may become a requirement in some extended timescale - possibly by the end of the century. Even so, it is highly likely that a substantial economic burden would be passed on to the end user, notwithstanding the technical, commercial and enforcement difficulties.

TABLE 1: LIMIT VALUES AND ENFORCEMENT DATES.

Vehicle Category	Current limits 1988/89/90 84/424/EEC	Directive 92/97/EEC 1995/96	European Parliament
M_1 (Passenger Cars)	77dB(A)	74	71
$M_2 > 3.5t$ & M_3 (Large Buses & Coaches (GVW > 3.5t))			
- engine < 150kW:	80dB(A)	78	75
- engine ≥ 150kW:	83dB(A)	80	77
$M_2 \leq 3.5t$ & N_1 (Small Buses & LGV (GVW ≤3.5t))			
- GVW ≤ 2t:	78dB(A)	76	72
- 2 < GVW ≤ 3.5t:	79dB(A)	77	74
N_2 & N_3 (Heavy Goods (GVW > 3.5t))			
- engine < 75kW:	81dB(A)	77	77
- 75 ≤ engine < 150kW:	83dB(A)	78	77
- engine ≥ 150kW:	84dB(A)	80	78

7. ISO TEST TRACK SURFACE.

At the present time, the specification concerning the type-approval test track is only loosely defined in the directive. Variations of up to 4dB(A) can and do exist between different test tracks in Europe and concern has been expressed that some vehicle manufacturers might be tempted to seek-out tracks that will give the best result before applying for type approval, thereby achieving significant commercial advantage at reduced environmental benefit. The Commission and Member States, including the UK, recognised this problem and decided that the draft ISO standard, 10 844[9], was suitable to incorporate into the directive.

The Commission also recognised that other factors, such as meterological conditions, may influence the test result and have agreed to look at this area.

8. CONFORMITY OF PRODUCTION (CoP).

The UK opposed the introduction of the 1 dB(A) CoP tolerance to the new directive. In our view, CoP tolerances can and should be applied to allow for the vagaries of production systems providing that no overall increase in pollution occurs. With, for example, gaseous emissions, a high emitting vehicle can be balanced out by an equally low emitting vehicle with no overall detriment to the environment. In terms of noise - each and every noisy vehicle constitutes a nuisance, and production tolerances allow even noisier vehicles onto the road.

An additional and unfortunate effect of this tolerance is to effectively deny the UK the achievement of its long stated aim of reducing the noise from the largest HGV to 80 dB(A) - we are, in practice, still 1dB(A) adrift. However, whilst the UK abided by the majority decision of the Community to introduce the tolerance, 80dB(A) still remains our policy goal.

9. LOUDNESS MEASURES VERSUS dB(A).

Because of doubts about the continued use of the dB(A) scale as the most effective means of assessing vehicle noise, coupled to the Government's primary responsibility of lessening the noise nuisance of motor vehicles, the DoT sponsored a fundamental research programme aimed at determining the most efficient method of judging a vehicle's subjective noisiness. This three stage project is nearing completion at TRL.

Early results were encouraging, indicating that vehicles with equal dB(A) could differ in terms of subjective noisiness when assessed on a rating scale by panels of listeners. However, the concluding phase of the project (as yet unpublished) has shown that within similar vehicle groupings there is little benefit to be gained from changing to a loudness scale as opposed to the A weighted scale. Consequently we will no longer be pursuing this avenue of research, although it was an interesting and useful exercise which clearly demonstrated the complexities involved with the public's perception of noise nuisance.

10. IN-SERVICE CONTROLS.

Beyond the scope of C&U regulations 98 & 99, dealing with the *"Avoidance of Excessive Noise"* and the *"Use of Audible Warning Devices"*, there are presently no quantifiable measures of vehicle noise whilst in-service. Earlier regulations, dealing with in-service measurement used a roadside "vehicle in motion" test, were found to be extremely difficult to set-up. Suitable monitoring sites were few and far between and even when a check had been established, so few prosecutions resulted that the provisions were dropped from the 1986 regulations.

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The DoT has recently been researching the possibilities for a revised in-service test. As part of this review the TRL has carried out a preliminary study looking at standards applied in other countries, existing international test methods, and how the new-vehicle stationary noise limit might be used for in-service assessment. The TRL report has confirmed that the stationary test included as part of the EC noise type-approval test could be relatively easily adapted to meet our needs. But even if the technological solution is eventually found, there remain a number of political concerns, not least of which is the impact on the immediate neighbourhood of regular in-service noise checks.

Other sources of in-service noise nuisances are also being considered, including HGV 'body rattle' and the ramifications of removing acoustic shields and enclosures from HGVs.

The body rattle problem is the subject of another research project at TRL. The preliminary report will be completed in March/April this year and if the results prove conclusive then we will consider extending the project to look at ways in which the noise can be either isolated or reduced. Another consideration is to establish a code-of-practice with the vehicle/body manufacturers and operating engineers to try and overcome this particularly annoying source of noise nuisance.

During discussions on directive 92/97/EEC, the UK made proposals to ensure that any new vehicle fitted with acoustic enclosures or shields would be designed to ensure that they were kept in place for the effective life of the vehicle. By a combination of thoughtful design coupled with appropriate marking, it should be possible to deter end-users from simply discarding removable panels at the time of first service. Unfortunately we were unable to finalise suitable provisions for inclusion within this directive. The Commission, however, have agreed with the principle and indicated that they will consider the problem when making fresh proposals through the committee for adaptation to technical progress. The effect of removing acoustic shields will also be considered in the TRL research project looking at in-service noise controls during 1994/5.

CONCLUSIONS

Legislators and manufacturers alike have progressed a long way towards providing quiet and efficient motor vehicles. However, as technology advances and traffic density increases, so do the aspirations of the general public to see even greater improvements in their immediate environment. Further reductions in overall noise are inevitable and a new round of proposals to limit vehicle noise is already under consideration for introduction towards the end of the century.

In terms of the present type approval procedure, we are rapidly reaching the point of diminishing returns. It is slowly becoming accepted that simply playing the numbers game and knocking a few more dB off present limits will impose substantial costs on the industry and the buying public with little benefit in lowering

perceived noise. More wide ranging measures are needed.

By the end of the decade, the Community legislators will have taken reduction of mechanical noise sources almost to their limits, and will start addressing areas which have, to date, received little attention. Some form of tyre test, possibly coupled with tyre limit values, will certainly be introduced. In-service controls will also be given greater prominence, either at national level or in those areas in which the Commission has a remit. Also, the wider use of road surfaces with high acoustic absorption properties, such as porous asphalt, is now being actively considered - but that is a whole new subject outside of the scope of this paper.

Overall, the skill and inventiveness of the acoustic engineer will be required for some years to come. Past cooperation between the industry and the legislator has proved very successful in civilising the motor vehicle. It is fully expected that this close cooperation will be maintained in the coming years to ensure that progress continues to the benefit of industry and the environment alike.

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