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The Institute of Acoustics was formed in 1974 through the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society and is the premier organisation in the United Kingdom concerned with acoustics. The present membership is in excess of two thousand and since 1977 it has been a fully professional Institute. The Institute has representation in many major research, educational, planning and industrial establishments covering all aspects of acoustics including aerodynamic noise, environmental, industrial and architectural acoustics, audiology, building acoustics, hearing, electroacoustics, infrasonics, ultrasonics, noise, physical acoustics, speech, transportation noise, underwater acoustics and vibration. The Institute is a Registered Charity no. 267026.

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Dear Fellow Member

Summer may bring something of a hiatus in our national calendar of meetings but the international scene has continued unabated. A major preoccupation for Bernard Berry and his colleagues on the Organising Committee during the last few weeks has been the preparations for inter•noise 96. Obviously the Institute takes great pride in the successful organisation of such a high profile event and, of course, its success or otherwise carries significant financial implications. Bernard and Nicole Porter were in Newport Beach during inter•noise 95 with an imaginative audio visual presentation and an array of other material to focus attention on the attractions of the UK next year. These efforts, together with a closing reception sponsored by CEL Instruments – one of the Institute's Key Sponsors – inviting delegates to next year's congress created considerable interest. There will be other opportunities for organisations to sponsor elements of the congress and Council would be pleased to hear from anyone interested.

The other major conference this summer was the International Congress on Acoustics in Trondheim which gave an opportunity for the Board/Council meetings of both EAA and FASE and there are signs of a coming together of these two bodies to the benefit of all. I know several of you travelled to Trondheim and I am sure you will have enjoyed Norwegian hospitality as well as the technical content of the conference. I am sorry I was unable to attend as intended.

The Autumn Conference in Windermere will take place at the end of October. During the 21st year of the Institute it is fitting that we should take stock of our development during this time and consider how this should continue. A session at the conference will allow those attending to express their views and those unable to be present may send their comments to the Institute office. In this connection I welcome the recent formation of the Measurement and Instrumentation Group which is to assist in the organisation of the conference. A brief note regarding this group is contained in this issue.

You wil shortly receive your copy of this year's Register. The time spent cross-checking for spurious data (it is surprising how many individuals imagine they are members when they are not) is the main reason for the late appearance of this Bulletin. The deadline for the next issue should permit printing in time for the Autmmn conference,

Sincerely yours

Alex Burd

Alex Burd

ON THE PHYSICAL ACOUSTICS OF COLLOIDAL MIXTURES

John S Tebbutt & Richard E Challis

Introduction

A colloid is a mixture of materials in which small particles are suspended in a liquid. The particles can be solid or liquid, and in the latter case the mixture is known as an emulsion. The particle size is important, and it is generally accepted that the term 'colloid' implies particles that are small enough to be subject to Brownian motion in the mixture: generally between 0.1 μm and 1 μm. Very many commercially and environmentally significant materials are either colloids themselves, or will have passed through a colloid state during their formation. A few examples from a very long list are foods, paints and dyestuffs, oils and lubricants, ceramics, cements, sewage, and turbid water in many natural situations.

For a wide variety of reasons which include product quality, process economy, and environmental protection, it is necessary to determine the physical state of colloidal mixtures both in the research laboratory and at plant testing stations either by sampling or via on-line measurements.

There is a vast range of techniques for achieving this, encompassing optical turbidity tests, optical scattering, sedimentation rate tests, electric conductivity and/or permittivity, neutron and X-ray scattering, electroacoustic methods, and of course, acoustic methods alone. Acoustic methods are not yet well developed but are presently attracting considerable interest because of the way they complement the other possibilities. They are cheaper, more compact, and much safer than techniques based on ionising radiation; they are applicable where electrical test systems may not be, and, most importantly, they can be used on mixtures of high concentrations that would be too opaque for optical methods.

Dilution of concentrated mixtures to facilitate optical testing is not always an appropriate manoeuvre because it may change the physical state of the mixture to be tested. The physical chemistry of colloids is complex and the information required from any given test varies greatly across the many combinations of product and process. However what is universally required is a quantitative indication of dispersed particle size (and its distribution), and the concentration of the dispersed phase. In many situations a very useful addition would be a measure of the state of association between particles which form flocs (abbreviation of flocculi) of patterns which vary greatly in complexity.

Because of this complexity the term 'measure' is at present difficult to define in this context. The simplest structures may resemble a bag of oranges, the base particle being represented by a single orange. More complex structures may resemble a house of cards (for platelet shaped particles), loose flakes, and even highly ordered pseudocrystalline forms. The challenge to scientists of physical acoustics is manifold. We need to understand how acoustic disturbances interact with these complex mixtures in order to make appropriate acoustical measurements that will lead to determinations of dispersed particle size and concentration, and 'measures' of structure. There are two aspects to this – firstly, can we develop theoretical formulations that, given known physical constants and properties of the mixture, enable us to predict the acoustic absorption coefficient and phase velocity as functions of frequency? In many cases this is possible but we note that a given combination of absorption coefficient and phase velocity at a spot frequency may not correspond to unique combinations of concentration and particle size, let alone size distribution. Thus it may be necessary to make measurements over wide frequency bandwidths in order to characterise a colloidal mixture and secondly, even if this is done, the task of inverting a theoretical model to get back to the required particle size and concentration will certainly not be trivial, and may even prove to be impossible.

In the following paragraphs we offer an outline of the present state of knowledge of the physics of compression wave propagation in colloidal mixtures. Due to the constraints of space the review is by no means complete. We have taken an engineer's view in choosing to describe those formulations that are either most commonly employed by chemists, or are most likely to contribute to the development of instruments for colloid characterisation. We have included a selection of recent experimental results which illustrate agreements, and disagreements, with theory.

Theoretical Formulations

Much of the early interest in acoustic wave propagation in particulate mixtures took place within the context of sound propagation in foggy atmospheres as well as particles suspended in liquids [1–7]. The simplest, non scattering, theory [5a,b] was developed out of an attempt to determine the adiabatic compressibility of suspended particles via sound velocity and density measurements. It gave a sound speed that depended on a volume average density ρ_{eff} and compressibility, β_{eff} thus

$$V = 1/\sqrt{\rho_{eff}\beta_{eff}} \quad (1)$$

where

$$\rho_{eff} = \phi\rho_D + (1-\phi)\rho_C \quad (2)$$

$$\beta_{eff} = \phi\beta_D + (1-\phi)\beta_C \quad (3)$$

here ϕ is the volume fraction of the disperse phase, ρ_D

and ρ_C the densities, and β_D and β_C the compressibilities of the disperse and continuous phases respectively.

For kaolin, the theory predicted a characteristic minimum in sound speed when plotted against dispersed phase volume fraction. More generally the velocity in the suspension was a parabolic function of ϕ with lower and upper velocity limits of the pure continuous and dispersed phases respectively (Figure 1). This theory does not

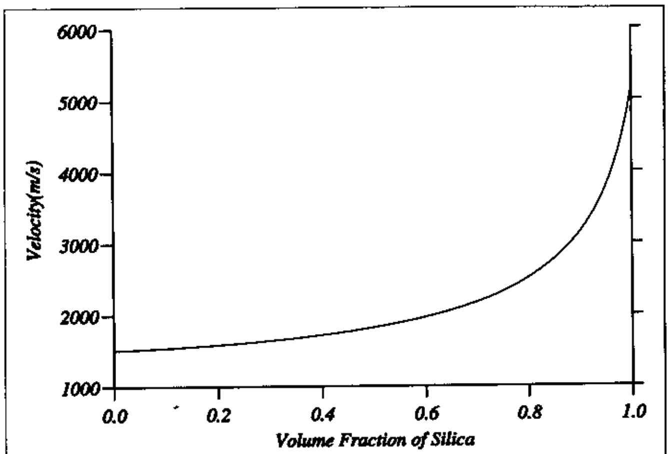

Fig. 1. Sound speed V versus dispersed phase volume fraction of silica particles in water according to the volume average of equation 1.

involve particle shape and can therefore be considered only in the long wavelength limit. With significant contrasts between the thermal properties and/or the densities of the two phases, or with increasing particle size, the predictions of the model become less realistic due to thermal and viscosity losses at the particle boundary, and due to reradiation from thermal and inertial scattering.

However there are situations in which the theory is applicable in that it represents a lower sound velocity limit through dilute suspensions.

Viscous and Thermal Transport Mechanisms

A significant step forward in the area of theoretical formulation came with the work of Epstein [8], and Epstein and Carhart [9], the latter being extended by Allegra and Hawley [10]. This last paper is generally recognised as a cornerstone in the theoretical development, and their model is employed by many research workers throughout the world. The theory required that there were no interactions between particles, that the suspensions were dilute, and that the effects of individual particles were

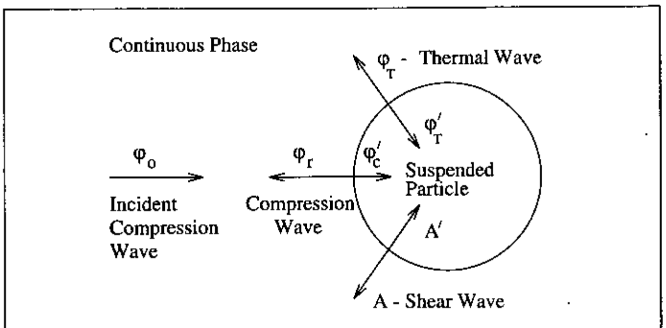

Fig. 2. The three wave types scattered into and away from an isolated particle, as modelled by Allegra and Hawley [10].

additive. The theory directly applied to suspensions, but could be reformulated for emulsions, and included a rigorous description of viscous and thermal transport mechanisms.

In the formulation a plane compression wave incident on a particle resulted in compression waves, (evanescent) transverse waves, and thermal waves scattered away from and into the particle (Figure 2). Continuity relationships at the boundary between phases gave solutions to the six resulting wave equations in spherical polar coordinates, as potentials for the three types of wave, ie three propagating within each phase away from the boundary. Choosing the compression wave potential as an example we can study the field around an excited particle, ϕ_r,

$$\phi_r = \sum_{n=0}^{\infty} i^n (2n+1) A_n h_n (k_c r) P_n (\cos\theta) \tag{4}$$

Here $i = \sqrt{-1}$, A_n are coefficients that link basic physical phenomena to the scattered field – generally as functions of frequency, h_n is the spherical Hankel function of order n, $k_c r$ is the continuous phase wavenumber multiplied by the radial distance from the local origin (ie the particle centre); it is valid outside the particle boundary. P_n is the ordinary Legendre polynomial of order n. For wavelengths long with respect to particle dimensions the dominant coefficients are A_0 and A_1. A_0 incorporates the difference in volume change between the particle and the surrounding fluid in response to the pressure variations in the wave, due to the different compressibilities of the two phases. It also incorporates the difference in the attenuation between the material of the particle and the material of the continuous phase, and the coupling between pressure cycles in the wave and local temperatures; for example if the changes in temperature brought about by the sound wave in the two materials are not equal, heat will flow between the two materials, and if this is not in phase with the sound wave, attenuation of the wave occurs.

Also included in the A_0 coefficient is the phenomenon of thermal scattering that arises when the thermal expansion coefficients of the dispersed and continuous phases differ from each other. A_0 thus includes effects on wave propagation which are dominant where there is a low contrast in density and a high contrast in thermal properties between the particles and the continuous phase.

The coefficient A_1 contains the effects of motions of the particles with respect to the continuous phase, and results in viscous drag losses as well as reradiation in the form of a dipole; the effects increase with an increasing difference in density between the two phases. It is instructive to consider equation (4) in the light of the above. For a given frequency A_n gives the amplitude of the nth scattered component. The Hankel functions give the field as a function of radial distance from the particle centre

$$i^0 h_0 = \frac{-i e^{iz}}{z} \tag{5a}$$

$$i^1 h_1 = -i\left(\frac{1}{z} + \frac{i}{z^2}\right) e^{iz} \tag{5b}$$

where $z = k_c r$

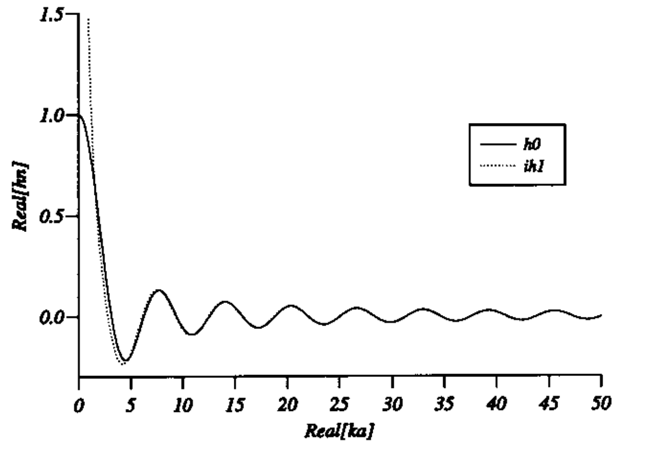

Fig. 3. Real parts of h_0 and ih_1 as a function of radial distance, *ka*, from the particle surface.

We see that both provide the phase change with increasing distance, $e^{-ik_c r}$; h_0 incorporates the inverse distance relationship $1/r$ which we would expect from a small spherical source, and h_1, provides for a higher order fall-off closer to the particle which results from its motion with respect to the continuum. The real parts of these functions are shown in Figure 3.

The *n*th order Legendre polynomial in equation 4 describes the angular distribution of the radiated potential around the particle. Figure 4 shows that $P_0(\cos\theta)$ is circular, indicating that the A_0 contribution behaves as a small monopole source. However $P_1(\cos\theta)$ has the distinct form of a dipole pattern that results from the to-fro motion of the particle in response to the passage of the wave.

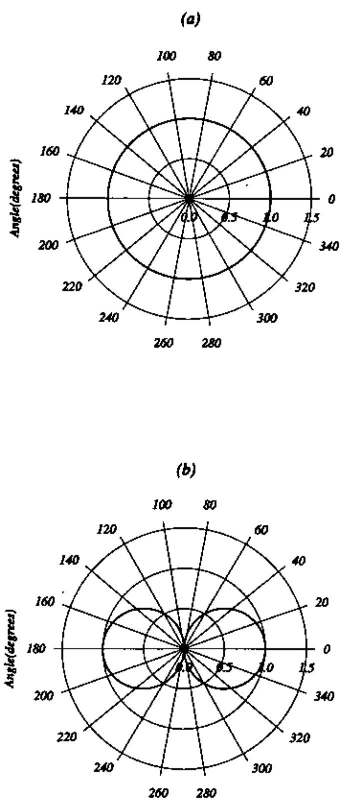

Fig. 4. Angular distribution of radiated fields (a) $P_0(\cos\theta)$ and (b) $P_1(\cos\theta)$ versus θ.

The fields from a homogeneous distribution of particles can be summed in the long wavelength far-field limit to give a complex wavenumber β for the suspension

$$\beta = \frac{\omega}{c(\omega)} + i\,\alpha(\omega) \tag{6}$$

where $c(\omega)$ is the frequency dependent phase velocity and $\alpha(\omega)$ the frequency dependent attenuation coefficient for plane compression wave propagation through the mixture. It is related to A_n the particle radius R and the disperse phase volume fraction ϕ thus

$$\left(\frac{\beta}{k_c}\right)^2 = 1 + \frac{3\phi}{i k_c^{\,3} R^3} \sum_{n=0}^{\infty} (2n+1) A_n \tag{7}$$

Here the wavenumber for the continuous phase, k_c can itself include a loss term. Extensions to this are possible which approximate the effects of multiple scattering [11, 12], and distributions of particle size can be approximated by further summations over $\phi(R)$. In a number of experiments we have found that multiple scattering effects are most likely to be observed in strongly scattering systems in which there is a strong contrast in acoustic impedance between the materials of the two phases. For example, the transition from single to multiple scattering occurs at volume fractions below 10% for aqueous suspensions of Fe_3O_4, but not until around 50% volume fraction for aqueous suspensions of ice or pentane.

The above and cognate theories have been compared to experiment and examined in a number of recent publications [13–16]; and a very interesting extension to the case of filled spherical shells as distinct from whole spherical scatterers has been suggested by Anson and Chivers [17]. It is possible to make wide bandwidth measurements of ultrasonic compression wave absorption and phase velocity versus frequency using a short pulse transmission spectrometer [18] and interesting comparisons between theory and experiment result. We have recently studied silica suspensions, in which the A_1 term dominates, and polystyrene suspensions in which the A_0 term dominates.

Generally speaking we find good agreement with the predictions of wave attenuation and Figure 5 shows results for a relatively high concentration of polystyrene. We also find good agreement between theory and experiment for phase velocity dispersion, that is, the change in phase velocity as a function of frequency for both suspensions (Figure 6). However, in the case of polystyrene particles in water, we have observed that whilst the change in phase velocity is predicted closely by the theoretical model, the low frequency values of phase velocity are offset by errors that are not simple functions of particle size or concentration [16].

Hitherto we have attributed this anomaly to structure in the suspension brought about by forces between the charged particles, and which is affected by the ion concentration in the continuous phase. Many more experiments are required here to relate the complex chemistry of the mixture to the observable effects iin wide bandwidth ultrasonic signals.

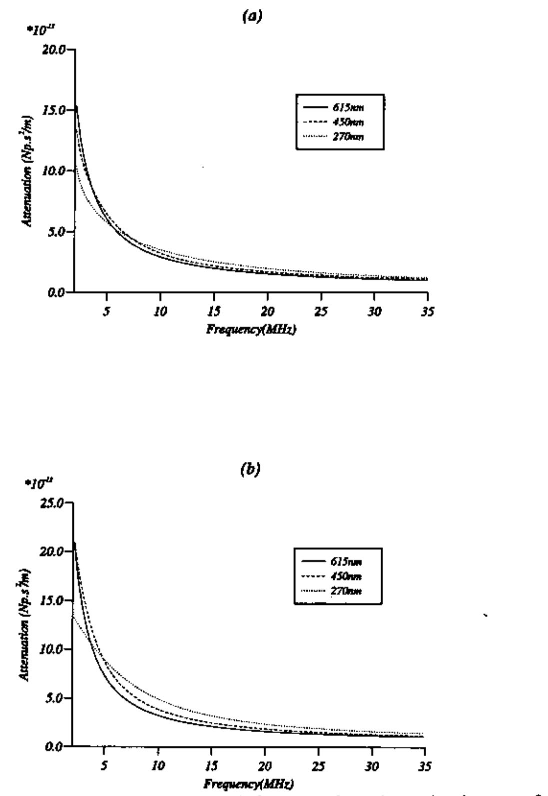

Fig. 5. (a) Experimental and (b) Simulated on the basis of the Allegra and Hawley formulation, attenuation for 30% volume fraction, aqueous polystyrene suspension plotted as α/f^2 versus frequency for three particle diameters.

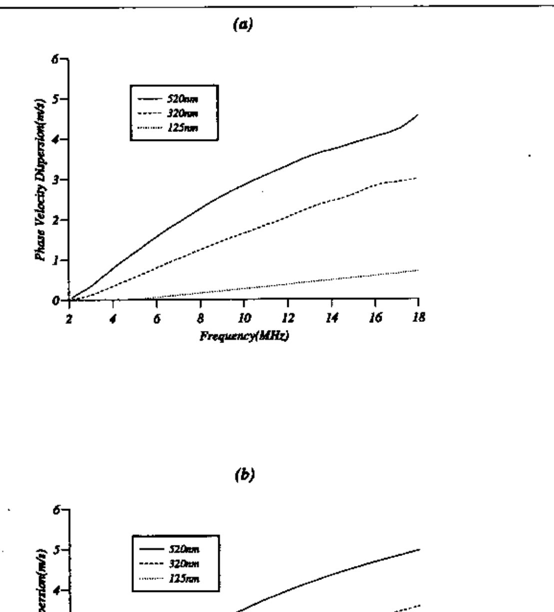

Fig. 6. (a) Experimental and (b) Simulated on the basis of the Allegra and Hawley formulation, phase velocity minus velocity at 2 MHz for 8% volume fraction, aqueous silica suspension for three particle diameters.

A Purely Hydrodynamical Theory

This theory [19] is based on four differential equations – a continuity equation for each phase, an equation expressing the drag on one phase by the other, and a conservation of momentum equation for the mixture. In forming the wave equation the rate of change of particle momentum was related to pressure gradients in the fluid surrounding the particle, the force required to accelerate the induced mass of the particle (dependent on the concentration of the solid phase), a Stokes' viscous drag, and a term which modelled the effect that the acceleration of the particle would have on the viscous drag.

It is worth briefly mentioning at this point the induced (or added) mass phenomenon. Consider a wide flat bladed paddle. In air this paddle would be easy to move from rest in any direction. If the paddle was then dipped into water and likewise accelerated from rest, a much larger resistance to the motion would be experienced, particularly in a direction perpendicular to the blade. This 'resistance' or *apparent inertia* was greatly increased by the presence of the water, and gives rise to a quantity called the virtual mass of the object being accelerated. The difference between the real and *virtual mass* of an object is called the induced or added mass. The induced mass can be shown to be dependent upon the shape of the object being moved and the density of the fluid.

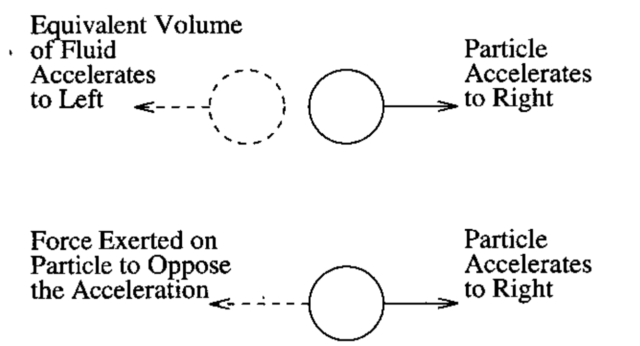

Fig. 7. The strength of the fluid-particle coupling illustrated by a consideration of the relative fluid and particle motions The top half illustrates the normal particle and fluid motion; the bottom half represents the particle accelerating in a completely stationary fluid, and the resultant force that exists.

A frequency dependent complex coupling coefficient $M(\omega)$ arose from some of the constituent parts of the wave equation, and gave a measure of the strength of the coupling between the two phases: ie how the physical properties of one phase affected the other. Figure 7 illustrates qualitatively this situation where initially an isolated particle is considered to be accelerated within a fluid that is able to move, and secondly where an isolated particle is assumed to be accelerated in a completely stationary fluid. This latter case gives rise to a force on the particle that opposes the resultant direction of particle motion. The formulation used the same effective compressibility and density as used by Urick, equations 2 and 3, and an effective viscosity for the fluid that changed with solid content to account for the fact that the particles can no longer be assumed to be isolated from each other. For spherical particles this was given by:

$$\eta_{eff} = \eta\left(1 + 2.5\phi + 7.349\phi + \ldots\right) \qquad (8)$$

The final complex wavenumber obtained was given by:

$$k^2 = \beta_{eff}\,\omega^2\left[\frac{\rho_C\left[\rho_D + \left(\phi\rho_D + (1-\phi)\rho_C\right)M(\omega)\right]}{\left(\phi\rho_C + (1-\phi)\rho_D\right) + \rho_C M(\omega)}\right] \qquad (9)$$

where $M(\omega, \phi, R, \eta_{eff})$ is the viscous coupling term, a function of frequency, concentration, particle radius and effective viscosity.

Comparison of Theories

Ideally we would have liked to report that we have found one theory of acoustic propagation in suspensions that can be applied in any experimental situation, no matter how concentrated or dilute, viscous or near inviscid the system under examination might be. Unfortunately this is not the case, and we have concentrated on four main models [5a, 10, 19, 25] in our work, some of which have been commented on briefly so far.

These four models differ greatly in their mathematical formulation and complexity: the simplest allowing quick 'pen and paper' calculations of the acoustic velocity and attenuation, the most complicated requiring exact solutions of a 6 x 6 matrix where the elements are complex numbers. Only the Allegra and Hawley model incorporates both the thermal and visco-inertial effects arising from both phases. This has led to the application of this model particularly to suspensions where a large contrast in the thermal properties of both phases exist but the densities are of a similar magnitude – for example, aqueous polystyrene suspensions. For the opposite situation of large density differences but similar thermal properties, the theories of Allegra and Hawley, Harker and Temple and Urick and Ament each predict similar behaviour – for example, in aqueous quartz suspensions. Recently, dilute samples that possess both large thermal and large density differences have shown experimental correlation with the Allegra and Hawley simulations at frequencies up to 35 MHz, but divergence away from the other models at frequencies typically around 10 MHz and above, for an aqueous suspension of iron particles.

When considering real systems it has to be remembered that a wholly monodisperse suspension of spherical particles is difficult to achieve even in a laboratory environment, if at all. It is possible to combine appropriate particle size distributions into the models where the relevant statistical information for the sample is available. The Harker and Temple model, via the equation for effective viscosity (equation 8), allows different 'shape factors' for non-spherical particles to be included. Due to the mathematical formulation of the Allegra and Hawley model, a similar alteration is not possible at present, and this would appear to be the main limitation of the model, along with the difficulty of obtaining all the physical parameters required (particularly for the solid phase) to solve this more complicated model. So the universal model does not exist (yet!), and the choice and applicability of a model for a particular situation is based, fundamentally, on the physical properties of both phases of the mixture.

Some Other Significant Work

Related to the issue of sound propagation in colloids is the problem of acoustic propagation in fluid-filled porous solids. In 1941 Biot, working for the Shell Development Company in America, formulated a linear theory for the deformation of a porous isotropic elastic solid that contained a viscous fluid [21]. This was later extended to the anisotropic case [22], and in 1955 he published two papers [23, 24] on the propagation of acoustic waves in fluid-filled porous solids.

More recently Biot's theories have enjoyed a revival; Ogushwitz has used them to model wave propagation in low porosity saturated sedimentary rocks [26] and to dilute suspensions modelled as high porosity solids [27]. Gibson and Toksoz [28], working in marine sediments combined earlier theories (eg Urick and Ament [25]) with the ideas of Biot with some success.

Conclusion

We hope that this short review gives to our readers a flavour of what we see as a fascinating corner of physical acoustics. Due to limitations of space there will have been many omissions and for this we apologise. In our discussion of relevant theory we have simplified some very complex ideas as far as was possible and in doing so we may have blurred some significant issues. In particular we have not differentiated between solid-in-liquid and liquid-in-liquid suspensions, where the detailed treatment of their elastic and viscous effects differs in formalism. In the case of polymer inclusions further complications arise in not only including their thermal properties, but also an appropriate formulation of their intrinsic viscoelasticity. In most of our discussion the continuous phase was treated as a relatively simple liquid, although in practice many mixtures will have a continuous phase in which a range of relaxation phenomena can occur, all leading to velocity dispersion and an attenuation term in the continuous phase wavenumber. However we hope that we have been able to demonstrate that this is an area with complex and interesting physics, considerable challenges to the designer of appropriate instrumentation, and potentially wide application in many sectors of industry.

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COMPLAINTS ABOUT POOR SOUND INSULATION BETWEEN DWELLINGS

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Introduction

The Department of the Environment supports a research programme at BRE which currently includes monitoring the standard of sound insulation in new dwellings and conversions. This paper presents the findings of a small study, undertaken in England and Wales between April 1992 and March 1994, where we specifically investigated complaints about poor sound insulation between dwellings. The purpose of this project was to determine the types of noise that cause complaint and to see if it was common for complainants to live in dwellings having sound insulation below the level generally regarded as reasonable.

Selection of Cases to Investigate

A total of forty case studies of complaints were investigated. Each case study involved interviews with the complainant and adjacent residents, together with physical measurements of airborne sound insulation and impact sound transmission. We also decided only to include dwellings where the construction details were believed to comply with the requirements of post 1985 Building Regulations. Details of cases have been obtained from a number of sources including Local Authorities, Housing Associations, National House Building Council (NHBC), Department of the Environment and private individuals. The importance of building construction type, building defects or poor workmanship has not been investigated. Sometimes the actual building construction was under dispute at the time of our involvement.

It should be stressed that the complaints investigated were, in general, specific complaints about sound insulation rather than more general complaints about noisy neighbours where an element of unreasonable behaviour may have been involved. We made efforts to include only those cases where the occupants appeared to be behaving reasonably, or, in other words, where inadequate sound insulation was suspected to be contributing to the cause of complaint. For example, complaints about all night parties have been excluded whilst complaints about hearing everyday noises, such as footfalls, normal conversation and televisions have been included. It has been reported [1] that a television news broadcast at a 'typical' listening level would not constitute a noise problem in a neighbour's dwelling if the separating wall meets certain nominal values.

What is a 'Reasonable' Level of Sound Insulation?

In England and Wales the current Building Regulations are intended to secure a reasonable standard of health and safety for persons in or about the building. Approved Document E, 1992 [2] describes various constructions that are normally considered to meet this requirement in the case of resistance to the passage of sound. The constructions are selected for inclusion in Approved Document E on the basis of field tests that show the mean and minimum performance is likely to reach or exceed certain values. For the basis of this paper the nominal performance deemed to be reasonable will be that included in Section 3 of the Approved Document where sound transmission values are given under the similar construction method for new buildings. Section 3 gives the values of the single number ratings for tests between at least eight pairs of rooms shown in Table 1.

Airborne sound tests

Test Element	$D_{nT,w}$ (dB) Mean Value	$D_{nT,w}$ (dB) Individual Value
Walls	≥ 52	≥ 49
Floors	≥ 51	≥ 48

Impact sound tests

Test Element	$L'_{nT,w}$ (dB) Mean Value	$L'_{nT,w}$ (dB) Individual Value
Floors	≤ 62	≤ 65

Table 1. Standard of sound insulation*
(from Section 3 Approved Document E)

** $D_{nT,w}$ is an index of airborne sound insulation, defined by BS5821 : Part 1 : 1984*
$L'_{nT,w}$ (is an index of impact sound transmission, defined by BS5821 : Part 2 : 1984

It must be made clear that there are no performance criteria for post construction testing in Approved Document E and that the assessment of complaints about sound insulation is also beyond its scope.

Nature of Complaints

As part of every site investigation each complainant was asked whether they considered the sound insulation and the behaviour of their neighbour to be reasonable. Similar questions were also asked of the neighbour(s) involved. In 98% of the cases investigated the complainant blames the problem wholly or partly on the standard of sound insulation. In 85% of cases the neighbour believes the complaint to be reasonable. This confirms that we do have a sample of complaints about sound insulation rather than complaints about neighbour noise in general. It is interesting that 93% of complainants and 83% of their neighbours also claim to have modified their behaviour in some way because of the problem.

It is apparent that this type of complaint represents a very different situation from the more typical 'noisy neighbour' problem where there is unlikely to be agreement between neighbours that each is behaving reasonably. In view of this general agreement between complainant and neighbours that the building is to blame, it has been possible to combine the answers received to parts of the questionnaire. For example, questions were asked about activity disturbance and the general effects of living with poor sound insulation. The results are summarised in Tables 2 and 3 below.

Activities Disturbed	Percentage of Cases Where Reported
Sleeping, Resting	83%
Watching Television	53%
Listening to Music	15%
Reading	15%
Entertaining	13%

Table 2. Activity disturbance attributed to poor sound insulation

The most commonly reported problems attributed to poor sound insulation are the disruption of everyday activities requiring a quiet environment such as sleeping, resting and watching television. Similar types of activity disturbance have also been reported [3] from exposure to neighbour noise in general.

However, when people were asked the question 'How does the problem affect your life?', two main features emerged. Firstly, the most commonly reported emotional effects are stress, embarrassment, worry, irritation and depression. These are the inwardly directed emotional effects reported in the BRE national noise attitude survey [4]. This may well reflect the difficulties being experienced by most complainants who had tried to deal with the problem, or perhaps it reflects a perceived inability to do anything about suspected poor sound insulation.

Secondly, poor sound insulation appears to affect peoples' social lives. 35% of people said that both they themselves and visitors had to behave quietly and 18% said that they don't have visitors because of the noise they might make or might hear. Some 5% of people admitted that it restricted their sex lives. This effect on social life is quite distinct from the usual types of adverse reactions experienced with noisy neighbour problems.

How Does the Problem Affect Your Life?	Percentage of Cases Where Reported
I, we, or visitors have to be quiet	35%
Stress, blood pressure, migraine, affects nerves, seen GP	28%
Lack of privacy	23%
Don't have visitors because of embarrassment or worry	18%
Changed room use, have to go out or intending to move	13%
Irritation	13%
Depression	5%
Restricts sex life	5%
Annoyance	3%

Table 3. Effects on home life attributed to poor sound insulation

Noises Heard in Cases Investigated

The following three tables show the most commonly heard types of noises reported during this study. However, the study was not designed to determine which of these noises were the most important aspects of a particular complaint. It does not necessarily follow that the more frequently heard noises are the more significant causes of dissatisfaction.

Table 4 shows the most common types of airborne noise sources heard by people included in this study. As expected the most common noises heard are from the ubiquitous sources of amplified speech and sound, namely the television, radio and music systems. Also commonly heard are neighbours' voices both when raised and, in some cases, in normal conversation. Hearing neighbours use bathroom and toilet facilities was mentioned by half the people interviewed. Modern everyday household appliances such as washing machines, vacuum cleaners and telephones ringing are also frequently reported, washing machines being a particular problem when used at night.

Airborne Noise Source Heard (Wall & Floor Tests)	Percentage of Cases Where Reported
Music, television, radio	98%
Voices	78%
Bathroom use, wc use and/or flush	50%
Washing machine	48%
Telephone ringing	45%
Vacuum cleaner	30%

Table 4. Airborne noise sources heard (wall & floor tests)

Table 5 shows the most common structure borne noise sources heard by people complaining about the sound insulation of floors. Footfalls on the floor were heard in 95% of cases. The next most frequently reported structure borne noise source is from doors and cupboard doors closing and slamming. In the majority of cases this noise is likely to be transmitted through flanking routes involving walls. It is likely that flanking routes also play an important role in the transmission of the other commonly heard noises particularly impacts on kitchen work surfaces and the noise from use of sockets and switches.

Table 6 lists the most common structure borne noise sources heard by people complaining about the sound insulation of separating walls. The noise from sockets, switches, doors and cupboard doors are most frequently heard and they are probably due to a combination of direct and flanking transmission.

Footfalls on stairs are heard by 68% of complainants and in most cases this is mainly direct transmission by a separating wall.

Structure Borne Noise Source Heard (Floor Tests)	Percentage of Cases Where Reported
Footfalls on floor	95%
Doors and cupboard doors	68%
Bathroom use, wc use and/or flush	50%
Washing machine	41%
Sockets and switches	27%
Impacts on kitchen work surfaces	23%

Table 5. Structure borne noise sources heard (floor tests)

Structure Borne Noise Source Heard (Wall Tests)	Percentage of Cases Where Reported
Sockets and switches	79%
Doors and cupboard doors	74%
Footfalls on stairs	68%
Bathroom use, wc use and/or flush	53%
Impacts on kitchen work surfaces	42%
Washing machine	37%

Table 6. Structure borne noise sources heard (wall tests)

As previously noted, it is not possible to state with any degree of certainty which of the various noises heard are the most likely reason for any individual complainant's dissatisfaction with sound insulation. For example, although 79% of cases in Table 6 report hearing sockets and switches it does not necessarily follow that this noise source causes more than a passing irritation.

The types of noise heard by this sample of complainants and their neighbours is very similar to the findings of previous BRE surveys such as the 'most disturbing' noises found by Parkin [5] in the 1960s and noises 'causing bother' identified by Langdon [6] in the 1970s. The most notable additions are the noises from modern household appliances such as washing machines, vacuum cleaners and telephones which were presumably not in such widespread use at the time of the earlier surveys.

Sound Insulation Test Results

The distribution of all test results are shown in the three frequency histograms included as Figures 1 – 3. All measurements have been made in accordance with BS2750 Parts 4 & 7 (1980) and the single figure ratings have been calculated in accordance with BS5821 Parts 1 & 2 (1984).

Separating walls – airborne sound insulation

Figure 1 contains the results of all the individual tests on separating walls. The average $D_{nT,w}$ is 49.8 dB (σ = 4.4 dB) with a range of 17 dB between the worst and best measured performance. In 70% of cases the airborne sound insulation of the wall falls below the 'mean value' and in 35% of cases is also below the 'individual value' given in Section 3 of Approved Document E.

A closer examination of those cases where the sound insulation is greater than 52 dB $D_{nT,w}$ (ie better than the 'mean value') is important because these are the cases where we would not expect to receive complaints if current standards are correct. These cases have a number of features which may explain how they have come to be included in this study:

a) In most cases the main problem is impact noise rather than airborne noise and this is not covered by Building Regulations or assessed by standard test procedures.

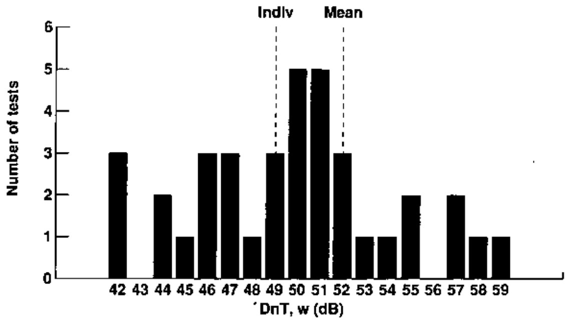
b) In many cases the property is located in a quiet area which is likely to affect the perception of sound insulation.

c) In one case the complainant was thought to be unreasonable.

The results obtained provide evidence of poor standards of airborne sound insulation in examples of recently built party walls and some support for the view that the inherent 'mean value', a minimum $D_{nT,w}$ of 52 dB for walls, is set at about the correct value.

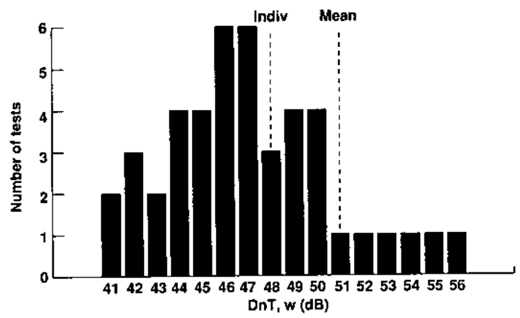
Separating floors – airborne sound insulation

Figure 2 contains the results of all the individual airborne tests on separating floors. The average $D_{nT,w}$ is 47.0 dB (σ = 3.6 dB) and the range between the worst and best



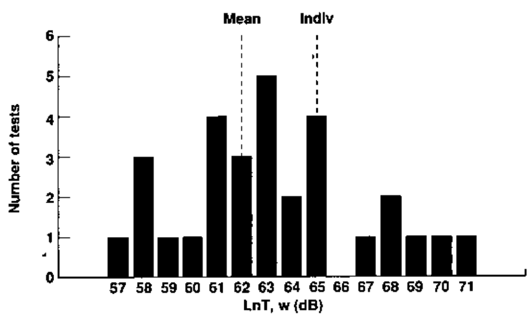
SOUND INSULATION COMPLAINTS -
Distribution of airborne test results for party walls

Fig. 1. Party Walls



SOUND INSULATION COMPLAINTS -
Distribution of airborne test results for party floors

Fig. 2. Party Floors (airborne)



SOUND INSULATION COMPLAINTS -
Distribution of impact test results for party floors

Fig. 3. Party Floors (impact)

measured performance is 15 dB. In 86% of cases the airborne sound insulation of the floor falls below the 'mean value' and in 61% of cases is also below the 'individual value' given in Section 3 of Approved Document E.

Looking more closely at those cases where the $D_{nT,w}$ is greater than 51 dB (ie better than the 'mean value') reveals a number of important points:

a) In half the cases the problem is impact noise rather than airborne noise and this is assessed by a different procedure.

b) In half the cases the good airborne insulation is accompanied by good impact test results indicating that this may heighten awareness of airborne insulation.

c) In one case the complaint was thought to be unreasonable.

The results obtained provide evidence of poor airborne sound insulation in examples of recently built party floors and support for the view that the 'mean value', a minimum $D_{nT,w}$ of 51 dB for floors, is set at about the correct value. If we compare Figures 1 and 2, it would appear that the data for floors is possibly more supportive of current inherent values than is the case for the wall data.

Separating floors – impact sound transmission

Figure 3 contains the results of all the individual impact tests on separating floors. The average $L'_{nT,w}$ is 63.2 dB (σ = 3.7 dB) and the range between the worst and best measured performance is 14 dB. In 57% of cases the impact sound transmission level is above the 'mean value' and in 20% of cases is also above the 'individual value' given in Section 3 of Approved Document E.

Closer examination of the cases where the $L'_{nT,w}$ is less than 60 dB (ie the best six test results obtained) is interesting:

a) In the majority of cases good impact insulation is coupled with poor airborne insulation and the main complaint appears to be about airborne noises.

b) In two cases the complaint is about noises such as creaking floors and stairs that may not be adequately represented by the standard tapping machine test, but which should, nevertheless, be fairly simple to remedy at source. c) In one case the property was located in a quiet area which is likely to affect the perception of sound insulation. d) In one case the behaviour of the occupant above was thought to be unreasonable.

Examination of the cases where the $L'_{nT,w}$ equals 61 dB (ie better than the 'mean value' but excluding the best six test results) gives the following additional points:

a) In general these cases are associated with reasonable or good airborne sound insulation and the main complaint appears to be about impact noises.

b) The majority of these cases are complaints about everyday noises such as normal footfalls and other impacts on the floor, walls or work surfaces.

c) In one case the complaint was thought to be unreasonable.

Noise from footfalls and other noises such as sliding and jumping are reported across the whole range of impact test results, irrespective of the single figure rating. Evidence from elsewhere [7] supports the view that limitations of the assessment method will be an important factor when interpreting the impact sound transmission tests.

Considering all this information together results in a confused picture with some evidence that the current measurement and rating system does not adequately reflect actual experience of impact sound transmission problems. Certainly, both the 'individual value' and 'mean value' for impact sound transmission by floors are less supported by this field data than is the case for the equivalent airborne sound insulation values for walls and floors. The results do, nevertheless, provide evidence of poor standards of impact sound transmission in examples of recently built party floors.

Conclusions

The study has revealed examples of poor airborne and impact sound insulation amongst the cases investigated and this is of concern because all are believed to be typical examples of modern building construction. However, the guidance given in Approved Document E was strengthened [8] during the course of this project and the situation may now have improved.

The study has shown that in the main complainants do live in dwellings having sound insulation below the standard generally regarded as reasonable for Building Regulations purposes. However, the survey also indicates that some people are dissatisfied even when their home meets the intended standard – although these complaints are often concerned with banging doors and other noises not controlled by Regulations. It must be borne in mind that the study was confined to dwellings where the occupants were dissatisfied and the results cannot therefore be extrapolated to indicate what proportion of the total population are dissatisfied with the standard of sound insulation in their homes, nor to rank inadequate sound insulation amongst other building defects, nor indeed to investigate what proportion of neighbour noise complaints might be attributed to poor sound insulation.

It is interesting to compare some of the findings of this study with the actual standards that are inherent in Approved Document E. In general terms the findings are supportive of the current inherent 'mean value' for the airborne sound insulation of walls and floors because few people complain when these values are met. However, there is some evidence that the current minimum standard, the 'individual value', may be set at too low a level. The findings are less supportive of the inherent standards for the assessment of impact sound transmission by floors. The transmission of impact sounds by walls is a common source of complaint but this is outside the scope of current Building Regulations and there are no standard methods of measurement or rating currently available.

The main noises heard by complainants are music/television/radio, voices, footfalls, closing and banging doors, sockets, switches, impacts on kitchen work surfaces and plumbing noises. Noises from modern household appliances such as washing machines, vacuum cleaners and telephones are also commonly mentioned as part of a complaint about domestic sound insulation.

It should also be noted that in most cases people are complaining about both airborne and structure borne noises and that these are probably not perceived as separate aspects of sound insulation by the complainants. It is not possible to say from this work which of the various noise sources are the most likely reasons for a particular complaint. Some of the noises heard by complainants may well not be critical in terms of overall dissatisfaction with sound insulation or of the dwelling in general.

In broad terms the findings show that people are not complaining about hearing normal conversation when the 'mean value' for airborne sound insulation is met. The complaint in such cases tends to be about hearing louder 'everyday' noises such as raised voices, coughing, sneezing, snoring as well as impact noises of various types. It is possible that this observation may be of some assistance in making an initial subjective assessment of airborne sound insulation in peoples' homes.

The assessment of the reasonableness of a sound insulation complaint is not a straightforward matter. There may be other factors to take into account besides the measured physical performance of the separating element under test. Perhaps the most important factor is an assessment of impact sound transmission by the walls. Other factors to consider include the background noise levels inside the rooms concerned, the number of adjoining dwellings, the number of people living in adjoining dwellings and the combined effects of airborne and impact sounds.

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THE APPROACH TO ENVIRONMENTAL ACOUSTICS PROBLEMS IN POLAND

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The human environment can be broadly sub-divided as outdoors and indoors. The outdoor environment may be a temporary or permanent place of stay and the indoor environment within buildings may be a space for living, leisure or work. The interests of science in urban planning centre around the four basic functions of settlements, to allow general habitation, work, recreation and transportation. Sources of noise affecting both outdoor and indoor environments derive from the work function, stemming from process technologies and heavy industry, and from means of transportation. Noise control involves urban planning, design of public and municipal housing, design of different kinds of installation (including industrial installations) and traffic management. Because of this diversity in approach to environmental noise problems, the Acoustic Committee of the Polish Academy of Science (PAN) covers them all through one group with the title of Architectural Acoustics.

The scope of the Architectural Acoustics group includes building acoustics, urban acoustics, installation and industrial acoustics, and acoustics of interiors. Research is conducted in these fields by scientific teams in Polish high schools, institutes of the Polish Academy of Science, and departments of other institutes. The total number of research workers in acoustics is difficult to establish, because many are involved in more general scientific and teaching activities. Scientific investigations in the field of architectural acoustics are conducted in sixteen institutes, but only a few of these are involved regularly in test work. The most important institutes and their respective fields of involvement are as follows:

Building Acoustics

• Department of Acoustics of the Building Research Institute (ITB), Warsaw • Department of Mechanics and Vibroacoustics of the Academy of Mining and Metallurgy (AGH), Cracow • Department of Noise and Electromagnetic Hazards of the Central Institute for Labour Protection (CIOP), Warsaw • Department of Acoustics of the Music Academy, Warsaw.

Urban and Environmental Acoustics

• Department of Acoustics of the Building Research Institute (ITB), Warsaw • Institute of Acoustics at Adam Mickiewicz University (UAM), Poznan • Institute of Telecommunications and Acoustics of Wroclaw Technical University • Department of Mechanics and Vibroacoustics of the Academy of Mining and Metallurgy (AGH), Cracow • Institute of Basic Technical Problems (IPPT) of the Polish Academy of Science • Department of Acoustics, Laser Technology and Radiometry at the Central Institute of the Mining Industry (GIG), Katowice • Department of Environmental Acoustics of the Institute of Environmental Protection (IOS), Warsaw • Department of Acoustics of Gdansk Technical University • Institute of Experimental Physics of Gdansk University.

Installation and Industrial Acoustics

• Department of Noise and Electromagnetic Hazards of the Central Institute for Labour Protection (CIOP), Warsaw • Department of Acoustics of the Building Research Institute (ITB), Warsaw • Department of Mechanics and Vibroacoustics of the Academy of Mining and Metallurgy (AGH), Cracow • Department of Vibroacoustics of the Institute of Heat Engineering (ITC) • Institute of Experimental Physics of Gdansk University.

Acoustics of Interiors

• Institute of Acoustics at Adam Mickiewicz University (UAM), Poznan • Department of Electroacoustics of Warsaw Technical University • Department of Acoustics of the Building Research Institute (ITB), Warsaw • Department of Mechanics and Vibroacoustics of the Academy of Mining and Metallurgy (AGH), Cracow.

The leading institute in the area of building acoustics is ITB, where work is in progress on protection against both outdoor and indoor noise. The work is focussed on the development of assessment criteria for the noise level of noise sources, acoustic properties of materials and building structures, parameters of indoor and outdoor acoustic climates, establishment of a basis for the proper acoustic climate in public and industrial buildings and their surroundings, production methods to ensure adequate acoustic properties of noise-protective materials, products and constructions, and noise control at source. ITB is the only institute in Poland that has been accredited by the Polish Center of Investigation and Certification to carry out acoustic testing of buildings and building materials.

In the field of protection against occupational noise, the leading institute is CIOP. Interest here centres on development of methods used to measure and evaluate health effects of noise, infrasound and ultrasound, mechanical vibration and electromagnetic fields. The methods used to reduce or eliminate harmful factors are also of interest, including limiting emissions at source, materials and constructions to prevent the spread of these hazards, and use of personal protective equipment.

Particular Environmental Noise Problems in Poland

Traffic noise as the main outdoor noise hazard

The damage resulting from the war of 1939–1945 and the migrations of country populations to towns necessitated extensive reconstruction and erection of new houses. This was done during the 1950s using mainly pre-fabricated constructions to speed up the building process. The method of building construction influenced the appearance of Polish towns, especially the larger ones, where high apartment buildings predominate. The problem of insufficient number of apartments was then very often solved through lower standards, relating both to a smaller living area per inhabitant and to the standard of workmanship. Many surveys have been conducted, showing poor sound insulation of partitions and inadequate standards of installations and equipment within buildings.

From the 1960s, the development of the transport system was undertaken with regard only to the free flow and speed of traffic, and without attention to the nearby housing conditions. This is why, in the Polish codification system, roads are qualified according to traffic volume and capacity, and not according to their function in the city.

In more recent years, a return has taken place to architecture in a human context, with a tendency to low apartment blocks and single family housing, and local streets which form a recognizable urban whole. Even so, the road transport system is still the predominant factor affecting the acoustic quality of towns and settlements. Current estimations of exposure to environmental noise in Poland from different noise sources are lacking and can only be made approximately from a report dating from 1987, produced to give data for a National Programme of Environmental Protection and Natural Resources to the year 2010 [1]. Information was obtained on areas exposed to a sound level L > 60 dB and this was related to statistics of population density, see Table 1 [2].

Problems of protection against road traffic noise have multiplied especially in recent years with the remarkable growth of traffic density. Also, changes in road category and the building of new express roads through towns (eg Lazienkowska Road in Warsaw) have brought about changes of acoustic conditions in areas that, being previously mostly residential, were fairly quiet.

In addition, there is the problem of the noisiness of the vehicles themselves. According to investigations by the Institute of Transportation (ITS) in Warsaw, the noise emitted by cars exceeds the limit value for all types of car except those imported from Western countries and the Polish car Polonez 2000 [3]. For heavy vehicles, the limit values are exceeded by 3 to 9 dB.

Noise Source	Number of inhabitants exposed to noise	
	Million	%
Transportation noise		
1 Road traffic	8.30	22.0
2 Railways	1.90	5.0
3 Aircraft	0.75	2.0
4 Industry	4.60	12.0
5 Multiple sources	15.55	41.5
Neighbours	5.70	15.3
Appliances and building services	0.78	2.2

Table 1. Estimated numbers of inhabitants exposed to sound levels above 60 dB in dwellings in 1986.

The average sound levels of traffic noise in Polish towns [4] are approximately as follows:
- large towns with more than 200,000 inhabitants, L_{Aeq} = 65 to 75 dB
- medium-sized towns with 50,000-200,000 inhabitants, L_{Aeq} = 63 to 73 dB
- small towns with less than 50,000 inhabitants, L_{Aeq} = 62 to 72 dB
- health resorts, L_{Aeq} = 60 to 68 dB.

National Institute of Hygiene (PZH) investigations show that subjective reaction to traffic noise nuisance is:
- low for $L_{Aeq} < 52$ dB
- average for $52 < L_{Aeq} \leq 62$ dB
- high for $63 < L_{Aeq} \leq 70$ dB
- very high for $L_{Aeq} > 70$ dB.

Thus in all sizes of town, traffic noise nuisance is above average. More details of inhabitants and apartments exposed to traffic noise in Warsaw are shown in Table 2, from which it can be seen that more than 30% of the inhabitants are seriously disturbed by the noise.

Public roads in Poland total over 365,000 km, including 232,000 km with a hard surface. The essential national road system is 45,000 km long, of which 4,800 km are international (E) roads [5]. The rail network has 24,000 km of track, of which 11,000 km is electrified.

The fundamental changes to the Polish boundary in recent years have resulted in a significant increase in the amount of traffic using the existing border crossings and this has created a strong need for new crossings to be opened. Further to this, the programme of international motorways said to be needed to satisfy the requirements of an economically integrated Europe forecasts that over the next 15 years three main motorways will be needed in Poland of total length 1961 km. One of these (A-2, Berlin-Warsaw-Moscow) will link Russia, Byelorussia and Poland with Western Europe. Another (A-4, Dresden-Cracow-Kiev) will join Ukraine and Southern Poland with Western Europe. The third will be part of a north-south trans-European motorway joining Scandinavia and the Baltic countries with southern Europe and the Near East; it will run from Gdansk through Lodz and Upper Silesia in the direction of Bratislava and Budapest. Traffic forecast for these motorways in the year 2010 shows 20,000 vehicles per 24 h and even in some parts of the network 27,000 vehicles per 24 h [5].

L_{Aeq}, dB	Apartments		Inhabitants	
	%	number	%	number
Over 50	89.7	480,000	90.6	644,000
Over 60	29.0	155,000	30.8	492,000
Over 65	12.6	67,300	14.0	224,000
Over 70	4.1	21,900	4.9	78,000

Table 2. Number of apartments and inhabitants exposed to traffic noise in Warsaw.

Besides motorways of international importance, a current question in Poland is that of the modernization of the railways. For example, on the line Warsaw-Poznan-Kunowice going to the west, of total length 500 km, a twofold growth of traffic is forecast, with train speeds rising simultaneously from 100 to 160 km/h.

Industrial noise

Noise of industrial origin is the second basic source of outdoor environmental noise, after that of road traffic. The results of a survey on subjective feelings about noise have shown that more than 15% of respondents recognized industrial noise as annoying. Heavy industry, which predominates in Poland, mostly has old buildings equipped with old machines. The largest group of noise sources comprises mines, metallurgical plants including ironworks, ceramics, heat and power generating stations, cement mills and chemical plants.

The problem of industrial noise in residential areas was first studied by ITB in 1978 and methods of noise prediction in zones in the vicinity of industrial plant were developed. Outside of these zones, the equivalent sound level, L_{Aeq}, now does not exceed recommended limits. Currently, industrial noise is assessed using the ITB method, which is now in its fifth edition, the last one containing a computer program.

Noise at Work

According to the Polish Central Statistical Office (GUS) approximately 400,000 workers are exposed to noise exceeding $L_{Aeq,18h}$ = 85 dB. This is probably an underestimate, since data are not collected from small enterprises employing fewer than 50 people and private farms. Approximately 3,000-4,000 new cases of occupational hearing damage are recorded annually, and these make up about 1/3 of all occupational injuries. Regulations and standards in force until the end of 1994 included the following noise exposure limits:

* $L_{Aeq,8h}$ = 85 dB
* for noise exposure over periods shorter than 8 h, L_{Aeq} may exceed 85 dB
* L_{AMax} = 115 dB regardless of duration
* no limit set for impulsive noise.

The process of adjustment of Polish regulations and standards concerning safety and health protection of workers to European requirements began in 1990. The reference documents for this purpose concerning noise are EC Council Directive 86/188/EEC on exposure to noise at work, Directive 89/392/EEC and its later amending directives on machinery, Commission proposal 93/C77/02 on risks from physical agents, and ISO 1999. The new Polish Standard PN-95/N-01307 on permissible values of noise in the workplace applies to all types of noise (steady, variable, impulsive, continuous or intermittent). The standard assumes simultaneous use of three methods of noise observation that differ from each other with respect to averaging time:

* long-term averaging over a nominal 8-hour working day or over a nominal week of five 8-hour days
* short-term averaging over 1 s, specially important for assessment of non-steady and short-duration noise lasting for several seconds
* quasi-instantaneous peak level observation, specially important for control of impulsive and transient noise.

The limits given in the new standard are as follows:

* $L_{EX,8h} \leq 85$ dB, corresponding to $E_{Ad} \leq 3.64 \times 10^3$ Pa^2 s, for noise over a working day; or, in the case of workplaces where the noise exposure varies markedly from day to day $L_{EX,w} \leq 85$ dB ($E_{A,w} \leq 18.2 \times 10^3$ Pa^2s) for noise over a 5-day week
* $L_{AMax,S} \leq 115$ dB or $L_{Aeq,1s} \leq 115$ dB
* $L_{Cpeak} \leq 135$ dB

The standard provides general guidance for methods of noise measurement and determination of the results, microphone locations and measurement positions.

Legislation

In Poland, the legal requirements for protection against environmental noise are included in Acts, Regulations and Ordinances, and Polish Standards.

Acts

Acts are issued under the authority of the President of the Republic of Poland and published in the Journal of Laws of the Republic of Poland (Polish abbreviation Dz U). The essential Act for noise control and abatement is the Act of 31 January 1980 on the Protection and Shaping of the Environment, Dz U No 3, item 6. The Act defines the basic directions, performance, economic means, penal rules and organization of environmental protection. Chapter 7 (articles 49 to 52) is entitled Environmental Protection Against Noise and Vibration. Article 49 reads *1. Protection against noise and vibration shall consist in prevention of their occurrence and propagation to the environment. 2. Organisational units and natural persons shall ensure environment protection against noise and vibration by giving up the activities which cause noise or vibration or by using appropriate technical means preventing occurrence or propagation of noise or vibration to the environment and also aiming at reduction of their level. As the need arises, the sources of noise or vibration shall be insulated by creating special protective zones.*

Article 52.1 reads *The layout and technical means of communication routes shall ensure the least arduousness of noise and vibration to the environment.*

Article 68.1 in Chapter 2, Environment Protection in Investment Activity reads *The investor, the designer and performer of the works, each within the scope of his tasks, shall be obliged to: (1) take into account the requirements of environment protection while pursuing investment activity, and (2) ensure usage in construction, especially of housing and public utility buildings, of building materials and elements effectively protecting the users against noise and vibration, as well as against other harmful impact on human health.*

The problem of environment protection against noise is also covered in other Acts, eg the Act of 7 July 1994 on Building Law (Dz U No 89 of 1994, item 414), the Act of 7 July 1994 on Spatial Planning (Dz U No 89 of 1994, item 415), and the Act of 1 February 1983 on Road Traffic (Dz U No 6, item 35, No 11 of 1992, item 41, and No 26 of 1992, item 114).

Regulations and Ordinances

Regulations and Ordinances are issued under the authority of the President of the Council of Ministers, Ministers or presidents of Central Offices. Regulations are published in the Dz U and Ordinances are published in Monitor Polski (MP). Regulations and Ordinances concerning the impact of noise on the environment are as follows:

• Regulation of the Council of Ministers of 30 September 1980 on Environment Protection Against Noise and Vibration (Dz U No 24, item 90) states permissible A-weighted equivalent sound pressure levels of outdoor noise arising from all sources during daytime and night-time, see Table 3. Five categories of areas requiring to be protected against noise are distinguished. This Regulation is under revision and the new draft proposal sets out permissible limits for aircraft noise and for noise from all sources except aircraft.

• Regulation of the Ministry of Labour and Social Policy of 23 December 1994 on harmful agents in the working environment (Dz U No 3 of 1995, item 16) enforces maximum values of $L_{Ex,8h}$ $E_{A,d}$ $L_{EX,w}$ $E_{A,w}$ L_{AMaxS} or $L_{Aeq,1s}$, and L_{Cpeak} given in Polish Standard PN-95/N-01307.

• Regulations of the Ministry of Transport and Marine Economy (Dz U No 21 of 1993, item 91, and No 134, item 656, No 116 of 1994, item 557, and No 45 of 1995, item 236) on technical conditions and testing of vehicles enforce type approval requirements and specify noise limits, measurement methods and the necessary equipment of the control station.

Ordinance by the Minister of Environment Protection, Natural Resources and Forestry of 23 April 1990 on investments particularly harmful to the environment and human health and the requirements to be met in environmental impact assessments (MP No 6, item 126) reads: *An investment particularly harmful to the environment and human health is an investment which, in the period of realization or exploitation thereof, may cause....8) a noise level which, despite the technical solutions having been applied, exceeds those specified under separate provisions.*

The last of these Ordinances applies to new projects. Up to now there have not been any legal settlements in the Polish law system relating to noise protection of existing buildings, the acoustic conditions of which have grown steadily worse. There are at present no regulations which make it clear who should bear the cost of possible building protection. Proposals have been put forward that the organization responsible for the highway investment which gives rise to the increased traffic noise hazard should be the one responsible.

Standards

Until 1993, all Polish Standards were obligatory and contained essential requirements (technical specifications, permissible values of noxious agents, etc). An example of such a Standard is PN-87/B-02151, in three parts, which gives permissible L_{Aeq} for daytime and night-time in apartments and places where people stay. It also gives permissible sound levels from building services. The Standard distinguishes 19 categories of apartments. The lowest permissible L_{Aeq} of 30 dB applies to rooms providing intensive medical care. In housing apartments, homes for the aged, boarding schools, S-category hotels and lodging houses, L_{Aeq} should not exceed 40 dB during the day and 30 dB at night. In restaurants, cafes and shops, L_{Aeq} should not exceed 50 dB.

According to the Act of 3 April 1993 on Standardization (Dz U No 55 of 1993, item 251) Polish Standards are in principle not mandatory from 1994 onwards, but they may be recognised as obligatory through appropriate regulations by Ministers or Presidents of Central Offices. Many Polish Standards on the environment and health protection against noise are equivalent to International (ISO and IEC) Standards.

Legal Metrology

According to the Act of 3 April 1993 giving the Law on Measures (Dz U No 55 of 1993, item 248) acoustical measuring instruments (sound level meters, sound calibrators, audiometers) are subject to legal control, ie pat-

Kind of area	Permissible L_{Aeq}, dB		Permissible L_{AMax}, dB
	06.00–22.00 h	22.00–06.00 h	
Housing areas			
suburban	45	35	70
urban, with few business and service premises and traffic volume 1,000 vehicles/h	50	40	75
as above, but traffic volume < 2,000 vehicles/h	55	45	80
cities with traffic volume > 2,000 vehicles/h	60	50	85
Around sanatoria and hospitals	45	35	70
Areas of collective tenancy and social welfare	50	40	75
Around school buildings or places where children and young people stay for many hours	50	40	75
Around business, service or office buildings	60	50	85

Table 3. Permissible levels of outdoor noise according to the Regulation of 30 September 1980.

1995 Autumn Conference

(Marking the Institute's 21st Anniversary)

Windermere Hydro Hotel
26 – 29 October 1995

Standards, Criteria and Measurements in Acoustics and Vibration

incorporating

The Autumn '95 Noise & Vibration School

Hands-On Tutorial Sessions For Practitioners

An integrated programme of ten practical exercises designed to illuminate and inform on typical problems encountered by those working in noise and vibration. Delegates will be organised in groups and the activities, led by experts in the various fields, will involve both field work and measurement exercises and discussions within the Hotel. Bring your own sound level meter!

• The Tonal Component in BS 4142 • Applying BS 2750 in dwellings • Structure Borne Sound • Speech Privacy • Flanking Transmission • Vibration and BS 6472 • Speech Intelligibility and BS 7433 • Calibration • Measuring clay target shooting sound • Workshop on the intended revisions to BS 5228 •

The full programme of formal papers as well as further details on the above and other planned workshop sessions and noise control demonstrations will be distributed to members in the near future
The delegate fee is £195 (IOA members), £225 (for CIEH and REHIS members) or £375 (non-members)
Accommodation including single room occupancy and all meals from lunch on Thursday until lunch on Sunday £165; accompanying persons (sharing a room with a delegate) £135 (VAT to be added to all prices)
Capacity is necessarily limited; bookings are now being accepted by fax

CPD certificates will be issued

Institute of Acoustics, Agriculture House, 5 Holywell Hill, St Albans, Herts AL1 1EU

Tel: + 44 (0)1727 848195 Fax: + 44 (0)1727 850553 email: Acoustics@clus1.ulcc.ac.uk

Registered Charity no. 267026

CONFERENCE NOTICE

11th Residential Week-end Conference and 3rd Annual Training Course

Reproduced Sound 11

Organised in collaboration with ABTT, AES, APRS, ISCE and PLASA.

Windermere Hydro Hotel

16 – 19 November 1995

Technical Sessions

- Aural Modification of Performance Spaces
- In-Car Acoustics and Entertainment Systems
- Standards and Codes of Practice
- Loudspeaker Developments
- Speech Intelligibility
- Open Session

Evening Workshop Discussion

The implementation of Standards relevant to the field

Hands-On Tutorial Session

Practical Aspects of Speech Intelligibility

in a local church involving Word Scores, STI and RASTI

Music Recital

presented by LARES Aural Enhancement System

(sponsored by Harman UK)

Third Annual Training Course

'Acoustics for Sound System Engineers'

The usual social and accompanying persons' programmes and technical exhibition

Offers of late contributions should be sent in the form of a short abstract to the Institute office as soon as possible

Technical Programme Committee Chairman: Ken Dibble FIOA

Institute of Acoustics, Agriculture House, 5 Holywell Hill, St Albans, Herts AL1 1EU

Tel: + 44 (0)1727 848195 Fax: + 44 (0)1727 850553 email: Acoustics@clus1.ulcc.ac.uk

MEETING NOTICE

Workshop on

Environmental Noise Assessment

University of Ulster
Newtownabbey, Co Antrim

Friday 22 September 1995
(Organised by the Environmental Noise Group)

Following the formation of the Environmental Noise Group, a series of half day regional workshops is being organised. This workshop is a repeat of the successful meetings held in Bristol and Glasgow.

12.00	Buffet Lunch
13.00	Introduction
13.10	The requirements of the noise element of an Environmental Statement *M Baxter, Institute of Environmental Assessment*
13.40	Environmental Noise Assessment - current techniques available *K M Collins, Ashdown Environmental & S W Turner, TBV Science*
14.10	Tea
14.30	Workshop Session
16.00	Feedback
16.30	Close

As can be seen, the workshop is concentrating upon the techniques that are currently available for meeting the environmental assessment requirements for the noise impact of a project. The techniques include measurement and prediction methodologies, guidelines and standards, and the level of detail required. Having set the scene with the two presentations, the workshop session will enable small groups to consider separately what is needed in order to improve the methods available for carrying out the noise element of an environmental assessment. The feedback session will allow the ideas to be shared.

Meeting Organisers: Nicole Porter MIOA, NPL and Dr G C McCullagh MIOA, University of Ulster

I wish to attend the workshop on **Environmental Noise Assessment**
Full Name:
Organisation:

Address:

Tel No: Fax No:

☐ I enclose a cheque for the delegate fee ☐ Please invoice me

☐ IOA Members £30 incl VAT ☐ Non-members £45 incl VAT

Institute of Acoustics, Agriculture House, 5 Holywell Hill, St Albans, Herts AL1 1EU.
Tel: +44 (0)1727 848195 Fax: +44 (0)1727 850553. Registered Charity no. 267026

INSTITUTE DIARY 1995

5 OCT
IOA Medals & Awards, Council
St Albans

13 OCT
IOA CofC in Workplace Noise Assessment exam
Accredited Centres

18 OCT
London Branch mtg: Cross-Rail Project
London

25 OCT
Eastern Branch mtg Sound Reproduction
Ipswich

26–29 OCT
21st Anniversary Event Autumn Conference
Windermere

3 NOV
IOA CofC in Env Noise M'ment exam
Accredited Centres

10 NOV
IOA CofC in W'place Noise Ass't Advisory Committee
St Albans

16–19 NOV
Reproduced Sound 11
Windermere

20 NOV
IOA Publications, Meetings Committee
St Albans

21 NOV
Yorks/Humberside Branch mtg: Instrumentation/Rev Chambers
York

22 NOV
Eastern Branch mtg Medical Acoustics and Audiology
Cambridge

22 NOV
London Branch mtg: Annual Dinner
London

23 NOV
IOA Membership, Education Committee
St Albans

29 NOV
Midlands Branch mtg

- NOV
South-west Branch mtg Underwater Acoustics
Filton

1 DEC
IOA CofC in Environmental Noise Mm'nt Advisory Committee
St Albans

7 DEC
IOA Medals & Awards, Council
St Albans

7 DEC
Southern Branch mtg: Instruments and PCs – the Great Divide?
ISVR Southampton

13 DEC
London Branch mtg: Instruments and PCs – the Great Divide?
Epsom

18-20 DEC
Underwater Group Conference - Sonar Signal Processing
Loughborough

Certificate of Competence in Workplace Noise Assessment

The following were successful in the 19th examination held in May 1995

Bristol
Bater, B
Copley, C B
Dunn, P J
Evans, C
Kimber, M A
Pettifer, A R
Pickwell, B
Stewart, S E
Thorpe, M J
Wahwerit, P A

Colchester
Ahmet, P M
Goodwin, G P
Green, R
Howlett, K R
Lillistone, P
Spence, W D
Walker, J P

Leeds
Cunningham, N J
Gaunt, C A
Higham, D A
Parkinson, N J
Richardson, E F
Taylor, G
Taylor, N J

Liverpool
Bischoff, M A
Flook, S
Love, E R

Loughborough
Brown, G J
Cawthorne, A J
Hayward, M R
Hind, J
Houghton, R A
Pullar, C M
Salmon, J F
Smith, R G J
Sprinks, P L
Yule, M J

Salford
Gibson, R
Holdhusen, C D

Sheffield
Sheader, C B

Certificate of Competence in Environmental Noise Measurement

The following were successful in the 7th examination held in June 1995

Bell College
Bradley, P
Buchanan, I A
Caldwell, D A
Douglas, G
Ferrier, M
Gimson, S L
Harkin, J
Hunter, C J
Ingram, A G
Kerr, P
Lamond, E A
Martin, G M
McGuinness, E J
Nairn, D
Pickering, L
Piggot, F
Rankine, F C
Riley, J
Sweeney, S J R

Bristol
Birch, N
Hayball, D
Taylor, G

Colchester
Howes, G P
Stammers, P G

Liverpool
Symonds, R S

NESCOT
Beaman, R
Clark, L J
Gibson, B K
Smith, A

Non-Institute Meetings

The Institute is a collaborating organisation for the following

Noise and Health

4 October 1995
The Cavendish Conference Centre, London

Organised by the Faculty of Public Health Medicine and the Faculty of Occupational Medicine

To raise awareness of the effects of noise on health in the environment and the workplace.

Further details: Professional Briefings, 120 Wilton Road, London SW1B 1JZ

Practical Aspects of Health Surveillance in Noisy Industries

12 October 1995
Royal Society, London

Organised by British Society of Audiology, Hearing Conservation Group

Further details: British Society of Audiology, 80 Brighton Road, Reading RG6 1PS

(IOA members may attend each meeting at a reduced fee) tern approval and verification. The responsibility for this control falls to the Central Office of Measures, which is also involved in establishment and maintenance of the National Measurement Standards and international intercomparisons. The Polish National Measurement Standard for sound pressure is traceable to the United Kingdom standards held by the UK National Physical Laboratory.

International Events in Poland Concerning Environmental Acoustics

Noise Control '95, the 10th International Conference on Noise Control, was held in Warsaw in June 1995, at the Central Institute for Labour Protection. The topics covered were basic research, training, production, technical advice, legislation and standardization, in the environmental and labour protection fields. The theme was 'Noise – a Civilization Hazard'. The first such conference was held in 1970. This year, about 300 persons were expected to attend, 50 of them from abroad, and about 150 scientific papers were to be presented.

Acknowledgements

The authors would like to express their thanks for help in preparing this article to Professor Jerry Sadowski, Head of the Department of Acoustics of ITB, who made available the information on institutes conducting research into environmental acoustics problems; also to Associate Professor Danuta Augustynska, Head of the Department of Noise and Electromagnetic Hazards of CIOP for material concerning occupational noise and the Noise Control '95 conference.

References

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[2] B SZUDROWICZ, 'Noise in Buildings', Proceedings of XL Scientific Conference of PAN, Krynica, Poland, Vol 1, (1984)
[3] UN Document No E/ECE/Trans/505, Appendices 40, 50 and 62
[4] M STAWICKA-WALKOWSKA, 'Protection Against Noise in Urban Design', Proceedings of XL Scientific Conference of PAN, Krynica, Poland, Vol 1, 81-94, (1984)
[5] A KOZIEL & M ROLLA, 'Road Link Needs Between Poland and Neighbouring Countries', Proceedings of the East-West European Road Conference, Warsaw, Poland, Vol 2, 63-67, (1993)

Maria Stawicka-Walkowska is at the Building Research Institute, Warsaw, and Maria Szelag is at the Central Office of Measures, Warsaw.

I-INCE Working Party Meeting on Community Noise

The Institute of Acoustics is one of 38 member societies of the International Institute of Noise Control Engineering (I-INCE). In 1992 the board of I-INCE authorised the establishment of two working parties on 'Noise in the Workplace' and 'The Effect of Regulations on Motor Vehicle Noise'. This work has recently been completed and published in Noise News International. At Internoise 1994 the board of I-INCE approved four more initiatives including an examination of community noise. The broad I-INCE objective for this initiative was set down as the development and promotion of practical, well balanced community noise criteria for the guidance of those involved in the legislative and technical control of noise.

A working party was set up, to which IOA appointed Nicole Porter of NPL as its representative, tasked to advise the I-INCE General Assembly on how the present and possible future working parties should proceed; the starting point was the World Health Organisation (WHO) draft document on Community Noise 'Environmental Health Criteria' published in June 1993 and, in particular, engineering aspects of the evaluation of the community noise exposure. The historical background to this document begins in 1974 when the US-EPA 'Levels document' was published. 1980 saw the publication of the results of a WHO working party on community noise – 'Environmental Health Criteria 12'. A WHO task force meeting took place in Dussledorf in 1992 to discuss the contents of a revised version of this document. The relevant WHO Task Force, consisting of 18 participants from 9 countries covering three regions of the WHO and two international organisations, reviewed a draft and an external review draft was issued in 1993. In the same year the revised version was distributed to delegates at the ICBEN conference 'Noise and Man 1993' in Nice. This document is a expanded and elaborated revision of the earlier WHO document.

Prior to the 7 July 1995 meeting of the I/INCE Working Party, its members were asked to comment on the limitations of the WHO draft. However, since this was not widely available, obtaining a representative view by approaching individual IOA members was not an easy task. It was therefore decided to await the publication of the final WHO document, the early publication of which Professor Birgitta Berglund from the University of Stockholm had predicted at the 1995 Institute Spring Conference. With this in mind it has been decided to form a small IOA working party to consider the UK position, produce an article in the Acoustics Bulletin and arrange a workshop discusion on the issues identified.

Such general comments on the existing draft as were available from IOA members were put before the 7 July meeting. The observations presented concerns bout the following:

- The recommended guidelines should take into account the specific effects of noise and specific environments by allowing for specific urban, suburban and rural environments or the actual types of noise sources.
- The WHO recommendations should be taken as ideal world targets which will not be realistically achievable in the very near future.
- The WHO recommendations make few concessions to practicabilities and might lead to much confusion if applied inappropriately.
- The 55 dB(A) criterion may be used as a panacea for

environmental noise control (this was originally applied to transportation noise studies only, and not to industrial or construction site noise). The statement that 'daytime noise limits in the region of 55 dB(A) L_{eq} might be considered as a general environmental health goal for outdoor noise levels in residential areas' gave rise to disquiet. There was a feeling that it may be taken as a level to be achieved in all situations and, without clear reference to its original use, may be misused.

Before the meeting, a skeleton of a possible I-INCE paper on 'Environmental Noise Criteria: Technical Assessment' was circulated for consideration as a paper to complement the WHO document. Its aim would be to overcome the practical limitations of the latter that have been identified. It was anticipated that this would serve as a framework for (1) comments to WHO and (2) recommendations to the I-INCE Board of Directors for future work.

At the meeting it was suggested that work be undertaken to refine the paper and that taking the 1974 US-EPA 'Levels Document' as a starting point might ease the workload. It was agreed that the comments already received on the draft document would be communicated to WHO. Secondly, it was agreed that this I-INCE group, with Dr J Ollerhead as Convenor, and with coopted specialist advisors as considered necessary, would set out to produce a separate complimentary document based on the skeleton as outlined above.

Nicole Porter MIOA

Medal for Dr R C Chivers FIOA

At the opening of the 12th Symposium on Hydroacoustics held at Jurata in Poland on 16–19 May 1995, Dr Robert Chivers FIOA, Institute Education Committee Chairman and member of Council, was honoured by the presentation of the Medal of the Polish Naval Academy in the name of the Heroes of Westerplatte. The medal is awarded occasionally for an outstanding contribution to science related to the activities of the Academy. In this instance it was awarded for Dr Chivers' work in acoustics and particularly his contribution to the development of the Roxann system for sea bed discrimination. Hitherto the medal has been awarded only to the most senior Polish professors, thus Dr Chivers is the first non-Polish person (and the youngest) to be honoured in this way.

Later in the Symposium Professor Antoni Sliwinski, President of the Polish Acoustical Society, conferred Honorary Membership of the Society on Dr Chivers. This is the highest honour the Society can bestow and is given in recognition of remarkable contributions to the subject of acoustics and to the activities of the Society. Dr Chivers is only the second Englishman to be recognised in this way, the first was Dr R W B Stephens, the Founding President of the Institute of Acoustics. ❖

(from left to right) Vice Admiral A Tchaikowski, Cmmr Debinski of the Polish Ministry of Defence, Captain Professor Z Kitorski (Vice-Rector of the Academy, who presented the medal), Dr Chivers and Captain Professor E Kozaczka

COMMUNICATION FROM THE DIRECTOR GENERAL OF THE ENGINEERING COUNCIL

As we count down towards 'unification' of the profession on January 1, 1996, I welcome the opportunity to give you my views on how The Engineering Council plans to address the key issues for our profession.

In the few months that I have been with the Council, it has been borne in on me how much we need the coming together which unification represents. Let me give you just three examples. Everybody now recognizes the importance of the educational establishment giving proper weight to engineering and technology. Every organization is keen to make its own contribution. But at present there is such a diversity of initiatives coming from government, industry, Institutions, The Engineering Council and many other quarters that many teachers are baffled. Not only is there a duplication of effort, but I suspect there are some gaps, too. I believe the new Engineering Council is ideally placed to work with stakeholders to improve collaboration and co-ordination of education activities.

Secondly, almost everyone I have spoken to has emphasized the importance of professional engineering activities in the regions and this is clearly right. But Institutions mostly have their own regional structures, all with different geographical boundaries and different arrangements. Without in any way wishing to impose upon these arrangements, mutually agreed boundaries and better coordination of activities would increase the strength of our links with registrants, industry, educational establishments and Government at the regional level as well as perhaps making better use of resources.

Thirdly, Government is perplexed by the inconsistency of advice it gets from the profession when all concerned give their views independently. The result of that perplexity has, in my opinion, been a major factor in our failure to influence Government policy in the way we would have wished. The Engineering Council was, of course, set up by the Government to provide a focus but without the democratic basis to encourage individual bodies to sink their differences. We may not even now always be able to agree but a determined effort to achieve a corpus of view is surely in all of our interests. In my initial discussions, I have detected a real will to make this work and I have every confidence that we are building a durable structure. We have Sir John Fairclough to thank for brokering this vital deal.

Among the key issues that face us, the following seem particularly significant to me. First, we have to construct mechanisms that will involve Institutions in every Council activity, with the Council Executive playing a facilitating role. Next, we need to establish stronger links with Government, earning the credibility that will enable us to become fully involved in Government policy-making at the development stage. We also need to understand better and respond more effectively to the needs of industry. We can do more to communicate effectively with registrants who must understand what the profession is doing in their interests and have the opportunity to come back with their own views. I want us to use our public affairs resources in ways which will raise the image of engineering to reflect the true contribution it makes to the nation's prosperity and quality of life. This is partly a deep-rooted cultural problem and has to be addressed in a planned and co-ordinated way.

I do not believe we know nearly enough about ourselves and I would like to develop a comprehensive picture of engineering activity, including statistics, directories and geographical dispositions. We also need to look at our total resources to see whether we could not agree to coordinate activities jointly to increase cost-effectiveness. Finally, and perhaps as important as anything else, we have to maintain a 'gold standard' regulatory framework covering nomination of Institutions, accreditation of courses and registration of individuals. Each Institution has to be confident that its own high standards are matched by those of others and Government, employers and public need our assurance that an engineer knows his business.

I also believe we should benchmark ourselves against the rest of the world because international standards are always rising and we dare not fall behind. We all have an interest in staying world class and not giving our precious imprimatur to those who cannot or will not make the grade.

The new relationship means working together or it means nothing. Institutions have so much expertise and resource to offer their members and the nation. I am confident that with the whole profession pulling on the same rope we can produce the national contribution that has so far eluded us.

Mike Heath CB CBE CEng, Director General

NEW CHARTERED AND INCORPORATED ENGINEERS

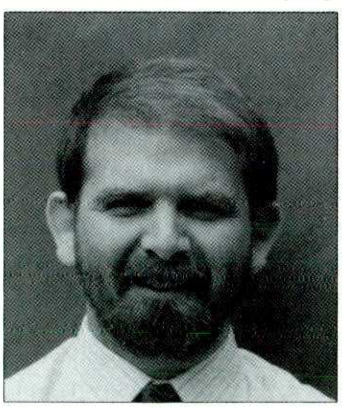
Chartered Engineers

David C Anderson graduated from the ISVR in 1989, obtaining an MEng in acoustics and vibration. As part of the 4 year course, David took up summer vacation placements at Hann Tucker Associates (1987) and at the JK Mining Research Centre, Brisbane, Australia (1988). These placements confirmed his interest in acoustic consultancy and he joined the Winchester office of Arup Acoustics after graduation.

David has carried out a wide range of projects at Arup Acoustics, including a major involvement in the design of the new Manchester Concert Hall, currently under construction.

David was promoted to Acoustic Consultant in 1993 and has now transferred to the Sydney office of the practice on a long term secondment.

David W Anderson graduated from Manchester University Department of Electrical And Electronic Engineering in 1981 and started work at GEC Telecommunications, developing telephone handsets. With a combined background of electronics and acoustics he progressed his career with Calrec Audio as Head of the Microphone Department responsible for the production and development of the Soundfield Microphone. David left Calrec to start his own company Bridge Microphones, to install PA systems and produce a reference microphone to fill a gap in the market. Simultaneously with starting Bridge Microphones David took up a position at Salford University to maintain and develop their impulse remote monitoring devices. From this he has been responsible for the new generation of computer-based solid state remote monitors which will allow full remote accessing of recorded data. He also has an interest in writing database software.



Susan Boyle graduated in Engineering Acoustics and Vibration from the Institute of Sound and Vibration Research in 1989, having been sponsored by the Defence Research Agency, Portland, where she specialised in underwater acoustics. She worked for a year as an acoustical engineer for Wimpey Environmental, gaining wide experience in all aspects of consultancy work.

This was followed by a return to ISVR to study for a PhD, under the supervision of Professor Phillip Nelson. The research was sponsored by the DRA, Alverstoke, and involved investigating the acoustic characteristics of military 're-breather' diving apparatus. The PhD research had a large practical element, including both sea trials and trials in the A B Wood underwater acoustics test facility at the ISVR. Susan also qualified as an HSE Part IV Commercial Diver during this period, in order to supervise dives and to appreciate both the safety aspects and practical limitations of diver breathing apparatus.

Susan joined the Passive Sonar Data Processing Section of DRA, Portland, in 1993, where she was responsible for initiating and managing a programme of research into acoustic transient classification. She is currently on loan to the Strategy Assessment Section of the Building Research Establishment, in order to broaden her work experience to incorporate knowledge of the methods and practices used by other government departments. Here she is the project officer responsible for assessing the impact of the Department of the Environment's Best Practice programme (worth £8M pa) to promote energy efficiency in buildings. This experience is proving invaluable and will prepare her for an intended career in engineering management.

Patrick Corbishley, Chairman of the Scottish Branch of the IOA, commenced his career in acoustics with Michelin Tyre plc where he worked as a Development Engineer in the noise and vibration section of the company's Tyre-Vehicle Research Department. He obtained a BSc Degree in Physics at the North Staffordshire Polytechnic. While with Michelin he also provided technical support on noise and vibration related matters to the company's Engineering Departments and the Occupational Health Group. In 1986 he joined the Health and Safety Executive's Technology Division. He was posted to Edinburgh where he is now the Principal Specialist Inspector with responsibility for providing, throughout Scotland, the technical advice and support to all Health and Safety Inspectorates and Agencies engaged in enforcement action under UK health and safety legislation.

David Hothersall is Reader in Acoustics in the Department of Civil and Environmental Engineering at the University of Bradford. His main research interests are in environmental acoustics and transport noise.

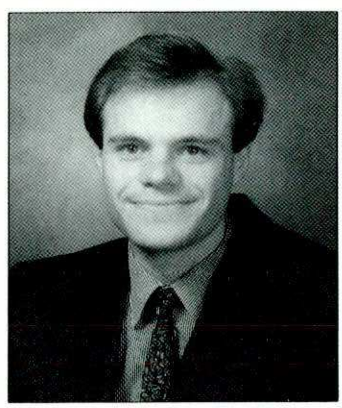
Following postgraduate and postdoctoral research in electron interference effects his initial experience in acoustics was gained in the Department of Physics at the

University of Salford where he studied the effects of floor coverings on impact noise insulation. On appointment as Lecturer at Bradford University he began research into methods of improving the prediction of noise from road traffic. This led to an interest in the description of sound fields above multi-impedance planes using the boundary element method. The method was further developed to model numerically sound propagation over noise barriers. The versatility of this approach has led to a detailed analysis of the performance of complex modern designs of noise barrier and suggestions for innovative, efficient designs. A parallel interest has been in the development and assessment of absorbing materials for use in outdoor noise abatement. His research has been continuously supported by research council funding. Publications include many journal and conference papers and the book Transport and the Environment. He was awarded a DSc by the University of Salford in 1994.

David is a member of the Editorial Board of Applied Acoustics and a Member of the I/INCE Working Party on The Efficiency of Noise Walls. He has recently retired after serving for eight years on the Council of the Institute. For six of these years he was Honorary Secretary.

David M Howard graduated in Electrical and Electronic engineering with a first class honours degree from University College London (UCL) in 1978. He then went on to read for a PhD in Human Communication in the Phonetics and Linguistics Department at UCL which he gained in 1985 after becoming a lecturer in experimental phonetics in 1979. He moved to the Electronics Department at the University of York as a lecturer in music technology in 1990 where he is now a Senior Lecturer. David's research interests include the analysis and synthesis of speech, singing and musical instruments, and the development of real-time visual displays for voice teaching. He is a Fellow of the Institute of Acoustics, a Member of the IOA Speech Group Committee, a Member of the British Association of Academic Phoneticians, a Founder Member of the International Association of Forensic Phoneticians, and a National Board Member of the British Voice Association, for whom he edits their Journal: Voice.

Rick Jones graduated from Loughborough University in 1973 with an Automotive Engineering Degree. He developed an interest in road traffic noise during his studies and went on to complete an MSc at Loughborough by research into the effect of interruption of traffic flow on noise characteristics and annoyance. This was followed by appointment to the post of Research Assistant working for Dr David Hothersall at the University of Bradford. This led to the award of a PhD for further research into road traffic noise characteristics in restricted flow situations. On leaving Bradford in 1979 Rick joined British Rail Research. Since that time he has worked, both within BR Research and in other parts of British Rail, on a wide variety of acoustic topics as well as taking on non-technical managerial roles. He rejoined BR Research in 1991 to manage a strategic research project into railway noise control by means of vehicle-mounted shrouds combined with low trackside barriers. He currently maintains his responsibility for that project, but is also involved in BR Research's acoustic consultancy which covers general noise and vibration matters as well as work specifically for the railway industry.



Ian Lewis graduated from the University of Salford in 1983, with a first class honours degree in Electro-acoustics and moved to the North-east to join GEC Telecommunications as an Acoustics Engineer in the design / development department. His main task was the development of low cost, highly specified microphones and receivers for telephones but also included work on loudspeaking telephones and other ancillary acoustic devices such as bells, ringers and loudspeakers.

In December 1989 Ian joined Brüel & Kjær as the Applications and Sales Engineer responsible for noise and vibration products in the North-east of England. This gave exposure to the very diverse requirements of industry and research in acoustics and vibration.

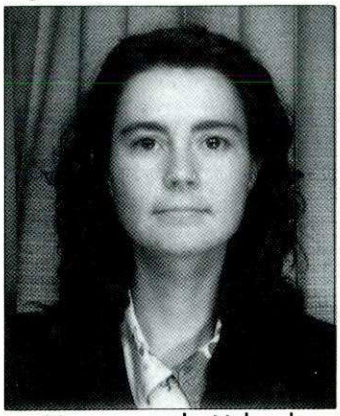
Ian has recently been appointed National Account Manager for Brüel & Kjær's Telecommunications and

Audio Division products, responsible for application support and all sales of these products throughout the UK and Ireland.

Michael Sugiura graduated in July 1974 from Sheffield University with a BSc Hons in Mathematics and subsequently gained in 1976 an MSc Technology in Control Systems Engineering. He started his career as an Environmental Health Technician with Westminster City Council and became the acoustics specialist in the Pollution Control team. While working in local government he undertook the Diploma in Acoustics and Noise Control at NESCOT. He has been a Member of the Institute of Acoustics since 1980 and has been awarded the Certificate of Competence in Workplace Noise Assessment. In 1982 Michael provided technical assistance to the Tosho Engineering Co, Tokyo on the design of noise control for

power generation plant serving island communities and became an Associate Member of the Acoustics Society of Japan. In 1990 Michael joined Frank Graham Consulting Engineers establishing the Environmental Division acoustics team. He was primarily responsible for the environmental noise and quality appraisal of trunk road schemes along with the design and specification of mitigation measures. Michael's role also involved the assessment of the impact of construction site noise and he acted as expert witness at a number of local planning inquiries. He worked with Professor Frank Fahy on noise barrier research and co-authored a paper on the development of a novel modular form of sound absorbent facing for traffic noise barriers with road and railway applications. Michael has recently established his own acoustic practice providing consultancy, environmental noise impact assessment in the development planning and transportation sectors, inquiry and litigation work, noise surveys, noise control engineering and occupational noise.

Helen Thornton graduated in 1988 with a BSc in Engineering Acoustics and Vibration from ISVR, joining the London office of Arup Acoustics as a graduate that year to assist on projects in fields of environmental and building acoustics.



As a consultant with Arup Acoustics and now working in the Winchester office, Helen has specialised in work in the building acoustics of schools, offices and courtrooms etc and in work in the design of auditoria, being involved in the successful completion of the new Glyndebourne Opera House and The Anvil at Basingstoke.

More recently Helen has been involved in the design of a new multipurpose theatre in Milton Keynes and the redevelopment of the Royal Opera House in Covent Garden.

Incorporated Engineer

Cathie Barlow graduated from the University of East Anglia in 1990, with a BSc (honours) degree in Environmental Science and joined West Yorkshire Highways and Technical Services (WYHETS) as part of the Environmental Studies team. She became involved in all aspects

of noise assessments and environmental impact assessments for a wide variety of transportation schemes.These have included road, rail and air traffic impacts. In 1992 Cathie completed the Institute's Diploma in Acoustics and Noise Control at Sheffield Hallam University. Also in 1992, WYHETS merged with Leeds City Council to form the City Engineers Department.

Over the following three years she has been responsible for several noise assessments for Environmental Statements including Leeds Inner Ring Road Stages 6 and 7. These have included calculation and measurement activities together with the analysis of results, report writing and the design and specification of noise mitigation measures. Cathie has also been involved in the measurement and prediction of noise and vibration from construction sites.

Acoustics '95 – 1995 Spring Conference

9 – 11 May 1995, Liverpool

The 1995 Institute Spring Conference, Acoustics '95, was held for the first time at the Britannia Adelphi Hotel, Liverpool. This vast and impressive building easily absorbed the 190 delegates and 20 exhibitors, providing accommodation, lecture facilities and catering in a way which hardly impinged on the other guests in the hotel. The conference provided valuable guidance and experience for the hosting, by the Institute, of Internoise '96 in Liverpool.

But back to Acoustics '95; the organising committee deserve our thanks for producing a conference packed full of valuable, wide ranging specialist sessions, interesting invited papers and medal lectures and stimulating workshop discussions. The Son et Lumiére performance at the Anglican Cathedral provided light (perhaps not an apt description in view of the weight of sound produced by the 32ft pipe of the magnificent Willis organ!) relief from the serious matters of the conference.

There were two Invited Lectures. V Irmer, DGXI, European Commission, gave an interesting and valuable review of the noise policy matters currently being dealt with by the EC. Professor Birgitta Berglund, Karolinska Institute, and Stockholm University, gave an absorbing account of her work on the adverse health effects of community noise.

Professor Lara Saenz, President of the Spanish Acoustical Society, in delivering the 1995 R W B Stephens Lecture spoke comprehensively on the Generalised Impedance Concept: Analogies and Acoustic Applications.

Professor R H Lyon of MIT and Lyon Corporation, USA, presented the Rayleigh Medal Lecture and spoke in a most engaging way on his topic, Theory of Sound (or is it noise?). He was presented with the Rayleigh Medal.

Also during the conference, Dr J M Bowsher was presented with his certificate of Honorary Fellowship and Michael Hewitt received the Institute Prize for best student in the 1994 IOA Diploma examinations. Michael studied by the Tutored Distance Learning programme.

The reports on the sessions given below are based on reports submitted by the session chairmen.

Noise propagation

Seven papers, in an interesting and varied session dealt with the effects of ground reflection, topography, barriers, atmospheric refraction and ground vibration.

Professor Keith Attenborough's paper presented theoretical and experimental results to demonstrate the effects of ground roughness on outdoor sound propagation. The frequency of the well known 'ground-effect dip' is shifted by the effect of surface roughness, and a fuller understanding of these effects may one day lead to their exploitation as a method of controlling outdoor sound propagation. Professor David Oldham described how theoretical prediction of sound propagation from a point source over a reflecting plane can be extended to plane directional sources, such as buildings. In a third paper on the ground effect Tim Water-Fuller described a pulse technique for measuring the excess attenuation due to the effect of ground reflections which allows in-situ measurements and demonstrated the use of the technique to the investigation of propagation over agricultural land. Ralph Weston reviewed and compared the way in which the methods for predicting aircraft noise in different countries take into account the topography in the vicinity of airfields, with particular reference to slant range adjustment, ground attenuation and the barrier effect. Phillip Morgan described the development of a modified two dimensional boundary element model for predicting the performance of parallel traffic noise barriers. The new model agrees well with the original model, except at high frequencies, and gives a considerable saving in computing time. Andrew Peplow showed how the boundary element method may be applied to produce a two-dimensional model of ground vibration propagation over layered media. Comparison with a semi-analytical method confirmed the accuracy of the model, and results were presented which demonstrate the importance of variations in the thickness of layers in determining vibration propagation characteristics. In the final paper of the session Dr Li discussed methods for predicting the effects of refraction due to temperature gradients on outdoor sound propagation.

Transportation noise/vibration

Three out of the four papers in the first session dealt with ground vibration and noise from rail traffic. Nigel Cogger of Arup Acoustics considered the effect on sensitive buildings of noise and vibration from urban rail systems. He described the propagation paths of the vibration from the wheel/track interface via the track bed and ground to the building foundations and structure. He then discussed the criteria for acceptability of noise and vibration from railways.

Professor Victor Krylov of Nottingham-Trent University presented a review of progress in the theory of railway-generated ground vibrations mentioning specifically vibrations caused by heavy freight trains, high speed trains and by underground trains.

Raymond Heng of Sheffield Hallam University rounded up the rail noise part of the session with a paper considering the acceptable levels of rail noise at the facades of residences.

The one paper on traffic noise was given by Peter Hepworth of Hepworth Acoustics. He discussed the methods of environmental assessment given in the Department of Transport's Design Manual for Roads and Bridges Vol 11 and the accuracy of the estimates of traffic noise made using the DOT's Calculation of Road Traffic Noise CRTN. He welcomed the updated publications but suggested that CRTN should be updated more frequently, say every five years, in view of the changes in the design of noise barriers and the use of quieter road surfaces. He also suggested that a change in the qualifying level for noise insulation should be considered.

The second session commenced with a paper by Professor Krylov comparing two mechanisms of generating ground vibrations by road vehicles; vehicles accelerating/decelerating and vehicles travelling at constant speed. Through theoretical analysis, he identified the factors which determine the vibration levels at different frequencies from these two mechanisms. This was followed by Dr Vasudevan of NESCOT who, with one of her students, S A Cox, carried out a field trial of the measured facade correction from a railway noise source. She found that the correction seemed to be nearer to +3.5 dB(A) compared with the +1.5 dB(A) suggested in the Calculation of Railway Noise (CRN).

The theme of railway noise continued with Ken Collins comparing the prediction model (TNPM) developed by Ashdown Environmental in connection with their Channel Rail Link work and the proposed CRN.

Two relatively new methods of tackling road traffic noise were featured in the final two papers. Firstly, Steve Philips presented the results of a study into the benefits of porous asphalt. Compared with old hot rolled asphalt (HRA) surfaces, a benefit of about 8 dB(A) was found. A difference of about 4 dB(A) would be expected when compared with new HRA. Secondly Jim Johnston described the noise barriers that are being erected between junctions 10 and 11 of the M25.

Industrial noise/planning

The first session commenced with a paper from Mel Kenyon considering the difficult problem of what background noise level should be used in connection with assessing wind farm developments. This was followed by a description by Geoff Leventhall of various applications of active noise control. The session concluded with an exposition by John Seller proposing a new rating method which had the air of 'back to basics' about it.

John Seller commenced the second session with a description of the examples proposed to be included in the revision of BS4142. There was some interesting discussion and various useful comments were made. This was followed by a description by John Hinton and Bridget Shield of a noise survey carried out in Birmingham last year which repeated measurements made at the same sites some 10 years before. In terms of $L_{Aeq,24hr}$ there has not been much change, but night time traffic noise levels have increased. Those sites affected by railway noise, though, have shown a decrease in noise. The session concluded with two papers on wind farm noise. The first described a study by A Bathmore and Andy Mckenzie which attempted to define a tonal penalty based on a subjective test. Finally an interesting exposition was given by Alistair Mackinnon which looked at the correlation of wind speed and acoustic data.

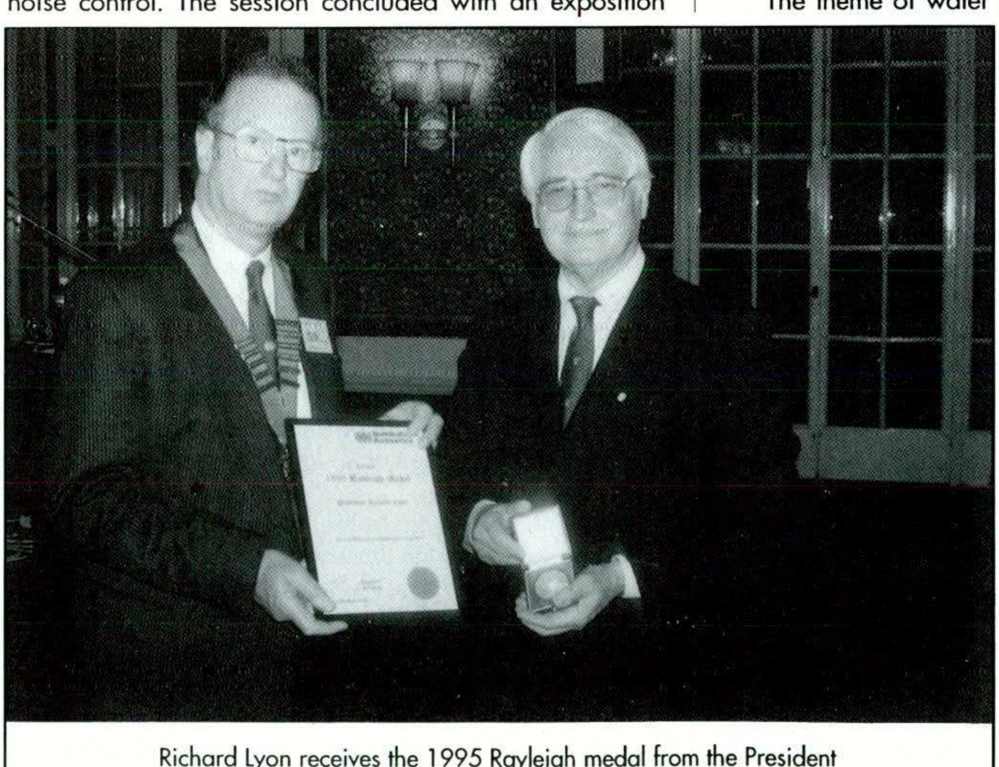
Leisure Noise

The early morning start on the morning after the Conference Dinner did not in any way dampen the enthusiastic presentation of the papers during this session. The first paper by Mike Fillery of the University of Derby levelled some criticism at the static test as a means of controlling noise from motor sports at Donington Park. It was pointed out that some vehicles passed the static test but still generated high emissions when on the track. The new drive-by test is based on two years of field work and initial tests conducted by Mike have indicated that the drive-by test is effective.

The next presentation was by C A Kirby of Scarborough Borough Council. He illustrated the methods he has used to evaluate the likelihood of the complaints being received by the local authority being justified.

The theme of water sports was continued by the next speaker Moir Nelson from Dumbarton District Council who presented a very interesting review of the problems encountered by his local authority in attempting to maintain balance between the right of visitors and local residents to enjoy the peace and quiet of Loch Lomond and its environs whilst permitting adequate recreational use of the Loch. The effectiveness of the local Byelaws for Loch Lomond generated enthusiastic discussion.

The theme for the final paper was again motor sport noise. Andy Watson's paper examined the work being funded by the Association of Motor Racing Circuit Owners and the RAC Motor Sport Association to improve the controls for reducing the impact of community noise from all



Richard Lyon receives the 1995 Rayleigh medal from the President motor sport activities. His support of the static test provoked a range of questions and only time prevented a very interesting debate on the merits of static versus drive-by testing.

Occupational noise

Keith Broughton of the HSE described a recently completed project to gather information in the form of 60 case studies of occupational noise control, to be published in a new guidance booklet. This, together with two other key publications, form part of the three year Occupational Health Management Campaign, just launched.

Andy Moorhouse from the University of Liverpool outlined an interesting systematic procedure designed to rank noise sources in terms of their contribution to personal noise exposure and to provide a single figure rating for the comparison of the benefits of different noise control options.

In a fascinating insight into occupational noise problems faced by orthopaedic surgeons during hip replacement operations, the paper by Mike Squires from Exeter City Council dealt with the measurement, and subsequent reduction of noise from a bone cutter/drill – described as the 'Black and Decker of bone surgery'. The audience were for once probably glad that no colour slides were shown in the presentation.

Cutting machinery of a rather different kind featured in the final paper in the session, by Simon Clampton, which discussed aspects of the noise control programme used in the submarine construction industry. The presentation covered the identification of high noise levels in the shipyard, determination of the noise exposure of the workforce and the provision of relevant acoustic treatments to reduce levels.

Noise Nuisance

The session started with a thought provoking paper from Professor Krylov of Nottingham Trent University. He considered the rate of increase of complaints with regard to low-frequency noise and suggested that a possible mechanism of the 'low frequency hum' may originate in ground vibrations propagating to buildings as surface Rayleigh waves.

BRE's work on complaints related to low frequency noise was described by John Sargent. The objective was to develop a simple technique to cast light on sources of low frequency noise complaints. Despite the use of an evolved measurement technique it was found that in most of the cases investigated it was not possible to identify the source.

The final paper in the session was produced by Ken Scannell who talked the audience through some of his investigations into environmental vibration complaints. His review of the relevant standards on structural damage criteria and human reaction to vibration will serve as a useful guide to those investigating vibration complaints.

Structure-borne sound

With only three papers this session was short in length, but certainly not in quality. Barry Gibbs from Liverpool University began with an excellent review of the state of the art in characterisation of structure-borne sound sources. It is hoped that his clear presentation will help to remove some of the mystique from this difficult subject. Peter Clark from ISVR then gave a lively presentation of some experimental work on an attenuating device for structure-borne sound in pipes and rods. The work was carefully carried out and the results look promising.

Finally Jane Horner from Loughborough University presented analysis and results for frameworks made up of beams joined at angles. Again, the quality of the presentation was good. A common theme was that all the authors presented their results in terms of vibrational power rather than the more traditional parameters of force or velocity.

Although the thrust of the conference was towards practitioners, this 'scientific' session was reasonably well attended, perhaps indicating an increased awareness of the importance of structure-borne sound in noise control. All the authors faced well informed and searching questions and answered them well.

Professor Lara-Saenz, 1995 R W B Stephens lecturer on the left with Rev Harold Stephens, son of the late R W B Stephens

Construction noise/vibration

Peter Clark of ISVR presented a theoretical treatment of ways to reduce unwanted vibration in structures by the use of vibrational power transmission analysis. This was followed by Ken Collins of Ashdown Environmental Ltd who gave an interesting account of the estimates of the vibration effects associated with the construction and operation of the Channel Tunnel Rail Link (CTRL). Criteria were presented for ground-borne noise or perceptible vibration affecting residential or non-residential resources and potential vibration effects on buildings.

Paul Bassett of Hepworth Acoustics dealt with the problems of

SAVOIR: Sound and Vibration - Organisation, Information and Resources

SAVOIR is an association which was formed in 1990 with support from the European Community COMETT programme. The SAVOIR project - training in Sound and Vibration: Organisation, Information and Resources - is the focus for European training in the high technology field of sound and vibration. The partners are currently: The Institute of Sound and Vibration Research (England), Metravib RDS (France), Brüel and Kjaer and DELTA Acoustics and Vibrations (Denmark), TNO (The Netherlands), Catholic University Leuven (Belgium), BeSB GmbH (Germany)

Short Courses

Noise and Vibration from Rail Transport Systems: 25-29 September 1995, Köln, Germany

Systematic Low Noise Design: 25-28 October 1995, Berlin, Germany

Human Vibration: The EU Machinery Safety Directives and Work Place Regulations: Spring 1996, France

For further information about these courses and/or SAVOIR, please contact Maureen Strickland, ISVR, University of Southampton, Southampton SO17 1BJ. Tel: 01703 592294; Fax: 01703 593033; e-mail: mzs@isvr.soton.ac.uk assessing construction noise at the planning stage of new developments and the factors needing to be considered when assessing what level of construction noise may be acceptable. He gave several interesting examples of recent cases where construction noise has been assessed at the planning stage.

The next paper was concerned with the effects on people of blasting operations. In his paper, the author, Moir Nelson, an Environmental Health Officer with Dumbarton District Council, outlined his experiences to illustrate the problem of vibration nuisance as perceived by the public. He reported that most people were more concerned about possible damage to their property than the disturbance or annoyance they suffered.

The final paper of the session was given by Bernadette McKell on the control of construction site noise. The paper reviewed the current local authority practices in Scotland with regard to the control of construction site noise and in particular the interpretation of Sections 60 and 61 of the Control of Pollution Act 1974.

Instrumentation and Measurement

This session had eight contributions. The morning session was started with a paper from David Aldridge of NPL in which he described the development of an alternative method to ISO DC 10843 for the absolute impulse calibration of microphones at peak sound pressure levels between 90 and 150 dB. This is needed to provide a primary standard for peak acoustics pressure to support the EC Directive 86/188/EEC and the Noise at Work Regulations 1989. Richard Barham, also from NPL, described the free-field/pressure sensitivity differences for laboratory standard microphones. He explained that the growing importance of quality schemes is placing a greater emphasis on the calibration of equipment. IEC standards specify the methods of free-field calibration but there is no data available for half inch microphones relating to free-field pressure sensitivity differences. This paper described the research to develop facilities for the absolute free-field calibration of laboratory standard microphones to support these new standards. John Shelton of Acsoft Ltd gave a presentation on the measurement, assessment and solution of a noise nuisance from a rifle range using new computer-based instruments. The measurements were approached using Short L_{eq} techniques implemented on a notebook computer platform.

Geoff Kerry from the University of Salford started the afternoon describing the importance of adequate bandwidth in low frequency impulse measurement. He explained that restricted bandwidth instrumentation removes energy and has considerable influence on single figure parameters. The wide tolerances on weighting networks increases inaccuracies and makes comparisons between measurements at different locations meaningless. He then recommended that to ensure reliable predictions that measurements should be made with wideband instrumentation through from source to final location. Raymond Heng of Sheffield Hallam University explained his work into the utilisation of audio-acoustic signals for monitoring rolling element bearings using spectrum and cepstrum analysis. The study showed how sound intensity techniques can offer signals with better signal to noise ratio in the presence of high background noise when compared with the use of sound pressure signals.

EC Directive 89/332, commonly referred to as the Machinery Directive, gives essential safety requirements which all new types of machinery coming onto the market must meet. Roger Higginson of Higginson Acoustics gave an update on developments since the publication of a full review of machinery noise emission standards under development in 1994. John Shelton returned to give his second presentation in the session and addressed virtual instrumentation. He described the concept and how measuring systems can be built up, using commonly available components from the personal computer world. In particular he examined the Microsoft Windows operating system and its implications in relation to flexibility of measurement and reporting of noise and vibration results. The final paper in this session, given by Ken Scannell of INVC, described the environmental noise buying standard. The standard related to the simple concept of 'buy quiet' incorporating a pro-active approach. The paper demonstrated the stages of applying the standard and examined noise control measures. It is suggested that by using his approach the work load concerning industrial noise problems would start to diminish.

Education

The special session on education had four interesting papers. The first presentation from Jacqui Marsh of Nottingham Trent University described the provision for deaf and hearing impaired students in universities. She gave a variety of statistics on the numbers of deaf students at universities and the human and technical resources provided to support the students. She examined the possible future developments but concluded that emphasis should be placed on helping students to select those aids or forms of communication support best suited to their types of hearing loss. John Goodchild of the University of Liverpool then gave an informative report on the first two years operation of the Institute of Acoustics Certificate of Competence in Environmental Noise Measurement. In this account he covered its aims and objectives, the course programme, the written and practical tests and the results to date.

The next paper was given by David Oldham, also from the University of Liverpool. In his presentation he explained an exciting new multi-media package 'Mediacoustics' for teaching environmental noise which had been developed through a joint European research programme (see the News From Industry section of this issue). The package offers the ability to demonstrate principles of acoustics through visual and auditory examples. An English version will be available towards the end of the year.

The session concluded with a student paper from Matthew Thewlis from the University of Loughborough, who described a final year project using a Ford car and noise path analysis to assess a saloon car suspension system.

Open Session

This short open session consisted of four very varied presentations. The first of two papers from Osman Tokhi of

Sheffield University introduced the subject of Active Control Using Neural Networks. Active noise control using a cancelling source is well known. Neural network control takes this further in that it uses its learning and memory capability to control variations in a noise source, particularly time-varying phenomenon which cannot be controlled by normal ANR techniques. A number of advanced algorithms were presented together with suggested control systems for broadband noise cancellation.

Kate McCambridge from NESCOT identified disparities in current standards for end correction calculations for ventilation ductwork. Osman Tokhi then gave a theoretical paper on processing requirements in the real-time simulation of flexible manipulator systems. The mathematics of a flexible manipulator was described, together with a finite difference simulation algorithm.

The last, and very interesting, paper in the open session was given by Dr David Manley on infrasound generated by large sources. The title was perhaps a little misleading, since it ended up with a discussion of structure and ground borne infrasound. Dr Manley described low frequency measurement of the sound emitted by the largest organ pipe in Liverpool cathedral, the 32ft diapason (bottom 'C), which attendees experienced at the first evening demonstration at the cathedral. The tests were carried out using accelerometers and seismometers, but for airborne transmitted waves the seismometer was isolated from the solid floor. The results showed different attenuation rates between airborne and ground borne propagation. Repeating similar measurements at some distance from a wind farm produced identifiable odd-numbered harmonic peaks. The author went on to explain that there were a number of current investigations into illness which may be caused by ground borne infrasound, and concluded that it causes annoyance after long periods of continuous exposure.

Michael Hewitt receives the Institute's 1994 Award for Best Student in the Diploma examinations.

Workshops

The first workshop of the conference considered the DOE discussion document on neighbour noise which reviews the effectiveness of current neighbour noise controls. An authoritative panel had been gathered comprising a policeman, a solicitor, Environmental Health Officers and Mary Dyer of the DOE. The key elements of the discussion paper were outlined, but the main debate was on the possible introduction of a new criminal noise offence, separate from the statutory nuisance regime, which involves in part an objective measure of the alleged nuisance suffered by a complainant. From this discussion the Environmental Noise Group will be compiling the formal Institute response to the DOE.

The Instrumentation Workshop was organised by instrumentation companies that are sponsor members of the Institute, with the prime intention that it should be a feedback and information gathering session. The opinions and experience of the users of equipment were felt to be of prime concern to these companies, and it was the objective of this workshop to provide an opportunity to put forward users particular needs or to share any problems. There were about 60 attendees and at the end of the session there was a proposal to form an Institute Instrumentation Group

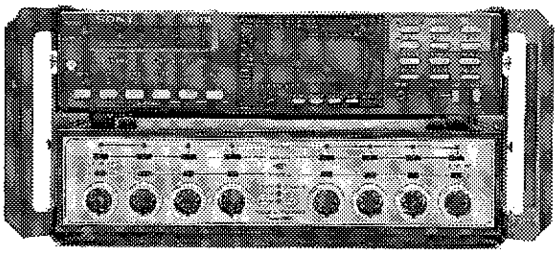
The PPG 24 Workshop began with a talk by Mr Richard Stein a barrister with Leigh Day & Co Environmental Lawyers on the legal interpretation of the guidance notes. He was keen to stress the point that PPG24 is not a 'blueprint', rather an outline framework of the government's view on planning and noise. He gave his views on how the guidance notes can be interpreted and used in the context of Sec.54a of the Town and Country Planning Act 1990.

The second speaker, Roger Tompsett of WS Atkins & Partners took the audience through the derivation of the Noise Exposure Categories. The workshop continued with very enthusiastic discussion on the application of PPG24 to UK countries other than England, the accuracy of predicted levels and the failure of the NECs to account for future increases or decreases in transportation noise.

As the centre point of the Vibration Workshop, Ken Irish of Vibronoise spoke authoritatively on many practical aspects of the measurement and assessment of building vibration and fielded many questions from the floor.

The Workshop on BS 414 2 was the final part of the conference and the importance of that standard was shown by the large number of delegates who remained to the very end. The background to the alterations were explained by Bernard Berry of NPL with support from Nicole Porter and other members of the BS 4142 Committee. The proposed revision, which should be published in October, is aimed at improving the 1990 revision rather than introducing a radical change.

John Tyler, Editor ❖



Environmental Noise Group/Scottish Branch

The second workshop on Environmental Noise Assessment organised by the Environmental Noise Group was held in conjunction with the Scottish Branch and the Royal Environmental Health Institute of Scotland at Strathclyde University on 11 April 1995. Following a similar format as before, over 50 delegates heard presentations from Martin Slater of the Institute of Environmental Assessment and Ken Collins of Ashdown Environmental before separating into groups to discuss various specific issues. A short feedback session concluded the proceedings.

Stephen Turner FIOA

Measurement and Instrumentation Group

Following a proposal raised at the IOA's Spring Conference in Liverpool, Council voted in May to investigate the establishment of a Measurement and Instrumentation Group. The inaugural meeting of an ad-hoc group of interested parties was held at the IOA office on 19 June led by Bob Peters, Vice-President for Groups and Branches, at which it was agreed that there was sufficient support to form a new Group.

The Measurement and Instrumentation Group will assist in the organisation and presentations at the 1995 Autumn Conference in Windermere, 26–29 October, and will hold its first AGM during that Conference. A one-day meeting is also being planned for February 1996. The group is being chaired by Richard Tyler from CEL Instruments Ltd, with Peter Hanes of NPL as secretary, until formal elections can take place. Anyone interested in joining the Group should contact the IOA office.

Richard Tyler FIOA

Underwater Acoustics Group

Following a busy 1993, 1994 was a relatively quiet year for IOA UWG conferences. The only conference held was the 'Underwater Acoustic Scattering' conference at Weymouth in December 1994. The topic drew an international response, and the meeting provided an excellent forum for interaction. A highlight of the meeting was the A B Wood Lecture presented by Dr Mike Collins which roamed from terrestrial underwater acoustic propagation to propagation in the Jovian atmosphere. The second European conference on 'Underwater Acoustics' was held in Copenhagen in July 1994. This drew a large response and these European conferences are providing a valuable framework for European acousticians to mix and engage through MAST in joint programmes of research. Other news is the second IOA UWG book is almost complete, and Tim Leighton of ISVR, University of Southampton, has been awarded the 1994 A B Wood Medal.

Peter Thorne FIOA

Midlands Branch

The third meeting of the recently established Midlands Branch of the IOA was held in the Boulton Suite at Aston Science Park, Birmingham on the evening of the 12 July 1995.

The audience, which comprised 28 members and non-members, was addressed by two speakers. The first was Sue Bird, chairperson of the IOA's Continuing Professional Development (CPD) Working Party who gave a presentation on their proposals for CPD within the Institute. Members of the Midlands area are reminded that Sue would welcome written comment on the proposals.

The second address was made by Henry Cleary who is currently Head of the Local Environmental Quality Division at the Department of Environment. Henry gave an excellent overview of the recommendations of the DOE's working party on neighbour noise which recently produced its report. Anyone who has to deal with neighbour noise problems will not be surprised to learn that this produced a very lively debate.

As many may already be aware, the debate centres around Recommendation 9 which concerns the introduction of a new criminal offence for severe night time neighbour noise disturbance.

The next meeting of the Branch will take place on the evening of the 29 November 1995 when the main speaker will be Colin Grimwood of the Building Research Establishment who will address the subject of sound insulation particularly between dwellings. At this meeting the first AGM will take place primarily to elect an officially mandated committee. Midlands Branch members of the IOA will be sent further details, including the time and venue of the event at a later date.

John Hinton MIOA & John Magrath MIOA

Southern Branch

Twenty-three members attended an evening meeting on Wednesday 24th May 1995 at Environmental Resources Management at Oxford, and chaired by Simon Hewitt from ERM. The meeting topic was 'User Perspectives on PPG24'. Richard Stein, a solicitor from Leigh, Day and Co presented a legal view, Stuart Tagg from Newbury District Council presented a local government view, and Stuart Dryden from ERM presented a consultant's view. The presentations were intended to help attendees to gain a better understanding of the sometimes conflicting alternative points of view in planning and noise problems and stimulated a very interesting discussion.

The Southern Branch AGM was held immediately afterwards. Graham Parry and Ian Flindell were re-elected to serve as Chairman and Secretary for a further term. It was agreed that the existing committee would continue for a further term and that anyone expressing an interest or ideas should be encouraged to join.

The next meeting of the Southern Branch will be held on 7 December at ISVR when John Shelton of AcSoft will talk on 'Instruments and PCs – the great divide'. This will be followed by practical demonstrations of advanced PC-based acoustic measurement procedures in the newly refurbished ISVR anechoic chambers.

Ian Flindell MIOA ❖

News from BSI

BS EN Publications

The following are British Standard implementations of the English language versions of European Standards (ENs).

BS EN 21683: 1994 Acoustics – Preferred reference quantities for acoustic levels. Specifies reference quantities and gives definitions of some levels for acoustics. Applies to oscillatory quantities. No current standard is superseded.

BS EN 60534: Industrial process control valves.

BS EN 60534–8: Noise considerations.

BS EN 60534–8–4: Prediction of noise generated by hydrodynamic flow. No current standard is superseded.

BS EN 61157: 1995 Requirements for the declaration of the acoustic output of medical diagnostic output of medical diagnostic ultrasonic equipment. Specifies the requirements for declaration by manufacturers of the acoustic output derived from measurements made in water. No current standard is superseded.

BS EN 61161: 1995 Specification for ultrasonic power measurement in liquids in the frequency range 0.5 MHz to 25 MHz. Specifies principles for the use of radiation force balances and methods for measuring ultrasonic power in liquids in the megahertz range. No current standard is superseded.

BS EN 60645: Audiometers BS EN 60645–1: 1995 Pure-tone audiometers – Specifies general requirements for audiometers and particular requirements for pure-tone audiometers designed for use in determining hearing threshold levels in comparison with the standard reference threshold level by means of psychoacoustic test methods. Supersedes BS 5966: 1980.

BS EN 60704: Test code for the determination of airborne acoustical noise emitted by household and similar electrical appliances.

BS EN 60704–2: Particular requirements. BS EN 60704–2–1: Vacuum cleaners – Defines the methods to be used for measuring the level of noise of vacuum cleaners and for informing consumers. Supersedes BS 6686: Section 2.1: 1990

British Standards

BS 4727: Part 3: Group 08: 1995 Acoustics and electroacoustics – Supersedes BS 4727: Part 3: Group 08: 1985

British Standard Implementations

BS ISO 3744: 1994 Acoustics – Determination of sound power levels of noise sources using sound pressure. Engineering method in an essentially free field over a reflecting plane. Supersedes BS 4196: 1981.

BS ISO 389: Reference zero for the calibration of audiometric equipment.

BS ISO 389–2: 1994 Reference equivalent threshold sound pressure levels for pure tones and insert earphones. No current standard is superseded.

BS ISO 389–3: Reference equivalent threshold force levels for pure tones and bone vibrators.
Supersedes BS 6950: 1988

BS ISO 389–4: Reference levels for narrow-band masking noise. Supersedes BS 7113: 1989

BS ISO 3743: Acoustics – Determination of sound power levels of noise sources using sound pressure. Engineering methods for small, movable sources in reverberant fields.

BS ISO 3743–2: 1994 Methods for special reverberation test rooms. Supersedes BS 4196: Part 3: 1991

BS ISO 4869: Acoustics – Hearing protectors.

BS ISO 4869–2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn. No current standard is superseded.

BS ISO 10844: 1994 Acoustics – Specification of test tracks for the purpose of measuring noise emitted by road vehicles. No current standard is superseded.

British Standards Reviewed and Confirmed

BS 5652: 1979 Specification for hydrophones for calibration purposes.

BS 5653: 1978 Specification for hydrophones for calibration purposes.

BS 7041: 1989 Specification for characteristics and calibration of hydrophones for operation in the frequency range 0.5 MHz to 15 MHz.

British Standards Withdrawn

BS 4196: Sound power levels of noise sources.
BS 4196: Part 4: 1981 Engineering methods for determination of sound power levels for sources in free-field conditions over a reflecting plane. Superseded by BS ISO 3744: 1994.
BS 4196: Part 3: 1991 Engineering methods for determination of sound power levels for sources in special reverberation test rooms. Superseded by BS ISO 3743–2: 1994.
BS 7113: 1989 Specification for reference levels for narrow-band masking noise. Superseded by BS ISO 389–4: 1994.
BS 6686: Methods for determination of airborne acoustical noise emitted by household and similar electrical appliances.
BS 6686: Part 2 Particular requirements.
BS 6686: Section 2.1 1990 Vacuum cleaners. Superseded by BS EN 60704–2–1: 1995.

Cancellation of Approved Safety Standards

BS 6344: Industrial hearing protectors.
BS 6344: Part 1 1989 Specification for ear muffs.

Draft British Standards for Public Comment

94/706817 DC EN 583 Ultrasonic examination – Part 3: Transmission technique (prEN 583–3).
94/306984 DC EN 352 Hearing protectors – Safety requirements and testing. Part 4: Level-dependent earmuffs (prEN 352–4).
94/506270 DC BS EN ISO 11821 Acoustics – Determination of the *in situ* sound attenuation of a removable screen (ISO/DIS 11821).
94/507017 DC Revision of ISO 266 Acoustics – Preferred frequencies. (Possible new British Standards BS EN ISO 266) (ISO/DIS 266 and prEN 20266).
94/507033 DC Amendment 1 to BS EN 20354 Acoustics – Measurement of sound absorption in a reverberation room – Amendment 1: Annex D – Test specimen mountings for sound absorption tests (ISO/DIS 354: 1985/DAM 1/prEN 20354).
94/507034 DC Amendment 1 to BS ISO 6395: 199X Acoustics – Measurement of exterior noise emitted by earth-moving machinery – Dynamic test (ISO 6395: 1988/DAM 1).
94/712748 DC Aerospace series. EN 4050 Test method for metallic materials – Ultrasonic inspection of bars, plates, forging stock and forgings – Part 3: Reference blocks (prEN 4050–3).
94/714299 DC EN 1713 Non-destructive examination of welds – Ultrasonic examination – Characterization of imperfections in welds (prEN 1713).
94/714300 DC EN 1714 Non-destructive testing of welds – Ultrasonic examination of welded joints (prEN 1714).
95/700676 DC EN 1330 Non-destructive testing – Terminology – Part 4: Terms used in ultrasonic testing (prEN 1330–4).
95/100426 DC EN 1793 Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 1: Intrinsic characteristics – Sound absorption (prEN 1793–1).
95/100427 DC EN 1793 Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 2: Intrinsic characteristics – Airborne sound insulation (prEN 1793–2).
95/100428 DC EN 1793 Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 3: Normalized traffic noise spectrum (prEN 1793–3).
95/100429 DC EN 1794 Road traffic noise reducing devices – Nonacoustic performance – Part 1: Mechanical performance and stability requirements (prEN 1794–1).
95/100430 DC EN 1794 Road traffic noise reducing devices – Nonacoustic performance – Part 2: General safety and environmental considerations (prEN 1794–2).
95/520104 DC BS ISO 14605 Acoustics – Measurement of airborne noise emitted by computer and business equipment (Revision of ISO 7779: 1988) (ISO/DIS 14605).
95/520504 DC BS EN 20140 Acoustics – Measurement of sound insulation in buildings and of building elements – Part 1: Requirements for laboratory test facilities with suppressed flanking transmission (ISO/DIS 140–1/prEN 20140–1).
95/520703 DC BS EN 20140 Acoustics – Measurement of sound insulation in buildings and of building elements. Part 8: Laboratory measurement of the reduction of transmitted impact noise by floor covering on a solid standard floor (ISO/DIS 140–8/prEN 20140–8).
95/521168 DC BS ISO 6926 Acoustics – Determination of sound power levels of noise sources. Requirements for the performance and calibration of reference sound sources (ISO/DIS 6926).
95/521169 DC BS ISO 13473 Acoustics – Characterization of pavement texture using surface profiles. Part 1: Determination of mean profile depth (ISO/DIS 13473–1).
95/643677 DC Implementation of Amendment 2 to ISO/IEC 13818–1: 1995 Information technology. General coding of moving pictures and associated audio information. Part 1: Systems. Amendment 2: Registration procedure for 'format identifier' (ISO/IEC 13818–1: 1995/DAM 2).
95/643679 DC Implementation of Amendment 1 to ISO/IEC 13818–1: 1995 Information technology. Generic coding of moving pictures and associated audio information. Part 1: Systems. Amendment 1: Registration procedure for 'copyright identifier' (ISO/IEC 13818–1: 1995/DAM1).

Draft International Standards

94/507019 ISO/DIS 11654 Acoustics – Sound absorbers for use in buildings – Rating of sound absorption (prEN ISO 11654).

European New Work Started

EN 4050: Test method for metallic materials. Ultrasonic

inspection of bars, plates, forging stock and forgings:
Part 3: Reference blocks.
Part 4: Acceptance criteria.
Engineering: Non-destructive testing: Acoustic emission – Equipment characterization. ECISS/TC 28/SC 1 through ISE/31.
EN 61063: Acoustics – test code for the measurement of airborne noise emitted by steam turbines and driven machinery. Will be implemented as BS EN 61063.

European Telecommunications Standards Institute (ETSI) Publications

ETS 300 580–4: 1994 Comfort noise aspect for full rate speech traffic channels (GSM 06.12).
I-ETS 300 302–1: 1994 Integrated Services Digital Network (ISDN) – Videotelephony teleservice. Part 1: Electro-acoustic characteristics for handset telephony function when using Pulse Code Modulation (PCM) encoding.
I-ETS 300 380: 1995 Universal Personal Telecommunication (UPT); Access devices; Dual Tone Multi-Frequency (DTMF) sender for acoustical coupling to the microphone of a handset telephone.

IEC Publications

IEC 50(801): July 1994 (Edition 2) International Electrotechnical Vocabulary. Chapter 801: Acoustics and electroacoustics.
IEC 704–2–6: September 1994 Test code for the determination of airborne acoustical noise emitted by household and similar electrical appliances. Part 2: Particular requirements for tumble-dryers. Will not be implemented as a British Standard at this stage – awaiting ratification of corresponding European Standard (prEN 60704–2–6).
IEC 1266: December 1994 Ultrasonics – hand-held probe Doppler foetal heartbeat detectors – Performance requirements and methods of measurement and reporting.
IEC 50(561): Chapter 561 – Piezoelectric devices for frequency control and selection. Section 561–06: Surface acoustic wave filters. Amendment 1: May 1995 to IEC 50(561): 1991.

International New Work Started

IEC 268 Sound system equipment – Part 15: Preferred matching values for the interconnection of sound system components. Will correct Amendment 1 to IEC 268.
IEC 268 Sound system equipment – Part 3: Amplifiers. Will revise IEC 268–3.
ISO 12713 Non-destructive testing – Standard method for primary calibration of acoustic emission transducers.
ISO 12715 Ultrasonic non-destructive testing – Reference blocks and test procedures for the characterization of contact search unit sound fields.
ISO 12710 Non-destructive testing – Ultrasonic inspection – Evaluating electronic characteristics of instruments.
ISO 12709 Non-destructive testing – Ultrasonic inspection – Inspection detection and evaluation of discontinuities by the immersed pulse-echo ultrasonic method using longitudinal waves.
Electrotechnical: Ultrasonics – Focusing transducers – Measurement and characterization of transmitting properties. IEC/TC 11 through PEL/11.

IEC CISPR Publications

ISO 140–3: 1995 (Edition 2) Acoustics – Measurement of sound insulation in buildings and of building elements. Part 3: Laboratory measurements of airborne sound insulation of building elements. BS EN 140–3: 1995 superseding BS EN 20140–3: 1994 and BS 2750: Part 3: 1994.

ISO Standards

ISO 389–2: 1994 Acoustics – Reference zero for the calibration of audiometric equipment. Part 2: Reference equivalent threshold sound pressure levels for pure tones and insert earphones. Will be implemented as BS ISO 389–2. (BS 2497: 1992).
ISO 4869–2: 1994 Acoustics – Hearing protectors. Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn. Will be implemented as BS EN 24869–2 when adopted by CEN.
ISO 389: Acoustics – Reference zero for the calibration of audiometric equipment.

ISO 10844: 1994 Acoustics – Specification of test tracks for the purpose of measuring noise emitted by road vehicles. Will be implemented as BS ISO 10844: 1994.
ISO 3743-2: 1994 Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering methods for small, movable sources in reverberant fields. Part 2: Methods for special reverberation test rooms. Will be implemented as BS ISO 3743-2: 1994, superseding both ISO 3743: 1988 and BS 4196: Part 3: 1991.
ISO 10124: 1994 Seamless and welded (except submerged arcwelded) steel tubes for pressure purposes. Ultrasonic testing for the detection of laminar imperfections. Action is taking place in Europe which will result in the publication of BS EN 10246: Part 14.
ISO 7960: 1995 Airborne noise emitted by machine tools. Operating conditions for woodworking machines.
ISO 362: 1994 (Edition 2) Acoustics – Measurement of noise emitted by accelerating road vehicles – Engineering method. Will not be implemented as a dual-numbered British Standard because of absence of UK interest.
ISO 7188: 1994 (Edition 2) Acoustics – Measurement of noise emitted by passenger cars under conditions representative of urban driving. Will not be implemented as a dual-numbered British Standard because of absence of UK interest.
ISO 8297: 1994 Acoustics – Determination of sound power levels of multisource industrial plants for evaluation of sound pressure levels in the environment – Engineering method. Will be implemented as BS ISO 8297: 1994.
ISO 12094: 1994 Welded steel tubes for pressure purposes – Ultrasonic testing for the detection of laminar imperfections in strips/plates used in the manufacture of welded tubes. Will not be implemented as a British Standard as action is in hand to produce a European Standard (EN 10246-15).
This information, provided by Ms Nicole Porter of NPL, was announced in the May 1994 to July 1995 issues of BSI News.

Hansard

13 July 1995
Railways (Noise Insulation Regulations)
Mr Jacques Arnold: To ask the Secretary of State for Transport when he will publish the draft Noise Insulation Regulations for New Railway Lines; and if he will make a statement.
Mr Watts: The Draft Noise Insulation Regulations for New Railway Lines and associated technical memorandum have been laid before Parliament today. The regulations are intended to provide equity of treatment as between those living alongside new railway lines and those living alongside new roads, who are protected by existing noise insulation regulations.
Although I fully expect developers of new railway lines to take all practical measures to reduce railway noise at source, there will inevitably be instances where this may not be possible or cost-effective.
The new regulations will create a duty, in the case of new lines and additional tracks constructed alongside existing lines, to provide insulation, or a grant for the costs of carrying out works, when noise exceeds certain levels. They also give a discretionary power to offer insulation in the case of certain alterations to existing railway lines.
With a number of new railway projects either planned or under construction, it is only fair and proper that people who live alongside these lines should have a similar degree of statutory noise protection that their neighbours living near new roads have benefited from over the last 20 years.
In the case of existing railway lines, which now carry new channel tunnel rail traffic, noise mitigation schemes have been agreed between BR/Railfreight Distribution and Kent and Surrey County Councils and the London Borough of Bromley. Under these schemes, acoustic barriers are being erected at affected locations alongside existing lines to and from the channel tunnel. They are being jointly funded by the organisations involved, with Government assistance.
I would like to see BR/Railfreight Distribution actively entering into similar agreements with other local authorities whose areas might be similarly affected in future.
Extracts provided by Rupert Taylor FIOA ❖

The Association of Noise Consultants

The Annual General Meeting of the Association took place on the 31st May 1995 at the offices of BDP Acoustics Ltd. The Chairman and Secretary both retired from their positions, although the outgoing Chairman (Tony Jones from AIRO) would continue to be a member of Council as the Immediate past Chairman. It was also decided to activate the post of Vice Chairman. The new officers appointed were Ken Ratcliffe (ISVR Consultancy Services) as Chairman, Sue Bird (Bird Acoustics) as Vice Chairman and John Miller (Acoustic Consultant) as Secretary. Alan Saunders (Alan Saunders Associates) continues as Treasurer.

Following the AGM, a dinner was held at the Royal Thames Yacht Club, which was attended by 19 members and guests. Richard Barlow from Browne Jacobson Solicitors was the guest speaker. He is the Convenor of the UKELA (UK Environmental Law Association) Noise Working Party, and he described the work undertaken by the Association. He stressed that membership is open to all those interested in the environment and not just lawyers, and urged members to consider joining.

At the Council meeting on 26th July, a large part of the meeting was spent considering all the correspondence which comes into the Association's office. Much of this correspondence is only of interest to a few members, but it does provide information and opportunities of which members may not be aware. One item of Any Other Business raised the problem of how a small business can keep up with government publications, press releases and other relevant information, and one of the advantages of membership of the ANC is that the Association can provide some of this information. Other matters discussed were the calibration of sound level meters, and the ANC Guidelines for Noise Measurements in Buildings. One of the new Chairman's first duties will be to present the Association's 1994 Diploma Prize which is awarded each year for best project submitted for the IOA Diploma in Acoustics and Noise Control to Mr H B Fritsch from the Colchester Institute.

Sue Bird MIOA

New Products

CEL INSTRUMENTS LTD

Building Acoustics - A New Approach

A new building acoustics measurement system has been announced which will, say CEL Instruments, take reverberation time and transmission loss measurements in buildings into a new era.

The system combines a CEL real-time sound level analyser to carry out the measurement, control and analysis functions together with a choice of noise sources.

The analyser, weighing less than a kilo, acts as the core of the system and uses its advanced processing power and speed to give the operator a range of features usually associated with much larger and heavier instruments.

The building acoustics application provided by the analyser has four modes of operation; reverberation time measurements with an impulsive or constant noise source and measurement levels on the transmit and receive sides of a partition.

All of these operating modes can be used with any of the bandwidths (Broadband, Octave or Third Octave) that are available for CEL analysers.

The application is an option for all new CEL sound level analysers or can be installed quickly in existing units because no hardware changes or accessories are needed.

The easily portable CEL electronic noise source incorporates a combined loudspeaker/amplifier unit a graphic equaliser and a pink noise source. This can be remotely triggered from the analyser, via an optional radio transmitter, thus eliminating the problems associated with long cable connections. The system can also be set to automatically trigger, up to 20 times, for repeated tests.

The hand-held analyser can also be used on its own to measure the effects of an impulsive noise, like that provided by the CEL dummy pistol, in large spaces like auditoria. Many of the expected measurement criteria are automatically calculated reducing tiresome manual calculations on site.

The 'Fastore' rapid data storage facility, supplied with the building acoustics package, can be used separately for the capture of other transient signals like vehicle drive by, speech and ballistics tests.

Information on the CEL building acoustics application may be obtained by contacting CEL Instruments Ltd, 35–37 Bury Mead Road, Hitchin, Herts SG5 1RT Tel: 01462 422411 Fax: 01462 422511.

CEL Instruments Ltd is a Key Sponsor of the Institute

NOISE & VIBRATION ENGINEERING LTD

VIBRAS - Vibration Monitoring System

Swiss-made VIBRAS are seismological measuring instruments that operate on digital principles using microcomputers. With the VIBRAS instruments all manner of vibrations and tremors can be recorded and evaluated.

They are ideal for the registration of short duration events as well as measurements over extended periods of time. Using the built-in alarm and printout system, the instrument may be installed as a monitoring facility. Especially attractive is the possibility of connecting up to 12 sensor devices on a single evaluation instrument thereby enabling blanket surveillance of a given area.

Although the instruments are virtually completely programmable parametrically, the operation remains simple. For general applications such as explosion-, ramming-, traffic-, effective- and KB-value measurements, the default parameters of the instruments may be used and acquisition commenced as soon as the sensors required are defined.

The extent of applications to which the instruments may be applied lies in general where a fully automatic initial-evaluation of the occurring tremors or vibrations is required. To facilitate supplementary or after-event evaluations, the recorded data can be retained in the VIBRAS. The stored data can then be further evaluated against other criteria or transferred to another computer such as IBM-PC or Macintosh as desired. To aid in evaluation and documentation of the data there are a number of software packages available.

Further details can be obtained from Tom Brodowski, Noise & Vibration Engineering Limited, 1 Rothesay Avenue, Wimbledon Chase, London SW20 8JU Tel: 0181 542 9226 Fax: 0181 540 8481.

QUANTITECH LTD

Rion SA-77 handheld, real time signal analyser

The new RION SA-77 FFT Signal Analyser offers performance normally associated with laboratory-based equipment in a handheld, portable unit. It enables instant on site signal analysis across a full 80 dB dynamic range, covering a frequency range from DC to 50 kHz.

This lightweight, battery-powered instrument delivers the flexibility to monitor noise and vibration wherever, and whenever required. Direct input using either a microphone or accelerometer yields immediate feedback on current noise or vibration levels.

The capability for taped input ensures that pre-recorded signals can be measured with confidence. Each unit is supplied with a combined RS-232-C and parallel interface. Stored data can be conveniently downloaded for further interpretation. The clear LCD screen provides real-time results with advanced zoom functions. So up to 800 lines can be displayed in a compact, handheld instrument. The RION SA-77 is battery-powered for truly portable convenience.

For further details, please contact Roberto Lorenzetto, Quantitech Ltd, Unit 3, Old Wolverton Road, Old Wolverton, Milton Keynes MK12 5NP Tel: 01908 227722. Fax: 01908 227733

BRUEL & KJÆR

Acoustic and Vibration Transducer Catalogue

Brüel & Kjær has just released a new Acoustic and Vibration Transducer Catalogue which covers its complete transducer product line.

The catalogue which covers microphones, accelerometers and other transducers and accessories provides 80 pages of technical information on more than 300 transducers.

The catalogue is available from Brüel & Kjær (UK) Ltd, 92 Uxbridge Road, Harrow HA3 6BZ Tel: 0181 954 2366 Fax: 0181 954 9504. **Brüel & Kjær (UK) Ltd is a Key Sponsor of the Institute**

DIAGNOSTIC INSTRUMENTS LTD

Real Time FFT Analyser

The new D-2200 FFT analyser from Diagnostic Instruments has a real time bandwidth of up to 20 kHz. It is truly portable weighing approximately 3 kg and can be battery or mains powered. A memory card facility is provided to allow Data/ Setup storage, to load specific applications using a D-CARDTM and provide direct data transfer to/from a PC.

For acoustic analysis full and third octave bands are available with selectable A- weighting.

For transient events the comprehensive trigger options can be combined with the time domain processes to provide flexible data capture. Time domain data can be post-processed into the frequency domain and then stored.

Further details are available from Diagnostic Instruments, 264 West Main Street, Whitburn, West Lothian EH47 0LB Tel: 01501 743031 Fax: 01501 743933.

ILLBRUCK LTD

Sound absorbers

The illsonic range of products for industrial sound protection and room acoustics includes vertical and horizontal suspended absorbers, lay-in sound absorbers, direct bonding panels and a new internal walling system.

All the illsonic range of ceiling and walling products are lightweight, free from mineral fibres, halogens and CFCs and have a Class O spread of flame rating.

Further details may be obtained illbruck Ltd, 1 Peverel Drive, Granby Industrial Estate, Milton Keynes MK1 1NJ Tel: 01908 271700 Fax: 01908 27203.

News Items

ARUPS

Royal Opera House Redevelopment

Following their recent success on Glyndebourne Opera House, Ove Arup & Partners have been appointed by Royal Opera House Developments Limited to provide integrated, multi-disciplinary engineering design services for the £213 M redevelopment of the Opera House facilities, due to commence in July 1996.

Arups' commission covers structural, mechanical and electrical engineering, as well as fire safety and lighting design consultancy. Arup Acoustics have been appointed to advise on improving the acoustic of the main auditorium and on the acoustic design of the extensive new side and rear stage areas, and on a second auditorium for small scale performances and chamber music.

The Grade 1 listed auditorium and Floral Hall will both be refurbished, and new stage areas, a second auditorium, rehearsal rooms, ballet studios and full facilities for the Royal Opera and Royal Ballet will be constructed.

The operation and management of the House will be improved by the installation of modern equipment in a modern building. £55 M was awarded by the Arts Council Lottery Board (with a further £23.5 M once a number of conditions have been satisfied). The major portion of the remainder will be financed through private sources.

Mediacoustics

Revolutionising the teaching of acoustics

French company 01dB has designed Mediacoustics a software package for teaching acoustics to engineers and technicians which uses multimedia techniques and, claims the company, offers a unique combination of sound, text and pictures on a personal computer.

Mediacoustic is a training tool for engineers and technicians who are faced with noise related problems and illustrates each chapter (500 sections in all) with video animation and audio messages. It is built around a central core containing the fundamentals of acoustics along with several specialist modules.

Mediacoustic is available on CD-ROM for PC's equipped with a sound card and loudspeaker. Developed in French, the programme will be available in English, German and Spanish this autumn.

For more information contact John Shelton, ACSOFT, 6 Church Lane, Cheddington, Leighton Buzzard Tel: 01296 662852 Fax: 01296 661400.

People

David Leversedge

Change of post

David Leversedge MIOA moved from London Underground Ltd on 17 July to the position of Senior Acoustics Consultant with Symonds Travers Morgan Ltd located at East Grinstead Office. He will be covering topics that include transport, construction and entertainment noise.

Philip Northfield and Associates

New company

Following over thiry years as Managing Director of Sargents Acoustics, the noise and vibration manufacturing division of Hunter International plc, Philip Northfield MIOA has formed a new acoustical consulting practice, Philip Northfield and Associates based in Robertsbridge, East Sussex.

This new practice continues the service provided by Sargents Acoustics, offering professional advice on all aspects of noise and vibration control within the environment and the workplace.

Information on new products should be sent to John Sargent MIOA at BRE, Garston, Watford WD2 7JR ❖

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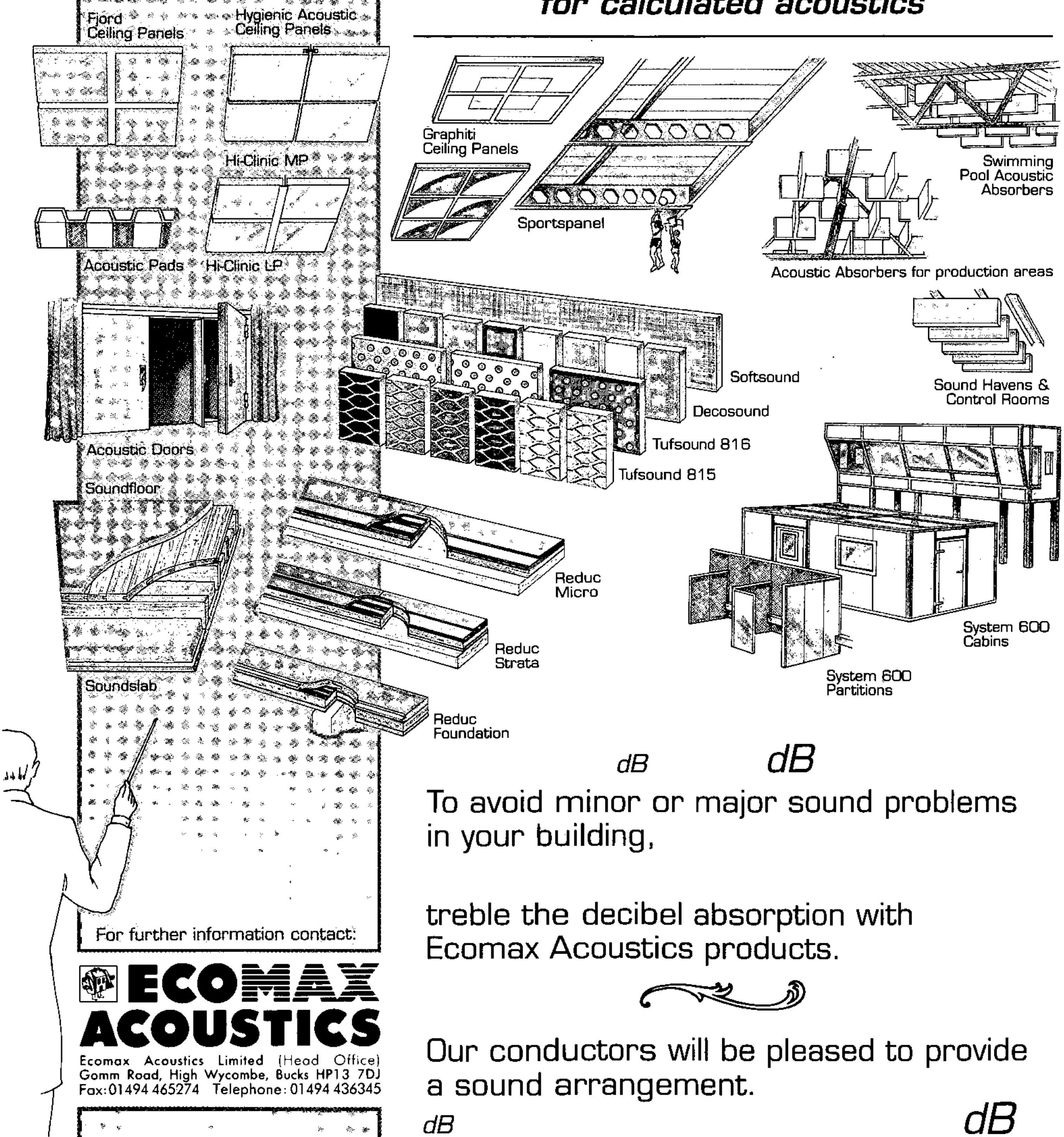

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