
Technical Contributions

Planning and Noise: 21 Years Forward?

Planning Policy Guidance PPG 24

Steve Goswell MIOA

An Investigation into a Method for the Assessment of
Disturbance Caused by Amplified Music
from Neighbours

Colin Grimwood MIOA & Nick Tinsdeall

Ultrasound Applications in Medicine

Tony Evans

A Bat's Eye on Food

Malcolm J W Povey

The Acoustics World

The Assessment of Industrial Noise: A Review of
Various National Practices

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I/INCE Working Parties

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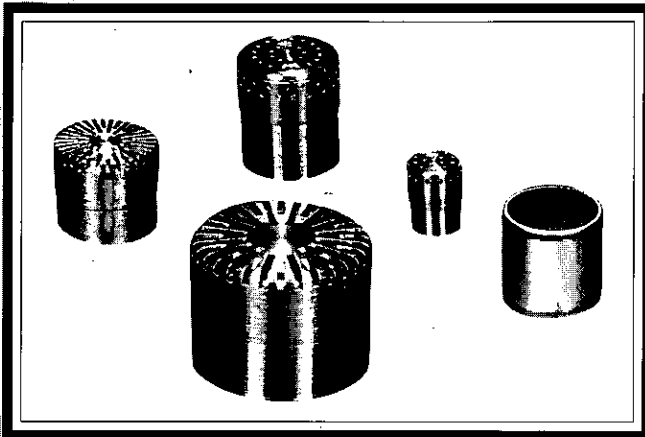
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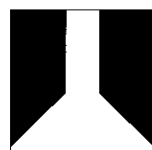
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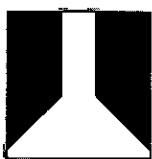
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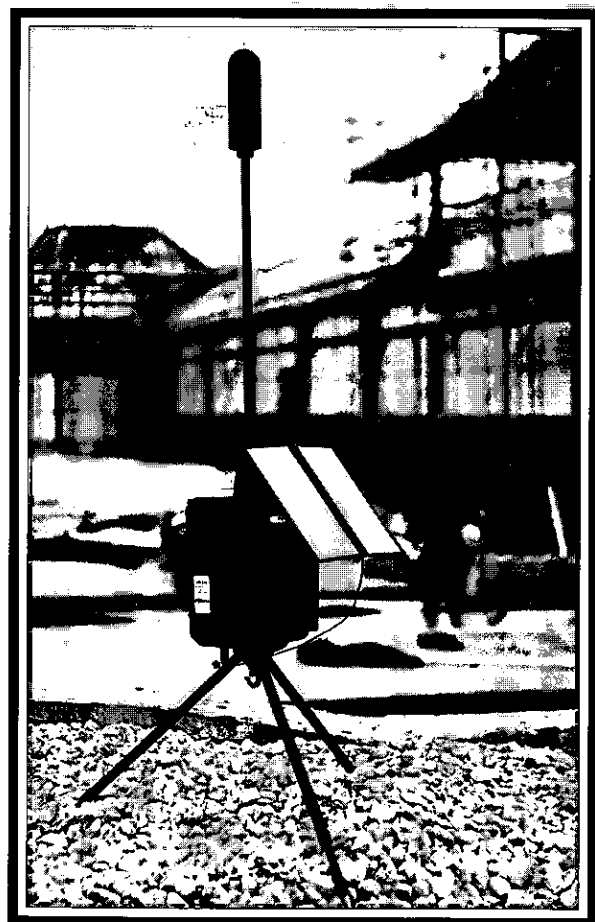


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Dear Fellow Member

Set95 has come and gone - and those of you who don't know what Set95 is have not been reading your newspapers. It is, of course, this year's Science, Engineering and Technology week under the aegis of the British Association for the Advancement of Science with the aim of raising public awareness of S, E & T.

The reason for this interest (apart from its topicality) is that I recently responded to a letter from The Office of Science and Technology of The Cabinet Office on the subject of The Public Understanding of Science, Engineering and Technology. We were asked to indicate what we did to foster such understanding and I regretted that as an organisation we were not very much into serving the public. As some of you will know, a Committee under the chairmanship of Sir Arnold Wolfendale has been set up to take evidence on the subject and to consider if the available funding is adequate. Many years ago I organised Sixth Form Lectures on behalf of the British Acoustical Society with two speakers giving a presentation with plenty of demonstrations at two or more venues on successive days. Is there a place for such an activity today or is the market saturated? I would be glad to hear any thoughts on the subject or any other suggestions on ways in which we could contribute, at the same time supporting our charitable status.

This issue of the Bulletin sees an update on CPD. Read the proposals, think about them and let us have your views.

Acoustics '95 will be with us very shortly and all the signs are that it will be a particularly successful conference. I look forward to seeing many of you there. Publicity for Internoise '96, also in Liverpool is building up through the International INCE and the Internet. There is now a dedicated electronic mailbox with the Email address Internoise96@newton.npl.co.uk. In due course it is intended that Agriculture House will be on the net. Perhaps when this happens members will find it convenient to send their views electronically to the Institute office.

Sincerely yours

Alex Burd

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PLANNING AND NOISE: 21 YEARS FORWARD? PLANNING POLICY GUIDANCE PPG 24

Steve Goswell MIOA

Introduction

In 1973 Department of the Environment Circular 10/73 firmly highlighted noise as an important consideration in planning matters. It advised that there should be close liaison between Local Authority Planning Officers and Environmental Health Officers (EHOs) in order to minimise environmental noise problems in relation to new development.

Some Local Authorities were slow to develop proper internal liaison between Planning Officers and EHOs. However, most now have a well developed consultation process based on the advice given in Circular 10/73.

The long awaited review of the Circular was published as a consultation draft in 1992 and a revised final version was issued by the Department of Environment in September 1994, namely Planning Policy Guidance – PPG24 (HMSO).

The new guidance was conceived in a political climate of 'ease the burden' which is quite different from that which prevailed 25 years earlier when Circular 10/73 was issued.

This paper examines the differences between Circular 10/73, the consultation draft and the final document PPG24 and identifies a number of areas in which further advice is needed. In the following text direct quotations from PPG24 are in italic type.

General Principles

'The aim of the guidance is to provide advice on how the planning system can be used to minimise the adverse effect of noise'.

PPG24 reiterates much of the advice in Circular 10/73 and states that development plans should indicate: *'those areas in which particular types of development will be acceptable and those in which special measures may be required in order to mitigate the impact of noise'.* Basically, the general advice is to separate noisy activities from noise sensitive development (houses, schools, hospitals etc). Where this is not possible planning authorities should consider *'whether it is practicable to control or reduce noise levels or to mitigate the impact of noise through the use of conditions or planning obligations'.*

It is worth noting that planning conditions, attached to a planning consent when it is first granted, can be altered on appeal by the developer, relaxed on a temporary basis by agreement with the local Planning Authority, or changed or relaxed by a later application. It is quite normal for a Planning Authority to relax a condition on a temporary basis, eg the control of working hours if a Company has a special order to fulfil. Conditions may be relaxed or removed by a subsequent appli-

cation, eg if it could be shown that an industrial site, with a planning restriction on operating hours, could operate outside normal hours without causing any disturbance. In this case the new consent might contain additional conditions (eg a boundary noise level condition) to protect local residents.

Planning obligations are made under Section 106 of the Town and Country Planning Act 1990 (or substituted by Section 12 of the Planning and Compensation Act 1991). They can be used to ensure that a developer, by agreement with the local Planning Authority, is obliged to carry out or fund works outside the application site, eg the provision of acoustic treatment to nearby buildings.

Noise Exposure Categories for Residential Development

The Guidance introduces a new concept of Noise Exposure Categories (NECs) which provides a useful structure for categorising the level of noise that a proposed residential site will be exposed to. An explanation of the NEC groups is reproduced in Table 1. Table 2 shows the recommended NECs for new dwellings near existing noise sources.

- | |
|--|
| <p>A Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.</p> <p>B Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.</p> <p>C Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.</p> <p>D Planning permission should normally be refused.</p> |
|--|

Table 1 Noise Exposure Categories

PPG24 states that: *'in some cases it may be appropriate for local Planning Authorities to determine the range of noise levels which they wish to attribute to any or each of the NECs. For example, when there is a clear need for new residential development in an already noisy area, some or all NECs may be increased by up to 3 dB(A) above the recommended levels. In other cases, a reduction of 3 dB(A) may be justified.'*

The guide goes on to state that: *'The NEC procedure is only applicable where consideration is being given to introducing residential development into an area with an*

Noise levels corresponding to the Noise Exposure Categories for new dwellings $L_{Aeq,T}$ dB				
Noise source	Noise Exposure Category			
	A	B	C	D
road traffic 07.00 – 23.00 23.00 – 07.00	<55 <45	55 – 63 45 – 57	63 – 72 57 – 66	>72 >66
rail traffic 07.00 – 23.00 23.00 – 07.00	<55 <45	55 – 66 45 – 59	66 – 74 59 – 66	>74 >66
air traffic 07.00 – 23.00 23.00 – 07.00	<57 <48	57 – 66 48 – 57	66 – 72 57 – 66	>72 >66
mixed sources 07.00 – 23.00 23.00 – 07.00	<55 <45	55 – 63 45 – 57	63 – 72 57 – 66	>72 >66

Table 2. Recommended Noise Exposure Categories for new dwellings near existing noise sources

existing noise source, rather than the reverse situation where new noise sources are to be introduced into an existing residential area. This is because the planning system can be used to impose conditions to protect incoming residential development from an existing noise source but, in general, developers are under no statutory obligation to offer noise protection measures to existing dwellings which will be affected by a proposed new noise source.'

In practice there is little doubt that developers and their advisors will quote NEC values in the reverse situation when it is advantageous to do so, particularly in the light of the availability of the planning obligation procedure which could be used to offer noise protection measures (to a better level than statutory schemes) to the occupiers and owners of nearby sensitive development.

The levels given in Table 2, and the new measurement procedures involved, represent perhaps the most controversial element of the new guidance. Interestingly, and perhaps fortunately, the NEC values do not directly include NECs for industrial sources.

None of the NEC levels in Table 2 have any relation to background noise levels. For road traffic noise from major roads this may be justified on the basis that the subsequent noise is fairly continuous and dominates and replaces background. However, in the case of the intermittent noise pollution from rail traffic and air traffic, one might expect that noise pollution would be much more obtrusive (for the same L_{Aeq} value) in a quiet rural area than it would be in a noisy area with high background noise levels. However, there is some evidence that noise from rail traffic causes less disturbance than noise from road traffic at the same level.

Nevertheless local Planning Authorities in quiet areas may well be advised to reduce NEC levels in their Local Plans for road, rail and air traffic to 3 dB(A) below the levels shown in Table 2.

PPG24 introduces new measurement procedures for

road and rail traffic which are to be measured in terms of $L_{Aeq,T}$. The sixteen-hour day measurements are to be from 07.00 – 23.00 hours and the eight-hour night measurements from 23.00 – 07.00 hours. Significantly, there is also a new measurement position, 1.2 – 1.5 metres above the ground, well away from buildings. This method of measurement corresponds to the existing 'Noise exposure contours' method for measuring daytime aircraft noise.

If Local Authorities and their advisors are to use the new 18-hour day and 8-hour night L_{Aeq} levels it would be extremely useful if the Department of Environment gave advice on a shortened measurement period which would give a reasonable approximation of these indices. A short 3-hour period was an option for road traffic noise in *Calculation of Road Traffic Noise*, DoT 1988. Advice on a similar 2- or 3-hour measuring period, stating the times for which it should be made, would be very helpful.

It is worth noting that research in both England and Germany has shown that nighttime L_{Aeq} levels for road traffic noise are generally around 10 dB(A) lower than daytime levels [1].

Using either predicted noise levels or measured levels, a local Planning Authority could mark approximate NEC boundaries alongside road and railway lines on their Planning use constraint maps. This would simplify the identification of land where special acoustic protection would be needed for residential development. Small residential developments, extensions and alterations to dwellings are often carried out in noisy areas without special protection and the marking of NEC boundaries might help to identify such premises. It may well be worth while to require basic acoustic protection of, say, 6–12–6 glazing and sound insulated airbricks to be provided to habitable rooms, as an alternative to trickle ventilators, where buildings are extended.

Transport Noise

The Guidance contains an explanation of how each NEC has been arrived at and specific advice on road, railway and aircraft noise is contained in annex 3. It is important to recognise that the NEC levels are intended to relate to new residential development proposed on land exposed to transport noise.

Noise from Road Traffic The NEC levels for road traffic represent a substantial increase over the recommended levels of exposure detailed in Circular 10/73.

PPG24 explains how to convert 18-hour L_{A10} facade level readings to the new 16-hour daytime L_{Aeq} . This is done by deducting 2 from the 18-hour L_{A10} level and, if it is a facade level, deducting a further 3 to convert to a free field level.

For example, the worst scenario road traffic noise levels specified in Circular 10/73 as the figure above which there should be a strong presumption against permitting residential development, namely, levels in excess of 70 dB(A) $L_{A10,18h}$, now equates to a free field 16-hour L_{Aeq} of 65 (ie 70–2–3).

The Department of Environment design bulletin *New housing and road traffic noise*, 1972 quoted in Circular

10/73 urges that sites with 18-hour L_{A10} levels above 70 should, wherever possible, not be used for new housing. It concedes that this cannot always be avoided but advises that designers should utilise such design solutions or barrier blocks in order to reduce external facade L_{A10} noise levels to at least 70 dB. Where this cannot be achieved it states: 'some form of dwelling insulation will have to be used'.

The new equivalent level of $L_{Aeq,16h} = 65$ falls within the C category of NECs for daytime road traffic, the wording of which can be argued to correspond with Circular 10/73 advice to some extent. However, the new worst scenario noise levels under NEC D is $L_{Aeq,16h} > 72$ (corresponding to $L_{A10,18h} > 77$, facade value). In addition, the new guidance indicates that existing levels should be used for existing roads (rather than the 15 year forecast advised for all major roads in 10/73) and that the new NECs may be increased by a further 3 dB (A) 'where there is a clear need for new residential development'.

There is one other very important point about the new 8-hour and 16-hour L_{Aeq} measurements to be used in the NEC tables. PPG24 specifies that these should be measured '1.2 – 1.5 metres above the ground'. Circular 10/73 advice concerning L_{A10} facade levels was generally interpreted as noise affecting the facades of habitable rooms exposed to noise. When considering sites for residential development which are or will be protected from road or rail traffic noise by barriers, there may be a substantial difference between noise levels at first floor levels and above, compared to measurements 1.2 – 1.5 metres above ground level where the protection of a barrier would provide the greatest noise reduction. PPG24 should be revised to take account of this difference.

There is no doubt that PPG24 will be of much more help to the developer wishing to build on land polluted by high levels of road traffic than it will be to those wishing to oppose the use of such noisy locations.

Noise from Railways Railway noise was not covered in Circular 10/73. The draft PPG proposed a minimum distance of 15 metres between any building and the railway line and suggested that proposals for residential development within 60 metres of the track may need a vibration assessment.

These requirements have been dropped from PPG24 which merely states: 'The likelihood of significant ground-borne vibration will depend on the nature of the ground and the types of train. The possibility of vibration and re-radiated noise caused by trains running in tunnels should not be overlooked. Advice on acceptable levels of vibration can be found in BS 6472:1992.' The NEC threshold between categories B & C is higher in PPG24 than it was in the draft.

The NEC values given in Table 2 permit slightly higher levels for noise from rail traffic compared to the NECs for road traffic.

Noise from Aircraft For major airfields NNI contours have been used for many years to aid development control. In 1990 the DoT adopted a new index of noise exposure contours expressed in terms of L_{Aeq} from 07.00

– 23.00. This conveniently compares with the day levels specified in the Noise Exposure Categories (NECs) of PPG24. However, unlike road traffic noise, there is no direct conversion from the old indices to the new, so it is difficult to compare the new NEC levels to the advice in Circular 10/73 which related to NNI levels.

Interestingly for aircraft noise, the text of PPG introduces another category of 'major' new noise sensitive development for which it states $L_{Aeq,16h} = 60$ should be the desirable upper limit. This falls in the lower half of category B NEC.

The NEC values given in Table 2 permit slightly higher levels for noise from air traffic compared to the NECs for road traffic. This is in spite of the fact that intermittent air traffic noise may be more obtrusive than road traffic noise measured against a quiet background noise level.

No advice is given on the assessment of planning applications for new small airfields although the number of these is growing rapidly. For small airfields a commonsense approach of restricting the number of movements, 'touch and go' operations, maximum aircraft weights and times of operation may be the solution. Advice on draft planning conditions covering these points is contained in Annex 4 of PPG24.

The guidance also touches briefly on the subject of military aerodromes and heliports.

Noise from Industrial and Commercial Developments

PPG24 gives surprisingly little advice on dealing with noise from industrial and commercial developments, although this area is probably the most complicated and contentious dealt with by local Planning Authorities and their EHO advisers.

As far as new residential development near to existing sites are concerned, industrial noise appears not to be covered by the NEC categories until one reads the small print in the notes referring to mixed sources, namely: 'Mixed Sources: This refers to any combination of road, rail, air and industrial noise sources. The 'mixed source' NEC should only be used where no individual noise source is dominant. To check if any individual source is 'dominant' the noise level from the individual sources should be determined by decibel addition. If the level of any one source lies within 2 dB(A) of the calculated combined value, then that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the mixed source NECs.'

If the dominant source is industrial the general advice is to use BS 4142.

Background noise normally includes transport noise and perhaps industrial noise. Elsewhere in the guidance (Annex 5(1)) the code admits that practical L_{Aeq} values may be 10 dB(A) or more above the L_{A90} in quiet areas and this would certainly not be uncommon in rural areas where L_{Aeq} tends to be dominated by light intermittent traffic noise and L_{A90} is primarily determined by the noise levels between traffic peaks. In that context and using the NEC guidance it appears that an existing tonal and inter-

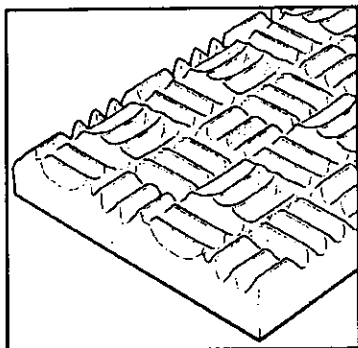
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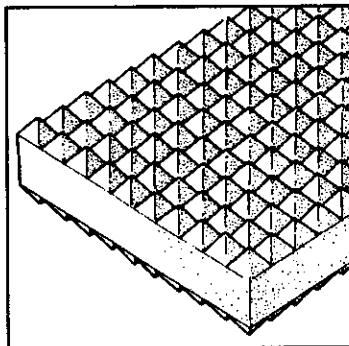
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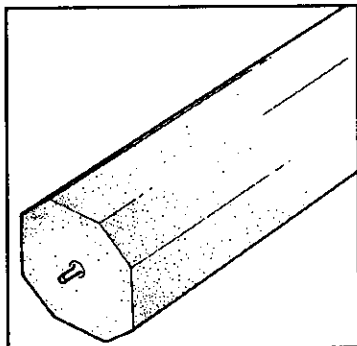
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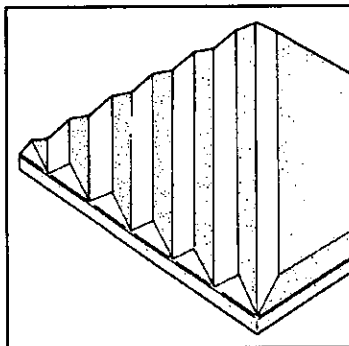
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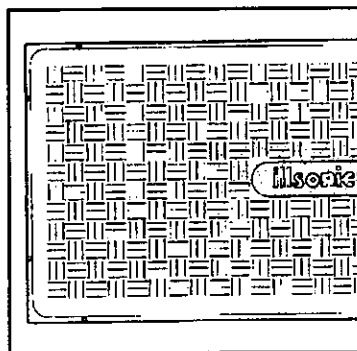
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mittent industrial noise source operating for 4 hours a day at which time it produces a level, say, 13 dB(A) above background L_{A90} would not be reported as the dominant source from a measurement of $L_{Aeq,16h,day}$. In that case it would not have to be taken into account using the NEC tables for new residential development!

As far as new industrial or commercial development is concerned, the PPG24 advice on this complex subject is to refer the reader to the guidance in BS 4142. It quotes the BS advice that 'a difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance'. Missing from PPG24 and the earlier draft are the concerns about the increase in creeping ambient background noise levels. The Circular 10/73 advice that, for a new industrial development near an existing sensitive development, the applicant should be required to provide a prediction of corrected noise levels, has also disappeared.

It is normal practice for EHOs to recommend that planning conditions are used to try to control noise from new industrial and commercial developments. The new guidance gives examples of planning conditions in Annex 4 following the general lines of the guidance given in Circular 1/85. The most effective control for industrial noise favoured by many Local Authorities is the use of a planning condition to set noise limits, commonly termed Boundary Noise Levels (BNLs).

In the next issue of *Acoustic Bulletin* the use of planning controls to control noise from industrial and commercial developments, including the use of BNLs, will be examined in detail.

Other Noisy Activities

PPG24 also mentions briefly noise from recreational activities, construction and landfill sites. In each case it refers to existing guidelines, namely PPG17 for sport and recreation and BS 5228 for noise from construction and landfill sites.

Insulation of Buildings Against External Noise

The number of people exposed to high levels of road, rail and air traffic noise has increased substantially over the last twenty years. The new guidance appears to relax requirements in respect of planning and noise, certainly as far as a new residential development exposed to new road traffic noise is concerned. It is, therefore, very disappointing that so little practical advice on the insulation of buildings against external noise is given in PPG24.

Annex 6 of the Guidance addresses this area. It points out that windows provide the main route for noise to enter buildings. It refers to BRE Information Paper IP6/94 and reproduces information from it by stating that: 'to provide good sound insulation a window must be fitted with effective seals'.

The guidance goes on to explain that the sound insulation of windows increases with the thickness (or mass) of the glass, that double glazing generally provides higher levels of sound insulation than single and that, in general, the wider the spacing between the panes, the

better the sound insulation. However, it also points out that the wider spacing provided by secondary glazing of the sort specified in the Noise Insulation Regulations 1975 for protection against road traffic noise, provides little additional benefit compared with standard thermal double glazing for road traffic noise (see Table 3 reproduced from Table 1 of PPG24).

Difference between dB(A) levels outside and inside

	single glazing	thermal double glazing	secondary glazing
Road Traffic	28	33	34
Civil Aircraft	27	32	35
Military Aircraft	29	35	39
Diesel Train	28	32	35
Electric Train	30	36	41

Note: The values in the Table are the difference between dB(A) levels measured outside and inside typical dwellings; they have not been corrected for reverberation time or window area, and so cannot be compared with values obtained under other conditions. The Table is intended to give an idea of the insulation likely to be achieved in practice – not under ideal conditions. Secondary glazing systems in particular will perform better in installations where sound insulation is not limited by poor sealing or by flanking sound paths such as thorough doors or acoustically weak parts of window bays. The values for single glazing are representative of well sealed windows.

Table 3. Typical noise reduction of a dwelling façade with windows set in a brick/block wall.

Annex 6 gives the following advice on ventilation: 'To provide adequate insulation against external noise it is necessary to keep closed those windows and ventilators which have not been designed to provide sound insulation (even when closed some ventilators may still not be adequately sealed). Therefore, alternative methods of providing ventilation and control of summertime temperatures must be considered. Sound insulation ventilators may be 'whole house' systems or individual units installed where necessary. Ventilators of the type specified in the Noise Insulation Regulations will limit the insulation against traffic noise to about 38 dB(A). Further guidance can be found in BRE Digests 338 Insulation against external noise and 379 Double glazing for heat and sound insulation.

None of the advice in PPG24 or in the BRE publications quoted give clear practical advice on how adequate and cost effective noise insulation can be provided to a residential development that is permitted in NECs B & C. Practical advice on this subject is not available at the moment. The work done by the Building Research Establishment is mainly concerned with the testing and performance of existing systems rather than suggesting practical solutions for protecting buildings from environmental noise. PPG24 gives no real advice on design and construction solutions to minimise internal noise levels in new dwellings.

The thrust of the new NEC procedure is that, if planning consent is granted for residential developments in NECs B & C, planning conditions should be imposed to

ensure an adequate level of protection against noise. This level of protection should be commensurate with the level of noise exposure. Let us consider how this may be achieved and what further advice is needed.

Design Solutions: These are fairly well understood and may include the use of barriers or screening dwellings from the noise source by other buildings. In high noise level areas, balconies or gardens may be located on the quietest side of the building. Less noise sensitive rooms, such as toilets, bathrooms, kitchens and landings, may be located on the noisiest elevations and smaller windows provided to these rooms.

The design solutions are not applicable, however, to aircraft noise. Noise coming from above will affect all rooms and recreational areas. BRE advise that the insulation to be expected from a standard pitched roof is in the region of 35 dB(A).

Windows: Windows are the main path for external noise to enter rooms. The effective noise insulation offered depends upon the sealing and room ventilation arrangements and the glazing design.

Effective seals are perhaps the most important provision and could be simply covered by a requirement that compression seals (neoprene or similar material) must be provided to all windows and doors on noisy elevations.

With regard to glazing, the Building Regulation requirements for thermal insulation mean that virtually all new build dwellings are provided with thermal double glazing. Information on the optimum cost effective glass thickness and spacing for different types of transport noise is not readily available from any independent source. The R_{tra} value of a 6-12-6 thermal double glazing unit is 26 dB(A). One proprietary 10-12-6 double glazing unit has a R_{tra} value of 32 dB(A) and it is estimated that for the figures given in the double glazing column in Table 3, there would be a 3-5 dB(A) enhancement for all the noise sources specified.

The matter of ventilation requirements is a difficult area and one on which practical advice is urgently needed. The sound insulation provided by a window with any glazing configuration will only be in the region of 10-15 dB(A) when partially open. It is therefore essential that to achieve good sound insulation, dwellings must be provided with a system that can adequately ventilate habitable rooms in warm weather with windows closed.

The current Building Regulations require that 4,000 mm² of permanent ventilation is required to all habitable rooms and this requirement is usually met by providing trickle ventilators to the windows of new dwellings. Little information is available on the acoustic performance of these trickle ventilators in respect of transport noise. Tests carried out by BRE have indicated that they do reduce the insulation provided by double glazed windows, mainly above 315 Hz, with little or no effect at lower frequencies. (This may reduce insulation against transport noise by 1 to 3 dB(A) on the figures shown in Table 3).

Sound insulated air bricks are available with quantified acoustic performance and these are, therefore, preferable from a sound insulation point of view until such time as well attenuated trickle ventilators become

available. Larger permanent ventilation areas are required by Building Regulations in rooms having flued heating appliances and the acoustically treated air inlets detailed in the Noise Insulation Regulations 1975 may be suitable in these rooms. Mechanical ventilation may be desirable in kitchens and bathrooms and whilst these are not regarded as habitable rooms, the acoustically treated mechanical ventilators described in the Noise Insulation Regulations 1975 may be worth considering for these areas and to habitable rooms in higher levels of noise exposure.

An effective solution on which there is little advice at the moment is whole house ventilation which can be achieved without opening windows. This could be similar to some existing warm air central heating systems which have the ability to circulate fresh cool air in warmer weather. This type of system would be particularly useful for higher levels of noise exposure. (The attenuation values stated in Table 3 depend on window size, room size and furnishings. So, for example, a room with a large patio door would not be provided with the same level of acoustic protection suggested in the Table.)

What is required is clear unbiased advice for Local Authorities and the building industry as to the preferred glazing options for NEC categories B & C for different transport noise sources.

The secondary glazing, window blinds and ventilation package for the 1975 Noise Insulation Regulations has, over the last twenty years, been provided to over 100,000 dwellings at public expense. Table 3 shows that the effectiveness of the secondary glazing for road traffic noise (based on a simple dB(A) basis) provides virtually no improvement over thermal double glazing units. Research by BRE [2] in the 1980s on dwellings treated with the Noise Insulation Regulations 1975 package showed some deterioration in seals resulting in reduced noise insulation, some ventilation fans operating at unsatisfactorily high noise levels and less than universal satisfaction with the appearance and bulk of the hardware involved.

One suspects that a repeat of that research, fifteen or twenty years after installation, would reveal a substantial loss in the acoustic integrity of the supplied secondary glazing and ventilation systems.

Nevertheless, a number of Local Authorities have specified this secondary glazing package for new build dwellings exposed to high transport noise levels and are likely to continue to do so under the new guidelines unless they are advised on a more practical solution.

The new package of protection for noise from the new high speed Channel Tunnel link is likely to provide the same noise insulation solution of secondary glazing, blinds and mechanical ventilation. One suspects that research into this subject would reveal a cheaper, more durable and attractive solution to the existing statutory package. Enquiries by the author to two national and one local double glazing companies as to the best way to reduce external traffic noise in a single glazed living room brought the same response. Namely that secondary glazing with acoustic treatment of the reveals was the

most effective solution but that replacement windows provided with 4-16-4 or 4-20-4 glazing was also extremely effective. None of the companies mentioned window seals or ventilation. It may be that the double glazing and replacement window industry also needs some clear advice on this subject.

Discussion

PPG24 is the Government's policy document giving guidance on planning and noise. The guidance is mainly concerned with new residential development exposed to existing air, rail and road traffic noise sources. There is little or no new advice on any other areas of noise pollution.

On the credit side the guidance introduces much needed advice on residential development near to railways. It also attempts to simplify and unify noise measurement criteria for air, rail and road traffic and introduce for the first time standards for nighttime noise. The new Noise Exposure Criteria should help local Planning Authorities to focus attention on and improve the identification of new residential development needing protection against transport noise. It is the author's experience that many small developments, residential conversions and extensions exposed to high transport noise levels have, in the past, been approved without any special acoustic protection.

On the debit side the new guidance on road traffic noise in PPG24, using the new measurement criteria, relaxes criteria set down in Circular 10/73 twenty-one years earlier. It may well be that nationally the demand for land for residential development is such that the use of land exposed to higher levels of traffic noise for this purpose is justified.

From the acoustic point of view it can be argued that there should be no objection to the use of such land provided that residential development on it is constructed so that (a) the occupiers can enjoy a well protected acoustic environment in habitable rooms provided with adequate ventilation and (b) some parts of gardens or balconies are shielded from higher levels of noise exposure.

PPG24 attempts to address this in the wording of Table 1. Namely, for land exposed to the high noise levels and Noise Exposure Category B, it states that noise must be taken into account and *'where appropriate, conditions imposed to ensure an adequate level of protection against noise'*.

For the very high noise levels specified in NEC category C permission for residential accommodation should not normally be granted but, if it is, *'conditions should be imposed to ensure a commensurate level of protection against noise'*.

However, this advice is of little value because there is no clear guidance on the optimum cost effective solutions available to meet the requirements for 'adequate' or 'commensurate' levels of protection against noise for new residential developments.

The lack of understanding of this problem is underlined by the fact that so many houses, including newly built ones, have been provided with the secondary glaz-

ing package available under the Noise Insulation Regulations 1975 although it is known that secondary glazing is of little value in providing protection against road traffic noise.

Local Authorities should have available clear guidance on sound insulation standards for new build residential development exposed to traffic noise levels NEC B & C. Until these are available, local Planning Authorities are likely to apply different and sometimes unsuitable standards.

Recommendations

1. The new measuring position advice in PPG24 should be amended to take account of the higher noise levels affecting upper floor facades in locations where ground level measurements are expected to be significantly lower.
2. Advice on a new short time period for measuring L_{Aeq} day and night levels for road, rail and air traffic noise should be provided and used to give an estimate for longer periods.
3. Research should be carried out to identify optimum, cost effective, solutions to protect residential development against environmental noise. Clear advice on building construction solutions, appropriate for NEC levels B & C for each type of noise source, should be available to Local Authorities and the building industry.
4. The Noise Insulation Regulations 1975 insulation package should be urgently reviewed and further research on dwellings insulated with this package fifteen years or more ago, should be carried out to assess the long term suitability of the package. Research should be carried out on more durable and consumer attractive solutions providing good sound insulation against the various types of transport noise.

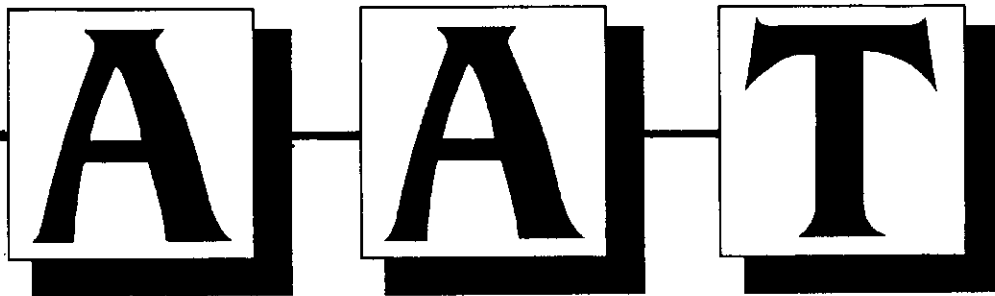
Research should be carried out to design window ventilators with good acoustic performance against transport noise. If a trickle ventilator with good acoustic performance or a larger acoustically treated ventilator was designed in an enlarged window frame head, the manufacturer might well corner the market in this field.

References

- [1] Railway noise and the Insulation of Dwellings, Department of Transport, (1991)
- [2] Journal of Sound and Vibration, Volume 109 (1), (1986)

Steve Goswell MIOA was Principal EHO with South Cambridgeshire District Council and is now a consultant specialising in planning and noise at 22 Glebe Road, Barrington, Cambridge CB2 5RP. In the next issue of the *Acoustic Bulletin*, he will examine planning and noise controls for industrial and commercial developments and the use of boundary noise level conditions.

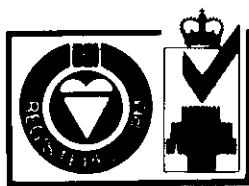
Editor's note: As a critique of PPG24, parts of this article are necessarily controversial. Comments, and perhaps dissenting views, are invited as contributions to the Letters section of the Bulletin. However, readers are reminded that it is editorial policy to abridge or otherwise amend letters for reasons of space or relevance. ❖



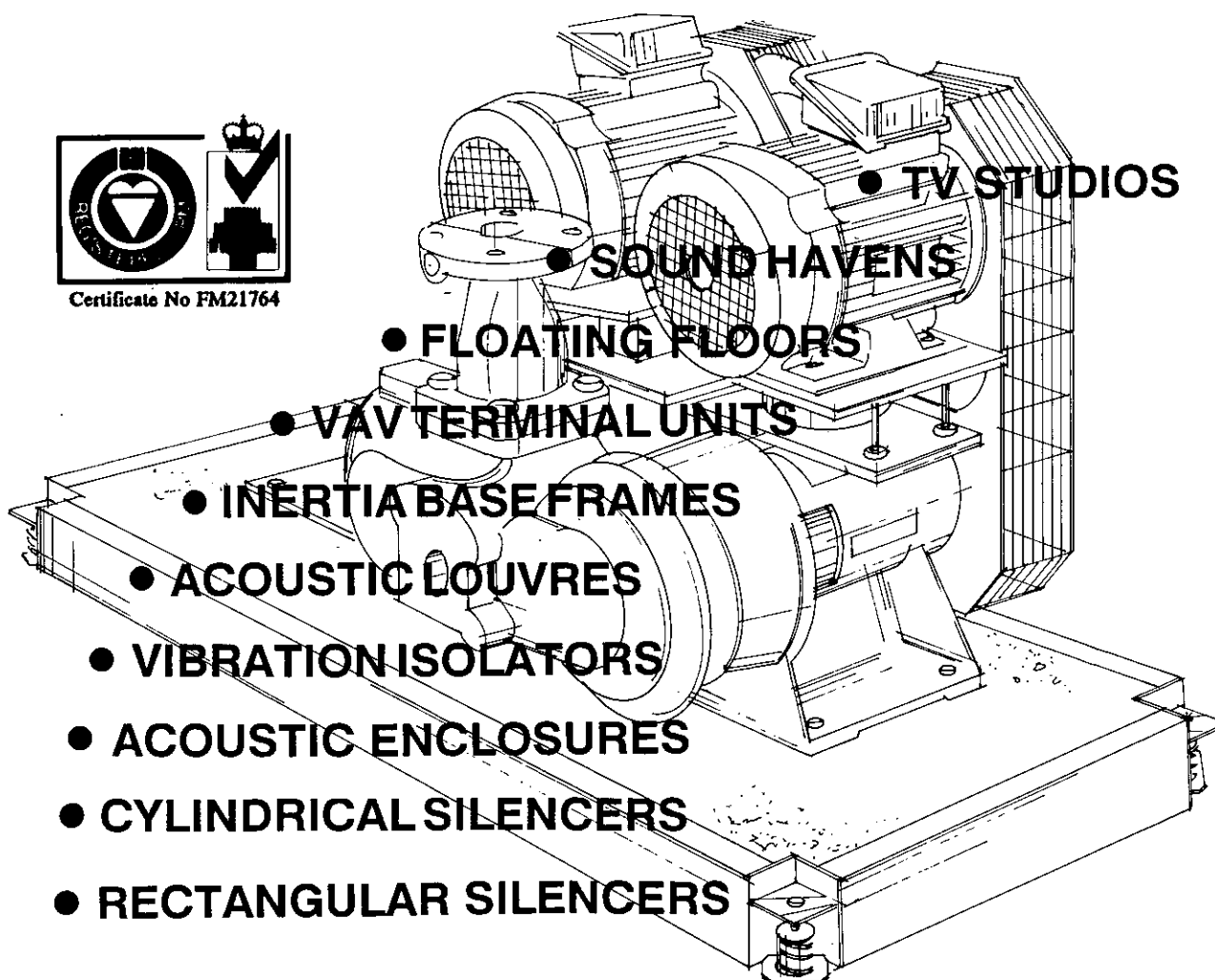
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AN INVESTIGATION INTO A METHOD FOR THE ASSESSMENT OF DISTURBANCE CAUSED BY AMPLIFIED MUSIC FROM NEIGHBOURS

Colin Grimwood MIOA and Nick Tinsdeall

Introduction

The decision on whether or not a particular type of neighbour noise is a nuisance is traditionally based on a subjective assessment by an investigating officer, usually an environmental health officer (EHO). It was felt that an objective method of assessment might be useful in order to support any decision that was likely to be disputed. Complaints about amplified music from neighbouring premises were identified as possible candidates for such an approach.

An objective method for the assessment of disturbance caused by amplified music was developed by the Open University [1] in 1991 under contract to the Building Research Establishment (BRE). The method was developed following the analysis of twenty nine case studies. In order to establish the usefulness and accuracy of this method two field trials have been conducted. The findings of the first field trial were reported in Environmental Health in 1993 [2]. This paper presents the data collected in the second field trial undertaken between 1993 and 1994.

The results of both field trials are combined for the discussion in the section entitled Levels in Complainants' Homes. Methods and the definitions of terms used in this article can be obtained from the reproduction of the assessment form supplied to the Local Authorities (LAs) which participated in the trial (Figure 1). The paper also presents the findings of a short experiment to investigate the use of an alternative measurement technique.

From Figure 1 it can be seen that the noise level L used to assess the disturbance from amplified music is equal to the difference between the measured average maximum noise level L_d (including normal background noise) and an estimate of background noise L_b made in the absence of audible disturbing music. An overall correction factor L_c is provided to allow for the time of day,

duration of disturbance and bass prominence. The final disturbance rating L_{dc} is given by $L_{dc} = L + L_c$. All units in dB(A).

Field Trial Details

More than fifty LAs expressed an interest in the project and were sent assessment forms. Officers from those LAs were requested to complete an assessment form as part of their normal investigation of a complaint about disturbance due to amplified music.

In July 1994 a further survey of the same fifty LAs was undertaken in order to encourage the return of completed assessment forms and to seek further opinions and comments on the method.

Findings

Return of assessment forms: Completed assessment forms were received from ten LAs, providing details on seventy six cases. The vast majority of investigations included in this study were carried out during the day or evening period; a few were carried out at night. The results are summarised in Table 1.

From these results we can see that:

1. The agreement between the subjective assessment and the objective rating is very good in all cases where the investigating officer subjectively considered the noise to be a *definite nuisance*.
2. In the majority of cases that fell into the marginal situations there was no agreement between the subjective assessment and the objective rating.
3. Relatively few investigations were actually undertaken for cases that were not considered a definite nuisance. The number of cases in these situations is too small to draw any firm conclusions.

During the survey the method has been used in two distinct ways. Firstly, as a direct assessment method with

Assessment of investigating officer	Disturbance rating L_{dc} (dB(A))		Total number of cases	Number of cases where officer assessment and objective rating agree
	Measured	Recommended		
(1) Nuisance	$10 < L_{dc} \leq 57$	$L_{dc} \geq 10$	57	57
(2) Nuisance (marginal)	$0 \leq L_{dc} \leq 23$	$5 \leq L_{dc} \leq 10$	11	2
(3) Not nuisance (marginal)	$1 \leq L_{dc} \leq 13$	$5 \leq L_{dc} \leq 10$	6	3
(4) Not nuisance	$L_{dc} \leq -4$	$L_{dc} < 5$	2	2

Table 1. Summary of assessment forms – second field trial

ASSESSING NUISANCE CAUSED BY AMPLIFIED MUSIC

Guidance on completing assessment form

Thank you for participating in this study. Please complete a separate sheet for each investigation. If you have any queries contact: BRE, Watford, WD2 7JR

Your objective assessment

Measurements

- (i) The measurements should be made at a typical listening position in a room where the complainant is disturbed by the noise.
- (ii) Estimate the level of disturbing music from average of maximum readings on a sound level meter set to F time weighting
- (iii) Estimate the background noise level from average of minimum readings on a sound level meter set to S time weighting when the disturbing music is not audible.

Correction terms

- (iv) In (a) if the disturbance spans 'time of day' categories record both, but take the higher correction value.
- (v) in (b) the 'duration of the disturbance' is the time for which music is played, not the duration of individual extracts from it that are audible.
- (vi) In (b) if the disturbance spans 'time of day' categories please record the time in each 'duration' category, but base the correction on the total time duration.

Your comments

Your comments on the value of the method and how it could be improved are welcome. Particular points of interest are:

- (a) the choice of F weighting instead of S weighting for measuring the music level;
- (b) how you take account of the frequency of occurrence of the disturbance when making your subjective judgement of nuisance;
- (c) if the objective assessment does not match your judgement where is the method going wrong?

THE ASSESSMENT FORM

Your name and address:

Details of noise complaint and date of investigation:

Your subjective assessment of noise problem (please tick one):

1. nuisance (definite)
2. nuisance (marginal)
3. not a nuisance (marginal)
4. not a nuisance (definite)

Comment on decision if marginal case

Your objective assessment:

typical maximum level of disturbing music L_d dB(A) (F time weighting)
 typical level of background noise L_b dB(A) (S time weighting)
 $L = L_d - L_b =$ dB(A)

Corrections (circle one from each of (a), (b) and (c))

(a) time of day disturbance occurs:

day:	09.00 – 19.00	0
morning:	07.00 – 09.00	+5
evening:	19.00 – 23.00	+5
night:	23.00 – 07.00	+10

(b) duration of disturbance:

>2 hours	0
45 min – 2 hours	-5
20 min – 45 min	-10
<20 min	-15

(c) bass prominence

not prominent	0
noticeable	+5
very prominent	+10

Sum of three corrections $L_c =$

DISTURBANCE RATING $L_{dc} = L + L_c =$

Provisional interpretation of L_{dc} :

$L_{dc} > 10$	nuisance;
$L_{dc} < 5$	not a nuisance;
$5 < L_{dc} < 10$	judgement needed

Frequency of occurrence of noise causing complaint (for information – not used in assessment)

Please mark one of the following:

- daily
 more than 3 times a week
 more than once a week
 other (please state)

Fig. 1. Form used in assessment

the measurements being taken by the investigating officer in the complainant's house. Secondly, as an indirect assessment method where the investigating officer is analysing a calibrated tape recording of the disturbing music sometime after the event. The use of calibrated tape recordings in the assessment of domestic music complaints seems to be increasing at the present time. Such procedures are claimed by some LAs to be a more efficient method of investigating neighbour noise complaints.

Although the method was developed to assess noise from next door neighbours, during the trial it was also used by some LAs to assess amplified music in other circumstances including music from pubs and clubs.

Local Authority opinions on method: The fifty LAs were approached for further views on the method using a simple questionnaire. Twenty eight LAs responded, of whom only seventeen had used the method. Twenty one considered that there was a need for an objective method to assist in the assessment of nuisance caused by amplified music. Six LAs supported a method that could be used to provide guidance. One LA was unsure. All seventeen LAs which had used the method reported that they had found it useful.

The method of assessment advocated the use of aver-

aging (by eye) of the sound level meter display to obtain both the music level during the disturbance and estimates of the background noise level. Most LAs now possess digital sound level meters, and the envisaged estimation procedure was judged to be too difficult with some modern digital displays. Further, the description of the averaging procedure in the guidance supplied was said to be unclear with different operatives obtaining different readings for the same assessment.

Several LAs commented that they would prefer to measure a background level in the absence of music using L_{A90} and measure the level of music using L_{A10} . Others commented on the bass prominence penalty seeking further guidance on how to assess this more objectively. A few users felt that the thresholds were incorrect. It is apparent from Table 1 that several cases which were considered to be a marginal nuisance had a L_d rating of more than 10 dB(A). It would, of course, be possible to adjust the threshold levels in the method but there is insufficient data from these marginal cases to support any re-assessment of the thresholds.

Levels in complainants' homes: The data collected during both field trials is examined here as this provides additional information that is of interest and clearly demonstrates why any full assessment procedure should consider more than just the level of the disturbing music.

Figure 2 shows the level of disturbing music measured in all the homes considered during this study. The spread of data is quite considerable. It should be noted that many of the levels are comparable to background levels measured in homes close to busy roads. There is no clear level at which the disturbance due to the amplified music is considered to be a nuisance.

Figure 3 presents the background levels measured in all the homes visited during this study. Comparing Figures 2 and 3 it is immediately clear that the background level in some cases is greater than the level of the disturbing music in other cases.

Figure 4 shows a comparison of the amount by which the disturbing music exceeds the background noise level with the assessment of the investigating officer. Fig-

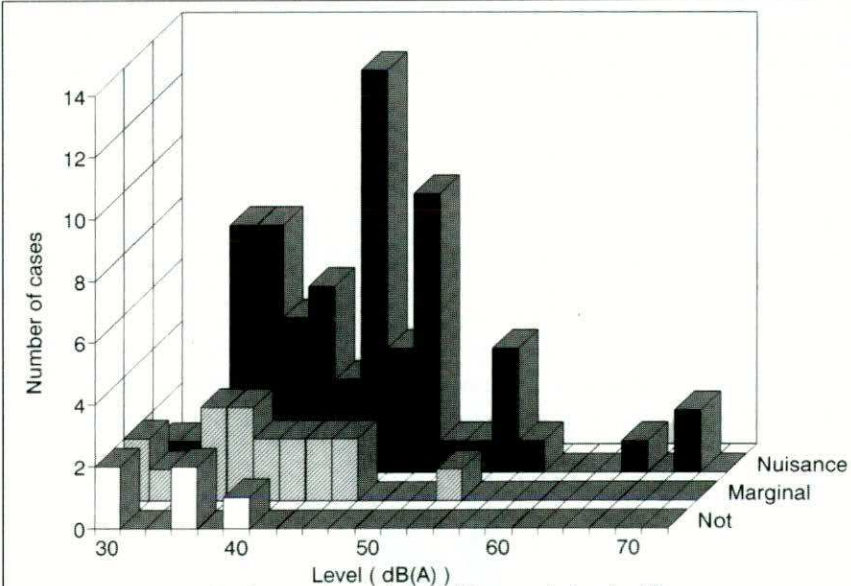


Fig. 2. Comparison of disturbing music level with assessment of investigating officer

Estimation using described objective method (dB(A))			Statistical Indices (dB(A))			Difference between methods (dB(A))
L_d	L_b	$L(L_d - L_b)$	L_{10}	L_{90}	$L_{10} - L_{90}$	
51	24	27	46.7	26.5	20.2	- 6.8
50	33	17	51.5	27	24.5	+ 7.5
47	35	12	50	28	22	+ 10
52	30	22	49.5	27	22.5	+ 0.5
50	30	20	50	32	18	- 2.0
48.5	30	18.5	49	28	21	+ 2.5

Table 2. Results of experiment to compare measurement techniques

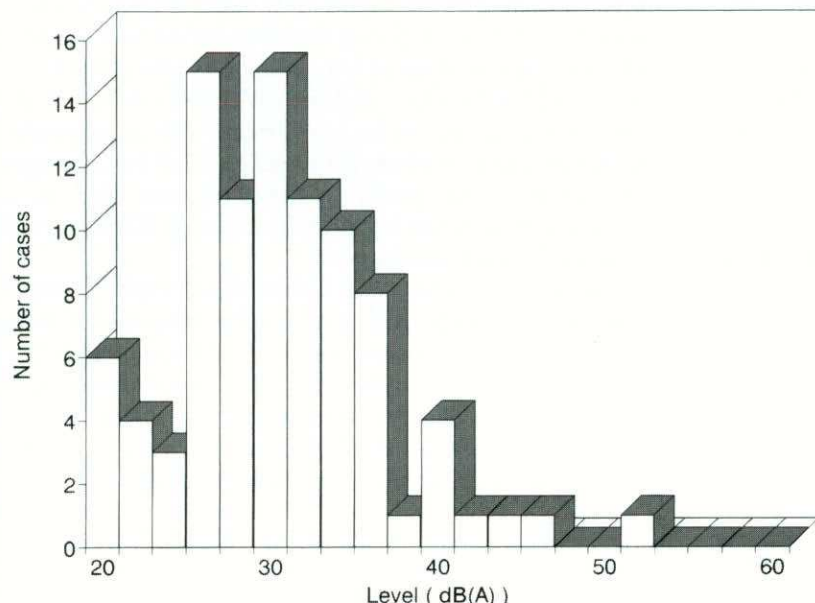


Fig. 3. Measured background level for all cases

ure 5 compares the disturbance rating, L_{dc} with the assessment of the investigating officer.

It can be seen from Figure 4 that it would be possible to select a minimum value for the amount by which the disturbing music exceeds the background level above which one could be reasonably certain that an investigating officer would consider the disturbing music to be a definite nuisance. Figure 5 demonstrates that if the disturbance rating exceeds 20 dB(A) the majority of cases investigated in this study were considered to be a definite nuisance. Both graphs illustrate that there is a considerable 'grey area' between the marginal and definite cases.

Other Measurement Techniques

We decided to explore the use of alternative measurement indices for the assessment of music disturbance and so a simple experiment was conducted at BRE. The experiment consisted of using two noise sources: (i) an amplified music source, shaped using a spectrum shaper to simulate a real life amplified music problem, and (ii) a recording of traffic noise inside a house to serve as a realistic background noise.

Both sources were played into the BRE quiet room and subjects requested to estimate the disturbing music level and the background noise level (using a sound level meter with an analogue display) as required in the assessment method. The measurement was then repeated, but this time measuring L_{A10} and L_{A90} using a statistical sound level meter. The results are given in the Table 2 where each row corresponds to one subject under test.

These results are not encouraging, particularly as the same piece of disturbing music was used in all cases. Using the tech-

nique required by the objective assessment method, different operatives have obtained very different values for what should be identical data. The measurement of a background level has proved to be particularly difficult. The spread of the background levels is reduced when the statistical indices are used. This suggests that the use of the statistical indices as opposed to the assessment method will give more consistent results. The authors are also aware of a similar experiment conducted by one LA which claims, by way of contrast, to have achieved good agreement between measurements resulting from the assessment method and those using statistical indices. We found that two of the most important measurement issues, in order to achieve consistency between investigations (of the same piece of disturbing music), are to ensure that the sample time for all measurements is long enough to obtain repre-

sentative values and that the background noise measurement is obtained in the absence of the disturbing music. In some circumstances it may be possible to obtain an estimate of background noise during short quiet sections of the music, but this is particularly dependent on the type of music and type of measuring equipment and requires further investigation.

Conclusions

The response to the field trial has been very disappointing. More than fifty LAs expressed an interest in participating in the field trial, but completed assessment forms have only been received from ten LAs. However, the following conclusions can be made:

1. The procedure does not work as a replacement for the subjective assessment of nuisance by an investigating officer. The poor response from local authorities may, in

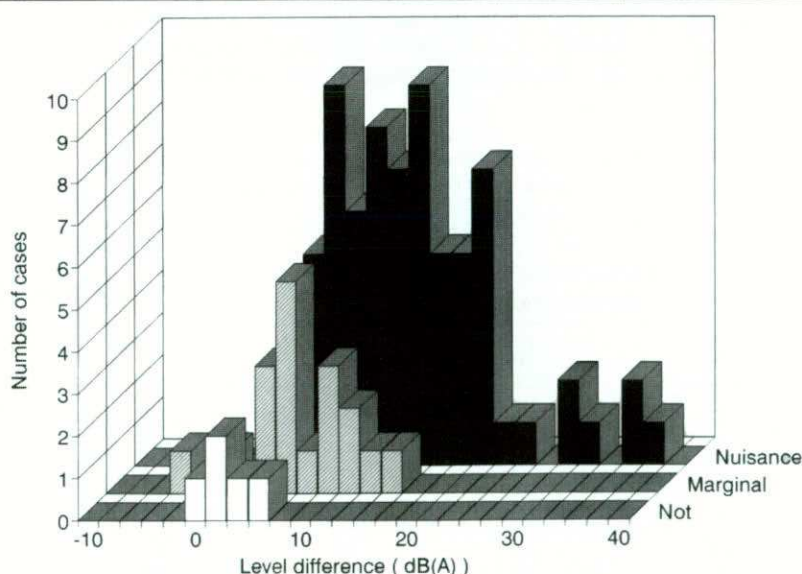


Fig. 4. Comparison of the amount by which the disturbing music exceeds the background noise level with assessment of investigating officer



Fig. 5. Comparison of disturbance rating (L_{dc}) with assessment of investigating officer

2. The procedure does have some value in providing objective support for the opinion of an investigating officer in clear cut cases where there is a definite nuisance from amplified music. However, data presented here suggests that a simpler procedure, perhaps based on the amount by which the disturbing noise exceeds the background noise level, might also be capable of providing similar support in many cases. Further research and field

[1] A Watson, J Brooks & K Attenborough, 'An investigation of amplified music disturbance in dwellings', *Proc IOA Vol 13 Part 8*, 303 - 310, (1991).

[2] L Fothergill, 'Assessing nuisance caused by amplified music', *Environmental Health*, Vol 101/09, September 1993, 287 - 288.

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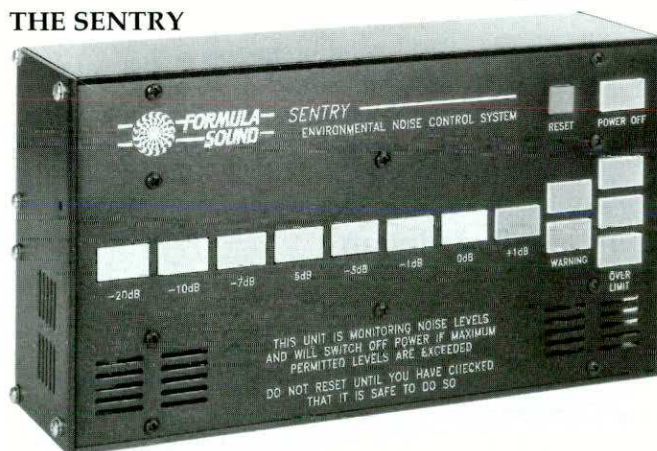
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ULTRASOUND APPLICATIONS IN MEDICINE

Tony Evans

Introduction

It is difficult to identify an area of physics applied to medicine which has developed in the last decade as rapidly as ultrasound. Not only has it improved as a diagnostic tool including both imaging and Doppler techniques but also there have been several examples of major surgical ultrasound developments, although space does not permit discussion of these here. Despite a series of prognostications over the last decade, there is no firm evidence that the rate of development is slowing, although where it goes next is a matter best left to those who deal in stock exchange 'futures'! The purpose of this article is to examine briefly the main recent areas of development.

The essential characteristics of any imaging tool might be described under the following headings: (i) spatial resolution (ii) temporal resolution (iii) contrast resolution. Each of these will be examined in turn.

Spatial Resolution

Medical ultrasound imaging has been dominated by reflection-mode imaging using the pulse-echo principle, although other proposals have been made from time to time. In this mode, the spatial resolution is different in the three orthogonal imaging planes since it is limited by different factors in each case. Figure 1 shows a typical

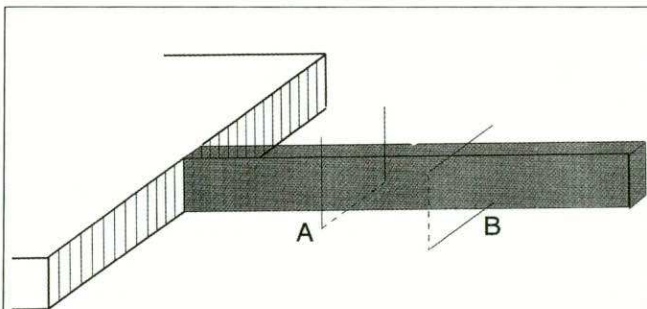


Fig. 1. The difference between in-plane resolution and slice-thickness resolution may be large since focusing techniques often result in beams which are rectangular in cross-section as shown here.

transducer, as commonly used in medical imaging, which consists of an array of many independent rectangular transducers arranged in a linear array and fired sequentially. Each firing generates one line of acoustic information. The ability of the system to distinguish the two targets positioned laterally and labelled A in the diagram depends upon the lateral beamwidth whereas the ability to resolve the same two targets rotated through 90° and labelled B, will depend upon the vertical beamwidth or slice thickness. One of the major developments in recent years has been to use combinations of the individual transducer elements to produce a synthetic aperture and thereby allow focusing. Thus in the scan plane (ie case A)

the resolution (typically 1 – 2 mm) now often approaches a wavelength, in the other plane (case B) it is rare for the resolution to be better than 3 mm and even this is only achieved over a small depth range (Figure 2). It seems likely therefore that spatial resolution is beginning to approach rather fundamental limitations of the order of one wavelength. The obvious solution is to use higher frequencies, but this is normally excluded because of the high attenuation of soft tissue at frequencies above the normally used 3 – 7 MHz range.

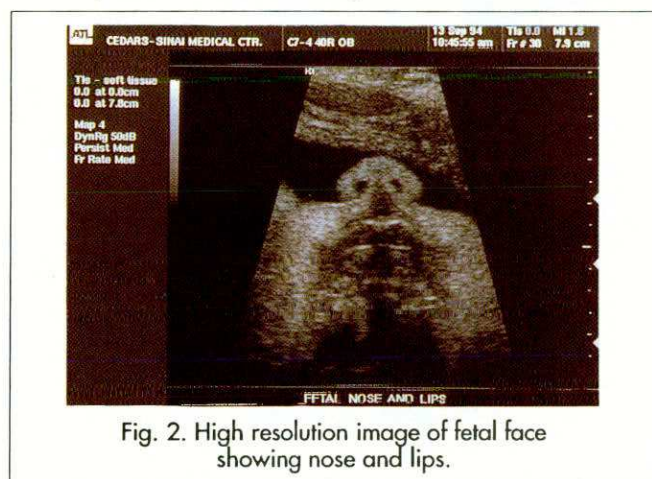


Fig. 2. High resolution image of fetal face showing nose and lips.

There are two major exceptions. The first is the development of so-called 'endoprobes', which are devices designed to be inserted into specific body orifices; the rectum, oesophagus and vagina are good examples. The advantage of such probes is that the ultrasound is delivered closer to the target, resulting in less overlying tissue and hence allowing higher frequencies to be used. In addition, this approach bypasses some anatomical barriers (typically bone and gas) which make it difficult to visualise organs through the more traditional route.

It is perhaps, surprising that patient resistance to these new probes has not been greater but there is evidence that, in some cases, patients actually prefer these more 'invasive' techniques.

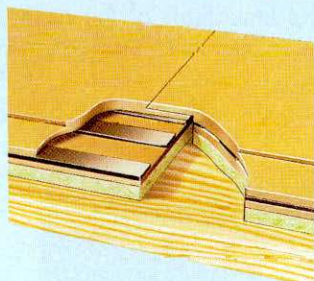
A logical extension of this development is to make the ultrasound probe small enough to travel along blood vessels and this has also been made available by a number of manufacturers (Figure 3). This has enabled the use of frequencies of up to 30 MHz with corresponding resolution improvements.

The ability to image the build up of plaque in the inside of, for example, the carotid artery, has excited much interest. There are drawbacks however, since the probes cannot easily be sterilised and there is sometimes a reluctance on the part of clinicians to insert a probe into a region where it might accidentally strike an unstable region of plaque releasing dangerous fragments into the bloodstream.



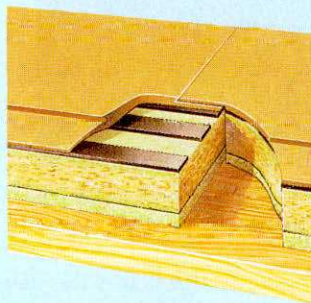
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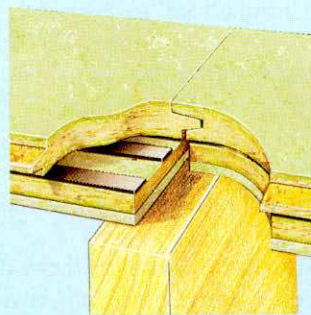
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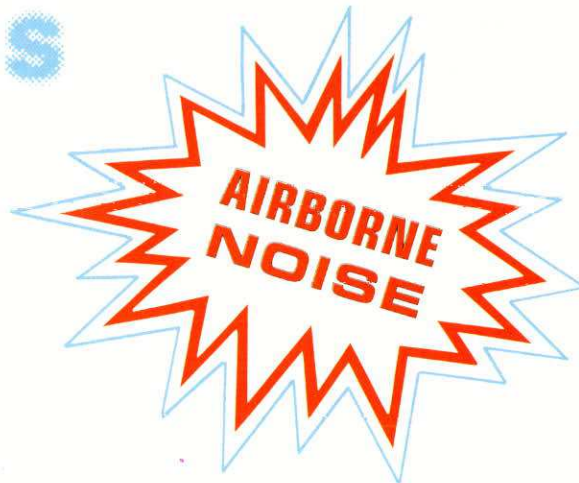


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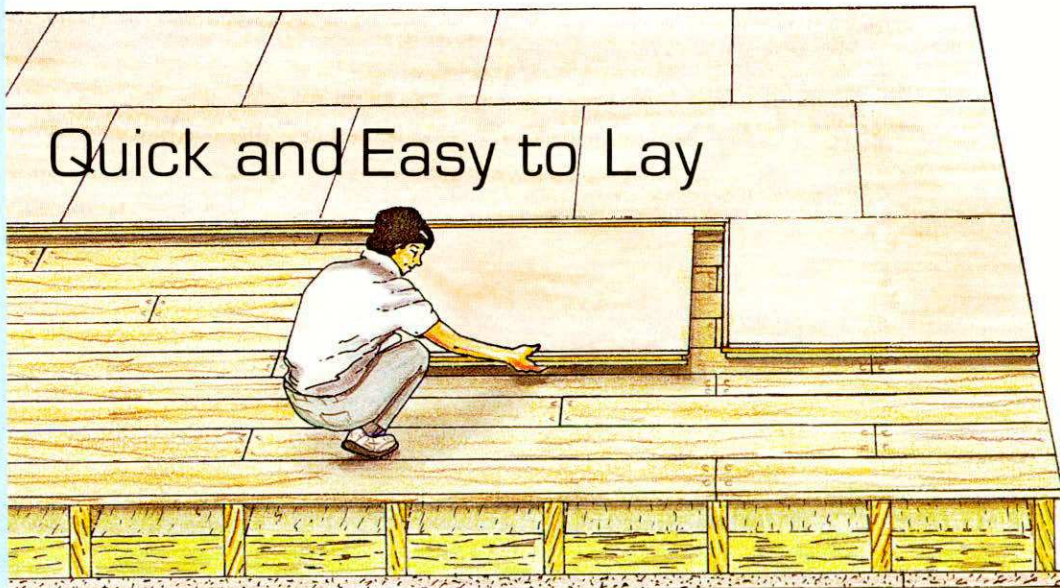


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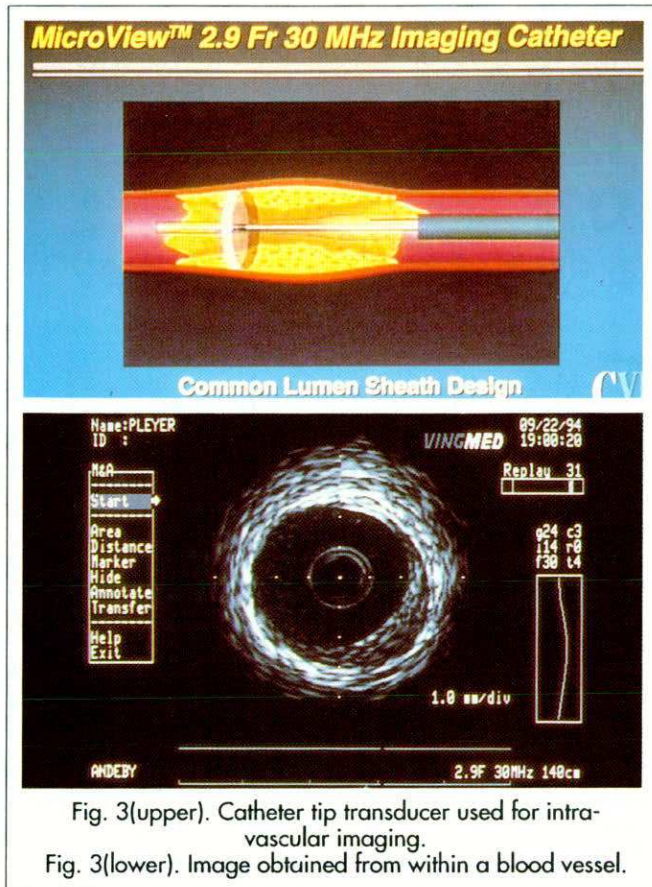


Fig. 3(upper). Catheter tip transducer used for intra-vascular imaging.

Fig. 3(lower). Image obtained from within a blood vessel.

Temporal Resolution

The operators of medical ultrasound scanners have grown used to their machines delivering real-time images ie frame rates are typically 20 – 30 fps. This feature along with the free hand-held probe has been important in the rapid acceptance of ultrasound by both staff and patients. Hence movements of large structures has been readily visualised and recorded and only rarely have there been targets moving too quickly to be captured.

However, smaller objects, particularly those smaller than the resolution cell cannot be so readily recorded. The most important of these are blood cells since there is an obvious interest in monitoring blood flow. The Doppler effect has been exploited for such targets and Doppler probes have been available for several decades. The problem for pure Doppler movement detectors is that any moving object lying along the beam axis will contribute and make it confusing for the operator. The advent of pulsed Doppler has largely overcome this limitation making available both range and velocity information on the same screen (Figure 4). However, pulsed Doppler does suffer from the limitation that it only detects and records information from one selected depth on one selected scan line and so the operator has to know where to look.

A recent development has been to use colour to superimpose Doppler information from almost the whole image space. This has been done, not by having a vast number of pulsed Doppler range gates, but by using an autocorrelation technique. The method relies on taking multiple views along the same scan line in quick succession. The captured lines are digitised at high speed and compared in pairs using an autocorrelation function. If there has been no movement between the samples, the autocorrelation function will peak at zero frequency. However, movement between samples will show up as peaks in frequency domain. By comparing successive pairs of scan lines, an overall mean Doppler shift frequency can be established along with its variance which gives an index of the range of frequencies present. The mean Doppler frequency is computed in this way for each of 100 or so segments of each scan line. Typically each scan line must be transmitted 8 times to produce acceptable frequency resolution. The mean Doppler frequency is then displayed as a sequence of colours superimposed on the existing grey-scale image. In order not to obscure the underlying image, hardware and software techniques are used to permit colour imposition only in pixels which

would otherwise be close to black and hence might be expected to be blood vessels. Clearly, the colour scale chosen is arbitrary but a popular scale is to use red for flow towards the probe and blue for flow away from the probe, with the brightness of each colour representing the mean flow in that direction (Figures 5 & 6). Under these circumstances, yellow or green is often added as a measure of turbulence as measured by the variance of the autocorrelation function. This has resulted in some inexperienced users assuming that red indicates arterial flow, and blue venous, thereby matching the real blood colour. This is potentially disastrous if an artery with high blood flow is mistaken for a vein with low flow and pressure.

There have been two significant

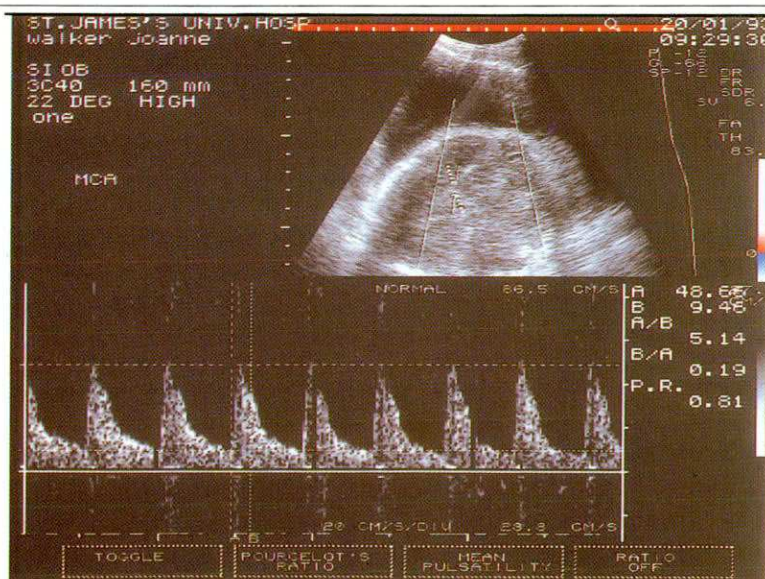


Fig. 4. Pulsed Doppler image of fetal middle cerebral artery. Note that the Doppler spectrum is obtained solely from the region identified by the range gate on the conventional image.

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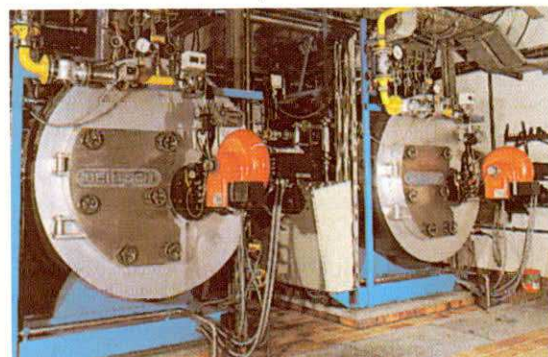
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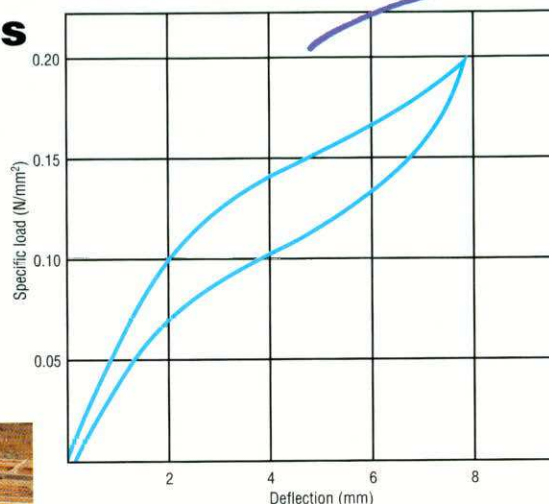
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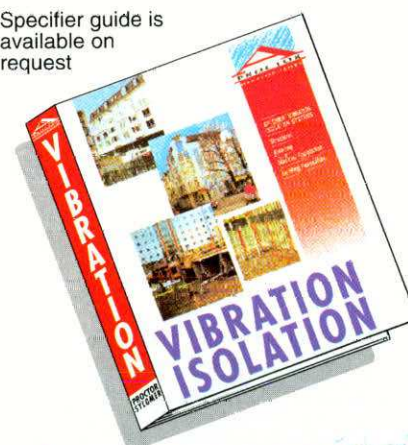


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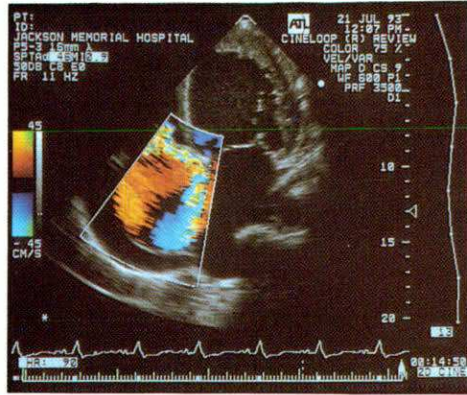


Fig. 5. Cardiac image obtained using colour flow ultrasound demonstrating tricuspid valve regurgitation.

recent developments in ultrasonic flow detection and display. The first of these is the use of time domain rather than frequency domain processing to measure velocities. This technique relies on the scattered signal, the so called speckle pattern, remaining constant from pulse to pulse. The time domain processor attempts to track the movement of this pattern from pulse to pulse and hence estimate the mean velocity of the target associated with that particular pattern. There appear to be a number of significant advantages with this technique although its introduction has been hampered by the fact that patent protection has restricted its availability to one manufacturer.

The second major development is the introduction of power spectral Doppler. In this mode the total Doppler shifted backscattered power is integrated rather than the signal being analysed into spectral components. Thus the power signal is a measure of total volume flow but without detailed information about the relative magnitudes of the components at each velocity. It has been suggested that this is a measure of tissue perfusion although this seems a little optimistic. Nonetheless the technique offers

freedom from the familiar problems of aliasing and angle dependence (Figures 7 & 8).

Contrast Resolution

It is well known that the dynamic range of signals returning to the ultrasound transducer from the body is very large, perhaps 120 dB. This presents major problems for electronic signal processing and image display. Even if 512 level grey-scale image memories are used, it is clear that many echoes which have different amplitudes are



Fig. 7. Spleen image using power spectral Doppler.

assigned to the same grey level and hence the ability of the system to distinguish between them is lost. The situation is made worse by the limitations of grey-scale displays which rarely have dynamic ranges in excess of 30 dB. This represents a loss of contrast resolution and has been the subject of concern for some years.

It might be assumed that the obvious solution to this problem is to capture the image and use various post-processing options to 'window' the information in the memory thereby improving contrast resolution in one region albeit at the expense of turning other regions into peak white or complete black. However, this would entail the abandonment of the real-time facility, which is not a price which many users seem prepared to make.

An alternative approach is to use other means to improve the acoustic contrast between different regions of interest. This can be achieved using ultrasonic contrast agents which are typically trapped air bubbles carried around the body providing strong scatter whenever they pass through an ultrasound beam. In particular, they have been found useful in certain cardiac studies and in investigations of infertility when contrast materials can be used to demonstrate the patency or otherwise of the fallopian tubes (Figures 9 & 10).

Thus the search continues for better ways to display the ultrasound information, much of which continues to be ignored by ultrasound scanners because there are no

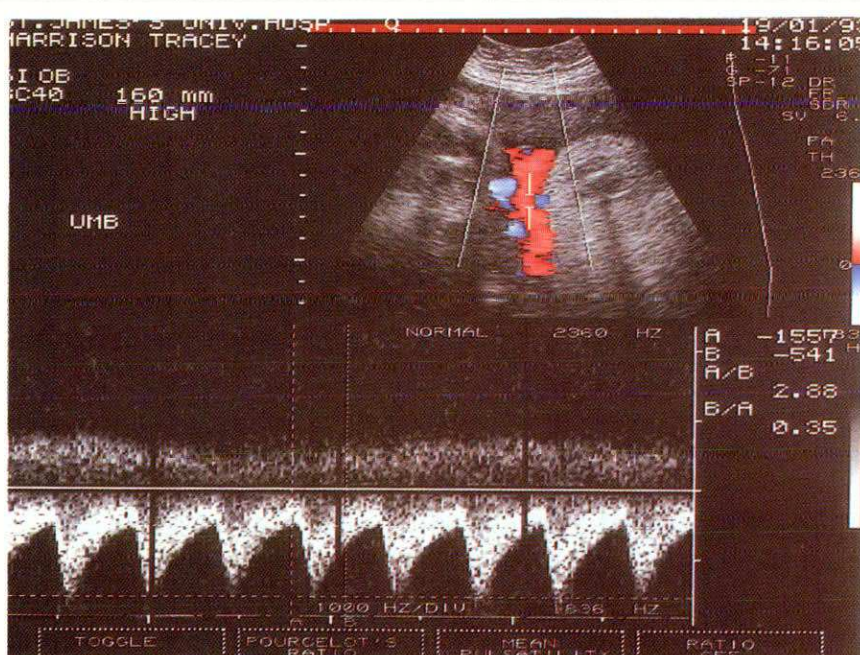


Fig. 6. Obstetric image obtained using colour flow ultrasound.

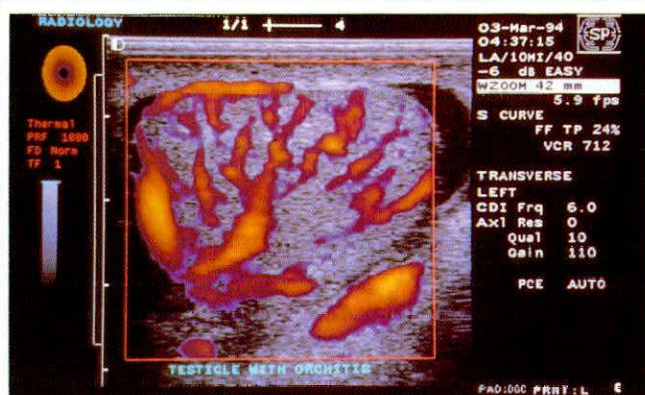


Fig. 8. Image obtained using power spectral Doppler of testicle with orchiditis.

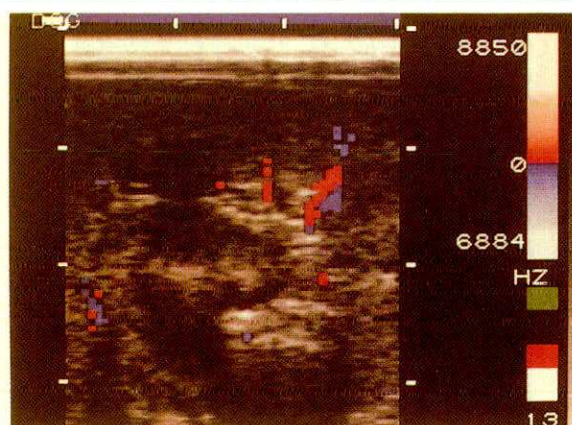


Fig. 9. Image without contrast.

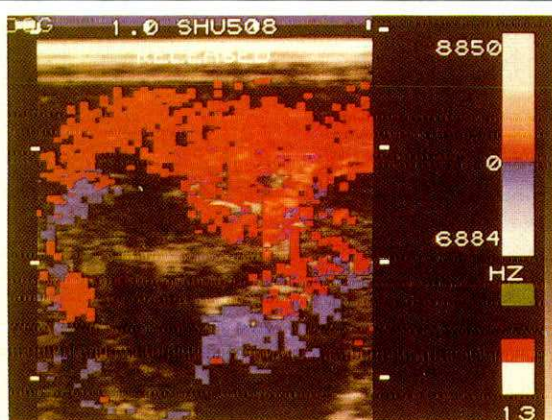


Fig. 10. Image with contrast.



Fig. 11. 3-D image of fetal face.

accepted techniques for dealing with it. One new approach is to exploit the increased availability of computing power to capture and display the information in 3D. Although this does not create any new information, it may be that by displaying the echoes in planes which could not be directly accessed, that the operator may perceive a significant advantage (Figure 11). The 3-D techniques currently available however, require the sacrifice of the precious real-time facility which has proved to be impossible to oust in other areas. Time will tell.

Overall, it seems that ultrasound may be approaching certain fundamental limitations in spatial resolution but that the opportunities in terms of image processing and display are only just beginning to be realised. The future promises much.

Figures 3, 5, 7 & 8 courtesy of Sonotron. Figures 9 & 10 courtesy of ATL. Figure 11 courtesy of Kretztechnik (UK) Ltd.

Tony Evans is in the Centre for Bone and Body Composition Research in the University of Leeds/Leeds General Infirmary ❖

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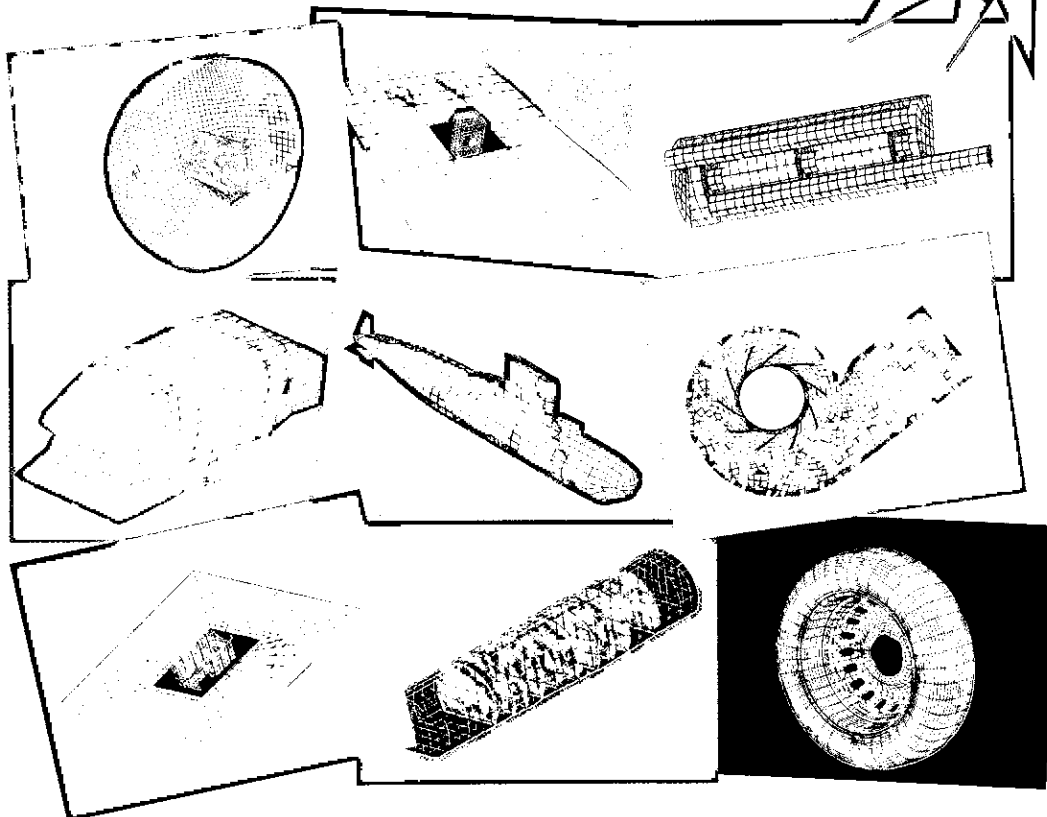
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A BAT'S EYE ON FOOD

Malcolm J W Povey

The Bat's Eye

The bat's eyes are, of course, its ears. In the previous issue of *Acoustics Bulletin* Professor David Pye gave an excellent review account of the fantastic array of acoustic signal processing methods that bats have available to them. Suffice it to say for our purposes that no human acoustical sensor array has, so far as I know, matched the bat in sophistication. Nevertheless, it is certainly within our capabilities to reproduce the bat's ultrasound system, although it is very doubtful that we could miniaturise it as successfully for sometime yet. The point is that the bat shows what may be achieved with ultrasound, a form of radiation the capabilities of which we have barely begun to explore.

In many applications in the food industry only one ultrasound sensor is used, acting as both generator and detector of ultrasound. Hence the singular 'eye' in the title. In other areas, particularly medical ultrasound but also in the petroleum industry, multiple sensor techniques are used to generate a 'picture' using a class of techniques which come under the general heading of tomography. It seems highly likely that the bat has a much more detailed 'picture' of its surroundings in its head than any tomography system has yet achieved. Information which is 'coloured' in the same sense that the human eye detects colour in light but enhanced by the phase information available from a pair of ears. Human eyes are insensitive to phase.

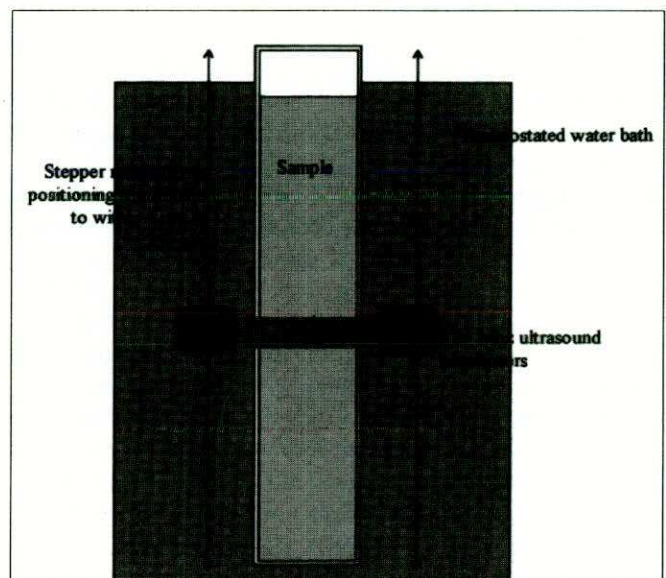
Current Applications

Ultrasound is very widely used for a variety of applications in the food industry. The interested reader is referred to surveys by Javanaud [1] and by Povey [2] for detailed information. Many of the applications described in these papers were the subject of research papers, however, most of the applications have not actually been realised in practice in the food industry. The largest application area is probably level detection, to which ultrasound is well suited because of its relative insensitivity to layers of foam and other material which tends to congregate at air/liquid interfaces. Flow rate measurement is another popular application because of the ability to use sensors that simply strap on to pipelines and hence are not intrusive. However, this technique is not without its difficulties and it is certainly true to say that the interpretation of data from ultrasound systems must always be carried out with care. Ultrasound speed measurement is a good way of monitoring solids in liquids, particularly crystallizing solids (McClements and Povey [3]).

Determination of alcohol for customs and excise is an application which exemplifies the ability of ultrasound speed measurement, when allied to a temperature meas-

urement, to determine the concentration of solute. Animal backfat thickness determination is often carried out using ultrasound instrumentation (Miles et al [4]). This completes the list of ultrasound applications which the author knows for certain are presently in use in the food industry.

The majority of these applications employ a technique variously called 'pulse time of flight', 'pitch and catch' or in a slightly different incarnation 'sing around'. The 'pulse time of flight' technique in its modern form was first described by Pellam and Galt [5]. In Figure 1 a pulse is generated in a piezo-electric element, usually a disk of Lead Zirconium Titanate ceramic (PZT). The pulse is produced by exciting the disk with a short electrical pulse (ca 1 μ s) of between 30 V and 300 V in amplitude.



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Fig. 1. Sound speed scanner for characterising the stability of emulsions.

The oscillation of the disk that this induces is transmitted across the sample to be detected by the second transducer which converts the pressure wave back into an electrical signal. A simple electrical timer counter is started by the stimulating pulse and is stopped by the returning pulse. This extremely simple system can be made to measure sound speeds to an accuracy of 1 part in 1500. The whole system is first calibrated by filling the sample holder with distilled water since the velocity of sound in water is very accurately known, (eg del Grosso and Mader [6]).

Because it is much easier to couple ultrasound to liquids than to solids, most applications of ultrasound in the food industry have been confined to liquids. In most circumstances, in liquid and other systems capable of flow, a modified form of the Urlick Equation (Pinfield et al, [7]) may be used.

$$v = \frac{1}{\sqrt{\kappa\rho}} + f(\phi, \phi^2), \quad \kappa = \sum_i \phi_i \kappa_i, \quad \rho = \sum_i \phi_i \rho_i \quad (1)$$

which for a two phase system is

$$\kappa = \phi \kappa_2 + (1 - \phi) \kappa_1, \\ \rho = \phi \rho_2 + (1 - \phi) \rho_1, \quad f(\phi, \phi^2) = \gamma\phi + \delta\phi^2$$

where v is the sound speed in the dispersion, ϕ is the volume fraction of dispersed phase. The subscripts refer to the constituent phases; in particular (1) refers to the continuous phase, (2) to the dispersed phase in a two-phase system. (In a three phase system, (2) refers to the liquid dispersed phase and (3) to the solid dispersed phase.) γ and δ are experimentally determined coefficients which can be directly related to the scattering coefficients. This enables a relationship to be established between sound speed and the volume fraction of pure material in a mixture, so long as the density of the components are similar.

$$\frac{1}{v^2} = \sum_{i=1}^n \frac{\phi_i}{v_i^2} \quad (2)$$

To illustrate the technique, three applications of ultrasound to foods are described in detail, one unsuccessful and two successful.

Testing eggs: A successful method for testing eggs is described by Povey and Wilkinson [8] and that account exemplifies the difficulties of developing any new technique for testing foods. The technique rests on the fact that the protein that makes up the egg white transmits ultrasound with an attenuation that falls progressively with the age of the egg. This increasing acoustic transparency is associated with a reducing rigidity in the white and a thick white is commercially important as customers generally prefer their poached and fried eggs surrounded in a thick layer of white. More importantly for food processors, thick white is essential for the production of the foam in whose structure caster sugar is permanently suspended, once heat degradation of the protein transforms it into a solid foam. In addition, the ageing of the protein is an obvious indicator of the age of the egg, since this is the most rapid degradation mechanism in eggs held in cold store. A fresh egg should always show a good thick white, attached to the yolk. Once the white has broken down it becomes runny and is no longer attached to the yolk.

The ultrasound technique consists of holding the egg between two ultrasound probes, tipped with a flexible silicon rubber face which moulds itself to the egg shell (Figure 2). A sound pulse is transmitted through the egg and its amplitude measured. Using this method, eggs of 30 days or more in age could be distinguished from new laid eggs with over 90% certainty. The technique is easily adapted to the candling tables used for the visual inspection of eggs. Its manufacturing cost would be comparable to that of packing machinery used for many quality food products (~ £70k). But here is the rub. When the egg industry was approached for funding to engineer a pro-

duction version of a non-destructive evaluation machine for use in the egg industry, we were told that 'there were quite enough eggs being rejected already without another technique'. Of course, it may be possible to convince the supermarkets that it is worth their while to grade eggs by quality but so far we have been unsuc-

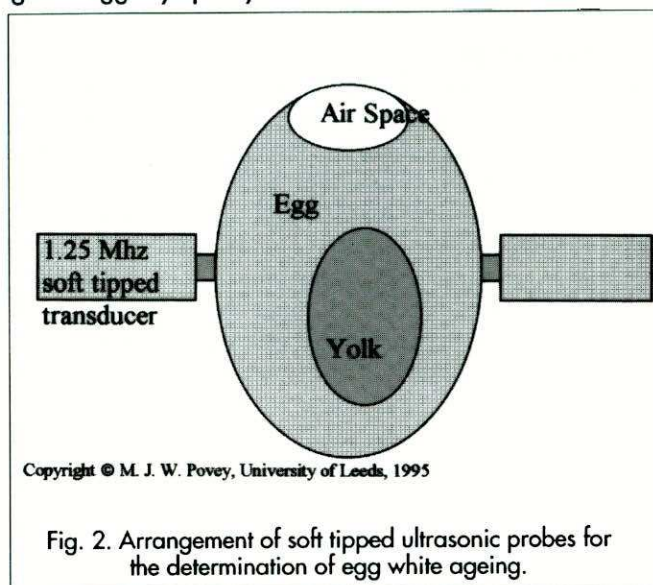


Fig. 2. Arrangement of soft tipped ultrasonic probes for the determination of egg white ageing.

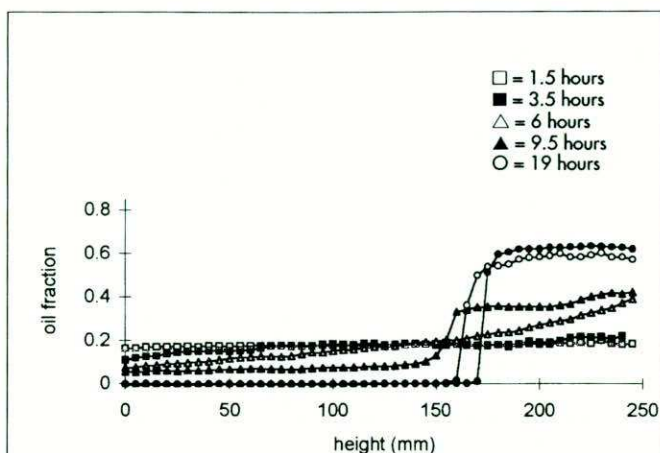
cessful in this. In any case, at the end of the day it is always a profit calculation which determines whether a testing technique will be used.

Crystallization in biomolecular systems: Sound speed measurement is often very sensitive to the solid/liquid phase transition because of the large change in compressibility that accompanies the phase transition. It has been shown by Pinfield et al [7] that the amount of solid material, ϕ , suspended in a liquid is given by

$$\phi = \frac{\left(\frac{1}{v_s^2} - \frac{1}{v_l^2} \right)}{\left(\frac{1}{v_s^2} - \frac{1}{v_l^2} \right)} \phi_s \quad (3)$$

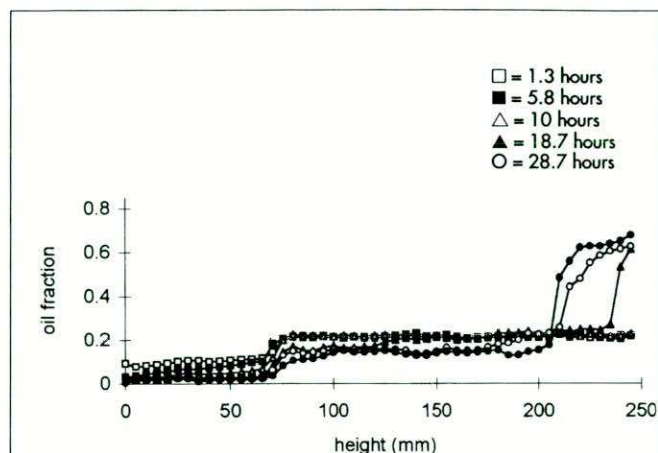
where v_s is the sound speed measured when the crystallizing phase has solidified and v_l is the sound speed measured before crystallization begins. The speeds v_s and v_l are determined by extrapolation to the working temperature. ϕ_s is the volume fraction occupied by the material that is engaged in crystallization. This method has been successfully applied to the measurement of solid fat content (SFC) in fatty spreads such as margarine. (McClements and Povey [9])

Gravitational destabilization in colloids: *Sound speed scanning.* If a liquid is dispersed in another liquid it is subjected to gravitational forces which may be great enough to cause the dispersed phase to float upwards (creaming) or sink downwards (sedimentation). This is of great concern to any manufacturer who wishes that their emulsion should remain stable over the shelf life of the product. Shelf lives for food emulsions vary from a few days (fresh milk) to months or years (salad cream). Ideally, a product developer would not want to wait



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Fig. 3. Creaming profile of 18 (vol) % mineral oil / water emulsion containing 0.1733 % (wt in aqueous phase) xanthan at 30 °C. The profile was derived from ultrasound speed measurements at 1.92 MHz.



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Fig. 4. Creaming profile of 18 (vol) % mineral oil / water emulsion sample containing 0.0347 (wt in aqueous phase) xanthan. The profile was derived from ultrasound speed measurements at 1.92 MHz.

months or years to discover if the product is stable. Sound speed measurement offers the possibility of a more rapid determination of shelf life. In addition, it provides an insight into the creaming process which is unavailable from other techniques. From Equation 1 the volume fraction of the dispersed phase can be determined from sound speed measurements. If sound speed measurements are made at various depths in a vertical tube the movement of the dispersed phase can be followed. Three main types of destabilisation can be distinguished. In Figure 3, (Dickinson, Ma and Povey [10]) the simplest type can be seen. Here, an initially uniform distribution of oil is gradually transformed into a cream at the top of the tube, with a serum layer below it. This is produced by the competing effects of diffusion (Brownian motion) which moves the particles in all directions, gravity which displaces the lighter oil particles upwards, the downward drag of viscosity and the hydrodynamic drag on the

smaller particles of the upward motion of larger particles displacing the continuous phase downwards. In Figure 4 there is a more complex situation in which a third layer can be seen between the serum and the cream. This third layer is probably caused by weak flocculation of the particles whose basis is a process called depletion flocculation (Asakura and Oosawa, [11]). Depletion flocculation involves the osmotic driven process of particle aggregation created by polymer chains in solution which are large enough to be excluded from between closely approaching particles. Under these conditions, the increasingly pure solution between the approaching particles prefers to move out to dilute the more concentrated polymer solution outside, so pushing the particles closer together. This process is often reversible. In Figure 5 a more dramatic appearance of a cream can be seen. This 0.2 μm soya bean oil in water emulsion appears stable for 12 days, followed by the gradual appearance of a

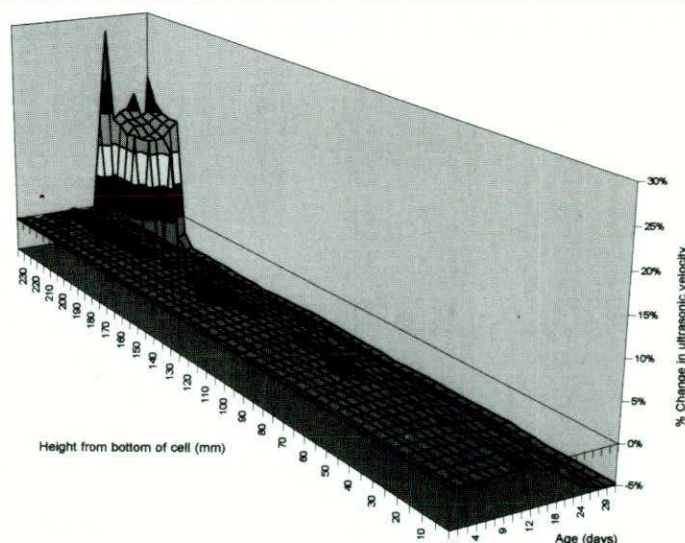


Fig. 5. Plot of change in sound speed against height in the tube in Figure, against time in days. This plot is for an initially uniform dispersion of 0.2 μm soya bean oil in water. Lecithin dissolved in the oil phase was the surfactant.

serum layer but without a corresponding cream. Then suddenly, at about 18 days, and within a few hours, a cream layer appears. This 'catastrophic' appearance of a cream cannot be explained by the diffusion processes described above.

There are two possible explanations for this. Bacterial contamination can produce the effect seen in Figure 5; bacterial growth often exhibits a delay phase, followed by exponential growth and this can easily destabilize the emulsion. Alternatively, weak flocculation could lead to the formation of a particle gel which has then collapsed under its own weight. The sharp peaks in the cream are probably due to fractionation of particle size which is known to occur due to the hydrodynamic process described above. This concentrates an originally small number of particles which lie in the dispersive region of the scattering curve into a thin layer in which they can have a disproportionate effect on sound speed.

Conclusion

This article has hopefully shown the potential for sound speed measurement in the food industry. In future we may expect a more sophisticated use of sound speed, amplitude and phase measurement. Two areas which may be identified for immediate development are ultrasound foreign body detection and ultrasound non-destructive evaluation of texture. Both will require the development of transducers which mimic aspects of the bat's vocal and aural apparatus and employ custom chips which mimic aspects of the bat's brain.

References

- [1] C JAVANAUD, 'Applications of Ultrasound to Food Systems', *Ultrasonics*, 26, 117-123, (1988).
- [2] M J W POVEY, *Ultrasonics In Food Engineering II*, J FoodEng, 9, 1, 20, (1989).
- [3] D J MCCLEMENTS & M J W POVEY, 'Comparison Between Pulsed NMR and Ultrasonic Velocity Techniques For Determining Solid Fat Contents', *IntJFoodSciTech*, 23, 159-170, Blackwell, Oxford, (1988).
- [4] C A MILES, G A J FURSEY & R C D JONES, 'Ultrasonic Estimation of Solid/Liquid Ratios in Fats, Oils and Adipose Tissue', *JSciFoodAgric*, 36, 215, 499, (1985).
- [5] J R PELLAM & J K GALT, 'Ultrasonic Propagation in Liquids. 1 Application of Pulse Echo Technique to Velocity and Absorption Measurements at 15 Megacycles', *JChemPhys*, 14, 608-614, (1946).
- [6] V A DEL GROSSO & C W MADER, 'Speed of Sound in Pure Water', *JASA*, 52, 1442-1445, (1972).
- [7] V J PINFIELD, M J W POVEY & E DICKINSON, 'The Application of Modified Forms of the Urlick Equation to the Interpretation of Ultrasound Velocity in Scattering Systems', *Ultrasonics*, 1, 1, 0, (1994).
- [8] M J W POVEY & C WILKINSON, (1980) 'Application of the Ultrasonic Pulse Echo Technique to Egg Albumen Quality Testing: A Preliminary Report, *BrPoultrySci*, 21, 489-495, (1980).
- [9] D J MCCLEMENTS & M J W POVEY, 'Ultrasonic analysis of edible fats and oils', *Ultrasonics*, 30, 383-388, (1992).
- [10] E DICKINSON, J MA & M J W POVEY, 'Creaming of Concentrated Oil in Water Emulsions Containing Xanthan', *Food Hydrocolloids*, 8, 481-497, (1994).
- [11] S ASAKURA, F OOSAWA, 'On the interaction between two bodies immersed in a solution of macromolecules', *JChemPhys*, 22, 1255-1256, (1954).

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THE ASSESSMENT OF INDUSTRIAL NOISE: A REVIEW OF VARIOUS NATIONAL PRACTICES

Nicole D Porter MIOA

Introduction

A three-year programme of research at the National Physical Laboratory (NPL), sponsored by the Building Research Establishment (BRE) on behalf of the Department of the Environment, has examined the objective and subjective assessment of industrial noise. Work began in December 1990 with the overall aim of refining current methods for rating industrial noise. The research was divided into three parts:

- (1) A systematic evaluation of BS 4142 : 1990 'Method for rating industrial noise affecting mixed residential and industrial areas' by means of a data sheet study on its application.
- (2) A review of various national practices for rating industrial noise.
- (3) Subjective listening tests on the judged annoyance of specific types of industrial noise to explore the effect of impulsiveness and tonality on subjective annoyance and to assess the performance of objective assessment methods.

This article is concerned only with item 2 of this programme of work.

It was intended that the research should provide data to support the refinement of standards such as ISO 1996 'Acoustics - Description and measurement of environmental noise' and BS 4142 : 1990 'Method for rating industrial noise affecting mixed residential and industrial areas'. In this context it was considered useful to gain a broader knowledge of current national practices for the rating of industrial noise by reviewing various national equivalents of BS 4142 and examining how ISO 1996 has been implemented. Previous work reviewing inter-

national legislation on external industrial noise was carried out by Hay twenty years ago.

This review is limited to the noise impact on communities, ie noise immission, and does not deal with machinery noise emission standards or the health effects of noise on workers. The paper firstly summarises current UK practice in the rating of industrial noise and then describes the main aims of the review and how it was carried out. The response to the study is discussed, and the results summarised in a set of tables. Following comments on noise regulation and standardisation, conclusions are drawn at the end. In compiling the review, reference was made to a large number of sources. Space does not permit citation of these sources in this article, but a full report on the work, including the references, is available from NPL.

Current UK Practice in the Rating and Assessment of Industrial Noise

ISO 1996 aims to provide authorities with material for the description of noise in community environments. The standard does not specify limits for environmental noise but, based on the principles described in the standard, acceptable limits of noise can be specified and compliance with these limits can be controlled. The standard uses L_{Aeq} to describe the noise has recently been adopted as a dual numbered British Standard BS 7445 : 1992 in an identical form. For the assessment of human reaction to noise, necessary adjustments are made to the measured values in order to arrive at a more meaningful basis for the assessment. More than one adjustment can be applied in a given situation.

BS 4142:1990 was updated to keep in line with ISO 1996 using L_{Aeq} to replace the Corrected Noise Level (CNL) of the earlier standard. This standard applies only to industrial noise affecting residential communities and predicts the likelihood of complaints by examining the 'intrusion' of a specific noise (assessed by a rating level) above the residual noise. The standard is intended primarily for investigating complaints and for planning purposes although it is often used for applications outside its scope. The BS 4142 rating method applies a 5 dB adjustment to the rating level to take into account noise that is subjectively judged to be tonal or impulsive in nature or irregular enough to attract attention. The rating procedure is summarised in Figure 1 and Table 1. Only a single adjustment is applied for noise with specific characteristics as described in section 7 of the standard:

The UK Department of the Environment's Circular 10/73 *Planning and Noise* gives guidance to local authorities on the use of their planning powers and gives guid-

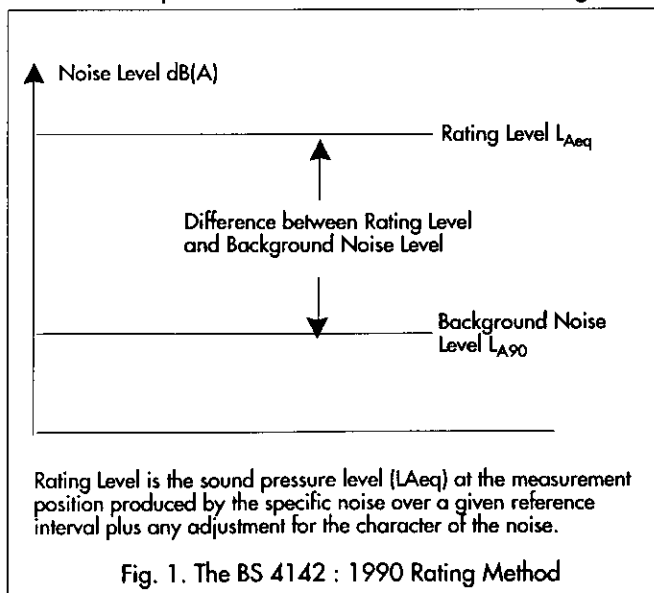
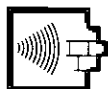


Fig. 1. The BS 4142 : 1990 Rating Method



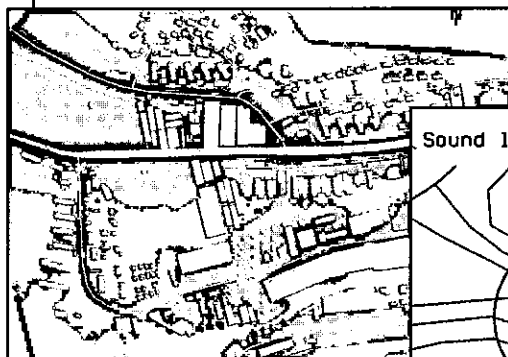
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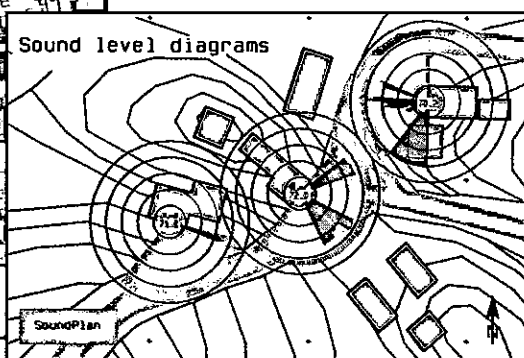
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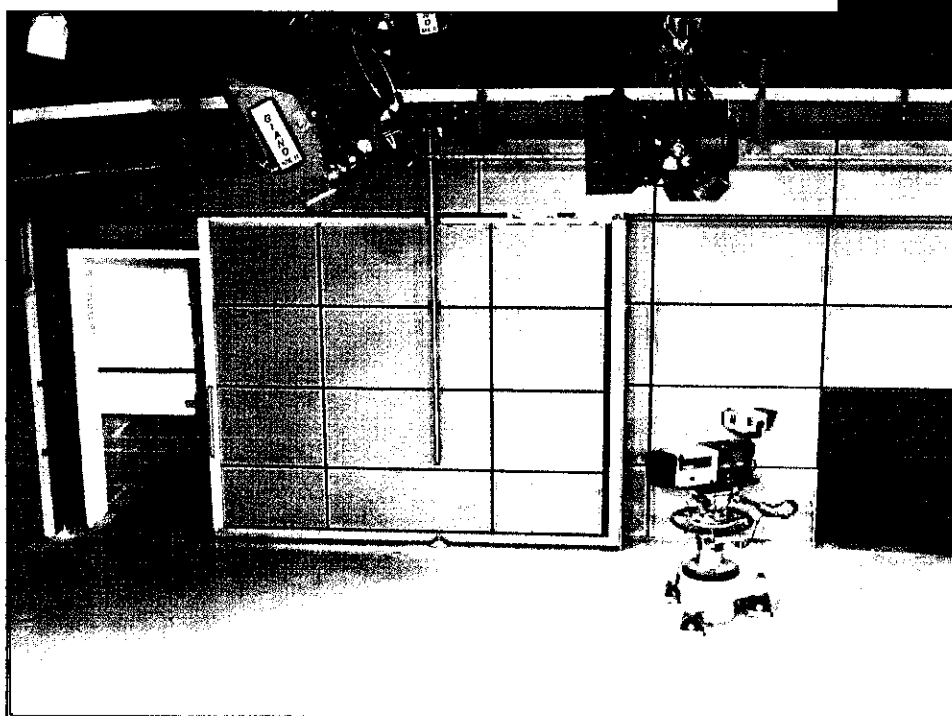
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Rating Level minus Background Noise Level	Complaint likelihood
10 dB or higher	Complaints are likely
Around 5 dB	Marginal significance
Below 5 dB	The lower the value, the less is the likelihood of complaints
- 10 dB	Positive indication that complaints are unlikely

Table 1. Complaint potential as inferred from BS 4142 : 1990

ance on industrial noise. This has recently been updated to a Planning Policy Guidance. This sets out the UK Government's policies on different aspects of planning which should be taken into account by local authorities as they prepare their development plans. It gives guidance to local authorities on the use of their powers to minimise the adverse impact of noise. It outlines the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities which will generate noise. It also introduces the concept of noise exposure categories for residential development, encourages their use and recommends appropriate levels (absolute values) for exposure to different sources of noise.

Noise can also be assessed as a nuisance under the provisions of the UK Environmental Protection Act with the UK Control of Pollution Act remaining in force to deal with construction noise, noise abatement zones, codes of practice and noise in streets. Construction noise is controlled using the British Standard method BS 5228. In 1993 the Noise and Statutory Nuisance Act came into force and extended the Environmental Protection Act to include noise that is prejudicial to health or a nuisance and is emitted from or caused by a vehicle, machinery or equipment in a street.

Having outlined the UK practice for rating industrial noise, the practices in other countries will now be reviewed.

Objectives of the Review

The objectives of the review were:

- (1) To determine current practices in the rating and assessment of industrial noise.
- (2) To establish how ISO 1996 had been adopted in various countries.
- (3) To determine the indices adopted in the relevant standards.
- (4) To examine the treatment of noise with specific characteristics within the relevant standards.
- (5) To establish the types of rating procedure used.
- (6) To obtain information on other relevant documents.

Strategy for Obtaining Information

In 1991, letters were sent to National Laboratories, Standards Institutions, Environmental Protection Authorities and Ministries of the Environment covering over 20 countries worldwide. Each letter explained the project and gave a brief description of standards and current prac-

tices in the UK for the rating and assessment of industrial noise. Enclosed with each letter was a printed list of questions to be answered and returned to NPL. These questions related to (i) standards similar to BS 4142, implementations of ISO 1996 and its relevance to industrial noise, other legislative documents in use, availability of English translations of any document referenced and (ii) possible points of contact to obtain further information.

Papers giving the results were presented at two European conferences in 1992 during which requests were made for additional information. Finally, at the end of 1993, letters were sent out to various organisations to check and update existing data and to obtain information relating to some additional countries.

Response and Results

In all, 19 replies were returned to NPL, giving various levels of detail about 13 countries, and in some cases full copies of standards were enclosed. It is not possible in this article to describe the results in detail, but nine out of twenty countries were reported to have standards or guidelines that relate specifically to industrial noise assessment and fifteen countries follow environmental noise standards or guidelines. Eleven countries have methods which were reported to be implementations of, or follow, ISO 1996. However, ISO 1996 does not set noise limits and many countries have proceeded to recommend noise limits for various regions, time of day, indoor and outdoor receiver points, etc. These may be used to set criterion values for noise control measures,



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Type of area	Time of day	Australia (dB(A))*	Austria (L _{eq})**	Belgium	Canada (dB(A))	Denmark (L _{Aeq})	France (dB(A))
Heavy industrial/ industrial	Day		65			70	70
	Evening					70	65
	Night	55	55			70	60
Light industrial/ commercial/certain industries excepted	Day		60/65	60		60	65
	Evening			55		60	60
	Night	50	50/55	55		60	55
Mixed residential and industrial	Day		60	50		55	60
	Evening			45		45	55
	Night	40	50	40		40	45
Suburban residential	Day		55	45		45	50
	Evening			40		40	45
	Night	35	45	35		35	40
Urban residential	Day		50	45		50 ¹	55
	Evening			40		45 ¹	50
	Night	35	40	35	50	40 ¹	45
Leisure/recreational/ hospital	Day		45/50	40-50	55	40	45
	Evening			35-45		35	40
	Night	30	35/45	30-40		35	35

Type of area	Time of day	Germany (dB(A))	Hong Kong (L _{eq})	Italy (L _{Aeq})	Japan dB(A)	Luxembourg (L _{Aeq})	Malaysia (dB(A))
Heavy industrial/ industrial	Day	70	75	70	70 (60 ²)	70	65
	Evening		70		60		
	Night	70	65	70	55	60	55
Light industrial/ commercial/certain industries excepted	Day	65	75	70-65	60 (55 ²)	65	
	Evening		70		55		
	Night	50	65	60-55	50	50	
Mixed residential and industrial	Day	60	70-75	65-60	50 (45 ²)	60	60
	Evening		65-70		45		
	Night	45	55-65	55-50	45	45	50
Suburban residential	Day	50	65	55	45 (40 ²)	50-55	
	Evening		60		40		
	Night	35	50	45	40	35-40	
Urban residential	Day	55	70	60-55	50 (45 ²)	60	
	Evening		65		45		
	Night	40	55	50-45	45	45	
Leisure/recreational/ hospital	Day	45		50		45	
	Evening						
	Night	35		40		35	

Type of area	Time of day	Netherlands (dB(A))	Norway (L _{eq})	Spain ³	Switzerl'd ⁴ (dB(A))
Heavy industrial/ industrial	Day	55		60-70	65
	Evening	50		55-65	
	Night	45		50-60	55
Light industrial/ commercial/certain industries excepted	Day	55		55-65	65
	Evening	50		50-60	
	Night	45		45-55	55
Mixed residential and industrial	Day	50		50-60	60
	Evening	45		45-55	
	Night	40		40-50	50
Suburban residential	Day	50	50	40-50	55
	Evening	45	45	35-45	
	Night	40	40	30-40	45
Urban residential	Day		50	45-55	55
	Evening		45	40-50	
	Night		40	35-45	45
Leisure/recreational/ hospital	Day	45	40	35-45	50
	Evening	40	35	30-35	
	Night	35	35	25-30	40

Data are based on various values for planning, immission limits, recommended ambient levels, zones etc. Area/region descriptions and intervals for time of day differ between documents and this table gives a guide comparison only. For a complete definition of areas and limits, reference has to be made to the national standards.

Notes

- 1 Applies in residential areas with multi-storey buildings
- 2 Early am (0600 - 0800)
- 3 Night values may have another 5 dB subtracted
- 4 Planning limits (+5 dB for immission limits, +15 dB for alarm values).

Table 2. Comparison of recommended outdoor noise guide limits for weekdays

* Guide values: each state and territory sets its own limits. ** Immission limits for planning.

Workshop Discussion

PC Programs in Acoustics & Vibration**South Bank University****31 May 1995**

A one-day workshop has been arranged for 31 May 1995. It is intended that the morning will be devoted to a series of short presentations in which the contributors will outline the scope and objectives of their particular programs. After lunch there will be time to take a closer look at the programs and two rooms have been set aside for this purpose.

Contributors to date are as follows:

Martin Armstrong	Brüel & Kjær
Richard Tyler	CEL
Dudley Wallis	Cirrus Research plc
John Shelton	01dB
John Charles	Kirby Charles Associates
Russ Bown	Pafec Ltd
Bob Lorenzetto	Quantitech
Phil Pyatt	Munro Associates

The meeting commences at 10 am with registration from 9.30 am. The meeting organiser is John Seller MIOA of South Bank University.

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The purpose of the conference will be to review the present state of this rapidly developing subject and to report on new developments and future trends. As previously, the presentation of practical systems and results will be encouraged and a poster/demonstration session will be a key feature of the conference.

Prospective authors are invited to submit a 200 word abstract not later than 17 June 1995. Successful authors will be notified by mid-July 1995. Complete manuscripts may be up to 8 pages long, including diagrams, and must be prepared in the correct camera-ready format. Special paper will be provided. All manuscripts must be in the hands of the conference secretary by 23 September 1995. Those arriving after this date will not be printed. The conference proceedings will be published in book form in Volume 17 of the Proceedings of the Institute of Acoustics (1995) and copies will be available at the beginning of the conference.

The conference will be chaired jointly by Professor J W R Griffiths FIOA and Professor H D Griffiths FIOA. It will take place at the University of Technology, Loughborough, which is situated on a very pleasant open campus close to the town. Full board and accommodation will be available, both in a student hall of residence at very reasonable rates and in a new residential building with en-suite facilities. Although the weather in the UK in December is not at its best we hope the excellent facilities on campus will provide some compensation.

For those of you who have been before we know you will want to come again. We also look forward to welcoming many new faces.

Send your abstracts, and address any questions regarding the conference programme, to Professor J W R Griffiths, Dept of Electronic and Electrical Engineering, Loughborough University of Technology, Loughborough, Leicestershire LE11 3TU, UK.

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| 26 APR
Eastern Branch mtg:
The Ear and Hearing -
Latest Developments
<i>Colchester</i> | 25 MAY
IOA Medals & Awards,
Council
<i>St Albans</i> | 12 JUL
Midlands Branch mtg | 10 NOV
IOA CofC in W'place
Noise Ass't Advisory
Committee
<i>St Albans</i> |
| 26 APR
Yorks/Humberside
Branch mtg:
Barriers/Absorbents
<i>Bradford</i> | 31 MAY
"PC Programs in
Acoustics"
<i>South Bank University</i> | 13 JUL
CEng interviews
<i>St Albans</i> | 16-19 NOV
Reproduced Sound 11
Windermere |
| 27 APR
IOA Publications,
Meetings Committee
<i>St Albans</i> | 7 JUN
Eastern Branch mtg:
Long Distance Sound
Propagation
<i>Braintree</i> | 20 SEP
Yorks/Humberside
Branch mtg:
Legislation/Steel Indy
<i>Rotherham</i> | 20 NOV
IOA Publications,
Meetings Committee
<i>St Albans</i> |
| 2 MAY
Acoustics '95
Committee
<i>St Albans</i> | 8 JUN
Speech Group mtg:
Speech Systems for the
Handicapped
<i>Edinburgh</i> | 21 SEP
IOA Publications,
Meetings Committee
<i>St Albans</i> | 21 NOV
Yorks/Humberside
Branch mtg:
Instrumentation/Rev
Chambers
<i>York</i> |
| 4 MAY
IOA Membership,
Education Committee
<i>St Albans</i> | 9 JUN
IOA CofC in Env Noise
M'ment exam
Accredited Centres | 27 SEP
Midlands Branch mtg
Clay Target Shooting
Workshop
<i>Birmingham</i> | 23 NOV
IOA Membership,
Education Committee
<i>St Albans</i> |
| 9-11 MAY
ACOUSTICS '95
Spring Conference:
Environmental Noise &
Vibration
Liverpool | 15 JUN
Yorks/Humberside
Branch mtg:
Vibr'n/Env Statements
<i>Leeds</i> | 28 SEP
IOA Membership,
Education Committee
<i>St Albans</i> | 29 NOV
Midlands Branch mtg |
| 10 MAY
IOA 1995 AGM and
Annual Dinner
<i>Liverpool</i> | 15-16 JUN
IOA Diploma
Examinations
Accredited Centres | - SEP
Southern Branch mtg
Lesser Known
Techniques in
instrumentation/measu
rement
<i>ISVR Southampton</i> | - NOV
Southern Branch mtg
Environmental Noise
Barriers
<i>Winchester</i> |
| 18 MAY
CEng interviews
<i>St Albans</i> | 20 JUN
Reproduced Sound 11
Programme Committee
<i>St Albans</i> | 5 OCT
IOA Medals & Awards,
Council
<i>St Albans</i> | 1 DEC
IOA CofC in
Environmental Noise
Mm'nt Advisory
Committee
<i>St Albans</i> |
| 19 MAY
IOA CofC in Workplace
Noise Assessment exam
Accredited Centres | 21 JUN
London Branch mtg
Occupational Noise
<i>NESCOT, Epsom</i> | 13 OCT
IOA CofC in
Workplace Noise
Assessment exam
Accredited Centres | 7 DEC
IOA Medals & Awards,
Council
<i>St Albans</i> |
| 20 MAY
Eastern Branch Dinner:
<i>Dedham</i> | 23 JUN
IOA CofC in W'place
Noise Ass't Advisory
Committee
<i>St Albans</i> | 26-29 OCT
Autumn Conference
Methodology,
Standards and
Measurement in
Acoustics
Windermere | 18-20 DEC
Underwater Group
Conference - Sonar
Signal Processing
Loughborough |
| 24 MAY
Southern Branch mtg
User Perspectives on
PPG24
<i>Oxford</i> | | | |

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Contributions invited for

1995 Autumn Conference

Methodology, Standards and Measurement in Acoustics

26 - 29 October 1995

Reproduced Sound 11

16 - 19 November 1995

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Certificate of Competence in Workplace Noise Assessment

The following were successful in the 18th
examination held in February 1995

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Colchester Birkett, H G Hurst, J E Murray, K Newton, F W Robinson, S G Warren, D E	Staffordshire Baptiste-Destouche, V Bracewell, C E Horsley, C S Munroe, A
Liverpool Byron, M A Fance, J P Hesketh, D A Hodgson, J McGreal, H J Rogers, A S	Ulster Byrne, J Kelly, P McLoughlin, P Scott, P A Smyth, G B Topley, P
Loughborough Bayford, M C Benson, B C Campbell, D	

Certificate of Competence in Environmental Noise Measurement

The following were successful in the 6th
examination held in March 1995

Bristol Berry, A Hartley, J Nicholls, P J Pitt-Kerby, K B Russell, F	Liverpool Hilton, J L Jones, H M Laidlaw, L M Lewis, J A Walker, P J White, A
Colchester Kettridge, K Kingham, C L Read, K Scurry, S F Walsh, D	NESCOT Adams, L Bland, J Buckley, R R Edmondson, J Fox, R G Franklin, D P Pegram, W F Rangecroft, M Sims, N
Derby Benton, M R Brinkworth, N G Brotherton, C M Conway, S J	

Institute Council Elections 1995

As there have been no nominations forthcoming from the membership for the vacancies on Council as notified to the membership in the Notice dated 29 March 1995, the following Nominees of Council will be elected to serve on Council from the 1995 Institute Annual General Meeting: Mr K A Broughton MIOA, Dr P F Dobbins MIOA, Dr C A Hill FIOA and Professor M A A Tatham FIOA.

noise abatement actions, permissible/acceptable levels or for planning purposes.

An approximate comparison of the recommended outdoor noise guide limits for various countries for different regions and times of day is shown in Table 2. The range of values shows Hong Kong to have higher limits than most other countries whilst Australian limits form the lower end of the scale. Excluding Hong Kong, daytime limit values fall within a span of 5 dB.

It is interesting to compare these values with those from the UK Planning and Policy Guidance Document, PPG 24, discussed elsewhere in this issue. Noise is not considered to be a determining factor in granting planning permission for daytime mixed sources below 55 dB (A) and for night-time for all sources below 42 dB(A). These values could be compared against the guide limits given in Table 2 for mixed residential and industrial areas, and as expected fall near to the bottom end of the range of values for day and night.

Several standards have gone further and have introduced community response indicators, eg France uses 'level emergence' nuisance indicators to predict potential nuisance, and the UK method in BS 4142 predicts complaint likelihood based on difference between the rating level and background level. Others adopting a similar approach are Spain, Austria and Canada where the methods quantify the level of excess above a recommended value and hence the level of community response or action to be taken. The USA, for impulsive noise affecting the community, adopts a system of estimating the percentage of people highly annoyed.

The most commonly used noise descriptor for the rating level of the specific noise is L_{AeqT} which is usually measured over a representative time period and averaged over various time intervals dependent on the time of day. This descriptor is in line with ISO 1996. L_{Aeq} is often calculated from representative sound pressure levels (L_p) of steady noises, shorter term levels (L_{Aeq}) sound exposure levels (L_{AE}), sound power levels (L_W) etc (eg Japan and Netherlands). Interestingly, the Flemish standard differs and adopts an $L_{A95,1h}$ value.

Background noise is described by various methods including an energy equivalent level, an average A-weighted sound pressure level (eg Australia) and L_{A90} (eg UK). Maximum levels are taken into account in several standards (eg Denmark).

The treatment of noise with specific characteristics varies with country and with the actual features and their levels in the noise.

The procedures are both objective and subjective. Excluding the countries which closely follow ISO 1996, thirteen countries have been found to have procedures for dealing with noises with various characteristics. About half of these set out an objective procedure for calculating adjustments including Australia, Denmark, France, Hong Kong, Italy and Japan. In the case of Australia, a subjective procedure seems to be followed when the necessary instrumentation is not available. The adjustment for tonal noise is commonly 2, 3, 5 or 6 dB. Impulsivity adjustments range from 0 to 6 dB.

Further Comment

Noise is an inevitable byproduct of our mechanised society and much of it arises from sources of an industrial nature. The OECD report 'Fighting noise in the 1990s' effectively summarises the government measures available to reduce noise, involving five functions:

- Planning
- Regulating
- Enforcement of regulations
- Incentives
- Investment

The OECD report states that hardly any country consistently uses all of these instruments today.

The planning and regulating functions are used most frequently to control noise, and make use of legislation and standardization. An interesting view on noise regulations and standards was given by Von Gierke in 1993, who identified the following tiers of laws and standards:

International Treaties (ICAO, GATT, OIML)	International Standards
Federal Laws EEC	European Standards
State Laws	National Standards
Local laws/guidelines/ordinances	

Verdan, in his address to the FASE 92 Congress, presented his views on the public aspects of noise control and described the instruments of government policy available for noise abatement. He commented that some countries take a 'reactive' approach to noise control, permitting only the most pressing problems to be solved. He pointed out that other countries, such as the Netherlands and Switzerland, have a more preventative and co-ordinated policy on noise abatement which should lead systematically to more acceptable acoustic environments without depending on complaints. Finally, he set out six elements for a coherent and comprehensive noise abatement policy. Verdan expressed the view that in order to solve the noise problems of the future, the utilisation of economic incentives would act as an important complement to regulations.

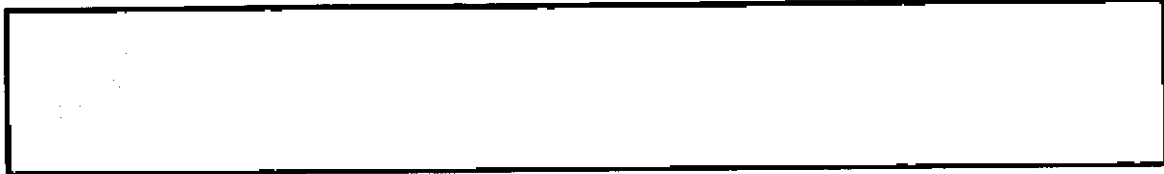
Müller of the Commission of the European Communities (CEC) Directorate General XI, Environment, Nuclear Safety and Civil Protection, (Sound and Vibration), in his presentation to the Institute of Acoustics 1992 Autumn Conference, gave some interesting personal reflections on the future of noise policy in the European Commission.

It was explained that future noise activities of the Commission in the area of environmental protection are laid down in the 5th Environmental Action Programme. The objective 'no person should be exposed to noise levels which endanger health and quality of life' is in agreement with Art 130r of the EEC Treaty. To protect EC citizens against unreasonable noise, he recommended that a directive on noise criteria must be set up which would involve:

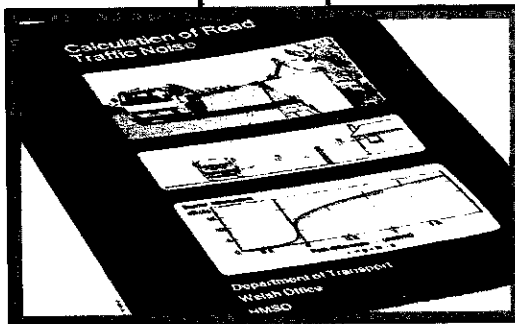
- choosing the most suitable descriptors for defin-

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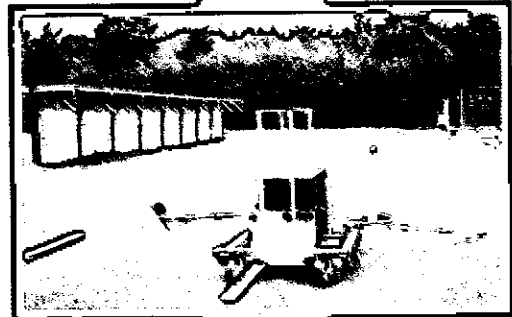
Topics include:



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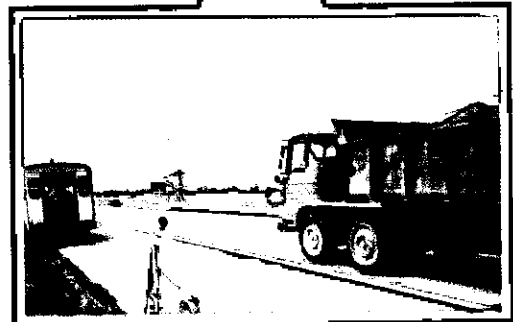
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Paul Nelson, Senior Project Manager
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ing a noise situation, following ISO 1996 as closely as possible

- reviewing noise quality criteria from selected countries in order to examine a scheme of noise quality criteria.
- considering how the competence of the Community and the Member States should be shared.

A proposal has been drafted for a Council Directive on 'Integrated Pollution Prevention and Control' which deals with the emissions from industrial installations. Müller would like to see immission limit values established according to the category of neighbourhood in which an installation is sited, and to compare the sound pressure levels measured at residences affected by the noise with the appropriate immission limit values.

The rationale for the review of national practices reported here was to contribute to a larger study on the subjective and objective assessment of industrial noise, but the information contained herein may provide information in working towards defined noise quality criteria. As Daldrop pointed out at Internoise '93, '*international co-operation and harmonisation of research and development and, where necessary, recommendations and regulation in international bodies such as OECD, ICAO and EC are a logical step in the effort to improve the noise situation in our countries*'.

The material in this paper is believed to be up to date at the time of writing. However, it is recommended that regular updating of this information should be carried out so as to provide a sound basis for reference and further study.

Conclusions

A review of current national practices for the rating of industrial noise, and of the various implementations of ISO 1996, has shown the variety of practices currently in use. Principles incorporated in ISO 1996 have been shown to contribute significantly to the methods used by many countries. In addition to adopting the principles of ISO 1996, some countries have introduced recommended limits based on absolute acceptable or permissible levels or based on the use of 'community response indicators'.

There is some commonality in the various practices, for example, the choice of L_{Aeq} as a suitable descriptor, but also large differences in some areas such as the rating of noise with specific characteristics. Working towards an international or a European standard for the rating and assessment of industrial noise could therefore present a problem when trying to harmonise standards between countries.

An effective noise assessment method should provide as complete a description of the noise as possible, lead to consistent decision making, and ideally point the way to a cost effective method of noise control. The standards and guidelines identified in this study generally fulfil these requirements only to a limited extent, and further development of the standards for noise assessment may benefit from a fresh approach.

During the ICBEN Congress, Noise and Man '93, Team 9 'Standards and Regulations' presented its results

for the first time. Future work topics were identified and included comparisons of existing guidelines and recommendations on national and international criterion levels, and the present review is a contribution to this effort. More generally, this review has provided valuable information to support the future development of national and international standards and noise policy.

Acknowledgments

The investigation described in this paper was sponsored by the Department of the Environment. The support of the Department is gratefully acknowledged. NPL would also like to thank all the organisations that provided valuable information without which this work could not have been completed.

Nicole D Porter MIOA is at the National Physical Laboratory

I/INCE WORKING PARTIES

Upper Noise Limits in the Workplace

Foreword The General Assembly of the International Institute of Noise Control Engineering (of which the Institute of Acoustics is a member) on 22 July 1992 approved an initiative to review current knowledge and practice concerning Upper Noise Limits in the Workplace.

Each member of the Working Party that prepared this report represents a different Member Society that supports the International Institute of Noise Control Engineering, in addition there was a Special Advisor and a Convenor. Countries and members of the Working Party were as follows:

Convenor, Tony F W Embleton; Australia, Bruce Gibson-Wilde; Brazil, Jules G Slama; Canada, Edgar A G Shaw; France, René Gamba; Germany, Hans Lazarus; Hungary, Peregrin Lazlo Timar; New Zealand, George Bellhouse; USA (ASA), W Dixon Ward; USA (INCE/USA), Stephen I Roth; Special Advisor, Alice H Suter.

A draft of their report has been circulated for approval and comment by member societies. The following is an abstract and any member requiring a copy of the full draft report should contact the Institute of Acoustics office, to where comments should be sent.

Abstract It is becoming widely recognised that the economic and social costs of high noise levels in the workplace require significant action to reduce the noise exposure of workers. Such costs include not only the financial compensation or damages that must be paid, and the reduced enjoyment of everyday life for those with a hearing loss, but also less quantifiable factors such as reduced productivity, increased stress and risk of accidents for a much larger number of workers. This technical assessment is presented in the form of a report which briefly reviews the extensive scientific and epidemiological evidence relating noise exposure to risk of hearing damage, and discusses the factors that are relevant to legislation. The basic features of existing legislation from many jurisdictions are tabulated. The report

makes specific recommendations for legislation in the areas of 8-hour daily noise exposure level, acceptable level changes for longer or shorter daily exposure periods, limitation of peak sound levels for short-duration (impulsive) noises, audiometric testing on schedules that depend on exposure level, sound absorption treatment in working areas, and the inclusion of noise performance in purchase specifications for new production machinery.

Background This initiative of International INCE deals with the effects of upper noise limits on individuals in their working environments. It concerns the potential of prolonged exposure to high noise levels to induce hearing loss in those exposed to the noise. It is not concerned with sound levels at the workplace which are so low that the chances of causing noise-induced temporary or permanent hearing threshold shift are insignificant.

Many countries have introduced regulations which set upper limits on noise levels at the workplace. There is little, if any, coordination internationally in the setting of the upper noise limits. Regionally, the European Community (EC) has taken steps to coordinate the setting of upper limits, and several Member States have already adopted these uniform limits. There is general agreement in Europe, as well as within scientific communities elsewhere, that the methods defined in International Standard ISO 1999:1990, 'Acoustics - Determination of occupational noise exposure and estimation of noise-induced hearing impairment,' are valid and should be used by regulatory bodies for guidance in setting upper limits. Nonetheless, this International Standard contains a dis-

claimer which states: 'The selection of maximum tolerable or maximum permissible noise exposures... require(s) consideration of ethical, social, economic and political factors not amenable to standardization. Individual countries differ in their interpretation of these factors and these factors are therefore considered outside the scope of this International Standard.'

Since workplace noise regulations were introduced over 30 years ago, there have been many proposals that the upper limits should be significantly lowered. But this has generally not happened as the factors mentioned in the ISO disclaimer above have come into play.

Few question the need for workplace noise limits, but the cost to comply is frequently cited as the reason for non-compliance. For this and other reasons, it is important to present the technical basis for the establishment of upper noise limits in a manner as independent as possible of the non-technical factors that influence the selection. In this area, I-INCE has identified a lack of objective evidence to support the selection of upper limits.

Work Statement I-INCE has decided to undertake a study of the technical basis for the selection of upper noise limits at the workplace by regulatory authorities. This study will disregard the non-technical factors that influence the selection of upper noise limits and will be undertaken as follows:

1. Identify the development of regulations specifying upper limits on noise at the workplace during the past four decades.
2. Concentrate on the two most widely specified limits ($L_{eq} = 85$ dB and $L_{eq} = 90$ dB for eight-hour exposures) and the 'fence' with the greatest degree of acceptance in the scientific community, and answer the question: what percentage of workers would suffer noise-induced threshold shifts due to long-time exposure at these levels?
3. Examine the scientific basis for the two trading relationships (equivalent continuous A-weighted sound pressure level versus time) most commonly used, 3 dB and 5 dB, and recommend the one that is more appropriate for regulatory purposes.
4. Develop a model regulation which includes an upper limit, a 'fence' (hearing threshold level above which degrees of hearing disability exist), a trading relationship, and a noise measurement methodology.

Community Noise

Background This initiative of I-INCE deals with *community noise*, the outdoor noise environment in the vicinity of inhabited areas. Community noise originates from many sources: transportation sources, industrial plants, commercial equipment, sports events, etc. The noise levels of the outdoor environment vary greatly in magnitude and character from one location to another in a particular community and with the time of day. Any method for measuring community noise levels must take into account these spectral, temporal and spatial variations.

In 1980, the World Health Organization (WHO) published 'Noise - Environmental Health Criteria 12.' In 1992, a WHO task force was convened to revise and update the 1980 publication. An external review draft of

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the revised publication entitled 'Community Noise – Environmental Health Criteria Document' was issued on 28 June 1993 with the request that reviews be completed by 1 September 1993. A two-month review period was much too short a time for review of such a detailed and important document. While International INCE was not requested as an organization to review the revised draft, a number of individual members of I-INCE Member Societies did submit comments.

The WHO draft has eleven sections: 1 Introduction; 2 Scope; 3 Physical Aspects of Noise; 4 Types of Environmental Noise; 5 Exposure to Environmental Noise; 6 Anatomy, Physiology and Psychophysics of the Auditory System; 7 Effects of Noise on Humans; 8 Societal Economic Costs and Benefits of Community Noise; 9 Measurements of Exposure; 10 Evaluation of Health Risks from Exposure to Noise; 11 Recommendations (Guideline Values and Research Needs)

Concept The decision has been made that International INCE will undertake a study of the technical aspects of the WHO draft, and, in particular, the engineering aspects of the evaluation of community noise exposure. The objective is to develop a program of work for a future I-INCE Working Party dealing with the measurement and evaluation of community noise.

The Effectiveness of Noise Walls

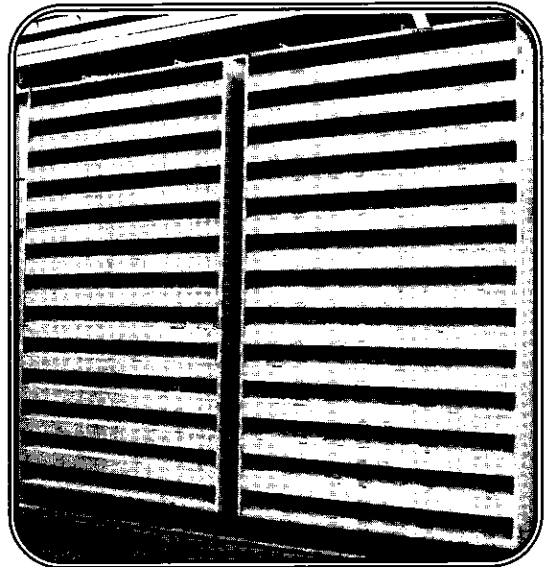
Background This initiative of International INCE deals with *noise walls* – the outdoor barriers erected in parallel with highways and rail lines, and in other areas (such as airport runways), where there is a demand to reduce the noise levels of surface transportation sources. There is worldwide interest in the control of noise by the erection of such barriers. Walls are composed of wood, metal, masonry, earth, and other materials, both opaque and transparent. Most of the walls that have been erected to date completely block the sight lines between vehicles and roadside housing. The cost of installation usually exceeds USD one million per kilometre.

In some countries, governmental authorities have authorized the use of highway construction funds for the erection of noise walls. When building a new highway or widening an existing highway in some jurisdictions, the construction of noise walls is required when the predicted noise levels of the road traffic exceed defined governmental guidelines. The key questions are: how valid are the traffic noise predictions, and how effective are the noise walls acoustically after they have been erected?

Concept The decision has been made that International INCE will undertake a study of the technical aspects of the sound attenuation afforded by noise walls; in particular, a comparison of predicted attenuations and actual noise reductions measured after installation. The objective is to develop a program of work for a future I-INCE Working Party dealing with the measurement and evaluation of noise walls.

Source: Noise/News International Vol 2 No 4, December 1994

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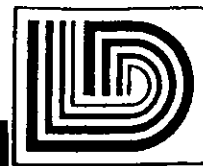
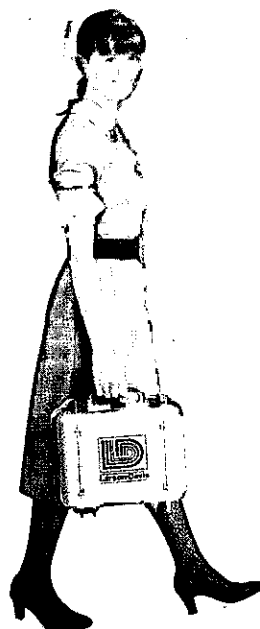
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OPERA & CONCERT HALL ACOUSTICS

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10 - 12 February 1995

This international conference, which was attended by 94 delegates, was opened by the President on the Friday at the Crest Hotel where the technical sessions were to take place. On the Saturday the conference moved to the Glyndebourne Opera House.

Three long and intensive days began at 10 am on the first day and the following is a synthesis of the various chairman's reports.

Peter Mapp coped admirably with the task of giving the first paper at this international event. Peter introduced various investigations he had recently undertaken into the resolution of problems in auditorium acoustics from his electro-acoustician's viewpoint. Peter introduced the increasing problem of designing and maintaining quiet electro-acoustics systems in the new virtually silent concert halls. (Later delegates were to hear about the similar problem for the theatre consultants of controlling noise from lighting equipment.) Peter demonstrated use of impulse response studies in the detection and isolation of unwanted reflections in auditoria and warned that unacceptable reflections are not adequately recorded by STI measurements.

Richard Guy from Montreal introduced his new directional measurement methods, including their use for studies such as mentioned earlier by the previous speaker in providing sound spatial information for acoustical defect diagnosis. Richard's equipment determines the Intensity Impulse Response (IIR); use of this parameter to study musicians' complaints about the effects of side reflections was outlined. The use of this method to quantify diffusion was also described.

The importance of diffusion in the prediction of room acoustics

was highlighted by Bengt Dalenbäck from Chalmers University, Sweden who sought to convince the audience that the use of computer models without allowing for diffusion was not appropriate. The mistakes arising from ignoring diffusion were stated to include severe overestimation of reverberation times, and possible exaggeration of the effects of specific reflections.

David Griesinger from the USA considered the importance of sound energy arriving after the direct sound. David concluded that for halls with reverberation time in the range 1.8 to 2.2 seconds, and direct/reverberant ratios in the range +2 to -2 dB, Early Decay Time as originally conceived by Jordan is an adequate measure of hall reverberance. Interestingly he proposed the use of EDT380 for other situations and sought a change in the usual assessment of Clarity to accommodate the apparent starting time of musical notes.

This session included also a stimulating presentation by Ken Jacobs of the Bose Auditorium simulation system. The system allows designers to hear a simulation of the sound that would be produced in a proposed auditorium generated by computer predictions based on the AutoCad drawings. Although the design tool had not been developed specifically for concert hall venues, the system was felt to give a sufficiently accurate acoustic impression of an auditorium for key design decisions to be taken. An elementary demonstration was made of recordings from an auditorium and from the Bose system set up to simulate that auditorium.

The second session which occupied Friday afternoon involved presentations on the acoustic design of five auditoria. Lawrence Haslam described the major redevelopment

of the former Empire Theatre that was to provide the long awaited auditorium for the Edinburgh Festival. This involved a completely new fly tower, a fully flexible orchestra pit and full air conditioning. Due to the historically good acoustics of the main auditorium, modifications within the auditorium itself were limited but included re-raking the stalls seating. Tests indicated a mid-frequency reverberation time in the range 1.3 - 1.45 seconds; subjective response was reported as very favourable for this important auditorium which is used for pop music, theatre, opera, ballet and concerts.

Richard Cowell described the construction of a new facility, the Anvil at Basingstoke, which included a multipurpose auditorium. Richard's paper outlined the development of the acoustic design of this stretched octagonal shape and discussed the detailed side and rear wall reflectors and the overstage reflector. The diffusion introduced by the overhead services, trusses and walkways was mentioned. This hall can be altered to accommodate concert/proscenium or platform formats. It has also variable acoustics, using theatrical drops deployed when less reverberant conditions are needed. A favourable subjective response was reported both by Richard and Derek Sugden; the latter informed the conference of a close friend's favourable reaction to Mahler that only this venue has evoked. For concert conditions, the mid-frequency reverberation time in the occupied condition is 1.6 seconds and 2.2 seconds when it is unoccupied.

Albert Xu then described his continuing battle with the acoustic problems of the Salle Pleyel in Paris. This auditorium was completed in 1927 and has been subject to many modifications, the most important being

those by Abe Melzer in 1981. Albert discussed the remaining acoustic problems and his recently completed improvements. These included the introduction of maximum length sequence diffuser panels above the stage to reduce excessive frontal reflections and the addition of diffusing elements to the side walls. The latter were said to have overcome the unnatural sound perception that arose from the original large smooth walls. Albert discussed the further improvements he would like to make, including tracking down the source and removal of a discrete echo.

After tea, Neil Spring described his challenging work on the new York Barbican auditorium. The challenge arose from the acoustic design objectives which embraced suitability for international badminton whilst providing excellent acoustics for symphonic performance. A further challenge was the requirement to accept a basically circular plan layout. Neil's acoustic design placed emphasis on the minimal introduction of sound absorbents,

the use of a heavy roof section (to exclude noise emission and intrusion) and overhead platform reflections. The resultant reverberation time was approximately 2 seconds in the unoccupied format. This sports hall was said to have been well received already during concerts by the London Concert Orchestra and is considered very satisfactory for broadcasting. Neil confirmed, in response to the earlier comment by Derek Sugden, that his wife felt the acoustics were excellent.

Albert Xu then returned to the lectern to present his second paper, on the unique new wooden auditorium, La Grange Au Lac, constructed for the Evian mineral water company and the Evian musical festival conductor, Mstislav Rostropovitch. Albert advised on his design intentions, the project realisation and the response of the users. The hall was designed for, and achieved, a reverberation time of 1.7 seconds at mid-frequencies, using a volume of 11,070 m³ for the 1156 seats. The hall is situated on a quiet site such that the 30 dB(A) sound insulation of

the timber walls was said to be sufficient. The author described his concern over the possible excess of low frequency absorption due to the generally lightweight construction; in practice the hall has a reverberation time of 1.5 seconds at 125 Hz. Albert sought advice from the other delegates as to whether earlier custom and practice of seeking larger reverberation at low frequencies relative to mid-frequencies was still appropriate. Helmut Müller suggested to all present that this idea related to developments in loud-speaker systems and was purely a matter of fashion. Albert said that in his new wooden concert hall, the musicians' response had been generally good and assessments included 'very natural', 'beautiful and transparent'. It transpires that some felt the sound quite rich for Mozart, but short of liveliness for the late Romantic symphony.

Mike Barron concluded this session with a review of opera house acoustics, in order to prepare delegates for the Saturday visit to Glyndebourne. Mike reviewed the

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historical development of the opera house format since its origin in 1637 in Vienna. He stressed the apparent ease of concert hall design, in contrast to the many compromises necessary for an opera house. These included the provision of a reverberation that is suitable for both the sung word and warm orchestral sound. Other aspects included the balcony overhang and the acceptance of a degree of non-uniformity in listening conditions. Mike stressed the design importance of including a suitably designed proscenium splay to assist singers' audibility above the pit sound in the audience areas together with a need to assist pit players to hear each other and the singers on the stage above. This matter was raised again on Saturday by Iain MacKintosh, in relation to one of the compromises that the Glyndebourne team had reluctantly had to accept. Mike concluded with the evidence from a subjective survey which suggested that individual listeners have different preferences, so that the inevitable non-uniformity of acous-

tics in opera houses need not be inequalitarian.

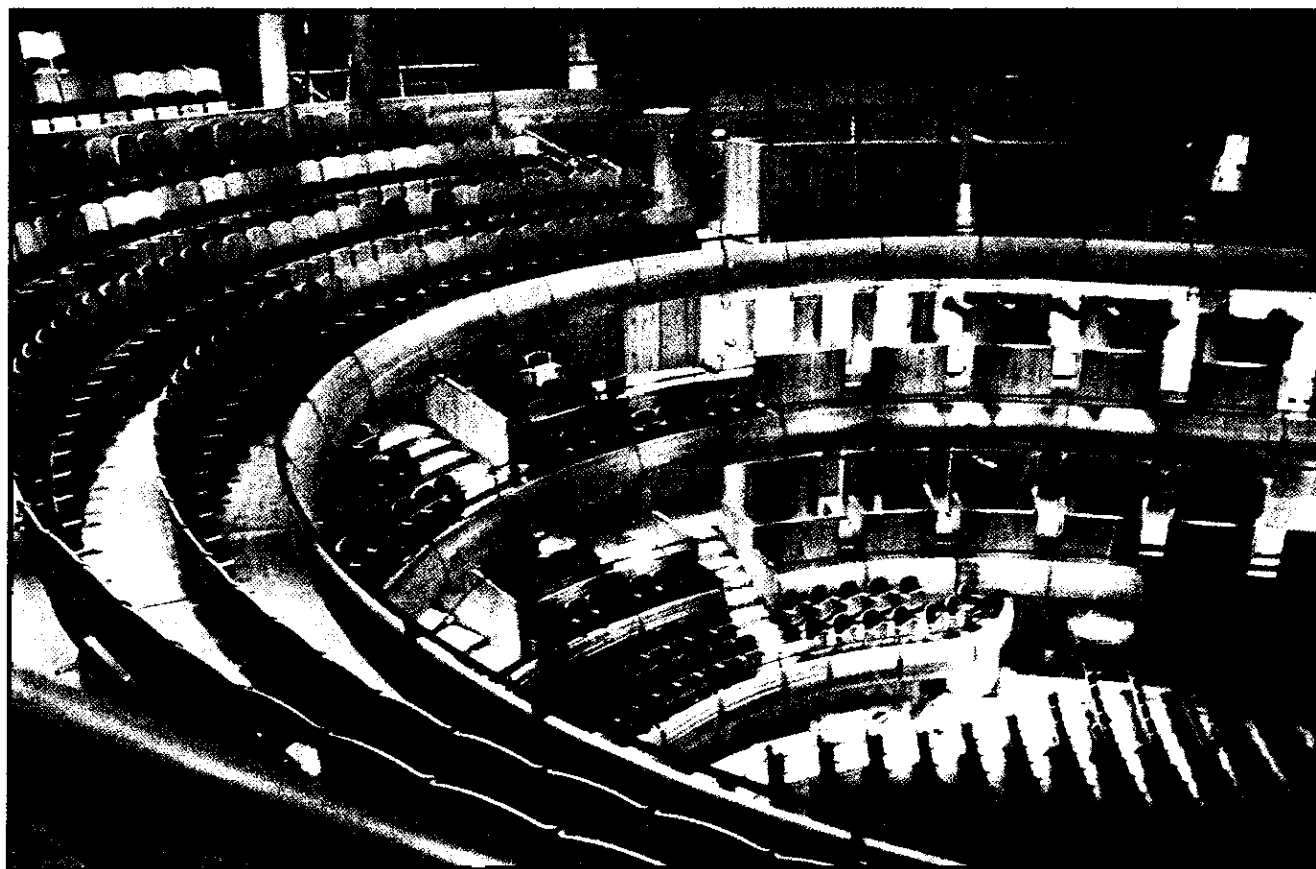
Saturday was to provide a long day out at Glyndebourne complete with two concerts and an exploding amplifier.

The day started with the departure of two coaches at 8.30 am, and completed prior to conference dinner at 7.30 pm. Sussex was wet. The delegates however were mainly in the dry during the small concerts in Glyndebourne and St Mary's, Reigate; they only got thoroughly soaked four times getting to the coaches which could never quite reach the drop and pick up points.

On arrival at the new opera house, coffee was taken prior to a very welcoming speech by Andrew Davis, musical director of Glyndebourne. Andrew confirmed his delight and that of the performers and musicians with the new house. Then followed a short concert by four singers, Natalie Herman, Linda Hibberd, Paul Wilson, Noel Mann, accompanied by Caroline Dowdell. The programme included songs composed by Mozart, Purcell,

Gluck, Bizet and Britten. The delegates were allowed to change seats in between each piece, just like musical chairs. One delegate even insisted on arranging where one of the singers should stand to sing on the large Glyndebourne stage.

Iain MacKintosh gave the first lecture to the delegates who by then were back in the Stalls. Iain described his difficult work to radically alter the architects' competition winning entry of a fan shaped auditorium to the classical circular shape ultimately adopted. Iain reviewed opera venues world-wide, and explained the way in which the optimum format had evolved and his design scheme development inspired by Le Grand Theatre at Bordeaux. Iain stressed his unsuccessful attempt to achieve a proscenium zone with stepped boxes and sliding side stages to link the performers and the audience. He noted the excellent work of Michael and Patty Hopkins in setting the final curves of the auditorium, and the challenge of this semi-circular design to the acoustic team.



Glyndebourne Opera House (photo Arup Acoustics)

Rob Harris of Arup Acoustics and Anne Minors from Theatre Projects then gave a joint presentation on the detailed acoustic and theatre design. In this situation, they were able to point delegates to the actual construction details. Anne explained the rationale adopted with regard to the acceptable sight lines at Glyndebourne, and Rob explained his rationale to exclude external noise, control services noise, and achieve excellent conditions for players, singers and the audience. Rob confirmed that commissioning tests had shown that the design intentions had been met, background noise level PNC 15, a mid-frequency reverberation time of 1.25 seconds, an EDT of 0.95 seconds and a Clarity of 3.3 dB.

After these technical contributions, parties of delegates were allowed to visit parts of the auditorium which they would not normally reach, prior to luncheon in an adjoining building. Fortunately lunch had not been planned for the lawn; it rained throughout the visit.

The coaches then departed back

to Gatwick for a short tea stop, prior to departing for a special concert by the English Arts Chorale in St Mary's Church, Reigate. The twenty-four strong chamber choir, accompanied by the organ, presented a varied programme including works by Handel, Byrd, Brahms, Fauré and Mendelssohn. The conductor, Leslie Olive, sought guidance from the delegates on whether the choir sound was better with the choir set well within the chancel or at the edge. Alec Burd responded by suggesting that the delegates would not be able to reach a united view on such a question, but that the sound was excellent in either arrangement.

The delegates then returned to prepare for the 7.30 pm Reception and Conference Dinner. Prior to making his after dinner speech, the President presented the Simon Alport Prize to Bengt Dalenbäck for his excellent work on diffusion. The President solemnly reported on a time and motion study that had been undertaken on an orchestra; this had identified massive savings that could be made if there was neither repeti-

tion of musical passages in compositions nor use of musicians playing the same thing! The delegates continued to discuss auditoria during which time the power amplifier of the PA system suddenly ceased operation, simulating an acoustic spark source.

Technical proceedings continued on the Sunday morning when Ben Kok commenced by describing his work on the Royal Dutch Theatre in Antwerp using SIAP electroacoustic enhancement technology to overcome poor acoustics under a large balcony overhang, and extending good acoustics to a new expanded coupled rear space. The project included achieving good acoustics using this electroacoustic system for an auditorium where the seating capacity was increased from 800 to 2000. It used over 120 loudspeakers that are of modest performance specification since they are operated at low output. Four hyper-cardioid Sennheiser microphones collect the sound for the SIAP system. The installation increases the reverberation from 1.3 seconds to at least 2.5



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seconds dependent on the setting selected. For speech it is possible to increase only the direct level leaving the reverberation unaltered. It also reduces the marked fall off in sound level towards the rear of the new, larger, auditoria. Discussion took place over the detailed form of the microphone array over the stage. The Theatre, after modification, was sold out seven days/week, for three months with a musical based on a comic strip, and then sold out for ballet.

John O'Keefe from Toronto then gave his two papers on detailed studies on orchestra pits and proscenium arch stages. He started with a discussion on stage acoustics by reviewing Gade and Naylor's work. He reported his investigations of the effect of practical matters of measurement on the stage acoustic support parameters; the effect of chairs on the stage and of musicians was small.

John described tests on three types of overstage reflectors. The support parameters were surprisingly insensitive to the differences. He then presented measurements showing large attenuation rates of reflected sound across stage, much greater than found by others for audience areas. His developed computer model agreed with these tests. He concluded his first presentation with recent anecdotal findings. He had noticed that in selecting the optimum height for a stage reflector the height suitable for the conductor is different from that for the orchestral players. He also had found practical support for Marshall's suggestion of a 45° rake for choir rostrum arrangements.

His design finding was that a shoe box shape was best for a platform, and that a tiered stage is essential in order to try to seek retention of the direct field component.

John mentioned his studies into three orchestra pits in Canada. He repeated Graham Naylor's tests of 1985, and then reviewed his own initial measurements of pit playing conditions, pit to stage coupling, and pit to audience coupling. He reported his finding that the meas-

ured balance between stage and pit sound (determined as a modulation transfer function) appears to be better on the balcony. Discussion occurred over alternative use of total level differences as opposed to MTF.

Alan Russell sought to provide insight into the noise arising from lighting fittings which may be a problem in a PNC 15 auditorium. Alan mentioned the need for new quiet products, and adequate manufacturer's noise information. The noise originates from thermal movement, electrical ballast noise, motors driving accessories and fans used for cooling, and whole movement of the luminaires. Alan mentioned the use of moving lights, developed originally on Phil Collins' initiative; these involve fast movement and consequential noise. He also mentioned lights which physically track in 3D, with every likelihood of much generated noise. He mentioned colour changing lights which include a motorised scroll of varying colours and need cooling fans. Alan expressed his concern over thermal noise generated as luminaires cool and suggested that the principle should be to locate dimmers and high power projectors separately. He mentioned new 6 kW light units, simulating sunlight, that can be over the open stage and will produce noise.

Alan concluded by discussing filament noise caused by third harmonics arising from distant solid state dimmers. He mentioned the need for more research to optimise techniques to minimise their harmonic generation, and the consequential noise.

Daniel Commins described his work on acoustic recovery of the National Opera House in Lisbon. He stressed that such work can be simple, that reverberation time is a relevant parameter, and care over details is essential. This 200-year old theatre had a reverberation time of 0.8 seconds prior to restoration. Daniel mentioned a list of measures considered, including removal of curtains, carpets, very absorbent seating, and closing openings to nearby rooms, refixing and thickening flooring and panelling. Daniel

stressed the possibility, when generally removing absorbent material from a hall, that this may make existing discrete reflections undesirable. He also mentioned the quite surprising benefit of large chandeliers in overcoming focusing effects from domed roofs.

It was stated that the change achieved by the work was a profound surprise to those experienced with the hall. The reverberation time had been increased to 1.3 seconds, and the users now delighted with this acoustic recovery.

Patrizio Fausti described the acoustic design of the new 'Nuovo Teatro Comunale' in Cagliari. The project was started in 1967 and the acoustic consultant joined the team in 1985. The original plan was a wide fan shape, with galleries of asymmetrical shape. A 1-50 scale acoustic was used, and identified insufficient early reflections. The architect resisted use of proposed side wall reflectors, or diffusing elements. Therefore other measures were introduced especially in balcony fronts and side walls near the pit. The optimal value for reverberation was set at about 1.5 seconds at the design stage for this auditorium of volume 16,000 m³.

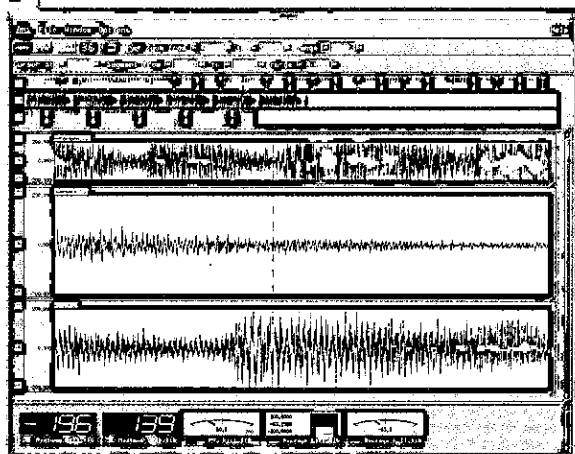
The hall was completed as a concert venue, not as an opera house, and therefore a stage enclosure was included. The measured reverberation time in the completed hall was 1.7 seconds at mid-frequencies.

Patrizio demonstrated the performance of the hall with and without the stage enclosure by playing sound recordings. The hall was stated to have been well received, by both audience and the performers.

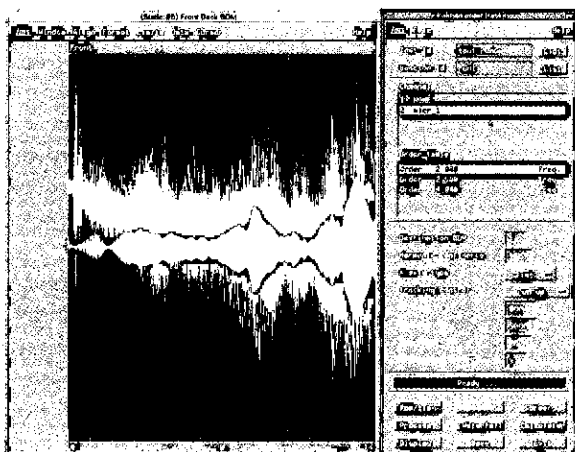
Sunday afternoon opened with Gaetano Licitra describing his studies into determination of the present acoustics at a large horseshoe plan auditorium in Livorno.

The Goldoni Theatre was built in 1843 and has a volume of 14,000 m³. He stressed the difficulty of altering such old buildings and the power of Italian architects. He then described his detailed analysis of the current acoustics which is being used to resolve the details of the

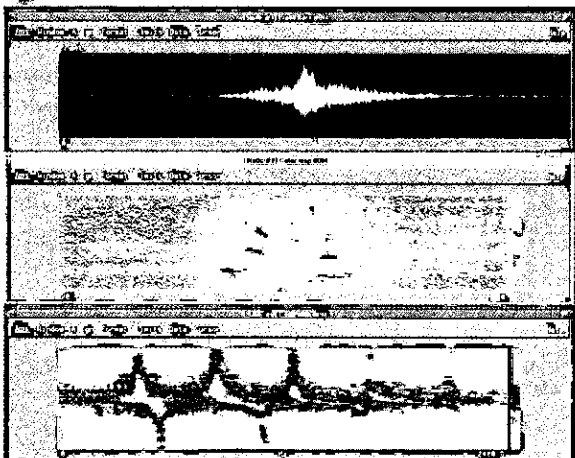
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planned refurbishment. The testing had to be carried out with no seats in the boxes, and no stage fittings. He highlighted the variation in sound level between boxes and throughout the stalls, which conflicts with the current Italian need for equal conditions for all. The mid-frequency reverberation time was 2.8 seconds. RASTI measurements were used to assess clarity showing a variation from 0.45 – 0.60 in the stalls. Many parameters were measured and most fitted the design objectives envisaged by Licitra.

A computer model was produced, and developed to match with the measurement survey; good correlation has been achieved despite considerable simplification in the modelling of the side wall boxes.

Denis Paoletti discussed work on the War Memorial Opera House in San Francisco. The renovation currently in progress on this 'old' building, being 63 years old, was initiated due to the aftermath of an earthquake. The major upgrade concerns the seismic provision. Denis' brief was to retain the acoustics, given that any improvement could only be financed on the back of seismic or other improvements. The Hall was originally built for multipurpose use and on the opening night in 1932, press reports had been favourable.

Denis described the new rehearsal spaces and his wish to include absorption, splayed walls, diffusion and high sound insulation lightweight walls. He reported on his measurement studies of the effect of the large semi-open sidewall organ grillage which showed a very frequency dependent performance. Tests were also made at locations where new shear walls are planned to ensure the acoustics remain unaltered. Current work concerns the specification of new seating for parts of the house.

John O'Keefe described his acoustic design of the new Princess of Wales Theatre in Toronto which seats 2000. It was recommended that the theatre should have two balconies, and be based very much

on the design of a nearby theatre. John discussed his original research when at Cambridge, UK, on theatres which, when combined with Canadian tests, helped inform the acoustic design criteria. He developed computer software to study sound reflections from the surfaces of the design. John highlighted the use of diffusers in the pit, the use of panels nailed to poured concrete to avoid low frequency absorption and diffusion arising from modern art sculptures. The achieved reverberation time was 1.1 seconds at mid-frequencies. The loudness variation, due to the deep balconies, was more than desired. The general response of this auditorium built specifically for the performance of the 'Miss Saigon' musical has been good; he also reported that his wife liked the acoustics.

Discussion took place on whether for this use there was such a need to retain low frequency reverberation. John's computer model experience has led him to use scale models.

Derek Sugden concluded the conference with his lecture on listening and looking. Derek described his aural childhood mentioning both his Methodist chapel and sounds in the environment. He then reported his regular attendance at Watford Town Hall – acoustic consultant Hope Bagenal. His acoustic education then progressed to concerts at the National Gallery, an Albert Hall experience, the Wigmore Hall and the Royal Festival Hall. Derek then described his experience of regularly listening in many small and large concert and opera venues throughout the world. Derek's wide ranging experience indicated how excellent acoustics can be experienced in auditoria of vastly different size and form. This excellent lecture gave delegates much to consider, and left them to muse on Derek's final statement; small is beautiful, big is better?

J G Charles

Euronoise '95

Software for Noise Control

Lyon, 21 – 24 March 1995

The Euronoise '95 Conference was organised by the French Acoustical Society (SFA) and jointly sponsored by the European Acoustical Association (EAA) and the International Institute of Noise Control Engineering (I-INCE). This was the second in the series of Euronoise conference – the idea of a European conference scheduled for those years Internoise is elsewhere was originally put forward by the Institute who organised the first one at Imperial College, London three years ago. The Lyon conference had the theme 'Software for Noise Control'.

Over 300 delegates attended the conference from 24 countries with around half of those from France. Over 160 papers were given in three parallel sessions which were included in the following topic

areas; noise prediction in factories, outdoor and traffic noise, prediction of structure-borne noise and related machinery noise, aero- and hydrodynamic sources and machines, materials for noise control, active noise control, and noise measurement using dedicated software.

A plenary lecture was held on each of the three days. Professor C Leseur of Laboratoire Vibrations-Acoustique, INSA, France gave a lecture on the contributions and limitations of prediction methods in acoustics. Professor Leseur gave the conference software theme immediate attention by taking advantage of a multi-media system to present many of his results to music which lent a professional, novel and entertaining slant to his lecture.

Congratulations go to Professor Frank Fahy of ISVR, who was

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awarded the SFA Medal for his work in acoustics. Professor Fahy gave his medal lecture on spatial correlation in vibroacoustics. This paper addressed the problems of characterising the vibrational field of a complex shell structure for the purpose of evaluating the sound pressure level at specific points not in the far sound field.

The third plenary was given by Dr J Leuridan of LMS International on 'Software for acoustics...crossing the chasm'. In his lecture he remarked on the current implementation of software making many assumptions about the level of expertise of the user, and that this very likely prohibits larger scale deployment of such software. He suggested that the path to successful implementation of software is reaching the proper level of software quality.

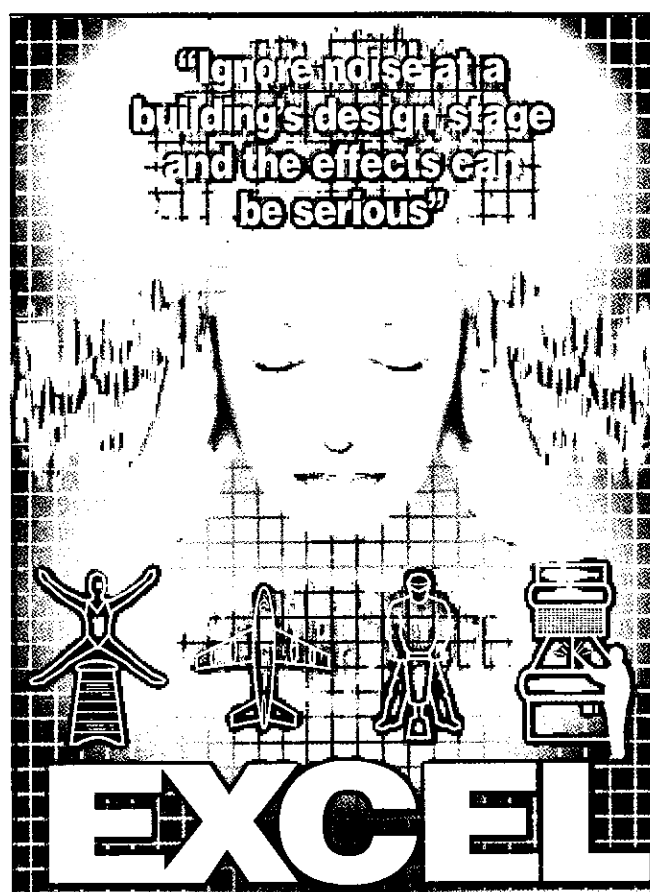
One of the aims of my visit was to promote Internoise '96. This also included the tasks of inviting prominent members of the profession to give plenary lectures and to act as session chairmen and meeting some members of the board of INCE. General invitations were available to each delegate together with information on the Britannia Adelphi Hotel and Liverpool. The publicity was supported with a number of bright posters.

The exhibition was well attended with 26 companies taking an active involvement. A number of interesting projects were on display throughout the three days. Of particular interest was the results of a programme, benefiting from financial contributions from the European research programme COMETT, carried out by 6 different establishments including Liverpool University. The collaboration had led to the development of a teaching software package 'Mediacoustic' which uses multimedia to offer a unique combination of sound, text and pictures on a personal computer. The package offers four main groups of subjects illustrated by sound clips, text, pictures, photos and video animations.

As a member of the organising committee for Internoise '96, I became more aware of the amount of detailed preparation required for a conference to run successfully. I was most impressed by the professional organisation of this conference and learnt many lessons. These ranged from the most effective methods of moving people around a large conference and the need for effective planning and timing systems for each parallel session. It was also clear that effective briefing of session chairmen is important, as is the need for making informal seating and discussion areas available along with the provision of practical tourist and travel information etc.

In my role as technical programme manager for Internoise '96, I met with one important member of the INCE Board, Dr George Maling with whom the IOA will be dealing on an increasing number of occasions. Internoise '96 is the 25th Anniversary year of this series of conferences and discussions took place about the most suitable guest lecturers which in turn led to one preliminary invitation. In addition, attending Euronoise '95 gave the opportunity personally to invite five people to act as specialist session organisers at the 1996 conference. Our target is to have at least 25 special sessions.

Nicole D Porter MIOA



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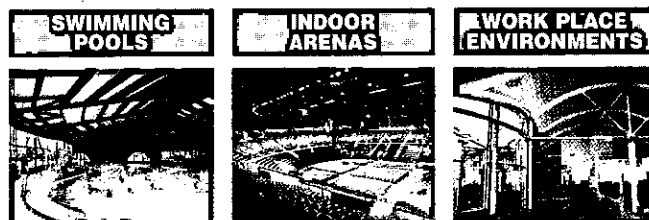
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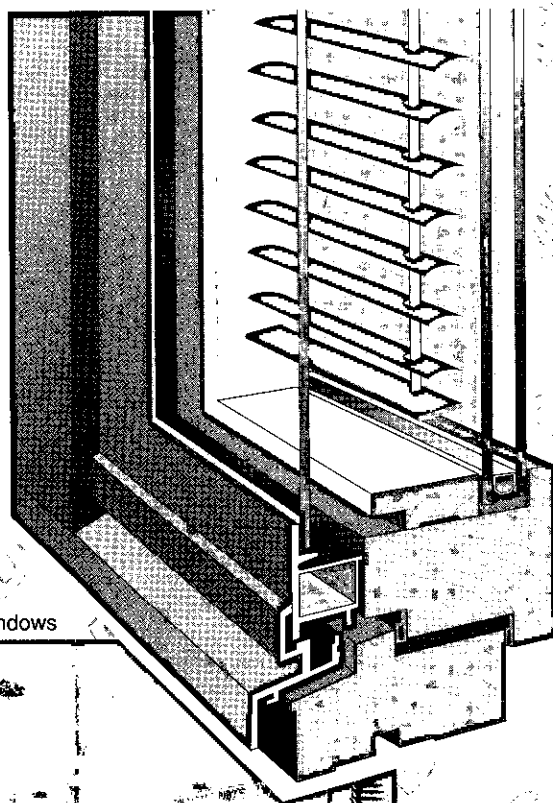
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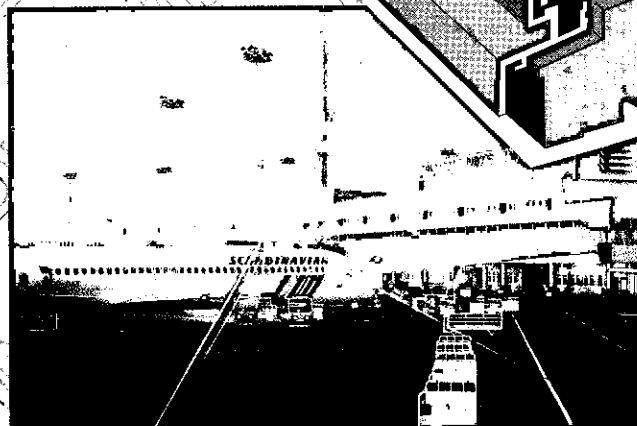
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Noise In Building Services Church House Conference Centre, London 15 March 1995

This one-day meeting was organised by the London Branch and the Environmental Noise Group. With the wide range of interests represented by nearly 50 delegates and speakers, it is concluded that the meeting only began to scratch the surface of many of the residual noise problems in building services but nevertheless offered some interesting solutions. It soon became clear from the paper by Bob Peters from NESOT that there is still considerable uncertainty in making accurate predictions of the acoustic performance of heating and ventilating systems. Research work carried out on the CIBSE and ASHRAE approach to noise predictions was illuminatingly backed up by survey questionnaires which suggest that although there are substantial inaccuracies in estimates, service designs usually have plenty of margin in hand for errors. Alan Fry's description of results obtained from extensive measurements on a fully commissioned system at Surrey University tended to confirm the view.

Where there are noise problems associated with air moving systems it appears that the immediate reaction is frequently to blame the fan manufacturers. Neil Jones described the kind of work which is done by manufacturers accredited to carry out work under BS 848 and how installers may take advantage of the information available which often seems to constitute a free acoustic consultancy service! It seems that the vast majority of cases where problems occur still originate from inadequate attention to detail at the installation stage or simply poor design of the air handling systems. One manufacturer estimates that the cost to him in free consultancy to solve such problems is in excess £100,000 per annum.

Having reasonably well established that there is as much art as science in the design and prediction

of performance, Neil Jarman drew our attention to the plethora of international noise criteria including NC, NR, PNC and RC. Many of the criteria trace their origins to work by Beranek whose further observation on application and use were reported. CIBSE, it seems, are not proposing to change from using NR.

Turning to practical solutions in the field, Helen Thornton provided a fascinating insight into the problems and solutions in two very different but highly demanding auditoria. Designs for Glyndebourne, dedicated to one highly specific purpose, and the Anvil at Basingstoke, intended for multi-purpose applications, showed the success achieved by close attention to detail in the use of isolation, damping and adequate research prior to installation.

These two facilities did not use active noise control which was the subject of Geoff Leventhall's paper with its descriptions of the theory and practical application of the 'new technology' – which he pointed out has been around for 30 years. The benefits of noise control work can rarely be demonstrated at the flick of a switch. This is the case, however, with complete building installations using active noise control for low frequency noise and conventional techniques for high frequency components.

The conference finished with a challenge. John Miller described progress on the Draft ANC Guidelines for the measurement and assessment of noise from completed building services installations. He reported on considerations of issues ranging from the noise index and averaging through to measurement equipment, measurement techniques and the presentation of results. Anyone active in building services noise control should obtain a copy of the Draft Guidelines and make their voice heard to the Committee.

John Simson MIOA

Integrating Speech Recognition & Natural Language Processing Systems University of Durham 23 March 1995

The theme of this one-day meeting organised by the Speech Group and hosted by the Laboratory for Natural Language Engineering in the University of Durham was to explore ways in which research into speech recognition technology and natural language processing can be integrated to produce spoken language understanding systems. The meeting was attended by 29 people from UK academic and industrial sites. Due to late withdrawals only five papers were presented.

The meeting was opened by Russell Collingham followed by an introduction to the IOA Speech Group by Briony Williams. The first talk was given by Steve Young (CUED) on the state of the art in automatic speech recognition. He

reviewed the structure of current continuous speech recognition systems and summarised the main developments over the last five years. He briefly described the ARPA Resource Management, ATIS and Wall Street Journal CSR Evaluation. It was demonstrated that if the trend in performance improvements is maintained, useable large vocabulary speech recognition systems will be available very soon. He pointed out that the challenge to integrate them with comparable natural language understanding capability is therefore urgent.

Robert Gaizauskas (Sheffield) then spoke on the state of the art in natural language understanding system from the perspective of building real systems designed to work on

real language in the real world. He gave an overview of several areas of NLU and presented results for various systems. He then went on to describe in detail the ARPA MUC-S and MUC-6 message understanding conferences.

George Demetriou (Leeds) presented a talk on semantics for speech by looking at the different approaches that have been undertaken and their various problems. A taxonomy classifying the various approaches in six main categories (semantic grammars, semantic networks, case-frames, unification-based, statistical-modelled and connectionist) was presented. Details were then given of the ongoing research at Leeds concerning the clustering of related words (or word meanings) from on-line dictionaries, and similar sets of conceptual (or semantic) tags from large text corpora, to provide semantic constraints for the disambiguation of word-candidate lattices output by speech recognisers.

Valtcho Valtchev (CUED) gave a talk on using n-grams for large vocabulary speech recognition. He described the n-gram approach to structuring the probabilistic dependencies for words in natural language. A practical development framework was presented, which allows for the easy creation and manipulation of complex language models (LMs) from a very large text corpus (230 million words). He also discussed the incorporation of trigram and fourgram LMs into the HTK large vocabulary continuous speech recognition system which achieved state of the art performance in the 1994 ARPA evaluation.

The final talk was given by Gavin Churcher (Leeds) on the development of a corpus-based grammar model for use with a commercial continuous speech recognition package. He described the results of experiments with a commercial 'off-the-shelf' continuous speech recognition system, applied to the (apparently) restricted domain of Air Traffic Control for light aircraft.

Briony Williams MIOA

Yorkshire & Humberside Branch

An evening meeting of the branch was held at Leeds Metropolitan University on Thursday 2nd February. This was the first meeting of the branch since 1987 and attracted 18 members with an equal number of apologies from members in the area who declared their support for a regeneration of branch activity. The President, Alex Burd and the Vice President for Branches & Groups were present and expressed support for the future of the branch. A Chair, Secretary, Treasurer and Committee were elected and it was agreed that a programme of events should be devised for the coming year. The programme will be printed in the Bulletin.

Two short papers were presented by Bill Davies and Tim South from Leeds Metropolitan University on research topics currently in progress. Bill Davies's presentation addressed the problem of low frequency absorption in auditoria due to seating, covering both the modelling and theoretical approaches while Tim South explained his approach to measuring absorption coefficients using the intensity method. Both papers attracted a number of questions and a lively discussion followed.

Branch Committee: Chair: Richard Scott, British Steel; Technical Secretary: John Bickerdike, White Young Consulting Engineers; Treasurer: John Tubby, Leeds Environment Department. Committee Members: David Hothersell, University of Bradford; John Charman, Anti-Sonics; David Marsh, Larson Davis; Frank Irving, HSE.

John Bickerdike FIOA

Midlands Branch

The second meeting of the recently established Midlands Branch of the IOA was held at the Hillman Lecture Theatre, Coventry University on the evening of 29 March 1995.

The audience, which was made up of 32 members and non-members, was addressed by John Sargent of the Building Research Establishment on the subject of that Establishment's research into low frequency environmental noise. This soon had the audience 'humming' contentedly. However, no one could trace the precise source of this 'hum'. (I still think it was the chap from British Gas). John eventually spoke for well over an hour and this was followed by a lengthy period of questions which was a reflection of how well his presentation was received and how much interest it generated.

Many thanks to Coventry University for their hospitality and in particular to Alan Barr who helped with the arrangements.

The *ad hoc* committee which is currently organising the Midland Branch intend to arrange two further evening meetings this year. These will take place on the 12 July and on 29 November (details including speakers and venues will be announced). At the latter of these meetings an AGM will be held to elect an officially mandated committee. All Midlands Branch members are respectfully urged to continue to actively support the newly formed branch meetings and to attend if at all possible. Non-member colleagues with an interest in any aspect of acoustics will be more than welcome.

John Hinton MIOA

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CONTINUING PROFESSIONAL DEVELOPMENT

– UPDATE

Introduction

Members will no doubt have heard of Continuing Professional Development from a variety of quarters, but for those uncertain about the concept, CPD is widely taken to cover the whole gamut of activities by which an individual continues his or her professional development throughout a working lifetime. A CPD scheme is an agreed structure set in place by an organisation that is designed to encourage activities that are appropriate to the general aims of CPD. It usually embraces some form of official recognition of an individual's adherence to the requirements of the scheme.

The Institute of Acoustics, as an affiliate of the Engineering Council, is obliged to have an acceptable scheme for its Chartered and Incorporated Engineers operating by the beginning of 1996. This determines a time scale for the introduction of a scheme, although the Institute is concerned that this fact should not lead to an in-built emphasis towards engineering.

This article sets out the present views of Council with the intention of promoting discussion that will help shape the final document to be published in October of this year.

Background

Council takes the view that there is nothing fundamentally innovative in the concept of CPD. It is reasonable to assume that, at least to some degree, every member of this Institute enhances his or her personal professional competence with each action undertaken that contributes to the completion of a professional task. Indeed, in common with many others, this institution has in its Code of Conduct for Members a requirement that, in order to continue in membership, the individual is required to undertake such activities as he or she considers necessary to enable them to continue to offer a fully professional service to those they serve.

The present Council thinking is that a satisfactory institution-based CPD scheme should be designed to offer opportunities for an individual member to become more systematic in approach to development than may have hitherto been the case. Setting up a scheme primarily involves consideration of the following points: (i) the range of activities that are considered valid for the purpose, (ii) a means of evaluating the participation in those activities and (iii) a standard against which involvement in these activities over a chosen time span is deemed adequate.

Council considers the Institute has a number of somewhat unusual features that are mostly related to its relatively small size and the fact that the interest areas cover a wide range of disciplines. It also takes the view that a

satisfactory CPD scheme will have to take these features fully into account and the following points have been central to Council's deliberations:

- (i) a mandatory scheme in which individuals are removed from membership for non-conformance would not be appropriate.
- (ii) the Institute scheme should essentially offer a service to members who wish to participate, by supporting rather than replacing members' own endeavours.
- (iii) the same form of scheme may not be appropriate for all members, partly as a result of differing employment circumstances. Some members, for example, may want formal supervision and recognition of their compliance with the scheme whilst others may only seek guidance.
- (iv) proper account should be taken of the small size of the Institute from the point of view that many members reside and work in remote areas, making it difficult for them to attend organised events.
- (v) the costs of the scheme and how it is funded. This will have to be considered in the light of the benefit it brings to members.

The Institute's Proposals

The following represents Institute thinking on the proposals at present.

Except for Chartered and Incorporated Engineers who are registered through the Institute of Acoustics, the scheme would be completely voluntary. This means that, unlike some other institutional schemes, it is neither compulsory nor mandatory, and is intended as a service to support rather than replace members' normal efforts in personal development.

Participation would be available at two levels at the member's own choice. The lower level simply offers guidance and a form of log book which the member would complete along the lines offered in the guidance. This is in essence a form of self-attestation.

The higher or registered level of participation would involve submitting the log book for inspection by the Institute, and if satisfactory, the Institute could issue a certificate or letter of attestation.

For the purpose of quantifying CPD activities, the Institute has decided to adopt the notional number of hours as the basic measure that is interchangeable with the schemes of most other institutions. The Engineering Council suggests that a figure of 35 hours per year is reasonable. The Institute is proposing the adoption of a rolling total of 90 hours over a three year period, with a minimum of 15 hours in any year, to allow for career variations.

Regarding the sorts of activities that may be considered, the range is very wide; as stated above a unifying requirement is that the work must be structured. The

Engineering Council suggests a variety of activities which range from the immediately obvious attendance at courses, meetings and conferences through distance learning, structured reading and research to relevant voluntary work. Council considers that the Institute scheme should be based upon a similar view.

It is intended that the guidance notes will suggest a number of hours for attendance at meetings and conferences of various lengths. The same would apply variously for work involved in preparing and presenting refereed and non-refereed papers at such meetings, irrespective of whether they are organised by the Institute. With regard to this latter point, it is possible that the guidance will indicate that a certain minimum should be explicitly acoustics or vibration based.

Although final figures are yet to be settled, the guidance may well suggest that 5 hours be assumed on account of a one-day meeting, 15 for a three-day conference and 25 hours for a five-day certificate course with external examination. Council is aware that the possibilities for members to attend Institute regional or national meetings and conferences is necessarily limited. One suggestion put forward to overcome this is to follow the lead offered by other institutions and allow members to opt for writing a study paper on a relevant topic that can be assessed by an individual appointed by the Institute for the purpose.

The importance of personal development beyond the boundaries of the subject is to be enshrined in the guidance to members. Management skills are an obvious

choice here alongside the likes of marketing and finance. Equally it is accepted that many courses and conferences attended by members are organised by bodies other than the Institute; these would be accepted on the basis of their relevance.

On the financial side, whilst the Institute sees the move into CPD as an important one that will both offer an additional service to those members who wish to participate and a strengthening of the role of the Institute within the profession, it is important that the scheme is self-financing. The true costs of operating the programme, and hence the charges to participating members, will only become clear when the final scheme takes shape following discussions with members.

Conclusion

Council's view is that a satisfactory CPD scheme offers an important contribution to quality assurance in respect of professional standards and enthusiastically commends the present outline proposals for careful consideration.

Council is aware that the eventual proposals may have to be modified as a result of experience so it sees the initial three years as a pilot scheme.

It is intended that the points set out in this article will be discussed at branch and group meetings and at Acoustics '95 so that Council will be able to give approval to the final scheme in October 1995. If you find you are unable to be present at any of these meetings, please address your observations to Sue Bird MIOA via the Institute office. ♦

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NEW CHARTERED AND INCORPORATED ENGINEERS

Chartered Engineers

Susan Bird started her career at the British Aircraft Corporation Weybridge after obtaining a degree in Applied Physics from the Lanchester Polytechnic in Coventry. After 3 years working on flyover noise on the BAC 1-11 and Concorde, and model tests on hush kits for the BAC 1-11, she moved to the GLC Scientific Services Branch. Here she worked for 12 years as an acoustic consultant specialising in building acoustics, environmental noise, building services noise and other noise problems affecting the capital.



After the demise of the GLC in 1986, she took the opportunity to work for herself, setting up Bird Acoustics, where she has worked mainly on transportation noise, building acoustics, noise for planning purposes and noise induced hearing loss.

Sue has been active in the engineering profession, as President of the Women's Engineering Society from 1991 - 93, and as a member of the Office of Science and Technology's working group on Women into Science Engineering and Technology, which produced its report in 1994. In 1994 she visited New Zealand to give an invited lecture on Continuing Professional Development at the Conference of the Institute of Professional Engineers New Zealand. She now chairs the Institute of Acoustics committee on Continuing Professional Development, and is a member of the Chilterns ECRO (Engineering Council Regional Organisation).

Rod Bleach gained a degree in Chemical Engineering then worked for a period as an industrial engineer in the glass manufacturing industry. In 1979 he began his involvement in the noise control field by joining Sound Attenuators Ltd specialising in industrial noise control.

In 1985 he joined his present employers, now known as AMEC Process and Energy Ltd, undertaking the acoustic design of petro-chemical installations, mainly offshore production platforms. He is now in his second period with the company having worked between times with the now defunct CEGB as an environmental specialist concerned with power stations, transmission line and wind turbine noise and then ERM as a senior consultant working on the environmental assessment of major projects including surface and underground railways and land developments. In 1986 he completed an MSc in Noise and Vibration Control from Heriot Watt University.

He is at present Deputy Chief Safety and Environmental Engineer with AMEC Process and Energy Ltd.

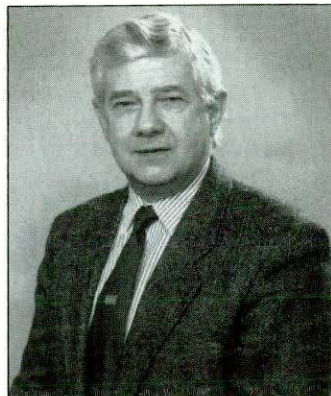
Mick Jenkins graduated in July 1985 with a BSc in Electrical Engineering, and subsequently joined the ISVR to undertake an MSc in Acoustics and Vibration. On completing this course of studies, he continued MSc project work under a three-year research contract, investigating practical applications and implementations of active vibration isolation systems. Mount/actuator design and useful operating regimes for a range of practical systems were investigated under the guidance of Professors P A Nelson & S J Elliott. As a result of this work, he authored or co-authored five conference and two journal papers and his PhD awarded in January 1990.

At this time Mick joined Acoustic Technology Limited (ATL) as a consulting engineer and gained valuable experience in a wide range of practical engineering problems, mainly related to the Oil & Gas, Ministry of Defence and General Industrial markets.

In 1992 Mick joined British Gas plc and was responsible for establishing noise limits for all capital projects and ensuring satisfactory detailed acoustic design through management of detailed design contractors. During this time Mick was also responsible for maintaining noise & vibration services to the various operational business units of British Gas and gained first-hand experience of British Gas's Exploration and Production, Transmission & Storage and Power Generation operations.

In September 1994, Mick joined the Consents & Environment group within Global Gas Power Generation. The group is responsible for obtaining all consents & licences necessary for operation of Combined Cycle Gas Turbine power stations and international gas developments. He also maintains the responsibility for establishing noise limits for new capital projects.

Geoff Kerry first became interested in acoustics at school when he installed and operated a sound reinforcement system for the drama group. As a student apprentice at



Hawker Siddeley Aviation, he naturally gravitated towards the noise and vibration section where he remained for two years after graduating from Salford University with a degree in Applied Physics.

In 1969 he became an experimental officer at Salford and ran the acoustic test facilities and was involved in a number of research contracts including a study into the effects of Concorde's supersonic boom and the development of double glazing for acoustic control. In 1977 he joined a team studying quarry blast noise and was instrumental in getting the meteorological office interested in blast noise

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propagation. This led subsequently to the team working for the Ministry of Defence which has resulted in the development of the impulse noise propagation prediction model now used as standard on UK firing ranges. Geoff has been responsible for developing instrumentation and techniques for measuring and monitoring impulse noise and he is the UK representative on a number of ISO and NATO committees. He is currently involved in research contracts for both the US Army and the Norwegian Defence Forces.

When the Acoustics Department moved buildings in 1985/6 he took on the job of redesigning and supervising the installation of the new test facilities and more recently he organised a successful application for NAMAS accreditation. He was a founder member of the NW branch of the Institute and organised the spring conferences in 1986 and 1994. He has been an active Council Member of the Institute since 1984. In 1985 he became Vice President responsible for Groups and Branches and in 1990 was appointed to the post of Honorary Treasurer.

Bernadette Mckell's involvement in acoustics began as an Environmental Health Officer. After completion of her BSc Honours degree in Environmental Health at Strathclyde University in 1980, she worked with a Local Authority and in 1984, while working in local government, undertook the MSc in Acoustics, Vibration and Noise Acoustics at the Heriot Watt University. The award of the MSc in 1986 coincided with her joining the Robin Mackenzie Partnership as Associate Partner where she gained very broad experience all aspects of the Partnership's consultancy work.



Bernadette was appointed Partner with Robin Mackenzie Partnership in 1989 and while progressing her consultancy career was also involved in research in

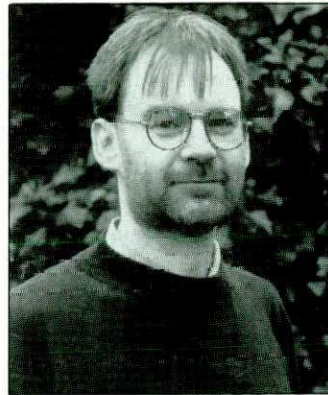
building acoustics at the Heriot-Watt University, initially on an SERC scholarship and then as a part-time research assistant. The work undertaken during this period on the development of a screening test to determine the impact sound insulation of floors led to the award of the Degree of Doctor of Philosophy by the Faculty of Engineering in 1991.

Since the completion of her PhD she has remained actively involved in all aspects of building and environmental acoustics with particular emphasis on environmental assessments. She also acts as an expert witness and lectures on the post graduate Occupational Health and Safety course in the University of Strathclyde.

Andy Moorhouse was interested in acoustics from an early age and at school pursued music and sciences with equal interest. He studied Mechanical Engineering at Nottingham University, graduating with a first class honours degree in 1982, and subsequently went on to GEC's

Engineering Research Centre in Leicester to work in structural and dynamic analysis.

In 1985 he joined Barry Gibbs's team at Liverpool University and, after three years development of practical techniques for structure-borne sound prediction was awarded a PhD. There followed four years at Sound Research Laboratories' (SRL) Northern Office where he was involved in a very wide variety of acoustics consultancy work, as diverse as in-flight testing of aircraft PA systems, teaching noise control to safety officers, quarry blasting etc. During 1991 and 1992 he was responsible for SRL's development in the North East.



He has been Examiner for the Noise Control Engineering Module of the IOA Diploma since 1991, and is currently continuing his research into structure-borne sound at Liverpool University Acoustics Research Unit. Andy continues to be an active musician and for the last two

years has been advising on the acoustics of the soon to be completed Liverpool Institute of Performing Arts (also known as the 'Paul McCartney Fame School') calling on both his scientific and musical backgrounds. In the future he will be further developing techniques in structure-borne sound and has recently been awarded a contract to advise the INRS (French equivalent of our HSE) as part of their 'vibro-acoustics' programme to reduce machinery noise.

Abigail Stinson spent three years working for Johnson Matthey, the precious metals and chemicals company, after completing a BSc in Aeronautical Engineering at Southampton University in 1987. Abi was engaged in numerous research projects at Johnson Matthey's Technology Centre where the sound engineering design experience she gained has proved invaluable throughout her subsequent career.

In 1990 Abi joined the Environmental Division of Frank Graham Consulting Engineers becoming involved



primarily in the environmental noise and air quality appraisal of major trunk road schemes along with the design and specification of noise mitigation measures. Abi's role also frequently involved assessing and advising on the control of construction site noise. She completed a Diploma in Acoustics and Noise Control in 1992.

Abi moved to Wimpey Environmental as a Senior Acoustics Engineer early in 1994 and is involved with all aspects of environmental acoustics including environmental noise impact assessment, noise control and pro-

viding evidence as expert witness. Her current work involves the appraisal of highway schemes and giving acoustic engineering advice on the design of housing developments, mineral working and landfill operations.

Incorporated Engineers

Paul Crank started his career in the construction industry studying for his HNC Building Construction after spending two years at college on an OND Building course. He has worked both in the private sector and public service and has been involved in a variety of noise surveys and projects over some fifteen years.

In 1980 he completed his Diploma in air pollution and has been a Member of the Royal Society of Health ever since. He has been a Member of the Institute of Acoustics since 1984, having passed the Diploma and has been awarded the Certificate in Workplace Noise Assessment.



Currently, he is employed by Test Valley Borough Council's Noise Control Section in the Environmental Health Department as the noise control

technician. This involves a wide variety of functions, primarily surveys with respect to planning applications, industrial, commercial, sport and entertainment noise control as well as routine noise and pollution related incidents.

Peter George started his working life as a technician apprentice and gained his HNC in Mechanical Engineering at Cornwall College in 1970 and has been employed in the manufacture of equipment for the Mining and Construction Industry throughout his 30-year career.

His current employer is Compair Holman (part of the Siebe group of companies) and is based in Cornwall where he is responsible for the development of all the products produced at this manufacturing site.



In 1980 he obtained the Institute of Acoustics Diploma after, again, studying at the Cornwall College.

He is active in the measurement and noise reduction of all types of equipment, especially compressors and hand held pneumatic tools. The vibration aspects of the hand tools produced is now considered to be an important area of his responsibilities.

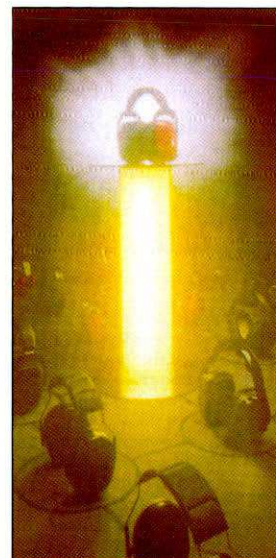
Ian M Benson and Peter R Hobbs were also registered as Incorporated Engineers ❖

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Hansard

12 December 1994

Noise Pollution

Mr Vaz: To ask the Secretary of State for Transport if he will make a statement concerning potential similar cases arising from building the A46-A47 link road and the eastern district distribution road in Leicester following the recent Court of Appeal decision to allow Colonel David Owen full compensation for the noise blight which has devalued his home; and what assessment he has made of the effects of potential claims for blight and the rise in costs on the continued viability of the A46-A47 link road and the EDDR.

Mr Watts: The right to compensation where an interest in land is depreciated by noise from the use of a new or improved highway is set out in part 1 of the Land Compensation Act 1973. In addition section 246 of the Highways Act 1980 provides highway authorities with a discretionary power to acquire by agreement land to mitigate the adverse effects of constructing or improving a highway.

The A46-A47 link road and the EDDR are roads for which Leicestershire county council is the highway authority. I am advised that the county council does not exercise its discretionary powers in respect of the purchase of properties. Information about the cost of these local road schemes can be obtained from the county council.

12 January 1995

Road Noise

Mr David Howell: To ask the Secretary of State for Transport if he will list his Department's current obligations relating to road noise arising from the construction of new trunk roads.

Mr Watts: This is an operational matter for the Highways Agency. I have asked the chief executive to write to my right hon. Friend.

Letter from Lawrie Haynes to Mr David Howell, dated 12 January 1995:

As you know, since the creation of the Highways Agency, it falls to me as Chief Executive to write to MPs who have tabled questions on matters which relate to operational matters of the Agency.

The Noise Insulation Regulations 1975 require highway authorities to carry out or pay grant towards the cost of insulation of qualifying residential property against traffic noise arising from the use of new or altered roads. Dwellings, or other buildings used for residential purposes, within 300 metres of a new or altered road are eligible for insulation if it is calculated that within 15 years of opening the noise level will increase by 1 dB to a level of at least 68 dB.

The Regulations also allow highway authorities discretion to carry out or pay grant towards the cost of insulation of residential property against noise arising from the construction of new or altered roads.

Mr David Howell: To ask the Secretary of State for Trans-

port (1) what decibel readings his departmental officials are receiving from within 300 m of the A3 in the region of Ash Grove, Guildford;

(2) what decibel readings his departmental officials are receiving from within 300 m of the A3 in the region of Weston Road, Guildford;

(3) what decibel readings his departmental officials are receiving from within 300 m of the A3 in the region of Burpham and Abbotswood.

Mr Watts: These are operational matters for the Highways Agency. I have asked the chief executive to write to my right hon. Friend.

Letter from Lawrie Haynes to Mr David Howell, dated 12 January 1995:

I have been asked to reply to your recent Parliamentary Questions asking what decibel readings we are receiving from within 300 metres of the A3 at several locations within Guildford.

There is no general monitoring by the Agency of noise levels on the trunk road network and I regret, therefore, that the information you require is not available.

You know that the section of A3 which passes Ash Grove, Weston Road and Abbotswood (and Burpham) is a post 1969 road. It forms part of the A3 Burpham to Ladymead scheme which opened to traffic in 1981. In his letter of 23 November, Dr Mawhinney explained that the obligations placed on the Department of Transport by the Land Compensation Act 1973 and associated regulations, both in terms of the noise mitigation measures and compensation for depreciation in the value of property caused by noise, were fully discharged in respect of that scheme. He also explained in some detail why existing unaltered roads in this category could not be reassessed and retreated for noise mitigation.

It follows that no purpose would be served in taking noise measurements along this section of the A3.

18 January

Noise Working Party

Mr Simon Hughes: To ask the Secretary of State for the Environment when he expects the working party on noise to complete its work; if it will take evidence; and in what form it will publish its conclusions.

Mr Atkins: The working party expects to complete its review shortly, and I intend to consult extensively on its conclusions and recommendations.

Mr Hughes: That answer is welcome. I believe, however, that the working party is composed of officials from the Home Office and other Departments, the police and local government; out there, the public want their shout on the issue. I consider that the public take a much harder line than officials on the need to be tough on noise makers. Will the Minister guarantee that they will have their say, and that their views will prevail rather than those of enforcement agencies which often want an easy life?

Mr Atkins: I am grateful for the hon. Gentleman's support. He will know of the campaign being run by The Mail on Sunday and the responses - more than 30,000 - that it has received; it is welcome that the newspaper has taken such a public interest in the issue.

We have sought the advice not only of the Departments to

ACOUSTIC APPOINTMENTS

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which the hon. Gentleman refers but of others, including environmental health officers, who are very much in the front line. I hope that the hon. Gentleman will welcome the conclusions of the working party, which will report in the not too distant future. I am only too aware of the problems of noise, not only in urban but in rural areas, and I intend to do something about them.

24 January Noise Pollution

Mr Evennett: To ask the Secretary of State for the Environment when he expects to be able to bring forward proposals to address the problems of noise pollution and noise nuisance.

Mr Atkins: Local authorities have a range of powers to prevent or abate noise nuisance from premises and from vehicles, machinery and equipment in the street. An inter-departmental working party was set up in October last year to review the current controls over neighbour noise and to investigate options for swifter remedies. The working party expects to complete its review shortly and I intend to consult fully on its conclusions and recommendations.

26 January Airports (Noise Nuisance)

Mr Jim Cunningham: To ask the Secretary of State for Transport if he will make a statement on the criteria for grants in respect of noise nuisance to people living near airports, with particular reference to (a) Coventry and (b) Birmingham.

Mr Norris (holding answer 24 January 1995): My right hon. Friend may lay down criteria for noise insulation grants for airports designated for the purposes of section 79 of the Civil Aviation Act 1982. The only airports so designated are Heathrow and Gatwick. At other airports, provision of noise insulation is at the discretion of the local airport management or may be the subject of planning conditions.

There have been various noise insulation schemes at Birmingham, but none at Coventry.

The boundary of the present scheme at Birmingham, which has been implemented in phases, was published in 1991. It is based on 66 Leq-16 hour - daytime aircraft noise exposure contour. The scheme provides grants for noise insulation to specified standards in up to three habitable rooms. The grants are subject to a cost limit of £1,600 plus VAT per dwelling and are paid by the operator of the airport.

1 February 1995 Noise Pollution

Mr Gordon Prentice: To ask the Secretary of State for the Environment what steps he is taking to encourage local authorities to give higher priority to tackling noise pollution.

Sir Paul Beresford: Local authorities have a wide range of powers to tackle noise pollution from premises and from vehicles, machinery equipment in the street. In response to rising numbers of complaints about noise an increasing



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number of authorities have introduced 24-hour noise complaint services but this is a matter for each authority to decide on the basis of local priorities and needs. An inter-departmental working party was set up in October last year to review the controls over neighbour noise and to investigate options for swifter remedies. The working party expects to complete its review shortly and I intend to consult fully on its conclusions and recommendations.

Mr Gordon Prentice: To ask the Secretary of State for the Environment how many (a) successful and (b) unsuccessful prosecutions have been brought for noise nuisance for each year since 1979.

Sir Paul Beresford: The numbers of prosecutions and convictions for noise nuisance in England and Wales for each year since 1979 are as shown in the table. Figures are not yet available for 1993-4.

Noise nuisance prosecutions and convictions

	Prosecutions	Convictions
1979	245	144
1980	240	171
1981	269	249
1982	263	205
1983-84	495	332
1984-85	355	298
1985-86	318	251
1986-87	430	342
1987-88	404	322
1988-89	446	418
1989-90	284	233
1990-91	559	465
1991-92	367	310
1992-93	416	343

Source: Chartered Institute of Environmental Health.

21 March 1995

Neighbour Noise

Mr Bill Michie: To ask the Secretary of State for the Environment what further progress has been made regarding the working party looking into noise from neighbours; and if he will make a statement.

Sir Paul Beresford: The working party has completed its review of the effectiveness of current neighbour noise controls. We hope to consult in the near future on its conclusions and recommendations.

27 March 1995

Neighbour Noise

Mr Evennett: To ask the Secretary of State for the environment what plans are there to deal with neighbour noise. **Mr Atkins:** Inconsiderate noisy neighbours can cause extreme distress and suffering to many. My concern about the steeply rising complaints about domestic noise and the effectiveness of the current legislation to deal with these problems resulted in the formation last October of a working party to review the situation.

I am today placing in the Library of the House and publishing a consultation paper which sets out the conclusions and recommendations of the working party. The key recommendations are:

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- Good practice guidance should be made available to local authorities on the management of noise services.
- Local authorities should be encouraged to provide information to residents about their authority's noise complaints service and to increase public awareness of neighbour noise issues. Government should consider supporting publicity initiatives to increase awareness of what constitutes unacceptable noise.

Consideration should be given to issuing general guidance on the sorts of noise problems which might constitute a statutory nuisance.

- Local authorities should be encouraged to provide services which respond to complaints outside working hours wherever such services are required.

- Local authorities should be encouraged to establish streamlined local arrangements for obtaining warrants to enter domestic premises to temporarily confiscate noise-making equipment or silence intruder alarms.

- A code of good practice should be issued jointly by the professional representative bodies to police forces and local authorities to encourage effective local arrangements for dealing with noise complaints

- A specific power of temporary confiscation of noise-making equipment - to provide a stronger legal base for existing practice - should be introduced, with the power for local authorities to levy an administration charge for its return.

- Local authorities should be encouraged to seek, where appropriate, deprivation orders for the permanent confiscation of noise-making equipment following prosecution.

- Consideration should be given to the creation of a criminal offence, separate to the statutory nuisance regime, to apply to night time neighbour noise disturbance.

The paper invites comments in particular on the options for creating a new criminal offence, including a direct noise offence based on the World Health Organisation guidelines of 35 dB(A) for acceptable indoor night noise levels. Such an offence has the potential to provide a swifter remedy than the current statutory nuisance regime for some of the most disturbing neighbour noise problems.

Copies of the consultation paper are being sent to all district, borough and island councils in England, Wales and Scotland, representative bodies for local authorities and the police, voluntary noise groups and a wide variety of other organisations. The consultation period lasts until 30 June.

Wherever possible, attempts should be made to resolve problems informally. However, it is vital that effective legislation is in place to deal with situations where a formal remedy is the correct course.

I am grateful to the working party for producing what I believe is a worthwhile package of proposals which, if implemented, will strengthen current neighbour noise controls, improve the management of local-authority noise services and improve liaison between local authorities and the Police.

Extracts provided by Rupert Taylor FIOA

Book Reviews

Transactions from Russia: Noise and Vibration
Institute of Marine Engineers, 32pp, 1995.

ISBN 0-907206-58-1 Cost: £12.50 from
IME, 76 Mark Lane, London EC3R 7JN

This rather unusual booklet from the Institute of Marine Engineers is a result of an agreement between IME and the Central Shipbuilding Research Institute of Economics (sic) of St Petersburg.

It contains a translation of a number of brief articles on sound and vibration authored by members of CSRI. The nature of the articles is generally a review of the relevant subject, which in some cases is at a textbook level whilst in others is at the frontiers of research. The titles of the eight articles are as follows:

- 1 Principles of Vibration Isolation for Shipboard Machinery
- 2 Acoustic Design of Ship Structure
- 3 Low Frequency Resonance Sound Absorbers
- 4 Optimisation of Sound Insulating Construction Elements
- 5 A Determination of Enclosure Soundproofing Capability Using the Principle of Reversibility
- 6 Accuracy and Reliability of Soundproofing Measurements and Calculations
- 7 Technical and Economic Optimisation Principles for Setting Standards for Noise in Ships
- 8 Economic Aspects of Noise Reduction in Ships

Article 1 is rather basic vibration theory. Article 2 is a perceptive and interesting account of soundproofing in ships which, in particular, clearly demonstrates how cost-effective it is to take account of acoustics at the design stage rather than later. Article 3 concerns the design of perforated sheet tile absorbers of the Helmholtz resonator type.

Article 4 makes rather extravagant claims for an optimisation algorithm for multi-layered soundproofing elements with only minimal experimental confirmation. Article 5 is the shortest piece involving five authors that I have seen for some time and appears to be rather basic acoustics.

Article 6 is a significant contribution on the reliability of soundproofing predictions and measurements and is, I believe, a valuable and original contribution.

Articles 7 and 8 are both essays on the cost-effectiveness of noise control measures in relation to criteria for noise control such as standards, codes of practice and guidelines to good practice. Both articles are interesting and perhaps expressed in a new way or new context, but add little to principles which are already well understood.

Insufficient attention has been paid to good translation. It seems that a native English speaker has worked on the translations so that the grammar and style is quite good, even attractive. However, this person does not appear to know the relevant technical terms so that in some places an odd term used can be recognised whereas in others it cannot, for example:



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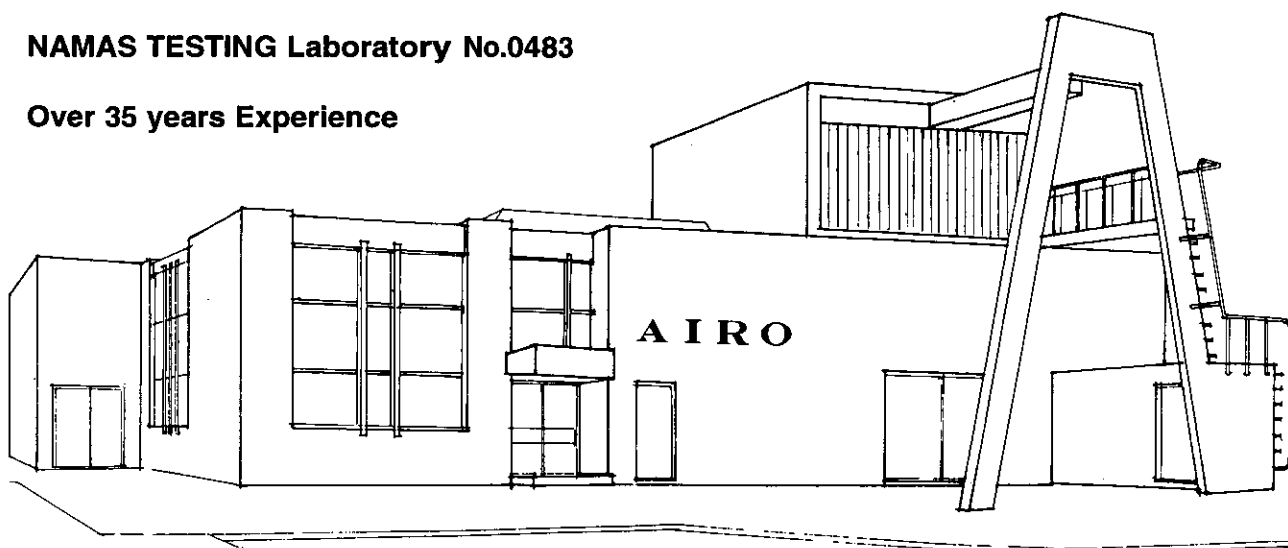
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In summary, several of the articles in this booklet are challenging and interesting and for this reason alone it is worth the relatively small outlay required. The standard of presentation is excellent.

A J Pretlove FIOA

Noise Control: Sourcebook 9

Information and Library Service

Institution of Mechanical Engineers, 1994, 245pp

ISBN 0 85298 941 5 £32.00

This sourcebook is intended to provide a selection of relevant sources of essential information for anyone interested in noise and noise control. As part of the introduction it states that it contains noise control information listing useful sources of information under a variety of headings and also noise control references of over 400 extracts and details of recently published material.

If the sourcebook had gone even halfway to achieving the above objectives, it would become a very useful source of reference data. In the compilers' desire to cram a wide range of data and references into one single book it has ended up as a mish mash of information with no clear direction as to what the end product should have been. It is very much like the 'curate's egg' in that it is good in parts.

The lists of abstracts, indexes, journals and databases are particularly useful and it is unlikely that any meaningful entries have been missed and it certainly serves as a useful start for those involved in research or literature reviews relating to noise control. Similarly the sections detailing university and short-term courses appear to be reasonably comprehensive, however, it is a great pity that telephone numbers for all of the contacts were not provided.

The section on software and software suppliers is alarmingly short on information and whilst the compilers may consider that there are very few suppliers it is nevertheless surprising that they have not included ENM or Soundplan. Both of these predictive models are used for noise source modelling in the UK. Perhaps, contacting some of the larger environmental consultancies or teaching establishments would have provided the necessary information sources, not least the perusal of our very own Acoustics Bulletin or contact with the Institute would have revealed some useful contacts or information.

The section dealing with standards (eg British Standards, ISO, DIN etc) is particularly disappointing. Whilst providing a listing and summary of some 47 standards it has failed to include many important standards. For instance, whilst listing BS 2750 : Part 8 which relates to transmitted impact noise in buildings, there is no mention to the other parts of the standard particularly Part 4 which must be equally important as it relates to airborne sound transmission through walls. Elsewhere in this sec-

tion the reader will find references to active noise reduction systems for the MH-53 Aircraft. It would seem that if it is obscure or likely to be of interest to a very small percentage of the potential readers of the source book then there is a good chance it will be listed here.

Finally, in the second half of the sourcebook are listed the Noise Control References. Careful reading of this section will reveal many useful references with quite useful summaries of the contents. However, it is nevertheless disappointing to find many obscure references which are unlikely to be of anything more than superficial or curiosity interest and no references to the Proceedings of the Institute of Acoustics.

In conclusion, this sourcebook is of limited use to established acousticians although it may prove a useful starter to those who are new to the subject of noise control. On a final note, my copy was so poorly bound that it fell apart – perhaps it should have been published in looseleaf format or provided on computer disk.

Graham A Parry MIOA

Notes on Sound Absorption Technology

U Ingard

Noise Control Foundation, PO Box 2469, Poughkeepsie, New York 12603, USA, 384 pages

ISBN 0 931784 28 X \$88

This book written by Professor Ingard, a Rayleigh Medalist of the Institute of Acoustics, is an exposition of the acoustic absorbing properties of materials and of design using such materials. The design analyses are supported by the provision of accompanying software which closely mirrors the analysis in the book. The software is directly executable from MS-DOS on a PC and provides both graphical output and the corresponding ASCII data files.

The details of the appropriate subject matter covered in the book are as follows:

- The acoustical properties of flow-resistive screens.
- The effects of viscosity and heat conduction on sound propagation.
- Design of multi-layer sound absorbers, including non-uniform absorber spacing.
- The properties of flexible porous sound absorbers, including open and closed cell materials.
- The effects of perforated facings and wire screens on the properties of sound absorptive materials.
- Attenuation in lined ducts.
- Resonator design, including scattering and absorption cross-section.
- Sound absorption in wind tunnels and the interactions between shock waves and flexible porous layers.
- Characteristics of sound absorptive materials, including a new apparatus for measurement of flow resistance and the measurement of complex modulus for compressible absorptive materials.

The one minor drawback is the lack of an index. The book and its software are a useful database for any acoustical engineers involved in the specification of acoustically absorptive materials for rooms and duct systems with flow and, as such, is highly recommended.

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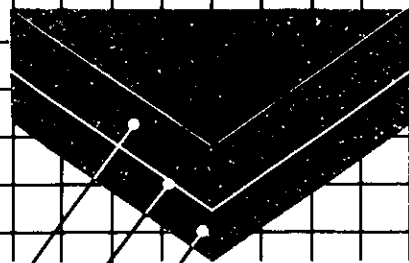
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The GA122 has the same facilities with the exception of the octave band modes. Both instruments have a video style timer for automatic operation and high speed logging mode which captures raw data for highly detailed analysis. Castle also produce dBdata, a software package which is compatible with all Castle logging sound and vibration meters. For further information contact: Simon Bull, Sales Manager, Castle Associates Ltd, Salter Road, Scarborough, North Yorkshire YO11 3UZ. Tel: 0723 584250. Fax: 0723 583728.

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plaints and environmental impact statements. The EL-235 is a rugged Portable Tri-Axial Vibration Logger for continuous unattended monitoring of groundborne or building vibration over long periods of time.

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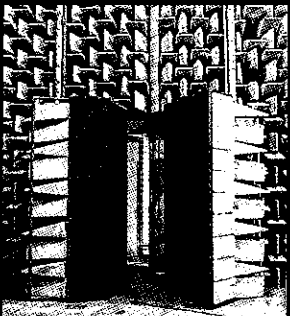
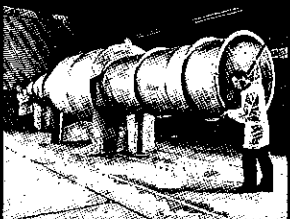
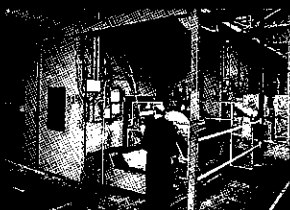
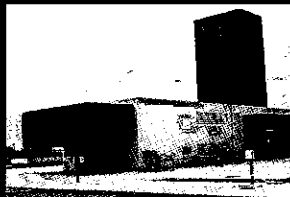
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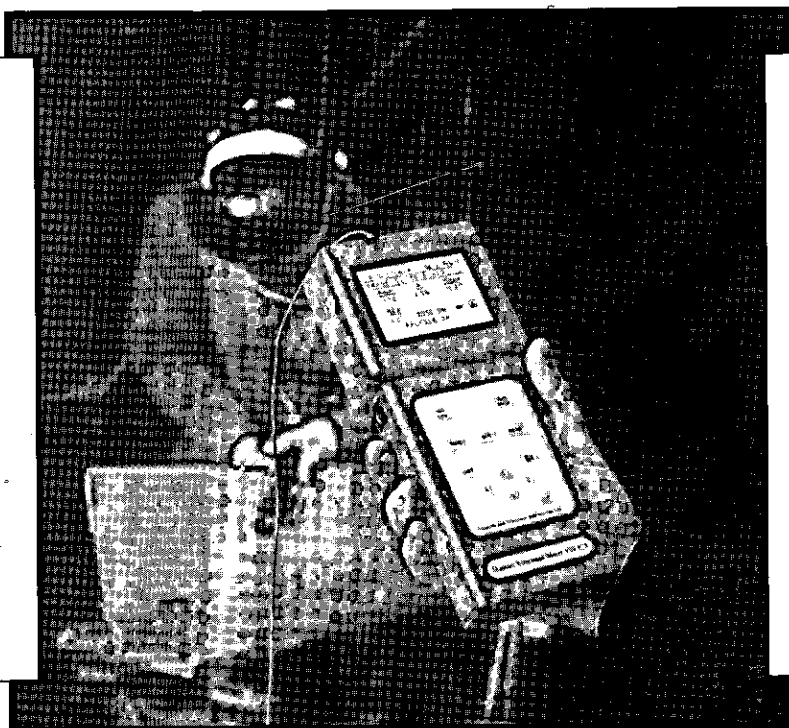
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The World's First

Dedicated Hand Arm Vibration Meter.

E.P.M. is proud to announce the world's first dedicated Hand Arm Vibration Meter. The VIS-015 is designed specifically to meet the proposed European Union Physical Agents Directive.



Frequency Weightings to the requirements and accuracy of ISO 8041

Displayed in accordance with ISO 5349

Three Measurement Ranges

Designed to measure Hand Arm Vibration levels in accordance with Health and Safety requirements and the E.U.P.A.D., the Human Vibration Meter will give measurement of both instantaneous vibration levels and the equivalent 8 hour exposure.

Includes Real Time Clock and Profile.

Allows 7 separate vibration measurements to be collected in each Run then gives the user options to enter exposure time for all relevant measurements and combine them to give the overall daily exposure in an easy to use program routine.

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